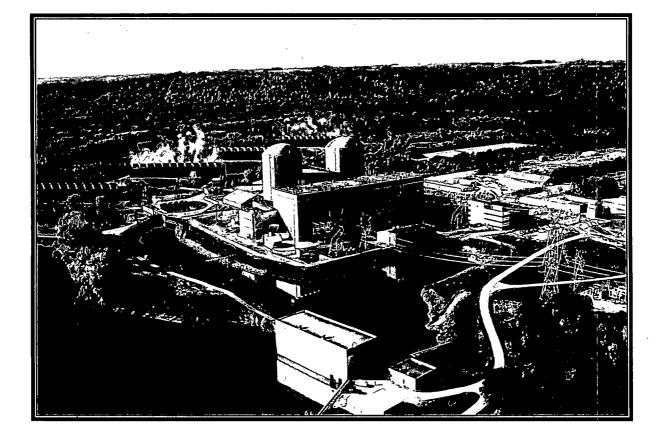


PRAIRIE ISLAND NUCLEAR GENERATING PLANT

LICENSE RENEWAL ENVIRONMENTAL REPORT ADDITIONAL INFORMATION



Documents Requested During NRC Environmental Review

Surface Water

Binder 1 of 3

Prairie Island Nuclear Generating Plant NRC Document Request List

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Item Number	Document
Liz Wexler	
63	Bodensteiner, J. 1991
64	ESWQD. 2000.
65	ESWQD. 2001.
66	ESWQD. 2002.
67	ESWQD. 2003.
68	ESWQD. 2004.
69	ESWQD. 2005.
71	HDR. 1978.
72	NSP. 1981a.
73	NSP. 1981b.
74	NSP. 1983.
75	Corr Binder: Letter from Matt Langan, MNDNR, Aug 10, 2007
76	Corr Binder: Letter from John Stine, MDH, April 10, 2008
77	Corr Binder: Letter from Gary Wege, USFWS, June 20, 2007
	Corr Binder: Letter from Terry Birkenstock, ACE, March 11 2008. If possible, include
78 · · · · ·	attachment (2002 Clam Chronicle.pdf)
79	Corr Binder: Email from Tom Lovejoy, WDNR, Aug 31, 2007
80	Report regarding fish kill in 2000
	Letter to H. Krosch and D. Kriens from W. Jensen, Chlorination of Circ Water System
82	Fish Loss Report, October 14
83	NUS Corporation. 1976.
84	Stone and Webster. 1983.
	Xcel Energy, 2007, PINGP Environmental Monitoring and Ecological Studies Program
85	2006 Annual Report.
86	Xcel Energy, 2008, PINGP Environmental Monitoring and Ecological Studies Program 2007 Annual Report.
87	NPDES Filing Cooling Data (Binder 14)
89	From Aquatic Review Binder: ESE. 1999.
91	
	DMR: 5/21/98
92	DMR: 6/19/98
93	DMR: 10/21/98
94	DMR: 5/21/99
95	DMR: 7/20/01
96	DMR 11/21/01
97	DMR: 8/21/03
98	DMR: 5/20/05
101	Entire 316(b) Binder (Comprehensive Demonstration Study)
102	Plume Modeling of Discharge Canal Discharge Sluice Gate flow into the river

Page 1 of 1 Rev. 9/8/08



Northern States Power Company

414 Nicoliet Mall Minneapolis, Minnesota 55401-1927 Telephone (612) 330-5500



Terry J. Mader Water Quality Division Minnesota Pollution Control Agency 520 Lafayette Road St. Paul, Minnesota 55155

PRAIRIE ISLAND GENERATING PLANT NPDES PERMIT NO. MN 0004006 Comments for Draft Reissuance

Regarding renewal of the Northern States Power Company Prairie Island Generating Plant's NPDES Permit (No. MN 0004006), NSP is requesting MPCA (Minnesota Pollution Control Agency) consideration for including the following proposals in the renewed permit or for concurring with the stated interpretation of permit conditions:

] . Apply blowdown restrictions after April 15 consistent with fine mesh screen start date and increase the April 15 to April 30 blowdown restriction to 300 cfs based on negligible impact identified by analyses of the impingement studies.

2. Replace "and shall not" with "so as not to" so Part I.C.5.a. of the permit reads, "During the period April 1 through October 31, the Permittee shall operate all cooling towers to the maximum practical extent so ac not to raise the temperature of the receiving water immediately below Lock and Dam No. 3 by more than 5°F (2.7°C) above natural based on the monthly averages of the maximum daily temperatures, except in no case shall it exceed a daily average temperature of 86°F (30°C)." Therefore, cooling towers will be operated to maintain the specified thermal restrictions; this operation is consistent with water quality standards for temperature under Minnesota Rules 7050.0220.

3.

To clarify the intent and make for easier consistent interpretation, split Part I.C.5.b. of the permit into three parts worded as follows:

"In November until the daily average ambient river temperature is consistently below 43°F (6.1°C), the

> File Copy PI Lab



Terry J. Mader - MPCA March 18, 1991 Page 2

> Permittee shall not raise the temperature of the receiving water immediately below Lock and Dam No. 3 by more than 5°F (2.7°C) above natural based on the average of the maximum daily temperature for the period of the month until the daily average ambient river temperature is consistently below 43°F (61.°C), except in no case shall it exceed a daily average temperature of 86°F (30°C)."

> "During the period November 1, through March 31, after the daily average ambient river temperature is consistently below 43°F (6.1°C), the Permittee shall not raise the mixed river temperature immediately below Lock and Dam No. 3 above 43°F (6.1°C) for an extended period of time. Should the daily average mixed river temperature immediately below Lock and Dam No. 3 equal or exceed 43°F (6.1°C) for two consecutive days the Permittee shall notify the Director and the Minnesota Department of Natural Resources. Following such notification, the Director may require the Permittee to operate the cooling towers until such time the above temperature criteria can be consistently met."

> "During the period November 1 through March 31, if the daily average ambient river temperature is not consistently below 43°F (6.1°C), the Permittee shall not raise the temperature of the receiving water immediately below Lock and Dam No. 3 by more than 5°F (2.7°C) above natural based on the average of the maximum daily temperatures for the period of the month when the daily average ambient river temperature is not consistently below 43°F (6.1°C), except in no case shall it exceed a daily average temperature of 86°F (30°C)."

4. Reach an agreement on acceptable procedures when ambient river temperatures are at or near the maximum daily average thermal limit of 86°F. NSP proposes notifying MPCA of such conditions and then under MPCA authorization continue plant operations while operating all cooling towers even though the 86°F limit may be exceeded. Also, please identify the supporting information needed and the criteria used in authorizing a written variance of temperature limits and standards when such conditions exist. Terry J. Mader - MPCA March 18, 1991 Page 3

5. Eliminate boron monitoring of discharges 20101 and 202102 since the typical concentration ranges have been established through past monitoring and since any significant increase in boric acid use requires prior MPCA approval under Part 1.C.3 of the permit.

6. Do not incorporate the proposed pH conditions for outfalls 012 (formerly 20102) as indicated in the draft NPDES permit reissuance; rather, maintain the existing pH conditions on the discharge to the river (outfall 010, formerly 20100). Analyses of the worst case scenarios for contributing wastestream and discharge canal pH will be provided to support this comment.

Also enclosed is the plant's Effluent Schematic revised to reflect some existing parking lot and roof drainage to the river (in front of the intake), to reflect the actual arrangement of discharge 20103 to the circulating water system, and to reflect the land application alternative to discharges 20104 and 20105 as authorized by the MPCA letter of approval dated August 5, 1987. Please consider these items as disclosed as part of the NPDES permit application and incorporate them as necessary in the draft permit reissuance.

NSP thanks you for the opportunity to discuss our proposals at our March 21 meeting. If you have any questions, please call me at 330-6625.

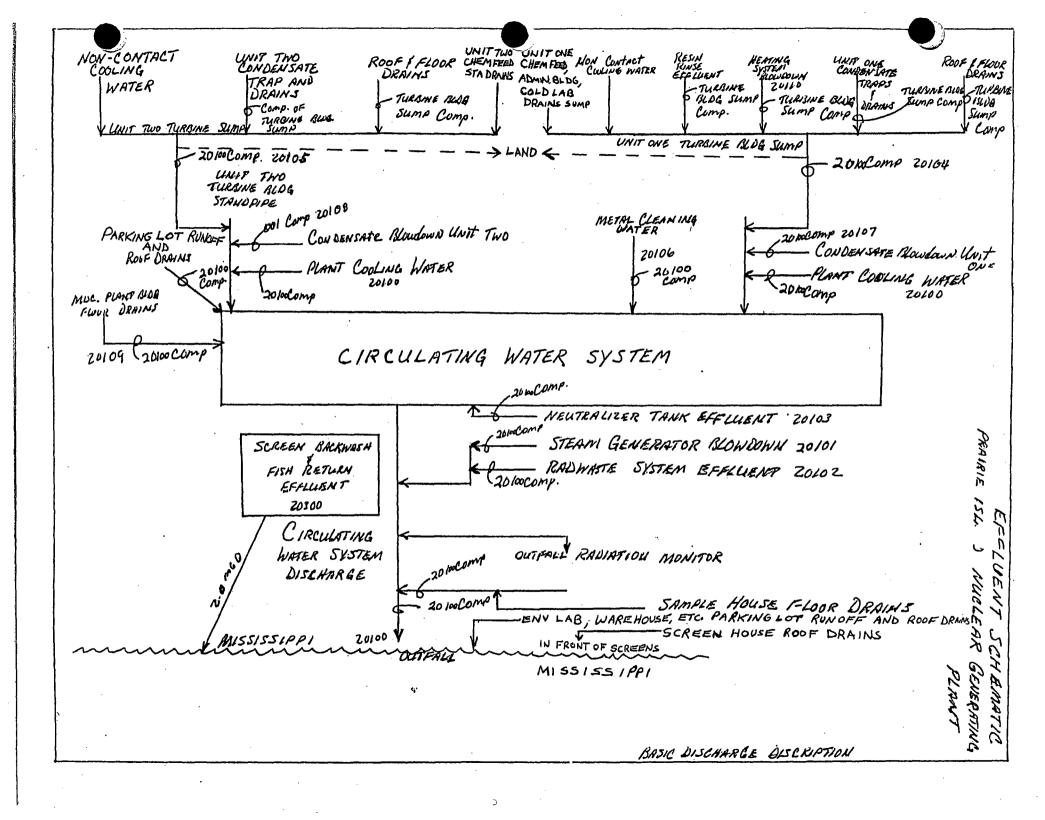
Jin Bodensteiner Plant Regulatory Analyst

Enclosure

cc: ERAD Records Center

bcc: Don Brown Mark Gruber Gerald Joachim Scott Lappegaard Gary Miller Mike Wadley Dennis Larimer Lee Eberley Dan Orr Ken Mueller





April Blowdown and the Impact on Larval Fish Impingement and Survival

The existing Prairie Island NPDES Permit limits plant blowdown beginning April 1 to 150 ofs to minimize larval fish and egg entrainment. The same permit requires installation of the finemesh screens by April 15 annually. Studies have been conducted annually by the environmental lab since 1984 to assess impingement and mortality of larval fish at the intake screen house. The results of these studies support the following proposal in the new permit application:

Apply blowdown restrictions after April 15 (rather than April 1) consistent with the fine-mask screen start date and increase the April 15 to April 20 blowdown restriction to 300 cfs.

The presence of larval fish in April is highly variable as indicated on Table 1. Ichthyoplankton impingement estimates for April of the five years studied ranged from 5088 to 19584. The high estimate was comprised of 75% unidentified eggs. Species composition is also variable although walkeye/sauger are present in most years. The number of walkeye/sauger impinged in April ranges from 0% to 22% of the annual estimated impingement of those species. The April impingement of burbot ranges from 0% to 42% of the annual total. These two groups comprise the bulk of the April impingement estimates. Walkeye/sauger April impingement estimates were high in 1985, and ranged from 10% to 22%, but were near or below 5% most other years.

Table 2 illustrates the proportion of the annual impingement of all species that occurs in April and how the increased blowdown would affect those numbers. These estimates are based on density estimates from the annual larval sampling program. This data indicates that even at the proposed blowdown rates less than 0.1% of the annual impingement would occur in April. The low estimated impingement in April reflects the low density of ichthyoplankton at MAR-18-91 MON 11:52

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P. 02

According to the larval program data ichthyoplankton density in April rarely exceeds one organism/100 cubic meters compared to 100 to 350 organisns/100 cubic meters

MAR-18-91 MON 11:52

SHERCO ADMIN

In addition to low organism density in April, larval survival is also higher. Figure 1 depicts survival of impinged larva on a daily basis with survival in April and early May ranging from 50% to 100%. Based on the sampling program results Larval survival is greatly effected by debris load of the Mississippi. Figure 2 plots both debris load and larval survivel showing this relationship. Figure 2 also indicates the low debris density present in April.

that time of year.

later in the year.

Based on the low ichthyoplankton density in April and the high survival at that time of year the impact of increased blowdown during April would be minimal. Doubling the blowdown volume would likely double the estimated inpingement. In the worst case based on 1985 this would have increased impingement of walleye/sauger from about 5800 to 10600 larval fish. Considering larval survival of 50% to 100% this increased impingement would have a limited impact on a river the size of the Mississippi.

B

Table 1. Percent of annual impingement occurring in April and April percent composition

			• •		
	Est. April Impingement	Est. Seasonal Impingement	April % of Season	April % Comp	MAR-15-91 FRI 14:39
1984	• -	• -		•	
Channel catfist	1152	328277857	0.0004%	6%	9-0
Cyprinidae	1152	48756633	0.0024%	6%	<u>خ</u> ــــ
Flathead catfish	192	1010311	0.0190%	1%	E
Percidae	1152	994091	0.1159%	6%	7
Walleye	768	258043	0.2976%	4%	
Carp	384	71891915	0.0005%	2%	[4
Unid. egg	14784	2747032	0.5382%	?5%	<u>.</u>
CHIG. CRS		2141022	V. JJ628	4, L 1	õ
April Total	19584			100%	
	•				
1985					SHERCO ADMIN
Bullhead spp.	384	2685	14.2857%	4%	ROC
Fercidae	2112	150967	1.3990%	22%	0
Sauger	3072	28657	10.7274%	23%	A
Stizcstedion spp.	576	2573	22.3863%	6%	M
Walleye	2112	13975	15.1095%	22%	IN
Eurbot	96	445	21.4286%	1%	
Carp	192	2043232	0.0094%	2%	
Catastomidae	288	1950543	0.0148%	3%	
Unid. egg	576	524093	0.1099%	6%	
April Total	9408		· · · · · · · · · · · · · · · · · · ·	300%	
1986					
Carp	283	20619534	0.0014%	83	FAX
Cyprinidae	864	1243768	0.0695%	17%	
Percidae	2280	249966	1.1522%	57%	NO.
Walleye	288	52774	0.5457%	6%	2
Unid. egg	763	328630	0.2337%	152	2
					513
April Total	5833			100%	2613154
1957	•			,	
Burbet	10175	24192	42.0635%	66%	
Cerp	576	4847034	C.0119%	4%	
Percidae	578	352552	C.1634%	4%	
Sauger	3453	85856	4.0253%	23%	
Walleye	578	10752	5.3371%	4%	
		10/02	CEGGIZZ		
April Total	15360	•		100%	
• •					7
1988					04
Burbot	6912	23072	29.9584%	100%	
<					

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'Table 2.	
	Based on mean April density from the annual larval sampling.

	April Nean	Bat # Fich In Aj		Est # Fish Impinged	% of Annu Impinged	
	Density	Ð	· 🔒	Per Ycar	0	£2
Yçar	#/100 ¥t3	150 cfs	300 nfs		150 ofp	300 ofs
1984	0.0197	98297	76594	492818639	0.008%	0.016%
1985	0.0076	11820	23639	42487029	0.028%	0.056%
1986	0.0038	6402	12804	62753051	0.010%	0.020%
1987	0.0083	26892	63784	77144700	0.035%	0.070%
1988	0.0041	12221	24449	67187232	0.018%	0.036%

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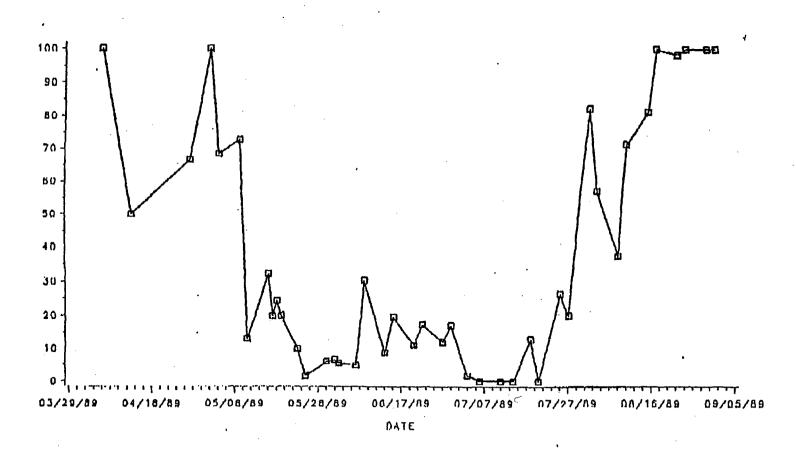
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FIGURE 1

PERCENT SURVIVAL OF OTHER FISH 1989

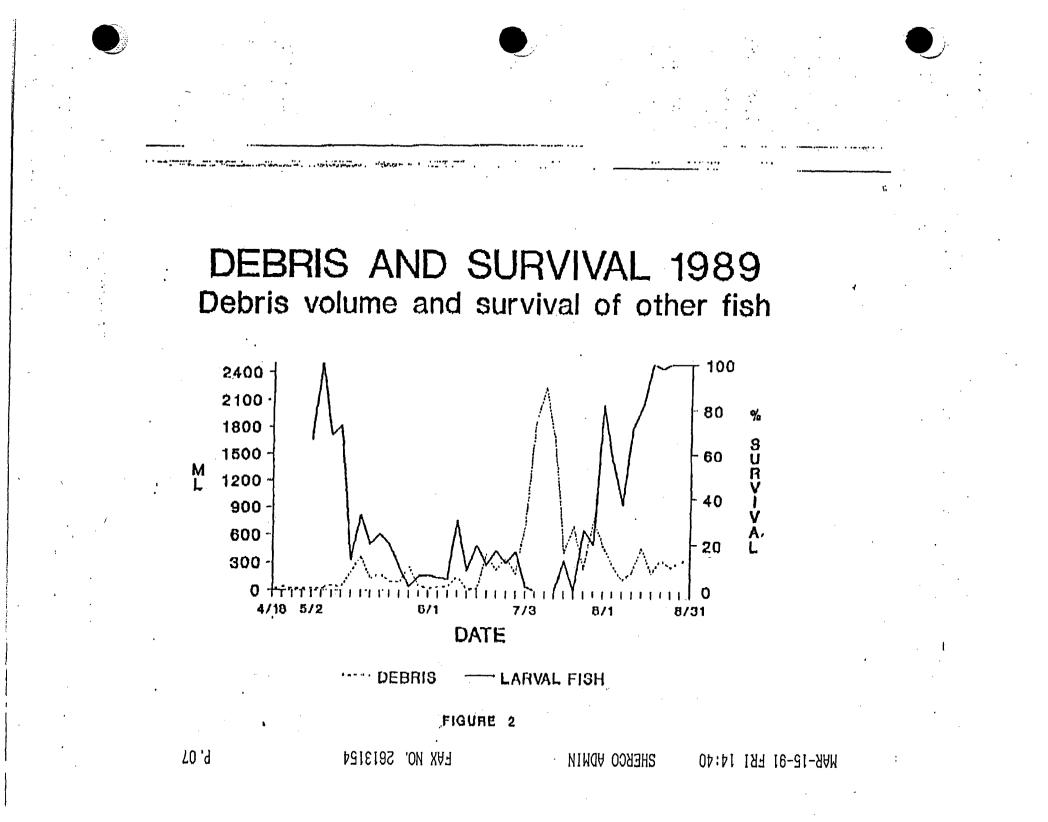


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PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING

AND

ECOLOGICAL STUDIES PROGRAM

PINGP-112

2000 ANNUAL REPORT

Prepared for:

Northern States Power Company d/b/a Xcel Energy Minneapolis, Minnesota

By

Environmental Services Water Quality Department

TABLE OF CONTENTS

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Water Temperature and Flow Section I

Summary of the Fish Population StudySection II

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SECTION I

PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2000 ANNUAL REPORT

WATER TEMPERATURE AND FLOW

(2) Support of the second structure of the second s Second secon second sec

Study and Report

by B. D. Giese and K. N. Mueller

Environmental Services Water Quality Department

WATER TEMPERATURE AND FLOW

INTRODUCTION AND METHODS

The Mississippi River is the source-water body for circulating and cooling water systems at the Prairie Island Nuclear Generating Plant (PINGP). This report presents daily plant operating hours, river inlet temperatures, site discharge temperatures and flows (blowdown). Site discharge temperatures are determined by thermocouples located downstream at U.S. Army Corps of Engineers Lock and Dam 3. Plant inlet (ambient river) temperatures are determined by remote sensors located in Sturgeon Lake, and the main channel at Diamond Bluff. Inlet temperatures are also recorded from thermocouples located in front of the intake screenhouse, which are maintained for back-up.

Also presented are daily and monthly average Mississippi River flows, as provided by U.S. Army Corps of Engineers at Lock and Dam 3. Other monthly averages reported include PINGP intake flows, and the percentage of Mississippi River water entering the plant. Data presented in this report are for environmental studies comparison, and are not intended as NPDES temperature compliance reporting.

172.

RESULTS AND DISCUSSION

Daily average river inlet and site discharge temperature data are presented by month in Table 1. Daily Mississippi River flows recorded at Lock and Dam 3 ranged from 4,500 to 33,200 cfs in 2000 (Table 2). Daily mean site discharge (blowdown) flows from the PINGP external circulating water log ranged from 148 to 1,208 cfs (Table 1).

PINGP withdrew an annual average of 8 percent of the Mississippi River flow during 2000 (Table 3). Table 4 shows the monthly average Mississippi River flows for the years 1983 through 2000. The average river flow in 2000 was 14,066 cfs, which was lower than the average river flow of 23,116 cfs in years 1983-1999. The range of annual average river flows is 8,709 cfs in 1988 to 37,787 cfs in 1986.

n an le saint i Chatal a seanna Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, wit recorded operating hours for Units 1 and 2 at PINGP in 2000.

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DATE OPERATING HOURS RIVER INLET SITE DISCHARGE MEAN SITE JANUARY UNIT 1 UNIT 2 TEMP. TEMP. DISCHARGE FLOW (oF) (oF) (oF) (oF) (BLOWDOWN-CFS) 1 24 24 33.3 36.8 949 2 24 24 33.7 36.6 949 3 24 24 32.8 36.0 949 4 24 24 32.4 36.0 949 5 24 24 32.8 36.0 949 6 24 24 32.5 35.9 949 7 24 24 32.1 35.6 949 8 24 24 32.5 36.4 949 8 24 24 32.5 36.4 949 9 24 24 32.7 36.9 949	
(oF) (oF) (bLOWDOWN-CFS) 1 24 24 33.3 36.8 949 2 24 24 33.2 36.6 949 3 24 24 33.7 36.8 949 4 24 24 33.7 36.8 949 5 24 24 32.8 36.0 949 5 24 24 32.4 36.0 949 6 24 24 32.5 35.9 949 7 24 24 32.1 35.6 949 8 24 24 32.5 36.4 949	
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12 24 24 32.2 35.9 955	
13 24 24 32.0 35.3 955	
14 24 24 32.2 35.7 955	
15 24 24 32.5 36.6 955	
16 24 24 32.2 36.9 955	
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22 24 24 32.3 36.6 949	
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26 24 24 31.7 35.7 949	,)
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28 24 24 32.0 36.2 949	۰.
29 24 24 32.1 35.8 949	
30 24 24 32.0 36.3 949	· · ·
31 24 24 32.4 36.6 949	
MONTHLY MINIMUM 31.6 35.3 949	
MONTHLY MAXIMUM 33.7 36.9 955	
MONTHLY MEAN. 32.4 36.1 950	



Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000.

FEBRUAF	RY UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW	1 + y. 1
			(oF)	(oF)	(BLOWDOWN-CFS)	·
						•
1	24	24	32.5	36.5	949	
2	24	24	32.3	36.4	949	
3	24	24	32.7	- 36.6	949	
4	24	24	32.6	36.9	949	
. 5	24	24	32.2	36.2	949	N
6	24	24	32.5	36.4	955	
7	24	24	32.6	36.3	945	
8	24	24	32.4	36.8	949	
9	24	24	32.9	36.5	949	
10	. 24	24	33.5	. 37.1	949	
11	24	24	32.0	36.2	949 .	**
12	24	24	32.3	36.4	949	÷
13	24	24	32.4	36.3	949	
14	24	24	32.9	36.6	949	
15	24	24	33.0	37.0	949	
16	24	24	32.2	36.6	949	:
17	24	24	32.6	37.0	. 949	
18	24	24	32.9	36.8	949	
19	24	24	33.1	37.1	949	•
20	24	24	33.1	37.3	949	
21	24	24	33.4	37.5	949	•
22	24	24	34.3	38.1	949	
23	24	24	35.1	38.7	949	
24	24	24	35.2	38.4	955	
25	24	24	35.9	37.5	- 955	
26	24	24	36.5	38.4	955	
27	24	24	36.7	37.9	955	
28	24	24	36.4	38.2	955	
29	24	24	38.1	39.0	979	
		· · ·			· ·	
	MONTHL	Y MINIMUM	32.0 `	36.2	945	
		(MAXIMUM	38.1	39.0	979	
		THLY MEAN	33.6	37.1	951	

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Page 2 of 12

Table 1. Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000.

DA' MA		OPERAT UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)	• •		
. /	1	24	24	37.0	38.2	973			
	2	24	24	35.9	37.2	979			
	3	24	24	36.0	37.4	979			
	4	24	24	36.6	37.8	979	·		
	5	24	24	37.0	38.6	979			
	6	24	24	38.5	39.2	979			
	7	24	24 .	39.3	41.1	979	•		
	8	24	24	41.1	43.3	1009			
	9	24	24	40.6	43.3	1015			
	10	24	24	39.8	41.9	1009			
	11	. 24	24	38.8	40.8	997			
	12	24	24	39.2	41.6	985			
	13	24	24	38.9	40.6	991			
	14	24	24	38.5	40.0	991			
	15	24	24	39.6	41.2	985			
	16	24	24	37.5	39.4	991	;	· · ·	
	17	24	24	36.9	38.7	973		5 C	
	18	24	24	38.3	39.7	979	-		
	19	24	24	38.4	39.9	979		*	
	20	24	24	38.5	39.8	979		. *	
	21	24	24	39.2	40.7	985	•		
	22	24	24	41.2	42.8	985		·	
	23	24	24	41.5	43.9	991			
	24	24	24	43.5	45.9	1009	1		
	25	24	24	42.6	45.6	1003		·	
	26	24	. 24	42.9	46.3	1009			
	27	24	24	43.4	45.7	1009	4. ¹ .		
	28	24	24	42.9	45.2	1009			
	29	24	24	42.5	45.1	1015	·		
	30	24	24	43.5	46.1	862			
·	31	24	24	45.9	48.6	418			
			LY MINIMUN		37.2	418	n an	•	
			Y MAXIMUN		48.6	1015			
		MON	THLY MEAN	J 39.9	41.8	969		· .	



	OPERATI UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARC TEMP. (oF)	GE MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)	
1	24 [·]	24 °	44.8	46.8	291	
2	24	24	46.9	48.2	291	
3	24	24	45.9	48.3	291	
4	24	24	44.0	46.0	291	
5	24	24	44.8	46.2	291	;
6	24	24	45.1	46.8	291	
7	24	24	45.7	47.3	283	
8	24	24	43.3	44.8	283	, in
9	24	24	44.5	45.8	283	
10	24	24	45.4	46.8	291	e e e e e e e e e e e e e e e e e e e
11	24	24	46.1	47.3	291	
12	24	24	45.3	46.1	283	
13	24	24	44.4	45.6	283	
14	24	24	47.1	48.0	227	
15	24	24	47.0	48.5	148	
16	24	24	46.1	47.2	148	;
17	24	24	44.5	45.2	148	
18	24	24	44.8	45.2	148	Х
19	24	24	46.8	47.0	148	р
20	24	24	46.3	47.1	148	
21	24	24	47.9	49.1	267	ул 1.
22	24	24	46.5	48.3	283	* *
23	24	24	48.5	50.3	291	
24	24	24	50.4	52.2	283	
25	24	24	51.6	53.9	283	
26	24	24	52.8	54.8	275	
27	24	24	54.7	56.3	291	
28	24	23	56.7	57.4	291	
29	24	0	57.1	58.7	259	
30	24	`O	56.4	57.9	148	
			,	· ·		
			· · · ·		4.40	
		LY MINIMUN		44.8	148	
		Y MAXIMUN	*. · ·	58.7	291	
	MON	ITHLY MEAN	N 47.7	49.1	251	a Ma

Table 1. Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000.

		 .					
DATE	OPERAT	ING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE	1 <u>1</u> 1	· · · · ·
	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW	κ.	
			(oF)	(oF)	(BLOWDOWN-CFS)		
				•			
1	24	0	60.1	60.4	151		
. 2	24	0	59.0	60.5	280		
3	24	0	61.9	63.2	291		•
4	24	0	62.7	63.9	283		
5	24	0	63.5	65.4	283		
6	24	0	65.8	67.3	283		
7	24	0	66.4	67.8	283		
8	24	0	67.5	68.7	283		•
9	24	0	65.2	66.3	291		
10	24	0	64.2	65.2	283	ť	
11	24	0	63.6	64.3	283	:	
12	24	0	63.3	64.1	299		· · · ·
13	24	0	60.6	62.2	283		<u>.</u>
14	24	0	57.6	58.3	283		-
15	24	0	58.1	59.1	275		
16	24	0	60.7	61.5	291		
17	24	0	60.5	61.4	283		
18	24	0	60.9	61.8	283		*
19	24	0	58.5	59.3	283		1. 1.
20	• 24	0	59.5	60.4	291		х. Х
21	24	0	61.3	62.2	291		2000 - 20000 - 20000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 -
22	24	0 2	63.6	64.4	299		· * *
23	24	0	65.5	66.3	291		· .
24	24	0	64.9	66.1	291		n gar
25	24	0	64.0	65.0	291		
26	24	0	65.9	66.6	291		
27	24	0	64.9	66.1	291		i i ji
28	24	0	63.5	63.8	291		241
29	24	· 0	62.0	63.0	299		
30	24	0	63.1	64.2	299	, \	
31	24	0	63.5	64.2	29 9		
					5 5 5 ¹⁹ 6		· ·
		ILY MINIMUN		58.3	151	te set d	8 ^{- 1} -
	MONTH	LY MAXIMUN		68.7	299		· .
	MO	NTHLY MEAI	N 62.6	63.6	284		

Table 1 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000.

Table 1 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000. •

DATE	OPERAT	ING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE			
JUNE	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW	¥		
		6 · ·	(oF)	(oF)	(BLOWDOWN-CFS)			
1	24	0	65.4	66.4	280			
2	24	0	64.5	65.4	. 372			
3	24	0	64.4	65.1	384			
4	24	0	65.4	66.4	396			
5	24	0	64.2	64.1	384			
6	24	0	63.3	64.2	384			
7	24	O,	65.2	66.2	396	- ,		
8	24	0	64.9	65.8	396			
9	24	0	68.6	69.7	396	•		
10	24	2	70.3	71.3	488			
11	24	24	72.0	72.9	500		ц. 1. 1.	1
12	24	24	71.6	72.9	488			
13	24	24	70.1	71.7	392			
14	24	24	71.4	71.4	392			
15	24	24	70.1	70.7	392			
16	24	24	69.0	70.8	768			
17	24	24	66.3	67.6	776			
18	24	24	67.0	68.2	776			
19	24	24	67.8	69.1	776			
20	24	24	69.1	70.3	760		-91	
21	24	24	69.3	69.0	776	1 •	-9. ₄	
22	24	24	68.0	69.0	776	2		
23	24	24	69.9	70.6	776	·**	N.	, ² *
24	24	24	70.8	72.1	776			
25	24	24	71.3	72.9	776			
26	24	24	71.8	73.2	776			
27	24	24	70.9	72.6	776		•	
28	24	24	71.5	72.9	776		÷.	
29	24	24	70.6	72.0	776			
30	24	24	71.9	73.1	776	` a		
			434					
	MONTHI	Y MINIMUM	63.3	64.1	280			
1	MONTHL	Y MAXIMUM	72.0	73.2	776			
	MON	THLY MEAN		69.6	589	```````````````````````````````````````		

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Table 1 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000.

DATE		ERATING HOURS		SITE DISCHARGE	MEAN SITE
JULY	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
			(oF)	(oF)	(BLOWDOWN-CFS)
1	24	24	74.8	76.3	776
2	24	24	73.6	75.5	1166
3	24	24	73.8	75.4	1166
4	24	24	74.0	75.8	1166
5 /	24	24	74.7	76.5	1166
6	24	24	76.9	78.1	1166
7	24	24	76.1	78.1	1166
8	24	24	76.0	77.6	1166
9	24	24	81.0	81.0	1166
10	24	. 24	78.9	80.1	1166
11	24	24	78.8	79.8	1166
12	24	24	79.3	80.3	1166
13	24	24	79.6	80.7	1166
14	24	24	79.6	80.6	1166
15	24	24	79.4	80.7	1166
16	24	24	80.0	81.0	1166
17	24	24	79.1	80.1	1166
18	24	24	76.9	77.9	1166
19	24	24	73.8	74.5	1166
20	24	24	74.3	75.1	1145
21	24	24	72.7	73.9	1124
22	24	. 24	73.5	74.2	1124
23	24	24	73.0	74.4	1145
24	24	24	73.1	74.9	1145
25	24	24	73.5	75.2	1166
26	24	24	74.2	76.0	1166
27	24	24	75.4	76.5	1166
28	24	24	76.0	77.7	1166
29	24	24	75.6	77.7	1166
30	24	24	75.4	77.5	1166
31	24	24	76.7	78.7	1166
				· .	
		MONTHLY MINIMUM	1 . 72.7	73.9	776
		MONTHLY MAXIMUM		81.0	1166
		MONTHLY MEAN	,	77.5	1149



Page 7 of 12

DATE AUGUST		PERATING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1 -	24	24	79.1	80.7	1166
2	24	24	78.0	79.7	1166
3	24	24	77.0	79.2	1166
4	24	24	77.0	79.0	1166
5	24	24	77.0	79.1	1187
6	24	24	75.3	77.5	1145
7	24	24	75.5	77.4	1145
8	24	24	76.8	78.6	1166
9	24	· 24	76.7	78.7	1166
10	24	24	77.2	78.8	1166
11	24	24	79.2	80.4	1187
12	24	24	78.7	80.1	1166
13	24	24	78.8	80.5	1166
14	24	24	79.6	80.9	1166
15	24	24	80.2	81.6	1166
16	24	24	78.3	78.8	1166
17	24	24	76.0	77.2	1166
18	24	24	74.1	75.1	1166
19	24	24	74.0	75.2	1187
20	24	24	74.0	75.1	1187
21	24	24	73.4	74.5	1187
22	24	24	73.6	74.5	1166
23	24	24	73.4	74.7	1166
24	24	24	· ^{···} 74.5	75.9	1166
25	24	24	75.1	76.4	1166
26	24	24	74.4	76.7	1187
27	24	24	75.8	77.2	1145
28	24	24	75.0	76.5	1187
29	24	24	74.8	75.2	1187
30	24	24	74.0	76.0	1187
31	24	24	75.0	77.6	1208
		MONTHLY MINIMUM	1 73.4	74.5	1145
		MONTHLY MAXIMUM	£ 80.2	81.6	1208
		MONTHLY MEAN	I 76.2	77.7	1171

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Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with
recorded operating hours for Units 1 and 2 at PINGP in 2000.

	3 A	• •	· · · · · ·	· · · · · · · · · · · · · · · · · · ·	
DATE	OI	ERATING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE
SEPTEMBER	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
			(oF)	(oF)	(BLOWDOWN-CFS)
1	24	24	74.8	77.4	1208
2	24	24	73.8	75.6	1208
3	24	24	73.0	74.1	1166
4	24	24	70.9	72.5	1166
5	24	24	70.8	72.4	1166
6	24	24	69.3	72.3	1166
7	24	··· 24	68.9	72.0	1166
8	24	· 24	68.5	70.7	1145
9	24	24	69.8	72.8	1124
10	24	24	70.9	73.7	1145
11	24	24	71.8	74.7	1166
12	24	24	70.6	73.8	1166
13	24	24	69.8	72.7	1166
14	24	24	70.1	73.9	1166
15	24	24	67.8	71.6	1145
16	24	24	67.8	70.8	1145
17	24	24	68.6	71.3	1166
18	24	24	68.8	71.4	1124
19	24	24	68.1	71.9	1145
20	24	24	67.0	70.4	1145
21	24	24	66.3	64.3	1145
22	24	24	63.1	66.5	1124
23	24	24	61.3	64.2	1145
24	24	24	59.9	63.3	1124
25	24	24	60.1	64.1	1103
26	24	24	59.7	64.9	1103
27	24	24	60.0	65.7	1145
28	24	24	60.6	65.3	1124
29	24	24	61.6	65.9	1124
30	24	24	62.1	66.9	1187
		MONTHLY MINIMU	JM 59.7	(3.3	1103
		MONTHLY MAXIMU		63.3 77.4	1208
					1208
		MONTHLY MEA	AN 67.2	70.2	1121

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000.

Table 1.

3.5

DATE	OPERATIN	IG HOURS	RIVER INLET	SITE DISCHARG	E MEAN SIT	Έ
OCTOBER	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE	LOW
	$\Omega_{2} = 1$		(oF)	(oF)	(BLOWDOWN	(-CFS)
1	24	24	_63.2	67.7	1187	
2	24	24	63.2	67.6	1166	
3	24	24	62.6	66.9	1166	
4	24	24	60.8	64.9	1166	
5	24	24	60.6	64.4	1166	
6	24	24	57.3	60.7	1145	
7	24	24	54.8	57.4	1124	
8	24	24	53.0	56.3	1124	· .
9	24	24	51.6	56.4	1124	
10	24	24	51.9	57.1	1124	
11	24	24	51.8	56.4	1124	
12	24	24	53.0	56.2	1166	
13	24	24	56.2	59.5	1166	
14	24	24	57.7	62.4	1166	
15	24	24	56.9	61.3	1166	
16	24	24	56.1	60.5	1166	
17	24	24	56.5	61.0	1166	
18	24	24	56.6	61.0	1166	
19	24	24	56.0	60.6	1166	
20	24	24	57.4	61.7	1187	
21	24	24	56.4	60.9	1166	
22	24	24	56.8	60.1	1145	
23	24	24	58.2	61.3	1145	
24	24	24	58.3	61.4	1145	
25	24	24	58.8	6 1.8	· 1145	
26	24	24	59.3	62.6	1145	
27	24	24	59.0	61.2	1145	
28	24	24	57.2	59.7	1145	
29	24	24	55.9	58.2	1145	*
30	24	24	54.9	57.9	1124	ч. ¹
31	. 24	24	54.8	56.9	1145	
	MONTHLY	MINIMUM	[51.6	56.2	1124	
	MONTHLY	MAXIMUM	[63.2	67.7 &	1187	
	MONT	HLY MEAN	57.0	60.7	(1) ≤ 1152	
		. 2	•	· · ·		, ,

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with
recorded operating hours for Units 1 and 2 at PINGP in 2000.

.

DATE NOVEMBER UN	OPERATING HOURS	TEMP.	SITE DISCHARGE TEMP.	MEAN SITE DISCHARGE FLOW
		(oF)	(oF)	(BLOWDOWN-CFS)
		-25	50.0	1145
1 2		56.4	58.8 58.0	1145
2 2		56.2		1124
	4 24	53.7	55.6	1145
	4 24	51.9	54.6	1124
1. i	4 24	51.3	54.3	1145
	4 24	51.4	53.8	1124
	4 24	51.3	52.7	1124
	4 24	47.7	48.4	1124
9 2	4 24	46.6	47.7	1124
10 2	24 24	45.4	46.3	1110
11 2	24 24	45.3	45.6	1096
12 2	24 24	45.3	45.7	1096
13 2	24 24	45.1	45.6	1096
14	24 24	43.9	44.3	1096
15	24 24	41.9	42.8	1054
16	24 24	40.8	41.3	979
17	24 24	40.4	40.7	973
18	24 24	38.6	38.7	955
	24 24	38.1	38.4	873
	24 24	36.9	37.2	873
	24 24	35.9	36.6	872
	24 24	36.0	35.8	··· 865
	24 24	35.3	35.7	865
	24 24	35.1	35.3	865
	24 24	35.3	35.7	765
	24 24	35.3	35.9	865
	24 24	35.6	36.2	872
	24 24	34.8	35.0	872
	24 24	36.2	36.4	865
	24 24	36.1	36.6	872
50	27 27		2010	
.`	MONTHLY MINIMU	M 34.8	35.0	765
	MONTHLY MAXIMUT		58.8	1145
	MONTHLY MEAD		43.7	999

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with
recorded operating hours for Units 1 and 2 at PINGP in 2000.



DATE DECEMBER U		PERATING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	22	24	35.9	37.2	865
2	0	24	35.4	35.5	462
3	0	24	33.6	34.2	402
4	Ö	24	34.4	34.4	412
5	0	24	31.8	33.3	413
6	0		32.3	33.6	402
7	0	24 24	32.4	33.8	402
8	0	24	32.2	33.6	402
9	· •	24	32.4	33.6	402
10	. 0	24	32.5	33.7	413
11	0	24	31.9	33,0	402
12	0	24	31.8	32.6	402
13	6	24	32.0	33.1	444
14	24	24	32.2	34.0	538
15	. 24	24	32.3	35.2	696
16	. 24	24	32.4	35.4	684
17	24	24	32.0	35.2	684
18	24	24.	32.1	35.1	684
19	24	24	31.9	34.6	684
20	24	24	32.2	34.3	684
21	24	24	31.9	34.3	696
22	24	24	31.7	34.4	696
23	24	24	32.0	34.7	720
24	24	.24	31.7	34.5	732
25	24	24	31.5	34.2	732
26	24	24	32.3	35.0	720
27	12	24	32.1	35.1	720
28	0	24	32.3	34.8	720
29) o	24	32.3	35.0	732
30	0	24	32.3	34.4	732
31	0	24	32.3	34.7	732
		MONTHLY MINIMUM	31.5	32.6	402
		MONTHLY MAXIMUM	35.9	37.2	865
		MONTHLY MEAN	32.5	34.4	594

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2000.

Table 1.

		·	۰. ب	Daily 20	00 Mississippi	Table River Dischar		cfs) at Lock D:	um 3			
	TANT	TRD	MAR	APR				•		OCT	NOU	DEC
1	JAN 10400.	FEB 8700.	28200.	19000.	MAY 14400.	JUN 19300.	JUL 18900.	AUG 11900.	SEP 6900.	OCT	NOV	DEC
2	10400.	8700. 8500.	28200. 25500.	18800.	13200.	20300.	16800.	12000.	7800.	5400.	9300.	14300.
2	10400.	8500. 8500.	25300. 26900.	17400.	12100.	20300.	17800.	12000.	7700.	5500. 5500	11300.	15200.
° 4	10400.	8500.	28900.	16200.	11100.	20100.	17800.	9600.		5500.	13500.	13400.
4 5	10700.	8300 . 8400.	28400. 28900.	15900.	11400.	26000.	16700.	9500. 9500.	14400.	6300.	11300.	10900.
6	10400.	8500.	28900.	17000.	12000.	26000. 26700.	14800.	8300.	8600.	6900. 5400	11300.	9300.
6 7	10700.	8600.	26600.	16000.	12000.	28700. 27400.	14800.	9800.	4500. 5300	5400.	12400.	8100.
8	9000.	8500. 8500.	26800.	16000.	12100.	27400.	14700.	9700.	5300.	5500.	19300.	8200.
° 9	9000. (ss.)	8600.	26200.	15500.	13300.	27700.	20900.	11100.	8200. 8000.	5400.	20700.	8100.
9 10	8900.	8400.	24000.	15300.	13100.	27900.	25800.	10900.	6200.	5400.	18600.	8100.
10	10800.	7800.	24000.	15500.	13200.	27300.	23800.	8000.	8200. 8400.	5400. 6200.	20200. 22400.	8400.
11	10500.	7700.	23700.	15100.	18600.	24800.	25900.	8000.	8900.	6700.		8900. 8100
- 13		7800.	25600.	13400.	21300.	20100.	30100.	8200.	7800.	6700.	23600.	9100. 8600
13	8500.	7800.	25700.	13800.	20000.	19200.	32200.	8200.	5800.		23200.	8600.
14	8400.	7700.	23700.	14500.	20000.	19200.	33200.	8300.	5800. 5100.	5400. 6200.	23500.	7200.
15	8500.	7800.	24800.	14300.	20000.	15800.	33200. 33200.	8200.			23000.	7200.
18	8100.	7800.	20700.	14300.	20900.	17100.	32000.	7300.	5200.	5400.	23300.	8200.
	7900.		20700. 19800.	14400.	22300. 22300.	16500.	32000.		7500. .	5400.	23800.	8500.
_ 18 19	7900. 8000.	7800. 7700.	19800.	13000.	22300.	18300.	29500.	12100. 14900.	7500.	6200.	22500.	8500.
19 20			17500.	15200.	23300.	18400.	29500.		5400.	6800.	22200.	9600.
	· · · · · · · · · · · · · · · · · · ·	7700. 7600.	17700.	15200.	22700.	19400. 22000.		11900. 10800.	5500.	6900. 7500	21000.	10100.
21 22	8100. 8000.		15800.	15200.	22300. 24800.	22000. 22100.	23800.		5500.	7500.	18700.	10100.
22	8000. 8000.	7700.	15700.	13200.	24800.	23900.	21200. 20400.	11200. 10600.	6100.	7400.	14000.	10000.
		8500.	15200.	16000.					6100.	7500.	14100.	9700.
24	7800.	10500.	16600.		27400.	24100. 23000.	16400.	10100.	6000.	8200.	14200.	9500.
25	8100.	12400.		16500.	26100.		12700.	10100.	5300.	8200.	14200.	9400.
26	8100.	13300.	16200.	17400.	25700.	23100.	13300.	10100.	5300.	8200.	13300.	9600.
27	8100.	14800.	17100.	16500.	23400.	22000.	15900.	12100.	5400.	9100.	13200.	9500.
28	8100.	17500.	19800.	16700.	22000.	21400.	14500.	11700.	5400.	8900.	16000.	9400.
29	8200.	21800.	21000.	14500.	197000.	20100.	12500.	8800.	5400	8700.	15700.	9900.
30	8300.		21400.	14300.	16900.	19800.	13600.	7400.	5400.	8700.	14100.	9900.
31	8300.		21000.		19500.		13400.	7400.		9500.		
MIN:	7800.	7600.	15000.	13000.	11100.	15800.	12500.	7300.	4500.	5400.	9300.	7200.
MAX:	10800.	21800.	28900.	19000.	27400.	27900.	33200.	14900.	14400.	9500.	23800.	15200.
MEAN	8974.	9548.	22219.	15570.	18839.	22070.	21052.	10026.	6687.	6790.	17463.	9558.

YEAR MAX. YEAR MIN. 33200.

4500.



Table 3

2000 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

	Mean Plant Flow		Percentage of Mean River Flow
Month	(cfs)	(cfs)	Entering the Plant Intake
January	950.2	8,974	10.5%
February	951.1	9,548	9.9%
March	968.5	22,219	4.3%
April	251.0	15,570	1.6%
May	283.8	18,839	1.5%
June	588.5	22,070	2.6%
July	1148.7	21,052	5.4%
August	1171.4	10,026	11.6%
September	1150.6	6,687	17.2%
October	1152.5	6,790	16.9%
November	998.6	17,463	10.4%
December	593.8	9,558	6.2%
Averages	850.7	14,066	8.1%

Month	2000	1999	1998	1997	1996	1995	1994	1993	1992
January	8,974	10,790	9,806	14,823	14,826	11,365	13,090	9,326	15,658
February	9,548	12,589	14,911	13,954	15,041	9,371	12,611	8,936	13,978
March	22,219	17,897	26,574	24,177	24,474	29,061	28,542	12,513	43,661
April	15,570	42,013	51,477	106,073	57,517	48,507	40,830	55,473	32,668
May	18,839	47,426	22,681	39,316	46,535	45,135	47,548	48,571	25,474
June	22,070	34,423	25,690	19,487	33,790	30,667	26,913	65,377	17,920
July	21,052	27,548	26,477	36,119	23,732	27,323	29,403	84,123	28,985
August	10,026	24,432	10,742	28,074	13,303	29,129	19,971	41,135	14,532
September	6,687	18,013	7,060	16,663	9,300	19,860	21,203	30,717	15,686
October	6,790	14,200	12,597	14,155	11,403	31,061	25,581	19,516	15,374
November	17,463	13,243	19,773	14,160	23,353	30,703	20,173	18,773	19,076
December	9,558	9,671	15,645	12,694	18,716	17,494	14,432	16,490	12,126
Averages	14,066	22,687	20,286	28,308	24,333	26,710	25,025	34,246	21,262
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Month	1991	1990	1989	1988	1987	1986	1985	1984	1983
January	5,542	4,965	6,294	7,303	13,758	13,710	12,526	13,375	14,260
February	5,879	4,889	6,529	7,634	12,586	12,804	10,239	18,557	13,375
March	15,081	17,484	11,300	14,810	17,287	24,790	32,265	27,290	55,276
April	34,268	12,842	33,264	21,463	20,267	84,870	45,317	56,277	56,239
May	44,753	22,310	24,287	13,119	13,655	81,242	43,518	49,528	38,155
June	44,960	31,610	13,237	4,667	14,573	37,043	30,105	55,613	24,404
July	33,856	20,323	7,690	2,903	11,674	34,684	25,676	37,165	36,353
August	21,535	16,322	4,658	5,103	10,477	30,813	18,226	13,826	14,141
September	25,182	9,923	8,307	6,080	7,183	41,957	29,665	9,678	14,213
October	15,458	11,135	6,358	7,019	7,771	49,319	39,590	23,866	17,536
November	22,467	9,903	6,793	7,919	8,693	24,260	21,337	21,157	18,108
December	20,503	6,184	4,961	6,487	9,016	17,774	16,094	15,903	16,729
Averages	24,124	13,991	11,140	8,709	12,245	37,787	27,047	28,519	26,566

Table 4. Mean Monthly Mississippi River Flow for 1983 - 2000, in cubic feet per second (cfs).

Note: Mean monthly river flow data for the years 1985, 1990, 1991 and 1992 have been adjusted to reflect the averages found in Table 2 of the corresponding annual report for each year.

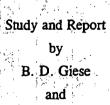




SECTION II

PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2000 ANNUAL REPORT

SUMMARY OF THE 2000 FISH POPULATION STUDY



K. N. Mueller

Environmental Services Water Quality Department

SUMMARY OF THE 2000 FISH POPULATION STUDY

INTRODUCTION

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To fulfill part of the continuing environmental monitoring requirements of the Prairie Island Nuclear Generating Plant, (PINGP), the Mississippi River fisheries population was sampled near Red Wing, Minnesota, May through October, 2000. The study area extends from 3.6 miles upstream of the plant (River mile 802) to 10.8 miles downstream of the plant (River mile 787.5), (Figure 1). The original objective of the study was to "determine existing ecological characteristics before plant operation and to assess any significant changes to the aquatic environment after operation" (NSP 1972). The objective was changed slightly after the plant became operational in 1973; to "determine environmental effects of the PINGP on the fish community in the Mississippi River and it's backwaters" (Hawkinson 1973). Presently, the objective is to monitor and assess the status of the fishery in the vicinity of the PINGP (Mueller 1994). Parameters analyzed and compared to previous years include species composition, length-weight regressions, percent contribution (fish/hr), length-frequency distributions, and catch per unit effort (CPUE) for selected species.

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METHODS AND MATERIALS

Fish were collected using a Smith-Root SR-18 Electrofishing boat equipped with a 5.0 GPP electrofishing unit (Figure 6). The power source was a 5.0 GPP generator. The 5000 watt generator has a maximum output of 16 amps, and a range of 0-1000 volts. The generator has the capability to be either pulsed AC or DC with a pulse frequency of 7.5, 15, 30, 60, and 120 Hz. The annode consists of two umbrella arrays, each with four dropper cables. The 18 foot boat and dropper cables hung from the front of the boat serve as the cathode. Collection occurred during daylight hours with a pulsed direct current. Due to the constantly changing river conditions, Electrofisher output was varied to enhance the effectiveness.

Sampling was done monthly, May through October, within four established sectors of the study area (Figures 1-5). The runs within each sector are similar to previous years sampling to ensure a similar set of relative data indices for yearly comparison. At the end of each "run", the elapsed shocking time was recorded from a digital timer, which only tallied the seconds that the electrical field was energized. A run was terminated after approximately 450 seconds shocking time or when the end of the prescribed run was reached.

Stunned fish were captured with one-inch stretch mesh landing nets equipped with eight-foot insulated handles. Fish were placed in live-wells, supplied with river water constantly, until the end of each run. At the end of each run fish were identified, measured to the nearest millimeter (total length), weighed to the nearest 10 grams, and released. Parameters used to describe the fisheries include species

composition, length-weight regressions, percent contribution, length-frequency distributions, and catch per unit effort (CPUE). It is assumed that population dynamics and spatial distribution is represented by CPUE.

Electrofishing CPUE was computed as numbers of fish per hour for each sector. Length frequencies in 20 millimeter intervals were calculated for all fish species. Length-weight relationships were calculated using the length-weight formula:

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 $\log W = \log a + b \log L,$

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where W is the weight in grams, a is the y axis intercept, b is the slope of the regression line, and L is the total length in millimeters.

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Initial PINGP preoperational annual environmental reports simply listed all data collected without discussion or analysis (NSP 1972). Individual species were not discussed, due to the amount of data collected during initial sampling efforts. Representative species were selected in 1975 for abundance comparisons based on electrofishing data (Gustafson et. al. 1975), modified in 1986 after seining was eliminated (Donkers 1986), and in 1989 smallmouth and largemouth bass were added as they "have been seen more frequently in the electrofishing catch during recent years in the PINGP study area" (Mueller 1989).

Electrofishing collection methods changed before the 1982 sampling season. The mesh size of the dip nets was increased to one inch stretch mesh. The larger mesh size enabled small adult fish and some young of the year fish of certain species to avoid collection. Currently, individual gizzard shad, freshwater drum, and white bass less than 160 mm are not collected. Also, logperch and cyprinids (other than carp) are no longer collected, due to their small size (Donkers 1987). Therefore, a direct comparison of electrofishing CPUE prior to 1982 is inappropriate to later years.

A total of 9,683 fish, comprising 38 species, was collected in the 2000 survey (Table 1).

Northern hogsucker, orangespotted sunfish, and musky were sampled in 2000, but not in 1999. Saugeye, goldeye, brown trout, chestnut lamprey and yellow perch were collected in 1999 (Giese and Mueller 1999), but not in 2000.

All species collected in 2000 are ranked according to electrofishing CPUE and listed in Table 2. Summaries for selected species (Tables 3-9) are based on electrofishing and trapnetting data for years 1977 through 1987, and on electrofishing data only for years 1988 through 2000, since trapnetting was discontinued after 1987 (Orr 1988). Annual CPUE for selected species is compared to previous



years (Figures 15-22), by sector (Figures 23-30), and by date (Figures 31-38). The top three abundant 45 species, based on CPUE, was determined for each sector.

	Sector One;	shorthead redhorse, carp and freshwater drum
·	Sector Two;	carp, gizzard shad and shorthead redhorse
• • • *	Sector Three;	white bass, gizzard shad and carp
$\dot{M} = \frac{1}{2} e^{-\frac{1}{2}}$	Sector Four;	white bass, gizzard shad and carp
心战。	Overall CPUE Average;	gizzard shad, white bass and carp
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Table 10 summarizes the percent contribution of historically predominant species in the annual catch. Length frequency distributions for selected species are illustrated by sector in Figures 7a through 14b.

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DISCUSSION

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When dealing with a large river environment, a high degree of natural variability exists in habitat conditions and therefore, in fish distribution. Palmquist (1982) proposed the wide range in species abundance between study sectors was largely due to habitat preferences of a species rather than PINGP induced. A high degree of variability in species abundance exists within sectors from year to year. Differences in collection efficiency and year class strengths may explain this variability.

A qualitative and quantitative discussion for selected species, with respect to other years, includes: 1) CPUE, 2) rank, 3) percent composition of catch, 4) population condition as depicted by length-weight regression analysis, and 5) mean length.

Average mean length was calculated by splitting the length data for each species into 20 mm intervals and multiplying the number of fish in each interval by the median length of that interval (Example: The number of fish in the 260-279 mm interval was multiplied by 270 mm). Interval totals were summed, divided by the total number of fish, and rounded to the nearest 10 mm.

GIZZARD SHAD

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Electrofishing CPUE for gizzard shad increased almost 50% from a previous high of 27.12 fish/hr in 1999 to 40.85 fish/hr in 2000 (Figure 15). CPUE increased in all sectors, except Sector 4, from 1999 to 2000 (Figure 23). CPUE was also examined on each sampling date for 2000, with the highest occurring in Sector 3 in May (Figure 31).

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Shad increased in rank from 24th in 1997 to eleventh in 1998 to fourth in 1999 to first in 2000 (Table 2). This is the first time since the study began that carp was not the species with the highes overall CPUE. Presently, adult gizzard shad comprise seventeen percent of the catch (Table 10). This dramatic increase supports the statement made in the 1998 annual report that many small gizzard shad (<160 mm) were observed while electrofishing, but were too small to collect (Giese and Mueller 1998).

The general condition of gizzard shad, 3.274, falls into the range of previous years, 2.38 to 3.46 from 1982-1999 (Table 3). Carlander (1969) sites a population in Canton Lake, Oklahoma with a range in total fish length of 173 to 335 mm and a regression slope of 3.066 which compares well to the fish in this study. The mean length for gizzard shad (290 mm) remained the same from 1999 to 2000 (Table 3). The length frequency data indicates a range of 180-410 mm, with peaks ocurring at approximately 250 mm upstream of the plant and 300 mm downstream of the plant (Figures 7a and 7b).

FRESHWATER DRUM

Freshwater Drum CPUE for 2000, (19.88 fish/hour) decreased from a high of 45.53 fish/hr in 1999 (Table 4) Presently, CPUE is similar to 1997 and 1998 (Figure 16). The highest CPUE in a sector for any date occurred in Sector 3 in May (Figure 32).

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Freshwater drum CPUE ranked fifth in 2000 (Table 2). Presently, adult freshwater drum comprise eight percent of the catch (Table 4),

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The general condition of freshwater drum has remained relatively stable, as depicted by a regression slope of 3.077 in 2000, in comparison to a range of slopes of 2.598 to 3.171 from previous years of the study (Table 4). The mean length for freshwater drum was approximately 310 mm in 2000 (Table 4). The length frequency data for freshwater drum suggest that a peak occurs at approximately 300 mm (Figures 8a and 8b).

SHORTHEAD REDHORSE

Electrofishing CPUE for shorthead redhorse has ranged from 7.07 to 24.52 fish/hour (Figure 17). CPUE for 2000 (25.94 fish/hr) was the highest recorded since the study began (Table 5). Historically, the CPUE within each sector is highly variable (Figure 25). The 2000 CPUE is also variable between sectors, ranging from 13.43 fish/hour in Sector 4, to 35.64 fish/hour in Sector one (Table 2). CPUE for each sector is highly variable during the collection year, with the highest CPUE occurring in Sector 1 in May (Figure 33).

Shorthead redhorse ranked fourth in 2000 (Table 2). There were 1,099 individuals collected during 2000. Presently, adult shorthead redhorse comprise eleven percent of the catch (Table 5).

The general condition of shorthead redhorse has remained relatively stable, as depicted by a regressionslope of 2.905 in 2000, in comparison to a range of slopes of 2.571 to 3.041 from previous years of the study (Table 5). The length-weight regression slope of shorthead redhorse in the vicinity of Prairie Island is about the same as that of another population of Upper Mississippi River shorthead redhorse as reported by Carlander (1969) as having a slope of 2.83. The mean length for shorthead redhorse at Prairie Island increased from approximately 350 mm in 1999, to approximately 360 mm in 2000 (Table 5). The length frequency data show that the main peak occurs at approximately 350 mm upstream and 400 downstream of the plant (Figures 9a and 9b).

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WHITE BASS

Electrofishing CPUE for white bass has ranged from 9.70 to 35.91 fish per hour; however, 2000 had the highest recorded CPUE, 39.90 fish/hour (Figure 18), topping the previous record of 35.91, set in 1999. A large difference in CPUE was evident comparing upstream of Lock and Dam 3 to downstream of Lock and Dam 3 (Table 2). Year to year variability within each sector is also evident (Figure 26). Sector 3 had the highest CPUE for any date in May with 250+ fish/hr (Figure 34).

White bass was second in rank in 2000 (Table 2). Although carp historically has had the highest CPUE overall, carp ranked third in 2000 behind gizzard shad and white bass (Table 2). Presently, adult white bass comprise sixteen percent of the catch, and the number of individuals collected (1,602) is the an sa sa sa highest since 1982 (Table 6).

The general condition of white bass has remained relatively stable, as depicted by a regression slope of 2.963 in 2000, in comparison to a range of slopes of 2.441 to 3.064 from previous years of the study (Table 6). The mean length for white bass is similar to the last five years (Table 6). The length frequency data shows that a main peak occurs for white bass at approximately 350 mm downstream, and a wide band between 230-310 mm upstream, with a smaller peak at approximately 380 mm upstream (Figure 10a, Figure 10b). A second se

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Electrofishing CPUE for walleye in 2000 was the highest recorded for the study, 7.72 fish/hour, eclipsing the old record of 7.63 fish/hour set last year (Figure 19). Historically, Sector 3 has had the highest CPUE, but there is a high degree of variability within all sectors since 1982 (Figure 27). It appears that the CPUE for each sector was highest in October (Figure 35). The highest CPUE for any sector on any date was Sector 3 in October (45 + fish/hr).



Walleye ranked eighth in 2000 in overall catch abundance (Table 2). Presently, adult walleye comprise three percent of the catch, and the number of individuals collected is the highest recorded since the study began (Table 7).

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The general condition of walleye has remained relatively stable, as depicted by a regression slope of 3.250 in 2000, in comparison to a range of slopes of 2.852 to 3.318 from previous years of the study (Table 7). The mean length for walleye has steadily increased from 1995 to a present length of approximately 460 mm (Table 7). The length-weight relationship indicates a peak occurring at approximately 200 and 450 mm, although it is not very distinct (Figure 11a-11b).

SAUGER

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Electrofishing CPUE for sauger decreased from a high of 18.26 fish/hr in 1999 to 9.81 fish/hr in 2000 (Figure 20). Sauger CPUE for each sector in 2000 decreased from the record levels of 1999 (Figure 28). Sauger CPUE for all sectors increased from May to June, then decreased from June to August. Sector 3 had the highest CPUE in June of any sector on any date (Figure 36).

Sauger ranked seventh in 2000 (Table 2), comprising 4 percent of the catch, which is the dowest recorded since 1994 (Table 8).

The general condition of sauger has remained relatively stable, as depicted by a regression slope of 3.306 in 2000, in comparison to a range of slopes of 2.65 to 3.34, in previous years of the study (Table 8). The mean length for sauger was approximately 280 mm in 2000 (Table 8). The length frequency data exhibit a range from 150-510 mm, with a relatively broad peak occurring at approximately 270 mm (Figures 12a and 12b).

SMALLMOUTH BASS

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Electrofishing CPUE for smallmouth bass appears cyclic with the peak CPUE (17.02 fish/hour) occurring in 2000 (Figure 21). CPUE in Sectors 1-3 appear cyclic and similar in shape to Figure 21, while Sector 4 CPUE is relatively low and the trend is not as definite (Figure 29). The highest CPUE occurred in Sector 3 in October, while Sector 1 CPUE was uniform throughout the year (Figure 37).

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Smallmouth bass ranked sixth in 2000 (Table 9), comprising seven percent of the catch. The population of smallmouth bass appears to be in good general condition as depicted by a regression line slope of 3.032, which compares well with smallmouth bass populations provided by Carlander (1977). Smallmouth bass have a length frequency range of approximately 90-470 mm, with a peak occurring at approximately 200 mm upstream, and a relatively broad peak occurring between 270 and 380 mm downstream (Figures 13a and 13b).



LARGEMOUTH BASS

Electrofishing CPUE for largemouth bass appears less variable than smallmouth bass due to the small numbers of fish captured (Figure 22). The largemouth bass CPUE for 2000, (4.67 fish/hour), is the highest since 1988 (Table 9). The CPUE for Sector 1 was virtually zero for all sampling dates, while Sectors 2-4 have a little more variability (Figure 30). The highest CPUE occurred in Sector 3 in October (Figure 38).

Largemouth bass rank increased from thirteenth in 1999, to eleventh in 2000 (Table 9), comprising 2 percent of the catch. Historically, largemouth bass rank has varied greatly, ranging from 9th to 20th (Table 9).

The population of largemouth bass appears to be in good general condition as depicted by a regression line slope of 3.101, which compares well with information on largemouth bass populations provided by Carlander (1977). The length frequency data indicates a range of 130-470 mm, with a peak occurring at approximately 280 mm (Figures 14a and 14b).

GENERAL

The ten most abundant species collected during 2000 in descending order, based on average CPUE for all sectors combined were: 1) gizzard shad, 2) white bass, 3) carp, 4) shorthead redhorse, 5) freshwater drum, 6) smallmouth bass, 7) sauger, 8) walleye, 9) bluegill, and 10) black crappie (Table 2).

Total average CPUE for all species and sectors combined decreased from 265.64 fish/hr in 1999, to 243.29 fish/hr in 2000.

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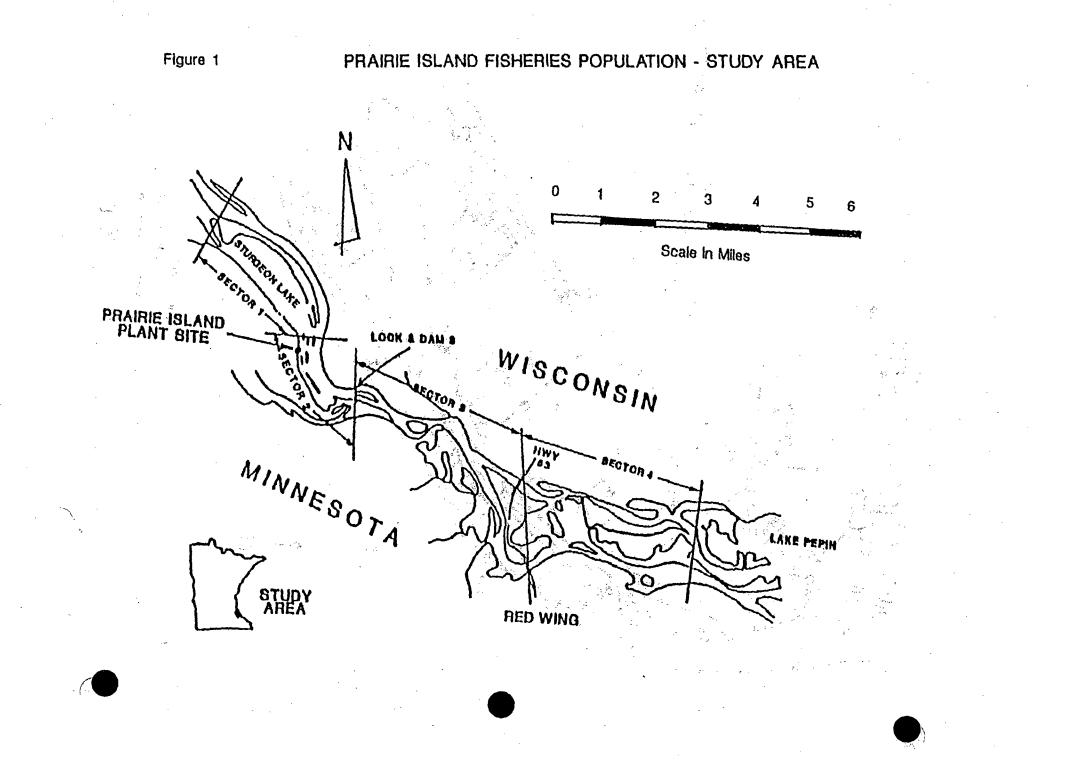
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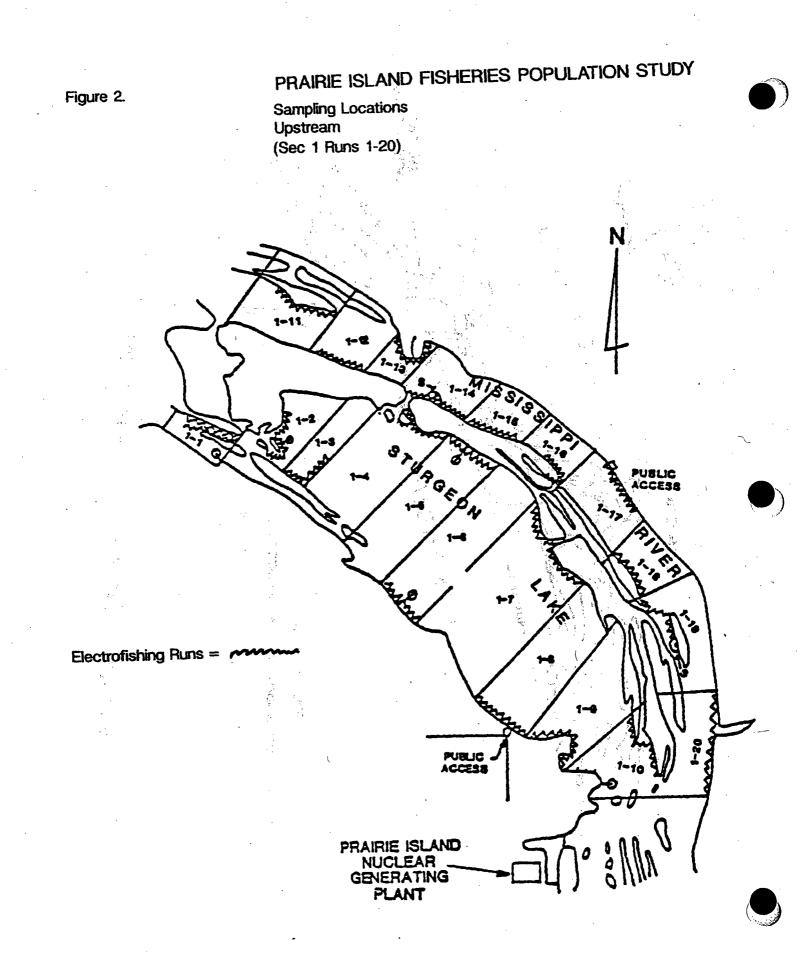
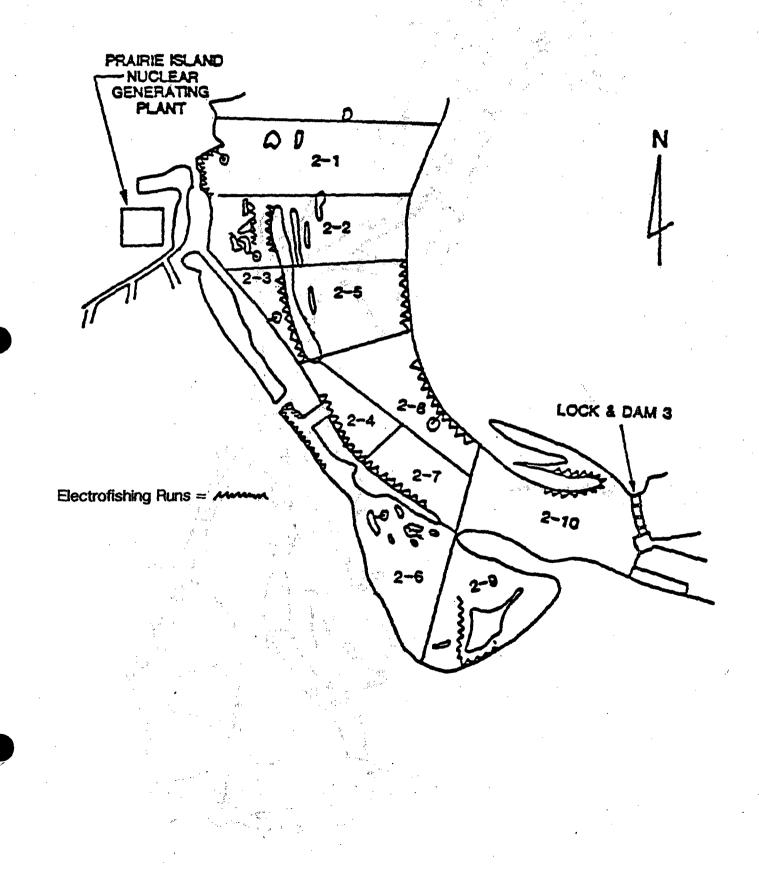




Figure 3.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations Plant Area (Sec 2 Runs 1-10)



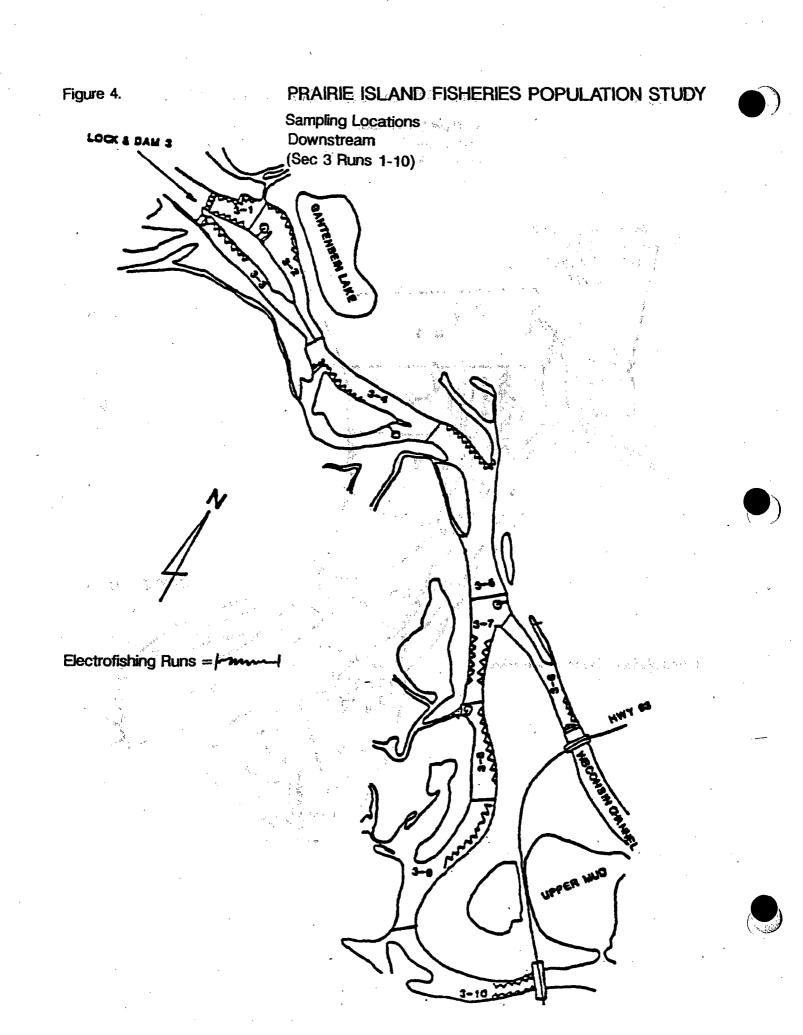
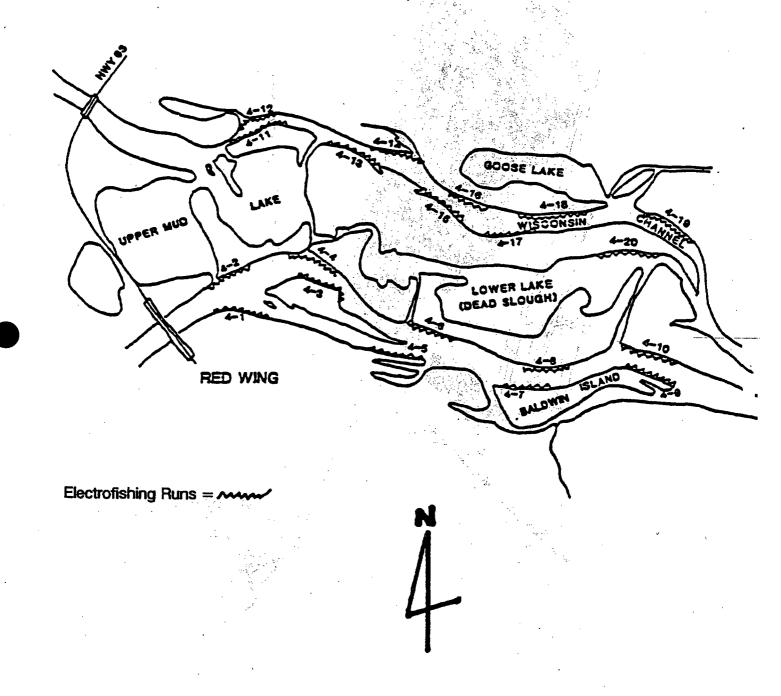


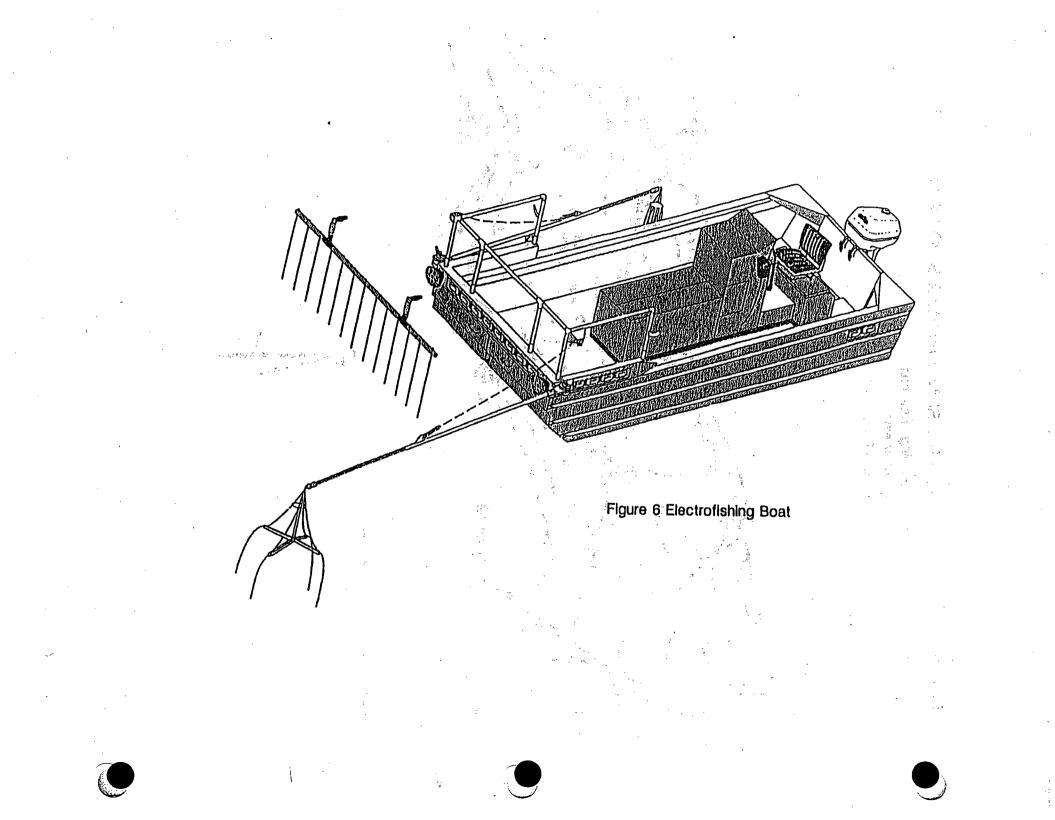


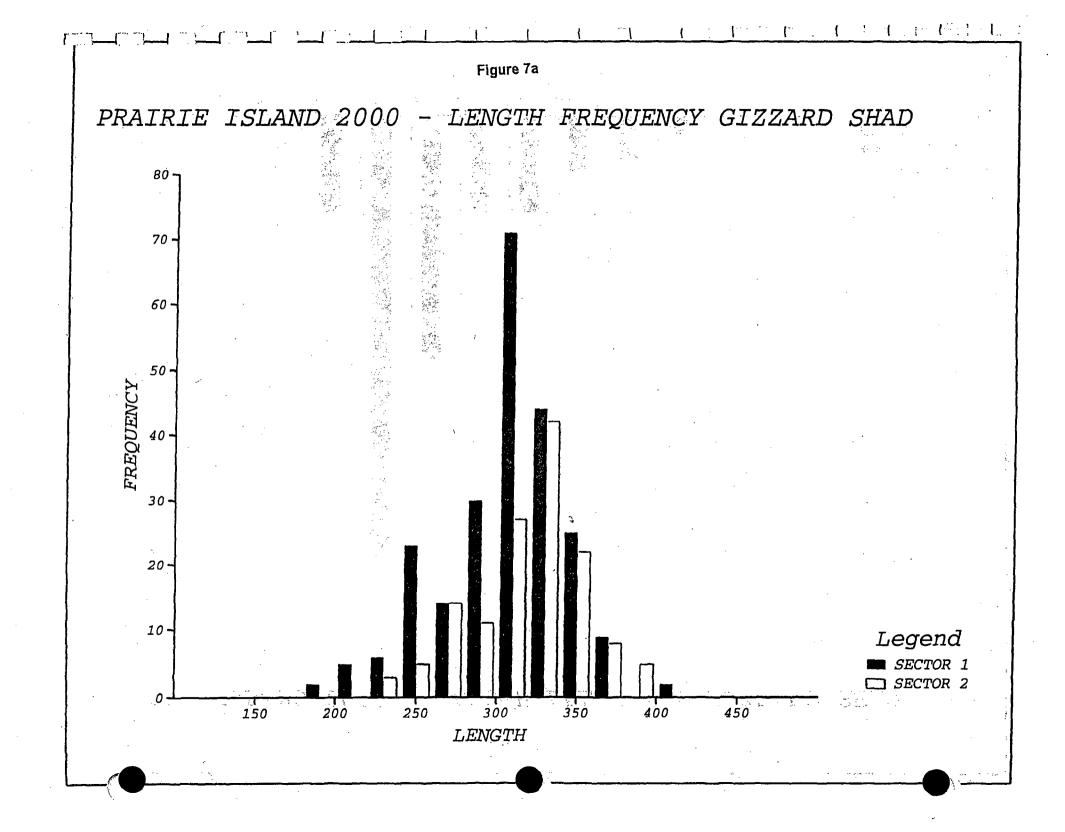
Figure 5.

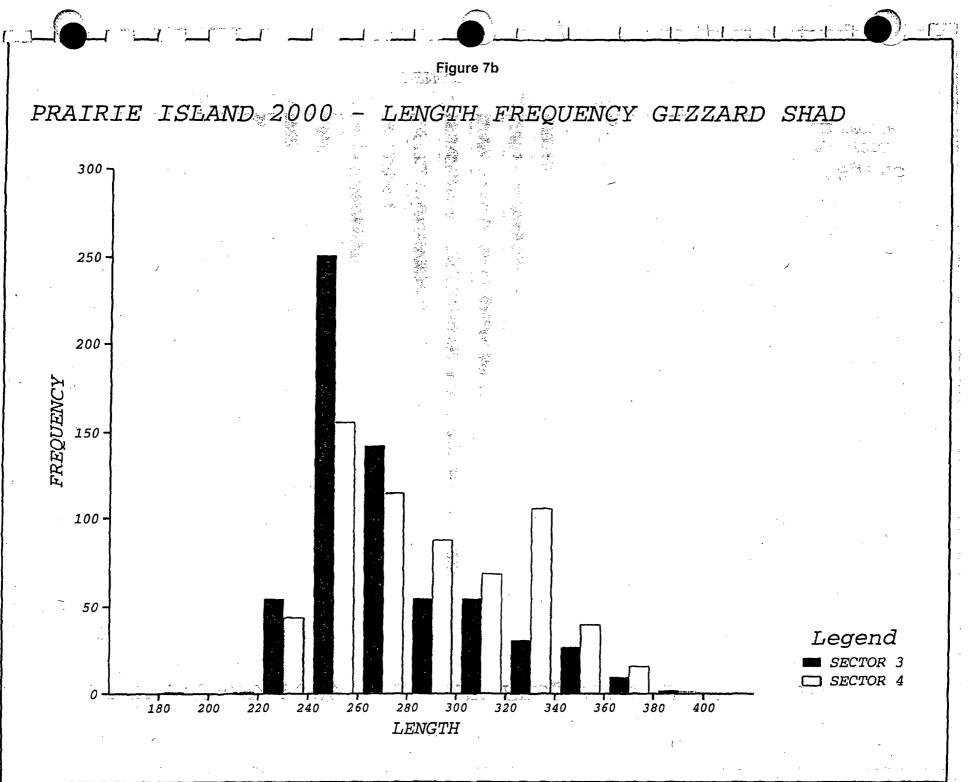
PRAIRIE ISLAND FISHERIES POPULATION STUDY

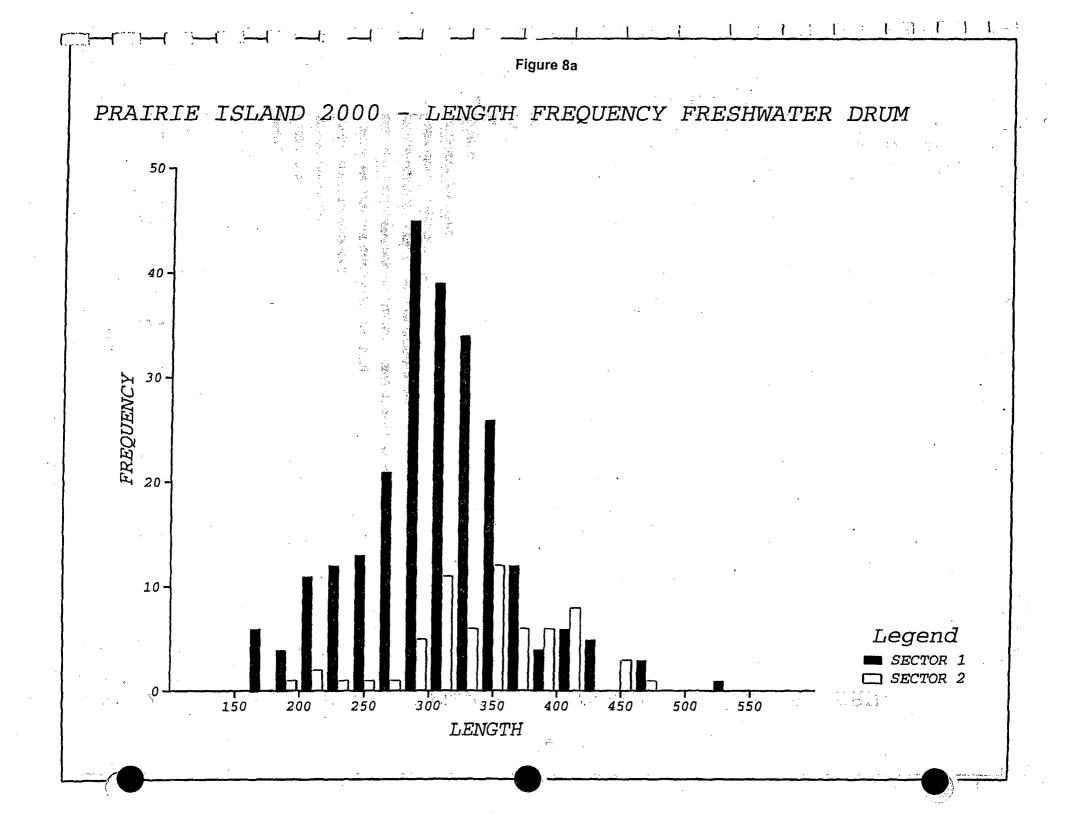
Sampling Locations Downstream (Sec 4 Runs 1-20)

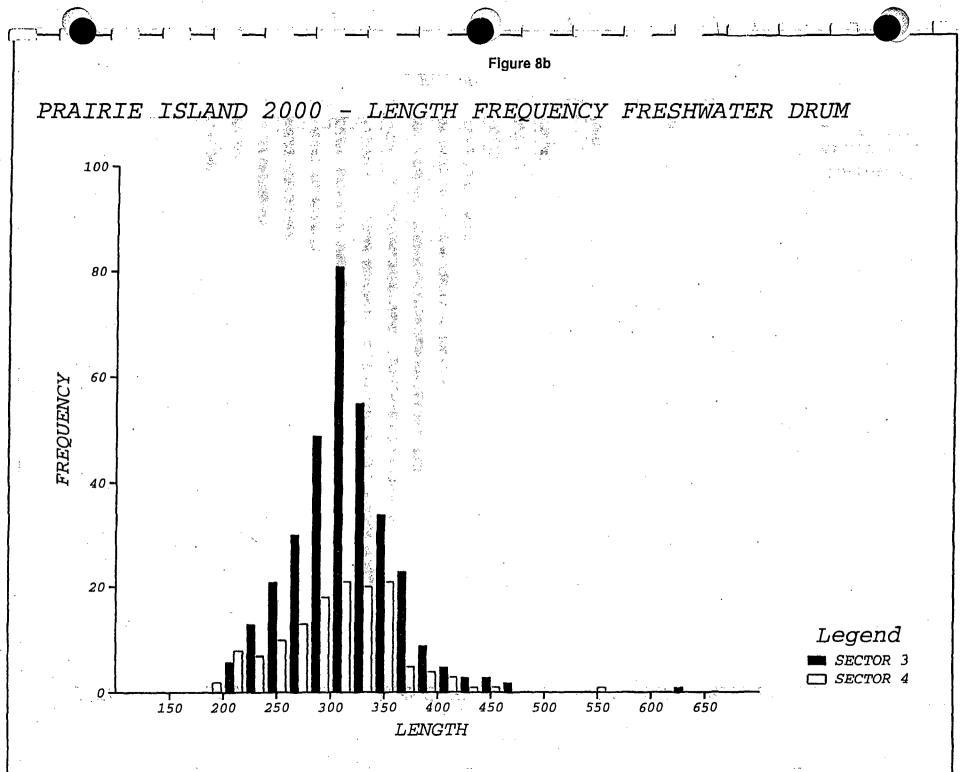


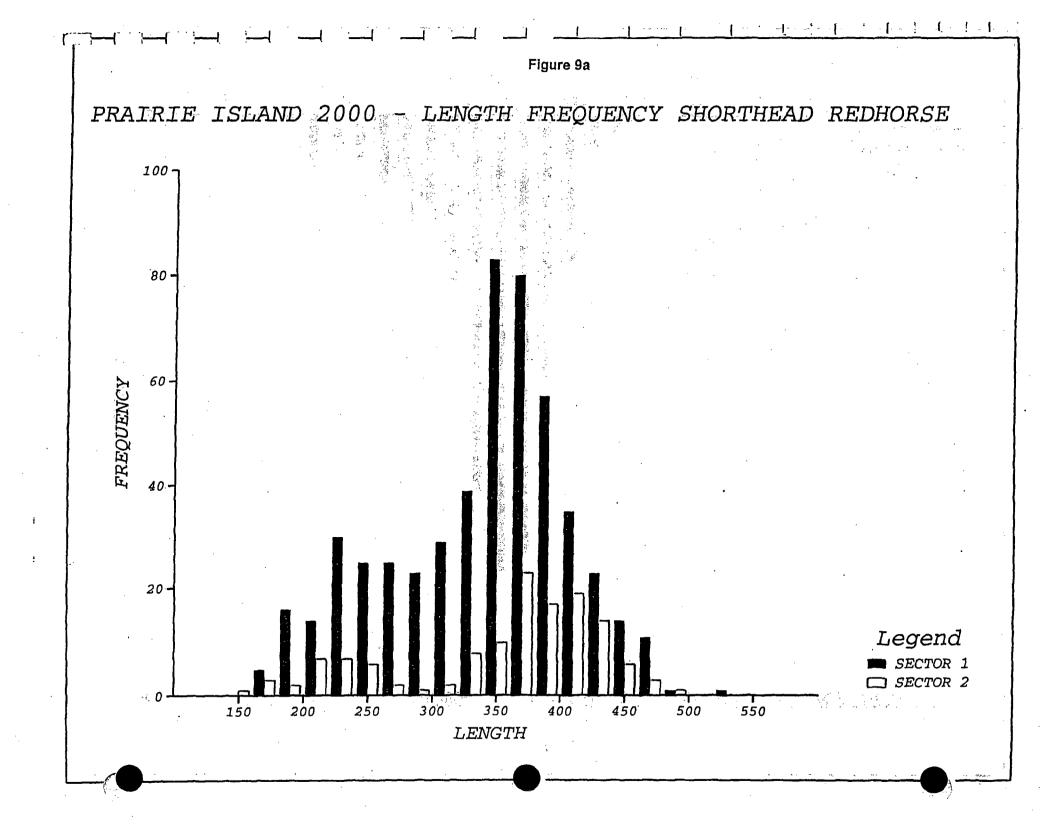


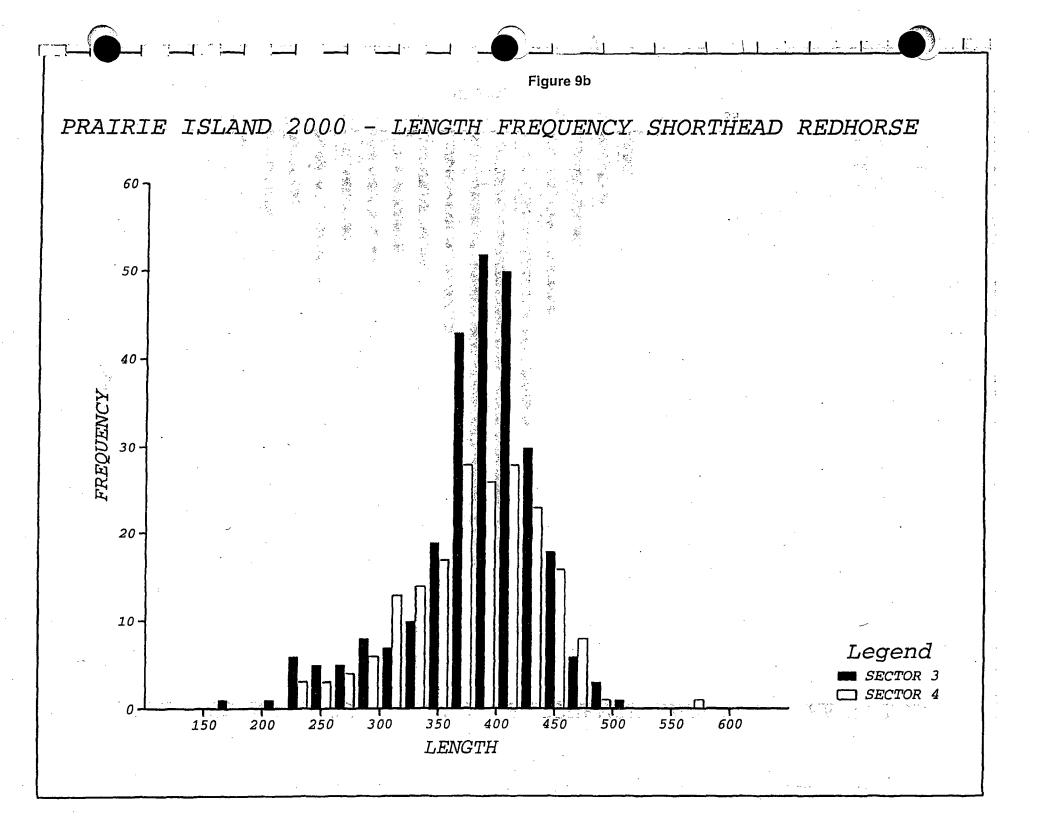












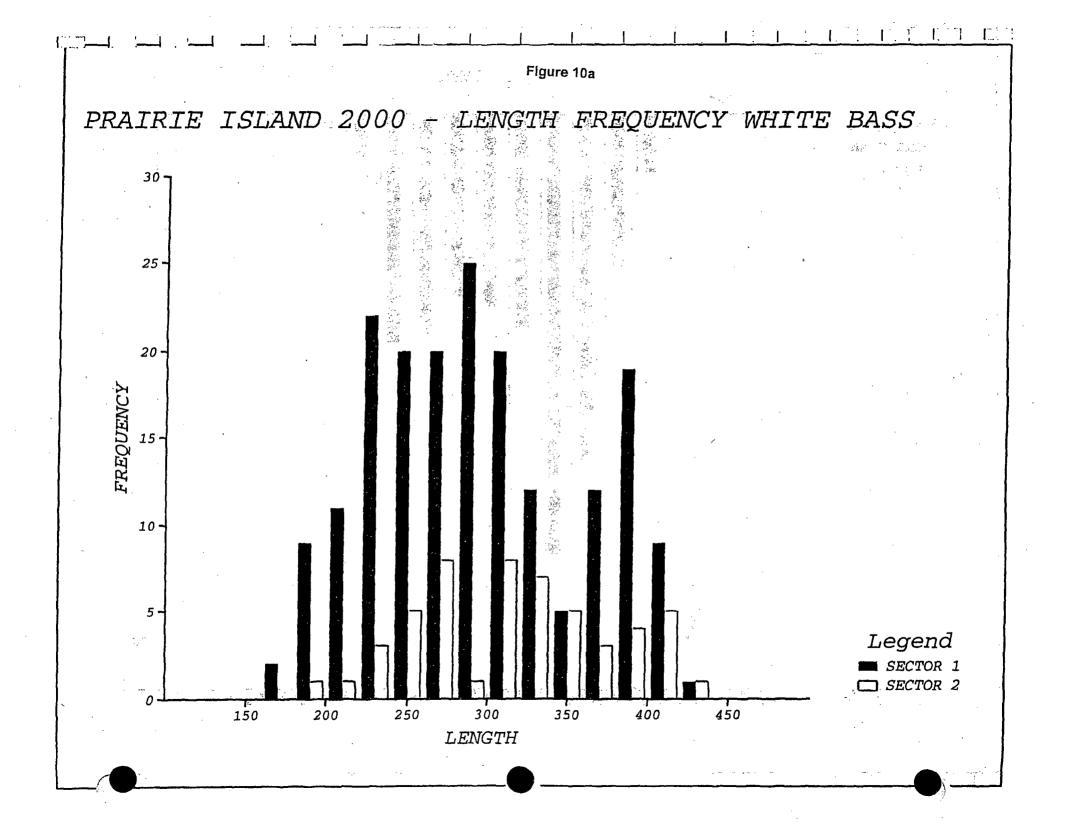
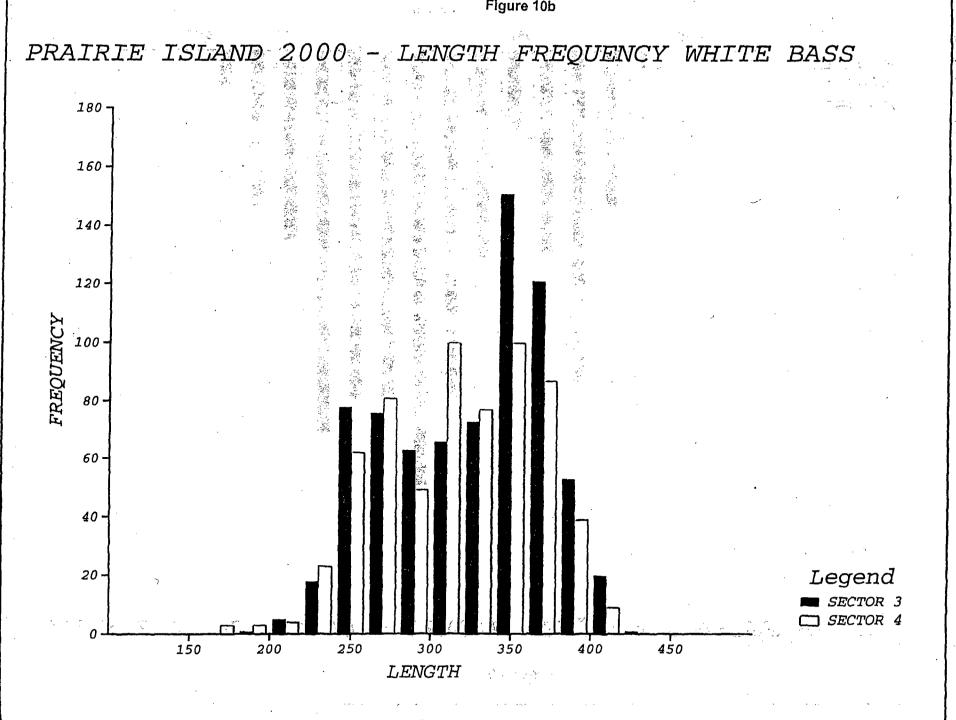
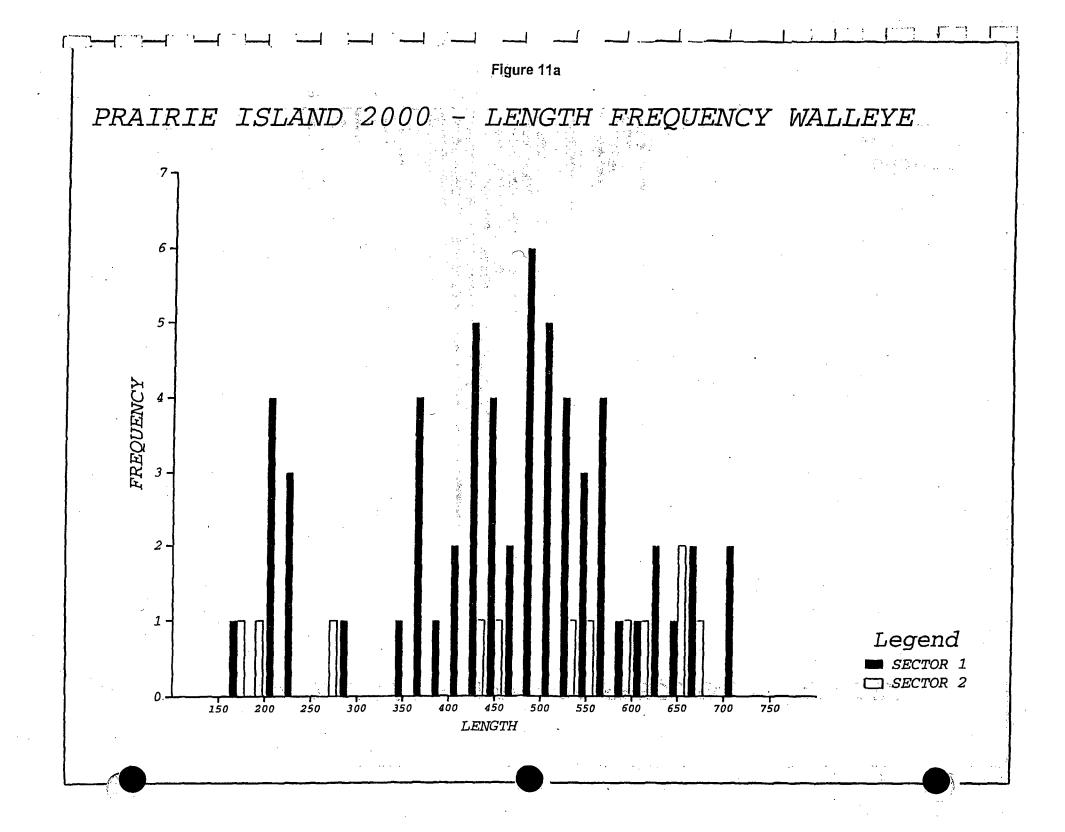
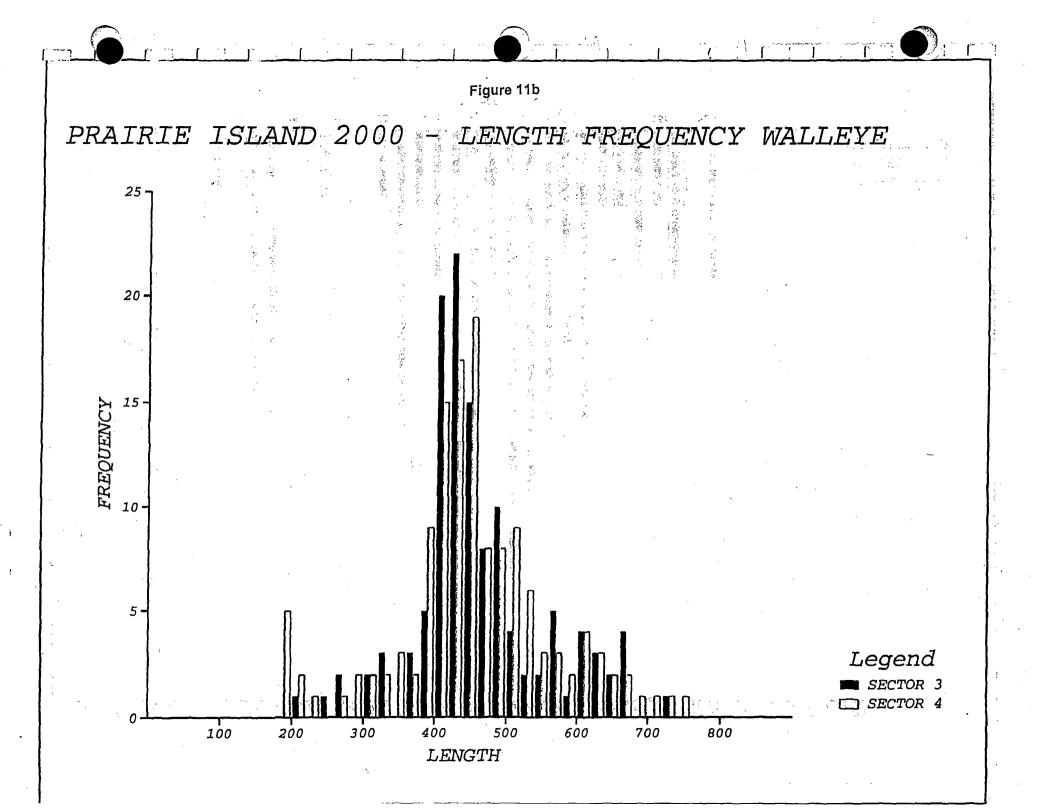
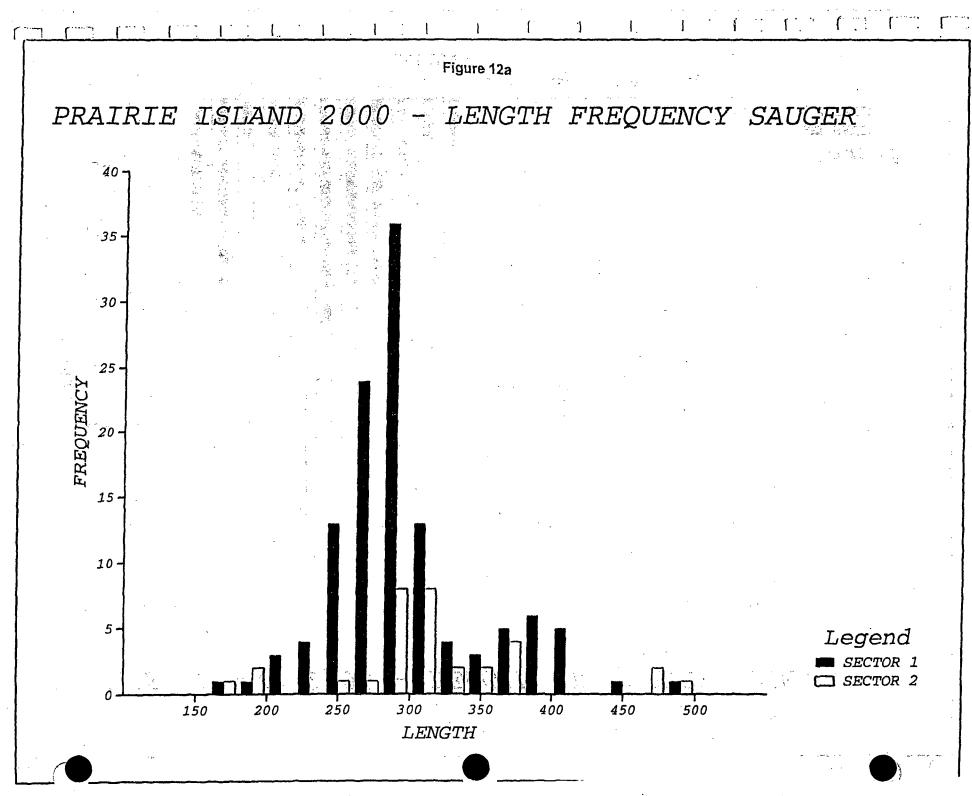


Figure 10b



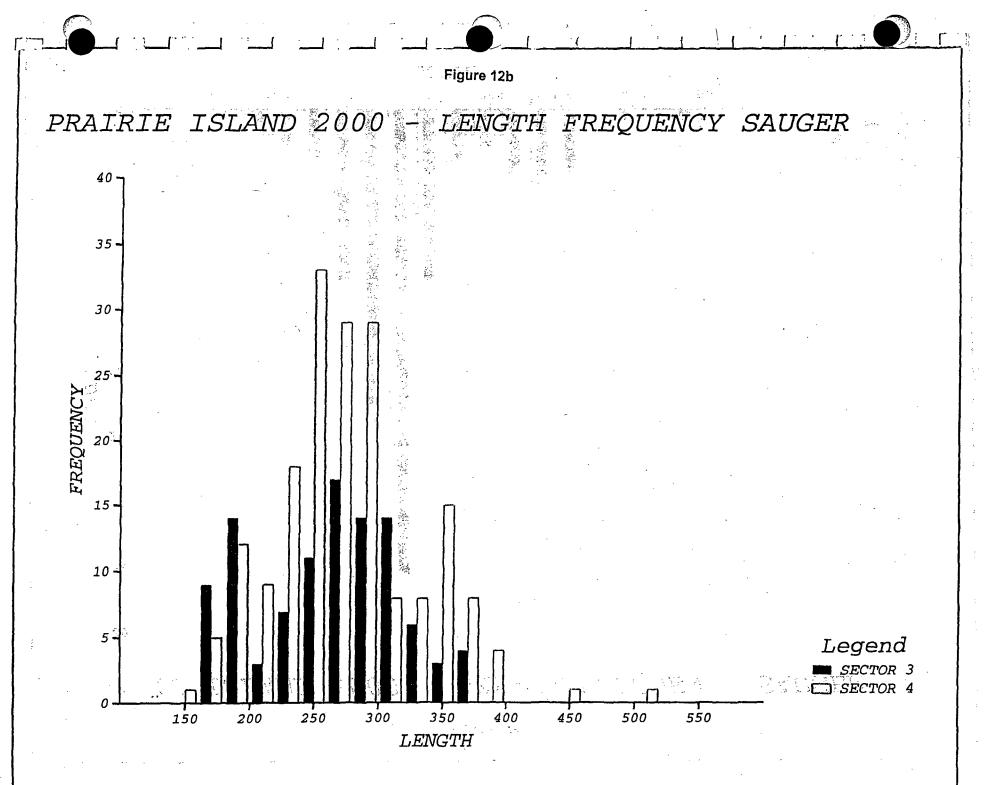


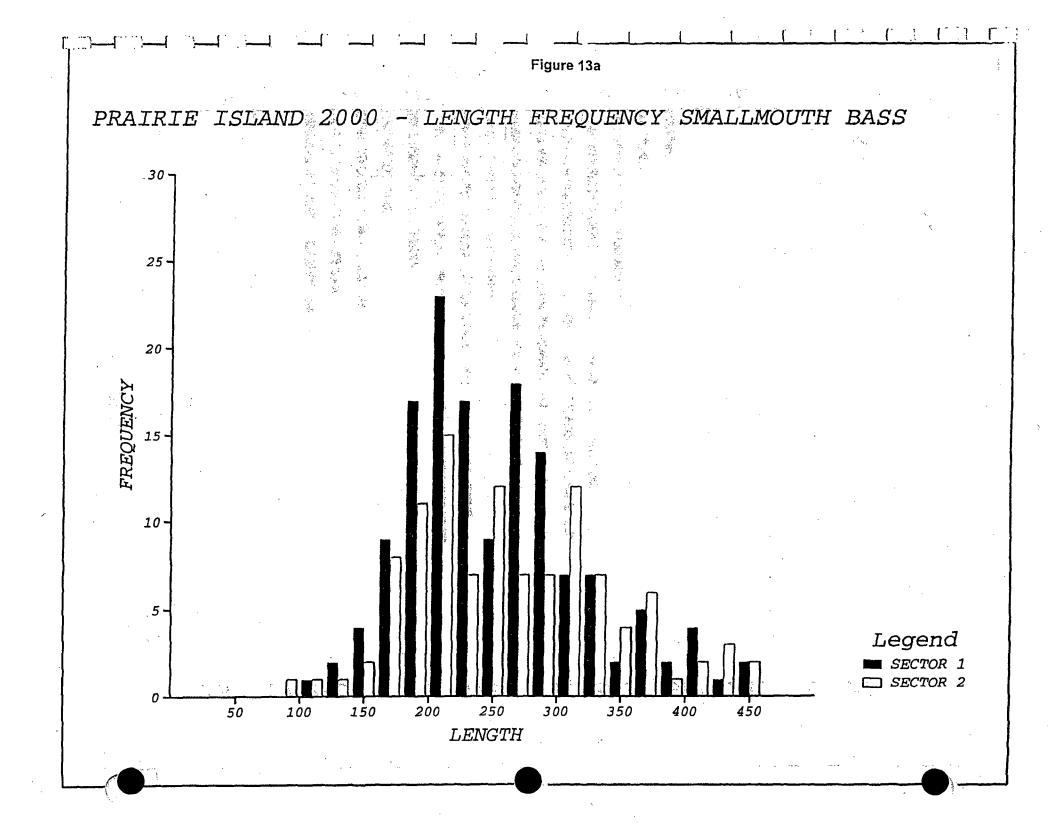


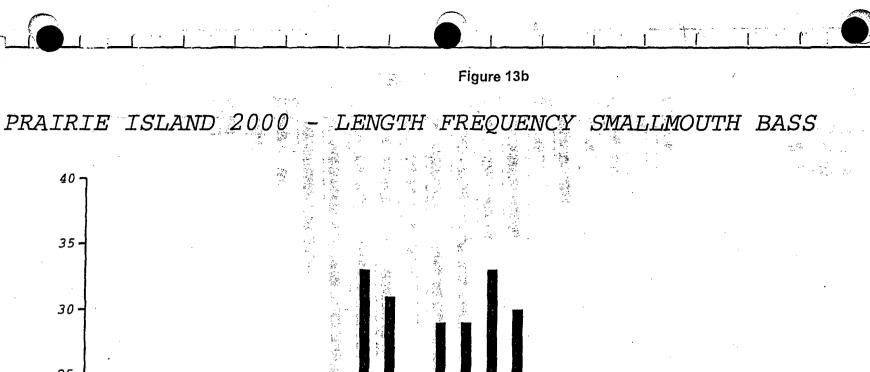


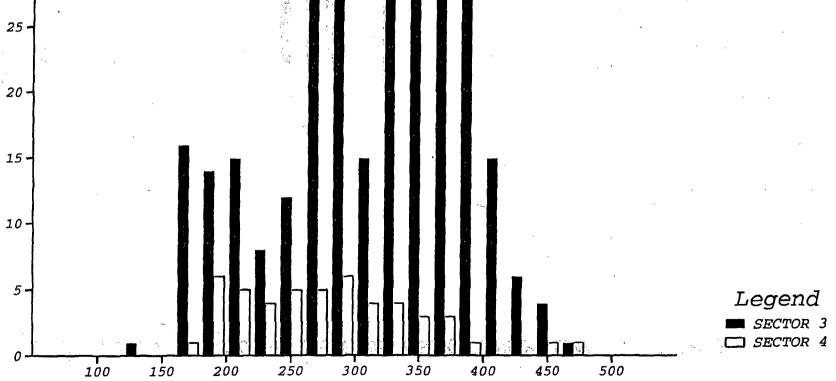
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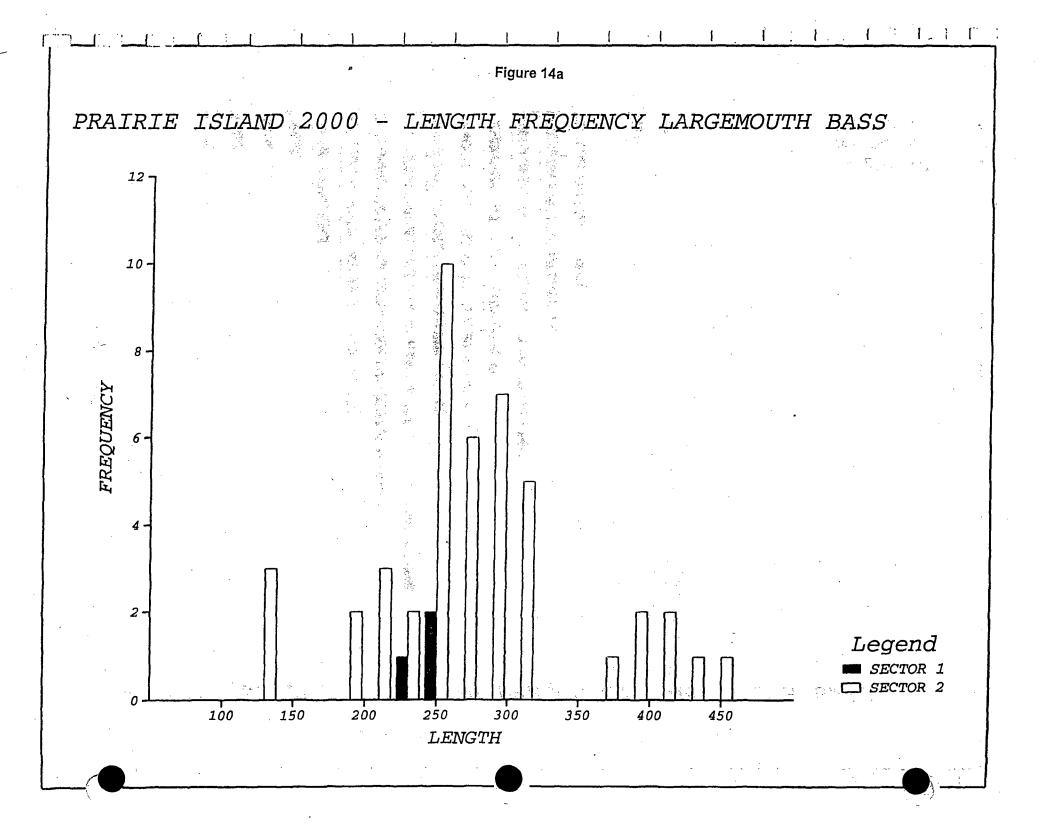


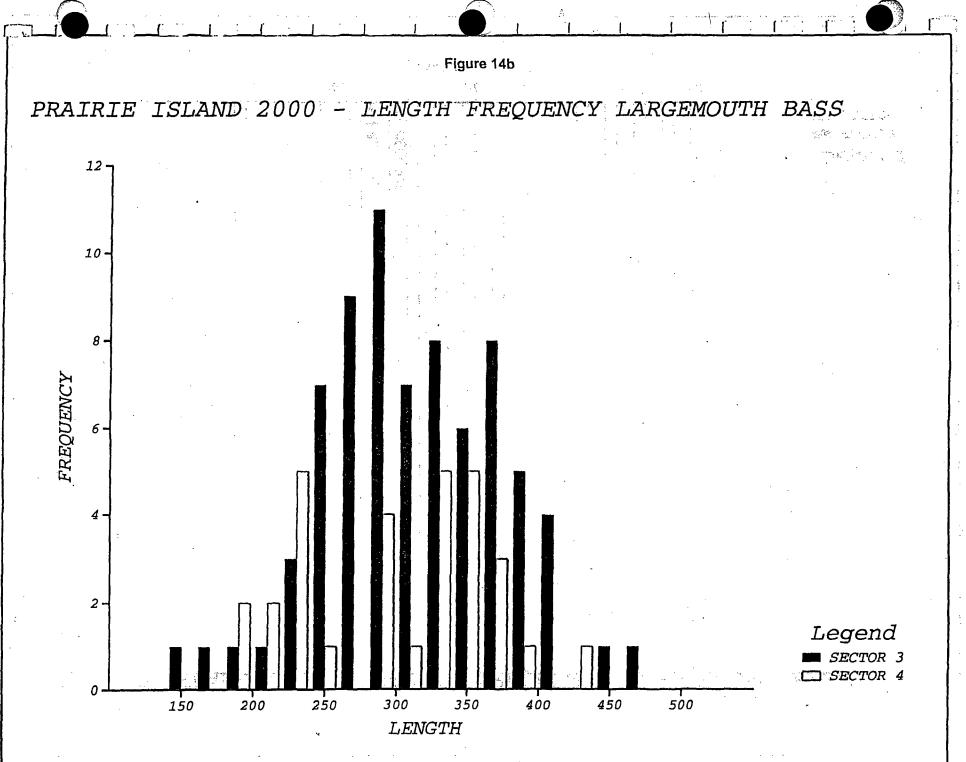




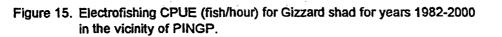
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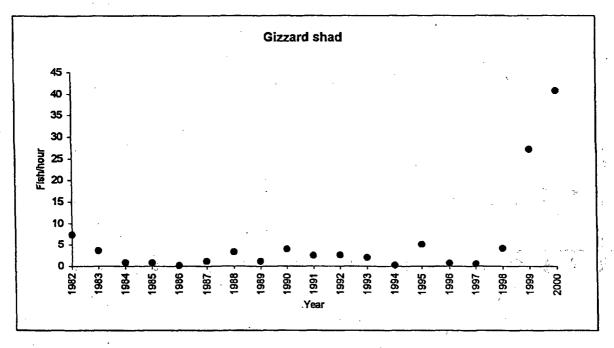
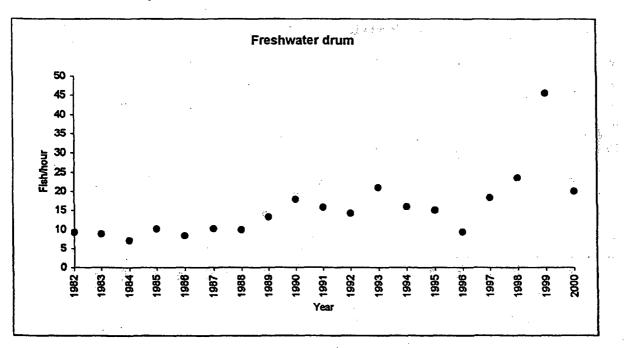


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2000 in the vicinity of PINGP.



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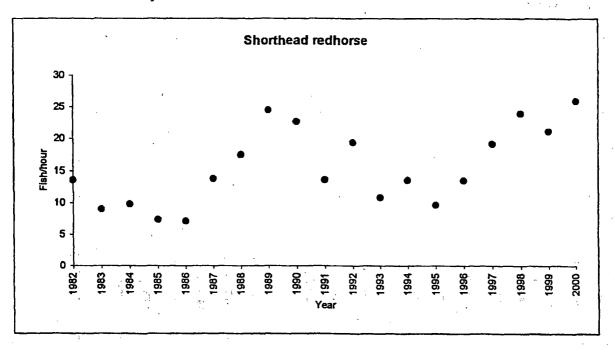


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2000 in the vicinity of PINGP.

Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2000 in the vicinity of PINGP.

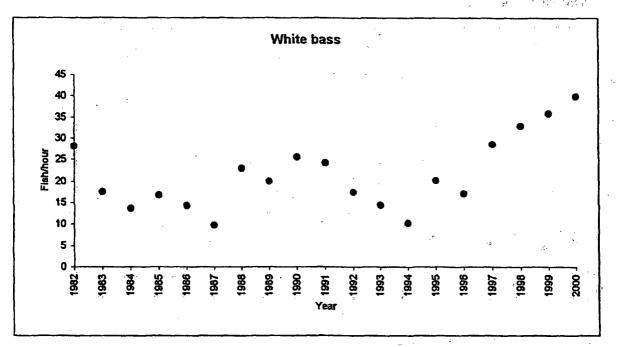




Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2000 in the vicinity of PINGP.

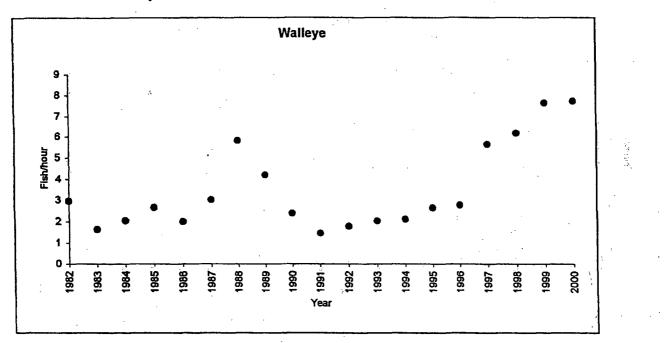
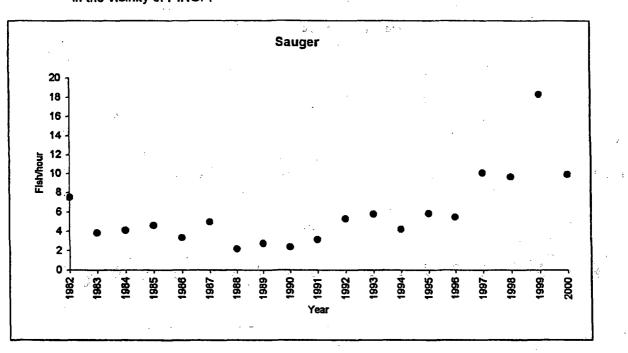


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2000 in the vicinity of PINGP.

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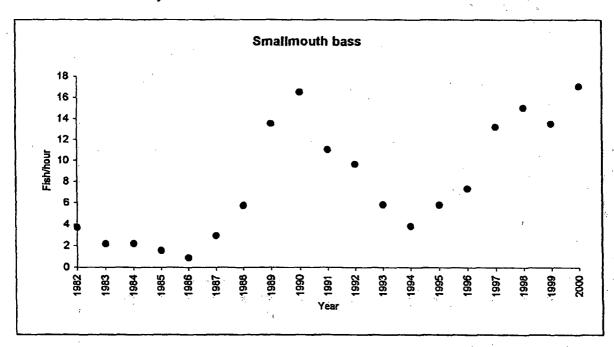
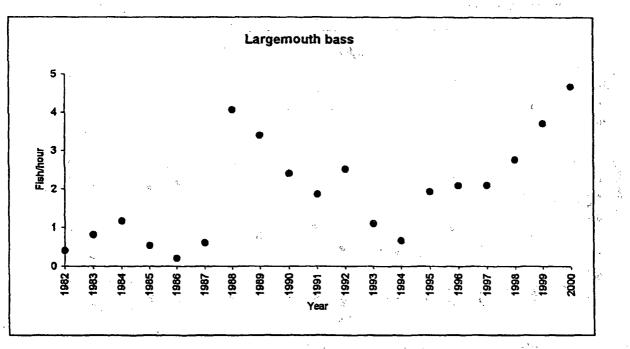


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2000 in the vicinity of PINGP.

Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2000 in the vicinity of PINGP.



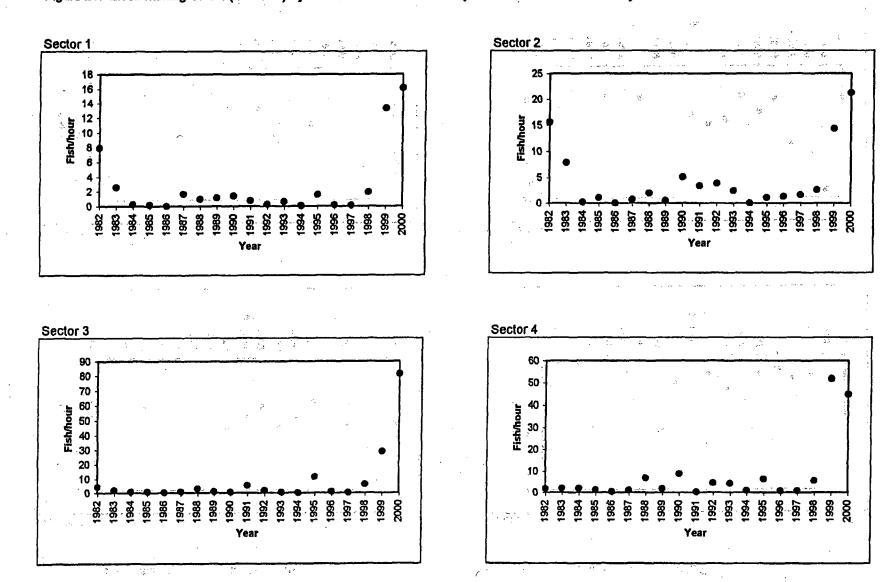
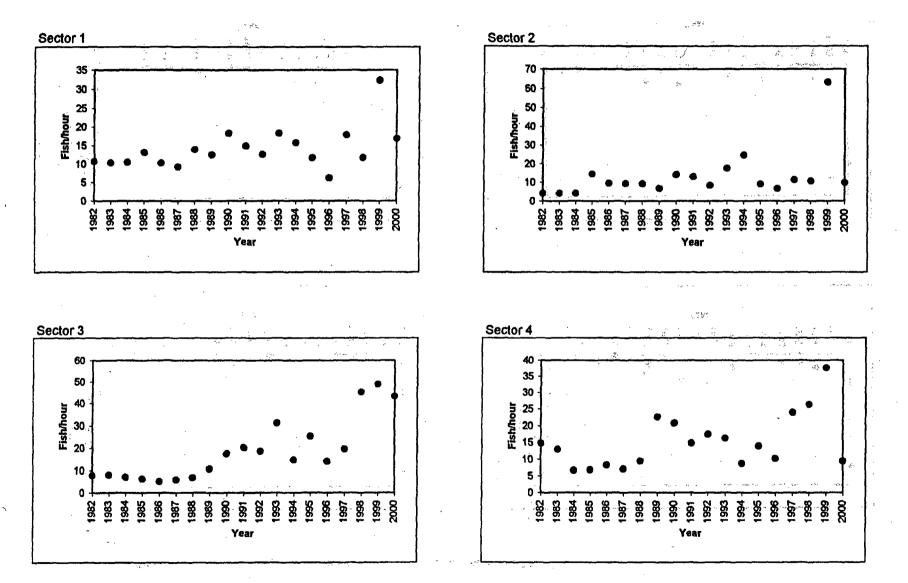


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2000 in the vicinity of PINGP.



Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2000 in the vicinity of PINGP.



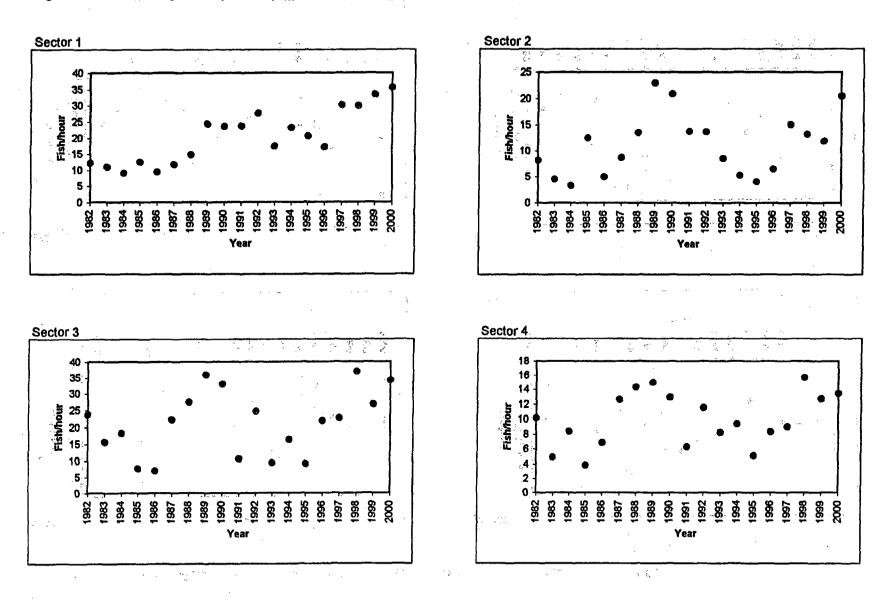
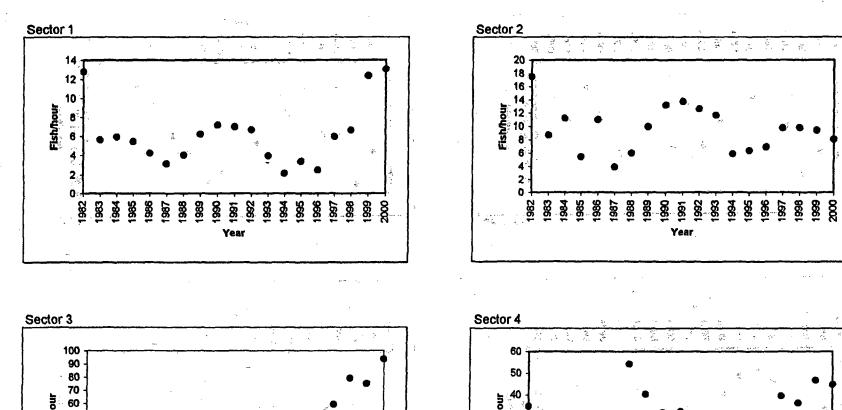


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2000 in the vicinity of PINGP.



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Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2000 in the vicinity of PINGP.

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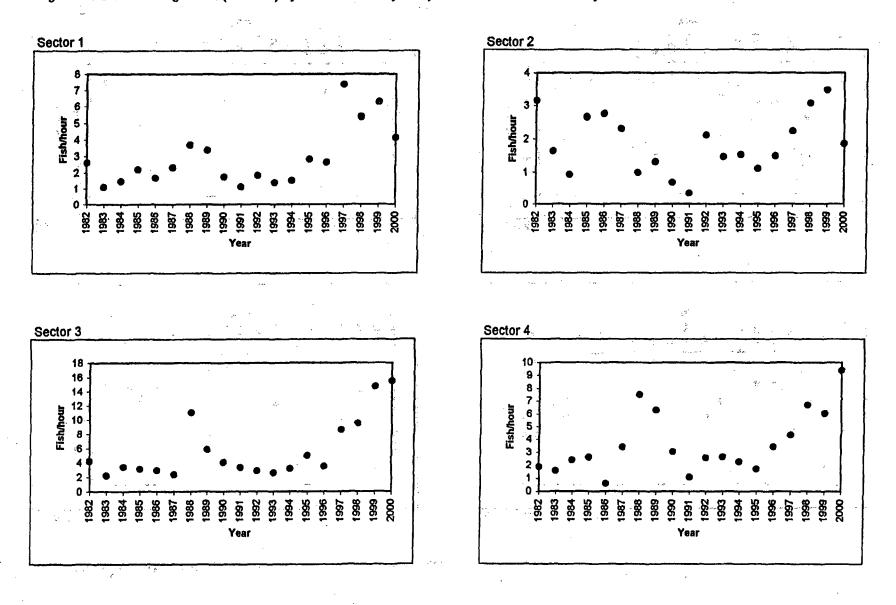


Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2000 in the vicinity of PINGP.

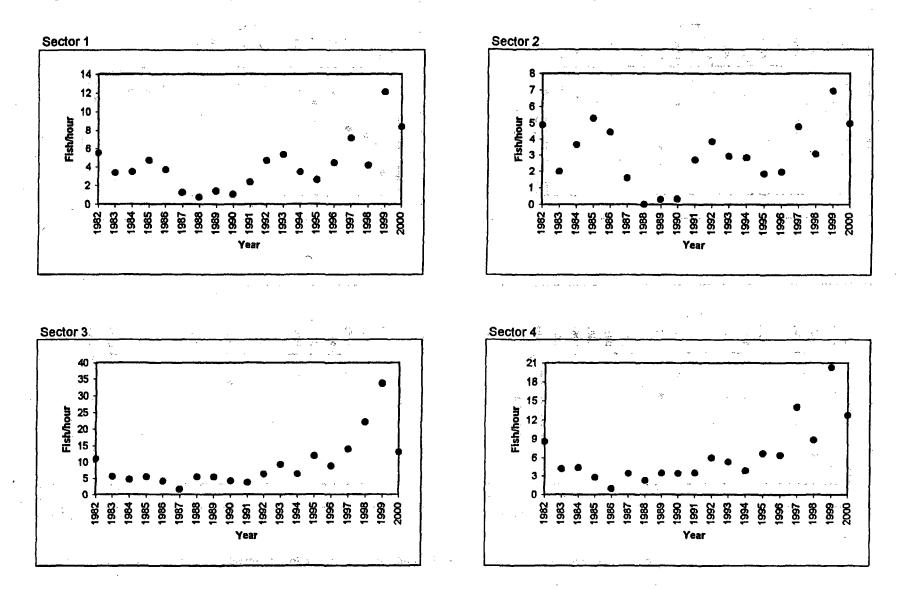


Figure 28. Electrofishing CRUE (fish/hour) by sector for Sauger for years 1982-2000 in the vicinity of PINGP

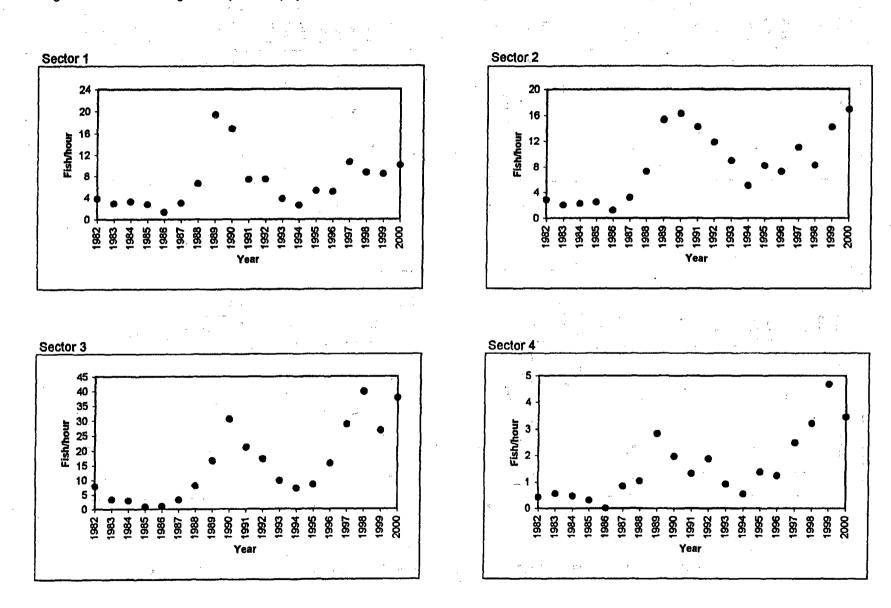
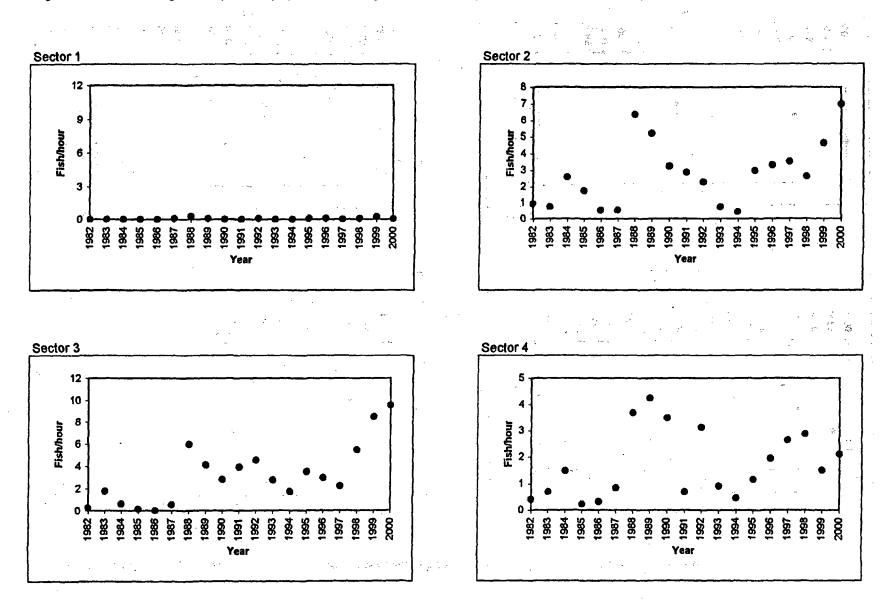
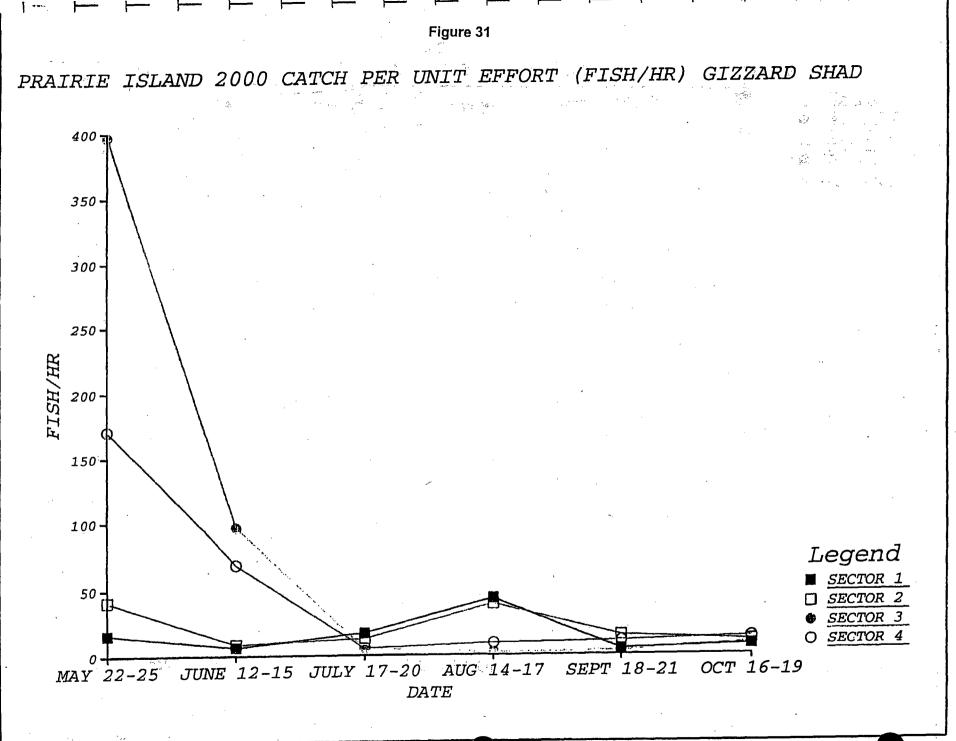


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2000 in the vicinity of PINGP.

Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2000 in the vicinity of PINGP.

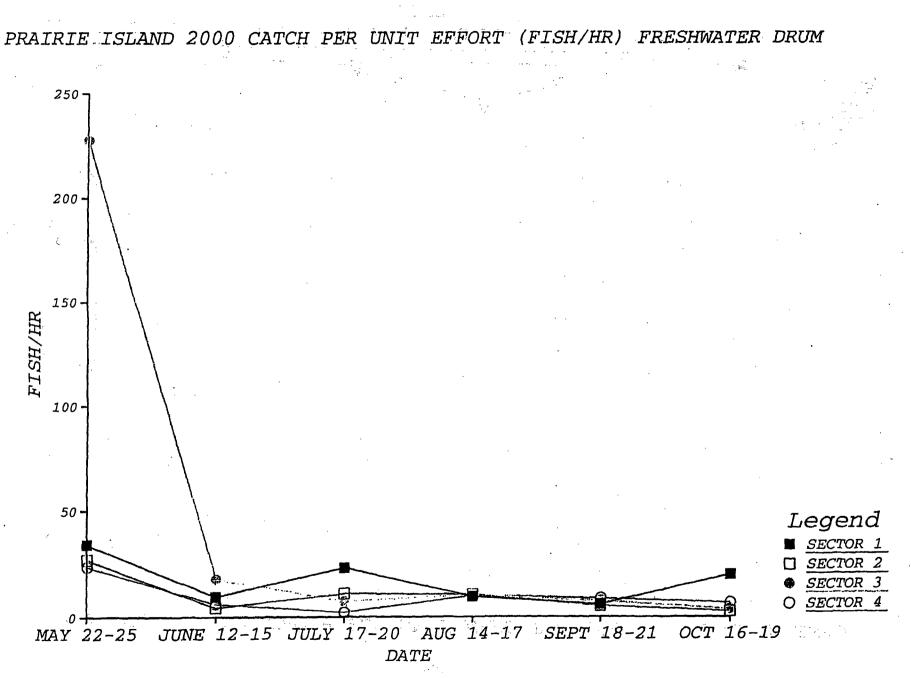


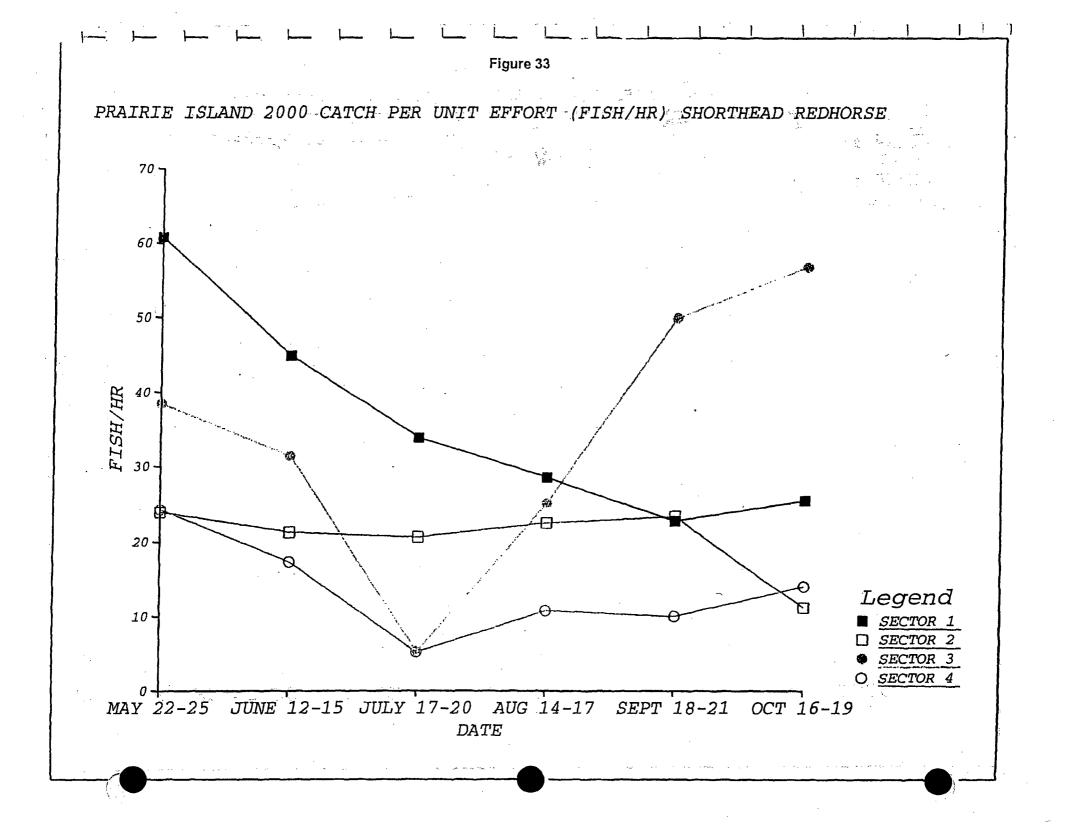


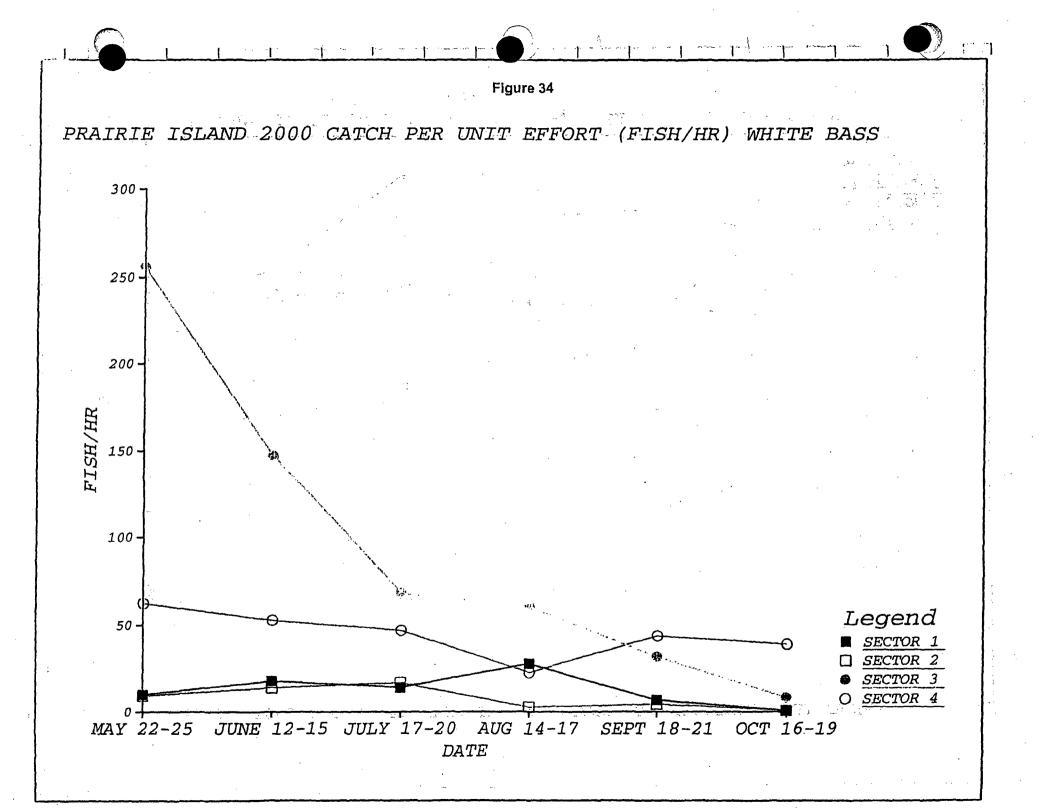
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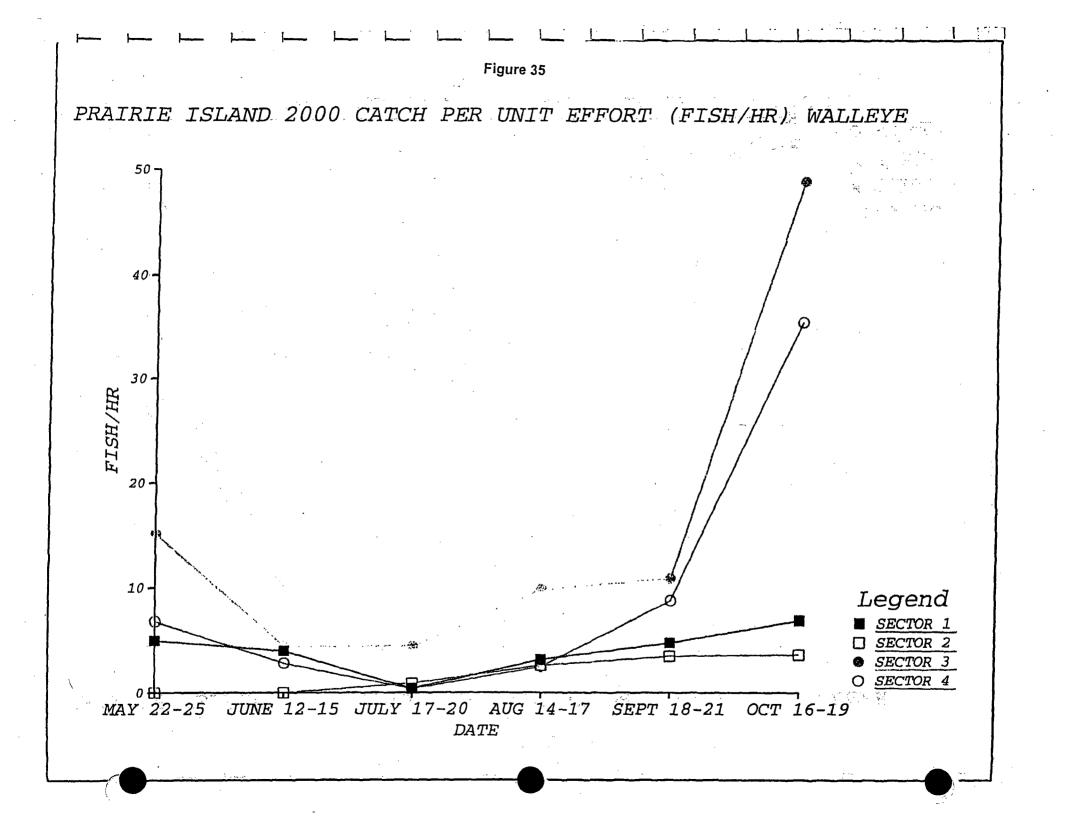


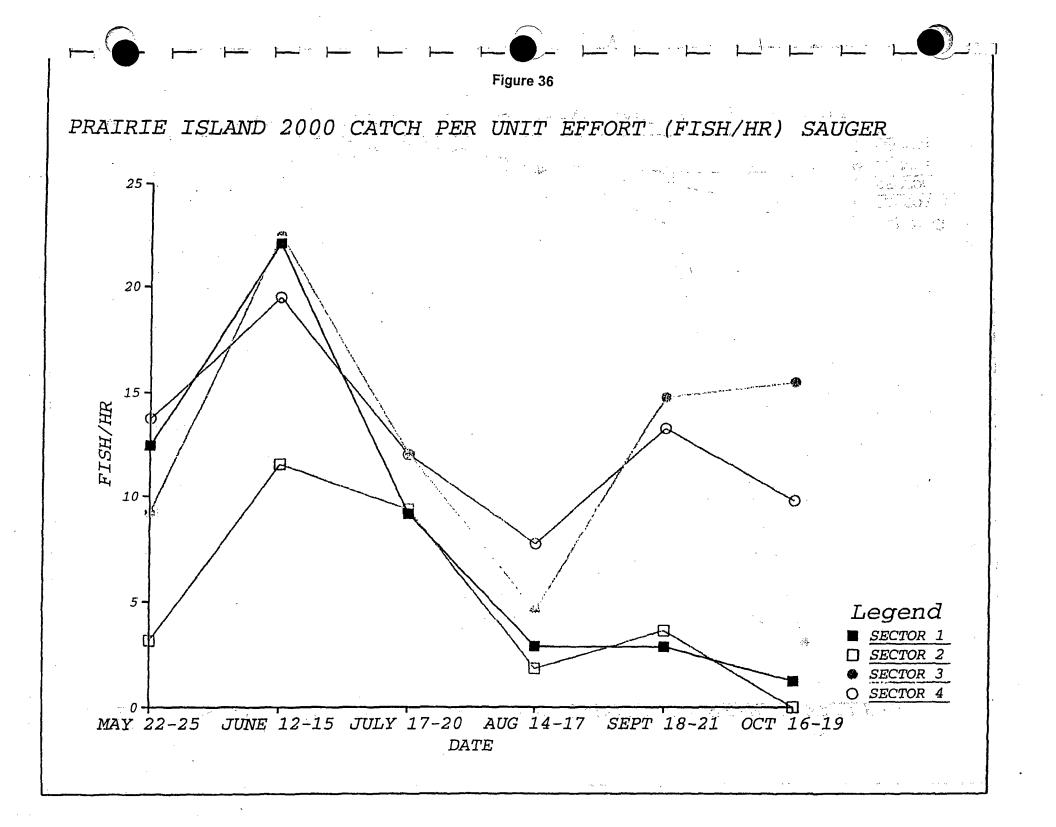
Figure 32

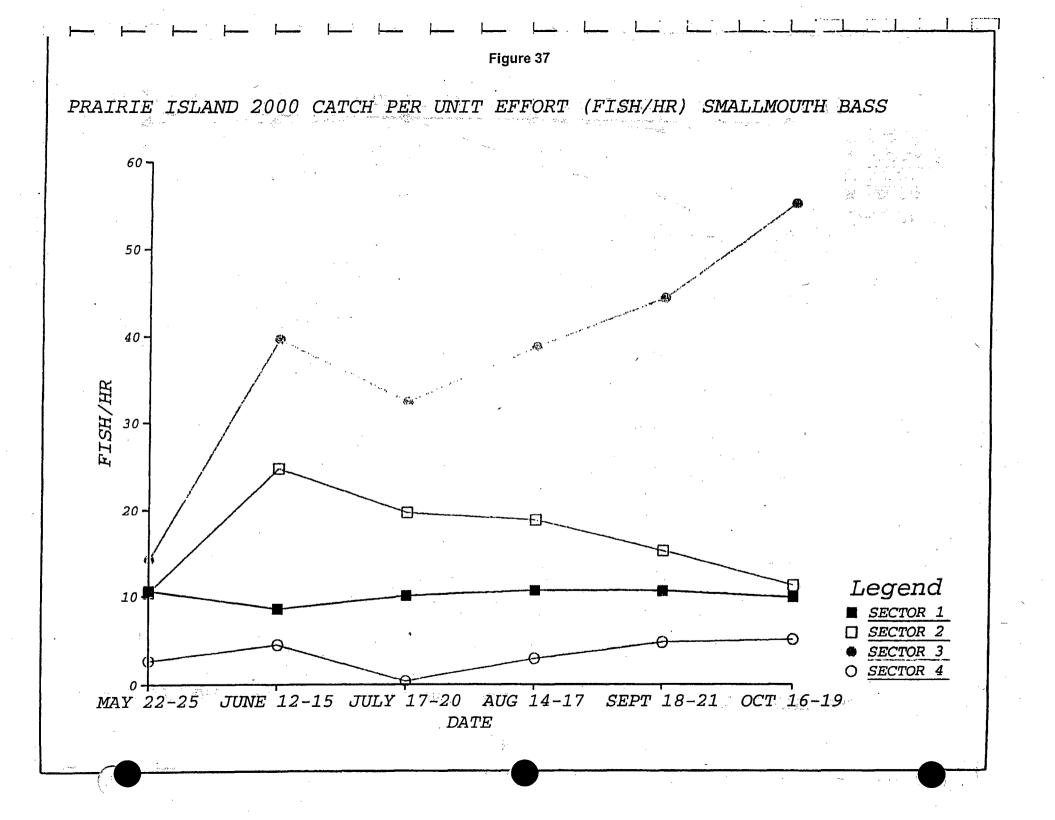


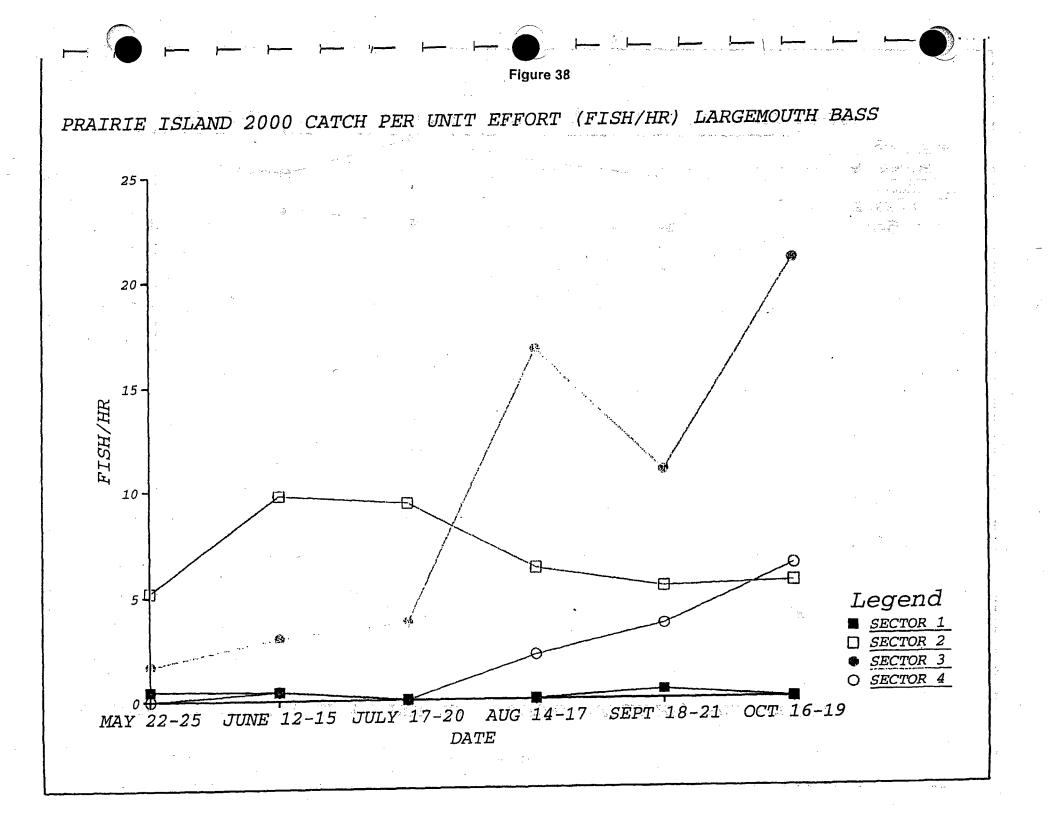












the second se						88	•	۰.		92	93	َ 94	95	96			99	ing Plant 1983-2000.
Species	83	84	85	86	87	00	03	. 90	31 4	92	93	34	90	90	97	98	99	00
а. А																		
Chestnut lamprey	x	· X							Χ.	X		*	x			x	X	
Ichthyomyzon castaneus							× • •							·				
Silver lamprey					° X	X	X	X	x	x		X	X	X	X	х	X	X
Icthyomyzon unicuspus																		
Paddlefish Balvadaa anothula															X			s A sum
Polyodon spathula	· •		v	v	i.	v	~	~	~	v	v	~	v	~		~	v	
Longnose gar Lepisosteus osseus	X	х	X	x	X	x	x	x	x	X	x	X	x	x	x	x	x	X
Shortnose gar	x	v	x	v	x	⁵ . v	. V	x	v	x	x	x	x	x	v .	v .	~	v
Lepisosteus platostomus	~	x	^	^	^ ·	^	×	^	х	^	^	^	^	^	х	•	x	*
Bowfin	х	X	Y	. Y	¹ X	x	x	X	x	x	x	x	x	x	x	x	X	×
Amia calva	^	~	^	~	~	~	~	~	~	~	<u> </u>		~	~	~	^	^	~
American eel	x	x		x	x	x	X	X	x	x	x	x	x	x			X	x
Anguilla rostrata				••	• •			• -										
Gizzard shad	x	х	x	X	x	x	х	X	Χ.	x	х	х	х	x	x	x	x	X
Dorosoma cepedianum																		
Goldeye	X	:	Χ.	. '	X	X	4	· .			x			x	X	x	x	
Hiddon alosoides																		
Mooneye	x	` X	X	х	x	Х	∕ X	х	X	х	x	X	Х	х	x	·X	X	X .
Hiodon tergisus																		
Brown trout		`* •	14 1	x		·, ·		υ.					X		x		X	
Salmo trutta																		
Northern pike	X	Т Х ,	X	X	X .	X	X	x	x	X	X	X	X	X	x	X	X	X
Esox lucius														. •				· ·
Musky					:			:										Χ,
Esox masquinongy								••			••		••					·
Carp	x	x	x	X	Χ.	x	x	X	X	x	x	x	x	x	x	x	x	X
Cyprinus carpio		v					v											
		Х.					x			. ·								×.
Carpiodes species River carpsucker	X	v	v	v	x		v	v	v	V	v	v	v	v	v	v	V	ý
Carpiodes carpio	^	X	x	Â.	^	^	x	^	X	x	^	^	x	^	^	^	^	∧
Quillback	Y	x	x	¥	x	¥	¥	x	Y	x	Y	x	x	X	Y	x	x	x
Carpiodes cyprinus	^	^ ·	^	^	<u>,</u>	^	^	^	^	^	^	^	^	^	<u>^</u>		∧ . 1885	
Highfin carpsucker	- 1		x	x	X	X	Y	X	x	Y	Y`	Y	x	Y	Y			
Carpiodes velifer				~	^	<u>^</u>	^ /	^										
White sucker	X	x	Х	x	X	X	X	·	x	./ч Х	1. Y	•	v ·		x X			na an a
Catomus commersoni	~	^	^	^	^	^	^	^	<u>^</u>	^	^	^	^		~	^	^	X



Species

Blue sucker

Table 1(cont) Species of fish captured in the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2000. 89 90 91 92 93 94 95 96 97 98 99 00 83 84 86 87 88 85 Х X Х Х х X Cycleptus elongatus Northern hogsucker х х Х Hypentelium nigricans Smallmouth buffalo X Х х X х X X X Х x Ictiobus bubalus

Bigmouth buffalo	х	x	х	x	x	х	×	x	x	х	x	x	х	х	х	x	x	X
<u>Ictiobus cyprinellus</u>																		
Spotted sucker	х	x	L-	x	÷,	X	x	ς.		х								
Minytrema melanops												`						
Silver redhorse	x	Χ.	х	X ¹ .	х	х	x	. X	х	х	X	х	х	X	х	x	X	x
<u>Moxostoma anisurum</u>																		
River redhorse		x	X		х		×	х	· X	X		х	X		4	X	X	X
Moxostoma carinatum																		
Golden redhorse	х	х	х	x	х	\mathbf{X}^{c}	х	х	х	х	X	х	X	x	X	х	x	X
Moxostoma erythrurum																		
Greater redhorse		x		x		X		x					-		x	X.		
Moxostoma valenciennesi																		
Shorthead redhorse	x	х	х	х	х	х	X	x	х	х	х	х	х	X	Χ.	х	х	x
M.macrolepidotum																		
Black bullhead	X	X	x	X	х	X				х		-					x	х
Ictalurus melas													,					
Yellow bullhead					X	X	x				1	X	·X					.'
Ictalurus natalis						,												
Brown bullhead	х	7	Ť										,					
Ictalurus nebulosus																		
Channel catfish	X	x	х	x	x	х	х	х	x	х	х	х	X	х	X	х	x	х
Ictalurus punctatus																		
Flathead catfish	X	Х	х	х	X	х	X	Х	Х	X	х	х	х	X	х	X	х	x
Pylodictus olivaris																		
Burbot	x	x			х				÷	X	x	х	X	x	x	X	х	x
Lota lota								·									• •	
White bass	х	х	X	х	х	х	х	х	х	х	x	x	х	х	x	х	х	x
Morone chrysops	••		1	<u>}</u>			ц <i>а</i>	5				: : : *			. :,			·
Rock bass	х	х	х	x	х	х	х	х	х	x	х	х	x	x	x	x	x	¹ X
Ambloplites rupestris	·	1997 - J		2	lia i				-				са, - ^{ст} .		× 1973 k		si ()	

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00
		•••	1 °.					. /			· .		- t +			• .	e"	~
Green sunfish	2 X -	X		e . Li e j	x	X	X	x	X	x	x	x	X	X	X	X	X	[°] X
Lepommis cyanellus		•	· .	· · · ·	· · · ·										2 X.	19 E.		
Pumpkinseed			÷				X	x	X	∴ X -{	X	X	X	X	XL	X	X	x
Lepomis macrochirus	~		ν.	÷	14							. '	,ł	3		ć.		
Orängespotted sunfish	۰.			1. ¹ .	11 A	• .							-	-		x		x
<u>Lepomis humilis</u>	•		5	• ? *							•							
Bluegill	X	X	х	x	x	X	X	х	x	x	x	X	X	x	x	X	x	x
Lepomis macrochirus																		
Smallmouth bass	x	х	х	x	x	х	x	х	х	x	x	x	X	х	x	x	x	x
Micropterus dolomieui																		,
Largemouth bass	x	х	х	X	x	x	Χ.	x	х	х	x	x	x	х	X	x	x	x
Micropterus salmoides		·.	· · .		· · · j		,	· •		A ·				,	2	°• ·	s	
White crappie	X	X	X	ί Χ	X	X	x	X	x	x 5	X	X	x	x	X	X	x	x
Pomoxis annularis																		
Black crappie	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pomoxis nigromaculatus		.25	, . ·	•.	· .	Ę	r.						· ·			•		,
Yellow perch	· X [*]	X	X	: •'	X	х	X	X	X	X .	X	x	x		x	x	x	
Perca flavens																		
Sauger	x	x	х	x	x	X	x	x	x	х	x	х	x	x	x	х	x	x
Stizostedion canadense		• ,										•				•.		
Walleye	X	X	X	X	x	X . ***	X.	X	x	X	x	Χ.	x	X .	X	x	x	x
Stizostedion vitreum																		
Saugeye															x	x	x	
S. vitreum x S. canadense			wî															
Freshwater drum		X	X	X	x	x	Χ.	X	x	X	x .	. X :	x	X	x	X .	X	X
Aplodinotus grunniens			- 41				-	-	-	-	• .			- •				4.3

Table 1(cont) Species of fish captured in the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2000.

Table 2. Electrofishing CPUE (fish/hour) for each sector in the vicinity of PINGP during 2000.Species are listed in ascending order by rank according to average CPUE.

	•			-à		
Ra	ink Species	Sector 1	Sector 2	Sector 3	Sector 4	Average,
	1 Gizzard shad	16.11	21.26	81.29	44.72	40.85
	2 White bass	13.04	8.07	93.68	44.79	39.90
	3 Carp	29.85	36.78	57.68	34.00	39.58
	4 Shorthead redhorse	35.64	20.48	34.19	13.43	25.94
	5 Freshwater drum	16.88	9.93	43.23	9.49	19.88
	6 Smallmouth bass	10.04	16.91	37.68	3.45	17.02
	7 Sauger	8.37	4.97	13.16	12.73	9.81
5	8 Walleye	4.12	1.86	15.48	9.42	7.72
	9 Bluegill	1.19	16.91	4.77	4.57	6.86
	10 Black crappie	0.09	7.76	1.42	12.80	5.52
	11 Largemouth bass	0.02	6.98	9.55	2.11	4.67
. :	12 Quillback carpsucker	2.37	4.03	5.16	5.56	4.28
	13 Silver redhorse	3.77	1.24	3.23	5.34	3.40
: :	14 Flathead catfish	1.26	3.72	6.58	1.34	3.23
	15 Smallmouth buffalo	1.95	5.43	2.71	1.34	2.86
· .,	16 Channel catfish	2.16	6.67	0.77	0.21	2.45
۰.	17 White crappie	0.07	8.69	0.39	0.35	2.38
	18 Bigmouth buffalo	0.77	0.31	3.36	1.41	1.46
	19 Green sunfish	0.14	2.95	0.26	0.00	0.84
:	20 Bowfin	0.07	0.31	1.03	1.76	0.79
	21 Rock bass	0.91	0.47	0.26	0.42	0.52
	22 Mooneye	0.49	0.00	1.03	0.49	0.50
	23 Blue sucker	0.28	0.31	0.39	0.77	0.44
-	24 Shortnose gar	• 0.07 [·]	0.31	0.90	0.21	0.37
	25 Golden redhorse	0.14	0.00	0.52	0.56	0.31
14.4	26 White sucker	0.00	0.00	0.52	0.70	0.31
•	27 River carpsucker	0.35	0.00	0.52	0.21	0.27
	28 Longnose gar	0.14	1.31	0.13	0.35	0.23
	29 Silver lamprey	0.21	0.16	0.13	0.42	0.23
$\mathcal{C}_{i,j}(z)$	30 Northern pike	0.00	0.00	0.77	0.07	0.21
	31 Pumpkinseed	0.07	0.47	0.00	0.00	0.14
	32 Black bullhead	0.07	0.00	0.26	0.07	0.10
	33 Musky	0.07	0.31	0.00	0.00	0.10
	34 Orange spotted sunfish	0.00	0.16	0.00	0.00	0.04
	35 American eel	0.07	0.00	0.00	0.07	0.04
	36 River redhorse	0.00	0.00	0.13	0.00	0.03
	37 Northern hogsucker	0.00	0.00	0.13	0.00	0.03
	38 Burbot	.a 0.00 7	0.00	0.13	0.00	0.03
	Totals	150.78	, 187.76	421.44	213.16	243.29

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Table 3.						
	ELECTRO 1		CATCH			a series and the
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)			LENGTH WEIGHT REGRESSIO
1977	7.92	0.61	4 5	135	NA	LOG W=3.101 LOG L-5.163
1978	10.20	0.20		73	NA	LOG W=3.068 LOG L-5.078
1979	1.81	0.06	1	NA	NA	NA BAN BA
1980	10.83	0.14	7.	NA	NA	NA
1981	23.03	0.38	9	917	216	LOG W=2.748 LOG L-4.348
1982		0.09	3	276	329	LOG W=2.917 LOG L-4.741
1983		0.26	2	155	355	LOG W=3.029 LOG L-5.049
1984		0.08	1	48	281	LOG W=2.684 LOG L-4.171
1985		0.01	1	.31	325	LOG W=2.388 LOG L-3.431
1986		0.06	<1	13	274	LOG W=3.248 LOG L-5.634
1987		0.05	1	55	256	LOG W=3.030 LOG L-5.046
1988		NA	3	-139	288	LOG W=2.629 LOG L-4.015
1989		NA	<1	47	323	LOG W=3.025 LOG L-5.021
1990		NA	3	170	326	LOG W=2.956 LOG L-4.857
1991		NA	4	198	338	LOG W=2.601 LOG L-3.940
1992		NA NA	1.8	91	357	LOG W=3.459 LOG L-6.127
1993			1.9	62	375	LOG W=2.920 LOG L-4.728
1994		NA	<1	14	394	LOG W=3.371 LOG L-5.955
1995		NA	4	204	272	LOG W=2.625 LOG L-4.073
1996		NA	<1	27	330	LOG W=3.275 LOG L-5.666
1997		NA NA	<1	23	400	LOG W=3.934 LOG L-7.373
						LOG W=3.104 LOG L-5.218
1998		NA	2	176	260	
1999	27.12	NA	12	1222	290	LOG W=2.981 LOG L-4.988
1999 2000	27.12 40.85	NA NA	12 17	1222 1634	290 290	
1999	27.12 40.85 Fisheries su	NA NA Immary for	12 17 Freshwate	1222 1634	290 290	LOG W=2.981 LOG L-4.988
1999 2000	9 27.12 9 40.85 Fisheries su ELECTRO	NA NA Immary for TRAPNET	12 17 Freshwate CATCH	1222 1634	290 290 977-2000.	LOG W=2.981 LOG L-4.988
1999 2000 Table 4.	27.12 40.85 Fisheries su ELECTRO CPUE	NA NA Immary for TRAPNET CPUE	12 17 Freshwate CATCH COMP	1222 1634 r drum 19	290 290 977-2000. MEAN	LOG W=2.981 LOG L-4,988 LOG W=3.274 LOG L-5.697
1999 2000 Table 4. YEAR	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr	NA NA Immary for TRAPNET CPUE Fish/hr	12 17 Freshwate CATCH COMP (%)	1222 1634 r drum 19 N	290 290 977-2000. MEAN LENGTH	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LENGTH WEIGHT REGRESSIO
1999 2000 Table 4. <u>YEAR</u> 1977	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7,49	NA NA Immary for TRAPNET CPUE Fish/hr 5.27	12 17 Freshwate CATCH COMP (%) 13	1222 1634 r drum 1 <u>N</u> 569	290 290 977-2000. MEAN LENGTH NA	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LENGTH WEIGHT REGRESSION LOG W=2.947 LOG L-4.756
1999 2000 Table 4. <u>YEAR</u> 1977 1978	27.12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7 7.49 3 11.97	NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28	12 17 Freshwate CATCH COMP (%) 13 17	1222 1634 r drum 1 <u>N</u> 569 422	290 290 977-2000. MEAN LENGTH NA NA	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1975	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7,49 3,11.97 9,7.47	NA NA IMMAINAT TRAPNET CPUE Fish/hr 5.27 6.28 5.22	12 17 Freshwate CATCH COMP (%) 13 17 21	1222 1634 r drum 1 <u>N</u> 569 422 360	290 290 977-2000. MEAN LENGTH NA NA NA	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1979	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7,49 3,11.97 3,747 5,89	NA NA IMMAINET TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83	12 17 Freshwate CATCH COMP (%) 13 17 21 18	1222 1634 r drum 1 569 422 360 520	290 290 977-2000. MEAN LENGTH NA NA NA NA	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.756 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1980	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 77,49 311.97 37,47 3,5.89 1,30.88	NA NA IMMAINAT TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12	1222 1634 r drum 1 569 422 360 520 1146	290 290 977-2000. MEAN LENGTH NA NA NA NA NA 267	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1980 1981 1982	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7,49 3,11.97 3,747 5,89 1,30.88 2,9.30	NA NA IMMAINAT TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24	1222 1634 r drum 1 569 422 360 520 1146 2225	290 290 977-2000. MEAN LENGTH NA NA NA NA NA 267 293	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1980 1981 1982 1983	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 77,49 311.97 311.97 5.89 130.88 29.30 38.80	NA NA IMMAINAT CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 24 22	1222 1634 r drum 1 569 422 360 520 1146 2225 1626	290 290 977-2000. MEAN LENGTH NA NA NA NA NA 267 293 287	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1980 1981 1983 1983 1984	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 77,49 311.97 311.97 331.88 30.88 29.30 38.80 47.07	NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212	290 290 977-2000. MEAN LENGTH NA NA NA NA 267 293 287 288	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927 LOG W=2.598 LOG L-3.919
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1979 1980 1981 1983 1983 1984 1985	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7,49 3 11.97 5 30.88 2 9.30 3 8 10.15	NA NA IMMary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.911 LOG L-4.756 LOG W=3.068 LOG L-4.710 LOG W=3.052 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1978 1981 1983 1983 1984 1984	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7 7.49 3 11.97 9 7.47 0 5.89 1 30.88 2 9.30 3 8.80 4 7.07 5 10.15 6 8.33	NA NA IMMary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856	290 290 977-2000. MEAN LENGTH NA NA NA NA 267 293 287 288 293 310	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=3.068 LOG L-4.710 LOG W=3.052 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.598 LOG L-4.625 LOG W=2.598 LOG L-3.919 LOG W=2.598 LOG L-3.919
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1983 1983 1983 1984 1984 1985 1986	27,12 40.85 Fisheries st ELECTRO CPUE Fish/hr 7 7.49 3 11.97 9 7.47 9 30.88 2 9.30 3 8.80 4 7.07 5 10.15 6 8.33 7 10.29	NA NA IMMAINET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.598 LOG L-4.625 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=3.089 LOG L-5.139 LOG W=2.874 LOG L-4.603
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1980 1981 1982 1984 1985 1986 1986 1987	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7 7.49 3 11.97 9 7.47 9 7.47 9 30.88 2 9.30 3 8.80 4 7.07 5 10.15 6 8.33 7 10.29 8 9.85	NA NA IMMAINET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=3.089 LOG L-5.139 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.205
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1980 1981 1982 1983 1984 1985 1988 1988 1988	27,12 40.85 Fisheries su ELECTRO CPUE Fish/nr 7 7 8 11.97 8 9 10.29 9 13.17	NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280 294	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=2.874 LOG L-4.603 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.205 LOG W=2.908 LOG L-4.707
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1980 1981 1982 1983 1984 1985 1988 1988 1988 1988 1988 1988	27,12 40.85 Fisheries su ELECTRO CPUE Fish/nr 7 8 9 13.17 0 17.70	NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724	290 290 977-2000. MEAN LENGTH NA NA NA NA 267 293 287 288 293 310 312 280 294 297	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=3.089 LOG L-5.139 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.205 LOG W=2.908 LOG L-4.707 LOG W=3.008 LOG L-4.957
1999 2000 Table 4. YEAR 1977 1978 1978 1978 1978 1979 1981 1983 1983 1984 1983 1984 1984 1984 1984 1984 1984 1984 1984	27,12 40.85 Fisheries su ELECTRO CPUE Fish/nr 7 7.49 3 11.97 3 11.97 3 7.47 5 7.47 5 7.47 5 30.88 2 9.30 3 8.80 4 7.07 5 10.15 5 8.33 7 10.29 8 9.85 9 13.17 0 17.70 1 15.68	NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596	290 290 977-2000. MEAN LENGTH NA NA NA NA 267 293 287 288 293 310 312 280 294 297 305	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.598 LOG L-4.625 LOG W=2.598 LOG L-3.919 LOG W=2.598 LOG L-3.919 LOG W=2.874 LOG L-4.452 LOG W=2.874 LOG L-4.603 LOG W=2.908 LOG L-4.205 LOG W=2.908 LOG L-4.957 LOG W=3.008 LOG L-4.957 LOG W=2.955 LOG L-4.824
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1978 1978 1979 1983 1984 1985 1984 1985 1986 1985 1986 1986 1987 1989 1999	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7 7.49 3 11.97 9 11.97 9 7.47 0 5.89 1 30.88 2 9.30 3 8.80 4 7.07 5 10.15 5 8.33 7 10.29 8 9.85 9 13.17 0 17.70 1 15.68 2 14.23	NA NA IMMary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 20 31 22 16 8 11 13 12 11	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 288 293 310 312 288 293 310 312 280 294 297 305 320	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.598 LOG L-4.625 LOG W=2.598 LOG L-3.919 LOG W=2.598 LOG L-3.919 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.603 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.957 LOG W=2.908 LOG L-4.957 LOG W=2.955 LOG L-4.824 LOG W=2.967 LOG L-4.829
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1978 1983 1983 1984 1985 1985 1986 1985 1986 1986 1986 1986 1987 1999 1999	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7 7.49 3 11.97 9 11.97 9 7.47 9 7.47 9 30.88 2 9.30 3 8.80 4 7.07 5 10.15 6 8.33 7 10.29 8 9.85 9 13.17 0 17.70 1 15.68 2 14.23 3 20.83	NA NA IMMAINET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12 11 13 12 11	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539 584	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280 294 297 305 320 334	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.988 LOG L-4.625 LOG W=2.598 LOG L-4.625 LOG W=2.846 LOG L-4.452 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.603 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.957 LOG W=2.955 LOG L-4.824 LOG W=2.967 LOG L-4.829 LOG W=3.063 LOG L-5.053
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1978 1978 1979 1983 1984 1985 1984 1985 1986 1986 1986 1986 1987 1999 1999 1999	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7 7.49 3 11.97 7 7.49 3 11.97 9 7.47 0 5.89 1 30.88 2 9.30 3 8.80 4 7.07 5 10.15 6 8.33 7 10.29 8 9.85 9 13.17 0 17.70 1 15.68 2 14.23 3 20.83 4 15.92	NA NA NA IMMAINET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12 11 13 12 11	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539 584 495	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280 294 297 305 320 334 332	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.625 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=3.089 LOG L-5.139 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.603 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.957 LOG W=2.955 LOG L-4.824 LOG W=2.967 LOG L-4.829 LOG W=3.063 LOG L-5.053 LOG W=3.072 LOG L-5.086
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1983 1984 1984 1984 1984 1984 1984 1984 1984	27,12 40.85 Fisheries su ELECTRO CPUE Fish/nr 7 7 8 11.97 8 9 13.17 0 17.70 15.68 2 14.23 2 14.23 2 14.23 2	NA NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12 11 13 12 11 18 14 12	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539 584 495 605	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280 294 297 305 320 334 332 317	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=3.089 LOG L-5.139 LOG W=2.874 LOG L-4.603 LOG W=2.908 LOG L-4.603 LOG W=2.908 LOG L-4.957 LOG W=2.908 LOG L-4.957 LOG W=2.967 LOG L-4.824 LOG W=3.063 LOG L-5.053 LOG W=3.072 LOG L-5.086 LOG W=3.124 LOG L-5.243
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1978 1980 1981 1982 1983 1984 1985 1984 1985 1986 1986 1986 1986 1986 1986 1987 1999 1999 1999 1999	27,12 40.85 Fisheries su ELECTRO CPUE Fish/nr 7 7 9 11.97 7 9 11.97 7 9 11.97 7 7 9 11.97 7 9 130.88 2 9.30 3 8 9 10.29 8 9 13.17 0 17.70 15.68 2 14.23 20.83 4 15.92 5 14.96 6 9.33	NA NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12 11 13 12 11 18 14 12 8	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539 584 495 605 374	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280 294 297 305 320 334 332 317 300	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=2.874 LOG L-4.603 LOG W=2.874 LOG L-4.603 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.957 LOG W=2.908 LOG L-4.957 LOG W=2.955 LOG L-4.824 LOG W=2.955 LOG L-4.824 LOG W=3.063 LOG L-5.053 LOG W=3.063 LOG L-5.086 LOG W=3.061 LOG L-5.093
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1983 1983 1984 1983 1984 1985 1986 1985 1986 1985 1986 1986 1986 1986 1987 1999 1999 1999 1999 1999	27,12 40.85 Fisheries su ELECTRO CPUE Fish/nr 7 7.49 3 11.97 7 7.49 3 11.97 7 7.49 3 11.97 7 7.49 3 11.97 7 7.49 3 10.88 2 9.30 3 8.80 4 7.07 5 10.15 5 8.33 7 10.29 8 9.85 9 13.17 0 17.70 1 15.68 2 14.23 3 20.83 4 15.92 5 14.96 6 9.33 7 18.18	NA NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12 16 8 11 13 12 11 18 14 12 11 18 14 12 11	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539 584 495 605 374 812	290 290 977-2000. MEAN LENGTH NA NA NA NA 267 293 287 288 293 310 312 280 294 297 305 320 334 332 317 300 300	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.911 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=3.089 LOG L-5.139 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.603 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.957 LOG W=2.955 LOG L-4.824 LOG W=3.063 LOG L-5.053 LOG W=3.072 LOG L-5.086 LOG W=3.072 LOG L-5.086
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1980 1983 1983 1984 1985 1985 1985 1986 1985 1986 1985 1986 1986 1989 1999 1999 1999 1999 1999	27,12 40.85 Fisheries st ELECTRO CPUE Fish/hr 7 7.49 3 11.97 9 11.97 9 7.47 9 7.47 9 30.88 2 9.30 3 8.80 4 7.07 5 10.15 5 8.33 7 10.29 8 9.85 9 13.17 0 17.70 1 15.68 2 14.23 3 20.83 4 15.92 5 14.96 6 9.33 7 18.18 8 23.47	NA NA NA IMMAINAL TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA NA NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12 11 13 12 11 13 12 11 13 12 11	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539 584 495 605 374 812 983	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280 294 297 305 320 334 332 317 300 300 320	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.947 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.068 LOG L-5.100 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=2.988 LOG L-4.625 LOG W=2.598 LOG L-4.625 LOG W=2.598 LOG L-4.625 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.603 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.957 LOG W=2.908 LOG L-4.957 LOG W=2.955 LOG L-4.824 LOG W=2.967 LOG L-4.829 LOG W=3.063 LOG L-5.053 LOG W=3.061 LOG L-5.086 LOG W=3.061 LOG L-5.093 LOG W=3.090 LOG L-5.159 LOG W=3.171 LOG L-5.344
1999 2000 Table 4. <u>YEAR</u> 1977 1978 1983 1983 1984 1983 1984 1985 1986 1985 1986 1985 1986 1986 1986 1986 1987 1999 1999 1999 1999 1999	27,12 40.85 Fisheries su ELECTRO CPUE Fish/hr 7 7.49 3 11.97 9 7.47 9 7.47 9 30.88 2 9.30 3 8.80 4 7.07 5 10.15 6 9.85 9 13.17 0 17.70 1 15.68 2 14.23 3 20.83 4 15.92 5 14.96 6 9.33 7 18.18 8 23.47 9 45.53	NA NA NA NA Immary for TRAPNET CPUE Fish/hr 5.27 6.28 5.22 3.83 4.76 11.00 8.18 6.21 7.92 0.39 3.75 NA NA NA NA NA NA NA NA NA	12 17 Freshwate CATCH COMP (%) 13 17 21 18 12 24 22 20 31 22 16 8 11 13 12 11 18 14 12 11 18 14 12 11 18 14 12 11 17	1222 1634 r drum 1 569 422 360 520 1146 2225 1626 1212 1712 856 940 419 570 724 596 539 584 495 605 374 812	290 290 977-2000. MEAN LENGTH NA NA NA 267 293 287 288 293 310 312 280 294 297 305 320 334 332 317 300 300 320 320	LOG W=2.981 LOG L-4.988 LOG W=3.274 LOG L-5.697 LOG W=2.947 LOG L-5.697 LOG W=2.911 LOG L-4.756 LOG W=2.911 LOG L-4.710 LOG W=3.052 LOG L-5.026 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.891 LOG L-4.625 LOG W=2.888 LOG L-4.625 LOG W=3.001 LOG L-4.927 LOG W=2.598 LOG L-3.919 LOG W=2.846 LOG L-4.452 LOG W=3.089 LOG L-5.139 LOG W=2.874 LOG L-4.603 LOG W=2.722 LOG L-4.603 LOG W=2.908 LOG L-4.707 LOG W=2.908 LOG L-4.957 LOG W=2.955 LOG L-4.824 LOG W=3.063 LOG L-5.053 LOG W=3.072 LOG L-5.086 LOG W=3.072 LOG L-5.086

Table 3.

Fisheries summary for Gizzard shad 1977-2000.

Table 5.	Fisheries su			redhorse	1977-200	00.
	ELECTRO				an a	
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)		LENGTH	LENGTH WEIGHT REGRESSION
1977		1.58	5	259	NA	LOG W=2.902 LOG L-4.691
1978		1.09	4	125	NA	LOG W=2.978 LOG L-4.917
1979		0.45	3	67	NA	LOG W=3.041 LOG L-5.090
1980		0.70	7	137	NA	LOG W=2.894 LOG L-4.678
1981		1.34	7	686	376	LOG W=2.791 LOG L-4.428
1982		0.92	7	675	392	LOG W=2.814 LOG L-4.496
1983		0.79	6	454	387	LOG W=2.849 LOG L-4.590
1984	1	0.51	7	435	386	LOG W=2.571 LOG L-3.840
1985		0.51	7	374	389	LOG W=2.787 LOG L-4.415
1986	* . * . // 0 * %	0.19	8	319	398	LOG W=2.911 LOG L-4.730
1987		1.24	12	722	403	LOG W=2.860 LOG L-4.608
1988		NA	13	667	381	LOG W=2.696 LOG L-4.176
1989		NA	17	902	370	LOG W=2.792 LOG L-4.448
1990		NA	14	838	361	LOG W=2.825 LOG L-4.544
1991		NA	11	538	355	LOG W=2.784 LOG L-4.443
1992		NA	14	721	403	LOG W=2.841 LOG L-4.587
1993		NA	10	332	382	LOG W=3.011 LOG L-4.991
1994		NA	14	505	389	LOG W=2.872 LOG L-4.655
199		NA	8	450	364	LOG W=2.925 LOG L-4.808
1996	· · · · · · · · · · · · · · · · · · ·	NA	11	551	380	LOG W=2.897 LOG L-4.719
1997		NA	10	833	350	LOG W=2.982 LOG L-4.960
1998			12	1047	360	LOG W=2.982 LOG L-4.960
1999		NA	9	931	350	LOG W=3.016 LOG L-5.050
2000			11	1099	360	LOG W=2.905 LOG L-4.760
Table 6.		Immary for		5 1977-2	000,	
	ELECTRO	TRAPNET	CATCH	5 1977-2	n a sila Na si	
	ELECTRO CPUE	TRAPNET CPUE	CATCH COMP		MEAN	LENGTH WEIGHT REGRESSION
YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN LENGTH	
YEAR 197	ELECTRO CPUE Fish/hr 7 7.76	TRAPNET CPUE Fish/hr 6.73	CATCH COMP (%) 19	N 565	MEAN LENGTH NA	LOG W=2.441 LOG L-3.529
YEAR 197 197	ELECTRO CPUE Fish/hr 7 7.76 8 7.11	TRAPNET CPUE Fish/hr 6.73 5.67	CATCH COMP (%) 19 17	N 565 369	MEAN LENGTH NA NA	
YEAR 197 197 197	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49	TRAPNET CPUE Fish/hr 6.73 5.67 3.02	CATCH COMP (%) 19 17 13	N 565 369 217	MEAN LENGTH NA NA NA	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057
YEAR 197 197 197 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97	CATCH COMP (%) 19 17 13 9	N 565 369 217 183	MEAN LENGTH NA NA NA NA	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022
YEAR 197 197 197	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39	CATCH COMP (%) 19 17 13 9 20	N 565 369 217	MEAN LENGTH NA NA NA	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057
YEAR 197 197 197 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07	CATCH COMP (%) 19 17 13 9 20 18	N 565 369 217 183 1996 1722	MEAN LENGTH NA NA NA 240 286	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677
YEAR 197 197 197 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52	CATCH COMP (%) 19 17 13 9 20 18 17	N 565 369 217 183 1996 1722 1277	MEAN LENGTH NA NA NA 240 286 300	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021
YEAR 197 197 197 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2,89	CATCH COMP (%) 19 17 13 9 20 18 17 15	N 565 369 217 183 1996 1722 1277 435	MEAN LENGTH NA NA NA 240 286 300 304	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677
YEAR 197 197 197 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39	CATCH COMP (%) 19 17 13 9 20 18 17 15 14	N 565 369 217 183 1996 1722 1277	MEAN LENGTH NA NA NA 240 286 300 304 308	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840
YEAR 197 197 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18	N 565 369 217 183 1996 1722 1277 435 768 732	MEAN LENGTH NA NA NA 240 286 300 304 308 325	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337
YEAR 197 197 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 15 14 18 10	N 565 369 217 183 1996 1722 1277 435 768 732 589	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958
YEAR 197 197 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009	MEAN LENGTH NA NA 240 286 300 304 308 325 321 242	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.855 LOG L-4.525
YEAR 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2,89 1.39 1.63 1.44 NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819	MEAN LENGTH NA NA 240 286 300 304 308 325 321 242 266	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.855 LOG L-4.525 LOG W=2.945 LOG L-4.765
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.855 LOG L-4.525 LOG W=2.945 LOG L-4.765 LOG W=2.913 LOG L-4.697
YEAR 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.9773 LOG L-4.337 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.945 LOG L-4.697 LOG W=2.911 LOG L-4.696
YEAR 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577	MEAN LENGTH NA NA NA 286 300 304 308 325 321 242 266 295 310 338	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.855 LOG L-4.525 LOG W=2.945 LOG L-4.765 LOG W=2.913 LOG L-4.697
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36 3 14.42	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.973 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.716 LOG W=2.855 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.967 LOG L-4.829 LOG W=2.939 LOG L-4.750
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36 3 14.42 4 10.20	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 328 339	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.571 LOG L-3.840 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36 3 14.42 4 10.20 5 20.16	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 339 267	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.571 LOG L-3.840 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36 3 14.42 4 10.20 5 20.16 6 16.99	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 339 267 320	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.9773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.958 LOG W=2.926 LOG L-4.958 LOG W=2.945 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975 LOG W=3.026 LOG L-4.975
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36 3 14.42 4 10.20 5 20.16 6 16.99 7 28.53	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14 11 12	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660 1159	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 329 339 267 320 300	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.973 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.958 LOG W=2.945 LOG L-4.958 LOG W=2.945 LOG L-4.958 LOG W=2.945 LOG L-4.697 LOG W=2.911 LOG L-4.697 LOG W=2.939 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975 LOG W=3.026 LOG L-5.068 LOG W=3.054 LOG L-5.038
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36 3 14.42 4 10.20 5 20.16 6 16.99 7 28.53 8 32.90	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14 15 16 14	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660 1159 1314	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 329 267 320 300 320	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.571 LOG L-3.840 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.958 LOG W=2.955 LOG L-4.958 LOG W=2.945 LOG L-4.958 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.939 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.696 LOG W=2.911 LOG L-4.696 LOG W=2.911 LOG L-4.696 LOG W=3.054 LOG L-5.068 LOG W=3.054 LOG L-5.038 LOG W=3.085 LOG L-5.106
YEAR 197 197 197 198 198 198 198 198 198 198 198 198 198	ELECTRO CPUE Fish/hr 7 7.76 8 7.11 9 3.49 0 2.48 1 30.88 2 28.11 3 17.50 4 13.53 5 16.75 6 14.23 7 9.70 8 22.90 9 20.00 0 25.49 1 24.15 2 17.36 3 14.42 4 10.20 5 20.16 6 16.99 7 28.53 8 32.90 9 35.91	TRAPNET CPUE Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA NA NA NA NA	CATCH COMP (%) 19 17 13 9 20 18 17 15 14 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14 15 16 14 15 16 14	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660 1159	MEAN LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 329 267 320 300 320 300	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.973 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.958 LOG W=2.945 LOG L-4.958 LOG W=2.945 LOG L-4.958 LOG W=2.945 LOG L-4.697 LOG W=2.911 LOG L-4.697 LOG W=2.939 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975 LOG W=3.026 LOG L-5.068 LOG W=3.054 LOG L-5.038



		isheries surr LECTRO T					
		CPUE	CPUE	COMP		MEAN	
	YEAR	Fish/hr	Fish/hr	(%)	N. I		LENGTH WEIGHT REGRESSION
2	1977	1.36	0.37	1	20	NA	LOG W=3.137 LOG L-5.377
	1978	1.54	0.96	2	28	NA	LOG W=3.056 LOG L-5.197
	1979	1.57	0.31	2	34	NA	LOG W=3.225 LOG L-5.640
	1980	1.20	0.13	1	22	NA	LOG W=3.250 LOG L-5.693
	1981	3.53	0.39	2	189	335	LOG W=3.082 LOG L-5.240
	1982	2.96	0.16	1	135	415	LOG W=3.097 LOG L-5.293
	1983	1.63	0.21	1	90	432	LOG W=3.095 LOG L-5.295
	1984	2.04	0.11	2	93	378	LOG W=2.852 LOG L-4.615
	1985	2.64	0.13	2	119	413	LOG W=3.159 LOG L-5.461
	1986	1.99	0.15	2 2	101	404	LOG W=3.085 LOG L-5.269
	1987	3.00	0.09	2	132	386	LOG W=3.151 LOG L-5.446
	1988	5.80	NA	2 5	234	450	LOG W=3.103 LOG L-5.272
	1989	4.19	. NA	3	173	408	LOG W=3.140 LOG L-5.379
	1990	2.36	NA.	2	95	420	LOG W=3.214 LOG L-5.594
	1991	1.44	NA	1	52	477	LOG W=3.318 LOG L-5.870
	1992	2.30	NA	1	82	403	LOG W=3.257 LOG L-5.727
	1993	2.00	NA	2	60	465	LOG W=3.001 LOG L-5.020
	1994	2.11	NA.	2	74	439	LOG W=3.261 LOG L-5.720
	1995	2.63	NA	2	107	333	LOG W=3.208 LOG L-5.586
	1996	2.75	NA	2	118	360	LOG W=3.159 LOG L-5.467
	1997	5.63	NA	3	248	400	LOG W=3.215 LOG L-5.617
	1998	6.16	NA	3	272	420	LOG W=3.148 LOG L-5.440
	1999	7.63	NA	3	308	440	LOG W=3.238 LOG L-5.690
					000		Le sette
	2000	112	NA	3	325	460	LOG W=3.250 LOG L-5.717
	2000 Table 8	7.72 Ficheries cu	NÀ mmany for s	3 Sauger 19	325	460	LOG W=3.250 LOG L-5.717
	Table 8.	Fisheries su	mmary for s	Sauger 19			
	Table 8.	Fisheries sur ELECTRO	mmary for S TRAPNET	Sauger 19 CATCH		•	
	Table 8. f	Fisheries sui ELECTRO CPUE	mmary for S TRAPNET CPUE	Sauger 19 CATCH COMP	77-2000.	MEAN	
	Table 8. F	Fisheries sui ELECTRO CPUE Fish/hr	mmary for S TRAPNET CPUE Fish/hr	Sauger 19 CATCH COMP (%)	77-2000. <u>N</u>	MEAN LENGTH	LENGTH WEIGHT REGRESSIO
	Table 8. F YEAR 1977	Fisheries sur ELECTRO CPUE Fish/hr 0.77	mmary for S TRAPNET CPUE Fish/hr 0.40	Sauger 19 CATCH COMP (%) 1	77-2000. <u>N</u> 20	MEAN LENGTH NA	LENGTH WEIGHT REGRESSIO
	Table 8. F <u>YEAR</u> 1977 1978	Fisheries sur ELECTRO CPUE Fish/hr 0.77 2.43	mmary for s TRAPNET CPUE Fish/hr 0.40 0.38	Sauger 19 CATCH COMP (%) 1 2	77-2000. N 20 38	MEAN LENGTH NA NA	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354
	Table 8. F YEAR 1977 1978 1979	Fisheries sur ELECTRO CPUE Fish/hr 0.77 2.43 1.57	mmary for s TRAPNET CPUE Fish/hr 0.40 0.38 0.30	Sauger 19 CATCH COMP (%) 1 2 2	77-2000. N 20 38 24	MEAN LENGTH NA NA NA	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158
	Table 8. F YEAR 1977 1978 1979 1980	Fisheries sur ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79	mmary for 5 TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17	Sauger 19 CATCH COMP (%) 1 2 2 2 2	N 20 38 24 16	MEAN LENGTH NA NA NA NA	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509
	Table 8. F <u>YEAR</u> 1977 1978 1979 1980 1981	Fisheries sur ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28	mmary for 5 TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29	Sauger 19 CATCH COMP (%) 1 2 2 2 2 4	N 20 38 24 16 NA	MEAN LENGTH NA NA NA NA NA	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982	Fisheries sur ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17	Sauger 19 CATCH COMP (%) 1 2 2 2 2 4 4 4	N 20 38 24 16 NA 329	MEAN LENGTH NA NA NA NA NA 256	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 4 3	N 20 38 24 16 NA 329 188	MEAN LENGTH NA NA NA NA 256 285	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1984	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 3	N 20 38 24 16 NA 329 188 182	MEAN LENGTH NA NA NA NA 256 285 262	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.864 LOG L-5.144 LOG W=2.648 LOG L-4.202
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1984 1985	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 4 3 3 3 4	N 20 38 24 16 NA 329 188 182 199	MEAN LENGTH NA NA NA 256 285 262 283	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.864 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.019
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986	Fisheries su ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29	mmary for 5 TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 4	N 20 38 24 16 NA 329 188 182 199 178	MEAN LENGTH NA NA NA 256 285 262 283 294	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-5.144 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1984 1985 1985 1986 1987	Fisheries sui ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94	mmary for 5 TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 2 2 4 2 4 2 4 2 2 4 4 2 2 2 4 2 2 4 2 2 4 2 2 4 2 2 2 4 2 2 2 4 2 2 2 2 2 2 2 4 2	N 20 38 24 16 NA 329 188 182 199 178 114	MEAN LENGTH NA NA NA 256 285 262 283 294 262	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-5.144 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1983 1984 1985 1986 1987 1988	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 2 2 2 4 4 2 2 2	N 20 38 24 16 NA 329 188 182 199 178 114 79	MEAN LENGTH NA NA NA 256 285 262 283 294 262 236	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.644 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.019 LOG W=2.996 LOG L-5.936 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=2.683 LOG L-4.285
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1983 1984 1985 1986 1987 1988 1989	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 2 2 2 2 2 2 2 2	N 20 38 24 16 NA 329 188 182 199 178 114 79 104	MEAN LENGTH NA NA NA 256 285 262 283 294 262 236 237	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.864 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.019 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=2.683 LOG L-4.285 LOG W=3.208 LOG L-5.639
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1983 1984 1985 1986 1987 1988 1989 1990	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 2 2 2 2 2 2 2 2 2	77-2000. N 20 38 24 16 NA 329 188 182 199 178 114 79 104 92	MEAN LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.644 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.019 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-4.285 LOG W=3.070 LOG L-5.277
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1985 1986 1987 1988 1989 1990 1991	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 2 2 2 2 2 2 2 2 2 2 2	N 20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117	MEAN LENGTH NA NA NA 256 285 262 283 294 262 236 237 291 308	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.648 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.019 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=2.683 LOG L-4.285 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.277 LOG W=3.155 LOG L-5.507
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1985 1986 1987 1988 1989 1990 1991 1992	ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07 5.24	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA NA	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 2 2 2 2 2 2 2 2 2 2 2	N 20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117 196	MEAN LENGTH NA NA NA 256 285 262 283 294 262 236 237 291 308 297	LENGTH WEIGHT REGRESSIO LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.648 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.144 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.336 LOG L-5.556 LOG W=3.208 LOG L-5.556 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.507 LOG W=3.029 LOG L-5.191
	Table 8. F YEAR 1977 1978 1979 1980 1981 1982 1983 1983 1984 1985 1985 1986 1987 1988 1989 1990 1991 1992 1993	Fisheries sur ELECTRO CPUE Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07 5.24 5.71	mmary for S TRAPNET CPUE Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA NA	Sauger 19 CATCH COMP (%) 1 2 2 2 4 4 3 3 4 4 3 3 4 4 2 2 2 2 2 2 2	77-2000. N 20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117 196 168	MEAN LENGTH NA NA NA 256 285 262 283 294 262 236 237 291 308 297 262	LENGTH WEIGHT REGRESSION LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.144 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=2.683 LOG L-5.556 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.507 LOG W=3.029 LOG L-5.191 LOG W=2.950 LOG L-4.976
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	10	nn, 1901-20 ⊴∛		特殊 5		
	2 (1897)) (1893)22	Smallmo	uth Bass	Largemou	uth Bass	
		CPUE	Rank	CPUE	Rank	
	1981	4.65	9	0.58	20	24 (* 1423)
·. ·	1982	3.72	7	0.41	18	
·	1983	2.17	8	0.80	1 <u>1</u> 5.	
	1984	2.19	7	1.16	11	
· ,.	1985	1.56	8	0.54	15	1 . 1
	1986	0.85	9	0.21	20	
	1987	2.94	7	0.61	16	
	1988	5.72	7	4.06	9	4 4 6 5 2 5
·	1989	13.52	4	3.40	10,	
	1990	16.44	5	2.39	9	
	1991	11.03	5	1.87	11	
	1992	9.61	5	2.50	11	
	1993	5.80	6	1.10	14	
• •	1994	3.83	7	0.65	15	120/2
	1995	5.81	5	1.93	12	
	1996	7.31	5	2.08	10	រឺ ភ្នំផ្ល
·	1997	13.23	5	2.10	15	1.550°
	1998	15.01	5	2,75	14	·
	1999	13.51	7 °	3.71	13	· ·
	2000	17.02	6	4.67	11	

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 Table 9.
 Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and rank, 1981-2000.

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		• •		•	1.55			
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	Year	Cam	White bass	Freshwater Drum	Sauger	Black Crappie	Shorthead Redhorse	Walleye	Gizzard Shad	Total %
		Carp				•••		-		Total %
	1981	17	20	12	4	15	7.	2	9	86
	1982	23	18	24	4	9	7	_ <b>1</b>	3	89
	1983	18	17	22	3	16	6	1	<b>\ 2</b>	85
	1984	26	15	20	3	12	7	2	1	86
	1985	20	14	31	4	9	7.	2	· 1	87
,	1986	21	18	22	4	9	8	2	<1	84
1	1987	27	10	16 8	2	11	12	2	1	81
÷.	1988*	23	20	8 3	2	3	13	5	3	77
	1989*	20	15	11 🗄	2	1	17	3	<1	<b>70</b> .
	1990*	20	16	13	1 -	<1	14	1	3	69
	1991*	24	18	12	2	1	. 11	1	4	73
	1992*	26	12	11	<b>4</b> '	1 -	14	2	2	72
	1993*	28	12	18	5	<b>`&lt;1</b>	- 10	2	2	76
	1994*	34	10	14	4	<1	14	2	<1	78
	1995*	30	16	12	5	1	8	2	· 4	78
	1996*	34	14	8	5	2	11	2	<1	76
	1997*	29	15	10	5	1	10	3	<1	73
đ.	.1998*	23	16	<b>,11</b>	-5	2	12	3	2	74
	1999*	17	14	17	7	3	9	3	12	82
	2000*	16	16	8	4	2	11	3	17	77

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Table 10.Species composition expressed as % of total annual catches for PINGP<br/>fisheries studies, electrofishing and trapnetting combined for 1981-1987,<br/>and electrofishing only for 1988 through 2000.

*Electrofishing only

### SECTION III

## PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2000 ANNUAL REPORT

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## FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

Study and Report

by .

B. D. Giese

and

K. N. Mueller

Environmental Services Water Quality Department

#### FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

#### INTRODUCTION

The 2000 study was a continuation of the study started in 1992 to evaluate effects of increased water appropriation from 150 to 300 cubic feet per second (cfs) during April on impingement of larval fish on 0.5 mm mesh traveling screens at the Prairie Island Nuclear Generating Plant (PINGP). Prior to 1992, the cooling water intake system operated with fine-mesh screens from April 16 through August 31, in accordance with Part I.C.6.c. of the plant's NPDES Permit (#MN0004006). Since 1992, for study purposes, the plant has implemented fine-mesh screen operation on April 1 to accommodate sampling during the month of April for years 1992 through 2000. Data for this evaluation were collected by predawn and daylight sampling of larval fish from the screenwash water. This report includes fish egg, larvae, and juvenile densities, initial survival estimates, and impingement estimates from the fine-mesh screens as described in the monitoring plan. The attached appendix includes species and lifestage codes used in the tables of this report.

#### METHODS AND MATERIALS

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#### SAMPLE COLLECTION

Two samples were collected per sample date beginning April 4, 2000 and continuing through the end of April, with a total of 16 samples collected. Samples were collected during pre-dawn and daylight hours to provide diurnal comparison.

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Samples were collected throughout April by diverting 25 percent (2 of 8 screens) of the screenwash water to collection tanks in the basement of the environmental lab. Screenwash water flows by gravity from the vertical traveling screenwash trough through an 18-inch pipe to the lab basement. The larval collection tank, manufactured by Lawler, Matusky, and Skelly Engineers (Figure 1), filters screenwash water through 0.5 mm mesh nylon screen. Filtered water returns to the circulating water system via a 12-inch diameter drain pipe. The screenwash trough was manually cleaned and the fish sampling system was flushed to remove accumulated debris and fish prior to sample collection on each date of the 2000 sample season.

During sample collection, physical parameters were recorded including collection time and duration, screen speed, number of screens sampled, river stage, and water temperature. Volume of river water filtered by the intake screens was obtained from the PINGP monthly external circulating water log.

Sample collection duration was 10 minutes for all but two samples which were 11 and 14 minutes. Upon completion of sample collection, all fish and any debris were rinsed into two collection baskets located at the outlet end of the collection tank (Figure 2). The baskets were then removed from the tank, the contents transferred to a five gallon bucket, and transported to the fish handling and sorting area for further processing. All samples were collected with the traveling screens in the "manual" mode at a rotation speed ranging from 2.5 to 3 feet per minute. and the second second

an and the second second Samples were sorted to remove live and dead fish, with an emphasis on doing so in a timely manner. Live or dead fish were categorized on the presence or absence of movement. Sorting efficiency was maximized by pouring small portions of the sample into glass baking dishes and sorting on a light table. 网络小学生 化化合理学 化过敏 网络斯特尔 化化合体 化合金

Fish and eggs found in the sample were removed, and the remaining debris was rinsed into a Tyler No. 60 sampling screen and drained, then preserved in a solution of 5% formalin containing rose bengal stain. Each sample was sorted a second time. Fish and eggs found during the second sort were included with those from the initial sort, and recorded as dead. 

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#### DATA ANALYSIS METHODS

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## Fish and Egg Density and the second of the second states and the second states and the second states and

and the second of the second Fish and egg densities were calculated on a pre-dawn and daylight basis from data collected during April 2000. A combination of sample duration, plant blowdown (discharge), and identification data provided density values, expressed as numbers of fish or eggs per, 100 cubic meters of water withdrawn from the river for plant use. The data are presented for individual taxa and lifestage for each date (Table 1a). Pre-dawn and daylight densities of all taxa and lifestages were combined and recorded by date (Table 1b). 

Estimates of fish survival following impingement on the fine-mesh screens were calculated for each sample by totaling the number of live fish in each sample and dividing by the total number of fish in each sample (Table 1a). 化乙酸 建化化物合金

Estimated numbers of fish and eggs impinged daily on the fine-mesh traveling screens was calculated by totaling the number of fish collected that day, multiplied by the proportion of the number of screens operting and sampled, and the number of minutes per day divided by the number of minutes sampled (Table 3). In years 1984 to 1989 fine mesh panels of the traveling screens were not required to be operable until April 16, resulting in inconsistent start dates which accounts for incomplete April data prior to 1992. However, when fine-mesh screens were installed earlier, impingement data were obtained. Table 4 provides water appropriation (as blowdown), flow, temperature, and average daily impingements for the dates that were sampled in April 2000. Study results contribute to the ongoing assessment of increased water appropriation effects on larval fish impingement.

#### Identification methodology

Terminology used to identify lifestage was similar to that described by Auer (1982). The larval stage was divided into two developmental phases which correspond to Auer's terms yolk-sac larvae and larvae, respectively.

#### Terminology and criteria:

Prolarvae (Yolk-sac larvae) - Phase of development from time of hatch to complete absorption of yolk.

Postlarvae (Larvae) - Phase of development from complete absorption of yolk to development of the full compliment of adult fin rays and absorption of finfold.

Juveniles - Phase of development from complete fin ray development and finfold absorption to sexual maturity; includes young-of-the-year (yoy) fish.

#### **RESULTS AND DISCUSSION**

Sixteen samples were collected during April 2000, of which 9 contained a total of 8 fish (6 prolarvae, 1 juvenile and 1adult) and 137 eggs. Survival was based on absence or presence of movement during the sort. Eight taxa/lifestage combinations were identified in the samples (Table 1a). Burbot is the only species expected to spawn early enough in Spring, for their larvae to be in the drift and subject to impingement on the traveling screens before late-April.

By examining embryos, eggs were determined to be those of carp. Carp have not been reported to spawn below 60 degrees Farenheit in this region (Scott and Crossman, 1973; Becker, 1983). The "logical" presumption was made that carp living between the bar racks and the traveling screens spawn prematurely underneath the intake screenhouse due to elevated water temperatures as a result of recirculating water and deicing line water.

#### Densities

Densities by taxa/lifestage combinations of fish collected during April 2000 from the fine-mesh screens are presented in Table 1a, expressed as organisms per 100 cubic meters of water sampled. Table 1b provides diurnal density comparisons for sample dates when fish and/or eggs were collected. The data indicate that more fish and eggs were impinged during predawn hours in 2000.

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#### Survival estimates

Survival estimates are included in Table 1a for taxa/lifestage combinations collected during April 2000. Overall initial survival of fish collected in 2000 was 75% (Table 1a). Due to the low number of fish collected, survival estimates presented in Table 1a may be weighted too heavily. Survivorship for all taxa/lifestage combinations collected during 1984 through 1988 was summarized in the 1988 Prairie Island Annual Report (Kuhl and Mueller 1988).

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#### Impingement estimates

Impingement estimates are available for years 1984-1989 and 1992-2000 (Table 4). Table 2 provides comparison of taxa/lifestage combinations collected in 2000 to previous years. Estimated impingement of fish collected in April of all years is shown in Table 3. Estimated impingement values during April 2000 were low as in past years during April, and taxa/lifestage combinations were similar. Data collected through 2000 suggest that few larval fish are impinged on the fine-mesh screens during April even with increased water appropriation to 300 cfs.

During April 2000 sampling 8 total fish were collected. All eggs were identified as carp eggs by examining embryos taken from the eggs. We are hesitant to quantify how many eggs survive impingement, because little is known on how many eggs in the river drift survive when not impinged.



#### SUMMARY

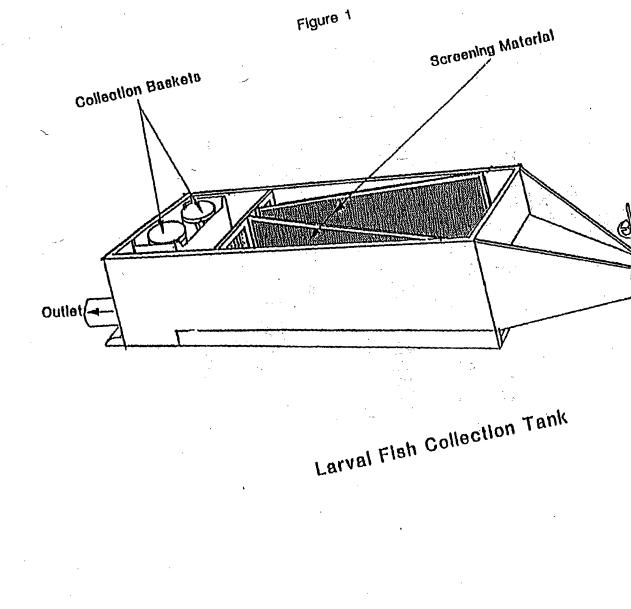
Larval studies were conducted at PINGP from 1984 through 1988 providing estimates of impingement, density, and survival. In 1989 and 1990 larval fish studies were done to evaluate sampling induced mortality. Sampling was not a requirement of the NPDES permit during 1991. In 1992-2000, finemesh screens were installed by April 1, and a larval fish study was conducted to assess impingement affects of increased water appropriation during April. In comparison to previous studies at PINGP, increased water appropriation in 2000 does not appear to have increased the number of larval fish impinged on the traveling screens during April.

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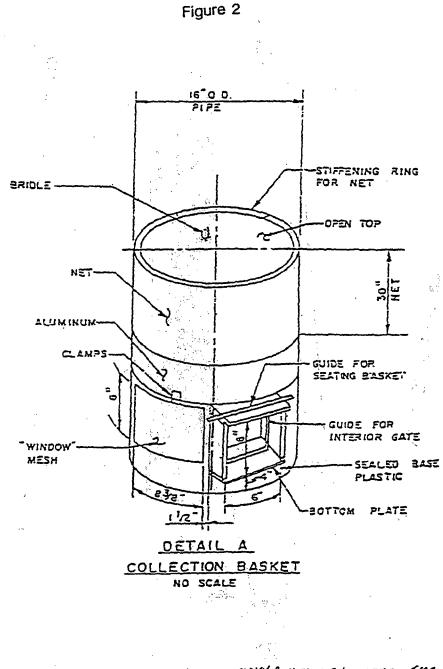
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# Table 1a.Survivorship and Density (fish and fish eggs/100 cubic meters) by Taxa/lifestagecombination of Fish Collected on PI Fine-mesh Intake Screens During April 2000.

· · · · · ·	we a substantion of the substant	1. 1995 1995. 		1. Jac 199	Numbe	ro
Date	Taxá .	Lifestage	Density	Percent Live	Fish	1
	ar in ar de man			·	ter t	
4-Apr-2000	UNID	EG	4.125653	0		(
4-Apr-2000	UNID	EG	0.404476	0	1.0.0	(
6-Apr-2000	UNID	EG	2.184169	0 1 1	2000 C	1
6-Apr-2000	Log perch	AD	0.080895	100	1. I.	
6-Apr-2000	UNID	EG	2.253508	0		
6-Apr-2000	Carp	PRO	0.057782	10010485	12	
13-Apr-2000	Burbot	PRO	0.083182	o de <b>O</b> recte	13	
18-Apr-2000	Shiner	JUV	0.159057	100	N SC N	
20-Apr-2000	Cyprinid	PRO	0.159057	01. 193		
27-Apr-2000	UNID	EG	0.735410	States Outros de		
27-Арг-2000	UNID	EG	0.367705	0		
27-Apr-2000	Sauger	PRO	0.147082	100		
27-Apr-2000	Walleye	PRO	0.073541	100	1.51	

Table 1b. 👘

Density of fish and eggs (fish/100 cubic meters) collected in pre-dawn and daylight samples in 2000.

Date	Pre-dawn	Daylight
	Density	Density
4/4/2000	4.125653	0.404476
4/6/2000	2.265064	2.311290
4/11/2000	0.000000	0.000000
4/13/2000	0.000000	0.083182
4/18/2000	0.159057	0.000000
4/20/2000	0.159057	0.000000
4/25/2000	0.000000	0.000000
4/27/2000	0.735410	0.588328

Table 2

# Taxa/life stage combinations of fish collected in April of 2000 and previous years. An extension of

Taxa	Adult	Juvenile	Postlarvae	Prolar
Carp			, <b>X</b>	0,>
Channel catfish		X	1	
Cyprinid	X	<b>X</b>	X	(O. 181
Flathead catfish		. X		
Percid	X		×	X
Walleye				0,)
Bullhead sp.		X		
Sauger		tura interiori	X	
Burbot				
Catostomid		X		X
Stizostedion spp.		in the second second	n second se	í X
White bass		X	1	n na se
Gizzard shad			A State of the second	
Freshwater drum		X	A superior and the second	د. بالا مرید مرتبع می ا
Johnny darter	2X (4. )	د <del>معمور در در ا</del> د رو	an sample a s	- 200
Shiner spp.	14/04/2	0,X	e produktion and and and and and and and and and an	ing 1
Emerald shiner	X	X	and the second s	
Bluegill		X		
Mooneye				×
Golden redhorse		x		
Unidentified				X
Log perch	0		1	X

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		ĩ		······				jer.			_		· · · · · ·		·····		
able 3. 👘	Estima	ted imp	ingement of fi	sh collected	on	PINGP fine-	mesh s	creens	during April, 1	<u>984-1989 a</u>	nd	<u>1992-2000.</u>	1	ļ		· · · · ·	
<u></u>	L	<u>,</u>			<u> </u>		artine:						<u> </u>				
)ate	Taxa	Life	Estimated	No of Fish	<u> </u>	Date	Taxa	Life	Estimated	No of Fish	4	Date	Taxa	Life	Estimated	No of Fish	L
		Stage	Impingement	Collected	<u>↓</u>			Stage	Impingement	Collected	╂			Stage	Impingement	Collected	<u> </u>
1984	<u></u>	<b>F</b> O			1.7.7	24 4 90	0000	1 INT	4700	ļ	<u> </u>	12.47.00	CV/DD	100		[·····································	
6-Apr-84		EG	384	1	S	24-Apr-86 25-Apr-86			1728	1	<u>'</u>	13-Apr-89			384		
8-Apr-84 3-Apr-84		PO	3840		1	23-Apr-86			480	i mana an		14-Apr-89			0		
5-Apr-84		EG	384	1		29-Apr-86		EG	864			18-Apr-89 20-Apr-89			0		
5-Apr-84		PO	384	1	1	29-Apr-86		EG	288			21-Apr-89		UN	0	0	
5-Apr-84		EG	3840			29-Apr-86		PR	288	<u> </u>	+	25-Apr-89		UN	0		
7-Apr-84		JU	384	the second s		1987	VE	<u> </u>	200		┝──	25-Apr-89		PR	1152	3	
7-Apr-84		10	384	1		6-Apr-87		PR	1536	4	+	1992	JUUR	1- K	1152		
7-Apr-84		EG	2304	6		8-Apr-87			576	1	-	1-Apr-92	CVDD	DD	288	<u></u>	
0-Apr-84		JU	384	21	┣	10-Apr-87		PR	2304	4		1-Apr-92			288		
0-Apr-84		AD	384	21	┣	13-Apr-87	and the second se	PR	2304	4	<u> </u>	1-Apr-92			200 576	2	
0-Apr-84		JU	192	1		15-Apr-87		PR	3456	6		2-Apr-92		UN	5/6	0	
0-Apr-84		PR	1152	-6		16-Apr-87		PR	576	0	_	8-Apr-92	× X	UN	0	0	
0-Apr-84		EG	4416	23		20-Apr-87		UN	5/6		<u> </u>	9-Apr-92		UN	0		
0-Apr-84		PR	768	4	2017	22-Apr-87		UN	0	Ö	_	14-Apr-92		UN	0	A-0_0	
1985	VVC	<u>F K</u>	/00			24-Apr-87		UN	0	0	·	16-Apr-92		UN	0	0	
9-Apr-85	BHS	JU	384	1		27-Apr-87			576	1		21-Apr-92		PR	576	1	,
2-Apr-85			1152	3		27-Apr-87		PR	576	1		23-Apr-92		UN	0	0	
3-Apr-85		EG	192	1		29-Apr-87		PO	2880	5		28-Apr-92		UN	0	Ő	
4-Apr-85			576	3		29-Apr-87		PR	576	. 1		30-Apr-92		JU	288	v 1	
4-Apr-85		PR	1344	7		1988			5		<u> </u>	30-Apr-92			288		
4-Apr-85		EG	384	2		8-Apr-88	BUR	PR	768	. 2		1993					
4-Apr-85		PR	1536	- 8		11-Apr-88		UN	0	0		2-Apr-93	UN: S	X	Ō	Ó	
5-Apr-85		PR	192	1		13-Apr-88		EG	384	1		6-Apr-93		PR	288	1	
5-Apr-85		PR	1536	8		15-Apr-88		PR	768	2	-	8-Apr-93		EG	288	il	<u> </u>
5-Apr-85		PR	. 384	2		18-Apr-88	X	UN	0	0		8-Apr-93		PR	288	1	···
5-Apr-85		PR	576	3		20-Apr-88		PR	768	2		13-Apr-93		X	0	0	
S-Apr-85		PR	192	1		22-Apr-88	BUR	PR	1920	5		15-Apr-93	BUR	PR	288	1	
6-Apr-85		PR	192	1	, · · ;	25-Apr-88	BUR	PR	1152	3		19-Apr-93		EG	1152	2	
-Apr-85	BUR	PO	96	1		27-Apr-88	BUR	PR	1152	3		21-Apr-93		X	0	0	
-Apr-85		PR	192	2		28-Apr-88		PR	384	1		27-Apr-93		X	0	0	
-Apr-85	CATO	PR	288	3	·	29-Apr-88	X	<b>UN</b>	0	0		29-Apr-93	UN	EG	288	<b>1</b>	······································
-Apr-85	PERC	PR	192	2		1989						1994	1				
1986	<i>2</i> 6. <i>1</i>		···		5 X	4-Apr-89		UN	0	0		5-Apr-94	UNID	EG	384	<b></b>	•.
3-Apr-86	CARP	PR	288	1		6-Apr-89	PERC	AD	384	1		5-Apr-94		JU	384	1	
B-Apr-86			288	1	<u> </u>	7-Apr-89		UN	0	0		5-Apr-94			384	1	
-Apr-86	CYPR	PO	288	1		11-Apr-89		UN	0	0		5-Apr-94		PR	384	1	
3-Apr-86			288	1		13-Apr-89		PR	384	1	. 1	7-Apr-94		PR	288	1	••••••

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Table 3. (c	ont)	Estima	ated impingem	nent of fish o		ected on PING	P fine-m	esh scr	eens during A	pril, 1984-1	989	and 1992-200	0.					
	192. j.	<u> </u>		· · · · · · · · · · · · · · · · · · ·		Are		1			1.50			ļ		<u>ىنىچىنې ،</u>	<u>l</u>	<u> </u>
Date	Taxa		Estimated	No of Fish		Date	Taxa	Life	Estimated	No of Fish		Date	Taxa	Life	Estim		No of	
i isa Atorian I		Stage	Impingement	Collected			ļ	Stage	Impingement	Collected	l÷-		13	Stage	Imping	gement	Collec	ned
1994 (con		00				1996 (cont)	1000	100			12	1999 (cont)		+			╬╧══╧	
12-Apr-94	ISA	PR	288			25-Apr-96		PR	504			9-Apr-99		JU	5. * 1	288	1-1	
12-Apr-94			288		14	25-Apr-96 30-Apr-96		PR	252	A	مید د. وقد فعو	9-Apr-99 9-Apr-99		PR	<u> </u>	576 288	<u> </u>	
14-Apr-94 19-Apr-94		X	288			1997	A	<u> </u>	U	U		9-Apr-99 13-Apr-99		JU	<b> </b>	288		
21-Apr-94	the second se	X	200	· · · · · · · · · · · · · · · · · · ·		3-Apr-97	LINIO	EG	17,280	30		13-Apr-99		EG		288		<u> </u>
26-Apr-94			1152	-		4-Apr-97	1	JU	1152	2		15-Apr-99		IPR	<u> </u>	288		
26-Apr-94		PR	288	the second s	┠	4-Apr-97		PR	576		1-	22-Apr-99		PR	5869 1	576	<u> </u>	<u></u>
28-Apr-94		PR	288			25-Apr-97		PR	2304	4	-	27-Apr-99			utalia Biologia Dalia	288	E	
28-Apr-94		PR	288		<u> </u>	29-Apr-97		JU	864	2		27-Apr-99		JU		288		
1995		<u> </u>		<u> </u>	┝	30-Apr-97		JU	432			27-Apr-99				288		
3-Apr-95	CATO	JU	288	1	┠	30-Apr-97		JU	432			30-Apr-97				288		<u> </u>
4-Apr-95		PR	288		┣	30-Apr-97		JU	432	1	20	30-Apr-97				576		
4-Apr-95		JU	576			30-Apr-97		EG	864	2		30-Apr-97			1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	288	<u> </u>	
4-Apr-95		JU	1152		<u> </u>	1998		EG _	004		<u>`</u>	2000	PERG	PU	101949 	205		
4-Apr-95		<u>10</u>				2-Apr-1998	LAND	EG	220	1				-		44.000	<b> </b>	
4-Apr-95		<u> 10</u>	1152 576			3-Apr-1998			229 252			4-Apr-2000 4-Apr-2000		EG EG		14,688 1440	<u></u>	5
		10	the second se						and the second se									
4-Apr-95		PR	9792	17		7-Apr-1998 9-Apr-1998		X	0 229	0	1	6-Apr-2000		EG	2.	7,776	1.1. ⁻	_2
										· · · · · · · · · · · · · · · · · · ·		6-Apr-2000		AD CO		288		_ 3
17-Apr-95		EG EG	13248 2880	46		14-Apr-1998 16-Apr-1998		<u> 10</u>	252 229		- 24-24 - 24-24	6-Apr-2000		EG	<u>.</u>	8023 206	·····	- 3
20-Apr-95				10		and the second se			229		5.46	6-Apr-2000		PRO	V ^{er}			
24-Apr-95 26-Apr-95		EG EG	1152	4		16-Apr-1998 21-Apr-1998			1512	1		13-Apr-2000		PRO		288	<u> </u>	
1996		EG	864	3		21-Apr-1998		EG	252	6		18-Apr-2000 20-Apr-2000		JU PRO		288 288	·····	
2-Apr-96	CADD	PR	252	1		23-Apr-1998		JU	252	1		20-Apr-2000 27-Apr-2000		EG		2618	<u> </u>	
4-Apr-96		EG	504	2		23-Apr-1998		EG	2016	8		27-Apr-2000		EG		1440	<u></u>	_1
9-Apr-96		AD	252	2		28-Apr-1998		PR	2018	9	<u>i</u>			PRO		576		
9-Apr-96			252			28-Apr-1998		PR	2268	9		27-Apr-2000 27-Apr-2000		PRO		288	с.н. т. П. (1)	
					<u> </u>							27-Apr-2000	VVAE	PRU	<u> </u>	208		
9-Apr-96		EG	252	1		28-Apr-1998			1512	6	<u>.</u>							
11-Apr-96		JU	252	1		28-Apr-1998		PR	252	1								
11-Apr-96		PR	252	1		30-Apr-1998		PR	2016	8		13. 3 ⁵ 1						
11-Apr-96		<u>JU</u>	504	2		30-Apr-1998		PR	14364	57				·i	77.24			
1-Apr-96		PR	252	1		30-Apr-1998		PR	2268	. 9	1.1							-
1-Apr-96		PR	252	1	·	30-Apr-1998			252	1			- 	<u></u>	<del></del>	ł		
11-Apr-96		PR	252	1		30-Apr-1998	GORH	JU	252	<u>erre i 1</u>							<del> </del>	
6-Apr-96		X	0	0	÷	1999				.31								
8-Apr-96		X	0	0		6-Apr-99			522	2								
23-Apr-96			504	2		6-Apr-99			4032	14		S of the			<u> </u>		· ·	
3-Apr-96	UNID	EG	1008	4		9-Apr-99	GIZ	<u> JN</u>	288	11	- 1					1		

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Table 4.	Estimated	fish and fish egg	j impingement d	ata for dates sa	mpled			
	in April 200	00 with correspo	nding blowdown	, river flow and t	temperatur	es.		
						ية. الأم		1919 1 - 1919
Date	Blowdown	Average Daily	Avg. daily	Est.avg daily				•
	(cfs)	R. Flow (cfs)	Inlet Temp. (F)	impingement.			1	
		10.000		10.100		·		
4/4/2000		16,200	44.0	16,128	···			. `
4/6/2000		17,000	45.1	16,293		•		
4/11/2000	291	15,100	46.1	0		· ·	~	
4/13/2000	283	13,400	44.4	288				
4/18/2000	148	14,300	44.8	288			1.	$\langle \cdot, \cdot \rangle$
4/20/2000	148	15,200	46.3	288				
4/25/2000	283	16,500	51.6	0	1	$  _{\mathcal{L}_{2}} =   _{\mathcal{L}_{2}} +   _{\mathcal{L}_{2}} =   \mathcal{L}  $	3	
4/27/2000	291	16,500	54.7	4922				
					1			
	1.	-		1		· · · · · ·	1 ·	· .

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# LEGEND

# LIFE STAGE

UN	=	Unidentified or Zero
EG	=	Egg
PR	=	Prolarvae
PO	=	Postlarvae
JU	=	Juvenile
AD	=	Adult

# TAXA CODE

UNID	=	Unidentified
CC	=	Channel Catfish
CYPR	Ξ	Cyprinids, other than
FHC	=	Flathead Catfish
PERC	H	Percids, other than
BHS	Ξ	Bullhead spp.
SA	=	Sauger
WE .	Ξ	Walleye
STIZ	=	Stizostedion spp.
BÙR	=	Burbot
CATO	=	Catostomids
CARP	=	Carp
		Maanava

- MOON = Mooneye
- X = No Fish

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT

# **ENVIRONMENTAL MONITORING**

# AND

# **ECOLOGICAL STUDIES PROGRAM**

# 2001 ANNUAL REPORT

Prepared for

Northern States Power Company d/b/a Xcel Energy Minneapolis, Minnesota

By

**Environmental Services** Water Quality Department

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Section I

Section II

# SECTION I

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM

2001 ANNUAL REPORT

WATER TEMPERATURE AND FLOW

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Study and Report

by K. N. Mueller and B. D. Giese

Environmental Services Water Quality Department

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### WATER TEMPERATURE AND FLOW

#### INTRODUCTION AND METHODS

The Mississippi River is the source-water body for circulating and cooling water systems at the Prairie Island Nuclear Generating Plant (PINGP). This report presents daily plant operating hours, river inlet temperatures, site discharge temperatures and flows (blowdown). Site discharge temperatures are determined by thermocouples located downstream at U.S. Army Corps of Engineers Lock and Dam 3. Plant inlet (ambient river) temperatures are determined by remote sensors located in Sturgeon Lake, and the main channel at Diamond Bluff. Inlet temperatures are also recorded from thermocouples located in front of the intake screenhouse, which are maintained for back-up. Data presented in this report are for environmental studies comparison, and are not intended as NPDES temperature compliance reporting.

Also presented in this report are daily and monthly average Mississippi River flows, as provided by U.S.' Army Corps of Engineers at Lock and Dam 3. Other monthly averages reported include PINGP intake flows, and the percentage of Mississippi River water entering the plant.

High river levels placed the plant's discharge canal and circulating water system in flood by-pass conditions from mid-April through early-May. Details of the flood by-pass period were reported to the MPCA in monthly Discharge Monitoring Reports for April and May dated May 21, 2001 and June 21, 2001, respectively (see Appendix).

#### **RESULTS AND DISCUSSION**

Daily average river inlet and site discharge temperature data are presented by month in Table 1. Daily Mississippi River flows recorded at Lock and Dam 3 ranged from 6,300 to 174,100 cfs in 2001 (Table 2). Daily mean site discharge flow (blowdown) from the PINGP external circulating water log ranged from 235 to 1,650 cfs (Table 1).

PINGP withdrew an annual average of 2.8 percent of the Mississippi River flow during 2001 (Table 3). Table 4 shows the monthly average Mississippi River flows for the years 1983 through 2001. The average river flow in 2001 was 30,085 cfs, which was higher than average river flow of 22,614 cfs for years 1983-2000. The range of annual average river flows is 8,709 cfs in 1988 to 37,787 cfs in 1986.

				· · · · · · · · · · · · · · · · · · ·		
DATE	OPERAT	ING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE	
JANUARY		UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW	
-			(oF)	. (oF)	(BLOWDOWN-CFS)	
				• •		
1	24	24	32.3	34.8	732	
2	24	24	32.2	35.3	696	
3	24	24	32.6	35.4	696	
4	24	24	32.6	35.2	684	
5	24	24	32.8	35.4	696	
6	24	24	32.9	35.2	696	<i>2</i>
7	24	24	32.7	34.8	684	·.
8	24	24	32.6	34.8	696	•
9	24	24	32.3	35.2	696	× •.
10	24	24	32.8	34.0	696	
11	24	· 24	33.1	35.6	696	•••
12	24	24	33.6	35.5	696	. •
13	24	24	33.4	35.3	684	
14	24	24	33.5	35.4	684	
15	24	24	33.9	35.2	684	
16	24	24	33.6	35.1	696	
17	24	24	32.8	35.3	696	14
18	24	24	32.9	35.4	696	
19	24	24	32.2	35.0	708	
20	24	24	32.0	32.8	251	
21	24	24	32.0	33.5	440	;
22	24	24	32.9	33.3	323	
23	24	24	32.6	33.9	372	`
24	、24	24	32.5	33.7	361	
25	24	24	32.2	33.4	350	۰.
<b>26</b>	24	24	32.5	33.4	350	
27	24	24	32.0	33.4	350	4. '
28	24	24	32.4	33.7	350	
29	24	24	32.8	33.6	350	
30	24	24	32.8	33.5	350	
31	24	24	33.2	33.6	350	2
		ILY MINIMUM		32.8	251	
		LY MAXIMUM		35.6	732	
·	MO	NTHLY MEAN	32.7	34.5	561.6	

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.

Table 1.

Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.

				2	<b>`</b>	· ·
DATE	OPERAT	TING HOURS	RIVER INLET	SITE DISCHARGI	E MEAN SITE	•
FEBRUARY	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW	
			(oF)	(oF)	(BLOWDOWN-CFS)	
		· · ·		:		
1	24	24	32.2	33.7	350	
2	24	24	31.7	33.0	350	
3	24	24	32.3	33.7	350	
4	24	24	32.6	33.9	350	
5	24	24	32.7	33.7	361	
6	24	24	32.6	33.4	350	•
. 7	24	24	32.4	. 33.6	350	
8	24	<b>24</b>	32.5	33.3	350	`.
9	24	24	32.5	33.3	350	
10	24	24	31.7	33.2	372	
<b>i</b> 1	24	24	31.9	33.1	361	
12	24	24	32.5	33.5	350	
13	24	<b>24</b> .	32.3	33.5	361	
14	24	24	32.2	33.1	361	
15	24	24	32.0	33.2	361	
16	24	· 24	32.1	33.3	361	- :
17	24	24	32.0	33.0	361	
- 18	24	24	31.8	33.2	361	
19	24	24,	32.6	33.7	361	
20	24	24	32.5	33.6	361	
21	24	24	31.8	33.0	372	
22	24	24	32.4	33.3	372	;
23	24	24	32.3	33.7	396	,
24	24	24	32.6	33.6	407	
. 25	24	24	32.8	33.8	500	
. 26	<b>24</b>	24	32.3	33.8	550	
27	24	24	32.2	34.3	550	
28	24	24	32.0	35.3	708	-
		. 3			· · ·	
	MONTH	LY MINIMUM	31.7	33.0	350	
		LY MAXIMUM		35.3	708	
	MON	NTHLY MEAN	32.3	33.5	392.4	
		, <i>*</i> * ,				12
		• •				



3

18%

DATE MARCH	OPERATI UNIT 1	NG HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (0F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	32.2	35.6	708
2	24	24	33.0	36.2	708
3	24	24	32.9	36.1	708
4	24	24	33.1	36.0	696
5	24	24	33.2	36.0	708
6	24	24	32.9	35.9	708
7	24	24	33.8	36.5	708
8	24	24	34.0	36.3	708
9	24	24	33.4	36.1	708
10	24	24	34.5	36.9	720
11	24	24	33.6	36.3	708
12	24	24	35.2	37.9	708
13	24	24	34.1	36.0	720
14	24	24	35.0	37.1	720
15	24	24	35.1	37.6	720
16	24	24	35.9	37.6	720
17	24	24	35.9	37.6	720
18	24	,24	36.4	38.2	720
19	24	24	37.1	39.3	738
20	24	24	37.1	39.3	753
21	24	24	38.7	40.9	768
22	24	24	38.6	40.6	760
23	24	24	37.7	39.3	760
24	24	24	35.5	37.0	760
. 25	24	24	35.0	36.1	753
26	24	24	33.8	36.0	730
27	24	24	34.6	36.5	730
28	24	24	36.0	37.5	745
29	24	24	36.9	37.9	738
30	24	24	37.1	38.2	738
31	24	24	37.4	39.7	753
		Y MINIMUM		35.6	696
		Y MAXIMUM		<b>40.9</b>	768
	MON	THLY MEAN	35.2	37.4	727.2

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with<br/>recorded operating hours for Units 1 and 2 at PINGP in 2001.

: a :

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DATE	OPERA	TING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE
APRIL	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
0			(oF)	(oF)	(BLOWDOWN-CFS)
				ζ, γ	
1	24	24	37.9	39.8	753
2	24	24	38.3	41.1	768
3	24	24	38.5	40.8	768
4	24	24	38.9	40.2	753
5	24	24	40.0	40.2	760
6	24	24	38.8	39.5	760
7	24	24	39.9	40.0	562
8	24	24	39.7	40.1	760
9	24	24	40.0	41.1	753
10	24	24	38.7	40.5	692
11	24	24	40.1	41.5	725
12	24	24	41.3	41.3	**
13	24	24	41.2	43.5	**
14	24	24	41.3+	43.2	**
15	24	24	41.2+	45.4	**
16	24	24	40.6+	43.9	**
17	24	24	41.1+	45.8	**
18	24	24	40.1	44.2	*
19	24	24	42.3	44.9	*
20	24	24	43.1	46.2	*
- 21	24	24	44.7	47.9	*
22	24	24	44.9	48.2	*
23	24	24	44.0	47.9	*
24	24	24	43.5	46.7 📉 🔨	*
25	24	24	43.7	48.4	*
26	24	24	44.3	49.0	*
27	24	24	-45.2	50.4	*
28	24	24	48.0	52.1	*
29	24	24	47.6	53.8	*
30	24	24	49.4	55.9	*
ъ.			•		
				,	
	MONTI	HLY MINIMUM	37.9	39.5	562
	MONTH	ILY MAXIMUM	49.4	55.9	762
	MC	NTHLY MEAN	42.1	44.8	732.2

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.

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Table 1.

** DUE TO FLOODING PLANT DISCHARGE FLOW CONTROL IS LOST

* NOT TAKEN DUE TO FLOOD, PRESENTLY IN AB-4, LEVEL TAKEN FROM INTAKE SCREEN HOUSE

MAY         UNIT 1         UNIT 2         TEMP. (oF)         TEMP. (oF)         DISCHARGE FLOW (BLOWDOWN-CFS)           1         24         24         51.3         56.8         *           2         24         24         53.5         59.0         *           3         24         24         53.5         59.0         *           4         24         24         55.7         59.9         *           5         24         24         57.1         59.9         *           6         24         24         57.4         59.0         *           7         24         24         57.8         59.0         *           9         24         20         57.7         59.3         318           10         24         0         59.1         60.2         235           11         24         0         59.5         61.0         275           13         24         0         63.0         65.2         283           16         24         0         65.4         67.1         283           17         24         0         66.6         66.3         283	DATE	OPERAT	TING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	MAY	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLO	W
2       24       24       53.5       59.0       *         3       24       24       55.7       59.9       *         4       24       24       55.7       59.9       *         6       24       24       57.1       59.9       *         6       24       24       57.4       59.0       *         7       24       24       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.1       60.2       235         12       24       0       59.1       60.2       235         11       24       0       59.0       59.9       259         13       24       0       59.5       61.0       275         14       24       0       61.1       62.2       275         15       24       0       65.4       67.1       283         16       24       0       66.6       68.6       283         20       24       0       66.6       66.3       283         21       24       0       61.1 <td></td> <td></td> <td></td> <td>(oF)</td> <td>(oF)</td> <td>(BLOWDOWN-CF</td> <td>ຽ) ິ</td>				(oF)	(oF)	(BLOWDOWN-CF	ຽ) ິ
3       24       24       54.8       59.6       *         4       24       24       55.7       59.9       *         5       24       24       57.1       59.9       *         6       24       24       57.4       59.0       *         7       24       24       57.4       59.0       *         8       24       24       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.5       61.0       275         13       24       0       61.1       62.2       283         16       24       0       65.4       67.1       283         17       24       0       66.6       68.6       283         20       24       0       66.4       68.6       283         21       24       0       66.6       66.3       283         22       24       0       61.7       61.2       291         24       0       61.7       61.2<	1	24	24	51.3	56.8	*	
4       24       24       55.7       59.9       *         5       24       24       57.1       59.9       *         6       24       24       57.4       59.0       *         7       24       24       59.6***       59.5       *         8       24       24       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.0       59.9       259         13       24       0       59.5       61.0       275         14       24       0       61.1       62.2       275         15       24       0       65.4       67.1       283         16       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         19       24       0       66.6       66.3       283         21       24       0       61.7       61.2       291         24       0       61.7	2	24	24	53.5	59.0	*	
5       24       24       57.1       59.9       *         6       24       24       57.4       59.0       *         7       24       24       59.6***       59.5       *         8       24       24       57.8       59.0       *         9       24       20       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.5       61.0       275         13       24       0       63.0       65.2       283         16       24       0       65.9       67.6       283         17       24       0       66.6       68.6       283         20       24       0       66.6       68.6       283         21       24       0       63.7       64.3       283         22       24       0       61.1       60.8       283         22       24       0       61.7       61.2       291         24       0       61.1	3	24	24	54.8	59.6	*	
6       24       24       57.4       59.0       *         7       24       24       57.8       59.5       *         8       24       24       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.0       59.9       259         13       24       0       59.5       61.0       275         14       24       0       61.1       62.2       275         15       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         18       24       0       66.6       68.6       283         20       24       0       66.6       66.3       283         21       24       0       61.7       61.2       291         24       0       61.7       61.2       291         24       0       61.1       60.8       283         22       24       0       61.1       60.8       <	4	24	24	55.7	59.9	*	
7       24       24       59.6***       59.5       *         8       24       24       57.8       59.0       *         9       24       20       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.5       61.0       275         13       24       0       63.0       65.2       283         16       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         17       24       0       66.6       68.6       283         20       24       0       66.6       66.3       283         21       24       0       66.6       66.3       283         22       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         23       24       0       61.7       61.2       291         24       0       61.1	5	24	24	57.1	59.9	*	
8       24       24       57.8       59.0       *         9       24       20       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.5       61.0       275         13       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         17       24       0       66.6       68.6       283         18       24       0       66.6       68.6       283         20       24       0       66.6       68.5       283         21       24       0       66.6       66.3       283         22       24       0       61.7       61.2       291         24       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0 <td< td=""><td>6</td><td>24</td><td>24</td><td>57.4</td><td>59.0</td><td>*</td><td></td></td<>	6	24	24	57.4	59.0	*	
9       24       20       57.7       59.3       318         10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.0       59.9       259         13       24       0       59.5       61.0       275         14       24       0       63.0       65.2       283         16       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         17       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         21       24       0       66.6       66.3       283         22       24       0       61.7       61.2       291         24       0       61.7       61.2       291         24       0       61.7       61.2       291         24       0       59.3       59.0       283         25       24       0       59.6       283	7	24	24	59.6***	59.5	* .	•-
10       24       0       59.1       60.2       235         11       24       0       59.3       59.7       235         12       24       0       59.0       59.9       259         13       24       0       59.5       61.0       275         14       24       0       61.1       62.2       275         15       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         17       24       0       65.9       67.6       283         19       24       0       66.6       68.6       283         20       24       0       66.6       66.3       283         21       24       0       66.6       66.3       283         22       24       0       61.7       61.2       291         24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.6       60.4       283         25       24       0       59.6	8	24	24	57.8	59.0	*	
11       24       0       59.3       59.7       235         12       24       0       59.0       59.9       259         13       24       0       61.1       62.2       275         14       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         17       24       0       65.4       67.1       283         18       24       0       66.6       68.6       283         20       24       0       66.6       66.3       283         21       24       0       66.6       66.3       283         22       24       0       66.6       66.3       283         23       24       0       61.7       61.2       291         24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         26       24       0       59.6       60.4       283         29       24       0       62.5	9	24	20	57.7	59.3	318	
12       24       0       59.0       59.9       259         13       24       0       59.5       61.0       275         14       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         17       24       0       65.4       67.1       283         18       24       0       66.6       68.6       283         20       24       0       66.6       68.6       283         21       24       0       66.6       66.3       283         22       24       0       61.7       61.2       291         24       0       61.7       61.2       291         24       0       61.1       60.8       283         23       24       0       61.7       61.2       291         24       24       0       59.9       59.6       283         25       24       0       59.9       59.6       283         25       24       0       59.6       60.4       283         26       24       0       59.6       60.4	10	24	0	59.1	60.2	235	
13       24       0       59.5       61.0       275         14       24       0       61.1       62.2       275         15       24       0       63.0       65.2       283         16       24       0       65.4       67.1       283         17       24       0       65.9       67.6       283         18       24       0       66.6       68.6       283         20       24       0       66.6       66.3       283         21       24       0       61.7       61.2       291         24       0       61.7       61.2       291         24       0       61.1       60.8       283         22       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       59.6       60.4       283         29       24       0       62.5       62.6	11	24	0	59.3	59.7	235	÷.,
14       24       0       61.1       62.2       275         15       24       0       63.0       65.2       283         16       24       0       64.4       66.7       283         17       24       0       65.4       67.1       283         18       24       0       65.9       67.6       283         19       24       0       66.6       68.6       283         20       24       0       66.6       66.3       283         21       24       0       66.6       66.3       283         22       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         23       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       58.8       58.3       283         29       24       0       62.0       61.8       283         30       24       0       <	12	24	0	59.0	59.9	259	
15       24       0       63.0       65.2       283         16       24       0       64.4       66.7       283         17       24       0       65.4       67.1       283         18       24       0       65.9       67.6       283         19       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         21       24       0       63.7       64.3       283         22       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       59.6       60.4       283         29       24       0       62.5       62.6       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         31       24       0       <	13	24	0	59.5	61.0	275	4 <u>.</u> .
16       24       0       64.4       66.7       283         17       24       0       65.4       67.1       283         18       24       0       65.9       67.6       283         19       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         21       24       0       63.7       64.3       283         22       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       59.6       60.4       283         26       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         29       24       0       62.5       62.6       283         30       24       0       62.9       63.5       283         31       24       0       <		24	0			275	
17       24       0       65.4       67.1       283         18       24       0       65.9       67.6       283         19       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         21       24       0       63.7       64.3       283         22       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       59.3       59.0       283         26       24       0       59.6       60.4       283         27       24       0       59.6       60.4       283         29       24       0       62.5       62.6       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3 <td< td=""><td>15</td><td>24</td><td>0</td><td>63.0</td><td>65.2</td><td>283</td><td></td></td<>	15	24	0	63.0	65.2	283	
18       24       0       65.9       67.6       283         19       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         21       24       0       66.6       66.3       283         22       24       0       63.7       64.3       283         23       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       59.6       60.4       283         26       24       0       59.6       60.4       283         27       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         31       24       0       <	16	24 ·	0	64.4	66.7	283	
19       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         21       24       0       66.6       66.3       283         22       24       0       63.7       64.3       283         23       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         26       24       0       58.8       58.3       283         27       24       0       59.6       60.4       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         31       24       0       62.9       63.5       318	17	24	0	65.4	67.1	283	1
19       24       0       66.6       68.6       283         20       24       0       67.3       68.5       283         21       24       0       66.6       66.3       283         22       24       0       63.7       64.3       283         23       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       58.8       58.3       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       3	18	24		65.9	67.6	283	
21       24       0       66.6       66.3       283         22       24       0       63.7       64.3       283         23       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       59.6       60.4       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         31       24       0       62.9       63.5       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	19	24	0	66.6	68.6	283	
22       24       0       63.7       64.3       283         23       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       58.8       58.3       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	20	24	0	67.3	68.5	283	
23       24       0       61.7       61.2       291         24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       58.8       58.3       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	21	24	0	66.6	66.3	283	ъ.
24       24       0       61.1       60.8       283         25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       58.8       58.3       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM 51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	22	24	0	63.7	64.3	283	
25       24       0       59.9       59.6       283         26       24       0       59.3       59.0       283         27       24       0       58.8       58.3       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM         51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	23	24	0	61.7	61.2	291	
26       24       0       59.3       59.0       283         27       24       0       58.8       58.3       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318		24	0	61.1	60.8	283	
27       24       0       58.8       58.3       283         28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318			0			283	-
28       24       0       59.6       60.4       283         29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM       51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	26	24	0				
29       24       0       62.0       61.8       283         30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM 51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	27	24	0		58.3		
30       24       0       62.5       62.6       283         31       24       0       62.9       63.5       283         MONTHLY MINIMUM 51.3       58.3       235         MONTHLY MAXIMUM       67.3       68.5       318	28	24	0		60.4		
31     24     0     62.9     63.5     283       MONTHLY MINIMUM     51.3     58.3     235       MONTHLY MAXIMUM     67.3     68.5     318		24	0		61.8		
MONTHLY MINIMUM         51.3         58.3         235           MONTHLY MAXIMUM         67.3         68.5         318	30	24	0	62.5	62.6	283	
MONTHLY MAXIMUM 67.3 68.5 318	31	24	0	62.9	63.5	283	:
MONTHLY MAXIMUM 67.3 68.5 318		MONT	HLY MINIMUM	51.3	58.3	235	x **
		MONTI	HLY MAXIMUM	67.3	68.5	318	while is the second
		MC	ONTHLY MEAN		61.8		

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with<br/>recorded operating hours for Units 1 and 2 at PINGP in 2001.

* NOT TAKEN DUE TO FLOOD, PRESENTLY IN AB-4, LEVEL TAKEN FROM INTAKE SCREENHOUSE

*** USED IT 2527A PER TI

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Table 1. Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.

DATE JUNE	OPERAT UNIT 1	ING HOUF UNIT 2	IS RI	VER INLET TEMP. (oF)		DISCHAR EMP. (oF)	DIS	MEAN SITE CHARGE FLOW OWDOWN-CFS)	
1	24	0		63.2		63.1		283	
2	24	0		61.9		62.3		396	
3	24	0		61.6	•	62.0		396	
4	24	0		62.6	J.	62.9	. •	396	
5	24	0		63.0		63.2		396	
6	24	20		61.5		62.1		396	
7	24	24		62.0	×	62.7		407	
8	24	24		63.2		64.1	•	396	•
9	24	24		65.5		66.5		396	
10	24	24		66.8		67.5		396	
11	24	24		67.8		69.5		412	
12	24	24		69.6	· :	70.2		525	
13	24	24		70.8		70.9		563	
14	24	24		70.9	· · · ·	72.0	ù	512	
15	24	24		70.8		71.3	14 	500	• •
16	24	24		70.5		70.8	· ·	744	
17	24	24		70.6		71.2		776	
18	24	24		70.7		71.1		783	
19	24	24		71.2		71.4		768	4
20	24	24	`	71.2		71.4		798	
21	24	24		70.6	· 1	71.0		791	
22	24	. 24		69.8	5. Č	70.2		791	
23	24	- 24	1.00	71.6		71.4		798	, ·
24	24	24		71.2	• •	71.4		798	5 ²⁰
25	24	24	•	71.5		72.1		798	•
26	24	24	1.5	73.4	- 07	74.1	1.1	806	
27	24	24		74.7	221	75.5	. <b>1</b> .3	798	
28	24	24	N., .	76.1	· · · ·	76.6	· · · · ·	798	
29 م	24	24		76.9		77.3		798	
30	24	24		78.1		78.2	· .	798	
			•		ć E k				
	MONTH	LY MINIM	UM	61.5	۶.	62.0	. * 	283	1
	MONTHI	LY MAXIM	UM	78.1	· 11.	78.2	•	<b>806</b>	
	MON	ITHLY ME	AN	69.0		69.5	• :	607.1	្រូវា

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Table 1. Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.

DATE	ÓDE	PATTNC MOUDS		SITE DISCHARGE	MEAN SITE	
DATE		ERATING HOURS	RIVER INLET TEMP.	TEMP.	DISCHARGE FLOW	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
JULY	UNIT 1	UNIT 2			(BLOWDOWN-CFS)	
		. /	(oF)	(oF)	(BLOWDOWN-CFS)	
1	24	24	78.9	79.0	798	
2	24	- 24	75.0	75.5	1208	
3	24	24	73.6	73.6	1229	F
4	24	. 24	75.1	75.4	1229	
<b>5</b> -	24	24	74.2	74.4	1229	
6	24	. 24	74.6	74.9	1229	,
7	24	24	74.3	74.6	1229	
8	24	24	76.1	76.6	1250	-1
9	24	24	77.3	77.0	1250	
10	24	24	78.2	-78.5	1229	
11	24	24	77.9	78.2	1229	
12	24	24	77.8	77.9	1250	2
13	24	24	77.3	78.5	1250	1
14	24	24	78.9	79.5	1250	
15	24	24	79.1	79.8	1250	,
16	24	24	78.4	79.2	1250	
17	24	24	78.2	79.4	1271	ι.
18	24	- 24	78.9	79.5	1271	
19	24	24	80.5	81.4	1271	2
20	24	24	80.8	81.7	1271	
21	24	24	81.0	81.4	1271	
22	24	24	81.5	82.3	1271	
23	24	24	81.8	82.9	1271	
24	24	24	81.5	82.0	1271	
25	24	24	79.6	80.2	1271	
26	24	24	78.4	79.3	1250	
27	24	24	77.0	77.8	1250	
28	24	24	76.5	78.0	1271	
29	24	24	75.9	76.7	1145	
30	24	24	77.7	78.2	1271	
31	24	24	78.7	79.6	1271	
		MONTHLY MINIM	IUM 73.6	73.6	798	
		MONTHLY MAXIM		82.9	1271	
		MONTHLY ME		78.5	1234.1	

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DATE AUGUST	OP UNIT 1	ERATI	NG HOURS UNIT 2	RI	VER INLET TEMP. (oF)		DISCHAR( TEMP. (oF)	Ε	MEAN SITI DISCHARGE F BLOWDOWN-	LOW
1	7		24		81.1		81.7		1292	
2	0		24		80.0		79.8		1250	
3	0		24		80.2		79.5		1250	
4	0		24		81.4	1.2	81.4	-,	1271	
5	0	•	24	з ^с .	82.5	•	82.8		1271	
6	0		24		*83.8	, r'i	84.3		1166	
7	· 0		24		*84.7	•	84.6		1040	
8 \	0		24	•	*86.0		85.7		1040	
9	0	· *	24		*85.6	. <i>X</i> .	86.4		955	
10	0		24		81.1	5. Y.V.	81.6		955	
11	0		24	•••	*79.4	420° .	80.0	1	955	
12	0	· .	24	• •	*79.4		80.0		955	, '
13	0		24	•	*78.0		78.5	•	955	h.
14	0		24		*78.2		78.5	ŝ	. 955	
15	0	,	24		*76.7		77.5		955	
16	0	•	24		*74.6		75.5	-	955	•
17	0		24		*73.0	¥	74.3		955	•
18	0		24		*74.5		74.5		955	
19	0		24		*73.6		73.9		955	
20	0	1	24		*74.6		74.6		955	1
21	0		24		*75.4		75.3		955	
22	0		24		*77.3		77.8		943	
23	0	'	24	.,	*77.2		77.6		955	
24	0	•	24	-	*77.3		77.6		873	
.25	0	і. К.С. 1	24		*76.9		77.2		880	
26	0	415.1 85.4	24		*76.5	1 1	76.8		880	
27	0	ater Reg	24		*77.4	1.1	77.4		873	
28	0		24		*76.9		77.2		865	
29	0	$V^{*,r}$	24		*77.2	•	77.6		872	;
30	0		24		*75.2	·	76.2		880	
31	0	:	24		*74.5		74.8		872	
		MON	NTHLY MINIM	UM	73.0		73.9		872	
		MON	THLY MAXIM	UM	86.0		86.4	• •	1292	
		1	MONTHLY ME	AN	81.1	т. т. 1. хх	78.7		996.4	н 

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with<br/>recorded operating hours for Units 1 and 2 at PINGP in 2001.

* Intake Canal Temp - due to Ambient temp being unreliable

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Table 1.

# Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.

DATE SEPTEMBER	O UNIT 1	PERATING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	0	24	*73.8	74.0	872
2	0	24	*73.0	73.9	872
3	0	24	*74.3	74.7	··· 872
4	0	24	*74.1	73.9	872
5	0	24	*74.0	74.4	872
6	0	24	*74.2	74.4	872
7	0	24	*73.6	74.4	872
8	· 0	24	*73.8	73.8	872
9	0	24	70.8	72.4	1271
10	0	24	69.5	72.0	1271
11	0	24	69.5	71.2	1271
12	17.5	24	69.6	71.2	1271
. 13	24	24	69.6	72.3	1271
14	24	24	67.9	70.8	1271
15	24	24	66.7	70.0	1271
16	24	24	66.8	69.8	1271
17	24	24	66.3*	69.7	1271
18	24	24	66.3*	69.4	1271
19	24	24	66.0	68.7 ⁽	1271
20	24	24	66.2	68.8	1271
21	24	24	66.0	68.5	1250
22	24	24	66.6	69.0	1250
23	24	· 24	63.6	66.2	1250
24	24	24	60.9	63.4	1250
25	24	24	60.7	64.1	1250
26	24	24	60.5	63.9	1250
27	24	24	61.3	64.9	1250
28	24	24	61.7	65.4	1250
29	24	24	61.4	65.0	1250
30	24	24	60.6	63.9	1250
		<u>.</u>		··· · ·	•
		MONTHLY MINI	MUM 60.6	63.4	872
		MONTHLY MAXI	MUM 74.3	74.7	1271
		MONTHLY M	EAN 65.3	69.8	1157.6

* Intake Canal Temp - due to Ambient temp being unreliable



DATE OCTOBER	OPERATIN UNIT 1	IG HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FL (BLOWDOWN-0	.OW
			(01)	(01)		
.1	24	24	61.5	65.0	1271	
2	. 24	24	61.9	65.7	1271	
3	24	24.		66.4	1250	
4	24	24		65.1	1292	
5	24	24		63.5	1271	
6	24	24	57.4	62.2	1271	
7.	24	24	55.1	60.1	1271	
8	24	24		59.0	1650	
9	24	24	54.8	58.7	1271	
10	24	24	56.6	59.7	1250	:,
11	24	24	55.2	58.5	1271	
12	24	24	56.1	59.9	1271	
13	24	24	56.6	60.6	1271	
14	24	24	55.5	59.3	1271	
15	24	24	53.6	57.6	1271	
16	24	24	53.3	57.1	1250	
17	24	24	51.5	55.9	1250	
18	24	24	50.1	56.0	1250	, se
19	24	24	51.3	55.2	1250	
20	24	24	51.9	56.0	1250	
21	24	24	52.8	55.6	1250	
22	24	24		55.8	1250	
23	24	24	52.6	56.3	1250	-
24	24	24	52.9	56.7	1250	
25	24	24	49.1	53.1	1250	
26	24	24	45.8	50.2	1250	
27	24	24	44.4	49.1	1181	
28	. 24	24	43.9	48.8	1197	
29	24	24		49.7	1197	
30	24	24		51.0	1197	
31	24	0	47.0	51.1	1197	x, x
				10.0		
		Y MINIMUM	43.9	48.8	1181	
		Y MAXIMUM			1650	
	MON	THLY MEAN	53.3		1262.6	
				. testal		

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Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with<br/>recorded operating hours for Units 1 and 2 at PINGP in 2001.

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					,
DATE	OF	PERATING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE
NOVEMBER	UNIT İ	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
			(oF)	(oF)	(BLOWDOWN-CFS)
			с		
1	24	0	47.4	49.2	1197
2	24	0	47.0	49.9	1197
3 .	24	0	47.5	50.1	° 1197
4	. 24	14.84	47.5	52.0	1230
. 5	24	24	47.7	52.0	1213
6	24	24	48.9	53.0	1230
7	24	24	49.3	53.5	1213
8	. 24	24	48.1	52.9	1213
9	24	24	41.8	51.8	1213
10	24	24	47.6	51.8	1213
11	24	24	46.5	51.5	1213
12	24	24	47.0	51.2	1213
13	24	24	47.8	52.2	1213
14	24	24	48.4	52.8	1213
15	24	24	48.4	52.9	1213
16	24	24	49.0	53.4	1213
17	24	24	49.2	53.2	1213
18	24	24	48.8	53.5	1213
19	24	24	47.7	52.0	1213
20	24	24	46.2	51.1	1213
21	24	24	45.2	50.0	1213
22	24	24	44.7	49.6	1213
23	24	24	45.9	49.9	1213
24	24	24	46.6	49.9	1213
25	24	24	47.0	49.6	1213
26	24	24	45.7	48.4	1181
27	24	24	42.9	45.6	1149
28	24	24	42.2	44.7	1132
29	24	24	40.4	43.6	1132
30	24	24	41.4	43:6	1132
	•	MONTHLY MINIMUM	[ 40.4	43.6	1132
		MONTHLY MAXIMUM	[ 49.3	53.5	1230
		MONTHLY MEAN	46.5	50.5	1201.2

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.

Table 1.

DATE	O	PERATING HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE
DECEMBER	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
			(oF)	(oF)	(BLOWDOWN-CFS)
· .	24	24	40.5	43.4	1132
1		24	40.5	43.1	
2	24	24	39.1	41.8	1132
3	24	24	38.4	41.4	1116
4	24	24	39.8	42.3	1116
5 6	24	24	41.4	43.6	1116
	24	24	40.4	43.2	1116
7	24	24	,s, <b>3</b> ,9.7	42.7	1116
8	24	24	,39.6	41.8	1116
9	24	24	37.6	39.9	1082
10	24	24	38.3	40.1	1068
11	24	24	37.7	40.0	1068
12	. 24	24	38.4	40.2	1068
13 :	24	24	37.6	39.6	1068
14		24	35.3	38.3	1068
15	24	24	35.6	37.2	1068
16	24	24	37.4	39.2	1068
17	24	24	36.9	39.4	1068
18	24	24	36.7	39.3	1068
19	24	24	35.3	38.0	1068
20	24	24	34.9	37.5	1082
21	, 24	24	34.8	37.1	967
22	24	24	35.5	37.6	967
23	24	24	32.9	37.2	961
24	24	24	32.3	36.1	. 961
25		24	32.0	36.9	961
	24	24	31.7	37.5	961
27	.24	24	31.8	37.0	961
28	24	24.	32.5	37.4	961
29	24	24	31.9	36.7	961
30	24	24	31.9	36.5	961
31	24	24	31.6	36.1	961
		MONTHLY MINIMUM	31.6	36.1	961
		MONTHLY MAXIMUM		43.6	1132
		MONTHLY MEAN	36.1	39.2	1044.7

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2001.



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		5 - 14 2	and and an	Daily 2	001 Mississippi	River Dischar	ge Flow Rate (c	ts) at Lock Dar	n 3		• .	
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	12100.	12400.	9300.	15300.	161600.	56000.	47700.	17000.	10400.	9800.	11000.	14700
2	11500.	10700.	9400.	18100.	153900.	55200.	43600.	18100.	8900.	9600.	11800.	14500
3	10900.	8800.	9600.	20000.	<u>145300.</u>	53600.	40100.	17700.	8900.	7700.	11700.	13700
· 4	11200.	8900.	10800.	25400.	130700.	51700.	36600.	17300.	7700.	7600.	10400.	14900
5	11900.	9200.	10800.	30500.	129700.	50300.	33000.	14800.	11100.	7700.	10300.	15800
6	11600.	11500.	10300.	33100.	119900.	48700.	31900.	15100.	9700.	6300.	9700.	16400
7	12200.	12000.	9800.	34700.	117200.	46600.	30800.	15400.	8300.	7100.	10400.	16500
8	12200.	11900.	9900.	40900.	109800.	44300.	29900.	13600.	8300.	6900.	11200.	16700
9	11700.	11800.	8900	49400.	102100.	42100.	28700.	13300.	11800.	7000,	10600.	16800
10	11100.	11000.	8900.	63500.	96700.	40100.	26800.	13400.	8800.	8200.	10100.	16700.
11	11100.	9900.	9100.	87400.	90900.	38400.	25700.	12200.	8900.	9100.	10100.	17000.
12	11200.	9500.	9900.	109600.	84600.	38200.	23899.	10500.	9000.	9000.	8800.	16800.
13	11500.	9800.	10500.	130800.	80400.	38000.	19600.	10600.	9100.	8300.	8800.	17100.
14	11700.	11500.	10400.	144900.	76700.	39800.	16900.	9800.	9000.	9800.	9600.	15600.
15	12400.	11000.	10900.	159900.	73100.	42500.	18400.	9700.	9000.	11200.	10900.	15700.
16	12200.	10600.	11000.	170900.	69000.	45100.	18000.	10500.	8300.	11100.	10900.	14700.
17	11800.	10300.	10600.	172200.	65700.	48800.	17200.	11100.	7000.	11000.	10800.	15200.
18	10900.	10100.	10400.	168900.	62000.	53100.	17700.	11200.	7700.	9600.	9500.	15100.
19	10700.	9700.	10600.	164400.	58300.	56300.	19300.	13100.	8400.	11000.	11100.	15300.
20	11000.	10600.	10800.	161300.	55700.	59200.	18100.	13000.	9100.	11000.	10900.	15200.
21	10800.	10600.	11700.	155000.	53700.	62200.	16700.	11000.	9100.	11100.	9600.	15300.
22	10000.	10400.	12700.	147300.	51100.	66800.	16600.	11000.	9100.	11100.	9600.	12100.
23	10000.	9600.	14000.	143100.	49700.	71100.	17300.	11000.	10700.	11100.	9600.	12300.
24	10400.	9800.	12800.	143000.	49500.	72600.	18600.	11000.	12600.	11000.	9700.	11500.
25	10900.	- 10300.	11500.	149800.	49500.	71900.	18500.	10300.	10900.	11500.	15000.	10000.
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27	10800.	10600 <b>.</b>	10700.	169400.	51600.	65400.	18600.	9600.	8200.	10500.	11900.	7700.
28	9800.	9800.	11800.	174100.	54000.	60800.	18800.	9700.	7700.	8900.	14700.	7600.
29	ຼ <b>10500.</b> ູ		12800.	172000.	56100.	56200.	19700.	8300.	8300.	10600.	15500.	9100.
30	11600.		13900.	166700.	57100.	51400.	18500.	8300.	8500.	10300.	13800.	9800.
31	12500.		<b>15000.</b>		56900.		17600.	9200.		10200.		10300.
MIN:	<b>9800.</b>	8800.	8900.	15300.	49500.	38000.	16600.	8300.	7000.	6300.	8800.	7000.
MAX:	12500.	12400.	15000.	174100.	161600.	72600.	47700.	18100.	12600.	11600.	15500.	17100.
MEAN	11271.	10471.	10948.	112703.	82661.	53177.	23981.	12164.	9193.	9577.	11040.	13813.
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Table 2 Daily 2001 Mississippi River Discharge Flow Rate (cfs) at Lock Dam 3

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Table 3 ηį.

2001 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

	Mean Plant Flow	Mean River Flow	Percentage of Mean River Flow
Month	(cfs)	(cfs)	Entering the Plant Intake
January	562	11,271	5.0 %
February	392	10,471	3.7 %
March	727	10,948	6.6 %
April	732	112,703	0.6 %
May	279	82,661	0.3 %
June	607	53,177	1.1 %
July	1,234	23,981	5.1 %
August	996	12,164	8.2 %
September	1,158	9,193	12.6 %
October	1,263	9,577	13.2 %
November	1,201	11,040	10.9 %
December	1,045	13,813	7.6 %
Averages	850	30,083	2.8 %
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Table 4. Mean Monthly Mississippi River Flow for 1983 - 2001, in cubic feet per second (cfs).

Month	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992
January	11,271	8,974	10,790	9,806	14,823	14,826	11,365	13,090	9,326	15,658
February	10,471	9,548	12,589	14,911	13,954	15,041	9,371	12,611	8,936	13,978
March	10,948	22,219	17,897	26,574	24,177	24,474	29,061	28,542	12,513	43,661
April	112,703	15,570	42,013	51,477	106,073	57,517	48,507	40,830	55,473	32,668
May	82,661	18,839	47,426	22,681	39,316	46,535	45,135	47,548	48,571	25,474
June	53,177	22,070	34,423	25,690	19,487	33,790	30,667	26,913	65,377	17,920
July	23,981	21,052	27,548	26,477	36,119	23,732	27,323	29,403	84,123	28,985
August	12,164	10,026	24,432	10,742	28,074	13,303	29,129	19,971	41,135	14,532
September	9,193	6,687	18,013	7,060	16,663	9,300	19,860	21,203	30,717	15,686
October	9,577	6,790	14,200	12,597	14,155	11,403	31,061	25,581	19,516	15,374
November	11,040	17,463	13,243	19,773	14,160	23,353	30,703	20,173	18,773	19,076
December	13,813	9,558	9,671	15,645	12,694	18,716	17,494	14,432	16,490	12,126
Averages	30,083	14,066	22,687	20,286	28,308	24,333	26,710	25,025	34,246	21,262
Month	1991	1990	1989	1988	1987	1986	1985	1984	1983	
January	5,542	4,965	6,294	7,303	13,758	13,710	12,526	13,375	14,260	
February	5,879	4,889	6,529	7,634	12,586	12,804	10,239	218,557	13,375	
March	15,081	17,484	11,300	14,810	17,287	24,790	32,265	27,290	55,276	
April	34,268	12,842	33,264	21,463	20,267	84,870	45,317	56,277	56,239	
May	44,753	22,310	24,287	13,119	13,655	81,242	43,518	49,528	38,155	
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June	44,960	31,610	13,237	4,667	14,573	37,043	30,105	55,613	24,404	
June July	33,856	20,323	7,690		14,573 11,674		30,105 25,676	55,613 37,165	24,404 36,353	
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July	33,856	20,323	7,690	4,667 2,903	11,674	37,043 34,684	25,676	37,165	36,353	
July August	33,856 21,535	20,323 16,322	7,690 4,658	4,667 2,903 5,103	11,674 10,477	37,043 34,684 30,813	25,676 18,226	37,165 13,826	36,353 14,141	·
July August September	33,856 21,535 25,182	20,323 16,322 9,923	7,690 4,658 8,307	4,667 2,903 5,103 6,080	11,674 10,477 7,183	37,043 34,684 30,813 41,957	25,676 18,226 29,665	37,165 13,826 9,678	36,353 14,141 14,213	
July August September October	33,856 21,535 25,182 15,458	20,323 16,322 9,923 11,135	7,690 4,658 8,307 6,358	4,667 2,903 5,103 6,080 7,019	11,674 10,477 7,183 7,771	37,043 34,684 30,813 41,957 49,319	25,676 18,226 29,665 39,590	37,165 13,826 9,678 23,866	36,353 14,141 14,213 17,536	

Note: Mean monthly river flow data for the years 1985, 1990, 1991 and 1992 have been adjusted to reflect the averages found in Table 2 of the corresponding annual report for each year.

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2001 ANNUAL REPORT

SECTION II

SUMMARY OF THE 2001 FISH POPULATION STUDY

Study and Report by

B. D. Giese

and K. N. Mueller

Environmental Services Water Quality Department



# SUMMARY OF THE 2001 FISH POPULATION STUDY

### INTRODUCTION

To fulfill part of the continuing environmental monitoring requirements of the Prairie Island Nuclear Generating Plant, (PINGP); the Mississippi River fisheries population was sampled near Red Wing, Minnesota, May through October, 2001. The study area extends from 3.6 miles upstream of the plant (River mile 802) to 10.8 miles downstream of the plant (River mile 787.5), (Figure 1). The original objective of the study was to "determine existing ecological characteristics before plant operation and to assess any significant changes to the aquatic environment after operation" (NSP 1972). The objective was changed slightly after the plant became operational in 1973; to "determine environmental effects of the PINGP on the fish community in the Mississippi River and it's backwaters" (Hawkinson 1973). Presently, the objective is to monitor and assess the status of the fishery in the vicinity of the PINGP (Mueller 1994). Parameters analyzed and compared to previous years include species composition, length-weight regressions, percent contribution (fish/hr), length-frequency distributions, and catch per unit effort (CPUE) for selected species.

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#### METHODS AND MATERIALS

Fish were collected using a Smith-Root SR-18 Electrofishing boat equipped with a 5.0 GPP electrofishing unit (Figure 6). The power source was a 5.0 GPP generator. The 5000 watt generator has a maximum output of 16 amps, and a range of 0-1000 volts. The generator has the capability to be either pulsed AC or DC with a pulse frequency of 7.5, 15, 30, 60, and 120 Hz. The annode consists of two umbrella arrays, each with six dropper cables. The 18 foot boat and dropper cables hung from the front of the boat serve as the cathode. Collection occurred during daylight hours with a pulsed direct current. Due to the constantly changing river conditions, Electrofisher output was varied to enhance the effectiveness.

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Sampling was done monthly, May through October, within four established sectors of the study area (Figures 1-5). The runs within each sector are similar to previous years sampling to ensure a similar set of relative data indices for yearly comparison. At the end of each "run", the elapsed shocking time was recorded from a digital timer, which only tallied the seconds that the electrical field was energized. A run was terminated after approximately 450 seconds shocking time or when the end of the prescribed run was reached.

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Stunned fish were captured with one-inch stretch mesh landing nets equipped with eight-foot insulated handles. Fish were placed in live-wells, supplied with river water constantly, until the end of each run. At the end of each run fish were identified, measured to the nearest millimeter (total length), weighed to the nearest 10 grams, and released. Parameters used to describe the fisheries include species composition, length-weight regressions, percent contribution, length-frequency distributions, and catch per unit effort (CPUE). It is assumed that population dynamics and spatial distribution is represented by CPUE.

Electrofishing CPUE was computed as numbers of fish per hour for each sector. Length frequencies in 20 millimeter intervals were calculated for all fish species. Length-weight relationships were calculated using the length-weight formula:

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 $= \log \mathbf{a} + \mathbf{b} \log \mathbf{L}_{\mathbf{a}}^{\mathbf{a}} + \mathbf{b} \log \mathbf{L}_{\mathbf{a$ 

where W is the weight in grams, a is the y axis intercept, b is the slope of the regression line, and L is the total length in millimeters.

### RESULTS

Initial PINGP preoperational annual environmental reports simply listed all data collected without discussion or analysis (NSP 1972). Individual species were not discussed; due to the amount of data collected during initial sampling efforts. Representative species were selected in 1975 for abundance comparisons based on electrofishing data (Gustafson et. al. 1975), modified in 1986 after seining was eliminated (Donkers 1986), and in 1989 smallmouth and largemouth bass were added as they "have been seen more frequently in the electrofishing catch during recent years in the PINGP study area" (Mueller 1989).

Electrofishing collection methods changed before the 1982 sampling season. The mesh size of the dip nets was increased to one inch stretch mesh. The larger mesh size enabled small adult fish and some young of the year fish of certain species to avoid collection. Currently, individual gizzard shad, freshwater drum, and white bass less than 160 mm are not collected. Also, logperch and cyprinids (other than carp) are no longer collected, due to their small size (Donkers 1987). Therefore, a direct comparison of electrofishing CPUE prior to 1982 is inappropriate to later years.

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A total of 8,044 fish, comprising 40 species, was collected in the 2001 survey (Table 1).

Chestnut lamprey, brown trout, greater redhorse, yellow perch, and saugeye, were sampled in 2001, but not in 2000. Northern hogsucker, and black bullhead were collected in 2000 (Giese and Mueller 2000), but not in 2001.



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All species collected in 2001 are ranked according to electrofishing CPUE and listed in Table 2. Summaries for selected species (Tables 3-9) are based on electrofishing and trapnetting data for years 1977 through 1987, and on electrofishing data only for years 1988 through 2001, since trapnetting was discontinued after 1987 (Orr 1988). Annual CPUE for selected species is compared to previous years (Figures 15-22), by sector (Figures 23-30), and by date (Figures 31-38). The top three abundant species, based on CPUE, was determined for each sector.

Sector One;	freshwater drum, carp and shorthead redhorse				
Sector Two;	carp, freshwater drum and bluegill				
Sector Three;	white bass, carp and smallmouth bass				
Sector Four;	white bass, freshwater drum and carp				
Overall CPUE Average;	white bass, freshwater drum and carp				

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Table 10 summarizes the percent contribution of historically predominant species in the annual catch. Length frequency distributions for selected species are illustrated by sector in Figures 7a through 14b.

# DISCUSSION

When dealing with a large river environment, a high degree of natural variability exists in habitat conditions and therefore, in fish distribution. Palmquist (1982) proposed the wide range in species abundance between study sectors was largely due to habitat preferences of a species rather than PINGP induced. A high degree of variability in species abundance exists within sectors from year to year. Differences in collection efficiency and year class strengths may explain this variability.

A qualitative and quantitative discussion for selected species, with respect to other years, includes: 1) CPUE, 2) rank, 3) percent composition of catch, 4) population condition as depicted by length-weight regression analysis, and 5) mean length.

Average mean length was calculated by splitting the length data for each species into 20 mm intervals and multiplying the number of fish in each interval by the median length of that interval (Example: The number of fish in the 260-279 mm interval was multiplied by 270 mm). Interval totals were summed, divided by the total number of fish, and rounded to the nearest 10 mm.

# **GIZZARD SHAD**

Electrofishing CPUE for gizzard shad decreased from a previous high of 40.85 fish/hr in 2000 to 10.43 fish/hr in 2001 (Figure 15). CPUE decreased in all sectors from 2000 to 2001, but is still higher than years 1982-1998 (Figure 23). CPUE was also examined on each sampling date for 2000, with the highest occurring in Sector 4 in June (Figure 31).

Shad decreased in rank from first in 2000, to sixth in 2001 (Table 2). Presently, adult gizzard shad comprise six percent of the catch (Table 10).

The general condition of gizzard shad, 3.767, falls into the range of previous years, 2.38 to 3.934 from 1982-2000 (Table 3). Carlander (1969) sites a population in Canton Lake, Oklahoma with a range in total fish length of 173 to 335 mm and a regression slope of 3.066 which compares well to the fish in this study. The mean length for gizzard shad (340 mm) increased from 2000 (Table 3). The length frequency data indicates a range of 270-450 mm, with peaks ocurring at approximately 340 mm upstream of the plant and 320 mm downstream of the plant (Figures 7a and 7b).

# FRESHWATER DRUM

Freshwater Drum CPUE for 2001, (28.17 fish/hour) increased from 2000 (19.88 fish/hr), and is second only to 1999 (Figure 16). CPUE was lower in all sectors, except sector 1, when comparing 2001 to 2000 (Figure 24). The highest CPUE in a sector for any date occurred in Sector 2 in May (Figure 32).

Freshwater drum CPUE ranked second in 2001 (Table 2). Presently, adult freshwater drum comprise fifteen percent of the catch (Table 4).

The general condition of freshwater drum has remained relatively stable, as depicted by a regression slope of 3.212 in 2001, in comparison to a range of slopes of 2.598 to 3.171 from previous years of the study (Table 4). The mean length for freshwater drum was approximately 330 mm in 2001 (Table 4). The length frequency data for freshwater drum suggest that a peak occurs at approximately 310 mm upstream and 340 mm downstream (Figures 8a and 8b).

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### SHORTHEAD REDHORSE

Electrofishing CPUE for shorthead redhorse has ranged from 7.07 to 24.52 fish/hour (Figure 17). CPUE for 2001 (17.43 fish/hr) is the lowest recorded since 1996 (Table 5). Historically, the CPUE within each sector is highly variable (Figure 25). The 2001 CPUE is also variable between sectors, ranging from 12.81 fish/hour in Sector 2, to 20.91 fish/hour in Sector 3 (Table 2). CPUE for each sector is highly variable during the collection year, with the highest CPUE occurring in Sector 3 in September (Figure 33).

Shorthead redhorse ranked fourth in 2001 (Table 2). Presently, adult shorthead redhorse comprise nine percent of the catch (Table 5).

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The general condition of shorthead redhorse has remained relatively stable, as depicted by a regression slope of 3.039 in 2001, in comparison to a range of slopes of 2.571 to 3.041 from previous years of the study (Table 5). The length-weight regression slope of shorthead redhorse in the vicinity of Prairie Island is about the same as that of another population of Upper Mississippi River shorthead redhorse as reported by Carlander (1969) as having a slope of 2.83. The mean length for shorthead redhorse at Prairie Island increased from approximately 360 mm in 2000, to approximately 370 mm in 2001 (Table 5). The length frequency data show that the main peak occurs at approximately 360 mm upstream and 410 downstream of the plant (Figures 9a and 9b).

# WHITE BASS

Electrofishing CPUE for white bass in 2001 (32.37 fish/hr) falls into the historical range of 9.70 to 39.90 fish per hour (Figure 18). A large difference is evident when comparing CPUE upstream of Lock and Dam 3 to downstream of Lock and Dam 3 (Table 2). Overall CPUE appears cyclic (Figure 18) with year to year variability within each sector (Figure 26). Sector 3 had the highest CPUE for any date in June with 140+ fish/hr (Figure 34).

White bass ranked first in 2001 (Table 2). Although carp historically has had the highest CPUE overall, carp ranked third in 2001 behind white bass and freshwater drum (Table 2). Presently, white bass comprise seventeen percent of the catch (Table 10.

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The general condition of white bass has remained relatively stable, as depicted by a regression slope of 2.967 in 2001, in comparison to a range of slopes of 2.441 to 3.064 from previous years of the study (Table 6). The mean length for white bass is similar to the last six years (Table 6). The length frequency data shows that a main peak occurs for white bass at approximately 340 mm downstream, and 330 mm upstream, with a smaller peak at approximately 230 mm upstream (Figure 10a, Figure 10b).

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#### WALLEYE

Electrofishing CPUE for walleye in 2001 was the highest recorded for the study, (8.93 fish/hour), eclipsing the old record of 7.72 fish/hour set last year (Figure 19). Historically, Sector 3 has had the highest CPUE, but there is a high degree of variability within all sectors. Sectors 1 and 2 had the highest CPUE recorded since 1982 (Figure 27). The highest CPUE for any sector on any date was Sector 3 in October (Figure 35).

 Walleye ranked seventh in 2001 in overall catch abundance (Table 2). Presently, adult walleye comprise five percent of the catch, and the number of individuals collected is the highest recorded since the study began (Table 7).

The general condition of walleye has remained relatively stable, as depicted by a regression slope of 3.296 in 2001, in comparison to a range of slopes of 2.852 to 3.318 from previous years of the study (Table 7). The mean length for walleye decreased from 2000 to approximately 400 mm (Table 7). The length-weight relationship indicates peaks occurring at approximately 200 and 450 mm (Figure 11a-11b).

# SAUGER

Electrofishing CPUE for sauger decreased from 9.81 fish/hr in 2000 to 6.47 fish/hr in 2001 (Figure 20). Sauger CPUE for each sector in 2001 was lower than 2000 (Figure 28). Sauger CPUE for all sectors increased from May to June, then decreased from June to July. Sector 1 had the highest CPUE in June of any sector on any date (Figure 36).

Sauger ranked ninth in 2001 (Table 2), comprising three percent of the catch, which is the lowest recorded since 1991 (Table 8).

The general condition of sauger has remained relatively stable, as depicted by a regression slope of 3.356 in 2001, in comparison to a range of slopes of 2.65 to 3.34, in previous years of the study (Table 8). The mean length for sauger was approximately 310 mm in 2001 (Table 8). The length frequency data exhibit a range from 150-530 mm, with relatively broad peaks occurring at approximately 190 mm and 300 mm (Figures 12a and 12b).

# SMALLMOUTH BASS

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Electrofishing CPUE for smallmouth bass appears cyclic with the peak CPUE (17.02 fish/hour) occurring in 2000, while 2001 CPUE was 13.01 fish/hr (Figure 21). CPUE in Sectors 1-3 appear cyclic and similar in shape to Figure 21, while Sector 4 CPUE is relatively low and the trend is not as definite (Figure 29). The highest CPUE occurred in Sector 3 in September (Figure 37).

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Smallmouth bass ranked fifth in 2001 (Table 9), comprising seven percent of the catch. The population of smallmouth bass appears to be in good general condition as depicted by a regression line slope of 3.178, which compares well with smallmouth bass populations provided by Carlander (1977). Smallmouth bass have a length frequency range of approximately 110-530 mm, with peaks occurring at approximately 220 and 340 mm upstream, and a relatively broad peak occuring between 270 and 350 mm downstream (Figures 13a and 13b).

# LARGEMOUTH BASS

Largemouth bass CPUE for 2001, (5.21 fish/hour), is the highest since 1988 (Figure 22). The CPUE for Sector 1 was virtually zero for all sampling dates, while Sectors 2-4 have a little more variability (Figure 30). The highest CPUE occurred in Sector 4 in October (Figure 38).

Largemouth bass ranked eleventh in 2000 (Table 9), comprising three percent of the catch. Historically, largemouth bass rank has varied greatly, ranging from 9th to 20th (Table 9).

The population of largemouth bass appears to be in good general condition as depicted by a regression line slope of 3.154, which compares well with information on largemouth bass populations provided by Carlander (1977). The length frequency data indicates a range of 90-460 mm, with peaks occurring at 1-1-1-1 6 S. 12 approximately 150, 250 and 350 mm (Figures 14a and 14b). 

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# GENERAL

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The ten most abundant species collected during 2001 in descending order, based on average CPUE for all 1) white bass, 2) freshwater drum, 3) carp, 4) shorthead redhorse, 5) sectors combined were: smallmouth bass, 6) gizzard shad, 7) walleye, 8) bluegill, 9) sauger, and 10) quillback carpsucker (Table 5 . M. C. . ** 2).

Total average CPUE for all species and sectors combined decreased from 265.64 fish/hr in 1999, to 243.29 fish/hr in 2000 to 188.07 in 2001 (Table 2). and a start of 3 9 المريد المراجع والمحصوري

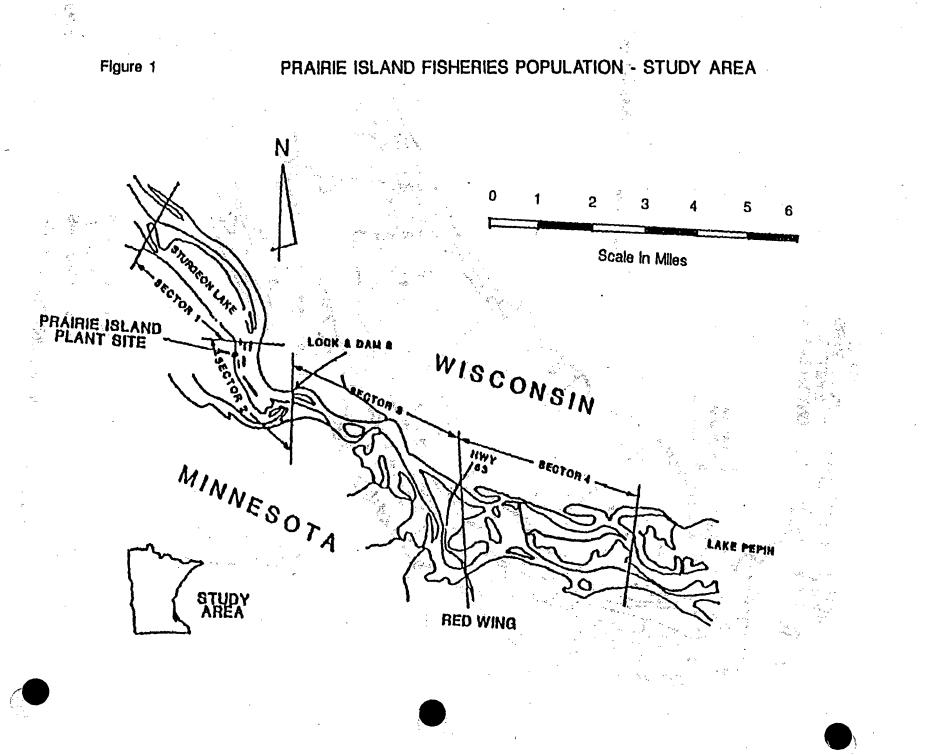
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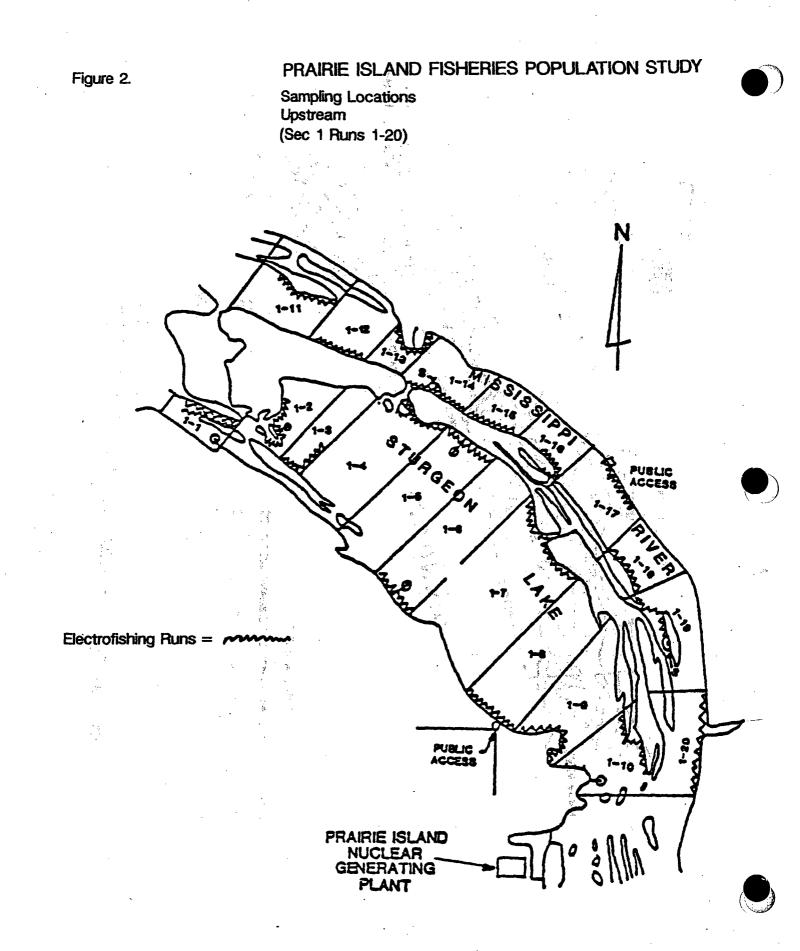
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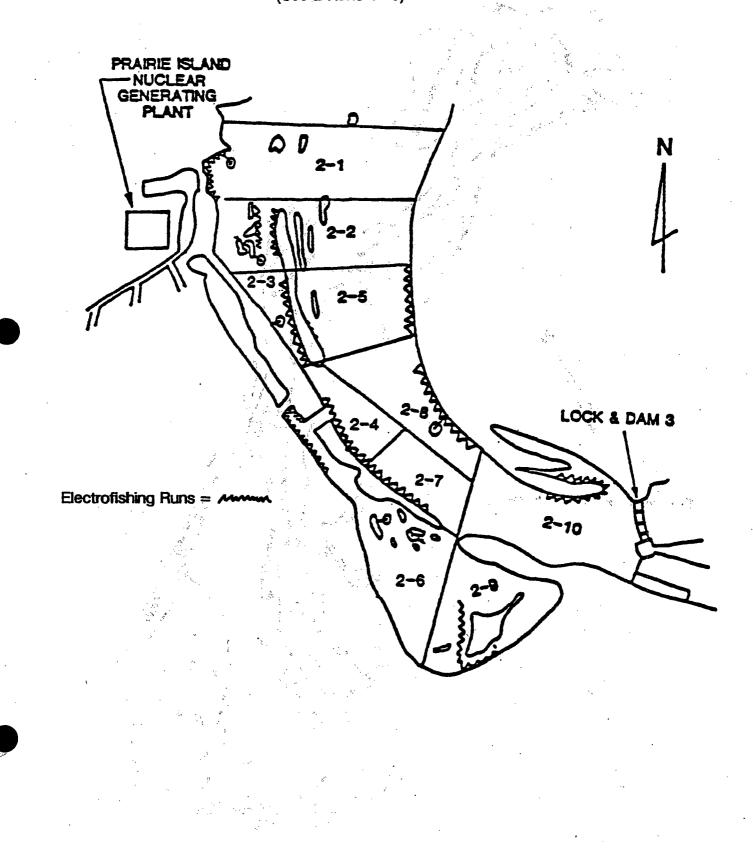






# PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations Plant Area (Sec 2 Runs 1-10)



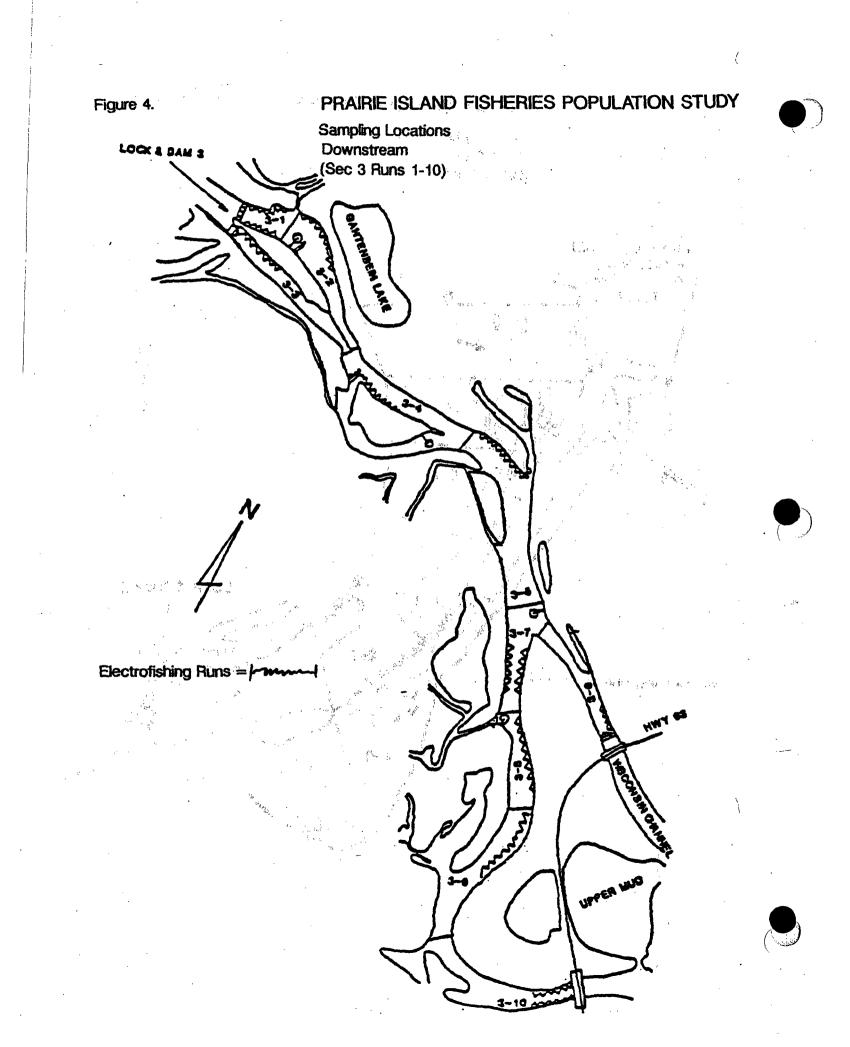


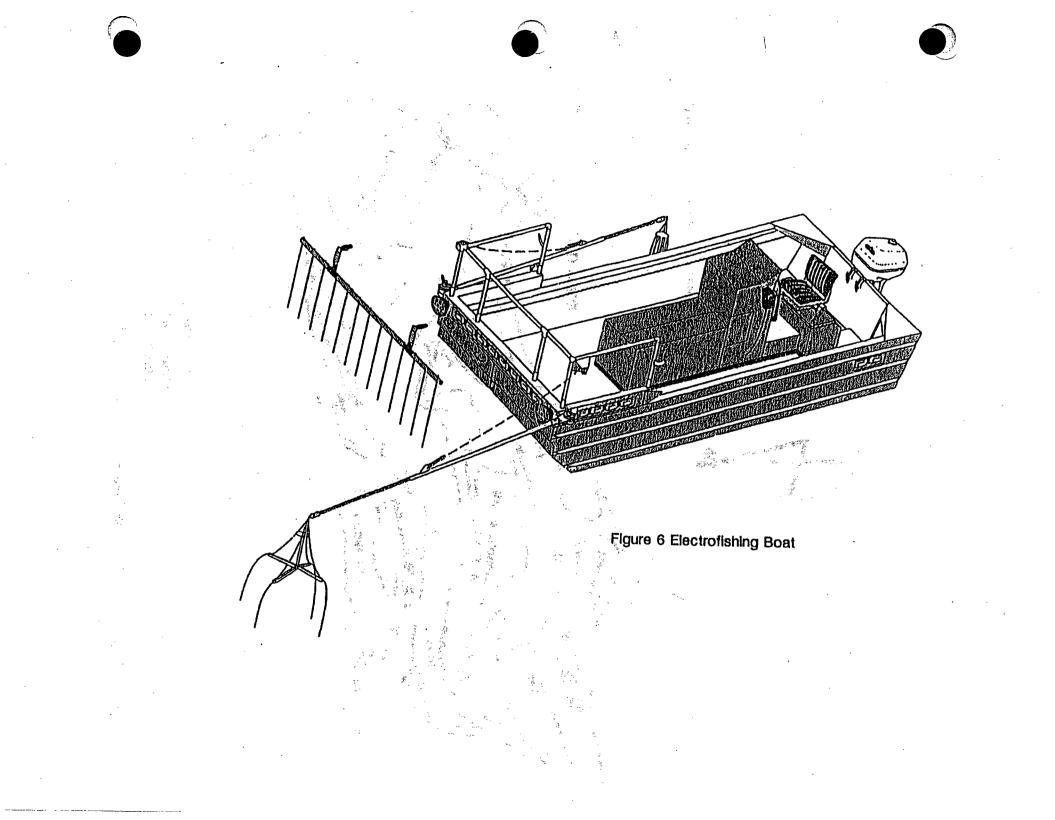
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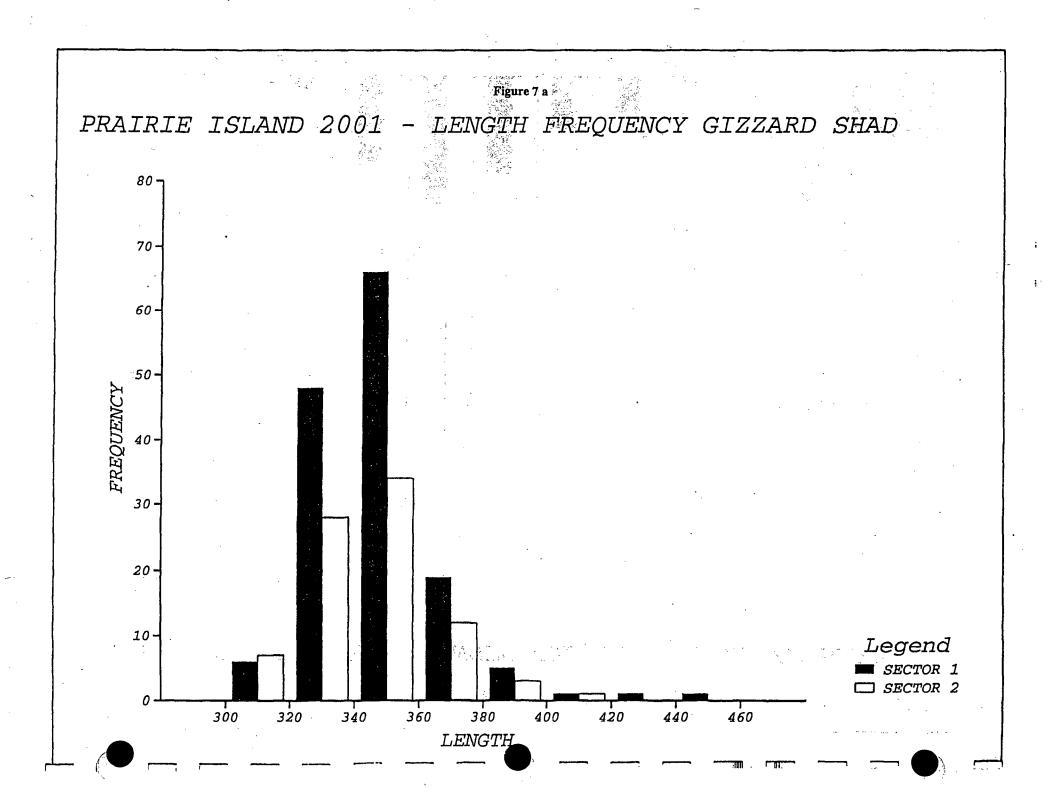
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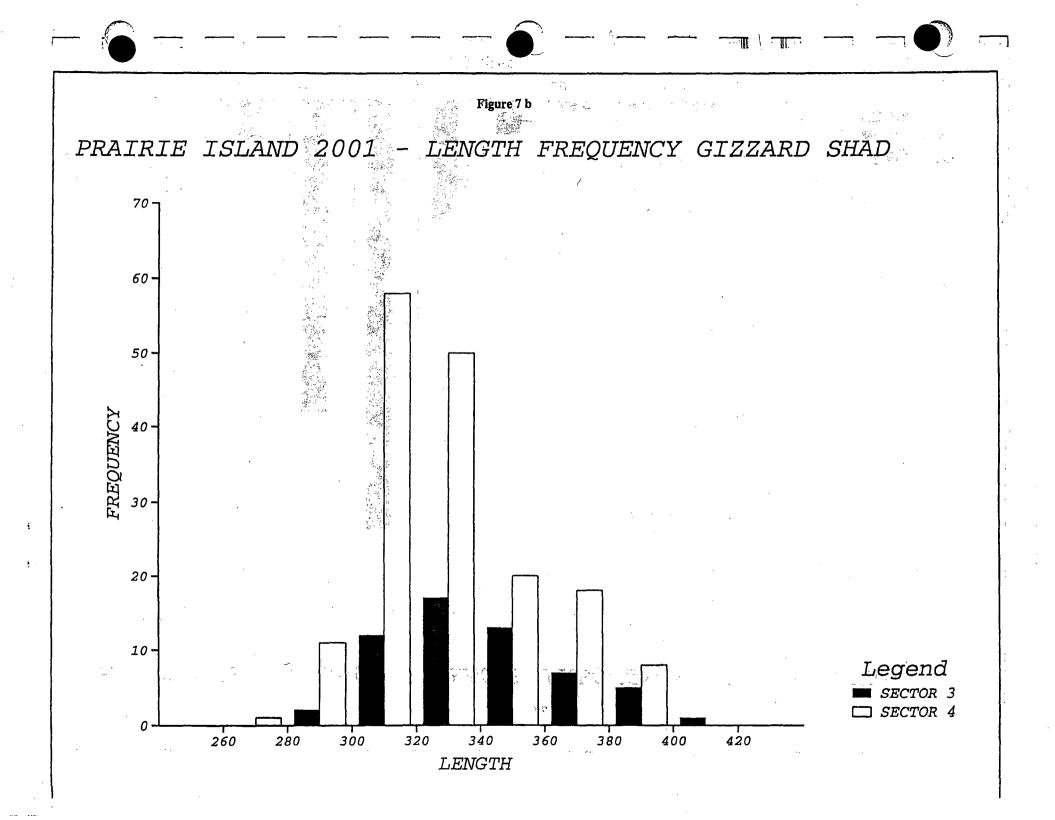
Sampling Locations Downstream (Sec 4 Runs 1-20)

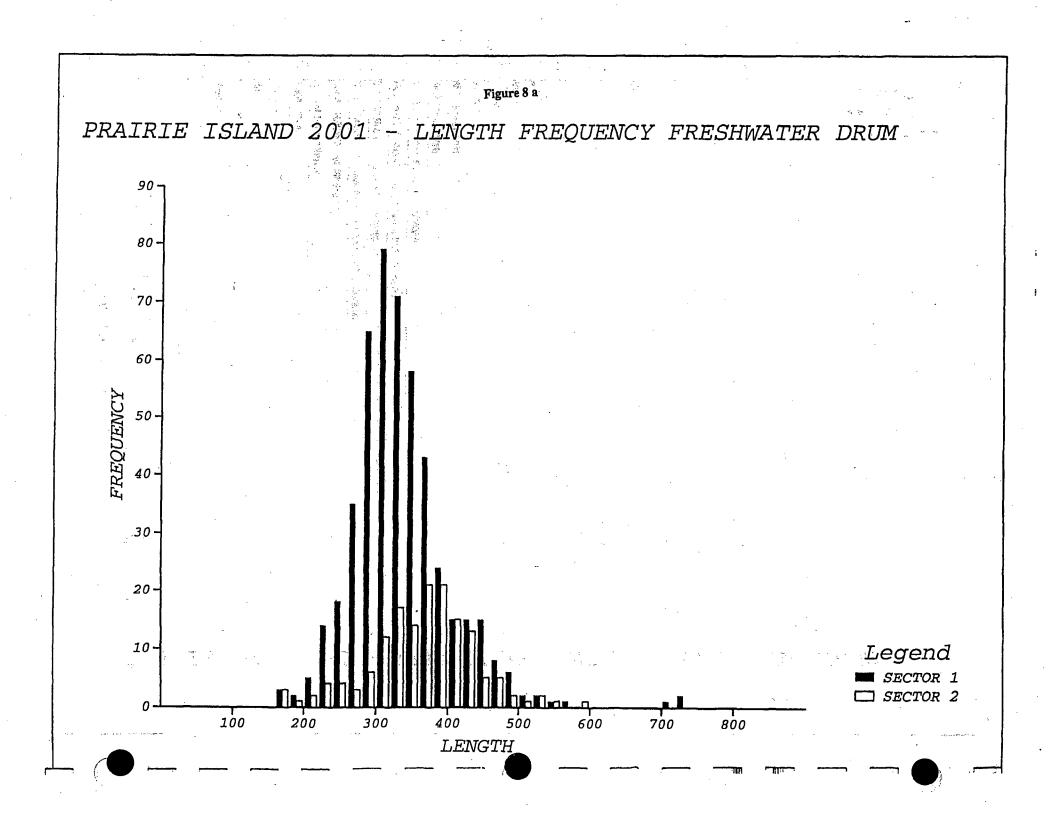
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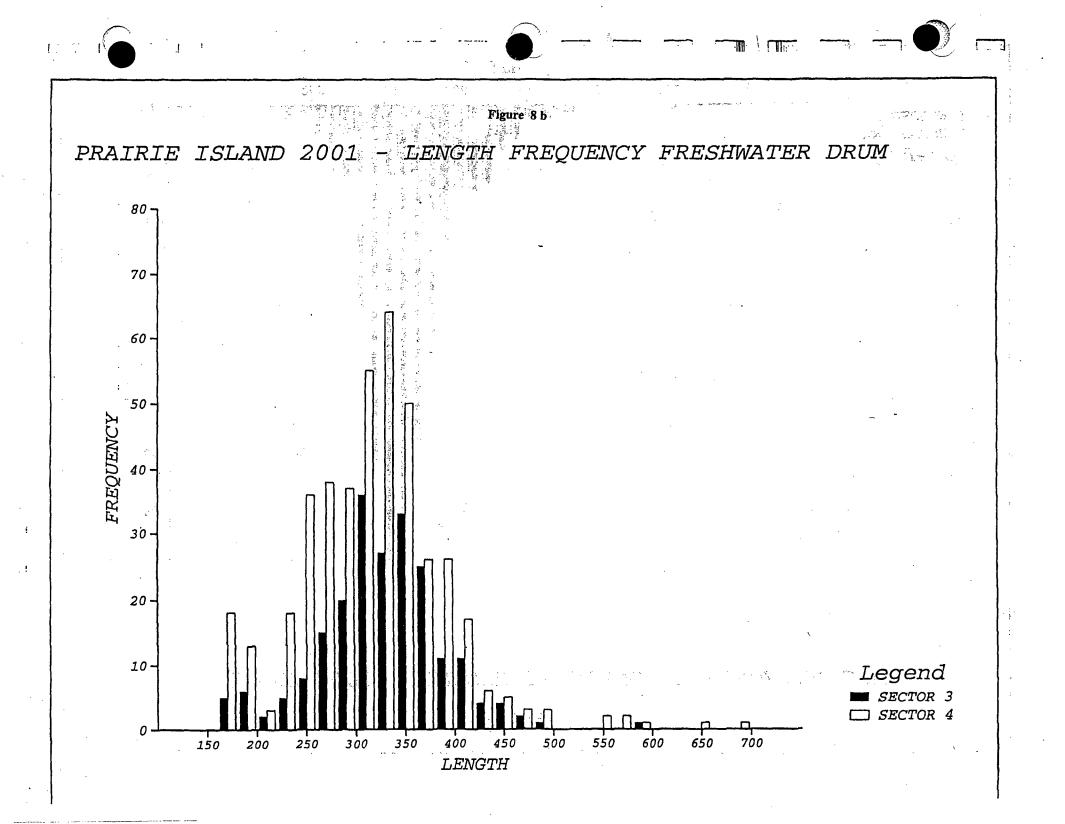


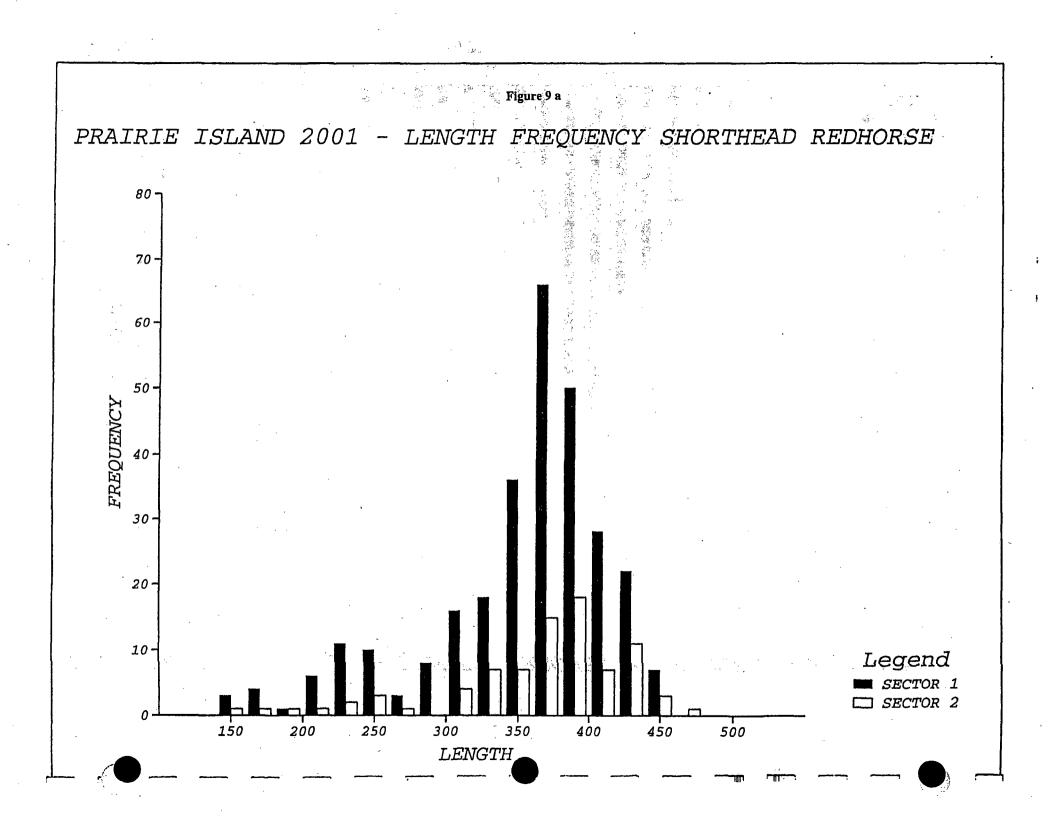


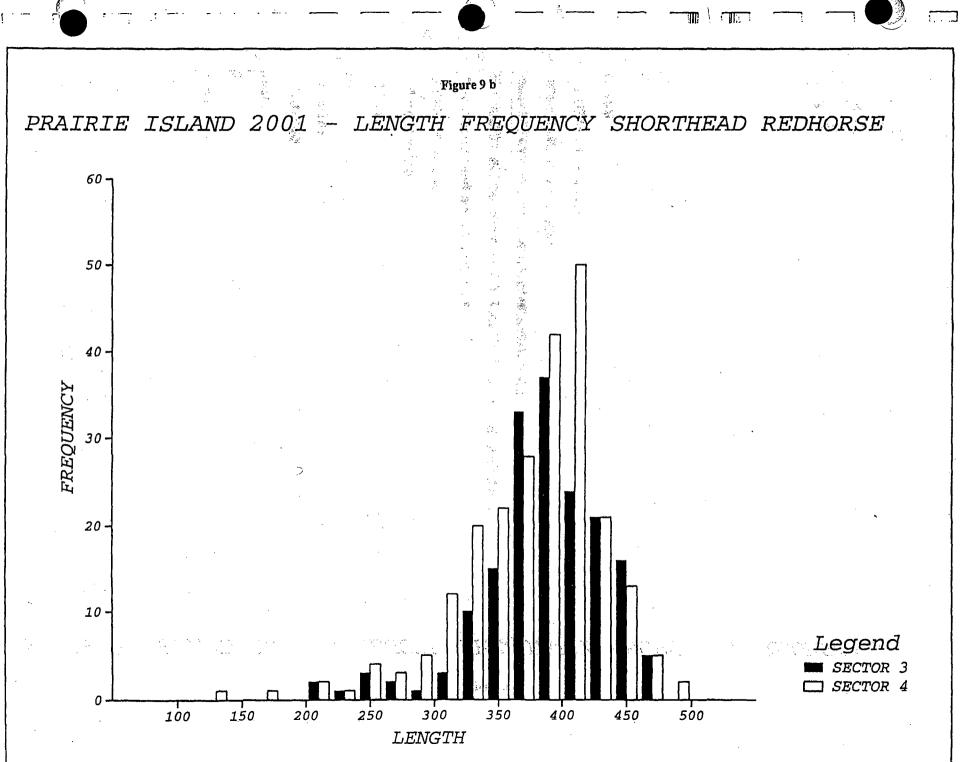




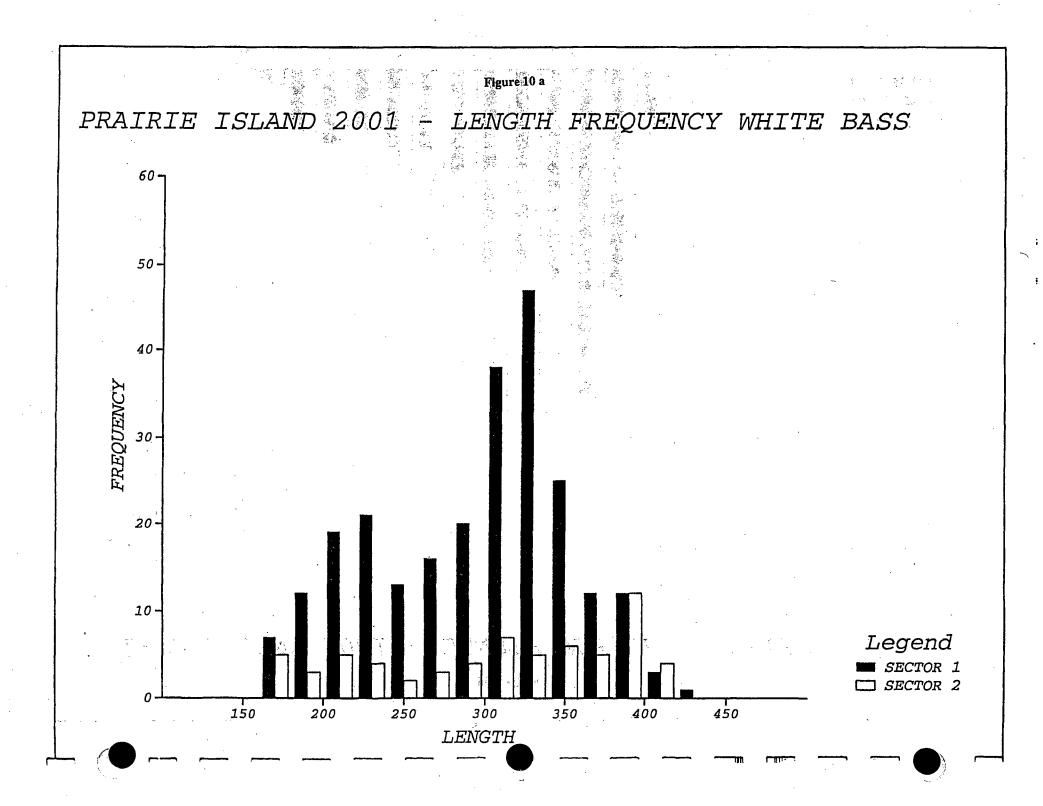


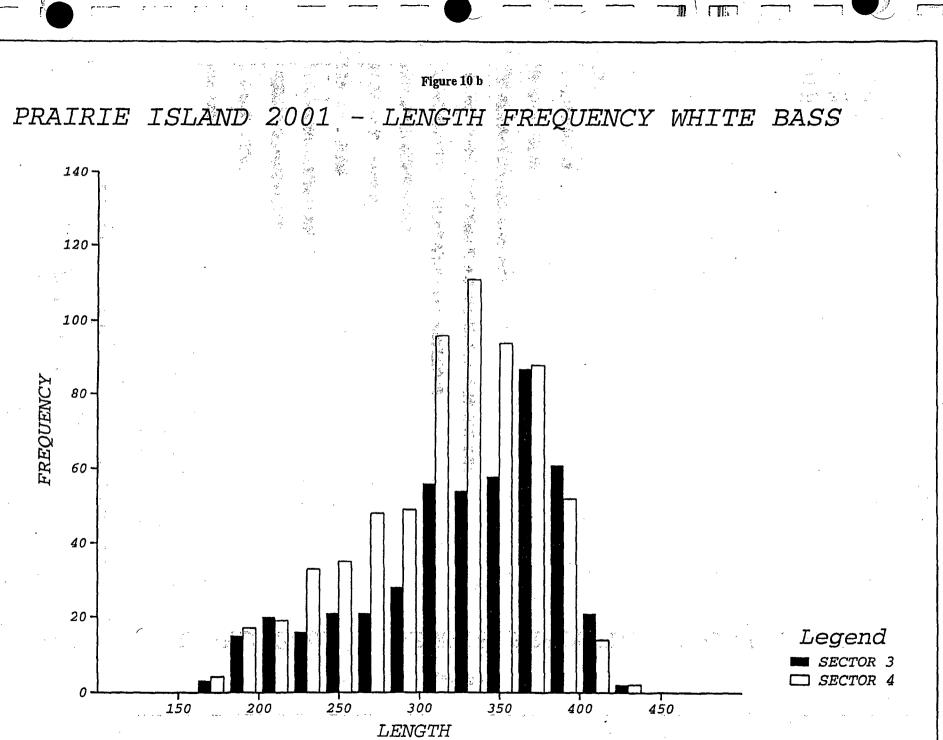




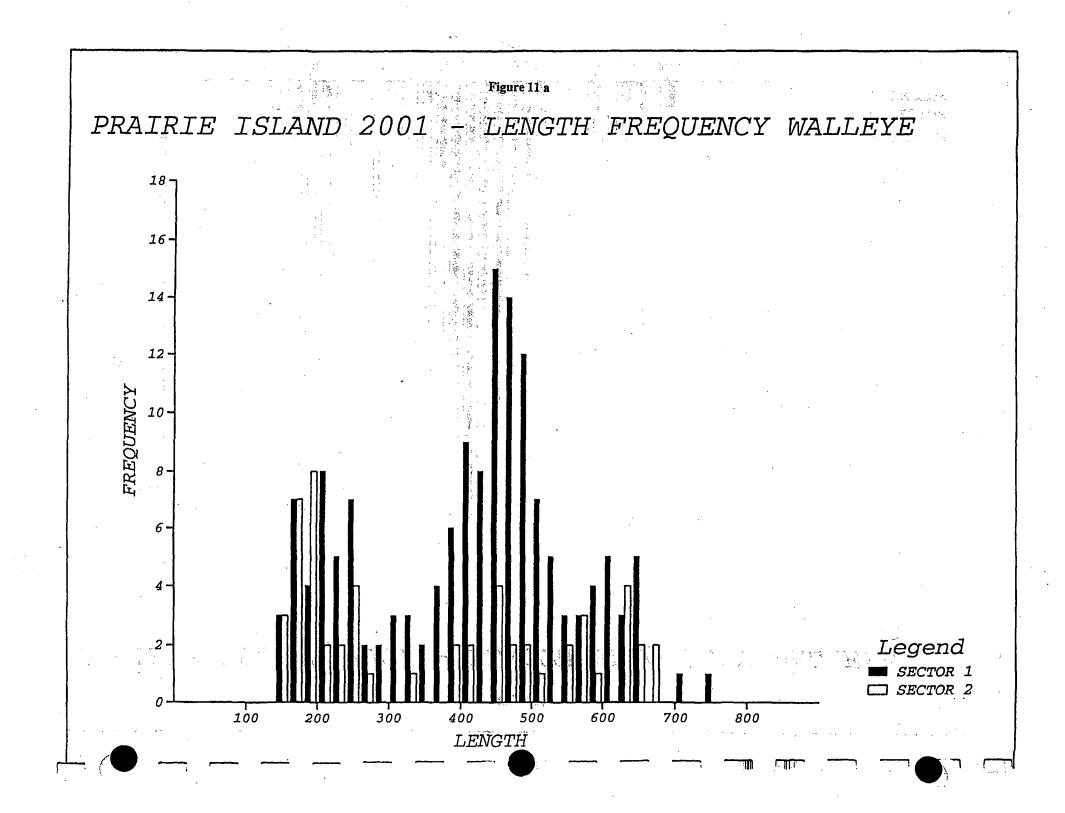


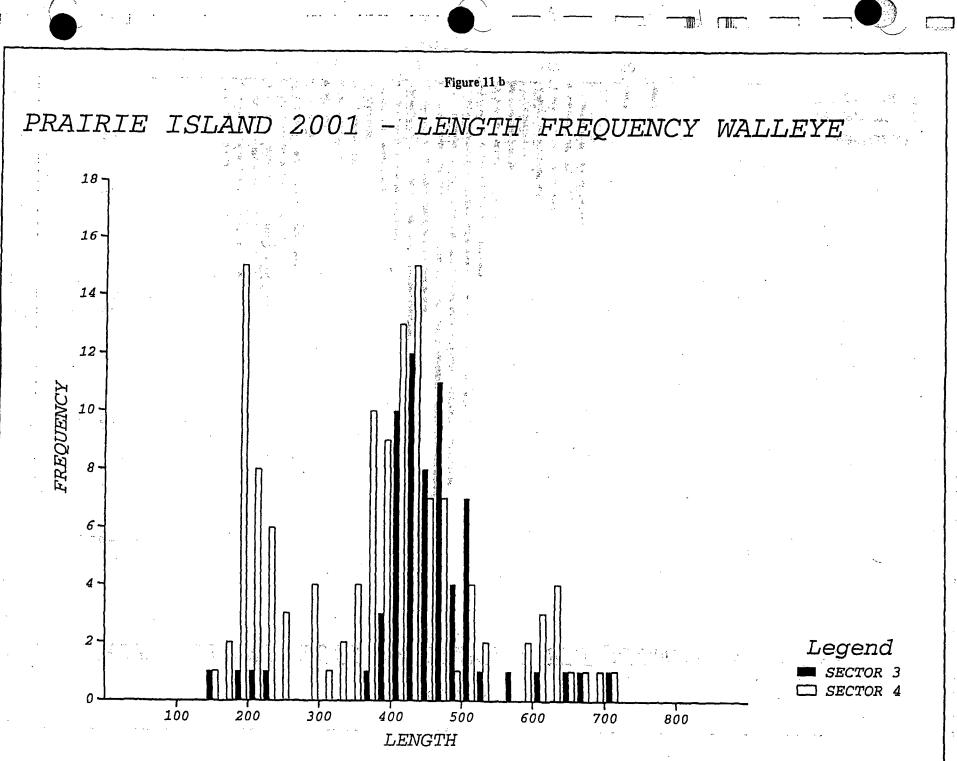
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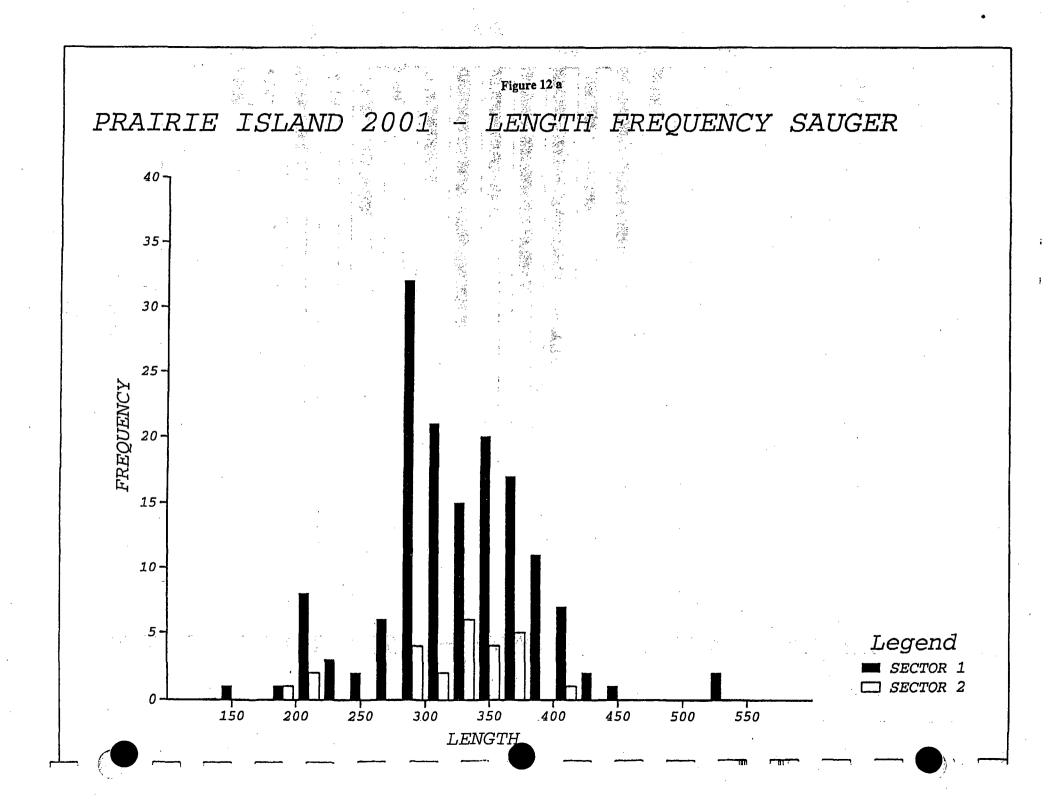
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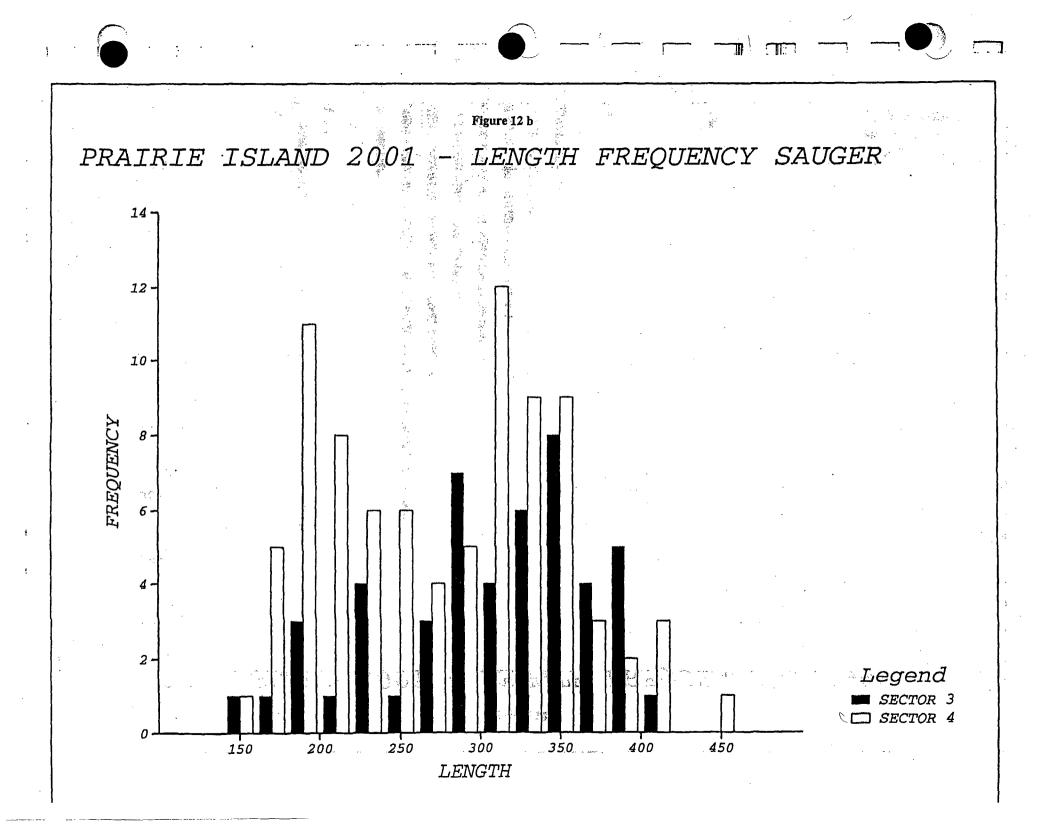


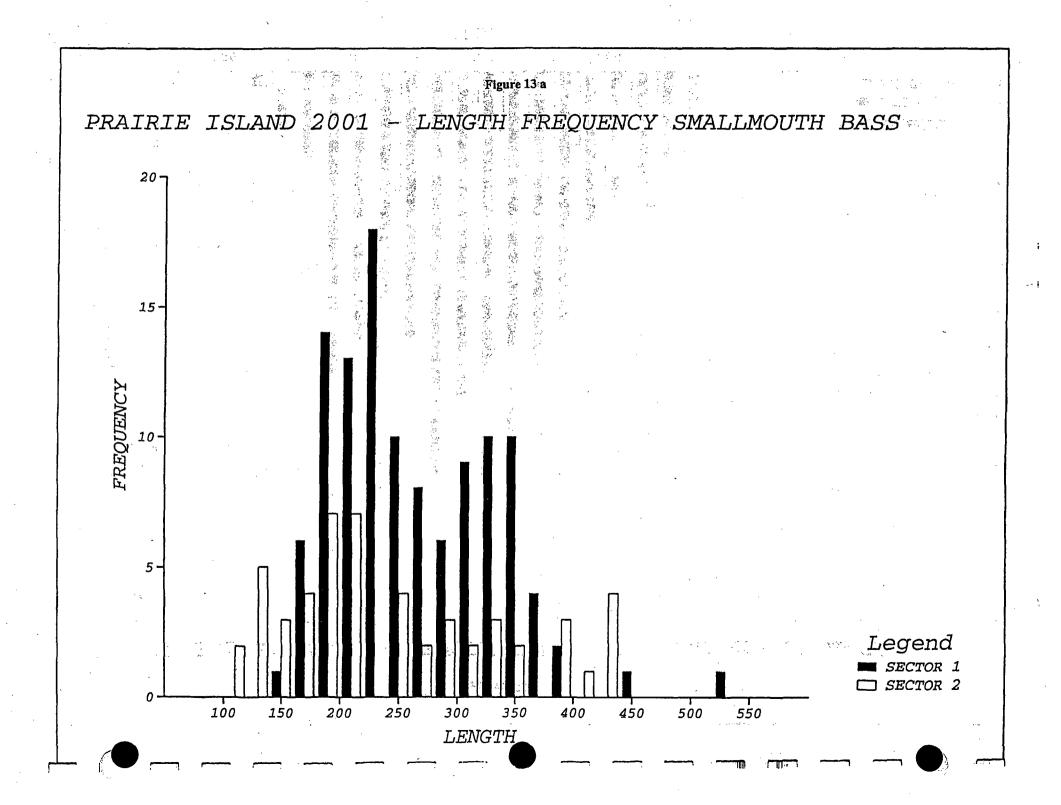


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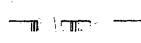




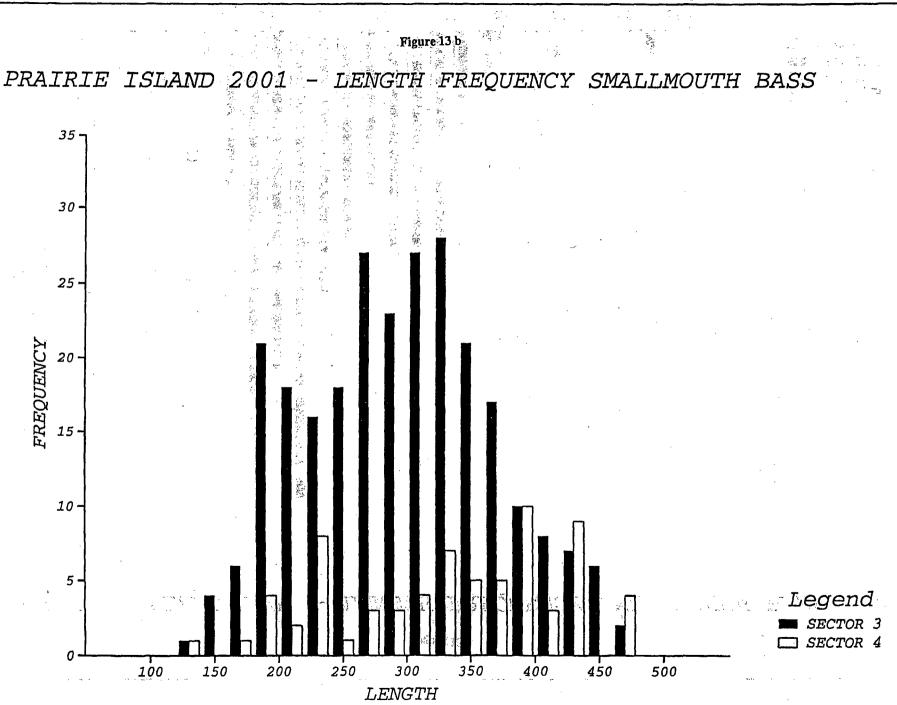


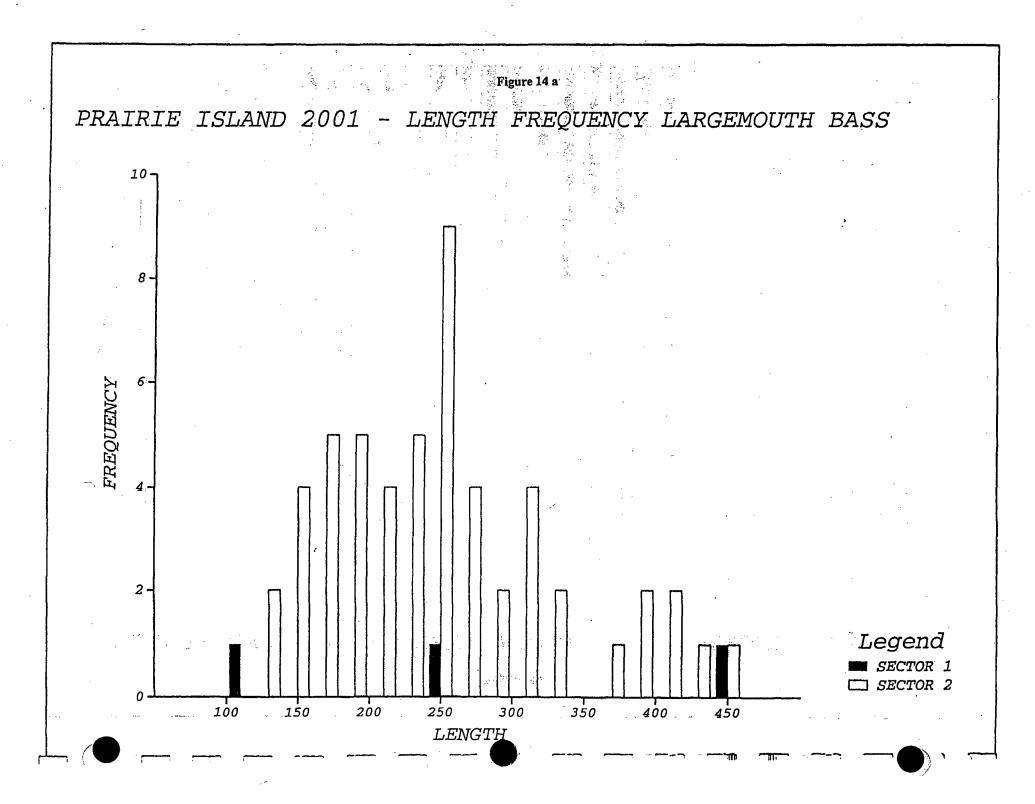


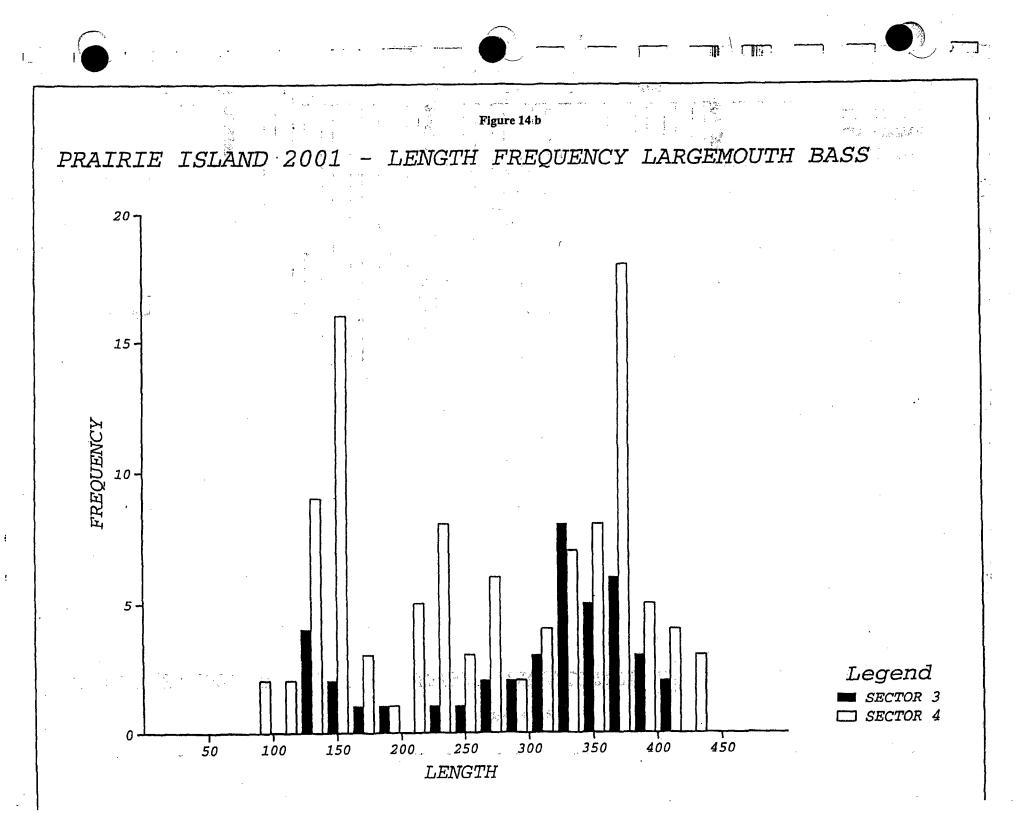




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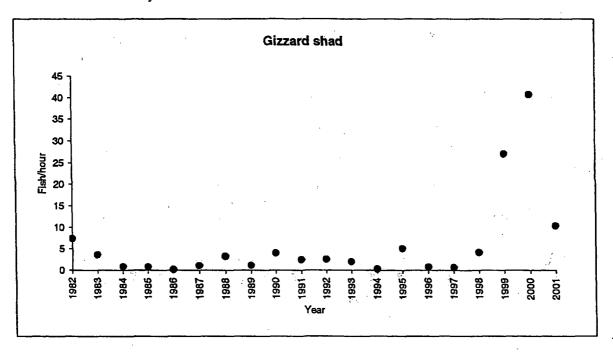
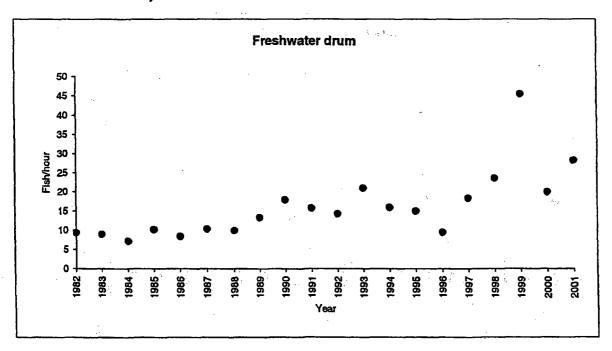


Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2001 in the vicinity of PINGP.

Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2001 in the vicinity of PINGP.





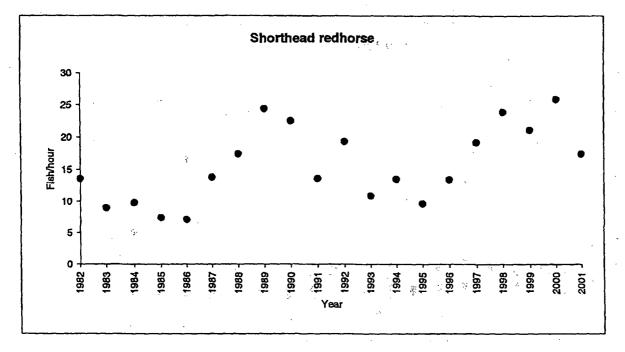
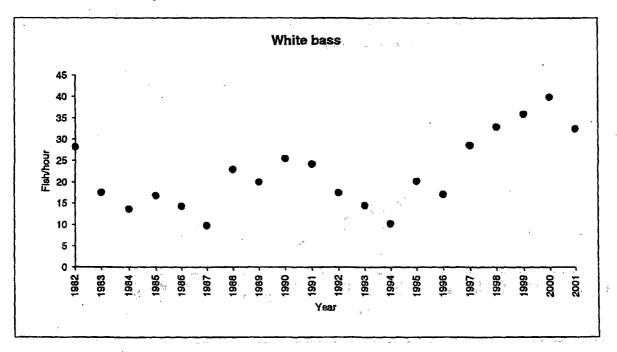
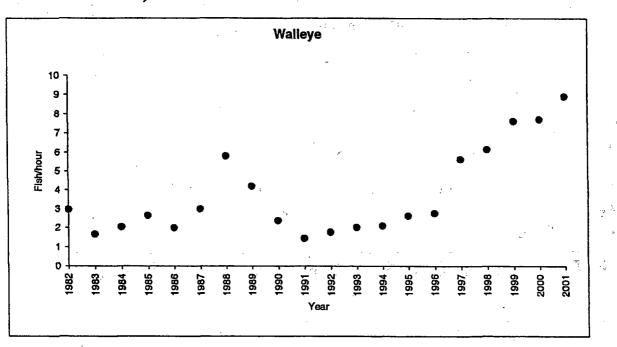


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2001 in the vicinity of PINGP.

Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2001 in the vicinity of PINGP.



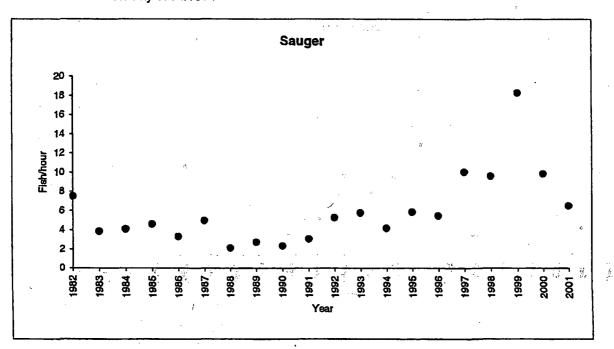




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Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2001 in the vicinity of PINGP.

Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2001 in the vicinity of PINGP.



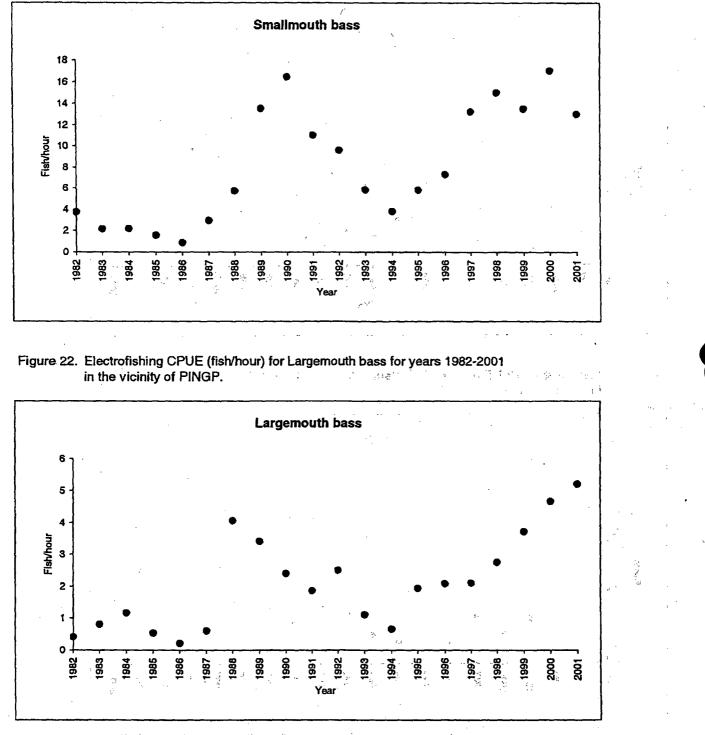
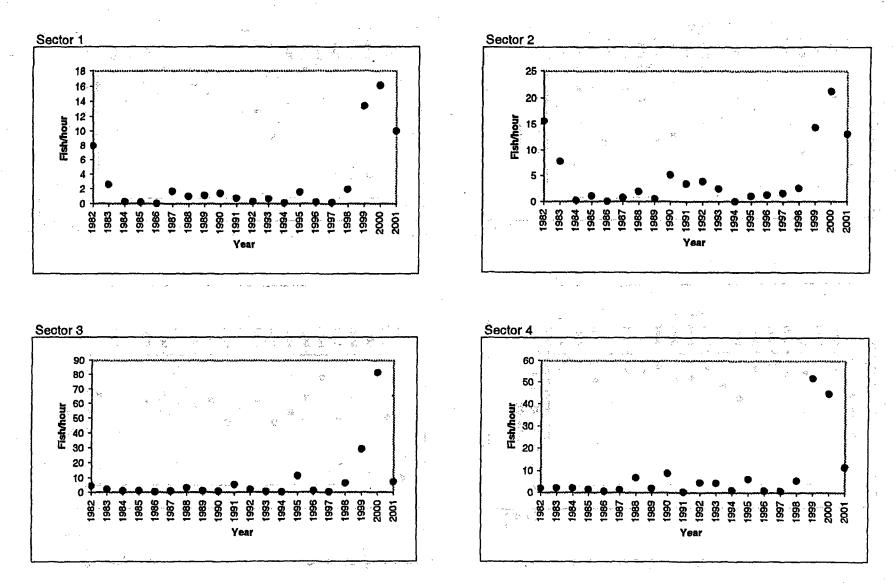


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2001 in the vicinity of PINGP.

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Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2001 in the vicinity of PINGP.





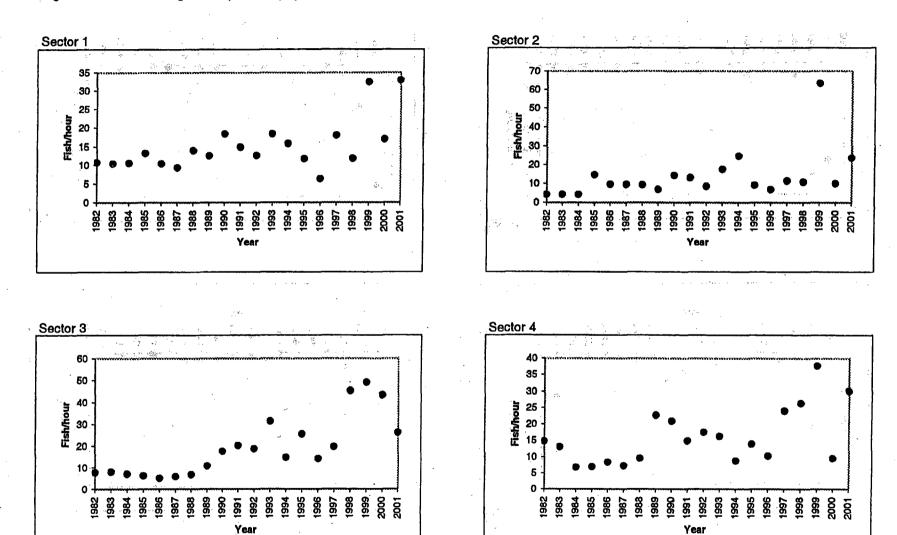


Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2001 in the vicinity of PINGP.

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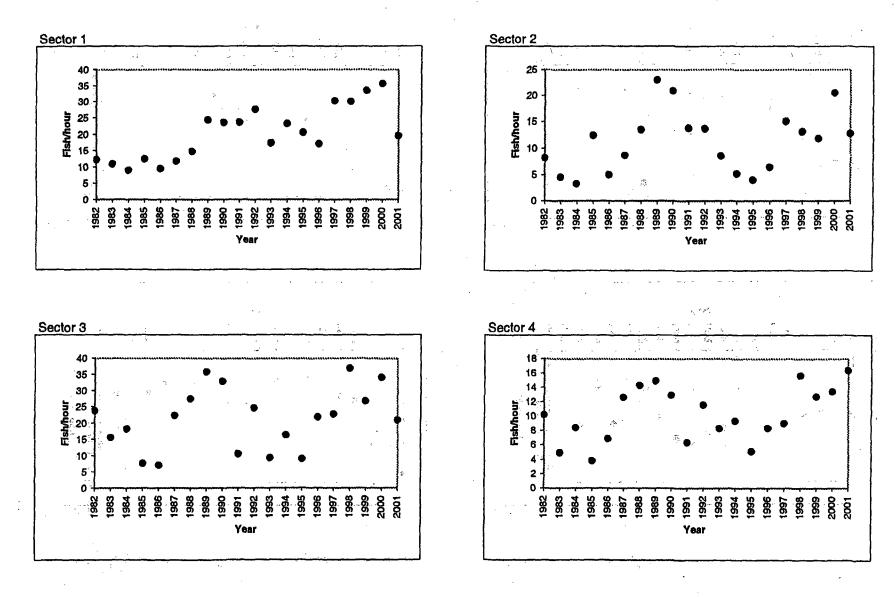


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2001 in the vicinity of PINGP.

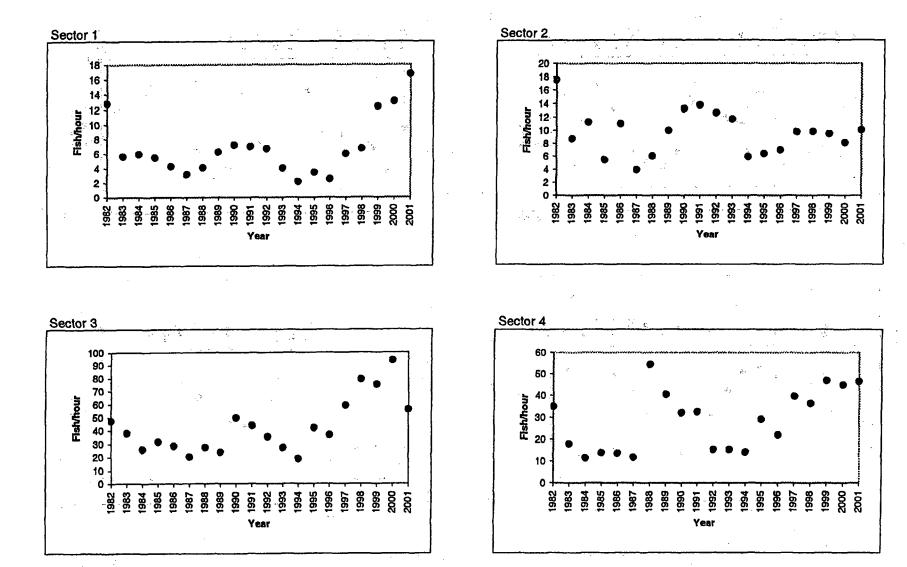
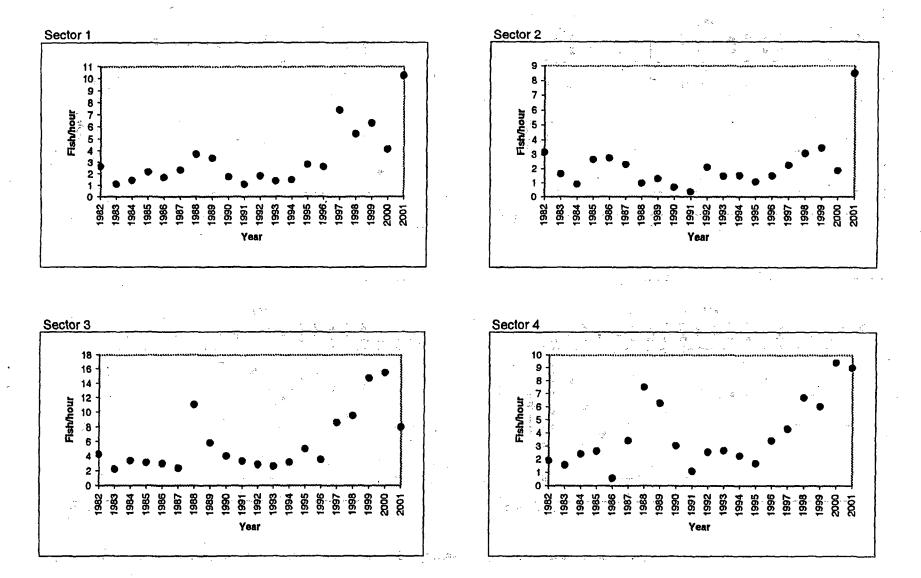


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2001 in the vicinity of PINGP.



Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2001 in the vicinity of PINGP.



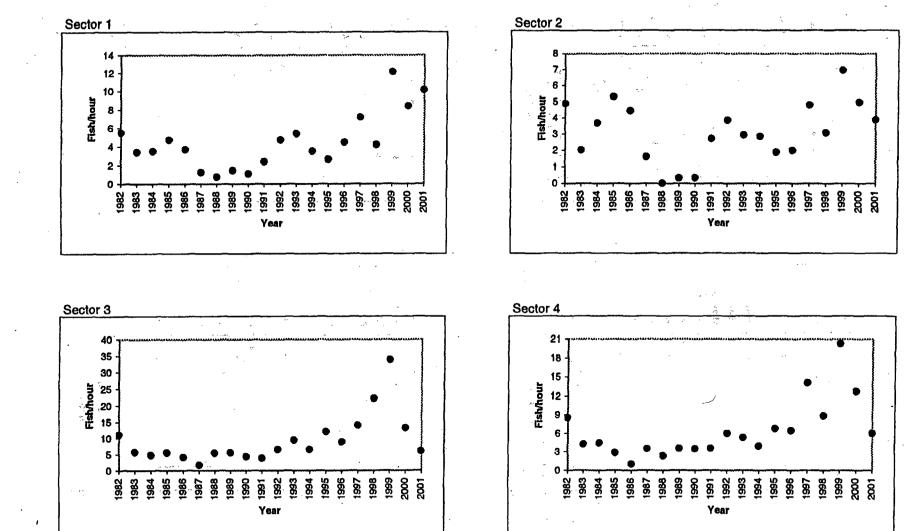


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2001 in the vicinity of PINGP

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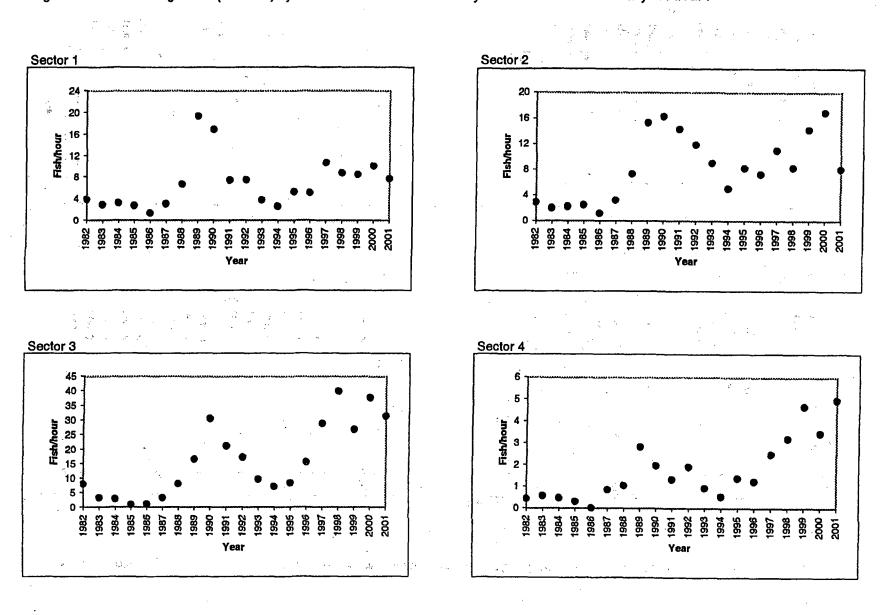
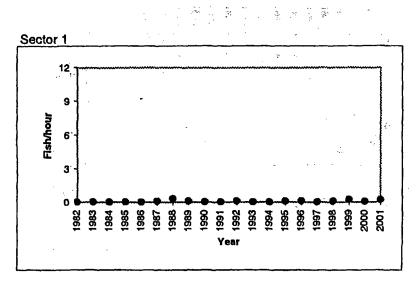
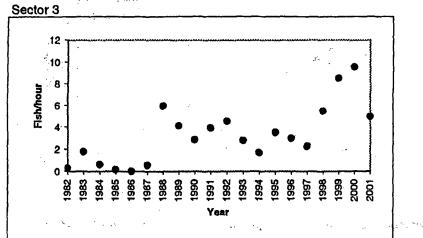


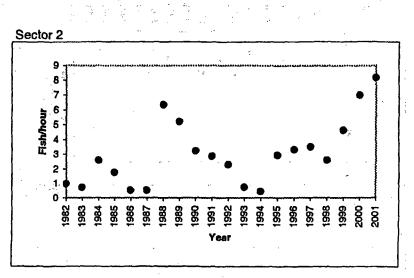
Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2001 in the vicinity of PINGP.



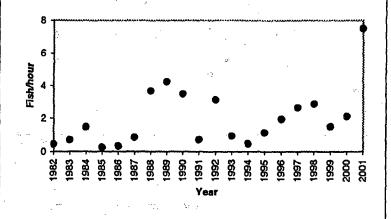


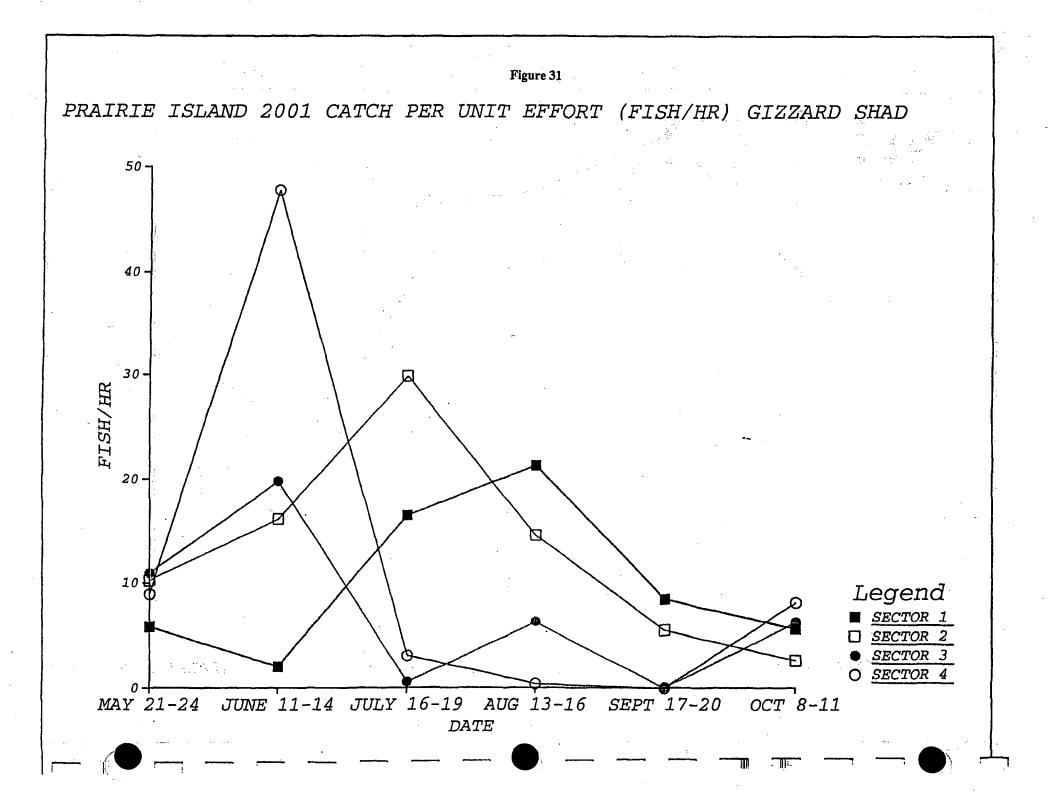


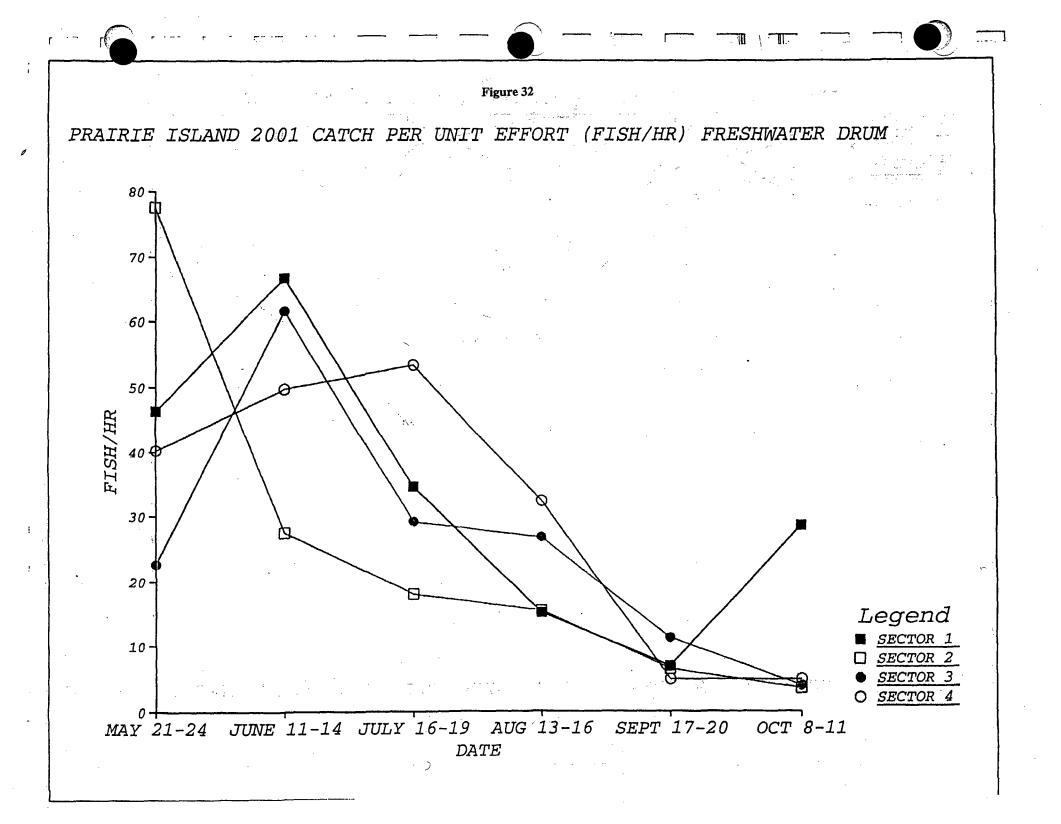


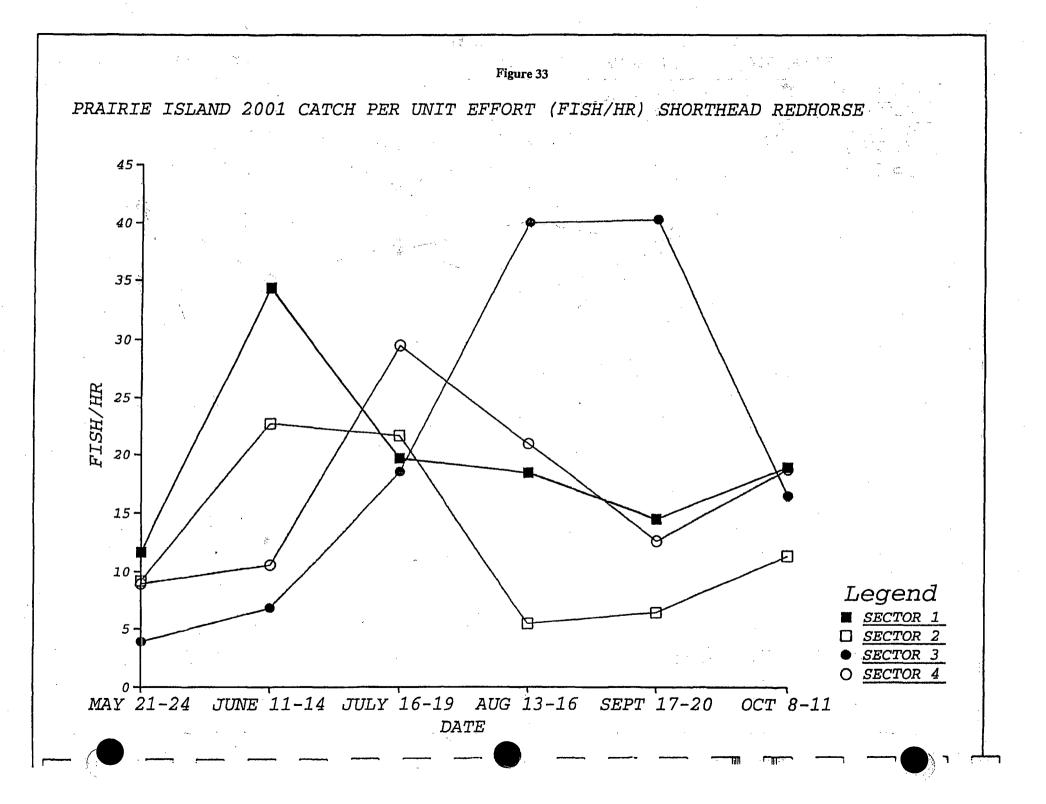


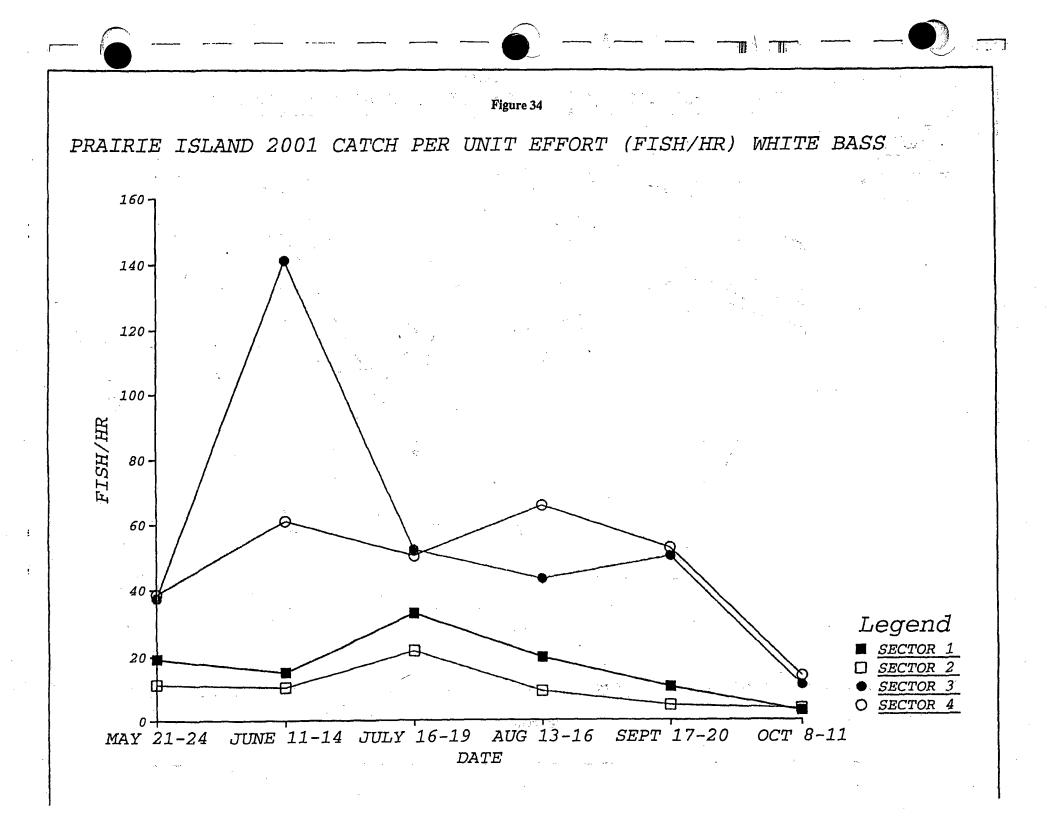


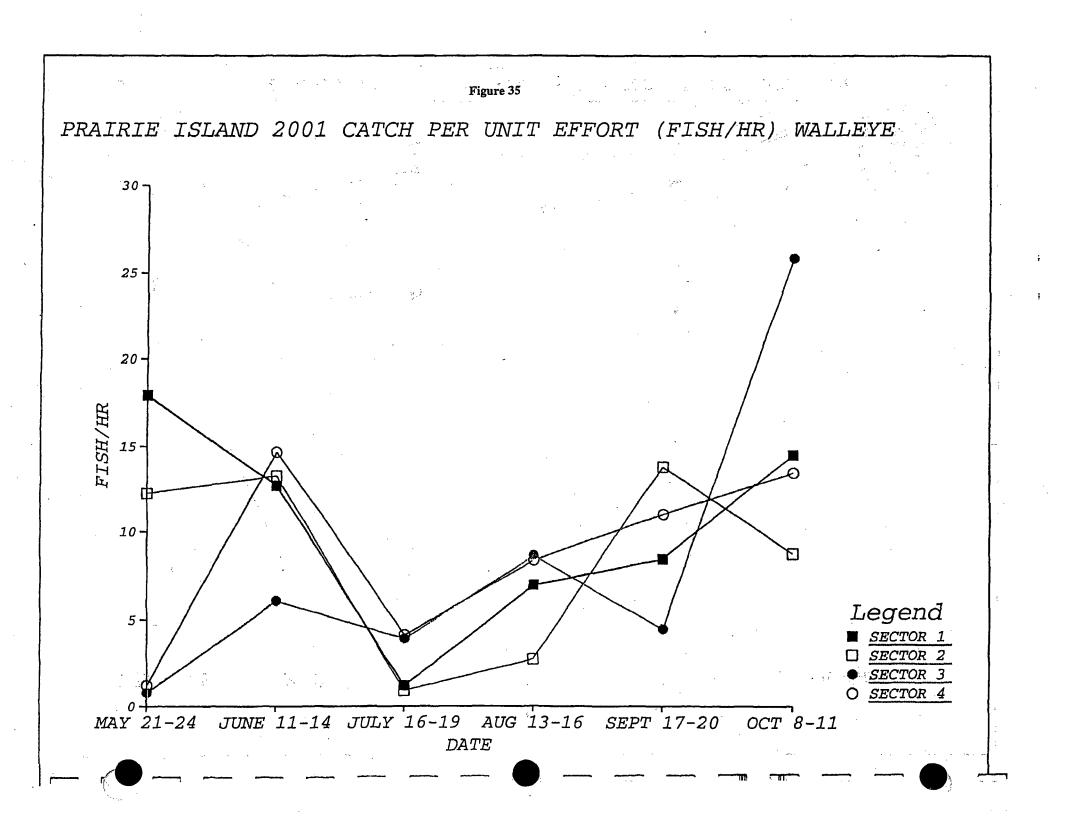


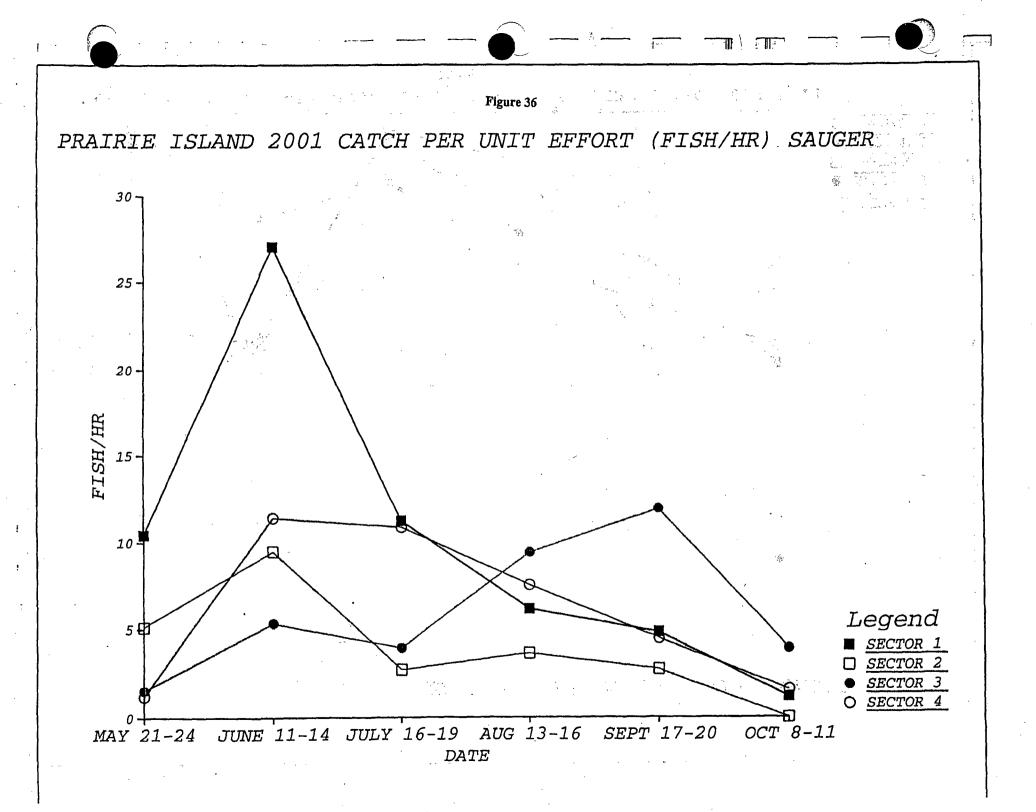


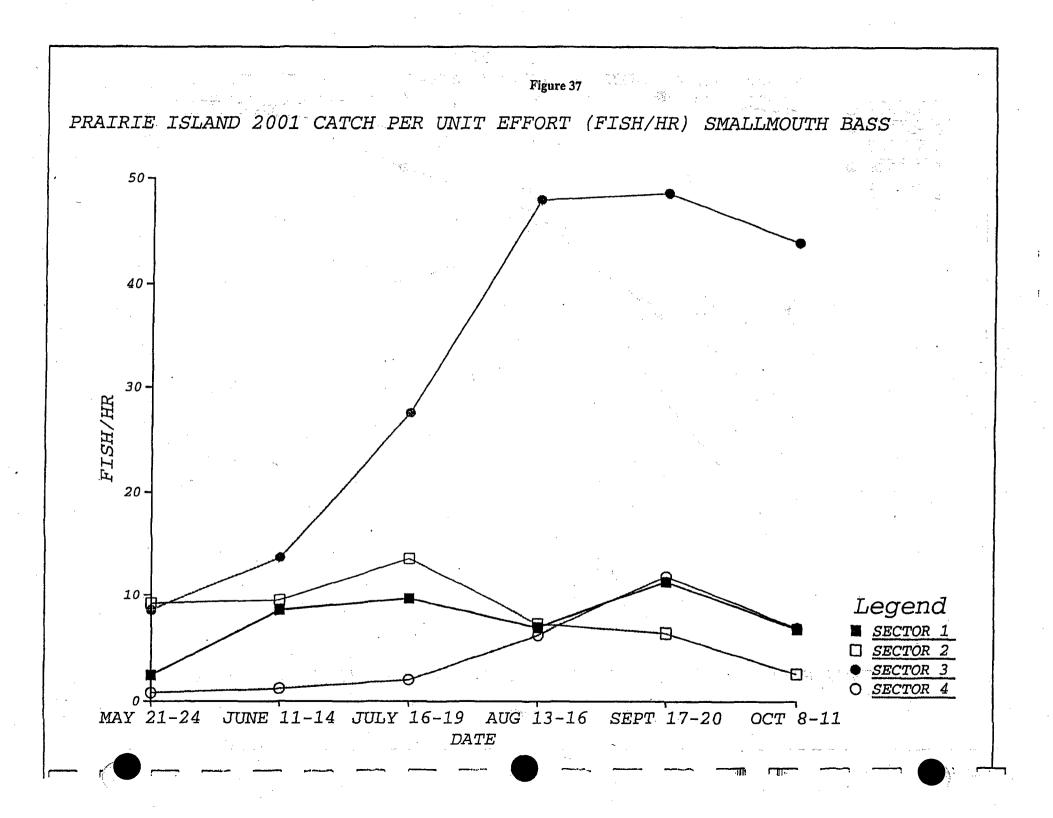


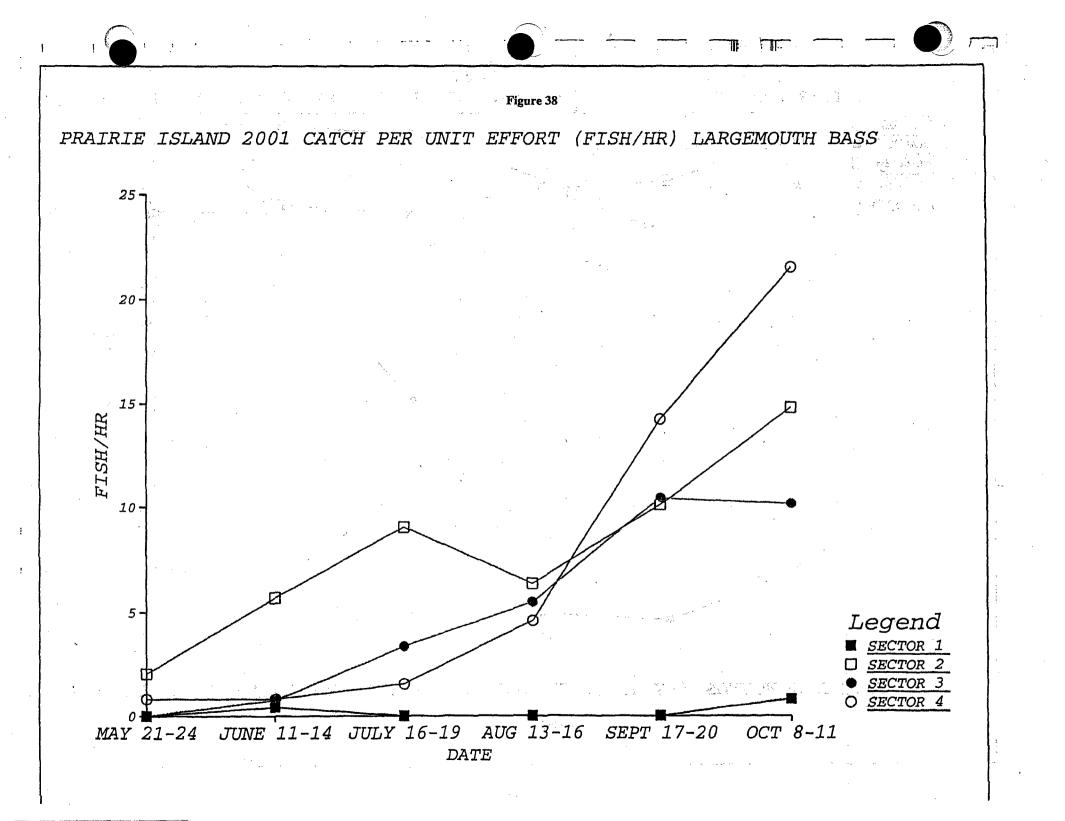












<u> </u>             	Chestnut lamprey <u>chthyomyzon castaneus</u> Silver lamprey	· X							89		91	-			95							
<u> </u>             	chthyomyzon castaneus Silver lamprey	X								·			. *	¢	2.							
E E E	Silver lamprey			х				·		4	x	х	X		X		2	X	X	5	x	
<u> </u> F <u>F</u>							x	x	X	x	х	<b>x</b> :		х	x	X	v	<b>v</b> .	X	<b>v</b> .	v	
<u> </u>	cthyomyzon unicuspus						~	^	^	^	^	~		^	^	~	x	^	*	X	~	
_	Paddlefish							۰.									x					
	<u>Polyodon spathula</u>																					
	ongnose gar <u>episosteus osseus</u>	Х		X	Χ ~	X	X	X	X	X	X	<b>X</b>	X	X	x	X	x	X	X	x	X	
S	hortnose gar	X		x	x	x	x	x	X	x	<b>X</b> .	x	x	x	X	x	X	X	x	x	x	
	episosteus platostomus owfin	х	-	x	x	x	x	x	x	x	x	x	<b>X</b> .	X °	x	x	x	x	x	x	x	
	mia calva	^	•	~	<b>^</b> .	^	~	· ·	~	~	~		~	~	^	^	~	^	~	^	^	
	merican eel nguilla rostrata	, Х	, .	X	•	X	х	x	x	X	X	x	X	X	x	x			x	x		
	izzard shad	x		X ·	x	x	x	<b>x</b> .	x	<b>X</b> .	x	x	x	x	x	x	x	x	<b>X</b> .	x	X	
	orosoma cepedianum																		,			
	ioldeye <u>Iodon alosoides</u>	X	·		x		X	х					x			<b>X</b> ,	x	x	x			
N	looneye	~ <b>X</b>		<b>x</b> .	X	X	X	х	x	<b>x</b> .	x	x	x	X	x	x	<b>X</b> -	x	x	x	x	
	lodon tergisus																					
	rown trout almo trutta					x									x		x		X		X	
	• • • • • • • • • • • • • • • • • • •	: <b>X</b>	_ <b>3</b>	x	<b>X</b> .	<b>X</b> .	X	х	х	х	х	<b>X</b> .	x	<b>X</b>	x	<b>X</b> '	x	X	<b>X</b>	<b>X</b> .	х	
	<u>sox lúcius</u> Iuskysea																			x	x	
	sox masquinongy																					
	arp	' <b>X</b>	2	X	X	X	x	х	x	X	X	х	X	X	X	X	X	x	x	x	x	
	yprinus carpio				•																	
	arpsucker Species		)	X					<b>X</b>		. :					-4						
	<u>arpiodes species</u> iver carpsucker	Y	•	x	x	x	x	x	x	x	x	x	x	x	Y	<b>x</b> .	x	Y	<b>y</b> ,	¥	v	
	arpiodes carpio	^	,		^	Â	~	~	~	^	~	~	~	~	^	~	^	^	^	^	^	
	uillback	x	>	Ķ	X	x	x	x	x	x	X	x	x	x	X	x	x	<b>x</b> :	<b>x</b> .	x	X	
	arpiodes cyprinus																					
	ighfin carpsucker													x		x	x					
	<u>arpiodes velifer</u> /hite sucker	Y	>		¥	¥	x	; X		x	x	x	х . Х	x	Y	:	¥	. , ¥	. ₹. X	j. V	×	
	atostomus commersoni	^					<b>^</b>						<b>^</b>	^								
																					an a si '	,

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Table 1 (cont) Species of fish captured in the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2001.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01			
										,												
Blue sucker	x			x	x	Χ.	x		x	x	х	Χ.	x	XA	x	X	X	X	x			
Cycleptus elongatus															~		~	~	~			
Northern hogsucker	x													4	X ·			x				
Hypentelium nigricans							~	-														
Smallmouth buffalo	х	х	X,	х	х	x	x	x	х	x	x	х	х	х	х	x	х	x	x			
Ictiobus bubalus																						
Bigmouth buffalo	x	<b>X</b> ·	X	x	х	x	х	х	х	x	х	X	X	x	Χ	X	x	х	x			
Ictiobus cyprinellus																						
Spottedsucker	х	х		x		х	х			x								۰.				
Minvtrema melanops						•																
Silver redhorse	Χ.	x	X	Х	<b>X</b> :	X	х	x	<b>X</b> :	x	х	x	х	х	<b>X</b> .	х	X ·	Χ.	x			
<u>Moxostoma anisurum</u>																						
River redhorse		X	x		х		х	х	x	х		x	х			x	x	x	<b>X</b> 1			
Moxostoma carinatum																						
Golden redhorse	Χ 🕔	х	<b>X</b> %	х	Χ	<b>X</b> 5.	х	х	x	х	х	х	Χ.	х	х	х	<b>X</b> ·	х	X	~		
Moxostoma erythrurum																						
Greater redhorse		х		X		x		X						·	х	х			X			
Moxostoma valenciennesi																						
Shorthead redhorse	X	Х	Χ	X	Х .	X	X	х	х	X	X	х	X	X	x	X	х	X	х			
M.macrolepidotum																						
Black builhead	Х	X	х	<b>X</b>	х	X				x		2					x	x	·			
Ictalurus melas																						
Yellow bullhead			•	<b>^.</b>	x	X	Х					x	Х	2%	۰.	• .						
<u>Ictalurus natalis</u>																						
Brown bullhead	x			5				`¢`		``		- 10		· .		4.	,					
Ictalurus nebulosus																						
Channel catfish	X	Х	X	X	X	X	X	X	X	X	X	X	X	X	Χ. ΄	X	X	X	х		,	
Ictalurus punctatus			•									•									*	
Flathead catfish	X	х	х	X	X	X	X	X	x	X	Х.	Х	X	X	X	X	X	X	X			
Pylodictus olivaris																						
Burbot	X	X			Χ.					X	X	X	X	X 🦉	X	X	X	X	X			
Lota lota																						
White bass	X	х	X	X	X	X	X	X	Х	X	X	X	X	X	X	X	X	X	XÌ			
Morone chrysops																						
Rock bass	X	X	X	X	x	x	x	х	X	x	X	х	X	X	X	X	x	x	x			
Ambloplites rupestris					, : , :			r;					: E.	19	Ĵ.		·* ·.	÷ ، ;	·			
Green sunfish	X	X			X	X	X	Х	х	X	х	x	X	X	x	X	x	x	x			
Lepommis cyanellus	· · · ·	, a ^{ns} -		-						-				, ,	* * . •	i			1 - K.S	• .	-	



Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01
Dumplinesed	ŕ		,			·. ·			.,				~ <b></b>		2				
Pumpkinseed		t e		1.1	· •		X	; <b>X</b>	X	<b>.</b> .	<b>X</b>	X	X	X	X	· X ·	X	X	x
Lepomis macrochirus Orangespotted sunfish					.:					1. 12		5			ан 1 1 ал	` <b>x</b>			X
Lepomis humilis			·· .					~ •						· .	< ·	Ŷ.		X	*
Bluegill	т. Х	x	X	Y	x	χ.	x	¥	x	x	¥ .	¥	. <b>X</b>	X	X	X	Ŷ	x	х
Lepomis macrochirus	^	~	<b>N</b>	<b>^</b>	~	<b>A</b> .	~	~	~	~	~	· ^ ·		<b>^</b> .		<b>^</b>	^	Ň	^
Smallmouth bass	x	x	x	X	X	х	х	х	х	x	x	X	X	x	x	x ^	x	x	X
Micropterus dolomieui	~	~	~	~		~	~	~	~	~	~	~	~	^	~	~	~	~	~
Largemouth bass	х	x	x	x	x	х	x	х	х	х	x	х	х	x	х	х	x	x	x
Micropterus salmoides			••											~	~		~		<b>N</b> .
White crappie	х	x	x	Χ.	х	х	x	х	x	х	х	х	Χ.	x	х	х	x	x	x
Pomoxis annularis																			
Black crappie	X	. <b>X</b>	<b>X</b> .,	x	x	х	х	x	х	х	x	x	x	x	x	X	x	x	X
Pomoxis nigromaculatus	• • • •	'		,		<u>-</u>	·	5 e		:	•		• •-	e. Curra Ver		· .	• 		
Yellow perch	X	Х	X		X	່X	x	x	х	X	X	x	X	· .	x	x	X		X
Perca flavens								,											
Sauger	X	<b>X</b>	X	<b>X</b> -	<b>ָx</b>	<b>X</b> ,	X	X	х	X	X	X	Х	Х	X	X	X	X	x
Stizostedion canadense	. · ,	•		<b>u</b> .	•	· · ·				·.					,				
Walleye	X	́Χ [°]	X	X	X	X	X	X	X	X	x	X	X	X	X	X	X	X	x
Stizostedion vitreum	,					•													
Saugeye															x	X	X		X
<u>S. vitreum x S. canadense</u>						·	•						:		•				.*
Freshwater drum	x	<b>X</b> .	х	X	Χ,	X	х	X	x	х	X	<b>X</b> .	X	х	X	х	<b>X</b> :	X	X,
Aplodinotus grunniens								•											·,

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Table 1(cont) Species of fish captured in the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2001.

 Table 2. Electrofishing CPUE (fish/hour) for each sector in the vicinity of PINGP during 2001.

 Species are listed in ascending order by rank according to average CPUE.

Rank Species	Sector 1	Sector 2	Sector 3	Sector 4	Average
1 White bass	16.68	10.03	55.95	46.83	32.37
2 Freshwater drum	32.88	23.61	26.10	30.07	28.17
3 Carp	24.68	30.09	38.19	19.53	28.12
4 Shorthead redhorse	19.59	12.81	20.91	16.41	17.43
5 Smallmouth bass	7.66	8.02	31.42	4.95	13.01
6 Gizzard shad	9.97	13.12	· ·	11.74	10.43
7 Walleye	10.24	8.49	7.98	8.99	8.93
8 Bluegill	0.75	13.42	4.96	9.06	7.05
9 Sauger	10.10	3.86	5.92	6.01	6.47
10 Quillback carpsucker	4.54	4.32	6.77	7.29	5.73
11 Largemouth bass	0.20	8.18	4.96	7.50	5.21
12 Black crappie	0.14	4.94	3.51	7.78	4.09
13 Flathead catfish	0.68	4.94	6.53	2.76	3.73
14 Smallmouth buffalo	3.32	6.64	2.05	1.98	3.50
15 Silver redhorse	3.86	2.16	2.18	4.74	3.24
16 Channel catfish	1.49	8.80	0.24	0.42	2.74
17 White crappie	0.14	3.09	0.60	0.35	1.05
18 Bigmouth buffalo	0.27	0.31	1.69	1.42	0.92
19 Bowfin	0.14	0.15	0.85	2.19	0.83
20 [°] Mooneye	0.68	0.00	0.48	1.20	0.59
21 Longnose gar	0.68	1.23	0.24	0.00	<b>0.54</b>
22 Green sunfish	0.00	1.54	0.24	0.14	0.48
23 River carpsucker	0.75	0.31	· 0.48	0.35	0.47
24 Blue sucker	0.41	0.00	1.09	0.21	0.43
25 Rock bass	0.20	0.00	0.12	1.20	0.38
26 Silver lamprey	0.48	0.46	0.36	0.00	0.33
27 Northern pike	0.00	0.15	0.60	0.50	-0.31
28 Shortnose gar	0.07	0.15	0.73	0.21	0.29
29 Brown trout	0.34	0.00	0.24	0.57	0.29
30 Golden redhorse	0.27	0.00	0.00	0.64	0.23
31 River redhorse	0.07	0.15	0.48	0.07	0.19
32 White sucker	0.00	0.00	0.48	0.28	0.19
33 Orange spotted sunfish	0.00	0.15	0.12	0.07	0.09
34 Pumpkinseed	0.00	0.15	0.12	0.00	0.07
35 Saugeye	0.07	0.00	0.12	0.00	0.05
36 Yellow perch	0.00	0.15	0.00	0.00	0.04
37 Greater redhorse	0.14	0.00	. 0.00	0.00	0.04
38 Musky	0.00	0.00 [°]	0.12	0.00	0.03
39 Burbot	0.00	0.00	0.12	0.00	0.03
40 Chestnut lamprey	0.07	0.00	0.00	0.00	0.02
Totals	151.56	171.42	233.84	195.46	188.07



Table 3.	Fisheries sur ELECTRO 1					$\sum_{i=1}^{n}  a_i  = \sum_{i=1}^{n}  a_i  = \sum_{i$
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)			LENGTH WEIGHT REGRESSION
1977	7.92	0.61	4	135	NA	LOG W=3.101 LOG L-5.163
1978		0.20	5	73	NA	LOG W=3.068 LOG L-5.078
1979	-4		1	NA	NA	NA
1980	10.83		7	NA NA	NA	NA
1981				917	216	LOG W=2.748 LOG L-4.348
1982	7.39	•	. 3	276	329	LOG W=2.917 LOG L-4.741
1983			2	155	355 281	LOG W=3.029 LOG L-5.049
198 <u>4</u> 1985			1	48 · 31	325	LOG W=2.684 LOG L-4.171 LOG W=2.388 LOG L-3.431
1985		0.01 0.06	1 <1	13	325 274	LOG W=2.386 LOG L-5.634
1980			1	55	256	LOG W=3.030 LOG L-5.046
1988			3.	139	288	LOG W=2.629 LOG L-4.015
1989				47	323	LOG W=3.025 LOG L-5.021
1990			3	170	326	LOG W=2.956 LOG L-4.857
1991			4	198	338	LOG W=2.601 LOG L-3.940
1992		NA	1.8	91	357	LOG W=3.459 LOG L-6.127
1993			1.9	62	375	LOG W=2.920 LOG L-4.728
1994			<1	14	394	LOG W=3.371 LOG L-5.955
1995		: NA	4	204	272	LOG W=2.625 LOG L-4.073
1996	0.76	NA	<1	27	330	LOG W=3.275 LOG L-5.666
1997		🖂 NA	i <b>&lt;1</b>	23		LOG W=3.934 LOG L-7.373
1998			2	<b>176</b>	260	LOG W=3.104 LOG L-5.218
1999				1222	290	LOG W=2.981 LOG L-4.988
2000				1634	290	LOG W=3.274 LOG L-5.697
2001		NA	6	455	340	LOG W=3.767 LOG L-6.967
Table 4.	Fisheries su ELECTRO				977-2001	
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)			LENGTH WEIGHT REGRESSION
1977		the second s		569	NA	LOG W=2.947 LOG L-4.756
1978			17	422		LOG W=2.911 LOG L-4.710
1979		5.22	21	<b>360</b> )	NA	LOG W=3.068 LOG L-5.100
1980	5,89	3.83	18	520	NA	LOG W=3.052 LOG L-5.026
1981	30,88	4.76	· 12 ·	1146	267	LOG W=2.891 LOG L-4.625
1982	9.30	11.00	:: <b>24</b>	2225		LOG W=2.888 LOG L-4.625
1983			22	1626		LOG W=3.001 LOG L-4.927
1984			20	1212	288	LOG W=2.598 LOG L-3.919
198				1712		LOG W=2.846 LOG L-4.452
198				856	310	LOG W=3.089 LOG L-5.139
198				940		LOG W=2.874 LOG L-4.603
198				419	280	LOG W=2.722 LOG L-4.205
198				570	294	LOG W=2.908 LOG L-4.707
199		· · · ·		724		LOG W=3.008 LOG L-4.957
199				·· 596		LOG W=2.955 LOG L-4.824
				539	320	LOG W=2.967 LOG L-4.829
199	n			584	334	LOG W=3.063 LOG L-5.053
199 199		NA NA		495	•	LOG W=3.072 LOG L-5.086
199 199 199				605		LOG W=3.124 LOG L-5.243
199 199 199 199	5 14.96	NA		274	200	
199 199 199 199 199	5 14.96 6 9.33	NA NA	8	374 812	300	LOG W=3.061 LOG L-5.093
199 199 199 199 199 199	5 14.96 6 9.33 7 18.18	NA NA NA	8 • 10	812	300	LOG W=3.090 LOG L-5.159
199 199 199 199 199 199 199	5 14.96 6 9.33 7 18.18 8 23.47	NA NA NA NA	8 10 11	812 ⁻ 983	300 320	LOG W=3.090 LOG L-5.159 LOG W=3.171 LOG L-5.344
199 199 199 199 199 199 199 199	5 14.96 6 9.33 7 18.18 8 23.47 9 45.53	NA NA NA NA	8 10 11 17	812 983 1745	300 320 320	LOG W=3.090 LOG L-5.159 LOG W=3.171 LOG L-5.344 LOG W=3.138 LOG L-5.289
199 199 199 199 199 199 199 199 200	5 14.96 6 9.33 7 18.18 8 23.47 9 45.53 0 19.88	NA NA NA NA	8 10 11 17 8	812 983 1745 776	300 320 320 310	LOG W=3.090 LOG L-5.159 LOG W=3.171 LOG L-5.344 LOG W=3.138 LOG L-5.289 LOG W=3.077 LOG L-5.161
199 199 199 199 199 199 199 199	5 14.96 6 9.33 7 18.18 8 23.47 9 45.53 0 19.88	NA NA NA NA	8 10 11 17 8	812 983 1745	300 320 320	LOG W=3.090 LOG L-5.159 LOG W=3.171 LOG L-5.344 LOG W=3.138 LOG L-5.289

	Fisheries sul				9 1977-200	
-	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)	Ν		LENGTH WEIGHT REGRESSION
1977	5.39	1.58	5	259	NA	LOG W=2.902 LOG L-4.691
1978	2.96	1.09	. 4	125	NA	LOG W=2.978 LOG L-4.917
1979	2.08	0.45	3	67	NA	LOG W=3.041 LOG L-5.090
1980	6.08	0.70	7	137	NA	LOG W=2.894 LOG L-4.678
1981	11.67	⊃ <b>1:34</b>	7	686	376	LOG W=2.791 LOG L-4.428
<b>1982</b>			′ <b>7</b>	675	392	LOG W=2.814 LOG L-4.496
<b>1983</b> .(	8.96	0.79	6	454	387	LOG W=2.849 LOG L-4.590
1984	9.74	0.51	7	435	386	LOG W=2.571 LOG L-3.840
1985	7.36		. 7	374	389	LOG W=2.787 LOG L-4.415
1986	7.07		·· 8	319	398	LOG W=2.911 LOG L-4.730
.1987		1.24	12	722	403	LOG W=2.860 LOG L-4.608
1988	17.48		13	667	381	LOG W=2.696 LOG L-4.176
1989	24.52	NA	: 17	· 902	370	LOG W=2,792 LOG L-4.448
1990	22.60	NA	14	838	361	LOG W=2.825 LOG L-4.544
1991		NA:		538	355	LOG W=2.784 LOG L-4.443
1992	19.35	NA	14	721	403	LOG W=2.841 LOG L-4.587
1993		NA		332	382	LOG W=3.011 LOG L-4.991
1994	13.51	NA	14	505	389	LOG W=2.872 LOG L-4.655
1995			8	450	364	LOG W=2.925 LOG L-4.808
1996 g			. 11	551 833	380	LOG W=2.897 LOG L-4.719
199 <u>7</u> ::		NA.		000	. 350	LOG W=2.982 LOG L-4.960
1998				. 1047 93 931	360	LOG W=2.982 LOG L-4.960 LOG W=3.016 LOG L-5.050
1999 2000		NA NA	9 · 11	1099	350 360	LOG W = 2.905 LOG L - 4.760
2000,0 2001			9	777		LOG W=2.903 LOG L-4.700
Table 6.						
	ELECTRO				.001.	
				• •		그 같아요. 이 밖에 많은 것이 같아요. 그는 것이 같아요. 이 것이 가지 않는 것이 있는 것이 없는 것이 없는 것이 없다.
	CPUE	CPUE	COMP	)	MEAN	ne en la Regelación de la Referencia de la composition de la composition de la composition de la composition de Referencia de la composition de la comp
YFAR	CPUE Fish/hr	CPUE Fish/hr	COMP		MEAN	LENGTH WEIGHT BEGBESSION
YEAR 1977	Fish/hr	Fish/hr	(%)	<u>N</u>	LENGTH	LENGTH WEIGHT REGRESSION
1977	Fish/hr 7.76	Fish/hr 6.73	<u>(%)</u> 19	N 565	LENGTH NA	LOG W=2.441 LOG L-3.529
1977 1978	Fish/hr 7.76 7.11	Fish/hr 6.73 5.67	(%) 19 17	N 565 369	LENGTH NA NA	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813
1977 1978 1979	Fish/hr 7.76 7.11 3.49	Fish/hr 6.73 5.67 3.02	(%) 19 17 13	N 565 369 217	LENGTH NA NA NA	LOG W=2:441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057
1977 1978 1979 1980	Fish/hr 7.76 7.11 3.49 2.48	Fish/hr 6.73 5.67 3.02 1.97	(%) 19 17 13 9	N 565 369 217 183	LENGTH NA NA NA NA	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813
1977 1978 1979 1980 1981	Fish/hr 7.76 7.11 3.49 2.48 30.88	Fish/hr 6.73 5.67 3.02 1.97 5.39	(%) 19 17 13 9 20	N 565 369 217 183 1996	LENGTH NA NA NA NA 240	LOG W=2:441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022
1977 1978 1979 1980 1981 1982	Fish/hr 7.76 7.11 3.49 2.48 30.88	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07	(%) 19 17 13 9 20	N 565 369 217 183 1996 1722	LENGTH NA NA NA 240 286	LOG W=2:441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498
1977 1978 1979 1980 1981	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07	(%) 19 17 13 9 20 18	N 565 369 217 183 1996 1722	LENGTH NA NA NA 240 286 300	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813 LOG W=3:055 LOG L-5.057 LOG W=3:064 LOG L-5:022 LOG W=2:842 LOG L-4.498 LOG W=2:909 LOG L-4.677
1977 1978 1979 1980 1981 1982 1983	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89	(%) 19 17 13 9 20 18 17 15	N 565 369 217 183 1996 1722 1277 435	LENGTH NA NA NA 240 286 300 300	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813 LOG W=3:055 LOG L-5:057 LOG W=3:064 LOG L-5:022 LOG W=2:842 LOG L-4:498 LOG W=2:909 LOG L-4:677 LOG W=3:041 LOG L-5:021 LOG W=2:571 LOG L-3:840
1977 1978 1979 1980 1981 1982 1983 1984 1985	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 47.50 13.53 16.75	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39	(%) 19 17 13 9 20 18 17 15 14	N 565 369 217 183 1996 1722 1277 435 768	LENGTH NA NA NA 240 286 300 304 304 308	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813 LOG W=3:055 LOG L-5:057 LOG W=3:064 LOG L-5:022 LOG W=2:842 LOG L-4:498 LOG W=2:909 LOG L-4:677 LOG W=3:041 LOG L-5:021 LOG W=2:571 LOG L-3:840 LOG W=2:773 LOG L-4:337
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16.75 14.23	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63	(%) 19 17 13 9 20 18 17 15 14 18	N 565 369 217 183 1996 1722 1277 435	LENGTH NA NA NA 240 286 300 304 304 308 325	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813 LOG W=3:055 LOG L-5:057 LOG W=3:064 LOG L-5:022 LOG W=2:842 LOG L-4:498 LOG W=2:909 LOG L-4:677 LOG W=3:041 LOG L-5:021 LOG W=2:571 LOG L-3:840
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16:75 14.23 9.70	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39	(%) 19 17 13 9 20 18 17 15 14 18 10	N 565 369 217 183 1996 1722 1277 435 768 732 589	LENGTH NA NA NA 240 286 300 304 308 325 321	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813 LOG W=3:055 LOG L-5:057 LOG W=3:064 LOG L-5:022 LOG W=2:842 LOG L-4:498 LOG W=2:909 LOG L-4:677 LOG W=3:041 LOG L-5:021 LOG W=2:571 LOG L-3:840 LOG W=2:773 LOG L-4:337 LOG W=2:926 LOG L-4:716
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16:75 14.23 9.70 22.90	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009	LENGTH NA NA NA 240 286 300 304 308 325 321 242	$\begin{array}{c} \mbox{LOG W=2.441 LOG L-3.529} \\ \mbox{LOG W=2.956 LOG L-4.813} \\ \mbox{LOG W=3.055 LOG L-5.057} \\ \mbox{LOG W=3.064 LOG L-5.022} \\ \mbox{LOG W=2.842 LOG L-4.498} \\ \mbox{LOG W=2.909 LOG L-4.677} \\ \mbox{LOG W=3.041 LOG L-5.021} \\ \mbox{LOG W=2.571 LOG L-3.840} \\ \mbox{LOG W=2.773 LOG L-4.337} \\ \mbox{LOG W=2.926 LOG L-4.716} \\ \mbox{LOG W=3.027 LOG L-4.958} \\ \mbox{LOG W=2.855 LOG L-4.525} \end{array}$
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16:75 14.23 9.70 22.90 20:00	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.855 LOG L-4.525 LOG W=2.945 LOG L-4.765
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16:75 14.23 9.70 22.90 20.00 25.49	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295	$\begin{array}{c} \mbox{LOG W=2.441 LOG L-3.529} \\ \mbox{LOG W=2.956 LOG L-4.813} \\ \mbox{LOG W=3.055 LOG L-5.057} \\ \mbox{LOG W=3.064 LOG L-5.022} \\ \mbox{LOG W=2.842 LOG L-4.498} \\ \mbox{LOG W=2.909 LOG L-4.677} \\ \mbox{LOG W=3.041 LOG L-5.021} \\ \mbox{LOG W=2.571 LOG L-3.840} \\ \mbox{LOG W=2.773 LOG L-4.337} \\ \mbox{LOG W=2.926 LOG L-4.716} \\ \mbox{LOG W=3.027 LOG L-4.958} \\ \mbox{LOG W=2.855 LOG L-4.525} \\ \mbox{LOG W=2.945 LOG L-4.765} \\ \mbox{LOG W=2.913 LOG L-4.697} \end{array}$
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16.75 14.23 9.70 22.90 20.00 25.49 24.15	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310	$\begin{array}{c} \mbox{LOG W=2.441 LOG L-3.529} \\ \mbox{LOG W=2.956 LOG L-4.813} \\ \mbox{LOG W=3.055 LOG L-5.057} \\ \mbox{LOG W=3.064 LOG L-5.022} \\ \mbox{LOG W=2.842 LOG L-4.498} \\ \mbox{LOG W=2.909 LOG L-4.677} \\ \mbox{LOG W=3.041 LOG L-5.021} \\ \mbox{LOG W=2.571 LOG L-3.840} \\ \mbox{LOG W=2.773 LOG L-4.337} \\ \mbox{LOG W=2.926 LOG L-4.716} \\ \mbox{LOG W=3.027 LOG L-4.958} \\ \mbox{LOG W=2.945 LOG L-4.765} \\ \mbox{LOG W=2.913 LOG L-4.697} \\ \mbox{LOG W=2.911 LOG L-4.696} \end{array}$
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 47.50 13.53 16:75 14.23 9.70 22.90 20.00 25.49 24:15 17:36	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.716 LOG W=2.855 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.967 LOG L-4.829
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1987 1988 1989 1990 1991 1992	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16.75 14.23 9.70 22.90 20.00 25.49 24.15 17.36 14.42	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.755 LOG W=2.945 LOG L-4.765 LOG W=2.913 LOG L-4.696 LOG W=2.911 LOG L-4.696 LOG W=2.939 LOG L-4.750
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1989 1990 1991 1992 1993 1994	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16:75 14.23 9.70 22.90 20.00 25.49 24.15 17.36 14.42 10:20	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 328 339	LOG W=2.441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.755 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 47.50 13.53 16:75 14.23 9.70 22.90 20.00 25.49 24.15 17.36 14.42 10:20 20.16	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 329 267	LOG W=2:441 LOG L-3.529 LOG W=2:956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.945 LOG L-4.765 LOG W=2.913 LOG L-4.655 LOG W=2.911 LOG L-4.697 LOG W=2.967 LOG L-4.829 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16.75 14.23 9.70 22.90 20.00 25.49 24.15 17.36 14.42 10.20 20.16 16.99	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14 14 10 10 16 14	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660	LENGTH NA NA NA 240 286 300 286 304 308 325 321 242 266 295 310 338 328 329 267 320	LOG W=2:441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.571 LOG L-3.840 LOG W=2.973 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.765 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.696 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975 LOG W=3.066 LOG L-5.068
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16.75 14.23 9.70 22.90 20.00 25.49 24.15 17.36 14.42 10.20 20.16 16.99 28.53	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14 15 14 15 15 15 15 16 15 15 15 16 15 15 15 15 15 15 15 15 15 15	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660 1159	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 329 267 320 300	LOG W=2:441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.571 LOG L-3.840 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.697 LOG W=2.939 LOG L-4.750 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975 LOG W=3.026 LOG L-5.068 LOG W=3.054 LOG L-5.038
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 47.50 13.53 16:75 14.23 9.70 22.90 20.00 25.49 24:15 17:36 14.42 10:20 20.16 16:99 28:53 32:90	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14 15 16 14 15 16 14 15 16 16 17 15 16 18 17 15 16 16 17 15 16 16 17 15 16 16 17 15 16 16 17 15 16 16 17 15 16 16 17 15 16 16 16 16 17 15 16 16 16 16 16 16 16 16 16 16	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660 1159 1314	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 329 267 320 300 300 320	LOG W=2:441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.773 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.716 LOG W=2.926 LOG L-4.758 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.913 LOG L-4.697 LOG W=2.939 LOG L-4.697 LOG W=2.939 LOG L-4.750 LOG W=2.939 LOG L-4.750 LOG W=3.026 LOG L-4.751 LOG W=3.026 LOG L-4.975 LOG W=3.026 LOG L-5.068 LOG W=3.054 LOG L-5.068
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997	Fish/hr 7.76 7.11 3.49 2.48 30.88 28.11 17.50 13.53 16.75 14.23 9.70 22.90 20.00 25.49 24.15 17.36 14.42 10.20 20.16 16.99 28.53	Fish/hr 6.73 5.67 3.02 1.97 5.39 0.07 4.52 2.89 1.39 1.63 1.44 NA NA NA NA NA NA NA NA NA NA NA	(%) 19 17 13 9 20 18 17 15 14 18 10 20 15 16 18 11 12 10 16 14 15 16 14 15 16 14	N 565 369 217 183 1996 1722 1277 435 768 732 589 1009 819 941 886 577 390 360 809 660 1159	LENGTH NA NA NA 240 286 300 304 308 325 321 242 266 295 310 338 328 329 267 320 300 320 300 320 300	LOG W=2:441 LOG L-3.529 LOG W=2.956 LOG L-4.813 LOG W=3.055 LOG L-5.057 LOG W=3.064 LOG L-5.022 LOG W=2.842 LOG L-4.498 LOG W=2.909 LOG L-4.677 LOG W=3.041 LOG L-5.021 LOG W=2.571 LOG L-3.840 LOG W=2.571 LOG L-3.840 LOG W=2.926 LOG L-4.337 LOG W=2.926 LOG L-4.716 LOG W=3.027 LOG L-4.958 LOG W=2.945 LOG L-4.525 LOG W=2.913 LOG L-4.697 LOG W=2.911 LOG L-4.697 LOG W=2.939 LOG L-4.750 LOG W=2.939 LOG L-4.750 LOG W=2.911 LOG L-4.671 LOG W=3.026 LOG L-4.975 LOG W=3.026 LOG L-5.068 LOG W=3.054 LOG L-5.038

				Valleye 197	7-2001.		
		ELECTRO T		CATCH			
		CPUE	CPUE	COMP	÷	MEAN	•
_	YEAR	Fish/hr	Fish/hr	(%)	<u>N L</u>		LENGTH WEIGHT REGRESSION
_	1977	1.36	0.37	1	20	NA	LOG W=3.137 LOG L-5.377
	1978	1.54	0.96	2	28	NA	LOG W=3.056 LOG L-5.197
	1979	1.57	0.31	2	34	NA	LOG W=3.225 LOG L-5.640
	1980	1.20	0.13	1	22	NA	LOG W=3.250 LOG L-5.693
	1981	3.53	0.39	2	189	335	LOG W=3.082 LOG L-5.240
	1982	2.96	0.16	1	135	415	LOG W=3.097 LOG L-5.293
	1983	1.63	0.21	1	90	432	LOG W=3.095 LOG L-5.295
	1984	2.04	0.11		93	378	LOG W=2.852 LOG L-4.615
				2 2	119	413	LOG W=3.159 LOG L-5.461
	1985	2.64	0.13	~ ~			
	1986	1.99	0.15	2 2	101	404	LOG W=3.085 LOG L-5.269
	1987	3.00	0.09	2	132	386	LOG W=3.151 LOG L-5.446
	1988	5.80	NA	5 3	234	450	LOG W=3.103 LOG L-5.272
	1989	4.19	, NA	3	173	408	LOG W=3.140 LOG L-5.379
	1990	2.36	NA	2	95	420	LOG W=3.214 LOG L-5.594
	1991	1.44	NA	1	52	477	LOG W=3.318 LOG L-5.870
	1992	2.30	NA	1	82	403	LOG W=3.257 LOG L-5.727
	1993		NA	2	60	465	LOG W=3.001 LOG L-5.020
	. 1994	2.11	NA	2 2	74	439	LOG W=3.261 LOG L-5.720
	1995		NA	2	107	333	LOG W=3.208 LOG L-5.586
	1996		NA	2	118	360	LOG W=3.159 LOG L-5.467
	1997		NA NA	3	248	400	LOG W=3.215 LOG L-5.617
	1998		* NA	3	272	420	LOG W=3.148 LOG L-5.440
				3	308	420	LOG W=3.238 LOG L-5.690
	1999		NA				
	2000		NA	3	325	460	LOG W=3.250 LOG L-5.717
	2001	8.93	NA	5	399	400	LOG W=3.296 LOG L-5.837
	Table 8.	Fisheries su			7-2001.		Sec. West
		ELECTRO					
		CPUE	CPUE	COMP		MEAN	
	YEAR	Fish/hr	Fish/hr	(%)		LENGTH	
	1977	Fish/hr 0.77	Fish/hr 0.40	<u>(%)</u> 1	20	LENGTH NA	LOG W=2.984 LOG L-4.991
	1977 1978	Fish/hr 0.77 2.43	Fish/hr 0.40 0.38	(%) 1 2		LENGTH NA NA	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354
	1977	Fish/hr 0.77 2.43	Fish/hr 0.40	(%) 1 2 2	20 38 24	LENGTH NA NA NA	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158
	1977 1978	Fish/hr 0.77 2.43 1.57	Fish/hr 0.40 0.38	(%) 1 2	20 38	LENGTH NA NA	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354
	1977 1978 1979	Fish/hr 0.77 2.43 1.57 1.79	Fish/hr 0.40 0.38 0.30	(%) 1 2 2	20 38 24	LENGTH NA NA NA	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158
	1977 1978 1979 1980 1980	Fish/hr 0.77 2.43 1.57 1.79 7.28	Fish/hr 0.40 0.38 0.30 0.17 0.29	(%) 1 2 2 2 4	20 38 24 16 NA	LENGTH NA NA NA NA NA	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509
	1977 1978 1979 1980 1981 1981	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17	(%) 1 2 2 2 4 4	20 38 24 16 NA 329	LENGTH NA NA NA NA 256	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773
	1977 1978 1979 1980 1981 1982 1983	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25	(%) 1 2 2 2 4 4 3	20 38 24 16 NA 329 188	LENGTH NA NA NA NA 256 285	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144
	1977 1978 1979 1980 1981 1982 1983 1984	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19	(%) 1 2 2 2 4 4 3 3	20 38 24 16 NA 329 188 182	LENGTH NA NA NA NA 256 285 262	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202
	1977 1978 1979 1980 1981 1983 1983 1984 1985	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21	(%) 1 2 2 4 4 3 3 3 4	20 38 24 16 NA 329 188 182 182 199	LENGTH NA NA NA NA 256 285 262 283	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1986	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24	(%) 1 2 2 4 4 3 3 3 4 4	20 38 24 16 NA 329 188 182 199 178	LENGTH NA NA NA NA 256 285 262 283 294	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12	(%) 1 2 2 4 4 3 3 4 4 2	20 38 24 16 NA 329 188 182 199 178 114	LENGTH NA NA NA NA 256 285 262 283 294 262	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-5.144 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA	(%) 1 2 2 4 4 3 3 4 4 2 2	20 38 24 16 NA 329 188 182 199 178 114 79	LENGTH NA NA NA NA 256 285 262 283 294 262 294 262 236	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-5.019 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=2.683 LOG L-4.285
	1977 1978 1979 1980 1981 1983 1983 1984 1985 1986 1987 1988 1989	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA	(%) 1 2 2 4 4 3 3 4 4 2 2 2 2	20 38 24 16 NA 329 188 182 199 178 114 79 104	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=2.683 LOG L-4.285 LOG W=3.208 LOG L-5.639
	1977 1978 1979 1980 1981 1983 1983 1984 1985 1985 1985 1988 1989 1990	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA	(%) 1 2 2 4 4 3 3 4 4 2 2 2 2 2	20 38 24 16 NA 329 188 182 199 178 114 79 104 92	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-4.285 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.277
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA	(%) 1 2 2 4 4 3 3 4 4 2 2 2 2 2 2 2 2	20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291 308	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.639 LOG W=3.155 LOG L-5.507
	1977 1978 1979 1980 1981 1983 1983 1984 1985 1985 1985 1988 1989 1990	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA	(%) 1 2 2 4 4 3 3 4 4 2 2 2 2 2 2 4	20 38 24 16 NA 329 188 182 199 178 114 79 104 92	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.277 LOG W=3.155 LOG L-5.507 LOG W=3.029 LOG L-5.191
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07 2.24	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA	(%) 1 2 2 4 4 3 3 4 4 2 2 2 2 2 4	20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291 308	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.639 LOG W=3.155 LOG L-5.507
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07 2.29 3.07 2.24 3.571	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA NA	(%) 1 2 2 4 4 3 3 4 2 2 2 2 2 4 5	20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117 196	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291 308 297	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=3.013 LOG L-5.144 LOG W=2.648 LOG L-4.202 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.936 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.277 LOG W=3.155 LOG L-5.507 LOG W=3.029 LOG L-5.191
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1985 1985 1985 1985 1985 1995 1992 1992 1992	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07 2.29 3.07 2.24 3.07 4.57 4.16	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA NA NA NA	(%) 1 2 2 4 4 3 3 4 2 2 2 2 2 4 5 4	20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117 196 168 145	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291 308 297 262 280	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.864 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.648 LOG L-5.019 LOG W=3.336 LOG L-5.019 LOG W=3.177 LOG L-5.556 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-4.285 LOG W=3.070 LOG L-5.639 LOG W=3.155 LOG L-5.507 LOG W=3.029 LOG L-5.191 LOG W=2.950 LOG L-5.191 LOG W=3.153 LOG L-5.484
	1977 1978 1979 1980 1981 1982 1983 1984 1985 1985 1985 1985 1985 1992 1992 1992 1992	Fish/hr 0.77 2.43 1.57 1.79 7.28 7.50 3.80 4.07 4.57 3.29 4.94 2.10 2.70 2.29 3.07 2.29 3.07 5.24 5.71 4.16 5.80	Fish/hr 0.40 0.38 0.30 0.17 0.29 0.17 0.25 0.19 0.21 0.24 0.12 NA NA NA NA NA NA	(%) 1 2 2 4 4 3 3 4 4 2 2 2 2 4 5 4 5	20 38 24 16 NA 329 188 182 199 178 114 79 104 92 117 196 168 145 233	LENGTH NA NA NA NA 256 285 262 283 294 262 236 237 291 308 297 262 280 243	LOG W=2.984 LOG L-4.991 LOG W=3.100 LOG L-5.354 LOG W=3.009 LOG L-5.158 LOG W=3.169 LOG L-5.509 NA LOG W=2.864 LOG L-4.773 LOG W=2.864 LOG L-4.773 LOG W=2.648 LOG L-5.144 LOG W=2.996 LOG L-5.019 LOG W=3.336 LOG L-5.036 LOG W=3.177 LOG L-5.556 LOG W=3.208 LOG L-5.639 LOG W=3.070 LOG L-5.639 LOG W=3.029 LOG L-5.637 LOG W=3.029 LOG L-5.191 LOG W=3.029 LOG L-5.191 LOG W=3.153 LOG L-5.484 LOG W=3.090 LOG L-5.369
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		White	Freshwater		Black	Shorthead		Gizzard	
Year	Carp	bass	Drum	Sauger	Crappie	Redhorse	Walleye	Shad	Total %
1 <b>981</b>	17	20	12	4	15	7	2	9	86
1982	23	18	24	4	9	7	1	3	89
1983	18	17	22	3	16	6	1	2	85
1984	26	15	20	3	12	7	2	1	86
1985	20	14	31	4	9	7	2	1	87
1986	21	18	22	4	9	8	2	<1	84
1987	27	10	16	2	11	12	2	1	81
1988*	23	20	8	2	· 3	13	5	3	77
1989*	20	15	· 11	2	1	17	3 ·	<1	70
1990*	20	16	13	· 1	<1	14	1	3	69
1991*	24	18	12	2	1	11.	1	. 4	73
1992*	26	12	11	4	1	<u>.</u> 14	2	2	72
1993*	28	12	18	5	<1	÷ 10	2	2	76
1994*	34	10	14	4	<1	14	2	<1	78
1995*	30	16	12	5	<b>1</b> ·	8	2	4	78
1996*	34	14	8 .	5	2	11	2	<1	76
1997*	29	- 15	<b>10</b>	5	1	10	3	<1	73
1998*	23	16	11	5	2	12	3	- 2	74
1999*	17	14	17 -	7	3	9	3	12	82
2000*	16	16	8	4	2	11	3	17	77
2001*	15	17	15	3	2	9	5	6	72

*Electrofishing only

Table 10.

# Species composition expressed as % of total annual catches for PINGP fisheries studies, electrofishing and trapnetting combined for 1981-1987, and electrofishing only for 1988 through 2001.

# SECTION III

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# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2001 ANNUAL REPORT

ž:

# FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

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Study and Report by

K. N. Mueller

and

B. D. Giese

**Environmental Services** 

Water Quality Department

#### FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

#### INTRODUCTION

The 2001 study was a continuation of a study started in 1992 to evaluate effects of increased water appropriation from 150 to 300 cubic feet per second (cfs) during April on impingement of larval fish on 0.5 mm mesh traveling screens at the Prairie Island Nuclear Generating Plant (PINGP). Prior to 1992, the cooling water intake system operated with fine-mesh screens from April 16 through August 31, in accordance with Part I.C.6.c. of the plant's NPDES Permit (#MN0004006). Since 1992, for study purposes, the plant has implemented fine-mesh screen operation on April 1 to accommodate sampling during the month of April for years 1992 through 2001. Data for this evaluation were collected by pre-dawn and daylight sampling of larval fish from the screenwash water.

Due to river flood levels in Spring, 2001, sampling of larval fish from the fine-mesh traveling screens during April was extremely limited. The plant was operating in flood by-pass conditions from April 11th through May 9th as communicated with MPCA at the time, and as reported in the April and May monthly Discharge Monitoring Reports (DMRs) dated May 21, 2001 and June 21, 2001, respectively (see Appendix). Intake screenhouse emergency by-pass gates were opened and the traveling screens were shut down on April 12th. Traveling screens remained out of service for the remainder of April and were restarted on May 4th and 5th, and emergency by-pass gates were closed on May 5th. Due to limited sampling, results only are reported and include species, lifestage, and initial survival status of specimens collected on three dates in early April.

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#### METHODS

Two samples were collected per sample date on April 3, 5, and 9, for a total of 6 samples. Samples were collected during pre-dawn and daylight hours.

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Samples were collected by diverting screenwash water to collection tanks in the basement of the environmental lab. Screenwash water flows by gravity from the vertical traveling screenwash trough through an 18-inch pipe to the lab basement. The larval collection tank, manufactured by Lawler, Matusky, and Skelly Engineers (Figure 1), filters screenwash water through 0.5 mm mesh nylon screen.

Filtered water returns to the circulating water system via a 12-inch diameter drain pipe. The screenwash trough was manually cleaned and the fish sampling system was flushed to remove accumulated debris and fish prior to sample collection on each date of the 2001 sample season.

During sample collection, physical parameters were recorded including collection time and duration, screen speed, number of screens sampled, river stage, and water temperature. Volume of river water filtered by the intake screens was obtained from the PINGP monthly external circulating water log.

Sample collection duration was 10 minutes. Upon completion of sample collection, fish and debris were rinsed into two collection baskets located at the outlet end of the collection tank (Figure 2). The baskets were then removed from the tank, the contents transferred to a five gallon bucket, and transported to the fish handling and sorting area for further processing.

Samples were sorted to remove live and dead fish, with an emphasis on doing so in a timely manner. Fish were determined to be alive or dead based on the presence or absence of movement. Sorting efficiency was maximized by pouring small portions of the sample into glass baking dishes and sorting on a light table.

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Fish and eggs were removed from the sample, and the remaining debris was rinsed into a Tyler No. 60 sieve and drained. Sample remains were preserved in a solution of 5% formalin containing rose bengal stain. Each sample was sorted a second time. Fish and eggs found during the second sort were included with those from the initial sort, and recorded as dead.

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Terminology used to identify lifestage was similar to that described by Auer (1982). The larval stage was divided into two developmental phases which correspond to Auer's terms yolk-sac larvae and larvae, respectively.

- Prolarvae (Yolk-sac larvae) Phase of development from time of hatch to complete absorption of yolk.
- Postlarvae (Larvae) Phase of development from complete absorption of yolk to development of the full compliment of adult fin rays and absorption of finfold.
- Juveniles Phase of development from complete fin ray development and finfold absorption to sexual maturity; includes young-of-the-year (yoy) fish.



#### RESULTS

Six samples were collected during April 2001, which contained a total of 26 fish (5 prolarvae, 20 juveniles, and ladult). Survival was based on absence or presence of movement during the sort. Six taxa/lifestage combinations were identified in the samples (see below). Burbot is the only species expected to spawn early enough in Spring, for their larvae to be in the drift and subject to impingement on the traveling screens before late-April.

Date	Sample	Species	Life stage	Number	Live/dead
3-Apr	pre-dawn	Cyprinid spp.	juv.	2	live
	pre-dawn	Carp	pro-larvae	1	dead
3-Apr	daylight	Cyprinid spp.	juv.	1	live
5-Apr	pre-dawn	Cyprinid spp.	juv.	4	live
	pre-dawn	freshwater drum	juv.	1	live
	pre-dawn	white bass	juv.	1	live
	pre-dawn	burbot	pro-larvae	4	live
5-Apr	daylight	Cyprinid spp.	juv.	2	live
9-Apr	pre-dawn	Cyprinid spp.	juv.	3	live
	pre-dawn	emerald shiner	adult	1	live
9-Apr	daylight	Cyprinid spp.	juv.	6	live

#### **SUMMARY**

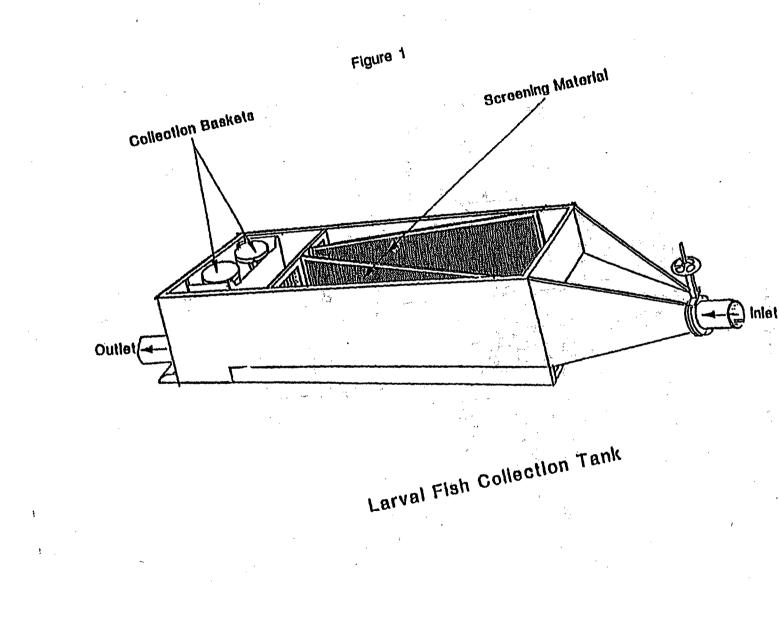
Larval studies were conducted at PINGP from 1984 through 1988 providing estimates of impingement, density, and survival. In 1989 and 1990 larval fish studies were done to evaluate sampling induced mortality. Sampling was not a requirement of the NPDES permit during 1991. In 1992-2000, fine-mesh screens were installed by April 1, and a larval fish study was conducted to assess impingement affects of increased water appropriation during April. Fine-mesh screens were installed by April 1, 2001, but due to river flood levels and related plant operating conditions, limited sampling was conducted. No comparisons to previous studies were made for year 2001.

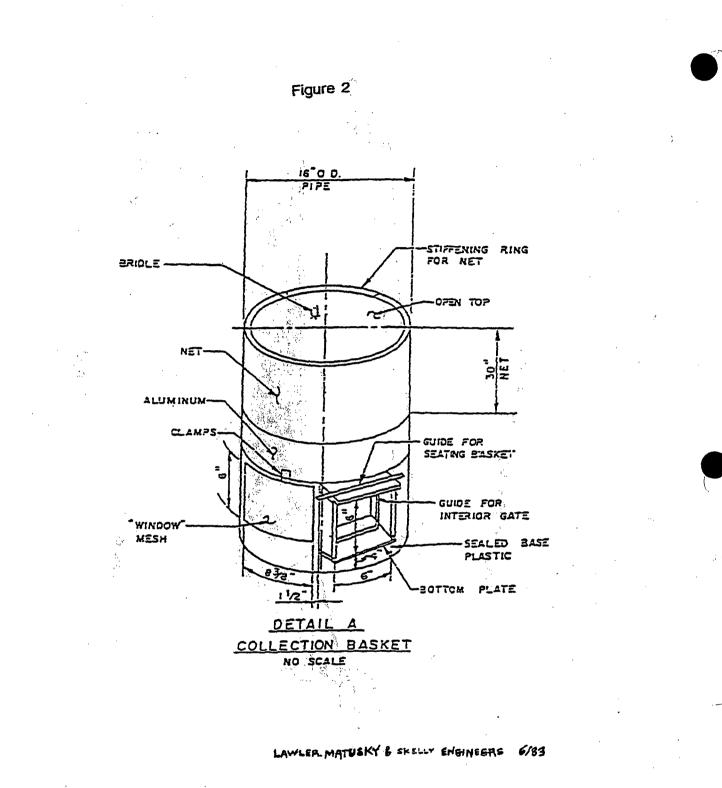
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Auer, N.A. (ed.) 1982. Identification of Larval Fish of the Great Lakes Basin with Emphasis on the Lake
 Michigan Drainage. Great Lakes Fishery Commission, Ann Arbor, Michigan. Special Pub. 8203;
 744 pp.

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# Appendix

**Monthly Discharge Monitoring Reports for** May & June 2001 the gal and the second second second and the second state of th · • a signa an A and the state of the state of the 1, 5

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Northern States Power Company

414 Nicollet Mall Minneapolis, Minnesota 55401-1927 Telephone (612) 330-5500

May 21, 2001

Metro/Major Facilities Attn: Discharge Monitoring Reports Minnesota Pollution Control Agency 520 Lafayette Road North St. Paul, MN 55155

Attention: Mary Hayes

### PRAIRIE ISLAND NUCLEAR GENERATING PLANT NPDES Permit No. MN0004006 Monthly Discharge Monitoring Reports

In accordance with Chapter 6 Part 3 of the subject NPDES permit, we are submitting our Discharge Monitoring Reports for discharges SD-001, SD-002, SD-003, SD-004, SD-005, SD-006, SD-007, SD-012, WS-001 and WS-002 at the Prairie Island Nuclear Generating Plant. The reports cover the period April 1, 2001 through April 30, 2001. As discussed with the MPCA, we are filing the discharge SD-001 monitoring report in the old format along with filing of the old Bromine/Chlorine Monthly Supplemental Report until receipt of a revised format Discharge SD-001 Monitoring Report form. Once the Discharge SD-001 Monitoring Report form is revised to include bromination/chlorination duration information for either intermittent or continuous treatment, we will discontinue filing the supplemental report as previously agreed.

Please note that the flows reported for discharges WS-001 and WS-002 include a total of both outfalls.

In accordance with Chapter 2 Part 4 of the subject NPDES permit, we are submitting the records of the daily maximum, minimum, and averaging temperatures for the monitoring locations of the temperature monitoring system in the new format with the entire month's results in one table.

Monitoring locations were out of service for extended periods as follows: the Sturgeon Lake monitors were removed for protection from winter conditions and will remain out until river levels and conditions allow reinstallation in accordance with NPDES Permit Chapter 2 Part 3.1. River flood levels have delayed reinstallation to a presently anticipated schedule of late May/early June. Therefore, from April 1 to April 11 the screenhouse inlet was utilized as the backup stream temperature monitoring. After April 11, the screenhouse was powered down due to river flood levels and screenhouse inlet temperatures were no longer available. Therefore, the Diamond Bluff monitor was utilized as the backup upstream temperature monitoring from April 12 through April 30. River flood levels influenced discharge canal (SD-001Etemperature Record

#### Page Two

monitoring from Mid-April through early May, particularly while river flood levels were above the canal banks. Additionally, the plant has identified the following downtimes or periods of incorrect operation within the listed day for some of the monitoring locations for durations typically greater than one hour, per Permit Chapter 2 Part 2.1:

April 5 Lock and Dam Piers 1 and 2 for 70 minutes and Lock and Dam Pier 3 for 85 minutes

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- April 7 Discharge Canal for 315 minutes
- April 30 Lock and Dam Pier 2 for 70 minutes

For your information, the daily percent up (in service) time of each temperature monitoring location is found in the monthly table.

Also for your information, the arrangement with Unit 1 chemical injection system in continuous bromination mode, Unit 2 chemical injection system in continuous chlorination mode, and the cross connect valve closed continued until April 27. On April 27 the Unit 2 chemical injection system was placed in continuous bromination mode so that both systems operated in the continuous bromination mode through the end of the month.

Please find enclosed a plant memorandum titled "April 2001 NPDES Related Issues" providing information on the switch to spring temperature restrictions and on floodrelated compliance, monitoring, and reporting items. As noted in the report, river flood levels precluded starting cooling towers in April. However, with the large river flow regime, no issues complying with the 5° F differential temperature limits at the Lock and Dam were presented. The plant calculated a monthly average differential temperature of 1.8°F using daily maximum temperatures from the Lock and Dam and from upstream data from the backup locations as indicated in the memorandum as well as earlier in this letter. Due to rising river flood levels, monitoring and control of discharge canal (outfall SD-001) flow was lost on April 11. River flood levels receded in early May allowing the plant to regain discharge canal blowdown monitoring and control on May 9. Therefore, restricting discharge canal blowdown during the last half of April and early May to the 300-cfs condition was not possible. Discharge canal (outfall SD-001) flow monitoring in April until the flood bypass condition on April 11 is summarized in the discharge SD-001 monitoring report. For operational information only, attached with the discharge monitoring report is a table of conservatively high estimates of the potential flow through the discharge canal during flood bypass, whereas the plant's more realistic estimate of flows during flood bypass is stated as 700 to 850 cfs in the introduction to the table. Additionally in a conservative manner during the flood bypass period, a very low end estimate of 150 cfs of circulating water flow was utilized as the volume that brominated/chlorinated service water is mixed into for the determination of resultant total residual oxidant. As indicated earlier, power to the intake screenhouse (and therefore the traveling fine mesh screens and the temperature monitoring) was shutdown on April 12 due to the rising river flood levels. Just prior to this shutdown, the intake screenhouse bypass gates were opened to ensure an adequate supply of river water. The memorandum identifies out of service

#### Page Three

screen arrangements during the time up to the flood bypass condition on April 12. An upset defense was filed with the MPCA covering flood-impacted NPDES monitoring and compliance items including the discharge canal blowdown and the intake screenhouse fine mesh screen operation.

In preparation to regain discharge canal blowdown control (and correspondingly the control on the draw of fish into the system from the river), the recycle gates were opened as much as feasible April 30 to May 1. As river flood levels receded in early May and with cooling towers still isolated, discharge canal temperatures rose to levels affecting fish. Both the MPCA and the DNR had been provided advance notification of the potential for such a fish loss. Electronic messages on initial identification and enumeration of lost fish have also been provided to the MPCA and DNR. A report on the loss of fish will be filed next month along with the May discharge monitoring reports. 法法律 化化酶 化乙

Also noted in the memorandum, the discharge SD-004 line to the recycle canal ruptured likely due in part to the back pressure created by canal flood levels rising above the line outlet as evaluated by the plant. A hose is being utilized as an alternate discharge line to the recycle canal until the corrective action of replacing the existing clay tile portion of the line with plastic pipe as implemented.

For your information, a graph of the Corps of Engineers' April river level and flow monitoring at Lock and Dam 3 is attached with the memorandum "April 2001 NPDES Related Issues". Sec. New

If you have any questions, please call me at 612-330-6625 j'ı

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Sincerely.

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Jim Bodensteiner 建制度过程。在公司中 Service Environmental Analyst Northern States Power Company d/b/a Xcel Energy 3 × a grade a start of a st an an a' se chiara Enclosures 二十四十二十四十二 a sa na managera a la stran ang palagina a tani ang palagina ang palagina ang palagina ang palagina ang palagin c: Terry Coss 。 "你们,我们这些你的,你就是你的你?"你们的,你们都能是你的。" Kevin Holstrom Gerald Joachim and the second 1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -Gary Kolle ana a shina a sh N 81 11.1 Katherine Logan (MPCA Rochester) · /杜玉 11. Ken Mueller and the second BARRA AND THE REPORT OF A Steve Schaefer 医白豆的 新生产 新国人的公共产品的 变化 ES Record Center and a state of the 
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Nuclear Management Company, LLC 🐲 Prairie Island Nuclear Generating Plant 1717 Wakonade Dr. East • Welch MN 55089

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MAY 01,2001 JIM BODENSTEINER NAME an an ann an ann an Anna an Ann Anna an ADDRESS XCEL ENERGY ENVIROMENTAL SERVICES and a set of the the terms of the set of the SUBJECT: APRIL 2001 NPDES RELATED ITEMS

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. All April and May dates in this letter are year 2001.

On April 1st the plant shifted to a 5 degree delta temperature limit as required in the NPDES permit even though the river temperatures remained well below 43 degrees (about 36).

Sturgeon Lake monitors #1 and #2 were not installed at this time because of ice and projected flooding later in the month.

。 11. 年山 医门泽克尔 化硫酸 计选择性 化输送机 On April 1st all fine mesh screens were installed and all screens except #125 screen were running. Screen #125 shutdown on March 24th because of mechanical failure. On April 8th the bank of four screens(125,126,127, 128 tripped. #127 and #128 were restarted quickly but #126 would not restart On April 9th #127 screen shutdown leaving #125,126 and 127 screens out of service. Late afternoon #125 and #126 screens were returned to service. Early on April 11th #122 and #126 screens shutdown leaving #122,126,127 off. Late on April 11th #126 screen was restarted leaving #122,127 off. These conditions remained until the screenhouse was shutdown at 0947 April 12th.

and a first 化化学合成的 化合金合金 化合金 . 1 On April 4th Xcel Enviromental Services responded by e-mail to Mary Hayes (MPCA Water Quality) on her April 4th request for information about response plans at the various XCEL power plants during expected flood conditions. We say the second first set a birth of the second sec

Since cooling towers must be isolated at the projected river levels, on April 9th Prairie Island staff decided that cooling tower startup, scheduled for April 9th in preparation for April 15th blowdown restrictions, would be postponed until the river level had receded after the flood. With the very large river flow the 5 degree delta temperature limit had not been and would continue not to be a problem. A state of the st

On April 10th the plant entered AB-4 FLOODS as required at a water level 678'. AB-4 is the Operations Manual Procedure that controls the plant's flood reponse. Xcel Enviromental Services discussed with MPCA Water Quality expectations for a reasonable and timely response for the plant regaining NPDES permit compliance after the river had receded. It was determined that a 4-5 day period was acceptable.

On April 11th the discharge sluice gates were all opened with river level at 680.4. This prevents the overflow of the canal road at about 683' with a canal delta height of about 2.5 feet. Late afternoon April 11th the plant lost measurable cooling tower blowdown flow because of low delta height between discharge canal and river. This condition remained the rest of April. The projected river crest was forecasted as 686.7' on April 19th.

At 0947 April 12th the power to the intake screenhouse was shutdown with a river level about 682.4 and rising. Just prior to this the intake screenhouse bypass gates were opened to ensure a supply of river water to the plant. This action is required by the Nuclear Regulatory Commission.

This power shutdown also caused the loss of screenhouse inlet temperature which was currently being used as the upstream temperature for NPDES purposes (5 degree delta). Diamond Bluff is the designated backup monitor for the screenhouse when Sturgeon Lake monitors are 0.0.S. and is used in the delta temp calculation as the upstream temperature.

On April 15th the plant's NPDES permit requires reducing cooling tower blowdown to less than 300 CFS. With the flood conditions this was impossible. With the current recycle gate position(35%) the blowdown was estimated to be 700-850 CFS.

The river crested on April 17th at about 685.6'. After a previous discussion with MPCA Water Quality the plant Xcel Environmental Service representative started drafting a Upset Defense letter in accordance with Chapter 6, Part 7 of the Prairie Island NPDES Permit. The letter indicates that the plant is not in compliance with the permit for blowdown and intake screens because of conditions beyond it's control i.e, flooding. The letter is included with this DMR submittal.

The Upset Defense letter was submitted to the Assistant MPCA Commissioner via MPCA Water Quality on April 19th. Early evening April 19th XCEL Environmental Services sent an e-mail update to MPCA Water Quality on flood conditions at the Xcel power plants.

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On April 19th the plant received direction from Xcel Enviromental Services to rinse any flood silt and sediment in the intake screenhouse back into the river. Additionally both MPCA Water Quality and Minn DNR were notified of the potential for a fishkill in the intake and discharge canals when river recedes and uncovers the canal road. Canal temperatures would rise rapidly and cooling towers would not be available at this time.

Early morning April 23rd the river level had dropped to about 683.9' but heavy rains in western and northern Minnesota caused a slight increase and another river crest was projected to be higher than the April 17th

On April 23rd the plant also reported to MPCA Water Quality via Xcel Enviromental Services that a large(100 gallons) sinkhole had developed near the neutralizing tank discharge line. A small sinkhole had been noticed about April 19th after a neutralizing tank was released. A rupture of a clay tile is the suspected cause. The discharge line is usually above the water level in the recycle canal but with the flood conditions the line was well below the water line. This would have created a back pressure in the discharge line possibly causing the line to rupture. The clay tile part of the line was excavated and later replaced with plastic pipe. In the interim a fire hose to the recycle canal is the alternate release path.





Around April 24th discussions between Prairie Island staff and Xcel Enviromental Services started concerning the issue of the potential for a fishkill and the correct position of the recycle gates. Opening the recycle gates from their current positon(35%) would reduce the blowdown flow closer to a flow of 300 CFS. Obtaining 300 CFS was probably not possible but this would be an attempt to reach it. However, opening the recycle gates would increase the chance of a fishkill dramatically when the canal level receded within it's banks because cooling towers would not be available until the river had receded more. The discussion centered on which situation was the highest priority. The question was reducing blowdown or reducing the chance of a fishkill, and the discussion was ongoing. Several keypoints were discussed. Reducing blowdown would dramatically reduce the number of larval fish, which is known from previous sampling to be high in May, brought into the plant intake through the open bypass gates. Reducing blowdown is consistent with the intent of the protective requirements of the NPDES permit for the spring time. Additionally increasing the temperature of the water entering the discharge canal now might cause some fish to exit the canal while it is still flooded over the the road.

The new crest prediction was for about 686.6 feet on May 2nd. The actual crest was about 685.7 feet on April 28th.

On April 30th a decision was made to open the recycle gates and reduce blowdown flow. Early afternoon April 30th the process of opening the recycle gates over a 24 hour period was started. The process was stopped at 80% on May 1st because of problems with the electric motors on the gates. Condenser inlets climbed about 7 degrees indicating more water was being recycled and temperature of water going to the recycle and discharge canals climbed to over 90 degrees. Because the canal was still overflowing the discharge canal temperature was still tempered by river temperature.

At 1400 April 30th Xcel Enviromental Services sent an e-mail to MPCA Water Quality, Wisc DNR and Minn DNR updating them on Prairie Island's plan to open the recycle gates and the high probability of a fishkill when the discharge canal was again isolated from the high river levels overflowing it's banks and later the cooling towers would be placed in service as soon as the river receded further.

The first dead fish started to show up in the intake canal on May 2nd and observations of the discharge canal showed no visible fish. The fish loss report will be covered in more detail by separate notification and a copy submitted with next month's DMR.

Please contact me at Ext. 4440 if additional information is needed. Thank you.

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Sincerely yours,

Gerald Joachim Senior Radiation Protection Specialist



#### Northern States Power Company

d/b/a Xcel Energy 1717 Wakonade Drive East Welch, MN 55089 Telephone 651-388-1121 ext. 4419

# April 17, 2001

Assistant Commissioner Minnesota Pollution Control Agency Metro District / Major Facilities 520 Lafayette Road St. Paul, Minnesota 55155-4194 . 19 ⁽¹⁾ (1) 1.2

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Attention: Mary Hayes

RE: Prairie Island Nuclear Generating Plant NPDES Permit No, MN0004006 Flood-water Related Upset

#### Dear: Ms. Hayes

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Xcel Energy - Environmental Services department is providing notice and explanation to MPCA of temporary non-compliance issues, thus utilizing the Upset Defense provision in the second NPDES Permit #:MN0004006, Chapter 6. Part 7, pg. 27. Due to river flood-water levels beyond the plant's control, Prairie Island, Plant may now be considered to be in a state of "temporary non-compliance", and the state to a set to set

Normal plant operating river level is approximately 674.0' (feet above sea level). Present river level is 685' 5" with a predicted crest of 686.2' expected Wednesday, April 18, 2001. The highest water level reached at PI Plant during the 1997 flood was 685.0'. 子宫护殿,设施了之际为威烈,子后来,东西 . 131

You and I discussed by phone at ~ 4:15 p.m. Tuesday 4/10/01, that due to flood-waters Prairie Island Plant may be out of compliance on requirements (reissued permit dated May 16, 2000) pertaining primarily to: · 옥사 문· 신제품함 · 영양· 영· 제품· (제품· 제품· 제품· 제 제품· 영양·영· 왕인· 이 중·사회 동안· 영양동· 제품· 제품· 제품·

- April 15th 300 cfs blowdown restriction, for fish protection at the plant's cooling water intake: and a second decision of the second - cooling tower operation associated with blowndown restrictions to maintain plant discharge temperature limits;
- and, larval fish sampling of fine-mesh screenwash throughout April.

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#### April 15th 300 cfs blowdown

Restriction of plant blowdown for fish protection at the plant intake (permit Chapter 1.Part, 3.8) is not achievable because:

- the sluice gates, which control plant discharge to the Mississippi River (SD 001), were opened at ~ 1600 hrs. on April 10th when the river level reached 680.0';
- the discharge canal dike was overtopped by flood-waters April 12th a.m. at river level 683.0'; and,

upon reaching river level 683.0' at ~ 0945 hrs. on April 12th, the emergency by-pass gates were opened and intake traveling screens were shut-down.

At river levels higher than 683' the external circulating water system gates and canal dikes are over-topped and control of the external circ water system cannot be regained until river levels drop to within confines of canal dikes and gates. Once river levels drop below 683', we can start bringing the external circulating water system back into a controlled situation and proceed to systematically regain permit compliance. Procedures include start-up traveling screens, close emergency by-pass gates, restore cooling towers to service, and operate recycle gates, while adhering to the delta 5°F/hour guideline for water temperature changes to minimize fish kills and get back into compliance with the NPDES Permit.

#### Cooling tower operation

Operation of cooling towers is not a non-compliance issue at this time, because:

- staying within the 5°F delta T (temperature limit) is not a problem now with high volume flood-water and cool river water temperatures;
- and, we are not exceeding 300cfs to achieve condenser inlet temperatures lower than 85°F, which would require operation of all cooling towers to the maximum practical extent (Permit Chapter 1. Part 3.9).

Electrical service, to cooling tower pumps and drive-motors for adjusting gates, has been temporarily disconnected and will not be reconnected until flood-waters recede.

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Cooling towers will be started one at a time over a period of 4 to 5 days after the emergency by-pass gates are closed and the traveling screens are restarted. The gradual start up of cooling towers is to provide a ramp up period to minimize risk of a fish-kill in the canals due to thermal stress.

#### Larval fish sampling

Sampling was conducted April 3rd, 5th, and 9th, but was suspended April 10th when river levels reached approximately 680'. The Environmental Lab basement floor elevation is 678.5' and sample water is drained to the river via floor drains. Once the river level exceeds 680', we can no longer dispose of sample water, thus ending sample collection until flood-waters recede. Depending on rate of river level descent after the crest, we may not be able to collect additional samples during April, 2001.

#### Other flood-water compromised systems

Emergency by-pass gates in the intake screenhouse were opened April 12th as the river level increased to 683', and the gates will remain open until the river level recedes below 683'.

Permit required operation of fine-mesh traveling screens April 1 through August 31 was suspended on the morning of April 12th. Fine-mesh traveling screens were operating since April 1st, but were shut-down after the emergency by-pass gates were opened and electrical service to floor-level equipment was temporarily disconnected. Traveling screens will be restarted once the river level recedes below 683' and electrical service to equipment has been restored.

Upstream Sturgeon Lake temperature sensors (SW-004) SL-1 and SL-2 will not be installed until after flood-waters recede for personnel safety and to prevent damage to the monitors.

The discharge sampling point for weekly pH at NPDES outfall SD-001 (sluice gates) was suspended for personnel safety. Samples are now collected at the discharge gates which is a representative sample point of the discharged water and allows access without wading through flood-water.

If you have questions, comments, and/or need additional information, please contact me by e-mail or phone. Thank you.

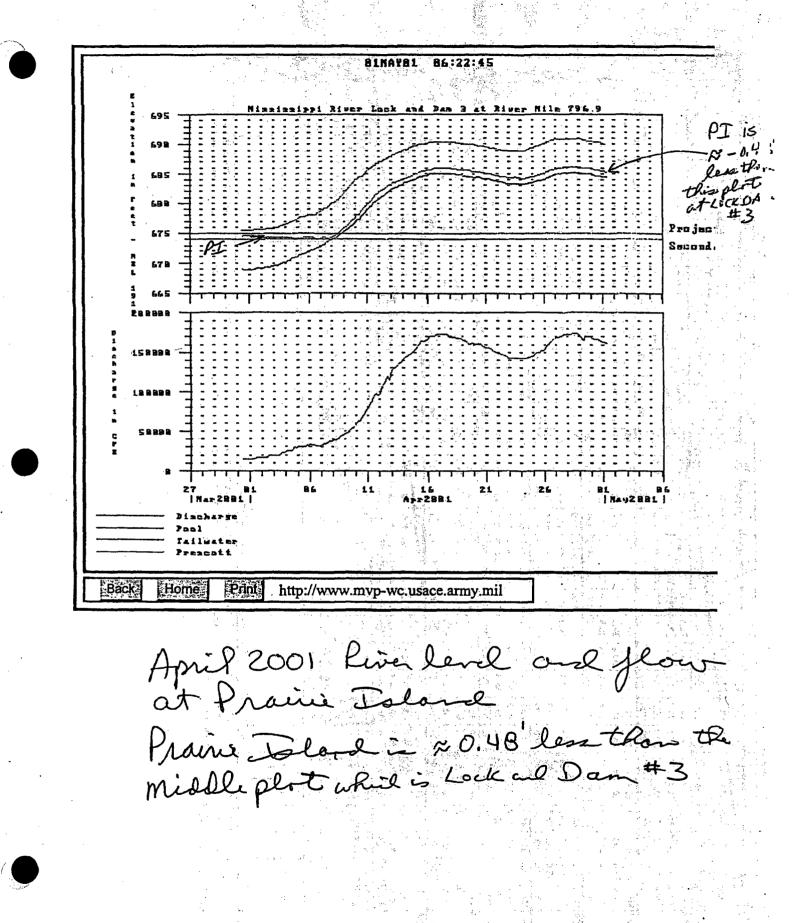
#### Sincerely.

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e-mail address: kenneth.n.mueller@xcelenergy.com

cc: Jack Enblom – MDNR Gary Kolle – Xcel – Pl Terry Coss – Xcel – Mpls Jim Bodensteiner - Xcel – Mpls Xcel ES Record Center

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Dete		34.7		35.7			30.2	39.4	30.0	38.4	50.4	40.8	90.1	91.3	42.3	43.5	43.4	43.2	49.0	44.0	40.7	100	40.0	47.0	40.7	800	40.7	50.0	31./	53.4	R	10.0	34.7	40.3
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2575A							42.8	42.4	42.5	42.5	42.7	42.0	42.9	43.7	44.8	45.6	45.1	45,6	46.2	46.7	48.5	49.3	49.2	49.2	49.2	49.9	51.1	52.8	54.2		57.6	600	60.0	60.0
LD3				42,5		17-2	41,1	41.5	41.4	41.0	41.5	42.1	42.3	42.9	43.7	44,8	<u>.44.4</u>	44,5	45.2	45.0	47.3	48.6	48.9	48.7	48,2	49.0	49.9	51.5	53.2	55.0	58.8	58.	46.1	47.3
	MIN	37.1	39.3	38.2	38.3	78.5	38,1	40.6	40.5	39.5	40.3	41.5	41.6	41,8	42.9	38.1	43.8	43.6	44.6	45.4	46.1	47.8	48.4	48.0	47.2	48.1	48.6	50.5	52.4	53.8	56.0	57.2	37.1	42.4
	the second s			97																		100												
T2527/	MAY	39.8	39.9	40.5	41.3	40.9	40.1	40.7	41.4	40.8	41.4	41.3	41.0	-0:0-	-00	40,1	0.0	0.0	0.0	0.0		41.3	41.3	41.3	41.3	41.3	41.3	41.3	41,3	بديه	-11.0	THAT.	41.4	41.4
SHI	AVG	38.0	39.1	39.4	40.1	40.0	<b>39,4</b>	40.2	40.2	40,5	40.4	412	.40.9	####	####	39.4	####	HHH.	initia.	âunu,	413		41.3	41.3	413	4.0	41.3	41.3	41.3	41.3	37.0	†##	####	331.7
	MIN	37.1	36.1	38.5	38.8	39.6	38.5	39.7	39.3	40.2	39.2	41.0	40.8	0.0	0.0	38.5	0.0	0.0	0.0	مم	44.8	41.3	41.3	41.3	41.5	44.2	41.3	41.3	41.3	41.3	31.7	92	0.0	0.0
Data	<b>\$%</b>	100	2100	1797	100	1100	석00				100											100										a an a suar	63	
T2530A							in the second second															75.0										68.0	98.7	98.7 ~
DC	1	+ A4		80.9			10.100	777	72.3	77,6,												62.9											70.0	174.7
	MIN	67.4	77.8	78.8	78.1	72.8	79.8	M	70.5	77.0	75.4	78.0	77.7	73.9	50.4	79.8	50.9	49.5	49.8	53.1	56.0	53.3	64.4	76.5	76.1	48.8	57.2	54.0	57.2	58.1				52.8
Dala	1%	1100	100	597.	100	1100	-297	57.	100	(100	100	\$100	100	1100	100	,100	100	100	100	100	199	100	100	100	.100	300 (	100	100	100	100	.97	18	- 98	. <i>2</i>
	ΔΤ	2.6	2.3	1.9	1.5	2.6	0.7	0.3	0.0	<b>⊻0.8</b>	0.2	0.4	0.7	2.1	2.8	2.7	-3,3	1.3	1:2	1.2	1.3	1.9	1.1	1.7	0.4	1.0	0.5	2.0	4.3	5.5	5.2	4.9	41.9	
	TD	4	4	4	4	4	4	4	-4	4	4	. 4	4	4	4	4	4	4	4	4	4	4	4	4	4'	4	4	4	4	4 :	5	EA	· .	11
5	8	11	11	11	1.	1.	1	1		1		1		i i	1			1	1	11	1	1	11	1	11	81. I	1	1	1	1	. /	NI		10,
	11	2	3	4	5	6	. 7	8	9	1.1	11	- 1-	1	1	-1			1	11	2	2	2	2 1	2	2	2	2	2	2	3	1			dil
	8		4	1			ļ			0	1	2	_ 3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	. 1	IA	15	1920
	1		1		1		1 11	STREE	m= 1	NATUR	S.H.	1	$\rightarrow$	4/57	LEAT	∩ = `;	PIAN	ona	BL.	IFFI		ł										V V		
	SL1	= Stur	geon	Lake T	emp 1	(j	ч¢	08 =	Diamo	and Bi	uff Ter	np 🔝		LD2 =	Lock	& Dar	n Tem	10 2		SH! =	Scree	nhous	e inlet	Temp	)	-	96% 0	r grea	ler is •	1 ho	ur data	aloss		
	SL2	= Stur	geon	Lake T	emp 2			LD1 =	= Lock	& Dai	uff Ten in Tem isza a	p 1	ž.,	LD3 =	LCCK	a Dar	r, Tem	рS		9C = 1	Dischi	arge Ci	anal A	və. Te	amp		95% a	r iess	is >= '	i hour	data I	loss		
11Ph	GNY	004	5 > 1	47.0	4Y j	s HI	GHL	.16#	TGD	. m:	57 0	1050	4 e 7	n b	LCCD.		: 55	T! 19	ATE	(m	ADE	<												
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# BROMINATION/CHLORINATION REPORT

		From: 01	1-APR-01	ro: 30-APR-01	•	n an tha an tha she an tha an tha she tha tha an tha tha she tha
Day	Bromine Kgms/day	Chlorine Kgms/day	Time mins/day	U-1 Residual	U-2 Residual	Outfall Residual
1	16.8	33.2	1380	0.24	0.21	<.001
2	16.8	32.6	1440	0.20	0.15	<.001
3	22.4	27.8	1440	0.16	0.20	<.001
	•			0.18	0.15	<.001
4	16.8	32.1	1440	0.20	0.15	.<.001
5	16.8	34.0	1440	0.19	0.09	<.001
5 6 7	11.2	31.2	1440	0.15	0.15	<.001
7	22.4	34.7	1440	0.15	0.12	<.001
8	16.8	32.1	1440	0.12	0.13	<.001
9	16.8	. 33.2	1440	0.13	0.10	<.001
10	22.4	34.2	1440	0.11	0.10	<.001
11	5.6	36.8	1440	0.12	0.10	<.001
12	16.8	33.7	1440	0.12	0.12	<.001
					0.13	
13	22.4	33.7	1440	0.09	0.11	<.001
				0.18	0.15	· `
14	16.8	38.3	1440	0.16	0.14	<.001
15	16.8	38.3	1440	0.13	0.14	<.001
16	16.8	39.5	1440	0.12	0.16	<.001
17	16.8	39.7	1440	0.12	0.17	<.001
18	22.4	37.4	1440	0.12	0.14	<.001
19	11.2	35.0	1440	0.10	0.12	<.001
14				0.10	<u>.</u>	in the
20	22.4	40.4	1440	0.15	0.12	<.001
21	16.8	40.5	1440	0.09	0.11	<.001
22	11.2	41.2	1440	0.08	0.12	<.001
23	5.6	43.6	1440	0.12	0.14	<.001
24	5.6	43.1	1440	0.12	0.13	<.001
25	5.6	22.0	1440	0.12	0.11	<.001
26	11.2	35.6	1440	0.13	0.08	<.001
					<.03	
27	28.0	50.0	1440	0.11	<.03	<.001
			· ·	0.12	0.17	<.001
28	28.0	52.2	1440	0.10	0.10	<.001
29	33.6	55.9	1440	0.11	0.14	<.001
30	33.6	55.2	1440	0.09	0.12	<.001

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Maximum Daily Chlorination Rate = 89.5 Kgms/day on the 29th.

#### APRIL 2001 BYPASS FLOW

The data table below lists the conservative flow(MGD) that may actually have been discharged through our disharge canal (SD001) during the flood bypass period of April 2001. It is based on a maximum flow of 1280 CFS in open cycle operation. We believe the actual flow during the flood bypass period was more likely in the 700-850 CFS range which would result in a daily MGD of 452-549 MGD.

April 11		828	million	gallons per	day
April 12			,		
April 13		828	,	•	
April 14	4 - 2	828			
April 19	5	828	۰ ۱		
April 16	5 2 3	828			
April 17		828			
April 18	7	828			
April 19	<b>9</b> · · ·	828		No. 1	
April 20	<b>)</b> (194	828		· · · ·	
April 2:	L - D	828			
April 22	2	828	- - 14		
April 2	3	828			
April 24	4	828	n A Bairtín I	1 - 4 C	
April 2		828			
April 2	5	828	1 9 m i	ž -	
April 2	7 1. 4	828			
April 28	3	828	. :		
April 29	9	828			
April 30	<b>)</b>	828	: •		
, -				×.	

TOTAL

16560 million gallons

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1717 Wakonade Dr E Welch, MN 55089 STATION INFORMATION:	در به ۲۵ در به ۲۵	• • • •		PERMIT#	AIT STATU FINAL	S FORMER #		ollet Mali polis, MN 554011993			
SD-001 (Combined Effluent) Surface Discharge, Effluent To Su	urface Water			MONIT EAR MO.   DAY 2001/04/01	ORING PE	YEAR MO. DAY	No	Discharge			
PARAMETER				QUANTITY	UNITS		CONCENTRAT	ION	UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	*****	•	4794	MG	4+++++	479.4	*****	mgd	10/30	BT
50050							DallyAve			TX Uay	MeaCon
рН	SAMPLE					7.8	600000	8,1	SU	1/7	COR
	VALUE PERMIT REQ					6.0 CalMoMin		S.O CalMoMax		1 X Week	Grab
Phosphorus Total (as P)	SAMPLE	•••••	onigener de	**************************************			*****	NR	mg/L		en la Langa.
00665	PERMIT REQ							REPORT DallyMax		1 x Week	Grab,
Chlorine Rate	SAMPLE VALUE	*****	•	89.5	kg/day	*****	******	*****		1/30	CAL
50059	PERMIT			REPORT DallyMax						ТХрау	Calcul
Oxidants (Bromine) Tot Residual Interm	SAMPLE	<b>***</b> *		******		110010	*****		mg/L		
34046	PERMIT							.05 InstantMax		1 X Day	Grab
Oxidants (Bromine) Tot Residual Contin	SAMPLE		1	*****	1	*****	*****	<0.001	mg/L	30/30	CALC
04223	PERMIT					******		001 DallyMax		TX Day	Calcul
Oxidants (Chlorine) Tot Residual Interm		2012 COLOR COLOR COLOR				*****	******		mg/L		
03775		64994W						2 iinstantMax			Grab
Send original with supplementa applicable) by the 21st day of m reporting period to: MINNESOTA POLLUTION CON 520 LAFAYETTE RD ST. PAUL, MN 55155-4194 ATTN: Discharge Monitoring R	onth follow		informal report a knowled	that I am familiar with tion contained in this nd that to the best of Ige and belief the info is true, complete, and e.	my SIGNA	TURE OF PRINCIPAL	EXECUTIVE OFFICE	R OR AUTHORIZED A	AGENT		

1717 Wakonade Dr E	Power Plant	• • ••	as internet	N EWA DISCHARGE N		REPORT	NSP	ICOllet Mail	n maan ^a domaaty is iyo iyo isadaa d		
Veich, MN 55089		Maria Maria			WIT STATUS	FORMER #		apolis, MN 5540119	193		
and starting at		et alla	M	N0004006	FINAL	010M 1			· · · · · · · · · · · · · · · · · · ·		
STATION INFORMATION: SD-001 (Combined Effluent)				MONIT	ORING PERIO	DISCONTRACTOR			51 w 12.000.		م . در
Surface Discharge, Effluent To	o Surface Water			MOLDAY	Ň	EAR MO. DAY		n Res en trainget a			2 <i>7 4 5</i> 1 1 1
		en en geografie de 19 - En geografie de la compositione de la compositione de la compositione de la composition de la composition 19 - En geografie de la compositione de la compositione de la compositione de la compositione de la composition	FROM 2	001/04/01	T0]	2001/04/30		Discharge	xi-la		
PARAMETER			al in aua	NTITY	UNITS			TION	UNITS	FREQUENC	
Oxidants (Chiorine) Tot Residual Contin	SAMPLE		•	•••••		4 <b>4444</b>	*****	<0.001	mg/L	25/20	and
03774	PERMIT					NING IN THE PROPERTY		-04			Calcul
Plant Capacity Fctr	REQ			PART SUC		TALISE		DallyMax			
% of Capacity For	SAMPLE VALUE			*****	4444	<b>****</b>	102,4	**************************************		Cart	MEASI
00180	PERMIT					Party more than a	REPORT			T X Day	Measur
# Phosphate	REQ	Caller of Factoring P					CalMoAvg			· · · · · · · · · · · · · · · · · · ·	
n an	and and a second and A second and a second A second and a second A second and a second A second and a br>A second and a  second and a					an a		in the second			
<ul> <li>An and a second s</li></ul>											
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Send original with suppleme applicable) by the 21st day of enorting period to:	ental DMR (if of month follow		information	l am familiar with contained in this	The	May 1	w	Alex (Second Second Second Second br>Second Second		5-	-15-01
	ental DMR (if of month follow		information report and t knowledge i	l am familiar with	The SIGNATU	May 1		Alex (Second Second Second Second br>Second Second		5	

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FACILITY NAME/ADDRESS: NSP - Prairie Island Nuclear Power Plant 1717 Wakonade Dr E Welch, MN 55089	DISCHARGE MO	ER TREATMENT NITORING REPORT STATUS FORMER #	PERMITTEE NAME/ADDRI Northern States Power Co 414 Nicollet Mall Minneapolis, MN 55401199	$( \ )$
STATION INFORMATION: SD-002 (Steam Generator Blowdown Discharge) Surface Discharge, Effluent To Surface Water	and and the first state of a second state	NING PERIOD YEAR MO. DAY TO 2001/04/30	No Discharge	and the second
PARAMÉTER	GUANTITY	UNITS	CONCENTRATION	UNITS OF ANALYSIS TYPE
50050	0,372 Карорт	MG	0.0/2	mgd 1/30 EST
TSS SAMPLE <0.	005 <0,005	kg/day		
00530	005 く0,005 53 10Avg (11) (11) (11) (11) (11) (11) (11) (11		<u>くつ,   くの,  </u> 30 CalMoAvg DallyMax	130 GLAB
		· · ·		
an a		M.		
Send original with supplemental DMR (if applicable) by the 21st day of month following reporting period to: MINNESOTA POLLUTION CONTROL AGENCY 520 LAFAYETTE RD ST. PAUL MN.65155-4194	I certify that I am familiar with the Information contained in this report and that to the best of my knowledge and belief the infor- mation is true, complete, and accurate.	SIGNATURE OF PRINCIPAL	EXECUTIVE OFFICER OR AUTHORIZED	AGENT DATE DATE DATE
ST. PAUL, MN 55155-4194	accurate.		PHONE	

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NSP - Prairie Island Nuclear Power Plant 1717 Wakonade Dr E Welch; MN 55089		ER TREAMENT DNITORING REPORT	Northern 5 414 Nicoli	States Power-Co	
STATION INFORMATION: SD-003 (Radwaste Treatment Effluent) Surface Discharge, Effluent To Surface Water	an and a second s	RING PERIOD XEARIMO DAY TO 2001/04/30		icharge	
PARAMETER	COANTITY STATE		CONCENTRATIO		FREQUENCY SAMPLE
Flow SAMPLE	0.033	MG		(mgc	1/30 EST
TSS SAMPLE	0,002 0,002	.kg/day	O.4	0,4 mg/	1/20 CRAR
00530	126.0 86.9 alMoAvg L DallyMax			100 DallyMax	1 X Month Grab
Send original with supplemental DMR (if applicable) by the 21st day of month following	I certify that I am familiar with th information contained in this		MAN		5-15-01

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NSP - Prairle Island Nuclear Power F 1717 Wakonade Dr E Welch, MN 55089	lent - Colto -		DISCHARGE I	tran an tra	: 	414 Nico Minneapo	States Power Co let Mall blis, MN 554011993	·····································		
STATION INFORMATION: SD-004 (Neutralizer + Resin Rinse I Surface Discharge, Effluent To Surfa	• ·		EAR MO. DAY. 2001/04/01	то	OD	No D	scharge		1 22 - 199 - 199 	
PARAMETER			UANTITY			CONCENTRATIO	N., .	UNITS	FREQUENCY OF ANALYSIS	TYPE
			0.256	MG	*****	0.009	*****	mgd .	9/30	EST
50050	ERMIT	2021 (1997) 2022 (1997)	REPORT. CalMoTot						1 x Month	Estima
	AMPLE (	), I	0.7	kg/day.	*****	Z.9	6.4	.mg/L	9/30	6RAB
00530			DallyMax			30 CalMoAvg	DallyMax		1 x Month	Grab
			A 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4							
an an an taon an an taon an tao Taon an taon an					M .				F	EMI
Send original with supplemental D	MR (If h following	informa	that I am familiar with tion contained in this ind that to the best of	SIGNAT			OR AUTHORIZED	AGENT		5-01 DATE
applicable) by the 21st day of mon									and the second second	
applicable) by the 21st day of mon reporting period to: MINNESOTA POLLUTION CONTR 520 LAFAYETTE RD	OL AGENCY	knowled mation accurat	dge and belief the info is true, complete, and	[ ] ]	URE OF CHIEF OP	/	PHONE	DATE		ICATION#

FROM	EAR MO: DAY 2001/04/01	NGPERIOD	fyr i wr y cyfrage en	in an ida, an	a sa
Flow SAMPLE ****** 50050 FIGURE SAMPLE ****** DERMIT TSS 00530 OII Total Recoverable 00552		TO 2001/04/30	No Discharge	•	
50050     SAMPLE VALUE     ******       50050     PERMIT     ******       TSS     SAMPLE     ******       00530     PERMIT     ******       Oll     SAMPLE     ******       Oll     SAMPLE     ******       Oll     SAMPLE     ******       00552     SAMPLE     ******	QUANTITY COMPANY	INITS	CONCENTRATION	UNITS C	FREQUENCY SAMPLE DF ANALYSIS TYPE
50050     PERMIT     IIIIIII       TSS     SAMPLE     IIIIIIII       00530     PERMIT     IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	1,801	AG	0.060	mgd	1/30 FST
00530 OII Total Recoverable 00552					1 x Month Estima.
00530 PERMIT			4.3 7.7	, mg/L	2/30 GRAB
Total Recoverable SAMPLE ****** 00552			30. CalMöAvg DallyMax		1 x Month Grab
		••••• •••••	< l, D < l, C 10 CalMoAvg S DallyMax	) Mg/L	1/30 GRAB
		andra († 1970) 1973 - Standard († 1970) 1973 - Standard († 1970) 1973 - Standard († 1970) 1973 - Standard († 1970)	and and a second se The second se The second se The second sec		
andra and an and an and an and an and an an and an		and a			
	that I am familiar with the tion contained in this	(Il AM			5-15-01
reporting period to: report MINNESOTA POLLUTION CONTROL AGENCY knowle	and that to the best of my dge and belief the infor-	SIGNATURE OF PRINCIPAL	EXECUTIVE OFFICER OR AUTHORI	LEU AGENT	DATE
520 LAFAYETTE RD     mation       ST. PAUL, MN 55155-4194     accura       OTTIN: Discharge Monitoring Report     accura	is true, complete, and le.	SIGNATURE OF CHIEF OPE	RATOR	DATE	CERTIFICATION#

FACILITY NAME/ADDRESS: NSP - Prairie Island Nuclear Power Plant 1717 Wakonade Dr E		ER TREATMENT NITORING REPORT	PERMITTEE NAME/ADDRESS: Northern States Power Co 414 Nicollet Mall	
Weich, MN 55089	CONTRACTOR AND CALMENT AND AN AN ANY AND AND AND AND AND AND	STATUS FORMER A	Minneapolis, MN 554011993,	
STATION INFORMATION: SD-006 (Unit 2 Turbine Bidg Sump Dschg) Surface Discharge, Effluent To Surface Water	9 ⁷ 10	ING PERIOD YEAR MO DAY TO 2001/04/30	No Discharge	
PARAMETER	ου Αντιτγ	UNITS	CONCENTRATION	FREQUENCY SAMPLE
Flow SAMPLE	· 0.872	MG	0,029	1/30 EST
0050	CalMotot		REPORT CalMoAve	1 x Month Estima
SS SAMPLE			4.0 4.0	1/30 GRAB
0530			30. CalMoAVg DallyMax	1 x Month Grab
otal Recoverable SAMPLE	• •••••	······	<1.0 < 1.0 mg/L	1/30 G43
	n de la construction de la granda de la construcción de la construcción de la construcción de la construcción d La construcción de la construcción d La construcción de la construcción d			
		Mar	/ h-1	
Send original with supplemental DMR (If applicable) by the 21st day of month following reporting period to: MINNESOTA POLLUTION CONTROL AGENCY 520 LAFAYETTE RD	I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the infor- mation is true, complete, and	SIGNATURE OF PRINCIPAL EXI	COR PHONE DATE	5-15-0/ DATE

NSP Prairie Island Nuclear Pov 1717 Wakonade Dr.E Welch, MN 55089	ver Plant	د در در معیومی به ۲۰۰۰ ۲۰۰۰ زبان ۲۰۰۰ زبان ۱۹۵۰ میلیم ۱۹۵۲ م	WASTEWATE DISCHARGE MON	NITORII	NG REPORT	Norther 414 Nic	TTEE NAME/ADDR n States Power Co ollet Mall polls, MN 5540119	an a		
STATION INFORMATION: SD-007 (Metal Cleaning Effluen Surface Discharge, Effluent To S		FROM	PERMIT W         LIMIT           MN0004006         FI           MONITOR         FI           EAR: MO         DAY           2001/04/01	NAL Laga di Marcia	016M 1		Discharge			
PARAMETER				UNITS				N PARTE	FREQUENCY	SAMPLE
Flow	SAMPLE			MG	•••••		•••••	ingd		
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reporting period to:			
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520 LAFAYETTE RD			
ST. PAUL. MN 55155-4194			

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ATTN: Discharge Monitoring Report

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and original with supplemental DMR (if plicable) by the 21st day of month following porting period to: /INNESOTA POLLUTION CONTROL AGENCY 20 LAFAYETTE RD	I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the infor- mation is true, complete, and	SIGNATURE OF PRINOIPAL EX	1		AGENT	5-15-07 DATE
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Northern States Power Company

414 Nicollet Mall Minneapolis, Minnesota 55401-1927 Telephone (612) 330-5500

June 21, 2001

Metro/Major Facilities Attn: Discharge Monitoring Reports Minnesota Pollution Control Agency 520 Lafayette Road North St. Paul, MN 55155

Attention: Mary Hayes

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT NPDES Permit No. MN0004006 Monthly Discharge Monitoring Reports

In accordance with Chapter 6 Part 3 of the subject NPDES permit, we are submitting our Discharge Monitoring Reports for discharges SD-001, SD-002, SD-003, SD-004, SD-005, SD-006, SD-007, SD-012, WS-001 and WS-002 at the Prairie Island Nuclear Generating Plant. The reports cover the period May 1, 2001 through May 31, 2001. As agreed we will continue to file the Bromine/Chlorine Monthly Supplemental Report to allow review of bromination/chlorination duration information which is not summarized in the Discharge SD-001 Monitoring Report form. I apologize for the incorrect statement in past cover letters that the supplemental report will be discontinued after receipt of a revised Discharge SD-001 Monitoring Report form.

Please note that the flows reported for discharges WS-001 and WS-002 include a total of both outfalls.

In accordance with Chapter 2 Part 4 of the subject NPDES permit, we are submitting the records of the daily maximum, minimum, and averaging temperatures for the monitoring locations of the temperature monitoring system in the new format with the entire month's results in one table.

Monitoring locations were out of service for extended periods as follows: in accordance with NPDES Permit Chapter 2 Part 3.1, the Sturgeon Lake monitors had been removed for protection from winter conditions and remained out until river levels and conditions allowed reinstallation and return to service on May 25. The screenhouse remained powered down due to river flood levels and screenhouse inlet temperatures were unavailable until May 4. Therefore, the Diamond Bluff monitor was utilized as the backup upstream temperature monitoring from May 1 through May 3, and then the screenhouse inlet was again utilized as the backup upstream temperature monitoring resumed utilizing the reinstalled the Sturgeon Lake monitors and the Diamond Bluff monitor. River flood levels influenced discharge canal (SD-001) temperature monitoring from mid-April

File Copy ERAD Record Center

### Page Two

through early May, particularly while river flood levels were above the canal banks. Additionally, the plant has identified the following downtimes or periods of incorrect operation within the listed day for some of the monitoring locations for durations typically greater than one hour, per Permit Chapter 2 Part 2.1:

 May 1 Diamond Bluff, all Lock and Dam Piers, and Discharge Canal for approximately 361 minutes

May 4 Lock and Dam Pier 1 for 72 minutes

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 May 5 Lock and Dam Piers 1 and 2 for 72 minutes and Lock and Dam Pier 3 for 87 minutes

For your information, the daily percent up (in service) time of each temperature monitoring location is found in the monthly table. Additionally, as written in the lower right hand corner of the table, the plant calculated a monthly average differential temperature of 0.4°F using daily maximum temperatures from the Lock and Dam and from the upstream data indicated earlier in this letter.

Please find enclosed a plant memorandum titled "May 2001 NPDES Related Issues" providing information on and a chronology of flood-related compliance, monitoring, and reporting items. River flood levels prevented the monitoring and control of discharge canal (outfall SD-001) flow from mid-April to early May. Therefore, restricting discharge canal blowdown during the last half of April and early May to the 300-cfs condition was not possible. River flood levels receded in early May allowing the plant to regain discharge canal blowdown monitoring on May 8 and control on May 9. Discharge canal (outfall SD-001) flow monitoring from May 9 to 31 is summarized in the discharge SD-001 monitoring report. For operational information only, attached with the discharge monitoring report is a table of conservatively high estimates of the potential flow through the discharge canal during flood bypass, whereas the plant's more realistic estimate of flows during flood bypass is stated in the introduction to the table. Additionally in a conservative manner during the flood bypass period, a very low end estimate of 150 cfs of circulating water flow was utilized as the volume that brominated/chlorinated service water is mixed into for the determination of resultant total residual oxidant.

As noted last month, river flood levels precluded starting cooling towers in April. However, with the large river flow regime, no issues complying with the 5° F differential temperature limits at the Lock and Dam were presented. Cooling tower start up took place in early May after receding river levels allowed. Some loss of fish occurred due to elevated temperatures as canal water became isolated from flood water prior to operation of all cooling towers. Advance notice of the anticipated loss of fish during flood recovery to normal operation was provided to the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency in April. The assessment of the flood-related fish loss is attached with the memorandum. The memorandum has a chronology of individual cooling tower start-up and the status of cooling tower fan operations.

### Page Three

As indicated earlier, power to the intake screenhouse (and therefore the traveling fine mesh screens and the temperature monitoring) was shutdown on April 12 due to the rising river flood levels. Just prior to this shutdown, the intake screenhouse bypass gates were opened to ensure an adequate supply of river water. Receding river levels allowed restarting the intake screens around the same time as the cooling towers. The memorandum summarizes their start-up and operations as well.

Also noted in the flood-related items in the memorandum, the discharge SD-004 line to the recycle canal which ruptured in April was excavated and repaired. The repair included the replacement of the existing clay tile portion of the line with plastic pipe on May 15. A hose was utilized as an alternate discharge line to the recycle canal until the corrective action was implemented.

For your information, a graph of the Corps of Engineers' May river level and flow monitoring at Lock and Dam 3 is attached with the memorandum "May 2001 NPDES energy and the state of the Related Issues". 

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If you have any questions, please call me at 612-330-6625.

Sincerely, A. Star al de la come 5. 1. 1 A start and a start of the star Jim Bodensteiner

Senior Environmental Analyst Northern States Power Company d/b/a Xcel Energy 1. S.A. Enclosures and the second 
and the second second second c: Terry Coss Kevin Holstrom and the second Gerald Joachim and the second · · · · Gary Kolle Katherine Logan (MPCA Rochester) Ken Mueller Steve Schaefer a part of a stranger and a stranger and a stranger and ES Record Center

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#### JUNE 01,2001 DATE

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JIM BODENSTEINER NAME XCEL ENERGY ENVIROMENTAL SERVICES ADDRESS

#### SUBJECT: MAY 2001 NPDES RELATED ITEMS

All May and JUne dates in the below letter are year 2001.

The river level had crested at about 685.7 feet on April 28th and the river level was receding. The plant was responding to the flood conditions in accordance with Operations Manual Section AB-4 FLOODS. On April 30th the plant had started to open the recycle gates in an attempt to regain permit compliance for blowdown to the river.

On May 1st the river level had dropped to about 685 feet. Early morning May 1st the recycle gates were 68% open and condenser inlets has risen several degrees. Around noon on May 1st recycle gates were at 80% and could not be opened further because of electric motor problems on gates. The gates were left at 80% open and the condenser inlets had climbed to around 67 degrees indicating that more water was being recycled. This would cause temperature in the recycle canal and the head of the discharge canal to be about 93 degrees.

An inspection of the intake canal, screenhouse trash racks and buckets, and discharge canal in the morning on May 1st showed no dead fish. Later in the afternoon around 1300 a very small number of floating fish were visible in the intake canal with an increase in the number of fish in the trash buckets. Inspection of canal showed no dead fish mainly because the canal was still overflowing significantly. A contract of the contr

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Early afternoon on May 1st the neut tank discharge pipe was also excavated. It showed a broken section of clay sewer pipe. This information was passed on to Xcel Enviromental Services. All the clay pipe will be replaced with plastic pipe.

121

Early morning on May 2nd an inspection of the intake canal showed some floating fish and a increased number in the trash buckets. The discharge canal had several dead fish. Canal temps would have been around 95 degrees before mixing.

Carl Parts Attack 12 11 110 Early morning May 3rd the river level had dropped to about 684.2. Significant number of fish in the trash buckets. Canal temps would have been around 96 degrees before mixing. Around 0800 the discharge canal started to ramp up rapidly as the road uncovered. It rose to low 70's by 1100 and would expect temps around 97 in canals. and the second second second REPORTS 1 and the second 

52.8

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Later on May 3rd the first inspection of the discharge canal was made via the west road. Noticed some big fish on road but not an excessive amount in the canal. Later around 1400 Xcel Enviromental Services inspected the canal counted about 53 fish. Late on May 3rd the discharge canal temp peaked around 95 by the installed temp monitor. Late May 3rd Xcel Enviromental Services sent an e-mail to MPCA Water Quality, Wisc DNR, and Minn DNR informing them of the preliminary fishkill results.

Early on May 4th #121, #123, #125 and #128 intake screens started. Also power was returned to the screenhouse inlet temperature monitor which becomes the primary upstream river temperature monitor instead of Diamond Bluff. Intake screenhouse bypass gates remain OPEN. River level was about 683.6'. #124 and #126 screens may be started later today.

About 0900 May 4th #121 cooling tower pump was started. Tower will soak for 48 hours before fans are sequenced on. At around 1300 May 4th #122 cooling tower pump was started and it will soak for 48 hours.

Inspection of discharge canal in early morning showed an increased number of fish in the discharge canal (2-3) times the previous afternoon). At about 1330 Xcel Enviromental Services sent an e-mail update to MPCA Water Quality with flood information for all Xcel plants.

At about 1600 Xcel Enviromental Services inspected the discharge canal and counted about 230 fish. See the second statements when

Early on May 5th #122,#124 and #126 screens were started. At 0900 May 5th #123 cooling tower pump was started and tower will be soaked for 48 hours. At 1135 May 5th #121 intake screenhouse bypass gate was SHUT. At 1319 May 5th #122 bypass gate wa SHUT. At 1515 May 5th #124 cooling tower pump was started and will soak for 48 hours.

Xcel Enviromental Services inspected the discharge canal on May 5th and didn't see any additional new fish. Significant new fish were in the screenhouse trash buckets.

-Xcel Enviromental Services inspected the discharge canal on May 6th and didn't see any additional fish. Significant new fish were in the screenhouse trash buckets.

. . . Discahrge canal temperature peaked at 96.5 on May 5th and 95.8 on May 6th. · . . ..

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Early morning on May 7th river level was 681.5. All intake screens running except #127. One fan on #121 and one fan on #122 tower would not run so 22 fans are currently running. Discharge canal temp peaked at 89.528 on May 7th and continued downward trend. Bush and any set of the so section and 化专用 医口口分泌的 网络德国铁铁路 國際

Early morning on May 8th river level was 681 feet. #126 screen had tripped so #126 and #127 are 0.0.S. 2 fans on #123 tower and in fan on #124 tower will not run leaving a total of 43 fans running and 5 off. Canal temp is 80 degrees. The 8 foot sluice gate has been SHUT to regain a delta height in the discharge canal. Later the 5 foot and 7 foot sluice gates were SHUT and around 1530 May 8th the delta height inn canle calculated a blowdown flow of about 200 CFS. The discharge canal may not have regained it's full height from the gates closures so this was an early indication.

Early morning May 9th river level 680.5. #126 screen had been restarted yesterday afternoon but tripped again leaving #126 and #127 off. Same 5 cooling tower fans off. Blowdown flow is bouncing around some while everthing settles out. Current is 308 CFS. Canal 81. River flow was 104,000 CFS. Later in afternoon on May 9th the plant regained blowdown control below 300 CFS. This met the MPCA expectations of April 10th which allowed 4-5 days after reaching 683'. With the regaining of blowdown control and the canal road, the weekly pH sample point was returned to the sluice gates and the daily total residual oxidant calculation for SD001 was done using the actual cooling tower blowdown flow.

Early morning May 10th river level 680.1. #126 screen was restarted yesterday afternoon but tripped again leaving #126 and #127 off. Same 5 fans off. Blowdown 227 CFS with only 6 foot sluice gate OPEN. Unit 2 had been shutdown about 2100 last night for maintenance on emergency diesels. All cooling towers and fans will be left running.

At 1955 May 10th the plant exited from AB-4 and had returned to normal operations

Early morning May 11th river level was 679.6. Blowdown 235 CFS. Canal temp 74. #124 screen was shutdown for maintenance so have #124,#126,#127 out of service. 4 towers and 43 fans are running.

The fire hose release path to the recycle canal is still being used until the neut tank release line has been repaired. In order to allow releases at night, some lights have been installed in the area.

River level at 0700 May 12th 679.2. #124 screen was restarted afternoon May 11th after fine screen repair. #8 fan on #123 tower tripped leaving a total of 6 fans off. Canal temp has droped to 70 degrees with Unit 2 shutdown.

River level at 1200 May 14th 678.7. #126 and #127 screens off. Same 6 fans off. Canal temp 71. One Unit 1 circ water pump turned off over weekend so one cooling tower is running in recirc mode.

River level at 0600 May 15th 678.5 #126,127 screens off with a total of 6 fans off. canal temp 81. One Unit 2 circ pump off. upstream 64.8 downstream 64.7.

In the afternoon of May 15th the clay tile section of the neutralizing tank discharge line was replaced with plastic sewer piping. The pipe will be inspected for leaks during the first tank discharge and then the discharge line will be buried.

River level at 0600 May 16th 678.2 #126,127 screens off with a total of 6 fans off, canal 81. blowdown 283 cfs. upstream 67.6 downstream 66.9 One Unit 2 circ pump off.

River level at 0600 May 17th 677.8 #126,127 screens off and a total of 6 fans off. Canal 77. blowdown 283 cfs. river flow 66,500 CFS

River level at 0600 May 18th 677.4 #126,127 screens off and a total of 6 fans off. Canal 75 blowdown 283 cfs. upstream-68.1 downstream-67.6

River level at 0600 May 21st 676.4 #126,127 screens off. 2 addtional fans off(#2 on #123 and #8 on #124) for a total of 8 fans off. up-67.4 down-66.8 cnal 77. One UNit 2 circ pump running. blowdown 283 CFS.

River level at 500 May 22nd 676.0 #127 sc en returned to service leaving #126 off with a total of 8 fans off. up-64.7 down-64.7 canal-72 blowdown 283 CFS.

River level at 0600 May 23rd 675.8 Conditions remained the same. 5/24 River held at 675.8. blowdown 291 CFS. other conditions remain 5/25 River held at 675.8 blowdown 283 cfs. other conditions remain

River has climbed about 1 foot to 676.7 at 0600 5/29. Sturgeon Lake monitors were placed back in service afternoon Friday May 25th. #126 screen has been returned to service(1500 5/27) placing ALL screens in service. 3 fans have been restarted leaving 5 fans off. Unit 2 heatup possible ThursdaY BLOWDOWN 283 cfs. canal 74. One UNit 2 circ pump running. The official upstream temperature becomes 20% of the average of the two Sturgeon Lake monitors and 80% of the Diamond Bluff temperature.

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On May 30th river up about 0.1 foot to 676.8. All screens running. #6 fan on #121 tower off leaving a total of 6 fans off. blowdown 283 cfs. river temps up about 1 degree. canal 75. River flow 57,100 CFS The neut tank discharge line is in the progress of being buried again.

On May 31st river holding at 676.8. ALL screens running with a total of 6 fans off. Canal 75. Blowdown 283 cfs. One Unit 2 circ pump running.

On June 1st ramping up to 400 CFS. river level 676.7 canal 69. ALL screens running with a total of 6 fans off.

On June 2nd blowdown 396 CFS. canal 67. ALL screens running with a set total of 6 fans off. Both Unit 2 circ pumps running. condenser inlets 66.5

Please contact me at Ext. 4440 if additional information is needed. Thank you. and the the the state which the second n de la companya de la comp the state of the state of the

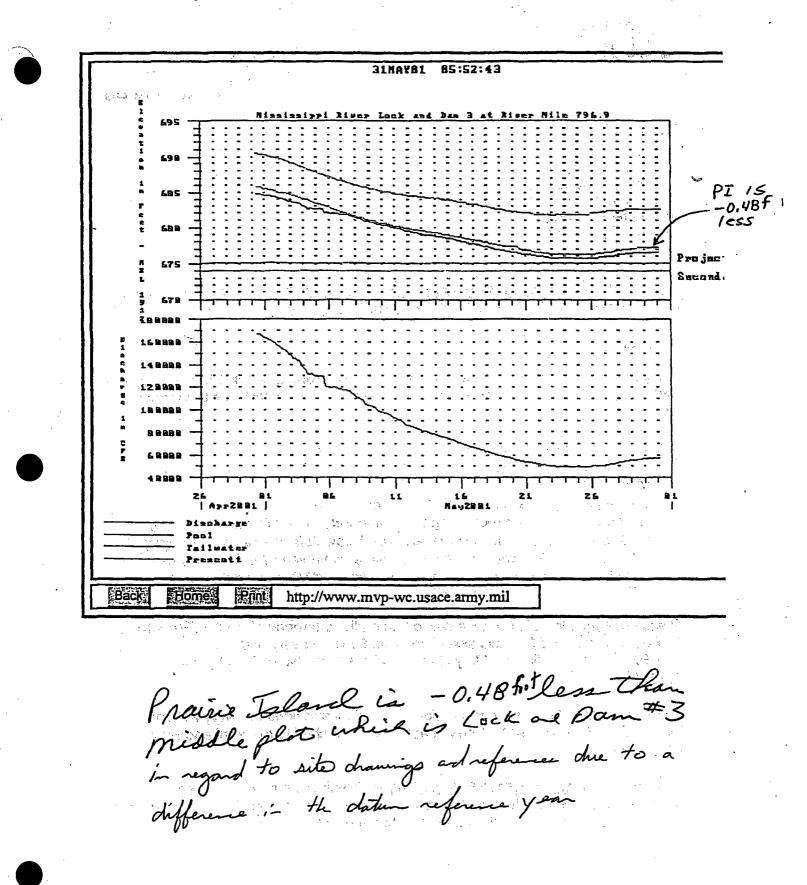
#### Sincerely yours,

Gerald Joachim Senior Radiation Protection Specialist

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USACE St Paul Project Data



http://www.mvp-wc.usace.army.mil/cgi-bin/enigma



Northern States Power Company

d/b/a Xcel Energy 1717 Wakonade Drive East Welch, MN 55089 Telephone 651-388-1121 ext 4419

June 15, 2001

Ms. Marilyn Danks Ecological Services Section Minnesota Dept. of Natural Resources 500 Lafayette Road St. Paul, MN 55155

Subject: Prairie Island Nuclear Generating Plant (NPDES Permit No. MN0004006) Flood related fish-loss assessment – Spring 2001.

Dear Marilyn,

As flood-waters receded in early May, a loss of approximately 2,300 fish occurred within the Prairie Island Plant's external circulating water system due to thermal stress.

Elevated water temperatures in the canals resulted as:

- flood-water levels dropped to within confines of the plant's dikes and controlstructures,
- plant equipment was being restored to service, and
- plant operations were recovering from temporary non-compliance with the NPDES Permit; ... "Once river levels drop below 683', we can start bringing the external circulating water system back into a controlled situation and proceed to systematically regain permit compliance." (knm, 4/17/01-upset defense letter to MPCA, w/cc: Mr. Jack Enblom - MDNR).

Please be reminded of my phone call to you on the afternoon of April 19th, notifying MDNR of anticipated fish-loss associated with flood recovery and reestablishing NPDES permit compliance. Mary Hayes – MPCA was also notified by phone on April 19th.

Please refer to detailed accounts of flood protection and flood recovery actions for the PI plant site, provided by Gerry Joachim and attached to the April and May MPCA DMRs.

See attachment <u>Spring 2001 PI Fish-loss Tally</u> for break down of fish species, numbers, size, and location. All fish removed from the plant's intake, recirculation, and discharge canals were disposed of by burial on site.

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# Assessment Summary Notes

- 5/2 5/7: observed and assessed PI fish-loss related to flood recovery and resultant thermal shock
- 5/2 5/6: counted, identified, and measured fish collected from intake/recirc canal barrack and traveling screens (1,812 total fish of 22 species, predominantly freshwater drum, white bass, black bullhead, and gizzard shad)
- 5/5: counted, identified, and removed discharge canal fish (464 total fish of 15 species, predominantly gizzard shad, carp, green sunfish, channel catfish, and freshwater drum)
- 5/5: observed and counted fish along shore outside of discharge canal dike (30 adult fish, predominately carp, catfish and shad)
- fish-loss was not as extensive as anticipated.

If you have questions, comments or need additional information, please call or e-mail me.

Sincerely,

with h. Mull

Ken Mueller, Environmental Analyst XE-Environmental Services, formally ERAD kennerth.n.mueller@xcelenergy.com

attachment: (1) Spring 2001 Fish-loss Tally

cc: Mary Hayes - MPCA Scott Lappegaard - NMC/PI Terry Coss - XE-ES Jim Bodensteiner - XE-ES XE-ES Record Center



Northern States Power Company

d/b/a Xcel Energy 1717 Wakonade Drive East Welch, MN 55089 Telephone 651-388-1121 ext. 4419

# Fish-loss assessment related to Spring flood recovery at Prairie Island Nuclear Generating Plant during May, 2001

prepared by knm 6/15/01)

### **Discharge** canal

A total of 464 fish were removed from the discharge canal, identified and counted, but not measured. They were all adult fish. Observations of the canal and shoreline were made on a regular basis during approximately the first 2 weeks of May, as flood waters were receding. Fish were identified and counted on 5/3, 5/4, and 5/5. Fish were not removed from the canal on 5/3 and 5/4. All fish were identified, counted and removed from the canal area on 5/5. Total numbers determined on 5/5 included those observed on the previous two days. Observations on 5/6, 5/7, and the following week, revealed no additional fish.

Species Gizzard shad	Numbers 153 136	· ·	
Carp Green sunfish	80		
Channel catfish Freshwater drum	36 25		en e
Bigmouth buffalo Smallmouth buffalo	12		
Quillback carpsucker	-		
Gar species Largemouth bass	2		v.
Northern pike Bowfin	1 1	× 2	an fan te skrieder en de Skriteringen en de skrieder. De sense fan de skrieder en de skrieder in de skrieder en de skrieder en de skrieder.
Black bullhead Flathead catfish	1		en en de lande ante en de lande ante
Black crappie	1		and and a second se
Total	464		

Additional adult fish were observed and counted outside of the discharge canal (river-side of dike) on May 5th, including:

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Сагр	12
Channel catfish	6
Gizzard shad	6
Unidentified	4
Smallmouth buffalo	- 1
Bigmouth buffalo	1

30

Total

## Recirculation and intake canals

Fish removed from the recirculation and intake canals were collected at the barrack and traveling screens of the plant screenhouse. Fish were identified, counted, and measured, with exception of young-of-year (yoy) White bass (WB) and Freshwater drum (FWD) which were identified and counted but not all were measured. Generally, yoy WB and FWD less than ~ 180 mmTL were sub-sampled, to provide average size and length-frequency determination.

Species			Number	/ Length R	ange (mm	TL)		
· · · · · · · · · · · · · · · · · · ·	<u>yoy</u>	<u>&lt; 99</u>	100-199	200-299	300-399		other	total
Freshwater drum	607	5	306	217	63	<b>.</b>		1198
White bass	57		233	2	8	•	-	300
Black bullhead	<b>-</b> . ,	32	66	22	• *	•	-	120
Gizzard shad	- <b>-</b> -		1	19	47	1	-	68
Bluegill	-	18	16		-	-	-	34
Channel catfish	-	11	10	7	2	<b>-</b> 1	1 at 690	
Green sunfish		9	- 6	- · · ·		· 🚽	· _	15
Shiner/minnow spp.	-	12		-	-		-	12
Black crappie		. <b>1</b>	6	1	1	-	-	9
White crappie	<b>_</b>	3		i <b>1</b> - 1	-	•	-	4
Quillback	-	- i - i - i - i - i - i - i - i - i - i	2	19.2 <b>1</b> .24	-	1	-	4
Northern pike	-		<b>.</b>	· 1	•	1 1 H	1 at 550	3
Smallmouth buffalo	-	<b>1</b>	2	<b>1</b>	· · · · ·	• <u>}</u>	-	3
Sauger	•		-		2	-	-	2
Shorthead redhorse	e i <mark>e </mark> ez i e	-	2			•	-	2
Bigmouth buffalo	•	· . <b>-</b> :.	4 - 2	. <b>é</b> :	-		1 at 540	1
Rock bass	-	- <b>-</b> '	👘 <b>1</b> 👘		-,	· • .	-	1
Mooneye		-		College all f <del>e</del> rrest	1 <b>1</b>	-	-	1
Bowfin	14			-	-	- 1	1 at 685	1
Walleye	: . <b></b>		- j	· · · · · · · · · · · · · · · · · · ·		1	•	1
Shortnose gar	. <b>-</b> [4] 5.	-	•	-		-	1 at 660	1
Carp	•	····· <b>·</b> •·	1		i		1 at 560	1

Summation

).

Discharge canal	2	464
Outside of canal Recirc/Intake	:	30 1812
Grand total =		2306

VNM 6/15/01

Total

	ISL/		R	?	ERA.	<u></u>	REPU	<u>.</u>																	Mon	th - \				May-	2001		Ú,	lax-Avg-Min
	_	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		Month	Max Value
12570A SL1		.79.0 67.9	51.8 45,4	38.9			57.2	65.0 61.1	72.7	80.5	88.3	96.0	99.0	0.0 تتناش	0.0	0.0	0.0	0.0		98.7	92.5	88.3	80.1		67(6)				62.0	62.8	63.8 62.7	63.3  63.1	99.0 ##	99.0 59.7
021	MIN	52.7		31.0	37,8	41.6	49.4	57.2	128.91	78.8	84.4 80.5	92;1 88.3	97,5	2010 100	<i></i>	0.0	<b>HH</b> 0.0	0.0	98.9 98.7	02.5	89.4 86.3	83,2	78,9	67.6	646	57.1	58.0. 57.5	57.2	60.6 59.2	82,0 61.3				0.0
Data			100				1100	100	100	100	19001	100	2:38		MAR.			TUR		1100	100	Hodi					1100				100	100		
2571A		51.5	47.5	37.8	43.4		_	_	73.6	81.1	88.6				0.0	. 0:0	0.0.	0.0	99.0	98.8	92.8	86:8	80.8	74.9	68.9	62.9	58.4		60.3	61.6	62.4	63.0	9/0	99.0
SL2	ÁVG	150.4	427	3477	3918	472	64/	62.2	69.6	<del>87</del> 5	84,9	192 A	67.6	0.0	<i></i>	1		ATT I	98,9	95,8	89.8	18318	77.8	VIE	350	60.0	57.8	58.1	******	80.8	61.9	62.6	4	58.8
			37,8	32.0	35.9	43.4	50.9	58.5	66.0	73.6	81.1	88.6	96.2	0.0	-0.0	0.0	0.0	0.0	98.8	,92:8	86.8	80.8	74.9	68.9	62.A		57.5	57.2	58.9	60.2			0.0	0.0
			_			_		100	_			1100											the second s	100					the second se	_	100	the second s	78	
			54.6 53.8	,55.8	57.7		58.9	59.8	60.0			60.5			63.6	6578		67.1					65.4	82.6	62.3		59.7		62.2	62.9		63.9		68.5 62.0
	AVG		52.4	64.1	56.5	67.3	0/.U	58.4 58.7	1.00.0	50.8 57.6	29,0	50.0	50.0	81.0	60 0	04.0	64.4	66.2	66.8 65.5	010	0/ 0	60.0	03.0	61.9 61.1	61.0	59.9	59.4 58.2	59,5	60.8	62,0	82.9	83.3	60,9 49.5	54.4
	\$ <b>96</b> 13	and the second sec	100			100	1100	2100	100.2	100	100	100.1	100	-100	100	100	100	1460	80.0 100	100.2	1100	100					58.2 100			61.0 100			99	9.99
the second s	MAX		58,6		59.8		59.7	59.9	59.7	59.7	60.1		1.000	62.3	63.4		and the second se	the second s	67.9			66.9		62.1	61.5	60.0	59.2		60.8	62.0		63.5	68.7	68.7
		17.6		59.0	59.6	160ki		59,4			69.8		60.3	61,3	82.4	64.5	66.0	66.8	87.1	68:0		68,0								61.4	62.5		81.8	82.3
	MIN	68/0	58.0	58.5	59,1	158,7	58.5	59.0	58.6	58.9	59.5	59.3	59.7	60.8	61.7	63.4	65.7	66.4	66.6	67,6	66.9	65.2	62.0	61.5	59.9	.59.2	58.5	58.3	59.6	60.7	61.7			58,4
Dala	1.%	1.1.1	/100	100	5 95	開	100	(100	. · · · · ·	100	100	and the second	100	and the second se	100	100			100	100	100	100.	100	100	100	100	100	1100	100	100	100	100	99	
	MAX	59.5	59.7	60.6	61.0	60.6				60.3	61.0			63.3	64.8		67.8	68.5	68.9		69.4				61.6	60.1	59.5	60.3	61.6	62.5	- 20 million			69.4
	AVG	5812 56.8	59,4	60,0	<u>60,4</u>	1992			69.7		60.4			62.0	63.1	65.6	67.1	67.8	68.2 67.5	68,9	68,5	68.5	163.7	61,4	60.6	59,6	59.1		60.7	61,9	,62.9		1	63.1
			58.8		60.D	59:3 8:05		59.6 100.	58.9					60.9		64.4		67.3				85.0	61.6	60.5				57.9	59.7 19361	60.6	81.9 1100		Sec. 1	59.5
the second s	MAX		60.1		61.5		60.9	_	60.7		61.0	_	the second second		65.3	a second seco	_		69.6				_		61.5	60.0	59.6	60.6	62.1	63.0	-	64.4	69.9	69,9
			59,9	60.4	60.9	00/3			59.9	60.1	60.5	60.6	811	82.3	83.5	166.3	67.8	68.2	68.6	69.3	88.7	66.6	63.6	18114	60.8	59.5	59.0	59.3	60.9	62.2	63[2]		62,6	3 83.4
ľ			59.5	59.9	60.5	603 59,6	59.4	160.6 60.0	59.2	59.5	60.0	59.9	60.0	60.1	62.1	59.4	67,8	67.5	67.8	66.4	67.7	65.4	61.8	81 ⁴ 60.4	59.3	57.7	58.0	58,1	59.9	60.8			57.2	59.6
Data	1%)	記録	100	100	( <b>198</b> )	影响	100	100	100	100	100	100	100'	1001	100	100	100	100	100	100	-100	100	100				100			100	100	100	13.99	
i.	MAX	18181	W0,08	160.8		61.3	60.5	60.8	60.4	60.3		61.1		63,4	65.0	6015	68,7	68.7	69.6	69.9	69.8	68.0	65.6	61.3	60.5	59,7	60.0	61.2	63,0	63.9		64.6		69.9
SHI	AVG				60.4	60,8	59,7	80:1, 59.8	59,9	59,9	60.3	60.4	60.9	62 (j	83,2	59.7	66.0 67.0	68.1	'6 <b>8</b> i7	69.6	69.0	66.8	63.8	60,7	60.0	59,5	59.6	59.8	Ð.	63,2	84.0	844		165 <b>9</b> ,3
Data	MIN	10.01		57.6	59.9	60.3 1100	59,4	59.8	59.4	59.4 3722	60.0	59.8	59.8 SLOV	61.0 19380	62.1	59.4	67.0	67.3	67.9	69.3	68.0	85.8	61.3	60.2	59.7 Fattan	59.4	59.0	59.0	60.7	62.6	63.3 1100	64,0	Levis 19 14	0.0
	MAX		1.1.1.1	93.9	95.3	95.9	95.8	89.1	84.1		83.1				82.7							78.5			_		-	_	the second s	1001	15100	1100	92	05.0
DC	AVG	ALC: N	80,7		(93,0	94 8		85.4	80 0	AIG	78.7	195 Å	70.2	72.0	763	07 6	36.5	77.3	76.5	178.0	77.7	70.5	73.0	70.9	72.6 1911 - 5	72.4	73.4 Still	74.5 1977:	76.8	77.0 572 67	70.4	73.6	95.9 767	95.9 1[[80.0]]
	MIN	60.6	59.9	60.1	92.4	92.6	89.1	79.5	78.7	77.1	74.3	70.4	66.6	69.8	69.7	89.1	79:2 74.5	73.6	72.2	72.3	78.5	168 EG	69.1	65.6	68.9	底印始 70.7	715 68.3	10 1224 67.5	1.2×5 69.0	35.74 71.4	69.5	71.2	59.9	61.6
Data	1%	<b>坡</b> 前	100	100	2100	1900	100	1700	100	100	100	100	100	100	100	100	100	7100	100	100	100	100	100	100	100	100	100	5100	166	100	100	1100	<b>7159</b>	
			0.9				- 6.7	-0.5		lan		51,2	-1:0	14.5	14.5	15.0	13.0	13.0	0.2			-0.0	-0.5-	-0.1	-£.+-	0.0	0.0	-0.+	-0,4-	-0.0			-	
	D	5	5	5	5	5	5	5	5	5	£	5	5	ε	5	5	5	5	. 5	5	5	5	5	5	5	5	5	5	5	5	5	6	1	
1	a	1	1	1	- 1.ŝ	1	1	1	1		1	$  \rangle$	1		,	•	: :			1	, 2 1	· ;	; /	•	1	1	1	1	1	1	1	11	[	1/2
	1	2	3.	. <b>4</b>	5	6	7	8	9		1				1				1	2	2	2	2	2	2	2	2	2	2	3	3	11	1	
}	8									0		2	3	•	5		i (. 4	3	5	0	1	- 2	3	4	5	6	7	8	9	0	1	1		6/ 7/266/
وليصح		Sture	eon L	ake T	emn 1	L	L	DB =	Diamo	nd Ali	Iff Tor	i	;	.02 =	Lock	& Da	m Terr	5.2		SH' =	Scre	sahou	ss Inia	t Tem		·	96%		tor ie	ـــــــــــــــــــــــــــــــــــــ	i our dal	L lose	<u> </u>	Ľ
			eon L					LD1 =									m Ten							Ave. T			95%	or jesa	ls >=	1 100	ur data	1055	5	T=0.4
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# BROMINATION/CHLORINATION REPORT

From: 01-MAY-01 To: 31-MAY-01

Day	Bromine Kgms/day	Chlorine Kgms/day	Time mins/day	U-1 Residual	U-2 Residual	Outfall Residual
1	39.1	58.2	1440	0.11	0.12	<.001
2	28.0	47.9	1440	0.11	0.09	<.001
-	2000			0.12	0.12	
3	44.7	63.1	1440	0.10	0.11	<.001
4	33.6	63.1	1440	0.12	0.13	<.001
5	33.6	58.6	1440	0.12	0.13	<.001
5 6	33.6	48.1	1440	0.12	0.14	<.001
7	44.7	62.7	1440	0.08,	0.09	<.001
8	33.6	62.7	1440	0.10	0.10	<.001
9	11.2	56.6	1440	0.09	0.11	<.001
10	50.3	64.5	1440	0.10	0.13	<.001
11	39.1	64.5	1440	0.09	0.12	<.001
12	33.6	63.8	1440	0.12	0.12	<.001
13	33.6	61.1	1440	0.11	0.13	<.001
14	44.7	62.2	1440	0.12	0.10	<.001
15	22.4	62.4	1440	0.10	0.12	<.001
16	22.4	55.3	1440	0.13	0.12	<.001
17 ·	28.0	61.9	1440	0.11	0.13	<.001
18	39.1	61.9	1440	0.13	0.14	<.001
19	33.6	61.9	1440	0.13	0.15	<.001
20	33.6	57.6	1440	0.13	0.15	<.001
21	39.1	57.6	1440	0.14	0.18	<.001
22	28.0	51.7	· 1440	0.16	0.18	<.001
				0.16	0.19	
				0.13	0.19	
23	33.6	52.4	1440	0.16	0.20	<.001
24	22.4	42.8	1440	<.03	0.11	<.001
		×		<.03 ·	0.11	<.001
				<.03	0.13	
25	28.0	42.8	1440	<.03	0.12	<.001
26	28.0	51.1	1440	0.11	0.12	<.001
27	33.6	59.9	1440	0.18	0.16	<.001
28	44.7	64.9	1440	0.15	0.18	<.001
29	28.0	63.0	1440	0.14	0.16	<.001
30	39.1	60.4	1440	0.12	0.17	<.001
31	28.0	60.4	1440	0.11	0.16	<.001

Maximum Daily Chlorination Rate = 114.8 Kgms/day on the 10th.

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# May 2001 Bypass Flow

The data table below lists the conservative flow (MGD) that discharged through our discharge canal (SD001) during the flood bypass period of May 2001. The calculation is based on a maximum flow of 1280 cfs in open cycle operation. We believe the actual flow during the flood bypass period was probably in the 300-cfs range.

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May 1	828 MGD
May 2	828 MGD
May 3	828 MGD
May 4	828 MGD
May 5	828 MGD
May 6	828 MGD
May 7	828 MGD
Total	5796 Million gallons

FACILITY NAME/ADDRESS: NSP - Prairle Island Nuclear Powe 1717 Wakonade Dr E Welch, MN 55089 STATION INFORMATION:	r Plant	م معنی محمد المحمد الله الله الله الله الله الله الله الل	WASTEWAT DISCHARGE MC	ONITORI T STATU: FINAL	NG REPORT	NSP 414 Nice	TEE NAME/ADDRES	S:		<b>Y</b>
SD-001 (Combined Effluent) Surface Discharge, Effluent To Su	rface Water	FRO	YEAR MO. DAY 2001/05/01	RING PEI TC	YEAR MO. DAY		Discharge		1 a	· · · · ·
PARAMETER			OUANTITY I IS	UNITS		CONCENTRATI	ON .		REQUENCY F ANALYSIS	TYPE
flow	SAMPLE VALUE		<b>¥</b> 4162	MG	*****	* 173.0	*****	mgd	24/31	EST
0050		A second	CalMoTol						T X Day	MeaCon
H	SAMPLE VALUE	*****	******		8.2	*****	8.4	28U (6	17	Grab
0400	PERMIT				6.0 CalMoMin		9.0 CalMoMax		tx Week	Grab
Phosphorus Total (as P)	SAMPLE	••••			*****	••••••	NR**	/mg/L	<u> </u>	in <u>Carlon</u> Grief Carlo
0665	PERMIT REQ				an dan se		REPORT		1 x Week	Grab
hlorine Rate	SAMPLE VALUE	44444 	114.8	kg/day		*****	•••••		131	calc
0059 [°]	PERMIT		DallyMax						TX Day	Calcul
xidants (Bromine) ot Residual Interm	SAMPLE VALUE						a a a a a a a a a a a a a a a a a a a	morL	en de la companya de La companya de la comp La companya de la comp	
4046	PERMIT REQ	an a					.05 InstantMax		1 X Day	Grab
xidants (Bromine) ot Residual Contin	SAMPLE VALUE				••••••	•••••	40.001	mo/L	31/31	Calc
4223	PERMIT						DallyMax		1 x Day	Calcul
xidanis (Chiorine) ot Residual Interm	SAMPLE		10.000 Control		44949764778477847784778479797979797979797979797		1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 20 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 2019 - 1. 20	mg/L	and a second	
3775 * North Content of the South State	PERMIT	4) 4)			A start		2 AlcinstantMax		1.x Day	Grab
end original with supplemental pplicable) by the 21st day of m			ify that I am familiar with th	18	after	<u> </u>	· · · · · · · · · · · · · · · · · · ·		6-1	4-01
eporting period to: MINNESOTA POLLUTION CON		NCY know	mation contained in this rt and that to the best of m viedge and balief the infor-		TURE OF PRINCIPAL	EXECUTIVE OFFICE	R OR AUTHORIZED A	GENT	D	ATE
520 LAFAYETTE RD ST. PAUL, MN 55155-4194 ATTN: Discharge Monitoring R	eport		on is true, complete, and trate.	SIGNA	TURE OF CHIEF OPE	/	PHONE	DATE	CERTI	FICATION
ST. PAUL, MN 55155-4194 ATTN: Discharge Monitoring R	eport tacha	acci			the second se	/		DATE		FICATION#

NSP - Praine Island Nuclear Powe 17.17 Wakonade Dr E Welch, MN 55089	r.Plant	A REPERMI	HARGE MONITORIN	FORMER #	NSP 414 Nic	Dilet Mail		
STATION INFORMATION: SD-001 (Combined Effluent) Surface Discharge, Effluent To Su	rrfacë Water	YEAR MO		010M 1. OD 2001/05/31	N61	Discharge		
PARAMETER		QUANTIT	Y UNITS		CONCENTRAT	ON as a the space	UNITS OF ANALYSI	SAMPLE STYPE
Oxidants (Chlorine) Tot Residual Contin	SAMPLE VALUE			####A#	100000	and the second sec	mg/L	
03774	PERMIT					04 DallyMax	TATIX Day	Calcul
Plant Capacity Fctr % of Capacity	5-1-2-C-3-11-3-1				64.6	**************************************	Cort	meas
00180	PERMIT				CalMoAvg		1 X Day	Measur
** phosphate	descalar	addition	uas tern	ni <i>ned</i> .				
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	and a second	in state in the second seco	ta militar da su da s					·
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Send original with supplemental DMR (if applicable) by the 21st day of month following	I certify that I am familiar with the information contained in this	Common	-	6-14-01
reporting period to: MINNESOTA POLLUTION CONTROL AGENCY 520 LAFAYETTE RD	report and that to the best of my knowledge and belief the infor- mation is frue, complete, and	SIGNATURE OF PRINCIPAL EXECUTIV	/E OFFICER OR AUTHORIZED AGE	ENT
ST. PAUL, MN 55155-4194 ATTN: Discharge Monitoring Report	eccurate	SIGNATURE OF CHIEF OPERATOR	PHONE	DATE CERTIFICATION
				Page D22 of D2

FACILITY NAME/ADDRESS: NSP - Prairie Island Nuclear Power Plant 1717 Wakonade Dr E Welch, MN 55089		ER TREATMENT NITORING REPORT STATUS FORMER #	PERMITTEE NAME/ADDRESS: Northern States Power Co 414 Nicollet Mall Minneapoils, MN 554011993	
STATION INFORMATION: SD-002 (Steam Generator Blowdown Discharge) Surface Discharge, Effluent To Surface Water	YEAR MO: DAY FROM 2001/05/01		No Discharge	an a
PARAMETER	ουΑΝΤΙΤΥ.	UNITS	U CONCENTRATION	INTS OF ANALYSIS TYPE
Flow	0.314	MG	0.010	5/31 EST
50050	REPORT		REPORT CalMoAvg	C1.x Month Estima
TSS SAMPLE 2		kg/day		mol 1/31 Grab
00530	65.3		30 100 100 Callockup	x Month Grab
				······································
	and a second br>Second second br>Second second			
an an an Araba an Ar Araba an Araba an Arab		M		
Send original with supplemental DMR (if	I certify that I am familiar with the		fmoc_	6-12-01
applicable) by the 21st day of month following reporting period to: MINNESOTA POLLUTION CONTROL AGENCY	information contained in this report and that to the best of my knowledge and belief the infor-		EXECUTIVE OFFICER OR AUTHORIZED AG	ENT DATE
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ATTN: Discharge Monitoring Report

CILITY NAME/ADDRESS: P - Prairie Island Nuclear Power Plant 17 Wakonade Dr E Ich, MN 55089	WASTEWATER TREA DISCHARGE MONITORIN	G REPORT Northe 414 N	ITTEE NAME/ADDRESS: rn States Power Co collet Mall apolls, MN 554011993	
²² Weight and the second se second second sec	PERMIT# LIMIT STATUS MN0004006 FINAL	FORMER # 2		
ATION INFORMATION: -004 (Neutralizer + Resin Rinse Discharge) rface Discharge, Effluent To Surface Water		OD	Discharge	
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SAMPLE ().3		····· <i>U</i> . <i>U</i>	18,5 Mar	15/
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20 LAFAYETTE RD 7. PAUL: MN 551554194		JRE OF CHIEF OPERATOR	PHONE DATE	CERTIFICATION#

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Welch, MN 55089			ALL AND LODGED AND AND A PROVIDED AND A DAMAGE VIE	STATUS A FORMER A		polis, MN_554011993	and the second s	Y	y
STATION INFORMATION: SD-005 (Unit 1 Turbine Bidg Sur Surface Discharge, Effluent To S		FROM		NG PERIOD YEAR MO. DAY: TO 2001/05/31		Discharge	., at.	•	
PARAMETER			JANTITY	UNITS	CONCENTRAT	ION	UNITS O	REQUENCY FANALYSIS	
Flow	SAMPLE	*****		MC	0.040	*****	mod 5	731	EST
50050	PERMIT				CalMoAvg			1 x Month	Estima
TSS	SAMPLE	*****			5,3	5.3	mg/L	731	Grab
00530	RERMIT					DallyMax		1 x Month	Grab
Oli Total Recoverable 00552	SAMPLE IZATUE BEDMIT	•••••	••••••	·····	2/1,0 10 10	- 1. 0 15 DallyMax	mg/C {	/3/ Tx Month	Grab
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ST. PAUL, MN 55155-4194	Report	accurate	<u> </u>	DIGNATURE OF CHIEF OF		PHONE	DATE		FICATION

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ACILITY NAME/ADDRESS: ISP - Prairie Island Nuclear Power Plant 717 Wakonade Dr E Velch, MN 55089		ER TREATMENT INITORING REPORT	PERMITTEE NAME/ADDRE Northern States Power Co 414 Nicollet Mall Minneapolis, MN 55401199	
STATION INFORMATION: SD-006 (Unit 2 Turbine Bldg Sump Dschg) Surface Discharge, Effluent To Surface Water	FROM 2001/05/01	TO 2001/05/31	No Discharge	
PARAMETER	QUANTITY	UNITS	CONCENTRATION	FREQUENCY SAMPLE
Flow SAMPLE		MG	D.D21 ······ REPORT CalMoAvg	mod 5/31 EST 1x Month. Estima
TSS SAMPLE SAMPLE			12,7 12.7	more 1/31 Grab
			CalMoAvg DallyMax	
Total Recoverable SAMPLE Val LE 00552 PERMIT			/, 0 /, 0 107 CalMoAvg 7511 DallyMax/1	1/31 Grab
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NSP - Prairie Island Nuclear Powe		ىقۇرىكەت	WASTEW	ATER TREA		14 A	TEE NAME/ADDRES	S: 35		
1717 Wakonade Dr E Welch, MN: 55089			DISCHARGE	the second second	s and a strong of the state of the second	414 Nice	n States Power Co bliet Mail polis, MN: 554011993	an a		
STATION INFORMATION: SD-007 (Metal Cleaning Effluent I Surface Discharge, Effluent To Su		FROM	EAR MO: DAY 2001/05/01	TORING PER	YEAR MO. DAY	Not	Discharge	ς, 2 μ. φ. 7 λ. κ.	. <u> </u>	
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TSS	SAMPLE			kg/day	*****			mg/L		
00530	PERMIT	16 CalMoAvg	1.9 Zo DallyMax		1111.775 1111.775 1111.775	, 30 CalMoAvg	100 DallyMax		1 x Day	Grab
pH .	SAMPLE	*****	*****					SU	<u> 1843 - 19 - 19 - 19 - 19 - 19 - 19 - 19 - 1</u>	SCOME FIGHT
00400	PERMIT				6.0 CalMoMin		9.0 CalMoMax		1 x Week	Grab
Copper Total (as Cu)	SAMPLE			kg/day	*****			img/L		
01042	VALUE PERMIT	02 CalMoAvg	.02 DallyMax			1.0. CalMoAvg	1.0 DallyMax		3 1 x Day	Grab
iron Total (as Fe)	SAMPLE			kg/day	*****			mg/L	<u>an ann an Staine An Charles</u> 1 Anna - An Charles 1 Anna - An	<u></u>
01045	PERMIT	of CalMoAvg	02- DallyMax			1.0 CalMoAvg	1.0 DáliyMax		1 x Day	Grab
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00552	PERMIT	2 CalMdAvg	Sec. 3			10 CalMóAvg	16 IN DallýMax 4		1 x Day	Grab
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MINNESOTA POLLUTION CONTROL AGENCY	knowledge and belief the infor-			
520 LAFAYETTE RD ST. PAUL, MN 55155-4194	mation is true, complete, and accurate.	SIGNATURE OF CHIEF OPERATOR PHONE	DATE	CERTIFICATION#
ATTN: Discharge Monitoring Report	· · · · · · · · · · · · · · · · · · ·		······································	Page D96 of D184

CILITY NAME/ADDRESS: P - Prairie Island Nucléar Power Plant 17 Wakonade Dr E		R TREATMENT IITORING REPORT	PERMITTEE NAME/ADDRESS: Northern States Power Co 414 Nicoliet Mail	
ich, MN 55089	MN0004006 FI	STATUS FORMER#	Minneapolis, MN 554011993	
ATION INFORMATION: -012 (Intake Screen Backwash + Fish Retn) race Discharge, Effluent To Surface Water	YEAR MO DAY FROM 2001/05/01	NG PERIOD YEAR MO. DAY TO 2001/05/31	No Discharge	
PARAMETER	CONTRACTOR AND A CONTRACTOR	UNITS	CONCENTRATION	EQUENCY SAMPL
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ESADALE ONLY L'MO 11		the to flood	conditions	
Screens operating 24	1 of 31 days c	due to flood		
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licable) by the 21st day of month following		SIGNATURE OF PRINCIPAL EXEC	CUTIVE OFFICER OR AUTHORIZED AGENT	DATE
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NSP - Prairie sland Nuclear	e constante	an a sua ana a Tana an An an	WASTEW/ DISCHARGE I	ATER TREAT		North	MITTEE NAME/ADDRES ern States Power Co	S:	сия с 1. (1090)	
Welch, MN ,55089				MITISTATUS	FORMER #		apolls, MN 554011993	2 2	UNU	
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STATION INFORMATION:		-		· 	me warmen in the state of the	· · · · · · · · · · · · · · · · · · ·	, an ere •	with the States	i sa na sing na sa sa s	a ya nyana Masa
WS-001 (Unit 1 Plant Coolin Waste Stream, Internal Wast		FROM	MONI] EAR MO: DAY 2001/05/01	TORING PERIO	D EAR],MO7   DAY 2001/05/31		o Flow			
PARAMETE			UANTITY	UNITS		GONCENTR	ATION CONTRACTOR	UNITS	FREQUENCY	SAMPL
Flow	SAMPLE	*****	* 819.1	MG	*****	24.4		ingd	31/31	EST
	ETC. DIAN SERVICE		REPORT			REPORT			<b>Days</b>	MeaCo
50050	PERMIT		CalMoTot			CalMoAvg				
50050 Oxidants Total Residual	PERMIT SAMPLE		CalMoTot			TOP HAN HAR SALE MICH SHE ALLER	0.18	mg/L	31/31	Grab

o¥	Flow	i's	0	total	01	WS 001	4	WS 003	)
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Send original with supplemental DMR (If applicable) by the 21st day of month following	I certify that I am familiar with the information contained in this	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	<u>(2 -/4 -0)</u> Date
reporting period to: MINNESOTA POLLUTION CONTROL AGENCY 520 LAFAYETTE RD	report and that to the best of my knowledge and belief the infor- mation is true, complete, and accurate.	SIGNATURE OF CHIEF OPERATOR	CERTIFICATION#
ATTN: Discharge Monitoring Report			

ATTN: Discharge Monitoring Report

FACILITY NAME/ADDRESS: NSP - Prairie Island Nuclear Power Plant 1717 Wakonade Dr E Welch, MN 55089			VATER TREA MONITORING IMIT STATUS FINAL		PERMIT Northern 414 Nic Minnear				
STATION INFORMATION: WS-002 (Unit 2 Plant Cooling Water Dscho Waste Stream, Internal Waste Stream	) FROM	YEAR MO. DAY 2001/05/01	ITORING PERI TO	ÓD (EAR MOS DAY 2001/05/31	No F	low			
PARAMETER		QUANTITY	UNITS		CONCENTRATI	ON	UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	•••••	* 819.1	MG.	*****	210.4	*****	mgd	31/31	EST
50050		REPORT CalMoTol						i x Day	MeaCon
Oxidants Total Residual SAMPL		******		*****		0.20	ing/Lis	³¹ / ₃₁	Grab
34044						2:0 DallyMax		A X Day	Grab.

* Flow is a total of wSDOI+ WSDO2

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applicable) by the 21st day of month following	information contained in this report and that to the best of my	SIGNATURE OF PRINCIPAL EXECUTIVE OFF	ICER OR AUTHORIZE	DAGENT	DATE
reporting period to: MINNESOTA POLLUTION CONTROL AGENCY	knowledge and belief the infor- mation is true, complete, and		/ .	······································	
520 LAFAYETTE RD ST. PAUL, MN 55165-4194	accurate.	SIGNATURE OF CHIEF OPERATOR	PHONE	DATE	CERT TION#
ATTN: Dischar					31C 3 ege 7



Peture 414 Nicollet Mall Minpespolis, Minnesota 55401-1993

JUN 3 0 2003

June 27, 2003

Sheryl Corrigan, Commissioner Minnesota Pollution Control Agency 520 Lafayette Road North St. Paul, MN 55155-4194

# RE: PRAIRIE ISLAND NUCLEAR GENERATING PLANT NPDES Permit No. MN0004006 Annual Environmental Monitoring and Ecological Studies Program Report

Dear Ms. Corrigan:

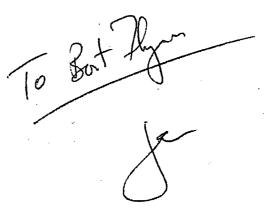
Attached is the Prairie Island Environmental Monitoring Report for 2002 which is being submitted in compliance with Chapter 1.3.14 of the subject NPDES permit dated May 16, 2000. The report summarizes results of the fish population study and the fine-mesh traveling screens fish impingement study. The report also provides an overview of plant and river water temperature and flow data, which can be referred to when reviewing summaries of the fisheries studies conducted at and within the vicinity of the facility.

If you have questions about the report please call me at (612) 388-1121 ext. 5026, or any questions or comments pertaining to report distribution and mailing list deletions/additions should be directed to Kellie Krenik at (612) 337-2087.

Sincerely,

fenneth R. Mueller

Kenneth N. Mueller Environmental Analyst III, Environmental Services



cc: Distribution

## TABLE OF CONTENTS

Water Temperature and Flow..... Section I

Summary of the Fish Population Study..... Section II

Fine-mesh Vertical Traveling Screens..... Section III Fish Impingement Study

# SECTION I

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2002 ANNUAL REPORT

# WATER TEMPERATURE AND FLOW

Study and Report by B. D. Giese

> and K. N. Mueller

Environmental Services Water Quality Department

#### WATER TEMPERATURE AND FLOW

### INTRODUCTION AND METHODS

The Mississippi River is the source-water body for circulating and cooling water systems at the Prairie Island Nuclear Generating Plant (PINGP). This report presents daily plant operating hours, river inlet temperatures, site discharge temperatures and flows (blowdown). Site discharge temperatures are determined by thermocouples located downstream at U.S. Army Corps of Engineers Lock and Dam 3. Plant inlet (ambient river) temperatures are determined by remote sensors located in Sturgeon Lake, and the main channel at Diamond Bluff. Inlet temperatures are also recorded from thermocouples located in front of the intake screenhouse, which are maintained for back-up. Data presented in this report are for environmental studies comparison, and are not intended as NPDES temperature compliance reporting.

Also presented in this report are daily and monthly average Mississippi River flows, as provided by U.S. Army Corps of Engineers at Lock and Dam 3. Other monthly averages reported include PINGP intake flows, and the percentage of Mississippi River water entering the plant.

### RESULTS AND DISCUSSION

Daily average river inlet and site discharge temperature data are presented by month in Table 1. Daily Mississippi River flows recorded at Lock and Dam 3 ranged from 8,000 to 65,000 cfs in 2002 (Table 2). Daily mean site discharge flow (blowdown) from the PINGP external circulating water log ranged from 155 to 1250 cfs (Table 1).

PINGP withdrew an annual average of 3.4 percent of the Mississippi River flow during 2002 (Table 3). Table 4 shows the monthly average Mississippi River flows for the years 1983 through 2002. The average river flow in 2002 was 23,405 cfs, which was similar to the average river flow of 23,444 cfs for years 1983-2001. The range of annual average river flows is 8,709 cfs in 1988 to 37,787 cfs in 1986.

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows,<br/>with recorded operating hours for Units 1 and 2 at PINGP in 2002

• ..

DATE JANUARY		TING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FL (BLOWDOWN-0	_OW
1	24	24	32.1	36.1	961	
2	24	24	31.6	36.6	961	
3	24	24	31.3	36.2	961	
4	24	24	32.3	35.9	961	
5	24	24	32.4	/36.0	961	
6	24	24	32.8	35.7	961	
7	24	24	31.7	35.8	961	
8	24	24	32.3	34.9	961	
9	24	24	33.1	35.3	961	
10	24	24	33.3	35.7	961	
11	24	24	32.7	36.0	961	
12	24	24	33.6	36.2	961	
13	-24	24	32.4	36.0	961	
14	24	24	33.4	35.7	961	3.
15	24	24	33.1	35.7	961	•
16	24	24	32.3	35.3	961	
17	24	24	32.4	35.5	961	۰.
18	24	24	32.3	35.4	961	N
19	24	24	29.7	35.5	961	•
	24	24	32.6	35.7	961	<u>,</u>
· 21	24	24	31.4	35.9 ^{&amp;}	· 961	
22	24	24	32.7	35.5	961	
23	-24	24	33.5	35.6	<b>961</b>	
24	24	·** 24	32.3	35.8	961	
25	24	24	33.7**	36.7	961	
26	24	24	34.2**	37.1	961	
27	24	24	34.5	36.9	961	
28	24	24	32.5	36.3	961	
29	24	24	33.2	36.1	955	• •
30	24	24	32.9	36.3	<b>95</b> 5	•
31	24	24	33.1	36.3	955	•
	MOŃ	THLY MINIMUM	31.3	34.9	955	
· ·	MONT	HLY MAXIMUM	34.5	37.1	961	
	Μ	ONTHLY MEAN	32.5	35.9	960	>

* Caculated ** IT2527A Used

Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2002

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DATE	OPERATING	HOURS	<b>RIVER INLET</b>		MEAN SITE	
FEBRUARY	UNIT 1 U	JNIT 2	TEMP.	TEMP.	DISCHARGE FLO	W
			(°F)	(°F)	(BLOWDOWN-CF	S)
	•		л. Л.		•	-
. 1	24	.21	32.8	36.1	955	
2	24	0	32.9	33.9	955	5
3	24	0	32.8	33.7	<b>500</b>	
4	24	. 0	32.0	34.1	525	
5	24	0	32.4	34.2	412	
6	24	0	32.6	34.9	450	<u>, L</u>
7	24	0	33.4	34.9	450	
. 8	24	0	33.6	35.3	» <b>381</b>	
9	24	:0	34.2	35.9	392	
10	24	. <b>0</b>	34.1	35.0	392	
11	24	0	32.9	35.4	392	
12	24	0	34.1	35.3	392	
13	24		33.4	35.2	381	
14	24	0	34.4	36.0	392	
15	24	0	35.4 🖉 🦉	36.3	392	
16	24	0	35.2	37.7	392	
17	24	0	35.4	37.1	392	·.
18	24	. <b>0</b>	<b>36.7</b> bits	37.8	402	1
19	24	/ <b>0</b>	37.5	<b>38.1</b>	<u>∖</u>	, ·
20	24	0	37.6	38.3	. 402	1.4
21	24	0	36.4	37.3	402	.ξ
22	24	0	35.7	36.9	402	4. 1. C
23	24	a, <b>0</b>	37.1	37.1	402	
24	24	0	36.5	37.9	402	·
25	24	0	36.5	37.6	402	
26	24	. 0 🗄	35.0	<b>36.0</b>	402	
27	24	0	32.5	33.8	<u> </u>	
28	24	0	33.5	35.0	550	
				а 1 — 1		
	MONTHLY	•	32.0	33.7	- State (S. <b>381</b>	
	MONTHLY N		37.6	38.3	955	
	MONTH	LY MEAN	34.5	36.0	460	

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Table 1. Monthly ambient river inlet temperatures, and site discharge temperatures and flows,with recorded operating hours for Units 1 and 2 at PINGP in 2002

DATE MARCH		TING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SIT	E DISCH/ TEMP. (°F)	ARGE	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
[`] 1	24	0	32.6	1 Q	34.5		550
2	24	0	33.5		34.4		600
3	24	0	31.3		34.6		708 -
4	24	0	32.0		36.0		855
5	24	24	32.3		36.1		855
6	24	24	30.0		36.2	a	855
7	24	24	32.5		36.5	•	855
8	24	24	32.4	1.5	36.2		855
9	24	24	33.4		35.8		855
10	24	24	31.6		35.5		855
11	24	24	31.2		35.9		855
12	24	24	33.3		36.4		855
13	24	24	34.6		36.7		855
14	24	24	34.2		<b>36.8</b>		855
15	24	24	33.5		35.4		855
16	24	24	36.0		33.5		855
17	24	24	35.7	۱.	38.8	2	862
18	24	24	36.2		39.0		862
19	24	24	36.6		39.2		889
20	24	24	37.5		40.3	• [	875
21	24	24	34.7		37.5		932
22	24	24	33.0		36.0		910
23	24	24	33.5		36.6		910
24	24	24	34.5		38.0		910
25	24	24	34.3	•	37.4		910
26	24	24	35.2	2	38.2		910
27	24	24	35.4	· ·	39.0		910
28	24	24	38.5		41.5		925
29	24	24	37.3		43.3		925
30	24	24	39. <del>9</del>		42.9		925
31	24	24	40.0		42.7	2	932
	MONT	HLY MINIMUM	30.0	· .	33.5		550
		ILY MAXIMUM	40.0		43.3		932
		NTHLY MEAN	34.4		37.4		857

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 Table 1.
 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2002

DATE <b>APRIL</b>	OPERAT UNIT 1	ring Hours Unit 2	RIVER INLET TEMP. (°F)	SITE DISCH TEMP. (°F)	ARGE	MEAN SITE DISCHARGE FLC (BLOWDOWN-CF		· · ·
1	24	24	38.8	40.4		932		
2	24	24	38.1	39.0		932		
3	. 24	24	37.4	38.1		932		
4	24	24	36.6	37.4	•	940		·. ·
5	24	24	35.9	37.4		932		۰.
6	24	24	34.8	38.6		940		
7	24	24	39.3	41.2		932	· · · .	
8	24	24	39.3	40.8		940		
9	24	24	*42.8	41.7		9 <del>9</del> 7		
10	24	24	*45.7	43.9		997		
11	24	24	43.2	45.7		997	÷ 1.	
12	24	24	42.1	44.3		997	11.0	
13	24	24	41.3	44.3		997		:
14	24	24	41.3	44.0		488		4
15	24	24	42.7	45.3		291		. '
16	24	24	53.5	48.0		291		
17	24	24	55.5	50.8	•	291	• •	in t
18	.24	24	48.8	<u>51.6</u>		155		
19	24	24	51.7	53.9	•	275		
20	24	24	56.6	53.4	7	291	,	• •
21	24	24	56.5	53.8	<u>,1</u>	267		
22	24	24	52.9	51.6	,	291		: `
23	24	24	52.0	52.0		299		
24	24	24	54.5	53.5		299	• *	÷.,.
25	24	24	51.7	50.4		299	۰`	÷ 27
26	24	24	50.8	50.3		299	41	.*
27	24	24	52.1	51.9	۰.	299		,`
28	24	24	49.2	49.1		283	•	<u>, v</u>
29	24	24	48.8	47.9		283	2.1	1.
30	24	24	49.2	50.2	- 7	291	· .	5 Q.
						· .	94 - C	a - 35
		· · · · ·					÷.	
		HLY MINIMUM	34.8	37.4		155		
		ILY MAXIMUM		53.9		.997	1.37	
	MC	ONTHLY MEAN	46.2	46.4		582	· `, '	

* IT2527A per TI 01-74

Table 1. Monthly ambient river inlet temperatures, and site discharge temperatures and flows,with recorded operating hours for Units 1 and 2 at PINGP in 2002

DATE MAY	OPERATI UNIT 1	NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)	.* .
1	24	24	49.8	50.4	291	
2	24	24	49.9	49.6	291	
, 3	24	24	49.2	49.1	291	
4	24	. 24	50.4	51.4	291	
5	24	24	° 50.7	52.2	291	ж, ÷
6	24	24	53.5	54.4	299	·* <u>*</u>
7	24	24	51.7	53.1	299	24.5
8	24	24	51.3	52.2	299	
9	24	24	51.0	<b>. 52.1</b>	299	
10	24	24	49.6	50.6	299	
11	24	24	51.1	51.1	299	
12	24	24	49.9	50.9	<b>299</b> , <i>r</i>	
13	24	24	50.3	50.1	299	
14	24	24	51.3	52.1	299	
15	24	24	52.5	53.5	299	
16	24	24	53.5	55.0	299	
17	24	24	53.6	55.4	291	
18	24	24	54.2	56.1	291	
19	24	24	54.2	55.9	291	
20	24	24	54.3	56.2	299	÷.,
21	24	24	55.2	57.1	299	
22	24	24	55.8	56.9	291	
23	24	24	60.8	61.2	299	
24	24	24	59.0	59.3	291	
25	24	24	60.2	60.5	291	
26	24	24	58.0	58.9	283	•-
27	24	24	61.7	61.6	307	
28	24	24	61.9	62.9	323	
29	24	24	62.9	64.0	407	
30	24	24	65.5	66.7	384	
31	24	24	67.2	67.4	326	
				49.1	283	
•		LY MAXIMUN		67.4	407	:
	MO	NTHLY MEAN	1 54.8	55.7	304	. •

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DATE <b>JUNE</b>	OPERAT UNIT 1	TING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)		
1	24	24	68.8	69.5	396		
2	24	24	69.4	69.7	392		
3	24	24	66.8	67.3	392		•
4	- 24	24	65.2	66.2	392		
5	24	24	63.8	64.6	392		,
6	24	24	65.9	66.2	392		
7	24	24	65.2	65.7	392		
8	24	24	65.6	65.9	392		
9	24	24	66.4	66.7	392	· · · ·	
10	24	24	68.1	68.5	412		•
11	24	24	68.4	69.6	444	· ·	,
12	24	24	69.9	71.1	454		
13	24	24	70.5	71.7	392	2 A.	
14	24	24	69.7	70.3	392	1 D N	
15	24	24	70.5	71.1	402	1 67 -	
16	24	24	70.6	71.3	768		
17	24	24	71.3	71.5	468	2	
18	24	24	70.2	71.1	768		
19	24	24	70.4	71.4	768		•
20	24	24	73.4	75.5	776		-:
21	24	24	71.5	73.9	776		2
22	24	24	69.8	73.6	776		
23	24	24	73.4	77.7	783		
24	24	24	73.9	79.2	783	* .	
25	24	24	75.5	75.7	791		2
26	24	24	75.3	76.0	791	- ,	
27	24	24	75. <del>9</del>	76.4	791		
28	24	24	77.0	77.7	791		
29	. 24	24	77.6	78.5	869		
30	24	24	79.1	79.6	991	к	
	MONTH	ILY MINIMUM	63.8	64.6	392		
		LY MAXIMUM	79.1	79.6	991		
		NTHLY MEAN	70.6	71.8	591		

	• • • • • • •	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	1				
date July		RATING HOURS UNIT 2	RIVER INI TEMP	. TEMI	<b>.</b>	MEAN SITE DISCHARGE FL	.OW
			(°F)	(°F	•)	(BLOWDOWN-C	CFS)
	\$2 ⁻¹				,		•
1	24	. 24	80.1	. 80.		1194	ŝ.
2	24	24	80.5	81.		1229	
3	24	24	81.3	82		1229	
. 4	24	24	81.1	82		1229	
5 6	24	24	80.3	81		1229	,
6	24	24	79.8	80		1229	
7		.24	80.5	81		· 1229	
8		24	82.1	82		1250	
9		24	81.6	82		1250	
10		, <b>24</b>	81.9	82		1250	•
11		24	76.2	76		1229	
12		24	77.4	<del>7</del> 7		1250	
13		24	77.3	77		1250	,
14		24	76.1	. 77		1229	
15		24	77.3	77		1229	. :
16		24	77.1	77		1229	<i>i</i> .
17		24	77.9	78		1229	· ·
18		24	79.0	79		1229	·
19		24	78.8	79		1229	
20		24	78.5	78		1229	s 1
2		24	78.2	79		1229	
22		24	79.4	80		1229	
2:		24	77.0	78		1229	
24		24	77.5	78		1229	-
2		24	74.9	75		1229	
20		24	75.1	75		1229 1229	
2		24 24	77.9	78		1229	
20		24	76.6	77			•
29 30		24	77.5	78		1205 1250	
				79			
3	1 24	24	78.0	79	.0	1187	
		MONTHLY MINIM		75	. =	1187	•
		MONTHLY MAXIM		82		1250	
		MONTHLY ME	EAN 78.6	/5	).3	1230	

	with recor	ded operating nour	s ior t	Jnits I and Z a	IL PING		er.		.,	
DATE AUGUST		ERATING HOURS UNIT 2		TEMP.	r siti	E DISCHARGE TEMP.	DISCHA	N SITE RGE FLOW		,
	2 <u>8</u> 8			(°F)	2 <b>-</b> 2	(°F)	(BLOWE	OWN-CFS)	<b>.</b>	
		1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -		70.7	•	00.4		1402		
1	24	24		79.7		80.1		187		
2	24	24		77.2	•	78.2		187		
3	24	24		77.9		78.3		187	. •	
4	24	24		76.0		76.9 76 7		187 1208		
5	24	24		75.8 74.9		76.7		1206		
6 7	24	24		74.9		75.6 74.4		1166	•.	
	24	24		73.2		74.4		1166	,	
8	24	24		74.1		75.7		1208		
9	24	24	۰.	74.5	V	76.2		1208		
10	24	24 24	: , `	75.4 75.5	. 1	76.2		1187	- 4	
11	24 24	24	,	75.5 76.4	•	78.6 77.9		1187		
12	24 24	24 24		76.4 74.7		76.0		1187		
13 14	24 24	24 24		73.8		75.4		1187 :		
14	24 24	24 24		73.0		75.3		1187		
15	24 24	24 24		74.0		75.0		1187		
16	24 · . 24	24 24		72.6		73.9		1187	•	
18		· 24 · 24	.*	72.8	•	72.1		1187		
19	24	24 24	1.1	70.8		72.4		1187	,	
	24	24		72.2		73.7		1187		
20	24	24 24		71.9		73.4		1187		
21 22	24 24	24 24		71.9	r r	72.2		1187		
22	24 24 ···	24 24	÷ .	71.0		73.1		1187		
23	24 24	24	1.11	71.4	··.	73.0		1187		
24 25	0 A	24		72.5	•	73.8		1187		• ·
25	24 24	24		73.3		74.2		1187		
20	24	24	,	74.1		75.4		1187		
28	24	24	:	74.3		75.8		1208	<u></u>	
29	24	24		74.6		76.2		1208	····	
30	24	24		74.0		76.0		1187		
31	24	24	; 	74.2		76.0		1208		
01	<b>~</b> ••	27 27		17.4	2013 1. 192		•		·	
		MONTHLY MINI	MUM	70.8	194 <u>7</u> 8	72.1		1166		
		MONTHLY MAXI		79.7		80.1		1208		
		MONTHLY		74.1	+	75.3		1190		
				77.1	n un sin The sin	1.0.0	• • • •			

Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2002

DATE SEPTEMBER		PERATING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHAI TEMP. (°F)	DISCH	EAN SITE IARGE FL VDOWN-C	A
1	24	24	74.1	75.9		1208	
2	24	24	75.7	77.2		1208	
3	24	24	73.1	· 74.9		1208	
4	24	24	72.6	74.7		1208	
5	24	24	73.3	75.0		1208	
6	24	24	72.8	74.5		1208	
. 7	24	24	74.0	75.3		1208	
8	-24	24	74.4	76.0		1208	
9	24	24	75.1	76.6	· .	1208	
10	24	24	75.3	76.5		1208	
11	24	24	76.0	77.2		1208	
12	24	24	73.9	75.7	,	1208	
13	24	24	73.4	74.1		1208	
14	24	24	71.9	74.0		1124	e *
15	24	24	70.1	71.6	<u> </u>	1114	
16	24	24	69.0	70.8		1145	
17	24	24	69.2	71.3		1145	
18	24	24	69.6	72.0		1145	
19	24	24	69.9	71.8		1145	
20	24	24	69.7	71.9		1145	
21	24	24	67.5	70.2		1145	
22	24	24	65.8	68.0		1145	
23	24	· 24	64.3	66.5		1145	
24	24	24	62.5	65.1		1145	1-3-
25	24	24	61.5	64.7		1103	
	24	24	61.7	63.6		1145	<u>.</u>
··· <b>27</b>	24	24	60.0	61.6		1145	
28	24	24	60.0	62.8		1145	•.
29	24	24	61.0	63.5		1145	17
30	24	24	61.0	64.0		1145	· •
						••	
		MONTHLY MINIMU	JM 60.0	61.6		1103	
		MONTHLY MAXIMU		77.2	• • • • • •	1208	
		MONTHLY ME		71.2		1169	
				· · ·			

			· ·	• •	,
DATE	OPERAT	ING HOURS	<b>RIVER INLET</b>	SITE DISCHARGE	
OCTOBER	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
			(°F)	(°F)	(BLOWDOWN-CFS)
1	24	24	61.6	64.5	1145
2	24	24	62.3	_ 64.1	1145
3	24	24	60.0	63.0	1040
4	24	24	58.5	60.9	1103
5	24	24	57.5	59.5	1103
6	24	24	57.5	59.0	1124
7	24	24	55.0	56.8	1124
8	24	24	53.9	55.3	1124
9	24	24	54.5	55.8	1166
10	24	24	54.4	55.7	1124
11	24	24	54.8	55.2	1103
12	24	24	56.1	56.3	1145
13	24	24	53.4	54.3	1103
14	24	24	52.6	53.4	1103
15	24	24	52.6	53.4	1145
16	[°] 24	24	50.4	51.3	1103
17 .	24	24	50.4	51.3	1082
18	24	24	49.6	50.9	1082
19	24	24	47.5	48.7	1145
20	24	24	46.9	47.5	1040
21	24	24	45.7	46.4	1084
22	24	24	44.8	45.6	961
23	24	24	43.9	44.3	937
24	24	24	43.6	44.3	955
25	24	24	44.1	45.2	955
26	24	24	43.9	44.8	955
27	24	24	43.4	44.3	955
28	24	24	43.3	44.5	955
29	24	24	43.4	44.1	955
30	24	24	43.0	44.1	955
31 -	24	24	41.9	42.2	955
				a diga di sa	9
,		HLY MINIMUM		42.2	937
		ILY MAXIMUM		64.5	1166
	MO	NTHLY MEAN	50.7	51.8	1060

Page 10 of 12

DATE NOVEMBER		PERATING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	40.3	41.1	943
2	24	24		41.0	955
3	24	24	40.0	41.5	955
4	24	- 24	39.6	40.7	943
5	24	<b>24</b> [°]	39.6	40.6	937
6	24	24	40.2	40.4	943
7	24	24	40.1	40.9	943
. 8	24	24	40.9	42.4	943
9	24	24	**42.8	42.8	955
10	24	24	**43.4	47.5	955
11	24	24	42.3	42.6	955
12	· 24 ,	. 24	40.3	41.8	937
13	24	24	39.4	40.8	937
14	24	24	40.0	40.7	937
15	20	24	38.3	39.2	937
16	0	24	38.9	38.3	454
17	0	24	36.9	37.3	444
18	~ . <b>0</b>	24	37.7	37.3	407
19	. 0	24	37.1	36.7	292
20	0	24	37.5	37.2	361
21	0	24	38.1	38.0	361
22	0	24	37.3	37.7	407
23	. 0	24	37.9	37.8	407
24	t. <b>O</b>	24		36.7	. 361
25	0	··· 24	36.3	36.2	395
26	0	24	35.1	35.1	384
27	0	24	35.0	35.2	315
28	0	24	34.7	35.1	361
29	0	.24	35.4	35.2	361
30	0	24	35.0	35.0	361
			•	•	, ·
		MONTHLY MINIMUN	A _34.7	35.0	292
		MONTHLY MAXIMUN		47.5	955
		MONTHLY MEAN		<b>39.1</b> )	662

* - BOTH UNITS ONE AND TWO ERCS COMPUTERS GOS ** - NOT ABLE TO OBTAIN DT

DATE DECEMBER UNI	OPERATING HOURS T 1 UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1 0	24	· <b>33.7</b>	34.0	338
2 0	24	33.4	34.0	372
3 0	24	32.5	33.3	327
4 0		32.9	34.1	451
5 0	24	32.7	33.9	462
6 7	24	32.8	33.8	472
7 24	24	33.1	34.1	397
8 24	24	32.7	34.5	660
9 24	24	32.3	34.3	708
10 24	24	33.2	35.0	708
11 24	L 24	33.5	36.0	684
12 24	l 24	33.8	34.7	612
13 24	24	32.9	34.9	612
14 24		33.8	35.4	600
15 24		34.9	36.8	<b>650</b>
16 24	• •	33.8	35.3	708
17 24		34.1	35.5	708
18 24		34.6	35.7	708
19 24		35.3	36.2	720
20 24		34.7	35.1	708
21 24		33.7	34.8	660
22 24		33.5	34.8	660
23 24	• •	32.3	34.6	720
24 24	1	32.5	34.7	660
25 24		32.8	34.8	672
26 24	,	32.8	35.2	672
27 24	•	33.0	35.1	672
28 24		33.5	36.1	708
29 24		33.5	35:3	708
30 24	•	34.1	36.1	660
31 24	24	33.0	34.5	660
	MONTHLY MINIMUM	32.3	33.3	327
**. •	MONTHLY MAXIMUM	35.3	36.8	720
•	MONTHLY MEAN	33.4	34.9	615

Page 12 of 12



 Table

 Daily 2002 Mississippi River Discharge Flow rate (cfs) at Lock Dam 3

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	10200	9900	8500	18200	35800	20100	43400	26600	27300	17400	23900	12300
2	10100	10500	10300	23600	35100	20300	43100	26200	25900	17600	22700	12200
3	10300	10100	11400	25700	34300	20200	42000	24800	26300	16200	21900	12300
4	11100	10000	10800	25100	33900	20400	40800	27300	26200	14701	21900	10500
5	11200	8100	9800	24500	32100	23900	39000	29400	27400	21200	21600	9000
6	11500	8100	9900	24400	31100	26700	37000	32000	28400	23200	20800	9300
7	11800	9900	10000	24000	30900	27600	34200	32900	32200	25001	20500	10400
8	11600	10300	10100	24700	30100	28600	32100	32800	32800	31500	20100	11000
9	11500	9900	11100	25000	30700	28000	31600	32800	32200	33800	20200	11500
10	11,600	9900	11100	27200	33500	26600	30600	32200	32500	37500	20300	12100
11	12400	9300	8900	30600	33500	25100	34700	31800	32400	40100	20300	11800
12	12000	8900	8900	35100	36500	24100	34500	30000	30900	41400	19100	13900
13	11700	8700	10900	33000	39200	21600	36400	29600	29400	40500	19500	14100
14	11500	8800	12400	38600	41600	21000	38700	27300	28800	39800	20000	14000
15	12000	9500	12500	45000	43100	21300	40200	26000	27700	38700	19400	13900
16	12600	9400	12500	52400	43700	22200	40400	25400	26900	37000	18400	13400
17	11300	9400	11500	60100	43800	21100	40100	23100	25200	34800	18200	13300
18	11200	9900	11000	64100	43500	20000	38900	25200	24000	33000	17400	12000
19	10000	10200	11400	65000	42300	17000	37700	24800	22800	31300	16800	12800
20	10100	11000	13000	64100	40700	18200	36100	24600	20300	29700	16900	16000
21	10400	11900	13700	61900	38700		34500	24700	19100	29000	17000	15500
22	10500	11400	12100	59200	36600	25100	33000	30900	18000	27900	17000	13500
23	11700	11200	10800	56300	33700	27700	31400	31200	17800	28200	17000	12100
24	11300	11800	10900	53400	31900	31900	30200	31800	16400	25500	17400	10900
25	10000	13300	11100	49300	29500	33700	29400	32000	16200	25100	16800	10300
26	9100	12500	13000	45700	28600	35200	28200	32500	17200	25500	16200	10200
27	10200	11000	12700	43600	27300	37700	27500	32400	18500	25400	15800	10200
28	10700	8000	11100	42500	25500	39900	26400	31500	17600	23200	12000	11100
29	10600		12100	39900	24000	41700	26500	30700	17600	23600	12200	11300
30	9400		15600	37500	22500	43100	27500	29800	17400	24700	12700	12300
31	9300		17300		19500		26400	28700	•	24100		13000
MIN	9100	8000	8500	18200	19500	17000	26400	23100	16200	14701	12000	9000
MAX	12600	13300	17300	65000	43800	43100	43400	32900	32800	41400	23900	16000
MEAN	10932	10104	11497	40657	33974	26323	34597	29065	24513	28600	18467	12135
					•							

YEAR MAX 65000 8000

YEAR MIN

Table 3	
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2002 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

	Mean Plant Flow	Mean River Flow	Percentage of Mean River Flow
Month	(cfs)	(cfs)	Entering the Plant Intake
January	. 960	10,932	8.8 %
February	460	10,104	4.6 %
March	857	11,497	7.5 %
April	582	40,657	1.4 %
May	304	33,974	0.9 %
June	591	26,323	2.2 %
July	1230	34,597	3.6 %
August	1190	29,065	4.1 %
September	1169	24,513	4.8 %
October	1060	28,600	3.7 %
November	662	18,467	3.6 %
December	615	12,135	5.1%
Averages	807	23,405	3.4 %

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1 2016 4.	iviean wonthiv	Wississippi Kiver Plo	x fot 1985 - 2002: 1n	cubic feet per second (cfs).
		where the second	, 101 1705	cubic feet per second (cfs).

Month	2002	2001	2000	1999	19	98	1	997	19	96	1995	199	)4	1993	1992
January	10,932	11,271	8,974	10,790	9	,806	1	4,823	14,	826	11,365	13,0	)90	9,326	15,658
February	10,104	10,471	9,548	12,589	14	,911	1	3,954	15,	041	9,371	12,0	511	8,936	13,978
March	11,497	10,948	22,219	17,897	26	5,574	2	4,177	24,	474	29,061	28,5	542	12,513	43,661
April	40,657	112,703	15,570	42,013	51	,477	10	6,073	57,	517	48,507	40,8	330	55,473	32,668
May	33,974	82,661	18,839	47,426	22	2,681	3	9,316	46,	535.	45,135	47,5	548	48,571	25,474
June	26,323	53,177	22,070	34,423	25	,690	1	9,487	33,	790	30,667	26,9	)13	65,377	17,920
July	34,597	23,981	21,052	27,548		,477	3	6,119	23,	732	27,323	29,4	103	\$84,123	28,985
August	29,065	12,164	10,026	24,432		,742	2	8,074	13,	303	29,129	19,9	071	41,135	
September	24,513	9,193	6,687	18,013	7	,060	1	6,663	9,	300	19,860	21,2	203	30,717	15,686
October	28,600	9,577	6,790	14,200	. 12	,597	1	4,155	11,	403	31,061	25,5	81	19,516	15,374
November	18,467	11,040	17,463	13,243	19	,773		4,160	23,		30,703	20,1		18,773	
December	12,135	13,813	9,558	9,671	15	,645	1	2,694	18,	716	17,494	14,4	32	16,490	12,126
Averages	23,405	30,083	14,066	22,687	20	,286	2	8,308	24,	333	26,710	25,0	25	34,246	21,262
			<u> </u>												
Month	1991	1990	1989	198	38	198		1986		1985		84		983	
January	5,542		5 6,2	294 7	,303	13,	758	13,7	10	12,52		,375		4,260	
February	5,879		) 6,5	529 7	,634		586	12,8		10,23		,557		3,375	
March	15,081	17,484	11,3	300 14	,810		287	24,7		32,20		,290		5,276	
April	34,268				,463		267	84,8		45,31		,277		5,239	•
May	44,753				,119		655	81,2		43,51		,528		3,155	
June	44,960	31,610	the second s		,667		573	37,0		30,10		,613		1,404	
July	33,856				,903		674	34,6		25,67		,165		5,353	
August	21,535	16,322			,103		477			18,22		,826		4,141	
September	25,182	and statements and st			,080		183	41,9	the second value of the second	29,60		,678		1,213	
October	15,458	11,135		358 7	,019		771	49,3		39,59		,866		7,536	
November	22,467	9,903	6,7	793 7	,919	8,	693	24,2	60	21,33	87 21	,157	18	3,108	
December	20,503	6,184	4,9	061 6	,487	9,0	016	17,7	74	16,09	04 15	,903	10	6,729	
Averages	24,124	13,991	11,1	40 8	,709	12,2	245	37,7	87	27,04	7 28	,519	20	5,566	

Note: Mean monthly river flow data for the years 1985, 1990, 1991 and 1992 have been adjusted to reflect the averages found in Table 2 of the corresponding annual report for each year.

## SECTION II

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2002 ANNUAL REPORT

## SUMMARY OF THE 2002 FISH POPULATION STUDY

Study and Report by B. D. Giese and K. N. Mueller

Environmental Services Water Quality Department

#### SUMMARY OF THE 2002 FISH POPULATION STUDY

#### **INTRODUCTION**

To fulfill part of the continuing environmental monitoring requirements of the Prairie Island Nuclear Generating Plant, (PINGP), the Mississippi River fisheries population was sampled near Red Wing, Minnesota, May through October, 2002. The study area extends from 3.6 miles upstream of the plant (River mile 802) to 10.8 miles downstream of the plant (River mile 787.5), (Figure 1). The original objective of the study was to "determine existing ecological characteristics before plant operation and to assess any significant changes to the aquatic environment after operation" (NSP 1972). The objective was changed slightly after the plant became operational in 1973; to "determine environmental effects of the PINGP on the fish community in the Mississippi River and it's backwaters" (Hawkinson 1973). Presently, the objective is to monitor and assess the status of the fishery in the vicinity of the PINGP (Mueller 1994). Parameters analyzed and compared to previous years include species composition, length-weight regressions, percent contribution (fish/hr), length-frequency distributions, and catch per unit effort (CPUE) for selected species.

#### METHODS AND MATERIALS

Fish were collected using a Smith-Root SR-18 Electrofishing boat equipped with a 5.0 GPP electrofishing unit (Figure 6). The power source was a 5.0 GPP generator. The 5000 watt generator has a maximum output of 16 amps, and a range of 0-1000 volts. The generator has the capability to be either pulsed AC or DC with a pulse frequency of 7.5, 15, 30, 60, and 120 Hz. The annode consists of two umbrella arrays, each with six dropper cables. The 18 foot boat and dropper cables hung from the front of the boat serve as the cathode. Collection occurred during daylight hours with a pulsed direct current. Due to the constantly changing river conditions, Electrofisher output was varied to enhance the effectiveness.

Sampling was done monthly, May through October, within four established sectors of the study area (Figures 1-5). The runs within each sector are similar to previous years sampling to ensure a similar set of relative data indices for yearly comparison. At the end of each "run", the elapsed shocking time was recorded from a digital timer, which only tallied the seconds that the electrical field was energized. A run was terminated after approximately 450 seconds shocking time or when the end of the prescribed run was reached.

Stunned fish were captured with one-inch stretch mesh landing nets equipped with eight-foot insulated handles. Fish were placed in live-wells, supplied with river water constantly, until the end of each run. At the end of each run fish were identified, measured to the nearest millimeter (total length), weighed to the nearest 10 grams, and released. Parameters used to describe the fisheries include species composition, length-weight regressions, percent contribution, length-frequency distributions, and catch

per unit effort (CPUE). It is assumed that population dynamics and spatial distribution is represented by CPUE.

Electrofishing CPUE was computed as numbers of fish per hour for each sector. Length frequencies in 20 millimeter intervals were calculated for all fish species. Length-weight relationships were calculated using the length-weight formula:

 $\log W = \log a + b \log L,$ 

where W is the weight in grams, a is the y axis intercept, b is the slope of the regression line, and L is the total length in millimeters.

### RESULTS

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Initial PINGP preoperational annual environmental reports simply listed all data collected without discussion or analysis (NSP 1972). Individual species were not discussed, due to the amount of data collected during initial sampling efforts. Representative species were selected in 1975 for abundance comparisons based on electrofishing data (Gustafson et. al. 1975), modified in 1986 after seining was eliminated (Donkers 1986), and in 1989 smallmouth and largemouth bass were added as they "have been seen more frequently in the electrofishing catch during recent years in the PINGP study area" (Mueller 1989).

Electrofishing collection methods changed before the 1982 sampling season. The mesh size of the dip nets was increased to one inch stretch mesh. The larger mesh size enabled small adult fish and some young of the year fish of certain species to avoid collection. Currently, individual gizzard shad, freshwater drum, and white bass less than 160 mm are not collected. Also, logperch and cyprinids (other than carp) are no longer collected, due to their small size (Donkers 1987). Therefore, a direct comparison of electrofishing CPUE prior to 1982 is inappropriate to later years.

A total of 7,983 fish, comprising 40 species, was collected in the 2002 survey (Table 1).

Highfin carpsucker, black bullhead, and American eel were sampled in 2002, but not in 2001. Orangespotted sunfish, greater redhorse, and musky were collected in 2001 (Giese and Mueller 2001), but not in 2002.

All species collected in 2002 are ranked according to electrofishing CPUE and listed in Table 2. Summaries for selected species (Tables 3-9) are based on electrofishing and trapnetting data for years 1977 through 1987, and on electrofishing data only for years 1988 through 2002, since trapnetting was discontinued after 1987 (Orr 1988). Annual CPUE for selected species is compared to previous years (Figures 15-22), by sector (Figures 23-30), and by date (Figures 31-38). The top three abundant species, based on CPUE, was determined for each sector.

Sector One;shorthead redhorse, freshwater drum and white bassSector Two;carp, white bass and bluegillSector Three;white bass, carp and smallmouth bassSector Four;white bass, freshwater drum and carpOverall CPUE Average;white bass, carp and freshwater drum

Table 10 summarizes the percent contribution of historically predominant species in the annual catch. Length frequency distributions for selected species are illustrated by sector in Figures 7 through 14.

#### DISCUSSION

When dealing with a large river environment, a high degree of natural variability exists in habitat conditions and therefore, in fish distribution. Palmquist (1982) proposed the wide range in species abundance between study sectors was largely due to habitat preferences of a species rather than PINGP induced. A high degree of variability in species abundance exists within sectors from year to year. Differences in collection efficiency and year class strengths may explain this variability.

A qualitative and quantitative discussion for selected species, with respect to other years, includes: 1) CPUE, 2) rank, 3) percent composition of catch, 4) population condition as depicted by length-weight regression analysis, and 5) mean length.

Average mean length was calculated by splitting the length data for each species into 20 mm intervals and multiplying the number of fish in each interval by the median length of that interval (Example: The number of fish in the 260-279 mm interval was multiplied by 270 mm). Interval totals were summed, divided by the total number of fish, and rounded to the nearest 10 mm.

#### **GIZZARD SHAD**

Electrofishing CPUE for gizzard shad increased from 10.43 fish/hr in 2001 to 14.02 fish/hr in 2002 (Figure 15). CPUE increased in Sectors 1, 3 and 4 from 2001 to 2002, with only a slight decrease evident in Sector 2 (Figure 23). CPUE was also examined on each sampling date for 2002, with the highest occurring in Sector 4 in May (Figure 31).

Shad ranked sixth in 2002 (Table 2), and presently comprise seven percent of the catch (Table 10). The general condition of gizzard shad, 3.200, falls into the range of previous years, 2.388 to 3.934 from 1982-2001 (Table 3). Carlander (1969) sites a population in Canton Lake, Oklahoma with a range in total fish length of 173 to 335 mm and a regression slope of 3.066 which compares well to the fish in this study. The mean length for gizzard shad (350 mm) increased from 2001 (Table 3). The length frequency

data indicates a range of approximately 160-460 mm, with a peak occurring at approximately 350 mm (Figure 7).

#### FRESHWATER DRUM

Freshwater Drum CPUE for 2002, (24.45 fish/hour) decreased from 2001 (28.17 fish/hr), and is the third highest CPUE recorded since 1982 (Figure 16). CPUE was lower in all sectors, except Sector 3, when comparing 2002 to 2001 (Figure 24). The highest CPUE in a sector for any date occurred in Sector 3 in May (Figure 32).

Freshwater drum CPUE ranked third in 2002 (Table 2). Presently, adult freshwater drum comprise twelve percent of the catch (Table 4).

The general condition of freshwater drum has remained relatively stable, as depicted by a regression slope of 3.155 in 2002, in comparison to a range of slopes of 2.598 to 3.212 from previous years of the study (Table 4). The mean length for freshwater drum was approximately 320 mm in 2002 (Table 4). The length frequency data for freshwater drum suggest that a peak occurs at approximately 310 mm (Figure 8).

#### SHORTHEAD REDHORSE

WHITE BASS

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Electrofishing CPUE for shorthead redhorse has ranged from 7.07 to 25.94 fish/hour (Figure 17). CPUE for 2002 (17.23 fish/hr) is the lowest recorded since 1996 (Table 5). Historically, the CPUE within each sector is highly variable (Figure 25). The 2002 CPUE is also variable between sectors, ranging from 11.07 fish/hour in Sector 4, to 30.73 fish/hour in Sector 1 (Table 2). CPUE for each sector is highly variable during the collection year, with the highest CPUE occurring in Sector 1 in June (Figure 33).

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Shorthead redhorse ranked fourth in 2002 (Table 2). Presently, adult shorthead redhorse comprise nine percent of the catch (Table 5).

The general condition of shorthead redhorse has remained relatively stable, as depicted by a regression slope of 2.954 in 2002, in comparison to a range of slopes of 2.571 to 3.041 from previous years of the study (Table 5). The length-weight regression slope of shorthead redhorse in the vicinity of Prairie Island is about the same as that of another population of Upper Mississippi River shorthead redhorse as reported by Carlander (1969) as having a slope of 2.83. The mean length for shorthead redhorse at Prairie Island was approximately 370 mm in 2002 (Table 5). The length frequency data show that the main peak occurs at approximately 370 mm upstream and 420 mm downstream of the plant (Figure 9).

Electrofishing CPUE for white bass in 2002 (41.69 fish/hr) is the highest recorded since the study began (Figure 18). A large difference is evident when comparing CPUE upstream of Lock and Dam 3 to downstream of Lock and Dam 3 (Table 2). Overall CPUE appears cyclic (Figure 18) with year to year variability within each sector (Figure 26). Highest CPUE for any date sampled, occurred in Sector 3 in June with 160+ fish/hr (Figure 34).

White bass ranked first in 2002 (Table 2). Although carp historically has had the highest composition expressed as percentage of total annual catch and resulting CPUE overall, carp ranked second in 2002 (Table 2). Presently, white bass comprise 21 percent of the catch (Table 10).

The general condition of white bass has remained relatively stable, as depicted by a regression slope of 3.042 in 2002, in comparison to a range of slopes of 2.441 to 3.085 from previous years of the study (Table 6). The mean length for white bass is similar to the last seven years (Table 6). The length frequency data shows that a main peak occurs for white bass at approximately 370 mm downstream, and 340 mm upstream, with a smaller peak at approximately 280 mm upstream (Figure 10).

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#### WALLEYE

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Electrofishing CPUE for walleye in 2002 was the highest recorded for the study, (9.75 fish/hour), eclipsing the old record of 8.93 fish/hour set last year (Figure 19). CPUE has increased every year since 1993 (Table 7). Historically, Sector 3 has had the highest CPUE, but Sector 1 has had the highest CPUE the past two years. Sectors 1 and 2 had the highest CPUE recorded since 1982 (Figure 27). The highest CPUE for any sector on any date was Sector 3 in October (Figure 35).

Walleye ranked seventh in 2002 in overall catch abundance (Table 2). Presently, adult walleye comprise five percent of the catch (Table 7). The number of individuals collected has increased every year since 1993, and is the highest recorded since the study began (Table 7).

The general condition of walleye has remained relatively stable, as depicted by a regression slope of 3.257 in 2002, in comparison to a range of slopes of 2.852 to 3.318 from previous years of the study (Table 7). The mean length for walleye decreased from 2001 to approximately 390 mm (Table 7). The length-weight relationship indicates peaks occurring at approximately 220 and 490 mm (Figure 11).

#### **SAUGER**

Electrofishing CPUE for sauger increased from 6.47 fish/hr in 2001 to 7.50 fish/hr in 2002 (Figure 20). Sauger CPUE increased in each sector in 2002, except for Sector 1, compared to 2001 (Figure 28). Sauger CPUE for all sectors increased from May to June, and August to September, then decreased from September to October. Sector 1 had the highest CPUE in September of any sector on any date (Figure 36). Sauger ranked eighth in 2002 (Table 2), comprising four percent of the catch (Table 8).

The general condition of sauger has remained relatively stable, as depicted by a regression slope of 3.350 in 2002, in comparison to a range of slopes of 2.648 to 3.356, in previous years of the study (Table 8). The mean length for sauger was approximately 280 mm in 2002 (Table 8). The length frequency data exhibit a range from 120-510 mm, with relatively broad peaks occurring at approximately 220 mm and 360 mm (Figure 12).

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#### SMALLMOUTH BASS

Electrofishing CPUE for smallmouth bass appears cyclic with the peak CPUE (17.02 fish/hour) occurring in 2000, while 2002 CPUE was 15.91 fish/hr (Figure 21). CPUE in Sectors 1-4 appear cyclic (Figure 29) with curves appearing similar in shape to the curve for all sectors combined shown in Figure 21. The highest CPUE (50+ fish/hr) occurred in Sector 3, June-August (Figure 37).

Smallmouth bass ranked fifth in 2002 (Table 9), comprising eight percent of the catch. The population of smallmouth bass appears to be in good general condition as depicted by a regression line slope of 3.155, which compares well with smallmouth bass populations provided by Carlander (1977). Smallmouth bass have a length frequency range of approximately 110-470 mm, with peaks occurring at approximately 150, 250 and 300 mm upstream, and a relatively broad peak occurring between 300 and 370 mm downstream (Figure 13).

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#### LARGEMOUTH BASS

Largemouth bass CPUE for 2002, (6.14 fish/hour), is the highest recorded since 1988 (Figure 22). Largemouth bass CPUE has increased every year since 1994 (Table 9). The CPUE for Sector 1 was virtually zero for all sampling dates, while Sectors 2-4 have a little more variability (Figure 30). The highest CPUE occurred in Sector 3 in October (Figure 38).

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Largemouth bass ranked eleventh in 2002 (Table 9), comprising three percent of the catch. Historically, largemouth bass rank has varied greatly, ranging from 9th to 20th (Table 9).

The population of largemouth bass appears to be in good general condition as depicted by a regression line slope of 3.221, which compares well with information on largemouth bass populations provided by Carlander (1977). The length frequency data indicates a range of 110-450 mm, with peaks occurring at approximately 220 and 370 mm (Figure 14).

#### GENERAL

The ten most abundant species collected during 2002 in descending order, based on average CPUE for all sectors combined were: 1) white bass, 2) carp, 3) freshwater drum, 4) shorthead redhorse, 5) smallmouth bass, 6) gizzard shad, 7) walleye, 8) sauger, , 9) quillback carpsucker and 10) bluegill (Table 2).

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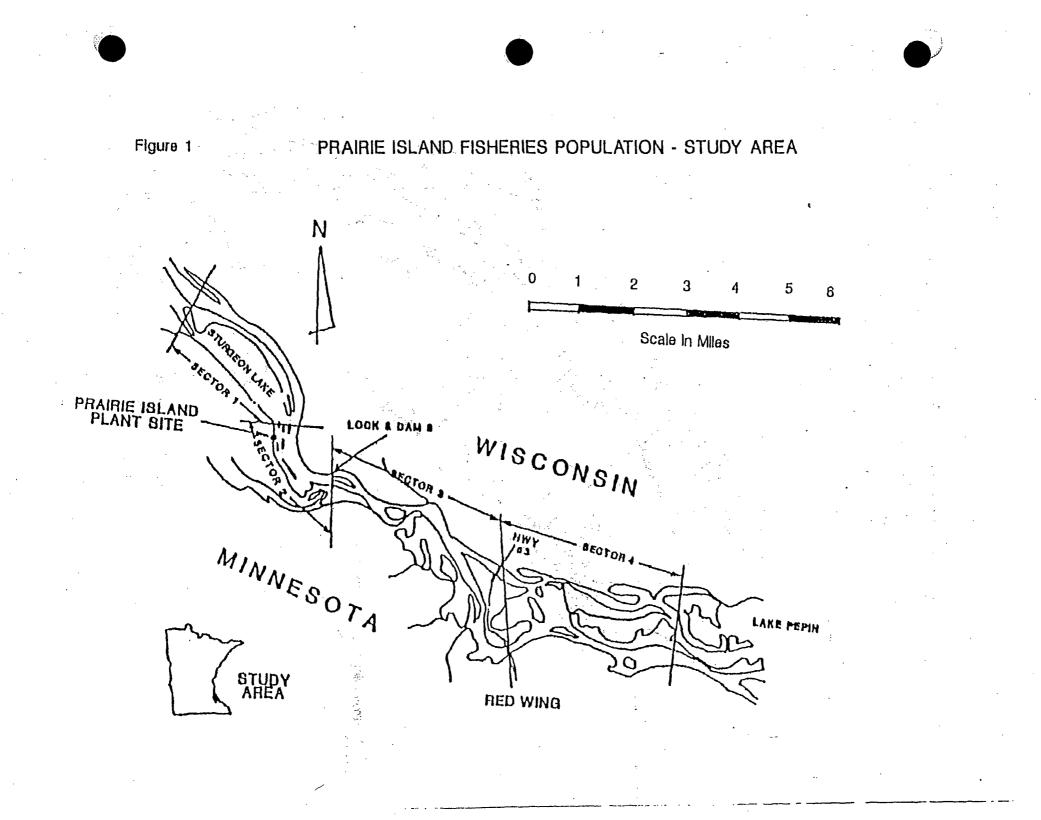
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Total average CPUE for all species and sectors combined increased from 188.07 fish/hr in 2001, to 199.57 fish/hr in 2002 (Table 2).

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PUBLIC ACCESS

PRAIRIE ISLAND NUCLEAR GENERATING PLANT Ν

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Sampling Locations Upstream (Sec 1 Runs 1-20)

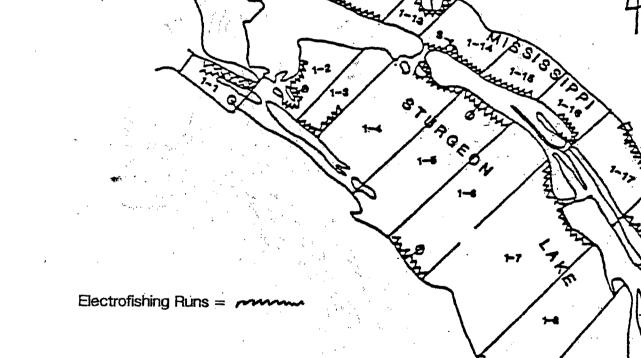




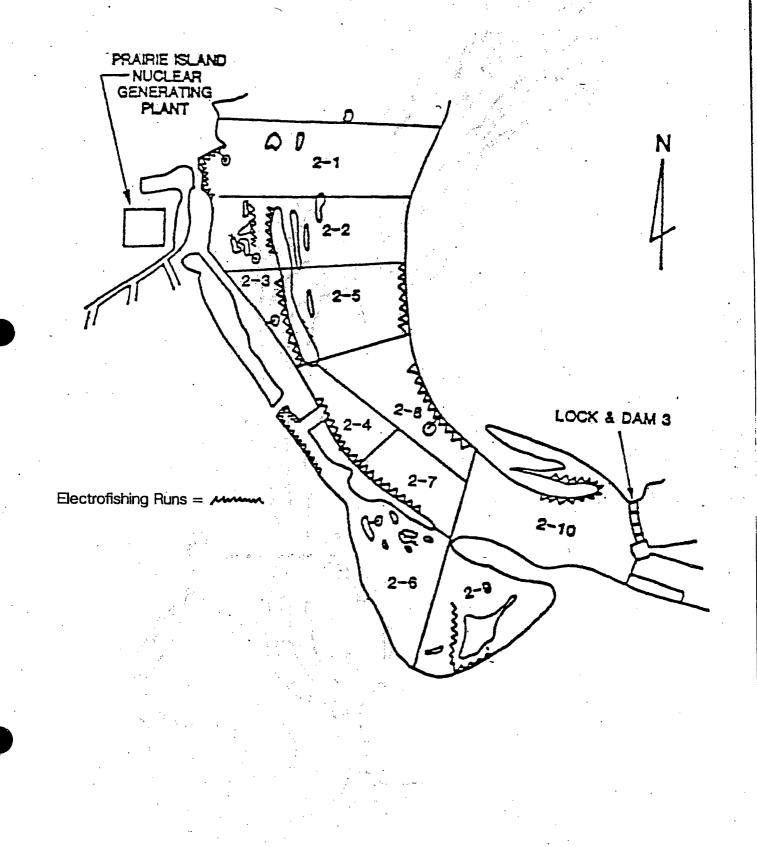
Figure 2,

Figure 3.

# PRAIRIE ISLAND FISHERIES POPULATION STUDY

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Sampling Locations Plant Area (Sec 2 Runs 1-10)



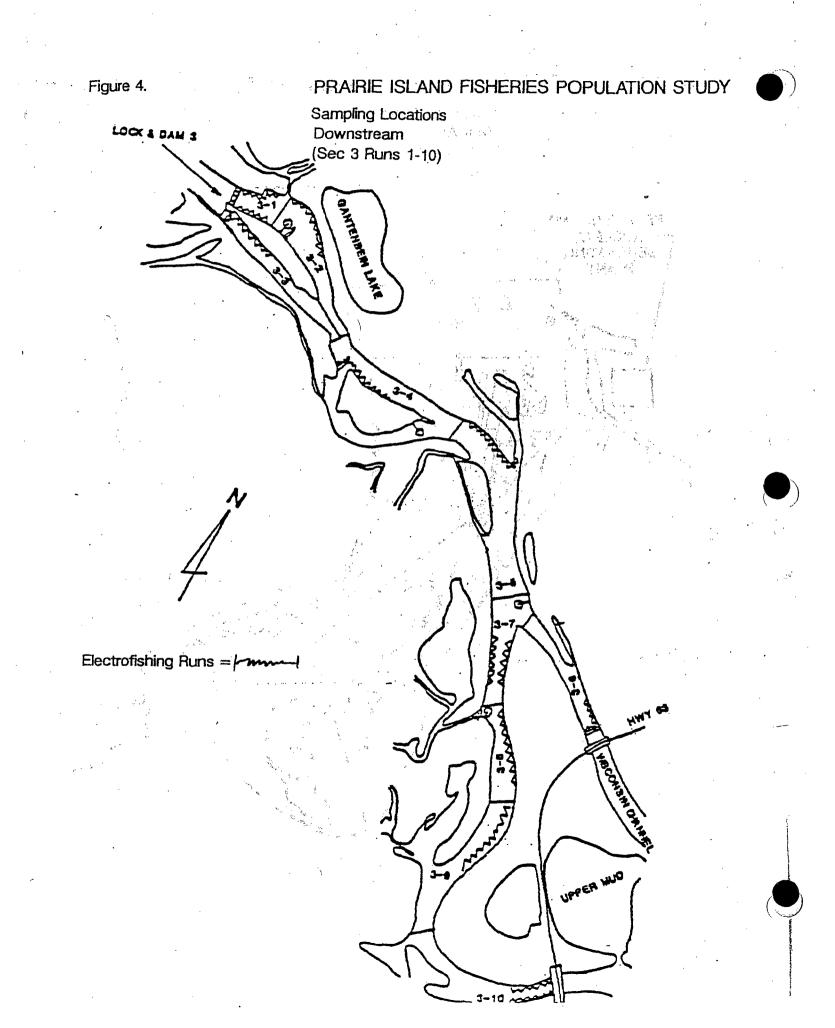


Figure 5.

# PRAIRIE ISLAND FISHERIES POPULATION STUDY

GOOSE LAKE

DEAD SLOUGH

4-18

VISCONSIN

DWN

4-20

AND

2.

Sampling Locations Downstream (Sec 4 Runs 1-20)

LAKE

RED WING

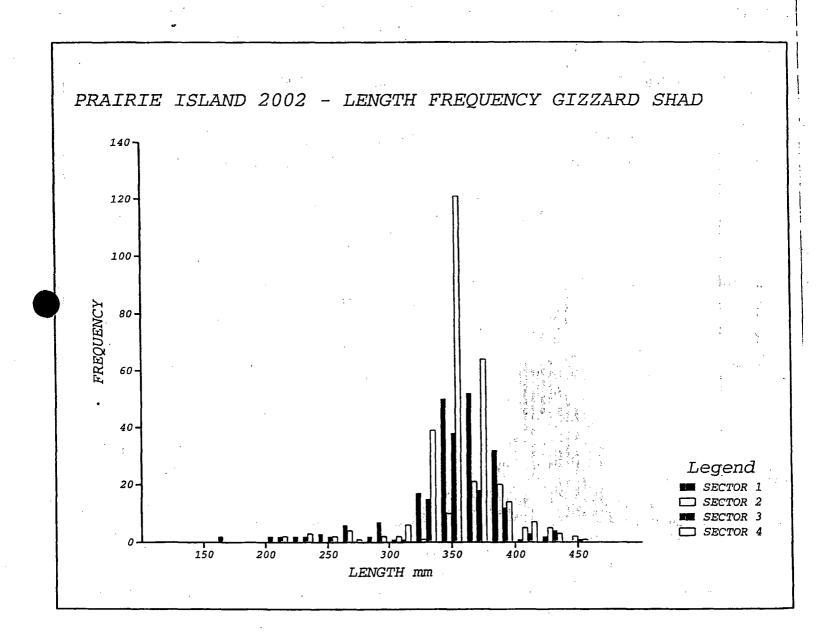
Electrofishing Runs = ~~~~

UPPER MUD

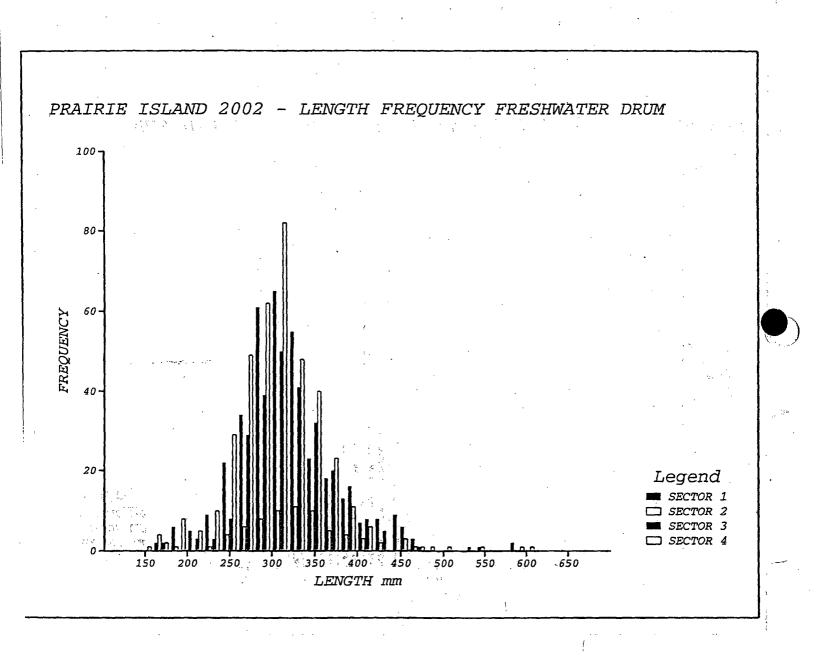
Figure 6 Electrofishing Boat



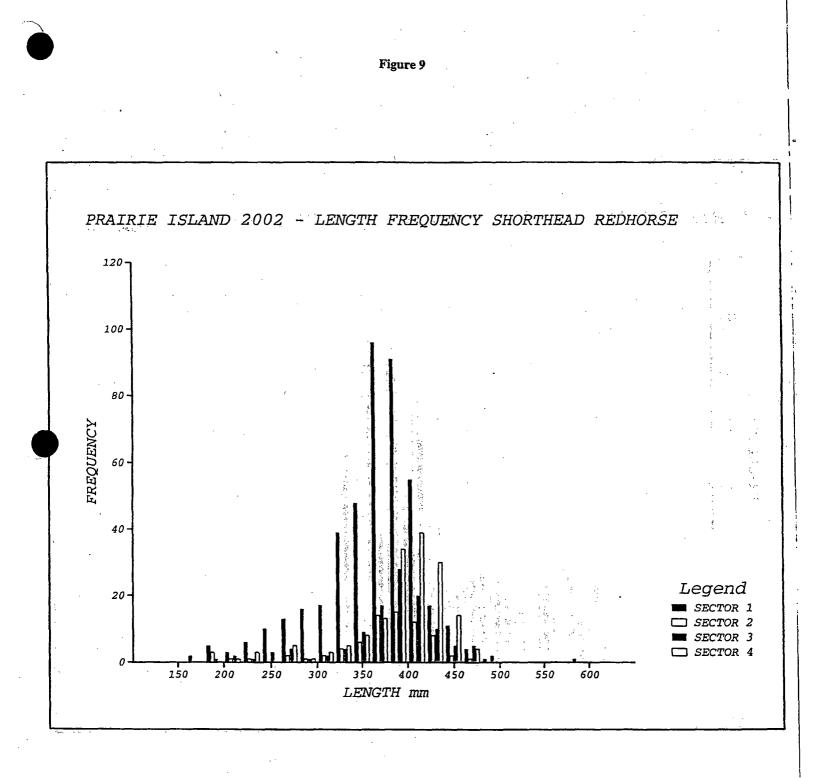




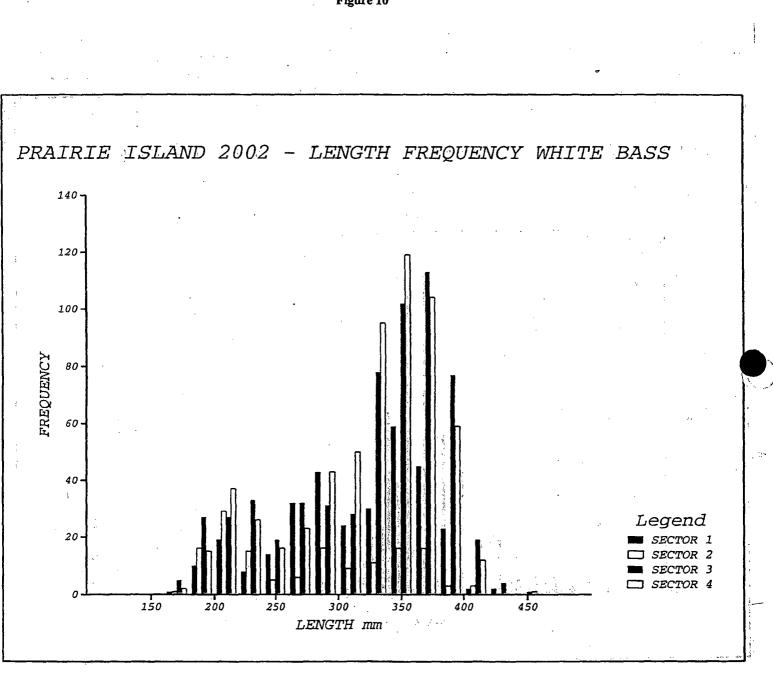
- dian



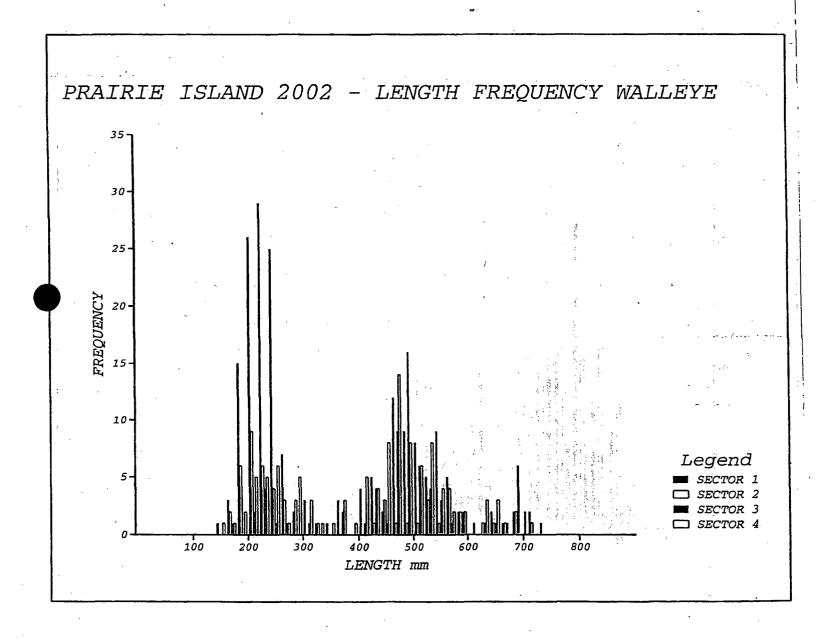


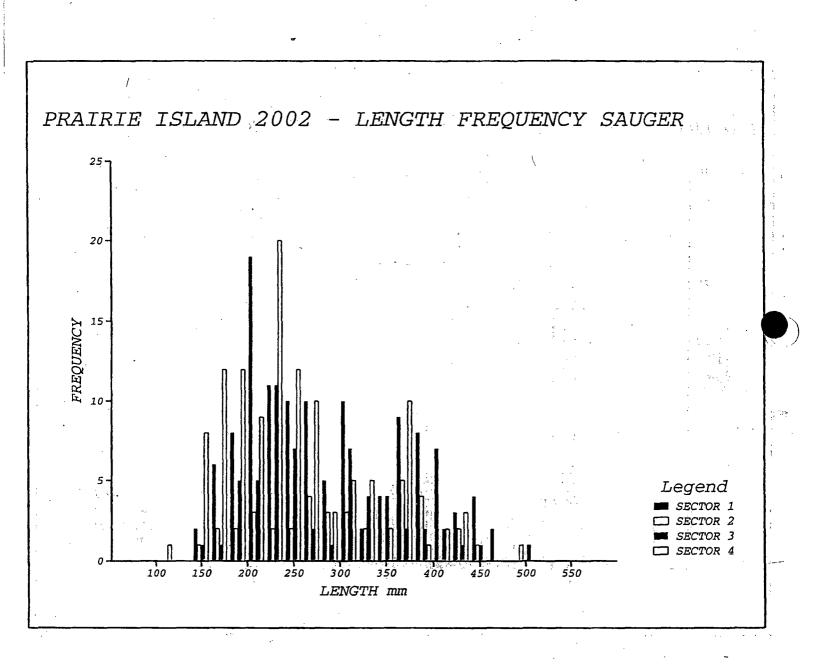


.

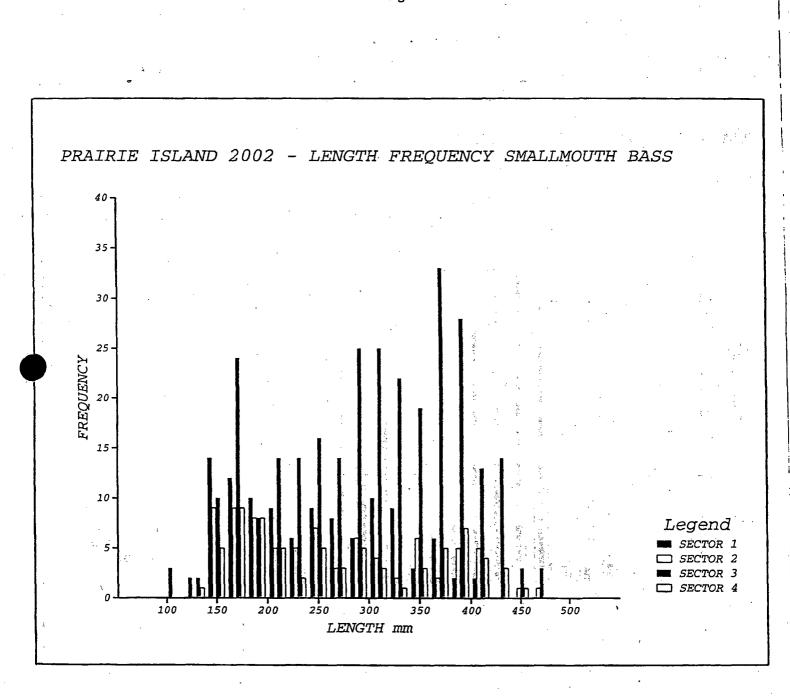


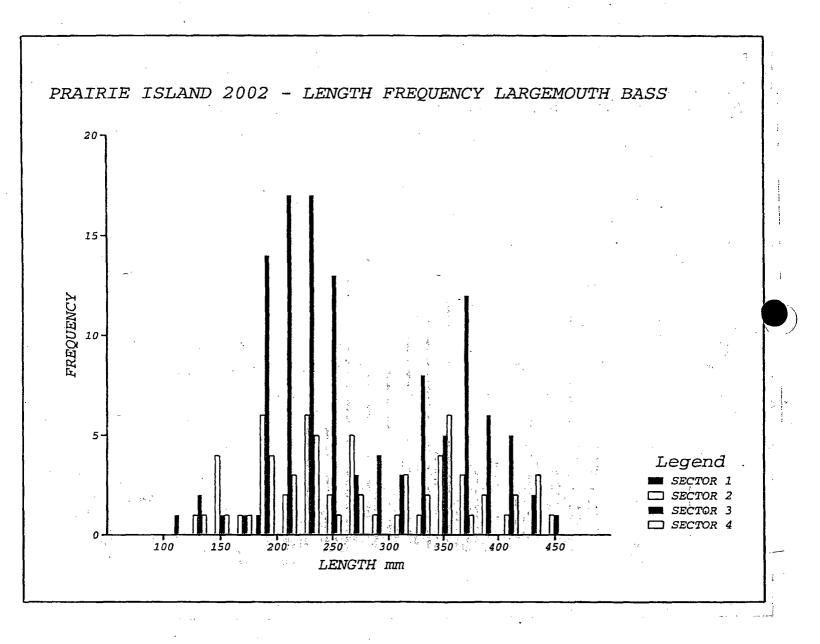












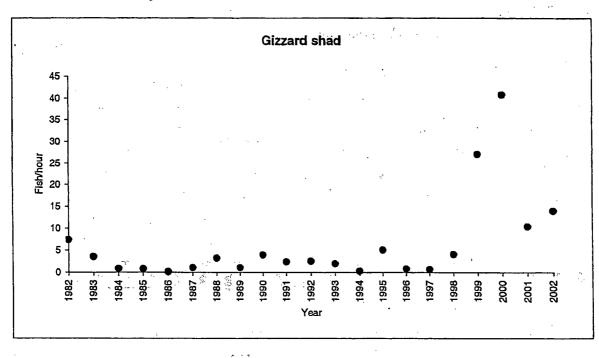
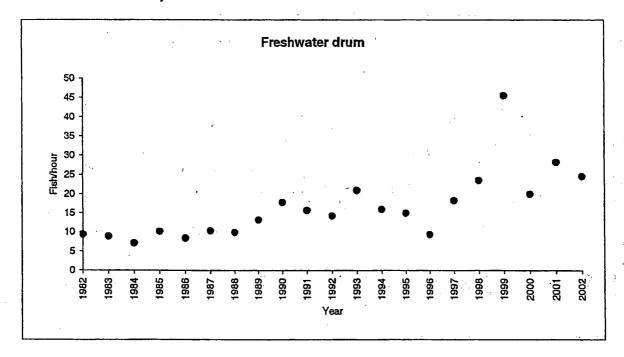
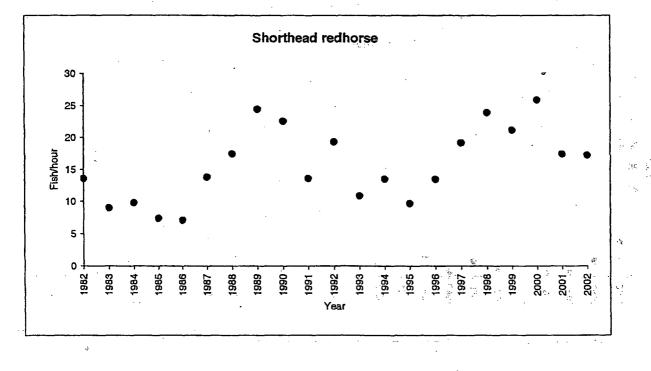


Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2002 in the vicinity of PINGP.

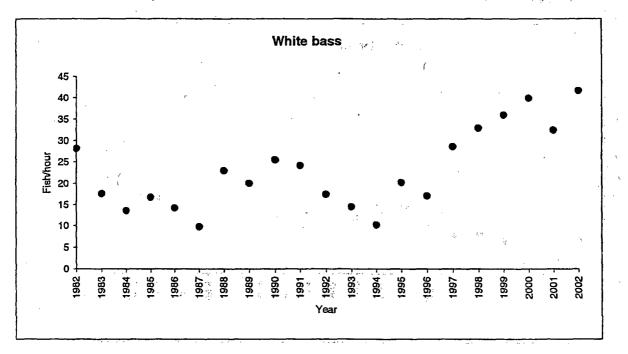
Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2002 in the vicinity of PINGP.

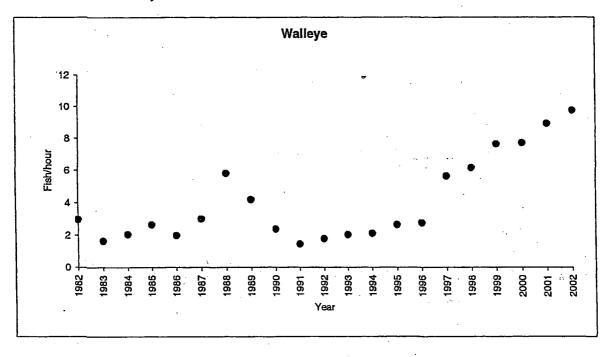




# Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2002 in the vicinity of PINGP.

Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2002 in the vicinity of PINGP.





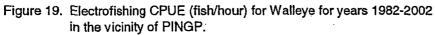
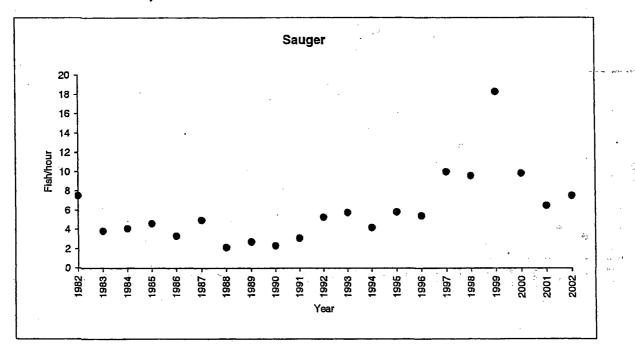
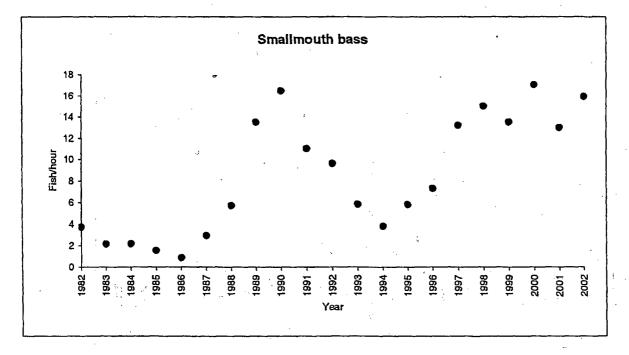


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2002 in the vicinity of PINGP.







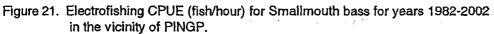


Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2002 in the vicinity of PINGP.

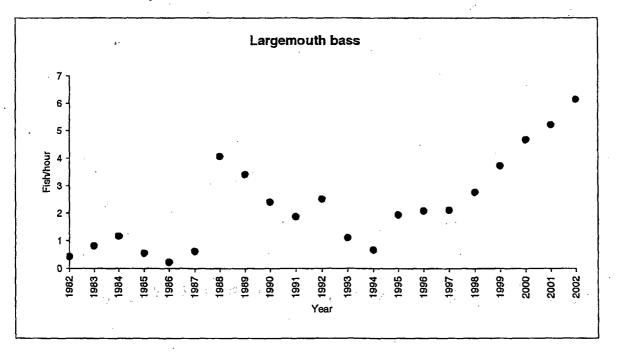
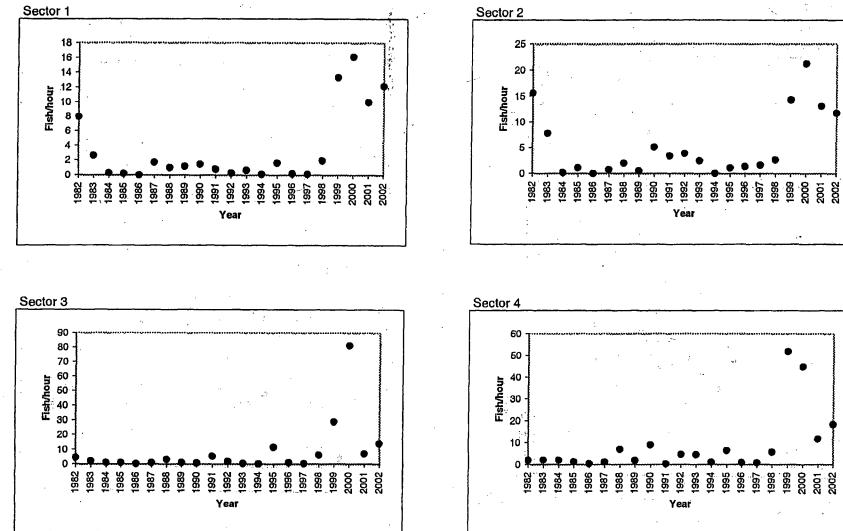




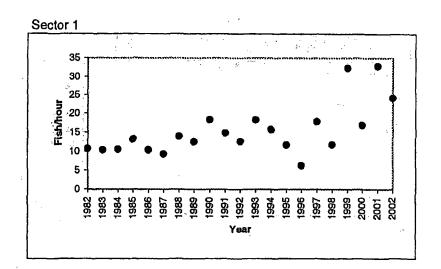
Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2002 in the vicinity of PINGP.

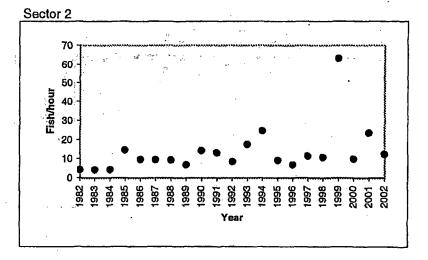


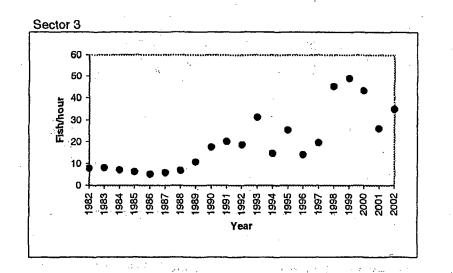
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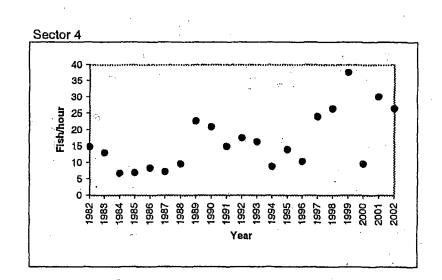
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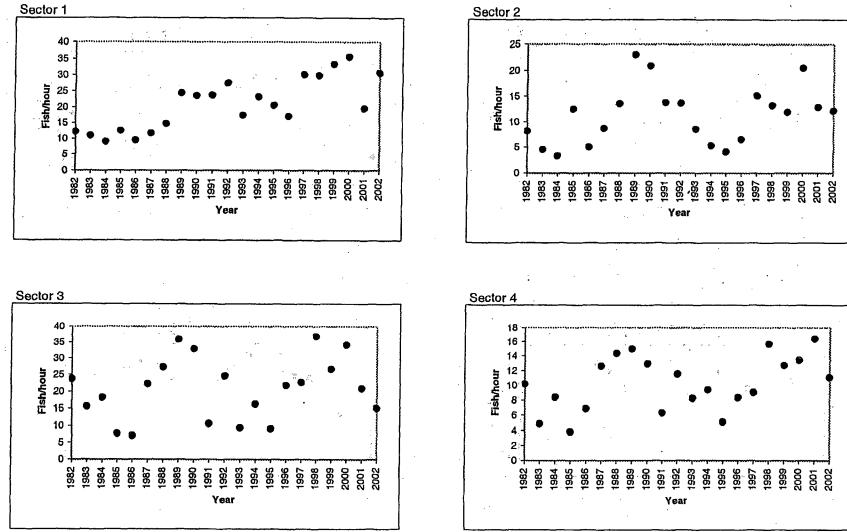








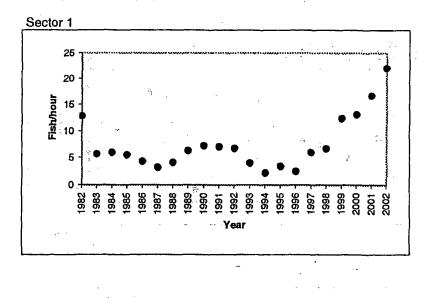


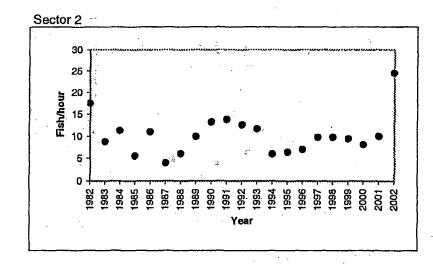


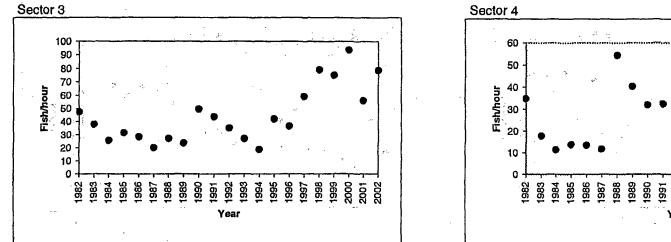
· Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2002 in the vicinity of PINGP.

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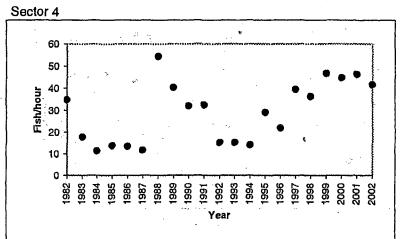
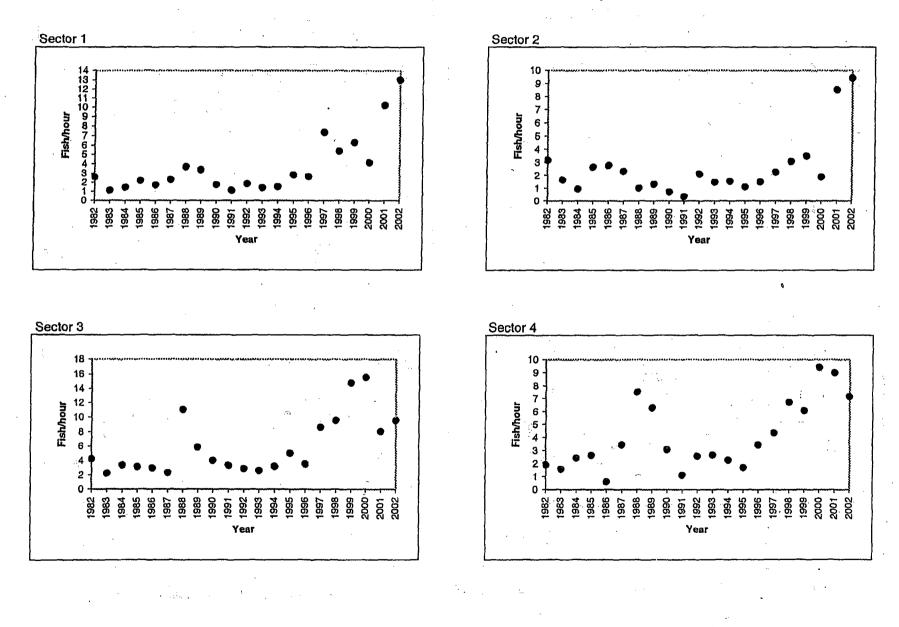


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2002 in the vicinity of PINGP.

Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2002 in the vicinity of PINGP.



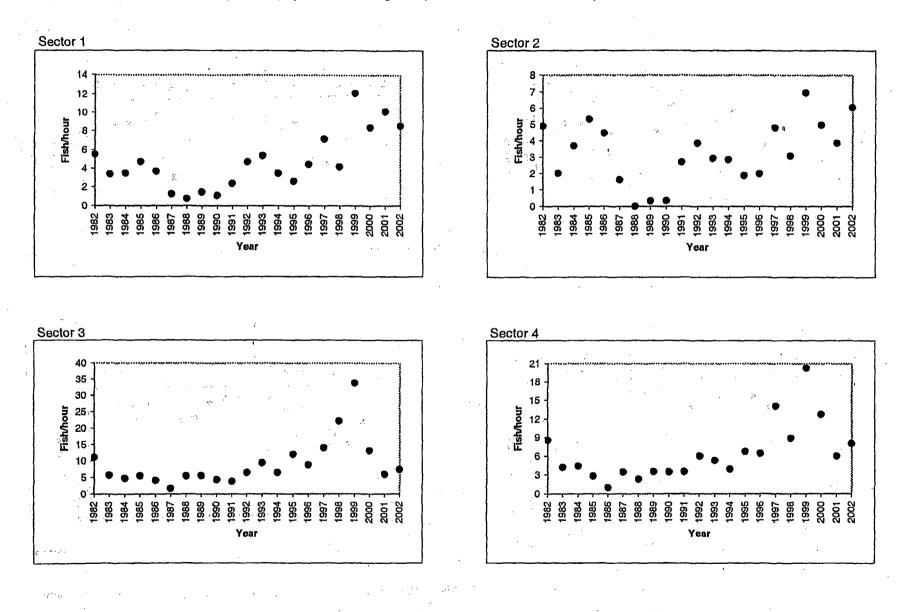


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2002 in the vicinity of PINGP





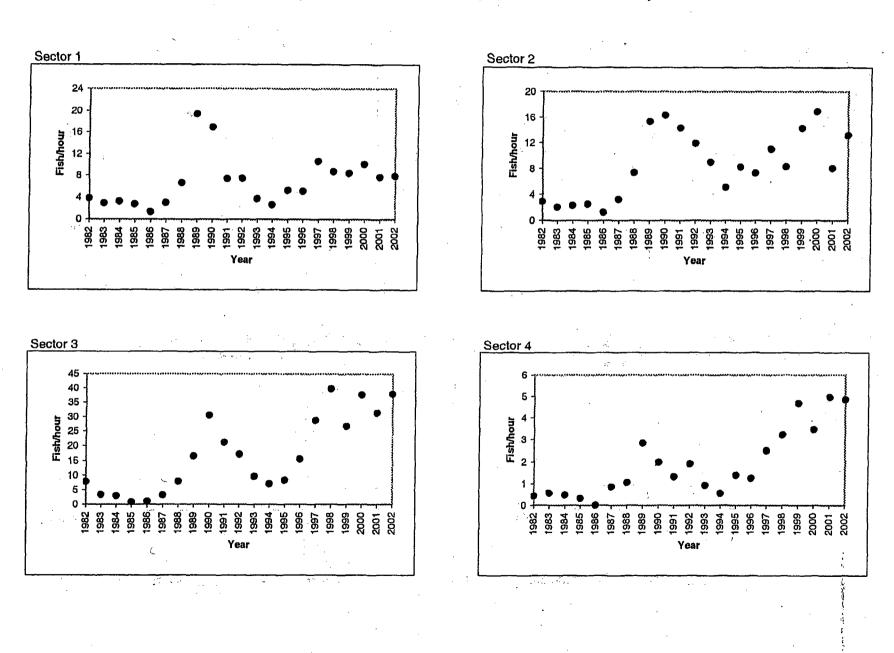


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2002 in the vicinity of PINGP.

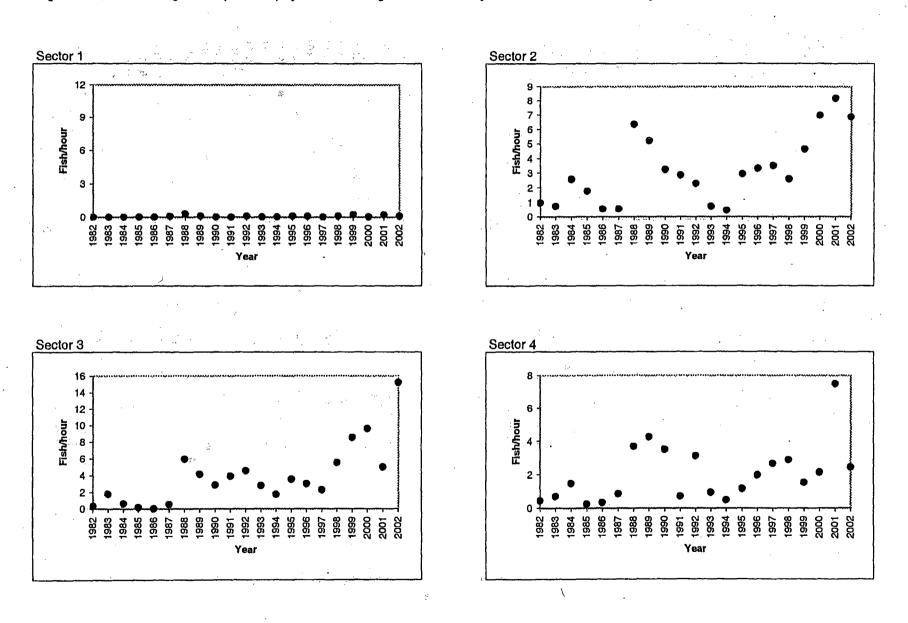
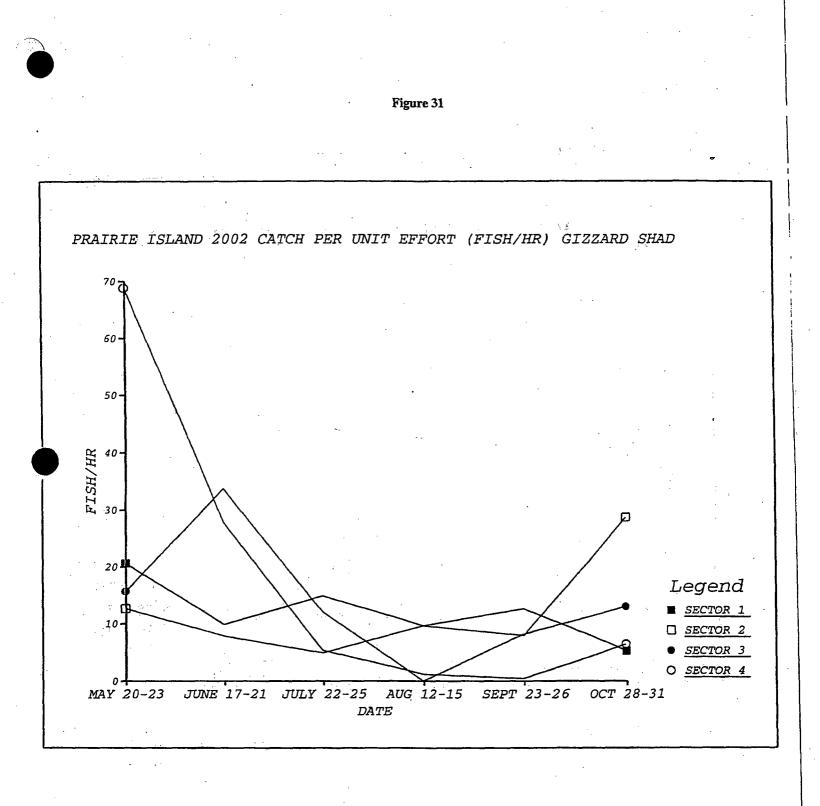
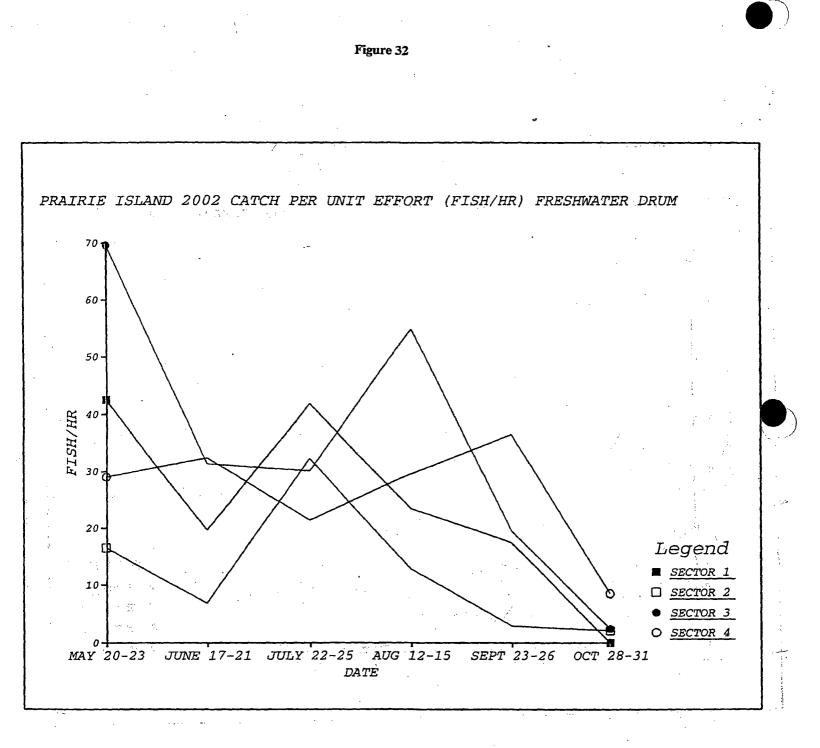
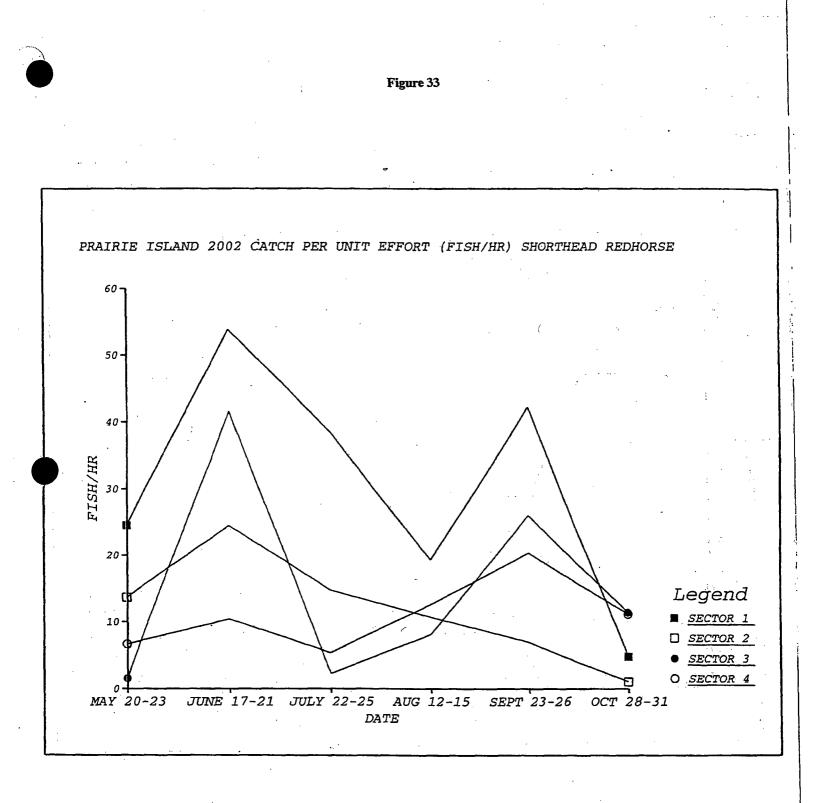


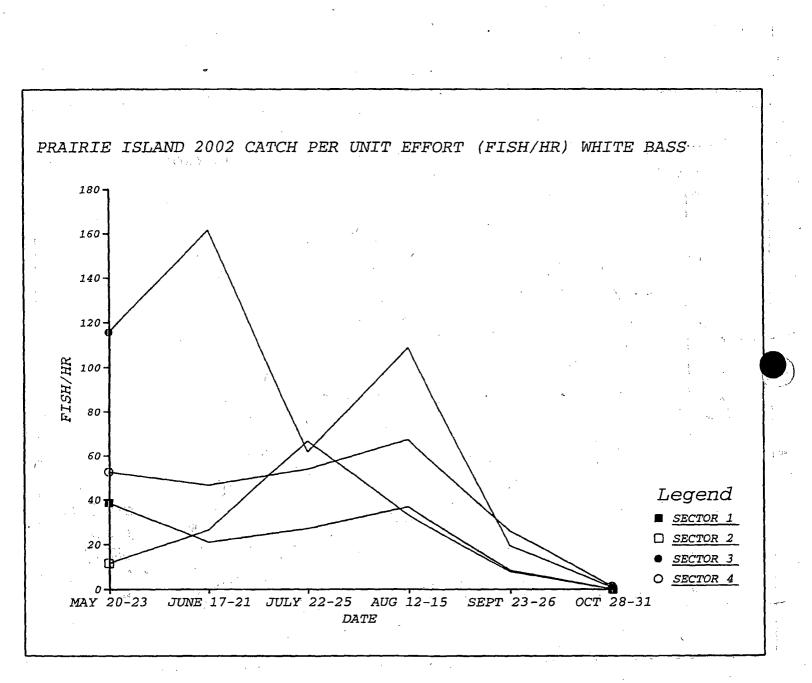
Figure 30, Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2002 in the vicinity of PINGP.

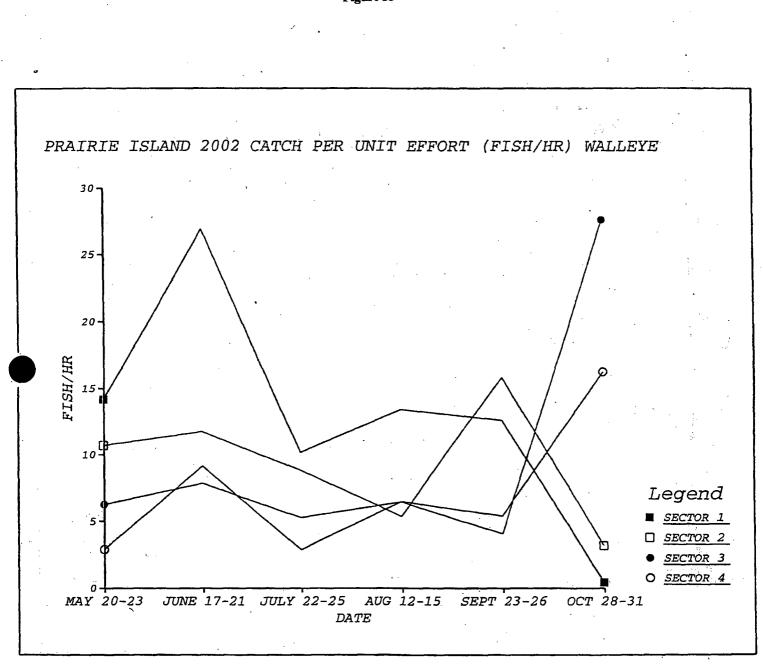
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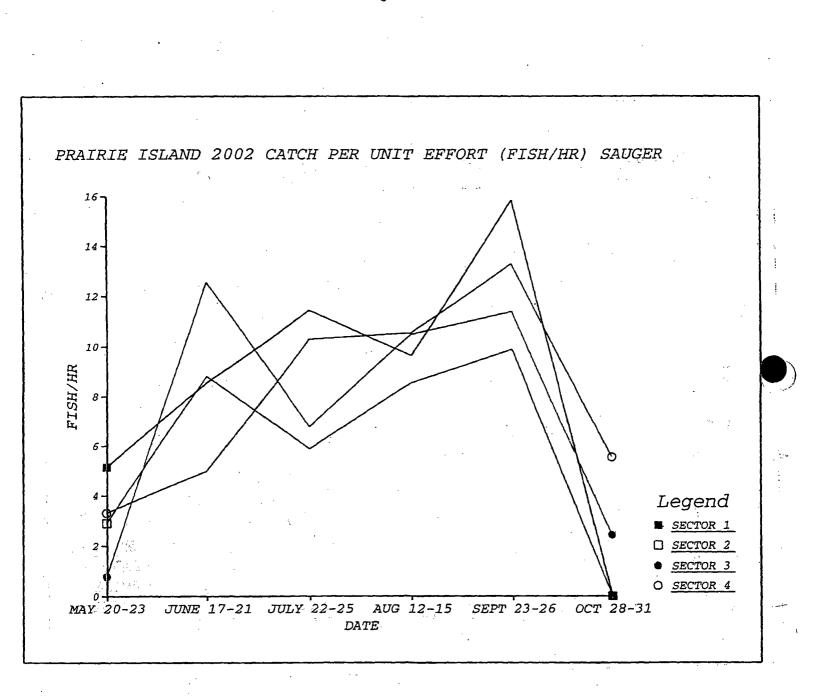




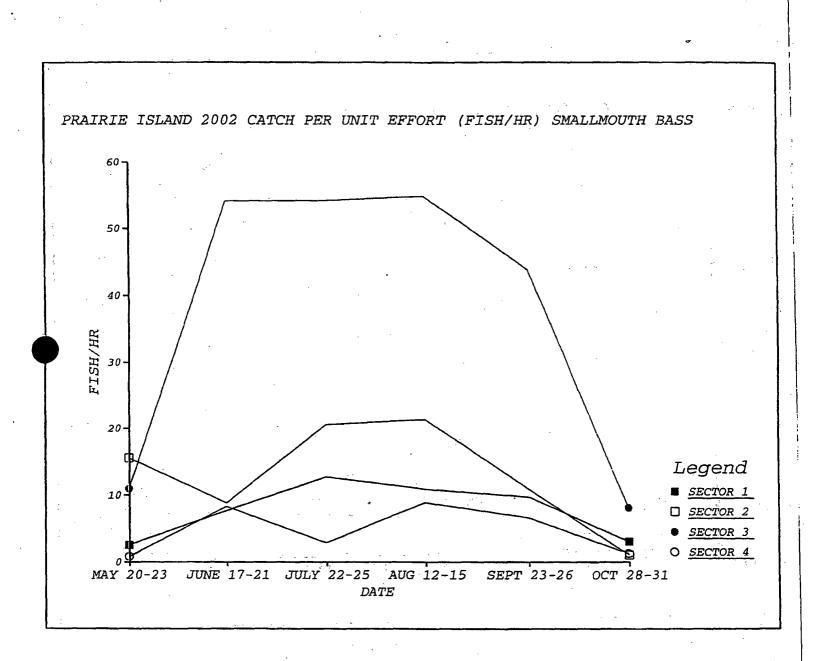


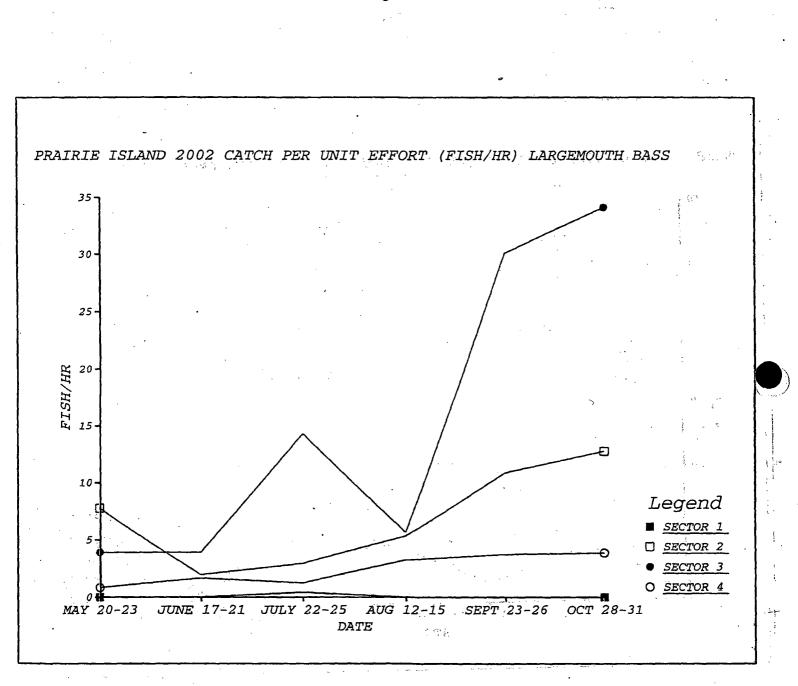






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Chestnut lamprey       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x																							•	
Ichthyomyzon castaneus       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x <th>Species States The</th> <th>83</th> <th>84</th> <th>85</th> <th>86</th> <th>87</th> <th>88</th> <th>89</th> <th>90</th> <th>91</th> <th>92</th> <th>93</th> <th>94</th> <th>95</th> <th>96</th> <th>97</th> <th>98</th> <th>99</th> <th>00</th> <th>01</th> <th>02</th> <th></th> <th></th> <th></th>	Species States The	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02			
Ishtiyomyzon caśtaneus     sikur lamprey     sz     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x     x	and and a second se								-															
Silver lamprey       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x		x	х					٩		х	х			x			х	x		x	x			
Paddlefish       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x	Silver lamprey				•	х	x	х	X	х	x		х	<b>X</b> .	X	x	х	X	x	х	х	1		
Longnose gar       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>x</td><td></td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></t<>																x		4						
Lepisosteus osseus       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x							•	•••				~	~	v	v	v	v	v	v	v	v			
Lepisosteus platostomus       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X <td>Lepisosteus osseus</td> <td>X</td> <td></td> <td>x</td> <td>х</td> <td>x</td> <td>x</td> <td></td>	Lepisosteus osseus	X		x	х	x	x																	
Amia calva       American eel       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x	Lepisosteus platostomus	x	x	х	X	x	х	х	х	. X				X					х	х	х			
Anguilla rostrata       Gizzard shad       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x <th< td=""><td>Amia calva</td><td>X</td><td>х</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>X</td><td>х</td><td>x</td><td>x</td><td>x</td><td>x</td><td>х</td><td>x</td><td>x</td><td>x</td><td></td><td></td><td></td></th<>	Amia calva	X	х	x	x	x	x	x	x	x	x	X	х	x	x	x	x	х	x	x	x			
Gizzard shad       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x <t< td=""><td></td><td>х</td><td>x</td><td></td><td><b>X</b></td><td>x</td><td>x</td><td>X</td><td>х</td><td>х</td><td>х</td><td>x</td><td>х</td><td>х</td><td>x</td><td></td><td></td><td>x</td><td>x</td><td></td><td>x</td><td></td><td></td><td></td></t<>		х	x		<b>X</b>	x	x	X	х	х	х	x	х	х	x			x	x		x			
Goldeyexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx <td>Gizzard shad</td> <td>х</td> <td>x</td> <td>x</td> <td>х</td> <td>x</td> <td>x</td> <td>X</td> <td>x</td> <td>X</td> <td>х</td> <td>x</td> <td>x</td> <td>X</td> <td>x</td> <td>x</td> <td>x</td> <td>х</td> <td>x`</td> <td>х</td> <td>X</td> <td></td> <td></td> <td></td>	Gizzard shad	х	x	x	х	x	x	X	x	X	х	x	x	X	x	x	x	х	x`	х	X			
Mooneye       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x </td <td>Goldeye</td> <td>x</td> <td></td> <td>x</td> <td></td> <td>x</td> <td>х</td> <td></td> <td>•</td> <td>4</td> <td></td> <td>x</td> <td></td> <td></td> <td>X</td> <td>X</td> <td>x</td> <td>x</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Goldeye	x		x		x	х		•	4		x			X	X	x	x						
Brown trout x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x	Mooneye	x	<b>x</b> :	x	x	x	x	х	x	x	х	x	x	×	x	x	x	x	x	x	x			
Northern pike       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       <	Brown trout				x									x		X		x		x	x			
Musky       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x <td>Northern pike</td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> <td>X</td> <td>x</td> <td>х</td> <td>х</td> <td>x</td> <td></td> <td>3</td> <td></td>	Northern pike	x	x	x	x	x	x	X	x	х	х	x	X	x	x	x	x	x	X	x	x		3	
Carpxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx<	Musky																		X	X		-	•	
Carpsucker SpeciesxxCarpiodes speciesRiver carpsuckerxxxxCarpiodes carpioQuillbackxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxxXxxxxXxxxxXxxxxXxxxXxxXxxXxxXxXxXxXxXXXXXXXXXXXXXXXXXXXXXXXXXX<	Carp	x	x	x	X ·	x	х	x	X	<b>x</b> _	x	x	x	x	x	X	x	x	x	x	x			
Carpiodes speciesRiver carpsuckerxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Cyprinus carpio Carpsucker Species		X					x							:			,						
Carpiodes carpional and a construction of the	Carpiodes species	x	x	<b>X</b> .	X s	<b>X</b> .	x	x	x	x	x	X	x	x	x	x	x	x	x	x	x	•		
	Carpiodes carpio																			•				
	Carpiodes cyprinus	^					•								<b>`</b> .		~		· ·					
Highfin carpsucker     X     X     X     X     X     X     X       Carpiodes velifer     -     -     -     -     -				х	Х	х	X	X	х	X	X	Χ_	<b>X</b>	~	<b>^</b> :	~	-				~			

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Table 1(cont) Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2002. 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 **Species** 83 84 85 Blue sucker Х х х Х Х Х XXX Х Х Х Х Х х Х X Х Cycleptus elongatus Northern hogsucker Х X X Hypentelium nigricans Smallmouth buffalo Х х Х Χ. х х х Х Х Х х х х х х х х Ictiobus bubalus Bigmouth buffalo х х х х Х х х х Х х х х х х х Ictiobus cyprinellus Spotted sucker X . X х х Х х Minytrema melanops Silver redhorse Х х х х х Х х Х Х Х Х х Х х х Х Х х Х х Moxostoma anisurum **River redhorse** Х Х х Х х х Х Х х х Х Χ. Х х Moxostoma carinatum Golden redhorse х Х х х х х х х х х х Х Х х х х х х х Х Moxostoma erythrurum Greater redhorse х Х Х Ŷ. Х Х х Moxostoma valenciennesi

X Shorthead redhorse х Х х х х Х Х Х Х Х Х Х Х х Х Х х х Х M.macrolepidotum Black bullhead Х Х Х Х Х х х Х · X х Ictalurus melas Yellow bullhead Х х Х Х Х Ictalurus natalis Brown bullhead Х Ictalurus nebulosus Channel catfish Х х Х X Х Х Х Х Х х Х х х Х Х х Х х Х Х Ictalurus punctatus Flathead catfish Х х х х х х х х Х Χ., Х х х х х Х X х Pylodictus olivaris Х Х Х Х Х Х х х Х Х Х Х Х Х Lota lota х Х Х Х White bass Х Х Х Х Х Х Х Х х х х Х Х х х х

Morone chrysops  $\boldsymbol{\xi}_{i,\tau}$ Rock bass Х Х X Х Χ. Х х Х Х х Х х Х х Х х Х х х х Ambloplites rupestris Green sunfish х х Х х Х х х х Х Х Х Х . **X** Х Х Х х Х . . . Lepommis cyanellus · • · • ....

> 1 2 2 3 4 1 T



Burbot

Species       83       84       85       86       87       88       89       90       91       92       93       94       95       96       97       98       99       00       01       02         Pumpkinseed       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x <th>Species</th> <th>83</th> <th>84</th> <th>85</th> <th>86</th> <th>87</th> <th>88</th> <th>89</th> <th>90</th> <th>91</th> <th>92</th> <th>93</th> <th>94</th> <th>95</th> <th>96</th> <th>97</th> <th>98</th> <th>99</th> <th>00</th> <th>01</th> <th>02</th> <th></th>	Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	
Lepomis macrochirus       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x	openeo	00	04	00		01	00	03	50		52	90	74	90	90	51	90	99	00	UI.	02	
Lepomis macrochirus       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x	Pumpkinseed							x	x	x	x	x	x	x	x	x	x	x	x	x	<b>x</b>	
Lepomis humilis         Bluegill       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x </td <td>Lepomis macrochirus</td> <td></td> <td>~</td> <td></td> <td></td> <td>n</td> <td></td>	Lepomis macrochirus																	~			n	
Bluegill       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x<								•			•						х		х	x		
Leponts macrochirus       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x																						
Smallmouth bass       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x		Х	х	x	х	х	х	х	х	х	х	Χ.	х	х	х	х	X	х	х	х	х	
Micropterus dolomieui         Largemouth bass       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x																					•	
Largemouth bassxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx		X	Х	X	Х	х	Х	X	Х	х	Χ.	Х	Х	Х	Х	х	Х	Х	<b>X</b> .	Х	Х	
Micropterus salmoides         White crappie       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X       X				,															•			
White crapple       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       <		X	х	x	х	х	. <b>X</b>	Х	х	х	х	<b>.</b> X	х	х	X	х	<b>, X</b>	х	х	Х	X	
Pomoxis annularisBlack crapplexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>•</td> <td></td> <td></td> <td>•</td> <td></td> <td></td> <td></td> <td>•</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>									•			•				•						
Black crapple       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       <		Х	Х	Х	X	<b>X</b>	Х	X	Х	х	х	Х	х	Х	Х	х	х	х	х	х,	x	
Pomoxis nigromaculatus         Yellow perch       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x		~	v	~	~									~								
Yellow perchxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx <th< td=""><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>х</td><td>X</td><td>Х</td><td>X</td><td>X</td><td>X</td><td><b>X</b> .'</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></th<>		X	X	X	X	X	X	X	X	х	X	Х	X	X	X	<b>X</b> .'	X	X	X	X	X	
Perca flavens         Sauger       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x		Y.	Y	Y		v	v	v	v	v	v	v	v	v		v	v	v		v	×	
Sauger       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x <td>•</td> <td>^</td> <td>~</td> <td>^</td> <td></td> <td>^</td> <td>^ .</td> <td>^</td> <td>^</td> <td>^</td> <td>^</td> <td>^</td> <td>^</td> <td>^</td> <td></td> <td>^</td> <td>^</td> <td>^ .</td> <td></td> <td>^</td> <td>^</td> <td></td>	•	^	~	^		^	^ .	^	^	^	^	^	^	^		^	^	^ .		^	^	
Stizostedion canadense         Walleye       X X X X X X X X X X X X X X X X X X X		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Walleye     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X <t< td=""><td></td><td></td><td></td><td></td><td></td><td>•••</td><td></td><td>~</td><td>~</td><td>~</td><td>~</td><td>~</td><td>~</td><td>~</td><td>~</td><td>~</td><td>~</td><td>~</td><td></td><td>~</td><td></td><td>•</td></t<>						•••		~	~	~	~	~	~	~	~	~	~	~		~		•
Stizostedion vitreum         Saugeye         S. vitreum x S. canadense		х	х	х	х	х	х	х	х	х	х	x	х	х	x	х	х	x	х	х	x	
Saugeye x x x x x x X X X X X X X X X X X X X		• •			• •	••																
S. vitreum x S. canadense														~		х	х	х		X	Χ.	
		х	х	х	х	x	х	х	x	x	x	x	х	х	x	х	х	x	х	· X	x	

## Table 2. Electrofishing CPUE (fish/hour) for each sector in the vicinity of PINGP during 2002. Species are listed in ascending order by rank according to average CPUE.

1993

•		:	. 1		
Rank Species	Sector 1	Sector 2	Sector 3	Sector 4	Average
	22.04	24.51	78.60	41.63	41.69
1 White bass	22.04 16.67	24.51 29.04	39.96	24.28	27.49 °
2 Carp		29.04 12.42		26.35	
3 Freshwater drum	24.23	12.42	34.82 15.03	11.07	24.45 17.23
4 Shorthead redhorse 5 Smallmouth bass	30.73 7.84	12.09	37.85	4.84	15.91
6 Gizzard shad	12.15	11.75	13.85	18.33	14.02
- Lat - II	10.00	9.40	9.50	7.12	9.75
8 Sauger	8.55	6.04	9.30 7.39	8.02	7.50
9 Quillback carpsucker	8.19	11.25	1.45	4.01	6.23
40 Diversili	0.42	15.95	5.80	2.63	6.20
10 Bluegill 11 Largemouth bass	0.42	6.88	15.17	2.00	6.14
12 Smallmouth buffalo	3.53	7.72	0.66	2.21	3.53
13 Black crappie	0.14	6.04	2.51	5.12	3.45
14 Flathead catfish	1.20	2.69	7.52	1.31	3.18
15 Silver redhorse	5.86		0.66	2.49	2.76
16 Channel catfish	1.77	7.55	0.00	0.48	2.65
17 Green sunfish	0.07		1.19	0.00	0.86
18 Blue sucker	1.70	0.50	0.40	0.69	0.82
19 Bowfin	0.00		0.92	2.01	0.73
20 Bigmouth buffalo	0.42	0.67	0.66	0.97	0.68
21 Northern pike	0.21	0.17	1.58	0.62	0.65
22 Longnose gar	0.14	0.84	0.79	0.28	0.51
23 White crappie	0.00	1.85	0.13	0.07	0.51
24 Silver lamprey	0.57	0.50	<b>0.79</b>	0.07	0.48
25 Rock bass	0.71	0.00	0.13	0.83	0.42
26 River carpsucker	0.49	0.34	0.26	0.28	0.34
27 Mooneye	1.13	0.00	0.00	0.21	0.33
28 Shortnose gar	0.14	0.17	0.53	0.14	0.24
29 Golden redhorse	0.14	0.17	0.40	0.14	0.21
30 River redhorse	0.28	0.17	0,13	0.07	0.16
31 Yellow perch	0.00	0.34	0.00	0.14	0.12
32 White sucker	0.07	0.00	0.26	0.00	0.08
33 Pumpkinseed	0.00	0.00	0.00	0.21	0.05
34 Brown trout	0.07	0.00	0.13	0.00	0.05
35 American eel	0.00	0.00	0.13	0.00	0.03
36 Burbot	0.00	0.00	0.13	0.00	0.03
37 Saugeye	. 0.07	0.00	0.00	0.00	0.02
38 Highfin carpsucker	0.00	0.00	0.00	0.07	0.02
39 Black bullhead	0.00	0.00	0.00	0.07	0.02
40 Chestnut lamprey	0.00	0.00	0.00	0.07	0.02
Totals	162.61	186.32	280.11	169.23	199.57

	i able 3.	Fisheries su			au 1977-2	2002.	في و ۱	and the second	
		ELECTRO			,	* 1			
		CPUE	CPUE	COMP	•	MEAN			
	YEAR	Fish/hr	Fish/hr	(%)	the second s		and the second se	REGRESSION	
	1977	1-	, 0,61	4	135		DG W=3.101 L		
	1978		0.20	5	73		DG W=3.068 L	OG L-5.078	
	1979		0.06	1	NA	NA 🚽	NA		
	1980	10.83	0.14	7	NA	NA ⁱⁿ	NA	e de la care br>La care de la	
	1981	23.03	0.38	9	917	216 LC	OG W=2.748 Ŀ	OG L-4.348	
	1982	7.39	0.09	:3	276	329 L(	DG W=2.917 L	OG L-4.741	
	1983	3.57	0.26	2	155		DG W=3.029 L	2	
	1984	0.84	0.08	<b>1</b>	48		DG W=2.684 L		
	1985		0.01	1	31		DG W=2.388 L	1	
	1986		0.06	<1	13		DG W=3.248 L		
	1987	,	0.05	1	55		DG W=3.030 L	, ,	
	1988		ŇA	3	139		DG W=2.629 L	(a) (a) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b	
	1989		NA	<1	47		DG W=3.025 L	· · · · · · · · · · · · · · · · · · ·	
	1990		NA	3	170		DG W=2.956 L		
	1991		NA	- 4	198		DG W=2.601 L		
	1992		NA NA	· 1.8	91		DG W=2.601 L DG W=3.459 L		
	1993		NA						
				1.9	62		DG W=2.920 L	A AN ALL A A A A	
	1994 1995		NA	-<1	14		DG W=3.371 L	the second se	
		1994 ) a	NA	4	204		DG W=2.625 L	National Additional Additional Additional Additional Additional Additional Additional Additional Additional Add	
	1996			<1	27		DG W=3.275 L	and strategies a	
	1997		NA	<1	23		DG W=3.934 L	The second se	
	1998		NA	2	176		DG W=3.104 L	· · · · · · · · · · · · · · · · · · ·	
	1999		NA	12	1222		DG W=2.981 L		
	2000		NA NA	<b>: 17</b>	1634		DG W=3.274 L	and the second	
	<u>`</u> 2001	10.43	NA	6	455	340 LO	DG W=3.767 L	OG L-6.967	. ¹⁷ .
		10.43				340 LO		OG L-6.967	, ¹⁷ 4
	<u>`</u> 2001	10.43	NA NA	6	455	340 LO	DG W=3.767 L	OG L-6.967	. 17.5
	<u>`</u> 2001	10.43	NA	6	455	340 LO	DG W=3.767 L	OG L-6.967	. ***
	<u>`</u> 2001	10.43	NA NA	6	455	340 LO	DG W=3.767 L	OG L-6.967	. ⁹⁶ 9
	<u>`</u> 2001	10.43	NA NA	6	455	340 LO	DG W=3.767 L DG W=3.200 L	OG L-6.967	199
	<u>`</u> 2001	10.43	NA NA	6	455	340 LO	DG W=3.767 L DG W=3.200 L	OG L-6.967	. ** *
	<u>`</u> 2001	10.43	NA NA	6	455	340 LO	DG W=3.767 L DG W=3.200 L	OG L-6.967	. 54 4
•	<u>`</u> 2001	10.43	NA NA	6	455	340 LO	DG W=3.767 L DG W=3.200 L	OG L-6.967	
•••	<u>`</u> 2001	10.43 14.02	NA NA	6 7	455	340 LO	DG W=3.767 L DG W=3.200 L	OG L-6.967	•
~	<u>`</u> 2001	10.43		6 3 7	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 LO	DG W=3.767 L DG W=3.200 L	OG L-6.967	
••*	<u>`</u> 2001	10.43 14.02	NA NA	6 7	455	340 L( 350 L(	DG W=3.767 L DG W=3.200 L	OG L-6.967	· .
•••	<u>`</u> 2001	10.43 14.02		6 3 7	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 LC 350 LC 44 44 44 44 44 44 44 44 44 44 44 44 44	DG W=3.767 L DG W=3.200 L	OG L-6.967	· .
	<u>`</u> 2001	10.43 14.02	NA NA NA NA NA NA NA NA NA NA NA NA NA N	6 7	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 LC 350 LC 444 444 444 444 444 444 444 444 444 4	DG W=3.767 L DG W=3.200 L	OG L-6.967	· .
	<u>`</u> 2001	10.43 14.02	NA NA State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State	6 3 7 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 Lo 350 Lo 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	DG W=3.767 L DG W=3.200 L		· .
	<u>`</u> 2001	10.43 14.02	NA NA State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State	6 3 7 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	455 612 100 100 100 100 100 100 100 100 100 1	340 LC 350 LC	DG W=3.767 L DG W=3.200 L		· .
	<u>`</u> 2001	10.43 14.02	NA NA State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State	6 3 7 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	455 612 100 100 100 100 100 100 100 100 100 1	340 Lo 350 Lo 24 24 24 24 24 24 24 24 24 24 24 24 24	DG W=3.767 L DG W=3.200 L	OG L-6.967	· .
	<u>`</u> 2001	10.43 14.02	NA NA NA Solution Solution Solution Constant Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution Sol	6 7	455 612 700 700 700 700 700 700 700 700 700 70	340 Lo 350 Lo 24 24 24 24 24 24 24 24 24 24 24 24 24	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
	<u>`</u> 2001	10.43 14.02	NA NA State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State State	6 3 7 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	455 612 100 100 100 100 100 100 100 100 100 1	340 LC 350 LC	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
•••	<u>`</u> 2001	10.43 14.02	NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Sec	6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 Loo 350 Loo 350 Loo 340 Lo	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
	<u>`</u> 2001	10.43 14.02	NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Sec	6 7	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 Lo 350 Lo 24 24 24 24 24 24 24 24 24 24 24 24 24	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
	<u>`</u> 2001	10.43 14.02	NA NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second	6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 Loo 350 Loo 350 Loo 340 Lo	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
•••	<u>`</u> 2001	10.43 14.02	NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Sec	6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 Loo 350 Loo 350 Loo 340 Lo	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
	2001	10.43 14.02	NA NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second	6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 Lo 350 Lo 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
	<u>`</u> 2001	10.43 14.02	NA NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second	6 3 7 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	455 612 200 200 200 200 200 200 200 200 200 2	340 Lo 350 Lo 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
	2001	10.43 14.02	NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Sec	6 3 7 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	455 612 20 20 20 20 20 20 20 20 20 20 20 20 20	340 Lo 350 Lo 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·
	2001	10.43 14.02	NA NA NA Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second	6 3 7 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	455 612 200 200 200 200 200 200 200 200 200 2	340 Lo 350 Lo 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	DG W=3.767 L DG W=3.200 L		· · · · · · · · · · · · · · · · · · ·

 Table 3.
 Fisheries summary for Gizzard shad 1977-2002.

 ELECTRO_TRAPNET__CATCH



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ĺ	ELECTRO ⁻	TRAPNET	CATCH			gen in the second
	CPUE	CPUE	COMP		MEAN	$\frac{34}{2}$
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
1977	7.49	5.27	13	569	NA	LOG W=2.947 LOG L-4.756
1978	11.97	6.28	17	422	NA ⁻	LOG W=2.911 LOG L-4.710
1979	7.47	5.22	ູ 21	360	NA -	LOG W=3.068 LOG L-5.100
1980	5.89	3.83	18	520	NA	LOG W=3.052 LOG L-5.026
1981	30.88	4.76	12	1146	267	LOG W=2.891 LOG L-4.625
1982	9.30	11.00	24	2225	293	LOG W=2.888 LOG L-4.625
1983	8.80	8.18	22	1626	287	LOG W=3.001 LOG L-4.927
1984	7.07	6.21	20	1212	288	LOG W=2.598 LOG L-3.919
1985	10.15	7.92	31	1712	293	LOG W=2.846 LOG L-4.452
1986	8.33	0.39	22	856	310	LOG W=3.089(LOG L-5.139)
1987	10.29	3.75	16	940	312	LOG W=2.874 LOG L-4.603
1988	9.85	. NA	8 🔹	419	280	LOG W=2.722 LOG L-4.205
1989	13.17	NA	11	570	294	LOG W=2.908 LOG L-4.707
1990	17.70	NA	13	724	. 297	LOG W=3.008 LOG L-4.957
1991	15.68	NA	12	596	305	LOG W=2.955 LOG L-4.824
1992	14.23	NA	11	539	320	LOG W=2.967 LOG L-4.829
1993	20.83	NA	18	584	334	LOG W=3.063 LOG L-5.053
1994	15.92	NA	14	495	332	LOG W=3.072 LOG L-5.086
1995	14.96	NA	12	605	317	LOG W=3.124 LOG L-5.243
1996	9.33	NA	8	- 374	300	LOG W=3.061 LOG L-5.093
1997	18.18	NA	10	812	300	LOG W=3.090 LOG L-5.159
1998	23.47	NA	11	983	320	LOG W=3.171 LOG L-5.344
1999	45.53	-NA	17	1745	320	LOG W=3.138 LOG L-5.289
2000	19.88	<b>NA</b>	8	776	310	LOG W=3.077 LOG L-5.161
2001	28.17	NA	15	1279	330	LOG W=3.212 LOG L-5.480
2002	24.45	NA	12	1062	320	LOG W=3.155 LOG L-5.346

 Table 4.
 Fisheries summary for Freshwater drum 1977-2002.

Tuble 0,		TRAPNET	CATCH		1011 200	· <b>C·</b>
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)	N.		LENGTH WEIGHT REGRESSION
1977		1.58	5	259	NA	LOG W=2.902 LOG L-4.691
1978	2.96	1.09		125	NA	LOG W=2.978 LOG L-4.917
1979	2.08	0.45	3	67	NA	LOG W=3.041 LOG L-5.090
1980	6.08	0.70	7	137	NA	LOG W=2.894 LOG L-4.678
1981	11.67	1.34	7	<b>686</b> <	376	LOG W=2.791 LOG L-4.428
1982	13.56	0.92	7	675	392	LOG W=2.814 LOG L-4.496
1983	8.96	0.79	6	454	387	LOG W=2.849 LOG L-4.590
1984	9.74	0.51	7	435	` 386	LOG W=2.571 LOG L-3.840
1985	7.36	0.51	7 型	374	<b>389</b>	LOG W=2.787 LOG L-4.415
1986	7.07	o.19 -	8	319	398	LOG W=2.911 LOG L-4.730
1987	13.80	1.24	12	722	403	LOG W=2.860 LOG L-4.608
1988	ef 17.48	NA	13 📑	667	<b>381</b> )	LOG W=2.696 LOG L-4.176
1989	2 <b>4.52</b>	NA	17	902	370	LOG W=2.792 LOG L-4.448
1990	2 <b>2.60</b>	NA	14	838	361	LOG W=2.825 LOG L-4.544
1991	13.58	.968€ - 5 - 5 <b>NA</b> -	11	538	355	LOG W=2.784 LOG L-4.443
1992	<b>19.35</b>	NA	14	721	403	LOG W=2.841 LOG L-4.587
1993	10.86	NA	· 10	332	382	LOG W=3.011 LOG L-4.991
1994	13.51	736 <b>NA</b> ≜	14	505	389	LOG W=2.872 LOG L-4.655
1995	ia de 1 <b>9.67</b>	<ul> <li>NA</li> </ul>	8	450	364	LOG W=2.925 LOG L-4.808
1996	13.42	NA NA	11	551	380	LOG W=2.897 LOG L-4.719
1997	a <b>19.21</b>	N.A. NA	10	833	350	LOG W=2.982 LOG L-4.960
1998	23.94	NA	12	1047	360	LOG W=2.982 LOG L-4.960
1999	21.17	NA	: <b>9</b>	931	350	LOG W=3.016 LOG L-5.050
2000	<b>25.94</b>	NA	11	1099	360	LOG W=2.905 LOG L-4.760
2001	17.43	NA	9	777	370	LOG W=3.039 LOG L-5.101
2002	17.23	NA	. 9	781	370	LOG W=2.954 LOG L-4.892
		1 A A				

 Table 5.
 Fisheries summary for Shorthead redhorse 1977-2002.

 FLECTBO_TRAPNET_CATCH





Table 0.	ELECTRO			3 13/1-20		· · ·
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
1977		.6.73	19	565	NA	LOG W=2.441 LOG L-3.529
			19	369		LOG W=2.956 LOG L-3.529
1978		5.67		14.4.4	NA	LOG W=2.958 LOG L-4.815
1979		3.02	13	217		
1980		1.97	9	183	NA	LOG W=3.064 LOG L-5.022
1981		5.39	20	1996	240	LOG W=2.842 LOG L-4.498
1982		0.07	18	1722	286	LOG W=2.909 LOG L-4.677
1983		4.52	17	1277	300	LOG W=3.041 LOG L-5.021
1984		2.89	15	435	304	LOG W=2.571 LOG L-3.840
1985	16.75	1.39	14	768	308	LOG W=2.773 LOG L-4.337
1986	14.23	1.63	18	732	325	LOG W=2.926 LOG L-4.716
1987	9.70	1.44	10	589	321	LOG W=3.027 LOG L-4.958
1988	22.90	NA	20	1009	242	LOG W=2,855 LOG L-4.525
1989	20.00	NA	15.	819	266	LOG W=2.945 LOG L-4.765
1990	) 25.49	NA	16	941	295	LOG W=2.913 LOG L-4.697
1991	24.15	NA	18	886	310	LOG W=2.911 LOG L-4.696
1992	2 17.36	NA	11	577	338	LOG W=2.967 LOG L-4.829
1993			12	390	328	LOG W=2.939 LOG L-4.750
1994				360	339	LOG W=2.911 LOG L-4.671
1995				809	267	LOG W=3.026 LOG L-4.975
1996		NA	14	660	. 320	LOG W=3.066 LOG L-5.068
1997			15	1159	300	LOG W=3.054 LOG L-5.038
1998		[™] NA	16	1314	320	LOG W=3.085 LOG L-5.106
1999			14	1461	300	LOG W=3.011 LOG L-4.942
2000			16	1602		LOG W=2.963 LOG L-4.830
200			17	1436		LOG W=2.967 LOG L-4.821
2002		NA		1400		LOG W=3.042 LOG L-5.013
2002		11/1	<u> </u>	1000	020	

Table 6. Fisheries summary for White bass 1977-2002.

	ELECTRO 7	TRAPNET	CATCH			
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	_ (%)	N	LENGTH	LENGTH WEIGHT REGRESSION
1977	1.36	0.37	1	20	NA	LOG W=3.137 LOG L-5.377
1978	1.54	0.96	2	28	NA	LOG W=3.056 LOG L-5.197
1979	1.57	0.31	2	34	NA	LOG W=3.225 LOG L-5.640
1980	1.20	0.13	1	22	NA	LOG W=3.250 LOG L-5.693
1981	3.53	0.39	2	189	335	LOG W=3.082 LOG L-5.240
1982	2.96	0.16	1 .	135	415	LOG W=3.097 LOG L-5.293
1983	1.63	0.21	1	90	432	LOG W=3.095 LOG L-5.295
1984	2.04	0.11	2 2	93	378	LOG W=2.852 LOG L-4.615
1985	2.64	0.13	2	119	413	LOG W=3.159 LOG L-5.461
1986	1.99	0.15	2	101	404	LOG W=3.085 LOG L-5.269
1987	3.00	0.09	2	132	386	LOG W=3.151 LOG L-5.446
1988	5.80	NA	5	234	450	LOG W=3.103 LOG L-5.272
1989	4.19	NA	3	173	408	LOG W=3.140 LOG L-5.379
1990	2.36	NA	2	95	420	LOG W=3.214 LOG L-5.594
1991	1.44	NA	1	52	<b>477</b> a	LOG W=3.318 LOG L-5.870
1992	2.30	NA	1 _(C)	82	403	LOG W=3.257 LOG L-5.727
1993	2.00	NA	2	60	465	LOG W=3.001 LOG L-5.020
1994	2.11	NA	2	74	439	LOG W=3.261 LOG L-5.720
1995	2.63	. NA	2	107	333	LOG W=3.208 LOG L-5.586
1996	2.75	NA	2	118	360	LOG W=3.159 LOG L-5.467
1997	5.63	NA	່ 3	248	400	LOG W=3.215 LOG L-5.617
1998	6.16	NA	3	272	420	LOG W=3.148 LOG L-5.440
1999	7.63	NA	3	308	440	LOG W=3.238 LOG L-5.690
2000	7.72	NA	3	325	460	LOG W=3.250 LOG L-5.717
2001	8.93	NA	5	399	400	LOG W=3.296 LOG L-5.837
2002	9.75	NA	5	415	<b>390</b>	LOG W=3.257 LOG L-5.744

Table 7. Fisheries summary for Walleye 1977-2002.



Tubic 0.						
	ELECTRO					
	CPUE	CPUE	COMP		MEAN	الم
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	
1977	0.77	0.40	1	20	NA	LOG W=2.984 LOG L-4.991
1978	2.43	0.38	2	38	NA	LOG W=3.100 LOG L-5.354
1979	1.57	0.30	· 2	24	NA	LOG W=3.009 LOG L-5.158
1980	1.79	0.17	2	16	NA	LOG W=3.169 LOG L-5.509
1981	7.28	0.29	4	NA	NA	NA
1982	7.50	0.17	4 3	329	256	LOG W=2.864 LOG L-4.773
1983	3.80	0.25	3	188	285	LOG W=3.013 LOG L-5.144
· 1984	4.07	0.19	3	182	262	LOG W=2.648 LOG L-4.202
1985	` 4.57	0.21	4	199	283	LOG W=2.996 LOG L-5.019
1986	3.29	0.24	4	178	294	LOG W=3.336 LOG L-5.936
1987	4.94	0.12	2	114	262	LOG W=3.177 LOG L-5.556
 1988	2.10	NA NA	2	79	236	LOG W=2.683 LOG L-4.285
1989	2.70	NA	. 2	104	237	LOG W=3.208 LOG L-5.639
1990	2.29	NA	, 2	92	291	LOG W=3.070 LOG L-5.277
1991	3.07	NA		. 117	308	LOG W=3.155 LOG L-5.507
1992	5.24	NA	4	196	297	LOG W=3.029 LOG L-5.191
1993	5.71	NA	5	168	262	LOG W=2.950 LOG L-4.976
1994	4.16	NA	4	145	280	LOG W=3.153 LOG L-5.484
1995	5.80	NA	5	233	243	LOG W=3.090 LOG L-5.369
1996	5.41	NA		228	270	LOG W=3.142 LOG L-5.475
1997	9.99	NA		437	270	LOG W=3.065 LOG L-5.294
1998	9.57	NA		386	250	LOG W=3.190 LOG L-5.596
1999	18.26	NA		756	260	LOG W=3.262 LOG L-5.788
2000	9.81	NA	4	435	280	LOG W=3.306 LOG L-5.892
2001	6.47	NA	3	308	310	LOG W=3.356 LOG L-6.015
2002	7.50	NA	4	329	280	LOG W=3.350 LOG L-6.018

 Table 8.
 Fisheries summary for Sauger 1977-2002.

Smallmout	h Bass		Largemouth	Bass	5				
Year CPUE	Rank	2	CPUE	Rank					
1981 4.65	9		0.58	20	•				
1982 3.72	7		0.41	18 state	<b>~</b> , /				
1983 2.17	8		0.80	11 💡 🐑	.;				
1984 2.19	7		1.16	<b>11</b>	1.1				
1985 1.56	8	•	0.54	15 🐋 🐒	i da se				
1986 0.85	9		0.21	20	· · · ·				
1987 2.94	7	11.	0.61	16	N 94				
1988 5:72	7	· · ·	4.06	. 9 📜					
1989 13.52	4	er 	3.40	<b>10</b> 55					
1990 16.44	5 5	1	2.39	9 m					
1991 11.03		- i 4, i	1.87	<b>11</b> (1)					
1992 9.61	5	2. 1 21 -	2.50	<b>11</b> 1.5 m	· · ·				
1993 5.80	6	· · ·	1.10	14	1. g				
1994 3.83	7	х - с.	0.65	15					
1995 5.81	5	,a.	1.93	12	1.3				
1996 7.31	5 5 5 7		2.08	10	·				
1997 13.23	5		2.10	15					
1998 15.01	5	• •	2.75	14					
1999 13.51	7 -		3.71	13					
2000 17.02	6		4.67	11					
2001 13.01	6 5 5		5.21	11	⁻ .				
2002 15.91	5		6.14	. 11	• , • ,				
	17		• • •						

## Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and rank, 1981-2002. Table 9.

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Table 10.

Species composition expressed as % of total annual catches for PINGP fisheries studies, electrofishing and trapnetting combined for 1981-1987, and electrofishing only for 1988 through 2002.

		White	Freshwater		Black	Shorthead	• •	Gizzard	
Year	Carp	bass	Drum	Sauger	Crappie	Redhorse	Walleye	Shad	Total %
1981	17	20	12	4	15	<b>7</b> ·	2	9	86
1982	23	18	24	4	9	7	1	. 3	89
1983	18	17	22	3	16	6	1	2	85
1984	26	15	20	3	12	7	2	1	86
1985	20	14	31	4	9	7	2	1	87
1986	21	18	22	4	9	8	2	<1	84
1987	27	10	16	2	11	12	2	1	81 «
1988*	23	20	8	2	3	13	5	3	77
1989*	20	15	11	2	1	17	3	<1	70
1990*	20	16	13	1	<1	14	1	3	69
1991*	24	18	12	2	1	11	1	4	73
1992*	26	12	11	4	1	14	2	2	72
1993*	28	12	18	5	<1	10	2	2	76
1994*	34	10	14	4	<1	14	2	<1	78
1995*	30	16	12	5	1	8	2	4	78
1996*	34	14	8	5	2	11	2	<1	76
1997*	29	15	10	5	1	10	3	<1	73
1998*	23	16	<b>11</b> ·	5	<b>2</b> ·	12	3	2	74
1999*	17	14	17	7	3	9	3	12	82
2000*	16	16	8	4	2	11	3	17	77 ·
2001*	15	17	15	3	2	9	5	6	72 ·
2002*	14	21	12	4	2	9	5	7	74

*Electrofishing only

## SECTION III

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2002 ANNUAL REPORT

## FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

Study and Report by B. D. Giese and K. N. Mueller

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Environmental Services Water Quality Department

#### FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

#### INTRODUCTION

The 2002 study was a continuation of a study started in 1992 to evaluate effects of increased water appropriation from 150 to 300 cubic feet per second (cfs) during April on impingement of larval fish on 0.5 mm mesh traveling screens at the Prairie Island Nuclear Generating Plant (PINGP). In 2002, permit approved blowdown (discharge) reduction to 300 cfs or less was initiated on April 15th, rather than on April 1st as in previous years. Prior to 1992, the cooling water intake system operated with fine-mesh screens from April 16 through August 31, in accordance with Part I.C.6.c. of the plant's NPDES Permit (#MN0004006). Since 1992, for study purposes, the plant has implemented fine-mesh screen operation on April 1 to accommodate sampling during the month of April for years 1992 through 2002. Data for this evaluation were collected by pre-dawn and daylight sampling of larval fish and fish eggs from the screenwash water. This report includes fish egg, larvae, and juvenile densities, initial survival estimates, and impingement estimates from the fine-mesh screens as described in the monitoring plan. A "Legend" is included following Tables and Figures, which lists species and lifestage codes used in the tables of this report.

#### METHODS

Two samples were collected per sample date beginning April 2, 2002 and continuing through the end of April, with a total of 18 samples collected on 9 days. Samples were collected during pre-dawn and daylight hours to provide diurnal comparison.

Samples were collected throughout April by diverting screenwash water to collection tanks in the basement of the environmental lab. The number of operable screens and number of screens sampled varied throughout April due to interruptions for maintenance. Appropriate notifications of traveling screens down-times were made to the MPCA, and communications with the agency were ongoing throughout the 2002 sampling season. Calculations for estimated impingement and density were adjusted accordingly to account for screens going in and out of sevice during the April sampling period.

Screenwash water flows by gravity from the vertical traveling screenwash trough through an 18-inch pipe to the lab basement. The larval collection tank, manufactured by Lawler, Matusky, and Skelly Engineers (Figure 1), filters screenwash water through 0.5 mm mesh nylon screen. Filtered water returns to the circulating water system via a 12-inch diameter drain pipe. The screenwash trough was manually cleaned and the fish sampling system was flushed to remove accumulated debris and fish prior to sample collection on each date of the 2002 sample season.

During sample collection, physical parameters were recorded including collection time and duration, screen speed, number of screens sampled, river stage, and water temperature. Volume of river water filtered by the intake screens was obtained from the PINGP monthly external circulating water log.

Sample collection duration was 5 minutes. Upon completion of sample collection, all fish and any debris were rinsed into two collection baskets located at the outlet end of the collection tank (Figure 2). The baskets were then removed from the tank, the contents transferred to a five gallon bucket, and transported to the fish handling and sorting area for further processing.

Samples were sorted to remove live and dead fish, with an emphasis on doing so in a timely manner. Fish were determined to be alive or dead based on the presence or absence of movement. Sorting efficiency was maximized by pouring small portions of the sample into glass baking dishes and sorting on a light table.

Fish and eggs were removed from the sample, and the remaining debris was rinsed into a Tyler No. 60 sieve and drained. Sample remains were preserved in a solution of 5% formalin containing rose bengal stain. Each sample was sorted a second time. Fish and eggs found during the second sort were included with those from the initial sort, and recorded as dead.

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### DATA ANALYSIS METHODS

Fish and Egg Density

Fish and egg densities were calculated on a pre-dawn and daylight basis from data collected during April 2002. A combination of sample duration, plant blowdown (discharge), and identification data provided density values, expressed as numbers of fish or eggs per 100 cubic meters of water withdrawn from the river for plant use. The data are presented for individual taxa and lifestage for each date (Table 1a). Pre-dawn and daylight densities of all taxa and lifestages were combined and recorded by date (Table 1b).

Estimates of fish survival following impingement on the fine-mesh screens were calculated for each sample by totaling the number of live fish in each sample and dividing by the total number of fish in each sample (Table 1a).

Estimated numbers of fish and eggs impinged daily on the fine-mesh traveling screens was calculated by totaling the number of fish collected that day, multiplied by the proportion of the number of screens operating and sampled, and the number of minutes in the 12-hour period, divided by the number of minutes sampled (Table 3). In years 1984 to 1989, fine mesh panels of the traveling screens were not required to be operable until April 16, resulting in inconsistent start dates which accounts for incomplete April data prior to 1992. However, when fine-mesh screens were installed earlier, impingement data were obtained. Table 4 provides water appropriation (as blowdown), flow, temperature, and average daily impingements for the dates that were sampled in April 2002. Study results contribute to the ongoing assessment of increased water appropriation effects on larval fish impingement.

#### Identification methodology

Terminology used to identify lifestage was similar to that described by Auer (1982). The larval stage was divided into two developmental phases which correspond to Auer's terms yolk-sac larvae and larvae, respectively.

#### Terminology and criteria

- Prolarvae (Yolk-sac larvae) Phase of development from time of hatch to complete absorption of yolk.
- Postlarvae (Larvae) Phase of development from complete absorption of yolk to development of the full compliment of adult fin rays and absorption of finfold.
- Juveniles Phase of development from complete fin ray development and finfold absorption to sexual maturity; includes young-of-the-year (yoy) fish.

#### **RESULTS AND DISCUSSION**

Eighteen samples were collected during April 2002, which contained a total of 48 fish (21 prolarvae, 27 juveniles, and 0 adult) and 6 eggs. Survival was based on absence or presence of movement during the

sort. Five taxa/lifestage combinations were identified in the samples (Table 1a). Burbot is the only species expected to spawn early enough in spring, for their larvae to be in the drift and subject to impingement on the traveling screens before late April.

Blowddown was reduced from unlimited (average 925 cfs) April 1 through April 14, to less than 300 cfs on April 15th. The number of fish and eggs collected during the first half of April was higher than during the second half of April. It appears that increased blowdown (thus appropriation) resulted in increased impingement. Although, the higher impingement numbers during early April were predominantly juvenile shiners and carp eggs.

All eggs were determined to be carp eggs, based on appearance and comparison to eggs collected during the 2000 study when embryos were examined and identified as carp. (Note: All eggs in 2000 were identified as carp eggs, but were inadvertently reported as unidentified ("Unid") in Table 1a and Table 3 in the 2000 report.) Carp have not been reported to spawn below 60 degrees F in this region (Scott and Crossman, 1973; Becker, 1983). The "logical" presumption was made that carp living between the bar racks and the traveling screens spawn prematurely underneath the intake screenhouse due to elevated water temperatures as a result of recirculating water and deicing line water.

#### **Densities**

Densities by taxa/lifestage combinations of fish collected during April 2002 from the fine-mesh screens are presented in Table 1a, expressed as organisms per 100 cubic meters of water sampled. Table 1b provides diurnal density comparisons for sample dates when fish and/or eggs were collected. The data indicate that more fish and eggs were impinged during daylight hours in 2002.

### Survival estimates

Survival estimates are included in Table 1a for taxa/lifestage combinations collected during April 2002. Overall initial survival of fish collected in 2002 was 56% (Table 1a). Due to the low number of fish collected, survival estimates presented in Table 1a may be weighted too heavily. Survivorship for all taxa/lifestage combinations collected during 1984 through 1988 was summarized in the 1988 Prairie Island Annual Report (Kuhl and Mueller 1988).

#### Impingement estimates

Impingement estimates are available for years 1984-1989, 1992-2000, and 2002 (Table 3). No data is presented for 2001 due to river flood levels in Spring 2001 when sampling of larval fish from the finemesh traveling screens during April was extremely limited. The plant was operating in flood by-pass conditions as communicated to MPCA at the time. Table 2 provides comparison of taxa/lifestage combinations collected in 2002 to previous years. Estimated impingement of fish collected in April of all years is shown in Table 3. Estimated impingement values during April 2002 were low as in past years during April, and taxa/lifestage combinations were similar. Data collected through 2002 suggest that more fish and eggs may be impinged on the fine-mesh screens during the first half of April with unlimited blowdown, but the total numbers are still low.

During April 2002 sampling 48 total fish were collected. All eggs were identified as carp eggs by examining embryos taken from the eggs, as explained earlier in the <u>Results and Discussion</u> section of this report. We are hesitant to quantify how many eggs survive impingement, because little is known on how many eggs in the river drift survive when not impinged.

#### **SUMMARY**

Larval studies were conducted at PINGP from 1984 through 1988 providing estimates of impingement, density, and survival. In 1989 and 1990 larval fish studies were done to evaluate sampling induced mortality. Sampling was not a requirement of the NPDES permit during 1991. In 1992-2002, fine-mesh screens were installed by April 1, and a larval fish study was conducted to assess impingement affects of increased water appropriation during April. In comparison to previous studies at PINGP, increased water appropriation may have resulted in increased impingement during the first half of April 2002, but numbers are still low. Year 2002 was the first year sampling was conducted while the plant was operating with unlimited blowdown during the first half of April. We are hesitant to draw conclusions based on one sampling season, and expect to monitor effects of unlimited blowdown on impingement during future sampong seasons.



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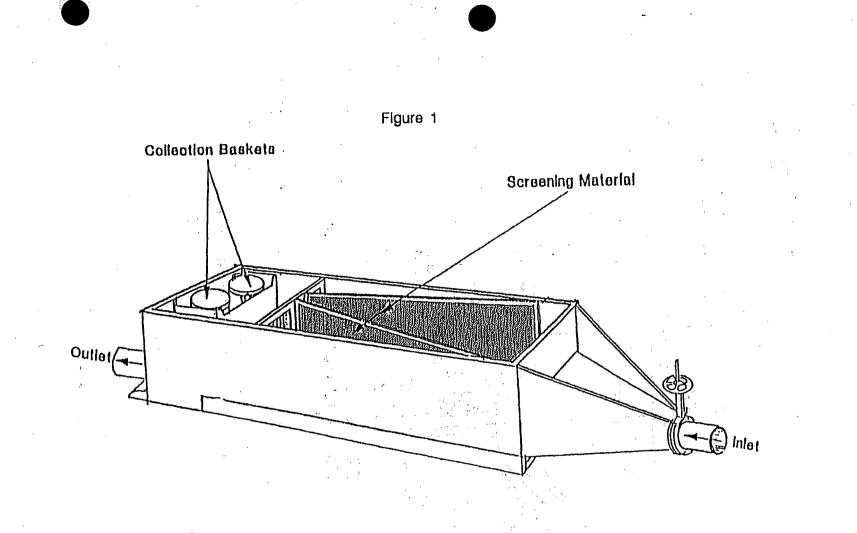
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Larval Fish Collection Tank

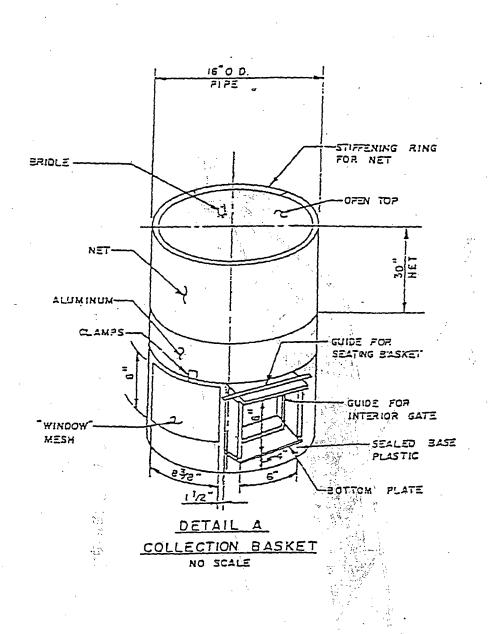


Figure 2

LAWLER MATUSKY & SKELLY ENGINEERS 6/83





### Table 1a.

Survivorship and Density (fish and fish eggs/100 cubic meters) by Taxa/lifestage combination of Fish Collected on PI Fine-mesh Intake Screens During April 2002.

-			· · ·		Number	of
Date	Taxa	Lifestage	Density	Percent Live	Fish	
· · · · · · · · · · · · · · · · · · ·		······································	· · · · · · · · · · · · · · · · · · ·			
2-Apr-2002	Emerald shiner	JUV	0.058935	100		2
4-Apr-2002	Emerald shiner	JUV	0.147339	100		5
4-Apr-2002	UNID	EG	0.058935	0		0
4-Apr-2002	Emerald shiner	JUV	0.147339	100		5
4-Apr-2002	Gizzard shad	JŪV	0.029468	100		7
4-Apr-2002	UNID	EG	0.088403	0	Avietic L	0
4-Apr-2002	Burbot	PRO	0.088403	0		3
9-Apr-2002	Gizzard shad	JUV	0.027547	100	:	1
9-Apr-2002	Emerald shiner	JUV	0.082640	100		3
9-Apr-2002	Burbot	PRO	0.055093	0	1 may 10 2 may 10	2
9-Apr-2002	UNID	EG	0.023611	0		0
11-Apr-2002	Emerald shiner	JUV	0.023754	100		1
11-Apr-2002	Burbot	PRO	0.071263	0		3
11-Apr-2002	Burbot	PRO	0.148464	60		5
11-Apr-2002	Emerald shiner	JUN	0.148464	60		5
11-Apr-2002	Cyprinid species	JUV	0.029693	100		-1
16-Apr-2002	Emerald shiner	JŪV	0.094378	100	and a second s	1
16-Apr-2002	Gizzard shad	JŪV	0.094378	0	1	1
18-Apr-2002	Emerald shiner	JŪV	0.178337	100 📖	5 75 8 5 151,6	1
23-Apr-2002	Burbot	PRO	0.183705	0		2
23-Apr-2002	Burbot	PRO	0.275558	0		3
25-Apr-2002	Burbot	PRO	0.183705	0		2
25-Apr-2002	Burbot	PRO	0.091853	0		1

Table 1b.

Density of fish and eggs (fish/100 cubic meters) collected in pre-dawn and daylight samples in 2002.

Date	Pre-dawn	Daylight
	Density	Density
4/2/2002	0.000000	0.058935
4/4/2002	0.206274	0.353613
4/9/2002	0.165279	0.023611
4/11/2002	0.095017	0.326621
4/16/2002	0.188755	0.000000
4/18/2002	0.178337	0.000000
4/23/2002	0.183705	0.275558
4/25/2002	0.183705	0.091853
4/30/2002	0.000000	0.000000



Table 2

Taxa/life stage combinations of fish collected in April of 2002 and previous years.

Taxa	Adult	Juvenile	Postlarvae	Prolarvae
Carp	•		X	X
Channel catfish		X		
Cyprinid	X	X	x	X
Flathead catfish		X		
Percid	x	£ .	X	X
Walleye				X
Bullhead sp.		A X		
Sauger	A MARKAN AND AND AND AND AND AND AND AND AND A		· X	X
Burbot			X	X,0
Catostomid	5 3 S	×	aree Sociality	x
Stizostedion spp.				` X
White bass		X		
Gizzard shad		X,O		
Freshwater drum		x	e .	
Johnny darter	<b>X</b>	• ·		
Shiner spp.		X,O		
Emerald shiner	X	X,0		
Bluegill		X		
Mooneye		í.		x
Golden redhorse	59 H (1	<b>X</b> · · ·		
Unidentified			• • • • •	x
Log perch	X			x
Legend:	x = previous y x = 2002 data			

o = 2002 data

Table 3.	Estima	ted imp	ingement of fis	sh collected o	<u>n F</u>	PINGP fine-n	nesh so	reens o	luring April, 19	<u>84-1989 an</u>	<u>d 19</u>	992-2002.	"	-	· ~ ·		
				· ·												ar ann. Na Stàiteanna	
Date	Taxa		Estimated	No of Fish		Date	Taxa	Life	Estimated	No of Fish		Date	Taxa	Life	Estimated	No of Fish	
<u>^</u>	: <u>.</u>	Stage	Impingement	Collected		<u> </u>		Stage	Impingement	Collected				Stage	Impingement	Collected	
1984					_							· · · ·					
16-Apr-84		EG	384	1		24-Apr-86	PERC	UN	1728	6		13-Apr-89	CYPR	AD	384	. 1	
18-Apr-84	CARP	PO	384	1		25-Apr-86	CYPR	JU	288	1	1	14-Apr-89		UN	0	. 0	
23-Apr-84	UNID.	EG	3840	10		28-Apr-86	UNID	EG	480	· 1	1	18-Apr-89	X	UN	0	0	
25-Apr-84	CC	JU	384	1		29-Apr-86	PERC	PR	864	3	1	20-Apr-89	X	UN	0	0	
25-Apr-84	CYPR	PO	384	1		29-Apr-86	UNID	EG	288	1		21-Apr-89	X	UN	0	0	
25-Apr-84		EG	3840	10		29-Apr-86		PR	288	1	1	25-Apr-89		UN	0		
27-Apr-84	CC	JU	384	1		1987					<u> </u>	27-Apr-89		PR	1152	3	
27-Apr-84			384			6-Apr-87	BUR	PR	1536	4	1	1992					
27-Apr-84		EG	2304	6		8-Apr-87		PR	576	1	<u> </u>	1-Apr-92	CYPR	PR	- 288	1	
30-Apr-84		JU	384	21		10-Apr-87		PR	2304	* 4		1-Apr-92			288	1	
30-Apr-84			384	1		13-Apr-87		PR	2304	4	[	1-Apr-92			576	2	
30-Apr-84	FHC	JU	192	1		15-Apr-87		PR	3456	6	<u> </u>	2-Apr-92		UN	0	0	
30-Apr-84	PERC	PR	1152	6		16-Apr-87		PR	576	. 1	1	8-Apr-92		UN	0	0	
30-Apr-84	UNID	EG	4416	23		20-Apr-87	X	UN	0	0		9-Apr-92	X	UN	0	0	
30-Apr-84		PR	768	4		22-Apr-87		UN	0	0		14-Apr-92	X	UN	0	0,	
1985						24-Apr-87		UN	0	· 0		16-Apr-92	X	ÚΝ	0	0	
19-Apr-85	BHS	JU	384	1	-	27-Apr-87	PERC	PR	576	. 1		21-Apr-92	BUR	PR	576	1	
22-Apr-85	PERC	PR	1152	- 3		27-Apr-87	SA	PR	576	1		23-Apr-92	X	UN	. 0	0	
23-Apr-85		EG	- 192	- 1		29-Apr-87	SA	PO	2880	5		28-Apr-92	X	UN	0	0	
24-Apr-85	PERC	PR	576	3		29-Apr-87	WE	PR	576	1		30-Apr-92	CC	JU	288	1	
24-Apr-85		PR ·	1344	7		1988						30-Apr-92	PERC	AD	288	. 1	
24-Apr-85		EG	384	2		8-Apr-88		PR,	768	2		1993					
24-Apr-85		PR	1536	8.		11-Apr-88		UN	0	. 0		2-Apr-93		X	0	0	
25-Apr-85			192	1		13-Apr-88		EG	384	1		6-Apr-93		PR	288	. 1	
25-Apr-85		PR	1536	8		15-Apr-88		PR	768	2		8-Apr-93		EG	288	1	
25-Apr-85		PR	384	2	۰ بر	18-Apr-88		UN	0	0		8-Apr-93		PR	288	· 1	
25-Apr-85		PR	576	3		20-Apr-88		PR	768	2	:	13-Apr-93		X	0	0	
26-Apr-85		PR-	192	1	<u></u>	22-Apr-88		PR	1920	. 5		15-Apr-93		PR	288	1	
26-Apr-85		PR	192	1		25-Apr-88		PR	1152	3		19-Apr-93		EG	1152	2	
29-Apr-85		PO	96	1		27-Apr-88		PR	1152	3	301	21-Apr-93		X	0	0	
29-Apr-85		PR	192	2		28-Apr-88		PR	384	1	1	27-Apr-93		X	0	0	
29-Apr-85	CATO	PR	288	3		29-Apr-88	X.	UN 🚡	0	0		29-Apr-93	UN	EG	288	1	
9-Apr-85	PERC	PR	<u>192</u>	2		1989						1994	<u></u> ;			•	
1986		31 10				4-Apr-89		UN :	0	506 ¹ 0		5-Apr-94		EG	384	. 1	
8-Apr-86		PR	288	1		6-Apr-89			384	1		5-Apr-94	CC	JU	384	1	
8-Apr-86	CYPR	PR	288	.1	1	7-Apr-89		UN	6. 19 (n. 19 <b>0</b> )	0		5-Apr-94			384	1	
23-Apr-86	CYPR	PO	288	1 ~	- 1	11-Apr-89	X	UN I		.0		5-Apr-94	bur T	PR	384		

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Table 3. (c	ont)	Estima	ated impingem	ent of fish coll	ected on PINGF	' fine-m	esh scr	ens during Ap	ril, 1984-19	<u>39 a</u>	and 1992-2002		ļ	ļ		
		1.10	<b>E</b> 1				;			<u> </u>		<u></u>	l		· · · · · · · · · · · · · · · · · · ·	
Date	Taxa	Life-	Estimated	No of Fish	Date	Taxa	Life	Estimated	No of Fish		Date	Taxa	Life	Estimated	No of Fish	
-			Impingement	Collected		<u></u>	Stage	Impingement	Collected	ļ			Stage	Impingement	Collected	
1994 (con			000		1996 (cont)		100		l	<b> </b>	1999 (cont)		1		ļ	<b></b>
12-Apr-94		PR	. 288		25-Apr-96			504			9-Apr-99		JU	288		
12-Apr-94 14-Apr-94		PR X	288		25-Apr-96			252		<u> </u>	9-Apr-99			576		<b>  </b>
19-Apr-94			288		30-Apr-98		<u> </u>	<u> </u>	0		9-Apr-99 13-Apr-99		JU EG	288		<b></b>
21-Apr-94		X	-0		3-Apr-97		EG	17,280	30		13-Apr-99		EG	288		-1
26-Apr-94		PR	1152		4-Apr-97		JU	1152		<u></u> -	15-Apr-99			288		<b>[]</b>
26-Apr-94		PR	288		4-Apr-97		PR	.576			22-Apr-99			576		<u>  </u>
28-Apr-94		PR	288		25-Apr-97			2304		·	27-Apr-99			288		
28-Apr-94		PR	288		29-Apr-97			864		_	27-Apr-99		JU	288		<u> </u>
1995					30-Apr-97			432			27-Apr-99			288		·
3-Apr-95	CATO	JU	288	1	30-Apr-97		JU	432			30-Apr-97			288		
4-Apr-95		PR	288	1	30-Apr-97			432			30-Apr-97			576		
4-Apr-95		JU	576	1	30-Apr-97		EG	864		÷	30-Apr-97		the second s	.288	. 1	
4-Apr-95		JU	1152	2	1998			1		<u> </u>	2000		1			
4-Apr-95		JU	1152		2-Apr-1998	UNID	EG	229	1		4-Apr-2000	UNID	EG	.14,688	51	
4-Apr-95	CATO	JU	576		3-Apr-1998		AD	252			4-Apr-2000		EG	1440	5	
4-Apr-95	FWD	JU	9792	17	7-Apr-1998	X	X	0	0		6-Apr-2000	UNID	EG	7,776	27	
10-Apr-95		PR	288	1	9-Apr-1998			229	• 1		6-Apr-2000		AD	288	1	
17-Apr-95		EG	13248		14-Apr-1998	CC :	JU	252	1		6-Apr-2000	UNID	EG	8023	39	
20-Apr-95		EG	2880		16-Apr-1998			229			6-Apr-2000		PRO	206	1	
24-Apr-95		EG	1152		16-Apr-1998			229			13-Apr-2000		PRO	288	1	
26-Apr-95	UNID	EG	864	3	21-Apr-1998		EG	1512			18-Apr-2000		JU	288	1	
1996		2.5			23-Apr-1998		the second se	252			20-Apr-2000		PRO	288	1	
2-Apr-96		PR	252		23-Apr-1998		JU	252			27-Apr-2000		EG	2618	. 10	
4-Apr-96		EĠ	504		28-Apr-1998		EG	2016			27-Apr-2000		EG	1440		_
9-Apr-96		AD -	252		28-Apr-1998			2268			27-Apr-2000		PRO	576	2	
9-Apr-98		JU	252		28-Apr-1998		PR	2268	9		27-Apr-2000		PRO	288	1	
9-Apr-96		EG	252		28-Apr-1998			1512	<u> </u>		2001	No valu	es calc	ulated~flood		
11-Apr-96		JU	252		28-Apr-1998		PR	252	1		2002	L		·		
11-Apr-96			252		30-Apr-1998		PR	2016			4/2/2002			672	2	
11-Apr-96	EMSH	ĴŬ	504		30-Apr-1998			14364			4/4/2002			1680	5	
11-Apr-96	CARP	PR:	252		30-Apr-1998	PERC	PR	2268			4/4/2002		EG	672		
11-Apr-96			252		30-Apr-1998			252			4/4/2002			1680	5	
11-Apr-96			252		30-Apr-1998	GORH	190	252	1		4/4/2002		JU	336	1	
16-Apr-96	X	X	0		1999			ļ	·		4/4/2002			1008	3	
18-Apr-96		X	0		6-Apr-99			522			4/4/2002			1008	3	
23-Apr-96			504	the second s	6-Apr-99			4032			4/9/2002		JU	336	1	
23-Apr-96	UNID	IEG	1008	4	9-Apr-99	IGIZ	JU	288	1		4/9/2002	EMSH	IJU	1008	3	







Table 3. (cont	)	Estima	ted impingem	ent of fish co	olle	cted on PINGP	fine-me	sh scree	ens during April	, 1984-1989	and	1992-2002
						ļ	· · · ·					
Date	Taxa	Life	Estimated	No of Fish		<u> </u>	ļ		ļ	· · · · · · · · · · · · · · · · · · ·		
		Stage	Impingement	Collected		<u> </u>		<u> </u>	ļ			
2002 (cont)		L				L	<u> </u>	ļ	ļ			
4/9/2002	BURB		672			[						
4/9/2002	Carp	EG	288									
4/1 1/2002	EMSH	JU	288	1					<u></u>			
4/11/2002			864			1						
4/11/2002	BURB	PRO	1800	5				<u> </u>				
4/11/2002	EMSH	JU	1800	5				·	· · · · ·	:. <u>·</u>		
4/11/2002	Cypr	JU	360	1								
4/16/2002	EMSH		336	1					·			
4/16/2002	GIZ	JU	336	1		3						
4/18/2002	EMSH	JU	336	1								
4/23/2002			672	2								
4/23/2002	BURB	PRO	1008	3						• • • • •		
4/25/2002	BURB	PRO	672	2		`````						
4/25/2002			336					[		ė		
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able 4.	Estimated	fish and fish egg	impingement da	ata for dates sar	npled (wher	1 fish and/or	eqqs were
		n April 2002 with					
		,					·
Date	Blowdown	Average Daily	Avg. daily	Est.avg daily	·		
	(cfs)	R. Flow (cfs)	Inlet Temp. (F)	impingement.	•		
	·,						
4/2/2002	932	23,600	38.1	672			
4/4/2002	940	25,100	36.6	6,384			
4/9/2002	997	25,000	42.8	2304			
4/11/2002	997	30,600	43.2	5112			
4/16/2002	291	52,400	53.5	672			
4/18/2002	155	64,100	48.8	336			
4/23/2002	299	56,300	52.0	1680			·
4/25/2002	299	49,300	51.7	1008			
4/30/2002	291	37,500	49.2	0			
		· · · · · · · · · · · · · · · · · · ·					

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# **LEGEND**

# LIFE STAGE

UN	=	Unidentified or Zero
EG		Egg
PR	=	Prolarvae
PO	=	Postlarvae
JU	÷	Juvenile
AD	=	Adult

# TAXA CODE

UNID =	Unidentified
= 33	Channel Catfish
CYPR =	Cyprinids, other than
FHC =	Flathead Catfish
PERC =	Percids, other than
BHS =	Bullhead spp.
SA =	Sauger
WE =	Walleye
STIZ =	Stizostedion spp.
BUR =	Burbot
CATO =	Catostomids
CARP =	Carp
MOON =	Mooneye
X =	No Fish

## PRAIRIE ISLAND NUCLEAR GENERATING PLANT

多·济东市和安排(新)-东门市市的市台

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ENVIRONMENTAL MONITORING

AND

**ECOLOGICAL STUDIES PROGRAM** 

## **2003 ANNUAL REPORT**

Prepared for

Northern States Power Company d/b/a Xcel Energy

Minneapolis, Minnesota

Environmental Services

By

Water Quality Department

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### SECTION I

### PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2003 ANNUAL REPORT

### WATER TEMPERATURE AND FLOW

Study and Report by . B. D. Giese and K. N. Mueller

Environmental Services Water Quality Department

STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET

#### WATER TEMPERATURE AND FLOW

### INTRODUCTION AND METHODS

The Mississippi River is the source-water body for circulating and cooling water systems at the Prairie Island Nuclear Generating Plant (PINGP). This report presents daily plant operating hours, river inlet temperatures, site discharge temperatures and flows (blowdown). Site discharge temperatures are determined by thermocouples located downstream at U.S. Army Corps of Engineers Lock and Dam 3. Plant inlet (ambient river) temperatures are determined by remote sensors located in Sturgeon Lake, and the main channel at Diamond Bluff. Inlet temperatures are also recorded from thermocouples located in front of the intake screenhouse, which are maintained for back-up. Data presented in this report are for environmental studies comparison, and are not intended as NPDES temperature compliance reporting.

Also presented in this report are daily and monthly average Mississippi River flows, as provided by U.S. Army Corps of Engineers at Lock and Dam 3. Other monthly averages reported include PINGP intake flows, and the percentage of Mississippi River water entering the plant.

### **RESULTS AND DISCUSSION**

Daily average river inlet and site discharge temperature data are presented by month in Table 1. Daily Mississippi River flows recorded at Lock and Dam 3 ranged from 3,900 to 61,100 cfs in 2003 (Table 2). Daily mean site discharge flow (blowdown) from the PINGP external circulating water log ranged from 144. to 1,208 cfs (Table 1).

PINGP withdrew an annual average of 4.7 percent of the Mississippi River flow during 2003 (Table 3). Table 4 shows the monthly average Mississippi River flows for the years 1983 through 2003. The average river flow in 2003 was 16,557 cfs, which was less than the average river flow of 23,026 cfs for years 1983-2002. The range of annual average river flows is 8,709 cfs in 1988 to 37,787 cfs in 1986.

Table 1.

. Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE		ING HOURS	RIVER INLET		
JANUARY		UNIT 2"	TEMP.	SITE DISCHARGE TEMP.	MEAN SITE
UNICAN		UNIT 2			DISCHARGE FLOW
			(°F)	(°F)	(BLOWDOWN-CFS)
1	24	24	33.1	34.5	672
2	24	24	32.9	35.0	660
3	24	24	33.1	35.0	660
4	24	24	33.2	35.3	684
5	24	. 24	34.0	35.7	696
6	24	24	33.6	35.3	696
7	24	24	33.6	35.9	672
8	24	24	34.3	36.1	672
9	24	24	34.8	36.4	672
10	24	24	33.0	34.6	720
· 11	24	24	32.3	34.8	720
12	24	24	32.5	35.1	660
13	24	24	33.5	36.1	612
14	24	24	33.1	36.6	696
15	24	24	32.2	36.1	645
16	24	24	32.6	36.1	720
17	24	24	32.4	35.0	696
18	24	24	32.9	35.4	696
19	24	24	32.3	34.9	660
20	24	24	32.0	35.3	648
21	24	24	32.3	35.9	636
22	24	24	32.5	35.9	648
23	24	24	32.2	. 35.9	648
24	24	24	32.5	36.1	660
25	24	24	32.8	36.1	660
. 26	24	24	32.3	35.8	660
27	24	24	32.3	35.5	660
28	24	24	32.9	38.3	660
29	24	24	32.4	37.1	648
30	24	24	32.5	36.4	672
31	24	24	33.0	37.2	720
	MON	THLY MINIMUM	32.0	34.5	612
			34.8	38.3	720
		ONTHLY MEAN	32.9	35.8	672
			· · ·		



Table 1 section 1.xls

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Table 1.

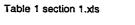
Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE FEBRUARY		NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	33.0	36.9	720
2	24 24	24 24	33.3	36.8	720
3	24 24	24	33.3	37.1	720
4	24	24	32.4	36.6	648
<b>5</b> .	24	24	33.6	36.3	648
6 6	24	24	32.4	36.7	648
7	24	24	31.9	36.7	636
. 8	24	24	33.4	36.9	660
9	24	24	32.4	36.5	648
10	24	24	32.5	36.9	648
11	24	24	32.3	36.8	588
12	24	24	32.3	36.8	588
13	24	24	33.6	36.2	600
14	24	24	33.5	35.3	600
15	24	24	32.7	35.3	588
16	24	24	33.6	35.6	588
17	24	24	32.1	35.7	636
18	24	24	33.2	35.6	636
19	24	24	32.9	35.4	624
20	24	24	32.9	35.9	648
21	24	24	34.2	36.4	648
22	24	24	33.3	36.3	600
23	24	24	32.6	35.9	612
24	24	24	32.6	35.2	612
25	24	24	32.3	35.3	600
26	24	24	32.5	35.8	624
27	24	24	33.8	35.6	624
. 28	24	. 24	33.5	35.7	624
	MONTHL		31.9	35.2	588
	MONTHLY	<b>MAXIMUM</b>	34.2	37.1	720
	MONT	THLY MEAN	32.9	36.2	633

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		•			
DATE	OPERAT	ING HOURS	<b>RIVER INLET</b>	SITE DISCHARGE	MEAN SITE
MARCH	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
			(°F)	(°F)	(BLOWDOWN-CFS)
					<b>,</b>
1	24	24	34.0	36.6	696
2	24	24	34.5	35.4	540
3	24	24	33.4	34.7	564
4	24	24	32.6	35.5	648
5	24	24	32.7	35.7	636
6	24	24	32.8	35.0	648
7	24	24	33.2	35.9	672
8	24	24	33.6	35.7	660
9	24	24	32.1	35.3	660
10	24	24	32.3	35.8	636
. 11	24	24	32.5	36.5	708
12	24	24	34.0	36.2	660
13	24	24	33.9	36.3	672
14	24	24	33.6	36.1	696
- 15	24	24	35.1	37.7	6 <b>96</b>
16	24	24	35.9	39.0	720
17	24	24	35.6	37.2	720
18	24	24	, 36.2	38.7	730
19	24	24	37.2	39.0	753
20	24	24	38.9	40.9	753
21		24	39.2	40.3	753
22	24	24	38.7	39.0	768
23	24	24	38.4	39.7	775
24	24	24	39.5	41.0	775
25	24	24	40.6	41.7	776
26	24	24	40.1	42.0	783
27	24	24	41.5	42.5	783
28	24	24	40.1	42.3	875
29	24	24	39.1	40.1	869
30	24	24	41.2	40.3	869
31	24	24	39.5	41.9	. 875
	MONTH	ILY MINIMUM	32.1	34.7	540
		LY MAXIMUM	41.5	42.5	875
		NTHLY MEAN	36.2	38.2	722
			,		

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows,<br/>with recorded operating hours for Units 1 and 2 at PINGP in 2003



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Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows,<br/>with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE <b>APRIL</b>	OPERAT UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
۱. ۱	24	24	42.0	40.4	040
1	24 24	24	42.0 42.0	42.4 42.9	940 940
3	24	24	42.0	43.9	940
. 4	24	24	40.5	43.9	918
5	24	24	38.3	39.3	888
· 6	23*	23*	39.8	41.2	888
7	24	24	39.5	41.0	865
8	24	24	38.7	40.1	903
9	24	24	41.8	41.9	903
10	24	24	41.1	43.0	. 903
11	24	24	43.9	46.4	925
12	24	24	46.4	48.7	873
13	24	24	46.9	49.3	550
14	24	24	48.4	49.6	251
15	1.8	24	53.0	53.8	165
16	0	24	52.8	53.8	144
17	Ō	24	49.9	50.7	148
18	0	24	49.1	49.5	275
19	0	24	48.2	49.6	291
20	1.8	24	46.5	47.0	299
21	24	24	46.8	47.3	235
22	24	24	47.4	48.0	251
23	24	24	48.6	49.9	267
24	24	24	49.4	50.7	291
25	24	24	50.5	52.0	283
26	24	24	50.7	52.4	291
27	24	24	52.1	54.2	259
28	24	24	53.1	54.8	275
29	24	24	53.9	54.9	283
30	24	24	53.6	55.5	283
* Daylight	savings				•
	MONTH	ILY MINIMUM	38.3	39.3	144
		Y MAXIMUM	53.9	55.5	, 948
		NTHLY MEAN	46.6	47.8	525





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 Table 1.
 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE MAY	OPERATI UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
_ 1	24	.24	54.3	55.7	283
2	24	24	55.6	56.8	283
3	24	24	58.2	58.6	283
4	24	24	55.5	55.9	291
5	24	24	54.7	55.6	283
6	24	24	54.8	55.3	283
7	24	24	56.0	57.1	291
8	- 24	24	56.0	57.4	291
9	24	24	55.7	56.7	291
10	24	24	55.9	56.9	291
11	24	24	55.6	56.5	291
12	24	24 ·	55.6	56.2	283
13	24	24	55.6	57.0	283
14	24	24	56.8	57.8	283
15	24	24	56.2	57.3	283
16	24	24	57.6	59.0	283
17	24	24	58.8	60.1	283
18	24	24	59.5	60.7	291
19	24	24	60.2	61.8	275
20	24	24	56.9	60.1	275
21	24	24	59.1	61.5	275
22	24	24	59.2	60.8	259
23	24	24	58.9	59.5	283
24	24	24	59.2	61.0	283
25	24	24	59.9	61.0	275
26	24	24	61.5	. 62.5	291
27	24	24	62.6	64.0	283
28	24	24	63.7	65.3	275
29	24	24	63.2	65.0	275
30	24	24	65.1	66.4	283
31	24	24	63.2	64.7	291
			54.3	55.3	259
		Y MAXIMUM	65.1	66.4	291
	MON	ITHLY MEAN	58.2	59.5	283



Table 1 section 1.xis

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 Table 1.
 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

1

DATE JUNE	OPERAT UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE ŤEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	63.7	64.6	384
2	24	24	65.5	66.4	384
3	24	24	64.4	65.5	361
4	24	24	65.8	66.3	361
5	24	24	64.7	66.0	361
6	24	24	66.4	67.1	361
7	24	24	65.5	66.5	350
8	24	24	66.1	66.3	361
9	24	24	65.5	66.2	372
10	24	24	66.2	67.5	372
11	24	24	67.0	67.5	372
· 12	24	24	66.1	66.5	372
13	24	24	67.2	67.5	361
14	24	24	68.6	69.4	350
15	24	24	69.9	70.5	384
16	24	24	70.4	71.7	753
17	24	24	72.1	72.8	768
18	24	24	73.4	74.1	768
19	24	24	73.5	74.6	768
20	24	24	73. <b>3</b>	74.2	753
21	24	24	72.6	73.6	768
22	24	24	72.5	73.0	768
23	24	24	72.9	73.9	768
24	24	24	73.6	75.0	776
25	24	24	74.1	74.8	835
26	24	- 24	72.5	73.7	738
27	24	24	70.6	71.2	738
28	24	24	71.0	71.8	760
29	24	24	71.0	71.8	760
30	. 24	24	/ 71.5	72.0	760
	MONTH	LY MINIMUM	63.7	64.6	350
		Y MAXIMUM		75.0	835
		NTHLY MEAN		70.1	566



Table 1 section 1.xls

 Table 1.
 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

				•		
DATE		NG HOURS	RIVER INLET	SITE DISCHARGE	MEAN SITE	. '
JULY	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW	
			(°F)	(°F)	(BLOWDOWN-CFS)	•
1	24	. 24	72.6	72.8	760	
2	24	24	73.0	73.9	1138	• • • • • •
3	24	24	72.8	73.9 74.4	1166	
4	24	24	75.4	74.4	1166	
4 5	24	24	75.1	76.6	1166	· * 5 · · · · ·
6	24 24	24	76.7	77.7		
					1152	• · · · · ·
7	24	24	76.6	77.9	1166	
8	24	24	75.9	77.0	1166	
9	24	24	75.9	77.0	1152	
10	24	24	74.3	75.2	1194	·
11	24	24	73.1	73.7	1152	
12	24	24	74.1	74.5	1152	
13	24	24	74.5	75.2	1138	
14	24	24	74.7	75.7	1152	
15	24	24	74.2	75.2	1152	
16	24	24	74.1	76.1	1152	
17	24	24	74.6	76.7	1152	
18	24	24	73.1	75.7	1138	
19	. 24	24	· 73.7	76.8	1138	
20	24	24	75.0	76.8	1152	
21	24	24	74.6	76.5	1152	
22	24	24	74.7	76.0	1152	
23	24	24	75.0	75.9	1124	
24	24	24	74.2	.76.4	1152	
25	24	24	73.6	75.4	1152	
26	24	24	74.5	76.6	1152	
27	24	24	75.7	77.9	1166	
28	24	24	75.7	78.2	1166	
29	24	24	76.4	79.0	1166	
30	24	24	77.0	80.1	1166	
31	24	24	77.2	80.0	1180	· ·
		1 \ Z & A1\ 11\ A1 \ 14	70.0	70.0	700	
		LY MINIMUM		72.8	760	
		Y MAXIMUM		80.1	1194	
1 · · · ·	MON	ITHLY MEAN	74.8	76.4	1143	



 Table 1.
 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

	DATE	OPERAT	TING HOURS	<b>RIVER INLET</b>	SITE DISCHARGE	MEAN SITE
9	AUGUST	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
				(°F)	(°F)	(BLOWDOWN-CFS)
					-	
	1	24	24	77.6	79.8	1180
	2	24	24	77.1	79.3	1180
	3	24	.24	77.4	79.1	1180
	4	24	24	76.0	77.7	1180
	5	24	24	76.2	78.4	1208
	6	24	24	75.2	77.5	1194
	· 7	24	24	76.0	78.5	1194
	8	24	24	76.5	78.7	1194
	9	24	24	<b>76.5</b> /	78.8	1194
	.10	24	24	76.8	79.2	1194
	11	24	24	77.2	79.8	─ 1194 ¹
	12	24	24	76.9	79.3	. 1180
	13	24	24	77.3		1194
	14	24	24	77.6	80.0	1194
	15	24	24	77.7	80.7	1194
	16	24	24	79.2	81.5	1194
	17	24	24	79.4	81.5	1194
	18	24	24	78.6	82.0	1194
	19	24	24	79.6	82.3	1180
	20	24	24	78.9	82.0	1194
	21	24	24	79.3	81.0	1194
	22	24	24	79.8	80.2	1124
	23	24	24	78.2	80.6	1180
	24	24	24	76.8	80.3	1180
	25	24	24	77.6	80.1	1180
	26	24	24	77.1	79.9	1180
	27	24	24	77.9	80.1	1180
	28	24	24	76.9	79.9	1166
	29	24	24	. 75.4	78.5	1180
	30	24	24	74.7	77.0	1180
	31	24	24	73.9	76.5	1166
			HLY MINIMUM		76.5	1124
					82.3	1208
		MO	NTHLY MEAN	I 77.3	79.7	1185

Table 1 section 1.xls

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Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE SEPTEMBER		NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	73.7	76.3	1166
2	24	24	73.4	76.6	1166
3	24	24	73.3	76.2	1166
4	24	24	70.7	74.0	1166
5	24	24	71.2	74.0	1166
6	24	24	72.4	75.1	1149
7	24	24	72.9	76.6	1149
8	24	24	73.1	76.4	1149
9	24	24	73.6	77.0	1149
10	24	24	73.6	77.5	1149
11	24	24	73.3	76.8	1149
12	24	22	73.0	76.1	1165
13	24	0	72.3	74.1	985
14	24	0	71.0	72.4	985
15	24	0	70.5	71.9	624
16	24	0	69.8	71.2	624
17	24	0	70.2	71.6	624
18	24	0	69.7	71.8	624
19	24	0	66.9	67.9	636
20	24	0	66.4	67.6	612
21	24	.0	65.9	68.2	612
22	24	0	64.0	65.9	624
23	24	0	63.4	64.6	612
24	24	0	64.4	65.7	612
25	24	0	60.0	63.3	612
26	24	0	61.1	63.2	612
27	24	0	59.4	60.9	612
28	24	0	57.3	59.3	612
29	24	0	57.8	59.3	612
30	24	0	56.1	58.0	600
	MONTHL	Y MINIMUM	56.1	58.0	600
		Y MAXIMUM		77.5	1166
		THLY MEAN	68.0	70.3	857

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Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows,<br/>with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE OCTOBER		NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	0	55.2	56.7	612
2	24	0	54.3	56.8	612
<b>3</b> "	24	0	55.2	57.1	600
4	24	0	54.8	56.5	612
5	24	· 0	55.3	57.4	612
6	24	0	56.3	58.6	612
7	24	0	56.4	59.6	882
.8	24	0	58.0	61.7 ·	932
9	24	10.6	60.2	63.2	1165
10	24	24	61.2	64.2	925
11	24	24	60.5	64.3	1132
12	24	24	59.1	. 61.6	1116
13	24	24	59.4	61.3	1116
14	24	24	58.5	61.5	1116
15	24	24	57.0	61.3	1116
16	24	24	57.0	61.2	1125
17	24	24	56.4	62.1	1120
18	24	24	57.5	62.7	1114
19	24	24	57.9	63.0	1125
20	24	24	58.0	63.5	1131
21	24	24	57.7	62.6	1131
22	24	24	55.6	60.8	1132
23	24	24	55.2	59.8	1116
24	24	24	54.9	60.1	1116
25	24	24	53.7	59.1	1116
26	25*	25*	52.4	56.8	1116
27	24	24	51.6	55.8	1100
28	24	24	<i>,</i> 50.5	55.0	1116
29	24	24	[/] 48.9	53.2	1100
30	24	24	48.6	52.1	1100
31	24	,24	48.2	. 51 <b>.</b> 8	1116
* Daylight s	avings				
		_Y MINIMUM	48.2	51.8	600
		Y MAXIMUM		64.3	1165
	MON	THLY MEAN	55.7	59.4	1001



Table 1.

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Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE NOVEMBER		UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	46.6	50.7	1100
2	24	24	46.9	50.8	1009
3	24	24	47.0	50.3	1003
4	24	24	45.6	49.2	1003
5	24	24	44.3	47.7	1003
6	24	24	41.7	46.1	979
7	24	24	41.2	45.2	967
8	24	24	39.3	43.4	937
9	24	24	38.4	43.1	932
10	24	24	39.6	44.0	932
11	24	24	40.4	44.9	932
12	24	[·] 24	41.8	45.6	932
13	24	24	39.4	43.2	932
14	24	24	39.9	43.7	932
15	24	24	40.9	44.2	932
16	24	24	40.1	43.2	815
17	24	24	40.9	44.7	815
18	24	24	40.9	44.7	815
19	24	24	40.9	44.7	815
20	24	24	42.6	46.4	848
21	24	24	41.1	45.0	848
22	24	24	45.1	45.2	828
23	24	24	44.6	43.8	828
. 24	24	24	38.2	42.2	<b>822</b> a
25	24	24	36.3	39.4	815
26	24	24	37.2	40.4	828
27	24	24	37.6	40.4	835
28	24	24	36.5	40.5	835
29	24	24	35.4	39.7	835
. 30	24	24	36.4	39.0	822
	MONTH		35.4	39.0	815
	MONTH	LY MAXIMUM	47.0	50.8	1100
		NTHLY MEAN		44.4	898



Table 1 section 1.xls

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Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2003

DATE DECEMBER		ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)	
1	24	24	36.4	39.2	822	
2	24	24	36.0	38.0	828	
3	24	24	35.4	37.9	828	
4	· 24	24	35.9	38.0	828	
5	24	24	36.4	38.5	822	
6	24	24	36.5	39.0	822	
7	24	24	36.3	38.7	822	
8	24	24	35. <b>8</b>	38.6	822	
9	24	24	36.1	39.4	822	
10	24	24	35.2	37.2	822	
. 11	24	24	34.2	36.9	822	
12	24	24	34.7	38.6	822	
13	24	24	34.9	38.1	815	
14	24	24	34.9	38.8	815	
15	24	24	34.5	37.7	815	
16	24	24	34.4	36.8	815	
17	24	24	34.6	36.5	808	
18	24	24	34.5	36.6	808	
19	24	24	34.4	36.9	808	
. 20	24	24	34.4	36.9	815	
21	24	24	34.4	36.7	808	
22	24	24	34.6	37.1	815	
23	24	24	34.8	37.3	815	
24	24	24	34.7	37.5	815	
25	24	24	34.7	36.6	815	
26	24	24	33.1	36.9	815	
27	24	24	34.6	38.5	815	
28	24	24	34.4	37.4	808	
29	24	24	35.3	38.5	815	
30	24	24	35.0	36.9	815	
31	24	24	34.4	36.4	815	
			33.1	36.4	808	
		Y MAXIMUM	36.5	39.4	828	
	MON	THLY MEAN	35.0	37.7	817	



Table 1 section 1.xls

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Table 2 Daily 2003 Mississippi River Discharge Flow rate (cfs) at Lock Dam 3

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	12500	8000	7300	18600	37300	31000	42700	14300	5400	6300	8300	8000	
2	12300	8000	7500	18400	34100	29900	44000	17200	5400	6300	7500	8800	
3	10800	8100	7100	18400	30900	29300	44600	14700	4700	6200	7600	9000	
4	10500	8900	7200	19000	29400	26600	44600	12400	4800	7000	8300	9200	
5	10900	8300	7000	17300	28200	26000	44400	13800	6300	6900	9100	9300	
6	10900	8100	7100	18000	27800	25900	44300	13700	5500	6900	9100	9200	
7	10800	7900	7300	17000	26500	23900	43600	13400	5500	6100	9100	9000	
8	11100	8000	7600	13800	28100	23700	42000	13400	6300	5400	8300	9300	
9	11400	7900	7400	14100	28900	23900	40200	12700	5400	4600	8200	10100	
10	11300	8000	7200	14200	32800	22800	38700	12000	3900	5400	6000	10500	
11	10300	7400	6400	14400	35000	24000	36900	11500	5500	7700	5400	8200	
12	9100	7400	6800	14300	36900	25300	34800	10900	10900	9100	7000	5300	
13	8000	7500	7700	14100	42300	28000	33400	<b>97</b> 00	10400	7400	8500	5400	
14	7700	7700	7800	12700	48400	28800	33800	9700	10400	6800	8300	5900	
15	7500	8100	7800	13600	55300	29300	34000	9700	9500	6900	8300	6500	
16	7600	8100	9000	14000	60200	29100	32900	9700	7500	6900	9700	8400	
17	8700	8100	13900	19400	61100	28500	33300	9700	7500	6900	9400	9000	
18	9500	8000	16400	23700	59700	28000	31900	6800	6100	4700	7500	8900	
19	9800	7800	15800	27100	57000	⁻ 26700	32000	7700	9200	5500	9000	8400	
20	9300	7800	15700	30600	53900	22200	31100	9800	9000	5500	9700	8000	
21	9100	7800	17500	33800	51600	21600	31700	9800	7500	7800	9800	8100	
22	8800	8200	19300	36600	50700	19500	28300	11000	8300	8400	8900	8100	
23	8300	8000	20000	39600	50400	18200	27100	5400	8400	8300	8200	8200	
24	7900	7900	20200	42700	49800	18500	26100	5400	8300	6700	9100	8100	
₂₅	7400	7700	20600	45200	48300	25500	23700	7000	7800	6100	7700	8200	
26	7400	7200	21800	46300	46600	37900	21700	6900	6100	6300	7600	8100	
27	7200	7200	23200	45800	44600	32700	22000	7600	7800	6300	7300	7800	
28	7300	7300	24000	43900	42300	36100	20400	6000	6900	7000	7700	8000	
29	7500		23600	42000	39300	38500	18800	7700	6100	7800	7100	8200	
30	7500	þ	21300	39800	36900	41000	16600	7600	6200	7600	7300	9000	
31	7700		18000		33700		15300	5400		9100		9400	
MIN	7200	7200	6400	12700	26500	18200	15300	5400	3900	4600	5400	E200	
IVIIIN	1200	1200	0400	12700	20000	10200	19900	5400	<u>2200</u>	4600	5400	5300	
MAX	12500	8900	24000	46300	61100	41000	44600	17200	10900	9100	9800	10500	
MEAN	9229	7871	13210	25613	42194	27413	32739	10084	7087	6771	8167	8310	
			-										

YEAR MAX 611

YEA

61100 3900

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Table 3

2003 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

	Mean Plant Flow	Mean River Flow	Percentage of Mean River Flow
Month	(cfs)	(cfs)	Entering the Plant Intake
January	672	9229	7.3%
February	633	7871	8.0%
March	722	13210	5.5%
April	525	25613	2.0%
May	283	42194	0.7%
June	566	27413	2.1%
July	1143	32739	3.5%
August	1185	10084	11.8%
September	857	7087	12.1%
October	1001	6771	14.8%
November	898	8167	11.0%
December	817	8310	9.8%
Averages	775	16557	4.7%

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Month	2003	2002	2001	2000	1999	199	8	1997	1996	1995	1994	1993
January	9,229	10,932	11,271	8,974	10,790	9	806	14,823	14,826	11,36	5 13,090	9,326
February	7,871	10,104	10,471	9,548	12,589	14,	911	13,954	15,041	9,37	1 12,611	8,936
March	13,210	11,497	10,948	22,219	17,897	26,	574	24,177	24,474	29,06	1 28,542	12,513
April	25,613	40,657	112,703	15,570	42,013	51,	477 1	106,073	57,517	48,50	7 40,830	55,473
May	42,194	33,974	82,661	18,839	47,426	22,	681	39,316	46,535	45,13	5 47,548	48,571
June	27,413	26,323	53,177	22,070	34,423	25,	690	19,487	33,790	30,66	7 26,913	65,377
July	32,739	34,597	23,981	21,052	27,548	26,	477	36,119	23,732	27,32	3 29,403	84,123
August	10,084	29,065	12,164	.10,026	24,432	10,	742	28,074	13,303	29,129	) 19,971	41,135
September	7,087	24,513	9,193	6,687	18,013	7,	060	16,663	9,300	19,860	) 21,203	30,717
October	6,771	28,600	9,577	6,790	14,200	12,	597	14,155	11,403	31,061	25,581	19,516
November	8,167	18,467	11,040	17,463	13,243	19,	773	14,160	23,353	30,703	3 20,173	18,773
December	8,310	12,135	13,813	9,558	9,671		645	12,694	18,716	17,494	14,432	16,490
Averages	16,557	23,405	30,083	14,066	22,687	20,	286	28,308	24,333	26,710	25,025	34,246
	· · · · · · · · · · · · · · · · · · ·											
Month	1992	1991	1990	198		988	1987	198		85	1984	1983
January	15,658	5,542	4,9		,294	7,303	13,75			2,526	13,375	14,260
February	13,978	5,879	4,8		,529	7,634	12,58		the second s	),239	18,557	13,375
March	43,661	15,081	17,4			14,810	17,28			2,265	27,290	55,276
April	32,668	34,268	12,8			21,463	20,26			,317	56,277	56,239
May	25,474	44,753	22,3			13,119	13,65		the second s	,518	49,528	38,155
June	17,920	44,960	31,6		,237 .	4,667				,105	55,613	24,404
July	28,985	33,856	20,3		,690	2,903	11,674		the second s	,676	37,165	36,353
August	14,532	21,535	16,3		,658	5,103	10,47			,226	13,826	14,141
September	15,686	25,182	9,92	the second s	,307	6,080	7,183			,665	9,678	14,213
October	15,374	15,458	11,13		,358	7,019	7,771				23,866	17,536
November	19,076	22,467	9,90		,793	7,919	8,693				21,157	18,108
December	12,126	20,503	6,18		,961	6,487	9,010				15,903	16,729
Averages	21,262	24,124	13,9	91 11	,140	8,709	12,245	5 37,7	87 27	,047	28,519	26,566

Table 4. Mean Monthly Mississippi River Flow for 1983 - 2003, in cubic feet per second (cfs).

Note: Mean monthly river flow data for the years 1985, 1990, 1991 and 1992 have been adjusted to reflect the averages found in Table 2 of the corresponding annual report for each year.

### SECTION II

## PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2003 ANNUAL REPORT

### SUMMARY OF THE 2003 FISH POPULATION STUDY

Study and Report by B. D. Giese and K. N. Mueller

Environmental Services Water Quality Department

### INTRODUCTION

To fulfill part of the continuing environmental monitoring requirements of the Prairie Island Nuclear Generating Plant, (PINGP), the Mississippi River fisheries population was sampled near Red Wing, Minnesota, May through October, 2003. The study area extends from 3.6 miles upstream of the plant (River mile 802) to 10.8 miles downstream of the plant (River mile 787.5), (Figure 1). The original objective of the study was to "determine existing ecological characteristics before plant operation and to assess any significant changes to the aquatic environment after operation" (NSP 1972). The objective was changed slightly after the plant became operational in 1973; to "determine environmental effects of the PINGP on the fish community in the Mississippi River and it's backwaters" (Hawkinson 1973). Presently, the objective is to monitor and assess the status of the fishery in the vicinity of the PINGP (Mueller 1994). Parameters analyzed and compared to previous years include species composition, length-weight regressions, percent contribution (fish/hr), length-frequency distributions, and catch per unit effort (CPUE) for selected species.

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### METHODS AND MATERIALS

Fish were collected using a Smith-Root SR-18 Electrofishing boat equipped with a 5.0 GPP electrofishing unit (Figure 6). The power source was a 5.0 GPP generator. The 5000 watt generator has a maximum output of 16 amps, and a range of 0-1000 volts. The generator has the capability to be either pulsed AC or DC with a pulse frequency of 7.5, 15, 30, 60, and 120 Hz. The annode consists of two umbrella arrays, each with six dropper cables. The 18 foot boat and dropper cables hung from the front of the boat serve as the cathode. Collection occurred during daylight hours with a pulsed direct current. Due to the constantly changing river conditions, Electrofisher output was varied to enhance the effectiveness.

Sampling was done monthly, May through October, within four established sectors of the study area (Figures 1-5). The runs within each sector are similar to previous years sampling to ensure a similar set of relative data indices for yearly comparison. At the end of each "run", the elapsed shocking time was recorded from a digital timer, which only tallied the seconds that the electrical field was energized. A run was terminated after approximately 450 seconds shocking time or when the end of the prescribed run was reached.

Stunned fish were captured with one-inch stretch mesh landing nets equipped with eight-foot insulated handles. Fish were placed in live-wells, supplied with river water constantly, until the end of each run. At the end of each run fish were identified, measured to the nearest millimeter (total length), weighed to the nearest 10 grams, and released. Parameters used to describe the fisheries include species composition, length-weight regressions, percent contribution, length-frequency distributions, and catch

per unit effort (CPUE). It is assumed that population dynamics and spatial distribution is represented by CPUE.

Electrofishing CPUE was computed as numbers of fish per hour for each sector. Length frequencies in 20 millimeter intervals were calculated for all fish species. Length-weight relationships were calculated using the length-weight formula:

$$\log W = \log a + b \log L,$$

where W is the weight in grams, a is the y axis intercept, b is the slope of the regression line, and L is the total length in millimeters.

### **RESULTS**

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Initial PINGP preoperational annual environmental reports simply listed all data collected without discussion or analysis (NSP 1972). Individual species were not discussed, due to the amount of data collected during initial sampling efforts. Representative species were selected in 1975 for abundance comparisons based on electrofishing data (Gustafson et. al. 1975), modified in 1986 after seining was eliminated (Donkers 1986), and in 1989 smallmouth and largemouth bass were added as they "have been seen more frequently in the electrofishing catch during recent years in the PINGP study area" (Mueller 1989).

Electrofishing collection methods changed before the 1982 sampling season. The mesh size of the dip nets was increased to one inch stretch mesh. The larger mesh size enabled small adult fish and some young of the year fish of certain species to avoid collection. Currently, individual gizzard shad, freshwater drum, and white bass less than 160 mm are not collected. Also, logperch and cyprinids (other than carp) are no longer collected, due to their small size (Donkers 1987). Therefore, a direct comparison of electrofishing CPUE prior to 1982 is inappropriate to later years.

A total of 7,845 fish, comprising 41 species, was collected in the 2003 survey (Table 2).

Species collected in 2003 are compared to previous years in Table 1. An individual lake sturgeon was collected in 2003. This was the first lake sturgeon collected since the study began. Greater redhorse and goldeye were sampled in 2003, but not in 2002. American eel and black bullhead were collected in 2002 (Giese and Mueller 2002), but not in 2003 (Table 1).

All species collected in 2003 are ranked according to electrofishing CPUE and listed in Table 2. Summaries for selected species (Tables 3-9) are based on electrofishing and trapnetting data for years 1977 through 1987, and on electrofishing data only for years 1988 through 2003, since trapnetting was discontinued after 1987 (Orr 1988). Annual CPUE for selected species is compared to previous years (Figures 15-22), by sector (Figures 23-30), and by date (Figures 31-38). The top three abundant species, based on CPUE, was determined for each sector.

Sector One;freshwater drum, carp, and shorthead redhorseSector Two;freshwater drum, carp, and smallmouth bassSector Three;white bass, freshwater drum and smallmouth bassSector Four;white bass, freshwater drum and shorthead redhorseOverall CPUE Average;freshwater drum, white bass, and carp

Table 10 summarizes the percent contribution of historically predominant species in the annual catch. Length frequency distributions for selected species are illustrated by sector in Figures 7 through 14.

#### **DISCUSSION**

When dealing with a large river environment, a high degree of natural variability exists in habitat conditions and therefore, in fish distribution. Palmquist (1982) proposed the wide range in species abundance between study sectors was largely due to habitat preferences of a species rather than PINGP induced. A high degree of variability in species abundance exists within sectors from year to year. Differences in collection efficiency and year class strengths may explain this variability.

A qualitative and quantitative discussion for selected species, with respect to other years, includes: 1) CPUE, 2) rank, 3) percent composition of catch, 4) population condition as depicted by length-weight regression analysis, and 5) mean length.

Average mean length was calculated by splitting the length data for each species into 20 mm intervals and multiplying the number of fish in each interval by the median length of that interval (Example: The number of fish in the 260-279 mm interval was multiplied by 270 mm). Interval totals were summed, divided by the total number of fish, and rounded to the nearest 10 mm.

#### GIZZARD SHAD

Electrofishing CPUE for gizzard shad decreased from 14.02 fish/hr in 2002 to 9.51 fish/hr in 2003 (Figure 15). CPUE decreased in Sectors 1, 3 and 4 from 2002 to 2003, with only a slight increase evident in Sector 2 (Figure 23). CPUE was also examined for each sampling month for 2003, with the highest occurring in Sector 4 in May (Figure 31).

Shad ranked sixth in 2003 (Table 2), and presently comprise five percent of the catch (Table 10). The general condition of gizzard shad, 3.469, falls into the range of previous years, 2.388 to 3.934 from 1982-2002 (Table 3). Carlander (1969) sites a population in Canton Lake, Oklahoma with a range in total fish length of 173 to 335 mm and a regression slope of 3.066 which compares well to the fish in this study. The mean length for gizzard shad (380 mm) increased from 2002 (Table 3). The length frequency data indicates a range of approximately 270-470 mm, with a peak occurring at approximately 370 mm (Figure 7).

#### **FRESHWATER DRUM**

Freshwater Drum CPUE for 2003, (37.51 fish/hour) increased from 2002 (24.45 fish/hr), and is the second highest CPUE recorded since 1982 (Figure 16). CPUE was higher in all sectors when comparing 2003 to 2002 (Figure 24). The highest CPUE in a sector for any month occurred in Sector 2 in May (Figure 32).

Freshwater drum CPUE ranked first in 2003 (Table 2). Although carp historically has had the highest composition expressed as percentage of total annual catch and resulting CPUE overall, carp ranked third in 2003 (Table 2). Presently, adult freshwater drum comprise nineteen percent of the catch (Table 4).

The general condition of freshwater drum has remained relatively stable, as depicted by a regression slope of 3.276 in 2003, in comparison to a range of slopes of 2.598 to 3.212 from previous years of the study (Table 4). The mean length for freshwater drum was approximately 350 mm in 2003 (Table 4). The length frequency data for freshwater drum suggest that a peak occurs at approximately 310 mm (Figure 8).

#### SHORTHEAD REDHORSE

Electrofishing CPUE for shorthead redhorse has ranged from 7.07 to 25.94 fish/hour (Figure 17). CPUE for 2003 (20.92 fish/hr) is higher than the two previous years (Table 5). Historically, the CPUE within each sector is highly variable (Figure 25). The 2003 CPUE is also variable between sectors, ranging from 12.43 fish/hour in Sector 2, to 31.42 fish/hour in Sector 3 (Table 2). CPUE for each sector is highly variable during the collection year, with the highest CPUE occurring in Sector 3 in October (Figure 33).

Shorthead redhorse ranked fourth in 2003 (Table 2). Presently, adult shorthead redhorse comprise eleven percent of the catch (Table 5).

The general condition of shorthead redhorse has remained relatively stable, as depicted by a regression slope of 3.033 in 2003, in comparison to a range of slopes of 2.571 to 3.041 from previous years of the study (Table 5). The length-weight regression slope of shorthead redhorse in the vicinity of Prairie Island is about the same as that of another population of Upper Mississippi River shorthead redhorse as reported by Carlander (1969) as having a slope of 2.83. The mean length for shorthead redhorse at Prairie Island was approximately 390 mm in 2003 (Table 5). The length frequency data show that the main peak occurs at approximately 380 mm (Figure 9).

### WHITE BASS

Electrofishing CPUE for white bass in 2003 (31.22 fish/hr) is the lowest recorded since 1997 (Figure 18). A large difference is evident when comparing CPUE upstream of Lock and Dam 3 to downstream of Lock and Dam 3 (Table 2). Overall CPUE appears cyclic (Figure 18) with year to year variability within each sector (Figure 26). Highest CPUE for any month sampled, occurred in Sector 3 in June with 120+ fish/hr (Figure 34).

White bass ranked second in 2003 (Table 2). Presently, white bass comprise 16 percent of the catch (Table 10).

The general condition of white bass has remained relatively stable, as depicted by a regression slope of 2.977 in 2003, in comparison to a range of slopes of 2.441 to 3.085 from previous years of the study (Table 6). The mean length for white bass is similar to the last eight years (Table 6). The length frequency data shows that a main peak occurs for white bass at approximately 350 mm, with a smaller peak at approximately 250 mm (Figure 10).

### <u>WALLEYE</u>

Electrofishing CPUE for walleye in 2003 (7.18 fish/hour) is the lowest recorded since 1998 (Figure 19). CPUE decreased upstream of the plant and increased slightly downstream comparing 2003 to 2002 (Figure 27). The highest CPUE for any sector in any month was Sector 3 in October (Figure 35).

Walleye ranked seventh in 2003 in overall catch abundance (Table 2). Presently, adult walleye comprise four percent of the catch (Table 7). The number of individuals collected decreased in 2003, ending a 10 year trend of increasing numbers (Table 7).

The general condition of walleye has remained relatively stable, as depicted by a regression slope of 3.253 in 2003, in comparison to a range of slopes of 2.852 to 3.318 from previous years of the study (Table 7). The mean length for walleye increased from 2002 to approximately 450 mm (Table 7). The length-weight relationship indicates peaks occurring at approximately 350 and 550 mm (Figure 11).

### SAUGER

Electrofishing CPUE for sauger decreased from 7.50 fish/hr in 2002 to 5.86 fish/hr in 2003 (Figure 20). Sauger CPUE decreased in each sector in 2003, compared to 2002 (Figure 28). Sector 1 had the highest CPUE in July of any sector in any month (Figure 36).

Sauger ranked eighth in 2003 (Table 2), comprising three percent of the catch (Table 8).

The general condition of sauger has remained relatively stable, as depicted by a regression slope of 3.281 in 2003, in comparison to a range of slopes of 2.648 to 3.356, in previous years of the study (Table 8). The mean length for sauger was approximately 300 mm in 2003 (Table 8). The length frequency data exhibit a range from 150-530 mm, with relatively broad peaks occurring at approximately 270 mm and 380 mm (Figure 12).

### SMALLMOUTH BASS

Electrofishing CPUE for smallmouth bass appears cyclic with the peak CPUE (17.02 fish/hour) occurring in 2000, while 2003 CPUE was 15.59 fish/hr (Figure 21). CPUE in Sectors 1-4 appear cyclic (Figure 29) with curves appearing similar in shape to the curve for all sectors combined shown in Figure 21. The highest CPUE (70+ fish/hr) occurred in Sector 3, in October (Figure 37).

Smallmouth bass ranked fifth in 2003 (Table 9), comprising eight percent of the catch. The population of smallmouth bass appears to be in good general condition as depicted by a regression line slope of 3.149, which compares well with smallmouth bass populations provided by Carlander (1977). Smallmouth bass have a length frequency range of approximately 130-520 mm, with a relatively broad peak occurring between 200 and 300 mm (Figure 13).

#### LARGEMOUTH BASS

Largemouth bass CPUE for 2003, (5.09 fish/hour), is the lowest recorded since 2000 (Figure 22). 2003 exhibits the first decrease in Largemouth bass CPUE since 1994 (Table 9). The CPUE for Sector 1 was virtually zero for all sampling dates, while Sectors 2-4 have a little more variability (Figure 30). The highest CPUE occurred in Sector 4 in October (Figure 38).

Largemouth bass ranked eleventh in 2003 (Table 9), comprising three percent of the catch. Historically, largemouth bass rank has varied greatly, ranging from 9th to 20th (Table 9).

The population of largemouth bass appears to be in good general condition as depicted by a regression line slope of 3.206, which compares well with information on largemouth bass populations provided by Carlander (1977). The length frequency data indicates a range of 100-480 mm, with peaks occurring at approximately 300 and 400 mm (Figure 14).

### GENERAL

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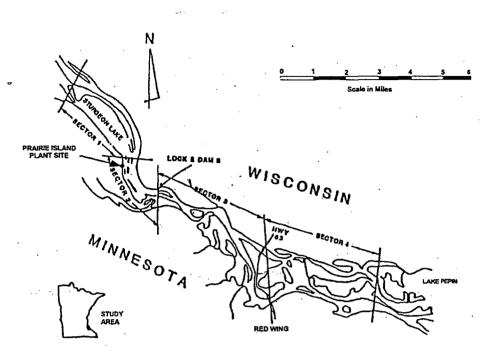
The ten most abundant species collected during 2003 in descending order, based on average CPUE for all sectors combined were: 1) freshwater drum, 2) white bass, 3) carp, 4) shorthead redhorse, 5) smallmouth bass, 6) gizzard shad, 7) walleye, 8) sauger, 9) quillback carpsucker and 10) silver redhorse (Table 2).

Total average CPUE for all species and sectors combined decreased slightly from 199.57 fish/hr in 2002, to 193.89 fish/hr in 2003 (Table 2).

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- Palmquist, P. R. 1982. Summary of the 1982 fish population study. <u>IN</u>: Prairie Island Nuclear Generating Plant Environmental Monitoring Program 1982 Annual Report. Northern States Power Company, Minneapolis, MN.

### PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA



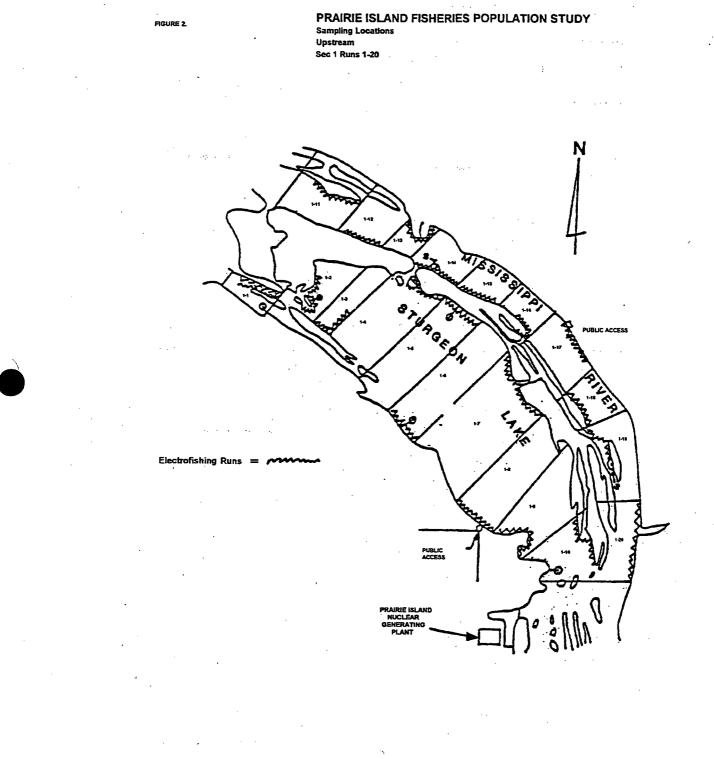




Figure 3.

PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Plant Area (Sec 2 Runs 1-10)

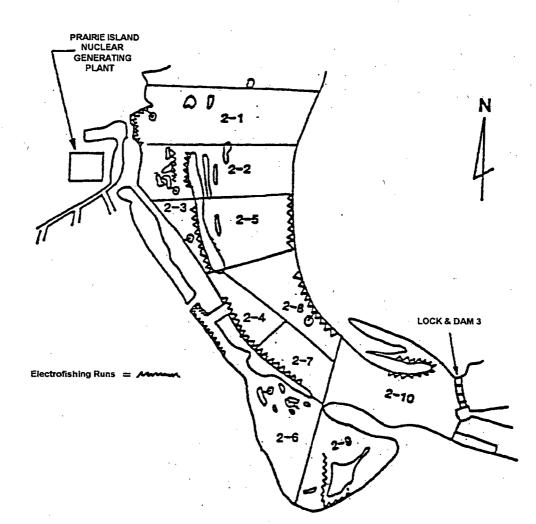
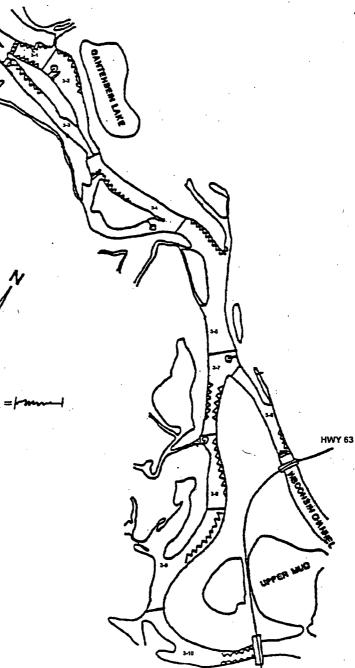




Figure 4.

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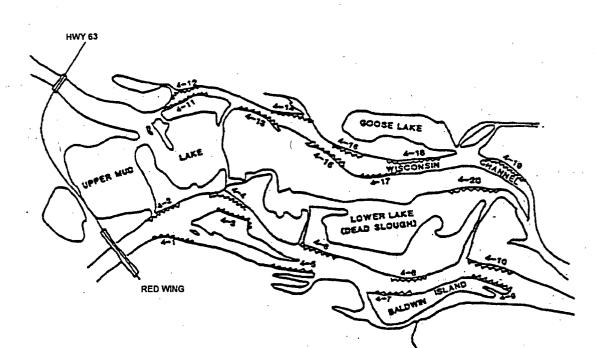
Electrofishing Runs

PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Downstream (Sec 3 Runs 1-10)



Figure 5. 1

## PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Downstream (Sec 4 Runs 1-20)

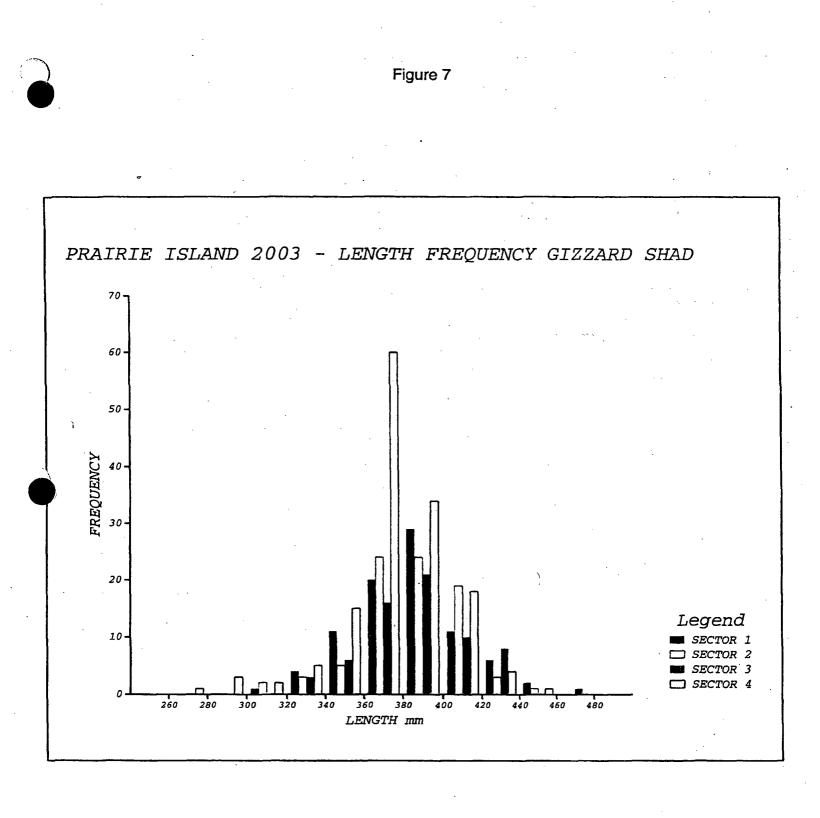


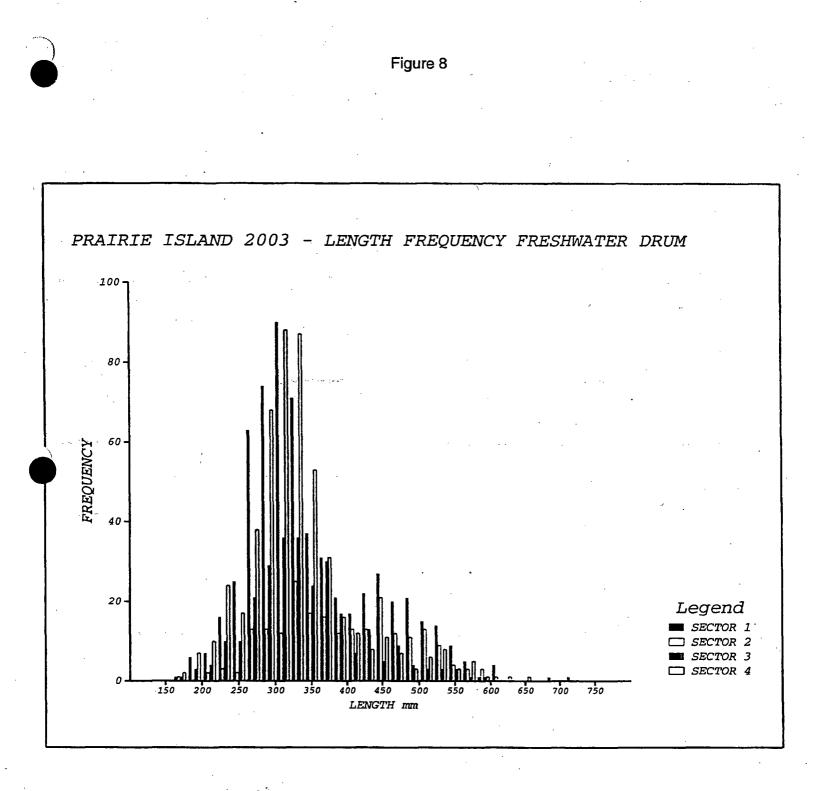
Electrofishing Runs = A

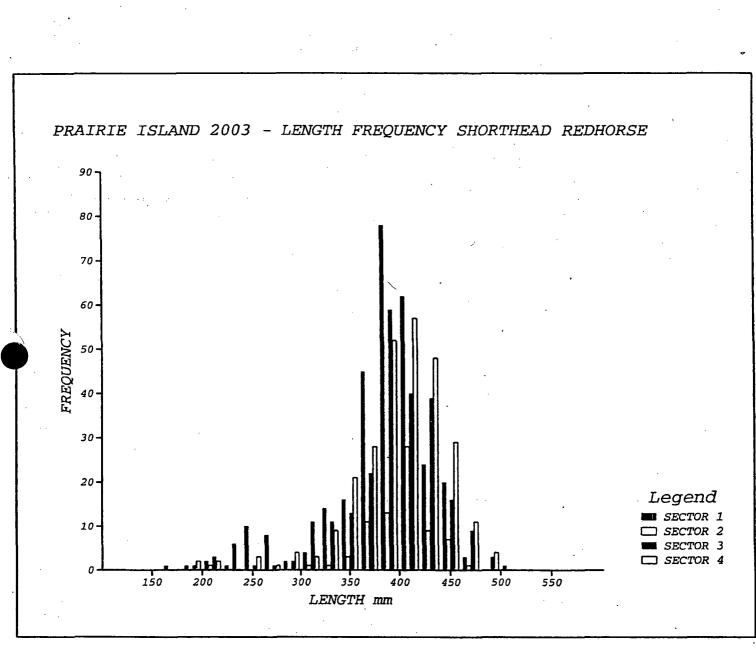


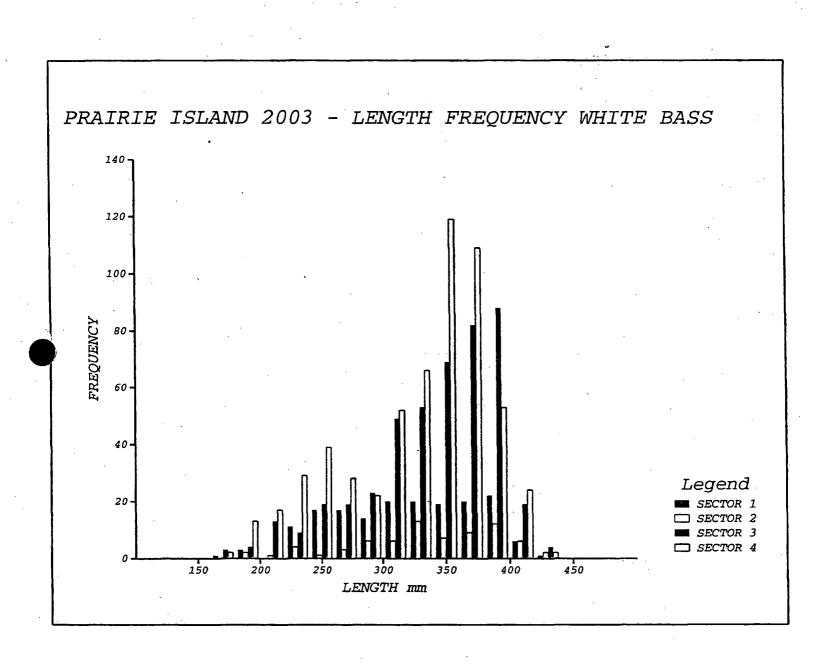
Figure 6 Electrofishing Boat

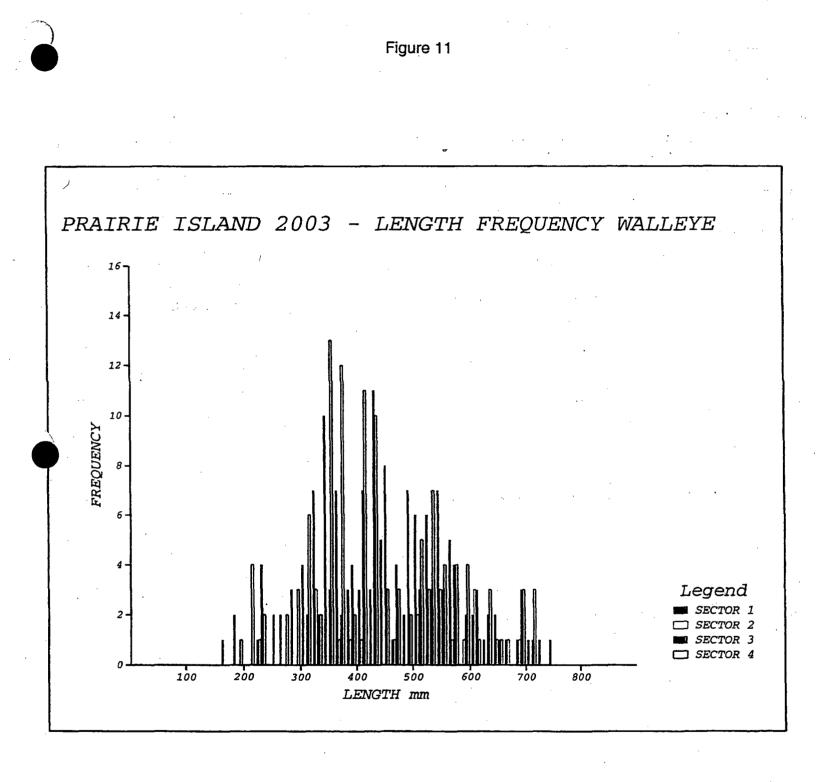


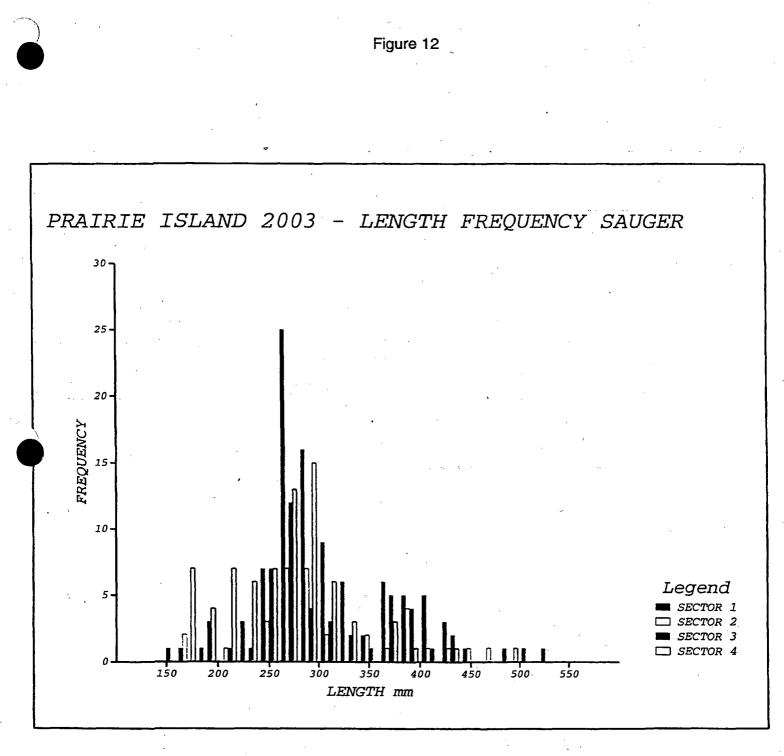






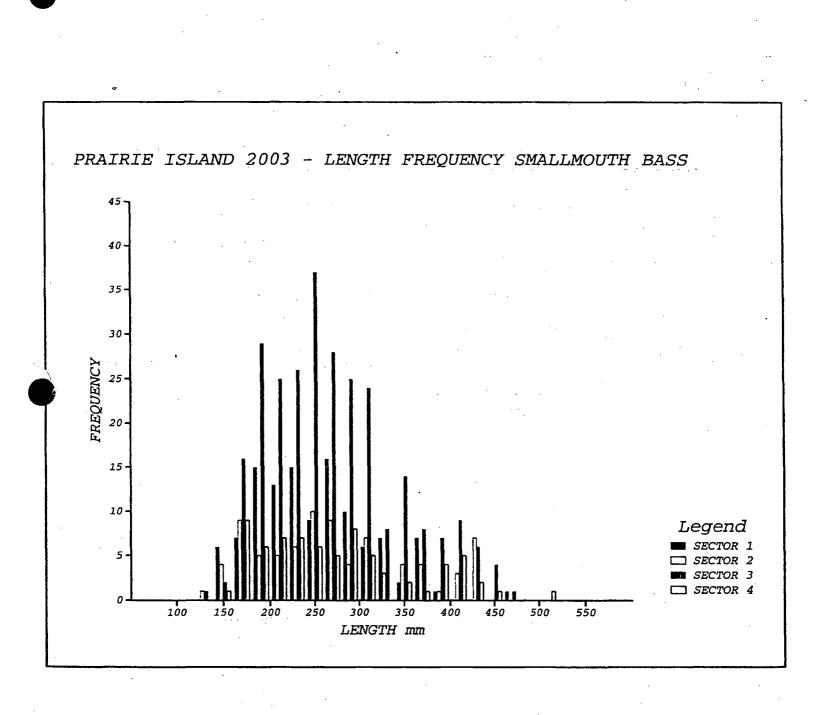


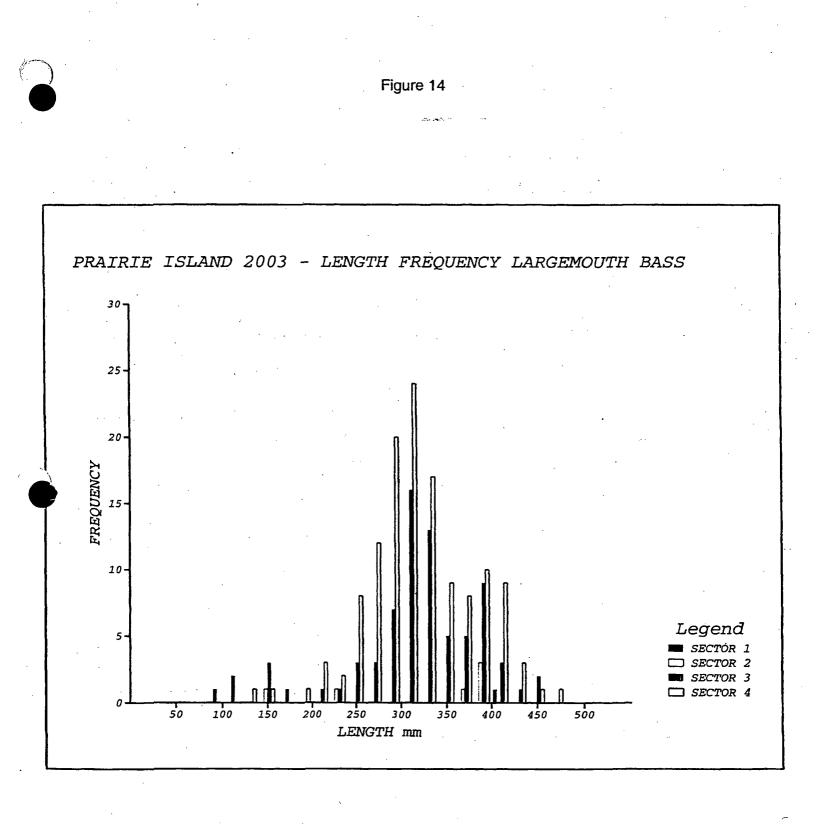




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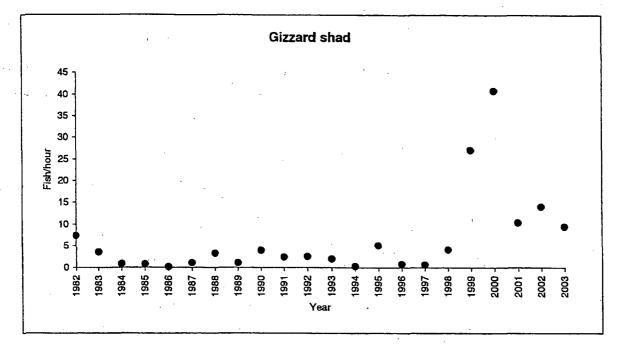
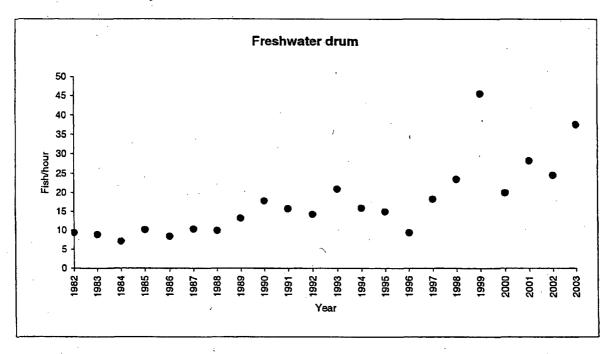


Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2003 in the vicinity of PINGP.

Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2003 in the vicinity of PINGP.



2003FIGUR.XLS

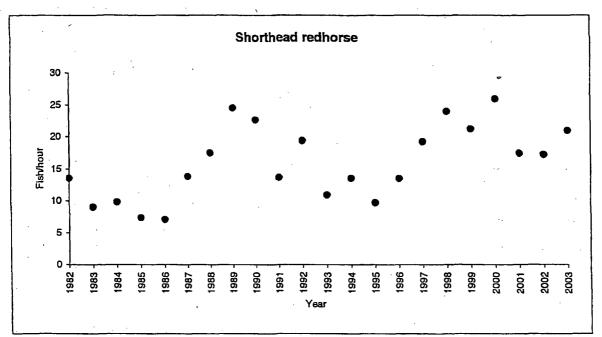
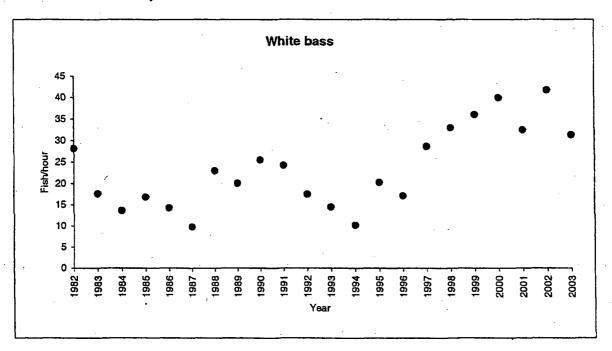


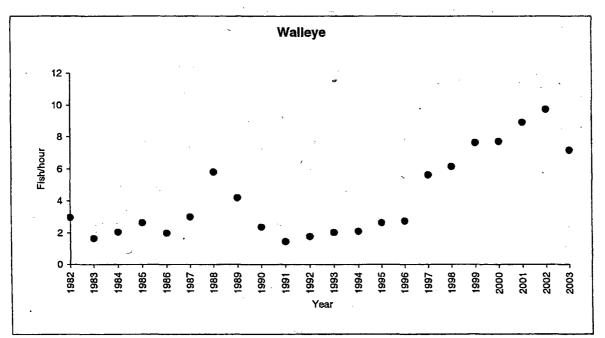
Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2003 in the vicinity of PINGP.

Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2003 in the vicinity of PINGP.



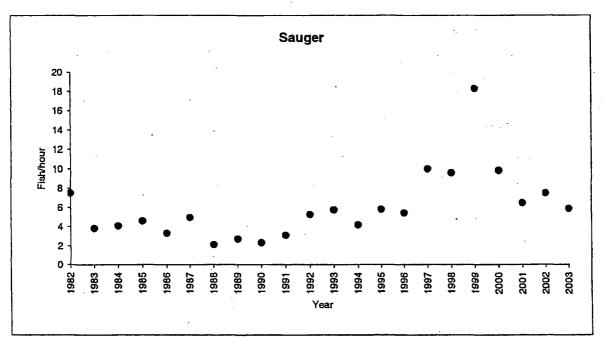


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# Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2003 in the vicinity of PINGP.

Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2003 in the vicinity of PINGP.



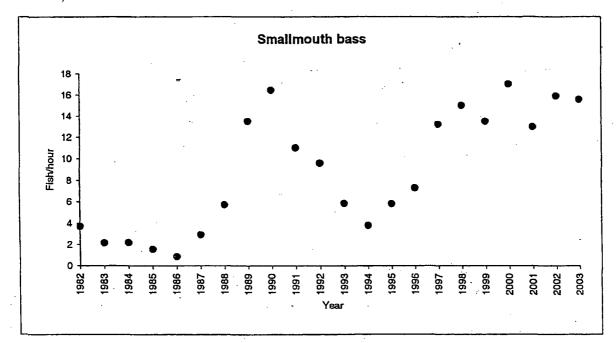


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2003 in the vicinity of PINGP.

Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2003 in the vicinity of PINGP.

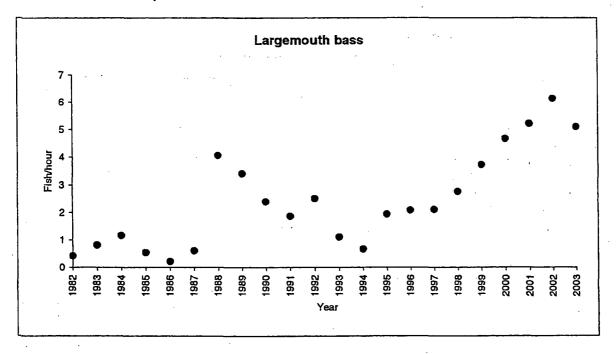
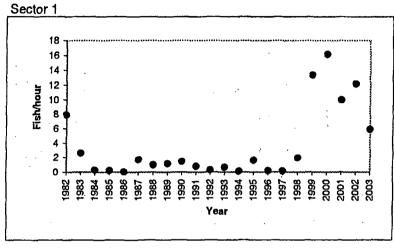
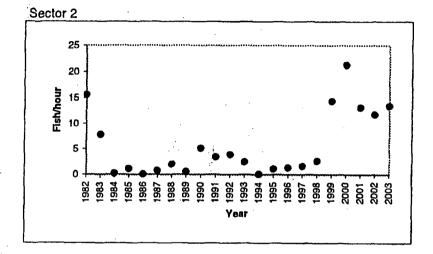
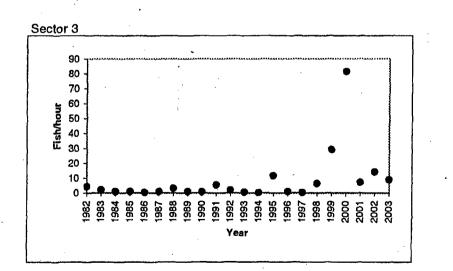
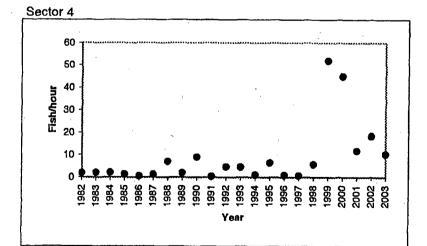


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2003 in the vicinity of PINGP.









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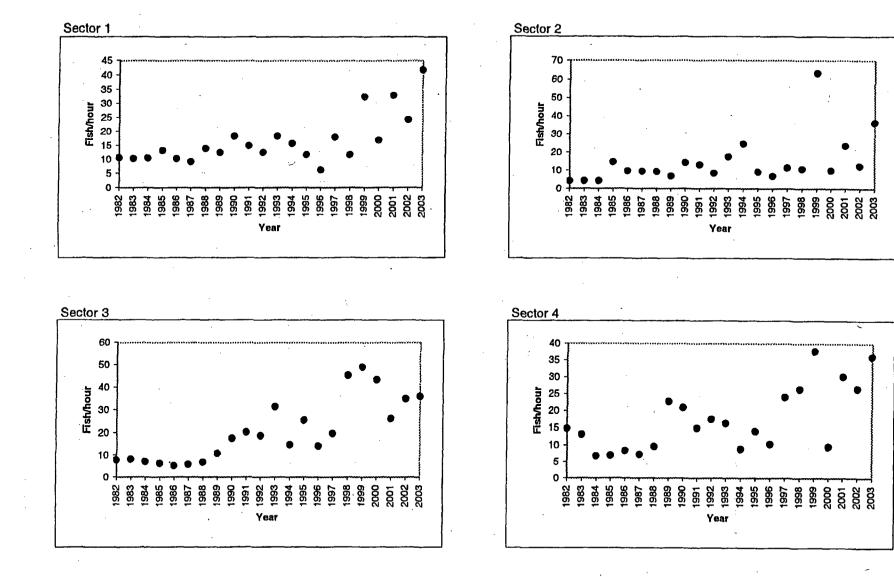


Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2003 in the vicinity of PINGP.

2003FIGUE XLS

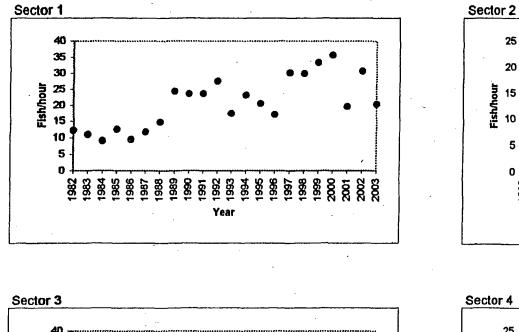
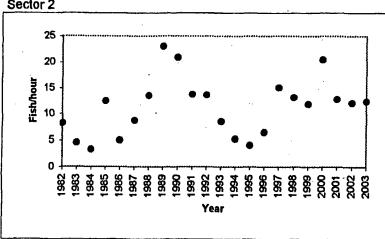
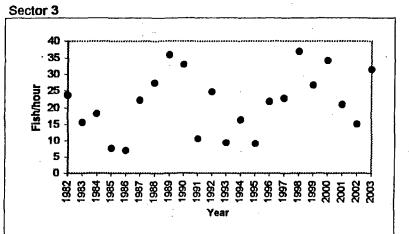
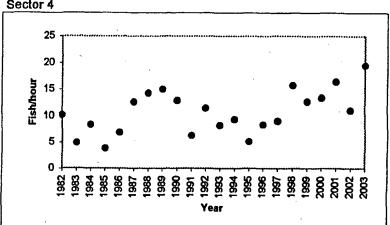


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2003 in the vicinity of PINGP.

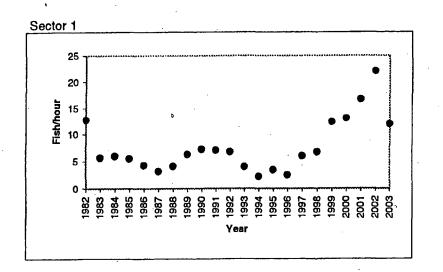




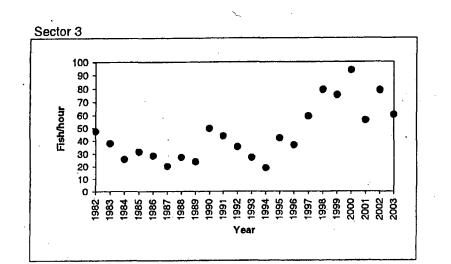


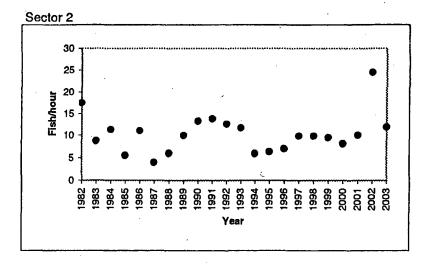
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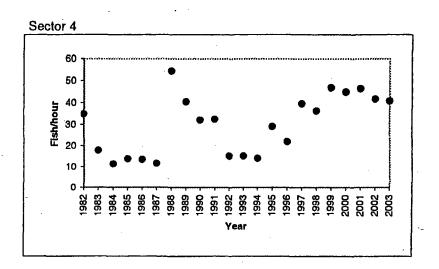
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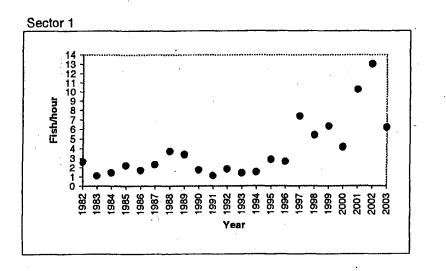


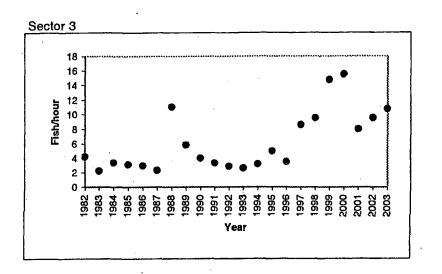


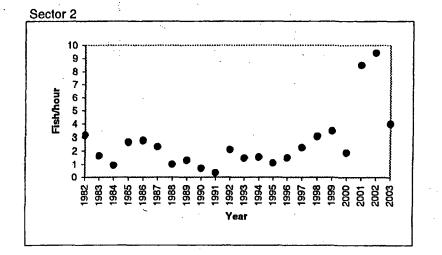




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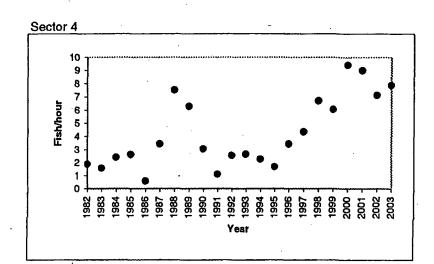
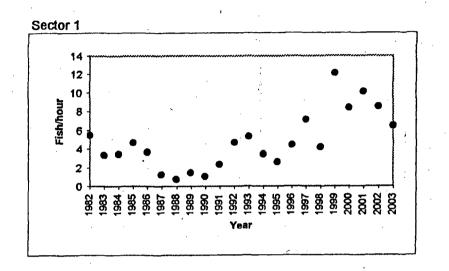
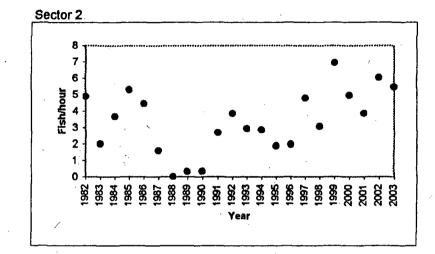
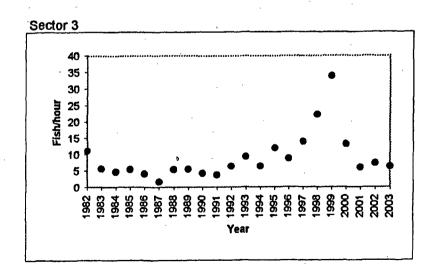


Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2003 in the vicinity of PINGP.

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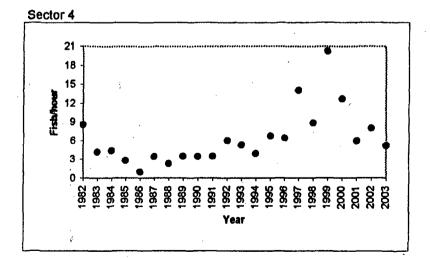


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2003 in the vicinity of PINGP

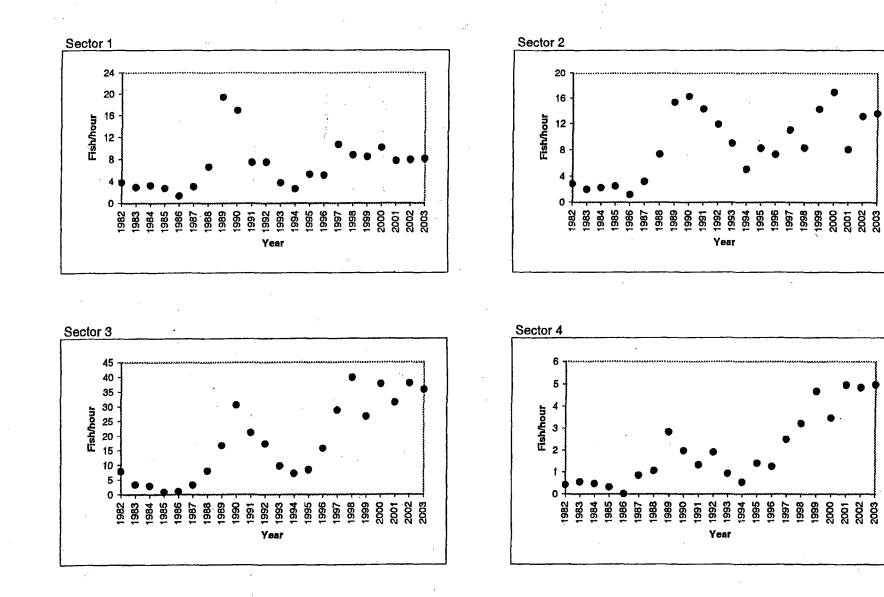


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2003 in the vicinity of PINGP.

2003FIGUR.XLS

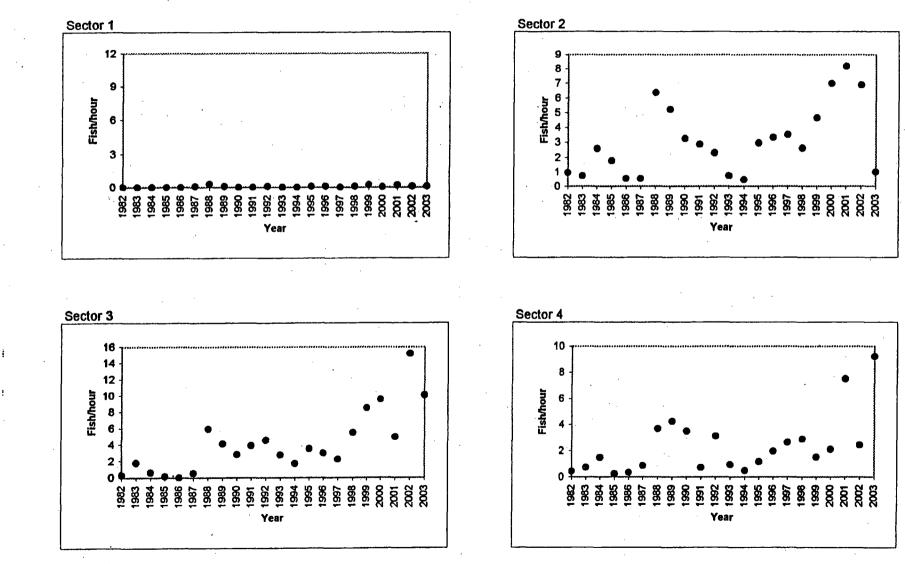
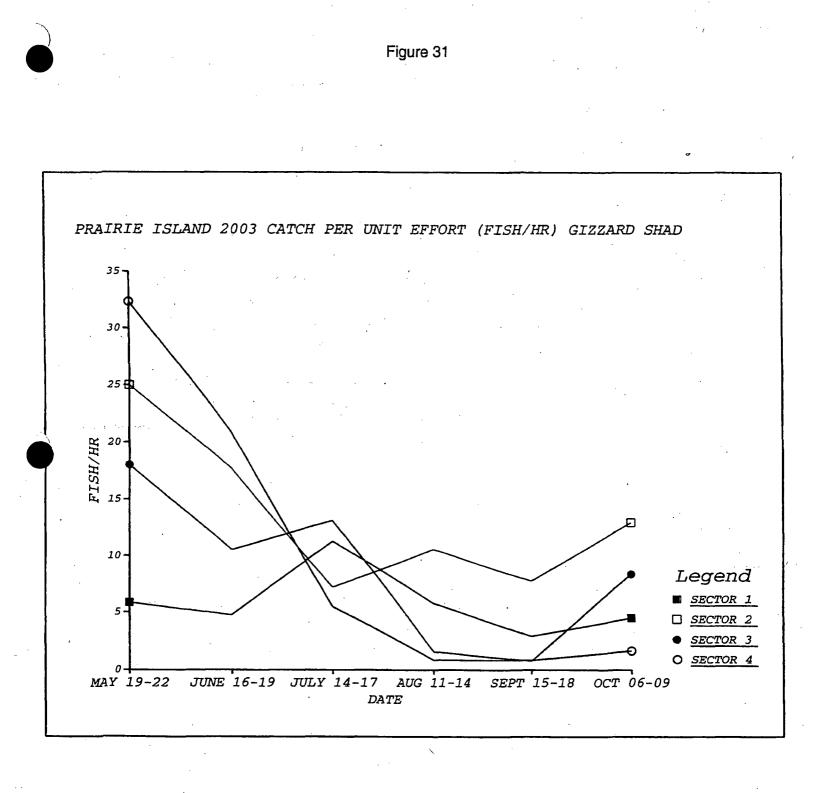
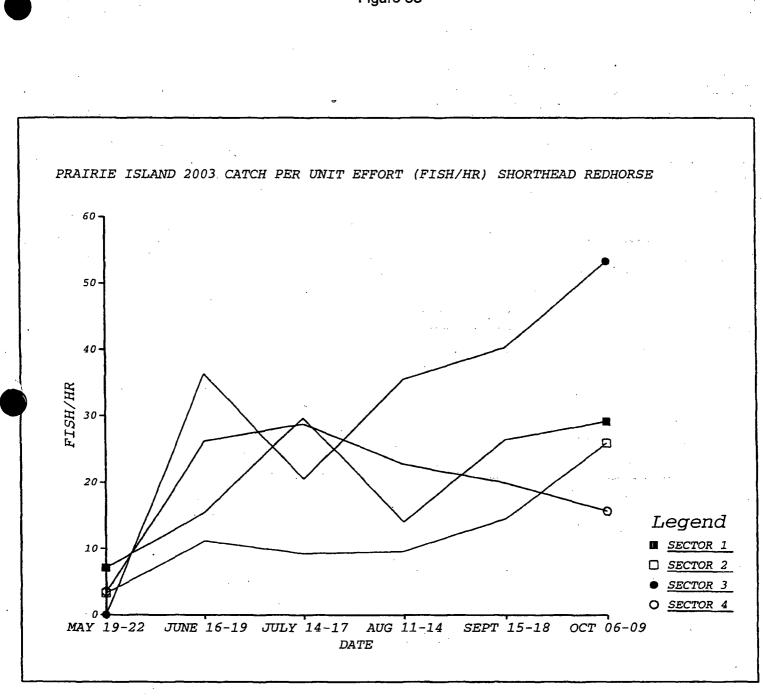
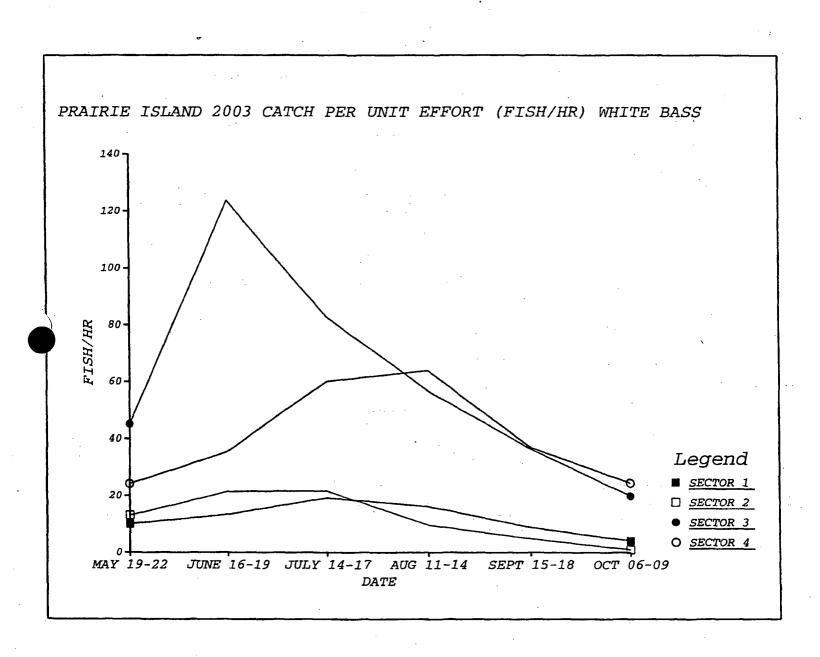


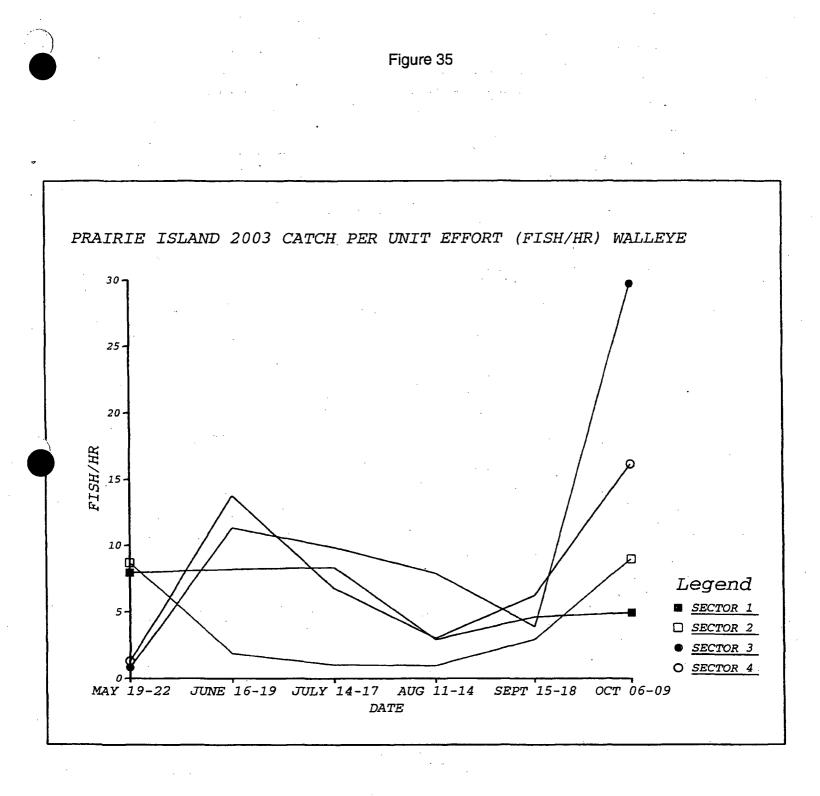
Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2003 in the vicinity of PINGP.

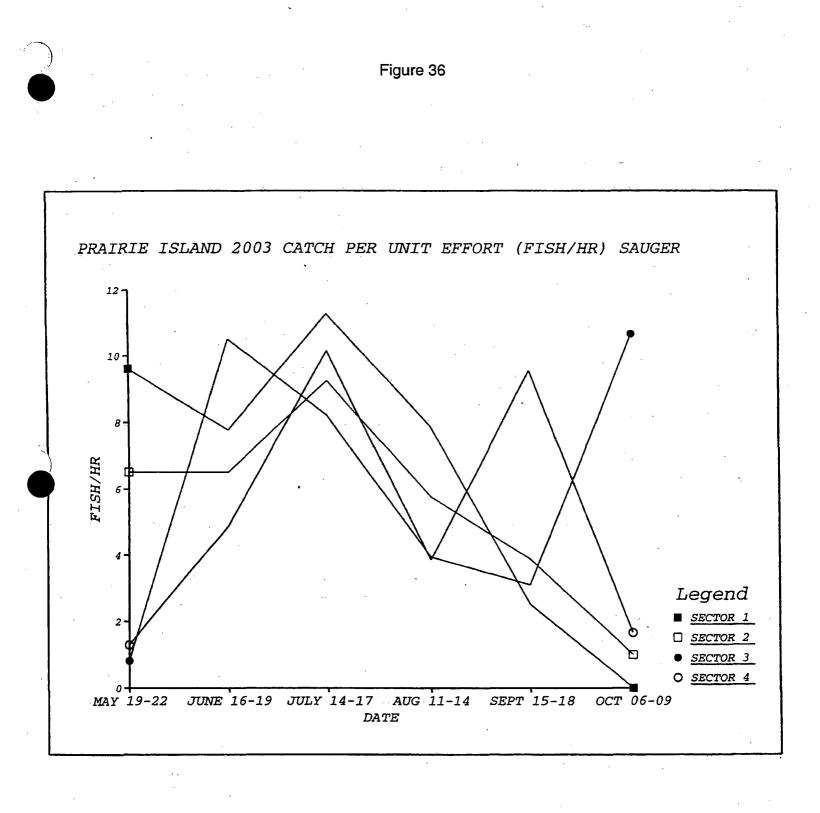


PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) FRESHWATER DRUM 140-120-100 FISH/HR 80. 60. 40· Legend SECTOR 1 20-SECTOR 2 SECTOR 3 O SECTOR 4 MAY 19-22 OCT 06-09 JUNE 16-19 JULY 14-17 AUG 11-14 SEPT 15-18 DATE



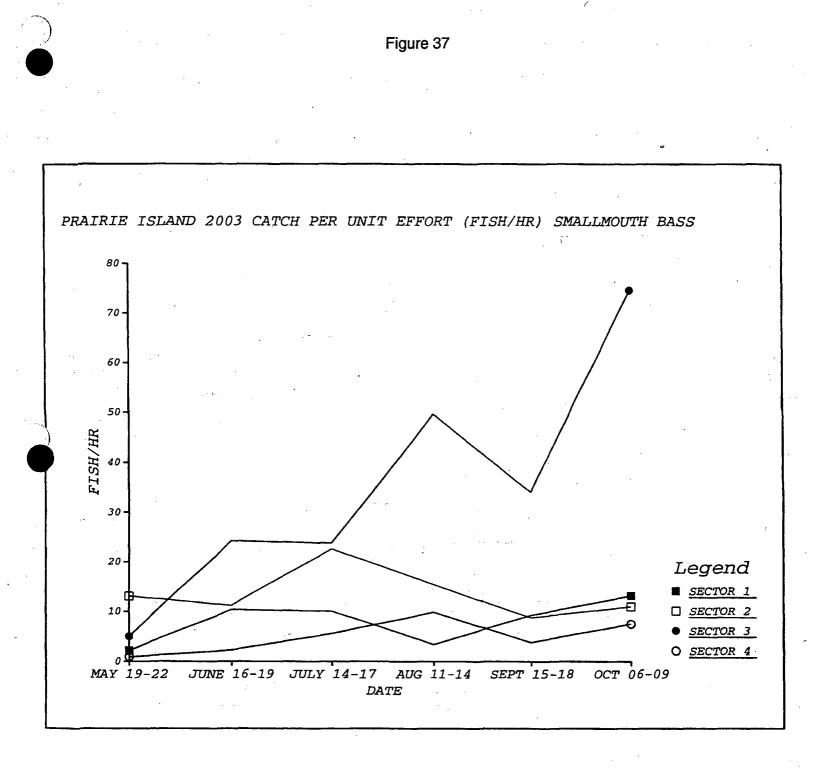




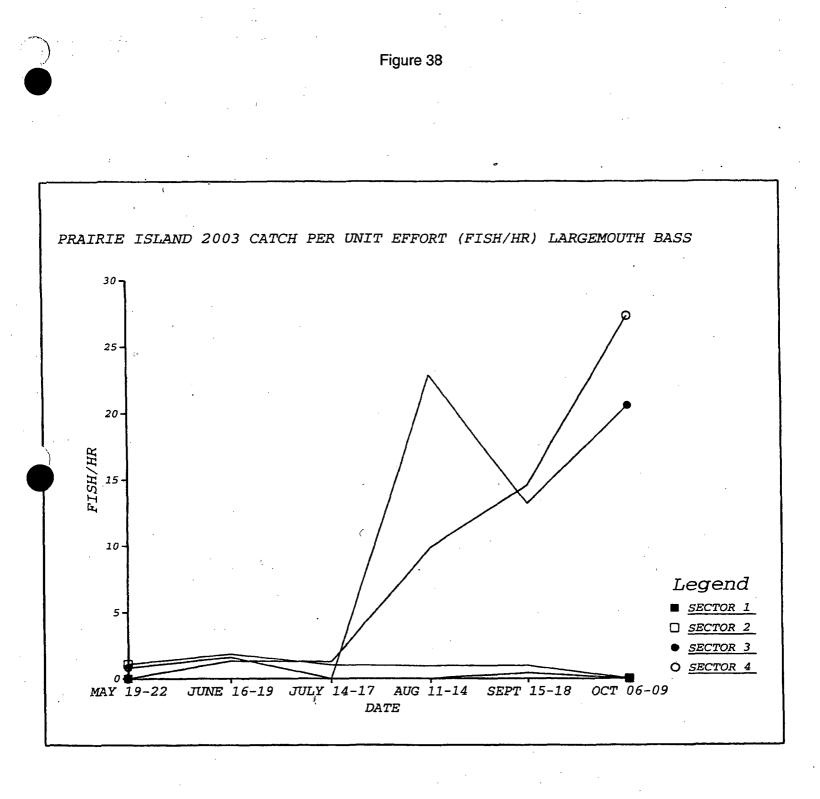


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Table 1.

Species of fish captured In the Mississippl River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2003.

Species	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>	<u>98</u>	<u>99</u>	<u>00</u>	<u>01</u>	<u>02</u>	<u>O3</u>
Chestnut lamprey	x	x							x	x			x			x	x		x	x	x
Ichthyomyzon castaneus					,														~	Ą	~
Silver lamprey					х	х	x	х	x	x		x	x	x	x	x	х	x	х	x	x
Icthyomyzon unicuspus																					·. ·
Paddlefish															x						
Polyodon spathula																					
Longnose gar	<b>X</b> .	х	x	х	х	x	x	x	x	<b>X</b> ·	х	х	x	x	x	x	х	х	х	х	x
Lepisosteus osseus																					
Shortnose gar	x	х	x	x	x	x	x	x	x	x	x	х	х	х	X	x	х	х	х	х	х
Lepisosteus platostomus			•																		
Bowfin	x	X	x	X	X	х	х	х	х	X	x	х	х	х	x	х	x	· <b>X</b>	х	х	x
<u>Amia calva</u>			·																		
American eel	x	x		x	х	x	х	х	x	x	х	х	x	х			х	х		х	
<u>Anguilla rostrata</u>																					
Gizzard shad	x	х	x	X	х	х	x	x	х	x	х	x	х	х	x	х	x	x	х	х	x
<u>Dorosoma cepedianum</u>																					
Goldeye	x		<b>X</b>		х	<b>X</b> .					x			х	x	x	х				x
<u>Hiodon alosoides</u>																					
Mooneye	x	х	х	х	х	х	х	х	X	х	х	х	х	x	x	x	х	х	х	х	X
Hiodon tergisus																					
Brown trout	~			x									x		x		x		х	х	x
Salmo trutta																					
Northern pike	x	x	x	х	х	x	x	x	X	х	х	х	х	х	X	Х	х	х	х	x	x
<u>Esox lucius</u>																					
Musky										5								х	х		
Esox masquinongy																					
Carp	x	х	Х	х	х	х	х	х	х	x	х	x	x	х	x	х	х	x	x	х	x
<u>Cyprinus carpio</u>																					
Carpsucker Species		х					x														
Carpiodes species											. '										
River carpsucker	x	x	- <b>X</b>	х	X	Х	X	х	х	Х	X	X	х	Х	x	х	x	X	x	x	x
<u>Carpiodes carpio</u>																					
Quillback	x	х	х	х	Х	х	х	X	x	х	х	x	х	x	х	x	x	х	x	X	x
<u>Carpiodes cyprinus</u>								-													•
Highfin carpsucker			x	х	х	x	х	х	x	x	<b>X</b> .	х	x	x	X					x	x
<u>Carpiodes velifer</u>																					
White sucker	<b>X</b>	x	x	x	x	x	x	x	x	x	<b>X</b> . :	x	x		. <b>X</b>	x	x	х	x	x	x
Catostomus commersoni							×-														
table to mans									,	$\frown$	:										
March Minia								•													

Table 1 (cont.)	Spe	cies c	of fist	capt	lured	In th	e Mis	sissi	opi Ri	iver li	n the	vicin	ity of	the f	Prairie	e Isla	nd N	uclea	r Ge	nerati	ing Pla	ant 1983	8-2003	J.
Species	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>	<u>98</u>	<u>99</u>	<u>00</u>	<u>01</u>	<u>02</u>	<u>03</u>			
Blue sucker	х			х	х	x	x		х	х	х	x	x	x	x	<b>x</b> .	x	x	х	x	x			
Cycleptus elongatus																								
Northern hogsucker	х		•												x			x						
Hypentelium nigricans			•	•														•						
Smallmouth buffalo	х	х	х	x	X	Ϊ <b>Χ</b>	x	х	х	х	X	х	x	x	х	х	х	x	х	х	x			
Ictiobus bubalus															•									
Bigmouth buffalo	х	x	х	x	X	х	х	х	x	x	x	x	x	х	X	x	х	x	x	x	х			
<u>Ictiobus cyprinellus</u>																								
Spotted sucker	х	x		X		x	х			x						. •								
<u>Minytrema melanops</u>																								
Silver redhorse	. X	х	х	х	x	x	x	×.	х	x	x	х	х	x	х	X	х	x	x	х	х			
Moxostoma anisurum															1									
River redhorse		х	x		· X		x	x	X	x		х	X			x	х	x	x	x	X			
<u>Moxostoma carinatum</u>																								
Golden redhorse	x	х	Χ_	х	x	Χ.	x	x	x	x	x	х	х	x	X	x	х	x	x	X	Х			
<u>Moxostoma erythrurum</u>															۰.									
Greater redhorse		х		х		×.		x							х	х			x		Х			
<u>Moxostoma valenciennesi</u>																								
Shorthead redhorse	х	х	Х	х	х	X	X	х	Х	х	х	х	х	Х	х	x	х	х	х	x	X			
Moxostoma macrolepidotum																								
Black builhead	x	х	Χ.	х	х	х				X	-						х	х		х				
<u>lctalurus melas</u>																								
Yellow bullhead					х	x	x					. <b>X</b>	х						2					
Ictalurus natalis																								
Brown bullhead	X j																							
<u>Ictalurus nebulosus</u>																								
Channel catfish	х	х	х	х	х	x	X	x	x	х	х	х	х	x	х	x	x	x	х	х	x			
Ictalurus punctatus																								
Flathead catfish	х	х	х	х	x	x	x	x	х	x	x	х	x	x	х	х	x	x	x	х	x			
<u>Pylodictus olivaris</u>																								
Burbot	x	x			<b>X</b>					x	х	х	х	x	x	х	x	х	х	x	x			
Lota lota																								
White bass	x	х	x	x	x	x	x	x	X	х	x	x	x	x	х	х	х	x	x	x	x			
Marone chrysops										÷.,												•		
Rock bass	х	х	х	x	x	х	x	x	x	х	х	×	X	x	x	<b>X</b> _	x	x	x	x	X			
Ambloplites rupestris																								
Green sunfish	x	x			x	x	x	х	х	x	х	x	x	x	x	x	x	x	x	x	x			-
<u>Lepommis cyanellus</u>																				:				

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Table 1 (cont.)

Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2003.

Species	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>	<u>98</u>	<u>99</u>	<u>00</u>	<u>01</u>	<u>02</u>	<u>O3</u>
Pumpkinseed .							x	x	x	x	x	x	x	x	x	x	x	×	x	x	x
Lepomis gibbosus			. •			•			-												
Orangespotted sunfish																x		x	x		
Lepomis humilis				•								•									
Bluegill	Х	х	<b>. X</b>	x	x	<b>X</b>	x	x	x	x	. <b>X</b>	x	х	x	x	x	x	x	x	X	х
Lepomis macrochirus																					
Smallmouth bass	x	x	x	x	x	X	x	Χ.	x	x	x	X	x	x	. <b>X</b>	<b>.</b> X	х	x	х	x	X
<u>Micropterus dolomieui</u> Largemouth bass	x		x	~		x			v		~	x	~	· ·							
Micropterus salmoides	~	x	<b>^</b> .	X	x	~	x	X	X	x	<b>X</b>	~	x	х	x	x	x	x	x	X	X
White crappie	x	x	x	Χ.	x	x	x	Χ.	x	x	x	x	x	x	x	x	x	x	x	x	x
Pomoxis annularis	^	Ŷ	^	<b>^</b> .	^	. ^	^	~ ·	^	^	^	^	^	^		^	^	^	^	^	^
Black crappie	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pomoxis nigromaculatus		~						n				~		~		~	~	~	^	~	~
Yellow perch	x	x	x		x	<b>x</b> .	x	X	x	x	x	x	x		x	x	x		x	x	x
Perca flavens																					
Sauger	X	х	x	x	x	<b>X</b> .	х	x	X	x	x	x	x	х	x	х	х	х	x	x	x
Stizostedion canadense																					
Walleye	х	x	X	x	х	x	x	x	x	X	x	X	х	х	x	x	x	x	x	x	x
Stizostedion vitreum																					
Saugeye						• .									х	x	x	÷	x	x	x
S. vitreum x S. canadense																					
Freshwater drum	x	x	x	x	X	X	x	x	x	x	x	x	x	x	x	x	x	x	х	x	X
Aplodinotus grunniens																					
Lake sturgeon																					x
Acipenser fulvescens																					



 Table 2.
 Electrofishing CPUE (fish/hour) for each sector in the vicinity of PINGP

 and total number of each species collected during 2003.

Species are listed in ascending order by rank according to average CPUE.

number

							number
Rank	Species	Sector 1	Sector 2	Sector 3	Sector 4	Average	collected
1	Freshwater drum	41.74	36.45	35.93	35.93	37.51	1595
2	White bass	11.94	11.93	60.19	40.82	31.22	1272
3	Carp	22.06	29.32	34.34	17.32	25.76	996
	Shorthead redhorse	20.38	12.43	31.42	19.45	20.92	878
5	Smallmouth bass	8.03	13.58	35.80	4.97	15.59	537
6	Gizzard shad	5.86	13.42	8.62	10.15	9.51	373
7	Walleye	6.14	3.98	10.74	7.88	7.18	304
· 8	Sauger	6.49	5.47	6.23	5.25	5.86	247
	Quillback carpsucker	5.30	8.45	3.05	6.32	5.78	239
	Silver redhorse	6.49	4.47	3.31	6.82	5.27	241
11	Largemouth bass	0.07	0.99	10.08	9.23	5.09	213
	Smallmouth buffalo	5.58	5.80	4.91	3.12	4.85	196
13	Bluegill	0.00	6.63	5.70	5.89	4.56	166
	Flathead catfish	0.56	4.31	5.17	1.78	2.95	98
15	Black crappie	0.49	1.66	1.72	4.62	2.12	95
	Channel catfish	1.54	4.80	0.27	0.36	1.74	58
	Bowfin	0.14	0.17	2.12	3.55	1.49	69
18	Bigmouth buffalo	1.19	0.66	1.99	0.99	1.21	50
	Longnose gar	0.63	1.16	0.80	0.43	0.75	28
	Northern pike	0.07	0.50	1.33	0.64	0.63	23
	Mooneye	1.12	0.00	0.53	0.50	0.54	27
	White crappie	0.00	1.16	0.00	0.78	0.49	18
	River carpsucker	0.77	0.17	0.40	0.36	0.42	20
	Blue sucker	0.70	0.17	0.40	0.36	··· 0.40	19
	Shortnose gar	0.42	0.17	0.80	0.14	0.38	15
	Golden redhorse	0.49	0.17	0.27	0.43	0.34	16
	Green sunfish	0.00	0.99	0.13	0.00	0.28	7
	Rock bass	0.35	0.00	0.27	0.43	0.26	13
	Silver lamprey	0.28	0.00	0.27	0.14	0.17	8
	Saugeye	0.00	0.33	0.13	0.07	0.13	4
	Pumpkinseed	0.00	0.17	0.13	0.07	0.09	3
	Goldeye	0.00	0.17	0.13	0.07	0.09	3
	River redhorse	0.07	0.17	0.13	0.00	0.09	3
34	White sucker	0.00	0.17	0.00	0.14	0.08	3
35	i Burbot	0.00	0.00	0.27	0.00	0.07	2
36	Chestnut lamprey	0.00	0.17	0.00	0.00	0.04	1
	Highfin carpsucker	0.00	0.00	0.13	0.00	0.03	1
	Greater redhorse	0.00	0.00	0.13	0.00	0.03	1
	Lake sturgeon	0.00	0.00	0.13	0.00	0.03	1
	) Yellow perch	0.00	0.00	0.00	0.07	0.02	
	Brown trout	0.00	0.00	0.00	0.07	0.02	
-	Totals	148.87	170.14	267.53	189.00	193.89	7845



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TABLES2003.XLS

		ELECTRO 7	TRAPNET	CATCH			· ·
		CPUE	CPUE	COMP		MEAN	· · · · ·
	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
-	1977	7.92	0.61	4	135	NA	LOG W=3.101 LOG L-5.163
	1978	10.20	0.20	5	73	NA	LOG W=3.068 LOG L-5.078
	1979	1.81	0.06		NA	NA	NA
	1980	10.83	0.14		NA	NA	NA
	1981	23.03	0.38	9	917	216	LOG W=2.748 LOG L-4.348
	1982	7.39	0.09	3	276	329	LOG W=2.917 LOG L-4.741
	1983	3.57	0,26	2	155	355	LOG W=3.029 LOG L-5.049
	1984	0.84	0.08	1	48	281	LOG W=2.684 LOG L-4.171
	1985	0.81	0.01	1	31	325	LOG W=2.388 LOG L-3.431
	1986	0.14	0.06	<1	13	274	LOG W=3.248 LOG L-5.634
	1987	1.08	0.05	1	55	256	LOG W=3.030 LOG L-5.046
	1988	3.25	NA	3	139	288	LOG W=2.629 LOG L-4.015
	1989	. 1.07	NA	<1	47	323	LOG W=3.025 LOG L-5.021
	1990	3.99	NA	3	170	326	LOG W=2.956 LOG L-4.857
	1991	2.39	NA	4	198	338	LOG W=2.601 LOG L-3.940
	1992	1.82	NA		91	357	LOG W=3.459 LOG L-6.127
	1993	1.99	NA		62		LOG W=2.920 LOG L-4.728
	1994	0.28	NA		14		LOG W=3.371 LOG L-5.955
	1995	5.10	NA		204		LOG W=2.625 LOG L-4.073
	1996	0.76	NA		27		LOG W=3.275 LOG L-5.666
	1997	0.66	NA		23		LOG W=3.934 LOG L-7.373
	1998	4.07	NA		176		LOG W=3.104 LOG L-5.218
	. 1999	27.12	NA		1222		LOG W=2.981 LOG L-4.988
	2000				1634		LOG W=3.274 LOG L-5.697
	2001	10.43	NA		455		LOG W=3.767 LOG L-6.967
	2002		NA		. 612		LOG W=3.200 LOG L-5.518
	2003	9.51	NA	5	373	380	LOG W=3.469 LOG L-6.198

Table 3. Fisheries summary for Gizzard shad 1977-2003.



TABLES2003.XLS

Table 4.	ELECTRO	•	CATCH		377-2000.	•
	CPÚE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr		N		LENGTH WEIGHT REGRESSION
<u>1977</u>		5.27	(%)	<u>N</u>	NA	LOG W=2.947 LOG L-4.756
			13 17	569 422	NA	LOG W=2.911 LOG L-4.750
1978		6.28				
1979			21	360	NA	LOG W=3.068 LOG L-5.100
1980		3.83	18	520	NA	LOG W=3.052 LOG L-5.026
1981	30.88	4.76	12	1146	267	LOG W=2.891 LOG L-4.625
1982		11.00	24	2225	293	LOG W=2.888 LOG L-4.625
1983		8.18	22	1626	287	LOG W=3.001 LOG L-4.927
1984		6.21	20	1212	288	LOG W=2.598 LOG L-3.919
1985		7.92	31	1712	293	LOG W=2.846 LOG L-4.452
1986		0.39	22	856	310	LOG W=3.089 LOG L-5.139
1987		3.75	16	940	312	LOG W=2.874 LOG L-4.603
1988		NA	8	419	280	LOG W=2.722 LOG L-4.205
1989	13.17	NA	11	570	294	LOG W=2.908 LOG L-4.707
1990	17.70	NA	13	724	297	LOG W=3.008 LOG L-4.957
1991	15.68	NA	12	596	305	LOG W=2.955 LOG L-4.824
1992	14.23	NA	11	539	320	LOG W=2.967 LOG L-4.829
1993	20.83	NA	18	584	334	LOG W=3.063 LOG L-5.053
1994	15.92	NA	14	495	332	LOG W=3.072 LOG L-5.086
1995	14.96	NA	12	605	317	LOG W=3.124 LOG L-5.243
1996	9.33	NA	8	374	300	LOG W=3.061 LOG L-5.093
1997	18.18	NA	10	812	300	LOG W=3.090 LOG L-5.159
1998	23.47	NA	11	983	320	LOG W=3.171 LOG L-5.344
1999		NA	17	1745	,	LOG W=3.138 LOG L-5.289
2000		NA	8	776		LOG W=3.077 LOG L-5.161
2001		NA	15 ′	1279		LOG W=3.212 LOG L-5.480
2002		NA	12	1062		LOG W=3.155 LOG L-5.346
2003		. NA	19	1595		LOG W=3,276 LOG L-5,637

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 Table 4.
 Fisheries summary for Freshwater drum 1977-2003.

 ELECTRO_TRAPNET_CATCH



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		ELECTRO	TRAPNET	CATCH		*	
		CPUE	CPUE	COMP		MEAN	
	YEAR	Fish/hr	Fish/h <b>r</b>	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
-	1977	5.39	1.58	5	259	NA	LOG W=2.902 LOG L-4.691
	1978	2.96	1.09	- 4	125	NA	LOG W=2.978 LOG L-4.917
	1979	2.08	0,45	3	67	NA	LOG W=3.041 LOG L-5.090
	1980	6.08	0.70	7	137	NA	LOG W=2.894 LOG L-4.678
	1981	11.67	1.34	7	686	376	LOG W=2.791 LOG L-4.428
	1982	13.56	0.92	7	675	392	LOG W=2.814 LOG L-4.496
	1983	8.96	0.79	6	454	387	LOG W=2.849 LOG L-4.590
	1984	9.74	0.51	7	435	386	LOG W=2.571 LOG L-3.840
	1985	7.36	0.51	7	374	389	LOG W=2.787 LOG L-4.415
	1986	7.07	0.19	. 8	319	398	LOG W=2.911 LOG L-4.730
	1987	13.80	1.24	12	722	403	LOG W=2.860 LOG L-4.608
	1988	17.48	NA	13	667	381	LOG W=2.696 LOG L-4.176
	1989	24.52	NA	17	902	370	LOG W=2.792 LOG L-4.448
	1990	22.60	NA	14	838	361	LOG W=2.825 LOG L-4.544
	1991	13.58	NA	11	538	355	LOG W=2.784 LOG L-4.443
	1992	19.35	NA	14	721	403	LOG W=2.841 LOG L-4.587
	1993	10.86	NA	10	332	382	LOG W=3.011 LOG L-4.991
	1994	13.51	NA	14	505	389	LOG W=2.872 LOG L-4.655
	1995	9.67	NA	8	450	364	LOG W=2.925 LOG L-4.808
	1996	13.42	NA	11	551	380	LOG W=2.897 LOG L-4.719
	1997	19.21	NA	10	833	350	LOG W=2.982 LOG L-4.960
	1998	23.94	NA	12	1047	360	LOG W=2.982 LOG L-4.960
	1999	21.17	NA	9	931	350	LOG W=3.016 LOG L-5.050
	2000	25.94	NA	11	1099	360	LOG W=2.905 LOG L-4.760
	2001	17.43	NA	9	. 777		LOG W=3.039 LOG L-5.101
	2002	17.23	NA	9	781	370	LOG W=2.954 LOG L-4.892
	2003	20.92	NA	11	878	390	LOG W=3.033 LOG L-5.071
							•

Table 5.Fisheries summary for Shorthead redhorse 1977-2003.FLECTRO_TRAPNET_CATCH



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CPUE         CPUE         COMP         MEAN           YEAR         Fish/hr         Fish/hr         (%)         N         LENGTH         LENGTH         WEIGHT         REGRESS           1977         7.76         6.73         19         565         NA         LOG         W=2.441         LOG         L-3.529           1978         7.11         5.67         17         369         NA         LOG         W=2.956         LOG         L-4.813           1979         3.49         3.02         13         217         NA         LOG         W=3.055         LOG         L-5.053	· · · · · · · · · · · · · · · · · · ·
1977         7.76         6.73         19         565         NA         LOG W=2.441 LOG L-3.529           1978         7.11         5.67         17         369         NA         LOG W=2.956 LOG L-4.813	· · · · · · · · · · · · · · · · · · ·
1978 7.11 5.67 17 369 NA LOG W=2.956 LOG L-4.813	
1979 3.49 3.02 13 217 NA LOG W=3.055 LOG L-5.05	,
1980 2.48 1.97 9 183 NA LOG W=3.064 LOG L-5.022	,
1981 30.88 5.39 20 1996 240 LOG W=2.842 LOG L-4.49	
「 1982 28.11 0.07 18 1722 286 LOG W=2.909 LOG L-4.67	
1983 17.50 4.52 17 1277 300 LOG W=3.041 LOG L-5.02	
1984 13.53 2.89 15 435 304 LOG W=2.571 LOG L-3.84	
1985 16.75 1.39 14 768 `308 LOG W=2.773 LOG L-4.33	, . 
1986 14.23 1.63 18 732 325 LOG W=2.926 LOG L-4.71	;
1987 9.70 1.44 10 589 321 LOG W=3.027 LOG L-4.95	1
1988 22.90 NA 20 1009 242 LOG W=2.855 LOG L-4.52	<b>;</b>
1989 20.00 NA 15 819 266 LOG W=2.945 LOG L-4.76	<b>;</b>
1990 25.49 NA 16 941 295 LOG W=2.913 LOG L-4.69	••
1991 24.15 NA 18 886 310 LOG W=2.911 LOG L-4.69	
1992 17.36 NA 11 577 338 LOG W=2.967 LOG L-4.82	}
1993 14.42 NA 12 390 328 LOG W=2.939 LOG L-4.75	)
1994 10.20 NA 10 360 339 LOG W=2.911 LOG L-4.67	
1995 20.16 NA 16 809 267 LOG W=3.026 LOG L-4.97	
1996 16.99 NA 14 660 320 LOG W=3.066 LOG L-5.06	3
1997 28.53 NA 15 1159 300 LOG W≃3.054 LOG L-5.03	3
1998 32.90 NA 16 1314 320 LOG W=3.085 LOG L-5.10	3
1999 35.91 NA 14 1461 300 LOG W=3.011 LOG L-4.94	2
2000 39.90 NA 16 1602 320 LOG W=2.963 LOG L-4.83	)
2001 32.37 NA 17 1436 320 LOG W=2.967 LOG L-4.82	
2002 41.69 NA 21 1656 320 LOG W=3.042 LOG L-5.01	3
2003 31.22 NA 16 1272 330 LOG W=2.977 LOG L-4.82	9

 Table 6.
 Fisheries summary for White bass 1977-2003.



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		ELECTRO	TRAPNET	CATCH			
		CPUE	CPUE	COMP		MEAN	
	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
-	1977	1.36	. 0.37	1	20	NA	LOG W=3.137 LOG L-5.377
'	1978	1.54	0.96	2	28	NA	LOG W=3.056 LOG L-5.197
	1979	1.57	0.31	2	· 34	NA	LOG W=3.225 LOG L-5.640
	1980	1.20	0.13	1	. 22	NA	LOG W=3.250 LOG L-5.693
	1981		0.39	2	189	335	LOG W=3.082 LOG L-5.240
	1982	2.96	0.16	1	135	415	LOG W=3.097 LOG L-5.293
	1983	1.63	0.21	1	90	432	LOG W=3.095 LOG L-5.295
	1984		0.11	2	93	378	LOG W=2.852 LOG L-4.615
	1985	2.64	0.13	2	119	413	LOG W=3.159 LOG L-5.461
	1986	1.99	0.15	2	101	404	LOG W=3.085 LOG L-5.269
	1987			2	132		LOG W=3.151 LOG L-5.446
	1988	5.80		5	234		LOG W=3.103 LOG L-5.272
	1989	4.19		3	173	408	LOG W=3.140 LOG L-5.379
	1990			. 2	95		LOG W=3.214 LOG L-5.594
	1991	1.44		1	52		LOG W=3.318 LOG L-5.870
	1992	2.30		1	82		LOG W=3.257 LOG L-5.727
	1993		*	2	60		LOG W=3.001 LOG L-5.020
	1994	2.11		2	74		LOG W=3.261 LOG L-5.720
	1995	2.63			107		LOG W=3.208 LOG L-5.586
	1996	2.75			118		LOG W=3.159 LOG L-5.467
	1997	5.63			248		LOG W=3.215 LOG L-5.617
	1998	6.16			272		LOG W=3.148 LOG L-5.440
	1999	7.63	NA		308		LOG W=3.238 LOG L-5.690
	2000				325		LOG W=3.250 LOG L-5.717
	2001				399		LOG W=3.296 LOG L-5.837
	2002				415		LOG W=3.257 LOG L-5.744
	2003	7.18	NA	4	304	450	LOG W=3.253 LOG L-5.726

Table 7. Fisheries summary for Walleye 1977-2003.



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		ELECTRO 1		CATCH			×
		CPUE	CPUE	COMP		MEAN	
	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
	1977	0.77	0.40	1	20	NA	LOG W=2.984 LOG L-4.991
	1978	2.43	0.38	2	38	NA	LOG W=3,100 LOG L-5.354
	1979	1.57	0.30	2	, 24	NA	LOG W=3.009 LOG L-5.158
	1980	1.79	0.17	2	16	NA	LOG W=3.169 LOG L-5.509
	1981	7.28	0.29	. 4	NA	NA	NA
	1982	7.50	0.17	4	329	256	LOG W=2.864 LOG L-4.773
	1983	3.80	0.25	3	188	285	LOG W=3.013 LOG L-5.144
	1984	4.07	0.19	3	182	262	LOG W=2.648 LOG L-4.202
	1985	4.57	0.21	4	199	283	LOG W=2.996 LOG L-5.019
	1986	3.29	0,24	4	178	294	LOG W=3.336 LOG L-5.936
	1987	4.94	0.12	2	114	262	LOG W=3.177 LOG L-5.556
	1988	2.10	NA	2	79	236	LOG W=2.683 LOG L-4.285
	1989	2.70	NA	2	104	237	LOG W=3.208 LOG L-5.639
	1990		NA	2	92	291	LOG W=3.070 LOG L-5.277
	1991	3.07	NA	2	117		LOG W=3.155 LOG L-5.507
•	1992	5.24	NA	4	196		LOG W=3.029 LOG L-5.191
	1993	5.71	NA	5	168		LOG W≈2.950 LOG L-4.976
	1994	4.16	NA	4	145		LOG W=3.153 LOG L-5.484
	1995		NA	5	233		LOG W≈3.090 LOG L-5.369
	1996	5.41	NA	5	228		LOG W=3.142 LOG L-5.475
•	1997	9.99	NA	5	437		LOG W=3.065 LOG L-5.294
	1998	9.57	NA	5	386		LOG W=3.190 LOG L-5.596
	1999	18.26	NA	7	756		LOG W=3.262 LOG L-5.788
	2000	9.81	NA	4	435		LOG W=3.306 LOG L-5.892
	2001	6.47	NA	3	308		LOG W=3.356 LOG L-6.015
	2002	7.50	NA	4	329		LOG W=3.350 LOG L-6.018
	2003	5.86	NA	3	247	300	LOG W=3.281 LOG L-5.842

 Table 8.
 Fisheries summary for Sauger 1977-2003.

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10	unk, 1901-20								
	Smallmo	uth Bass	Largemouth Bass						
Year	CPUE	Rank	CPUE	Rank					
1981	4.65	9	0.58	20					
1982	3.72	`7	0.41	18					
1983	2.17	8	0.80	11					
1984	2.19	7	1.16	11					
1985	1.56	8	0.54	15					
1986	0.85	9	0.21	20					
1987	2.94	7	0.61	16					
1988	5.72	7	4.06	9					
1989	13.52	4	3.40	10					
1990	16.44	5	2.39	9					
1991	11.03	5	1.87	11					
1992	9.61	5	2.50	11					
1993	5.80	6	1.10	14					
1994	3.83	7	0.65	15					
1995	5.81	5	1.93	12					
1996	7.31	5	2.08	10					
1997	13.23	5	2.10	15					
1998	15.01	5	2.75	14					
1999	13.51	7	3.71	13					
2000	17.02	6	4.67	11					
2001	13.01	5	5.21	11					
2002	15.91	5	6.14	11					
2003	15.59	5	5.09	11					

Table 9.Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and<br/>rank, 1981-2003.

TABLES2003.XLS

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Table 1	0.
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Species composition expressed as % of total annual catches for PINGP fisherles studies, electrofishing and trapnetting combined for 1981-1987, and electrofishing only for 1988 through 2003.

		White	Freshwater		Black	Shorthead		Gizzard	
Year	Carp	bass	Drum	Sauger	Crappie	Redhorse	Walleye	Shad	Total %
1981	17	20	12	.4	15	7	2	9	86
1982	23	18 ·	24	4	9	7	1 -	3	89
1983	18	17	22	3	16	6	· 1	2	85
1984	- 26	15	20	3	12	7	2	1	86
1985	20	14	31	4	9	7	2	1	87
1986	21	18	22	4	9	. 8	2	<1	84
1987	27	10	16	· 2	11	12	2	1	81
1988*	23	20	8	2	3	13	5	3	77
1989*	20	15	11	2	1	17	3	<1	70
1990*	20	16	13	1	<1	14	1	3	69
• <b>1991*</b>	24	18	12	2	1	11.	1	. 4	73
1992*	26	12	11	4	1	14	2	2	72
1993*	28	12	18	5	<1	10	2	2	76 [·]
1994*	34	10	14	4	<1	14	2	<1	78
1995*	30	16	12	5	1	8	2	4	78
1996*	34	- 14	8	5	2	11	2	<1	76
1997*	29	15	10	5	1	10	3	<1	73
1998*	23	16	11	5	2	12	3	2	74
1999*	17	14	17	7	3	9	3	12	82
2000*	16	16	8	4	2	11	3	17	77
2001*	15	17	15	. 3	2	9	5	6	72
2002*	14	21	12	4	2	9	5	7	74
2003*	13	16	19	3	1	. 11	4	5	72

*Electrofishing only





### SECTION III

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2003 ANNUAL REPORT

# FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

Study and Report by B. D. Giese and K. N. Mueller

Environmental Services Water Quality Department

### FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

### INTRODUCTION

The 2003 study was a continuation of a study started in 1992 to evaluate effects of increased water appropriation from 150 to 300 cubic feet per second (cfs) during April on impingement of larval fish on 0.5 mm mesh traveling screens at the Prairie Island Nuclear Generating Plant (PINGP). In 2003, permit approved blowdown (discharge) reduction to 300 cfs or less was initiated on April 15th, similar to 2002, rather than on April 1st as in previous years. Prior to 1992, the cooling water intake system operated with fine-mesh screens from April 16 through August 31, in accordance with Part I.C.6.c. of the plant's NPDES Permit (#MN0004006). Since 1992, for study purposes, the plant has implemented fine-mesh screen operation on April 1 to accommodate sampling during the month of April for years 1992 through 2003. Data for this evaluation were collected by pre-dawn and daylight sampling of larval fish and fish eggs from the screenwash water. This report includes fish egg, larvae, and juvenile densities, initial survival estimates, and impingement estimates from the fine-mesh screens as described in the monitoring plan. A "Legend" is included following Tables and Figures, which lists species and lifestage codes used in the tables of this report.

### METHODS

Two samples were collected per sample date beginning April 1, 2003 and continuing through the end of April, with a total of 18 samples collected on 9 days. Samples were collected during pre-dawn and daylight hours to provide diurnal comparison.

Samples were collected throughout April by diverting screenwash water from the intake screenhouse to collection tanks in the basement of the environmental lab. There were seven operable screens during the first two collection days (four sample collections). All eight screens were operating during the rest of April. Calculations for estimated impingement and density were adjusted accordingly for the first four samples.

Screenwash water flows by gravity from the vertical traveling screenwash trough through an 18-inch pipe to the lab basement. The larval collection tank, manufactured by Lawler, Matusky, and Skelly Engineers

(Figure 1), filters screenwash water through 0.5 mm mesh nylon screen. Filtered water returns to the circulating water system via a 12-inch diameter drain pipe. The screenwash trough was manually cleaned and the fish sampling system was flushed to remove accumulated debris and fish prior to sample collection on each date of the 2003 sample season.

During sample collection, physical parameters were recorded including collection time and duration, screen speed, number of screens sampled, river stage, and water temperature in the collection tank. Volume of river water filtered by the intake screens was obtained from the PINGP monthly external circulating water log.

Sample collection duration was 5 minutes, except for the samples collected during pre-dawn on 4/1 and 4/10. Heavy debris loading precluded us from sampling for 10 minutes during the other sample collection times. Upon completion of sample collection, all fish and any debris were rinsed into two collection baskets located at the outlet end of the collection tank (Figure 2). The baskets were then removed from the tank, the contents transferred to a five gallon bucket, and transported to the fish handling and sorting area for further processing.

Samples were sorted to remove live and dead fish, with an emphasis on doing so in a timely manner. Fish were determined to be alive or dead based on the presence or absence of movement. Sorting efficiency was maximized by pouring small portions of the sample into glass baking dishes and sorting on a light table.

Fish and eggs were removed from the sample, and the remaining debris was rinsed into a Tyler No. 60 sieve and drained. Sample remains were preserved in a solution of 5% formalin containing rose bengal stain. Each sample was sorted a second time. Fish and eggs found during the second sort were included with those from the initial sort, and recorded as dead.

### DATA ANALYSIS METHODS

Fish and Egg Density

Fish and egg densities were calculated on a pre-dawn and daylight basis from data collected during April 2003. A combination of sample duration, plant blowdown (discharge), and identification data provided density values, expressed as numbers of fish or eggs per 100 cubic meters of water withdrawn from the river for plant use. The data are presented for individual taxa and lifestage for each date (Table 1a). Pre-dawn and daylight densities of all taxa and lifestages were combined and recorded by date (Table 1b).

Estimates of fish survival following impingement on the fine-mesh screens were calculated for each sample by totaling the number of live fish in each sample and dividing by the total number of fish in each sample (Table 1a).

Estimated numbers of fish and eggs impinged daily on the fine-mesh traveling screens was calculated by totaling the number of fish collected that day, multiplied by the proportion of the number of screens operating and sampled, and the number of minutes in the 12-hour period, divided by the number of minutes sampled (Table 3). In years 1984 to 1989, fine mesh panels of the traveling screens were not required to be operable until April 16, resulting in inconsistent start dates, which accounts for incomplete April data prior to 1992. However, when fine-mesh screens were installed earlier, impingement data were obtained. Table 4 provides water appropriation (as blowdown), flow, temperature, and average daily impingements for the dates that were sampled in April 2003. Study results contribute to the ongoing assessment of increased water appropriation effects on larval fish impingement.

### Identification methodology

Terminology used to identify lifestage was similar to that described by Auer (1982). The larval stage was divided into two developmental phases which correspond to Auer's terms yolk-sac larvae and larvae, respectively.

#### Terminology and criteria

- Prolarvae (Yolk-sac larvae) Phase of development from time of hatch to complete absorption of yolk.
- Postlarvae (Larvae) Phase of development from complete absorption of yolk to development of the full compliment of adult fin rays and absorption of finfold.
- Juveniles Phase of development from complete fin ray development and finfold absorption to sexual maturity; includes young-of-the-year (yoy) fish.

### **RESULTS AND DISCUSSION**

Eighteen samples were collected during April 2003, which contained a total of 25 fish (22 prolarvae, 3 juveniles, and 0 adult) and 29 eggs. Survival was based on absence or presence of movement during the sort. Four taxa/lifestage combinations were identified in the samples (Table 1a). Burbot is the only species expected to spawn early enough in spring, for their larvae to be in the drift and subject to impingement on the traveling screens before late April. All of the prolarvae sampled were burbot, except one sauger sampled on April 29th. All of the juveniles were freshwater drum sampled on April 3rd.

Blowdown was reduced from unlimited (average 835 cfs) April 1 through April 14, to less than 300 cfs on April 15th. The number of fish collected during the first half of April was higher than during the second half of April, but the number of eggs collected during the first half of April was lower than during the second half of April.

All eggs were determined to be carp eggs, based on appearance and comparison to eggs collected during the 2000 study when embryos were examined and identified as carp. Carp have not been reported to spawn below 60 degrees F in this region (Scott and Crossman, 1973; Becker, 1983). The "logical" presumption was made that carp living between the bar racks and the traveling screens spawn prematurely underneath the intake screenhouse due to elevated water temperatures as a result of recirculating water and deicing line water.

#### Densities

Densities by taxa/lifestage combinations of fish collected during April 2003 from the fine-mesh screens are presented in Table 1a, expressed as organisms per 100 cubic meters of water sampled. Table 1b provides diurnal density comparisons for sample dates when fish and/or eggs were collected. The data indicate that more fish and eggs were impinged during daylight hours in 2003.

### Survival estimates

Survival estimates are included in Table 1a for taxa/lifestage combinations collected during April 2003. Overall initial survival of fish collected in 2003 was 60% (Table 1a). Due to the low number of fish collected, survival estimates presented in Table 1a may be weighted too heavily. Survivorship for all taxa/lifestage combinations collected during 1984 through 1988 was summarized in the 1988 Prairie Island Annual Report (Kuhl and Mueller 1988).

### Impingement estimates

Impingement estimates are available for years 1984-1989, 1992-2000, and 2002-2003 (Table 3). No data is presented for 2001 due to river flood levels in Spring 2001 when sampling of larval fish from the finemesh traveling screens during April was extremely limited. The plant was operating in flood by-pass conditions as communicated to MPCA at the time. Table 2 provides comparison of taxa/lifestage combinations collected in 2003 to previous years. Estimated impingement of fish collected in April of all years is shown in Table 3. Estimated impingement values during April 2003 were low as in past years during April, and taxa/lifestage combinations were similar. Data collected through 2003 suggest that more fish may be impinged on the fine-mesh screens during the first half of April with unlimited blowdown, but the total numbers are still low.

During April 2003 sampling 25 total fish were collected. All eggs were identified as carp eggs by examining embryos taken from the eggs, as explained earlier in the <u>Results and Discussion</u> section of this report. We are hesitant to quantify how many eggs survive impingement, because little is known on how many eggs in the river drift survive when not impinged.

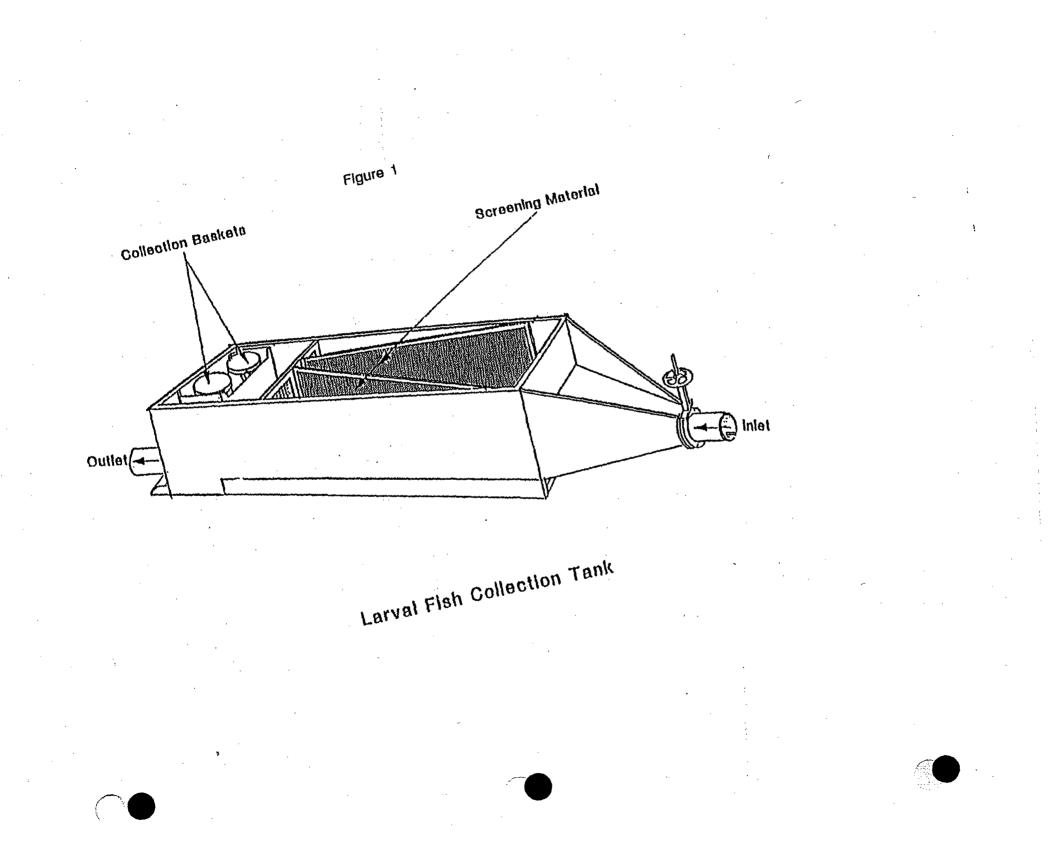
### **SUMMARY**

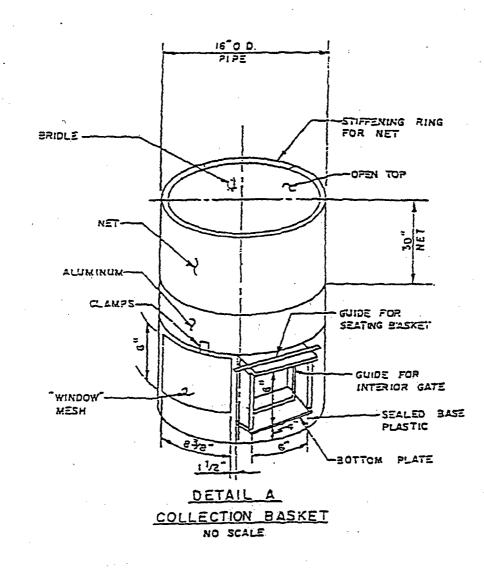
Larval studies were conducted at PINGP from 1984 through 1988 providing estimates of impingement, density, and survival. In 1989 and 1990 larval fish studies were done to evaluate sampling induced mortality. Sampling was not a requirement of the NPDES permit during 1991. In 1992-2003, fine-mesh screens were installed by April 1, and a larval fish study was conducted to assess impingement affects of increased water appropriation during April. Year 2003 was the second consecutive year sampling was conducted while the plant was operating with unlimited blowdown during the first half of April. In comparison to previous studies at PINGP, increased water appropriation may have resulted in increased impingement during the first half of April 2003, but numbers are still low. We are hesitant to draw conclusions based on two sampling seasons, and expect to monitor effects of unlimited blowdown on impingement during future sampling seasons.

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Figure 2

Date	Таха	Lifestage	Density	Percent Live	Number of Fish/Egg
1-Apr-2004	Burbot	PRO	0.043825	100	1
3-Apr-2004	Burbot	PRO	0.043456	100	1
3-Apr-2004	Burbot	PRO	0.173822	25	4
3-Apr-2004	Freshwater drum	JUV	0.130367	100	3
8-Apr-2004	Burbot	PRO	0.052138	100	1
8-Apr-2004	Burbot	PRO	0.052138	0	1
10-Арг-2004	Burbot	PRO	0.208554	50	8
10-Apr-2004	Burbot	PRO	0.104277	100	2
10-Apr-2004	Carp	EG	0.052138	0	1
15-Apr-2004	Carp	EG	6.562803	0	23
17-Apr-2004	Carp	EG	0.954344	0	3
17-Apr-2004	Carp	EG	0.318115	0	1
22-Apr-2004	Carp	EG	0.187574	0	1
24-Apr-2004		PRO	. 0.161790	100	1
24-Apr-2004	Burbot	PRO	0.323581	50	2
29-Apr-2004	Sau	PRO	0.166364	100	1

Survivorship and Density (fish and fish eggs/100 cubic meters) by Taxa/lifestage combination of Fish Collected on PI Fine-mesh Intake Screens During April 2003.

Table 1b.

Density of fish and eggs (fish/100 cubic meters) collected in pre-dawn and daylight samples in 2003.

Date	Pre-dawn	Daylight
	Density	Density
4/1/2004	0.000000	0.043825
4/3/2004	0.043456	0.304189
4/8/2004	0.052138	0.052138
4/10/2004	0.208554	0.136863
4/15/2004	0.000000	6.562803
4/17/2004	0.954344	0.318115
4/22/2004	0.187574	0.000000
4/24/2004	0.161790	0.323581
4/29/2004	0.166364	0.000000



Table 2

# Taxa/life stage combinations of fish collected in April of 2003 and previous years.

			·····	
Taxa	Adult	Juvenile	Postiarvae	Prolarvae
Carp			x	X
Channel catfish		x		
Cyprinid	X	x	x	×
Flathead catfish		X		
Percid	x		x	x
Walleye				×
Bullhead sp.		x		
Sauger			x	X,0
Burbot			X	X,O
Catostomid		X		x
Stizostedion spp.				X
White bass		· X		
Gizzard shad		x		
Freshwater drum		X,O		
Johnny darter	×			
Shiner spp.		x		
Emerald shiner	X	x		
Bluegill		x		
Mooneye				X
Golden redhorse		X		
Unidentified	· · ·			X
Log perch	x			X
Legend:	x = previous	s years data		

o = 2003 data

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Table 3.	Estima	ted imp	ingement of f	ish collecte	don	PINGP fine	e-mesh	screen	s during April,	1984-1989	an	d 1992-200	β			
Date	Taxa	Life	Estimated	No of Fish		Date	Таха	Life	Estimated	No of Fish		Date	Taxa	Life	Estimated	No of Fi
	Tuxu		Impingemen		'{· ··				Impingement						Impingement	
1984																
16-Apr-84		EG	384	1	<u> </u>	24-Apr-86			1728			13-Apr-89			384	
18-Apr-84		PO	384	1	<b>!</b>	25-Apr-86			288			14-Apr-89		UN	0	
23-Apr-84		EG	3840	10	<b> </b>	28-Apr-86		EG	480			18-Apr-89		UN	0	<b></b>
25-Apr-84	CC	JU	<u>384</u> 384	1		29-Apr-86 29-Apr-86		EG	864 288			20-Apr-89 21-Apr-89		UN UN	0	
25-Apr-84 25-Apr-84		EG	3840			29-Apr-86		PR	288			25-Apr-89		UN	0	
27-Apr-84		10	384		·	1987	<u> </u>			·····		27-Apr-89		PR	1152	A
27-Apr-84		<u> 10</u>	384	† i		6-Apr-87	BUR	PR	1536	4		1992		<u> </u>		<u> </u>
27-Apr-84		EG	2304	6		8-Apr-87			576			1-Apr-92	CYPR	PR	288	
30-Apr-84		JU	384	21		10-Apr-87	BUR	PR	2304	4		1-Apr-92	CYPR	PO	288	
30-Apr-84		AD	384		<u> </u>	13-Apr-87		PR	2304	4		1-Apr-92			576	
30-Apr-84		JU	192			15-Apr-87		PR	3456	6		2-Apr-92		UN	0	·
30-Apr-84		PR	1152			16-Apr-87		PR	576	1		8-Apr-92		UN	0	
30-Apr-84		EG	4416			20-Apr-87		UN	0	Ō		9-Apr-92		UN	0	
30-Apr-84	WE	PR	768	4		22-Apr-87		UN	<u>0</u> 0	0		14-Apr-92		UN	0	
1985	DUC		384	1	}	24-Apr-87 27-Apr-87			. 576			16-Apr-92 21-Apr-92		UN PR	576	
19-Apr-85 22-Apr-85	PERC	JU PR ,	1152	3		27-Apr-87		PR	576			23-Apr-92		UN	0	····
23-Apr-85		EG	192	1		29-Apr-87		PO	2880	5		28-Apr-92		UN	0	
24-Apr-85			576	3		29-Apr-87		PR	576	1		30-Apr-92		JU	288	
24-Apr-85		PR	1344	7		1988				·		30-Apr-92			288	
24-Apr-85		EG	. 384	2		8-Apr-88	BUR	PR	768	2		1993				
24-Apr-85		PR	1536	8		11-Apr-88	X	UN	0	0		2-Apr-93	UN	X	0	
25-Apr-85	PERC	PR	192	1		13-Apr-88		EG	384	1		6-Apr-93		PR	288	
25-Apr-85	SA	PR	1536	8		15-Apr-88		PR	768	2		8-Apr-93		EG	288	
25-Apr-85		PR	384	2		18-Apr-88		ŪN	00	0	]	8-Apr-93		PR	288	
25-Apr-85		PR	576	3		20-Apr-88		PR	768	2 5		13-Apr-93		X	0	
26-Apr-85		PR	192	1		22-Apr-88		PR	1920	5		15-Apr-93		PR	288	
26-Apr-85		PR	192	1		25-Apr-88		PR	1152	3		19-Apr-93		ËG	1152	
29-Apr-85 29-Apr-85		PO	96 192	1		27-Apr-88 28-Apr-88		PR PR	1152 384			21-Apr-93 27-Apr-93		X X	0	
29-Apr-85	CARP		288			29-Apr-88			0			29-Apr-93		ÊG	288	
29-Apr-85			192	3		1989	·					1994				
1986						4-Apr-89	$\overline{\mathbf{x}}$	ŪN	0	0		5-Apr-94		EG	384	· ··
18-Apr-86	CARP	PR	288	1		6-Apr-89			384	<u> </u>		5-Apr-94		<u>ju</u>	384	
18-Apr-86			288	1		7-Apr-89		UN	0	0		5-Apr-94			384	
23-Apr-86	CYPR	PO	288	1		11-Apr-89	X	UN	0	<u>ō</u>  -		5-Apr-94			384	· · · · · · · · · · · · · · · · · · ·
23-Apr-86			288	1		13-Apr-89		PR	384	1		7-Apr-94			288	•
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Table 3. (c	cont)	Estima	ated impingem	ent of fish	coll	ected on PINC	3P fine-	mesh s	creens during	April, 1984	-19	89 and 1992-	2003.				L
	<u> </u>													-			
Date	Taxa	Life		No of Fish		Date	Taxa	Life	Estimated	No of Fish		Date	Taxa	Life	Estimated	No of Fish	
	L	Stage	Impingement	Collected				Stage	Impingement	Collected				Stage	Impingement	Collected	Ì
1994 (con						1996 (cont)			· · · · · · · · · · · · · · · · · · ·		L	1999 (cont)					<b>_</b>
12-Apr-94		PR	288	1		25-Apr-96			504	2	1	9-Apr-99		JU	288	1	
12-Apr-94		PR	288	1		25-Apr-96			252	1	<b>.</b> .	9-Apr-99		PR	576		
14-Apr-94		X	0	0		30-Apr-96	X	X	Ō	0		9-Apr-99		JU	288		
19-Apr-94	CYPR	JU	288	1		1997					ļ	13-Apr-99		EG	288	1	ļ.
21-Apr-94		X	0			3-Apr-97		EG	17,280	30	l	13-Apr-99		EG	288	1	<b> </b>
26-Apr-94		PR	1152	4		4-Арг-97		JU	1152	2		15-Apr-99			288	1	
26-Apr-94		PR	288	1		4-Apr-97		PR	576	1		22-Apr-99			576	2	J
28-Apr-94		PR	288	1		25-Apr-97			2304	4	L	27-Apr-99			288	1	<b>.</b> .
28-Apr-94	BUR	PR	288	<u>1</u>	ļ	29-Арг-97			864	2		27-Apr-99		JU	288		<u> </u>
1995		•				30-Apr-97			432	1		27-Apr-99			288	1	ļ
3-Apr-95		JU	288	1		30-Apr-97		JU	432	1		30-Apr-97			288	1	
4-Apr-95		PR	288	1		30-Apr-97			432	1		30-Apr-97			576		
4-Apr-95		ĴŬ	576	1		30-Apr-97	UNID	EG	864	2		30-Apr-97	PERC	PO	288	1	Į
4-Apr-95		<u>JÚ</u>	1152	2		1998					ŀ	2000					
4-Арг-95		JU	1152	2		2-Apr-1998		EG	229	1		4-Apr-2000		EG	14,688	51	
4-Apr-95	CATO	<u> IN</u>	576	1		3-Apr-1998			252	1		4-Apr-2000		EG	1440	5	
4-Apr-95	FWD	JU	9792	17		7-Apr-1998		Χ.	0	. 0		6-Apr-2000	UNID	EG	7,776	27	
10-Apr-95			288	1		9-Apr-1998			229	1		6-Apr-2000		AD	288	1	
17-Apr-95		EG	13248	46		14-Apr-1998		JU	252	-1		6-Apr-2000		EG	8023	39	
20-Apr-95		EG	2880	10		16-Apr-1998			229	:1		6-Apr-2000		PRO	206	1	
24-Apr-95		EG	1152	4		16-Apr-1998	BURB	PR	229	1		13-Apr-2000		PRO	288	1	
26-Apr-95	UNID	EG	864	3		21-Apr-1998	UNID	EG	1512	6		18-Apr-2000	Shiner	JU	288	1	
1996						23-Apr-1998	PERC	PR	252	1		20-Apr-2000	Cypr.	PRO	288	1	
2-Apr-96	CARP	PR	252	1	• • •	23-Apr-1998	FWD	JU	252	1		27-Apr-2000	UNID	EG	2618	10	
4-Apr-96		EG	504	2		28-Apr-1998	UNID	EG	2016	8		27-Apr-2000	UNID	EG	1440	5	
9-Apr-96		AD	252	1	••••	28-Apr-1998	PERC	PR	2268	9		27-Apr-2000	Sau	PRO	576	2	
9-Apr-96		JU T	252	1		28-Apr-1998	STIZ	PR	2268	9		27-Apr-2000		PRO	288	1	• • • • •
9-Apr-96		EG	252	1		28-Apr-1998		PR	1512	6		2001		les calc	ulated~flood		
11-Apr-96		JU	252	1		28-Apr-1998		PR	252	1		2002		<u> </u>			
11-Apr-96			252	1		30-Apr-1998		PR	2016	8		4/2/2002	EMSH	JU	672	2	
11-Арг-96			504	2	• • • • •	30-Apr-1998		PR	14364	57		4/4/2002			1680	5	
11-Apr-96			252	1	{	30-Apr-1998			2268	9		4/4/2002		ĒĞ	672	2	
11-Apr-96	BURB	PR	252	···i	•	30-Apr-1998			252	1		4/4/2002			1680	5	
11-Apr-96			252	i	-	30-Apr-1998			252			4/4/2002		JU	336	1	· ·
16-Apr-96		x	0	o		1999						4/4/2002		EG	1008	3	
18-Apr-96		<b>x</b>	0	0	•••••	6-Apr-99	BURB	PR	522	····· 5	~-†	4/4/2002			1008	3	
23-Apr-96			504	2	• ••	6-Apr-99		EG	4032	14		4/9/2002		JU	336		}
23-Apr-96		EG	1008	2		9-Apr-99		JU	288	1		4/9/2002			1008		···
22-40L-20	UNIU	CO		4	]	a-whi-aai	UIL I	10	200	<b>_</b>		4/9/2002	ENOL	00	1000	3	

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Table 3. (con	t)	Estima	ted impingen	nent of fish	coll	ected on PINC	SP fine-r	mesh so	reens during	9 April, 198	4-1989	and 1992-20	003.	]
					<u> </u>		1							
Date				No of Fish		· · · ·						, ,		
	Ĺ	Stage	Impingement	Collected	L.									1
2002 (cont)					ļ	· · · · · · · · · · · · · · · · · · ·								
4/9/2002			672	2										
4/9/2002		EG	288	1				-l						
4/11/2002	EMSH	JU	288		L			· <b> </b>		· ·				
4/11/2002			864	3			l							ł
4/11/2002			1800	5	·	· · · · · · · · · · · · · · · · · · ·		. <u> </u>	· · ··· · ·					1
4/11/2002			1800				· [	4		·				1
4/11/2002 4/16/2002	Cypr	JU	360 336				·		·}			·		
4/16/2002		<u>10</u>	336		·	<b>_</b>		<b>_</b>	<u> </u>		· ·			1
4/18/2002			336		<b></b>		·							Í
4/18/2002			672		<u>``</u>		{· -·		· · · · · · · · · · · · · · · · · · ·					
4/23/2002	BURD	PRO DPO	1008	3			·   ·	<b>-</b>						1
4/25/2002			672	2		· · · · · · · · · · · · · · · · · · ·	·	· · · · · · · · · · · · · · · · · · ·			·····			i
4/25/2002		PRO	336	2	÷		•		<b></b>	••••		· · · · · - · · · ·		ł
2003	BOKB	<u></u>	550	<b>1</b>	·		+	<u> </u>	<u>}</u>					ł
4/1/2004	BURB	PRO	504	1		· · · · · · · · · · · · · · · · · · ·			····				· · · · · · · · · · · · · · · · · · ·	i
4/3/2004			504	1						· · · • • • • • • • • • • • • • • • • •		· · · ·	• •	Ι.
4/3/2004			2016	4					l'			·· · · · · · · · · · · · · · · · · · ·		i ·
4/3/2004	FWD	JU	1512	3										l
4/8/2004		PRO	576	1				· · · ···			÷			
4/8/2004	BURB	PRO	576	1							· · · ·			i
4/10/2004	BURB	PRO	2304	8										
4/10/2004		PRO	1152	2										i i
4/10/2004		EG	576	1										I
4/15/2004	Carp	EG	13248	23			· · · · · · · · · ·							
4/17/2004		EG	1728	3										
4/17/2004		EG	576	1										
4/22/2004		EG	576	1	· • · • ·									
4/24/2004			576	1	<b>.</b>			<b>├</b> ───						
4/24/2004 4/29/2004		PRO	1152 576	2	<b></b> .		·· ·· · ·						·}{	
4/29/2004	SAU	-RU	5/6										·[]	
	··· -··		···· · ·											
+				<del>.                                     </del>					· · · · · · · · · · · · · · · · · · ·				<u> </u>	
······									·				·} ·]	
·····									······································	·	•••			
													h	

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Table 4.			impingement da				
	collected) i	n April 2003 with	n corresponding	blowdown, river	flow and	temperatu	ires.
		1		1	L		
Date	Blowdown	Average Daily	Avg. daily	Est.avg daily	1	1	1
	(cfs)	R. Flow (cfs)	Inlet Temp. (F)	impingement.			
4/1/2004	940	18,600	42.0	504	ļ	<u> </u>	<u> </u>
4/3/2004	948	18,400	42.0	4,032	1		
4/8/2004	903	13,800	38.7	1,152			
4/10/2004	903	14,200	41.1	4,032			
4/15/2004	165	13,600	53.0	13,248	·		
4/17/2004	148	19,400	49.9	2,304			
4/22/2004	251	36,600	47.4	576			
4/24/2004	291	42,700	49.4	1,728			
4/29/2004	283	42,000	53.9	576		]	
	1						
		1		i .			

.

# **LEGEND**

# LIFE STAGE

(* :)

# TAXA CODE

UN	=	Unidentified or Zero
EG	=	Egg
PR	=	Prolarvae
PO	=	Postlarvae
JU	=	Juvenile
AD	=,	Adult

UNID	=	Unidentified
CC	=	Channel Catfish
CYPR	=	Cyprinids, other than
FHC	1	Flathead Catfish
PERC	=	Percids, other than
BHS	=	Bullhead spp.
SA	=	Sauger
WE	=	Walleye

- STIZ = Stizostedion spp.
- BUR = Burbot
- CATO = Catostomids
- CARP = Carp
- MOON = Mooneye
- X = No Fish

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT

PINGP-018

### ENVIRONMENTAL MONITORING

AND

ECOLOGICAL STUDIES PROGRAM

## **2004 ANNUAL REPORT**

# Prepared for

Northern States Power Company d/b/a Xcel Energy

Minneapolis, Minnesota

By

Environmental Services Water Quality Department TABLE OF CONTENTS

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Fine-mesh Vertical Traveling Screens ...... Section III Fish Impingement Study

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### SECTION I

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2004 ANNUAL REPORT

### WATER TEMPERATURE AND FLOW

> Study and Report by B. D. Giese and K. N. Mueller

Environmental Services Water Quality Department

### WATER TEMPERATURE AND FLOW

### **INTRODUCTION AND METHODS**

The Mississippi River is the source-water body for circulating and cooling water systems at the Prairie Island Nuclear Generating Plant (PINGP). This report presents daily plant operating hours, river inlet temperatures, site discharge temperatures and flows (blowdown). Site discharge temperatures are determined by thermocouples located downstream at U.S. Army Corps of Engineers Lock and Dam 3. Plant inlet (ambient river) temperatures are determined by remote sensors located in Sturgeon Lake, and the main channel at Diamond Bluff. Inlet temperatures are also recorded from thermocouples located in front of the intake screenhouse, which are maintained for back-up. Data presented in this report are for environmental studies comparison, and are not intended as NPDES temperature compliance reporting.

Also presented in this report are daily and monthly average Mississippi River flows, as provided by U.S. Army Corps of Engineers at Lock and Dam 3. Other monthly averages reported include PINGP intake flows, and the percentage of Mississippi River water entering the plant.

### **RESULTS AND DISCUSSION**

Daily average river inlet and site discharge temperature data are presented by month in Table 1. Daily Mississippi River flows recorded at Lock and Dam 3 ranged from 5,500 to 56,400 cfs in 2004 (Table 2). Daily mean site discharge flow (blowdown) from the PINGP external circulating water log ranged from 148 to 1,208 cfs (Table 1).

PINGP withdrew an annual average of 4.0 percent of the Mississippi River flow during 2004 (Table 3). Table 4 shows the monthly average Mississippi River flows for the years 1984 through 2004. The average river flow in 2004 was 26,566 cfs, which was more than the average river flow of 22,527 cfs for years 1984-2003. The range of annual average river flows is 8,709 cfs in 1988 to 37,787 cfs in 1986.

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2004 Annual Report.DOC

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

 $A_{ij}$ 

			·• · ·			
DATE			<b>RIVER INLET</b>	SITE DISCHARGE		
JANUARY	UNIT 1	UNIT 2	. TEMP.	TEMP.	DISCHARGE FLO	
·			(°F)	(°F)	(BLOWDOWN-CFS	S)
1	24	24	34.4	37.0	815	. <b>.</b>
2	24	24	34.3	37.2	815	
3	24	24	34.4	37.0	815	
4	24	24	34.0	36.4	815	
5	24	24	33.9	36.7	808	
6	24	.24	34.0	36.9	815	·* .
7	24	24	34.3	37.2	815	
8	24	24	34.3	37.5	822	· .
9	24	.24	34.3	37.5	808	
10	24	24	34.4	37.4	802	ì
11	24	24	<b>34.4</b>	37.4	802	
12	24	24	34.5	37.5	· 802	
13	24	24	34.7	37.4	802	
14	24	24	34.7	37.2	<b>802</b> s	
15	24	24	34.5	37.3	802	
16	24	24	34.3	37.2	802	
17	24	24	34.3	37.3	802	1
18	24	24	34.4	37.3	795	
19	24	24	34.1	37.3	795	. 7
20	24	24	34.1	37.5	. <b>802</b>	5.N. ¹ -
21	24	24	34.2	37.7	802	
22	24	24	34.3	37.7	795	
23	24	24	34.1	37.5	802	
24	24	24	34.0	37.5	808	
25	24	24	33.9	37.3	802	
26	24	24	33.9	37.2	802	
27	24	24	33.8	36.9	795	
28	24	24	33.7	37.1	795	
29	24	24	33.6	36.9	795	
30	24	24	33.6	37.2	788	4 1 mars
31	24	24	33.5	37.3	795	s stills
					a Maria Indonesia.	
		ITHLY MINIMUM	33.5	36.4	788	
		THLY MAXIMUM		37.7	822	
	N	IONTHLY MEAN	34.2	37.2	. 804	

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

	. •			•		
DATE		TING HOURS	<b>RIVER INLET</b>	SITE DISCHARG		. ,
FEBRUARY	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLO	Nationalist
			(°F)	(°F)	(BLOWDOWN-CFS	S) 21
						•
1	24	24	33.5	37.3	802	
2	24	24	33.6	37.4	795	
3	24	24	33.5	37.1	788	· , ·
4	24	24	33.5	37.0	788	
5	24	24	33.6	36.9	802	
6	24	<b>24</b>	33.5	36.9	795	
7	24	24	33.5	36.8	795	
· 8	24	24	33.4	36.7	<b>795</b>	
9	· 24	24	33.5	36.8	795	
10	24	<b>24</b>	33.5	36.8	795	- <b>1</b>
11	24	24	33.4	36.9	795	
12	24	24	33.4	37.0	795	1
13	24	24	33.4	37.1	802	
14	24	24	33.5	37.3	795	
15	24	24	33.5	37.3	795	
16	24	24	33.4	37.0	<b>795</b>	
17	24	24	33.5	37.2	795	
18	24	24	33.5	37.4	788	
19	24	24	33.6	37.9	788	
20	24	24	33.9	37.9	788	
21	24	24	33.8	36.9	440	
22	24	24	34.0	37.1	483	£5 × 1
23	24	24	34.2	37.9	537	5 - 25 S 15
24	24	24	34.2	38.3	730	1
25	24	24	34.6	38.7	730	14. j
26	24	24	34.7	38.9	730	ja. ¹
27	24	24	34.9	39.4	730	5. Å *
28	24	24	35.5	40.1	730	
29	24	24	36.4	40.7	730	:
		. 37	•	4	, , , , , , , , , , , , , , , , , , ,	18 - ¹
•	MONTH	ILY MINIMUM	33.4	36.7	440	
	MONTH	LY MAXIMUM	36.4	40.7	802	ċ.
		NTHLY MEAN	33.9	37.6	749	
		1.20		. · · · ·	a anti-	

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Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

DATE MARCH	OPERATI UNIT 1	NG HOURS UNIT 2	RIVER INLET TEMP (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FL (BLOWDOWN-C	_ow
1	24	67	36.6	40.0	730	
2	24	24	36.8	39.3	730	
3	24	[,] 24	36.8	39.5	730	
4	24	24	36.6	39.2	730	· . · ·
5	24	24	36.1	39.2	738	.`
6	24	24	36.9	39.6	738	
7	24	24	36.6	39.1	738	
8	24	24	35.9	38.8	738	
9	24	24	36.8	39.5	738	· · · · · · · · · · · · · · · · · · ·
10	24	<b>24</b>	37.5	40.1	738	
11 🗠	24	24	35.7	37.8	738	. •
12	24	24	34.8	36.7	730	
13	24	24	34.9	37.1	738	
14	24	24	35.0	36.5	738	
15	24	24	35.2	37.0	738	•
16	24	24	35.9	37.7	738	1
17	24 🦯	24	37.2	38.9	730	
18	24	24	38.2	39.9	730	
19	24	24	37.9	40.0	738	
20	24	24	37.8	40.0	753	
21	24	24	36.3	38.9	745	
22	24	24	37.7	· <b>39.7</b>	745	
23	24	24	39.6	41.7	745	• •
24	24	24	41.6	44.0	745	
25	24	24	43.1	45.3	768	· · · · · · · · · · · · · · · · · · ·
26	24	24	44.1	45.6	768	
27	24	24	45.4	46.7	862	
28	24	24	46.2	47.1	855	
29	24	24	45.9	45.4	<b>855</b>	ч,
30	24	24	43.1	42.3	855	· 5
31	24	24	42.5	42.9	855	a ^{, v} ∘ •,
	MONTHLY MINIMUM MONTHLY MAXIMUM MONTHLY MEAN			36.5	730	
				<b>47.1</b>		Star Contact
				40.5	759	SARTE ST

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Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

date <b>April</b>	OPERAT UNIT 1	ING HOUI UNIT 2	rs Riv	ER INLET TEMP. (°F)	SITE DISCHARGI TEMP. (°F)	e Me Disch (Blow	ARGE	FLOW	trigant that is An aigte	:	м.	
		· ·		SV+J	(')		DOWN	-01-0)				
1	24	24	$\gamma \in \Sigma$	42.7	41.3		848		. t.			
2	24	24	5 6 - 49 5 (m	43.3	42.4	1	848	41	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1			
3	24	24		45.0	43.3		692			•.		
4	23*	23*	4's :	41.1	42.5		652	. <i>v</i>	· . ·			
5	24	24	1. ye i	45.3	44.4	ę.	842	2. MT		•		
6	24	24	. **	47.1	45.4	4	842					
7	24	24	1.143	48.3	47.3		842		ł			
8	24	24	а 1 т. т.	48.2	46.8	8 - 68	849	1 j	12 5	,		
9	24	24		48.4	46.8	11 21	875			2		
10	24	24	2151	48.1	e < 47.3	·	889	٠. ۲.	5	- -		
11	24	24	$R_{\rm P}$	45.6	45.2	3	979	. [,] ,	P	5 1		
12	24	24	1.25	46.2	45.3	1	979	۲.	4	N 1		
13	24	24	· .	47.8	47.9		835		5 A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.	• .		
14	24	24	۶. د	49.0	49.1	6 g.	315	4				
15	24	24	۰.	48.5	50.5		259					
16	24	24	$\boldsymbol{\xi}_{i,i}$	49.0	51.0	1	283				4	
17	24	24	*	50.6	<b>52.8</b>		283	5				3
18	24	24		52.0	54.6	_ I	283		•		l,	
19	24	24		57.4	59.0		148		· · · · ·			
20	24	24	÷	54.9	<b>56.6</b>		283					
21	24	24	29	52.2	52.9		283	~	· *			
22	24	24	ť.,	51.7	<i>⊳ ⊜</i> ₽5 <b>3.1</b>	`. *	267				•.	
23	24	24	$\sigma^{-1}$	52.6	53.9	1	267	,				
24	24	24		52.6	53.7	• • •	267					
25	24	24	- 14g	52.3	53.0	7	267					
26	24	24	$[2^{n+1},1]$	52.6	53.5	$i = i_{i_{k}}$ .	291		- 			,
27	24	24	3 - 13 28 - 24	50.9	·	1 - C. C.	283	8. ¹ .	·			
28	24	24	*** ***	51.8	52.4	•	291	·		$t_{A_{2}}$		
29	24	24	07	54.5	55.5	5.15	291	5. J.	.* p			
30	24	24	ing i m	54.5	55.9	÷	291	ţ	. * * *			
* Daylight	savings		2 · ·		$\omega_{\pm} = -\frac{\hbar}{2} t$	· ·			•	•		
	MONT	( V & #16 116 #	118.4.5%	A.4. 4			4 4 0					
				41.1	a 🐎 41.3	· · ·	148		a e jan ja	• • • • •		
				57.4	<b>59.0</b>		979	가 작품을				
	MOL	NTHLY ME	AN S	49.5	49.9	14 1 4	<b>521</b>					



Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

DATE MAY	OPERATI UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)	•		
1	24	24	53.4	55.2	283			
. 2	24	24	53.6	55.4	283	. ×		
3	24	24	53.1	55.4	283			
4	24	24	56.1	57.1	283			
5	24	24	53.6	56.2	275			
6	24	24	56.4	58.1	275	5.7		
7	24	24	56.0	58.1	275			
8	24	24	56.7	58.0	275			
9	24	24	57.8	59.4	283			
10	- 24	24	58.6	61.3	283			
. 11	24	24	60.4	62.2	291			
12	24	24	62.7	65.1	291			
· 13	24	24	60.3	61.9	283			Υ.
14	24	24	58.1	58.8	283		·	
15	24 ,	24	56.7	58.5	283			
16	24	24	58.1	59.5	275	•		•
- 17	24	24	59.8	61.0	283			Ŷ.
18	24	24	59.5	60.8	283			1
19	24	24	61.1	<b>63.0</b> [°]	283			ç* -
20	24	24	62.7	64.8	291		4	1.,
21	24	24	62.9	64.1	291 .	0	• <u>.</u> .	
22	24	24	61.6	62.5	291	N.	۰.	
23	24	24	60.4	62.1	291		5 · ·	
24	24	24	59.4	59.9	291		<b>*</b>	
25	24	24	59.5	59.8	291	•	•	. •
26	24	24	58.9	59.8	291		191	
27	24	· 24	60.1	60.3	291		5.	
28	24	24	60.1	60.6	291		÷.,	
29	24	24	61.5	61.5	291			× 1
30	24	24	60.5	60.6	291			÷
31	24	24	61.5	62.0	291			
	MONTH		53.1	<b>55 0</b>	075	•		
				55.2 65.1	275			
MONTHLY MAXIMUM MONTHLY MEAN				291	• 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	3 1 2		
			58.7	60.1	285	•	•	





DATE JUNE	OPERATI UNIT 1	NG HOURS UNIT 2	RIVER INLET	SITE DISCHARGE TEMP.	MEAN SITE DISCHARGE FLOW	· · · .
			°(°F)	(°F)	(BLOWDOWN-CFS)	
					•	
1	24	24	61.8	63.3	291	
2	24	24	61.7	62.4	396	
3	24	24	61.6	63.8	: 396	· ·
4	24	24	62.5	64.6	396	
5	24	24	64.4	<b>66.0</b>	<u>.</u>	
6	24	24	63.8	65,7	384	
7	24	24	66.1	68.3	384	
8	24	24	68.3	70.3	ga <b>516</b>	
9	24	24	<u>;</u> 69.2	70.7	. 516 🛛 🗡	1.5
10	24	24	67.4	69.4	381	
11	<b>24</b>	24	66.2	67.1	381	×
12	24	24	66.6	68.0	381	
13	24	24	<b>68.0</b>	69.3	. 381	,e 4
14	24	24	68.6	70.1	381	
15	24	24	69.1	70.8	381	3
16	24	24	71.0	71.8	<b>381</b>	
17	24	24	.: <b>70.8</b>	71.4	768	ä
18	24	24	70.4	71.9	760	
19	<i>,</i> 24	24	69.1	69.3	760	•
20	24	24	69.6	70.8	760	1
21	24	24	68.2	69.8	768	
22	24	24	68.3	69.3	275	· · · · ·
23	24	24	69.1	69.3	291	
24	24	24	67.0	69.9	776	
25	24	24	67.8	68.4	768	
26	24	24	67.2	67.8	54 J 692	
27	24	24	68.7	69.7	730	. ,
28	24	24	67.3	68.5	<b></b>	
29	24	24	14 <b>68.1</b>	<b>69.4</b>	760	
30	24	24	69.9	71.4	760	~
			2 ¹ 1	:	27	,
			• • •			
		LY MINIMUM	61.6	62.4	275 and a de	
		Y MAXIMUM	71.0	71.9	<b></b>	No. 1 Sept.
	MON	THLY MEAN	67.3	68.6	533	

 Table 1. Monthly ambient river inlet temperatures, and site discharge temperatures and flows,

 with recorded operating hours for Units 1 and 2 at PINGP in 2004

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 Table 1.
 Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

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DATE JULY	OPERATI UNIT 1	NG HOURS	RIVER INLET TEMP.	SITE DISCHARGI TEMP.	E MEAN SITE DISCHARGE FLO	M		
		CINITZ .	(°F)	(°F)	(BLOWDOWN-CF			. • •
					(			
1	24	24	72.2	74.1	768		~	
2	24	24	72.0	74.6	1166			
3	24	24	73.8	76.6	: 1166			
4,	24	24	74.0	75.9	1166	÷.,	2	2
່ 5	24	24	74.7	76.9	1166	1.1		•
6	24	.24	73.7	72.3	1180			
7	24	24	72.0	73.6	📧 <b>1166</b>		;	
8	24	24	70.9	71.7	1166			
9	24	24	72.0	73.9	1166	5 A.		• ,
10	24	24	70.6	72.9	1166	,		. v
11	24	24	72.1	73.6	1180		2 P.	÷.,
12	24	24	73.2	74.6	1166		,	
13	24	24	75.4	76.9	· 1166		6 a.	•
14	24	24	75.8	76.7	1166			i
15	24	24	76.1	77.1	1166	•		
16	24	24	75.9	77.7	1166			: .
17	24	24	76.4	77.8	1152			
18	24	24	75.4	77.1	1152	,		1.1
19	24	24	76.1	77.7	: j 1 <b>166</b>			. ¹ .
20	24	24	77.5	79.3	`r: 1166	:		1. · · ·
21	24	24	78.1	79.9	1166			
22	24	24	78.4	80.2	1166	• • • •		
23	24	24	77.6	79.0	<b>1166</b>	<i>2</i>		
24	24	24	75.7	77.6	1180			
25	24	24	74.9	77.3	1166		•	
26	24	24	76.7	78.5	1180		2	
27	24	24	75.4	78.4	1166		8. j.,	
28	24	24	76.0	78.1	1180		5. ⁹⁷ .	
· 29	24	24	75.6	78.0	ୀ କରୁ     1180	1	35	
30	24	24	74.7	77.4	1180		11 A.	
31	24	24	73.7	76.5	· · · 1180		•	
		ILY MINIMUM	70.6	71.7	768	•		
		LY MAXIMUM		80.2	1180			
		NTHLY MEAN		76.5	1156			
			17.1	10.5		. `	-7	



Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

DATE	OPERATI	NG HOURS	RIV		SITE DISCHARGE	MEAN SITE			
AUGUST		UNIT 2		TEMP.	TEMP.	DISCHARGE FLO	w.		
	und in the second secon		· •	(°F)	(°F)	(BLOWDOWN-CF		}	
				())	(1)	(BEOMBONN-OF	0)		
1	24	24		74.9	77.3	1180			
2	24	24		75.8	78.1	1180			->-
3	24	24	·. · ·	76.3	79.1	1194			z∮.
4	24	24	<u>:</u>	75.6	77.6	1180	· •		5.45 1
5	24	24	•	74.2	76.7	·· 1180	· .		• :
6	24	24		73.9	76.4	1180			•
7	24	24	r 1.	74.4	77.1	1194			:.
8	24	24		73.5	76.1	1194	<i>'</i> .		4
9	24	24		74.3	77.0	1166	, ·		·
10	24	24		71.6	73.2	1180	• *		
11	24	24		68.4	70.5	1180			
12	24	24	• 、	66.9	68.8	1180			
13	24	24		67.9	70.0	1180			۰.
14	24	24	1.15	68.3	70.1	1166			
15 .	24	24	\$` 2	69.7	72.0	J 1180	• *	•	
16	24	24	. <i>i</i>	<b>69.7</b>	72.5	1180			
, 17	24	24		69.1	72.4	1180			
18	24	24	1.1	70.0	73.2	1166			
19	24	24		68.6	71.2	1180			
<b>20</b> .	24	24		6 <del>9</del> .2	70.9	1180			
21	24		19-17 	67.1	69.7	1180		•	2
22	24			67.9	70.8	· 1180			.a
23	24	24	uij 1	69.5	71.6	1180			
24	24	24	a Najari Karatari	69.2	71.4	1180	£ ·		
25	24	<b>2</b> 7	소양주 가	69.4	72.5	1180	÷.,		
26	24	24	ч. 1. с.	70.1	73.2	1180			
27	24	24	• • •	70.2	73.0	1180	1977) 1977	2	•
28	24	24	n tite. V	70.4	72.6	1180		2	
29	24	<u> </u>	93	69.2	71.0	1180		:	4
30	24	24		69.2	71.8	1180			
31	24	24		69.0	71.9	1180			2
									ł
		LY MINIMUM		66.9	68.8	1166	1. 1. 1. 1.	- 1 N.	. 1
		Y MAXIMUN		76.3	79.1	1194			1
	MON	THLY MEAN	1	70.8	73.2	1180	×	'	



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Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

DATE	OPEDAT	ING HOURS	<b>RIVER INLET</b>	SITE DISCHARGE	MEAN SITE
SEPTEMBER		UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW
JEFTEINDER		0,411 2	(°F)	(°F)	(BLOWDOWN-CFS)
			( )	( = )	(BLUMDUMA-CFS)
1	24	24	69.9	72.7	1180
2	24	24	71.3	74.3	1180
. 3	24	24	72.6	75.5	1180
4	24	24	72.3	76.0	1180
5	24	24	73.4	77.1	1180
6	24	24	72.3	75.1	1180
7	24	24	68.9	73.0	1166
8	24	24	70.8	72.8	1208
9	24	24	69.2	72.1	1194
10	20.5	24	69.0	71.8	1194
/ <b>11</b>	0	24	69.9	71.4	991
12	0	24	70.0	72.1	991
13	0	24	72.4	73.9	985
14	0	24	71.3	72.9	550
15	0	24	70.3	71.5	562
16	0	24	67.9	69.3	550
17	0	24	67.5	69.0	550
18	0	24	67.7	69.1	550
19	0	24	68.4	69.4	550
20	0	24	68.1	<b>69.1</b>	550
21	0	<b>24</b>	67.8	68.6	550
22	· <b>O</b>	24	67.2	<b>68.4</b>	538
23	0	24	68.4	69.4	538
24	Ο.	24	66.9	67.7	538
25	0	24	65.1	65.2	538
26	0	24	65.9	67.2	538
27	0	24	65.9	66.7	538
28	0	24	64.9	65.5	525
29	0	24	64.3	65.0	525
30	0	24	63.5	64.3	525
	MONTI	ILY MINÎMUM	63.5	<b>64.3</b>	525
		LY MAXIMUM		77.1	1208
		NTHLY MEAN		70.5	801

	·							·		
DATE	OPERATIN	NG HOURS	<b>RIVER INLET</b>	SITE	DISCHAP		MEAN SITE			
OCTOBER	UNIT 1	UNIT 2	TEMP.		EMP.		HARGE FLOW	· · ·		·
		· ·	(°F)	 	(°F)	(BLO	WDOWN-CFS)			
		١.				• · · ·		-		
1	0	24	63.7		63.0		525			
2	0	24	59.4	Υ.	60.3		512	,		
3	0	24	58.7		59.3	· ·	512	· · ·		
4	0	24	57.8		58.9		<b>512</b>	•		
5	0	24	56.3		57.0		525		4	
6	0	24	56.8		56.7	•	525		•	
7	0	24	58.3		58.8	•	538			
8	0	24	59.6		60.0		562		·	
9	0	24	58.4		59.7		550		۰.	
10	0	24	58.3		59.3		550			
11	0	24	58.2		60.3		550			
12	0	24	58.2		60.0	· · · ·	550			
13	0	24	58.0	. • • · ·	59.3	· · · ·	648			
14	0	24	56.3	, n	57.9		600			
15	0	24	. 54.5		56.2		600			
16	0	24	52.4		53.7		600			
17	0	24	49.5		50.5		600			
18	0	24	48.8		50.0	¥3	600			
19	0	24	50.0		51.1		600	•	۰ <u>۰</u> ۴	•
20	0	24	50.6		51.6		600	ñ		
21	0	24	50.2		52.2	ъ.,	600			
22	0	24	50.8		51.8	2.0	600 °		¢ 1	
23	0	24	52.6	:	53.3	N 173	600			
24	0	24	51.5		52.6	14.2	600		4.5	
25	0	24	52.4		53.4	£.\$\$	600	· · · ·		
26	0	24	51.9		54.6	R LAND	600 612			
27	0	24	50.6	· .,	52.2	$\Delta_{i}^{2} = -E$	612			
28	0	24	51.5 52.0		52.3	. in 2	612			
29	0	24	52.9 53.4	$\pm 10^{10}$	53.1		600		1	
30	0	24 25*		. * 4	54.9	1. A 1.5	600			
31 * Deviliant	0	25	52.1		53.2		000			
* Daylight			48.8		50.0		512			
		LY MINIMUN		1 I.	63.0	2	648	T Che		
		THLY MEAN			55.7	201	577	$= \sqrt{2} t + 2 g_{1}^{2}$		
	WUN		<b>₩</b> .0	1. <b>.</b> .	55.7	81 1. A. A.	STT.	(* - <u>7</u>		

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

Table 1.

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Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

date November		NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SIT	E DISCHA TEMP. (°F)	RGE	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)	а. Фол	, 1.13. 1.
1	. 0	24	51.0		51.9		600		
2	0	24	51.3		52.1	Γ.	600		
3	Q	24	49.8	•	50.0		600	,	
4	0	24	49.2		49.6		600		
5	0	24	47.6		48.5		588		
6	0	24	47.2		47.7	. •	588		
. 7	. 0	24	47.8		48.8		588		<u>\</u>
8	0	24	46.6		47.3		588	•	
9	• 0	24	45.0	· .	45.8	• ·	483	ν.	
10	0	24	46.5		46.8		483		
11	0	24	44.8	7.	45.9	2.5	483	- - -	•
12	0	24	43.3		43.7	÷ 4.	483		
13	0	24	41.3		43.9	s.2	815		
14	0	24	42.2		42.9	· . ·	815	<u>,</u>	۰.
15	0	<b>24</b>	42.1	i	42.9	2	815		•
16	0	24	43.0	1.25	43.0	•	815	2	
17	0	17.4	42.5	,	43.4		815		
18	0	0	43.1		43.5		808		<b></b>
19	0	17.4	<b>43.6</b>	, <b>-</b> .	43.6		808		• • •
20	0	24	43.3	•	44.3		808	• •	
21	0	24	42.0	÷,	42.9		808	•	
22	12	24	41.6	÷	42.6		808	;	
23	24	24	41.6		42.0		808		e
24	· 24	24	40.2		41.5		808		<u>^.</u>
25	24	24	39.1		40.1		<b>828</b> ^{··}	2	× .
× <b>26</b>	24	24	39.3		40.2		835	. 5	• , ' .
27	24	24	39.1		40.1	·	835		÷
28	24	24	37.6		38.3		828		
29	24	24	37.7	· .	38.8		828		- <u>-</u>
30	24	24	36.5		37.9		835	, ¹	3
	-						1. 1.		
	MONTH		36.5		37.9		483		
		Y MAXIMUM			52.1		835		
		ITHLY MEAN			44.3		713	er e	

Table 1.

Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2004

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DATE	OPERAT	ING HOURS	RIVER INLET	SIT	'E DISCHA	RGE	MEAN SITE	• .	
DECEMBER	-	UNIT 2	TEMP.	× •	TEMP.		DISCHARGE FLOW	•	· • • • •
		·.	(°F)		(°F)		(BLOWDOWN-CFS)		
·			• •		• •				
1	· 24	24	35.7	. *	35.9		835	•	
2	24	24	37.4	· ·	37.3	•	835	٠	
3	24	<b>24</b> Mar	36.5	, '	37.0	'	835		
4	24	24	37.7		37.5		835		
5	24	24	37.7		37.3	5 - V	835	· .	
6	24	24	37.2	·	36.7		835		
7	24	24	37.6	;	37.1	11.1	828		
8	24	<b>24</b>	37.8	. ;	37.4	.* . *	835	2	
. 9	24	24	38.4		38.5		828	۰.	
10	24	24	38.4		38.1	₹*	828		
11	24	24		Ŀ.,	38.3	14-14-1	828		·
12	24	24	38.1	• ,	37.9		828		
13	24	24	35.4		36.0		828		
14	24	24	34.9		35.0		612		• .
15	24	24	35.0		35.7	· ·	612	•	
16	24	24	35.1	•	36.3		576		
17	24	24	35.0		36.1		<b>600</b> [°]		
18	-24	24	33.3	1	35.8		696		
19	24	24	34.9		35.3	•••	720	,	··.
20	24	24	34.9		35.3	•	720		
21	24	24	34.7	· · ,	36.2	1	720	•	• • •
22	24	24	34.7		36.1		696	÷ 1	5. <b>.</b> .
23	24	24	34.7 💀	· ·	36.5		696		·
24	24	24	34.7	۰.	36.3	\	696		⁹
25	24	24	34.7	2.	36.0	1 · .	732	۰ ·	÷.
26	24	24	34.7		35.5		720		
27	24	24	34.6		35.2		720		
28	24	24	34.6		35.1		720		
29	24	24	34.5		34.6		720	·.	
30	24	24	34.4		35.1		720	;	
31	24	24	34.4		35.2		720		
	MONTH	ILY MINIMUM	33.3		34.6		576		
		LY MAXIMUM			38.5		835	•	
		NTHLY MEAN			36.3		749	н. 1	



 Table 2 Daily 2004 Mississippi River Discharge Flow rate (cfs) at Lock Dam 3

			ා <u>ද</u>							•		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	8200	5800	9400	33600	21700	36000	21900	11600	8300	28300	24400	17100
2	8300	5800	10000	34600	20000	38500	19100	12900	8300	26800	27100	15700
3	7900	6000	10500	35900	18499	42300	17200	12100	8300	25700	27700	14400
4	7.900	6300	11100	34700	14700	46500	18600	12100	7600	22800	29900	12200
<b>5</b> '	7600	6400	11300	33300		50700	<b>167</b> 00	12200	6100	22200	28900	13900
· 6	6400	6700	11700	31800	14700	53200	15800	11500	9900	22900	28300	13900
7 . *	6500	7100	12000	29400	15700	53800	19500	11500	11300	23500	27700	15200
8	6400	6800	11700	27600	12600	53200	20300	11500	11900	22100	26200	14900
· 9	6300	6900	10700	24300	14000	52300	19700	11700	11700	22200	24500	14100
10	6300	6800	9900	22400	14000	53500	19800	13200	12300	20300	24300	14900
11	6400	6700	13600	22400	14000	54000	20700	12400	12100	19700	24500	16500
12	6700	6700	13400	22200	11700	54900	24500	11000	12200	19700	22300	16600
13	6900	6500	10800	19200	14400	56100	25000	11700	11500	19000	21200	16400
14	7000	6300	14600	19500	14000	56400	24800	12400	12500	18700	19900	12200
15	7000	6300	15100	18400	12600	56000	27200	12200	15201	17400	20100	10600
16	6800	6300	13500	17500	9600	55000	27600	11300	21000	16800	19600	9300
17	6900	6400	12900	18400	12000	54100	27800	10700	16600	15800	19600	10200
18	7100	6300	13000	16300	14300	52900	27000	10700	21500	17200	18800	10800
19	6700	6400	13600	19000	16100	51400	25100	10200	24000	14900	17800	11500
<b>20</b> ³	6100	6600	14700	17300	18800	49800	23000	8900	25500	15400	19800	10900
21	5500	7200	15300	18300	20200	48000	20400	9000	27900	15400	20000	8000
<b>22</b>	5700	7200	15000	22200	21500	46100	17700	8900	29400	15000	17900	7900
23	5900	7400	15600	23600	22300	43900	18100	9700	31500	15400	18900	7600
24	5900	7800	15500	25000	23600	41400	16200	8000	30600	16400	19600	8400
25	5900	7800	15400	27400	25800	38300	15800	8200	32200	16600	18600	8900
. 26 .	6200	7700	17500	27900	28200	35300	13700	8900	32500	14000	18400	10300
27	6400	6900	19300	26000	29700	31300	13600	9000	32200	17100	18600	11100
28	6700	6800	21600	25300	31200	27800	13100	9100	32200	17200	19400	11200
29	6600	7200	25100	23900	32800	24100	10300	9700	30800	21400	17800	11700
30	6500		30500	22800	33300	22800	13000	8200	29700	<b>22700</b> `	16500	11600
31	5800		32400		34000		11600	8300		22900		12000
MIN	5500	5800	<b>9400</b>	16300	9600	22800	10300	8000	6100	14000	16500	7600
MAX	8300	7800	32400	35900	34000	56400	27800	13200	32500	28300	29900	17100
MEAN	6700	6700	15000	24700	19400	46000	19500	10600	19200	19500	21900	12300
-												

YEAR MAX

56400 5500

### Table 3

# 2004 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

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	Mean Plant Flow	Mean River Flow	Percentage of Mean River Flow
Month	(cfs)	(cfs)	Entering the Plant Intake
January	804	6700	12.0%
February	749	6700	11.2%
March	759	15000	5.1%
April	521	24700	2.1%
May	285	19400	1.5%
June	533	46000	1.2%
July	1156	19500	5.9%
August	1180	10600	11.1%
September	801	19200	4.2%
October	577	19500	3.0%
November	713	21900	3.3%
December	749	12300	6.1%
Averages	736	18458	4.0%
		eren en ser e La ser en ser e La ser en ser	

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Table 3section1.doc

* . . <u>}</u>.

Month	2004	2003	2002	2001	20	00	199	9	1998	19	97	199	6	1995	1994
January	6700	9,229	10,932	11,271		)74	10,7		9,80			14,8		11,365	
February .	6700	7,871	10,104	10,471	9,5	548	12,5	89	14,91	1 13,	954	15,0	41	9,371	12,611
March	15000	13,210	11,497	10,948	22,	219	17,8	97	26,57	The second s		24,4	74	29,061	28,542
April	24700	25,613	40,657	112,703	15,	570	42,0	13	51,47	7 106	,073	57,5	17	48,507	40,830
May	19400	42,194	33,974	82,661	18,	839	47,4	26	22,68	1 39,	316	46,5	35	45,135	47,548
June	46000	27,413	26,323	53,177	22,	070	34,4	23	25,69	0 19,	487	33,7	90	30,667	26,913
July	19500	32,739	34,597	23,981	21,	052	27,5	48	26,47	7 36,	119	23,7	32	27,323	29,403
August	10600	10,084	29,065	12,164	10,0	026	24,4	32	10,74	2 28,	074 -	13,3	03	29,129	19,971
September	19200	7,087	24,513	9,193	6,6	87	18,0	13	7,060	) 16,0	563	9,30	00	19,860	21,203
October	19500	6,771	28,600	9,577	6,7	'90	14,2	00	12,59	7 14,	155	11,4	03	31,061	25,581
November	21900	8,167	18,467	11,040	17,4	463	13,2	43	19,77	3 14,	160	23,3	53	30,703	20,173
December	12300	8,310	12,135	13,813	9,5	58	9,67	/1	15,64	5 12,0	s <b>94</b>	18,7	16	17,494	14,432
Averages	26,566	16,557	23,405	30,083	14,0	066	22,6	87	20,28	6 28,3	<b>308</b> 🦾	24,3	33	26,710	25,025
1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -			• ••••												
Month	1993	1992	1991				89		988	1987		<b>)86</b>	_	985	1984
January	9,326	15,658	5,542				294		,303	13,758	13,	710	12	,526	13,375
February	8,936	13,978	5,879				529		,634	12,586		804	10	,239	18,557
March	12,513	43,661	15,08				300	_	,810	17,287	24,	790	32	,265	27,290
April	55,473	32,668	34,26				264		,463	20,267		870	45	,317	56,277
May	48,571	25,474	44,75				287		,119	13,655		242	- 43	,518	49,528
June	65,377	17,920	44,96				237	_	,667	14,573		043		,105	55,613
July	84,123	28,985	33,85				90		,903	11,674	a second second	684	25,	,676	37,165
August	41,135	14,532	21,53			4,6			103	10,477		813	_	,226	13,826
September	30,717	15,686	25,18	2 9,9	23	8,3		6,	080	7,183	41,	957	29,	,665	9,678
October	19,516	15,374	15,45			6,3			019	7,771	_	319			23,866
November	18,773	19,076	22,46			6,7			919	8,693	the second s	260			21,157
December	16,490	12,126	20,503			4,9			487	9,016		774			15,903
Averages	34,246	21,262	24,124	4 13,9	91	11,1	140	8,	709	12,245	37,	787	27,	047	28,519

Table 4. Mean Monthly Mississippi River Flow for 1984 - 2004, in cubic feet per second (cfs).

Note: Mean monthly river flow data for the years 1985, 1990, 1991 and 1992 have been adjusted to reflect the averages found in Table 2 of the corresponding annual report for each year.

## SECTION II

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2004 ANNUAL REPORT

SUMMARY OF THE 2004 FISH POPULATION STUDY

Study and Report

by B. D. Giese

and

K. N. Mueller

Environmental Services Water Quality Department

#### SUMMARY OF THE 2004 FISH POPULATION STUDY

### INTRODUCTION

To fulfill part of the continuing environmental monitoring requirements of the Prairie Island Nuclear Generating Plant, (PINGP), the Mississippi River fisheries population was sampled near Red Wing, Minnesota, May through October, 2004. The study area extends from 3.6 miles upstream of the plant (River mile 802) to 10.8 miles downstream of the plant (River mile 787.5), (Figure 1). The original objective of the study was to "determine existing ecological characteristics before plant operation and to assess any significant changes to the aquatic environment after operation" (NSP 1972). The objective was changed slightly after the plant became operational in 1973; to "determine environmental effects of the PINGP on the fish community in the Mississippi River and it's backwaters" (Hawkinson 1973). Presently, the objective is to monitor and assess the status of the fishery in the vicinity of the PINGP (Mueller 1994). Parameters analyzed and compared to previous years include species composition, length-weight regressions, percent contribution (fish/hr), length-frequency distributions, and catch per unit effort (CPUE) for selected species.

#### METHODS AND MATERIALS

Fish were collected using a Smith-Root SR-18 Electrofishing boat equipped with a 5.0 GPP electrofishing unit (Figure 6). The power source was a 5.0 GPP generator. The 5000 watt generator has a maximum output of 16 amps, and a range of 0-1000 volts. The generator has the capability to be either pulsed AC or DC with a pulse frequency of 7.5, 15, 30, 60, and 120 Hz. The annode consists of two umbrella arrays, each with six dropper cables. The 18 foot boat and dropper cables hung from the front of the boat serve as the cathode. Collection occurred during daylight hours with a pulsed direct current. Due to the constantly changing river conditions, Electrofisher output was varied to enhance the effectiveness.

Sampling was done monthly, May through October, within four established sectors of the study area (Figures 1-5). The runs within each sector are similar to previous years sampling to ensure a similar set of relative data indices for yearly comparison. At the end of each "run", the elapsed shocking time was recorded from a digital timer, which only tallied the seconds that the electrical field was energized. A run was terminated after approximately 450 seconds shocking time or when the end of the prescribed run was reached.

Stunned fish were captured with one-inch stretch mesh landing nets equipped with eight-foot insulated handles. Fish were placed in live-wells, supplied with river water constantly, until the 2004 Annual Report DOC

end of each run. At the end of each run fish were identified, measured to the nearest millimeter (total length), weighed to the nearest 10 grams, and released. Parameters used to describe the fisheries include species composition, length-weight regressions, percent contribution, length-frequency distributions, and catch per unit effort (CPUE). It is assumed that population dynamics and spatial distribution is represented by CPUE.

Electrofishing CPUE was computed as numbers of fish per hour for each sector. Length frequencies in 20 millimeter intervals were calculated for all fish species. Length-weight relationships were calculated using the length-weight formula:

 $\log W = \log a + b \log L,$ 

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where W is the weight in grams, a is the y axis intercept, b is the slope of the regression line, and L is the total length in millimeters.

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#### RESULTS

Initial PINGP preoperational annual environmental reports simply listed all data collected without discussion or analysis (NSP 1972). Individual species were not discussed, due to the amount of data collected during initial sampling efforts. Representative species were selected in 1975 for abundance comparisons based on electrofishing data (Gustafson et. al. 1975), modified in 1986 after seining was eliminated (Donkers 1986), and in 1989 smallmouth and largemouth bass were added as they "have been seen more frequently in the electrofishing catch during recent years in the PINGP study area" (Mueller 1989).

Electrofishing collection methods changed before the 1982 sampling season. The mesh size of the dip nets was increased to one inch stretch mesh. The larger mesh size enabled small adult fish and some young of the year fish of certain species to avoid collection. Currently, individual gizzard shad, freshwater drum, and white bass less than 160 mm are not collected. Also, logperch and cyprinids (other than carp) are no longer collected, due to their small size (Donkers 1987). Therefore, a direct comparison of electrofishing CPUE prior to 1982 is inappropriate to later years.

A total of 7,381 fish, comprising 40 species, was collected in the 2004 survey (Table 2).

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Star Barris

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Species collected in 2004 are compared to previous years in Table 1. An individual spotted sucker was collected in 2004. This was the first spotted sucker collected since 1992 (Table 1). Orangespotted sunfish and musky were also sampled in 2004, but not in 2003. Chestnut lamprey, greater redhorse, lake sturgeon, and brown trout were collected in 2003 (Giese and Mueller 2003), but not in 2004 (Table 1).



All species collected in 2004 are ranked according to electrofishing CPUE and listed in Table 2. Summaries for selected species (Tables 3-9) are based on electrofishing and trapnetting data for years 1977 through 1987, and on electrofishing data only for years 1988 through 2004, since trapnetting was discontinued after 1987 (Orr 1988). Annual CPUE for selected species is compared to previous years (Figures 15-22), by sector (Figures 23-30), and by date (Figures 31-38). The top three abundant species, based on CPUE, was determined for each sector.

> Sector One; Sector Two; Sector Three; Sector Four; Overall CPUE Average;

shorthead redhorse, gizzard shad, freshwater drum carp, shorthead redhorse, gizzard shad white bass, smallmouth bass, carp white bass, freshwater drum, čarp shorthead redhorse, white bass, carp

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Table 10 summarizes the percent contribution of historically predominant species in the annual catch. Length frequency distributions for selected species are illustrated by sector in Figures 7 through 14.

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#### DISCUSSION

When dealing with a large river environment, a high degree of natural variability exists in habitat conditions and therefore, in fish distribution. Palmquist (1982) proposed the wide range in species abundance between study sectors was largely due to habitat preferences of a species rather than PINGP induced. A high degree of variability in species abundance exists within sectors from year to year. Differences in collection efficiency and year class strengths may explain this variability.

A qualitative and quantitative discussion for selected species, with respect to other years, includes: 1) CPUE, 2) rank, 3) percent composition of catch, 4) population condition as depicted by length-weight regression analysis, and 5) mean length.

Average mean length was calculated by splitting the length data for each species into 20 mm intervals and multiplying the number of fish in each interval by the median length of that interval (Example: The number of fish in the 260-279 mm interval was multiplied by 270 mm). Interval totals were summed, divided by the total number of fish, and rounded to the nearest 10 mm.

#### GIZZARD SHAD

Electrofishing CPUE for gizzard shad increased from 9.51 fish/hr in 2003 to 17.60 fish/hr in 2004 (Figure 15). CPUE increased in Sectors 1, 2 and 4 from 2003 to 2004, with only a slight decrease evident in Sector 3 (Figure 23). CPUE was also examined for each sampling month for 2004, with the highest occurring in Sector 1 in August (Figure 31).

Shad ranked fifth in 2004 (Table 2), and presently comprise ten percent of the catch (Table 10). The general condition of gizzard shad, 2.863, falls into the range of previous years, 2.388 to 3.934 from 1982-2003 (Table 3). Carlander (1969) sites a population in Canton Lake, Oklahoma with a range in total fish length of 173 to 335 mm and a regression slope of 3.066 which compares well to the fish in this study. The mean length for gizzard shad (290 mm) decreased from 2003 (Table 3). The length frequency data indicates a range of approximately 160-470 mm, with peaks occurring at approximately 250 and 400 mm (Figure 7).

#### FRESHWATER DRUM

Freshwater Drum CPUE for 2004, (21.12 fish/hour) decreased from 37.51 fish/hr in 2003 (Figure 16). CPUE was lower in all sectors when comparing 2004 to 2003 (Figure 24). The highest CPUE in a sector for any month occurred in Sector 3 in May (Figure 32).

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Freshwater drum CPUE ranked fourth in 2004 (Table 2). Although carp historically has had the highest composition expressed as percentage of total annual catch and resulting CPUE overall, carp ranked third in 2004 (Table 2). Presently, adult freshwater drum comprise twelve percent of the catch (Table 4).

The general condition of freshwater drum has remained relatively stable, as depicted by a regression slope of 3.080 in 2004, in comparison to a range of slopes of 2.598 to 3.212 from previous years of the study (Table 4). The mean length for freshwater drum was approximately 310 mm in 2004 (Table 4). The length frequency data for freshwater drum suggest that a peak occurs at approximately 310 mm (Figure 8).

### SHORTHEAD REDHORSE

Electrofishing CPUE for shorthead redhorse has ranged from 7.07 to 25.94 fish/hour (Figure 17). CPUE for 2004 (25.63 fish/hr) is the second highest value since the study began (Table 5). Historically, the CPUE within each sector is highly variable (Figure 25). The 2004 CPUE is also variable between sectors, ranging from 18.25 fish/hour in Sector 4, to 35.53 fish/hour in Sector 1 (Table 2). CPUE for each sector is highly variable during the collection year, with the highest CPUE occurring in Sector 3 in October (Figure 33).



Shorthead redhorse ranked first in 2004 (Table 2). Presently, adult shorthead redhorse comprise 15 percent of the catch (Table 5).

The general condition of shorthead redhorse has remained relatively stable, as depicted by a regression slope of 2.948 in 2004, in comparison to a range of slopes of 2.571 to 3.041 from previous years of the study (Table 5). The length-weight regression slope of shorthead redhorse in the vicinity of Prairie Island is about the same as that of another population of Upper Mississippi River shorthead redhorse as reported by Carlander (1969) as having a slope of 2.83. The mean length for shorthead redhorse at Prairie Island was approximately 360 mm in 2004 (Table 5). The length frequency data show that the main peaks occur at approximately 230 and 380 mm (Figure 9).

#### WHITE BASS

Electrofishing CPUE for white bass in 2004 (24.29 fish/hr) is the lowest recorded since 1996 (Figure 18). CPUE decreased in all four sectors when comparing 2004 to 2003 (Figure 26). A large difference is evident when comparing CPUE upstream of Lock and Dam 3 to downstream of Lock and Dam 3 (Table 2). Overall CPUE appears cyclic (Figure 18) with year to year variability within each sector (Figure 26). Highest CPUE for any month sampled, occurred in Sector 3 in May with 90+ fish/hr (Figure 34).

White bass ranked second in 2004 (Table 2). Presently, white bass comprise 14 percent of the catch (Table 10).

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The general condition of white bass has remained relatively stable, as depicted by a regression slope of 3.029 in 2004, in comparison to a range of slopes of 2.441 to 3.085 from previous years of the study (Table 6). The mean length for white bass is similar to the last eight years (Table 6). The length frequency data shows that a main peak occurs for white bass at approximately 370 mm, with a smaller peak at approximately 220 mm (Figure 10).

#### WALLEYE

Electrofishing CPUE for walleye in 2004 (5.02 fish/hour) is the lowest recorded since 1996 (Figure 19). CPUE decreased in all sectors when comparing 2004 to 2003 (Figure 27). The highest CPUE for any sector in any month was Sector 3 in October (Figure 35).



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Walleye ranked ninth in 2004 in overall catch abundance (Table 2). Presently, adult walleye comprise three percent of the catch (Table 7).

The general condition of walleye has remained relatively stable, as depicted by a regression slope of 3.175 in 2004, in comparison to a range of slopes of 2.852 to 3.318 from previous years of the study (Table 7). The mean length for walleye decreased from 2003 to approximately 440 mm (Table 7). The length-weight relationship indicates peaks occurring at approximately 250, 450 and 600 mm (Figure 11).

#### **SAUGER**

Electrofishing CPUE for sauger increased from 5.86 fish/hr in 2003 to 7.75 fish/hr in 2004 (Figure 20). Sauger CPUE decreased in both sectors upstream of lock and dam #3 and increased in both sectors downstream of lock and dam #3 in 2004, compared to 2003 (Figure 28). Sector 3 had the highest CPUE in August of any sector in any month (Figure 36).

Sauger ranked seventh in 2004 (Table 2), comprising four percent of the catch (Table 8).

The general condition of sauger has remained relatively stable, as depicted by a regression slope of 3.232 in 2004, in comparison to a range of slopes of 2.648 to 3.356, in previous years of the study (Table 8). The mean length for sauger was approximately 270 mm in 2004 (Table 8). The length frequency data exhibit a range from 150-530 mm, with relatively broad peaks occurring at approximately 240 mm and 350 mm (Figure 12).

#### SMALLMOUTH BASS

Electrofishing CPUE for smallmouth bass appears cyclic with the peak CPUE (17.02 fish/hour) occurring in 2000, while 2004 CPUE was 16.15 fish/hr (Figure 21). CPUE in Sectors 1-4 appear cyclic (Figure 29) with curves appearing similar in shape to the curve for all sectors combined shown in Figure 21. The highest CPUE (50+ fish/hr) occurred in Sector 3, in August (Figure 37).

Smallmouth bass ranked sixth in 2004 (Table 9), comprising nine percent of the catch. The population of smallmouth bass appears to be in good general condition as depicted by a regression line slope of 3.065, which compares well with smallmouth bass populations provided by Carlander (1977). Smallmouth bass have a length frequency range of approximately 100-540 nm, with a relatively obscure peaks occurring at approximately 200, 300 and 350 mm (Figure 13).

#### LARGEMOUTH BASS

Largemouth bass CPUE for 2004, (4.73 fish/hour), is the lowest recorded since 2000 (Figure 22). Even though CPUE decreased from 2003, rank increased from 2003 (Table 9). The CPUE for Sector 1 was virtually zero for all sampling dates, while Sectors 2-4 have a little more variability (Figure 30). The highest CPUE occurred in Sector 3 in October (Figure 38).

Largemouth bass ranked tenth in 2004 (Table 9), comprising three percent of the catch. Historically, largemouth bass rank has varied greatly, ranging from 9th to 20th (Table 9).

The population of largemouth bass appears to be in good general condition as depicted by a regression line slope of 2.856, which compares well with information on largemouth bass populations provided by Carlander (1977). The length frequency data indicates a range of 130-490 mm, with peaks occurring at approximately 240 and 340 mm (Figure 14).

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#### GENERAL

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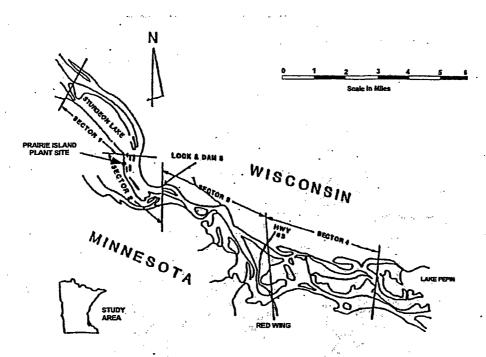
The ten most abundant species collected during 2004 in descending order, based on average CPUE for all sectors combined were: 1) shorthead redhorse, 2) white bass, 3) carp, 4) freshwater drum, 5) gizzard shad, 6) smallmouth bass, 7) sauger, 8) quillback carpsucker, 9) walleye and 10) largemouth bass (Table 2).

Total average CPUE for all species and sectors combined decreased from 193.89 fish/hr in 2003, to 174.73 fish/hr in 2004 (Table 2).

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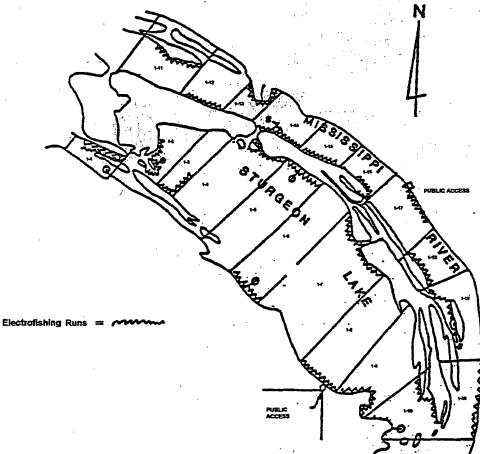
### PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA



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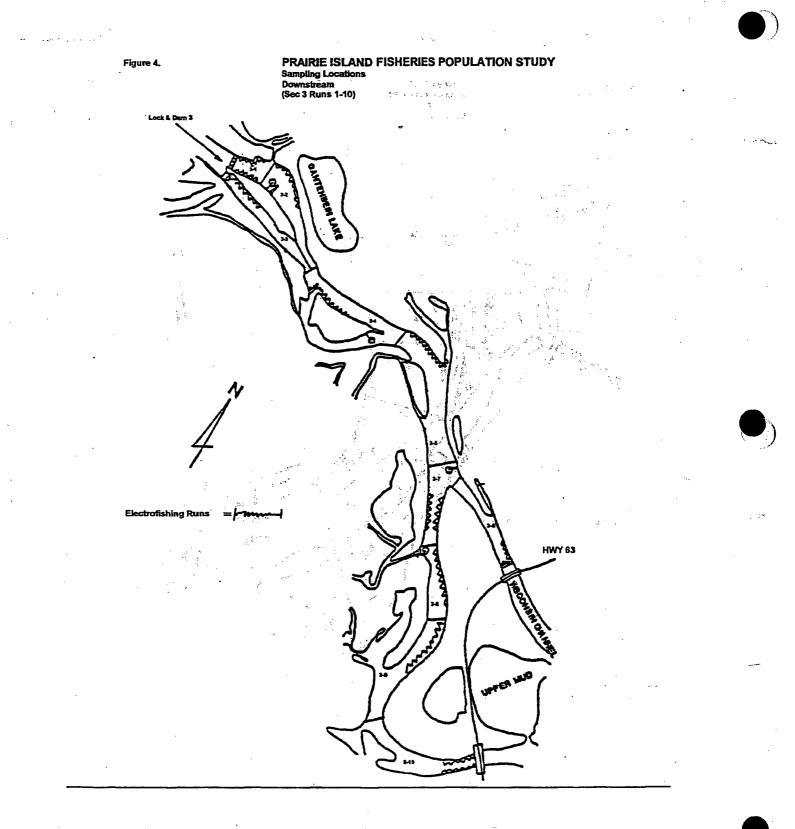


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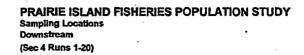
FIGURE 2

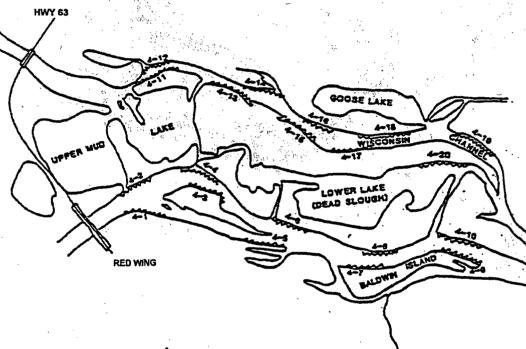
PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Plant Area (Sec 2 Runs 1-10) Figure 3. PRAIRIE ISLAND ____ NUCLEAR GENERATING PLANT 00 N 2 জ 2 3 2 2-8 LOCK & DAM 3 C 2-7 Electrofishing Runs = 2-10 D ģ 2-6 2-9

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Electrofishing Runs =

Figure 5.

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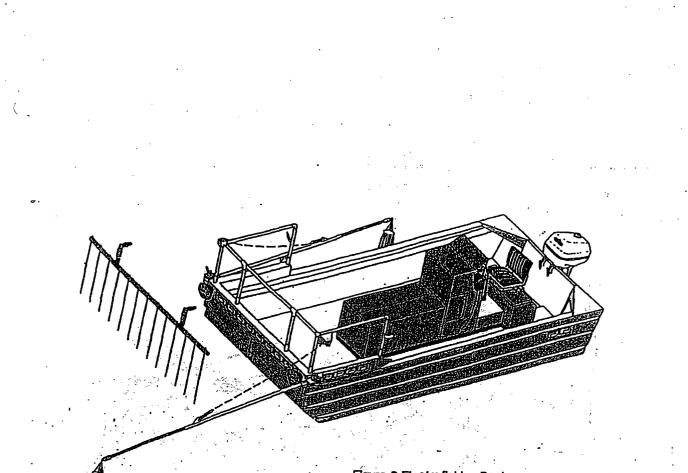


Figure 6 Electrofishing Boat

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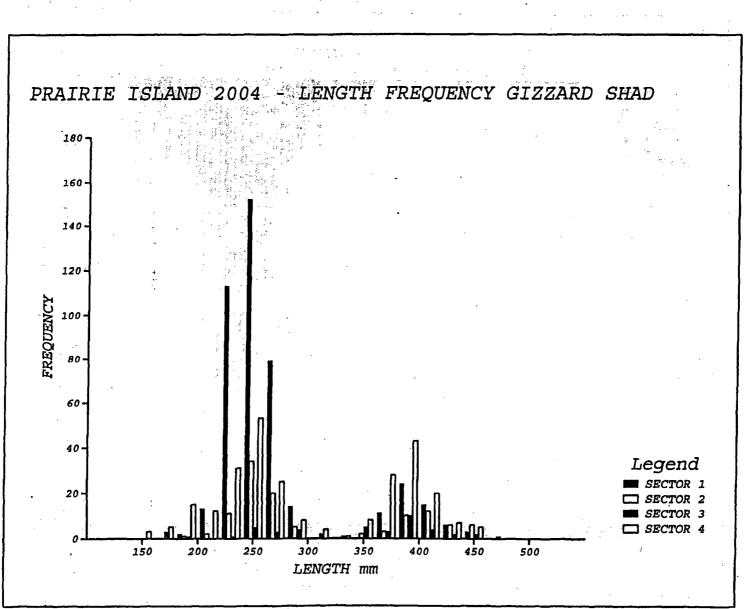
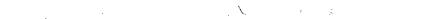
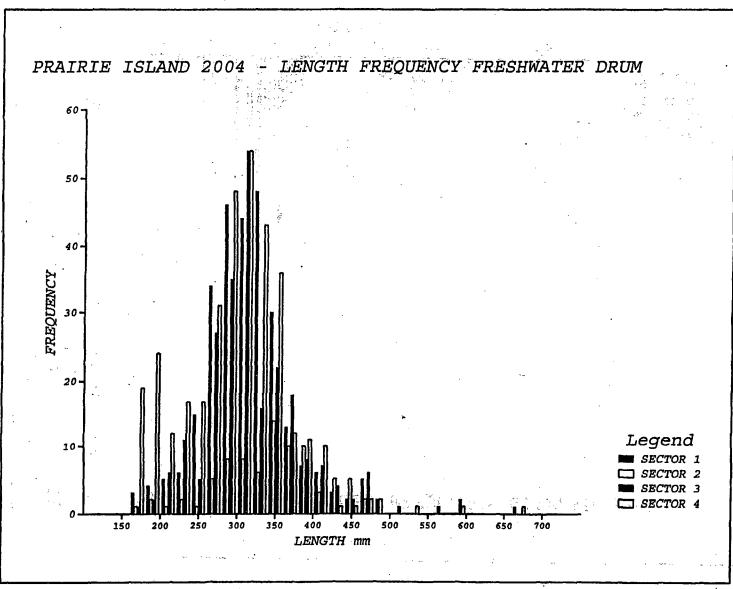


Figure 7

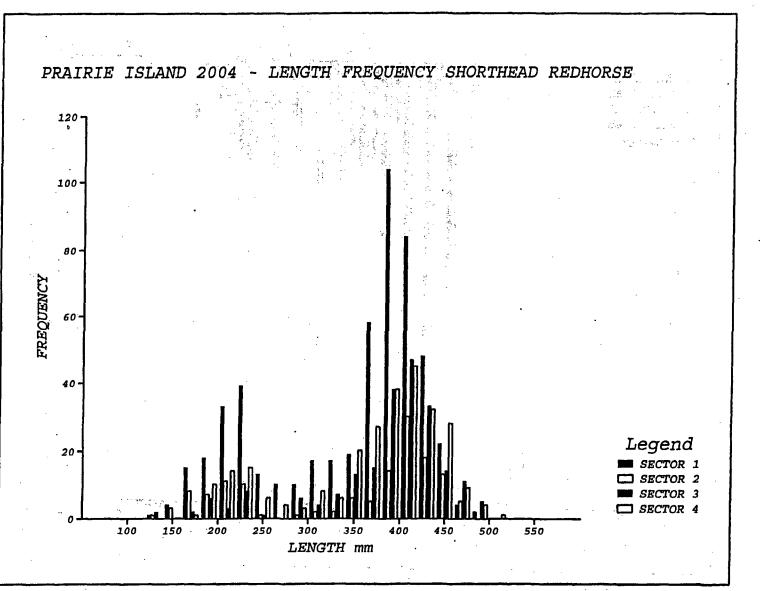
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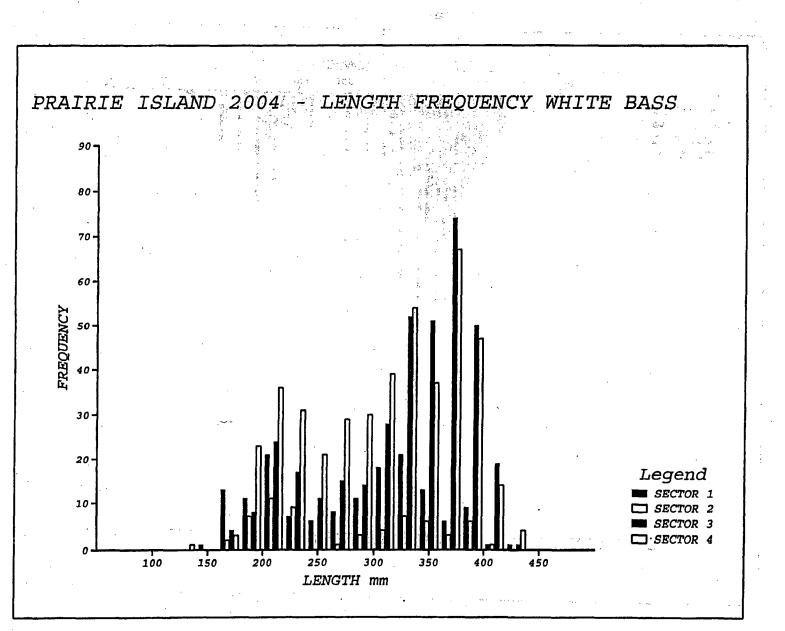




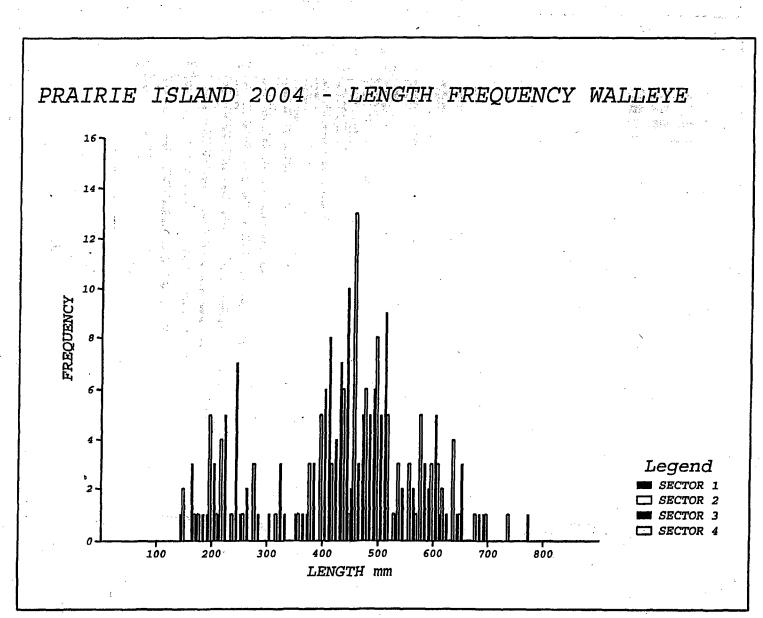
FWD Figure 8



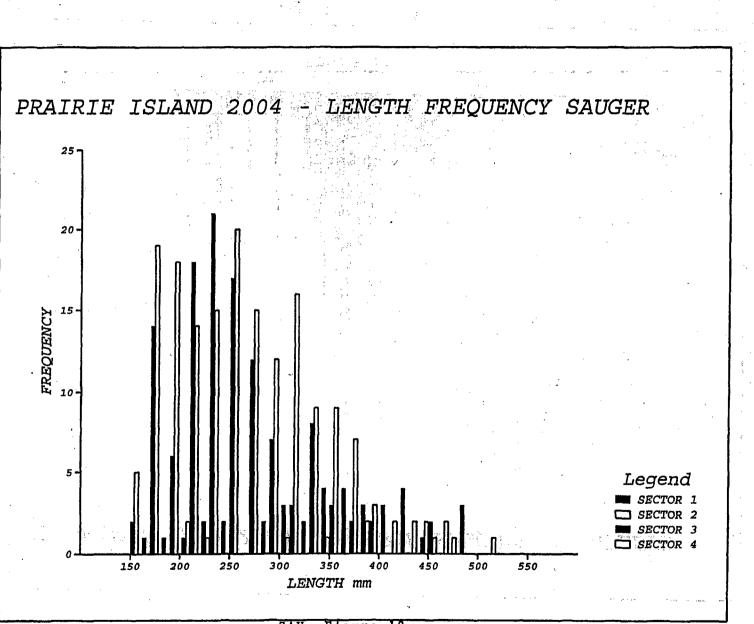
SHRH Figure 9



WB Figure 10

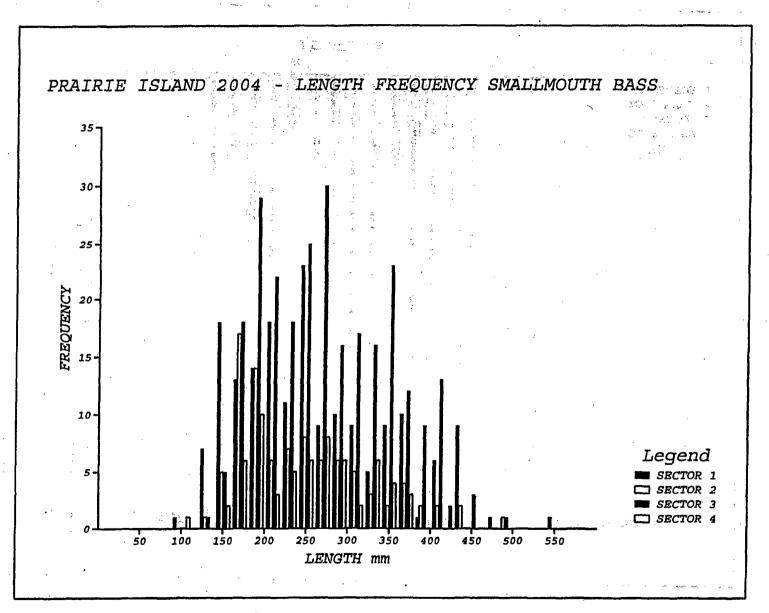


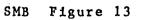
## WAE Figure 11



SAU Figure 12

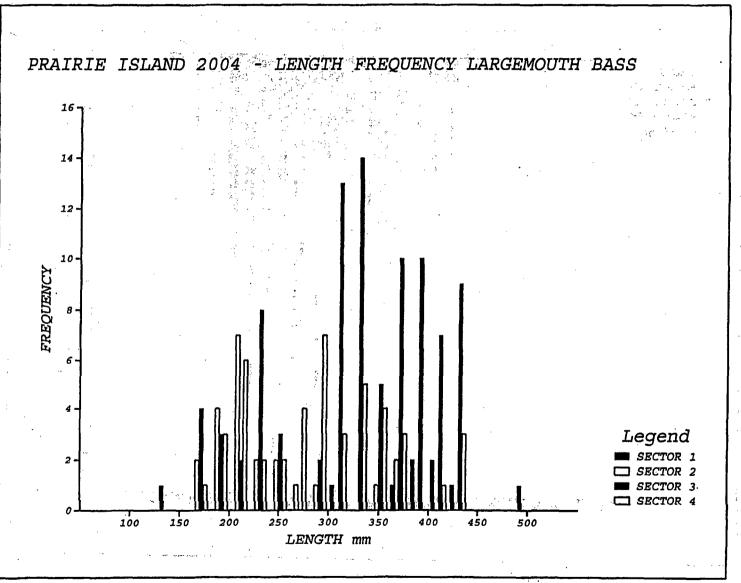
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LMB Figure 14



# Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2004 in the vicinity of PINGP.

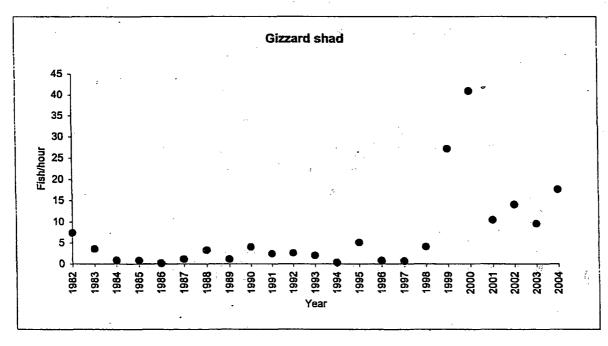
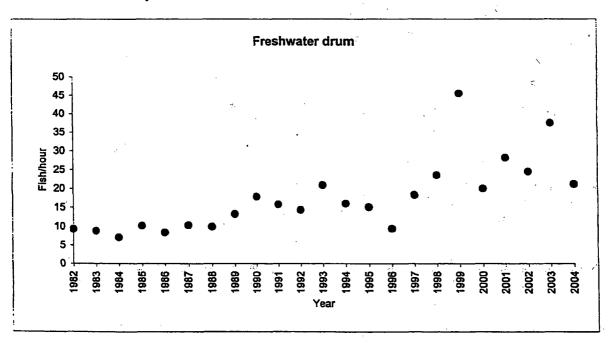


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2004 in the vicinity of PINGP.



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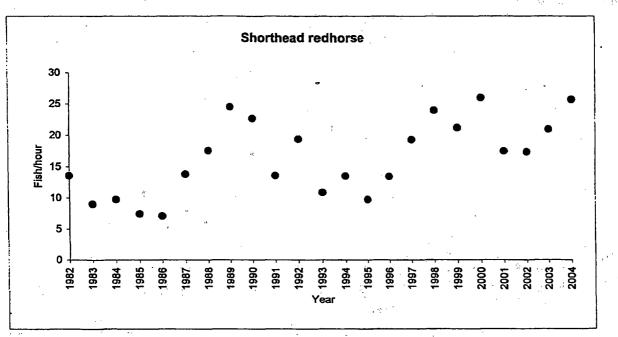
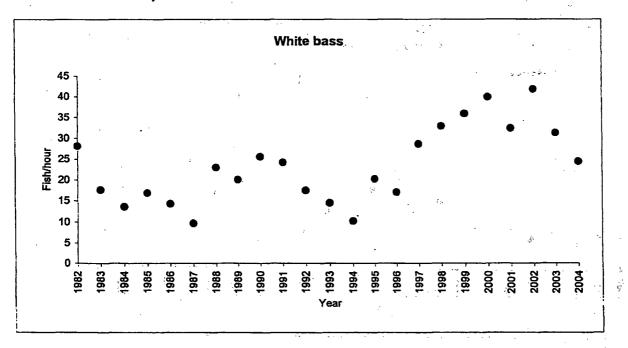


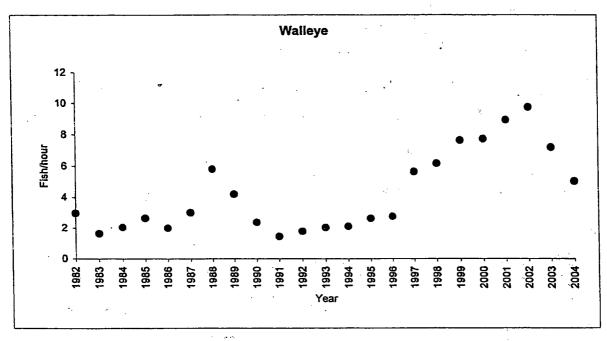
Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2004 in the vicinity of PINGP.

Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2004 in the vicinity of PINGP.

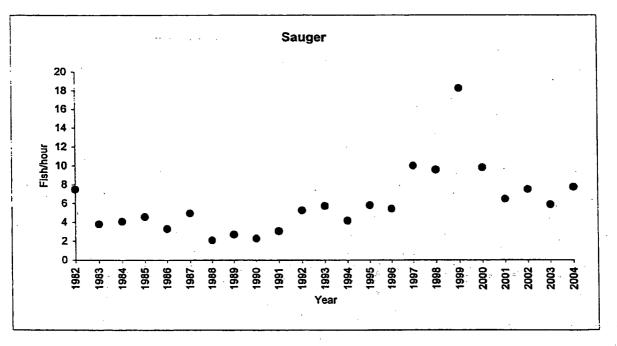




# Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2004 in the vicinity of PINGP.



# Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2004 in the vicinity of PINGP.



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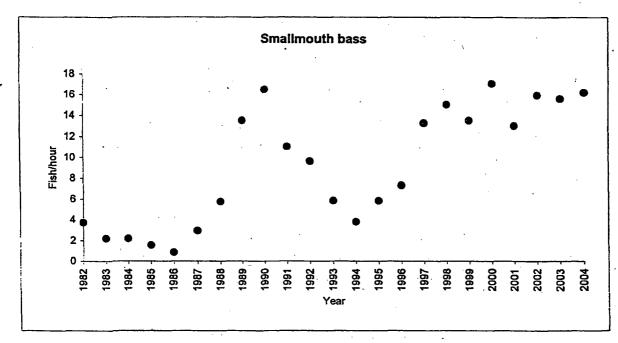
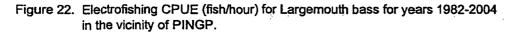
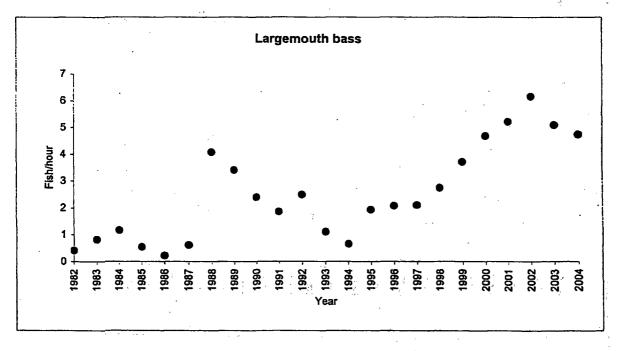


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2004 in the vicinity of PINGP.







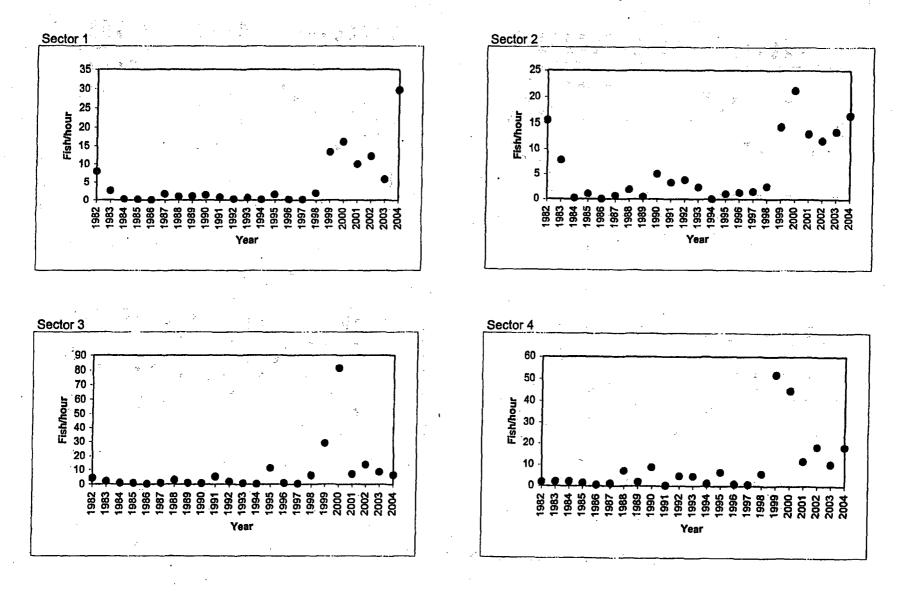
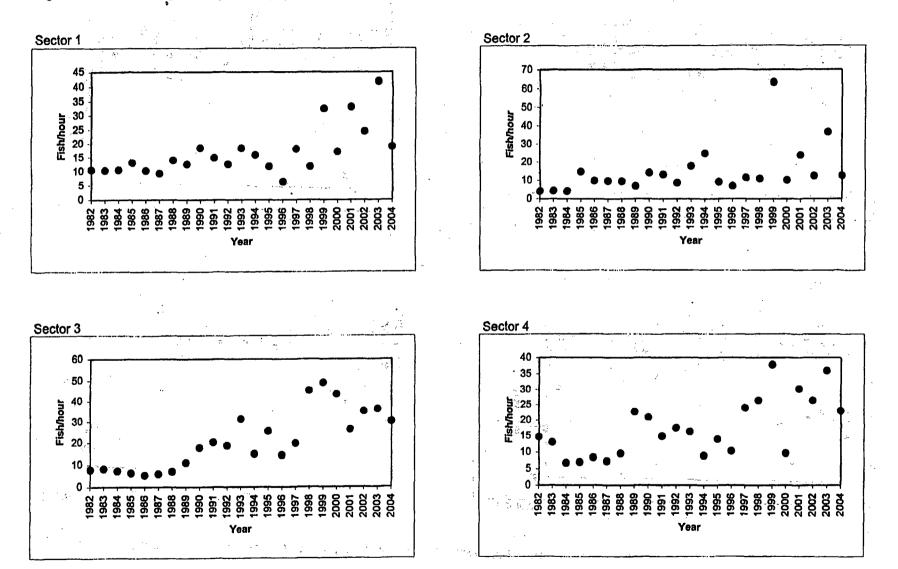


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2004 in the vicinity of PINGP.

Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2004 in the vicinity of PINGP.



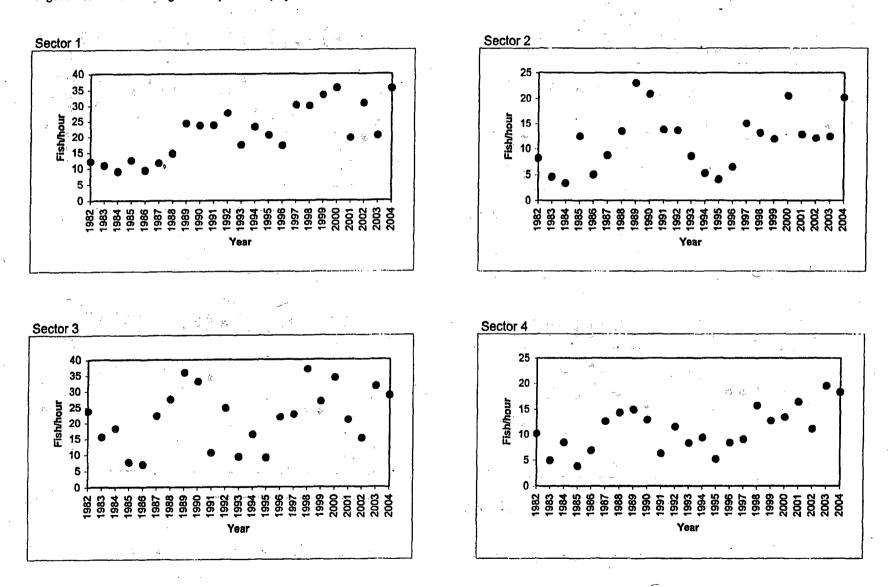
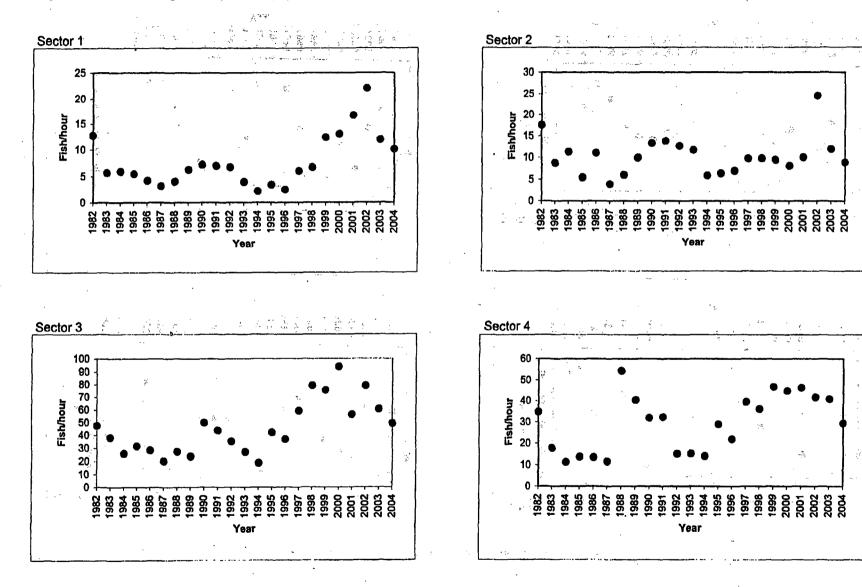


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2004 in the vicinity of PINGP.

Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2004 in the vicinity of PINGP.



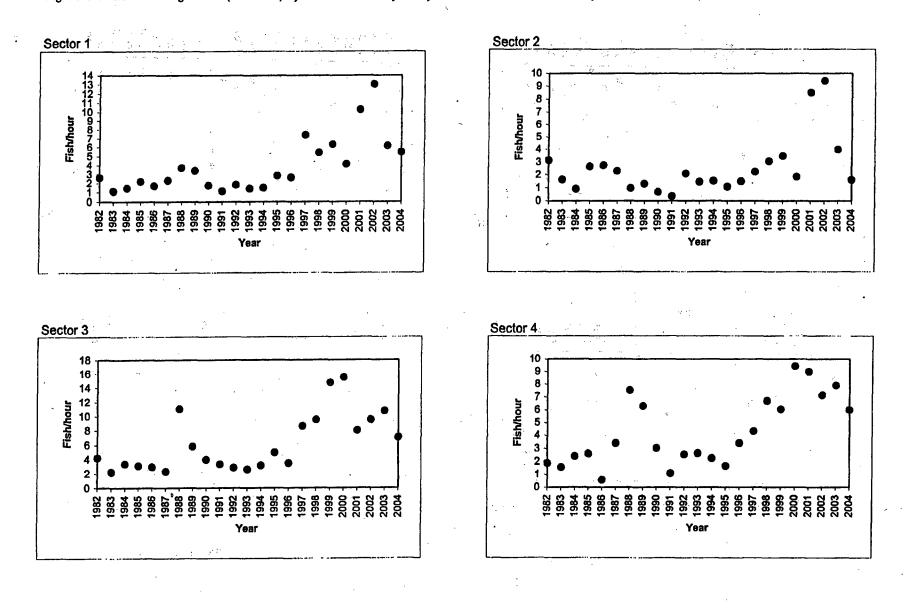
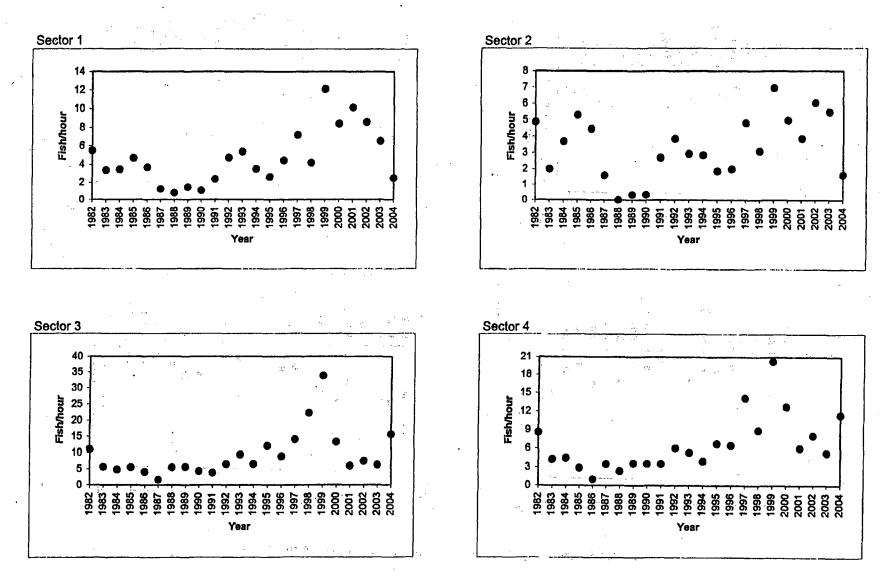
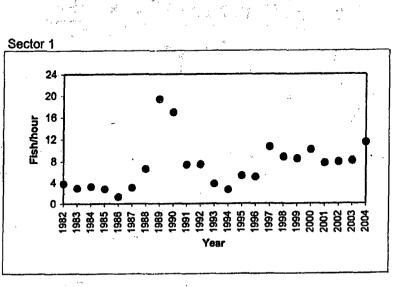


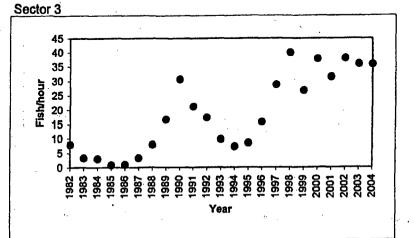
Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2004 in the vicinity of PINGP.

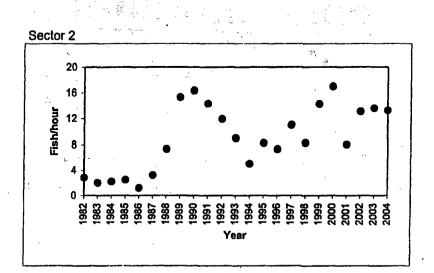
Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2004 in the vicinity of PINGP











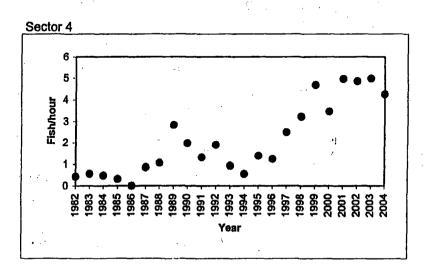
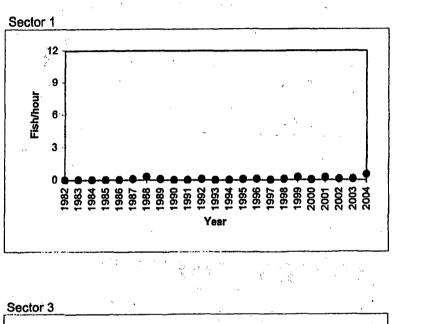
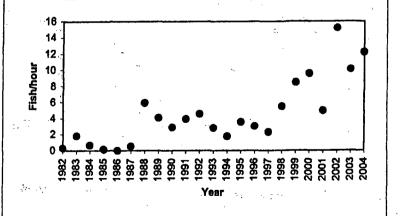
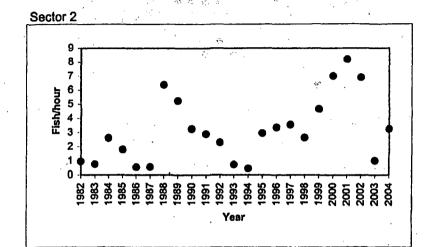
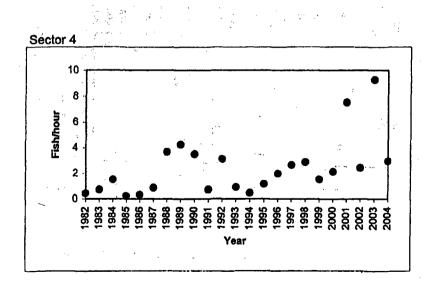


Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2004 in the vicinity of PINGP.

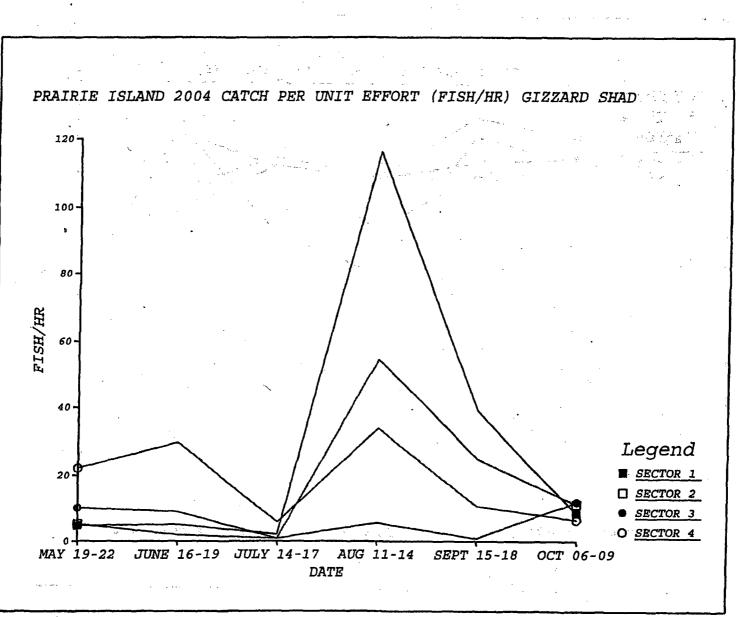






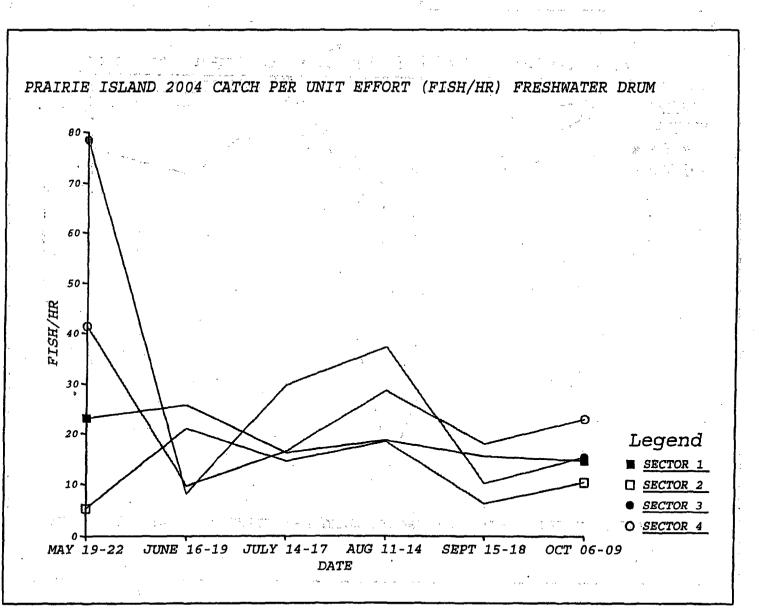


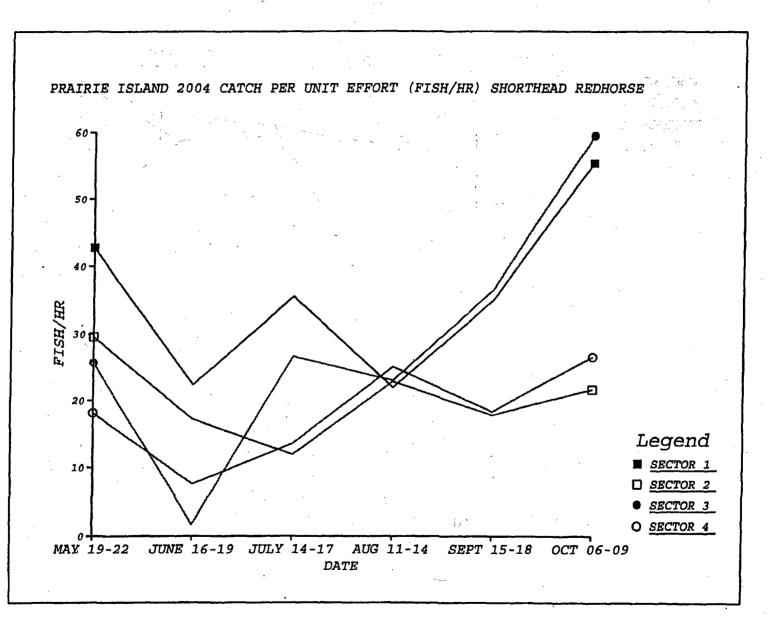
.



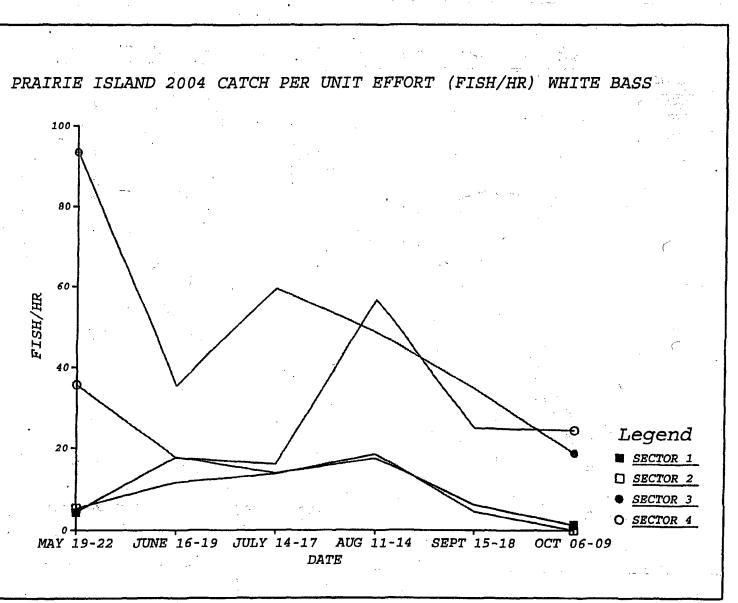


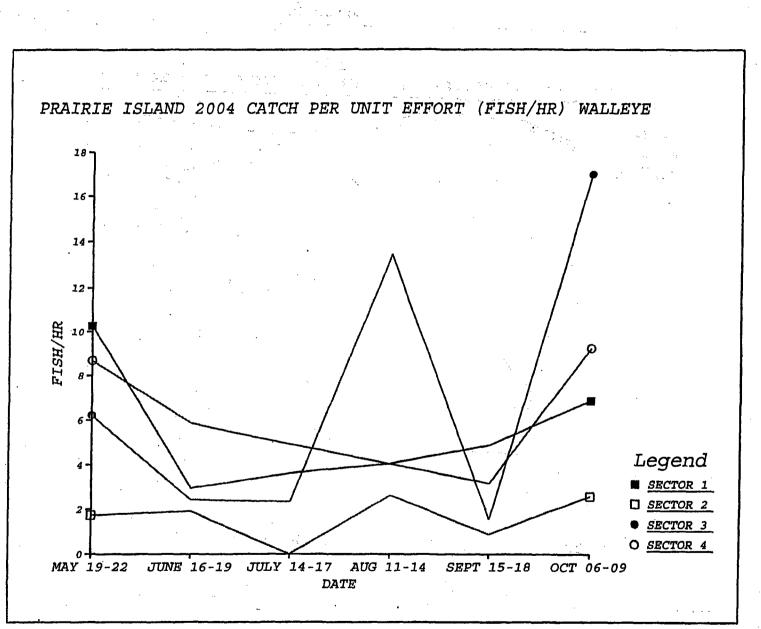




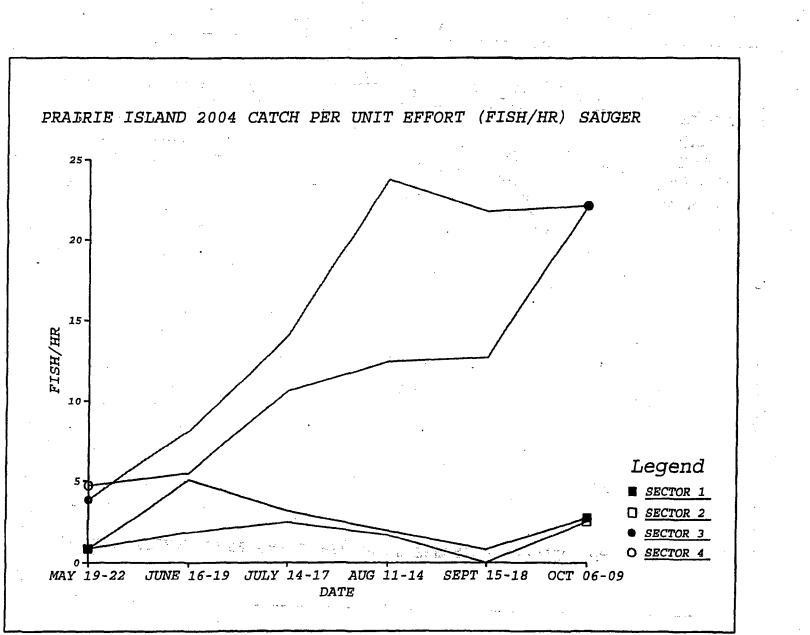


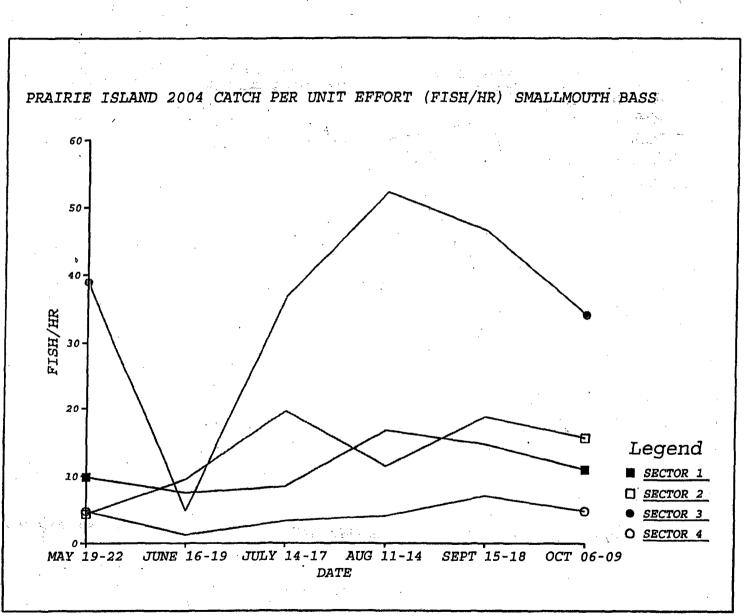


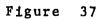




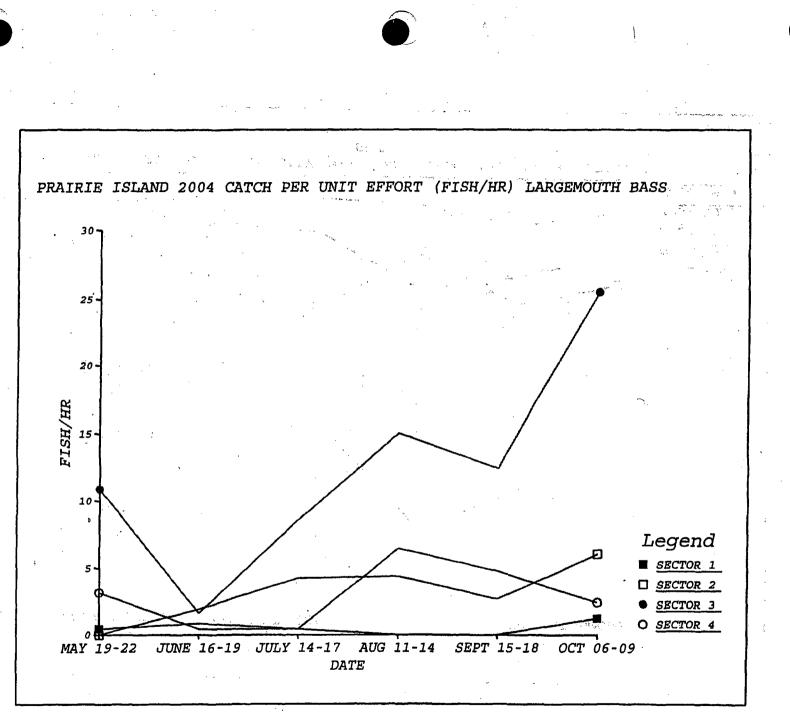








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																	•				•							٠			
	Table 1.	Sp	ecie	es of	fish	capt	ured	In t	he N	lissi	ssip	pi R	iver	in t	he v	vicin	ity c	of th	e Pr	rairie	e Isla	and I	vuclea	r Ge	nera	ating	Plan	it 198	33-20	004.	
	Species	<u> 83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u> 8	8 8	<u>9. 90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>	<u>98</u>	<u>99</u>	00	01	02	<u>2</u> <u>0</u>	<u>3 04</u>								·	
	Chestnut lamprey	Х.	. <b>X</b>						<b>. x</b> .	x		÷	x			x	x		x	x	x										
	Ichthyomyzon castaneus														÷		ć				•									. •	
	Silver lamprey		۰.	, ,	•	<b>x</b> ., 3	( X	X	<b>X</b> .,	X		Х	X	X	Х	X	X	x	Х	X	X	х									
	Icthyomyzon unicuspus				•											,	*														
	Paddlefish				ς.										Х																
	Polvodon spathula																														
	Longnose gar	Х	х	X	X	x )	(X	X	X	х	Х	X	X	Х	X	Х	X	х	X	X	X	Х									
	Lepisosteus osseus				•													•		·											
	Shortnose gar	х	x	X	x	x )	( X	х	Х	х	х	Χ.	x	x	x	x	X	х	Х	X	x	X									
	Lepisosteus platostomus																														
	Bowfin	x	х	х	x	x >	x x	х	X	x	Х	х	<b>X</b> _	х	X	x	X	х	х	X	X	x			· •						
	Amia calva																			•											
	American eel	х	x		х	х >	x x	X	х	Х	х	х	X	<b>X</b> [			х	х		х											
	Anguilla rostrata							•																							
	Gizzard shad	Χ.	Х	Х	x	х́х	X	Х	х	х	Х	Х	X	X	Х	x	X	Х	Х	х	X	х									
	Dorosoma cepedianum											•																			
	Goldeye	х		X		хх	2				Х			Х	X	X	Х			•	Х	х									
	Hiodon alosoides																											:		•	
	Mooneye .	Χ.	Χ.	X	X	х х	X	х	Х	Х	X	X	X	X	X	Х	X	Х	х	X	X	X									
	Hlodon tergisus																														
	Brown trout				x								Х		X		x		X	X	X										
	<u>Salmo trutta</u>					• •																									
	Northern pike	х	x	x	X	ĸ຺x	X	Х	X	Х	X	X	Х	X	X	X	X	X	Х	Х	X	x							2		
	<u>Esox lucius</u>																														
	Musky																	Х	х			x									
	Esox masquinongy																				·										
	Carp	x	Χ.	x	X X	x x	X	Х	Χ.	х	X	x	x	X	х	X	x	X	x	X	х	X									
	Cyprinus carpio																														
	Carpsucker Species		X				X																								
•	Carpiodes species																														
	River carpsucker	Х	X	X	X - 3	( X	_X	X	Х	Х	х	X	Χ.	Х	X	x	X	X	X	Х	Х	Х									
	Carpiodes carpio	·				,								•																	
	Quillback	X	X	X	X.)	(X	X	X	Χ,	X	X	X	X	X	X	x	X	х	X	X	X	Х								÷	
	Carpiodes cyprinus															•															
	Highfin carpsucker	445		Х	X J	X	X	Х	X	х	X	X	X	x	X					X	X	х									
	Carplodes velifer																								• A		• •	÷			
	White sucker	х	X	X	x )	(X	X	X	х	х	х	x	X		x	x	x	X	X	x	х	X									
	Catostomus commersoni	•										_	_																		
	-																														

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Table 1 (cont.)

Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2004.

Species         83         84         85         86         87         88         89         90         91         92         93         94         95         96         97         98         99         OO         O1         O2         O3	<u>04</u>
Blue sucker X X X X X X X X X X X X X X X X X X X	х
Cycleptus elongatus	
Northern hogsucker x x x	
Hypentelium nigricans	
Smallmouth buffalo x x x x x x x x x x x x x x x x x x x	x
Ictiobus bubalus	
Bigmouth buffalo x x x x x x x x x x x x x x x x x x x	x
Ictiobus cyprinellus	
Spotted sucker x x x x x x x	x
Minytrema melanops	
Silver redhorse x x x x x x x x x x x x x x x x x x x	х
Moxostoma anisurum	
River redhorse x x x x x x x x x x x x x x x x x x x	х
Moxostoma carinatum	
Golden redhorse x x x x x x x x x x x x x x x x x x x	x
Moxostoma erythrurum	•
Greater redhorse x x x x x x x x x x	
Moxostoma valenciennesi	
Shorthead redhorse x x x x x x x x x x x x x x x x x x x	x
Moxostoma macrolepidotum	
Black bullhead x x x x x x x x x x x x x x x x x x x	
ictalurus melas	
Yeliow bullhead x x x x x x	
Ictalurus natalis	
Brown builhead x	
Ictalurus nebulosus	
Channel catfish x x x x x x x x x x x x x x x x x x x	x
Ictalurus punctatus	
Flathead catfish x x x x x x x x x x x x x x x x x x x	x
Pylodictus olivaris	
Burbot x x x x x x x x x x x x x x x x x x x	X
Lota lota	
White bass x x x x x x x x x x x x x x x x x x	X
Marone chrysops	•
	x
Ambloplites rupestris	•
Green sunfish x x x x x x x x x x x x x x x x x x x	X
Lepommis cyanellus	•

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Table 1 (cont.)	-				878	· · · .	90	2						• .		,	47						,		·	6		-2004	-
	<u>. 00</u>				<u>, 1</u>	<u>0</u> <u>0</u>	S							:						,									
Pumpkinseed	. :	•			_N 8	X	₩ <b>X</b> ,	X	X	X	X	X	<b>X</b> .	х	<b>,X</b> =	: X ·	Х	Х	X	X	X			•••					
Lepomis gibbosus					14 14				1				•	7		~	v	v			v				2				
Orangespotted sunfish Lepomis humilis									;					•÷	<b>入</b>		^	X			x					2			
Bluegill	v	Y	x	v	Y 1	e x	X	Y	Y	x	Y	¥ .	Y	x	X	x	X	x	Y	<b>X</b>	¥			- -		÷			
Lepomis macrochirus	~	^	~	^	~ /			~	~	^	~	^	~	~	~		~	~	~	•	~				** <b>*</b>				
Smallmouth bass	x	x	x	x	хх	x	x	х	х	x	x	x	x	x	x	x	X	х	х	х	х								
Micropterus dolomieui																													
Largemouth bass	x	х	x	x	хх	x	х	х	х	x	x	x	x	.x	x	х	x	х	х	X	x								
Micropterus salmoides									• •												·								
White crapple Pomoxis annularis	<b>.</b> X	X	<b>. X</b>	X	ХХ	( 18 <b>X</b> ) 18	<b>. X</b>	<b>.</b> X	Χ,	X	X	Х .,	X	X .,	x	X	X	х	X	. <b>X</b>	Х	·.							
Black crappie	v	v	v	v	v v	v	х	¥	v	Y	Y	Y S	Y	Y	Y	¥.	x	Y	v	· Y	v			-		•			
Pomoxis nigromaculatus	~	~	~	^			~	~	~			~	~	~	~	~		~	~	~	~								
Yellow perch	x	х	x		x x	X	, <b>X</b>	. <b>X</b> -	х	x	x	Х.		x	x	x		х	X	х	х								
Perca flavens						.' .			•						·				•••				14						
Sauger	х	X	X	X	х х	X	X	X	X	X	X	X	x	Χ.	x	X	X	X	X	Х	X		•			•			
Sander canadense							•				•-																		
Walleye <u>Sander vitreum</u>	x	х	X	<b>X</b> _ :	хх	<b>X</b>	x	х	х	X	х	х	X	<b>X</b>	x	x	x	х	• <b>X</b>	х	х	• •							
Saugeye						•						. •		Х.	x	x		x	x	x	x		•.						
S. vitreum x S. canadense																				~	~		,						
Freshwater drum	х	х	x	<b>x</b> ່ :	x x	х	х	x	x	x	x	x	x	x	x	x	х	х	х	x	х								
Aplodinotus grunniens	•••		•		• •								15			÷ -						۰.,	۰.,						
Lake sturgeon			2	5					۰							•	•			X									
Acipenser fulvescens	•																												
																			. •	• '				;					
									•									•				2 - 1 -							



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Table 2. Electrofishing CPUE (fish/hour) for each sector in the vicinity of PINGP and total number of each species collected during 2004.

Species are listed in ascending order by rank according to average CPUE.

				· •			Number
Rar	nk Species	Sector 1	Sector 2	Sector 3	Sector 4	Average	collected
			00.40	00.57	40.05	) 05 00	
	1 Shorthead redhorse	35.53	20.16	28.57	18.25	25.63	1141
	2 White bass	10.08	8.83	48.89	29.37	24.29	1011
	3 Carp	14.34	26.19	34.94	19.20	23.67	935
	4 Freshwater drum	18.86	12.51	30.16	22.97	21.12	928
	5 Gizzard shad	29.63	16.48	6.24	18.05	17.60	859
	6 Smallmouth bass	11.39	13.24	35.74	4.24	16.15	588
	7 Sauger	2.47		15.55	11.38	7.75	333
·.	8 Quillback carpsucker	7.34	5.15	3.85	6.94	5.82	274
	9 Walleye	5.42	1.62	7.04	6.00	5.02	232
•	10 Largemouth bass	·· 0.48	3.24	12.22	2.96	4.73	165
	11 Silver redhorse	5.56	2.94	3.45	6.20	4.54	219
in a	12 Bluegill	0.07	8.68	1.86	3.17	3.44	121
	13 Smallmouth buffalo	2.95	3.53	2.13	1.35	2.49	103
	14 Black crappie	0.75	4.27	2.39	1.82	2.31	85
	15 Channel catfish	0.82	6.33	•	0.81	2.02	68
	16 Flathead catfish	• 0.48	2.35	1.06	1.21	1.28	49
	17 Bowfin	0.07	0.29	1.33	2.49	1.05	50
	18 Northern pike	0.00	0.15	1.86	0.81	0.70	27
	19 Blue sucker	0.69	1.03	0.00	0.81	0.63	29
	20 Green sunfish	0.00	2.06	0.13	0.00	0.55	15
	21 Bigmouth buffalo	0.27	0.29	0.53	0.88	0.49	23
	22 Pumpkinseed	··· 0.00	1.47	0.40	0.00	0.47	13
•	23 White crappie	0.07	1.03	0.53	0.07	0.42	13
÷	24 Mooneye	0.55	0.29	0.53	0.27	0.41	18
	25 Shortnose gar	0.07	0.88	0.27	^{~~} 0.07	0.32	
	26 Longnose gar	0.55	0.00	0.40	0.20	0.29	14
	27 River carpsucker	0.34	0.29	0.27	0.20	0.28	
	28 Rock bass	0.00	0.00	0.40	0.54	0.23	
	29 Silver lamprey	0.07	0.59	0.27	0.00	0.23	
	30 Yellow perch	0.00	0.88	0.00	0.00	0.22	
	31 Golden redhorse	. 0.14	0.15	0.13	0.00	0.10	
	32 River redhorse	0.00	0.00	0.40	0.00	0.10	
	33 Saugeye	0.07	0.00	0.27	0.00	0.08	
	34 Musky	0.00	0.00	0.13	0.14	0.07	
	35 Burbot	0.00	0.00	0.27	0.00	0.07	2
	36 White sucker	0.00	0.00	0.00	0.20	0.05	3
	37 Goldeye	0.00	0.15	0.00	0.00	0.04	. 1
	38 Orange spotted sunfish	0.00	0.15	0.00	0.00	0.04	· 1
÷	39 Highfin carpsucker	0.00	0.00	0.00	0.07	0.02	: 1
	40 Spotted sucker	0.00		0.00	0.07	0.02	: 1
	Totals	149.04	146.83	242.34	160.72	174.73	7381



Table 3. Fisheries summary for Gizzard shad 1977-2004.

		ELECTRO	TRAPNET	CATCH				
		CPUE	CPUE	COMP		MEAN		
	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSIC	)N
-	1977	7.92	0.61	4	135	NA	LOG W=3.101 LOG L-5.163	
	1978	10.20	0.20	5	73	NA	LOG W=3.068 LOG L-5.078	•
	1979	1.81	0.06	1	NA	NA	NA	• '
	1980	10.83	0.14	7	NA	NA	NA	
	1981	23.03	0.38	9	917	216	LOG W=2.748 LOG L-4.348	
	1982	7.39	0.09	3	276	329	LOG W=2.917 LOG L-4.741	
	1983	3.57	0.26	2	155	355	LOG W=3.029 LOG L-5.049	· , •
	1984	0.84	0.08	<u>1</u>	48	281	LOG W=2.684 LOG L-4.171	
	1985	0.81	0.01	1	<u></u> 31	325	LOG W=2.388 LOG L-3.431	•, 21
	1986	0.14	0.06	<1	13	274	LOG W=3.248 LOG L-5.634	
	1987	1.08	0.05	1	55	256	LOG W=3.030 LOG L-5.046	
•	1988	3.25	NA	3	139	288	LOG W=2.629 LOG L-4.015	
	1989	1.07	NA	<1	47	323	LOG W=3.025 LOG L-5.021	
	1990	3.99	NA	3	170	326	LOG W=2.956 LOG L-4.857	
	1991	2.39	NA.	4	198	338	LOG W=2.601 LOG L-3.940	۰.
	1992	1.82	NA	1.8	91	357	LOG W=3.459 LOG L-6.127	2.12
	1993	1.99	NA.	1.9	62	375	LOG W=2.920 LOG L-4.728	•
	1994	0.28	NA NA	<1	14	394	LOG W=3.371 LOG L-5.955	
	1995	5 5.10	) NA	4	204	272	LOG W=2.625 LOG L-4.073	,
	1996	6 0.76	NA	<1	27	330	LOG W=3.275 LOG L-5.666	
	1997	7 0.66	5 NA	ຸ໌ <1	23	400	LOG W=3.934 LOG L-7.373	
	1998	3 4.07	NA NA	2	176	260	LOG W=3.104 LOG L-5.218	
	1999	27.12	2 NA	. 12	1222	290	LOG W=2.981 LOG L-4.988	
	2000	40.85	5 NA	17	1634	290	LOG W=3.274 LOG L-5.697	
	2001	1 10.43	B. NA	6	455	340	LOG W=3.767 LOG L-6.967	
	2002	2 14.02	2 NA		612	350	LOG W=3.200 LOG L-5.518	•
	2003	3 9.5	I, NA	5	373	380	LOG W=3.469 LOG L-6.198	isti a
	2004	4 17.60	) NA	10	859	290	LOG W=2.863 LOG L-4.607	

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TABLES2004.XLS

Table 4.

Fisheries summary for Freshwater drum 1977-2004.

		ELECTRO	TRAPNET	CATCH				
		CPUE	CPUE	COMP		MEAN		
	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSIO	N.
Ξ	1977	7.49	5.27	13	569	NA	LOG W=2.947 LOG L-4.756	
	1978	11.97	6.28	17	422	- NA	LOG W=2.911 LOG L-4.710	
	1979	7.47	5.22	21	360	ŅA	LOG W=3.068 LOG L-5.100	
	1980	5.89	3.83	18	520	NA	LOG W≈3.052 LOG L-5.026	· · ·
	198 <b>1</b>	30.88	4.76	12	1146	267	LOG W=2.891 LOG L-4.625	
	1982	9.30	11.00	24	2225	293	LOG W=2.888 LOG L-4.625	· .
•	1983	8.80	8.18.	.22	1626	287	LOG W=3.001 LOG L-4.927	.• س
	1984	7.07	6.21	20	1212	288	LOG W=2.598 LOG L-3.919	
	1985	10.15	7.92	31	1712	293	LOG W=2.846 LOG L-4.452	 
	1986	8.33	0.39	22	856	310	LOG W=3.089 LOG L-5.139	nin 1955 - J
	1987	, 10.29	3.75	16	940	312	LOG W=2.874 LOG L-4.603	- 29 - -
	1988	9.85	NA	8	419	280	LOG W=2.722 LOG L-4.205	· /·
	1989	13.17	NA	11	570	294	LOG W=2.908 LOG L-4.707	1.51
	1990	17.70	NA	13	724	297	LOG W=3.008 LOG L-4.957	- 1-23 - 1-25
	1991	15.68	NA	12	596	305	LOG W=2.955 LOG L-4.824	• ,
	1992	14.23	NA	11	539	320	LOG W=2.967 LOG L-4.829	· v Atte
	1993	20.83	NA NA	18	584	334	LOG W=3.063 LOG L-5.053	
	1994	15.92	NA	14	495	332	LOG W=3.072 LOG L-5.086	
	1995	14.96	NA.	-12	605	317	LOG W=3.124 LOG L-5.243	
	1996	9.33	NA	. 8	374	300	LOG W=3.061 LOG L-5.093	
	1997	18.18	NA	10	812	300	LOG W=3.090 LOG L-5.159	
	1998	23.47	NA	11	983	320	LOG W=3.171 LOG L-5.344	
	1999	45.53	NA	17	1745	320	LOG W=3.138 LOG L-5.289	1. <u>5</u>
	2000	19.88	NA	8		310	LOG W=3.077 LOG L-5.161	ari: RM
	2001	28.17		15	1279	330	LOG W=3.212 LOG L-5.480	
	2002		ŃÁ	12	1062	320	LOG W=3.155 LOG L-5.346	а.,
	2003	37.51	NA.	19	1595	350	LOG W=3.276 LOG L-5.637	•••
	2004	21.12	NA.	12	. 928	310	LOG W=3.080 LOG L-5.131	

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Table 5. Fisheries summary for Shorthead redhorse 1977-2004.

	ELECTRO	TRAPNET	CATCH			
	CPUE	CPUE	COMP	- N	MEAN	
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
1977	5 A A	1.58	5	259	NA	LOG W=2.902 LOG L-4.691
1978	3 2.96		4	125	NA	LOG W=2.978 LOG L-4.917
- 1979	2.08	0.45	. 3	67	NA	LOG W=3.041 LOG L-5.090
1980	0 6.08	0.70	7	137	NA	LOG W=2.894 LOG L-4.678
198	1 11.67	1.34	7	686	376	LOG W=2.791 LOG L-4.428
1982	2 13.56		7	675	392	LOG W=2.814 LOG L-4.496
1983	3 8.96	0.79	6	454	387	LOG W=2.849 LOG L-4.590
198-	4 9.74	0.51	7	435	386	LOG W=2.571 LOG L-3.840
198	5 7.36	0.51	7	374	389	LOG W=2.787 LOG L-4.415
198	6 7.07	0.19	8	319	398	LOG W=2.911 LOG L-4.730
198	7 13.80	1.24	12	. 722	403	LOG W=2.860 LOG L-4.608
198			13	667	381	LOG W=2.696 LOG L-4.176
198			- 17	902		LOG W=2.792 LOG L-4.448
199			14	838		LOG W=2.825 LOG L-4.544
199		**	11	538		LOG W=2.784 LOG L-4.443
199			14	721		LOG W=2.841 LOG L-4.587
199	3 10.86	i na	10	332		LOG W=3.011 LOG L-4.991
199	4 13.51	NA	14	505	389	LOG W=2.872 LOG L-4.655
199	5 9.67	NA NA	8	450		LOG W=2.925 LOG L-4.808
199	6 13.42	2 NA	11	551	380	LOG W=2.897 LOG L-4.719
199	7 19.21	n NA	10	833	350	LOG W=2.982 LOG L-4.960
199	8 23.94	I NA	12	1047	360	LOG W=2.982 LOG L-4.960
199	9 21.17	7 NA	÷ 9	931	350	LOG W=3.016 LOG L-5.050
200	0 25.94	I NA	11	1099	360	LOG W=2.905 LOG L-4.760
200				777		LOG W=3.039 LOG L-5.101
200	2 17.23	B NA	9	781	370	LOG W=2.954 LOG L-4.892
200	3 20.92			878	390	LOG W=3.033 LOG L-5.071
200	4 25.63	B NA	15 -	1141	360	LOG W=2.948 LOG L-4.855



TABLES2004.XLS

Table 6.

Fisheries summary for White bass 1977-2004.

	ELECTRO	TRAPNET	CATCH		•.	
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
1977	7.76	6.73	19	565	NA	LOG W=2.441 LOG L-3.529
1978	3 7.11	5.67	17	369	NA	LOG W=2.956 LOG L-4.813
1979	) <u>3.49</u>	3.02	13	217	NA	LOG W=3.055 LOG L-5.057
1980	2.48	1.97	9	183	NA	LOG W=3.064 LOG L-5.022
1981	l 🚛 🔍 30.88	5.39	20	1996	240	LOG W=2.842 LOG L-4.498
1982	2 28.11	0.07	. 18	1722	286	LOG W=2.909 LOG L-4.677
1983	3 17.50	4.52	17	1277	300	LOG W=3.041 LOG L-5.021
1984	l 13.53	2.89	. 15	435	304	LOG W=2.571 LOG L-3.840
1985	5 16.75	1.39	. 14	768	308	LOG W=2.773 LOG L-4.337
1986			. 18	732	325	LOG W=2.926 LOG L-4.716
1987		1.44	· , 10	589	321	LOG W=3.027 LOG L-4.958
1980			<u>,</u> 20	1009	242	LOG W=2.855 LOG L-4.525
198		NA NA		· 819	266	LOG W=2.945 LOG L-4.765
199			16	941	a <b>295</b>	LOG W=2.913 LOG L-4.697
199 [.]			18	886	310	LOG W=2.911 LOG L-4.696
1993			11	577	338	LOG W=2.967 LOG L-4.829
1993			12	390	328	LOG W=2.939 LOG L-4.750
1994	4 10.20	NA NA	<u>,</u> 10	<b>360</b>	.339	LOG W=2.911 LOG L-4.671
199	5 20.16	S NA	16	809	267	LOG W=3.026 LOG L-4.975
199	6 16.99	NA NA	t, 14	660	. 320	LOG W=3.066 LOG L-5.068
199	7 28.53	B - NA	15	1159	300	LOG W=3.054 LOG L-5.038
199	4.5	_	16	_1314	320	LOG W=3.085 LOG L-5.106
199	9 35.91	NA NA	- 14	1461	300	LOG W=3.011 LOG L-4.942
· 200	0 39.90	) NA	· 16	1602	320	LOG W=2.963 LOG L-4.830
200				1436	320	LOG W=2.967 LOG L-4.821
200	· · · · · · · · · · · · · · · · · · ·	·· · ·		1656	320	LOG W=3.042 LOG L-5.013
200	3 31.22			1272	330	LOG W=2.977 LOG L-4.829
200	4 24.29	) NA	· 14	1011	310	LOG W=3.029 LOG L-4.960

TABLES2004.XLS

Table 7. Fisheries summary for Walleye 1977-2004.

·	ELECTRO	TRAPNET	CATCH			$e^{-i\omega t} e^{i\omega t} \chi^{2}$	
	CPUE	CPUE	COMP		MEAN	1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 - 1987 -	
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSIC	DN
 1977	1.36	0.37	<b>1</b>	20	NA	LOG W=3.137 LOG L-5.377	1.
1978	1.54	0.96	2	28	NA	LOG W=3.056 LOG L-5.197	
1979	1.57	0.31	2	-34	NA	LOG W=3.225 LOG L-5.640	. *
1980	1.20	0.13	· 1	22	NA	LOG W=3.250 LOG L-5.693	
1981	3.53	0.39	2	189	335	LOG W=3.082 LOG L-5.240	
1982	2.96	0.16	1	135	415	LOG W=3.097 LOG L-5.293	÷<
1983	1:63	0.21	· 1	. 90	432	LOG W=3.095 LOG L-5.295	1
1984	2.04	0.11	2	93	378	LOG W=2.852 LOG L-4.615	
1985	2.64	0.13	2	119	413	LOG W=3.159 LOG L-5.461	
1986	i 1.99	0.15	2	9101	404	LOG W=3.085 LOG L-5.269	· •
1987	3.00	0.09	2	132	386	LOG W=3.151 LOG L-5.446	$\mathcal{D}^{\prime}(t)$
1988	5.80	- NA	5	234	· 450	LOG W=3.103 LOG L-5.272	
1989	4.19	NA	. 3	173	408	LOG W=3.140 LOG L-5.379	
1990	2.36	NA NA	2	95	420	LOG W=3.214 LOG L-5.594	. ^{ge}
1991	1.44	NA	. 1	52	477	LOG W=3.318 LOG L-5.870	
1992	2.30	n 🥺 . <b>NA</b>	· · · 1	82	. 403	LOG W=3.257 LOG L-5.727	
1993	2.00	⊨	2	. 60	465	LOG W=3.001 LOG L-5.020	·•*
1994	2.11		2	74	439	LOG W=3.261 LOG L-5.720	:
1995	· 2.63	NA	2	107	333	LOG W=3.208 LOG L-5.586	
1996	2.75	NA NA	2	118	360	LOG W=3.159 LOG L-5.467	• * .
1997	5.63	i BAA	S. 2 3	248	400	LOG W=3.215 LOG L-5.617	
1998	6.16	NA	. est 3	272	420	LOG W=3.148 LOG L-5.440	N.
1999	7.63	B 🕄 NA	3	308	440	LOG W=3.238 LOG L-5.690	1 (
2000	7.72	2 NA	(19) <b>3</b>	325	5 460	LOG W=3.250 LOG L-5.717	1• 4 j
2001	8.93	B NA	5	399	400	LOG W=3.296 LOG L-5.837	÷
2002	9.75	5 NA	5	415	5 390	LOG W=3.257 LOG L-5.744	
2003	7.18	B NA	4	. 304	450	LOG W=3.253 LOG L-5.726	
2004	5.02	2 NA	3	232	2 440	LOG W=3.175 LOG L-5.494	. • .



#### TABLES2004.XLS

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# Table 8.

Fisheries summary for Sauger 1977-2004.

	ELECTRO	TRAPNET	CATCH			· · · ·	
-	CPUE	CPUE	COMP		MEAN	· · ·	
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSIC	N
1977	0.77	0.40		20	NA	LOG W=2.984 LOG L-4.991	
1978	2.43	0.38	2	- 38	NA	LOG W=3.100 LOG L-5.354	
1979	1.57	0.30	2	24	NA	LOG W=3.009 LOG L-5.158	.•
1980	1.79	· 0.17	2	16	NA	LOG W=3.169 LOG L-5.509	
1981	7.28	<b>0.29</b>	4	NA	NA	NA	
1982	7.50	0.17	4	329	256	LOG W=2.864 LOG L-4.773	- '
1983	3.80	0.25	· 3	188	285	LOG W=3.013 LOG L-5.144	
1984	4.07	0.19	3	182	262	LOG W=2.648 LOG L-4.202	
1985	4.57	0.21	4	199	283	LOG W=2.996 LOG L-5.019	
1986	3.29	0.24	6 (s <b>4</b> - 1	178	294	LOG W=3.336 LOG/L-5.936	1-11
1987	4.94	0.12	2	-114	262	LOG W=3.177 LOG L-5.556	
1988	2.10	NA	2	-79	236	LOG W=2.683 LOG L-4.285	· .
1989	2.70	. <b>NA</b>	2	104	237	LOG W=3.208 LOG L-5.639	• •
1990	2.29	NA NA	2	92	291	LOG W=3.070 LOG L-5.277	
1991	3.07	NA-	- Es <b>2</b>	117	308	LOG W=3.155 LOG L-5.507	•
1992	5.24	NA	Æ. <b>4</b>	, 196	297	LOG W=3.029 LOG L-5.191	$P_{i}$
1993	5.71	NA	<b>5</b> 5	168	262	LOG W=2.950 LOG L-4.976	· ·
1994	4.16	NA	4	145	280	LOG W=3.153 LOG L-5.484	: . !
1995	5.80	NA	5	233	243	LOG W=3.090 LOG L-5.369	
1996	5.41	NA	5	228	270	LOG W=3.142 LOG L-5.475	
1997	9.99	NA	5 5	437	270	LOG W=3.065 LOG L-5.294	
1998	9.57	NA	· · 5	386	250	LOG W=3.190 LOG L-5.596	
1999	18.26	NA	_ ≦ <b>7</b>	756	260	LOG W=3.262 LOG L-5.788	÷ .
2000	9.81	NA NA	4	435	280	LOG W=3.306 LOG L-5.892	
2001	6.47	NA	3	308	310	LOG W=3.356 LOG L-6.015	5
2002	7.50	NA	. 4	329	280	LOG W=3.350 LOG L-6.018	
2003	5.86	NA	3	247	300	LOG W=3.281 LOG L-5.842	<b>:</b> .
2004	7.75	NA NA	<b>4</b>	333	270	LOG W=3.232 LOG L-5.678	•





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Table 9. Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and rank, 1981-2004.

	Smallmo	uth Bass		Largemo	uth Bass
Year	CPUE	Rank		CPUE	Rank
1981	4.65	9	æ	0.58	20
1982	3.72	7		0.41	18
1983	2.17	8	;	0.80	11
1984	2.19	7		1.16	11
1985	1.56	8		0.54	15
1986	0.85	<u>_</u> 9		0.21	20
1987	2.94	7		0.61	16
1988	5.72	7	~	4.06	9
1989	13.52	4.		3.40	. 10
1990	16.44	5		2.39	9
1991	11.03	5		1.87	11
1992	9.61	5		2.50	· 11
1993	5.80	6		1.10	14
1994	3.83	7		0.65	15
1995	5.81	5		1.93	12
1996	7.31	5		2.08	10
1997	13.23	5		2.10	15
1998	15.01	5		2.75	14
1999	13.51	7		3.71	13
2000	17.02	6		4.67	11
2001	13.01	5		5.21	11
2002	- 15.91	5		6.14	11
2003	15.59	5 .		5.09	11
2004	16.15	6		4.73	10

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Table 10.

Species composition expressed as % of total annual catches for PINGP fisheries studies, electrofishing and trapnetting combined for 1981-1987, and electrofishing only for 1988 through 2004.

			White	Freshwater		Black	Shorthead		Gizzard	
	Year	Carp	bass	Drum	Sauger	Crapple	Redhorse	Walleye	Shad	Total %
	1981	17	20	12	4	15	7	2	9	86
	1982	23	18	24	4	9	[°] · 7	1	3	89
	1983	18	17	22	3	16	6	1	2	85
	1984	26	15	₇₀ 20	3	. 12	7	· 2	1	86
	1985	20	14 -	31	4	9	7	2	1	87
	1986	21	18	22	4	9	8	2	<1	84
	1987	27	10	16	2	11	12	2	1	81
	1988*	23	20	8	2	3	13	5	3	77
•	1989*	20	15	11	2	<u>,</u> 1 ,	17	3	<1	70
	· 1990*	20	16	13	1	<1	14	- 1	3	69
	1991*	24	18	12	2	1	11	1	4	73
	1992*	26	12	11	4	1	14	2	2	72
	1993*	28	. 12	18	5	<1	10	2	2	76
	1994*	34	10	14	4	<1	14	2	<1	78
	1995*	30	16	12	5	1	8	2	4	78
	1996*	34	14	8	5	2	11	2	<1	76
	1997*	29	15	2 10 m	5	<b>1</b> /	10	3	<1	73
	1998*	23	16	11	5	2	12	3	2	74
	1999*	17	14	17	7	3	9	3	12	82
	2000*	16	16	· <b>8</b>	· 4	2	11	3	17	77
	2001*	15	.17	15	3	2	9	5	6	72
	2002*	14	21	12	4	2	9	5	7	74
b	2003*	13	16	19	3	· 1	11	4	5	72
	2004*	14	14	12	4	1	15	3	10	73

*Electrofishing only

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## SECTION III

# PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2004 ANNUAL REPORT

#### TICAL TRAVELING SCREENS FINE-MES IMPINGEMENT STUDY FISH

Study and Report by B. D. Giese and

K. N. Mueller

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# Environmental Services Water Quality Department

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## FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

## INTRODUCTION

The 2004 study was a continuation of a study started in 1992 to evaluate effects of increased water appropriation from 150 to 300 cubic feet per second (cfs) during April on impingement of larval fish on 0.5 mm mesh traveling screens at the Prairie Island Nuclear Generating Plant (PINGP). In 2004, permit approved blowdown (discharge) reduction to 300 cfs or less was initiated on April 15th, similar to 2003, rather than on April 1st. Prior to 1992, the cooling water intake system operated with fine-mesh screens from April 16 through August 31, in accordance with Part I.C.6.c. of the plant's NPDES Permit (#MN0004006). Since 1992, for study purposes, the plant has implemented fine-mesh screen operation on April 1 to accommodate sampling during the month of April for years 1992 through 2004. Data for this evaluation were collected by pre-dawn and daylight sampling of larval fish and fish eggs from the screenwash water. This report includes fish egg, larvae, and juvenile densities, initial survival estimates; and impingement estimates from the fine-mesh screens as described in the monitoring plan. A "Legend" is included following Tables and Figures, which lists species and lifestage codes used in the tables of this report.

#### METHODS

Two samples were collected per sample date beginning April 1, 2004 and continuing through the end of April, with a total of 18 samples collected on 9 days. Samples were collected during predawn and daylight hours to provide diurnal comparison.

Samples were collected throughout April by diverting screenwash water from the intake screenhouse to collection tanks in the basement of the environmental lab. All eight intake screens were operating during the entire month of April.

Screenwash water flows by gravity from the screenwash trough through an 18-inch pipe to the lab basement. The larval collection tank, manufactured by Lawler, Matusky, and Skelly Engineers (Figure 1), filters screenwash water through 0.5 mm mesh nylon screen. Filtered water

returns to the circulating water system via a 12-inch diameter drain pipe. The screenwash trough was manually cleaned and the fish sampling system was flushed to remove accumulated debris and fish prior to sample collection on each date of the 2004 sample season.

During sample collection, physical parameters were recorded including collection time and duration, screen speed, number of screens sampled, river stage, and water temperature in the collection tank. Volume of river water filtered by the intake screens was obtained from the PINGP monthly external circulating water log.

Sample collection duration was 10 minutes. Upon completion of sample collection, all fish and any debris were rinsed into two collection baskets located at the outlet end of the collection tank (Figure 2). The baskets were then removed from the tank, the contents transferred to a five gallon bucket, and transported to the fish handling and sorting area for further processing.

Samples were sorted to remove live and dead fish, with an emphasis on doing so in a timely manner. Fish were determined to be alive or dead based on the presence or absence of movement. Sorting efficiency was maximized by pouring small portions of the sample into glass baking dishes and sorting on a light table.

Observed fish and eggs were removed from the sample, and the remaining debris was rinsed into a Tyler No. 60 sieve and drained. Sample remains were preserved in a solution of 5% formalin containing rose bengal stain. Each sample was sorted a second time. Fish and eggs found during the second sort were included with those from the initial sort, and recorded as dead.

#### DATA ANALYSIS METHODS

#### Fish and Egg Density

Fish and egg densities were calculated on a pre-dawn and daylight basis from data collected during April 2004. A combination of sample duration, plant blowdown (discharge), and identification data provided density values, expressed as numbers of fish or eggs per 100 cubic meters of water withdrawn from the river for plant use. The data are presented for individual taxa and lifestage for each date (Table 1a). Pre-dawn and daylight densities of all taxa and lifestages were combined and recorded by date (Table 1b).

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Estimates of fish survival following impingement on the fine-mesh screens were calculated for each sample by totaling the number of live fish in each sample and dividing by the total number of fish in each sample (Table 1a).

Estimated numbers of fish and eggs impinged daily on the fine-mesh traveling screens was calculated by totaling the number of fish collected that day, multiplied by the proportion of the number of screens operating and sampled, and the number of minutes in the 12-hour period, divided by the number of minutes sampled (Table 3). In years 1984 to 1989, fine mesh panels of the traveling screens were not required to be operable until April 16, resulting in inconsistent start dates, which accounts for incomplete April data prior to 1992. However, when fine-mesh screens were installed earlier, impingement data were obtained. Table 4 provides water appropriation (as blowdown), flow, temperature, and average daily impingements for the dates that were sampled in April 2004. Study results contribute to the ongoing assessment of increased water appropriation effects on larval fish impingement.

#### Identification methodology

Terminology used to identify lifestage was similar to that described by Auer (1982). The larval stage was divided into two developmental phases which correspond to Auer's terms yolk-sac larvae and larvae, respectively.

## Terminology and criteria

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- Prolarvae (Yolk-sac larvae) Phase of development from time of hatch to complete absorption of yolk.
- Postlarvae (Larvae) Phase of development from complete absorption of yolk to development of the full compliment of adult fin rays and absorption of finfold.
- Juveniles Phase of development from complete fin ray development and finfold absorption to sexual maturity; includes young-of-the-year (yoy) fish.

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## **RESULTS AND DISCUSSION**

Eighteen samples were collected during April 2004, which contained a total of 68 fish (39 prolarvae, 27 juveniles, and 2 adults) and 1 egg. Survival was based on absence or presence of movement during the sort. Nine taxa/lifestage combinations were identified in the samples (Table 1a). Burbot is the only species expected to spawn early enough in spring, for their larvae to be in the drift and subject to impingement on the traveling screens before late April.

Blowdown was reduced from unlimited (average 806 cfs) April 1 through April 14, to less than 300 cfs on April 15th. The number of fish collected during the first half of April (four sample dates) was higher (38 fish) than during the second half of April (five sample dates-30 fish).

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There was one egg collected but was not identified, but all eggs collected during 2003 were determined to be carp eggs, based on appearance and comparison to eggs collected during the 2000 study when embryos were examined and identified as carp. Carp have not been reported to spawn below 60 degrees F in this region (Scott and Crossman, 1973; Becker, 1983). The "logical" presumption was made that carp living between the bar racks and the traveling screens spawn prematurely underneath the intake screenhouse due to elevated water temperatures as a result of recirculating water and deicing line water.

## **Densities**

Densities by taxa/lifestage combinations of fish collected during April 2004 from the fine-mesh screens are presented in Table 1a, expressed as organisms per 100 cubic meters of water sampled. Table 1b provides diurnal density comparisons for sample dates when fish and/or eggs were collected. The data indicate that more fish and eggs were impinged during pre-dawn hours in 2004.

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## Survival estimates

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Survival estimates are included in Table 1a for taxa/lifestage combinations collected during April 2004. Overall initial survival of fish collected in 2004 was approximately 53% (Table 1a). Due to the low number of fish collected, survival estimates presented in Table 1a may be weighted

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too heavily. Survivorship for all taxa/lifestage combinations collected during 1984 through 1988 was summarized in the 1988 Prairie Island Annual Report (Kuhl and Mueller 1988).

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#### Impingement estimates

Impingement estimates are available for years 1984-1989, 1992-2000, and 2002-2004 (Table 3). No data is presented for 2001 due to river flood levels in Spring 2001 when sampling of larval fish from the fine-mesh traveling screens during April was extremely limited. The plant was operating in flood by-pass conditions as communicated to MPCA at the time. Table 2 provides comparison of taxa/lifestage combinations collected in 2004 to previous years. Estimated impingement of fish collected in April of all years is shown in Table 3. Estimated impingement values during April 2004 were low as in past years during April, and taxa/lifestage combinations were similar. Data collected through 2004 suggest that more fish may be impinged on the finemesh screens during the first half of April with unlimited blowdown, but the total numbers are still low.

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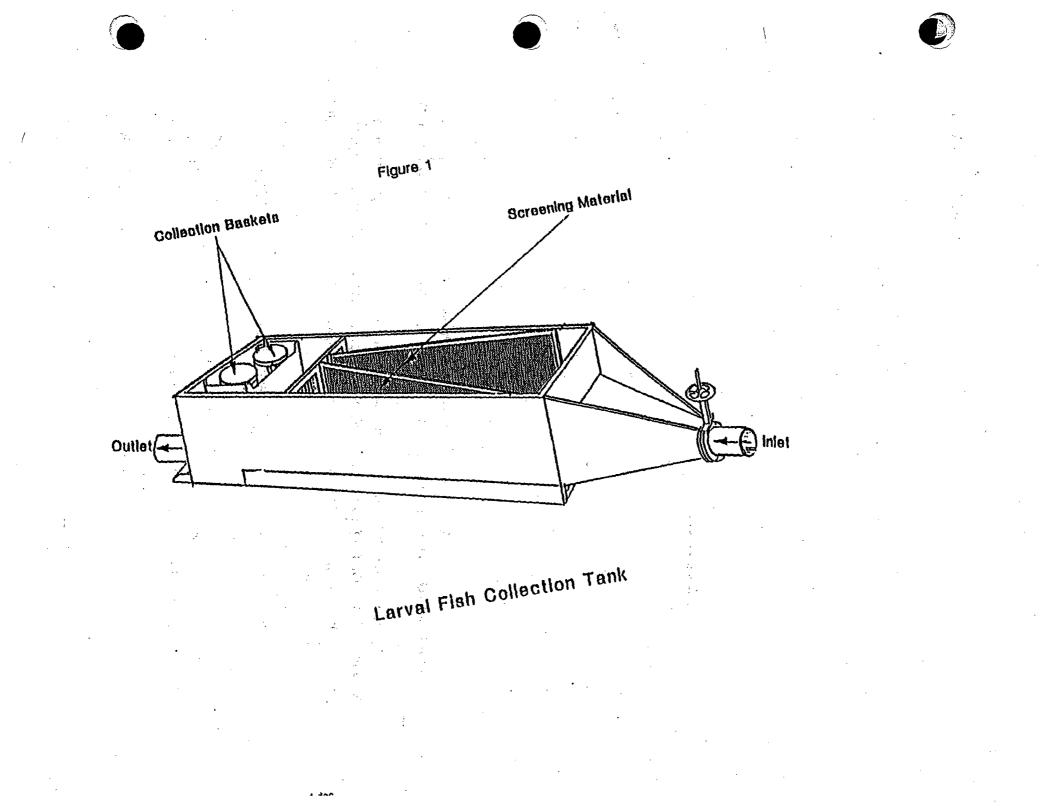
During April 2004 sampling 68 total fish were collected. The one egg collected was not identified, but assumed to be a carp egg, as explained earlier in the <u>Results and Discussion</u> section of this report. We are hesitant to quantify how many eggs survive impingement, because little is known on how many eggs in the river drift survive when not impinged.

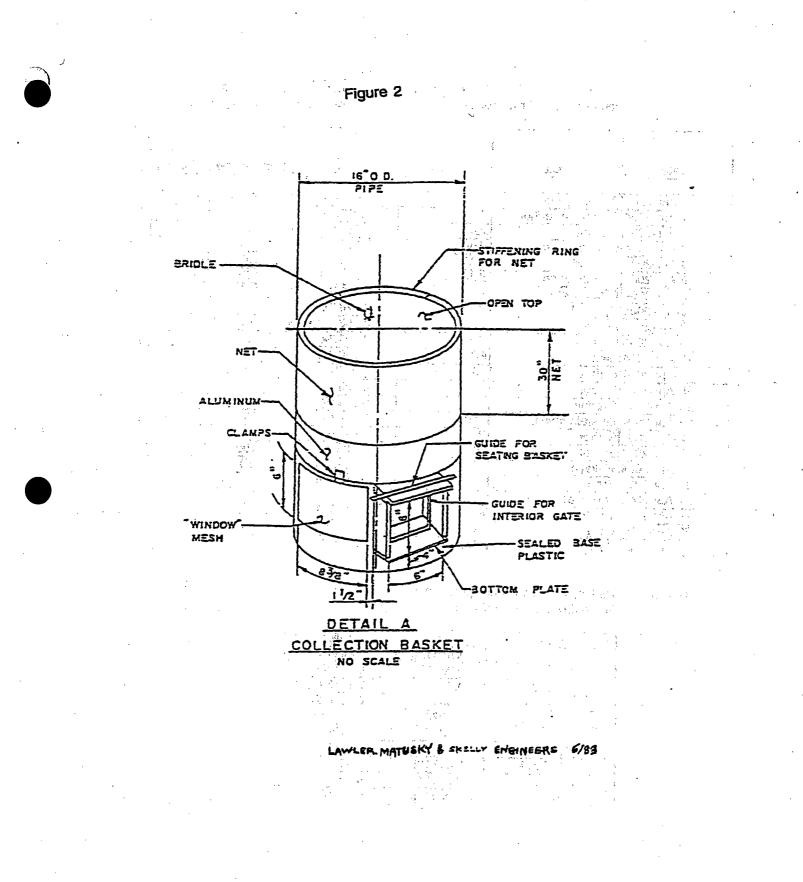
## SUMMARY

Larval studies were conducted at PINGP from 1984 through 1988 providing estimates of impingement, density, and survival. In 1989 and 1990 larval fish studies were done to evaluate sampling induced mortality. Sampling was not a requirement of the NPDES permit during 1991. In 1992-2004, fine-mesh screens were installed by April 1, and a larval fish study was conducted to assess impingement affects of increased water appropriation during April. Year 2004 was the third consecutive year sampling was conducted while the plant was operating with unlimited blowdown during the first half of April. In comparison to previous studies at PINGP, increased water appropriation may have resulted in increased impingement during the first half of April 2004, but numbers are still low. We are hesitant to draw conclusions based on three sampling seasons, and expect to monitor effects of unlimited blowdown on impingement during future sampling seasons.

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# Table 1a.Survivorship and Density (fish and fish eggs/100 cubic meters) by Taxa/lifestage<br/>combination of Fish Collected on PI Fine-mesh Intake Screens During April 2004.

					Number of
Date	Taxa	Lifestage	Density	Percent Live	Fish/Egg
	· · · · · · · · · · · · · · · · · · ·				
	Gizzard shad	JUV	0.083280	66	3
	Shorthead redhorse	JUV	0.027760	100	1
6-Apr-2004		JUV	0.167747	83	6
	Gizzard shad	JUV	0.027958	100	1
8-Apr-2004		JUV	0.305000	100	11
	Gizzard shad	JUV.	0.027727	100	1
	Gizzard shad	JUV	0.028192	100	1
13-Apr-2004	Cyprinid	JUV >	0.028192	100	1
13-Apr-2004	Burbot	PRO.	0.366499	46	13
15-Apr-2004	Cyprinid	JUV	0.090890	100	1
15-Apr-2004	UNID	EG	0.090890	0	1
15-Apr-2004	Burbot	PRO	0.090890	0	1
20-Apr-2004	Burbot	PRO	0.083182	100	1
20-Apr-2004	Cyprinid	JUV	0.083182	100	1
20-Apr-2004	Emerald shiner	Adult	0.166364	100	2
22-Apr-2004	Burbot	PRO	0.617166	- 11 <b>14</b> .0	7
27-Apr-2004	Burbot	PRO	0.166364	100	2
27-Apr-2004	Walleye	PRO	0.166364	50	2
27-Apr-2004	Percid	PRO	0.166364	0	2
27-Apr-2004	Yellow perch	PRO	0.249546	0	3
29-Apr-2004	Yellow perch	PRO	0.485371	100	6
29-Apr-2004	Walleye	PRO	0.080895	100	1
29-Apr-2004	Percid	PRO	0.080895	0	1

Table 1b.

Density of fish and eggs (fish/100 cubic meters) collected in pre-dawn and daylight samples in 2004.

Date	Pre-dawn	Daylight
	Density	Density
4/1/2004	0.083280	0.027760
4/6/2004	0.083873	0.111831
4/8/2004	0.332728	0.000000
4/13/2004	0.197345	0.225538
4/15/2004	0.181780	0.090890
4/20/2004	0.166364	0.166364
4/22/2004	0.617166	0.000000
4/27/2004	0.249546	0.499092
4/29/2004	0.404476	0.242685

Table 2

Taxa/life stage combinations of fish collected in April of 2004 and previous years.

	A Water Star		2. C.	, ¹⁴ (1.1
Taxa	Adult	Juvenile	Postiarvae	Prolarvae
Carp		and the second se	<b>X</b> (1)	X
Channel catfish		X		and the state of the state
Cyprinid	<b>X</b> (1)	X,0	11 <b>x</b> - 24	
Flathead catfish	8	X		
Percid	X		X	X,0
Walleye				X,O
Builhead sp.		X		
Sauger			<b>X</b>	
Burbot			X	X,O
Catostomid		X		x
Sander spp.				X
White bass	2007 - CRN -	X		
Gizzard shad		X,0		
Freshwater drum		X		
Johnný darter	$   \in X \to \mathbb{R}$			
Shiner spp.	- S. A. S. and the	and the X and the	Start Contraction	
Emerald shiner	X,0	X		
Bluegill		X	1.1.1	а ^х ( ах
Mooneye				X
Golden redhorse		X		
Unidentified				X
Log perch	x			X
Shorthead redhorse	,	0		
Yellow perch			, , ,	0

Legend:

x = previous years data o = 2004 data

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			<u>.</u>						~								
Table 3.	Estimat	ted imp	ingement of fi	sh collecter	d on	PINGP fine	e-mesh	screen	s during April,	1984-1989	an	d 1992-200	4	<b></b>			L
	L				<u> </u>						<b> </b>		<u> </u>			1	$\square$
Date	Taxa			No of Fish		Date	Taxa.			No of Fish	ļ	Date	Taxa_	Life.	Estimated	No of Fish	
		Stage	Impingement	Collected	L			Stage	Impingement	Collected		ļ		Stage	Impingement	Collected	<b> </b>
1984							<u></u>				┣—	40 4 00					<b> </b>
16-Apr-84		EG	384	1		24-Apr-86			1728		<u> </u>	13-Apr-89			384		the second second
18-Apr-84			384	1	<u> </u>	25-Apr-86			288			14-Apr-89		UN	0		
23-Apr-84	the second s	EG	3840	10	日常	28-Apr-86			480		┣	18-Apr-89		UN	0		
25-Apr-84		JU	384	<i></i>	2.4	29-Apr-86			864			20-Apr-89		UN	0		
25-Apr-84			384	1		29-Apr-86		EG	288			21-Apr-89		UN	0		
25-Apr-84			3840	10	ļ.	29-Apr-86	WE	PR	288	1		25-Apr-89		UN	0		1
27-Apr-84		JU	384	1		1987	-	2				27-Apr-89	BUR	PR	1152	3	
27-Apr-84			384	1		6-Apr-87		PR:	5 1536			1992					
27-Apr-84		EG	2304			8-Apr-87			576			1-Apr-92			288		<b></b>
30-Apr-84		JU	384	21	ļ.	10-Apr-87		PR	2304		ļ	1-Apr-92			. 288		
30-Apr-84			384	1	<u>.</u>	13-Apr-87		PR	2304	4		1-Apr-92			576		
30-Apr-84		JU	192	1	-	15-Apr-87		PR	3456 576		<u> </u>	2-Apr-92		UN	0		
30-Apr-84			1152	6		16-Apr-87		PR UN	0	1.12		8-Apr-92		UN UN	0		
30-Apr-84		EG	4416	23	. v.	20-Apr-87		UN	0	0 0		9-Apr-92		UN			
30-Apr-84	WE	PR	768	4	<u>.</u>	22-Apr-87		UN	0			14-Apr-92			0		
1985		<i>. . .</i>				24-Apr-87			576	0		16-Apr-92		UN	0	-	
19-Apr-85		JU	384	.1		27-Apr-87			576			21-Apr-92		PR	576		
22-Apr-85			1152	3		27-Apr-87		PR		<u> </u>		23-Apr-92		UN	0		
23-Apr-85		EG	192	1		29-Apr-87	_	PO PR	2880 576			28-Apr-92		UN	0	-	
24-Apr-85			576	3		29-Apr-87		FR	5/0	1		30-Apr-92			288		<u> </u>
24-Apr-85		PR	<u>1344</u> 384	7		1988 8-Apr-88		PR	768	2		30-Apr-92 1993	FERU		288	1	. <u> </u>
24-Apr-85		EG PR	1536	2		0-Apr-88		UN	00	0		2-Apr-93	LIN	x	0	0	
24-Apr-85 25-Apr-85			192	1	· -	13-Apr-88		EG	384	0		6-Apr-93		PR	288	1	
25-Apr-85		PR	1536	8	1.	15-Apr-88	-	PR	768	2		8-Apr-93		EG	288		
25-Apr-85		PR	384	° 2		18-Apr-88		UN	0			8-Apr-93		PR	288	.1	<u>.                                    </u>
		PR	576	2		20-Apr-88		PR	768	2		13-Apr-93		X	0	0	
25-Apr-85 26-Apr-85		PR	192			20-Apr-88		PR	1920	5		15-Apr-93		PR	288	1	
26-Apr-85		PR	192	- 1		25-Apr-88		PR	1152	3		19-Apr-93		EG	1152	2	
20-Apr-85			96			27-Apr-88		PR	1152	3		21-Apr-93		<u>v</u>		- 2	
29-Apr-85			90 192	2		28-Apr-88		PR	384		-	27-Apr-93	<del>111 -</del>	<del>x</del>	0	0	
29-Apr-85			288	3		29-Apr-88		UN	0			29-Apr-93		ÊG	288		
29-Apr-85			192	2		1989	<u> </u>			Ŭ		1994			200		
1986			132			4-Apr-89	x	UN	ō	0		5-Apr-94		FG	384	1	
18-Apr-86		<del></del>	288	1		6-Apr-89			384	1	-	5-Apr-94		<u>10</u>	384		
18-Apr-86			288			7-Apr-89				ó		5-Apr-94			384		
			288	i+		11-Apr-89			0	0		5-Apr-94			384		
23-Apr-86				1					384	1							<u> </u>
23-Apr-86	PERC	PR	288	1		13-Apr-89	BOK	PR	384	<u> </u>		7-Apr-94	BUK	PR	288	1	

		.41	1		1er	· · · · · · · · · · · · · · · · · · ·									· .	
Table 3. (c	cont)	Estima	ted impingen	nent of fish	coll	ected on PIN	SP fine-	mesh s	creens during	April, 1984	-19	89 and 1992-	2004.		<u>г — — — — — — — — — — — — — — — — — — —</u>	T
	1			1	<u>Ter</u>	1	1.	T	1	1	T	1	1		<u> </u>	┣━━━
Date	Taxa	Life	Estimated	No of Fish	1997	Date	Taxa	Life	Estimated	No of Fish		Date	Taxa	Life	Estimated	No of Fish
	+		Impingement	Collected	1		1.	Stage	Impingemen	Collected	-	1				
994 (con	t)					1996 (cont)			/	1	$\vdash$	1999 (cont)		10.000	in pargorneri	001100100
12-Apr-94		PR	288	1	1	25-Apr-96	BURB	PR	504	2		9-Apr-99	CC	10	288	1
12-Apr-94			288	1	<u> </u>	25-Apr-96			252			9-Apr-99		PR	576	
14-Apr-94		X	0 :	0	<u> </u>	30-Apr-96		X	, O			9-Apr-99		JU	288	
19-Apr-94	CYPR	JU	288	1	1	1997	1	1			1	13-Apr-99		EG	288	the second s
21-Apr-94		X	0	. 0	2.3	3-Apr-97	UNID	EG	17,280	30		13-Apr-99	UNID	EG	288	1
26-Apr-94		PR	1152	4		4-Apr-97	BG	JU	1152	2		15-Apr-99		PR	288	
26-Apr-94	BUR	PR	288	1	n g	4-Apr-97	UNID	PR	576			22-Apr-99	_	PR	576	
28-Apr-94		PR	288	1	85. j.	25-Apr-97		PR	2304	4	<b></b>	27-Apr-99			288	1
28-Apr-94		PR	288	1		29-Apr-97		JU	864		_	27-Apr-99		JU	288	1
1995				;		30-Apr-97		JU	432	1		27-Apr-99			288	1
3-Apr-95	CATO	JU	288	1	1 ⁰¹ 1	30-Apr-97		JU	432	1	÷.	30-Apr-97			288	1
4-Apr-95		PR	288	1	1.1.1	30-Apr-97	CYPR	JU	432	1		30-Apr-97			576	2
4-Apr-95		JU	576	1	12.	30-Apr-97	UNID	EG	864	2		30-Apr-97	PERC	PO	288	1
4-Apr-95	WB	JU	1152	2		1998					·	2000				
4-Apr-95		JU	1152	. 2	÷ . †	2-Apr-1998	UNID	EG	229	. 1		4-Apr-2000	UNID	EG	14,688	51
4-Apr-95	CATO	JU	576	1		3-Apr-1998	CYPR	AD	252	1	5 2	4-Apr-2000	UNID	EG	1440	5
4-Apr-95		JU	9792	17		7-Apr-1998	X	X	0	Ō		6-Apr-2000	UNID	EG	7,776	27
0-Apr-95	CATO	PR	288	. 1		9-Apr-1998	EMSH	AD	229	1		6-Apr-2000	Log P	AD	288	1
7-Apr-95	UNID	EG	13248	46		14-Apr-1998	CC	JU	252	1		6-Apr-2000	UNID	EG	8023	39
0-Apr-95	UNID	EG	2880	. 10	5	16-Apr-1998	CYPR	JU	229	1	į,	6-Apr-2000		PRO	206	1
4-Apr-95	UNID	EG	1152	4		16-Apr-1998	BURB	PR	229	: 1	••	13-Apr-2000	Burb	PRO	288	1
6-Apr-95	UNID	EG	864	3		21-Apr-1998	UNID	EG	1512	6		18-Apr-2000	Shiner	JU	288	1
1996			2 (S. A. S.			23-Apr-1998		PR	252	1		20-Apr-2000	Cypr.	PRO	288	1
2-Apr-96	CARP	PR	252	1		23-Apr-1998		JU	252	1		27-Apr-2000	UNID	EG	2618	10
4-Apr-96	UNID	EG	504	2		28-Apr-1998	UNID	EG	2016	8		27-Apr-2000	UNID	EG	1440	5
9-Apr-96	JDAR	AD	252	1	12	28-Apr-1998	PERC	PR	2268	9		27-Apr-2000	Sau	PRO	576	2
9-Apr-96	SHIN	JU	252	1		28-Apr-1998	STIZ	PR	2268	9		27-Apr-2000		PRO	288	1
9-Apr-96	UNID	EG	252	1		28-Apr-1998	CARP	PR	1512	6		2001	No valu	es calci	ulated~flood	
1-Apr-96	FWD	JU	252	1		28-Apr-1998	UNID	PR	252	1	1	2002	1	Ť		
1-Apr-96		PR	252	1	<u> </u>	30-Apr-1998		PR	2016	8	м ў.	4/2/2002	EMSH	JU	672	2
1-Apr-96			504	2		30-Apr-1998		PR	14364	57		4/4/2002			1680	5
1-Apr-96			252	1		30-Apr-1998			2268	9		4/4/2002		EG	672	2
1-Apr-96			252			30-Apr-1998			252	1		4/4/2002			1680	5
1-Apr-96			252	1		30-Apr-1998			252	1		4/4/2002		JU	336	
6-Apr-96		x	0	0	-	1999		╧╧╍╼┼			$\neg$ t	4/4/2002		EG	1008	3
8-Apr-96		<del>x</del> t	0	Ő		6-Apr-99	BURB	PR	522	2		4/4/2002		PR	1008	3
3-Apr-96			504	2	-	6-Apr-99		EG	4032	14		4/9/2002		JU	336	
3-Apr-96		EG	1008			9-Apr-99		JU	288	1	÷-+	4/9/2002			1008	3

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Table 3. (con	<u>it)</u>	Estima	ated impingen	the second s	colle	ected on PING	P fine-r		reens during A		989		04.
Data	7-1-1-	1 16-	Cottonatad	and (		Dete	Taur	1 18-	Catter at a d		12.1	· · · · · · · · · · · · · · · · · · ·	
Date	Taxa	Life	Estimated Impingemen	No of Fish		Date	Taxa	Life	Estimated Impingement	No of Fish	<u>. 3</u>	-	
2002 (cont)	<u> </u>	Slage	Impingemen	Conected		2004 (cont)		Oldye	Innpingement	Collected			i
4/9/2002	00100	DBO	672	2		4/8/2004	017	<u> </u>	288	1			+
4/9/2002		EG	288		7432 1	4/8/2004		JU	3168				· · · · · · · · · · · · · · · · · · ·
4/9/2002			288		in the second se	4/13/2004		10					
					· · · ·	4/13/2004			200	1	- 14	· · · · · · · · · · · · · · · · · · ·	·
4/11/2002			864		_	4/13/2004		JU	288	<u> </u>	<u> </u>	l	<u></u>
4/11/2002			1800			4/13/2004			2304	5			
		10	360		252.2	4/15/2004		JU	288		1944		<b></b>
4/11/2002 4/16/2002			336	1	1003	4/15/2004		EG	288	1			<u> </u>
4/16/2002		10 10	336			4/15/2004			288	1	<u> </u>		
4/18/2002			336			4/18/2004			288	1		<b></b>	
4/18/2002		100	672		-	4/20/2004			288				i
			1008		<u> </u>	4/20/2004							i
4/23/2002			1.4.1.4.1.4.1.						288	. ··· . · . · . · . · . · . · . · . · .	0 ja		Į
4/25/2002			672			4/20/2004		JU	288	karr, 200 €er ( <b>1</b>			
4/25/2002	BUKB	PRO	336	1	<u> </u>	4/22/2004			2016				i
2003	01100	000	504	1		4/27/2004		PRO	864		<u> </u>	1	
4/1/2003			1						576		1.6		3.11
4/3/2003			504			4/27/2004		PRO	576	2		2	
4/3/2003 4/3/2003		JU	2016 1512	4		4/27/2004		PRO	576	2			
				<u> </u>	1	4/29/2004			1152	4	<u> </u>		
4/8/2003			576 576			4/29/2004		PRO	288	1	<u>(11)</u>		
4/8/2003				100 A 1		4/29/2004			576	2	17 		
4/10/2003			2304	8		4/29/2004	VVAE	PRO	288	1	11		
4/10/2003			1152	2	, <u> </u>				.e.		1. Y.	i ng i	
4/10/2003		EG	576	1		e de la composición d		19-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-			<u>.</u>		
4/15/2003		EG	13248	23				31 3 <u>2</u> 1	. ¢				
4/17/2003		EG	1728	3	24						6. [.]		
4/17/2003		EG	576 576	્યર <b>ા</b> ગાસ પ્ર <b>1</b>		1		4			<u> </u>		
		EG	576		È.							y days	
4/24/2003			1152	1						197 197		· · · · · · · · · · · · · · · · · · ·	l
											100 at		I
4/29/2003	SAU .	PRO	.576	<u> </u>								t factor	
2004	<u></u>						·····						
4/1/2004		JU	576	2				710-11-11					
4/1/2004			288	1		A CARLES AND A CARLES		318 / S					14. A
4/1/2004		JU	288			(9.5%) 	a tha an	<u> </u>					
4/6/2004		JU	864	3					·				
4/6/2004	GIZ	JU	288	1 P. A. 19	计方	· · · · · · · · · · · · · · · · · · ·	1949 - 64 1949 - 64	4 - E	100 A	1) - 11 (Geo	. 1		

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	wn, river flow and t			conected) i	
	g daily	Avg. daily	Average Daily	Blowdown	Date
	ement.	Inlet Temp. (F)	R. Flow (cfs)	(cfs)	
	304	42.7	33600	848	4/1/2004
-	032	47.1	31800	842	4/6/2004
	912	48.2	27600	849	4/8/2004
2	640	47.8	19200	835	4/13/2004
	728	48.5	18400	259	4/15/2004
19833	304	54.9	17300	283	4/20/2004
	032	51.7	22200	267	4/22/2004
	184	50.9	26000	283	4/27/2004
	608	54.5	23900	291	4/29/2004

**LEGEND** 

### LIFE STAGE

<b>UN</b> [*]	Ξ	Unidentified or Zero
EG	=	Egg
PR	=	Prolarvae
-PO	=,	Postlarvae
JU	=	Juvenile
AD	= '	Adult

### TAXA CODE

UNID = Unidentified CC = **Channel Catfish** CYPR = Cyprinids, other than FHC = Flathead Catfish PERC = Percids, other than BHS Bullhead spp. = SA Sauger = WE Walleye = STIZ Stizostedion spp. = BUR **Burbot** = CATO = Catostomids CARP = Carp MOON = Mooneye Х No Fish =

LEGEND Section III.doc

### PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING AND ECOLOGICAL STUDIES PROGRAM

**2005 ANNUAL REPORT** 

Prepared for Northern States Power Company d/b/a Xcel Energy Minneapolis, Minnesota

> Environmental Services Water Quality Department

> > . .

By

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Water Temperature and Flow ..... Section I

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### SECTION I

### PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2005 ANNUAL REPORT

#### WATER TEMPERATURE AND FLOW

Study and Report by B. D. Giese

Environmental Services Water Quality Department

#### WATER TEMPERATURE AND FLOW

#### INTRODUCTION AND METHODS

The Mississippi River is the source-water body for circulating and cooling water systems at the Prairie Island Nuclear Generating Plant (PINGP). This report presents daily plant operating hours, river inlet temperatures, site discharge temperatures and flows (blowdown). Site discharge temperatures are determined by thermocouples located downstream at U.S. Army Corps of Engineers Lock and Dam 3. Plant inlet (ambient river) temperatures are determined by remote sensors located in Sturgeon Lake, and the main channel at Diamond Bluff. Inlet temperatures are also recorded from thermocouples located in front of the intake screenhouse, which are maintained for back-up. Data presented in this report are for environmental studies comparison, and are not intended as NPDES temperature compliance reporting.

Also presented in this report are daily and monthly average Mississippi River flows, as provided by U.S. Army Corps of Engineers at Lock and Dam 3. Other monthly averages reported include PINGP intake flows, and the percentage of Mississippi River water entering the plant.

#### **RESULTS AND DISCUSSION**

Daily average river inlet and site discharge temperature data are presented by month in Table 1. Daily Mississippi River flows recorded at Lock and Dam 3 ranged from 7,600 to 54,900 cfs in 2005 (Table 2). Daily mean site discharge flow (blowdown) from the PINGP external circulating water log ranged from 203 to 1,222 cfs (Table 1).

PINGP withdrew an annual average of 3.7 percent of the Mississippi River flow during 2005 (Table 3). Table 4 shows the monthly average Mississippi River flows for the years 1984 through 2005. The average river flow in 2005 was 22,700 cfs, which was very close to the average river flow of 22,370 cfs for years 1984-2004. The range of annual average river flows is 8,709 cfs in 1988 to 37,772 cfs in 1986.

2005 Annual Report.DOC

DATE J <b>ANUARY</b>		NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	32.1	34.9	720
2	24	24	32.7	35.1	720
3	24	24	32.2	35.4	720
4	24	24	32.3	35.1	720
5	24	24	34.2	35.1	708
6	24	24	34.2	35.7	708
7	24	24	34.3	35.6	720
8	24	24	34.2	35.5	720
9	24	24	34.2	35.4	720
10	24	24	34.2	35.3	720
11	24	24	34.1	35.2	720
12	24	24	34.2	37.3	708
13	24	24	34.1	36.7	708
14	24	24	31.9	37.3	696
15	24	24	34.1	36.0	696
16	24	24	34.1	36.3	708
17	24	24	34.1	36.0	708
18	24	24	34.1	35.5	708
19	24	24	34.0	35.4	708
20	24	24	34.1	35.8	708
21	24	24	34.0	35.5	708
22	24	24		<b>35.6</b>	696
23	24	24	33.8	35.4	684
24	24	24	33.9	35.7	696
25	24	24	34.0	36.0	696
26	24	24	34.0	35.9	696
27	24	24	33.9	36.0	696
28	24	<b>_ 24</b>	33.9	36.0	696
29	24	24	33.9	35.9	708
30	24	24	33.9	36.1	696
31	24	24	34.0	35.9	696
		THLY MINIMUM	31.9	34.9	684
		THLY MAXIMUM	34.3	37.3	720
	M	ONTHLY MEAN	33.8	35.8	707

DATE FEBRUARY		ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	34.0	36.3	696
2	24	24	. 34.0	35.8 [·]	696
3	24	24	34.0	35.8	696
4	24	24	34.1	35.9	696
5	24	24	34.2	36.8	696
6	24	24	34.3	37.0	696
7	24	24	34.3	36.3	696
8	- 24	24	34.2	36.4	696
9	24	24	34.2	36.4	696
x <b>10</b>	24	24	34.1	36.1	696
11	24	24	34.2	36.5	696
12	24	24	34.4	36.6	696
13	24	24	34.4	36.7	696
14	24	24	34.8	37.1	696
15	24	24	35.1	36.7	720
16	24	24	35.0	36.1	720
17	24	24	34.3	36.0	720
18	24	24	34.1	35.4	720
19	2	24	34.5	36.6	708
20	0	24	34.1	34.0	418
21	0	24	33.9	33.9	418
22	0	24	34.1	34.1	430
23	0	24	34.1	34.8	442
24	0	24	34.1	34.6	462
25	0	24	34.2	34.5	472
26	0	24	34.3	35.0	472
27	0	24	34.3	34.6	472
28	0	24	34.4	35.1	472
			33.9	33.9	418
		Y MAXIMUM	35.1	37.1	720
	MON	THLY MEAN	34.3	35.8	621



DATE <b>MARCH</b>	OPERAT UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	22.1	24	35.0	35.7	483
2	24	24	34.2	35.3	440
3	5	24	34.7	35.3	440
4	5.7	24	34.9	35.6	407
5	24	24	35.6	38.0	684
6	24	24	37.8	39.7	672
7	24	24	37.6	39.5	684
8	24	24	35.1	37.7	708
9	24	24	35.5	37.0	708
10	24	24	36.2	37.1	732
11	24	24	35.7	36.9	768
12	24	24	35.2	36.6	780
13	24	24	34.4	34.9	588
14	24	24	34.8	36.3	732
15	24	24	34.6	35.7	732
16	24	24	35.9	37.0	848
17	24	24	35.7	37.1	848
18	24	24	36.4	37.4	855
19	24	24	34.5	36.3	848
20	24	24	34.7	36.9	848
21	24	24	35.6	38.3	848
22	24	24	37.6	39.4	848
23	24	-24	37.6	39.8	848
24	24	24	39.5	40.8	848
25	24	24	39.1	40.8	848
26	24	24	38.9	41.0	848 '
27	24	24	40.6	41.5	889
28	24	24	41.2	42.3	997
29	24	24	42.4	42.7	1009
30	24	10.5	42.8	44.4	1003
31	24	0	41.5	42.8	973
	MONTI			34.9	407
	MONTH	ILY MAXIMUM		44.4	1009
	МО	NTHLY MEAN	36.9	38.4	767

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Monthly ambient river inlet temperatures, and site discharge temperatures and flows, with recorded operating hours for Units 1 and 2 at PINGP in 2005

DATE <b>APRIL</b>	OPERAT UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	0	43.0	42.5	979
2	24	0	. 39.0	41.6	961
3	23*	3	38.9	41.2	967
4	24	24	43.5	41.6	985
5	24	24	44.1	43.7	985
6	24	24	46.4	45.0	979
7	24	24	46.6	44.6	985
8 ·	24	.24	47.7	46.1	991
9	24	24	48.4	46.2	1015
10	24	24	49.9	48.8	1015
11	24	24	51.2	49.9	1165
12	24	24	51.7	51.3	1165
13	24	24	51.2	50.2	1149
14	24	24	52.0	52.9	483
15	24	24	52.9	53.4	291
16	24	0.5	52.7	54.3	259
·17	24	0	51.7	52.8	283
18	24	0	52.5	55.1	283
19	24	0	54.9	57.1	267
20	24	0	54.9	56.0	283
21	, 24	0	55.0	56.5	283
22	24	0	55.9	58.2	283
23	24	0	53.1	55.4	291
24	24	0	53.2	54.4	275
25	24	0	54.2	55.7	275
26	24	0	53.5	53.7	203
27	24	0	52.1	52.3	251
28	24	0	51.3	51.0	275
29	24	0	51.3	52.0	259
30	24	0	51.3	51.1	275
* Daylight	savings				
	MONTH		38.9	41.2	203
		Y MAXIMUM	55.9	58.2	1165
		ITHLY MEAN	50.1	50.5	605



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DATE MAY	OPERAT	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	0	50.1	50.4	283
2	24	0	48.7	48.9	259
3	24	0	47.4	47.8	259
4	24	· 0	49.5	50.2	251
5	24	. 0	51.4	50.6	267
6	24	• 0	53.0	53.1	267
7	24	0	55.7	56.1	267
8	24	0	56.4	56.4	267
9	24	. 0	58.4	59.1	267
10	24	0	58.8	59.9	<b>27</b> 5
11	24	0	59.2	59.9	275
12	24	0	57.4	57.2	267
13	24	0	53.9	54.1	275
14	24	0	55.3	56.2	267
15	24	0	53.5	53.7	267
16	24	0	53.2	53.7	267
17	24	· 0	52.3	53.5	259
18	24	0	54.6	55.1	267
19	24	0	54.7	55.6	267
20	24	0	56.3	56.7	267
21	24	0	57.5	57.7	267
22	24	0	58.8	59.9	259
23	24	0	59.2	60.5	259
24	24	0	61.1	62.1	259
25	24	0	62.5	63.8	267
26	24	0	61.1	63.0	259
27	. 24	0	61.8	63.6	259 [·]
28	24	0	61.7	63.1	259
29	24	0	61.7	62.7	259
30	24	0 ·	62.0	63.2	, <b>25</b> 9
31	24	0	64.0	65.0	267
		ILY MINIMUM		47.8	251
		LY MAXIMUM		65.0	283
,	MON	NTHLY MEAN	56.5	57.2	265

DATE JUNE	OPERAT UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	0	65.0	65.7	267
2	24	0	64.9	65.9	384
3	24	0	66.3	67.1	384
4	24	0	66.0	67.0	384
5	24	0	66.5	67.4	384
6	24	0	67.0	67.9	361
7	24	0	69.5	69.5	384
8	24	0	70.6	71.5	361
9	24	0	71.3	71.1	396
10	24	0.85	72.0	73.1	396
11	24	21.5	72.8	73.5	396
12	24	24	71.1	72.6	396
13	24	24	72.6	73.8	537
14	24	24	72.7	73.3	483
15	24	24	71.2	71.9	505
16	24	24	72.1	72.1	494
17	24	24	71.3	72.9	732
18	24	24	72.2	73.6	776
19	24	24	.72.6	73.6	776
20	24	24	73.3	74.5	783
21	24	24	73.0	74.0	791
22	24	.24	75.2	76.2	791
23	24	24	75.4	77.0	783
24	24	24	76.3	77.6	798
25	24	24	76.6	77.7	798
26	24	24	76.8	78.2	798
<b>27</b> ·	24	24	77.2	78.7	829
28	24	24	76.4	77.7	859
29	24	24	77.0	77.4	859
30	24	24	75.5	76.2	859
	MONTH	LY MINIMUM	64.9	65.7	267
	MONTHL	Y MAXIMUM	77.2	78.7	859
		ITHLY MEAN	72.0	73.0	591

DATE J <b>ULY</b>	OPERAT UNIT 1	ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	74.5	74.9	1208
2	24	24	74.0	74.9	1208
3	24	24	73.9	74.7	1208
4	24	24	74.0	75.1	1208
5	24	24	75.1	75.8	1208
6	24	24	73.5	74.6	1208
7	24	24	74.9	76.3	1208
8	24	24	75.4	76.3	1208
9	24	24	75.8	77.2	1208
10	24	24	77.5	78.8	1222
11	24	24	79.9	81.2	1124
12	24	24	78.9	80.7	1124
13	24	24	80.1	81.3	1124
14	24	24	81.1	82.4	1124
15	24	24	81.6	83.1	1145
16	24	24	82.7	84.3	1145
17	24	24	82.1	84.7	1145
18	24	24	81.6	83.5	1145
19	24	24	79.1	80.4	1145
20	24	24	78.9	80.3	1213
21	24	24	81.1	82.7	1197
22	24	24	81.2	82.7	1181
23	24	24	81.3	83.3	1197
24	24	24	80.3	82.4	1213
25	24	24	80.7	81.9	1213
26	24	24	78.9	79.8	1213
27	24	24	76.0	77.3	1197
28	24	24	75.7	77.1	1213
29	24	24	75.4	77.6	1197
30	24	24	76.4	78.6	1213
31	24	24	76.8	79.0	1213
		ILY MINIMUM		74.6	1124
		LY MAXIMUM		84.7	1222
	MON	NTHLY MEAN	78.0	79.4	1186

DATE		NG HOURS	<b>RIVER INLET</b>		MEAN SITE			
AUGUST	UNIT 1	UNIT 2	TEMP.	TEMP.	DISCHARGE FLOW			
			(°F)	(°F)	(BLOWDOWN-CFS)			
1	- 24	24	77.7	79.5	1213			
2	24	24	-78.9	81.4	1213			
3	24	24	80.3	82.4	1213			
4	24	24	80.5	82.1	1213			
5	24	24	78.8	80.7	1213			
6	24	24	77.8	80.4	1213			
7	24	24	79.0	80.6	1213			
8	24	24	79.3	81.5	1213			
9	· 24	24	80.2	, 82.1	1213			
10	24	24	78.9	81.1	1213			
11	24	24	78.2	80.5	1181			
12	24	24	77.1	79.7	1213			
13	24	24	77.1	78.9	1213			
14	24	24	75.4	77.4	1213			
15	24	24	75.6	77.2	1213			
16	24	24	76.5	79.0	1213			
17	24	24	76.5	78.6	1166			
18.,	24	24	76.1	78.4	1166			
19	24	24	75.6	78,1	1166			
20	24	24	75.4	78.1	1187			
21	24	24	74.4	77.2	1166			
22	24	24	74.4	77.2	1166			
23	24	24	71.7	75.0	1166			
24	24	24	72.0	75.7	1166			
25	24	24	71.8	74.9	1166			
26	24	24	73.1	76.3	1187			
27	24	24	72.3	74.8	1166			
28	24	24	72.9	75.2	1166			
29	24	24	74.7	75.9	1166			
30	24	24	74.3	76.5	1166			
31	24	24	75.3	76.8	1166			
		Y MINIMUM		74.8	1166			
		Y MAXIMUM	80.5	82.4	1213			
	MON	THLY MEAN	76.2	78.5	1191			

DATE SEPTEMBER		NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	73.6	76.7	1187
2	24	24	71.8	75.4	1187
3	24	24	73.2	74.7	1187
4	24	24	70.4	73.3	1187
5	24	24	70.5	73.0	1166
6	24	24	72.6	74.5	1166
7	24	24	74.2	76.3	1166
8	24	24	71.6	74.1	1187
9	24	24	71.0	73.2	1187
10	24	24	72.0	75.0	1187
/ 11	24	24	73.0	75.9	1166
12	_24	24	74.2	77.3	1166
13	24	24	73.9	76.2	1166
14	24	24	71.6	74.2	1166
15	24	24	71.0	73.4	1166
16	24	24	70.4	72.4	1187
17	8.9	24	70.6	71.8	1208
18	24	24	68.7	71.2	1166
19	24	24	69.6	71.7	1166
20	24	24	69.9	71.9	1166
21	24	24	69.9	72.0	1166
22	24	24	70.6	72.2	1166
23	24	24	67.8 ′	70.2	1144
24	24	24	67.2	69.3	1166
25	24	24	67.3	68.8	1166
26	24	24	66.9	68.5	1166
27	24	24	65.7	67.4	1166
28	24	24	66.2	67.4	1166
29	24	24	62.5	63.9	1166
30	24	24	61.0	62.3	1166
	MONTHL	Y MINIMUM	61.0	62.3	1144
	MONTHL	Y MAXIMUM	74.2	77.3	1208
		THLY MEAN	70.0	72.1	1172

Table 1.Monthly ambient river inlet temperatures, and site discharge temperatures and flows,<br/>with recorded operating hours for Units 1 and 2 at PINGP in 2005

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DATE OCTOBER	OPERATII UNIT 1	NG HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	62.8	63.5	1166
2	24	24	61.8	65.1	1166
3	24	24	64.7	65.8	1166
4	24	24	65.7	67.4	1145
5	24	24	65.8	67.4	1145
6 、	24	24	62.5	62.6	1145
7	24	24	61.4	60.6	1145
8	24	24	59.3	59.6	1145
9	24	24	58.2	59.2	1145
10	24	24	57.7	58.3	1145
11.	24	24	56. <del>9</del>	57.2	1166
12	24	24	56.7	56.5	1145
13	24	24	56.3	56.2	1145
14	24	24	55.1	56.0	1187
15	24	24	54.4	56.3	1145
16	. 24	24	53.8	55.5	1145
17	24	24	54.3	55.9	1145
18	24	24	54.0	56.2	1166
19	24	24	54.5	56.0	1145
20	24	24	53.5	55.1	1145
21	24	24	53.7	55.8	1145
22	24	24	52.2	53.8	1145
23	24	24	51.0	53.2	1145
24	24	24	51.1	52.2	1145
25	24	24	49 <i>.</i> 8	51.6	1145
26	24	24	50.0	51.1	1145
27	24	24	49.8	50.9	1145
28	24	24	49.6	51.1	1145
29	24	24	49.6	51.3	1145
30	25*	25*	51.2	53.0	1145
31	24	24	50.1	52.3	1145
* Daylight s					
		Y MINIMUM	49.6	50.9	1145
		Y MAXIMUM	65.8	67.4	1187
	MON	THLY MEAN	55.7	57.0	1150

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date November		ING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	49.0	50.9	1166
2	24	24	48.5	50.7	1166
3	24	24	49.7	52.2	1166
4	24	24	49.2	51.4	1166
5	24	24	48.7	50.6	1166
6	24	24	49.1	50.3	1145
7	24	24	48.5	50.1	1145
8	24	24	48.1	50.6	1145
9	24	24	48.4	50.4	1145
10	24	24	48.1	47.9	1124
11	24	24	48.2	47.7	1145
12	24	24	49.0	49.0	1145
13	24	24	50.0	48.5	1145
14	24	24	45.5	47.6	1152
15	24	24	44.4	46.2	1138
16	24	24	39.7	42.0	967
17	24	24	38.6	42.0	961
18	24	24	38.0	39.1	888
19	24	24	40.0	40.2	888
20	24	24	39.9	41.0	888
21	24	24	38.9	40.4	895
22	24	24	42.1	40.0	895
23	24	24	42.2	39.9	888`
24	24	24	37.2	38.2	888
25	24	24	37.0	37.4	888
26	24	24	37.7	36.0	828
27	24	24	37.5	36.2	835
28	24	24	39.5	38.1	835
29	24	24	40.5	37.6	835
30	24	24	37.4	35.8	828
	MONTH	LY MINIMUM	37.0	35.8	828
	MONTHL	Y MAXIMUM	50.0	52.2	1166
	MON	ITHLY MEAN	43.7	44.3	1016

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DATE DECEMBER		TING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1 .	24	24	37.2	35.7	828
2	24	24	36.9	35.3	828
3	24	24	36.6	34.9	835
4	24	24	36.5	34.5	835
5	24	24	36.5	34.2	835
6	24	24	32.3	34.6	828
7	. 24	24	32.5	34.6	835
8	24	24	32.2	34.4	835
9.	24	24	32.4	33.8	842
10	24	24	32.4	34.1	835
11	24	24	36.1	34.0	835
12	24	24	32.6	33.2	835
13	24	24	33.1	34.1	835
14	24	24	32.6	33.7	. 815
15	24	24	33.1	33.7	808
16	24	24	32.4	33.7	808
17	24	24	36.0	33.4	815
18	24	24	35.5	33.7	815
19	24	24	35.5	34.1	815
20	24	24	35.6	33.8	795
21	24	24	35.5	33.5	815
22	24	24	35.5	33.6	815
23	24	24	35.4	32.2	815
24	24	24	35.7	33.2	815
25	24	24	35.7	33.2	815
26	24	24	35.7	34.4	815
27	24	24	35.3	35.0	815
28	24	24	35.4	34.5	815
29	24	24	35.4	34.6	815
30	24	24	35.7	34.5	802
31	24	24	35.5	34.5	815
		LY MINIMUM	32.2	32.2	795
		Y MAXIMUM	37.2	35.7	842
	MON	ITHLY MEAN	- 34.8	34.1	821

Table 2 Daily 2005 Mississippi River Discharge Flow rate (cfs) at Lock Dam 3

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ОСТ	NOV	DEC	
1	11800	9600	11100	35200	32000	34900	33200	15200	7700	26700	20900	23400	
2	11800	10000	10500	36300	31700	34700	32200	13300	7800	27600	20400	23200	
3	11800	10200	10600	41500	30900	34300	32000	10900	7800	28100	20400	21600	
4	11700	10600	10500	46600	29500	33200	32300	11700	10000	28700	19700	19800	
5	11600	10400	10700	50900	27400	32900	32800	13000	12600	31600	19300	17800	
6	10700	10500	11400	53100	26400	32800	31700	10300	13600	41300	19500	15200	
7	9400	11000	13400	52300	23700	32700	31000	9000	11600	36200	19300	14100	
8	9700	11400	12600	51200	24100	33800	29300	9000	11600	38500	19200	15500	
9	10000	11100	14200	50`300	23100	33200	28700	9100	11500	44800	18900	17100	
10	10500	10900	14500	49500	24600	35100	27400	10500	10300	50300	15900	17600	
11	9700	11000	15600	48700	24300	36500	26600	10500	10300	54000	16100	18400	
12	9600	10900	15200	47500	24100	37500	24700	10300	10300	54900	16200	19500	
13	10100	10800	13800	45800	25200	38600	24600	8300	9700	53900	16300	20900	
14	9100	11100	12000	36900	28600	39800	21600	7700	14100	51800	16200	21700	
15	8800	12600	12700	44800	29800	41100	20400	7700	16900	49500	17300	22600	
16	8700	14800	12900	45000	32100	42500	18300	7700	17700	46700	19500	22800	
17	8600	14500	12700	45900	32200	44000	19000	7700	18500	43900	18900	22200	
18	8600	10000	12900	46400	33200	46300	18600	7600	18300	41100	18500	19900	
19	9200	10000	13100	46500	33000	47600	16500	9100	18200	38300	20900	17000	
20	9200	11700	12800	46900	32800	47700	15400	9000	18100	35800	21400	15500	
21	9500	15100	11100	47200	33200	47500	16700	8900	17900	33200	20300	16000	
22	9600	15200	11300	46900	35100	46600	16500	8300	19500	31100	21400	17400	
23	9600	13500	12500	46300	35600	45300	15300	8400	18800	29700	21900	18700	
24	9700	12200	13900	45300	36100	43800	16100	9700	17500	28500	23300	19800	
25	9900	11800	14600	43800	36500	42800	16700	8300	17300	27200	22400	21300	
26	10100	11000	17200	42300	36400	41200	16300	8300	18800	25700	20300	19000	
27	10000	10900	16800	40600	36000	39300	15200	11300	<u>16500</u>	25100	16400	17900	
28	10000	11300	20500	38300	35800	37800	14400	11300	20300	24100	14800	19100	
29	9800		20800	36300	35700	36500	13200	11800	25100	22800	17600	19200	
30	9200		26700	33600	35700	34700	10200	9700	27100	21400	21900	19000	
31	9300		36100		35500		11900	9000		21900		19600	
MIN	8600	9600	10500	33600	23100	32700	10200	7600	7700	21400	14800	14100	
MAX	11800	15200	36100	53100	36500	47700	33200	15200	27100	54900	23300	23400	
MEAN	9900	11600	14700	44700	31000	39200	21900	9800	15200	35900	19200	19100	
YEAR N	MAX	54900							••	•			

YEAR MIN

7600

### Table 3

# 2005 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

	Mean Plant Flow	Mean River Flow	Percentage of Mean River Flow
Month	(cfs)	(cfs)	Entering the Plant Intake
January	707	9900	7.1%
February	621	11600	5.4%
March	767	14700	5.2%
April	605	44700	1.4%
May	265	31000	0.9%
June	591	39200	1.5%
July	1186	21900	5.4%
August	1191	9800	12.2%
September	1172	15200	7.7%
October	1150	35900	3.2%
November	1016	19200	5.3%
December	821	19100	4.3%
Averages	841	22700	3.7%

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Table 4. Mean Monthly Mississippi River Flow for 1984 - 2005, in cubic feet per second (cfs).

Month	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
January	9,900	6,700	9,229	10,932	11,271	8,974	10,790	9,806	14,823	14,826	11,365
February	11,600	6,700	7,871	10,104	10,471	9,548	12,589	14,911	13,954	15,041	9,371
March	14,700	15,000	13,210	11,497	10,948	22,219	17,897	26,574	24,177	24,474	29,061
April	44,700	24,700	25,613	40,657	112,703	15,570	42,013	51,477	106,073	57,517	48,507
May	31,000	19,400	42,194	33,974	82,661	18,839	47,426	22,681	39,316	46,535	45,135
June	39,200	46,000	27,413	26,323	53,177	22,070	34,423	25,690	19,487	33,790	30,667
July	21,900	19,500	32,739	34,597	23,981	21,052	27,548	26,477	36,119	23,732	27,323
August	9,800	10,600	10,084	29,065	12,164	10,026	24,432	10,742	28,074	13,303	29,129
September	15,200	19,200	7,087	24,513	9,193	6,687	18,013	7,060	16,663	9,300	19,860
October	35,900	19,500	6,771	28,600	9,577	6,790	14,200	12,597	14,155	11,403	31,061
November	19,200	21,900	8,167	18,467	11,040	17,463	13,243	19,773	14,160	23,353	30,703
December	19,100	12,300	8,310	12,135	13,813	9,558	9,671	15,645	12,694	18,716	17,494
Averages	22,700	18,500	16,557	23,405	30,083	14,066	22,687	20,286	28,308	24,333	27,473
<b></b> 7								·		r	
Month	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984
January	13,090	9,326	15,658	5,542	4,965	6,294	7,303	13,758	13,710	12,526	13,375
February	12,611	8,936	13,978	5,879	4,889	6,529	7,634	12,586	12,804	10,239	18,557
March	28,542	12,513	43,661	15,081	17,484	11,300	14,810	17,287	24,790	32,265	27,290
April	40,830	55,473	32,668	34,268	12,842	33,264	21,463	20,267	84,870	45,317	56,277
May	47,548	48,571	25,474	44,753	22,310	24,287	13,119	13,655	81,242	43,518	49,528
June	26,913	65,377	17,920	44,960	31,610	13,237	4,667	14,573	37,043	30,105	55,613
July	29,403	84,123	28,985	33,856	20,323	7,690	2,903	11,674	34,684	25,676	37,165
August	19,971	41,135	14,532	21,535	16,322	4,658	5,103	10,477	30,813	18,226	13,826
September	21,203	30,717	15,686	25,182	9,923	8,307	6,080	7,183	41,957	29,665	9,678
October	25,581	19,516	15,374	15,458	11,135	6,358	7,019	7,771	49,319	39,590	23,866
November	20,173	18,773	19,076	22,467	9,903	6,793	7,919	8,693	24,260	21,337	21,157
December	14,432	16,490	12,126	20,503	6,184	4,961	6,487	9,016	17,774	16,094	15,903
Averages	25,025	34,246	21,262	24,124	13,991	11,140	8,709	12,245	37,772	27,047	28,519

Note: Mean monthly river flow data for the years 1985, 1990, 1991 and 1992 have been adjusted to reflect the averages found in Table 2 of the corresponding annual report for each year.

#### SECTION II

### PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2005 ANNUAL REPORT

### SUMMARY OF THE 2005 FISH POPULATION STUDY

Study and Report by B. D. Giese

Environmental Services Water Quality Department



#### SUMMARY OF THE 2005 FISH POPULATION STUDY

#### **INTRODUCTION**

To fulfill part of the continuing environmental monitoring requirements of the Prairie Island Nuclear Generating Plant, (PINGP), the Mississippi River fisheries population was sampled near Red Wing, Minnesota, May through October, 2005. The study area extends from 3.6 miles upstream of the plant (River mile 802) to 10.8 miles downstream of the plant (River mile 787.5), (Figure 1). The original objective of the study was to "determine existing ecological characteristics before plant operation and to assess any significant changes to the aquatic environment after operation" (NSP 1972). The objective was changed slightly after the plant became operational in 1973; to "determine environmental effects of the PINGP on the fish community in the Mississippi River and it's backwaters" (Hawkinson 1973). Presently, the objective is to monitor and assess the status of the fishery in the vicinity of the PINGP (Mueller 1994). Parameters analyzed and compared to previous years include species composition, length-weight regressions, percent contribution (fish/hr), length-frequency distributions, and catch per unit effort (CPUE) for selected species.

#### METHODS AND MATERIALS

Fish were collected using a Smith-Root SR-18 Electrofishing boat equipped with a 5.0 GPP electrofishing unit (Figure 6). The power source was a 5.0 GPP generator. The 5000 watt generator has a maximum output of 16 amps, and a range of 0-1000 volts. The generator has the capability to be either pulsed AC or DC with a pulse frequency of 7.5, 15, 30, 60, and 120 Hz. The annode consists of two umbrella arrays, each with six dropper cables. The 18 foot boat and dropper cables hung from the front of the boat serve as the cathode. Collection occurred during daylight hours with a pulsed direct current. Due to the constantly changing river conditions, Electrofisher output was varied to enhance the effectiveness.

Sampling was done monthly, May through October, within four established sectors of the study area (Figures 1-5). The runs within each sector are similar to previous years sampling to ensure a similar set of relative data indices for yearly comparison. At the end of each "run", the elapsed shocking time was recorded from a digital timer, which only tallied the seconds that the electrical field was energized. A run was terminated after approximately 450 seconds shocking time or when the end of the prescribed run was reached.

Stunned fish were captured with one-inch stretch mesh landing nets equipped with eight-foot insulated handles. Fish were placed in live-wells, supplied with river water constantly, until the 2005 Annual Report DOC

end of each run. At the end of each run fish were identified, measured to the nearest millimeter (total length), weighed to the nearest 10 grams, and released. Parameters used to describe the fisheries include species composition, length-weight regressions, percent contribution, length-frequency distributions, and catch per unit effort (CPUE). It is assumed that population dynamics and spatial distribution is represented by CPUE.

Electrofishing CPUE was computed as numbers of fish per hour for each sector. Length frequencies in 20 millimeter intervals were calculated for all fish species. Length-weight relationships were calculated using the length-weight formula:

 $\log W = \log a + b \log L$ ,

where W is the weight in grams, a is the y axis intercept, b is the slope of the regression line, and L is the total length in millimeters.

#### RESULTS

Initial PINGP preoperational annual environmental reports simply listed all data collected without discussion or analysis (NSP 1972). Individual species were not discussed, due to the amount of data collected during initial sampling efforts. Representative species were selected in 1975 for abundance comparisons based on electrofishing data (Gustafson et. al. 1975), modified in 1986 after seining was eliminated (Donkers 1986), and in 1989 smallmouth and largemouth bass were added as they "have been seen more frequently in the electrofishing catch during recent years in the PINGP study area" (Mueller 1989).

Electrofishing collection methods changed before the 1982 sampling season. The mesh size of the dip nets was increased to one inch stretch mesh. The larger mesh size enabled small adult fish and some young of the year fish of certain species to avoid collection. Currently, individual gizzard shad, freshwater drum, and white bass less than 160 mm are not collected. Also, logperch and cyprinids (other than carp) are no longer collected, due to their small size (Donkers 1987). Therefore, a direct comparison of electrofishing CPUE prior to 1982 is inappropriate to later years.

A total of 6,141 fish, comprising 40 species, was collected in the 2005 survey (Table 2).

Species collected in 2005 are compared to previous years in Table 1. An individual spotted sucker was collected in 2004 and 2005. These were the first spotted suckers collected since 1992 (Table 1). Orangespotted sunfish and musky were sampled in 2004, but not in 2005. We also did not collect a white sucker in 2005, the first time since 1996, and only the second year since 1983 that no white suckers were sampled. An individual American eel, paddlefish, and brown trout were collected in 2005 (Table 1), but not in 2004 (Giese and Mueller 2004).

All species collected in 2005 are ranked according to electrofishing CPUE and listed in Table 2. Summaries for selected species (Tables 3-9) are based on electrofishing and trapnetting data for years 1977 through 1987, and on electrofishing data only for years 1988 through 2005, since trapnetting was discontinued after 1987 (Orr 1988). Annual CPUE for selected species is compared to previous years (Figures 15-22), by sector (Figures 23-30), and by date (Figures 31-38). The top three abundant species, based on CPUE, was determined for each sector.

Sector One;	freshwater drum, shorthead redhorse, carp
Sector Two;	freshwater drum, carp, shorthead redhorse
Sector Three;	white bass, freshwater drum, carp
Sector Four;	freshwater drum, gizzard shad, white bass
Overall CPUE Average;	freshwater drum, white bass, carp

Table 10 summarizes the percent contribution of historically predominant species in the annual catch. Length frequency distributions for selected species are illustrated by sector in Figures 7 through 14.

#### DISCUSSION

When dealing with a large river environment, a high degree of natural variability exists in habitat conditions and therefore, in fish distribution. Palmquist (1982) proposed the wide range in species abundance between study sectors was largely due to habitat preferences of a species rather than PINGP induced. A high degree of variability in species abundance exists within sectors from year to year. Differences in collection efficiency and year class strengths may explain this variability.

A qualitative and quantitative discussion for selected species, with respect to other years, includes: 1) CPUE, 2) rank, 3) percent composition of catch, 4) population condition as depicted by length-weight regression analysis, and 5) mean length.

Average mean length was calculated by splitting the length data for each species into 20 mm intervals and multiplying the number of fish in each interval by the median length of that interval (Example: The number of fish in the 260-279 mm interval was multiplied by 270 mm). Interval totals were summed, divided by the total number of fish, and rounded to the nearest 10 mm.



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#### GIZZARD SHAD

Electrofishing CPUE for gizzard shad decreased from 17.60 fish/hr in 2004 to 14.06 fish/hr in 2005 (Figure 15). CPUE increased in Sectors 3 and 4 from 2004 to 2005, and decreased in Sectors 1 and 2 (Figure 23). CPUE was also examined for each sampling month for 2005, with the highest occurring in Sector 4 in May (Figure 31).

Shad ranked fourth in 2005 (Table 2), and presently comprise nine percent of the catch (Table 10). The general condition of gizzard shad, 3.072, falls into the range of previous years, 2.388 to 3.934 from 1982-2004 (Table 3). Carlander (1969) sites a population in Canton Lake, Oklahoma with a range in total fish length of 173 to 335 mm and a regression slope of 3.066 which compares well to the fish in this study. The mean length for gizzard shad (350 mm) increased from 2004 (Table 3). The length frequency data indicates a range of approximately 170-500 mm, with peaks occurring at approximately 300 and 400 mm (Figure 7).

#### FRESHWATER DRUM

Freshwater Drum CPUE for 2005, (32.02 fish/hour) increased from 21.12 fish/hr in 2004, and was the third highest CPUE since 1977 (Figure 16). CPUE was higher in all sectors when comparing 2005 to 2004 (Figure 24). The highest CPUE in a sector for any month occurred in Sector 3 in May (Figure 32).

Freshwater drum CPUE ranked first in 2005 (Table 2). Although carp historically has had the highest composition expressed as percentage of total annual catch and resulting CPUE overall, carp ranked third in 2005 (Table 2). Presently, adult freshwater drum comprise 22 percent of the catch (Table 4).

The general condition of freshwater drum has remained relatively stable, as depicted by a regression slope of 3.129 in 2005, in comparison to a range of slopes of 2.598 to 3.212 from previous years of the study (Table 4). The mean length for freshwater drum was approximately 330 mm in 2005 (Table 4). The length frequency data for freshwater drum suggest that a peak occurs at approximately 330 mm (Figure 8).

#### SHORTHEAD REDHORSE

Electrofishing CPUE for shorthead redhorse has ranged from 7.07 to 25.94 fish/hour (Figure 17). CPUE for 2005 (12.85 fish/hr) is the lowest value since 1995 (Table 5). Historically, the CPUE within each sector is highly variable (Figure 25). The 2005 CPUE is also variable between sectors, ranging from 20.90 fish/hour in Sector 1, to 5.99 fish/hour in Sector 4 (Table 2). CPUE

for each sector is highly variable during the collection year, with the highest CPUE occurring in Sector 1 in May (Figure 33).

Shorthead redhorse ranked fifth in 2005 (Table 2), comprising nine percent of the catch (Table 5).

The general condition of shorthead redhorse has remained relatively stable, as depicted by a regression slope of 2.833 in 2005, in comparison to a range of slopes of 2.571 to 3.041 from previous years of the study (Table 5). The length-weight regression slope of shorthead redhorse in the vicinity of Prairie Island is about the same as that of another population of Upper Mississippi River shorthead redhorse as reported by Carlander (1969) as having a slope of 2.83. The mean length for shorthead redhorse at Prairie Island was approximately 350 mm in 2005 (Table 5). The length frequency data show that the main peaks occur at approximately 230, 300 and 400 mm (Figure 9).

#### WHITE BASS

Electrofishing CPUE for white bass in 2005 (24.21 fish/hr) is the lowest recorded since 1996 (Table 6 and Figure 18). CPUE was similar in all four sectors when comparing 2005 to 2004 (Figure 26). A large difference is evident when comparing CPUE upstream of Lock and Dam 3 to downstream of Lock and Dam 3 (Table 2). Overall CPUE appears cyclic (Figure 18) with year to year variability within each sector (Figure 26). Highest CPUE for any month sampled, occurred in Sector 3 in June with 160+ fish/hr (Figure 34).

White bass ranked second in 2005 (Table 2). Presently, white bass comprise 16 percent of the catch (Table 10).

The general condition of white bass has remained relatively stable, as depicted by a regression slope of 2.947 in 2005, in comparison to a range of slopes of 2.441 to 3.085 from previous years of the study (Table 6). The mean length for white bass is similar to the last nine years (Table 6). The length frequency data shows that a main peak occurs for white bass at approximately 370 mm, with a smaller peak at approximately 270 mm (Figure 10).

#### WALLEYE

Electrofishing CPUE for walleye in 2005 (2.11 fish/hour) is the lowest recorded since 1994 (Figure 19). CPUE decreased in all sectors, except Sector 2, when comparing 2005 to 2004 (Figure 27). The highest CPUE for any sector in any month was Sector 1 in May (Figure 35). 2005 Annual Report.DOC

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Walleye ranked 13th in 2005 in overall catch abundance (Table 2). Presently, adult walleye comprise one percent of the catch (Table 7).

The general condition of walleye has remained relatively stable, as depicted by a regression slope of 3.225 in 2005, in comparison to a range of slopes of 2.852 to 3.318 from previous years of the study (Table 7). The mean length for walleye was the highest recorded since the study began (Table 7). The length-weight relationship indicates peaks occurring at approximately 200, 400 and 600 mm (Figure 11).

#### **SAUGER**

Electrofishing CPUE for sauger was the lowest recorded since 1994 (Table 8 and Figure 20). Sauger CPUE increased in both sectors upstream of lock and dam #3 and decreased in both sectors downstream of lock and dam #3 in 2005, compared to 2004 (Figure 28). Sector 3 had the highest CPUE in August of any sector in any month (Figure 36).

Sauger ranked seventh in 2005 (Table 2), comprising three percent of the catch (Table 8).

The general condition of sauger has remained relatively stable, as depicted by a regression slope of 3.163 in 2005, in comparison to a range of slopes of 2.648 to 3.356, in previous years of the study (Table 8). The mean length for sauger was approximately 290 mm in 2005 (Table 8). The length frequency data exhibit a range from 160-510 mm, with an apparent peak occurring at approximately 300 mm (Figure 12).

#### **SMALLMOUTH BASS**

Electrofishing CPUE for smallmouth bass appears cyclic with the peak CPUE (17.02 fish/hour) occurring in 2000, while 2005 CPUE was 9.77 fish/hr (Figure 21). CPUE in Sectors 1-4 appear cyclic (Figure 29) with curves appearing similar in shape to the curve for all sectors combined shown in Figure 21. The highest CPUE occurred in Sector 3, in September (Figure 37).

Smallmouth bass ranked sixth in 2005 (Table 9), comprising seven percent of the catch. The population of smallmouth bass appears to be in good general condition as depicted by a regression line slope of 2.850, which compares well with smallmouth bass populations provided by Carlander (1977). Smallmouth bass have a length frequency range of approximately 110-450 mm, with a relatively broad peak occurring at approximately 250 mm (Figure 13).

#### LARGEMOUTH BASS

Largemouth bass CPUE for 2005, (1.22 fish/hour), is the lowest recorded since 1994 (Figure 22). The CPUE for Sector 1 was virtually zero for all sampling dates, while Sectors 2-4 have a little more variability (Figure 30). The highest CPUE occurred in Sector 3 in August (Figure 38).

Largemouth bass ranked 17th in 2005, which is the lowest ranking since 1986 (Table 9), comprising less than one percent of the catch. Historically, largemouth bass rank has varied greatly, ranging from 9th to 20th (Table 9).

The population of largemouth bass appears to be in good general condition as depicted by a regression line slope of 3.156, which compares well with information on largemouth bass populations provided by Carlander (1977). The length frequency data indicates a range of 140-450 mm, with peaks occurring at approximately 250 and 350 mm (Figure 14).

#### GENERAL

The ten most abundant species collected during 2005 in descending order, based on average CPUE for all sectors combined were: 1) freshwater drum, 2) white bass, 3) carp, 4) gizzard shad, 5) shorthead redhorse, 6) smallmouth bass, 7) sauger, 8) silver redhorse, 9) quillback carpsucker, and 10) flathead catfish (Table 2).

Total average CPUE for all species and sectors combined decreased from 193.89 fish/hr in 2003, to 174.73 fish/hr in 2004 to 148.66 in 2005 (Table 2).

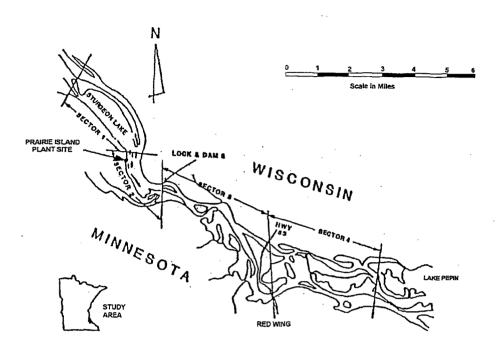


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## PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA

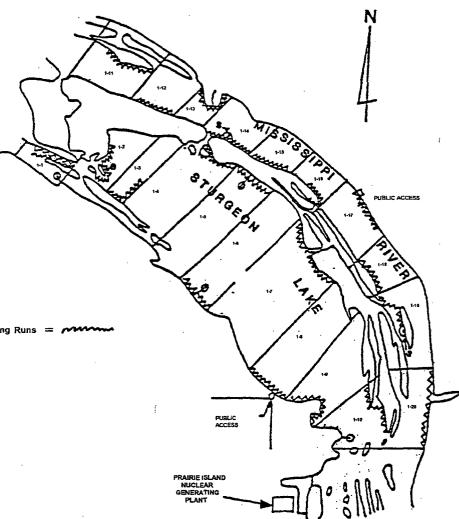


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Figure 1

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PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Upstream Sec 1 Runs 1-20

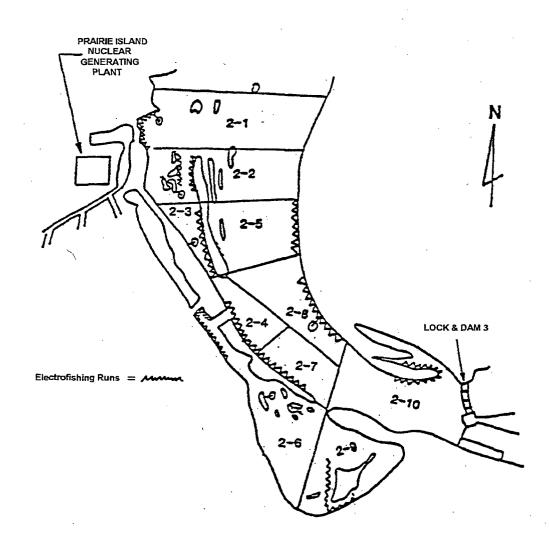


Electrofishing Runs =

FIGURE 2

Figure 3.

PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Plant Area (Sec 2 Runs 1-10)



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Figure 4.

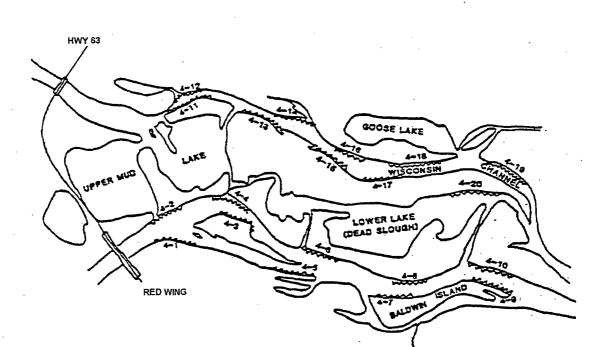
## PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Downstream (Sec 3 Runs 1-10)

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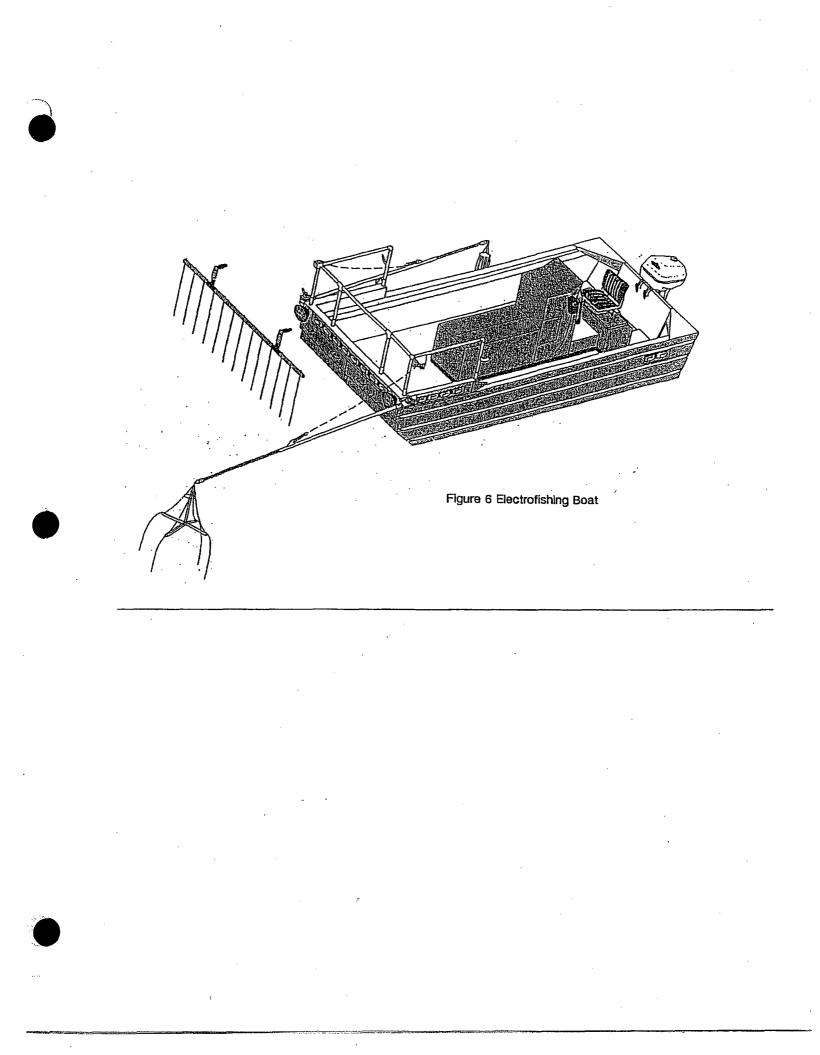
Figure 5.

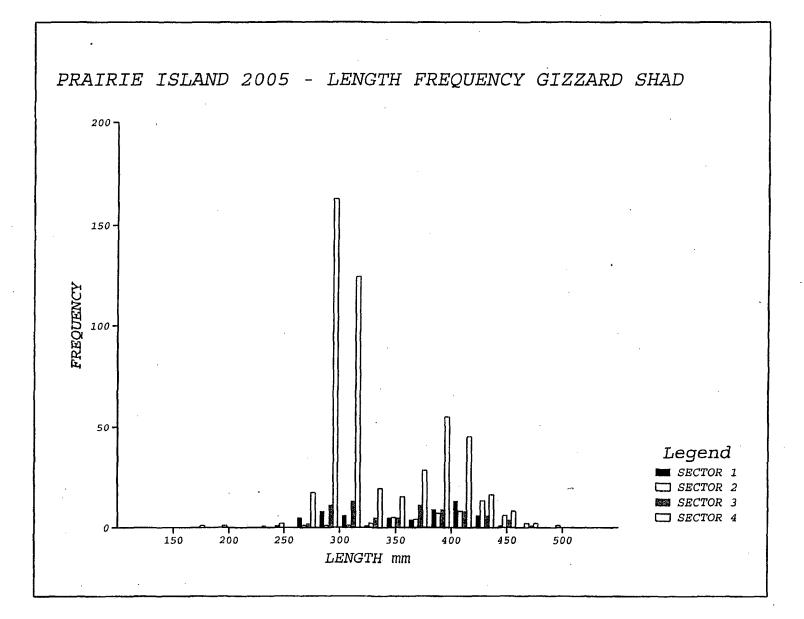
## PRAIRIE ISLAND FISHERIES POPULATION STUDY Sampling Locations Downstream (Sec 4 Runs 1-20)



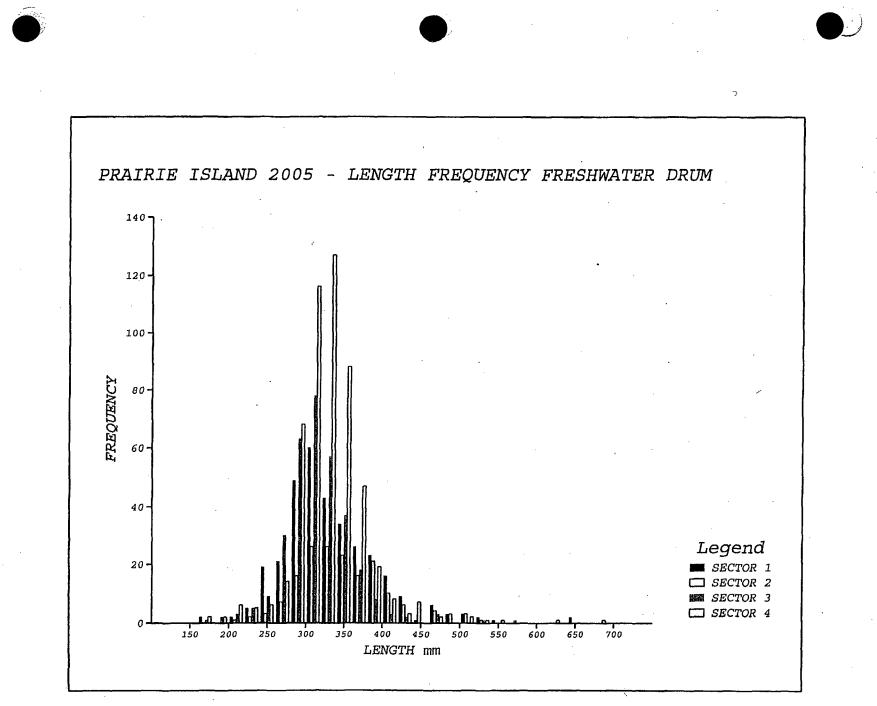
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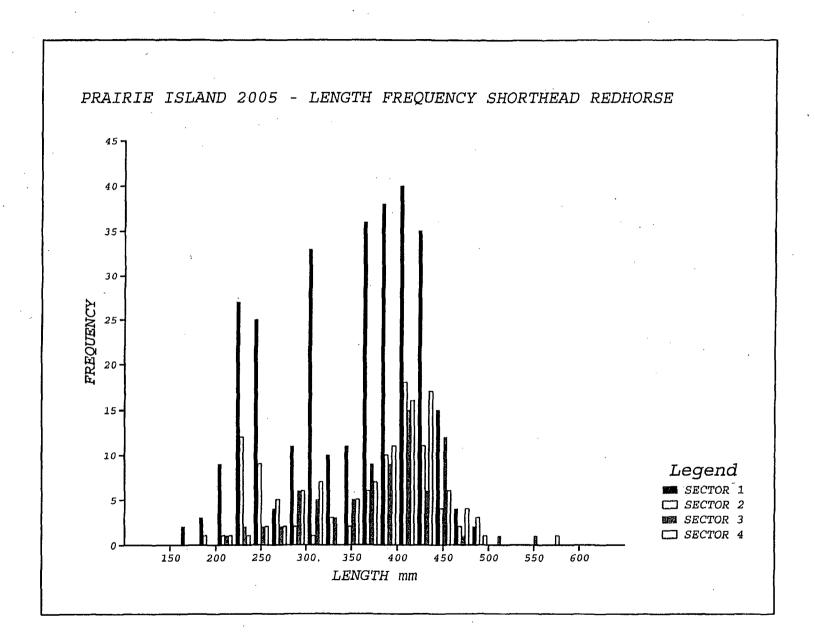
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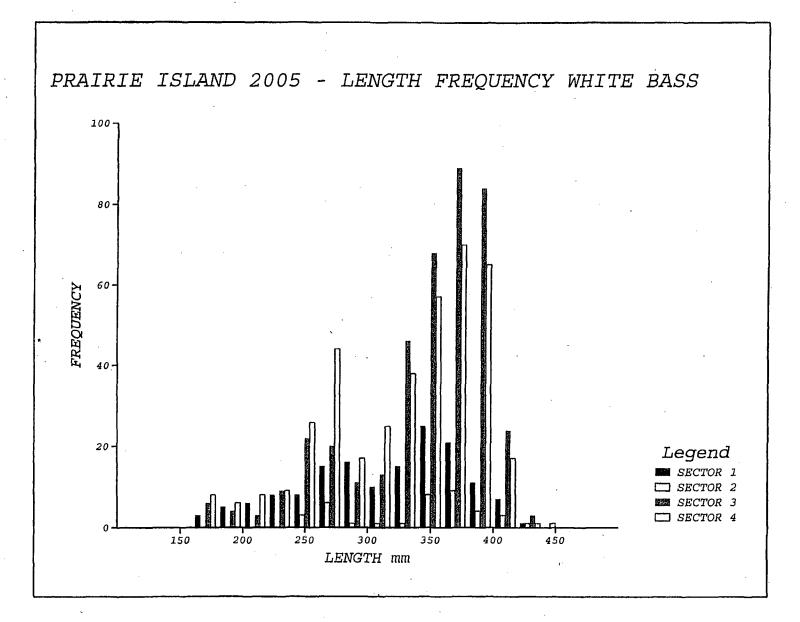
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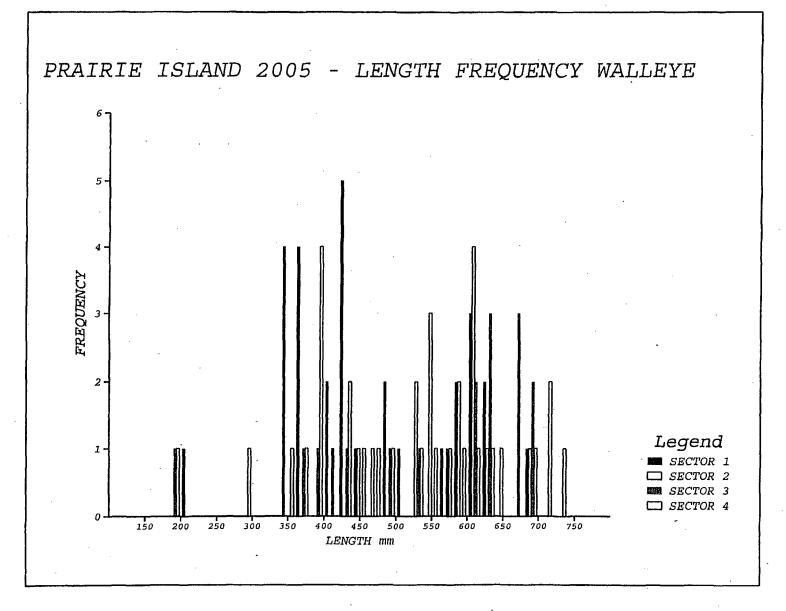


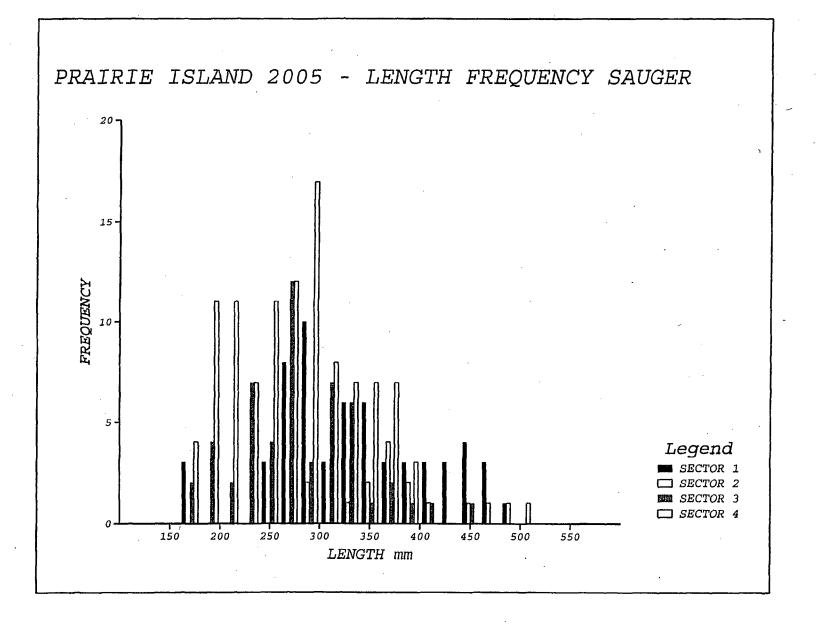
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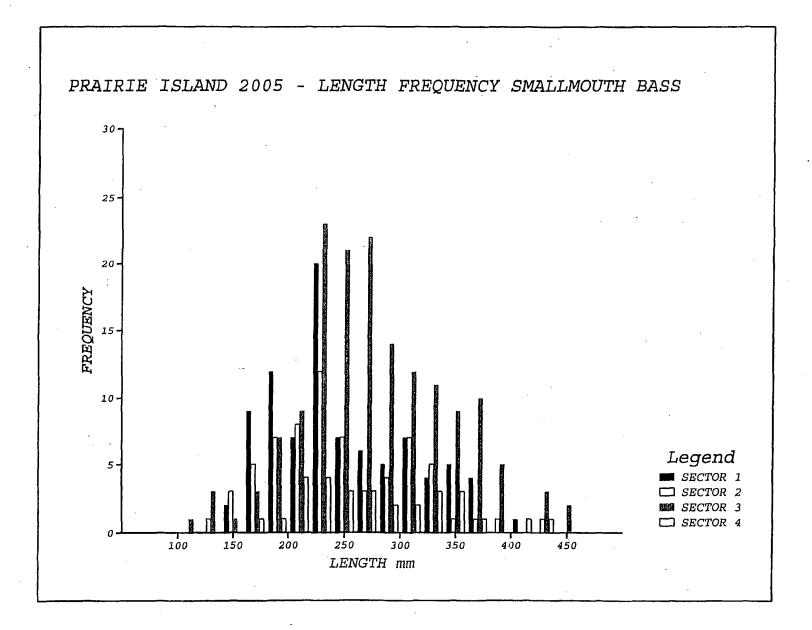
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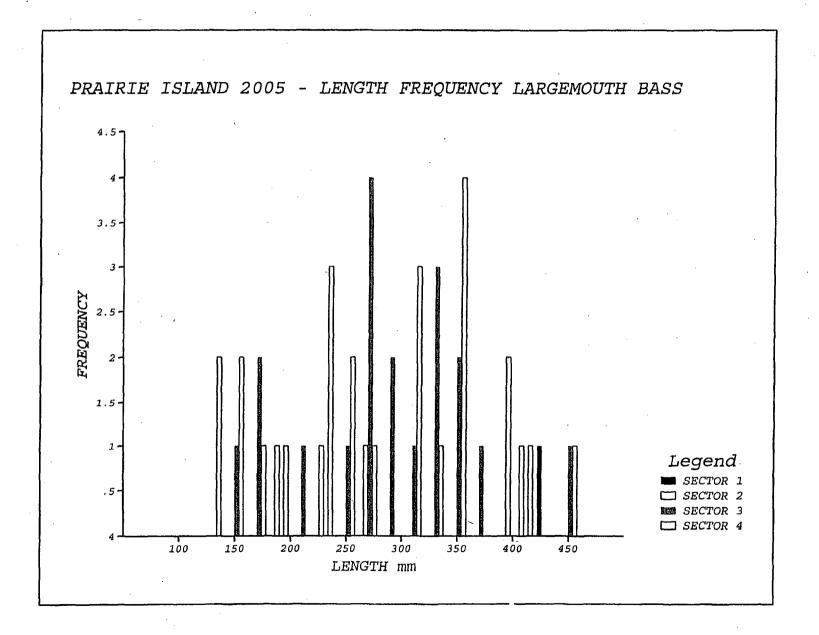
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Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2005 in the vicinity of PINGP.

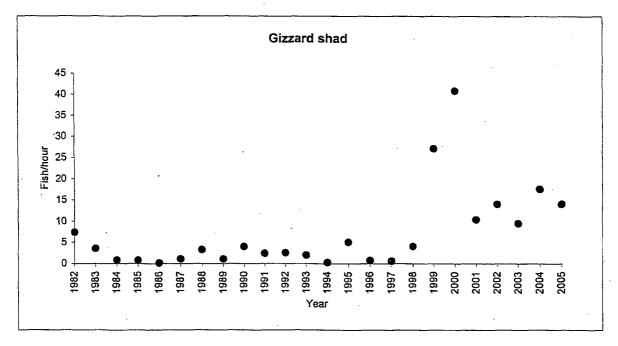


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2005 in the vicinity of PINGP.

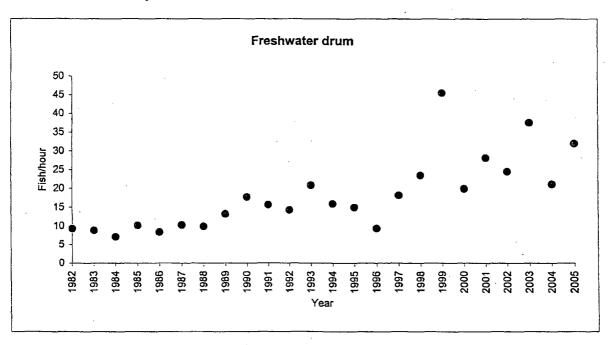




Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2005 in the vicinity of PINGP.

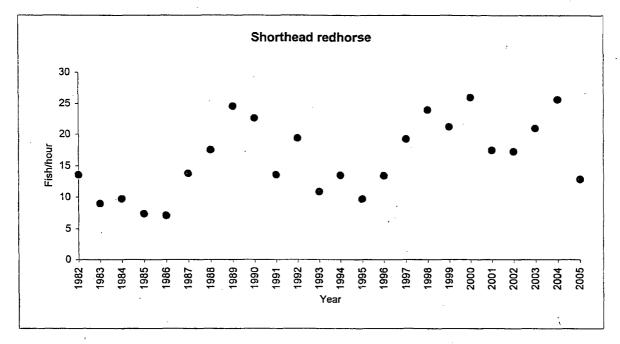
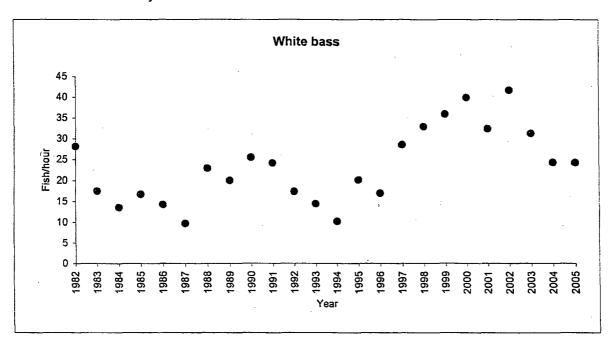


Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2005 in the vicinity of PINGP.



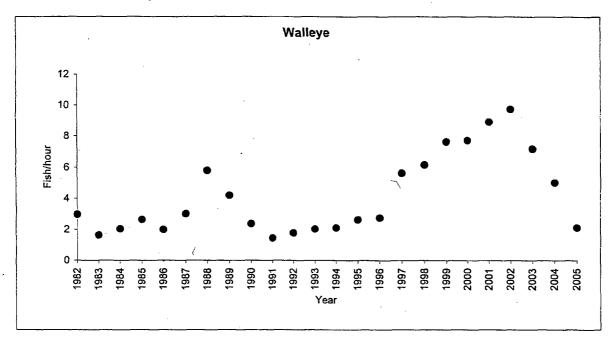
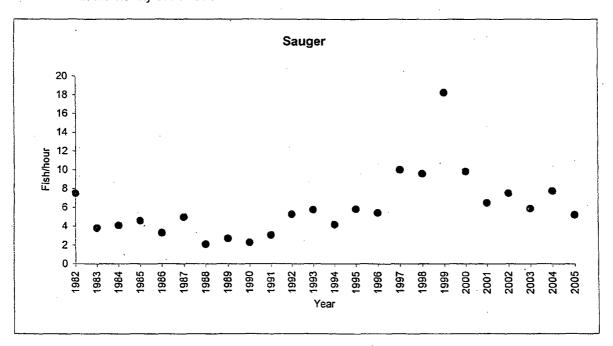


Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2005 in the vicinity of PINGP.

Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2005 in the vicinity of PINGP.



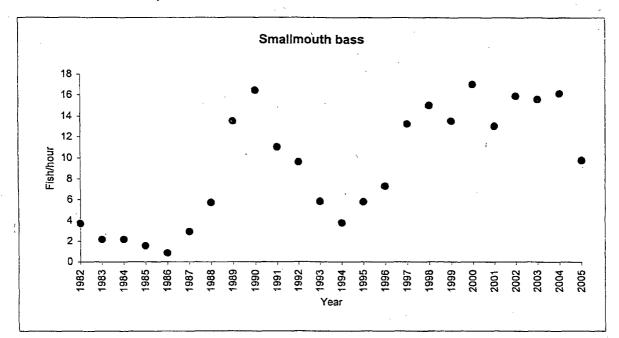
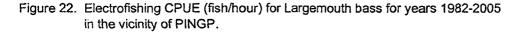


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2005 in the vicinity of PINGP.



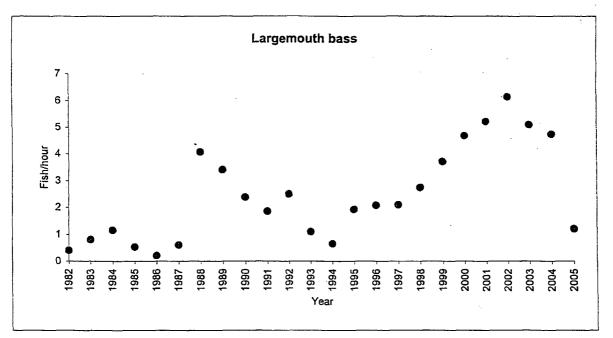
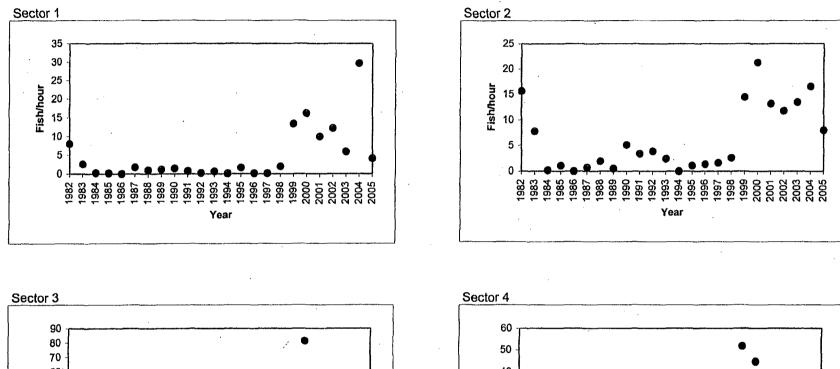
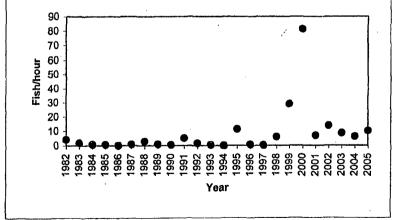
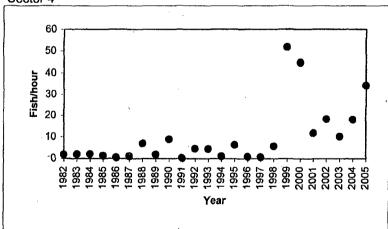


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2005 in the vicinity of PINGP.

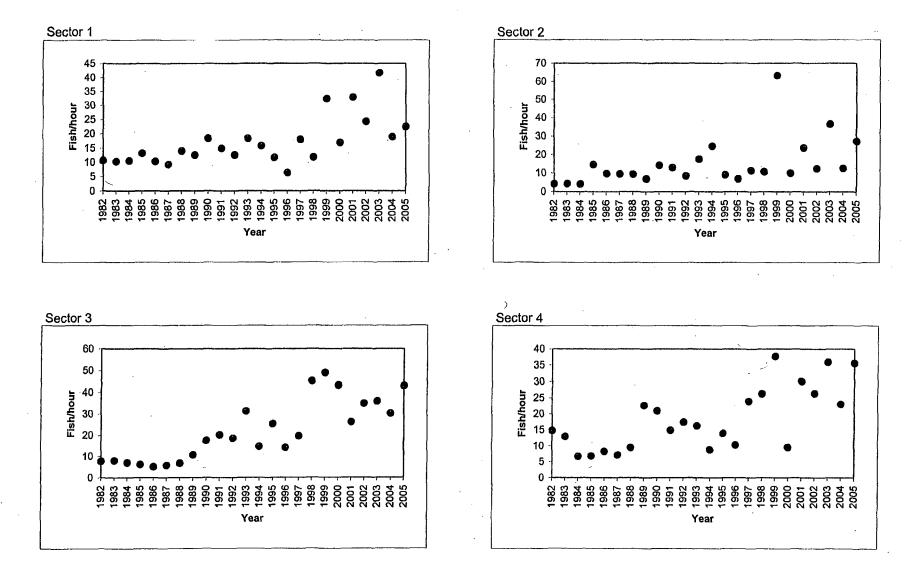














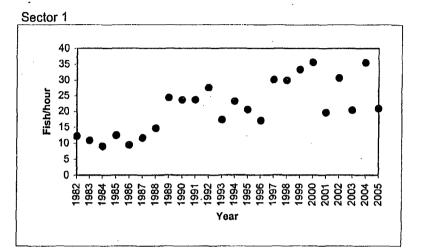
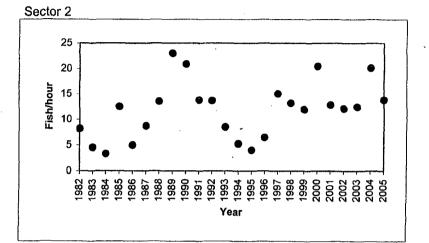
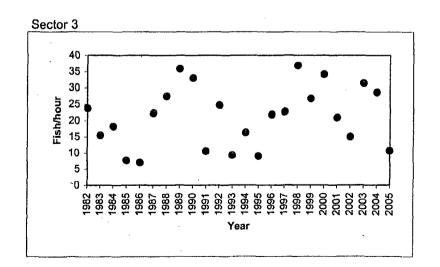
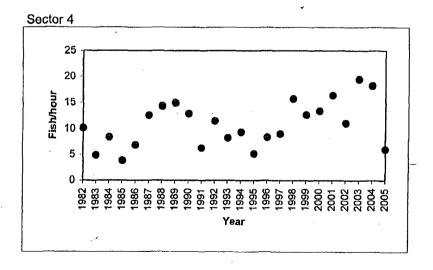


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2005 in the vicinity of PINGP.







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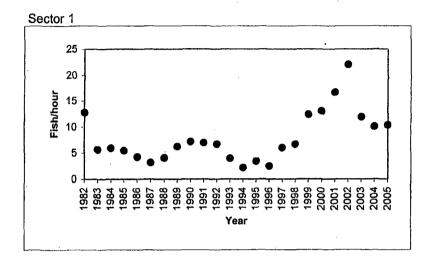
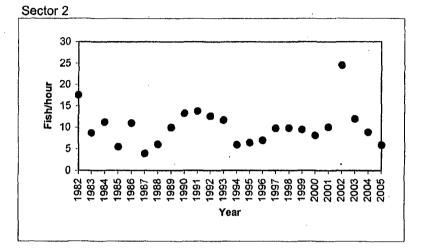
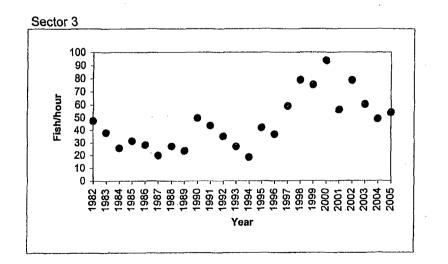
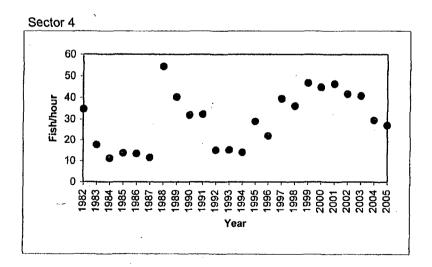


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2005 in the vicinity of PINGP.

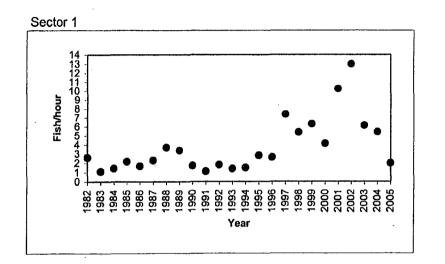


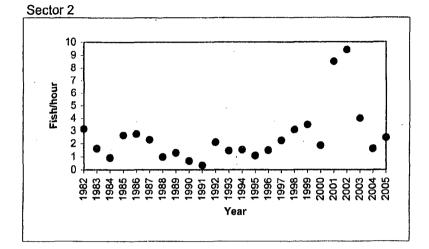


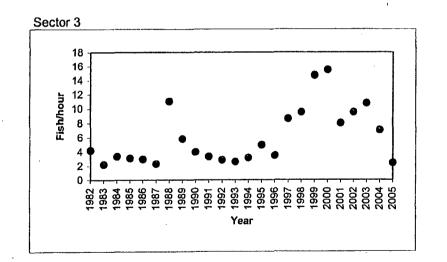


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Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2005 in the vicinity of PINGP.







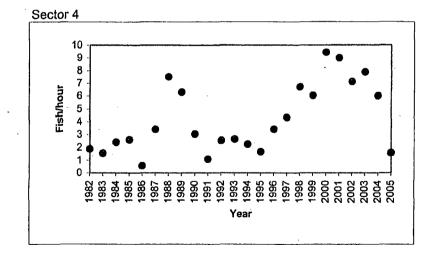
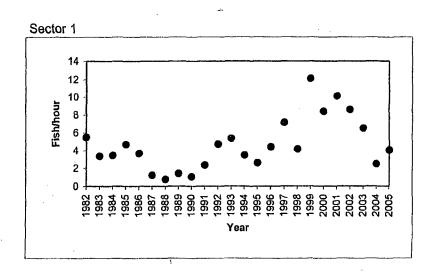
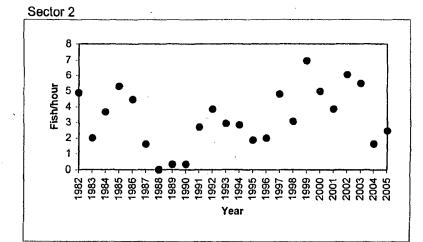
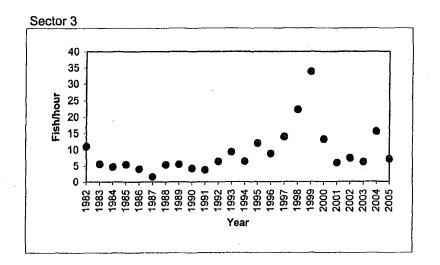
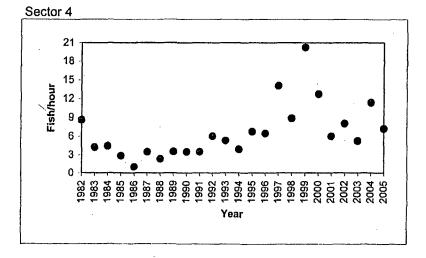


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2005 in the vicinity of PINGP





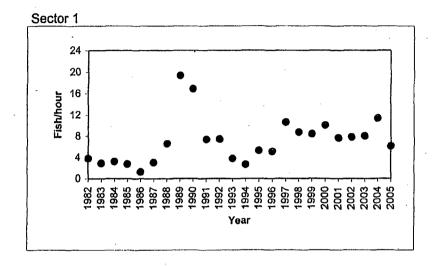


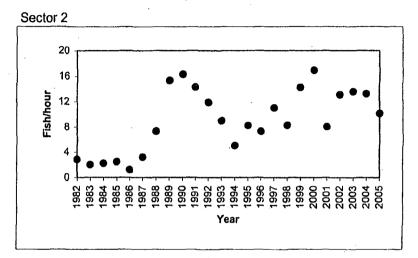


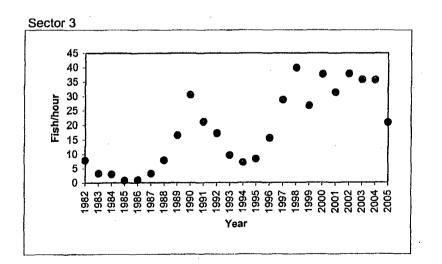
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Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2005 in the vicinity of PINGP.







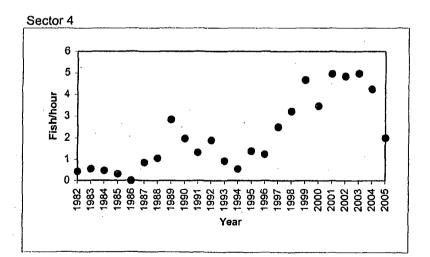
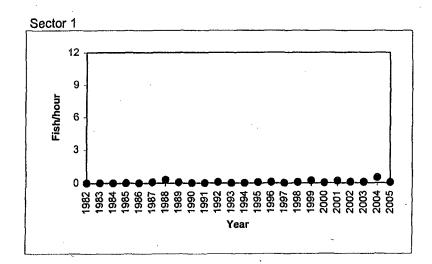
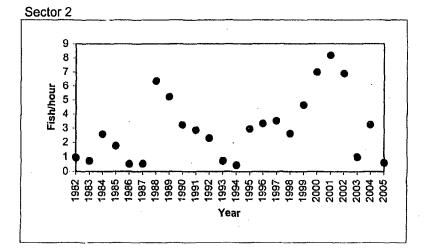
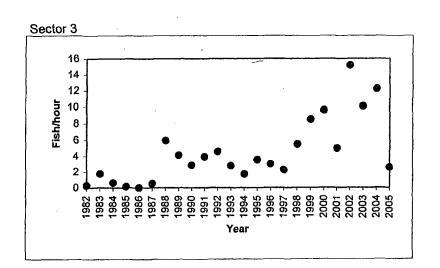


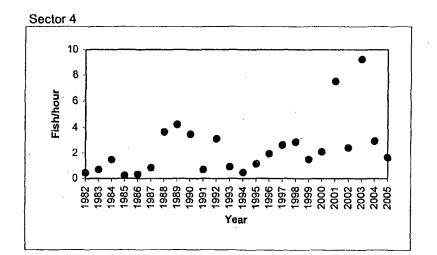


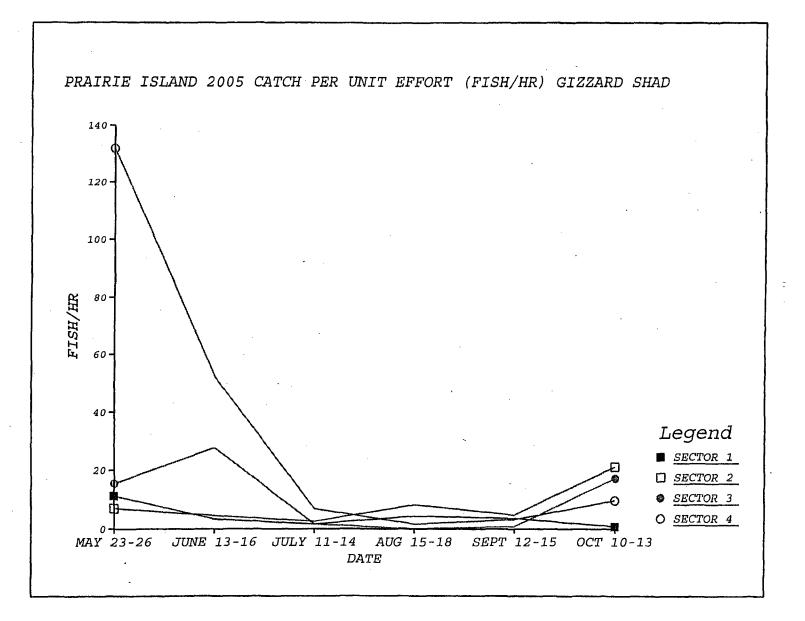
Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2005 in the vicinity of PINGP.

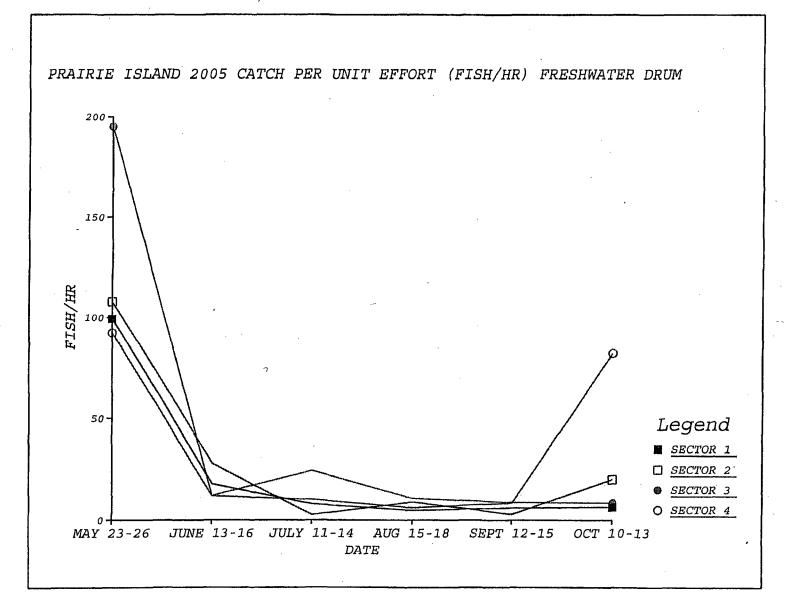




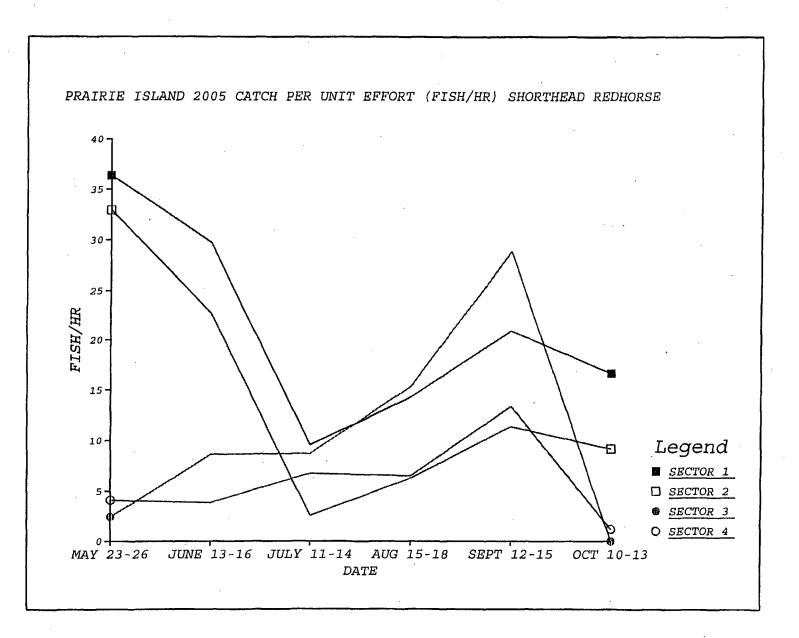


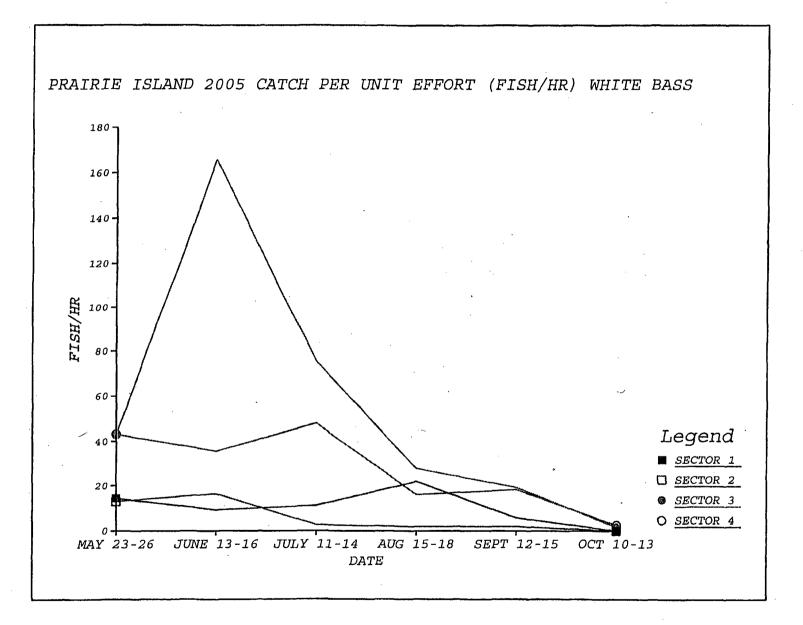


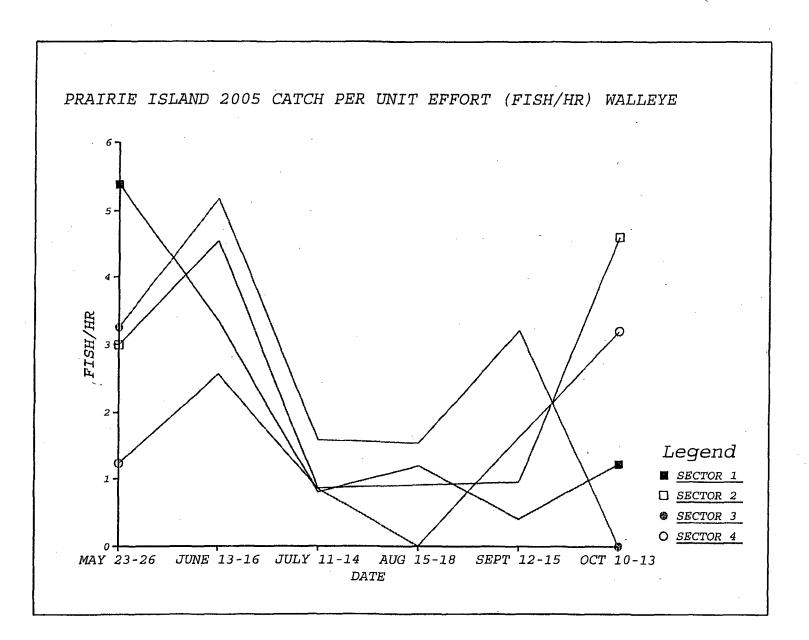


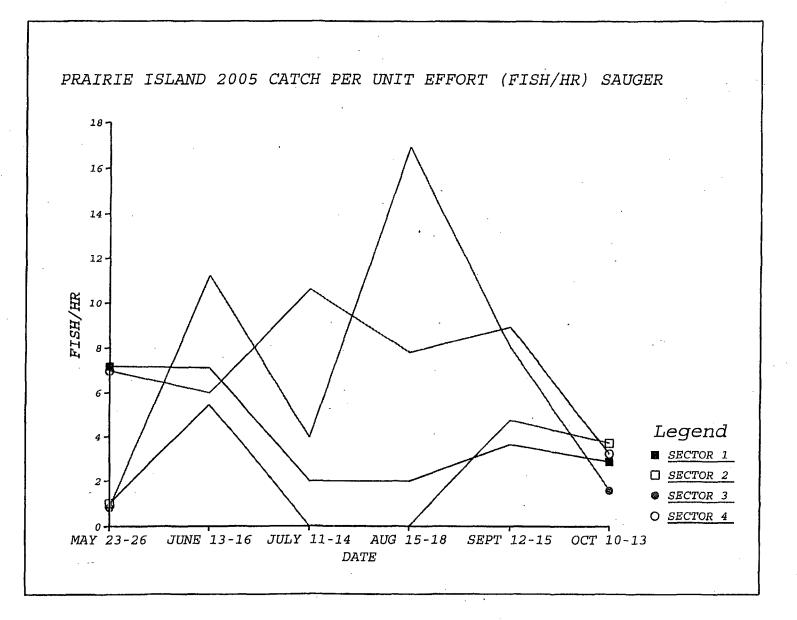


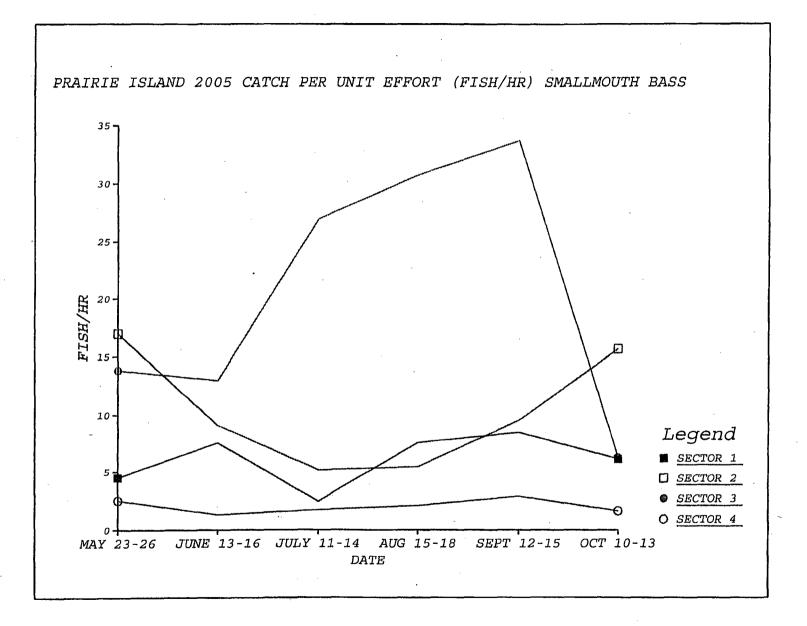
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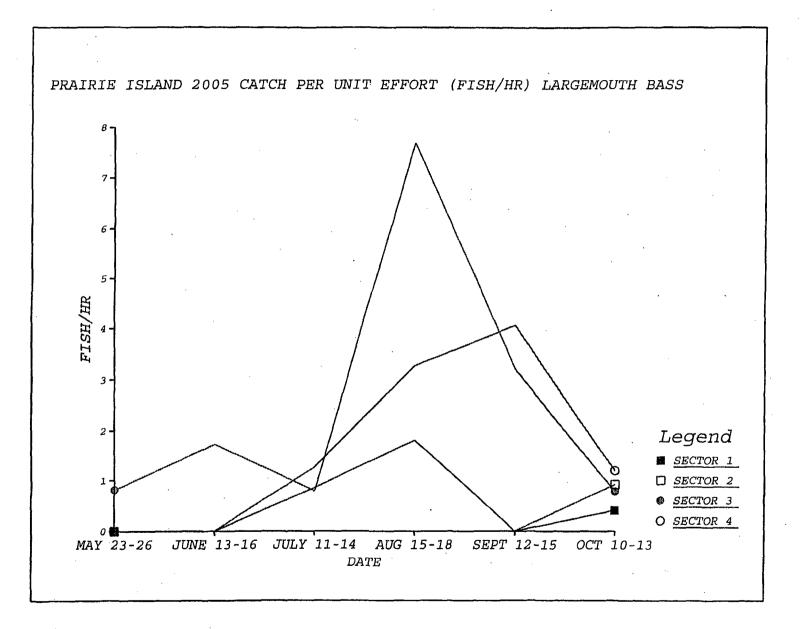


Table 1.

Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2005.

Species

<u>83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05</u>

	Chestnut lamprey	x	x							x	x			x			х	x		х	x	x			
	Ichthyomyzon castaneus		•																						
	Silver lamprey					х	х	Х	Х	X	X		Х	х	Х	х	х	х	х	х	х	х	х	х	
	Icthyomyzon unicuspus																								
	Paddlefish															х								х	
	Polyodon spathula																								
	Longnose gar	х	х	Х	х	х	Х	Х	Х	х	х	Х	х	х	х	х	х	х	х	х	х	х	х	х	
	Lepisosteus osseus																								
	Shortnose gar	Х	Х	Х	Х	Х	Х	Х	х	Х	Х	Х	Х	Х	Х	Х	Х	х	х	х	х	х	х	х	
	Lepisosteus platostomus																								
	Bowfin	х	Х	Х	Х	Х	х	Х	X	Х	Х	Х	Х	Х	Х	Х	Х	х	Χ.	х	х	Х	х	х	•
	<u>Amia calva</u>																			•					
	American eel	х	х		х	Х	Х	Х	х	Х	х	Х	х	х	Х			х	х		х			х	
	<u>Anguilla rostrata</u>																								
	Gizzard shad	Х	х	х	х	Х	х	,Χ	х	х	х	х	х	х	Х	Х	х	х	х	х	х	х	х	х	
	<u>Dorosoma cepedianum</u>							•																	
	Goldeye	х		х		х	х					х			х	х	х	х				х	х	х	
	<u>Hiodon alosoides</u>																								
	Mooneye	х	Х	Х	Х	Х	х	х	Х	х	Х	Х	Х	Х	х	Х	х	х	х	х	х	X	х	х	
	<u>Hiodon tergisus</u>									,															
	Brown trout				х									Х		Х		х		х	Х	Х		х	
	<u>Salmo trutta</u>																								
	Northern pike	х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	х	Х	Х	Х	х	х	
	Esox lucius																								•
	Musky																		х	х			х		
	Esox masquinongy																								
	Carp	х	Х	Х	х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	х	х	х	х	х	х	Х	х	х	
	<u>Cyprinus carpio</u>																								
	Carpsucker Species		Х					Х																	
	Carpiodes species							÷																	
	River carpsucker	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	X	Х	х	Х	Х	Х	х	х	
	Carpiodes carpio																								
	Quillback	х	Х	Х	X	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	х	Х	Χ.	х	Х	х	
	Carpiodes cyprinus															•									
	Highfin carpsucker			X	х	х	Х	Х	Х	Х	Х	Х	Х	х	Х	Х					Х	х	х	х	
	Carpiodes velifer																				·				
	White sucker	x	х	х	х	х	х	х	х	х	х	х	х	х		х	х	х	х	х	х	х	х		
	Catostomus commersoni										J														
											-														

Table 1 (cont.)

Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2005.

-	•	
Ľ.	n / / / / /	
	pecies	

<u>83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05</u>

Cycleptus elongatus       Northern hogsucker       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x       x
Hypentelium nigricans Smallmouth buffaloxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx<
Smallmouth buffaloxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx </td
Ictiobus bubalusBigmouth buffaloxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Bigmouth buffaloxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Ictiobus cyprinellusSpotted suckerxxxxxxxxxxxxMinytrema melanopsSilver redhorsexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Spotted suckerxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx<
Minytrema melanopsSilver redhorsexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Silver redhorsexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Moxostoma anisurumRiver redhorseXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
River redhorseXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX<
Moxostoma carinatumGolden redhorsexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx <td< td=""></td<>
Golden redhorsexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Moxostoma erythrurumGreater redhorsexxxxxxMoxostoma valenciennesiShorthead redhorsexxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Greater redhorseXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
<u>Moxostoma valenciennesi</u> Shorthead redhorse x x x x x x x x x x x x x x x x x x x
Shorthead redhorse x x x x x x x x x x x x x x x x x x x
Moxostoma macrolepidotum
Ictalurus melas
Yellow builhead x x x x x x
Ictalurus natalis
Brown bullhead x
Ictalurus nebulosus
Channel catfish x x x x x x x x x x x x x x x x x x x
Ictalurus punctatus
Flathead catfish x x x x x x x x x x x x x x x x x x x
Pylodictus olivaris
Burbot x x x x x x x x x x x x x x x x x x x
Lota lota
White bass x x x x x x x x x x x x x x x x x x
Marone chrysops
Rock bass x x x x x x x x x x x x x x x x x x
Ambloplites rupestris
Green sunfish x x x x x x x x x x x x x x x x x x x
Lepommis cyanellus

Table 1 (cont.)

Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2005.

Species

### <u>83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05</u>

Pumpkinseed							х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х
Lepomis gibbosus									`														
Orangespotted sunfish																х		х	х	·		х	
<u>Lepomis humilis</u>																							•
Bluegill	х	Х	х	X	х	х	х	х	х	х	х	х	Х	х	х	Χ.	х	х	х	х	х	х	х
Lepomis macrochirus																							
Smallmouth bass	х	х	х	х	х	х	х	Х	х	х	х	х	Х	х	х	х	х	х	х	х	х	х	х
Micropterus dolomieui																							
Largemouth bass	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	х	Х	Х	х	Х	х	Х	Х	х	х
Micropterus salmoides																		÷					
White crappie	х	Х	Х	х	Х	Х	Х	Х	Х	х	· X	Х	Х	х	х	Х	х	Х	х	Х	Х	Х	X
Pomoxis annularis																							
Black crappie	х	Х	х	Х	Х	Х	Х	X	Х	х	х	х	Х	х	Х	Х	х	х	$\cdot \mathbf{X}$	Х	х	х	х
Pomoxis nigromaculatus																							
Yellow perch	х	Х	х		х	х	х	х	х	х	х	Х	Х		Х	х	х		х	х	х	х	Х
Perca flavens						,																	
Sauger	Χ.	х	Х	х	х	Х	Х	Х	х	х	х	х	х	х	Х	х	х	х	х	х	х	х	х
Sander canadense																							
Walleye	х	х	х	х	Х	X	х	х	Х	X	х	х	Х	х	Х	х	х	Х	х	х	х	х	X
Sander vitreum																							
Saugeye															Х	Х	X		х	х	Х	х	Х
<u>S. vitreum x S. canadense</u>																							
Freshwater drum	х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Χ,	Х	Х	Х	Х	Х	X	- Х	Х	х	Х
Aplodinotus grunniens																							
Lake sturgeon																					х		
Acipenser fulvescens																					•		

# Table 2. Electrofishing CPUE (fish/hour) for each sector in the vicinity of PINGP and total number of each species collected during 2005.

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Species are listed in descending order according to average CPUE.

		according			Number	
Book Species	Sector 1	Sector 2	Sector 3	Sector 4	Average	collected
Rank Species	Sector	Seciol 2	Sector 5	Seciol 4	Average	COllected
1 Freshwater drum	22.41	27.18	42.92	35.57	32.02	1342
2 White bass	10.35	5.83	53.75	26.90	24.21	982
3 Carp	13.16	17.96	33.16	18.30	20.65	823
4 Gizzard shad	4.04	7.98	10.16	34.06	14.06	682
5 Shorthead redhorse	20.90	13.82	10.70	5.99	12.85	562
6 Smallmouth bass	· 6.10	10.13	20.86	2.00	9.77	340
	4.04	2.46	7.09	7.22	5.20	233
7 Sauger 8 Silver redhorse	5.55	3.84	1.47	4.95	3.95	189
			2.01	4.95 3.78	3.93	175
9 Quillback carpsucker	5.07	4.76				94
10 Flathead catfish	0.75	2.92	6.42	1.10 1.72	2.80 2.77	
11 Smallmouth buffalo	2.19	4.61	2.54			106
12 Bluegill	0.27	4.91	2.81	0.96	2.24	71
13 Walleye	1.99	2.46	2.41	1.58	2.11	86
14 Bigmouth buffalo	0.55	0.61	5.08	1.58	1.96	73
15 Channel catfish	0.75	5.22	0.67	0.34	1.75	55
16 Black crappie	0,27	2.76	0.40	1.79	1.31	51
17 Largemouth bass	0.07	0.61	2.54	1.65	1.22	48
18 Bowfin	0.07	0.46	0.67	2.13	0.83	40
19 White crappie	0.00	2.46	0.40	0.21	0.77	22
20 Shortnose gar	0.34	0.61	2.01	0.07	0.76	25
21 Green sunfish	0.00	2.00	0.40	0.00	0.60	16
22 Blue sucker	0.34	0.46	1.07	0.28	0.54	20
23 Mooneye	0.82	0.15	0.27	0.41	0.41	21
24 Silver lamprey	0.34	0.00	1.20	0.07	0.40	15
25 Longnose gar	0.34	0.46	0.13	0.48	0.36	16
26 Northern pike	0.14	0.00	0.54	0.55	0.31	14
27 River carpsucker	0.34	0.00	0.13	0.55	0.26	14
28 Rock bass	0.00	0.31	0.27	0.14	0.18	6
29 Yellow perch	0.14	0.31	0.13	0.00	0.14	5
30 Golden redhorse	0.07	0.00	0.00	0.21	0.07	4
31 Pumpkinseed	0.00	0.00	0.27	0.00	0.07	2
32 American eel	0.00	0.15	0.00	0.00	0.04	1
33 Highfin carpsucker	0.00	0.15	0.00	0.00	0.04	<b>1</b> .
34 Burbot	0.00	0.00	0.13	0.00	0.03	1
35 Brown trout	0.00	0.00	0.00	0.07	0.02	1
36 Goldeye	0.00	0.00	0.00	0.07	0.02	1
37 Paddlefish	0.00	0.00	0.00	0.07	0.02	
38 River redhorse	0.07	0.00	0.00	0.00	0.02	
39 Saugeye	0.07	0.00	0.00	0.00	0.02	
40 Spotted sucker	0.00	0.00	0.00	0.07	0.02	
_						
Totals	101.58	125.59	212.61	154.86	148.66	6141





Table 3. Fisheries summary for Gizzard shad 1977-2005.

		ELECTRO	TDADNET	CATCH			
		CPUE	CPUE	CATCH COMP		MEAN	
	YEAR	Fish/hr	Fish/hr	(%)	· N	LENGTH	LENGTH WEIGHT REGRESSION
-	1977	7.92	0.61	4	135	NA	LOG W=3.101 LOG L-5.163
	1978	10.20	0.20	5	73	NA	LOG W=3.068 LOG L-5.078
	1979	1.81	0.06	. 1	NA	NA	NA
	1980	10.83	0.14	7	- NA	NA	NA
	1981	23.03	0.38	9	917		LOG W=2.748 LOG L-4.348
	1982	7.39	0.09	3	276	329	LOG W=2.917 LOG L-4.741
	1983	3.57	0.26	2	155	355	LOG W=2.317 LOG L=4.741 LOG W=3.029 LOG L=5.049
	1984	0.84	0.08	1	48	281	LOG W=2.684 LOG L-4.171
	1985	0.81	0.00	1	31	325	LOG W=2.384 LOG L-3.431
	1986	0.14	0.06	<1	13	274	LOG W=2.388 LOG L-3.43 T
	1987	1.08	0.05	1	55	256	LOG W=3.030 LOG L-5.046
	1988	3.25	NA	3	139	288	LOG W=2.629 LOG L-4.015
	1989	1.07	NA	<1	47	323	LOG W=2.029 LOG L=4.015
	1990	3.99	NA	3	170	326	LOG W=2.956 LOG L-4.857
	1991	2.39	NA	4	198	338	LOG W=2.601 LOG L-3.940
	1992	1.82	NA	1.8	91	357	LOG W=3.459 LOG L-6.127
	1993	1.99	NA	1.9	62	375	LOG W=2.920 LOG L-4.728
	1994	0.28	NA	<1	14	394	LOG W=3.371 LOG L-5.955
	1995	5.10	NA	4	204	272	LOG W=2.625 LOG L-4.073
	1996	0.76	NA	<1	27	330	LOG W=3.275 LOG L-5.666
	1997	0.66	NA	<1	23	400	LOG W=3.934 LOG L-7.373
	1998	4.07	NA	2	176	260	LOG W=3.104 LOG L-5.218
	1999	27.12	NA	12	1222	290	LOG W=2.981 LOG L-4.988
	2000	40.85	NA	17	1634	290	LOG W=3.274 LOG L-5.697
	2001	10.43	NA	6	455	340	LOG W=3.767 LOG L-6.967
	2002	14.02	NA	7	612	350	LOG W=3.200 LOG L-5.518
	2003	9.51	NA	5	373	380	LOG W=3.469 LOG L-6.198
	2004	17.60	NA	10	859	290	LOG W=2.863 LOG L-4.607
	2005	14.06	NA	9	682	350	LOG W=3.072 LOG L-5.147

Table 4.

le 4. Fisheries summary for Freshwater drum 1977-2005.

		ELECTRO	TRAPNET	CATCH			
		CPUE	CPUE	COMP		MEAN	
_	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
	1977	7.49	5.27	13	569	NA	LOG W=2.947 LOG L-4.756
	1978	11.97	6.28	17	422	NA	LOG W=2.911 LOG L-4.710
	1979	7.47	5.22	21	360	NA	LOG W=3.068 LOG L-5.100
	1980	5.89	3.83	18	520	NA	LOG W=3.052 LOG L-5.026
	1981	30.88	4.76	12	1146	267	LOG W=2.891 LOG L-4.625
	1982	9.30	11.00	24	2225	293	LOG W=2.888 LOG L-4.625
	1983	8.80	8.18	22	1626	287	LOG W=3.001 LOG L-4.927
	1984	7.07	6.21	20	1212	288	LOG W=2.598 LOG L-3.919
	1985	10.15	7.92	31	1712	293	LOG W=2.846 LOG L-4.452
	1986	8.33	0.39	22	856	310	LOG W=3.089 LOG L-5.139
	1987	10.29	3.75	16	940	312	LOG W=2.874 LOG L-4.603
	1988	ʻ 9.85	NA	8	419	280	LOG W=2.722 LOG L-4.205
	1989	13.17	NA	. <b>11</b> ·	570	294	LOG W=2.908 LOG L-4.707
	1990	17.70	NA	13	724	297	LOG W=3.008 LOG L-4.957
	1991	15.68	NA	12	596	305	LOG W=2.955 LOG L-4.824
	1992	14.23	NA NA	11	539	320	LOG W=2.967 LOG L-4.829
	1993	20.83	NA	18	584	334	LOG W=3.063 LOG L-5.053
	1994	15.92	NA	14	495	332	LOG W=3.072 LOG L-5.086
	1995	14.96	NA	12	605	317	LOG W=3.124 LOG L-5.243
	1996	9.33	NA	8	374	300	LOG W≈3.061 LOG L-5.093
	1997	18.18	NA	10	812	300	LOG W=3.090 LOG L-5.159
	1998	23.47	NA	11	983	320	LOG W=3.171 LOG L-5.344
	1999	45.53	NA	17	1745	320	LOG W=3.138 LOG L-5.289
	2000	19.88	NA	8	776	310	LOG W=3.077 LOG L-5.161
	2001	28.17	NA	15	1279	330	LOG W=3.212 LOG L-5.480
	2002	24.45	NA	12	1062	320	LOG W=3.155 LOG L-5.346
	2003	37.51	NA	19	1595	350	LOG W=3.276 LOG L-5.637
	2004	21.12	NA	12	928	310	LOG W≈3.080 LOG L-5.131
	2005	32.02	NA	22	1342	330	LOG W=3.129 LOG L-5.238

Table 5.

ble 5. Fisheries summary for Shorthead redhorse 1977-2005.

ELECTRO TRAPNET         CATCH           CPUE         CPUE         COMP         MEAN           1977         5.39         1.58         5         259         NA         LOG W=2.902 LOG L-4.691           1977         5.39         1.58         5         259         NA         LOG W=2.978 LOG L-4.691           1978         2.96         1.09         4         125         NA         LOG W=2.978 LOG L-4.691           1979         2.08         0.45         3         67         NA         LOG W=3.041 LOG L-5.090           1980         6.08         0.70         7         137         NA         LOG W=2.894 LOG L-4.678           1981         11.67         1.34         7         686         376         LOG W=2.791 LOG L-4.428           1982         13.56         0.92         7         675         392         LOG W=2.849 LOG L-4.590           1983         8.96         0.79         6         454         387         LOG W=2.771 LOG L-3.440           1983         8.96         0.79         6         454         387         LOG W=2.787 LOG L-4.4590           1984         9.74         0.51         7         435         386         LOG W=2.787 LOG L-4.415     <	
YEARFish/hrFish/hr(%)NLENGTHLENGTHWEIGHTREGRESSION19775.391.585259NALOGW=2.902LOGL-4.69119782.961.094125NALOGW=2.978LOGL-4.91719792.080.45367NALOGW=3.041LOGL-5.09019806.080.707137NALOGW=2.894LOGL-4.678198111.671.347686376LOGW=2.791LOGL-4.428198213.560.927675392LOGW=2.814LOGL-4.49619838.960.796454387LOGW=2.849LOGL-4.59019849.740.517435386LOGW=2.787LOGL-3.84019857.360.517374389LOGW=2.911LOGL-4.41519867.070.198319398LOGW=2.911LOGL-4.608198713.801.2412722403LOGW=2.860LOGL-4.608	
1977       5.39       1.58       5       259       NA       LOG W=2.902 LOG L-4.691         1978       2.96       1.09       4       125       NA       LOG W=2.978 LOG L-4.917         1979       2.08       0.45       3       67       NA       LOG W=3.041 LOG L-5.090         1980       6.08       0.70       7       137       NA       LOG W=2.894 LOG L-4.678         1981       11.67       1.34       7       686       376       LOG W=2.791 LOG L-4.428         1982       13.56       0.92       7       675       392       LOG W=2.814 LOG L-4.496         1983       8.96       0.79       6       454       387       LOG W=2.849 LOG L-4.590         1984       9.74       0.51       7       435       386       LOG W=2.771 LOG L-3.840         1985       7.36       0.51       7       374       389       LOG W=2.787 LOG L-4.415         1986       7.07       0.19       8       319       398       LOG W=2.911 LOG L-4.730         1987       13.80       1.24       12       722       403       LOG W=2.860 LOG L-4.608	N
1979       2.08       0.45       3       67       NA       LOG W =3.041 LOG L=3.090         1980       6.08       0.70       7       137       NA       LOG W=2.894 LOG L=4.678         1981       11.67       1.34       7       686       376       LOG W=2.791 LOG L=4.428         1982       13.56       0.92       7       675       392       LOG W=2.814 LOG L=4.496         1983       8.96       0.79       6       454       387       LOG W=2.849 LOG L=4.590         1984       9.74       0.51       7       435       386       LOG W=2.771 LOG L=3.840         1985       7.36       0.51       7       374       389       LOG W=2.787 LOG L=4.415         1986       7.07       0.19       8       319       398       LOG W=2.911 LOG L=4.730         1987       13.80       1.24       12       722       403       LOG W=2.860 LOG L=4.608	
1980       6.08       0.70       7       137       NA       LOG W=2.894 LOG L=0.030         1981       11.67       1.34       7       686       376       LOG W=2.791 LOG L=4.678         1982       13.56       0.92       7       675       392       LOG W=2.814 LOG L=4.428         1983       8.96       0.79       6       454       387       LOG W=2.849 LOG L=4.590         1984       9.74       0.51       7       435       386       LOG W=2.787 LOG L=3.840         1985       7.36       0.51       7       374       389       LOG W=2.787 LOG L=4.415         1986       7.07       0.19       8       319       398       LOG W=2.911 LOG L=4.730         1987       13.80       1.24       12       722       403       LOG W=2.860 LOG L=4.608	
1981       11.67       1.34       7       686       376       LOG W =2.791 LOG L =4.428         1982       13.56       0.92       7       675       392       LOG W =2.814 LOG L =4.428         1983       8.96       0.79       6       454       387       LOG W =2.849 LOG L =4.496         1984       9.74       0.51       7       435       386       LOG W =2.571 LOG L =3.840         1985       7.36       0.51       7       374       389       LOG W =2.787 LOG L =4.415         1986       7.07       0.19       8       319       398       LOG W =2.911 LOG L =4.730         1987       13.80       1.24       12       722       403       LOG W =2.860 LOG L =4.608	
1982       13.56       0.92       7       675       392       LOG W 2.814 LOG L-4.496         1983       8.96       0.79       6       454       387       LOG W=2.849 LOG L-4.590         1984       9.74       0.51       7       435       386       LOG W=2.571 LOG L-3.840         1985       7.36       0.51       7       374       389       LOG W=2.787 LOG L-4.415         1986       7.07       0.19       8       319       398       LOG W=2.911 LOG L-4.730         1987       13.80       1.24       12       722       403       LOG W=2.860 LOG L-4.608	
1983         8.96         0.79         6         454         387         LOG W =2.849 LOG L=4.590           1984         9.74         0.51         7         435         386         LOG W=2.571 LOG L=3.840           1985         7.36         0.51         7         374         389         LOG W=2.787 LOG L=4.415           1986         7.07         0.19         8         319         398         LOG W=2.911 LOG L=4.730           1987         13.80         1.24         12         722         403         LOG W=2.860 LOG L=4.608	
1984         9.74         0.51         7         435         386         LOG W=2.571 LOG L=3.840           1985         7.36         0.51         7         374         389         LOG W=2.787 LOG L=4.415           1986         7.07         0.19         8         319         398         LOG W=2.911 LOG L=4.730           1987         13.80         1.24         12         722         403         LOG W=2.860 LOG L=4.608	
1985       7.36       0.51       7       374       389       LOG W=2.787 LOG L=4.415         1986       7.07       0.19       8       319       398       LOG W=2.911 LOG L=4.730         1987       13.80       1.24       12       722       403       LOG W=2.860 LOG L=4.608	
19857.360.517374389LOG W=2.787 LOG L-4.41519867.070.198319398LOG W=2.911 LOG L-4.730198713.801.2412722403LOG W=2.860 LOG L-4.608	
1987 13.80 1.24 12 722 403 LOG W=2.860 LOG L-4.608	
1988 17.48 NA 13 667 381 LOG M-2 505 LOC LA 175	
1989 24.52 NA 17 902 370 LOG W=2.792 LOG L-4.448	
1990 22.60 NA 14 838 361 LOG W=2.825 LOG L-4.544	
1991 13.58 NA 11 538 355 LOG W=2.784 LOG L-4.443	
1992 19.35 NA 14 721 403 LOG W=2.841 LOG L-4.587	
1993 10.86 NA 10 332 382 LOG W=3.011 LOG L-4.991	
1994 13.51 NA 14 505 389 LOG W=2.872 LOG L-4.655	
1995 9.67 NA 8 450 364 LOG W=2.925 LOG L-4.808	
1996 13.42 NA 11 551 380 LOG W=2.897 LOG L-4.719	
1997 19.21 NA 10 833 350 LOG W=2.982 LOG L-4.960	
1998 23.94 NA 12 1047 360 LOG W=2.982 LOG L-4.960	
1999 21.17 NA 9 931 350 LOG W=3.016 LOG L-5.050	
2000 25.94 NA 11 1099 360 LOG W=2.905 LOG L-4.760	
2001 17.43 NA 9 777 370 LOG W=3.039 LOG L-5.101	
2002 17.23 NA 9 781 370 LOG W=2.954 LOG L-4.892	
2003 20.92 NA 11 878 390 LOG W=3.033 LOG L-5.071	
2004 25.63 NA 15 1141 360 LOG W=2.948 LOG L-4.855	
2005 12.85 NA 9 562 350 LOG W=2.833 LOG L-4.544	

 Table 6.
 Fisheries summary for White bass 1977-2005.

	ELECTRO		CATCH			
	CPUE	CPUE	COMP		MEAN	
YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
 1977	7.76	6.73	19	565	NA	LOG W=2.441 LOG L-3.529
1978	7.11	5.67	17	369	NA	LOG W=2.956 LOG L-4.813
1979	3.49	3.02	13	217	NA	LOG W=3.055 LOG L-5.057
1980	2.48	1.97	9	183	NA	LOG W=3.064 LOG L-5.022
1981	30.88	5.39	20	1996	240	LOG W=2.842 LOG L-4.498
1982	28.11	0.07	18	1722	286	LOG W=2.909 LOG L-4.677
1983	17.50	4.52	17	1277	300	LOG W=3.041 LOG L-5.021
1984	13.53	2.89	15	435	304	LOG W=2.571 LOG L-3.840
1985	16.75	1.39	14	768	308	LOG W=2.773 LOG L-4.337
1986	14.23	1.63	18	732	325	LOG W=2.926 LOG L-4.716
1987	9.70	1.44	10	589	321	LOG W=3.027 LOG L-4.958
1988	22.90	NA	20	1009	242	LOG W=2.855 LOG L-4.525
1989	20.00	NA	15	819	266	LOG W=2.945 LOG L-4.765
1990	25.49	NA	16	941	295	LOG W=2.913 LOG L-4.697
1991	24.15	NA	18	886	310	LOG W=2.911 LOG L-4.696
1992	17.36	NA	11	577	338	LOG W=2.967 LOG L-4.829
1993	14.42	NA	12	390	328	LOG W=2.939 LOG L-4.750
1994	10.20	NA	10	360	339	LOG W=2.911 LOG L-4.671
1995		NA	16	809	267	LOG W=3.026 LOG L-4.975
1996	16.99	NA	14	660	320	LOG W=3.066 LOG L-5.068
1997	28.53	NA	15	1159	300	LOG W=3.054 LOG L-5.038
1998	32.90	NA	16	1314	320	LOG W=3.085 LOG L-5.106
1999	35.91	NA	14	1461	300	LOG W=3.011 LOG L-4.942
2000	39.90	NA	16	1602	320	LOG W=2.963 LOG L-4.830
2001	32.37	NA	17	1436	320	LOG W=2.967 LOG L-4.821
2002			21	1656	320	LOG W=3.042 LOG L-5.013
2003	31.22		16	1272	330	LOG W=2.977 LOG L-4.829
2004	24.29	NA	14	1011	310	LOG W=3.029 LOG L-4.960
2005	24.21	NA	16	982	330	LOG W=2.947 LOG L-4.742

Table 7. Fisheries summary for Walleye 1977-2005.

.

		ELECTRO CPUE	TRAPNET CPUE	CATCH COMP		MEAN	
	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
-	1977	1.36	0.37	1	20	NA	LOG W=3.137 LOG L-5.377
	1978	1.54	0.96	2	28	NA	LOG W=3.056 LOG L-5.197
	1979	1.57	0.31	2	34	NA	LOG W=3.225 LOG L-5.640
	1980	1.20	0.13	1	22	NA	LOG W=3.250 LOG L-5.693
	1981	3.53	0.39	. 2	189	335	LOG W=3.082 LOG L-5.240
	1982	2.96	0.16	1	135	415	LOG W=3.097 LOG L-5.293
	1983	1.63	0.21	1	90	432	LOG W=3.095 LOG L-5.295
	1984	2.04	0.11	2	93	378	LOG W=2.852 LOG L-4.615
	1985	2.64	0.13	2	119	413	LOG W=3.159 LOG L-5.461
	1986	1.99	0.15	2	101	404	LOG W=3.085 LOG L-5.269
	1987	3.00	0.09	2	132	386	LOG W=3.151 LOG L-5.446
	1988	5.80	NA	5	234	450	LOG W=3.103 LOG L-5.272
	1989	4.19	NA	3	173	408	LOG W=3.140 LOG L-5.379
	1990	2.36	NA	2	95	-420	LOG W=3.214 LOG L-5.594
	1991	1.44	NA	1	52	477	LOG W=3.318 LOG L-5.870
	1992	2.30	NA	1	82	403	LOG W=3.257 LOG L-5.727
	1993	2.00	NA	2	60	465	LOG W=3.001 LOG L-5.020
	1994	2.11	NA	2	74	439	LOG W=3.261 LOG L-5.720
	1995	2.63	NA	2	107	333	LOG W=3.208 LOG L-5.586
	1996	2.75	NA	2	118	360	LOG W=3.159 LOG L-5.467
	1997	5.63	NA	3	248	400	LOG W=3.215 LOG L-5.617
	1998	6.16	NA	3	272	420	LOG W=3.148 LOG L-5.440
	1999	7.63	NA	÷ 3	308	440	LOG W=3.238 LOG L-5.690
	2000	7.72	NA	3 ໌	325	460	LOG W=3.250 LOG L-5.717
	2001	8.93	NA	5	399	400	LOG W=3.296 LOG L-5.837
	2002	9.75	NA	5	415	390	LOG W=3.257 LOG L-5.744
	2003	7.18	NA	4	304	450	LOG W=3.253 LOG L-5.726
	2004	5.02	NA	3	232	440	LOG W=3.175 LOG L-5.494
	2005	2.11	NA	1	86	510	LOG W=3.225 LOG L-5.633

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Table 8. Fisheries summary for Sauger 1977-2005.

		ELECTRO	TRAPNET	CATCH			
		CPUE	CPUE	COMP		MEAN	
_	YEAR	Fish/hr	Fish/hr	(%)	N	LENGTH	LENGTH WEIGHT REGRESSION
_	1977	0.77	0.40	1	20	NA	LOG W=2.984 LOG L-4.991
	1978	2.43	0.38	2	38	NA	LOG W=3.100 LOG L-5.354
	. 1979	1.57	0.30	2 .	24	NA	LOG W=3.009 LOG L-5.158
	1980	1.79	0.17	2	16	NA	LOG W=3.169 LOG L-5.509
	1981	7.28	0.29	4	NA	NA	NA
	1982	7.50	0.17	4	329	256	LOG W=2.864 LOG L-4.773
	1983	3.80	0.25	3	188	285	LOG W=3.013 LOG L-5.144
	1984	4.07	0.19	3	182	262	LOG W=2.648 LOG L-4.202
	1985	4.57	0.21	4	199	283	LOG W=2.996 LOG L-5.019
	1986		0.24	4	178	294	LOG W=3.336 LOG L-5.936
	1987	4.94	0.12	2	114	262	LOG W=3.177 LOG L-5.556
	1988			2	79	236	LOG W=2.683 LOG L-4.285
	1989			2	104	237	LOG W=3.208 LOG L-5.639
	1990	2.29	NA	2	92	291	LOG W=3.070 LOG L-5.277
	1991	3 07	NA	2	117	308	LOG W=3.155 LOG L-5.507
	1992	5.24	NA	4	196	297	LOG W=3.029 LOG L-5.191
•	1993	5.71	NA	5	168	262	LOG W=2.950 LOG L-4.976
	1994	4.16	- NA	4	145	280	LOG W=3.153 LOG L-5.484
	1995	5.80	NA	5	233	243	LOG W=3.090 LOG L-5.369
	1996	5.41	NA	5	228	270	LOG W=3.142 LOG L-5.475
	1997	9.99	NA	5	437	270	LOG W=3.065 LOG L-5.294
	1998	9.57	NA	5	386	250	LOG W=3.190 LOG L-5.596
	1999	18.26		7	756	260	LOG W=3.262 LOG L-5.788
	2000	9.81	NA	4	435	280	LOG W=3.306 LOG L-5.892
	2001	6.47	NA	3	308	310	LOG W=3.356 LOG L-6.015
	2002			4	329	280	LOG W=3.350 LOG L-6.018
	2003			3	247	300	LOG W=3.281 LOG L-5.842
	2004	7.75	NA	4	333	270	LOG W=3.232 LOG L-5.678
	2005	5.20	NA	3	233	290	LOG W=3.163 LOG L-5.505

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Table 9.

Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and rank, 1981-2005.

	Smallmou	uth Bass	Largemouth Base					
Year	CPUÉ	Rank	CPUE	Rank				
1981	4.65	9	0.58	20				
1982	3.72	7	0.41	18				
1983	2.17	8	0.80	11				
1984	2.19	7	1.16	11				
1985	1.56	8	0.54	· 15				
1986	0.85	9	0.21	20				
1987	2.94	7	0.61	16				
1988	5.72	) 7	4.06	9				
1989	13.52	4	3.40	10				
1990	16.44	5	2.39	9				
1991	11.03	5	1.87	11				
1992	9.61	5	2.50	11				
1993	5.80	6	1.10	14				
1994	3.83	7	0.65	15				
1995	5.81	5	1.93	12				
1996	7.31	5	2.08	10				
1997	13.23	5	2.10	15				
1998	15.01	5	2.75	14				
1999	13.51	7	3.71	13				
2000	17.02	6	4.67	11				
2001	13.01	5	5.21	11				
2002	15.91	5	6.14	11				
2003	15.59	5	5.09	11				
2004	16.15	6	4.73	10				
2005	9.77	6	1.22	17				

Table 10.

Species composition expressed as % of total annual catches for PINGP fisheries studies, electrofishing and trapnetting combined for 1981-1987, and electrofishing only for 1988 through 2005.

		White	Freshwater		Black	Shorthead		Gizzard	
Year	Carp	bass	Drum	Sauger	Crappie	Redhorse	Walleye	Shad	Total %
1981	17	20	12	4	15	7	2	9	86
1982	23	18	24	4	9	7	1	3	89
1983	18	17	22	3	16	6	1	.2	85
1984	26	15	20	3	12	7	2	1	86
1985	20	14	31	4	9	7	2	1	87
1986	21	18	22	4	9	8	2	<1	84
1987	27	10	16	2	11	12	2	<b>1</b> ·	81
1988*	23	20	8	2	3	13	5	3	77
1989*	20	15	11	2	1	17	3	<1	70
1990*	20	16	13	1	<1	14	1	3	69
1991*	24	18	12	2	<u> </u>	11	1 -	4	73
1992*	26	12	11	4	1	14	2	2	72
1993*	28	12	18	5	<1	10	2	2	76
1994*	34	10	14	4	<1	14	2	<1	78
1995*	30	16	12	5	1	8	2	4	78
1996*	34	14	8	5	. 2	11	2	<1	76
1997*	29	15	10	5	1	10	3	<1	73
1998*	23	16	11	5	2	12	3	2	.74
1999*	17	14	17	7	3	9	3	12	82
2000*	16	16	8	4	2	11	3	17	77
2001*	15	17	15	3	2	9	5	6	72
2002*	14	21	12	4	2	9 .	5	7	74
2003*	13	16	19	3	1	11	4	5	72
2004*	14	14	12	4	1	15	3	10	73
2005*	14	16	22	3	<1	9	1	9	74

*Electrofishing only

#### SECTION III

## PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2005 ANNUAL REPORT

### FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

Study and Report by B. D. Giese

Environmental Services Water Quality Department



2005 Annual Report.DOC

#### FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

#### **INTRODUCTION**

The 2005 study was a continuation of a study started in 1992 to evaluate effects of increased water appropriation from 150 to 300 cubic feet per second (cfs) during April on impingement of larval fish on 0.5 mm mesh traveling screens at the Prairie Island Nuclear Generating Plant (PINGP). In 2005, permit approved blowdown (discharge) reduction to 300 cfs or less was initiated on April 15th, similar to 2003 and 2004, rather than on April 1st. Prior to 1992, the cooling water intake system operated with fine-mesh screens from April 16 through August 31, in accordance with Part I.C.6.c. of the plant's NPDES Permit (#MN0004006). Since 1992, for study purposes, the plant has implemented fine-mesh screen operation on April 1 to accommodate sampling during the month of April for years 1992 through 2005. Data for this evaluation were collected by pre-dawn and daylight sampling of larval fish and fish eggs from the screenwash water. This report includes fish egg, larvae, and juvenile densities, initial survival estimates, and impingement estimates from the fine-mesh screens as described in the monitoring plan. A "Legend" is included following Tables and Figures, which lists species and lifestage codes used in the tables of this report.

#### **METHODS**

Two samples were collected per sample date beginning April 5, 2005 and continuing through the end of April, with a total of 16 samples collected on 8 days. Samples were collected during predawn and daylight hours to provide diurnal comparison.

Samples were collected throughout April by diverting screenwash water from the intake screenhouse to collection tanks in the basement of the environmental lab. All eight intake screens were operating during the entire month of April.

Screenwash water flows by gravity from the screenwash trough through an 18-inch pipe to the lab basement. The larval collection tank, manufactured by Lawler, Matusky, and Skelly Engineers (Figure 1), filters screenwash water through 0.5 mm mesh nylon screen. Filtered water returns to the circulating water system via a 12-inch diameter drain pipe. The screenwash trough

was manually cleaned and the fish sampling system was flushed to remove accumulated debris and fish prior to sample collection on each date of the 2005 sample season.

During sample collection, physical parameters were recorded including collection time and duration, screen speed, number of screens sampled, river stage, and water temperature in the collection tank. Volume of river water filtered by the intake screens was obtained from the PINGP monthly external circulating water log.

Sample collection duration was 5 minutes, except the samples collected on April 14th, which had a duration of 7 and 6 minutes. Upon completion of sample collection, all fish and any debris were rinsed into two collection baskets located at the outlet end of the collection tank (Figure 2). The baskets were then removed from the tank, the contents transferred to a five gallon bucket, and transported to the fish handling and sorting area for further processing.

Samples were sorted to remove live and dead fish, with an emphasis on doing so in a timely manner. Fish were determined to be alive or dead based on the presence or absence of movement. Sorting efficiency was maximized by pouring small portions of the sample into glass baking dishes and sorting on a light table.

Observed fish and eggs were removed from the sample, and the remaining debris was rinsed into a Tyler No. 60 sieve and drained. Sample remains were preserved in a solution of 5% formalin containing rose bengal stain. Each sample was sorted a second time. Fish and eggs found during the second sort were included with those from the initial sort, and recorded as dead.

#### DATA ANALYSIS METHODS

#### Fish and Egg Density

Fish and egg densities were calculated on a pre-dawn and daylight basis from data collected during April 2005. A combination of sample duration, plant blowdown (discharge), and identification data provided density values, expressed as numbers of fish or eggs per 100 cubic meters of water withdrawn from the river for plant use. The data are presented for individual taxa and lifestage for each date (Table 1a). Pre-dawn and daylight densities of all taxa and lifestages were combined and recorded by date (Table 1b).



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Estimates of fish survival following impingement on the fine-mesh screens were calculated for each sample by totaling the number of live fish in each sample and dividing by the total number of fish in each sample (Table 1a).

Estimated numbers of fish and eggs impinged daily on the fine-mesh traveling screens was calculated by totaling the number of fish collected that day, multiplied by the proportion of the number of screens operating and sampled, and the number of minutes in the 12-hour period, divided by the number of minutes sampled (Table 3). In years 1984 to 1989, fine mesh panels of the traveling screens were not required to be operable until April 16, resulting in inconsistent start dates, which accounts for incomplete April data prior to 1992. However, when fine-mesh screens were installed earlier, impingement data were obtained. Table 4 provides water appropriation (as blowdown), flow, temperature, and average daily impingements for the dates that were sampled in April 2005. Study results contribute to the ongoing assessment of increased water appropriation effects on larval fish impingement.

#### Identification methodology

Terminology used to identify lifestage was similar to that described by Auer (1982). The larval stage was divided into two developmental phases which correspond to Auer's terms yolk-sac larvae and larvae, respectively.

#### Terminology and criteria

- Prolarvae (Yolk-sac larvae) Phase of development from time of hatch to complete absorption of yolk.
- Postlarvae (Larvae) Phase of development from complete absorption of yolk to development of the full compliment of adult fin rays and absorption of finfold.
- Juveniles Phase of development from complete fin ray development and finfold absorption to sexual maturity; includes young-of-the-year (yoy) fish.

#### **RESULTS AND DISCUSSION**

Sixteen samples were collected during April 2005, which contained a total of 63 fish (62 prolarvae and 1 juvenile) and 0 eggs. Survival was based on absence or presence of movement during the sort. Seven taxa/lifestage combinations were identified in the samples (Table 1a). Burbot is the only species expected to spawn early enough in spring, for their larvae to be in the drift and subject to impingement on the traveling screens before late April.

Blowdown was reduced from unlimited (average 987 cfs) April 1 through April 14, to less than 300 cfs on April 15th. The number of fish collected during the first half of April (four sample dates) was higher (46 fish) than during the second half of April (four sample dates-17 fish). Most of the fish collected during the first half of April were collected on the 12th when 36 individuals were sampled.

#### **Densities**

Densities by taxa/lifestage combinations of fish collected during April 2005 from the fine-mesh screens are presented in Table 1a, expressed as organisms per 100 cubic meters of water sampled. Table 1b provides diurnal density comparisons for sample dates when fish and/or eggs were collected. The data indicate that more fish and eggs were impinged during daylight hours in 2005.

#### Survival estimates

Survival estimates are included in Table 1a for taxa/lifestage combinations collected during April 2005. Overall initial survival of fish collected in 2005 was approximately 59% (Table 1a). Due to the low number of fish collected, survival estimates presented in Table 1a may be weighted too heavily. Survivorship for all taxa/lifestage combinations collected during 1984 through 1988 was summarized in the 1988 Prairie Island Annual Report (Kuhl and Mueller 1988).

#### Impingement estimates

Impingement estimates are available for years 1984-1989, 1992-2000, and 2002-2005 (Table 3). No data is presented for 2001 due to river flood levels in Spring 2001 when sampling of larval

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fish from the fine-mesh traveling screens during April was extremely limited. The plant was operating in flood by-pass conditions as communicated to MPCA at the time. Table 2 provides comparison of taxa/lifestage combinations collected in 2005 to previous years. Estimated impingement of fish collected in April of all years is shown in Table 3. Estimated impingement values during April 2005 were low as in past years during April, and taxa/lifestage combinations were similar. Data collected through 2005 suggest that more fish may be impinged on the fine-mesh screens during the first half of April with unlimited blowdown, but the total numbers are still low. Most of the fish collected during the first half of April were collected on the 12th when 36 individuals were sampled, which may have represented peak burbot drift for 2005.

#### **SUMMARY**

Larval studies were conducted at PINGP from 1984 through 1988 providing estimates of impingement, density, and survival. In 1989 and 1990 larval fish studies were done to evaluate sampling induced mortality. Sampling was not a requirement of the NPDES permit during 1991. In 1992-2005, fine-mesh screens were installed by April 1, and a larval fish study was conducted to assess impingement affects of increased water appropriation during April. Year 2005 was the fourth consecutive year sampling was conducted while the plant was operating with unlimited blowdown during the first half of April. In comparison to previous studies at PINGP, increased water appropriation may have resulted in increased impingement during the first half of April 2004, but numbers are still low.

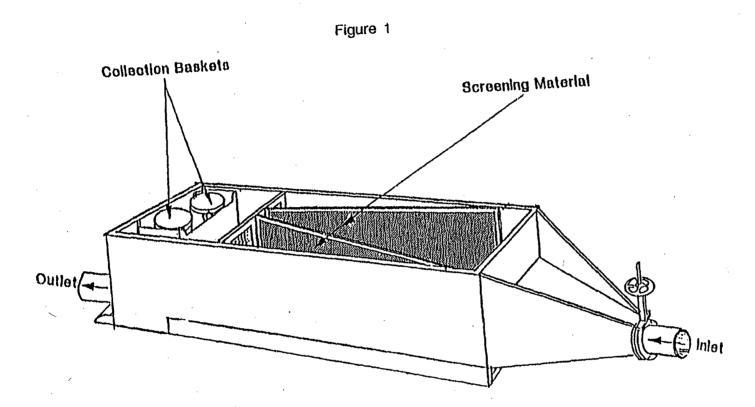
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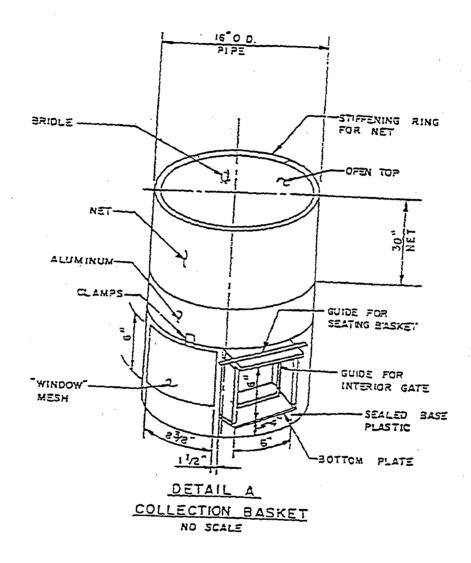




# Larval Fish Collection Tank

, Larval Fish Collection Tank Figure 1.doc





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#### Table 1a.

Survivorship and Density (fish and fish eggs/100 cubic meters) by Taxa/lifestage combination of Fish Collected on PI Fine-mesh Intake Screens During April 2005.

				· ·	Number of
Date	Taxa	Lifestage	Density	Percent Live	Fish/Egg
· · · · · · · · · · · · · · · · · · ·					
	Freshwater drum	JUV	0.047798	100	1
5-Apr-2005		PRO	0.095596	0	2
7-Apr-2005	Burbot	PRO	0.143394	33	3
12-Apr-2005	Burbot	PRO	1.414450	54	35
12-Apr-2005	Cato	PRO	0.040413	100	1
14-Apr-2005	Burbot	PRO	0.278503	50	4
19-Apr-2005	Burbot	PRO	0.176333	100	1
21-Apr-2005	Burbot	PRO	0.332728	100	2
27-Apr-2005	Yellow perch	PRO	0.187574	100	1
27-Арг-2005	Sander	PRO	0.187574	100	1
27-Apr-2005	Gizzard shad	PRO	0.187574	100	1
27-Apr-2005	Cato	PRO	0.375147	50	2
28-Apr-2005	Cato	PRO	0.171204	100	1
28-Apr-2005	Sander	PRO	0.171204	100	1
28-Apr-2005	Percid	PRO	0.684814	100	4
28-Apr-2005	Gizzard shad	PRO	0.513611	0	3

Pre-dawn Density

Table 1b.

Density of fish and eggs (fish/100 cubic meters) collected in pre-dawn and daylight samples in 2005.

Date	Pre-dawn	Daylight
	Density	Density
4/5/2005	0.095595897	0.047797949
4/7/2005	0.095595897	0.047797949
4/12/2005	0.282890004	1.171972875
4/14/2005	0.278503279	0
4/19/2005	0	0.176333256
4/21/2005	0	0.332727769
4/27/2005	0.187573623	0.750294491
4/28/2005	0.513610683	1.027221366



Table 2

Taxa/life stage combinations of fish collected in April of 2005 and previous years.

Таха	Adult	Juvenile	Postlarvae	Prolarvae
Carp			X	x
Channel catfish		x		
Cyprinid	x	X	X	X
Flathead catfish		X		
Percid	x		x	х,о
Walleye				x
Bullhead sp.		x		
Sauger			x	x
Burbot			X	Х,О
Catostomid		X		Х,О
Sander spp.				X,0
White bass		X		
Gizzard shad		x		0
Freshwater drum		X,0		
Johnny darter	x			
Shiner spp.		x		
Emerald shiner	x	x		
Bluegill		X.		
Mooneye				x
Golden redhorse		x		
Unidentified				x
Log perch	x			x
Shorthead redhorse		x		
Yellow perch				Х,О

Legend:

x = previous years data o = 2005 data



Table 3.	Estima	ted imp	ingement of f	ish collected	on P	INGP fine	-mesh	screen	s during April,	, 1984-1989	3 an	d 1992-200	Б	L		
		<u></u>				· · · · · · · · · · · · · · · · · · ·				l			L			
Date	Taxa	Life	Estimated	No of Fish	0	late	Taxa		Estimated	No of Fish	4	Date	Taxa	Life	Estimated	No of Fish
		Stage	Impingement	Collected				Stage	Impingement	Collected				Stage	Impingement	Collected
1984				·											<u></u>	
16-Apr-84		EG	384			4-Apr-86			1728			13-Apr-89			384	1
18-Apr-84		PO	384	1 _ 1		25-Apr-86			288			14-Apr-89		UN	0	· · · · · · · · · · · · · · · · · · ·
23-Apr-84		EG	3840			8-Apr-86		EG	480			18-Apr-89		UN	- 0	
25-Apr-84		JU	384			9-Apr-86			864			20-Apr-89		UN	0	0
25-Apr-84		PO	384			9-Apr-86		EG	288			21-Apr-89		UN	0	0
25-Apr-84		EG	3840		2	9-Apr-86	WE	PR	288	1		25-Apr-89		UN	0	
27-Apr-84		JU	384			1987						27-Apr-89	BUR	PR	1152	3
27-Apr-84		JU .	384			6-Apr-87		PR	1536			1992		·		
27-Apr-84		EG	2304			8-Apr-87	CARP	PR	576			1-Apr-92	CYPR	PR	288	
30-Apr-84		JŪ	384			0-Apr-87		PR	2304			1-Apr-92			288	
30-Apr-84			384			3-Apr-87		PR	2304			1-Apr-92			576	
30-Apr-84		JU	192			5-Apr-87		PR	3456		A	2-Apr-92		UN	0	
30-Apr-84		the second se	1152			6-Apr-87		PR	576			8-Apr-92		UN	0	0
30-Apr-84		EG	4416			0-Apr-87		UN	0		1	9-Apr-92		UN	0	
30-Apr-84	WE	PR	768	4		2-Apr-87		UN	0			14-Apr-92		UN	0	
1985				·		4-Apr-87		UN	0	- · ·		16-Apr-92		ŪN	0	0
19-Apr-85		JU	384	1		7-Apr-87			576		1	21-Apr-92		PR	576	1
22-Apr-85			1152	3		7-Apr-87		PR	576			23-Apr-92		UN	0	0
23-Apr-85		EG	192	1		9-Apr-87		PO	2880			28-Apr-92		UN	0	0
24-Apr-85			576		2	9-Apr-87	WE	PR	576	1		30-Apr-92		JU	288	1
24-Apr-85		PR	1344	7		1988						30-Apr-92	PERC	AD	288	1
24-Apr-85		EG	384	2		8-Apr-88	BUR	PR	768	2		1993				
24-Apr-85		PR	1536	8		1-Apr-88		UN	0			2-Apr-93		X	0	0
25-Apr-85			192	1		3-Apr-88		EG	384			6-Apr-93		PR	288	1
25-Apr-85		PR	1536	8		5-Apr-88		PR	768			8-Apr-93		EG	288	1
25-Apr-85		PR	384	2		8-Apr-88	<u>X</u>	UN	0			8-Apr-93		PR	288	1
25-Apr-85		PR	576	3		0-Apr-88		PR	768			13-Apr-93	UN	Х	0	0
26-Apr-85		PR	192	1		2-Apr-88		PR	1920	5		15-Apr-93		PR	288	1
26-Apr-85		PR	192	1		5-Apr-88		PR	1152	3		19-Apr-93		EG	1152	2
29-Apr-85		PO	96	1		7-Apr-88		PR	1152			21-Apr-93		Х	0	Ō
29-Apr-85			192	2		8-Apr-88		PR	384	1		27-Apr-93		Х	0	0
29-Apr-85			288	3	2	9-Apr-88	X	UN	0	0		29-Apr-93	UN	EG	288	1
29-Apr-85	PERC	PR	192	2		1989						1994				
1986						4-Apr-89		UN	0	0		5-Apr-94			384	1
8-Apr-86	CARP	PR	288	· 1		6-Apr-89			384	1		5-Apr-94		JU	384	1
8-Apr-86			288	1		7-Apr-89		UN	0	o	-1	5-Apr-94		PR	384	1
23-Apr-86			288	1	1	1-Арг-89		UN	0	0		5-Apr-94		PR	384	1
23-Apr-86			288	1	1:	3-Apr-89	BUR	PR	384	1		7-Apr-94		PR	288	1

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Table 3. (	cont)	Estima	ated impingen	nent of fish c	pllected on PINC	SP fine-	mesh s	creens during	April, 1984	-198	39 and 1992-2	2005.				╀
Date	Таха	Life	Estimated	No of Fish	Date	Таха	Life	Estimated	No of Fish		Date	Таха	Life	Estimated	No of Fish	1
	· ·	Stage	Impingement	Collected			Stage	Impingement	Collected				Stage	Impingement	Collected	
994 (con	it)				1996 (cont)						1999 (cont)					
12-Apr-94		PR	288		25-Apr-96		PR	504			9-Apr-99		JU	288		· (
2-Apr-94	CARP	PR	288	1	25-Apr-96		PR	252	1		9-Apr-99			. 576		
14-Apr-94		X	0	0	30-Apr-96	X	X	· 0	0		9-Apr-99		JU	288		4
19-Apr-94	CYPR	JU	288	1	1997		}				13-Apr-99		EG	288		<u> </u>
21-Apr-94		X	0	0	3-Apr-97		EG	17,280			13-Apr-99		EG	288		-
26-Apr-94	CARP	PR	1152	4	4-Apr-97		JU	1152			15-Apr-99		PR	288		
26-Apr-94	BUR	PR	288	1	4-Apr-97		PR	576			22-Apr-99		PR	576		
28-Apr-94		PR	288	1	25-Apr-97		PR	2304			27-Apr-99			288	1	-
28-Apr-94		PR	288	1	29-Apr-97		าก	864			27-Apr-99		JU	288		
1995					30-Apr-97		JU	432			27-Apr-99			288		_
3-Apr-95	CATO	JU	288	1	30-Apr-97		JU	432		1	30-Apr-97		PO	288		-
4-Apr-95	BUR	PR	288		30-Apr-97		JU	432			30-Apr-97		PR	576		
4-Apr-95	CC	JU	576		30-Apr-97	UNID	EG	864	2	1	30-Apr-97	PERC	PO	288	1	4
4-Apr-95		10	1152	2	1998						2000					1
4-Apr-95		JU	1152	2	2-Apr-1998		EG	229			4-Apr-2000		EG	14,688	51	
4-Apr-95			576		3-Apr-1998		AD	252	1		4-Apr-2000		EG	1440		
4-Apr-95		JU	9792	17	7-Apr-1998		Х	0			6-Apr-2000		EG	7,776		-
10-Apr-95	CATO	PR	288	1	9-Apr-1998	EMSH		229	1		6-Apr-2000		AD	288	1	Ľ
17-Apr-95	UNID	EG	13248		14-Apr-1998		JU	252	1		6-Apr-2000		EG	8023	39	
20-Apr-95	UNID	EG	2880	10	16-Apr-1998		JU	229			6-Apr-2000		PRO	206		-
24-Apr-95	UNID	EG	1152	4	16-Apr-1998		PR	229			13-Apr-2000		PRO	288	1	'
26-Apr-95		EG	864	3	21-Apr-1998		EG	1512	6		18-Apr-2000		JU	288	1	-
1996	1				23-Apr-1998		PR	252	1		20-Apr-2000		PRO	288	1	· .
2-Apr-96	CARP	PR	252	1	23-Apr-1998		JU	252	1		27-Apr-2000		EG	2618	10	_
4-Apr-96		EG	504	2	28-Apr-1998		EG	2016			27-Apr-2000		EG	1440		
9-Apr-96	JDAR	AD	252	1	28-Apr-1998		PR	2268			27-Apr-2000		PRO	576		
9-Apr-96		JU	252	1	28-Apr-1998		PR	2268	9		27-Apr-2000		PRO	288	1	
9-Apr-96	UNID	EG	252	1	28-Apr-1998		PR	1512	6			No valu	ies calo	culated~flood		
11-Apr-96	FWD	JU	252	1	28-Apr-1998		PR	252	1		2002					
11-Apr-96	BURB	PR	252	1	30-Apr-1998		PR	2016			4/2/2002			672	2	
11-Apr-96			504	2	30-Apr-1998	CARP	PR	14364			4/4/2002		JU	1680		
1-Apr-96			252	1	30-Apr-1998	PERC	PR	2268	9	· _	4/4/2002	Carp	EG	672	2	
1-Apr-96	BURB	PR	252	1	30-Apr-1998			252	1		4/4/2002		JU	1680	5	ſ
11-Apr-96			252	1	30-Apr-1998	GORH	JU	252	1		4/4/2002	GIZ	JU	336	1	
6-Apr-96		X	0	0	1999						4/4/2002		EG	1008	3	Ţ
18-Apr-96	x	X	0	ō	6-Apr-99	BURB	PR	522			4/4/2002	BURB	PR	1008	3	
23-Apr-96			504	2	6-Apr-99		EG	4032			4/9/2002	GIZ	JU	336	1	
23-Apr-96		EG	1008	4	9-Apr-99		JU	288	1		4/9/2002	FMSH	มม	1008	3	ſ

				c.								•			
Table 3. (conf	<u></u>	Fetime	ated impingen	ent of fish co	lected on PING	P fino_n	nach er	roons during A	nril 1084-	1080	and 1992-20	05	T	<del></del>	1
Table 0. (com	ý	Lound						100ns during /	(prii, 1504-	1303	1	<u>10.</u>			
Date	Taxa	Life	Estimated	No of Fish	Date	Таха	Life	Estimated	No of Fish	1	Date	Taxa	Life	Estimated	No of Fish
		Stage	Impingement	Collected			Stage	Impingement	Collected				Stage	Impingement	Collected
2002 (cont)					2004 (cont)						2005 (cont)				
4/9/2002			672		4/8/2004		JU	288			4/28/2005		PRO	864	3
4/9/2002		EG	288		4/8/2004		JU	3168			4/28/2005			288	1
4/11/2002			288		4/13/2004		JU	288		<u>  </u>	4/28/2005			288	1
4/11/2002			864		4/13/2004	Cypr	JU	288			4/28/2005	PERC	PRO	1152	4
4/11/2002			1800		4/13/2004			1440				<u>`</u>	l	<u>ل</u>	
4/11/2002			1800		4/13/2004			2304		3	·	ļ	<u> </u>	J	
4/11/2002		JU	360		4/15/2004		JU	288		·		<u> </u>	ļ	ļ	
4/16/2002			336		4/15/2004		EG	288			·		<b> </b>	ļ	
4/16/2002		JU	336		4/15/2004			288		ļ		ļ	ļ	ļ	
4/18/2002			336		4/20/2004			288				·	<u> </u>	<b> </b>	
4/23/2002			672		4/20/2004	ENGL	AD	288			<b> </b> '	<u> </u>		<u> </u> ]	
4/23/2002 4/25/2002		PRO	1008 672	2	4/20/2004		JU	288	1	4	<b>↓</b> /		<u> </u>	·	
4/25/2002		PRO	336		4/22/2004			2016	·	_	<b></b>	'	<u> </u>	II	
2003	anua	FILO		<u>'</u>	4/27/2004		PRO	864					'	<b>  </b>	
4/1/2003	BURB	PRO	504	1	4/27/2004			576			<u> </u>	'	{'	tt	
4/3/2003			504		4/27/2004		PRO	576			<b>∤</b> ∤	'	[	tt	
4/3/2003			2016		4/27/2004			576			<u> </u>			1	
4/3/2003		JU	1512	3	4/29/2004		PRO	1152						rt	
4/8/2003			576	1	4/29/2004			288		_			┢────┥	it	{
4/8/2003			576	1	4/29/2004		PRO	576						[]	
4/10/2003			2304	8	4/29/2004		PRO	288				[]			
4/10/2003			1152	2	2005								[]		
4/10/2003	Carp	EG	576	1	4/5/2005		JU	288	. 1	1				[]	
4/15/2003	Carp	EG	13248	23	4/5/2005			288							
4/17/2003	Carp	EG	1728	3	4/5/2005			288					$\square$	(	
4/17/2003		EG	576	1	4/7/2005			576							
4/22/2003		EG	576	1	4/7/2005			288				]		I	
4/24/2003			576	1	4/12/2005			1728			L			L	
4/24/2003			1152	2	4/12/2005	1		288			L]			L	
4/29/2003	SAU	PRO	576	1	4/12/2005			8352	29				L	L	
2004					4/14/2005			1152					I	<b>ا</b>	
4/1/2004	GIZ	JU	576	2	4/19/2005			288					ļ]	<u> </u>	
4/1/2004			288	1	4/21/2005			576	2		İİ			1	
4/1/2004		JU	288	1	4/27/2005		PRO	288	1				ļ]	·	·
4/6/2004	Cypr	JU	864	3	4/27/2005			288				·		·	
4/6/2004		JU	288	1	4/27/2005		PRO	288						J	
4/6/2004	Cvpr i	JUI	864	3	4/27/2005	ICATO	IPRO I	576	2	1 1	( . I	. 1			

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Table 4. Estimated fish and fish egg impingement data for dates sampled (when fish and/or eggs were collected) in April 2005 with corresponding blowdown, river flow and temperatures. Blowdown Average Daily Avg. daily Date Est.avg daily R. Flow (cfs) Inlet Temp. (F) impingement. (cfs) 4/5/2005 50900 44.1 864 985 46.6 864 4/7/2005 985 52300 4/12/2005 1165 47500 51.7 10368 52.0 4/14/2005 ,483 36900 1152 4/19/2005 267 46500 54.9 288 4/21/2005 283 47200 55.0 576 4/27/2005 251 40600 52.1 1440 275 51.3 4/28/2005 38300 2592



..... . .

# LEGEND

## LIFE STAGE

1

UN	=	Unidentified or Zero
EG	=`	Egg
PR	=	Prolarvae
PO	=	Postlarvae
JU	=	Juvenile
AD	=	Adult

# TAXA CODE

UNID =	Unidentified
CC =	Channel Catfish
CYPR =	Cyprinids, other than
FHC =	Flathead Catfish
PERC =	Percids, other than
BHS =	Bullhead spp.
SA =	Sauger
WE =	Walleye
STIZ =	Stizostedion spp.
BUR =	Burbot
CATO =	Catostomids
CARP =	Carp
MOON =	Mooneye
X =	No Fish

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