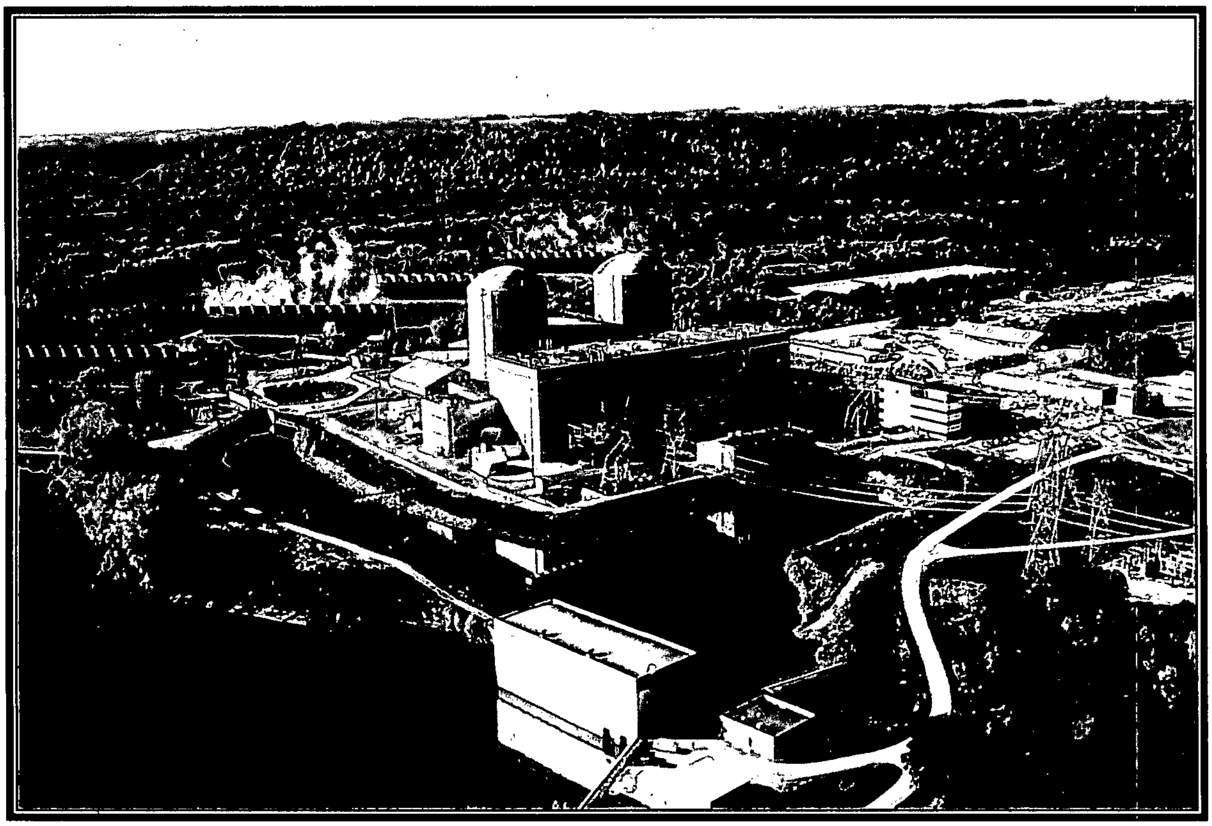
Xcel Energy

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

LICENSE RENEWAL ENVIRONMENTAL REPORT ADDITIONAL INFORMATION



Documents Requested During NRC Environmental Review

Surface Water

Binder 1 of 3

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
78	Corr Binder: Letter from Terry Birkenstock, ACE, March 11 2008. If possible, include attachment (2002 Clam Chronicle.pdf)
79	Corr Binder: Email from Tom Lovejoy, WDNR, Aug 31, 2007
80	Report regarding fish kill in 2000
82	Letter to H. Krosch and D. Kriens from W. Jensen, Chlorination of Circ Water System Fish Loss Report, October 14
83	NUS Corporation. 1976.
84	Stone and Webster. 1983.
85	Xcel Energy, 2007, PINGP Environmental Monitoring and Ecological Studies Program 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

NSP

Northern States Power Company

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

March 18, 1991

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:

1. 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 as 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

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PI Lab

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.

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.

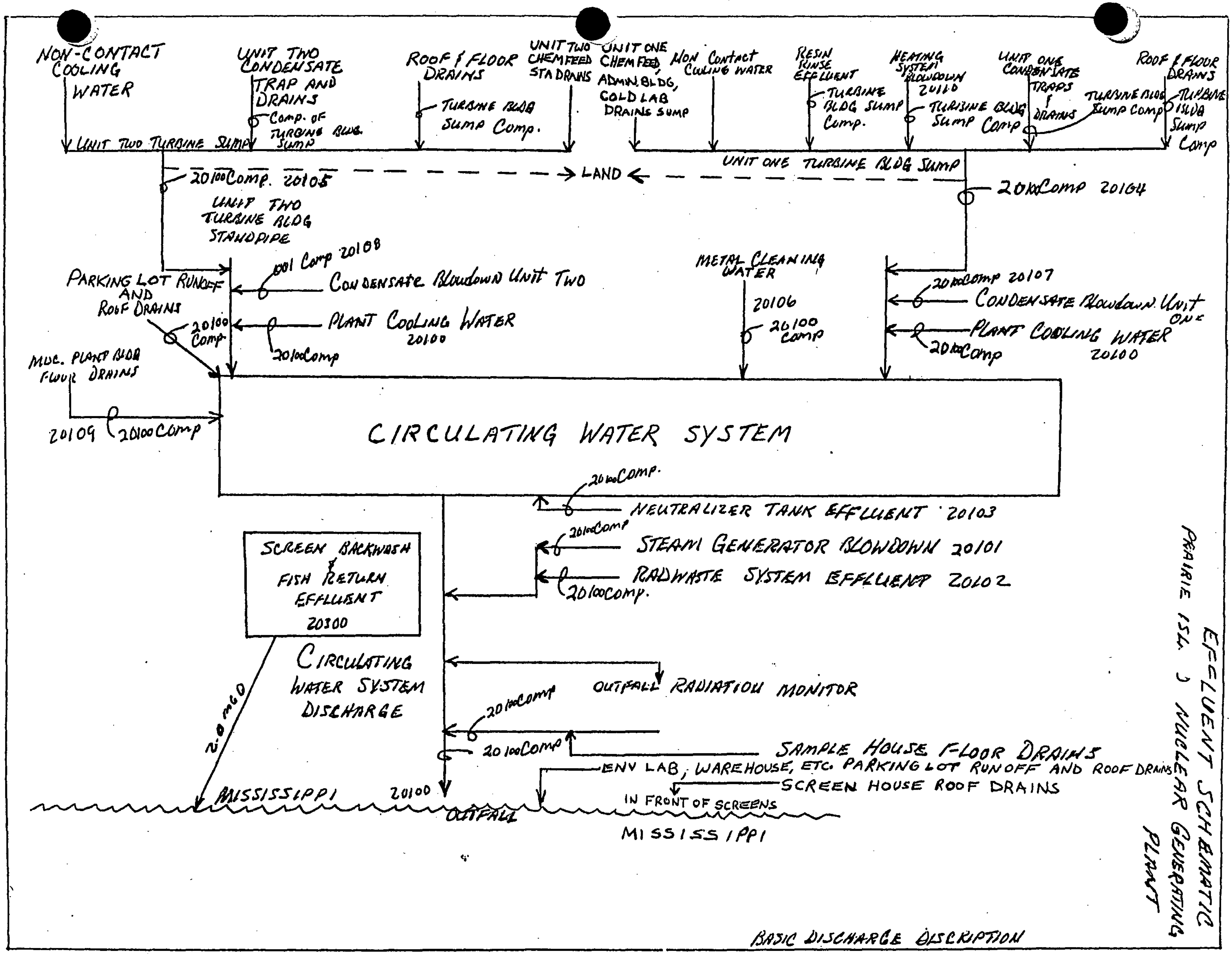
Jim Bodensteiner
Jim Bodensteiner
Plant Regulatory Analyst

kd

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


NON-CONTACT COOLING WATER
UNIT TWO CONDENSATE TRAP AND DRAINS
Comp. of TURBINE BLDG. SUMP
ROOF & FLOOR DRAINS
TURBINE BLDG SUMP Comp.
UNIT TWO CHEMFEED STA DRAINS
UNIT ONE CHEMFEED, ADMIN. BLDG, COLD LAB DRAINS SUMP
NON CONTACT COOLING WATER
RESIN RINSE EFFLUENT
TURBINE BLDG SUMP Comp.
HEATING SYSTEM BLOWDOWN 20110
TURBINE BLDG SUMP Comp
UNIT ONE CONDENSATE TRAPS & DRAINS
TURBINE BLDG SUMP Comp
ROOF & FLOOR DRAINS
TURBINE BLDG SUMP Comp
UNIT TWO TURBINE SUMP
UNIT ONE TURBINE BLDG SUMP
20100 Comp. 20105
LAND
20100 Comp 20104
UNIT TWO TURBINE BLDG STANDPIPE
001 Comp 20108
CONDENSATE BLOWDOWN UNIT TWO
PARKING LOT RUNOFF AND ROOF DRAINS
20100 Comp
PLANT COOLING WATER 20100
20100 Comp
MISC. PLANT BLDG FLOOR DRAINS
20109
20100 Comp
METAL CLEANING WATER
20106
20100 Comp
20100 Comp 20107
CONDENSATE BLOWDOWN UNIT ONE
PLANT COOLING WATER 20100
20100 Comp
CIRCULATING WATER SYSTEM
20100 COMP.
NEUTRALIZER TANK EFFLUENT 20103
20100 Comp
STEAM GENERATOR BLOWDOWN 20101
RADWASTE SYSTEM EFFLUENT 20102
20100 Comp.
SCREEN BACKWASH & FISH RETURN EFFLUENT 20300
CIRCULATING WATER SYSTEM DISCHARGE
2.0 MGD
OUTFALL RADIATION MONITOR
20100 Comp
20100 Comp
SAMPLE HOUSE FLOOR DRAINS
ENV LAB, WAREHOUSE, ETC. PARKING LOT RUNOFF AND ROOF DRAINS
SCREEN HOUSE ROOF DRAINS
IN FRONT OF SCREENS
MISSISSIPPI
20100
OUTFALL
MISSISSIPPI
EFFLUENT SCHEMATIC
PRAIRIE ISL. NUCLEAR GENERATING PLANT
BASIC DISCHARGE DISCRIPTION

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 cfs to minimize larval fish and egg entrainment. The same permit requires installation of the fine-mesh 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-mesh 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 walleye/sauger are present in most years. The number of walleye/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. Walleye/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 that time of year. According to the larval program data ichthyoplankton density in April rarely exceeds one organism/100 cubic meters compared to 100 to 350 organisms/100 cubic meters later in the year.

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 affected by debris load of the Mississippi. Figure 2 plots both debris load and larval survival showing this relationship. Figure 2 also indicates the low debris density present in April.

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 impingement. 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.

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

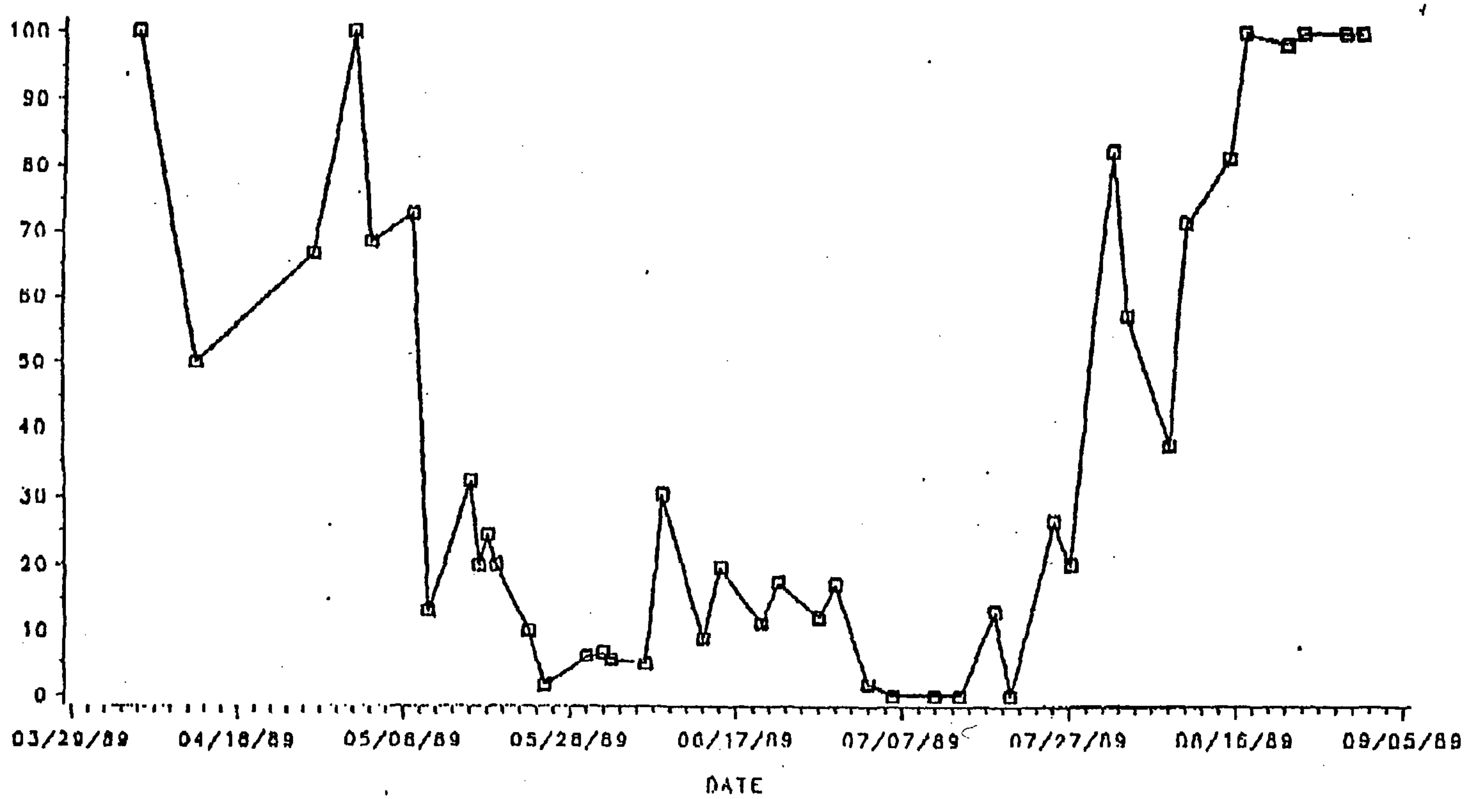
	Est. April Impingement	Est. Seasonal Impingement	April % of Season	April % Comp
1984				
Channel catfish	1152	328277837	0.0004%	6%
Cyprinidae	1152	48756633	0.0024%	6%
Flathead catfish	192	1010311	0.0190%	1%
Percidae	1152	994091	0.1159%	6%
Walleye	768	258048	0.2976%	4%
Carp	384	71891915	0.0005%	2%
Unid. egg	14784	2747032	0.5382%	75%
April Total	19584			100%
1985				
Bullhead spp.	384	2688	14.2857%	4%
Percidae	2112	150967	1.3990%	22%
Sauger	3072	28637	10.7274%	33%
Stizostedion spp.	576	2573	22.3863%	6%
Walleye	2112	13978	15.1095%	22%
Burbot	96	448	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			100%
1986				
Carp	288	20619534	0.0014%	6%
Cyprinidae	864	1243768	0.0695%	17%
Percidae	2880	249966	1.1522%	57%
Walleye	288	52774	0.5457%	6%
Unid. egg	768	328630	0.2337%	15%
April Total	5088			100%
1987				
Burbot	10176	24192	42.0635%	66%
Carp	576	4847034	0.0119%	4%
Percidae	576	352552	0.1634%	4%
Sauger	3456	85856	4.0253%	23%
Walleye	576	10752	5.3571%	4%
April Total	15360			100%
1988				
Burbot	6912	23072	29.9584%	100%

Table 2. Effect of plant blowdown volume on estimated impingement. Based on mean April density from the annual larval sampling.

Year	April Mean Density #/100 Ft3	Est # Fish Impinged In April @ 150 cfs	Est # Fish Impinged In April @ 300 cfs	Est # Fish Impinged Per Year	% of Annual Total Impinged In April @ 150 cfs	% of Annual Total Impinged In April @ 300 cfs
1984	0.0197	38297	76594	492818639	0.008%	0.016%
1985	0.0076	11820	23639	42407029	0.028%	0.056%
1986	0.0038	6402	12804	62753051	0.010%	0.020%
1987	0.0083	26892	53784	77144700	0.035%	0.070%
1988	0.0041	12221	24443	67187232	0.018%	0.036%

FIGURE 1

PERCENT SURVIVAL OF OTHER FISH 1989



DEBRIS AND SURVIVAL 1989

Debris volume and survival of other fish

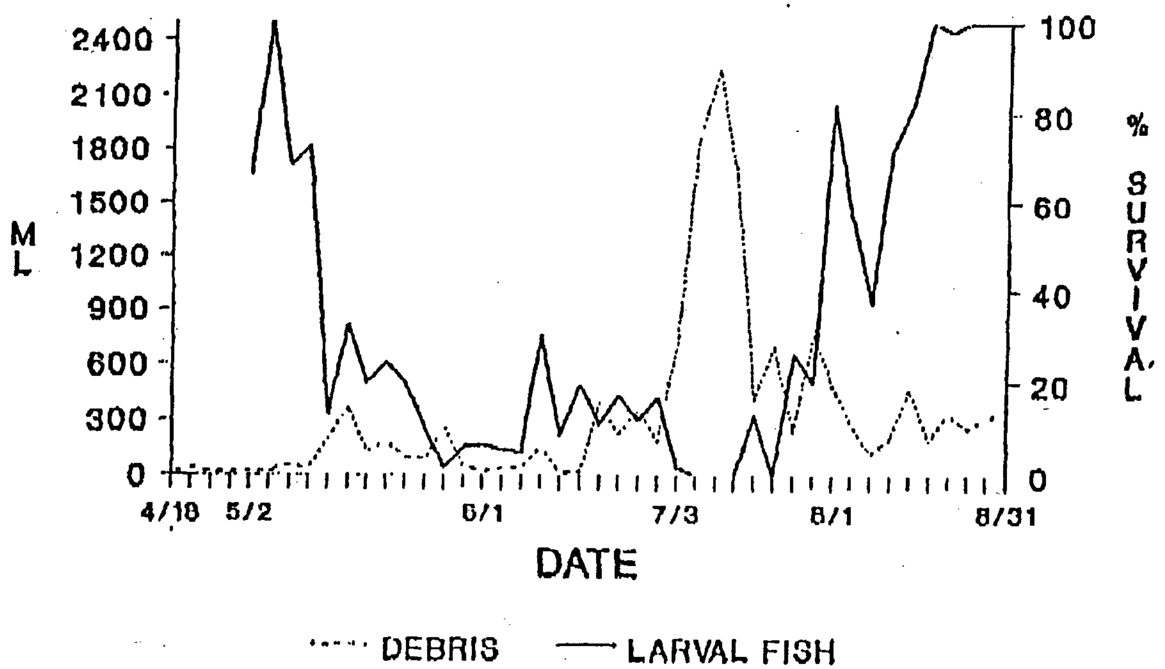


FIGURE 2

PINGP-112

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
ENVIRONMENTAL MONITORING
AND
ECOLOGICAL STUDIES PROGRAM

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

SECTION I

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
ENVIRONMENTAL MONITORING PROGRAM
2000 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.

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.

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.

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.

DATE JANUARY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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	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
9	24	24	32.7	36.9	949
10	24	24	33.5	36.1	949
11	24	24	32.8	36.2	955
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
17	24	24	32.4	36.4	949
18	24	24	32.3	36.4	949
19	24	24	32.5	36.0	949
20	24	24	31.6	35.4	949
21	24	24	31.6	35.6	949
22	24	24	32.3	36.6	949
23	24	24	32.0	36.4	949
24	24	24	31.9	35.6	949
25	24	24	32.4	35.9	949
26	24	24	31.7	35.7	949
27	24	24	31.8	36.0	949
28	24	24	32.0	36.2	949
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.

DATE FEBRUARY	PERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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
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
	MONTHLY MINIMUM		32.0	36.2	945
	MONTHLY MAXIMUM		38.1	39.0	979
	MONTHLY MEAN		33.6	37.1	951

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 MARCH	OPERATING HOURS UNIT 1	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
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
25	24	24	42.6	45.6	1003
26	24	24	42.9	46.3	1009
27	24	24	43.4	45.7	1009
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
		MONTHLY MINIMUM	35.9	37.2	418
		MONTHLY MAXIMUM	45.9	48.6	1015
		MONTHLY MEAN	39.9	41.8	969

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 APRIL	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	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
9	24	24	44.5	45.8	283
10	24	24	45.4	46.8	291
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
19	24	24	46.8	47.0	148
20	24	24	46.3	47.1	148
21	24	24	47.9	49.1	267
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	0	56.4	57.9	148
	MONTHLY MINIMUM		43.3	44.8	148
	MONTHLY MAXIMUM		57.1	58.7	291
	MONTHLY MEAN		47.7	49.1	251

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 MAY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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
11	24	0	63.6	64.3	283
12	24	0	63.3	64.1	299
13	24	0	60.6	62.2	283
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
20	24	0	59.5	60.4	291
21	24	0	61.3	62.2	291
22	24	0	63.6	64.4	299
23	24	0	65.5	66.3	291
24	24	0	64.9	66.1	291
25	24	0	64.0	65.0	291
26	24	0	65.9	66.6	291
27	24	0	64.9	66.1	291
28	24	0	63.5	63.8	291
29	24	0	62.0	63.0	299
30	24	0	63.1	64.2	299
31	24	0	63.5	64.2	299
	MONTHLY MINIMUM		57.6	58.3	151
	MONTHLY MAXIMUM		67.5	68.7	299
	MONTHLY MEAN		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.

DATE JUNE	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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	0	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
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
21	24	24	69.3	69.0	776
22	24	24	68.0	69.0	776
23	24	24	69.9	70.6	776
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
MONTHLY MINIMUM			63.3	64.1	280
MONTHLY MAXIMUM			72.0	73.2	776
MONTHLY MEAN			68.6	69.6	589

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 JULY	OPERATING HOURS UNIT 1	OPERATING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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	72.7	73.9	776
		MONTHLY MAXIMUM	81.0	81.0	1166
		MONTHLY MEAN	76.1	77.5	1149

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 AUGUST	OPERATING HOURS UNIT 1	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	73.4	74.5	1145
		MONTHLY MAXIMUM	80.2	81.6	1208
		MONTHLY MEAN	76.2	77.7	1171

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 SEPTEMBER	OPERATING HOURS UNIT 1	OPERATING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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 MINIMUM	59.7	63.3	1103
		MONTHLY MAXIMUM	74.8	77.4	1208
		MONTHLY MEAN	67.2	70.2	1151

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 OCTOBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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	61.8	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
31	24	24	54.8	56.9	1145
	MONTHLY MINIMUM		51.6	56.2	1124
	MONTHLY MAXIMUM		63.2	67.7	1187
	MONTHLY MEAN		57.0	60.7	1152

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	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	56.4	58.8	1145
2	24	24	56.2	58.0	1124
3	24	24	53.7	55.6	1145
4	24	24	51.9	54.6	1124
5	24	24	51.3	54.3	1145
6	24	24	51.4	53.8	1124
7	24	24	51.3	52.7	1124
8	24	24	47.7	48.4	1124
9	24	24	46.6	47.7	1124
10	24	24	45.4	46.3	1110
11	24	24	45.3	45.6	1096
12	24	24	45.3	45.7	1096
13	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
19	24	24	38.1	38.4	873
20	24	24	36.9	37.2	873
21	24	24	35.9	36.6	872
22	24	24	36.0	35.8	865
23	24	24	35.3	35.7	865
24	24	24	35.1	35.3	865
25	24	24	35.3	35.7	765
26	24	24	35.3	35.9	865
27	24	24	35.6	36.2	872
28	24	24	34.8	35.0	872
29	24	24	36.2	36.4	865
30	24	24	36.1	36.6	872
		MONTHLY MINIMUM	34.8	35.0	765
		MONTHLY MAXIMUM	56.4	58.8	1145
		MONTHLY MEAN	42.8	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	OPERATING HOURS UNIT 1	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	0	24	34.4	34.4	412
5	0	24	31.8	33.3	413
6	0	24	32.3	33.6	402
7	0	24	32.4	33.8	402
8	0	24	32.2	33.6	402
9	0	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	0	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

Table 2

Daily 2000 Mississippi River Discharge Flow Rate (cfs) at Lock Dam 3

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	10400.	8700.	28200.	19000.	14400.	19300.	18900.	11900.	6900.	5400.	9300.	14300.
2	10400.	8500.	25500.	18800.	13200.	20300.	16800.	12000.	7800.	5500.	11300.	15200.
3	10400.	8500.	26900.	17400.	12100.	20100.	17800.	12000.	7700.	5500.	13500.	13400.
4	10700.	8500.	28400.	16200.	11100.	21100.	16700.	9600.	14400.	6300.	11300.	10900.
5	10400.	8400.	28900.	15900.	11400.	26000.	16300.	9500.	8600.	6900.	11300.	9300.
6	10700.	8500.	28800.	17000.	12000.	26700.	14800.	8300.	4500.	5400.	12400.	8100.
7	10300.	8600.	26600.	16000.	12000.	27400.	14700.	9800.	5300.	5500.	19300.	8200.
8	9000.	8500.	26200.	16000.	12100.	27700.	14100.	9700.	8200.	5400.	20700.	8100.
9	9000.	8600.	26000.	15500.	13300.	27900.	20900.	11100.	8000.	5400.	18600.	8100.
10	8900.	8400.	24000.	15300.	13100.	27100.	25800.	10900.	6200.	5400.	20200.	8400.
11	10800.	7800.	24300.	15100.	13200.	27300.	24000.	8000.	8400.	6200.	22400.	8900.
12	10500.	7700.	23700.	15100.	18600.	24800.	25900.	8000.	8900.	6700.	23600.	9100.
13	10100.	7800.	25600.	13400.	21300.	20100.	30100.	8200.	7800.	6700.	23200.	8600.
14	8500.	7800.	25700.	13800.	20000.	19200.	32200.	8800.	5800.	5400.	23500.	7200.
15	8400.	7700.	24600.	14500.	20000.	18400.	33200.	8300.	5100.	6200.	23000.	7200.
16	8500.	7800.	22900.	14300.	20900.	15800.	33200.	8200.	5200.	5400.	23300.	8200.
17	8100.	7800.	20700.	14400.	22300.	17100.	32000.	7300.	7500.	5400.	23800.	8500.
18	7900.	7800.	19800.	14300.	22300.	16500.	31000.	12100.	7500.	6200.	22500.	8500.
19	8000.	7700.	19500.	13000.	23300.	18400.	29500.	14900.	5400.	6800.	22200.	9600.
20	8100.	7700.	17700.	15200.	22700.	19400.	27000.	11900.	5500.	6900.	21000.	10100.
21	8100.	7600.	15800.	15100.	22300.	22000.	23800.	10800.	5500.	7500.	18700.	10100.
22	8000.	7700.	15700.	15200.	24800.	22100.	21200.	11200.	6100.	7400.	14000.	10000.
23	8000.	8500.	1500.	14700.	26900.	23900.	20400.	10600.	6100.	7500.	14100.	9700.
24	7800.	10500.	15200.	16000.	27400.	24100.	16400.	10100.	6000.	8200.	14200.	9500.
25	8100.	12400.	16600.	16500.	26100.	23000.	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. 33200.

YEAR MIN. 4500.

Table 3 2000 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

Month	Mean Plant Flow (cfs)	Mean River Flow (cfs)	Percentage of Mean River Flow 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%

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

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**

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**

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

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

Environmental Services
Water Quality Department

SUMMARY OF THE 2000 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, 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.

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:

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

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 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 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
Sector Four;	white bass, gizzard shad and carp
Overall CPUE Average;	gizzard shad, 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 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 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).

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).

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

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 regression slope 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).

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 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).

WALLEYE

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).

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

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 lowest 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

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).

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 occuring 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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Figure 1 PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA

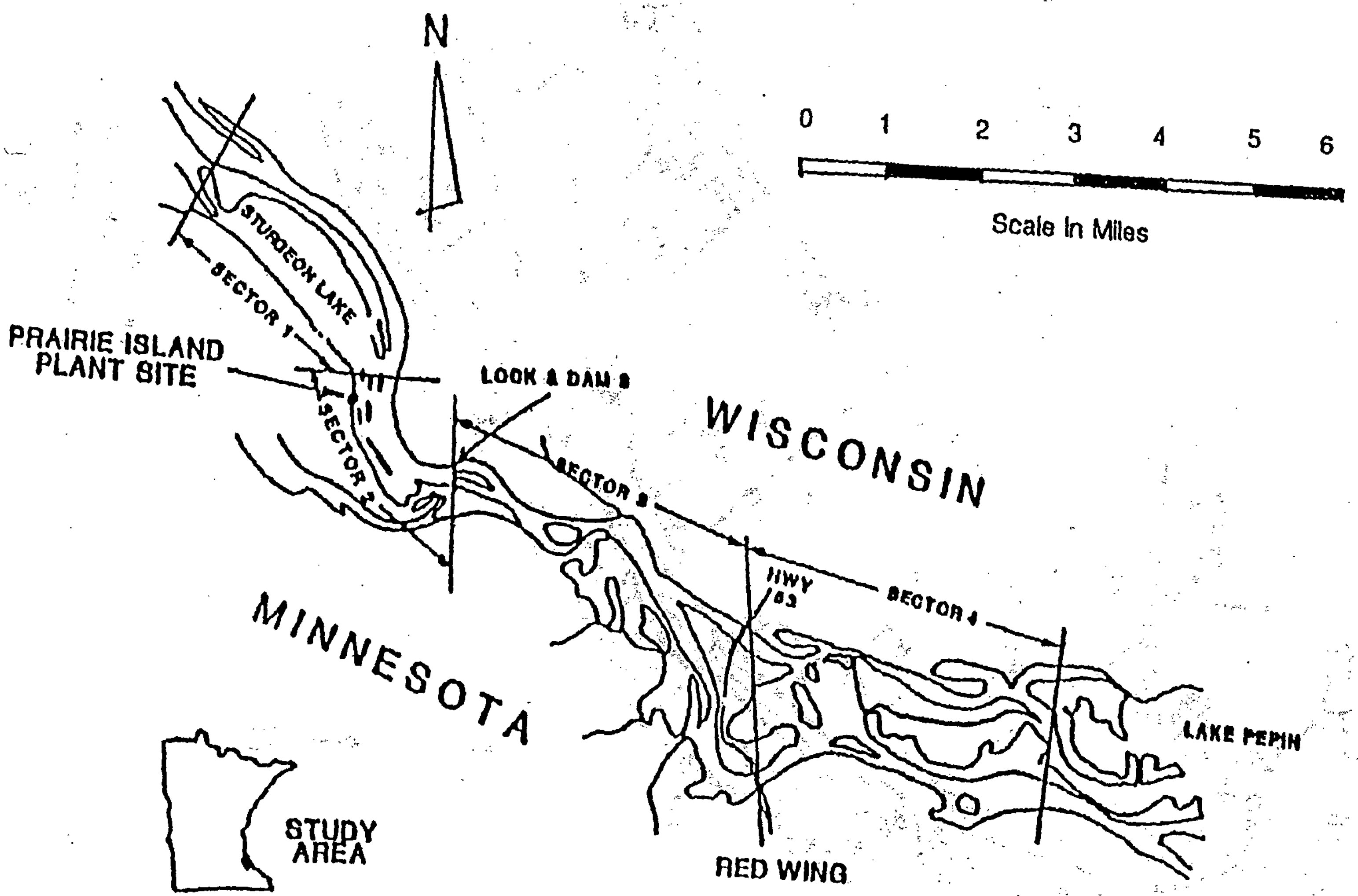


Figure 2.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Upstream
(Sec 1 Runs 1-20)

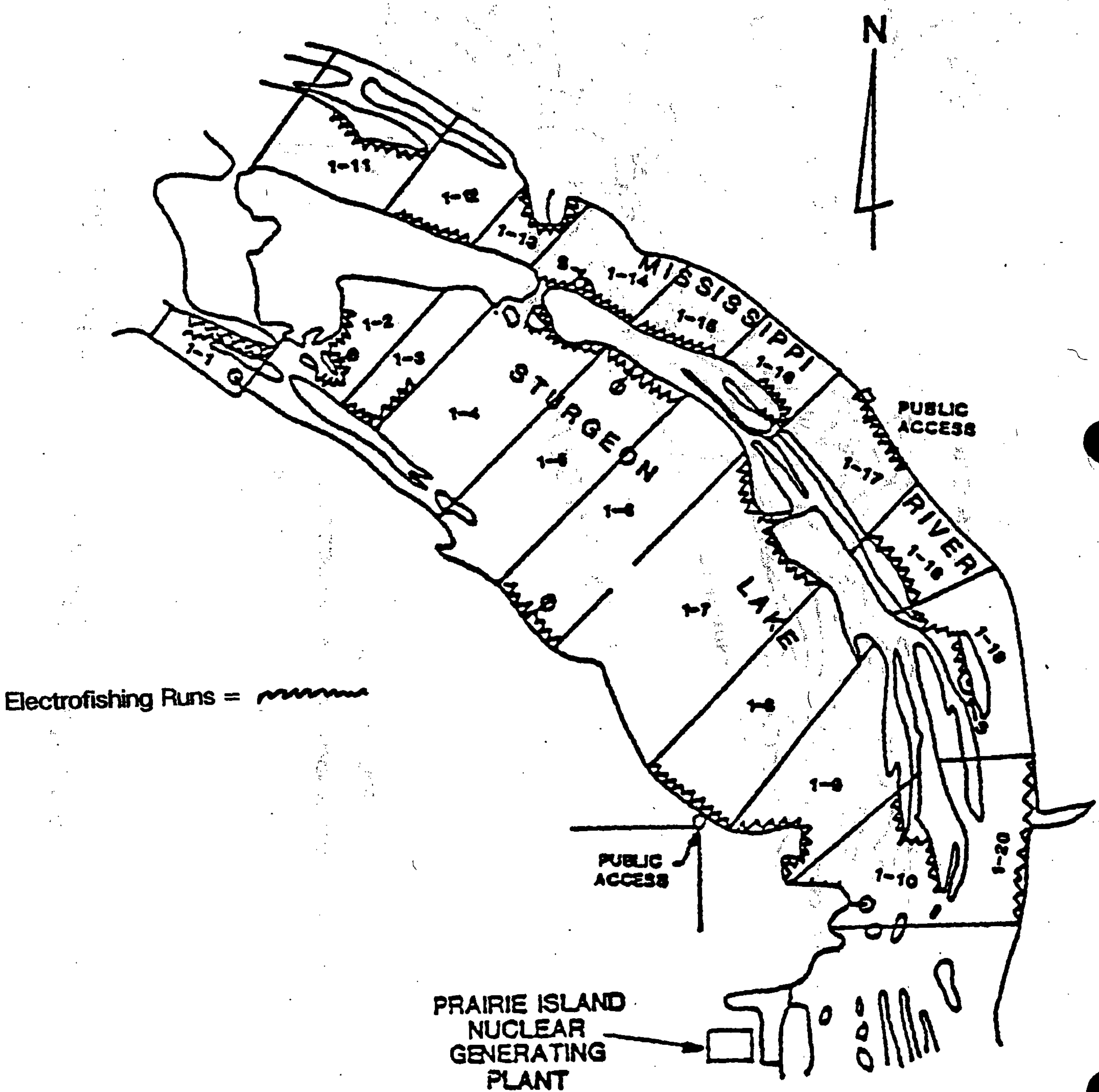


Figure 3.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

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

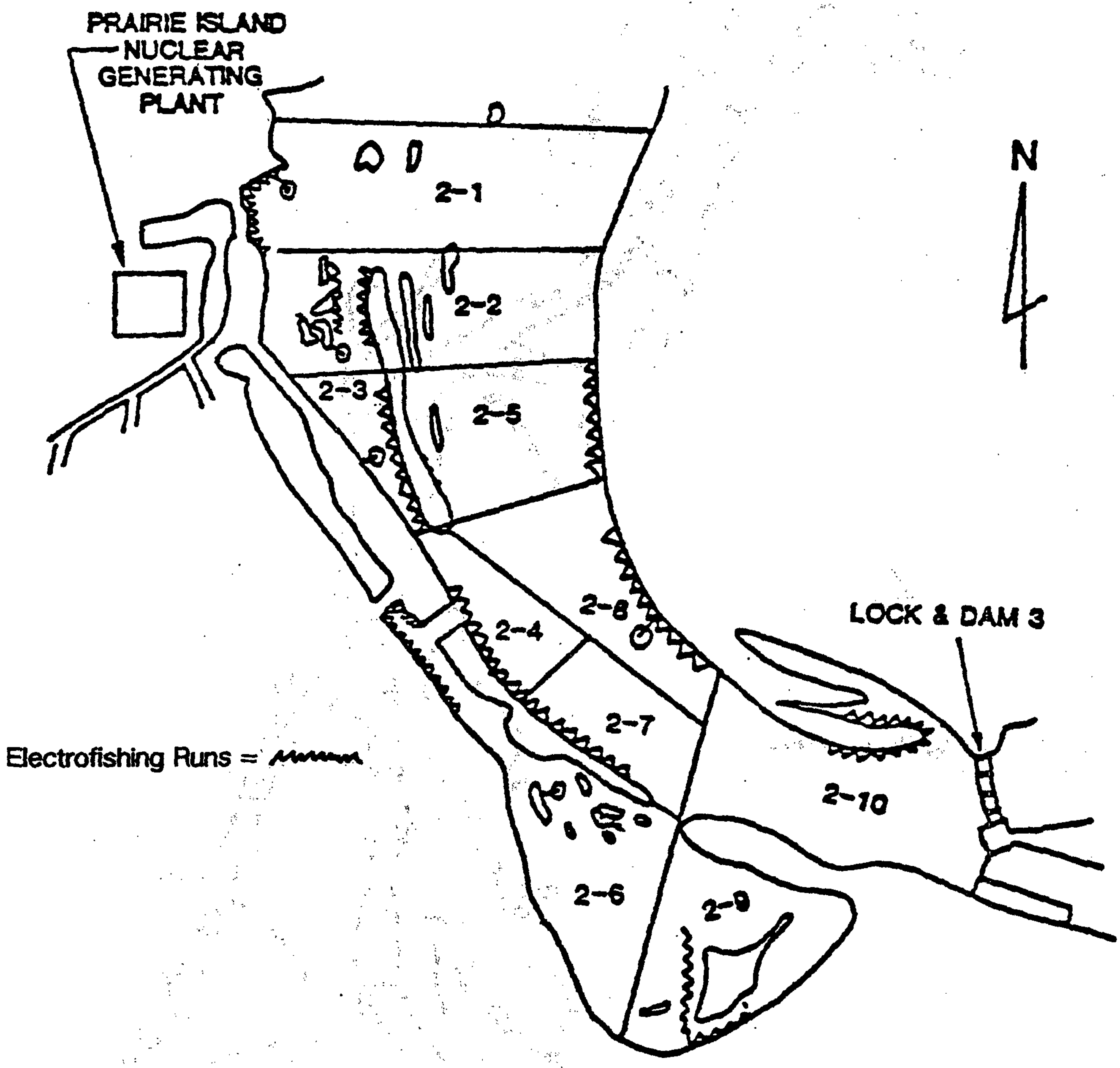
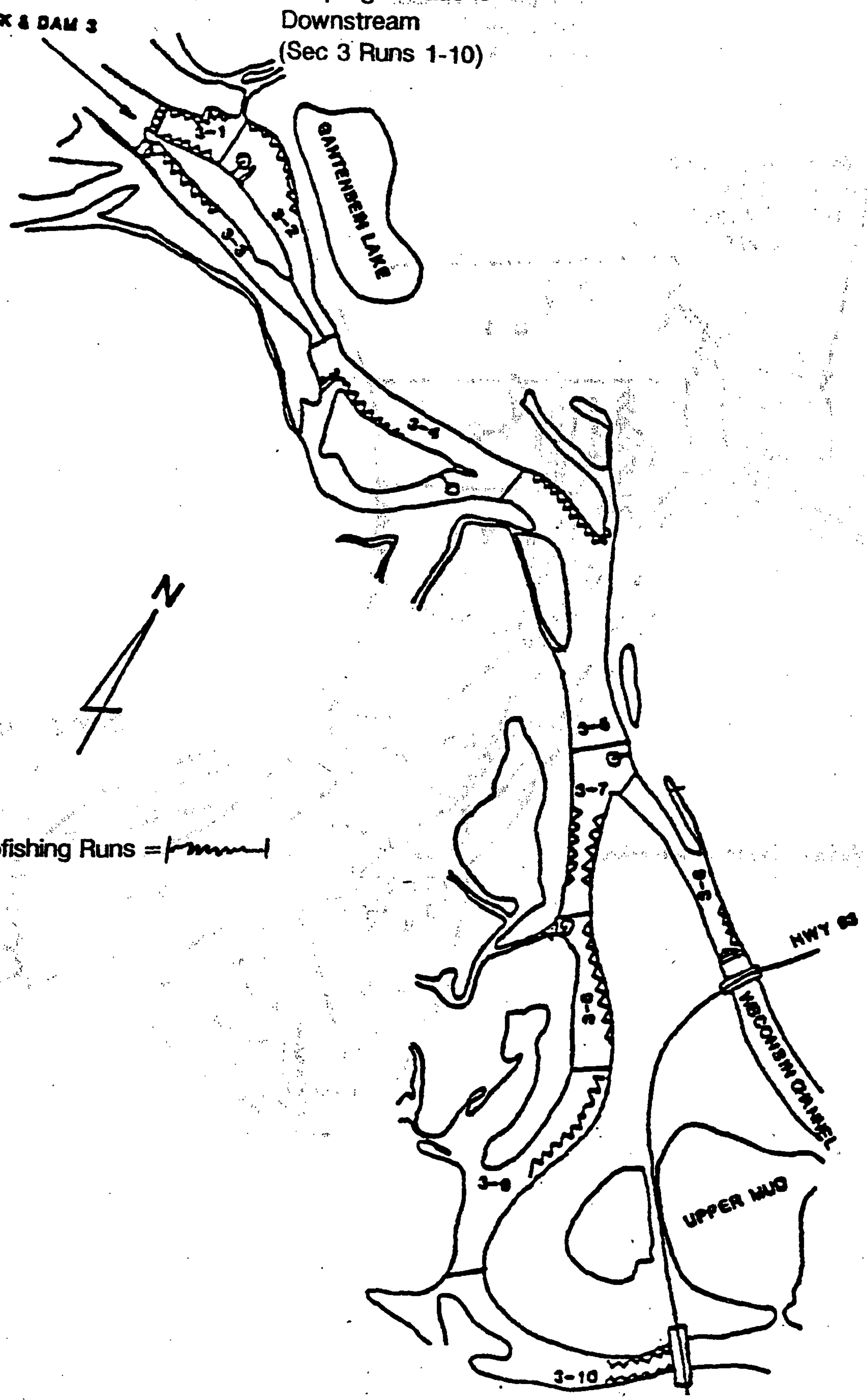


Figure 4.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 3 Runs 1-10)

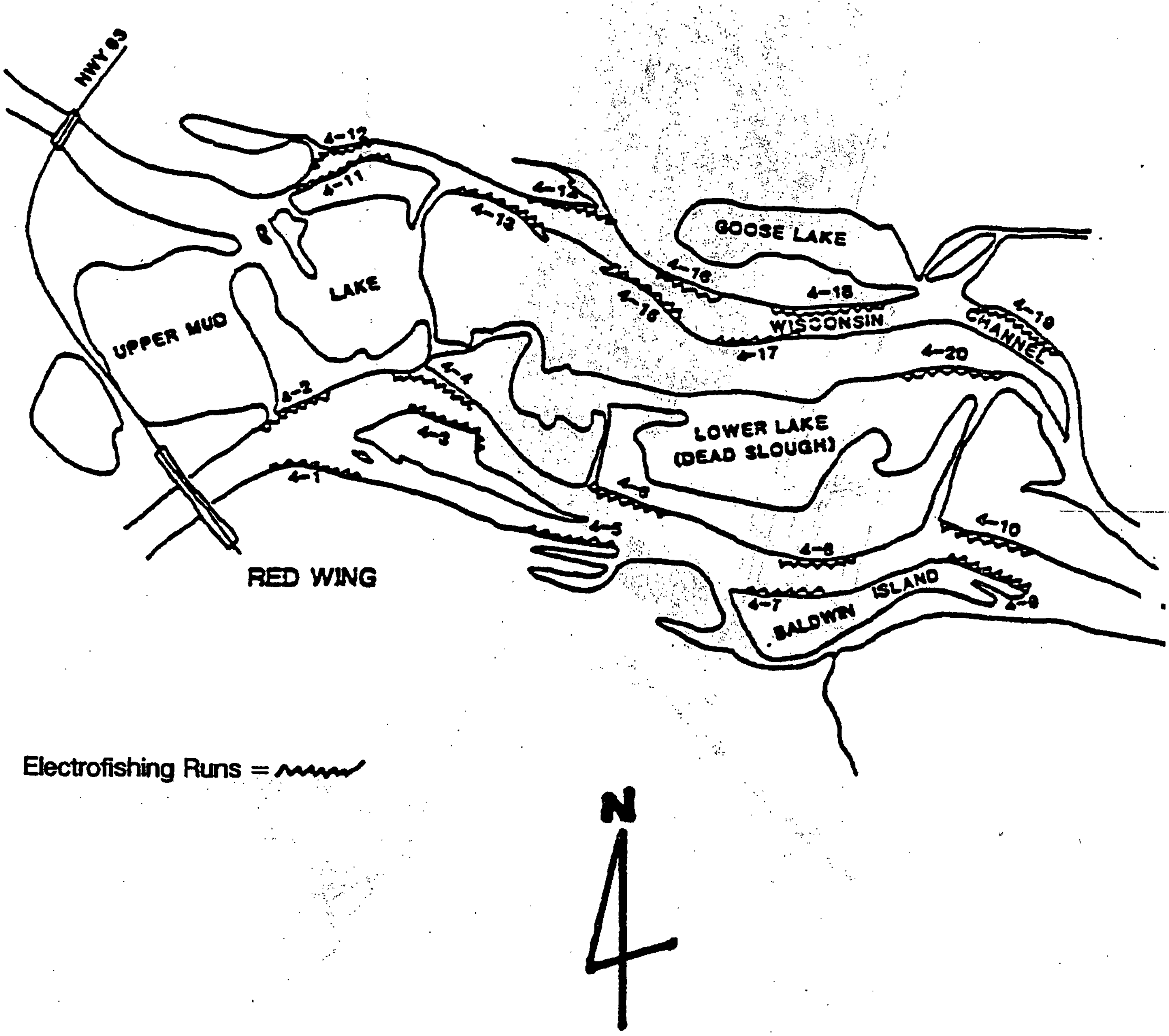


Electrofishing Runs = ⊢〰〰⊣

Figure 5.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 4 Runs 1-20)



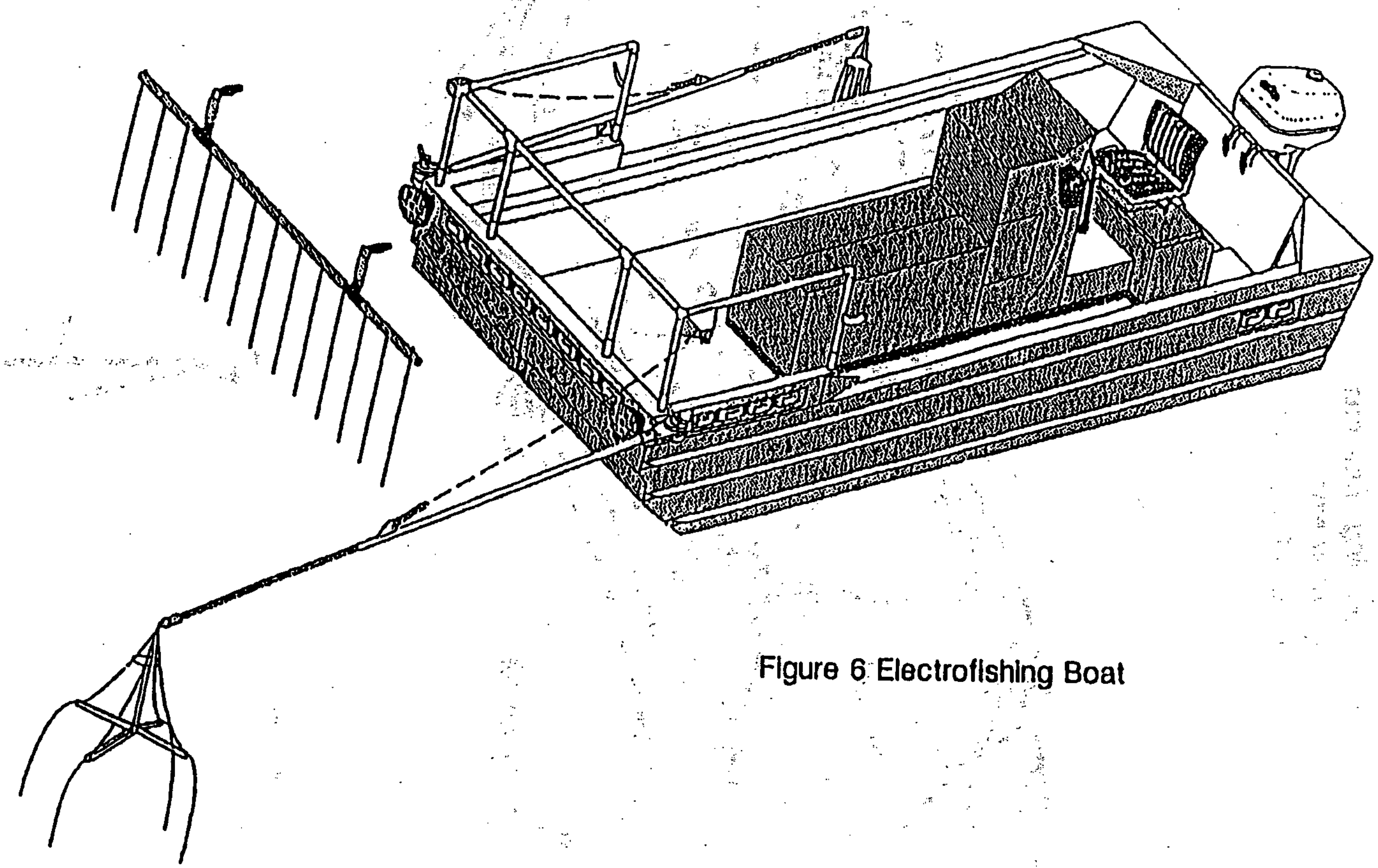
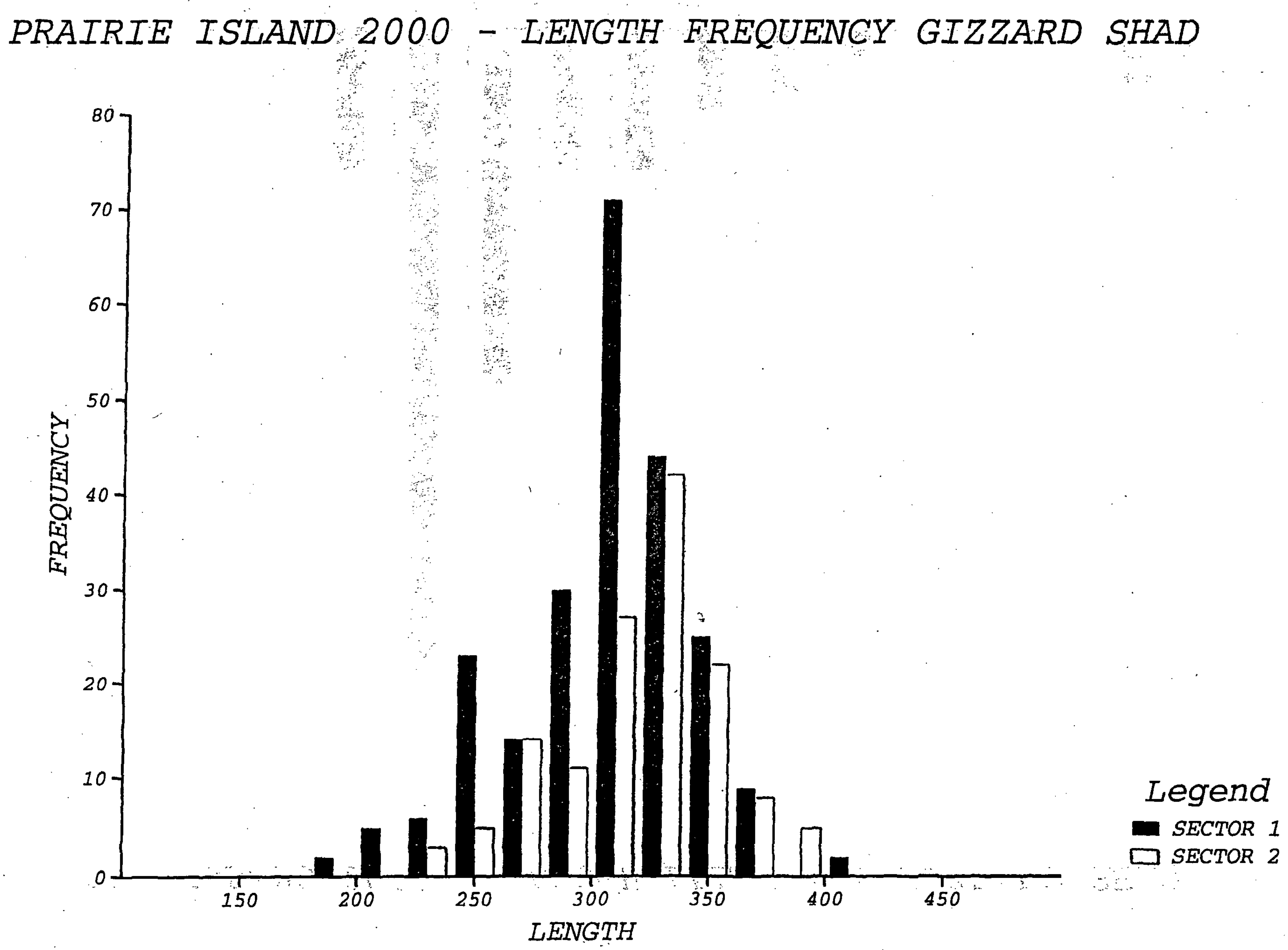


Figure 6 Electrofishing Boat

Figure 7a



PRAIRIE ISLAND 2000 - LENGTH FREQUENCY GIZZARD SHAD
FREQUENCY
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LENGTH
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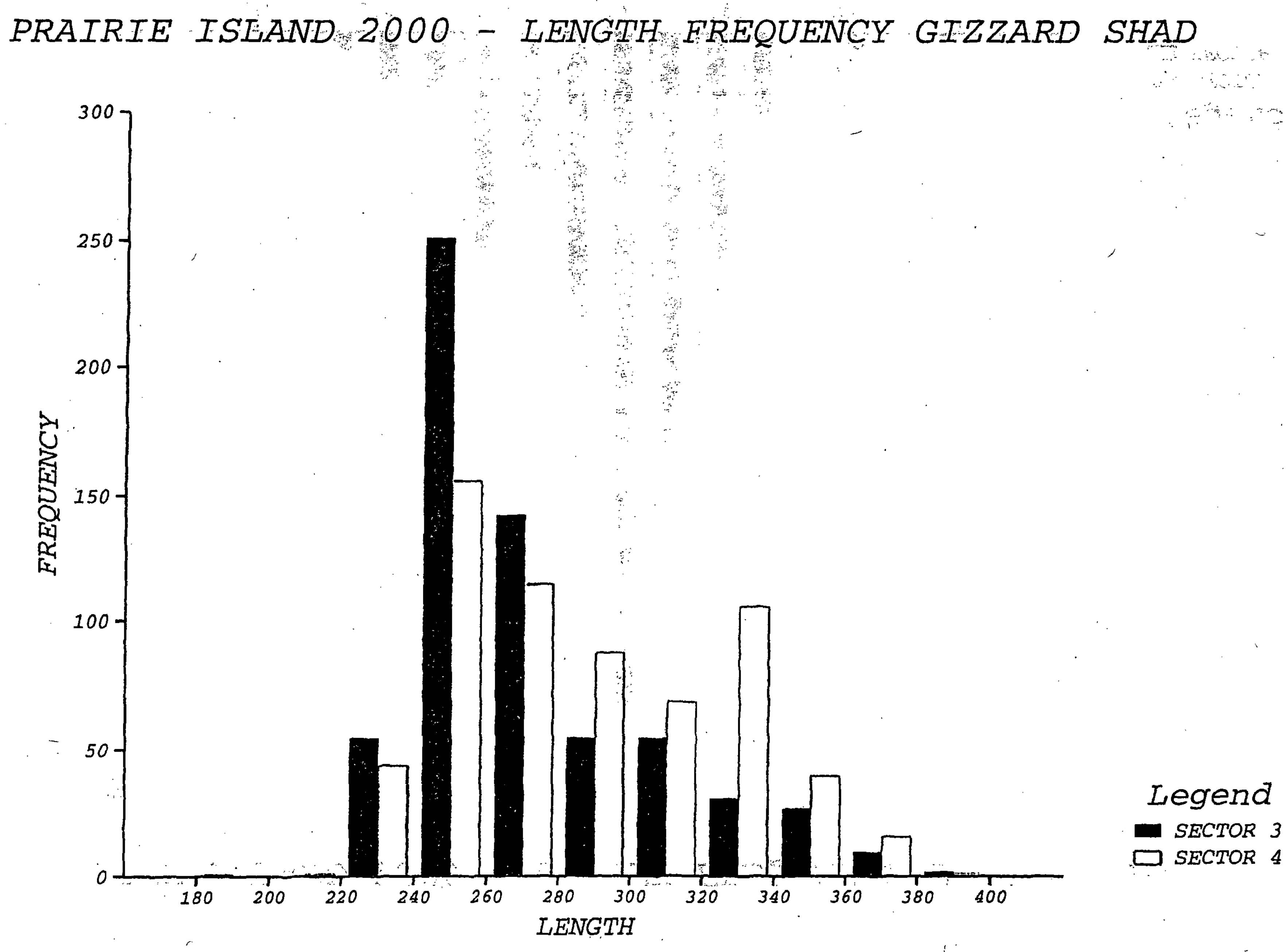
SECTOR 1
SECTOR 2

Figure 7b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LENGTH
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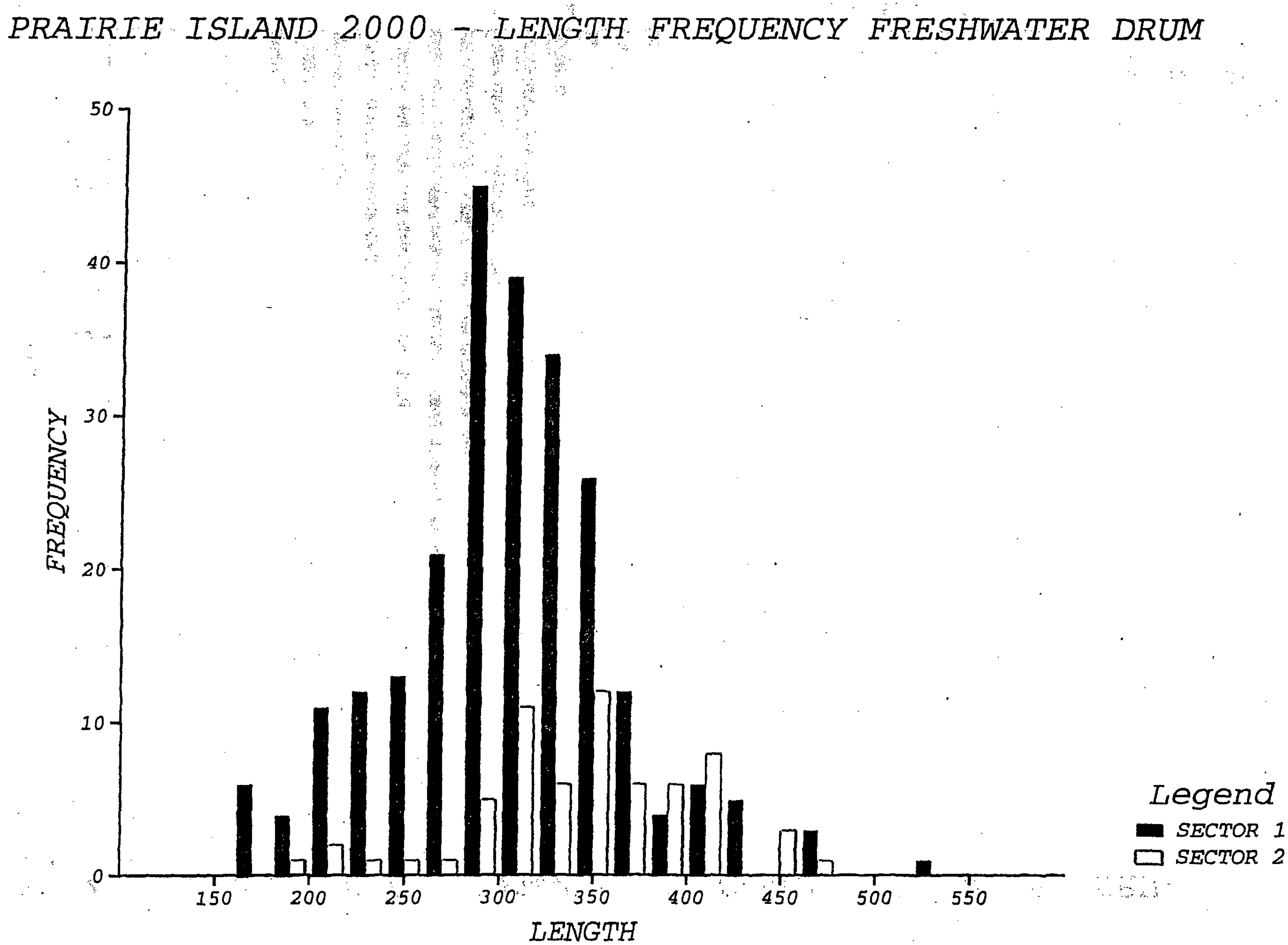
SECTOR 3
SECTOR 4

Figure 8a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LENGTH
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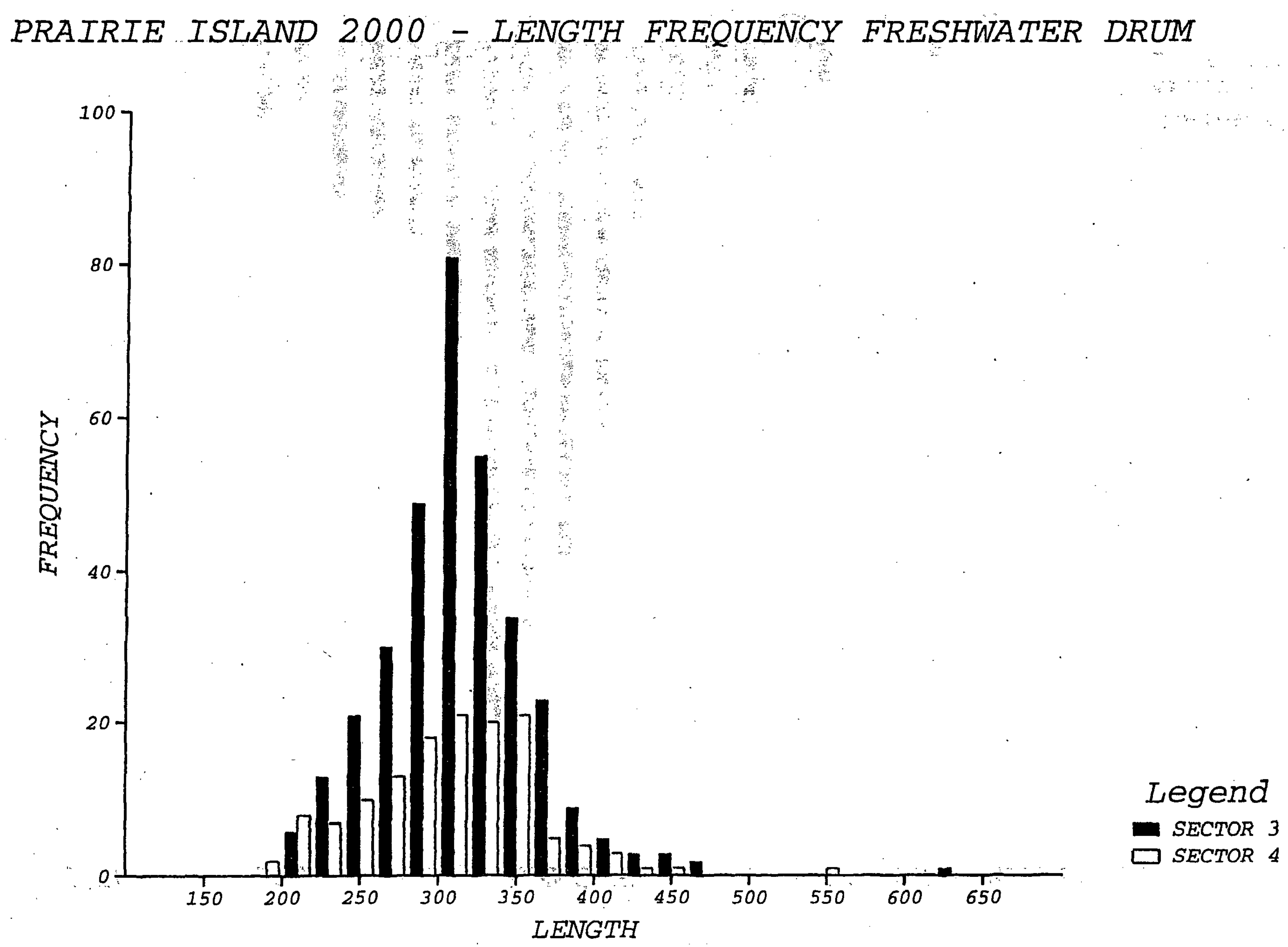
SECTOR 1
SECTOR 2

Figure 8b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LENGTH
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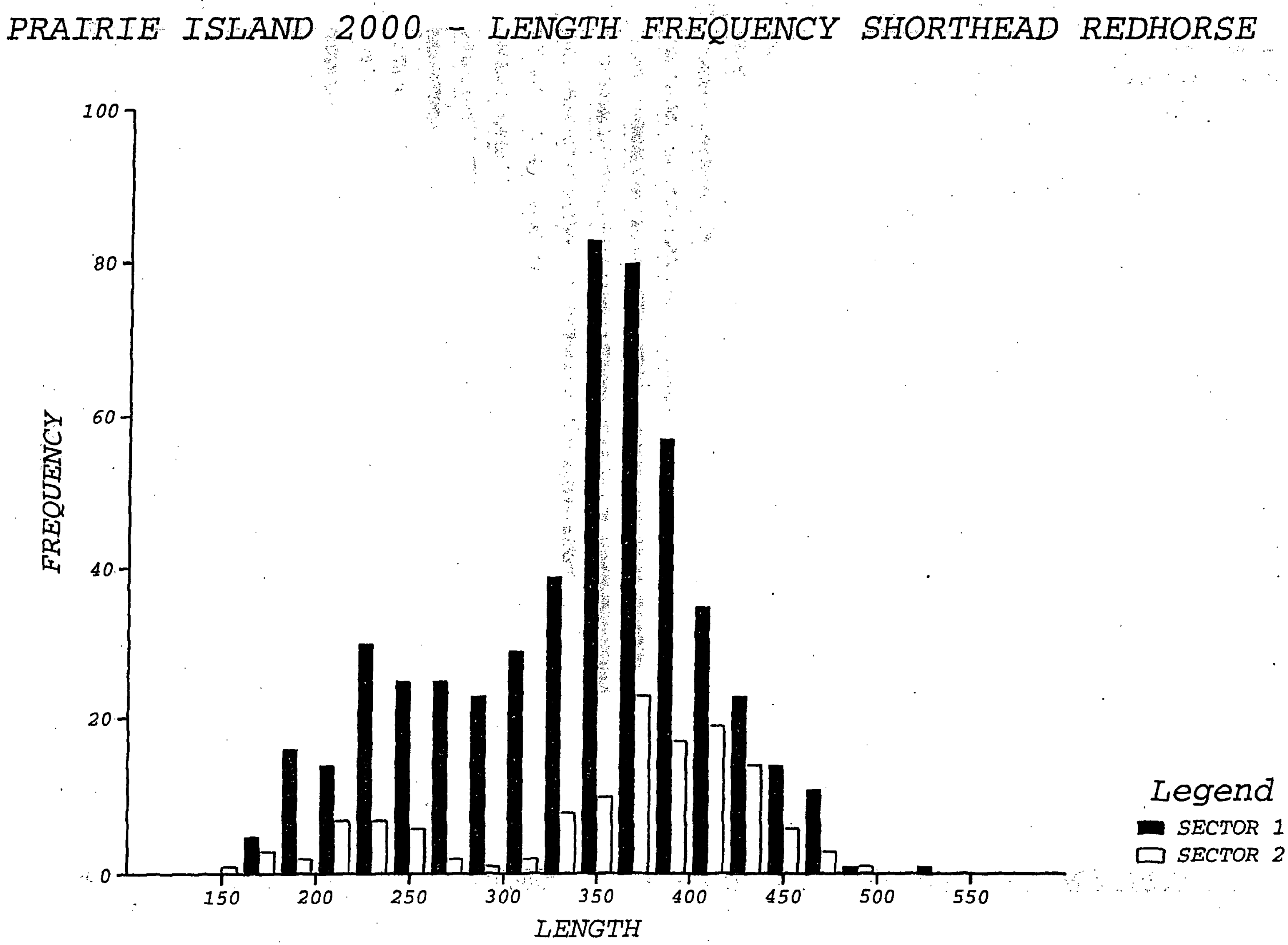
SECTOR 3
SECTOR 4

Figure 9a



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500
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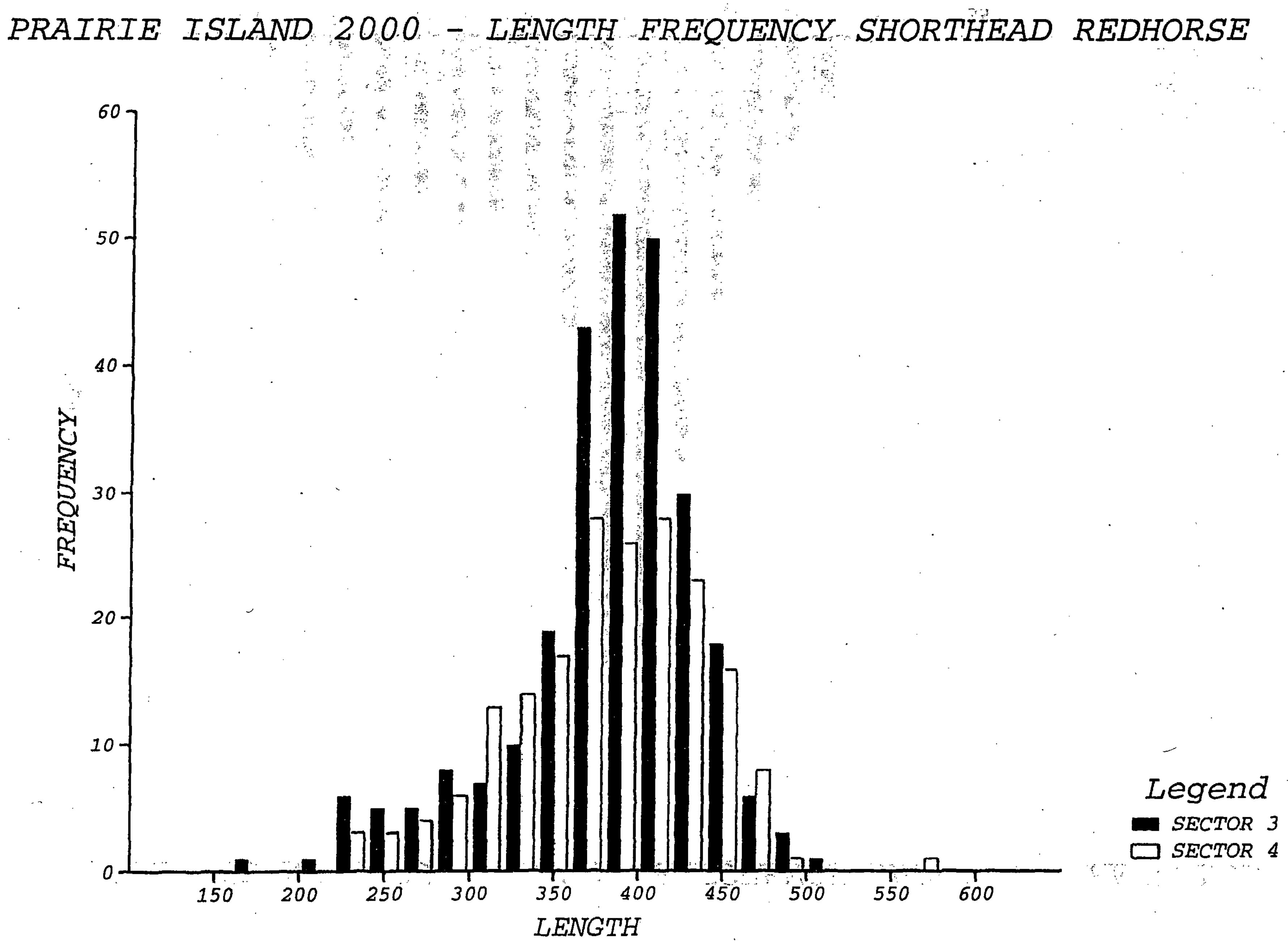
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 9b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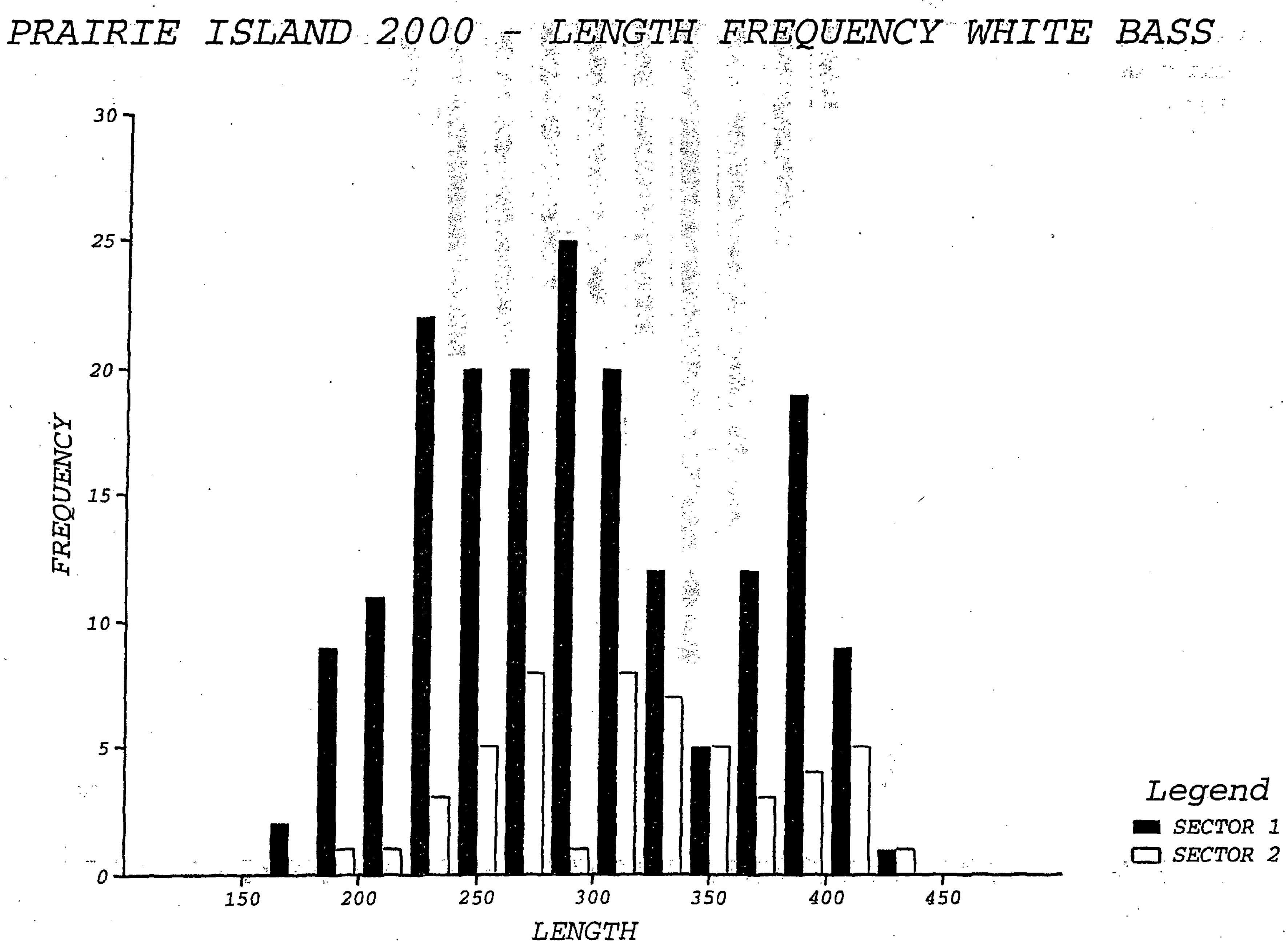
600
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 10a



PRAIRIE ISLAND 2000 - LENGTH FREQUENCY WHITE BASS
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25
20
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FREQUENCY
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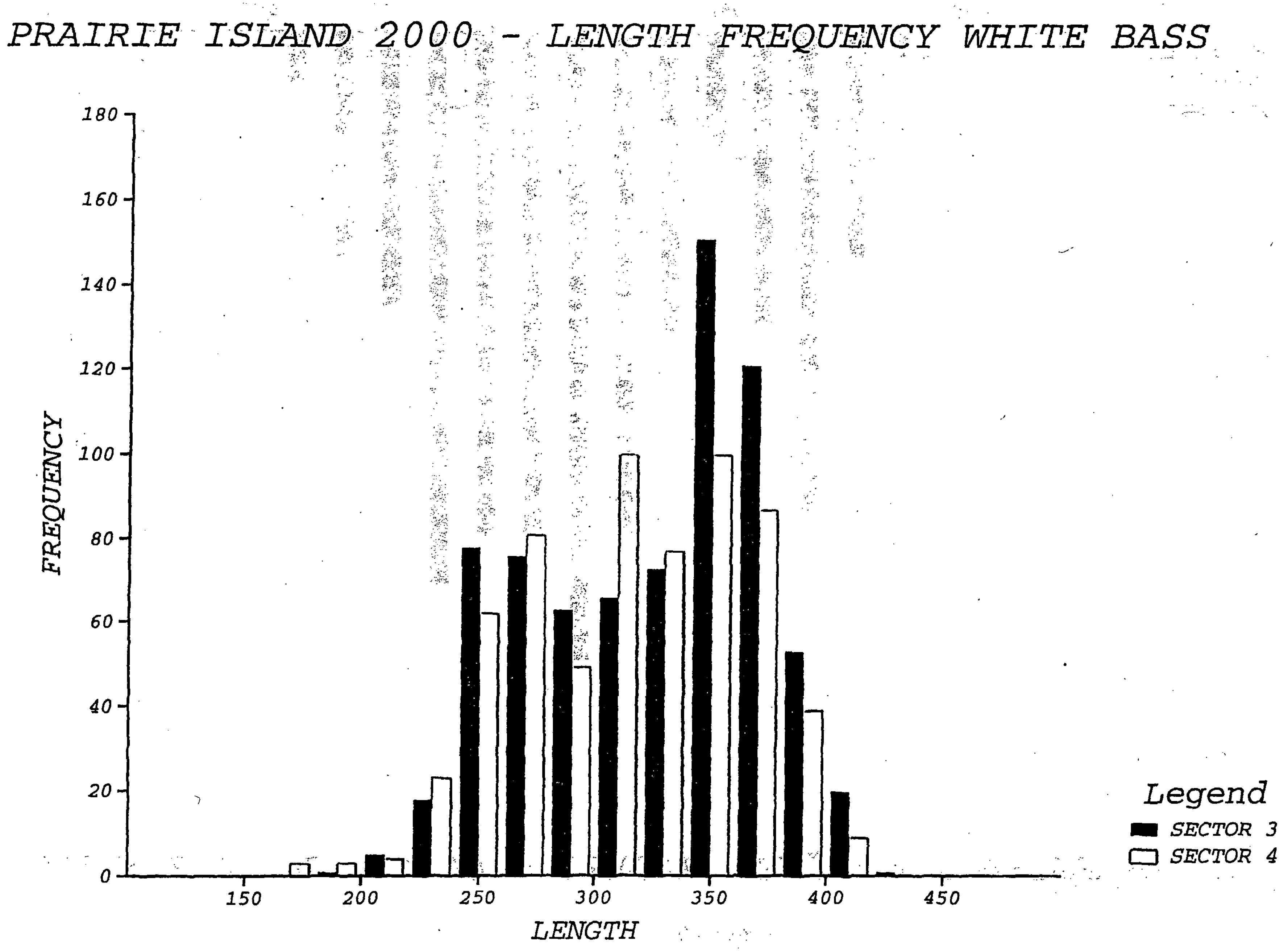
300
350
400
450
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 10b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80
60
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FREQUENCY
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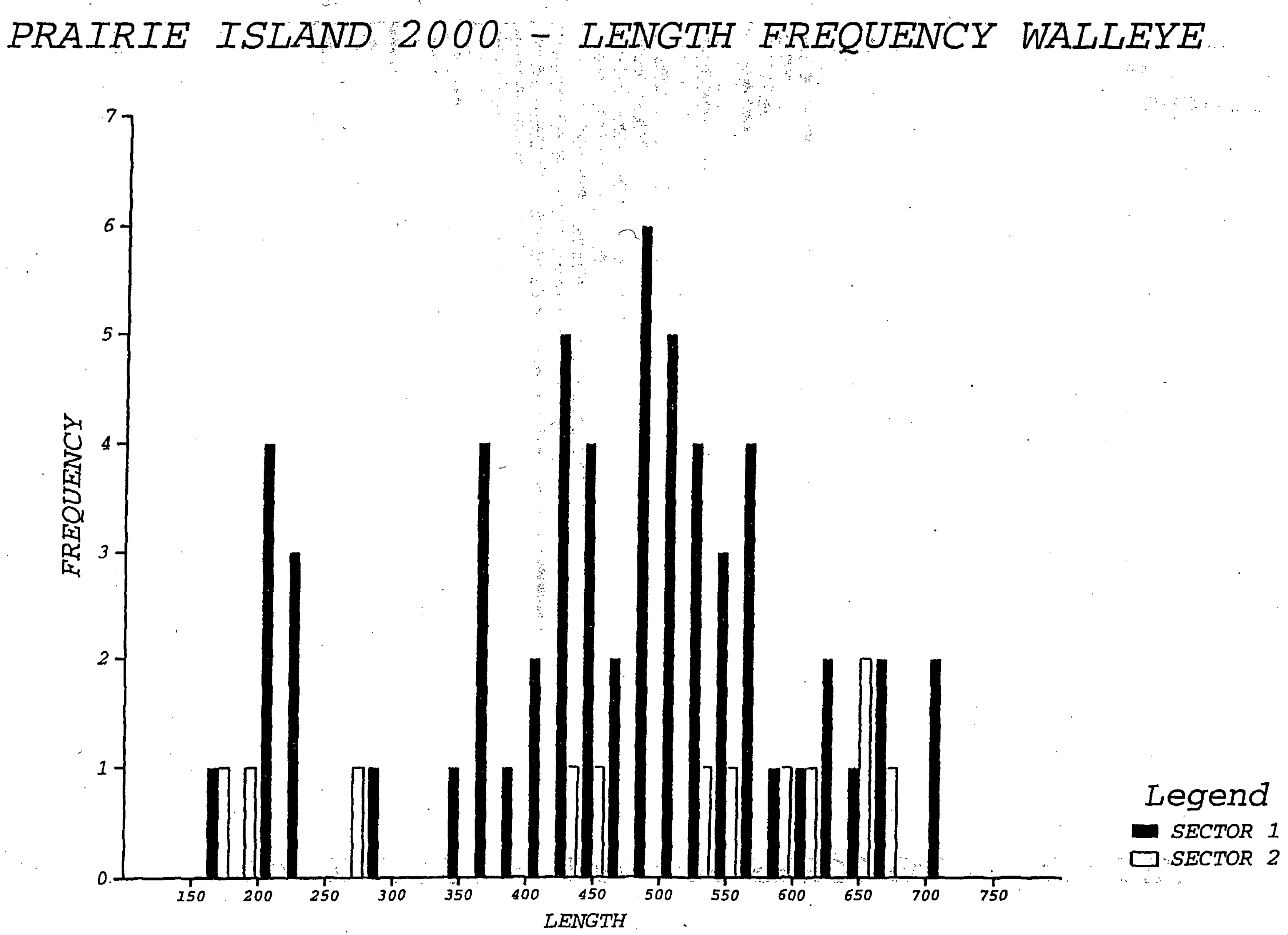
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 11a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2
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4
5
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300
350
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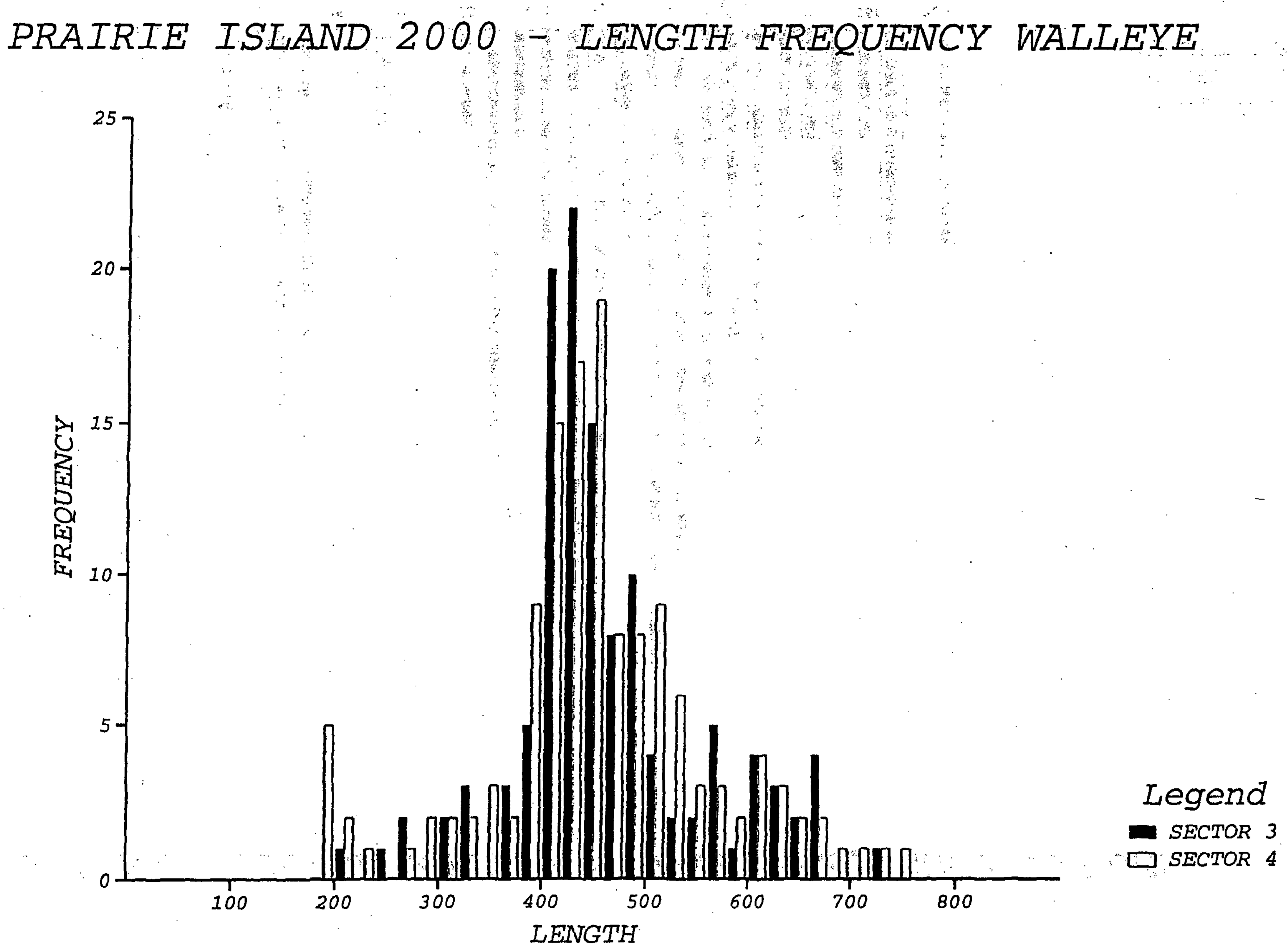
500
550
600
650
700
750
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 11b



PRAIRIE ISLAND 2000 - LENGTH FREQUENCY WALLEYE
FREQUENCY
0
5
10
15
20
25
100
200
300
400
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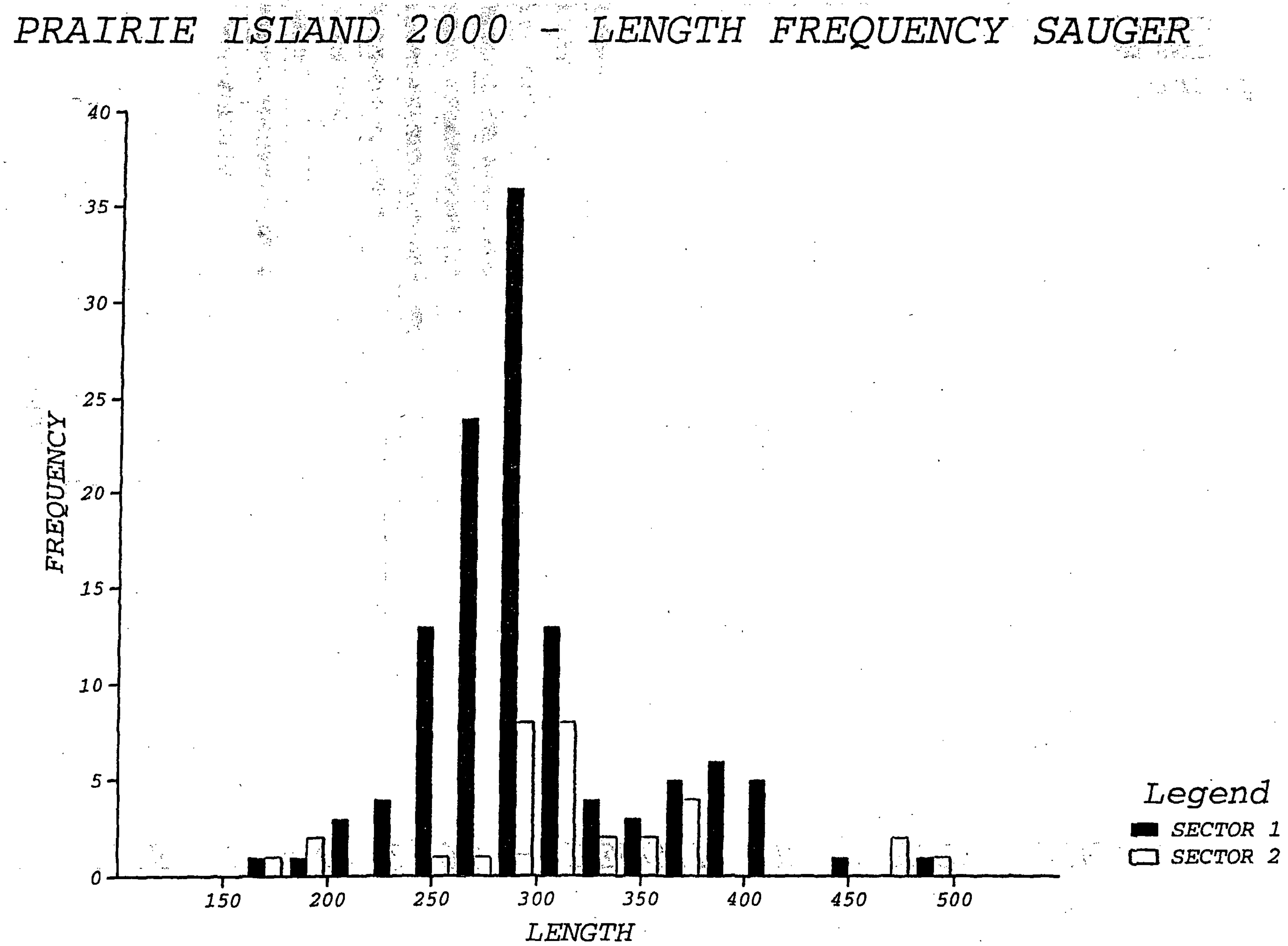
600
700
800
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 12a


PRAIRIE ISLAND 2000 - LENGTH FREQUENCY SAUGER
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10
15
20
25
30
35
40
LENGTH
150
200
250
300
350
400
450
500
Legend
SECTOR 1
SECTOR 2

Figure 12b

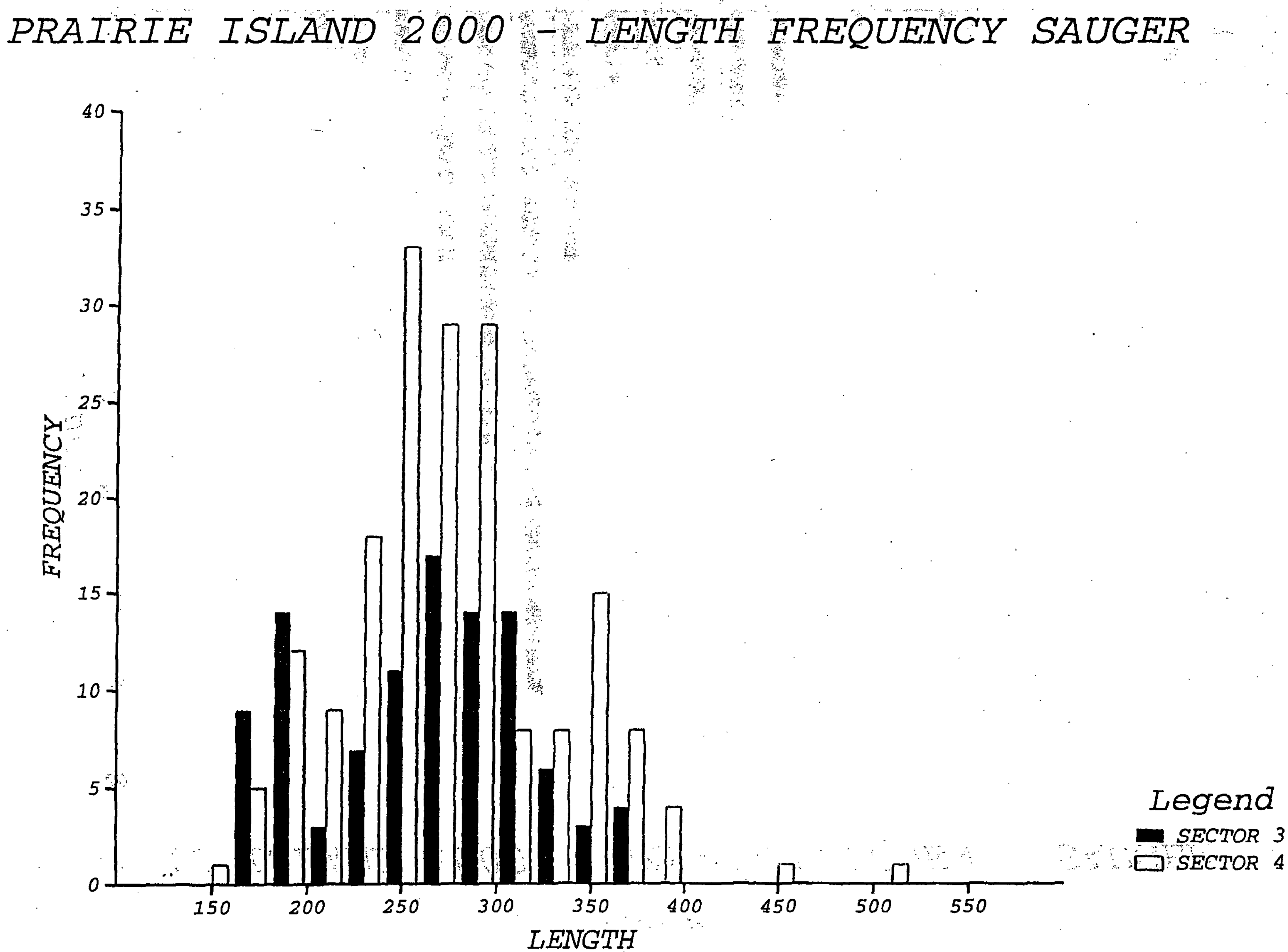

PRAIRIE ISLAND 2000 - LENGTH FREQUENCY SAUGER
FREQUENCY
0
5
10
15
20
25
30
35
40
150
200
250
300
350
400
450
500
550
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 13a

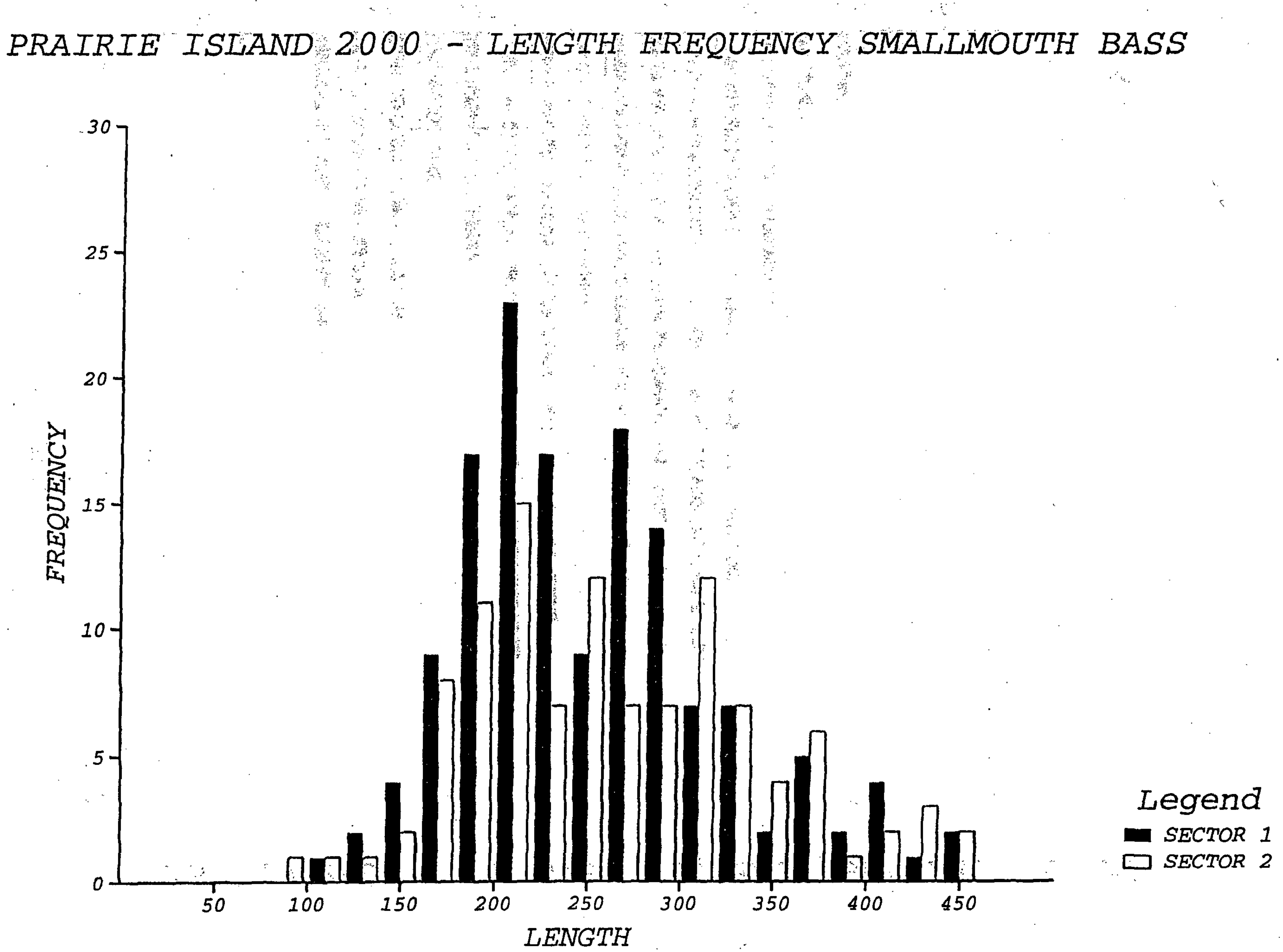

PRAIRIE ISLAND 2000 - LENGTH FREQUENCY SMALLMOUTH BASS
FREQUENCY
0
5
10
15
20
25
30
50
100
150
200
250
300
350
400
450
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 13b

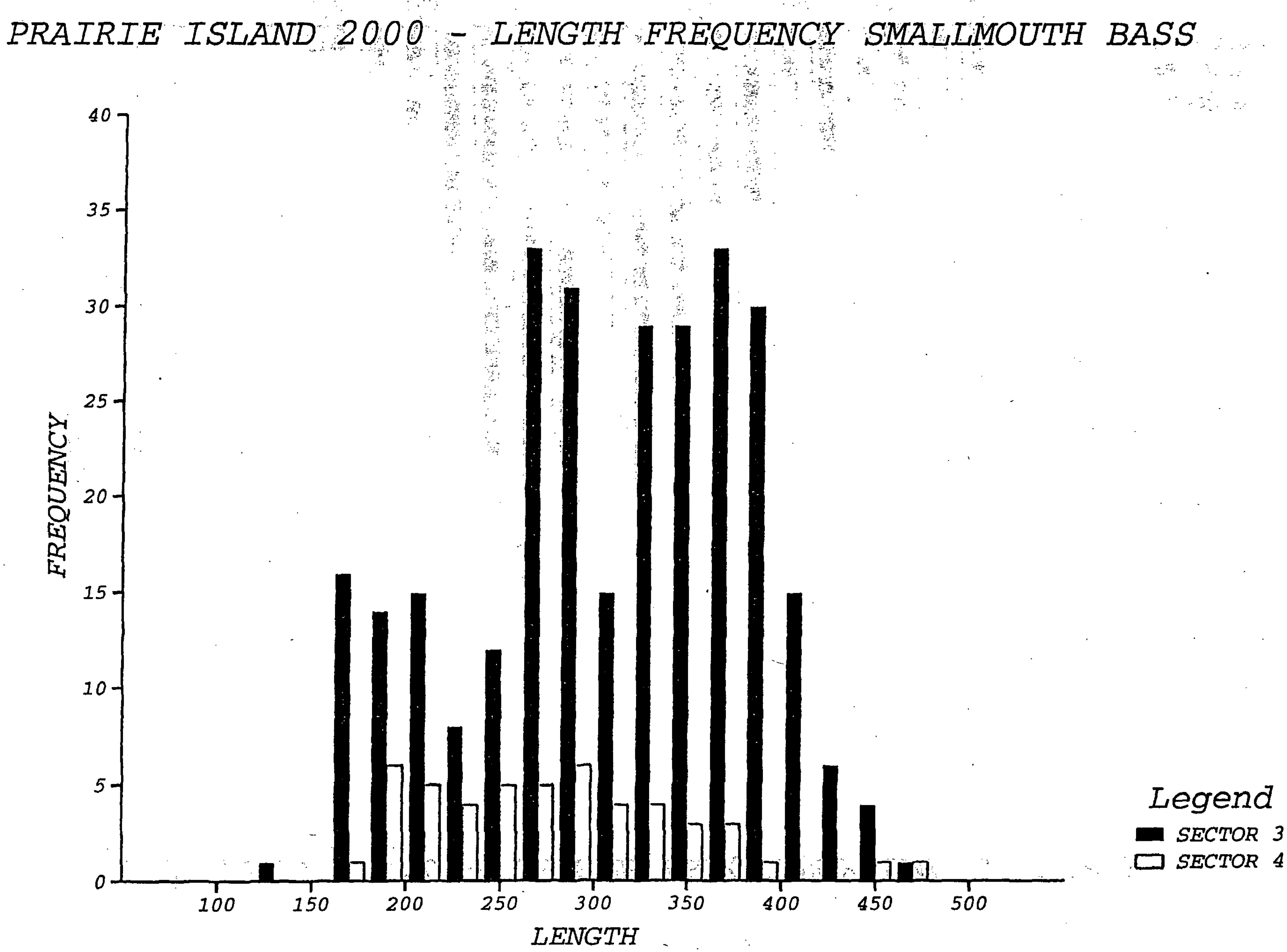

PRAIRIE ISLAND 2000 - LENGTH FREQUENCY SMALLMOUTH BASS
FREQUENCY
0
5
10
15
20
25
30
35
40
100
150
200
250
300
350
400
450
500
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 14a

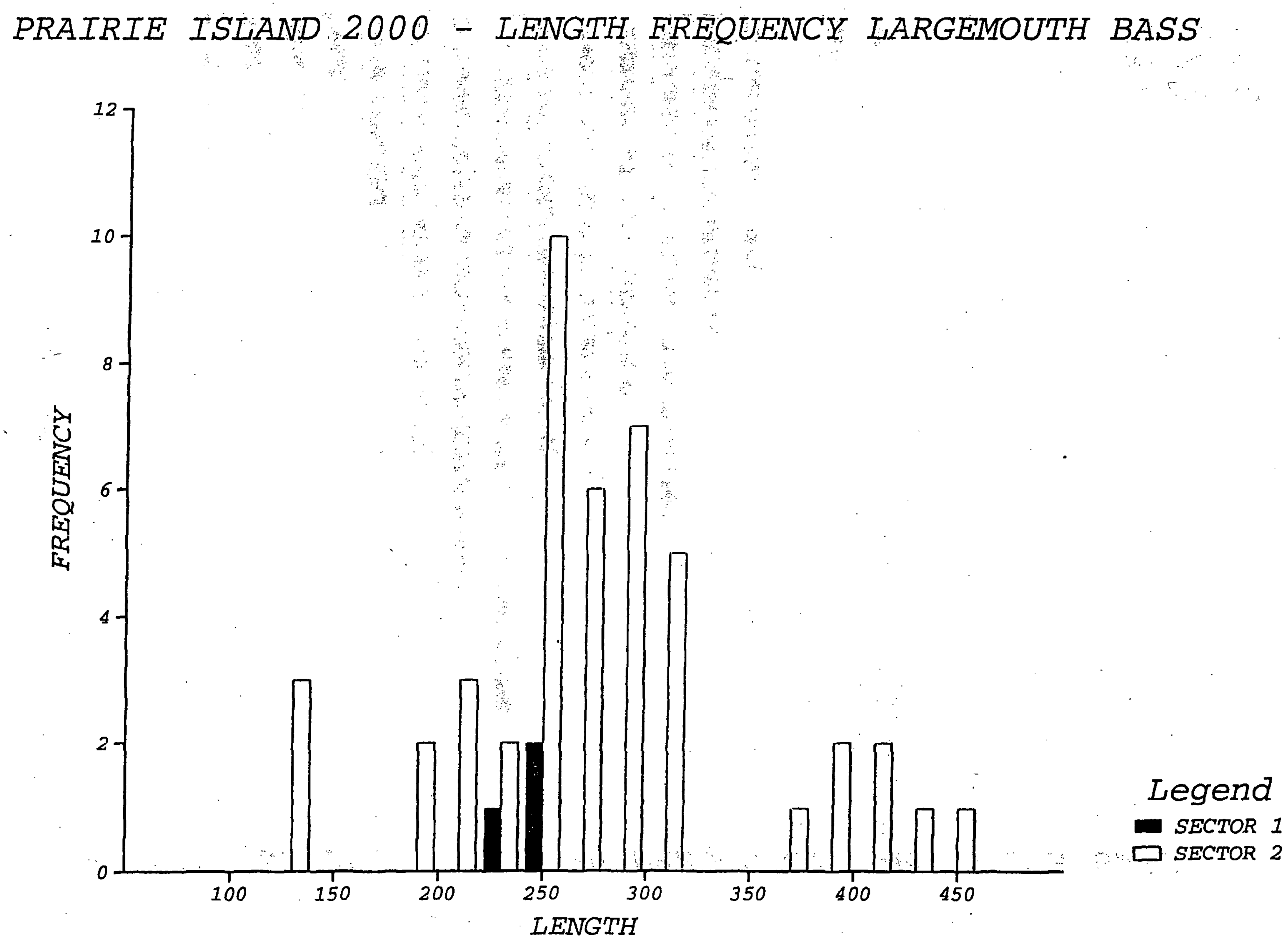

PRAIRIE ISLAND 2000 - LENGTH FREQUENCY LARGEMOUTH BASS
FREQUENCY
0
2
4
6
8
10
12
LENGTH
100
150
200
250
300
350
400
450
Legend
SECTOR 1
SECTOR 2

Figure 14b

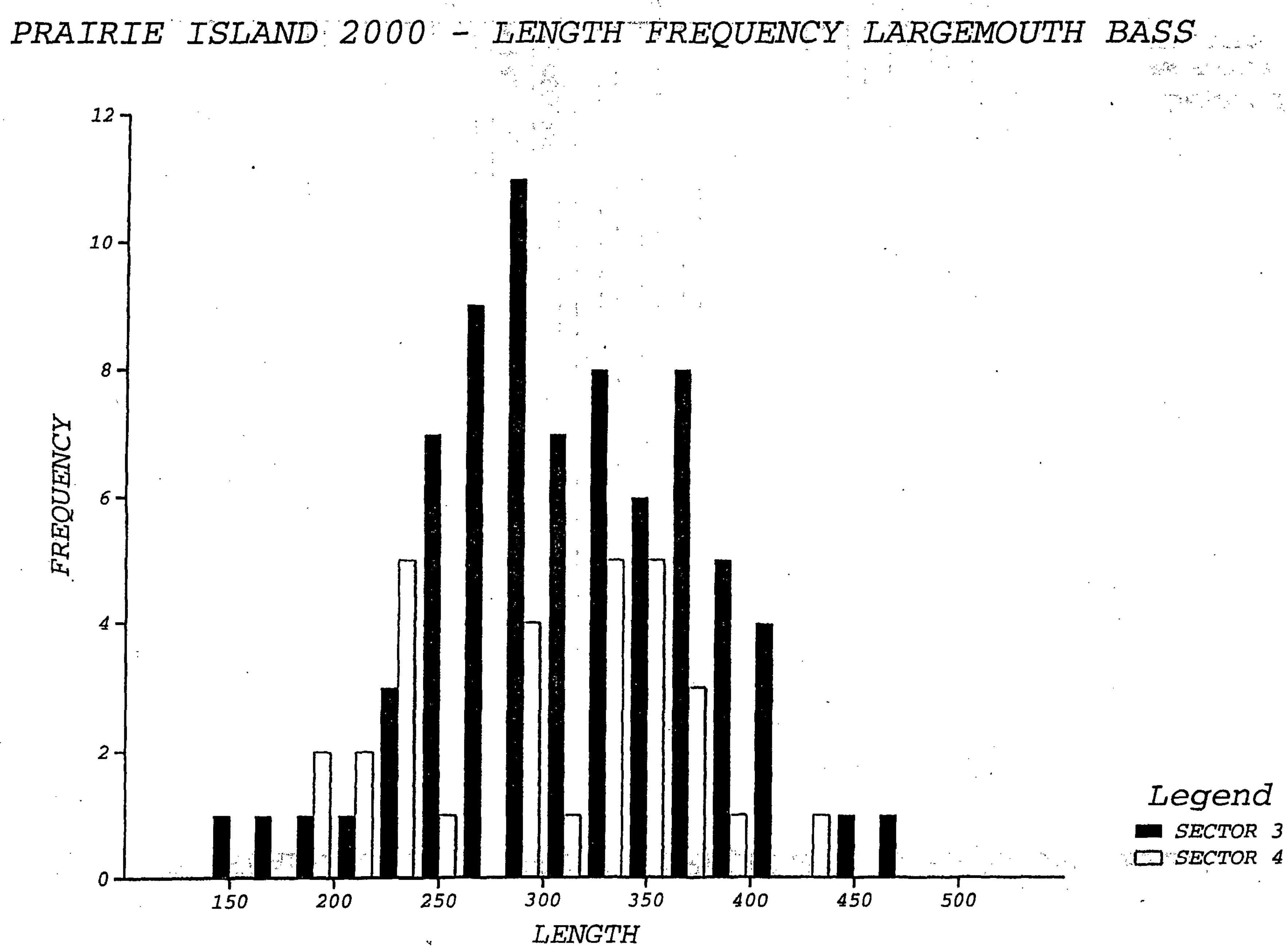

PRAIRIE ISLAND 2000 - LENGTH FREQUENCY LARGEMOUTH BASS
FREQUENCY
0
2
4
6
8
10
12
150
200
250
300
350
400
450
500
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2000 in the vicinity of PINGP.

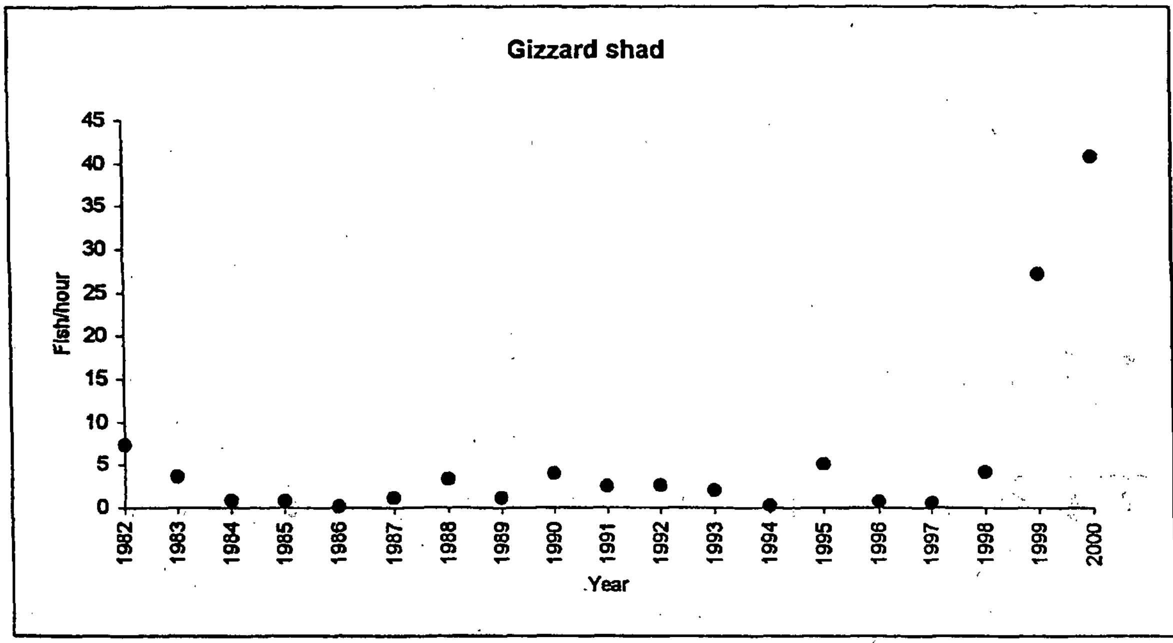


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2000 in the vicinity of PINGP.

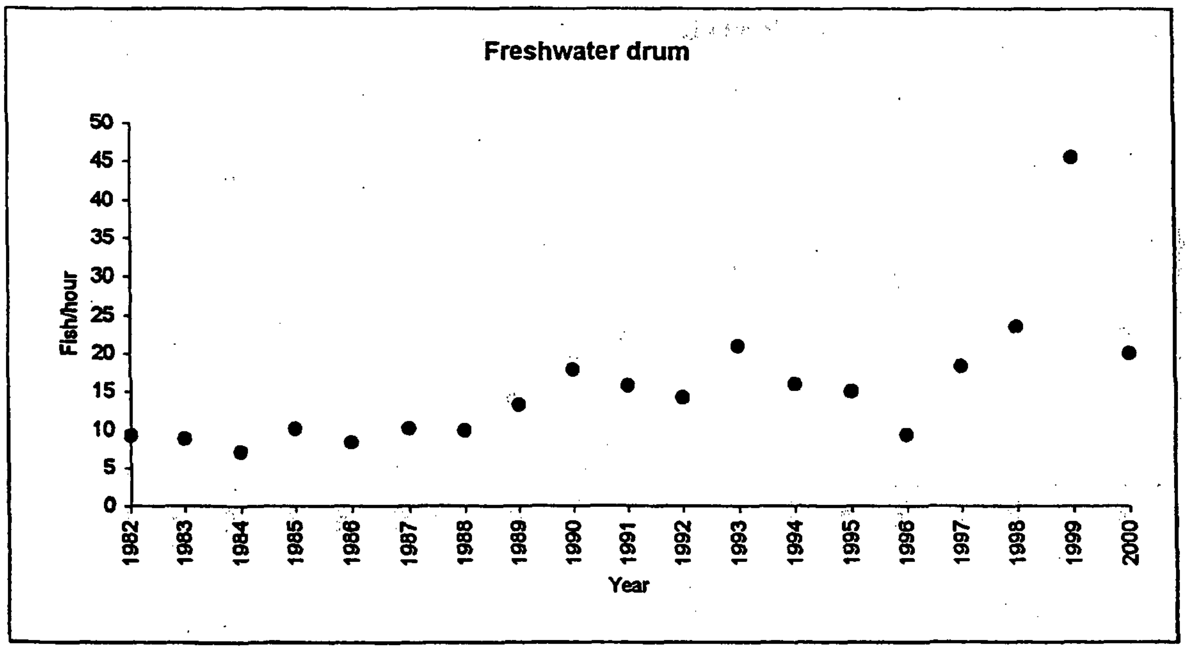


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2000 in the vicinity of PINGP.

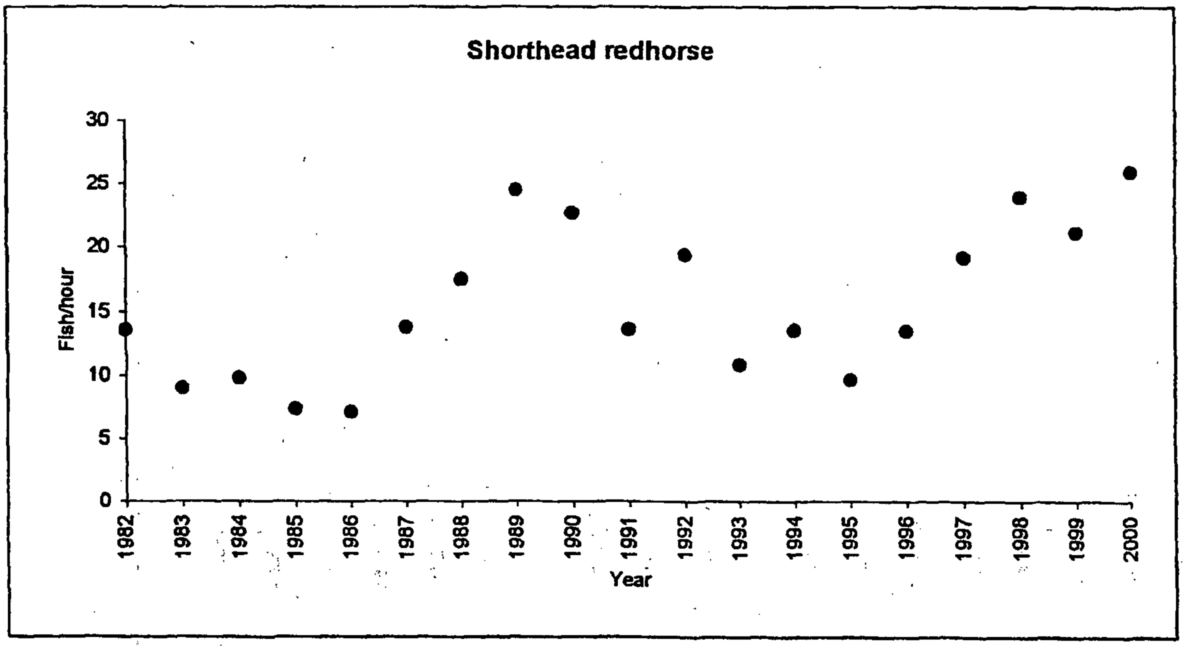


Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2000 in the vicinity of PINGP.

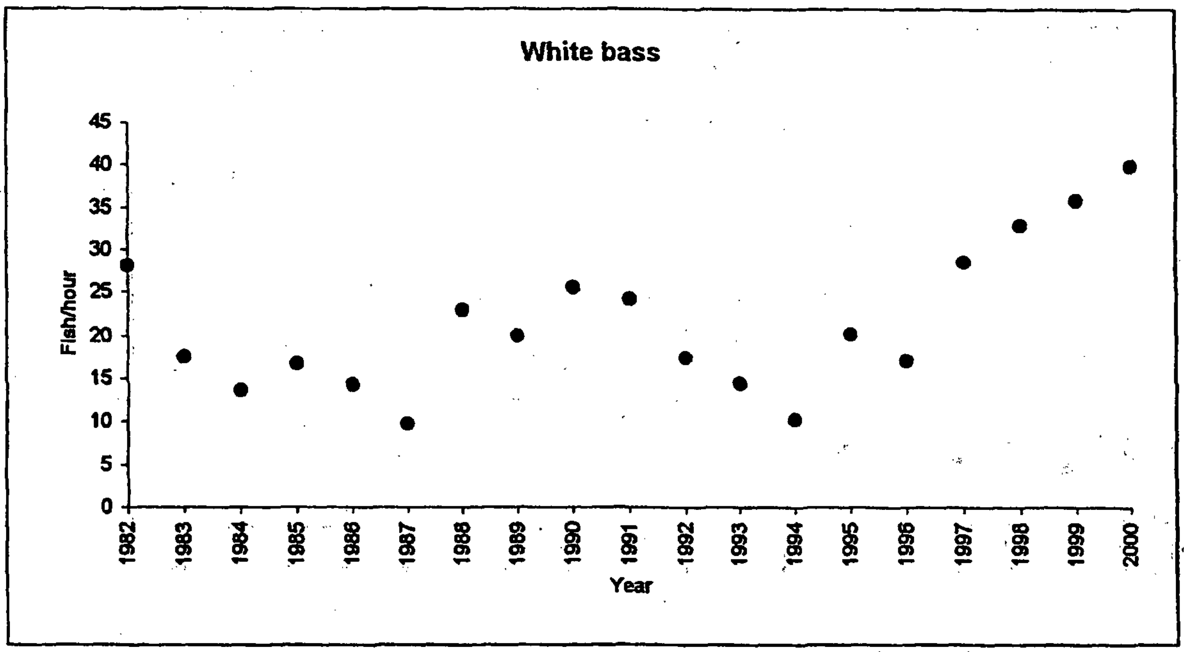


Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2000 in the vicinity of PINGP.

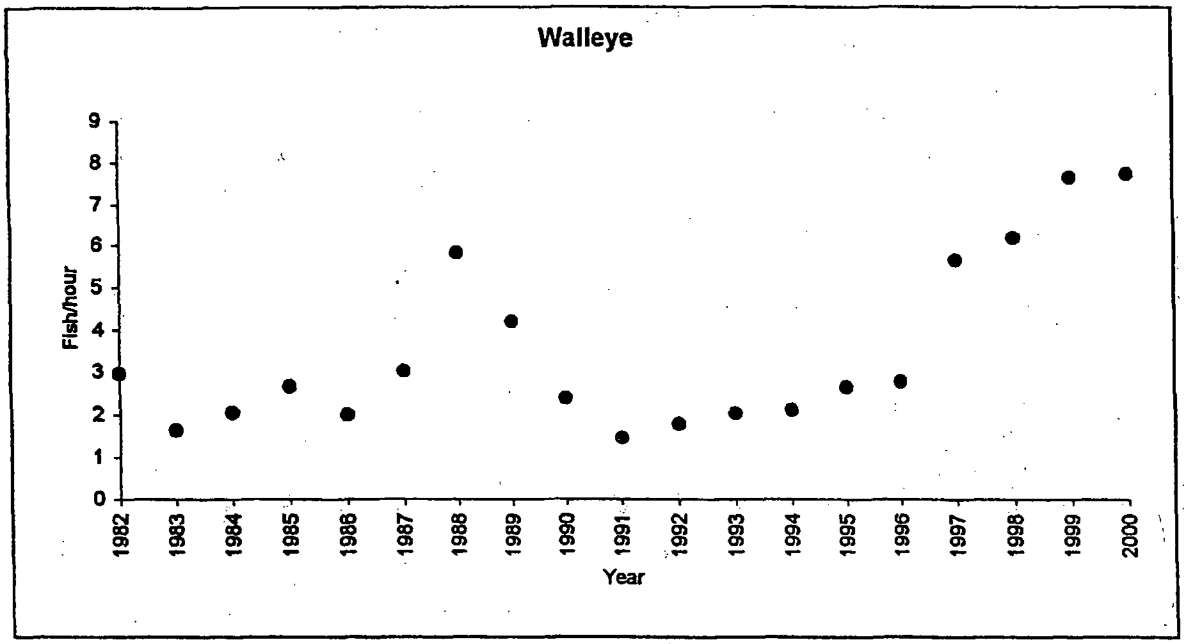


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2000 in the vicinity of PINGP.

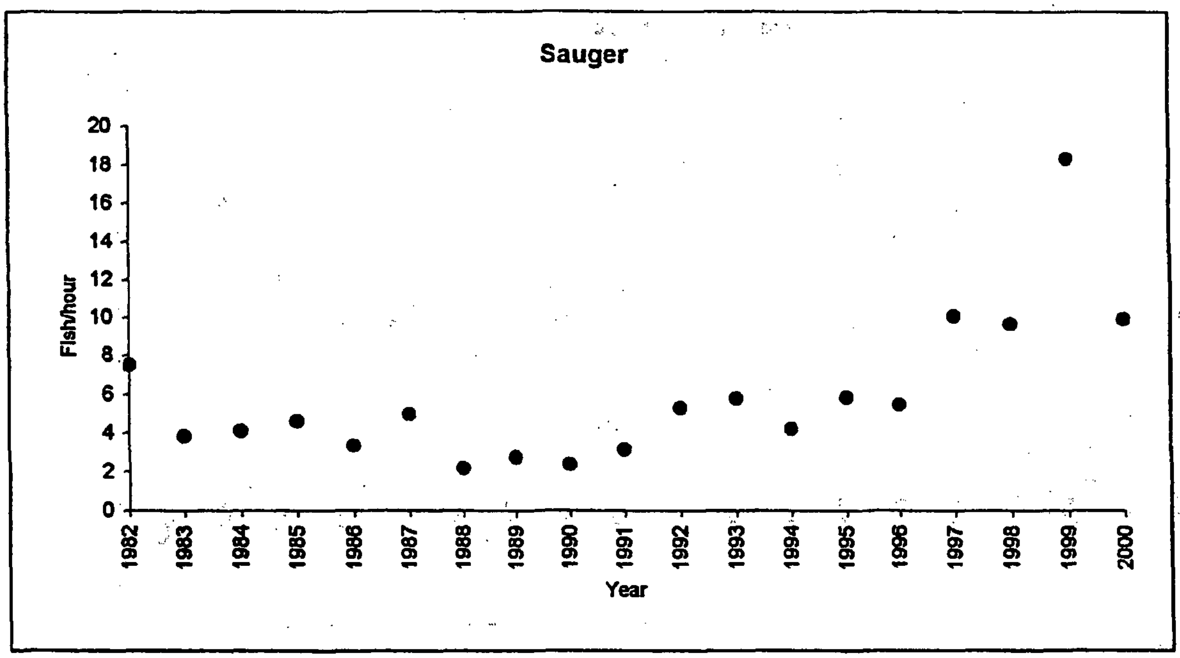


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2000 in the vicinity of PINGP.

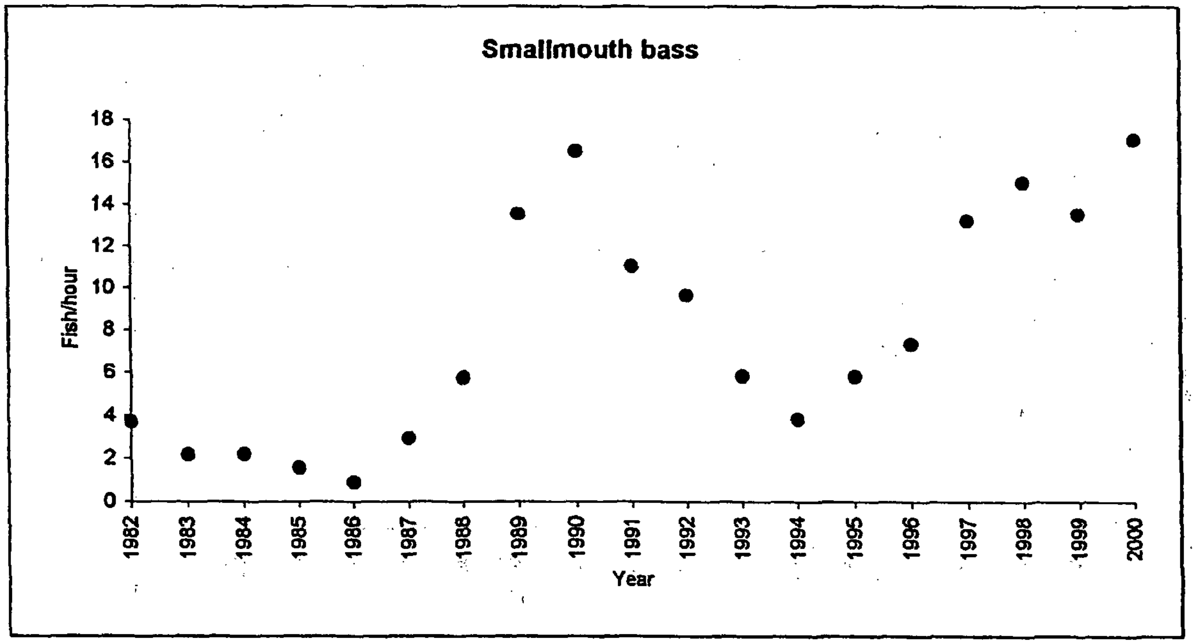


Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2000 in the vicinity of PINGP.

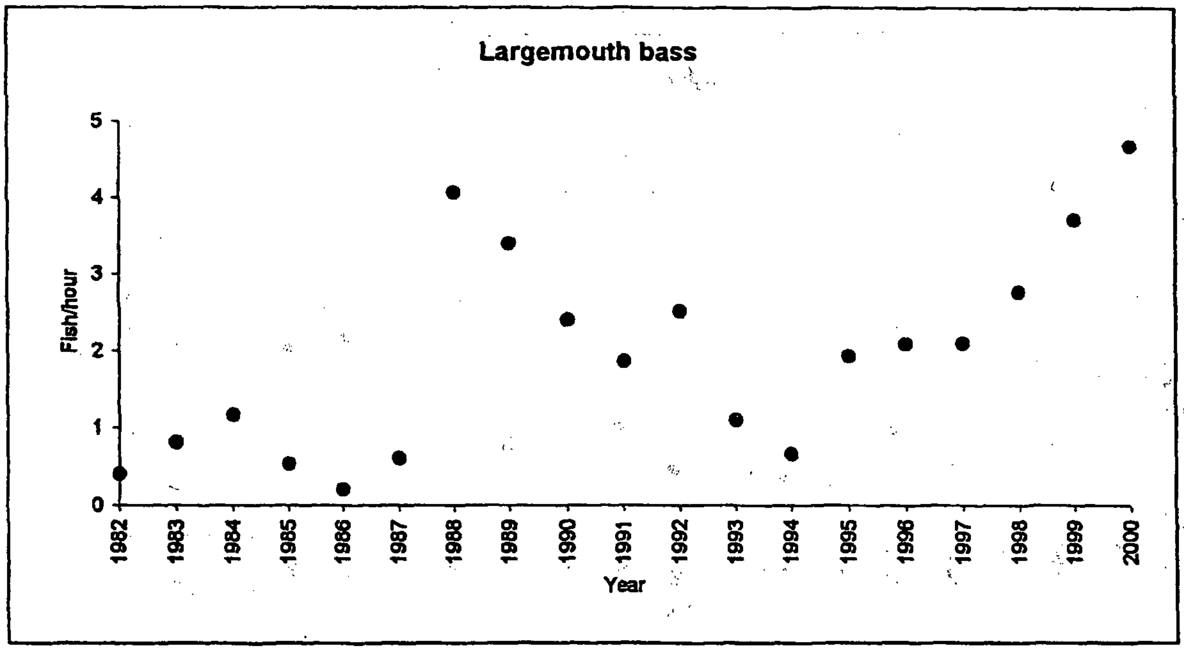


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2000 in the vicinity of PINGP.

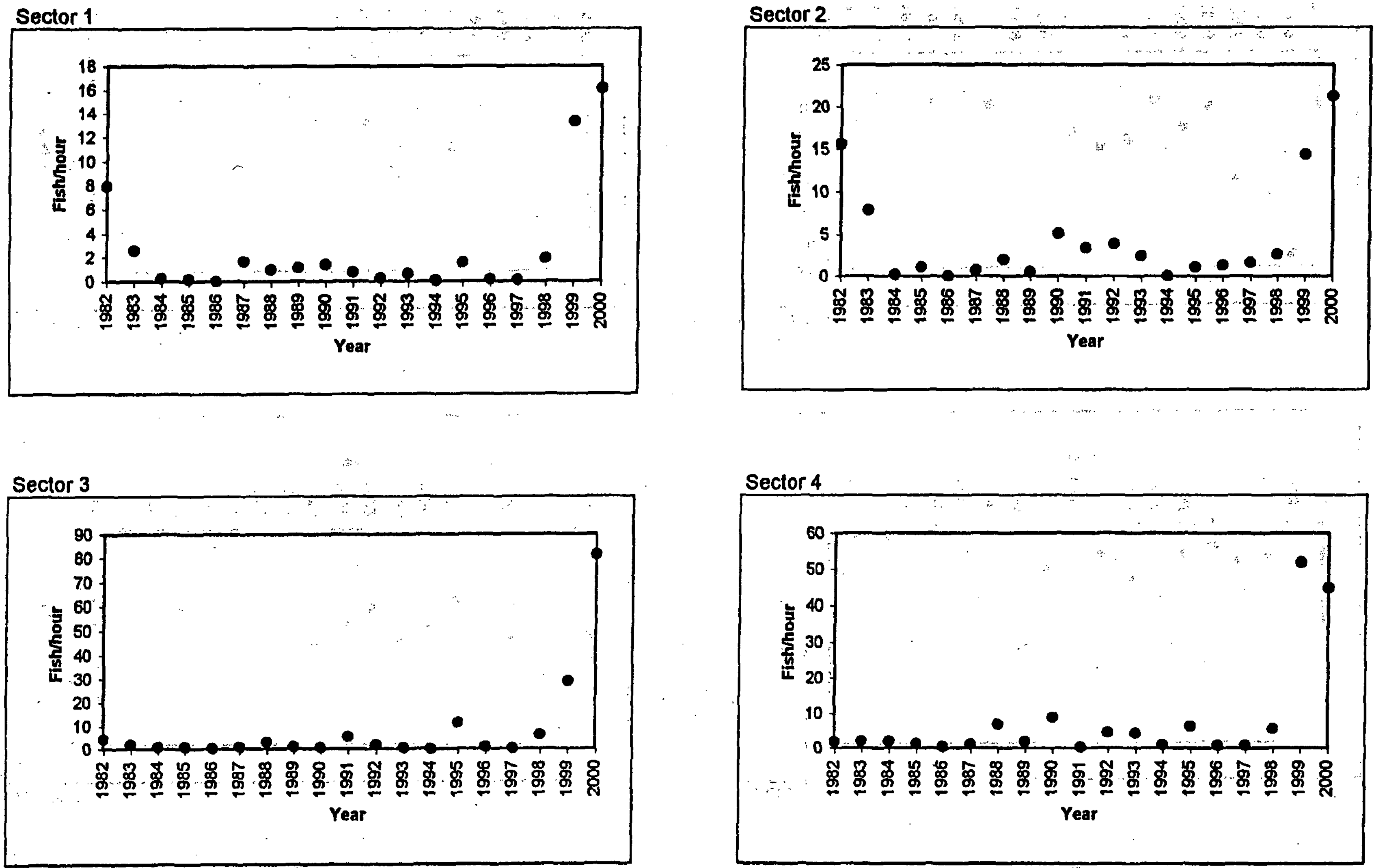


Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2000 in the vicinity of PINGP.

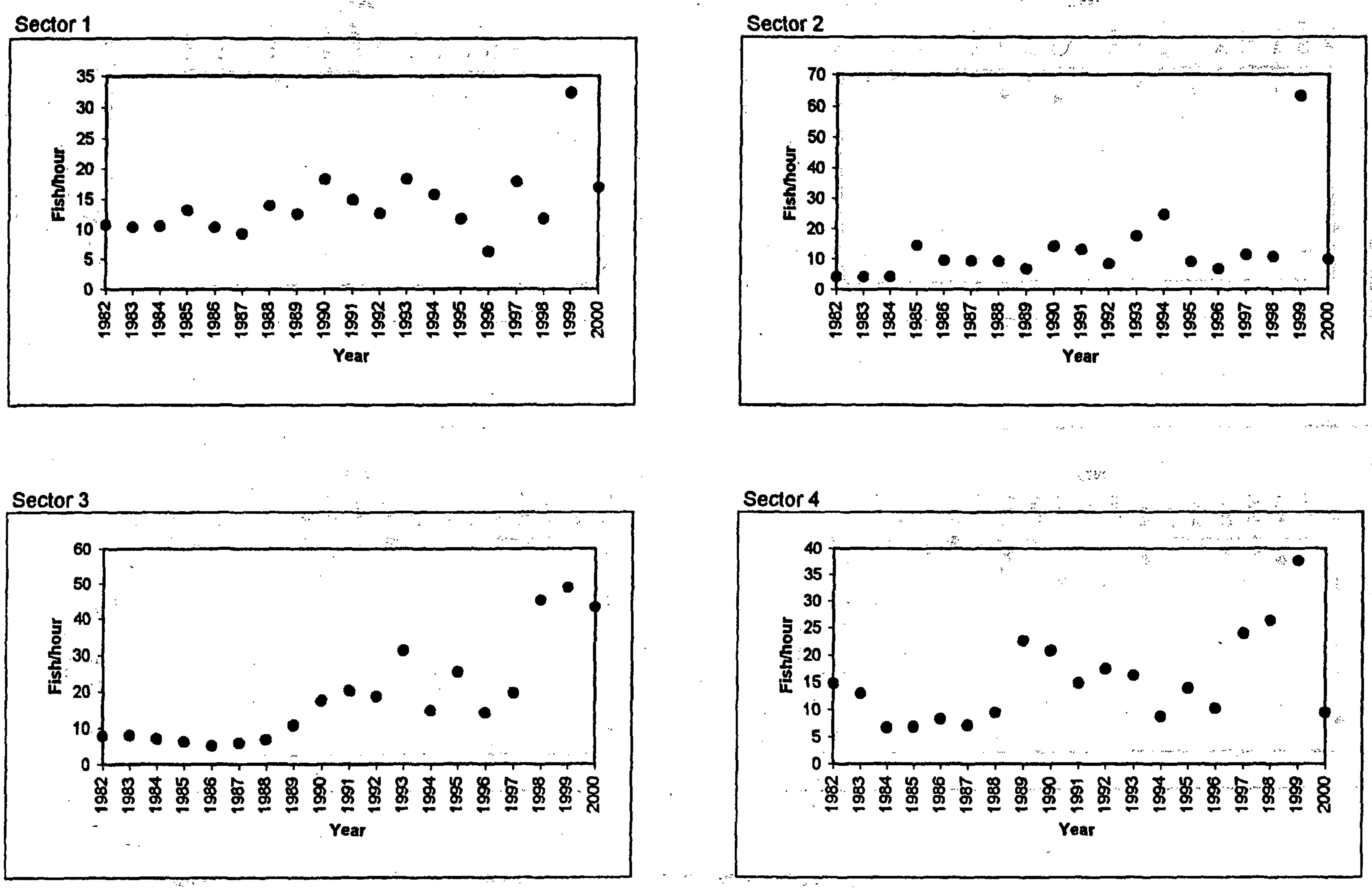


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2000 in the vicinity of PINGP.

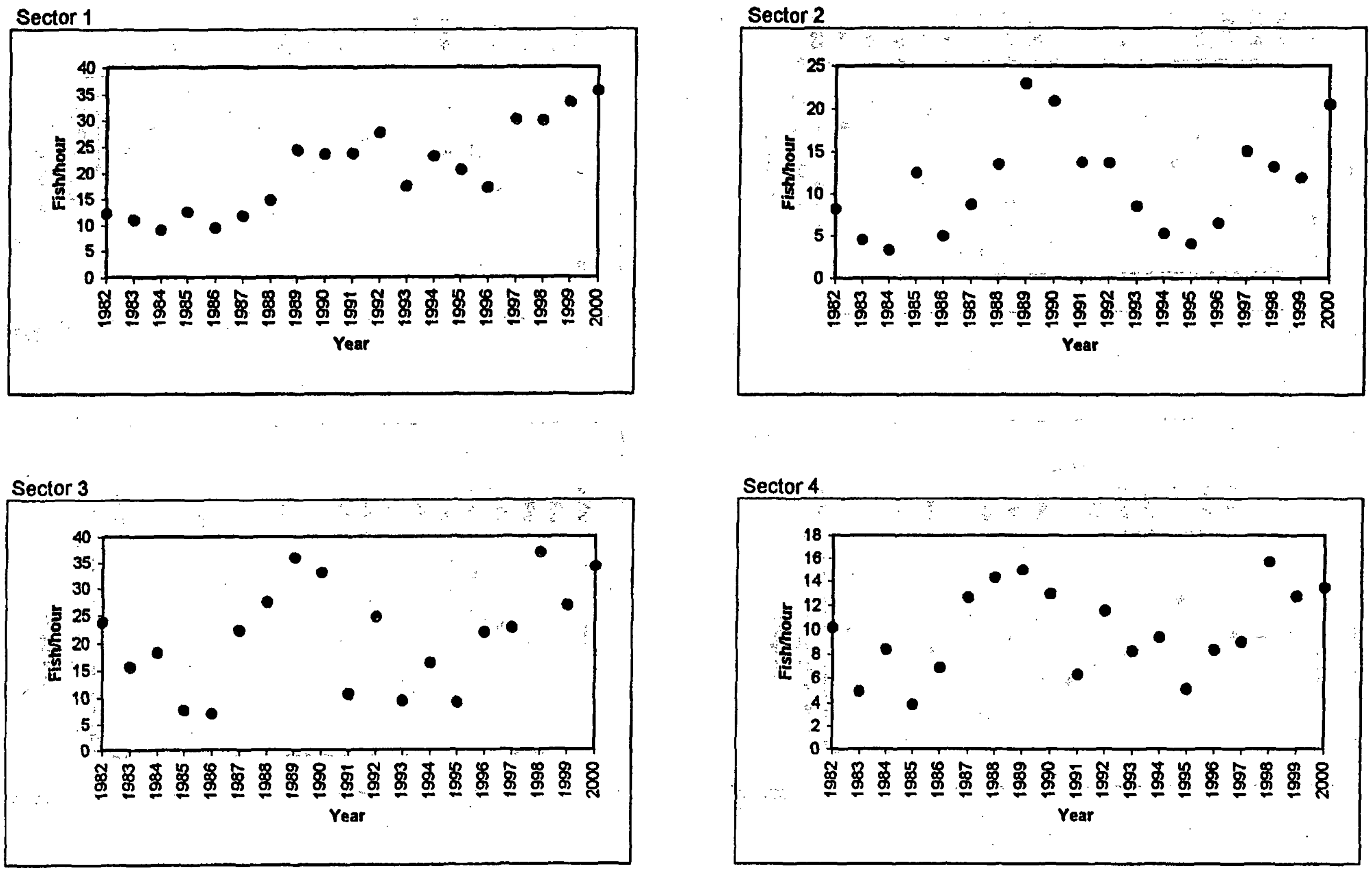
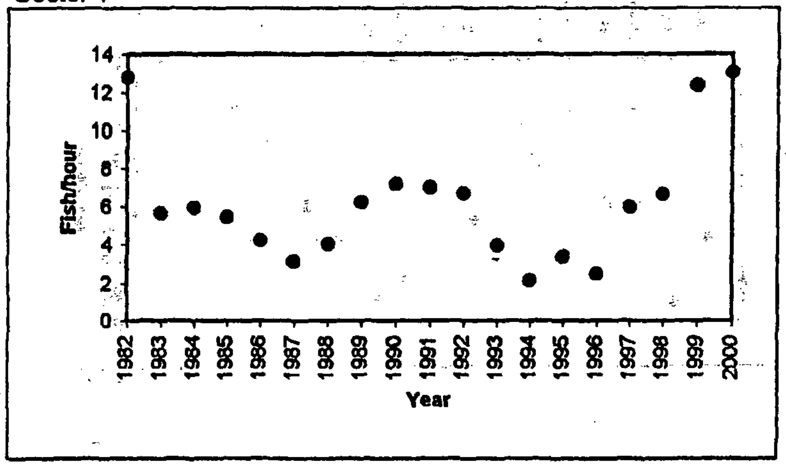
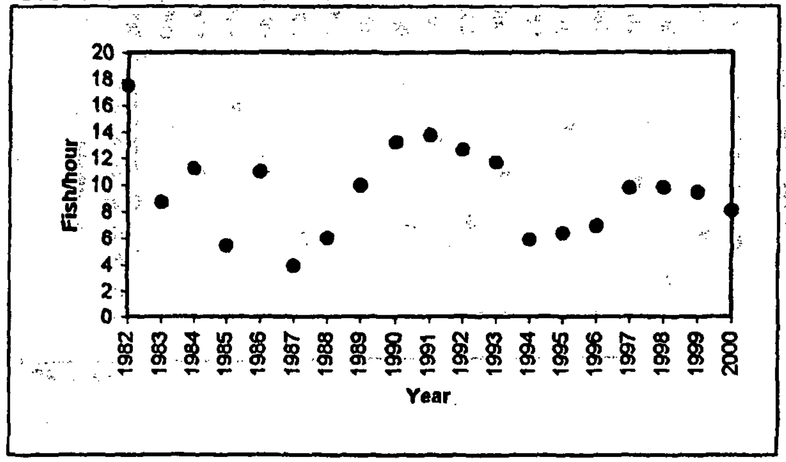


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2000 in the vicinity of PINGP.

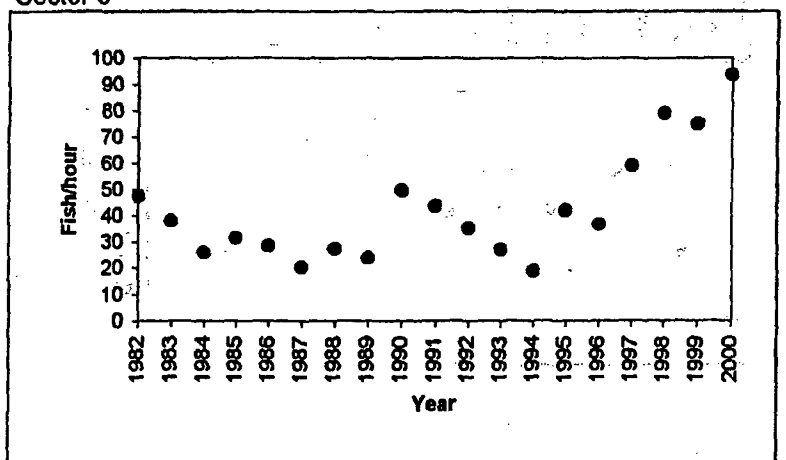
Sector 1



Sector 2



Sector 3



Sector 4

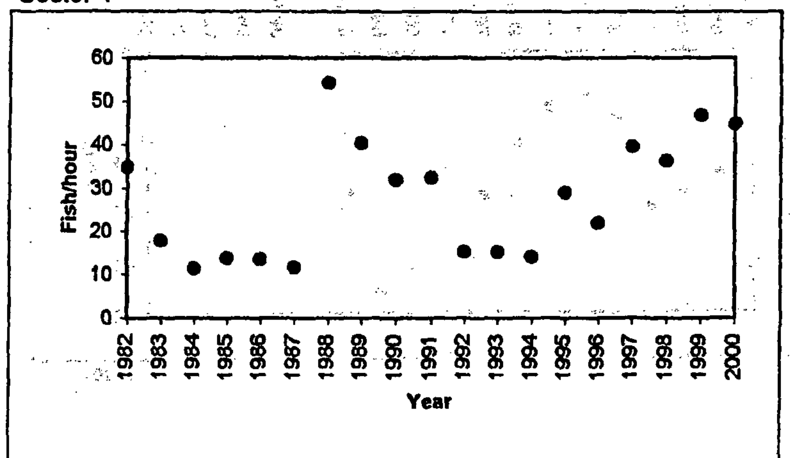
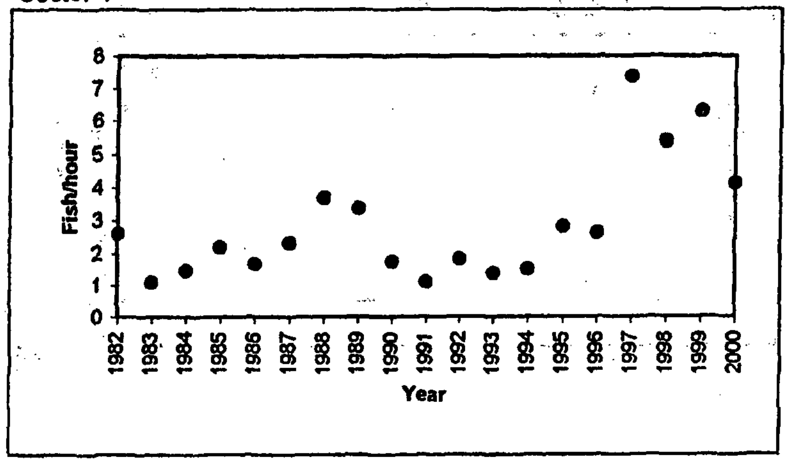
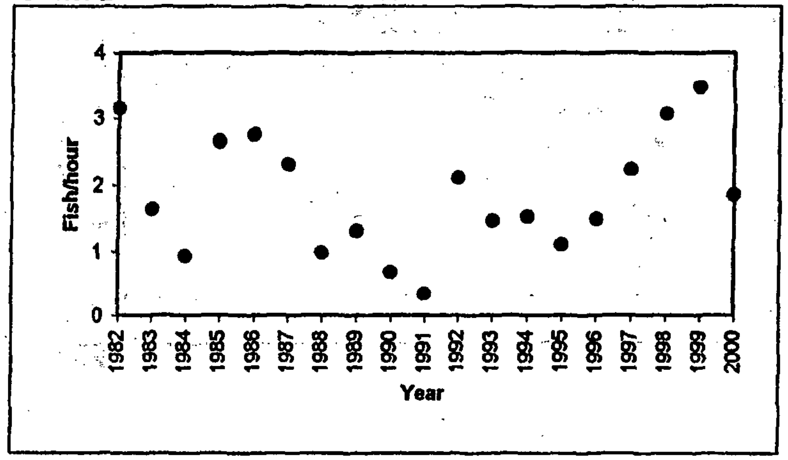


Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2000 in the vicinity of PINGP.

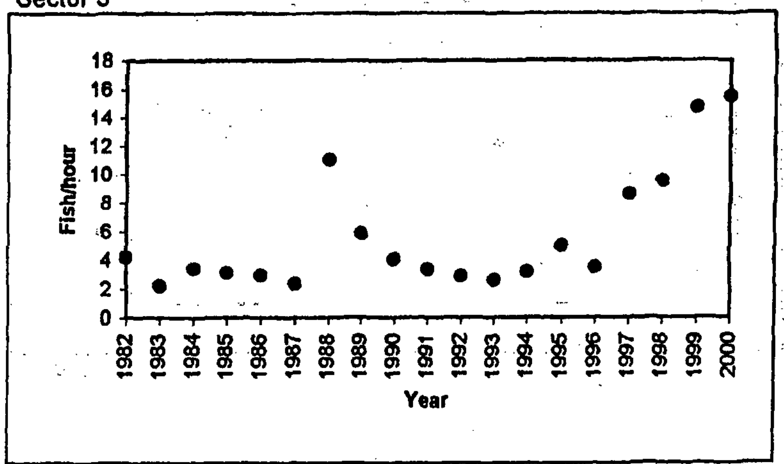
Sector 1



Sector 2



Sector 3



Sector 4

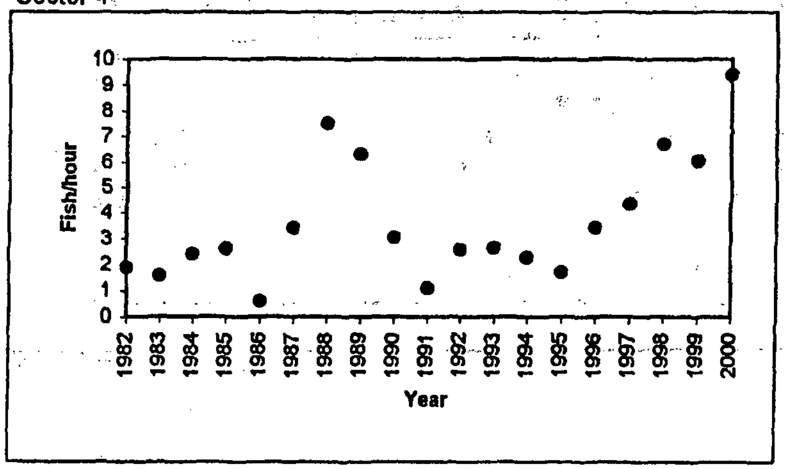


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2000 in the vicinity of PINGP

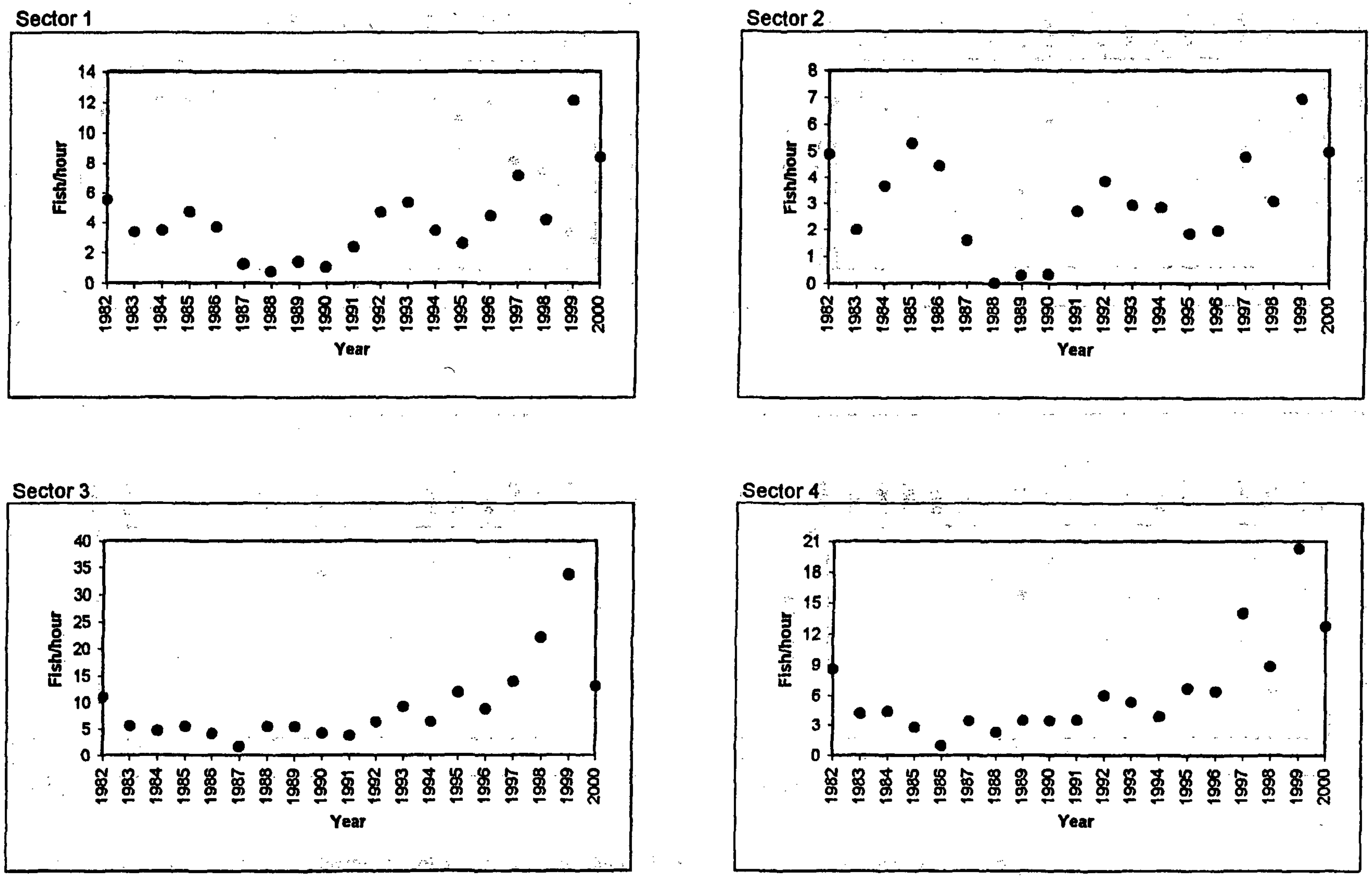


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2000 in the vicinity of PINGP.

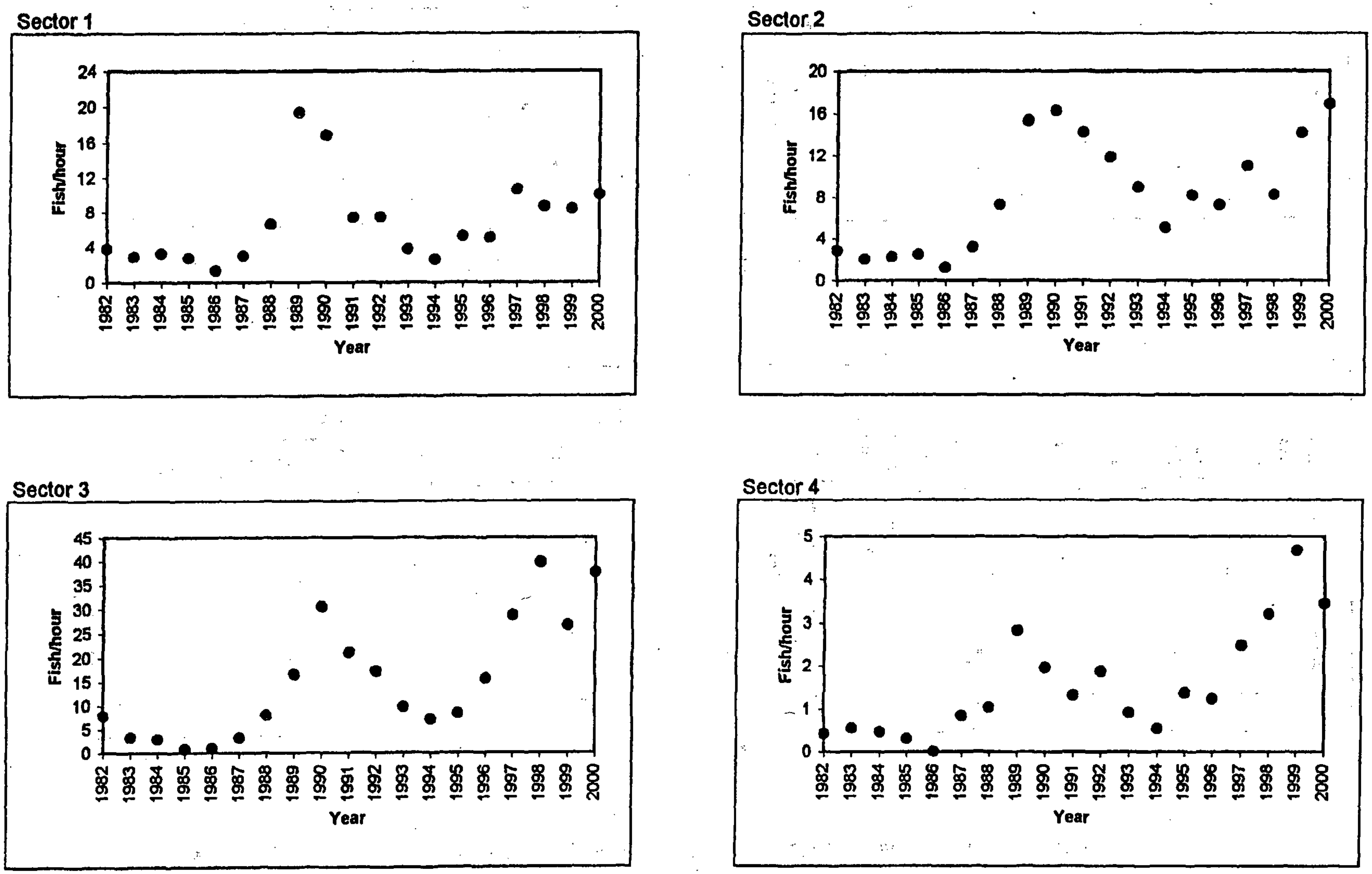


Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2000 in the vicinity of PINGP.

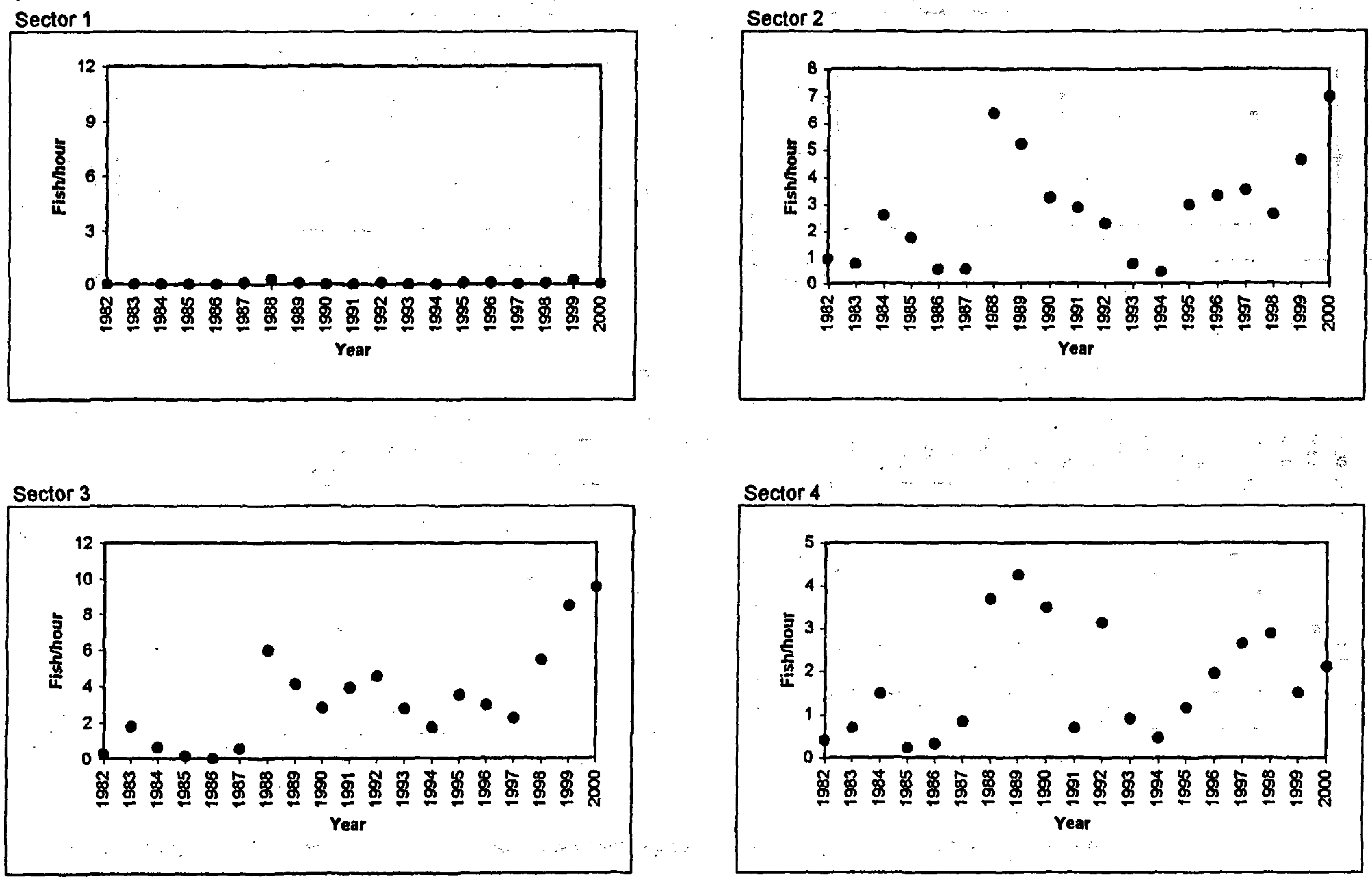


Figure 31

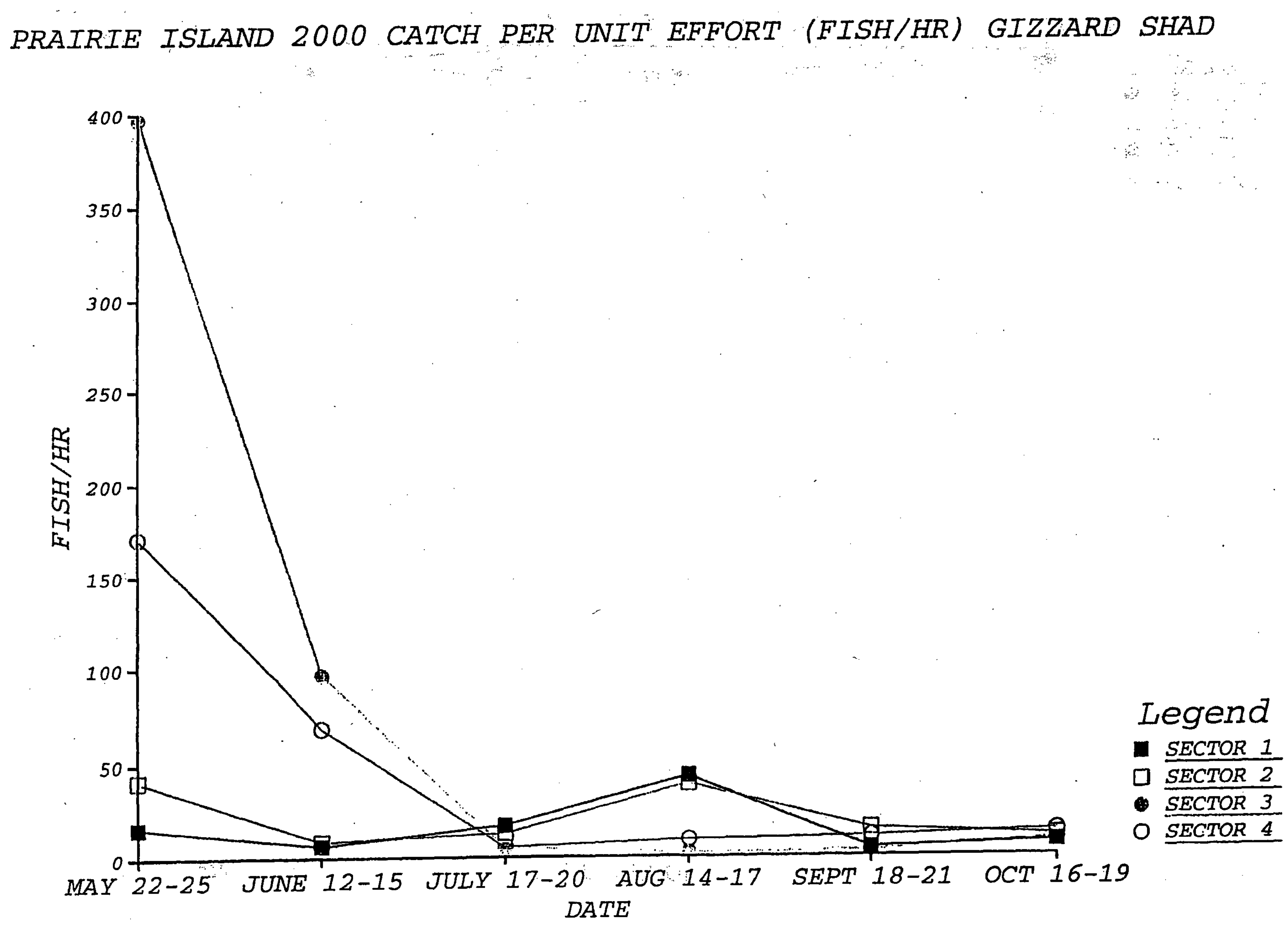

PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) GIZZARD SHAD
FISH/HR
400
350
300
250
200
150
100
50
0
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 32

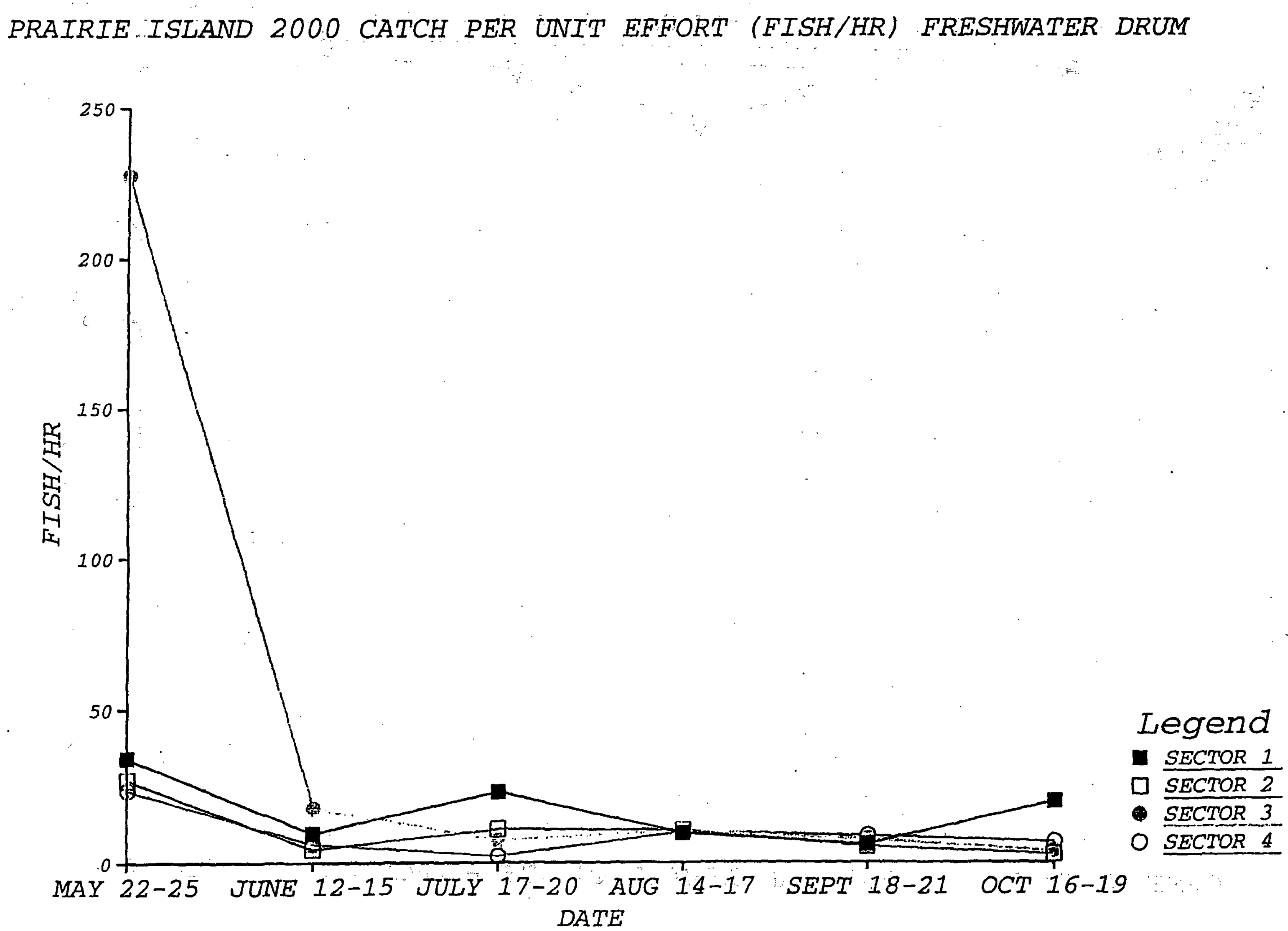
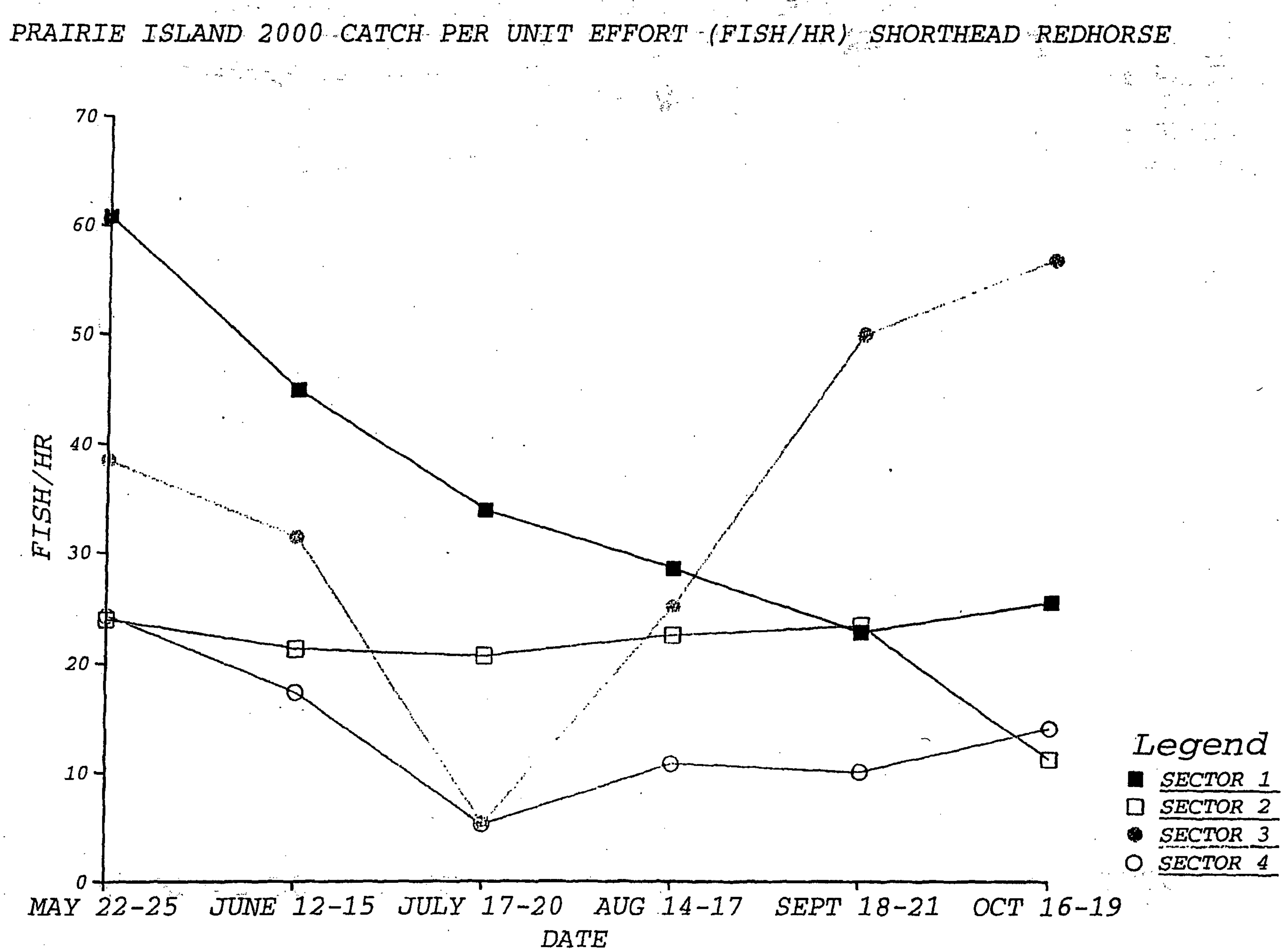
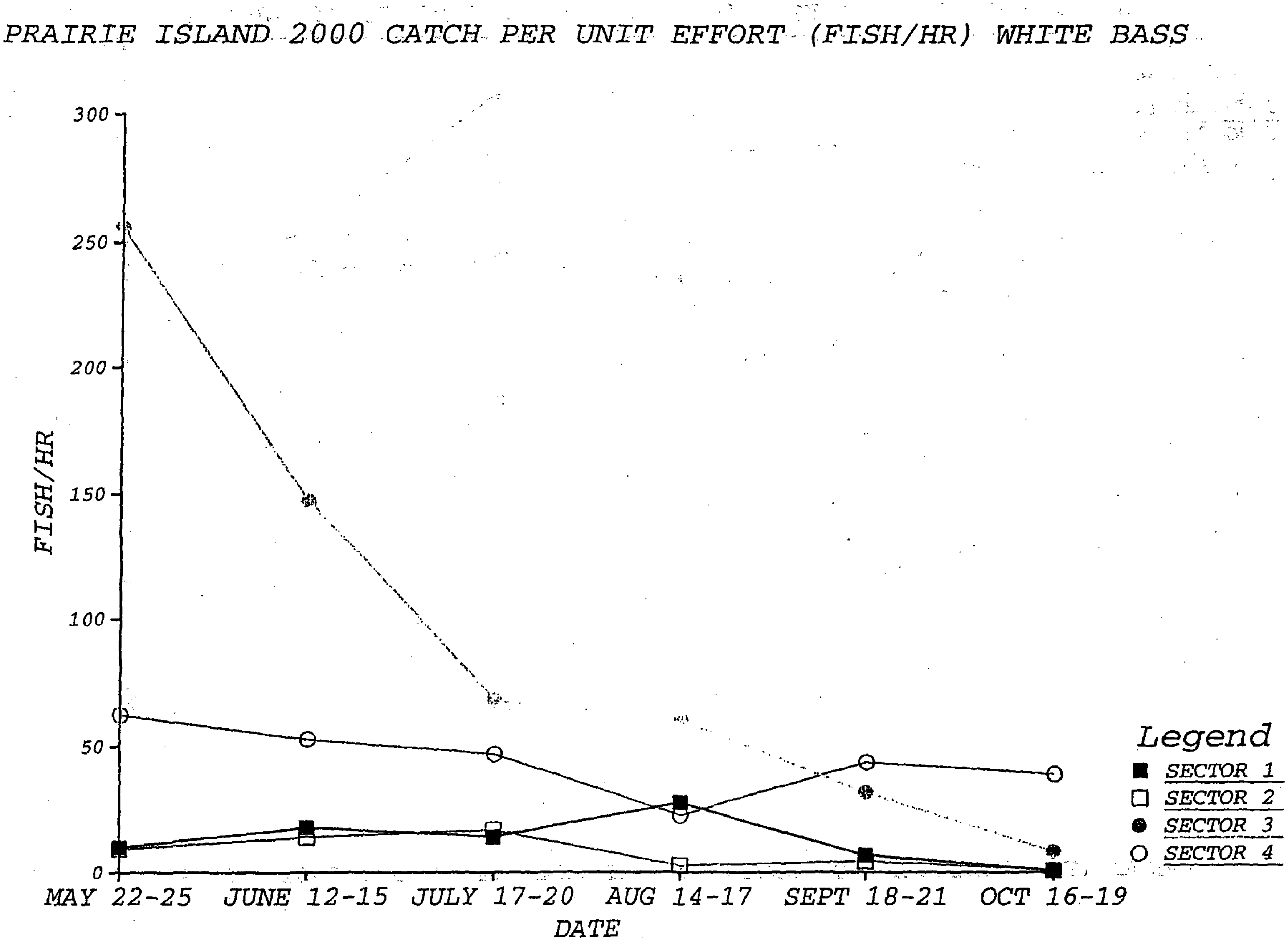

PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) FRESHWATER DRUM
FISH/HR
250
200
150
100
50
0
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 33



PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) SHORTHEAD REDHORSE
FISH/HR
70
60
50
40
30
20
10
0
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 34



PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) WHITE BASS
300
250
200
150
100
50
0
FISH/HR
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 35

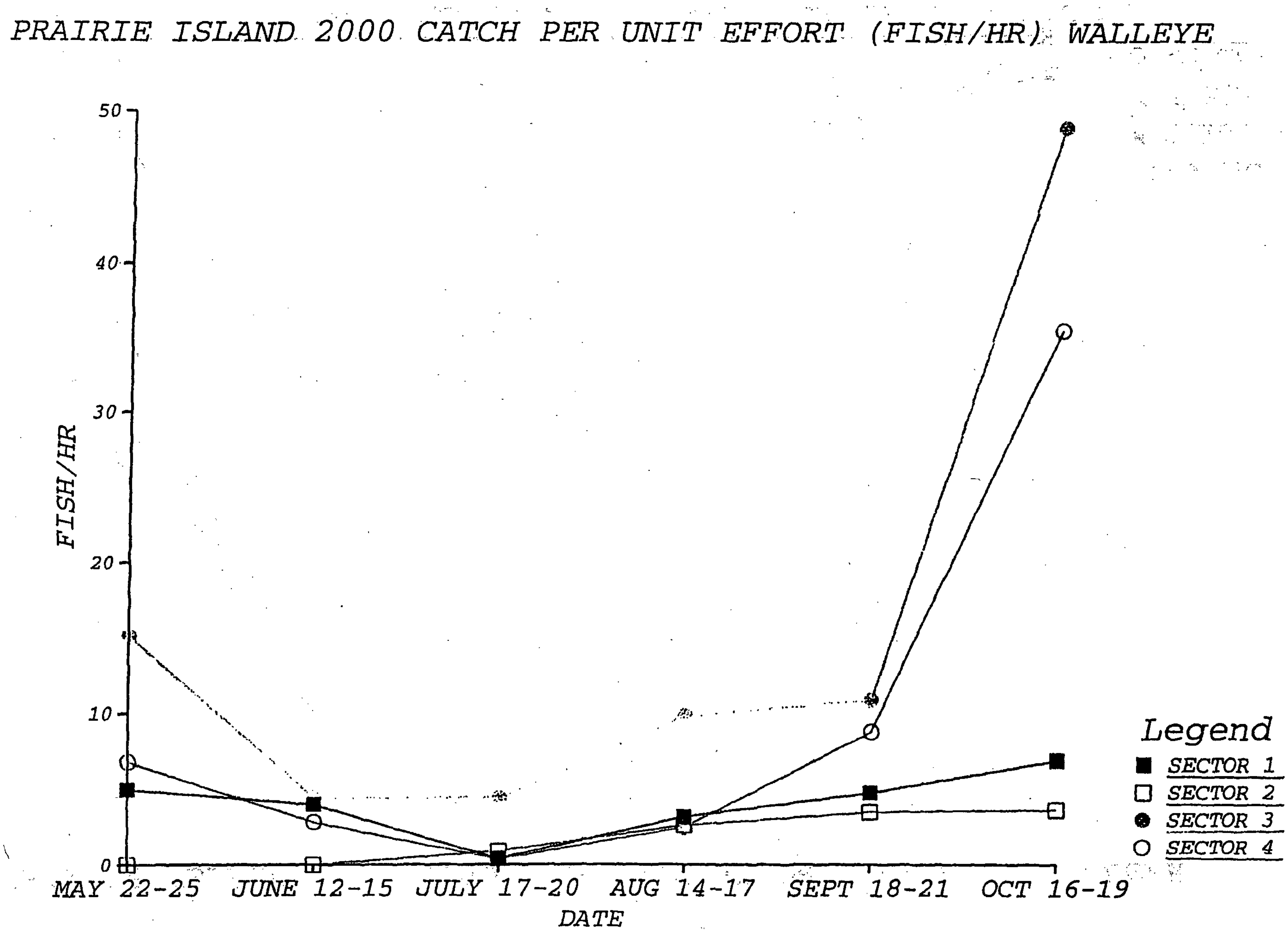

PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) WALLEYE
50
40
30
20
10
0
FISH/HR
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 36

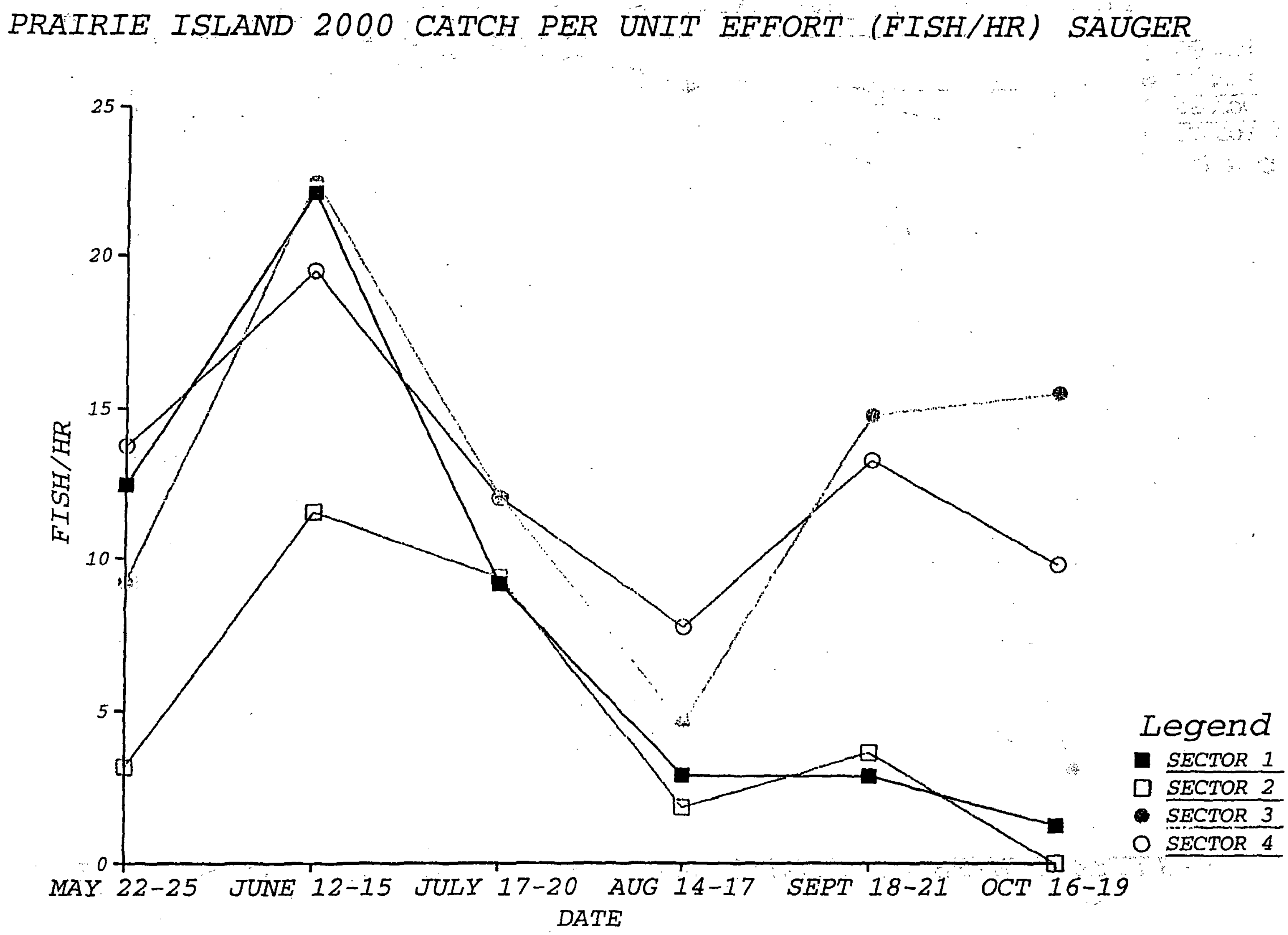

PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) SAUGER
25
20
15
10
5
0
FISH/HR
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 37

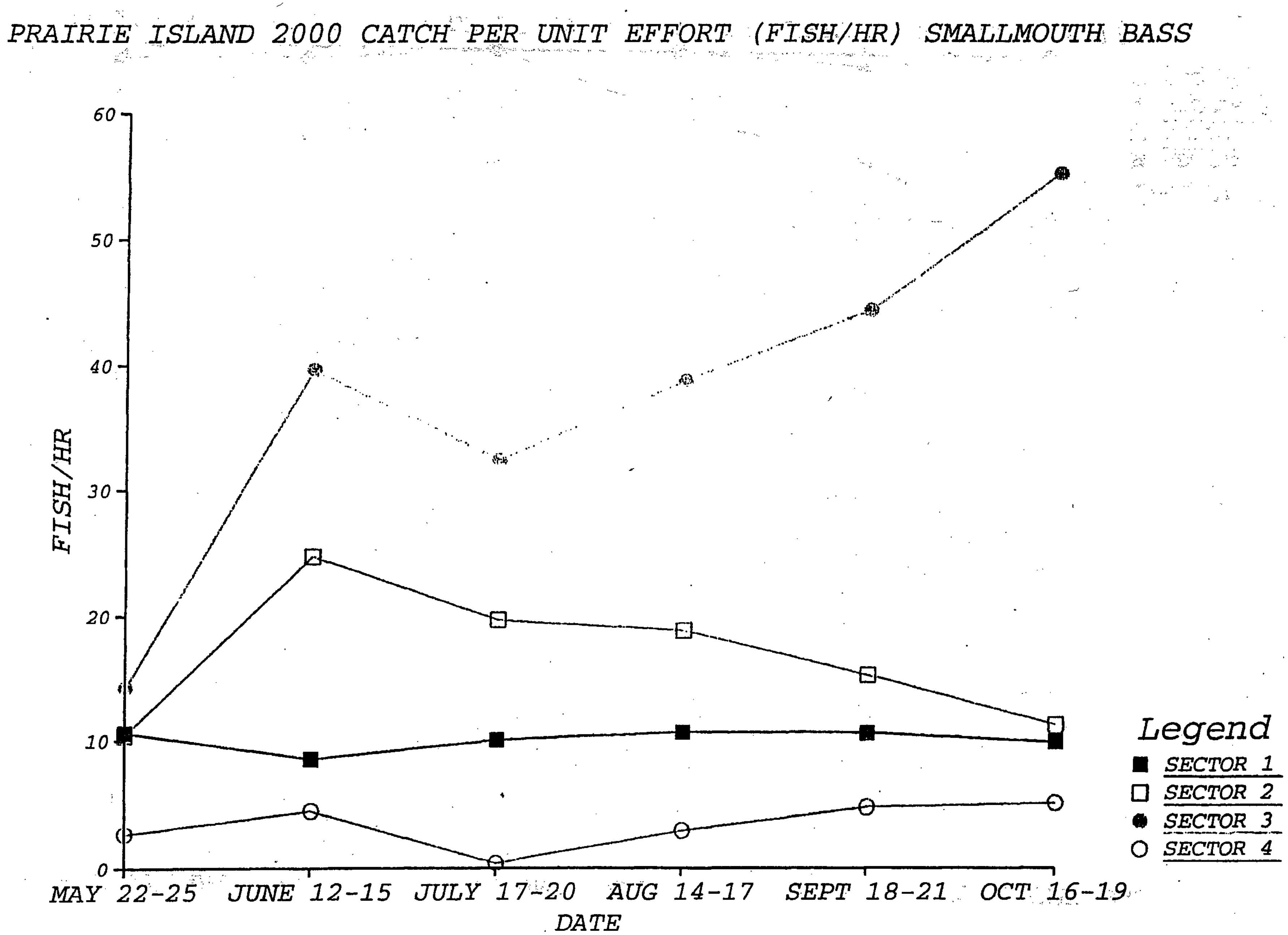

PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) SMALLMOUTH BASS
FISH/HR
60
50
40
30
20
10
0
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 38

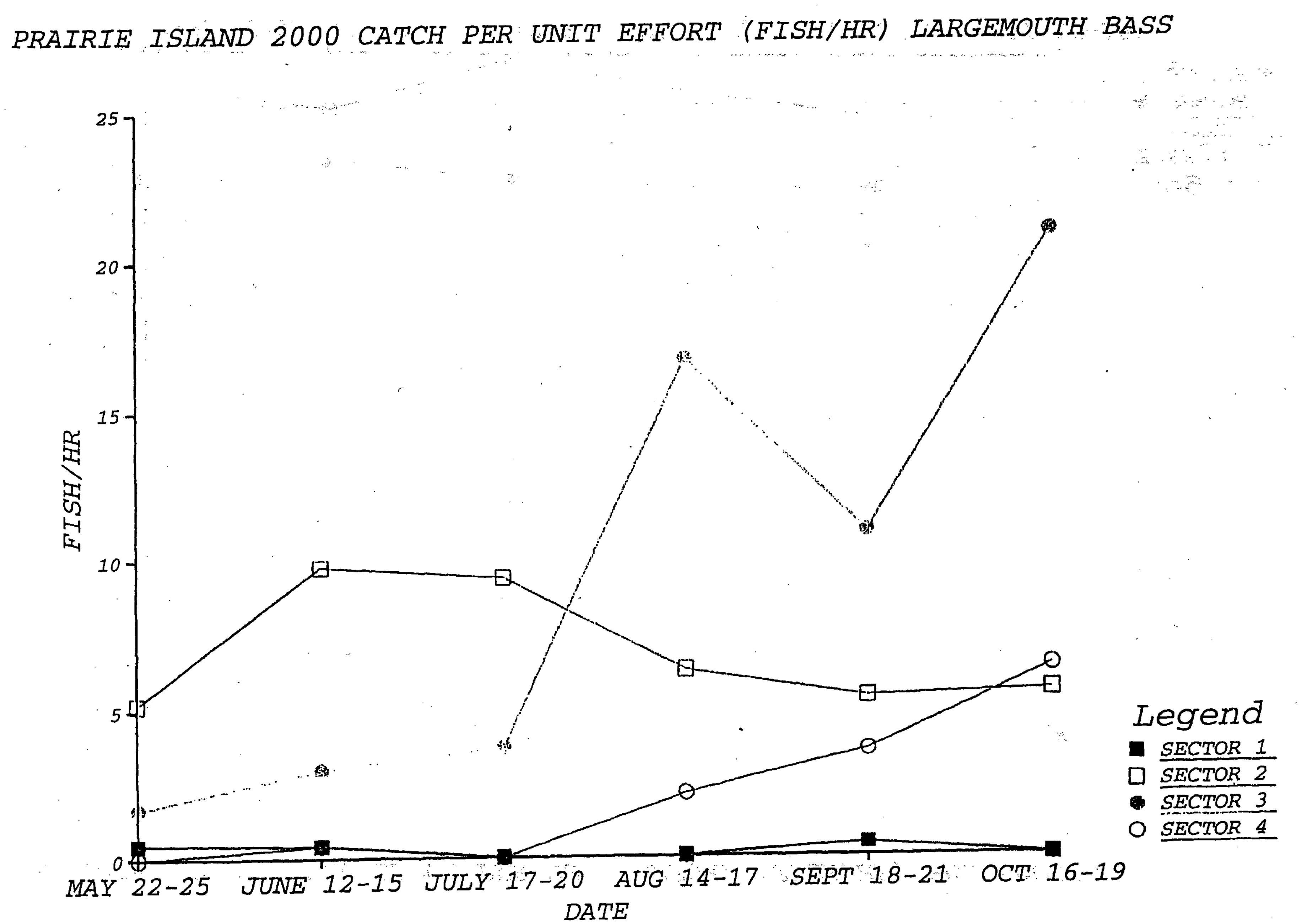

PRAIRIE ISLAND 2000 CATCH PER UNIT EFFORT (FISH/HR) LARGEMOUTH BASS
FISH/HR
25
20
15
10
5
0
MAY 22-25
JUNE 12-15
JULY 17-20
AUG 14-17
SEPT 18-21
OCT 16-19
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

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

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00
Chestnut lamprey Ichthyomyzon castaneus	x	x							x	x			x			x	x	
Silver lamprey Icthyomyzon unicuspus					x	x	x	x	x	x		x	x	x	x	x	x	x
Paddlefish Polyodon spathula															x			
Longnose gar Lepisosteus osseus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shortnose gar Lepisosteus platostomus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bowfin Amia calva	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American eel Anguilla rostrata	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x
Gizzard shad Dorosoma cepedianum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Goldeye Hiodon alosoides	x		x		x	x					x			x	x	x	x	
Mooneye Hiodon tergisus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brown trout Salmo trutta				x									x		x		x	
Northern pike Esox lucius	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Musky Esox masquinongy																		x
Carp Cyprinus carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carpsucker Species Carpiodes species		x					x											
River carpsucker Carpiodes carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Quillback Carpiodes cyprinus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Highfin carpsucker Carpiodes velifer			x	x	x	x	x	x	x	x	x	x	x	x	x			
White sucker Catostomus commersoni	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x

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

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00
Blue sucker <u>Cycleptus elongatus</u>	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x
Northern hogsucker <u>Hypentelium nigricans</u>	x														x			x
Smallmouth buffalo <u>Ictiobus bubalus</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bigmouth buffalo <u>Ictiobus cyprinellus</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Spotted sucker <u>Minytrema melanops</u>	x	x		x		x	x			x								
Silver redhorse <u>Moxostoma anisurum</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
River redhorse <u>Moxostoma carinatum</u>		x	x		x		x	x	x	x		x	x			x	x	x
Golden redhorse <u>Moxostoma erythrurum</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Greater redhorse <u>Moxostoma valenciennesi</u>		x		x		x		x							x	x		
Shorthead redhorse <u>M.macrolepidotum</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black bullhead <u>Ictalurus melas</u>	x	x	x	x	x	x				x							x	x
Yellow bullhead <u>Ictalurus natalis</u>					x	x	x					x	x					
Brown bullhead <u>Ictalurus nebulosus</u>	x																	
Channel catfish <u>Ictalurus punctatus</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Flathead catfish <u>Pylodictus olivaris</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Burbot <u>Lota lota</u>	x	x			x					x	x	x	x	x	x	x	x	x
White bass <u>Morone chrysops</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock bass <u>Ambloplites rupestris</u>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00
Green sunfish Lepommis cyanellus	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pumpkinseed Lepomis macrochirus							x	x	x	x	x	x	x	x	x	x	x	x
Orangespotted sunfish Lepomis humilis																x		x
Bluegill Lepomis macrochirus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Smallmouth bass Micropterus dolomieui	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Largemouth bass Micropterus salmoides	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
White crappie Pomoxis annularis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black crappie Pomoxis nigromaculatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Yellow perch Perca flavens	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	
Sauger Stizostedion canadense	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Walleye Stizostedion vitreum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Saugeye S. vitreum x S. canadense															x	x	x	
Freshwater drum Aplodinotus grunniens	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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.

Rank	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
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
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
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	0.31	0.13	0.35	0.23
29	Silver lamprey	0.21	0.16	0.13	0.42	0.23
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	0.00	0.00	0.13	0.00	0.03
	Totals	150.78	187.76	421.44	213.16	243.29

Table 3. Fisheries summary for Gizzard shad 1977-2000.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	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

Table 4. Fisheries summary for Freshwater drum 1977-2000.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	NA	8	776	310	LOG W=3.077 LOG L-5.161

Table 5. Fisheries summary for Shorthead redhorse 1977-2000.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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

Table 6. Fisheries summary for White bass 1977-2000.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	20.16	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

Table 7. Fisheries summary for Walleye 1977-2000.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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

Table 8. Fisheries summary for Sauger 1977-2000.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	NA	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

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

	Smallmouth Bass		Largemouth Bass	
	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

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 2000.

Year	Carp	White bass	Freshwater Drum	Sauger	Black Crappie	Shorthead Redhorse	Walleye	Gizzard 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
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	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

*Electrofishing only

SECTION III

PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2000 ANNUAL REPORT

FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

Study and Report
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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 pre-dawn 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

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.

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.

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.

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.

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 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).

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.

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).

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, 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 in 2000 does not appear to have increased the number of larval fish impinged on the traveling screens during April.

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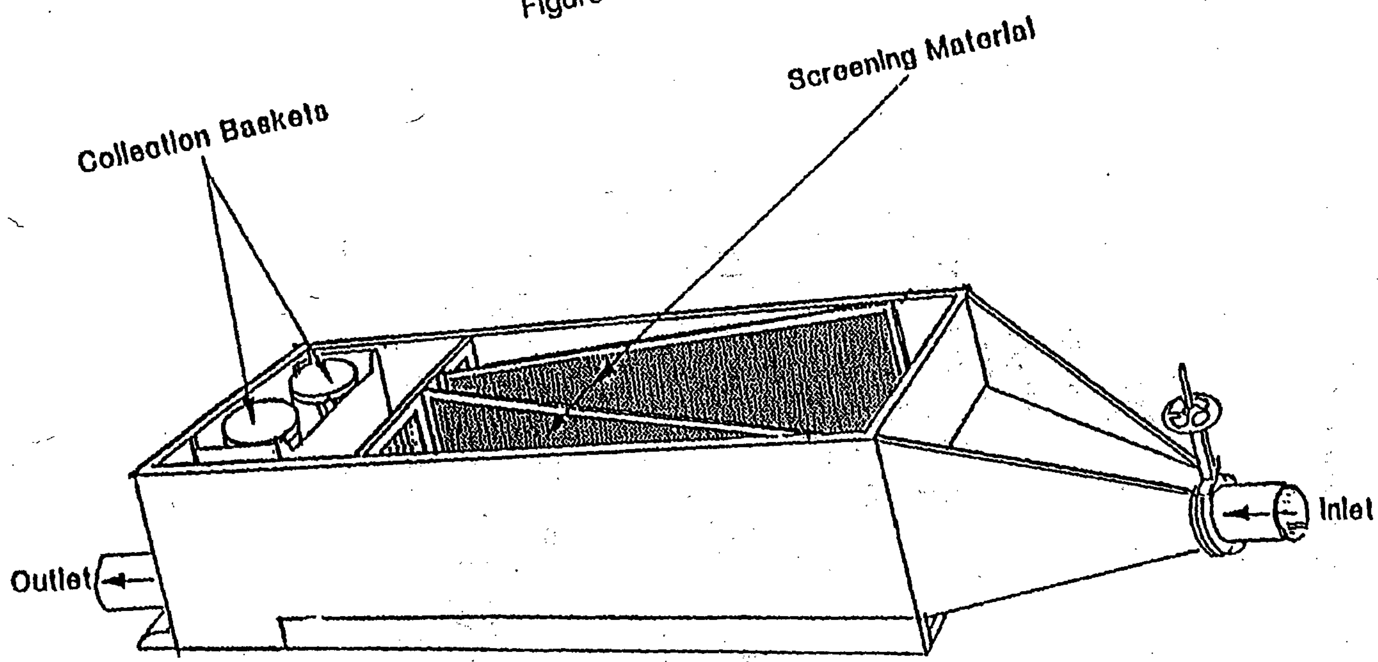
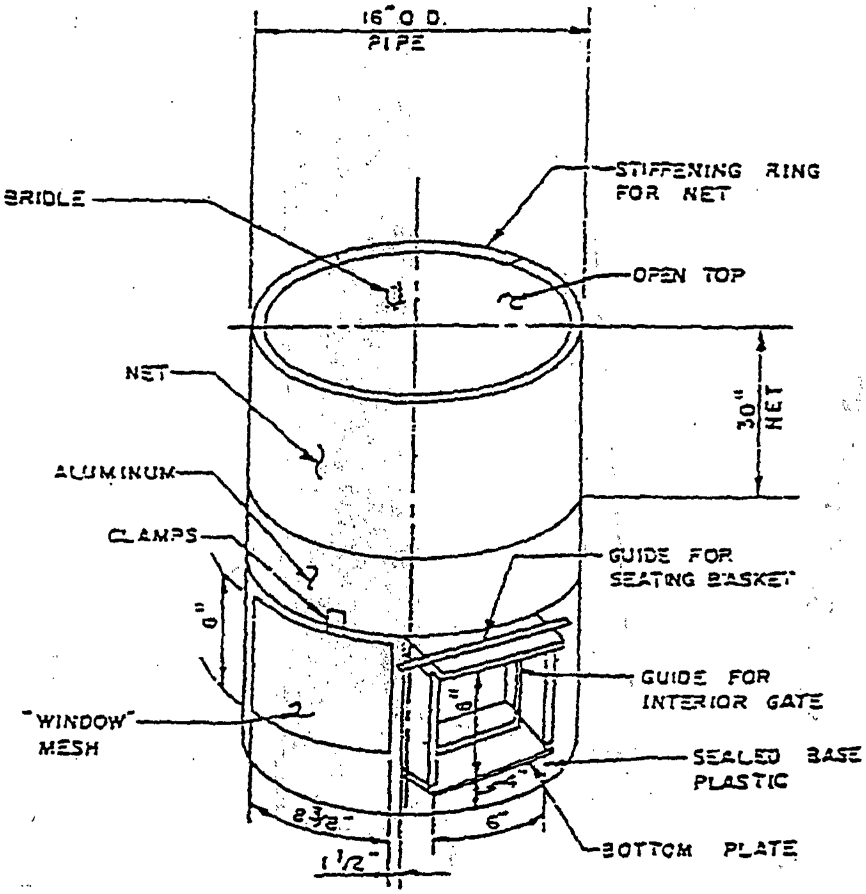
Figure 1



Larval Fish Collection Tank

Figure 2



DETAIL A

COLLECTION BASKET

NO SCALE

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 2000.

Date	Taxa	Lifestage	Density	Percent Live	Number of Fish
4-Apr-2000	UNID	EG	4.125653	0	0
4-Apr-2000	UNID	EG	0.404476	0	0
6-Apr-2000	UNID	EG	2.184169	0	0
6-Apr-2000	Log perch	AD	0.080895	100	1
6-Apr-2000	UNID	EG	2.253508	0	0
6-Apr-2000	Carp	PRO	0.057782	100	1
13-Apr-2000	Burbot	PRO	0.083182	0	1
18-Apr-2000	Shiner	JUV	0.159057	100	1
20-Apr-2000	Cyprinid	PRO	0.159057	0	1
27-Apr-2000	UNID	EG	0.735410	0	0
27-Apr-2000	UNID	EG	0.367705	0	0
27-Apr-2000	Sauger	PRO	0.147082	100	2
27-Apr-2000	Walleye	PRO	0.073541	100	1

Table 1b. Density of fish and eggs (fish/100 cubic meters) collected in pre-dawn and daylight samples in 2000.

Date	Pre-dawn Density	Daylight 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.

Taxa	Adult	Juvenile	Postlarvae	Prolarvae
Carp			x	o,x
Channel catfish		x		
Cyprinid	x	x	x	o,x
Flathead catfish		x		
Percid	x		x	x
Walleye				o,x
Bullhead sp.		x		
Sauger			x	o,x
Burbot			x	o,x
Catostomid		x		x
Stizostedion spp.				x
White bass		x		
Gizzard shad		x		
Freshwater drum		x		
Johnny darter	x			
Shiner spp.		o,x		
Emerald shiner	x	x		
Bluegill		x		
Mooneye				x
Golden redhorse		x		
Unidentified				x
Log perch	o			x

Legend: x = previous years data
o = 2000 data

Table 3. Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2000.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1984														
16-Apr-84	UNID	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	14-Apr-89	X	UN	0	0
23-Apr-84	UNID	EG	3840	10	28-Apr-86	UNID	EG	480	1	18-Apr-89	X	UN	0	0
25-Apr-84	CC	JU	384	1	29-Apr-86	PERC	PR	864	3	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	UNID	EG	3840	10	29-Apr-86	WE	PR	288	1	25-Apr-89	X	UN	0	0
27-Apr-84	CC	JU	384	1	1987					27-Apr-89	BUR	PR	1152	3
27-Apr-84	CYPR	JU	384	1	6-Apr-87	BUR	PR	1536	4	1992				
27-Apr-84	UNID	EG	2304	6	8-Apr-87	CARP	PR	576	1	1-Apr-92	CYPR	PR	288	1
30-Apr-84	CC	JU	384	21	10-Apr-87	BUR	PR	2304	4	1-Apr-92	CYPR	PO	288	1
30-Apr-84	CYPR	AD	384	1	13-Apr-87	BUR	PR	2304	4	1-Apr-92	CARP	PO	576	2
30-Apr-84	FHC	JU	192	1	15-Apr-87	BUR	PR	3456	6	2-Apr-92	X	UN	0	0
30-Apr-84	PERC	PR	1152	6	16-Apr-87	BUR	PR	576	1	8-Apr-92	X	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	WE	PR	768	4	22-Apr-87	X	UN	0	0	14-Apr-92	X	UN	0	0
1985					24-Apr-87	X	UN	0	0	16-Apr-92	X	UN	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	UNID	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	SA	PR	1344	7	1988					30-Apr-92	PERC	AD	288	1
24-Apr-85	UNID	EG	384	2	8-Apr-88	BUR	PR	768	2	1993				
24-Apr-85	WE	PR	1536	8	11-Apr-88	X	UN	0	0	2-Apr-93	UN	X	0	0
25-Apr-85	PERC	PR	192	1	13-Apr-88	UNID	EG	384	1	6-Apr-93	BUR	PR	288	1
25-Apr-85	SA	PR	1536	8	15-Apr-88	BUR	PR	768	2	8-Apr-93	UN	EG	288	1
25-Apr-85	STIZ	PR	384	2	18-Apr-88	X	UN	0	0	8-Apr-93	BUR	PR	288	1
25-Apr-85	WE	PR	576	3	20-Apr-88	BUR	PR	768	2	13-Apr-93	UN	X	0	0
26-Apr-85	SA	PR	192	1	22-Apr-88	BUR	PR	1920	5	15-Apr-93	BUR	PR	288	1
26-Apr-85	STIZ	PR	192	1	25-Apr-88	BUR	PR	1152	3	19-Apr-93	UN	EG	1152	2
29-Apr-85	BUR	PO	96	1	27-Apr-88	BUR	PR	1152	3	21-Apr-93	UN	X	0	0
29-Apr-85	CARP	PR	192	2	28-Apr-88	BUR	PR	384	1	27-Apr-93	UN	X	0	0
29-Apr-85	CATO	PR	288	3	29-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	X	UN	0	0	5-Apr-94	UNID	EG	384	1
18-Apr-86	CARP	PR	288	1	6-Apr-89	PERC	AD	384	1	5-Apr-94	CC	JU	384	1
18-Apr-86	CYPR	PR	288	1	7-Apr-89	X	UN	0	0	5-Apr-94	CARP	PR	384	1
23-Apr-86	CYPR	PO	288	1	11-Apr-89	X	UN	0	0	5-Apr-94	BUR	PR	384	1
23-Apr-86	PERC	PR	288	1	13-Apr-89	BUR	PR	384	1	7-Apr-94	BUR	PR	288	1

Table 3. (cont) Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2000.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1994 (cont)					**1996 (cont)**					**1999 (cont)**				
12-Apr-94	SA	PR	288	1	25-Apr-96	BURB	PR	504	2	9-Apr-99	CC	JU	288	1
12-Apr-94	CARP	PR	288	1	25-Apr-96	BURB	PR	252	1	9-Apr-99	BURB	PR	576	2
14-Apr-94	X	X	0	0	30-Apr-96	X	X	0	0	9-Apr-99	CC	JU	288	1
19-Apr-94	CYPR	JU	288	1	**1997**					13-Apr-99	UNID	EG	288	1
21-Apr-94	X	X	0	0	3-Apr-97	UNID	EG	17,280	30	13-Apr-99	UNID	EG	288	1
26-Apr-94	CARP	PR	1152	4	4-Apr-97	BG	JU	1152	2	15-Apr-99	BURB	PR	288	1
26-Apr-94	BUR	PR	288	1	4-Apr-97	UNID	PR	576	1	22-Apr-99	BURB	PR	576	2
28-Apr-94	SA	PR	288	1	25-Apr-97	BURB	PR	2304	4	27-Apr-99	PERC	PR	288	1
28-Apr-94	BUR	PR	288	1	29-Apr-97	CYPR	JU	864	2	27-Apr-99	CC	JU	288	1
1995					30-Apr-97	BLBH	JU	432	1	27-Apr-99	PERC	PR	288	1
3-Apr-95	CATO	JU	288	1	30-Apr-97	CC	JU	432	1	30-Apr-97	PERC	PO	288	1
4-Apr-95	BUR	PR	288	1	30-Apr-97	CYPR	JU	432	1	30-Apr-97	PERC	PR	576	2
4-Apr-95	CC	JU	576	1	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	GIZ	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	4-Apr-2000	UNID	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	CATO	PR	288	1	9-Apr-1998	EMSH	AD	229	1	6-Apr-2000	Log P	AD	288	1
17-Apr-95	UNID	EG	13248	46	14-Apr-1998	CC	JU	252	1	6-Apr-2000	UNID	EG	8023	39
20-Apr-95	UNID	EG	2880	10	16-Apr-1998	CYPR	JU	229	1	6-Apr-2000	Carp	PRO	206	1
24-Apr-95	UNID	EG	1152	4	16-Apr-1998	BURB	PR	229	1	13-Apr-2000	Burb	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	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	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	WAE	PRO	288	1
9-Apr-96	UNID	EG	252	1	28-Apr-1998	CARP	PR	1512	6					
11-Apr-96	FWD	JU	252	1	28-Apr-1998	UNID	PR	252	1					
11-Apr-96	BURB	PR	252	1	30-Apr-1998	STIZ	PR	2016	8					
11-Apr-96	EMSH	JU	504	2	30-Apr-1998	CARP	PR	14364	57					
11-Apr-96	CARP	PR	252	1	30-Apr-1998	PERC	PR	2268	9					
11-Apr-96	BURB	PR	252	1	30-Apr-1998	MOON	PR	252	1					
11-Apr-96	CARP	PR	252	1	30-Apr-1998	GORH	JU	252	1					
16-Apr-96	X	X	0	0	**1999**									
18-Apr-96	X	X	0	0	6-Apr-99	BURB	PR	522	2					
23-Apr-96	EMSH	JU	504	2	6-Apr-99	UNID	EG	4032	14					
23-Apr-96	UNID	EG	1008	4	9-Apr-99	GIZ	JU	288	1					

Table 4.	Estimated fish and fish egg impingement data for dates sampled in April 2000 with corresponding blowdown, river flow and temperatures.					
Date	Blowdown (cfs)	Average Daily R. Flow (cfs)	Avg. daily Inlet Temp. (F)	Est.avg daily impingement.		
4/4/2000	291	16,200	44.0	16,128		
4/6/2000	291	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		
4/20/2000	148	15,200	46.3	288		
4/25/2000	283	16,500	51.6	0		
4/27/2000	291	16,500	54.7	4922		

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	=	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

PINGP-113

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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by
K. N. Mueller
and
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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.

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.

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 JANUARY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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
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
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
26	24	24	32.5	33.4	350
27	24	24	32.0	33.4	350
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
	MONTHLY MINIMUM		32.0	32.8	251
	MONTHLY MAXIMUM		33.9	35.6	732
	MONTHLY MEAN		32.7	34.5	561.6

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 FEBRUARY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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	24	32.5	33.3	350
9	24	24	32.5	33.3	350
10	24	24	31.7	33.2	372
11	24	24	31.9	33.1	361
12	24	24	32.5	33.5	350
13	24	24	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	24	24	32.3	33.8	550
27	24	24	32.2	34.3	550
28	24	24	32.0	35.3	708
	MONTHLY MINIMUM		31.7	33.0	350
	MONTHLY MAXIMUM		32.8	35.3	708
	MONTHLY MEAN		32.3	33.5	392.4

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 MARCH	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	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
	MONTHLY MINIMUM		32.2	35.6	696
	MONTHLY MAXIMUM		38.7	40.9	768
	MONTHLY MEAN		35.2	37.4	727.2

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 2001.

DATE APRIL	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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	*
	MONTHLY MINIMUM		37.9	39.5	562
	MONTHLY MAXIMUM		49.4	55.9	762
	MONTHLY MEAN		42.1	44.8	732.2

** DUE TO FLOODING PLANT DISCHARGE FLOW CONTROL IS LOST
* NOT TAKEN DUE TO FLOOD, PRESENTLY IN AB-4, LEVEL TAKEN FROM INTAKE SCREEN HOUSE
+ = BAD QUALITY CODE

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 MAY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	51.3	56.8	*
2	24	24	53.5	59.0	*
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	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	59.0	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	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	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
	MONTHLY MINIMUM		51.3	58.3	235
	MONTHLY MAXIMUM		67.3	68.5	318
	MONTHLY MEAN		60.5	61.8	279.0

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

*** USED IT 2527A PER TI

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	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-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	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	512
15	24	24	70.8	71.3	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
20	24	24	71.2	71.4	798
21	24	24	70.6	71.0	791
22	24	24	69.8	70.2	791
23	24	24	71.6	71.4	798
24	24	24	71.2	71.4	798
25	24	24	71.5	72.1	798
26	24	24	73.4	74.1	806
27	24	24	74.7	75.5	798
28	24	24	76.1	76.6	798
29	24	24	76.9	77.3	798
30	24	24	78.1	78.2	798
	MONTHLY MINIMUM		61.5	62.0	283
	MONTHLY MAXIMUM		78.1	78.2	806
	MONTHLY MEAN		69.0	69.5	607.1

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.

DATE JULY	OPERATING HOURS UNIT 1	OPERATING HOURS UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (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
4	24	24	75.1	75.4	1229
5	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
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
13	24	24	77.3	78.5	1250
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
18	24	24	78.9	79.5	1271
19	24	24	80.5	81.4	1271
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 MINIMUM	73.6	73.6	798
		MONTHLY MAXIMUM	81.8	82.9	1271
		MONTHLY MEAN	77.9	78.5	1234.1

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.

DATE AUGUST	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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	81.4	1271
5	0	24	82.5	82.8	1271
6	0	24	*83.8	84.3	1166
7	0	24	*84.7	84.6	1040
8	0	24	*86.0	85.7	1040
9	0	24	*85.6	86.4	955
10	0	24	81.1	81.6	955
11	0	24	*79.4	80.0	955
12	0	24	*79.4	80.0	955
13	0	24	*78.0	78.5	955
14	0	24	*78.2	78.5	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	24	*74.6	74.6	955
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	24	*76.9	77.2	880
26	0	24	*76.5	76.8	880
27	0	24	*77.4	77.4	873
28	0	24	*76.9	77.2	865
29	0	24	*77.2	77.6	872
30	0	24	*75.2	76.2	880
31	0	24	*74.5	74.8	872
		MONTHLY MINIMUM	73.0	73.9	872
		MONTHLY MAXIMUM	86.0	86.4	1292
		MONTHLY MEAN	81.1	78.7	996.4

* Intake Canal Temp - due to Ambient temp being unreliable

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	OPERATING HOURS UNIT 1	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
		MONTHLY MINIMUM	60.6	63.4	872
		MONTHLY MAXIMUM	74.3	74.7	1271
		MONTHLY MEAN	65.3	69.8	1157.6

* Intake Canal Temp - due to Ambient temp being unreliable

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 **OCTOBER**	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	61.5	65.0	1271
2	24	24	61.9	65.7	1271
3	24	24	62.8	66.4	1250
4	24	24	60.9	65.1	1292
5	24	24	58.7	63.5	1271
6	24	24	57.4	62.2	1271
7	24	24	55.1	60.1	1271
8	24	24	54.6	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
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	51.4	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	45.8	49.7	1197
30	24	24	46.7	51.0	1197
31	24	0	47.0	51.1	1197
	MONTHLY MINIMUM		43.9	48.8	1181
	MONTHLY MAXIMUM		62.8	65.7	1650
	MONTHLY MEAN		53.3	57.4	1262.6

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 NOVEMBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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

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 DECEMBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (oF)	SITE DISCHARGE TEMP. (oF)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	40.5	43.1	1132
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	24	24	41.4	43.6	1116
6	24	24	40.4	43.2	1116
7	24	24	39.7	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	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	24	32.0	36.9	961
26	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	40.5	43.6	1132
		MONTHLY MEAN	36.1	39.2	1044.7

Table 2
Daily 2001 Mississippi River Discharge Flow Rate (cfs) at Lock Dam 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.	145300.	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.
26	11200.	10900.	10600.	159500.	50000.	68900.	18600.	10300.	9600.	11600.	132000.	8800.
27	10800.	10600.	10700.	169400.	51600.	65400.	18600.	9600.	8200.	10500.	11900.	7700.
28	9800.	9800.	11800.	174100.	54000.	60800.	18800.	9700.	7700.	8900.	14700.	7600.
29	10500.		12800.	172000.	56100.	56200.	19700.	8300.	8300.	10600.	15500.	9100.
30	11600.		13900.	166700.	57100.	51400.	18500.	8300.	8500.	10300.	13800.	9800.
31	12500.		15000.		56900.		17600.	9200.		10200.		10300.
MIN:	9800.	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.

YEAR MAX. 174100.
YEAR MIN. 6300.

Table 3 2001 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

Month	Mean Plant Flow (cfs)	Mean River Flow (cfs)	Percentage of Mean River Flow 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 %

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	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**

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
2001 ANNUAL REPORT

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.

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

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 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.

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

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).

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).

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.

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).

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

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).

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 approximately 150, 250 and 350 mm (Figures 14a and 14b).

GENERAL

The ten most abundant species collected during 2001 in descending order, based on average CPUE for all sectors combined were: 1) white bass, 2) freshwater drum, 3) carp, 4) shorthead redhorse, 5) smallmouth bass, 6) gizzard shad, 7) walleye, 8) bluegill, 9) sauger, and 10) quillback carpsucker (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 to 188.07 in 2001 (Table 2).

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Figure 1 PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA

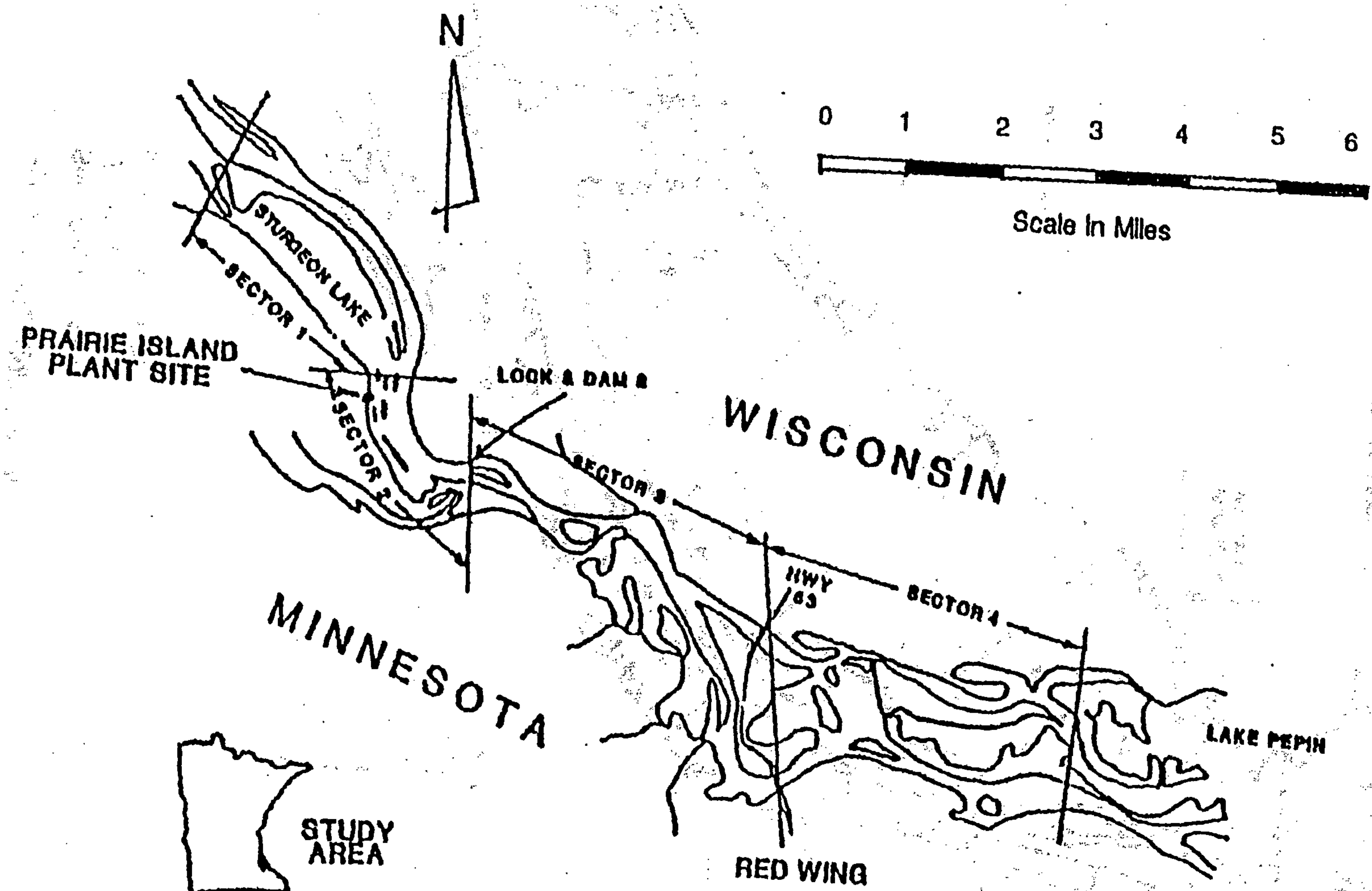


Figure 2.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Upstream
(Sec 1 Runs 1-20)

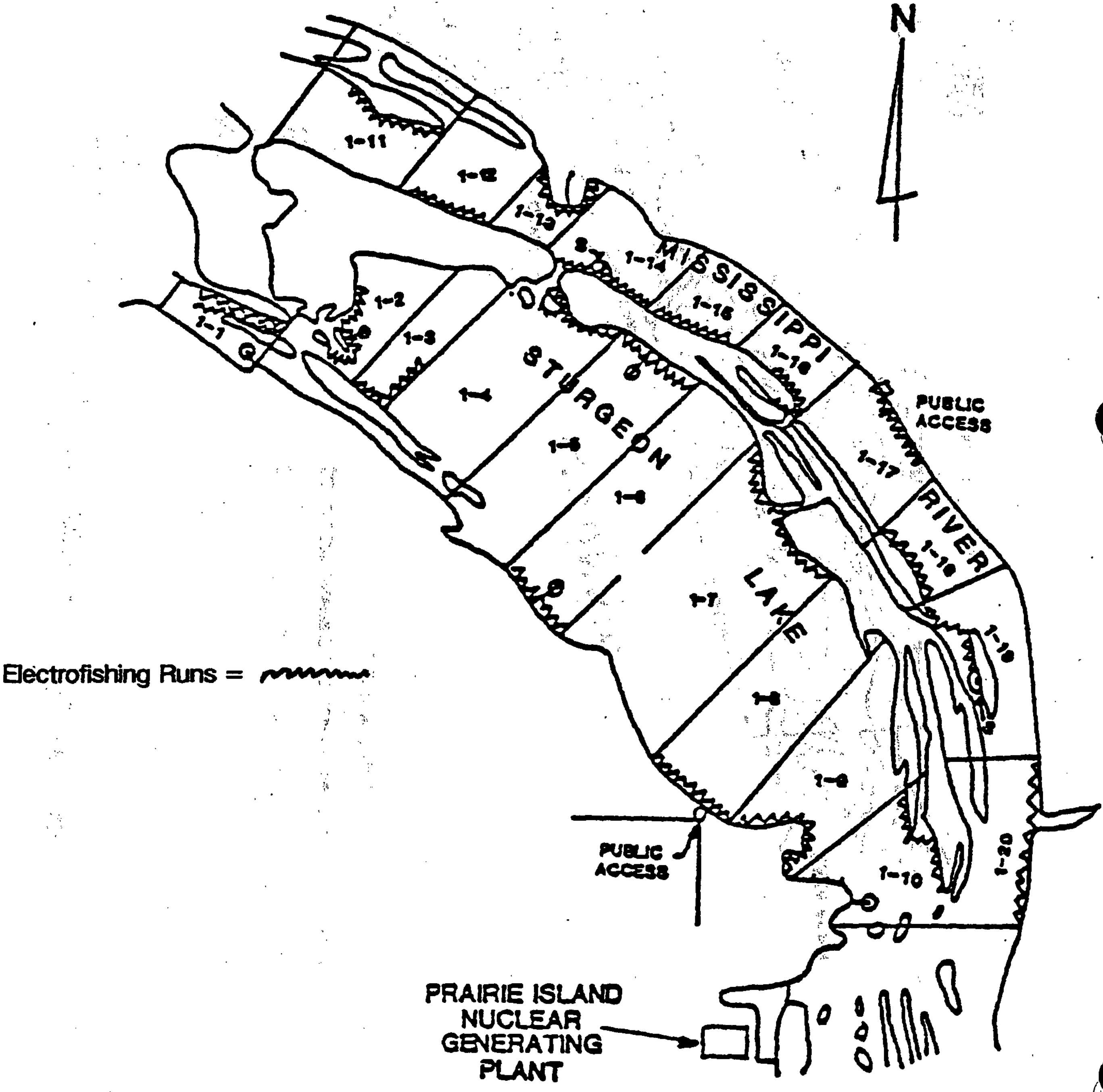


Figure 3.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

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

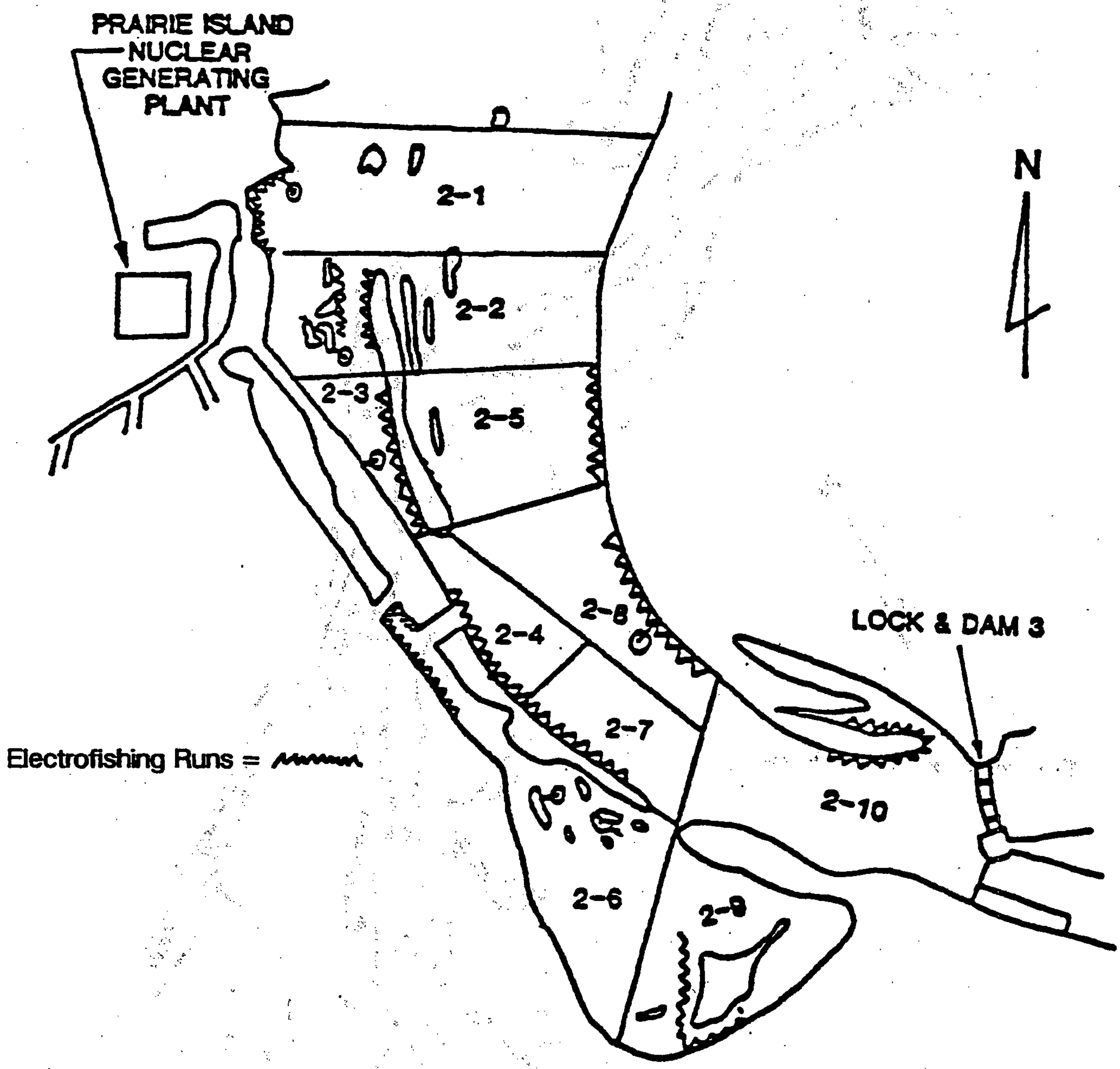


Figure 4.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 3 Runs 1-10)

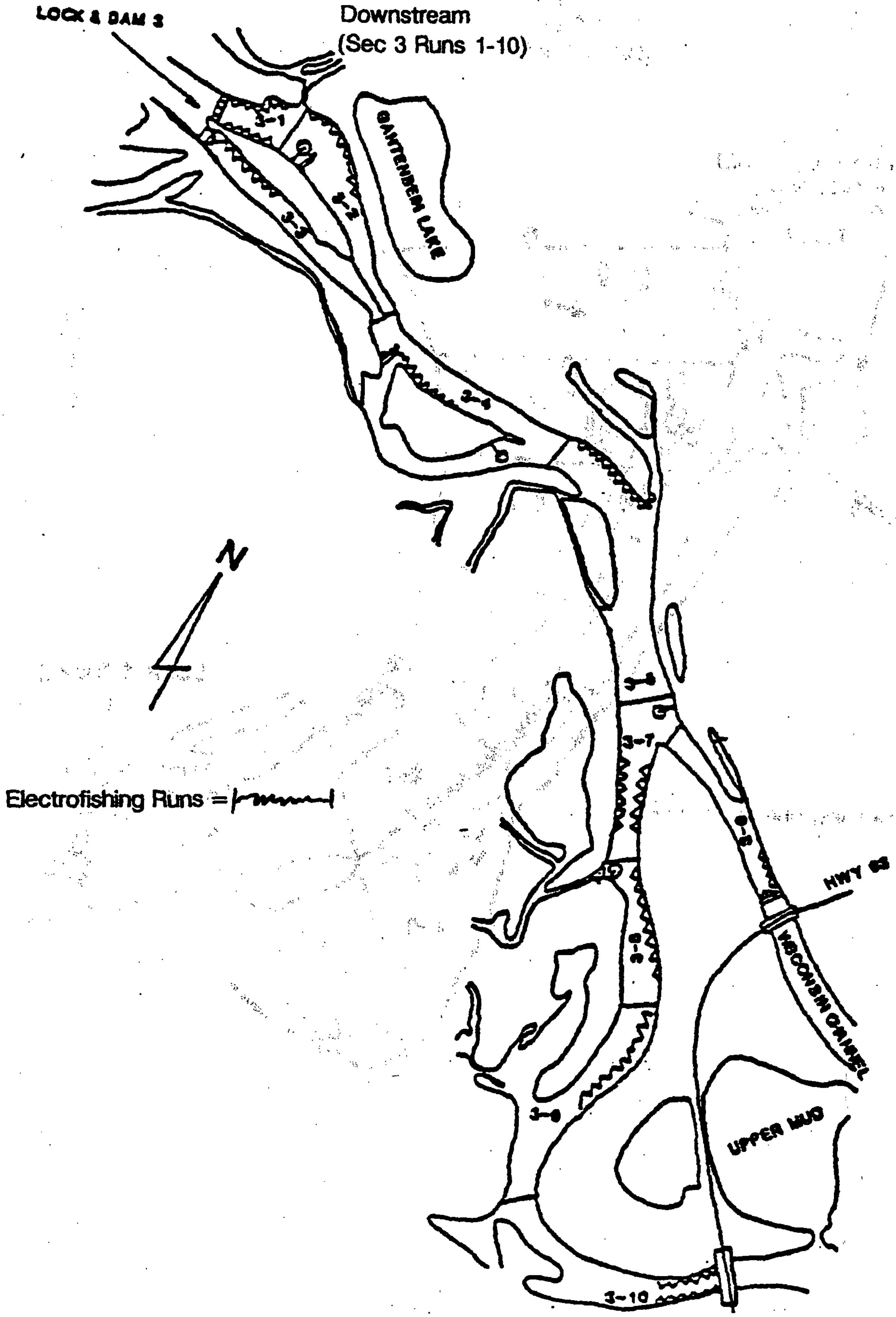
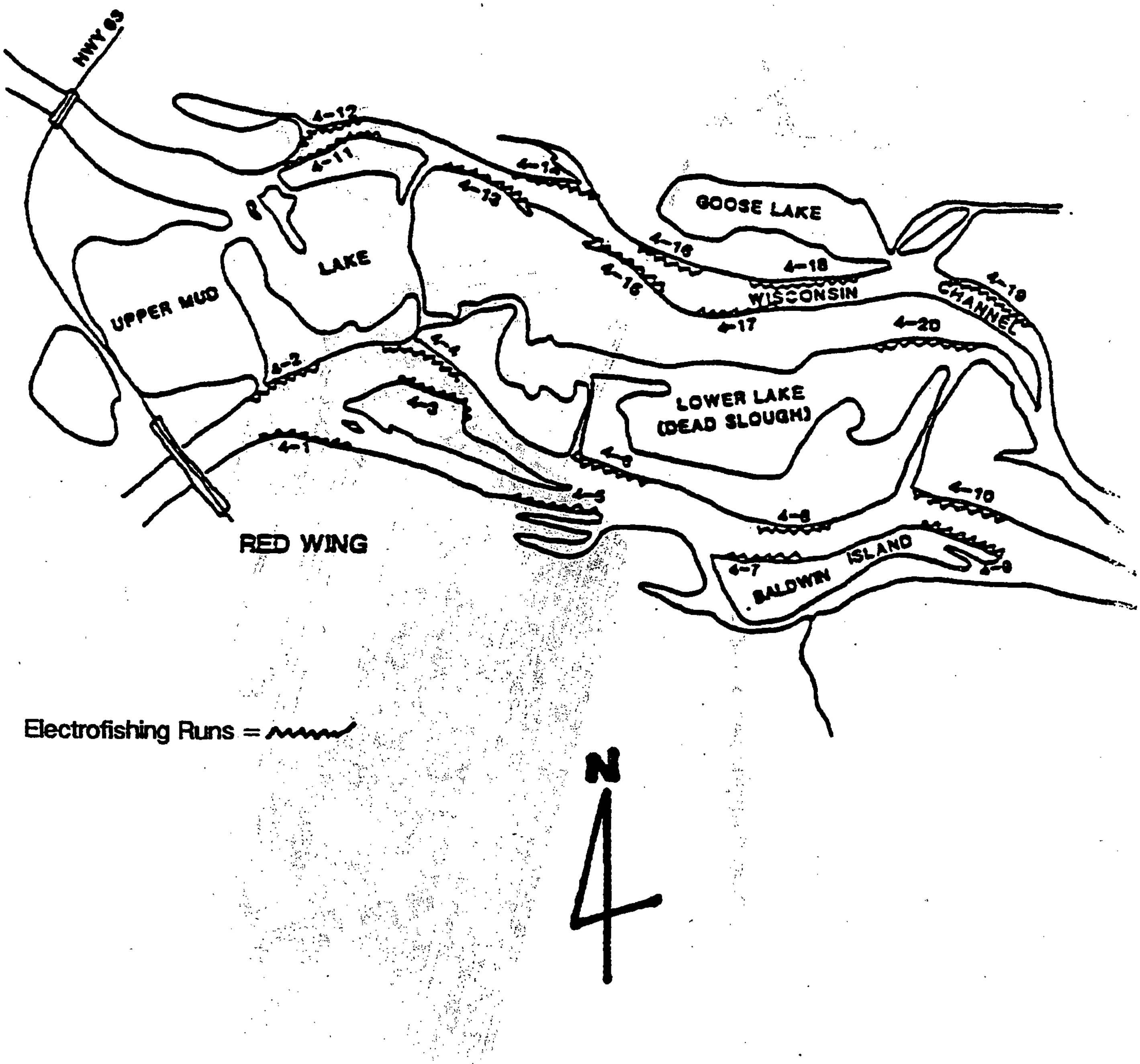


Figure 5.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 4 Runs 1-20)



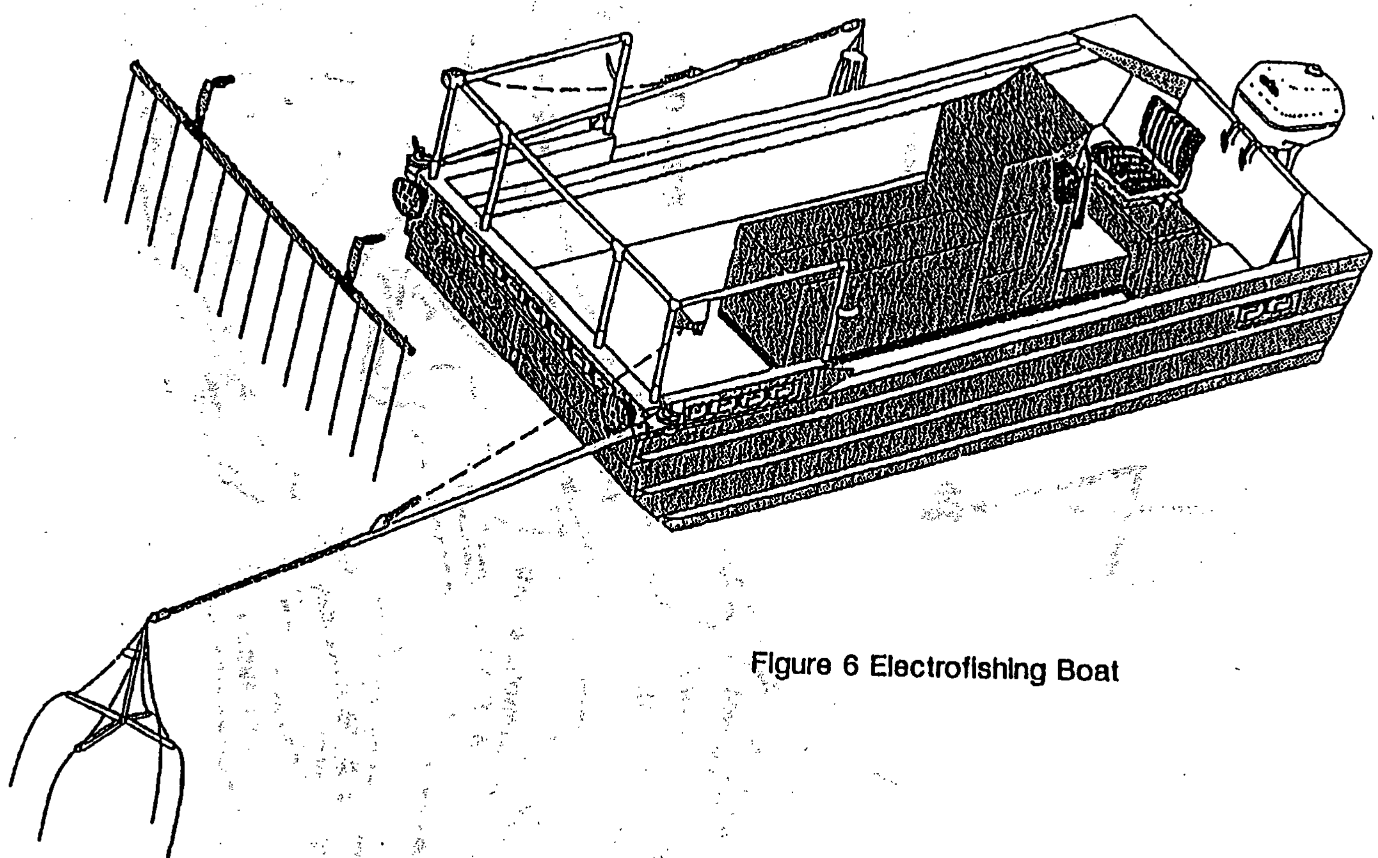
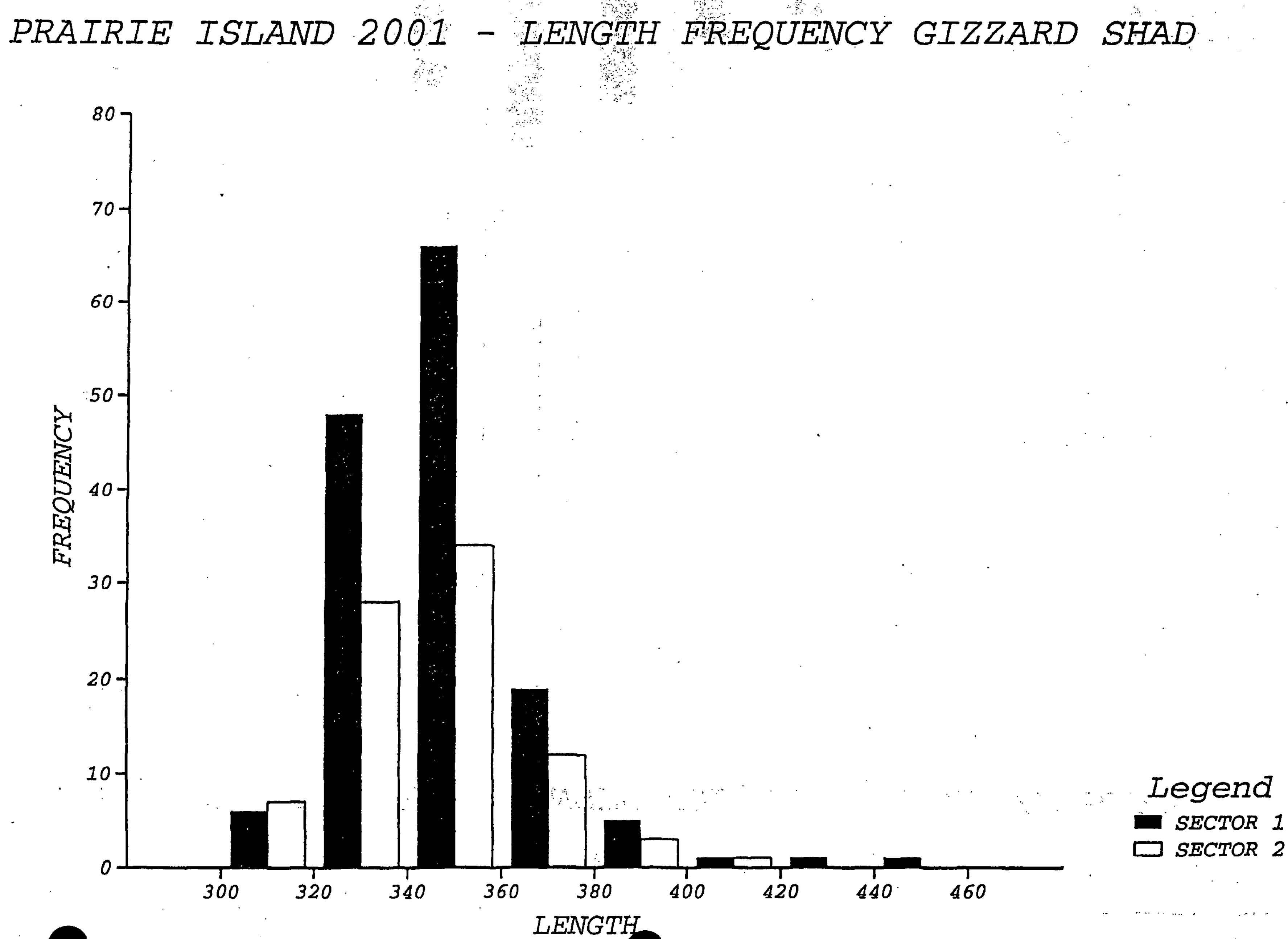


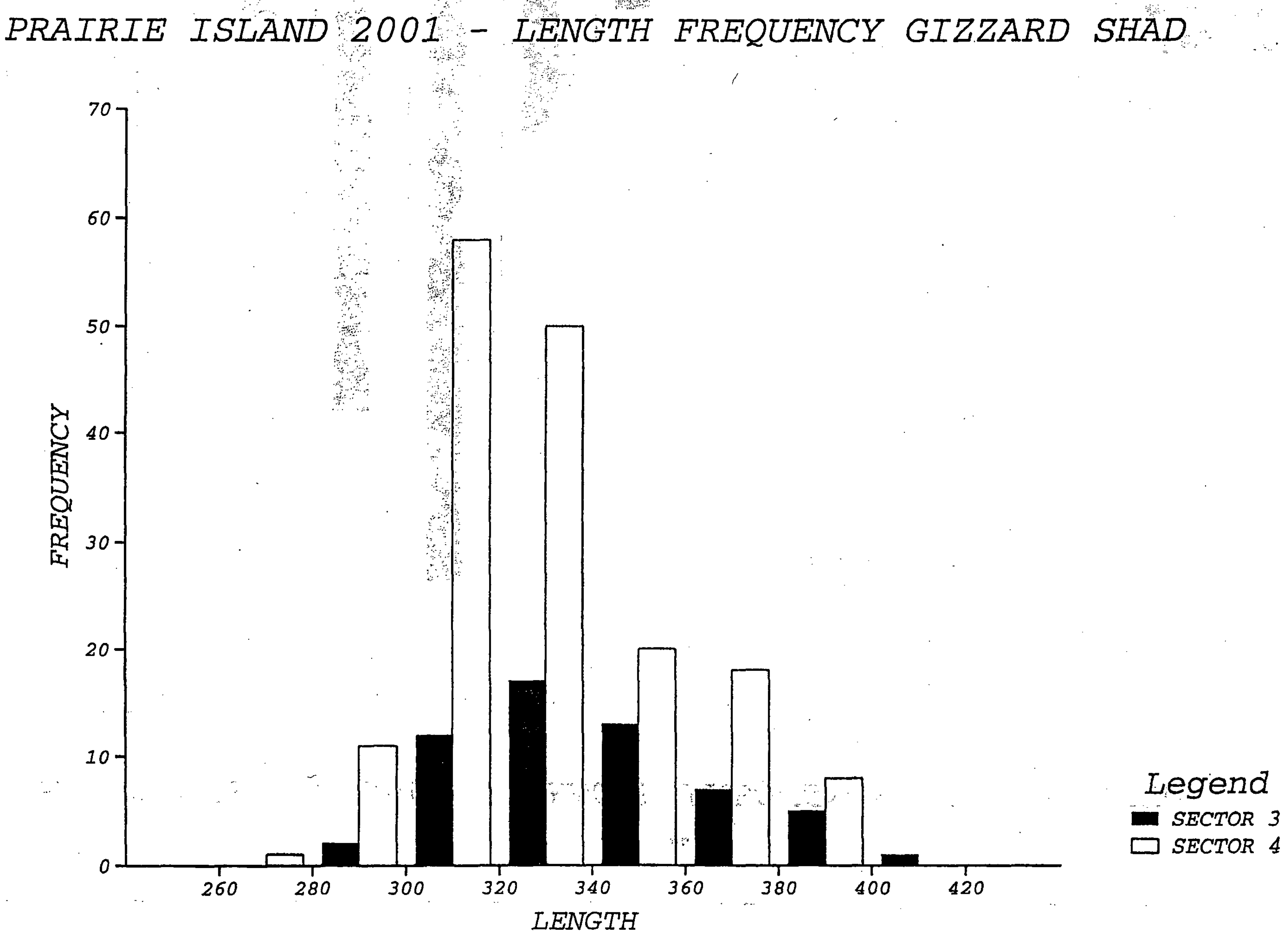
Figure 6 Electrofishing Boat

Figure 7 a



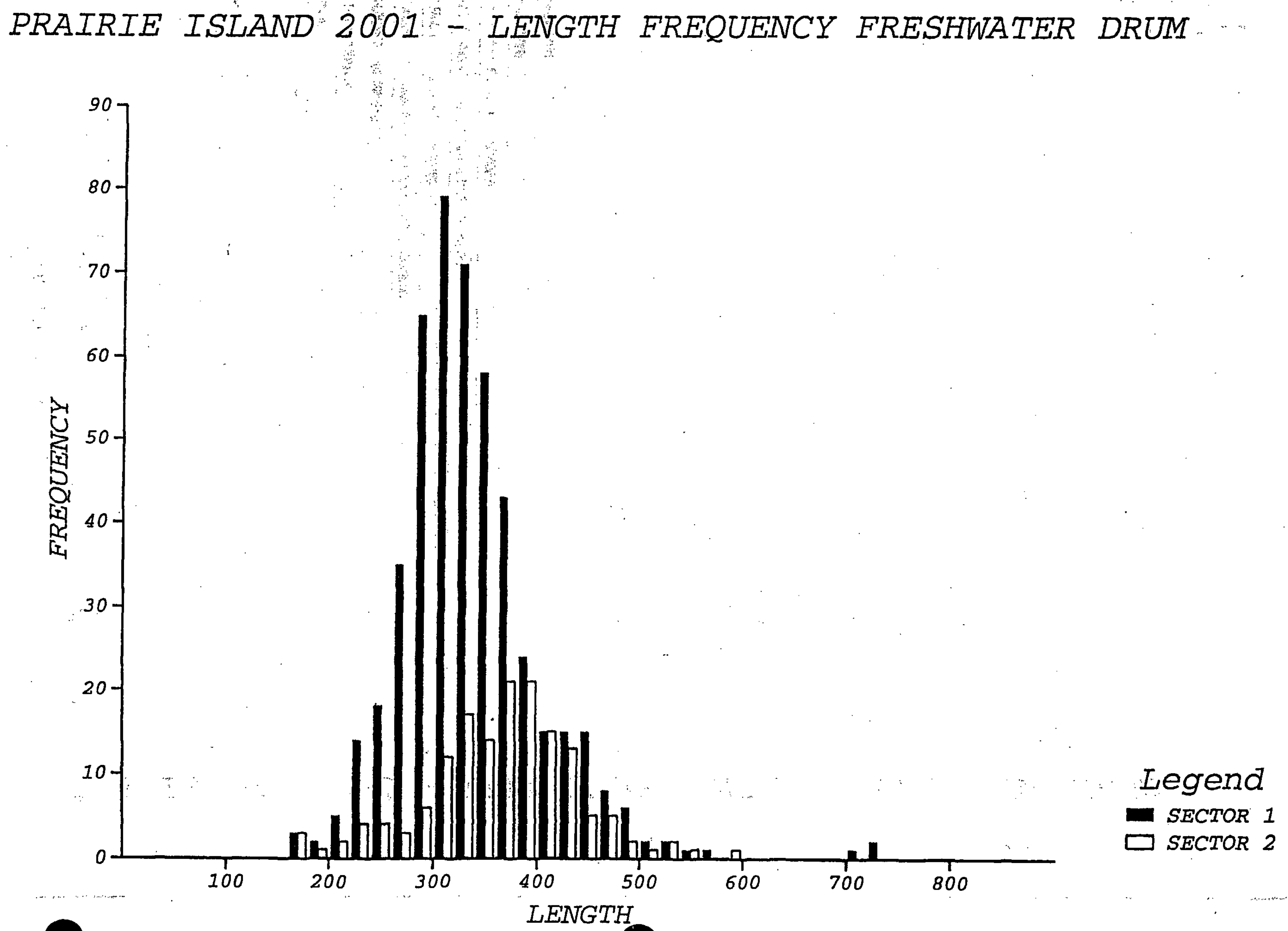
PRAIRIE ISLAND 2001 - LENGTH FREQUENCY GIZZARD SHAD
FREQUENCY
0
10
20
30
40
50
60
70
80
300
320
340
360
380
400
420
440
460
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 7 b



PRAIRIE ISLAND 2001 - LENGTH FREQUENCY GIZZARD SHAD
FREQUENCY
70
60
50
40
30
20
10
0
260
280
300
320
340
360
380
400
420
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 8 a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FREQUENCY
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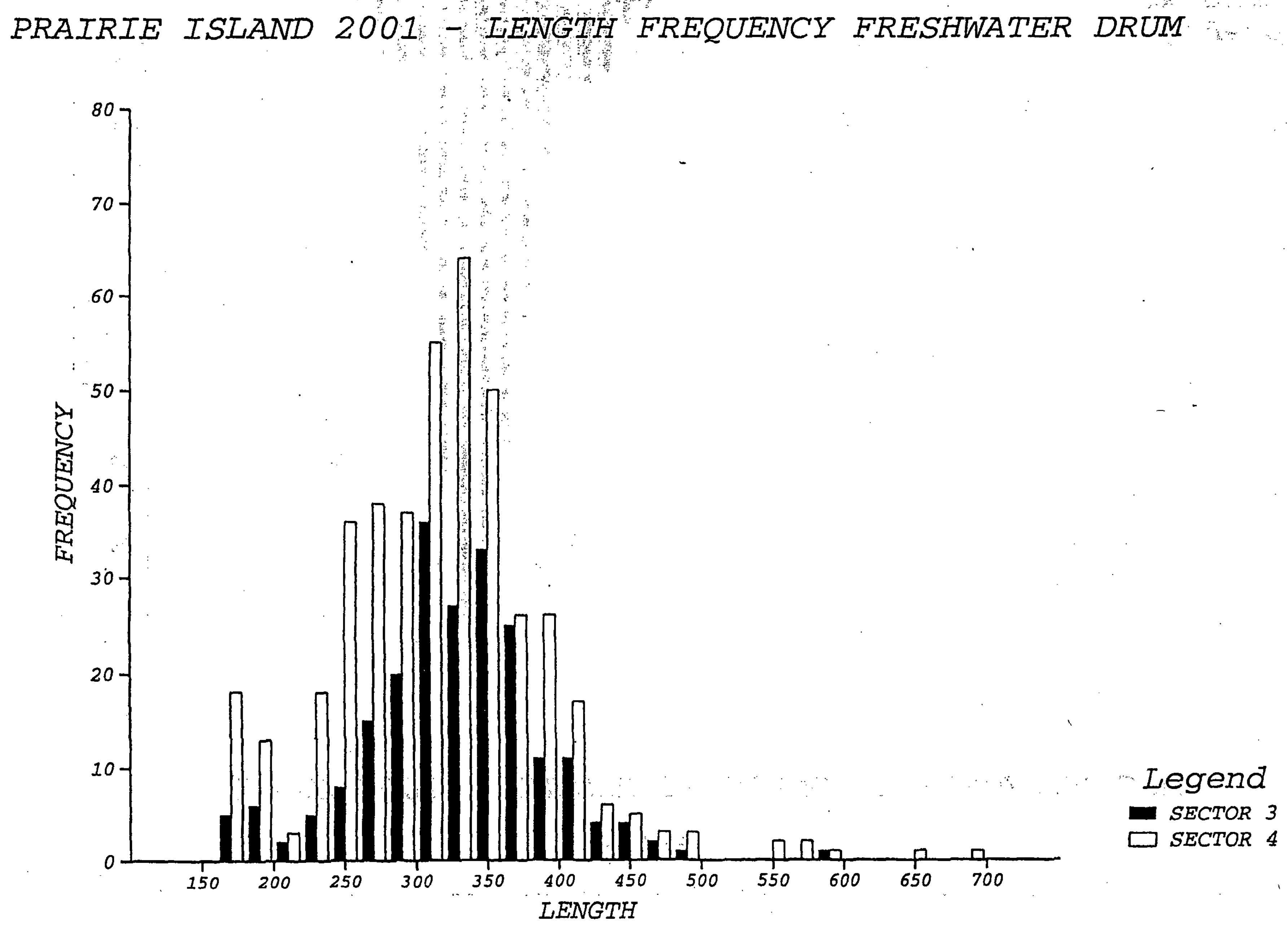
10
20
30
40
50
60
70
80
90
LENGTH
100
200
300
400
500
600
700
800
Legend
SECTOR 1
SECTOR 2

Figure 8 b


PRAIRIE ISLAND 2001 - LENGTH FREQUENCY FRESHWATER DRUM
FREQUENCY
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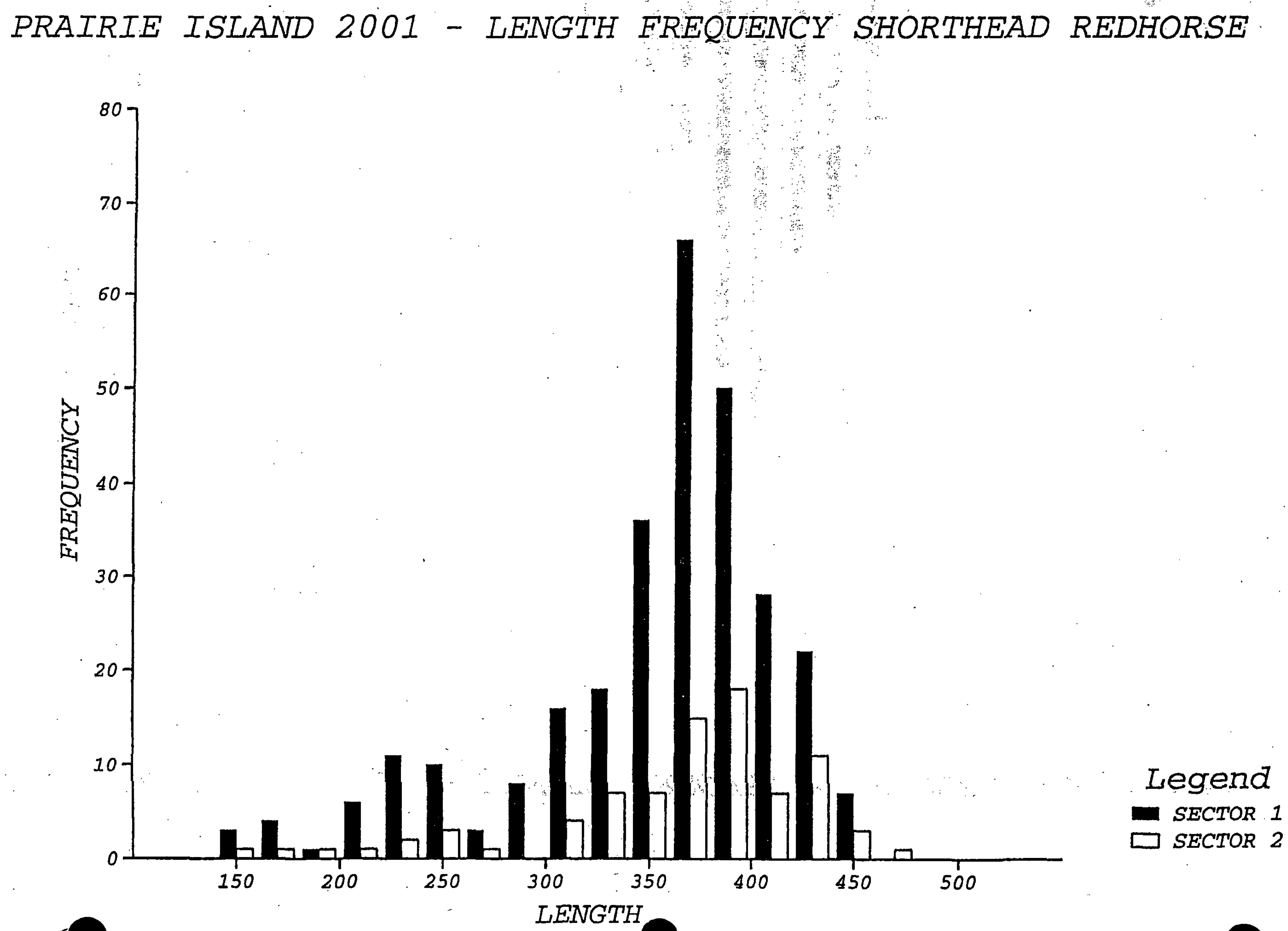
70
60
50
40
30
20
10
0
150
200
250
300
350
400
450
500
550
600
650
700
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 9 a



PRAIRIE ISLAND 2001 - LENGTH FREQUENCY SHORTHEAD REDHORSE
FREQUENCY
0
10
20
30
40
50
60
70
80
150
200
250
300
350
400
450
500
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 9 b

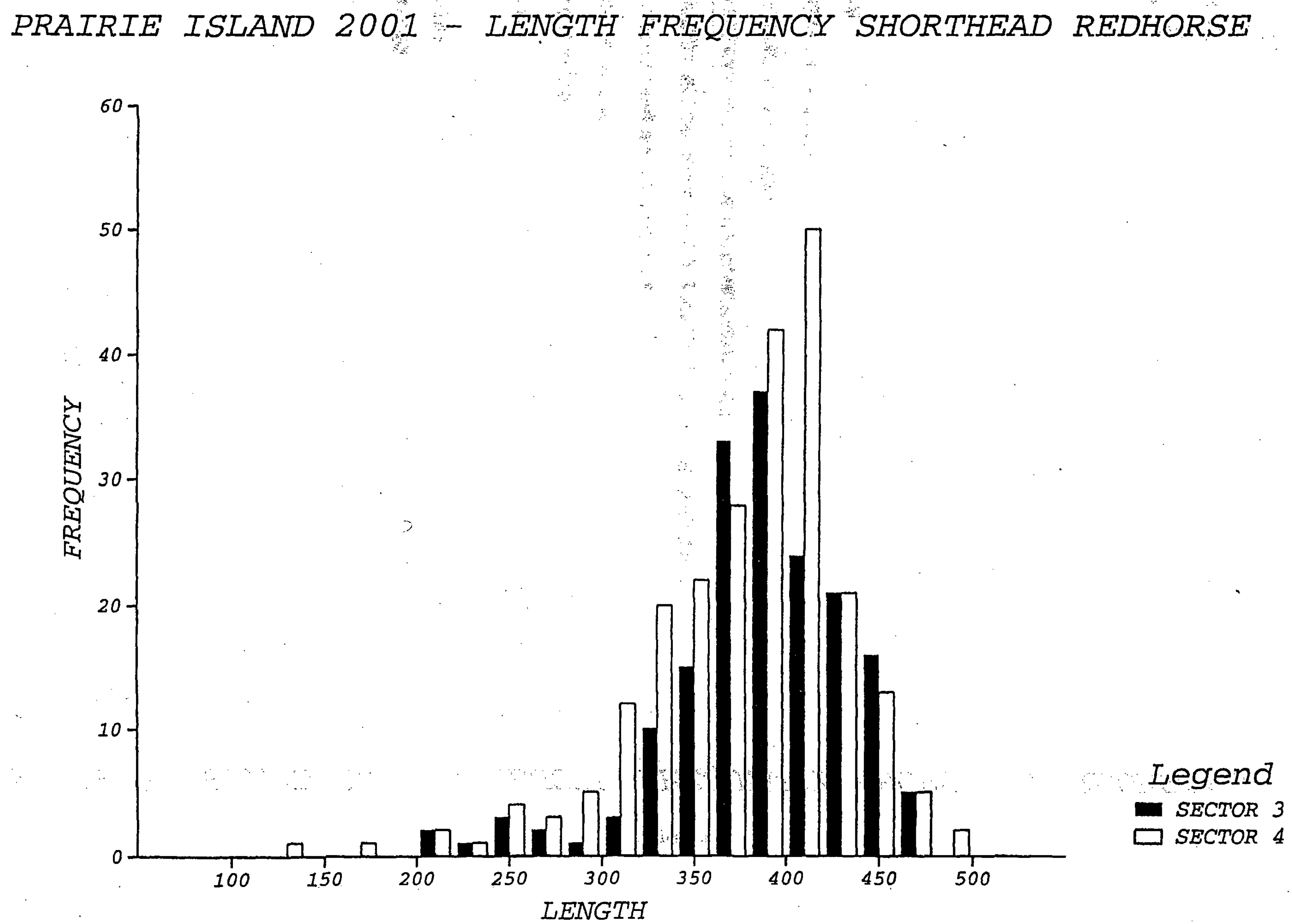

PRAIRIE ISLAND 2001 - LENGTH FREQUENCY SHORTHEAD REDHORSE
FREQUENCY
0
10
20
30
40
50
60
100
150
200
250
300
350
400
450
500
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 10 a

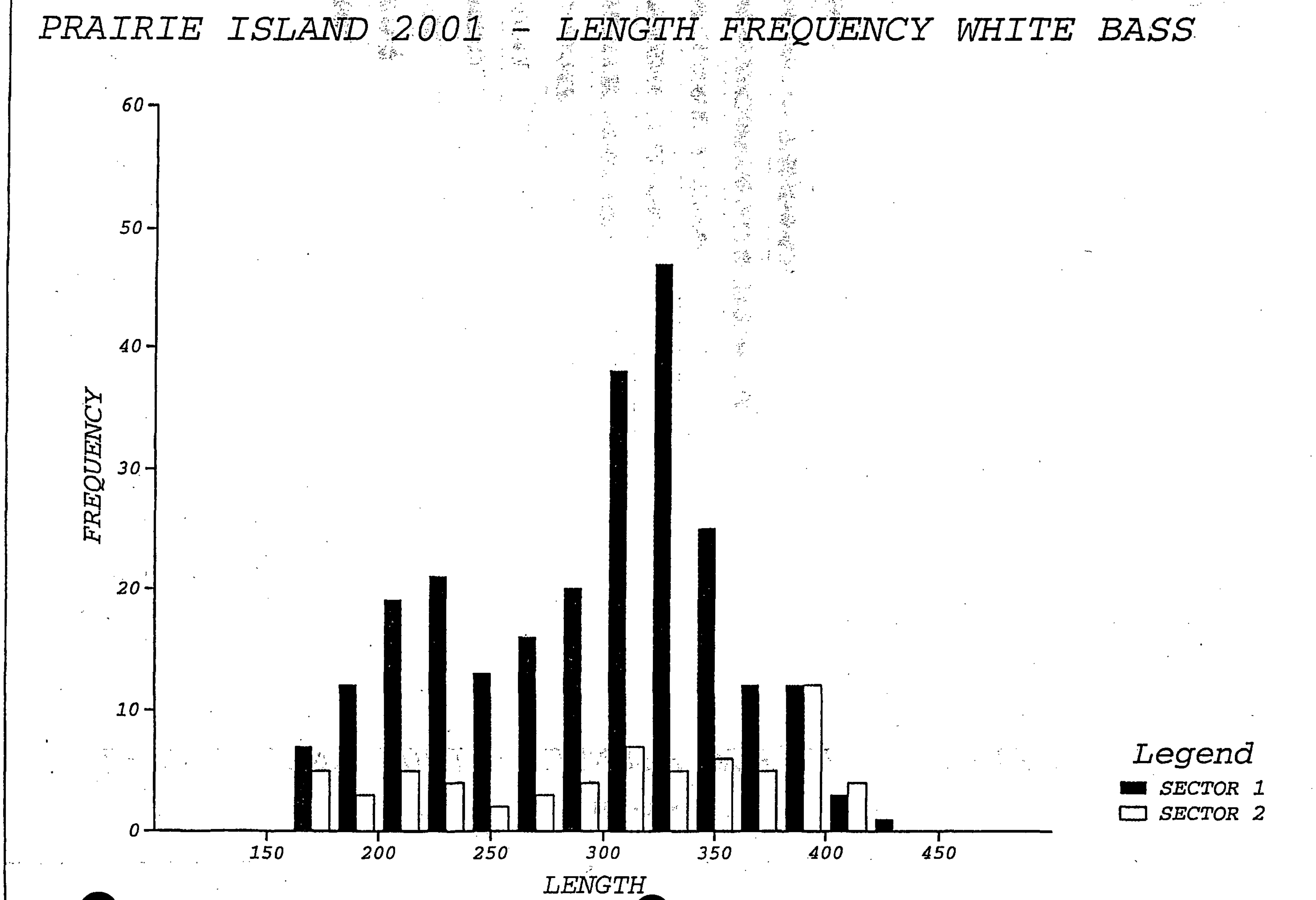
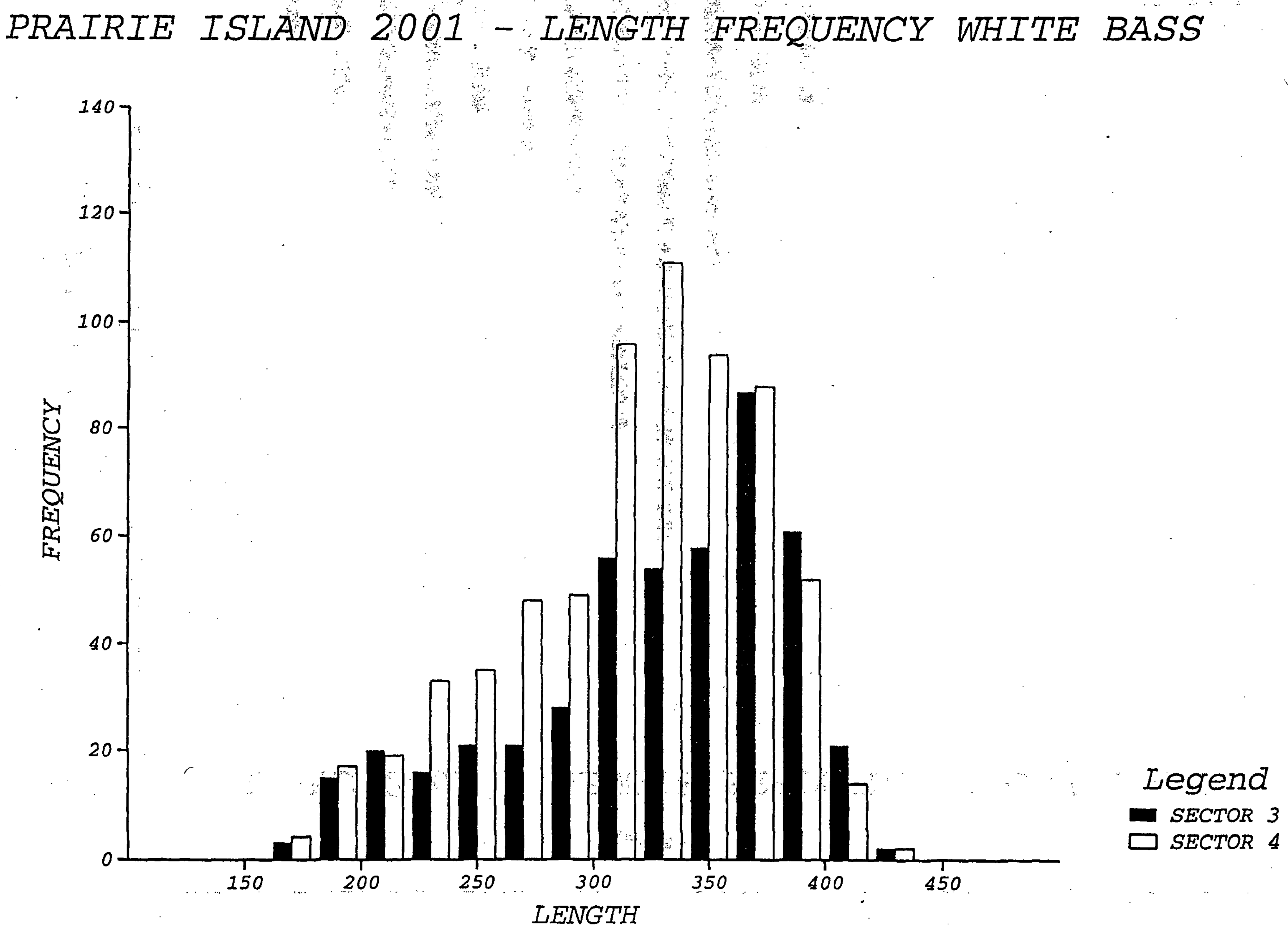
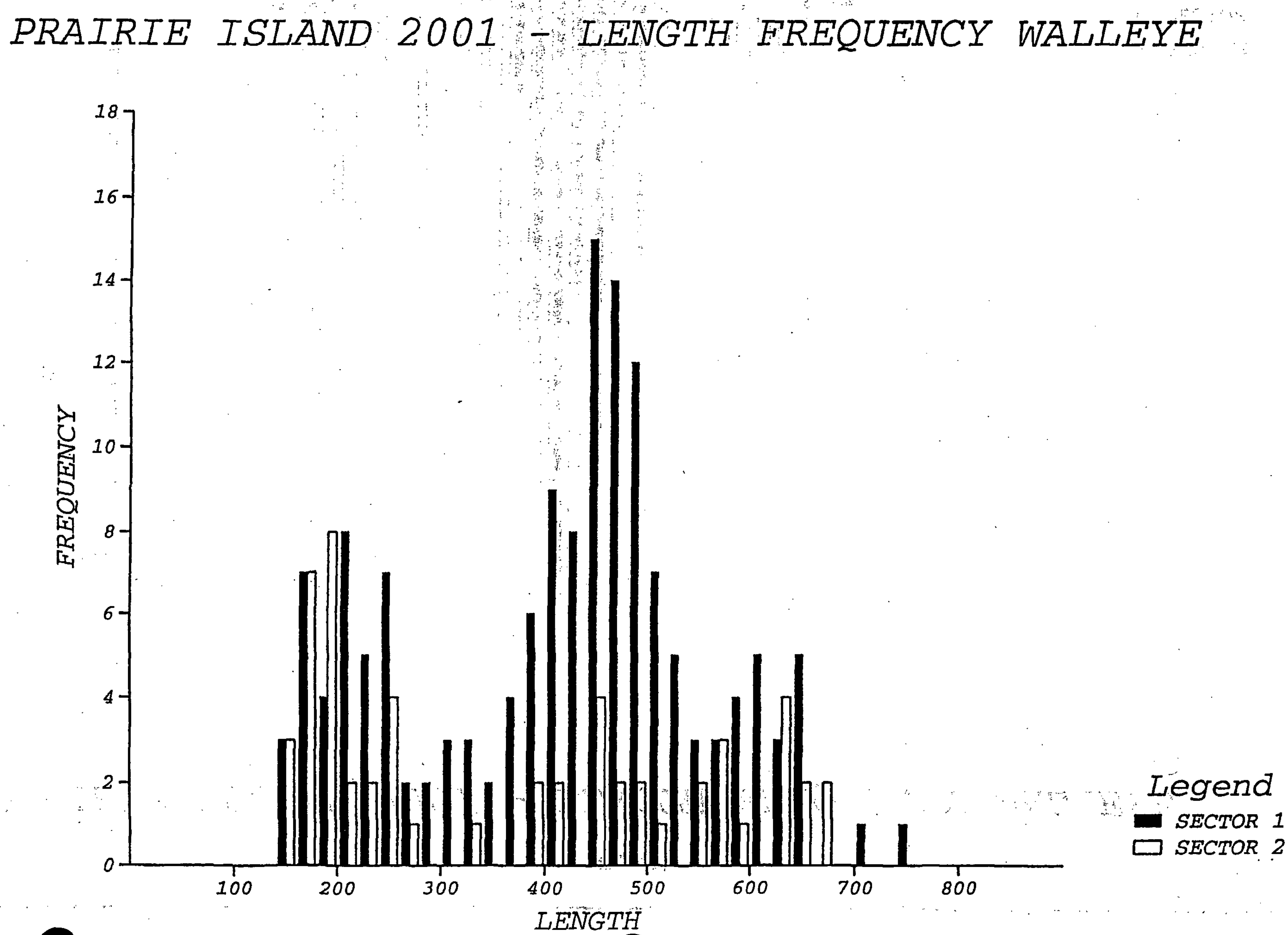

PRAIRIE ISLAND 2001 - LENGTH FREQUENCY WHITE BASS
60
50
40
30
20
10
0
FREQUENCY
150
200
250
300
350
400
450
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 10 b



PRAIRIE ISLAND 2001 - LENGTH FREQUENCY WHITE BASS
FREQUENCY
140
120
100
80
60
40
20
0
150
200
250
300
350
400
450
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 11 a



PRAIRIE ISLAND 2001 - LENGTH FREQUENCY WALLEYE
FREQUENCY
0
2
4
6
8
10
12
14
16
18
LENGTH
100
200
300
400
500
600
700
800
Legend
SECTOR 1
SECTOR 2

Figure 11 b

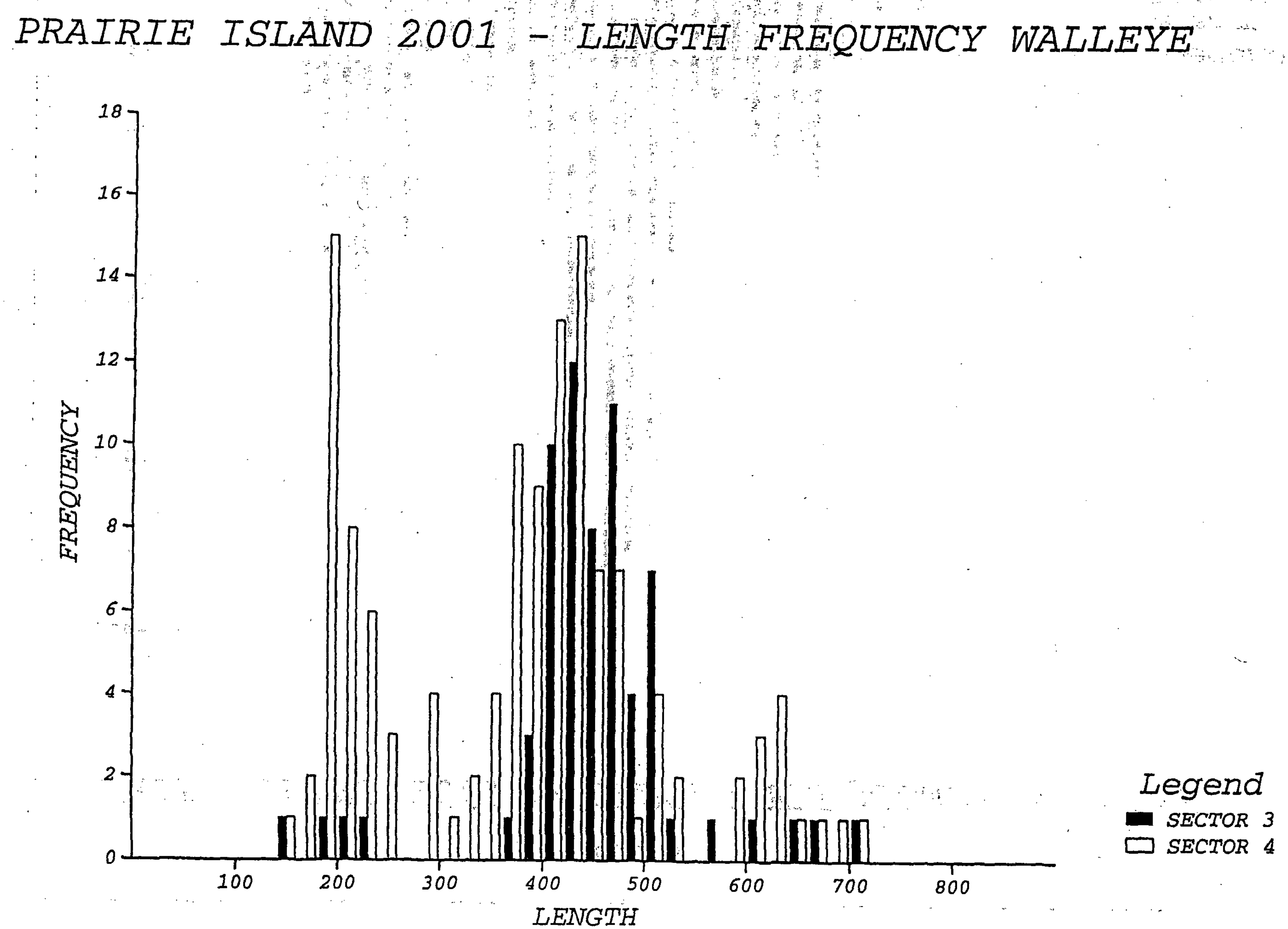

PRAIRIE ISLAND 2001 - LENGTH FREQUENCY WALLEYE
FREQUENCY
18
16
14
12
10
8
6
4
2
0
100
200
300
400
500
600
700
800
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 12 a

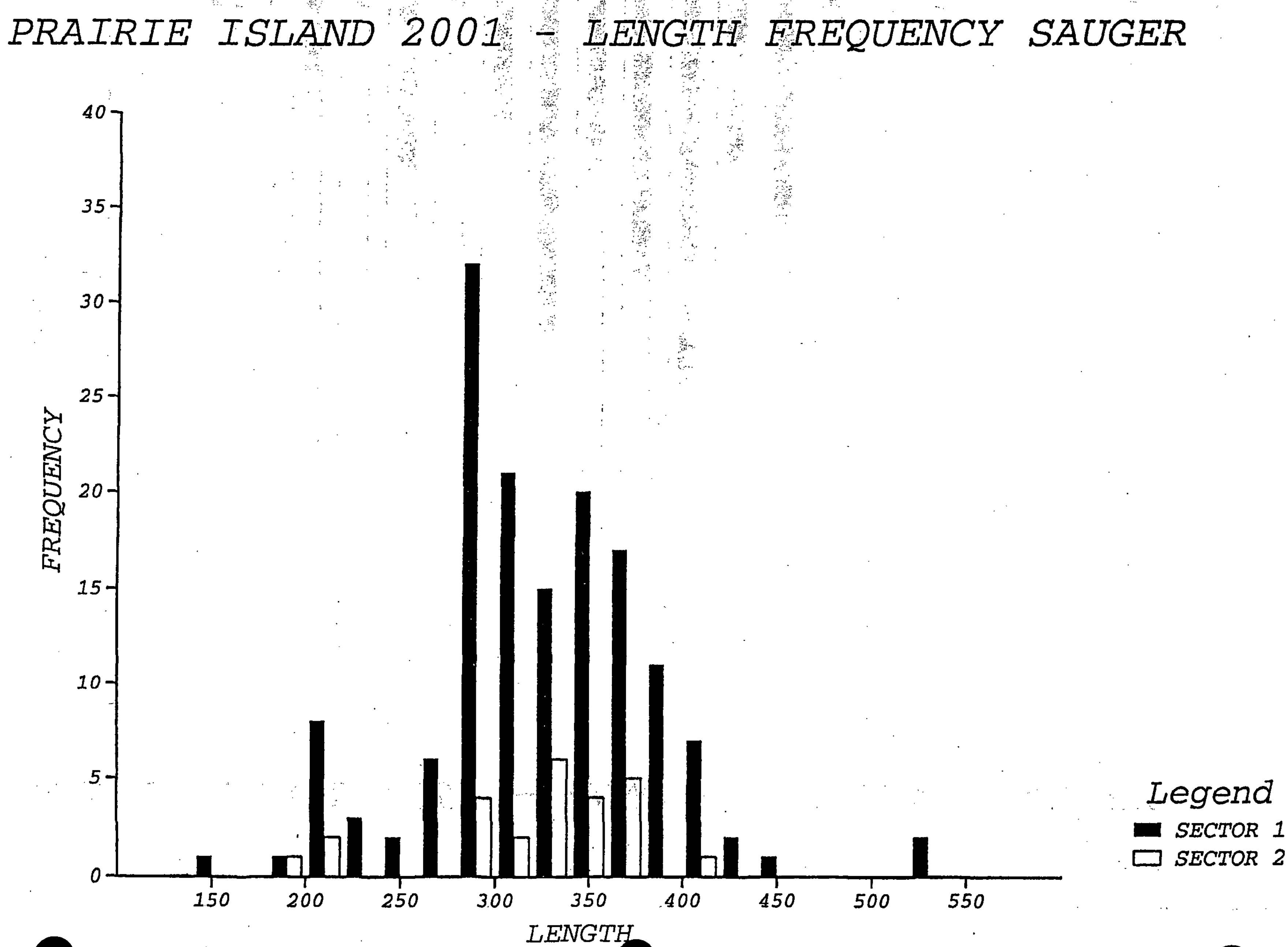

PRAIRIE ISLAND 2001 - LENGTH FREQUENCY SAUGER
FREQUENCY
40
35
30
25
20
15
10
5
0
150
200
250
300
350
400
450
500
550
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 12 b

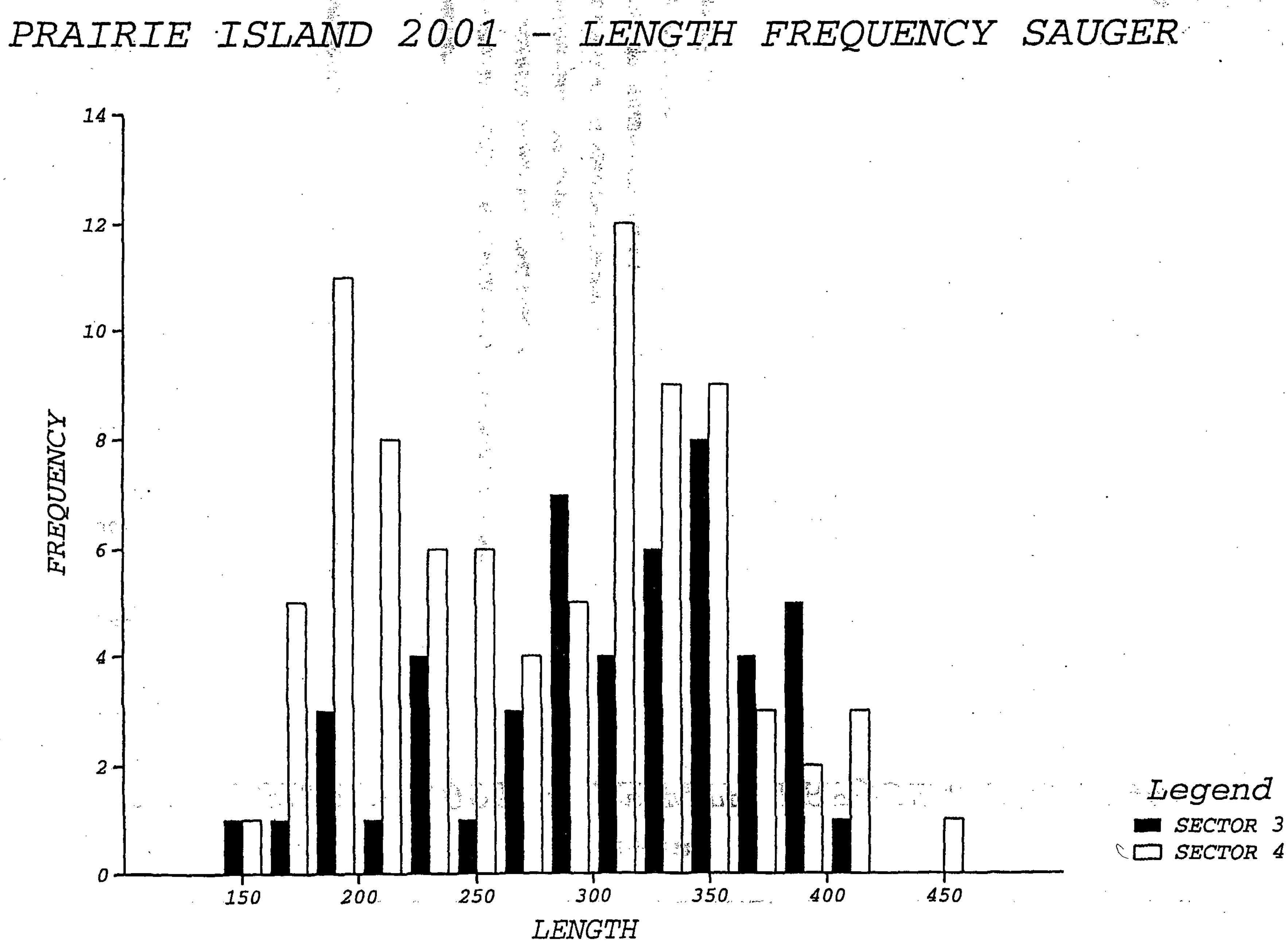
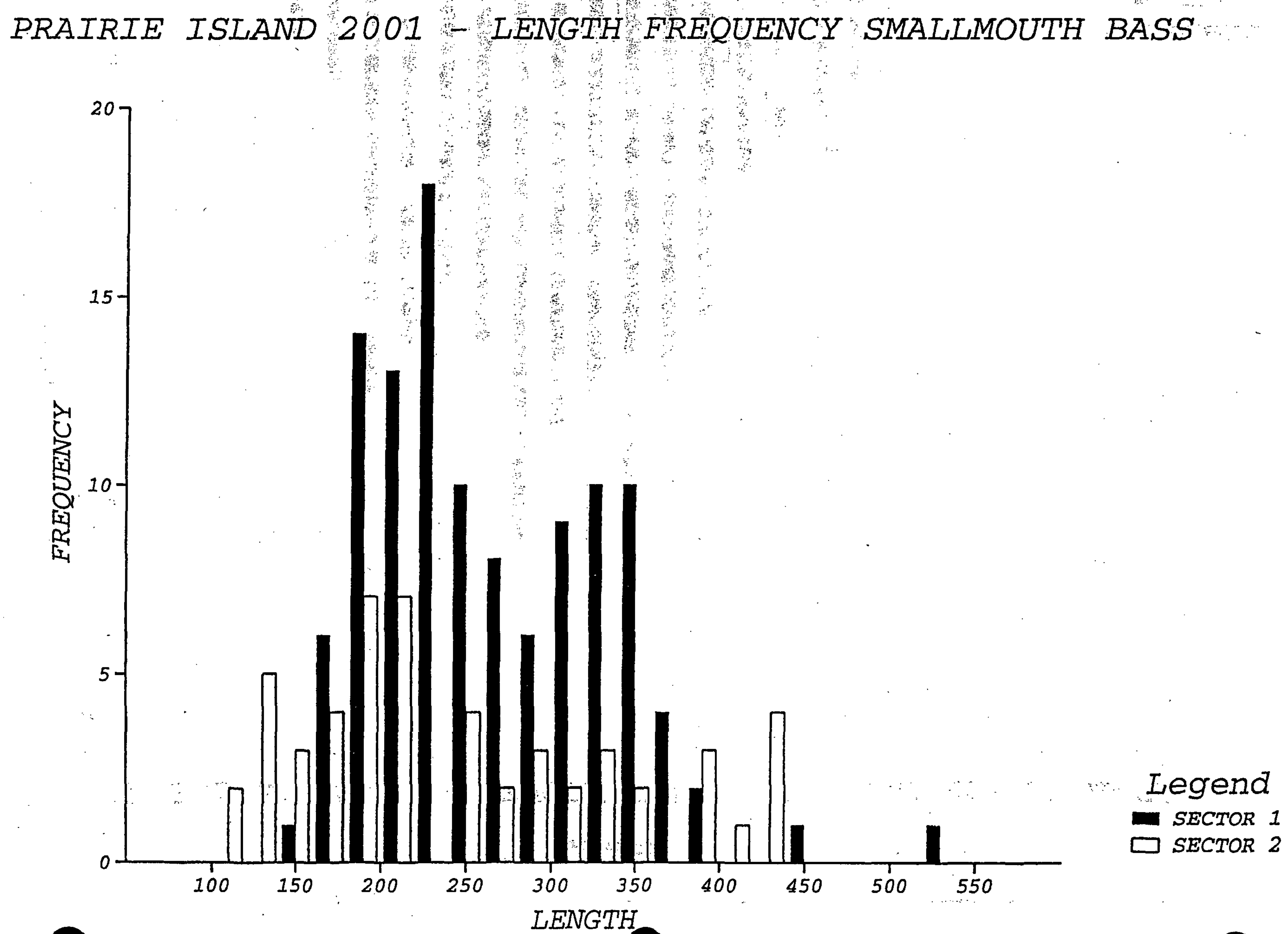
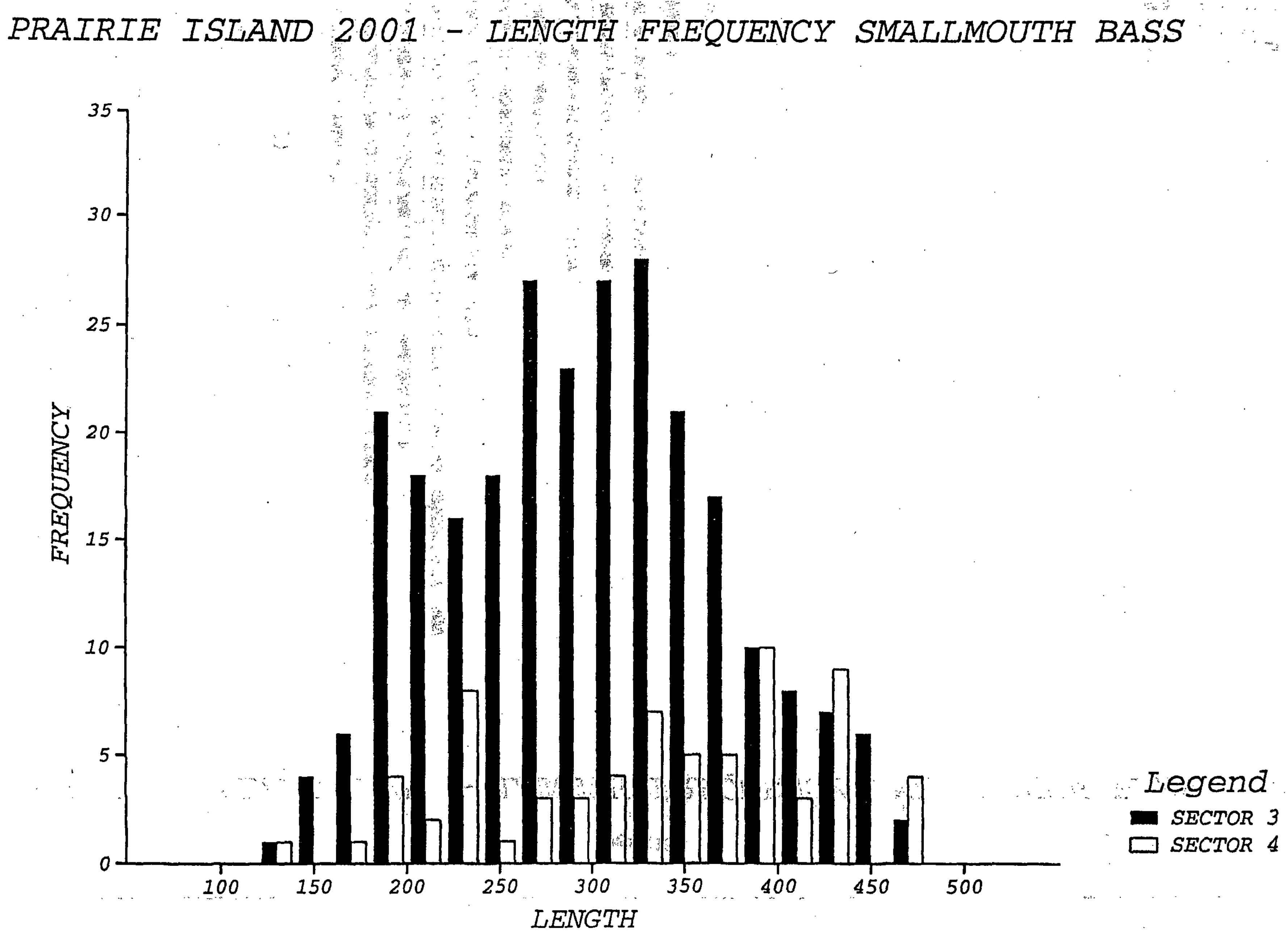

PRAIRIE ISLAND 2001 - LENGTH FREQUENCY SAUGER
FREQUENCY
14
12
10
8
6
4
2
0
150
200
250
300
350
400
450
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 13 a



PRAIRIE ISLAND 2001 - LENGTH FREQUENCY SMALLMOUTH BASS
FREQUENCY
20
15
10
5
0
100
150
200
250
300
350
400
450
500
550
LENGTH
Legend
SECTOR 1
SECTOR 2

Figure 13 b



PRAIRIE ISLAND 2001 - LENGTH FREQUENCY SMALLMOUTH BASS
FREQUENCY
35
30
25
20
15
10
5
0
100
150
200
250
300
350
400
450
500
LENGTH
Legend
SECTOR 3
SECTOR 4

Figure 14 a

PRAIRIE ISLAND 2001 - LENGTH FREQUENCY LARGEMOUTH BASS

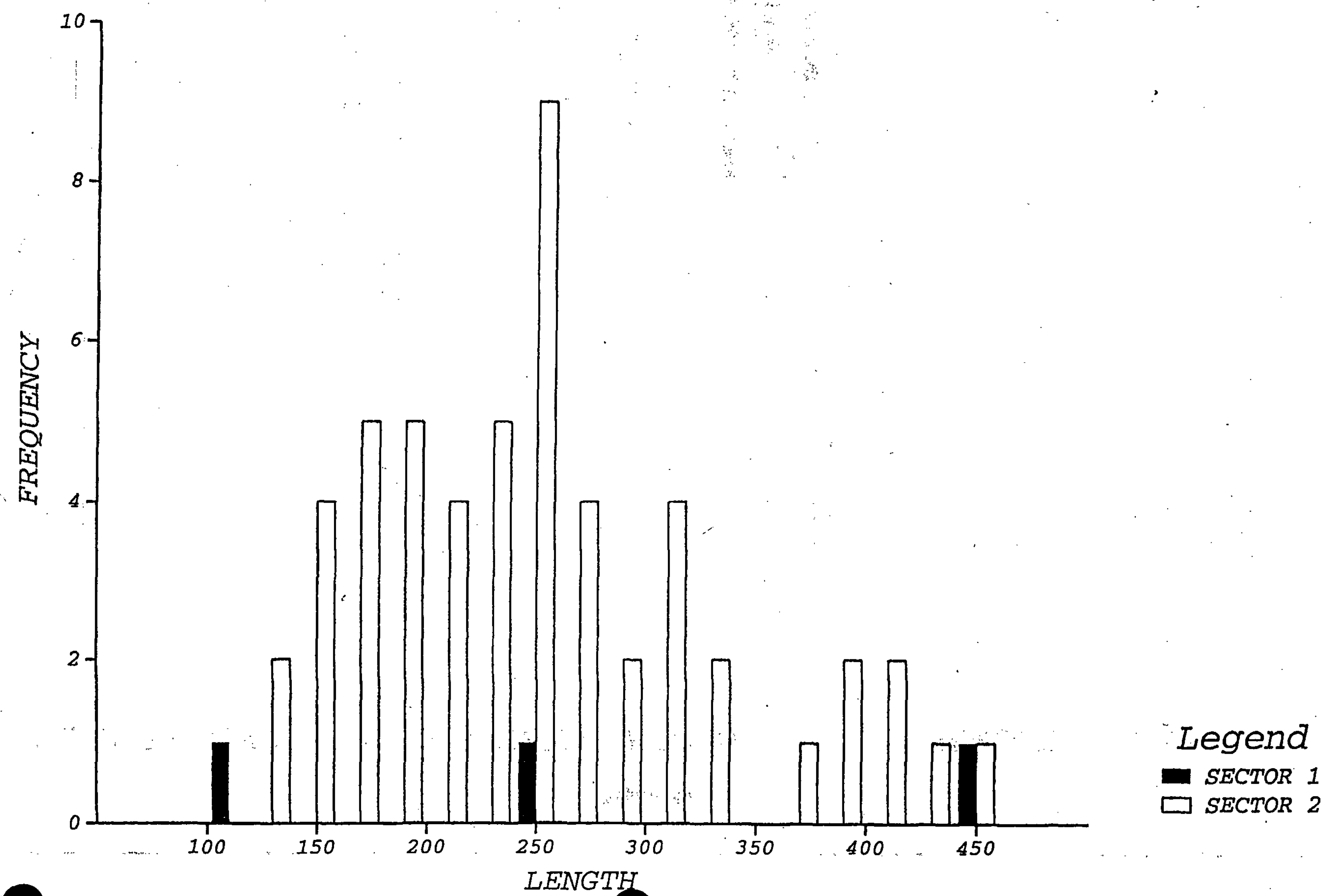
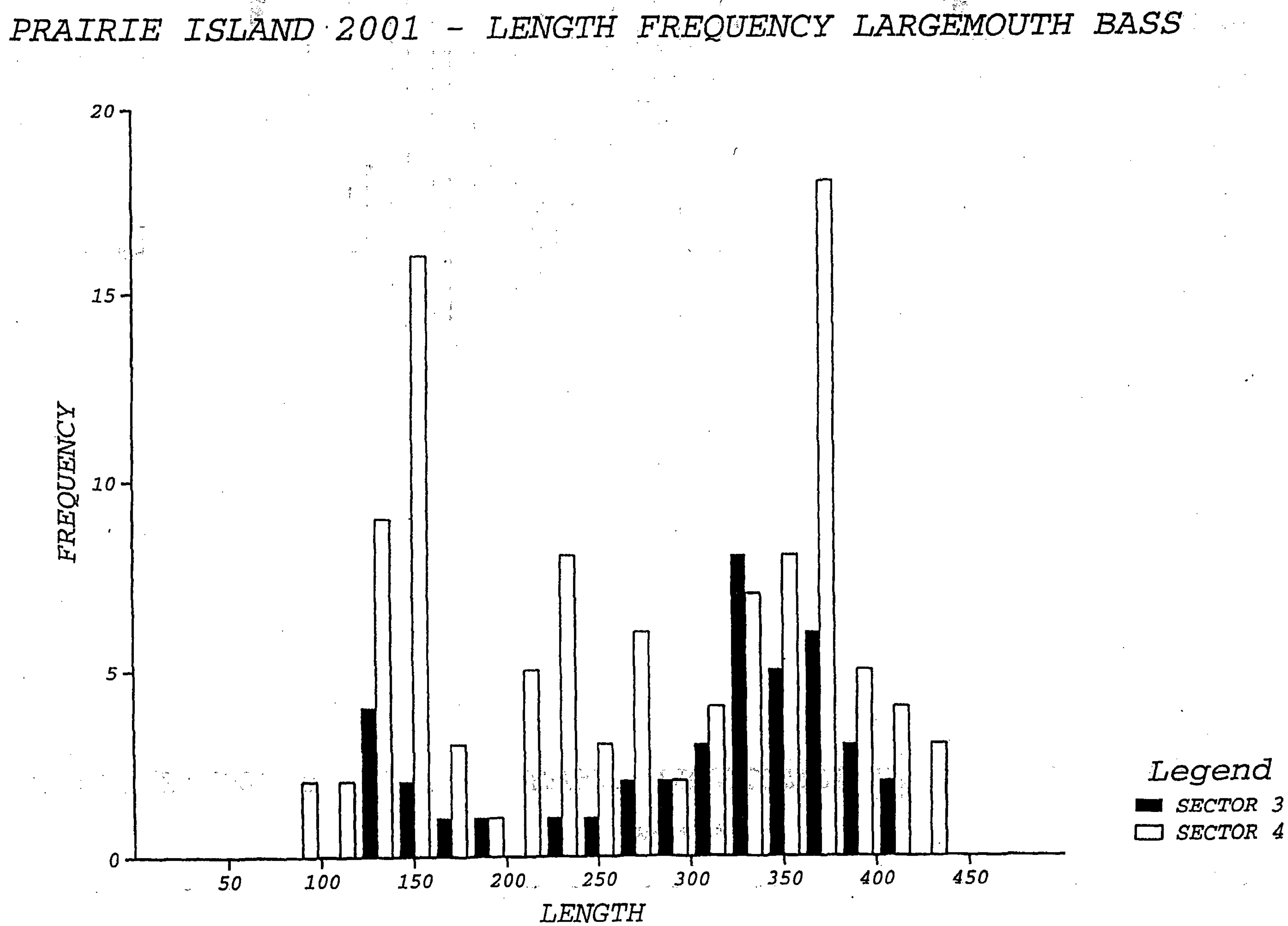


Figure 14.b



PRAIRIE ISLAND 2001 - LENGTH FREQUENCY LARGEMOUTH BASS
FREQUENCY
20
15
10
5
0
50
100
150
200
250
300
350
400
450
LENGTH
Legend
SECTOR 3
SECTOR 4

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

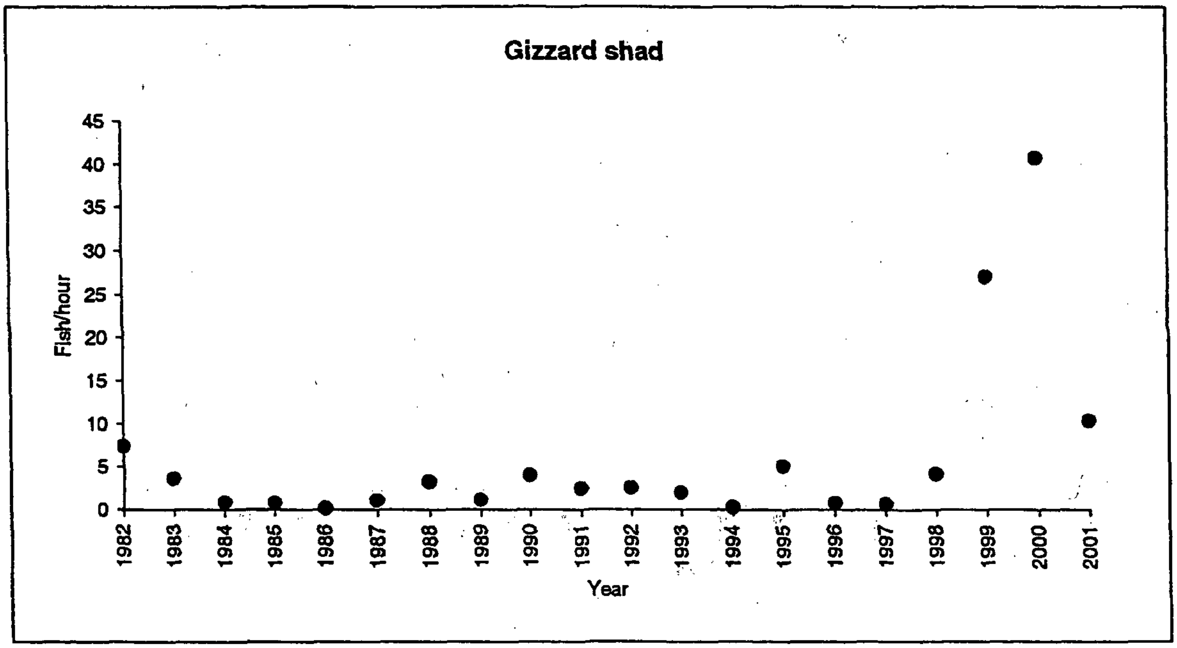


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2001 in the vicinity of PINGP.

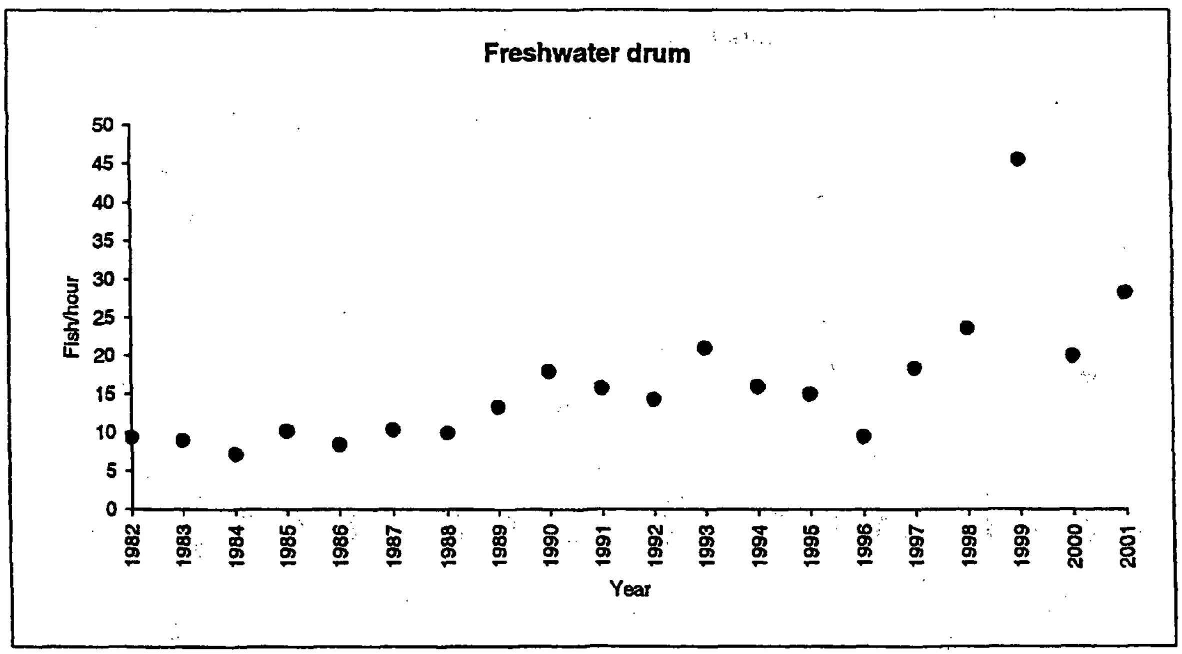


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2001 in the vicinity of PINGP.

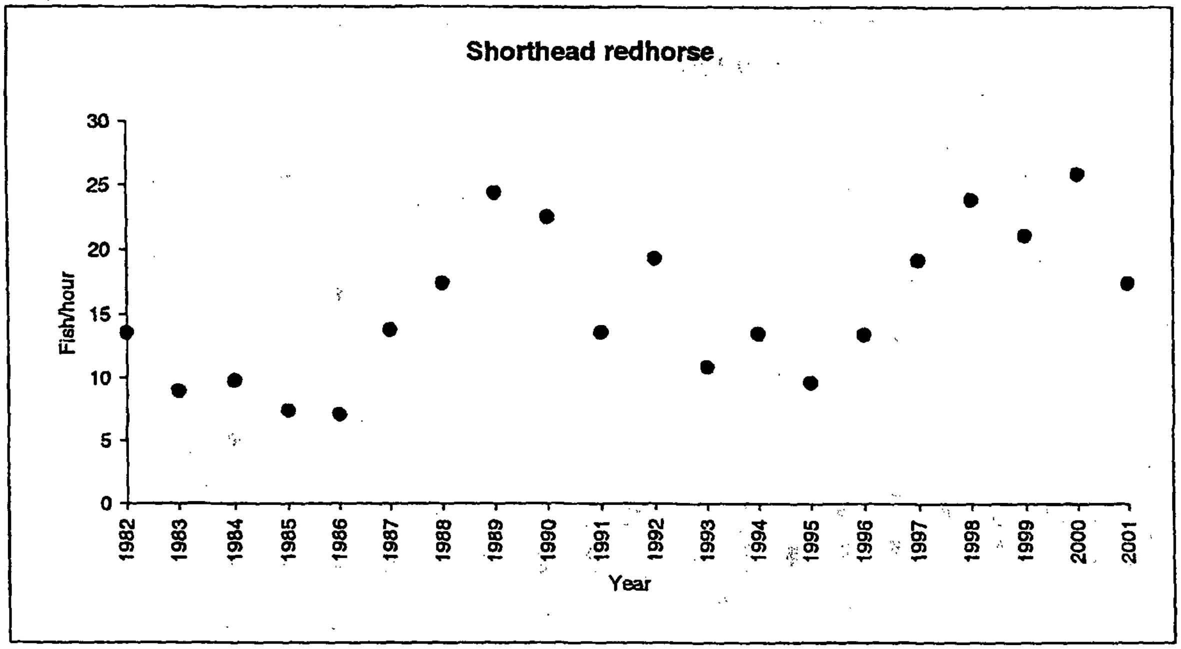


Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2001 in the vicinity of PINGP.

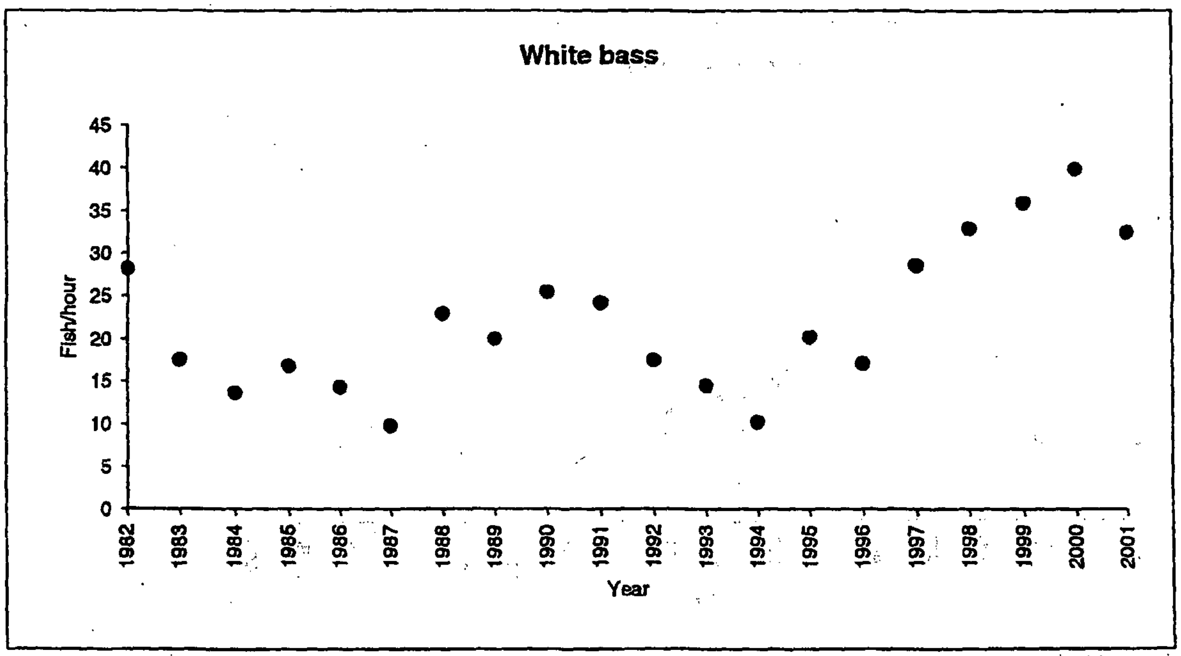


Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2001 in the vicinity of PINGP.

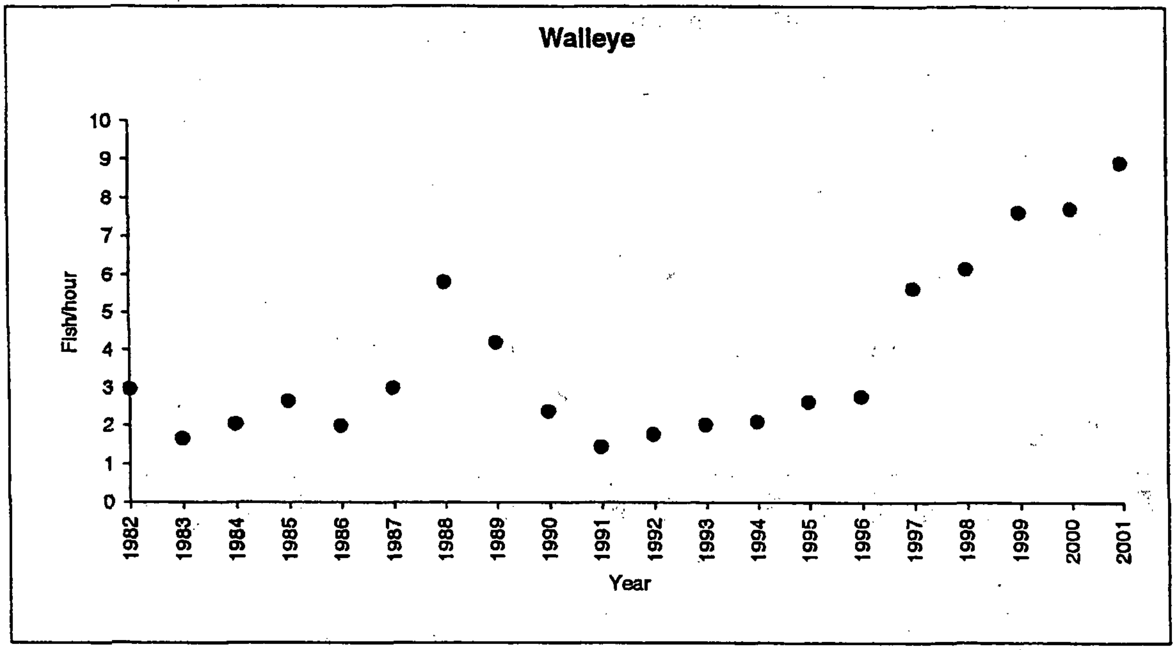


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2001 in the vicinity of PINGP.

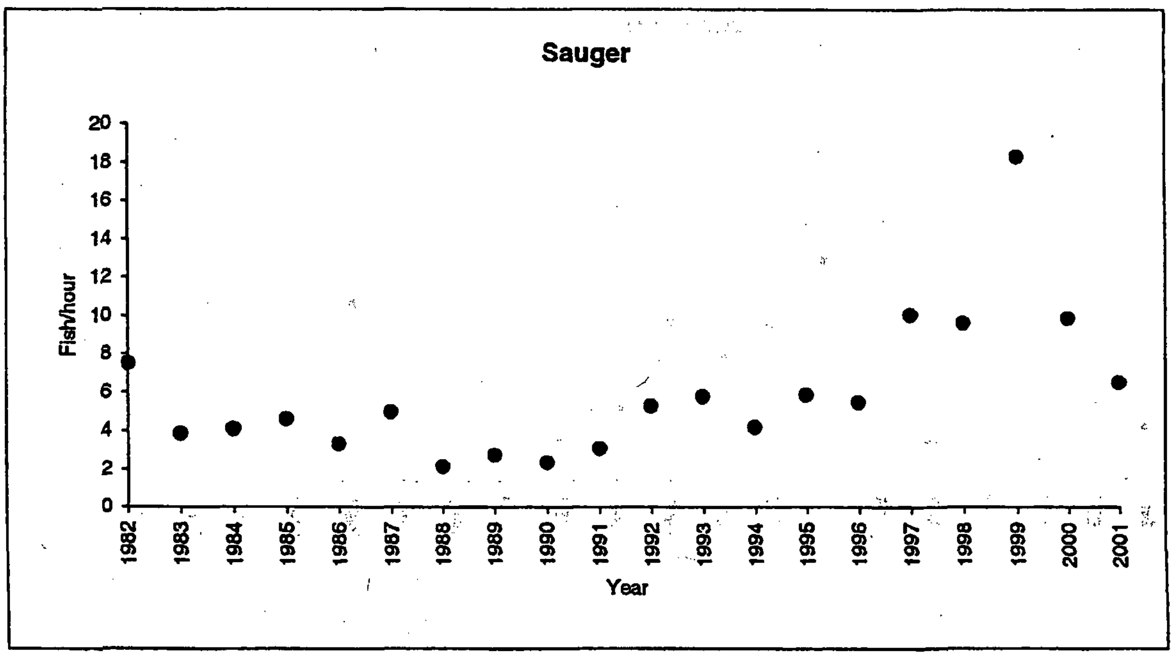


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2001 in the vicinity of PINGP.

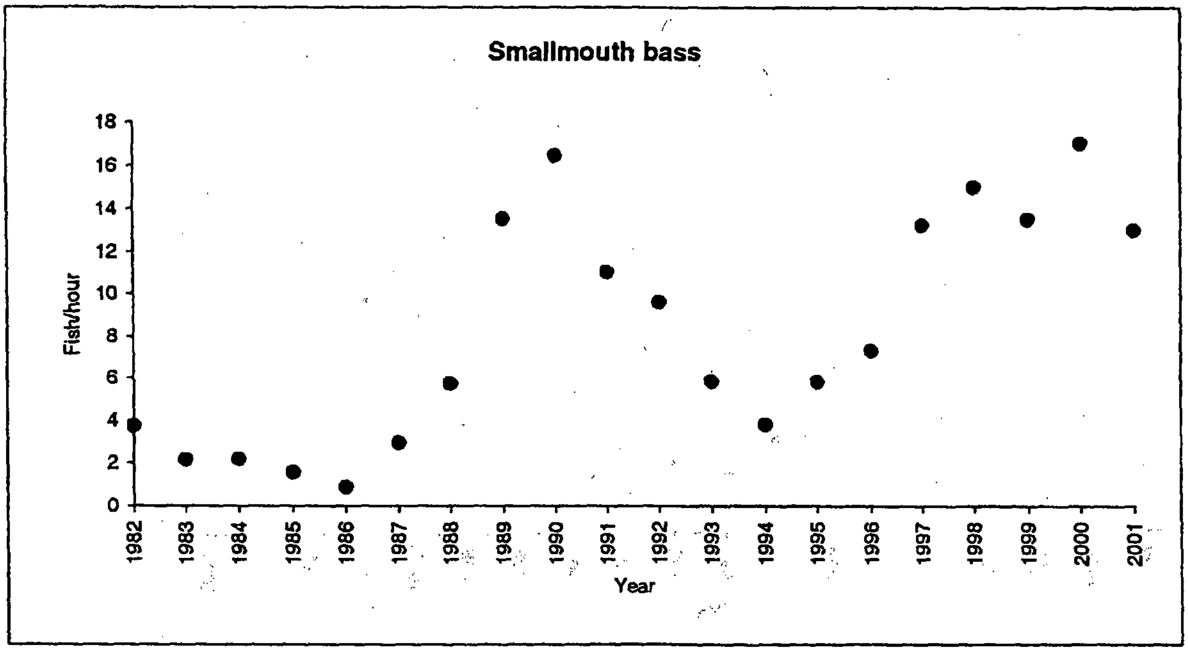


Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2001 in the vicinity of PINGP.

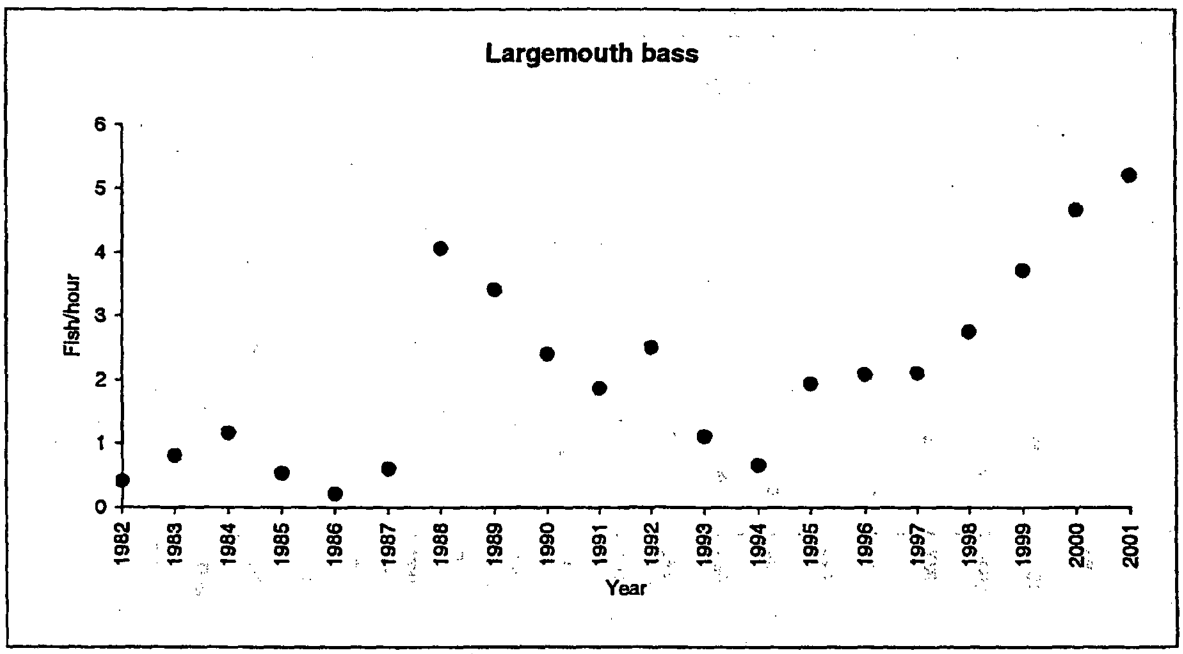


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2001 in the vicinity of PINGP.

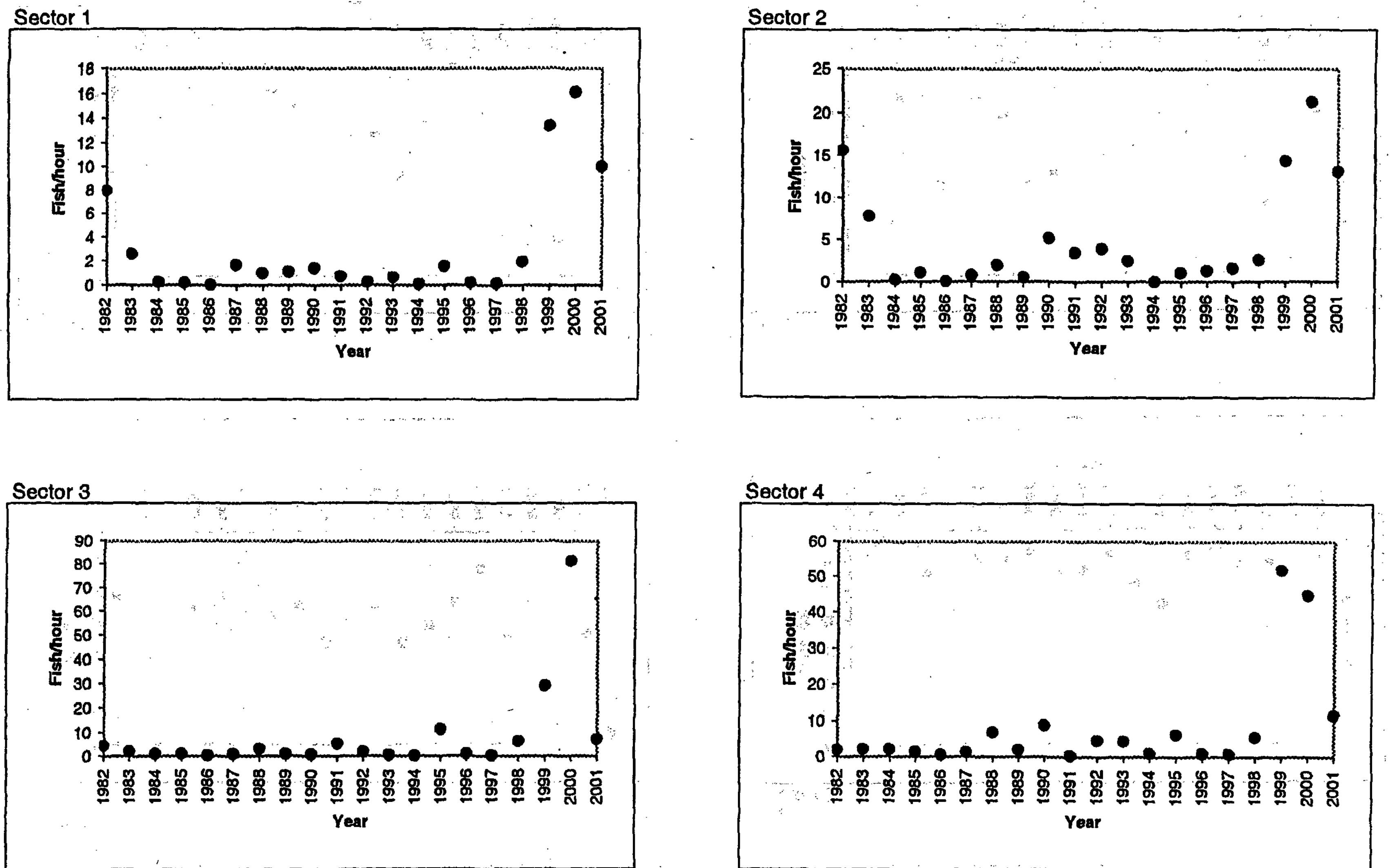


Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2001 in the vicinity of PINGP.

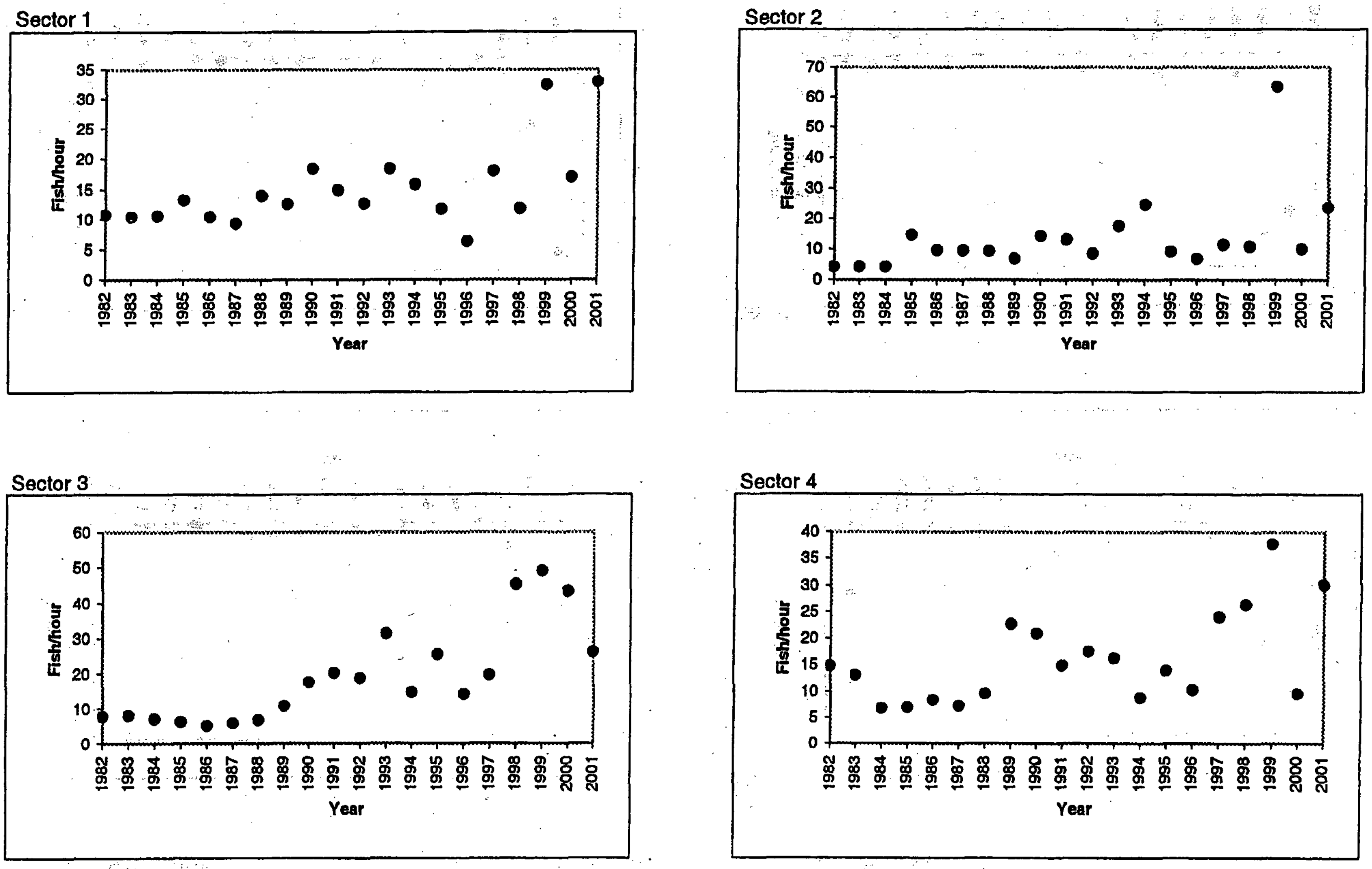


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2001 in the vicinity of PINGP.

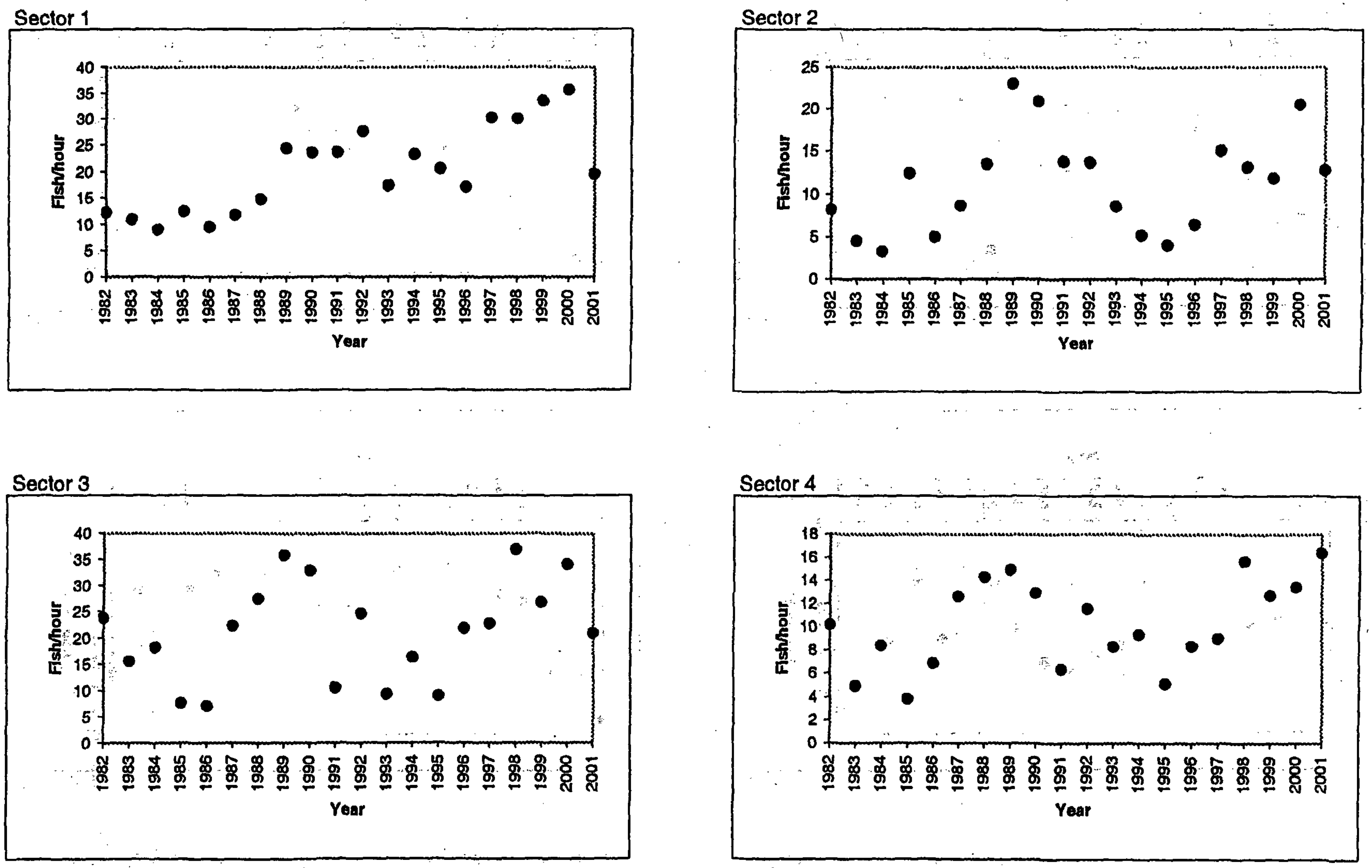
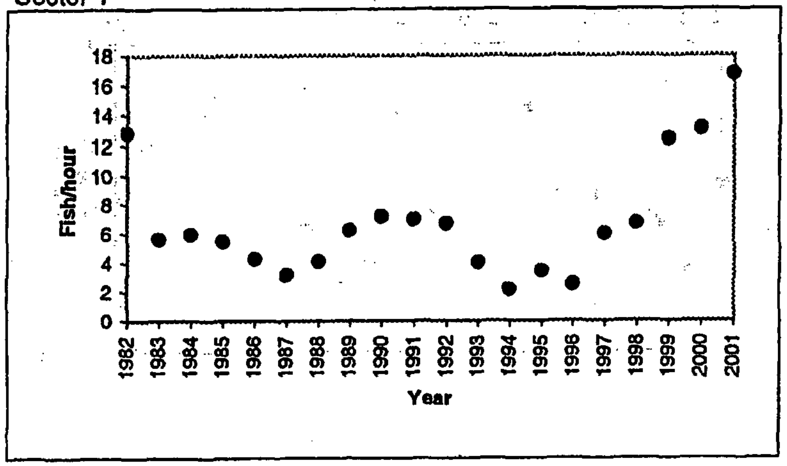
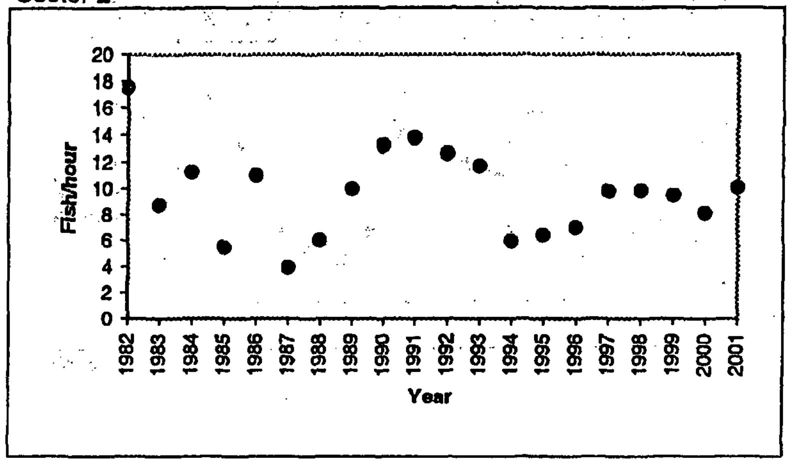


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2001 in the vicinity of PINGP.

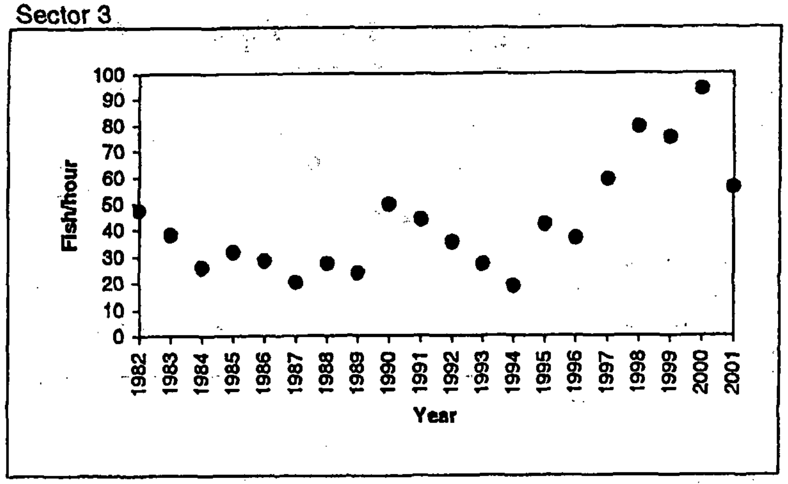
Sector 1



Sector 2



Sector 3



Sector 4

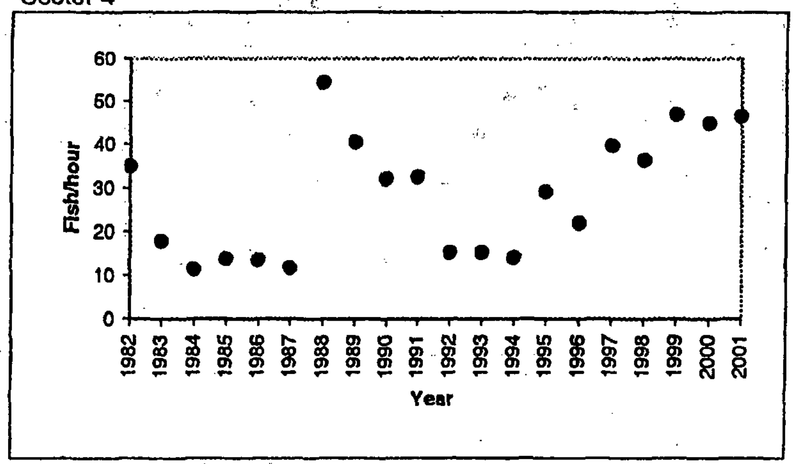


Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2001 in the vicinity of PINGP.

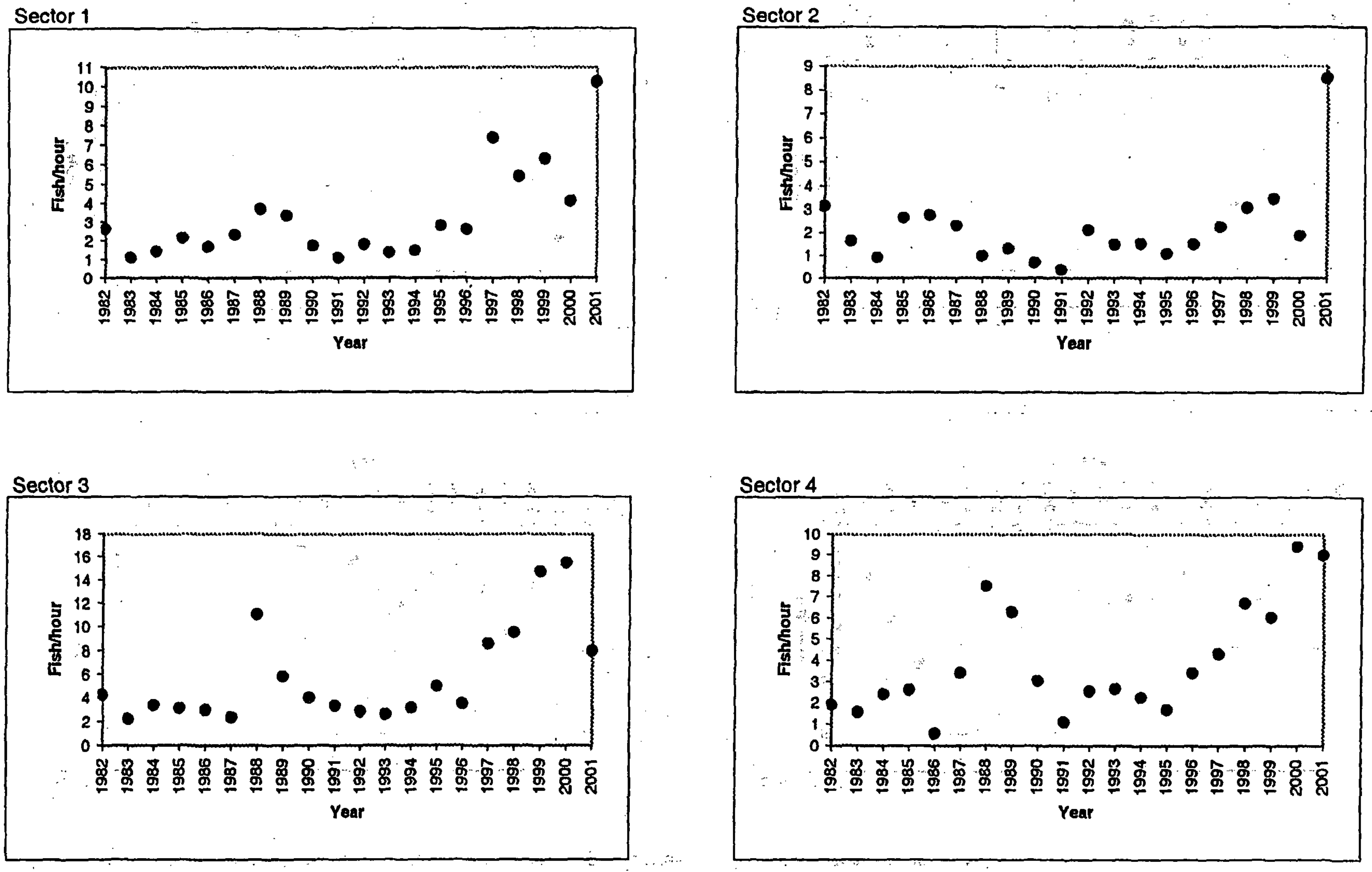


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2001 in the vicinity of PINGP

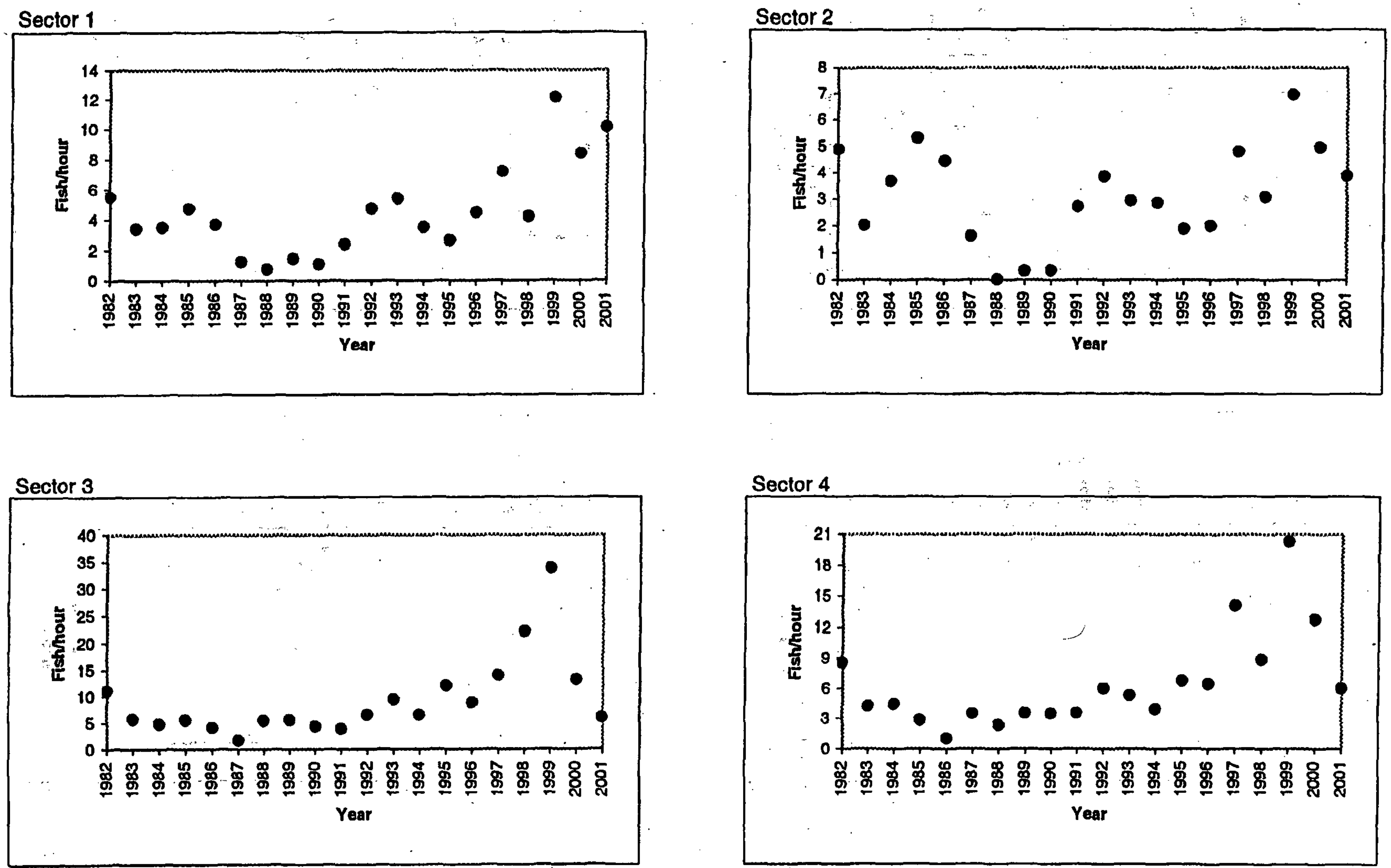


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2001 in the vicinity of PINGP.

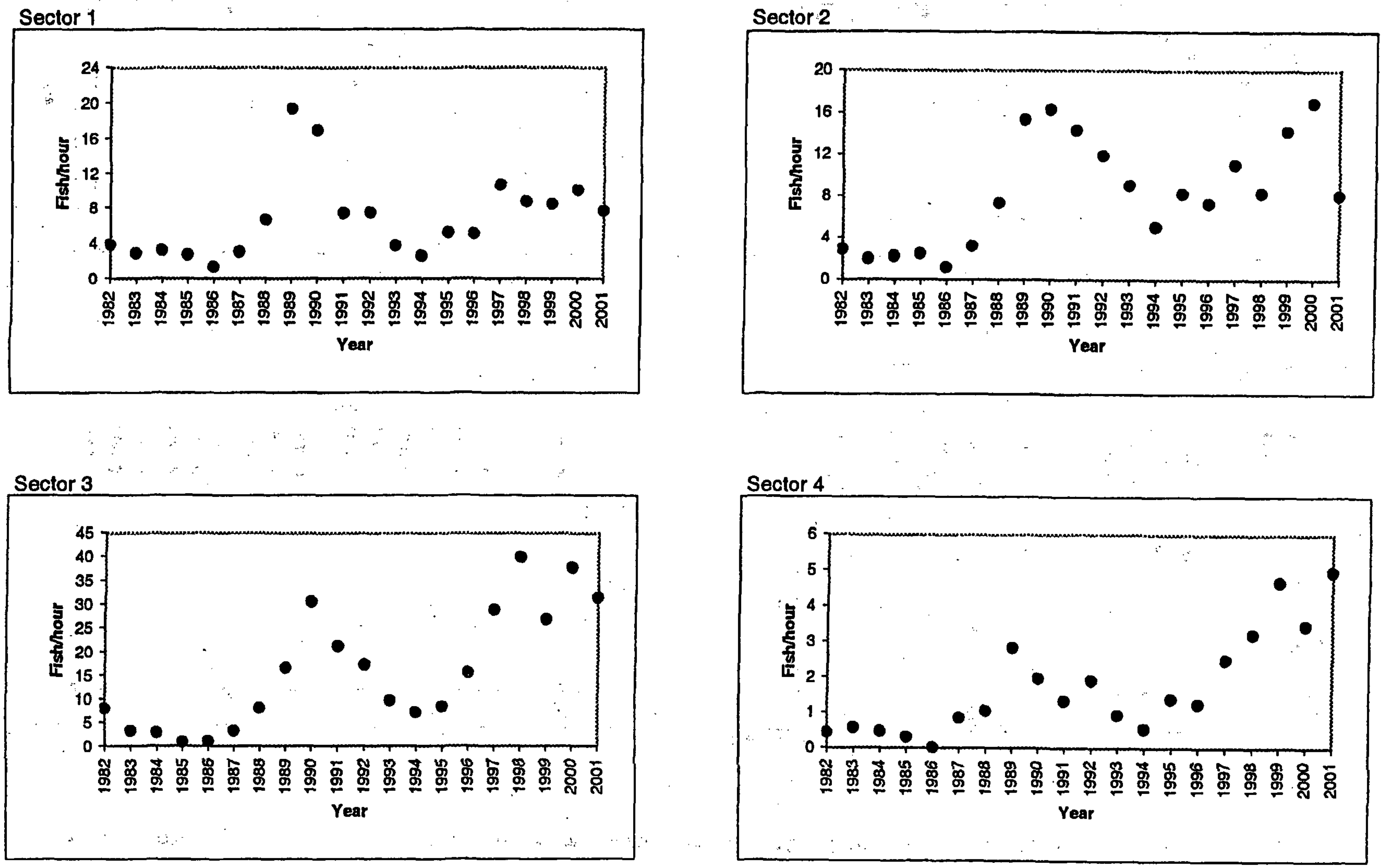


Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2001 in the vicinity of PINGP.

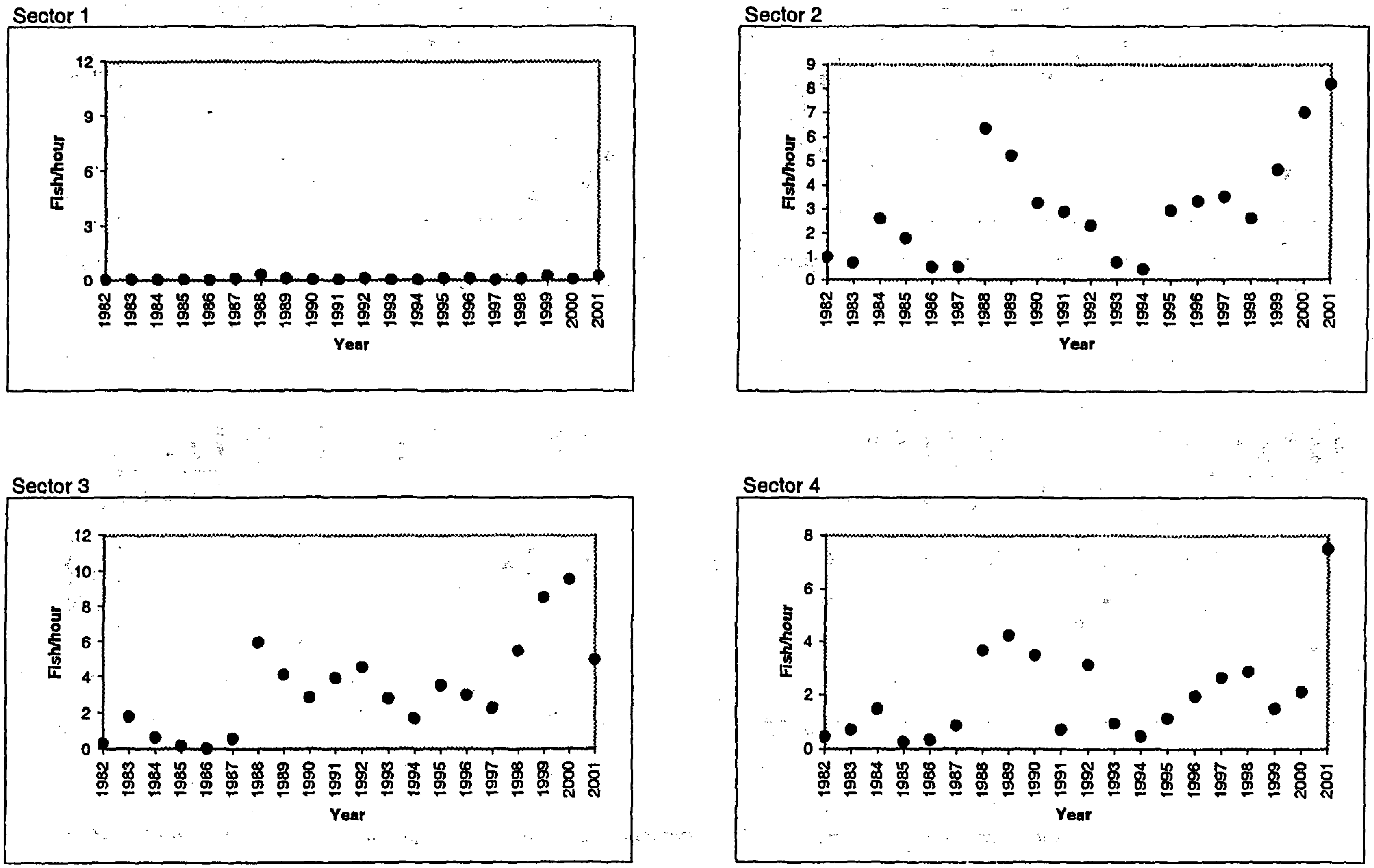


Figure 31

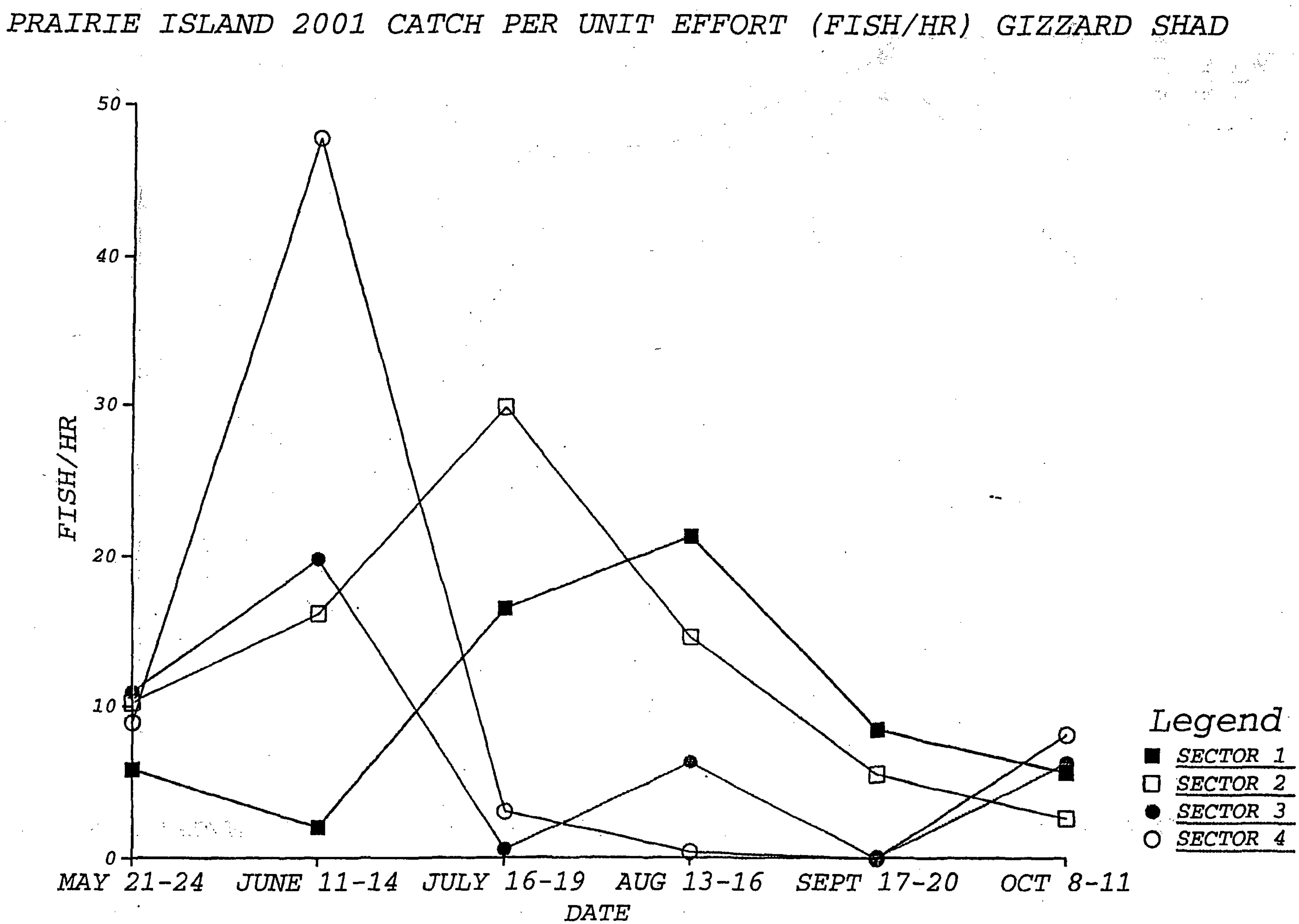

PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) GIZZARD SHAD
50
40
30
20
10
0
FISH/HR
MAY 21-24
JUNE 11-14
JULY 16-19
AUG 13-16
SEPT 17-20
OCT 8-11
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 32

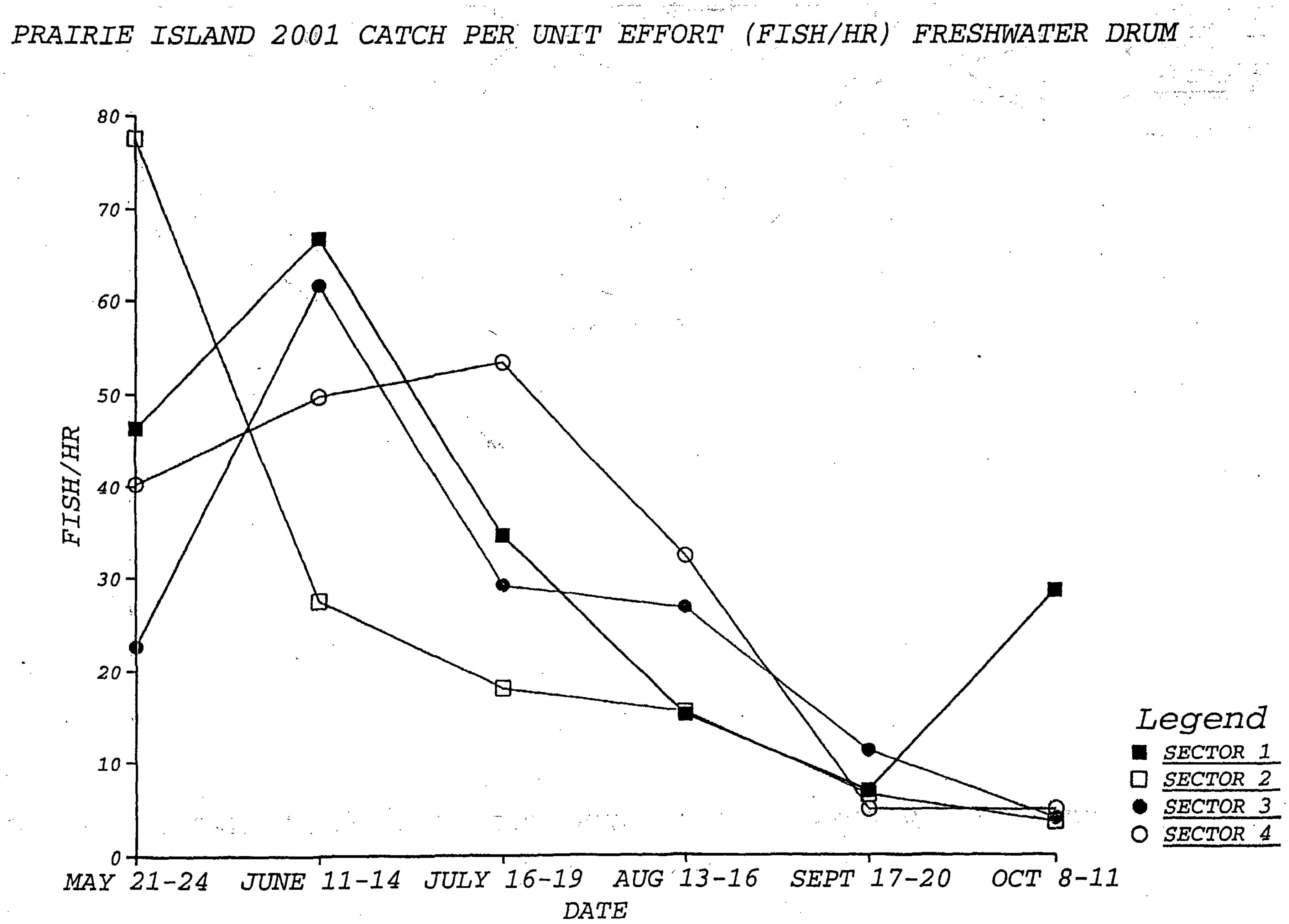

PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) FRESHWATER DRUM
FISH/HR
80
70
60
50
40
30
20
10
0
MAY 21-24
JUNE 11-14
JULY 16-19
AUG 13-16
SEPT 17-20
OCT 8-11
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 33

PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) SHORTHEAD REDHORSE

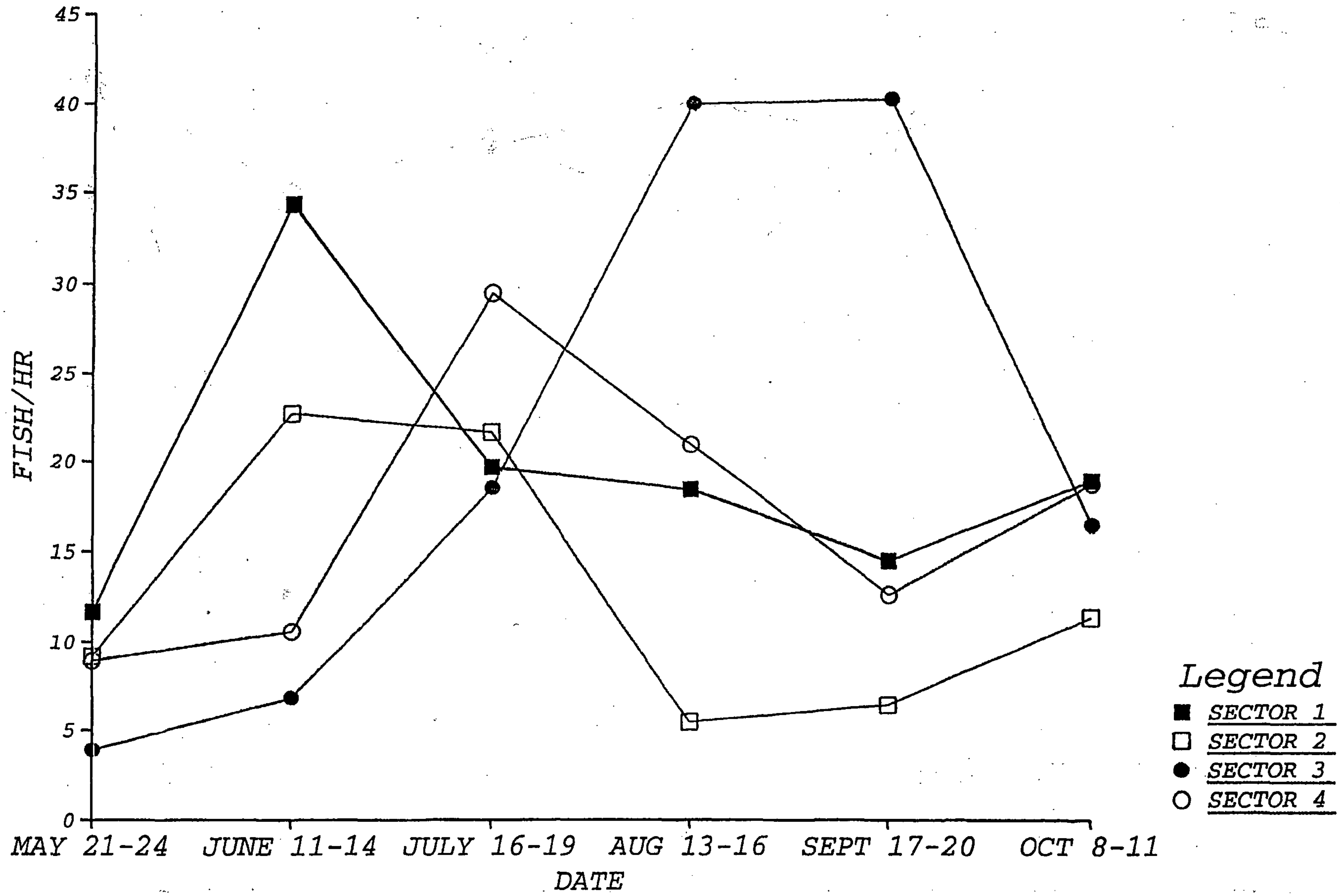


Figure 34

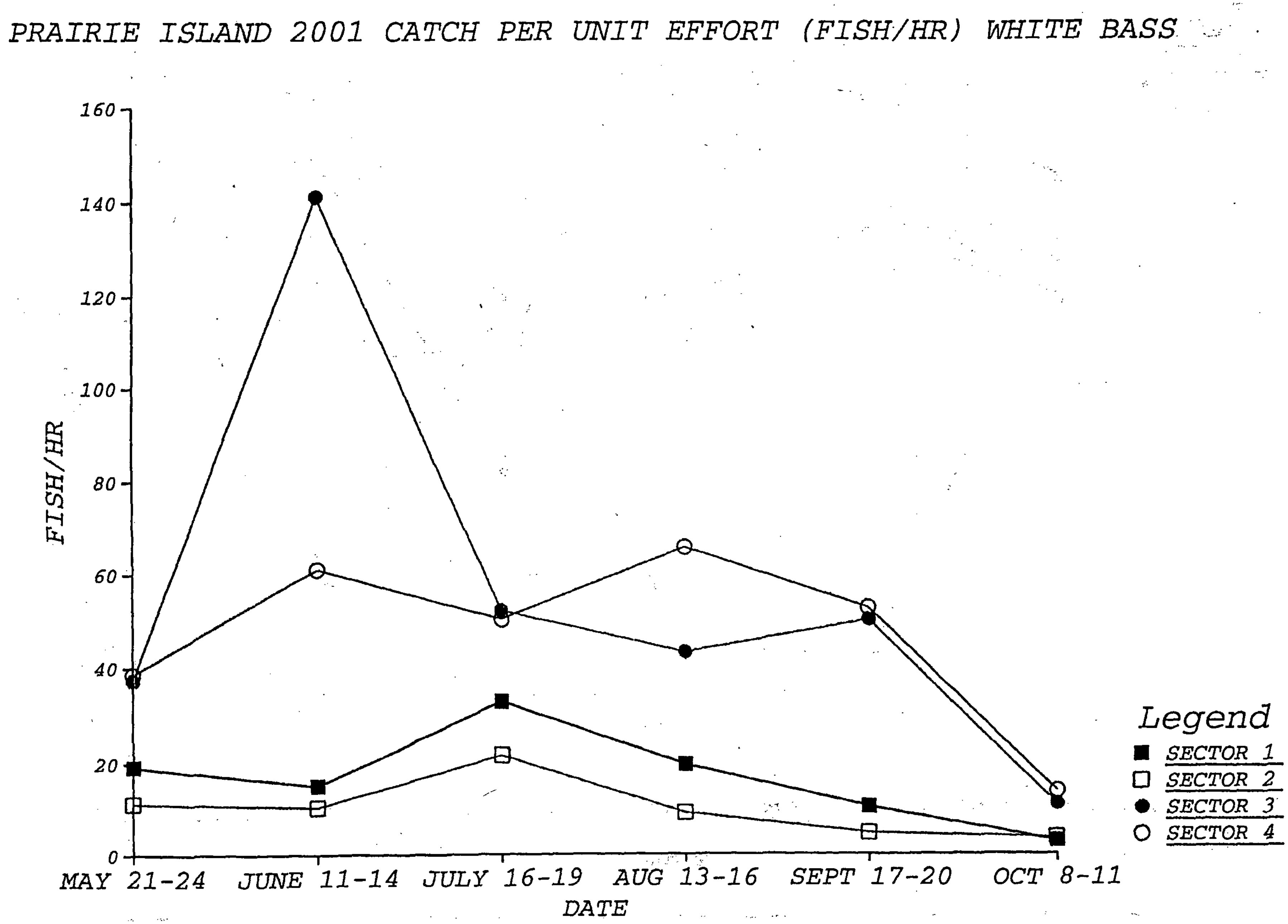

PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) WHITE BASS
FISH/HR
160
140
120
100
80
60
40
20
0
MAY 21-24
JUNE 11-14
JULY 16-19
AUG 13-16
SEPT 17-20
OCT 8-11
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 35

PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) WALLEYE

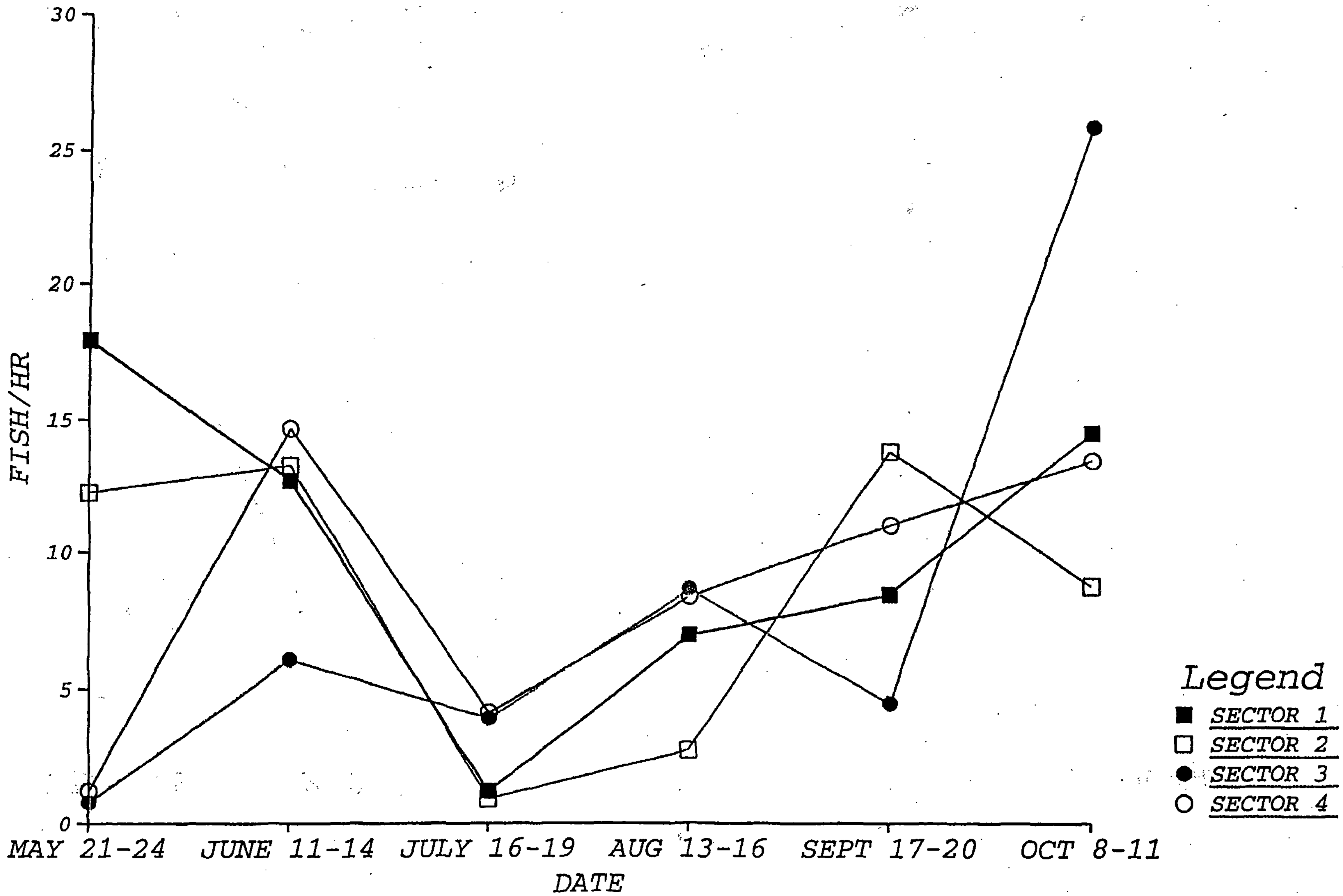
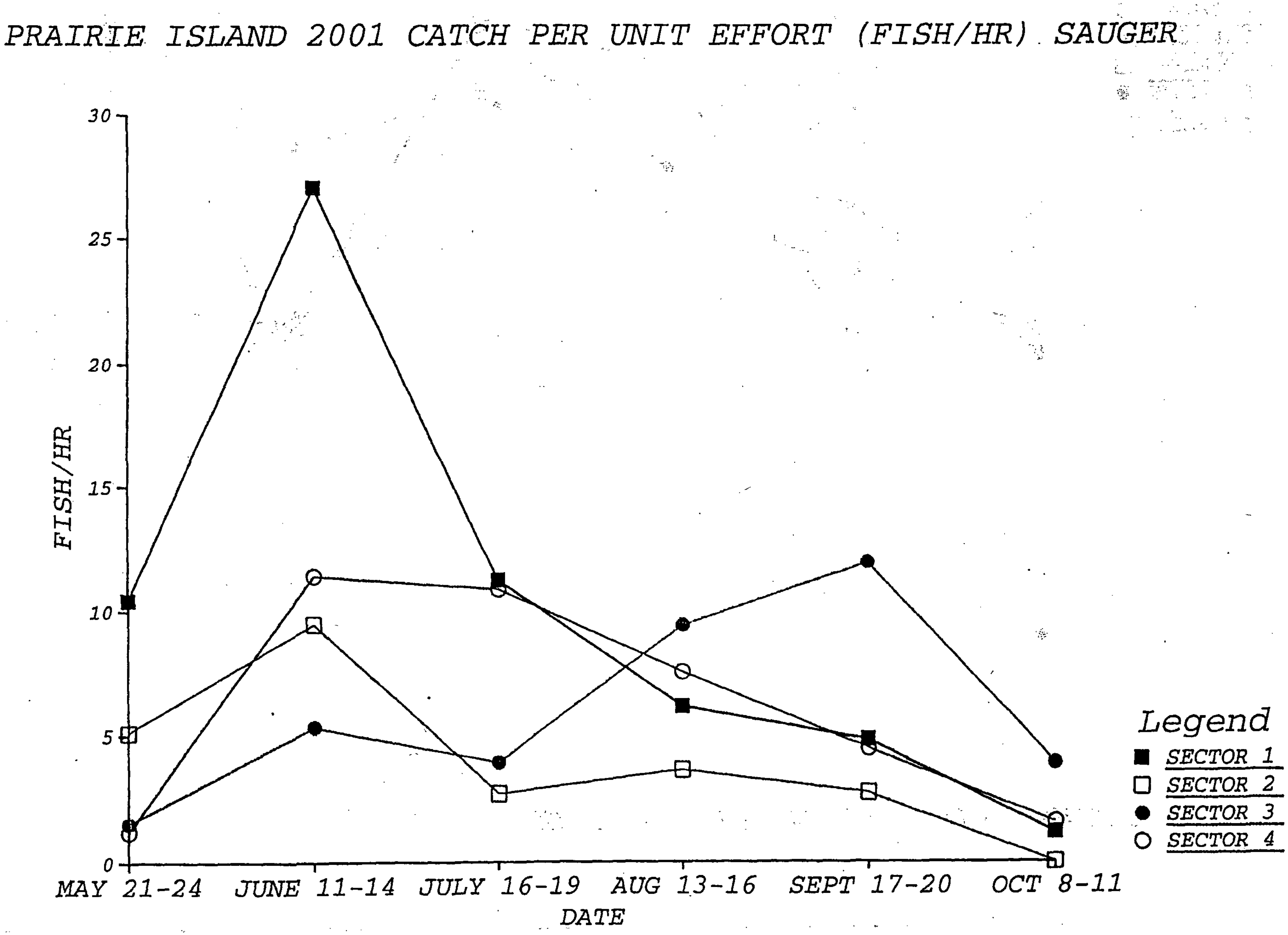


Figure 36



PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) SAUGER
FISH/HR
30
25
20
15
10
5
0
MAY 21-24
JUNE 11-14
JULY 16-19
AUG 13-16
SEPT 17-20
OCT 8-11
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 37

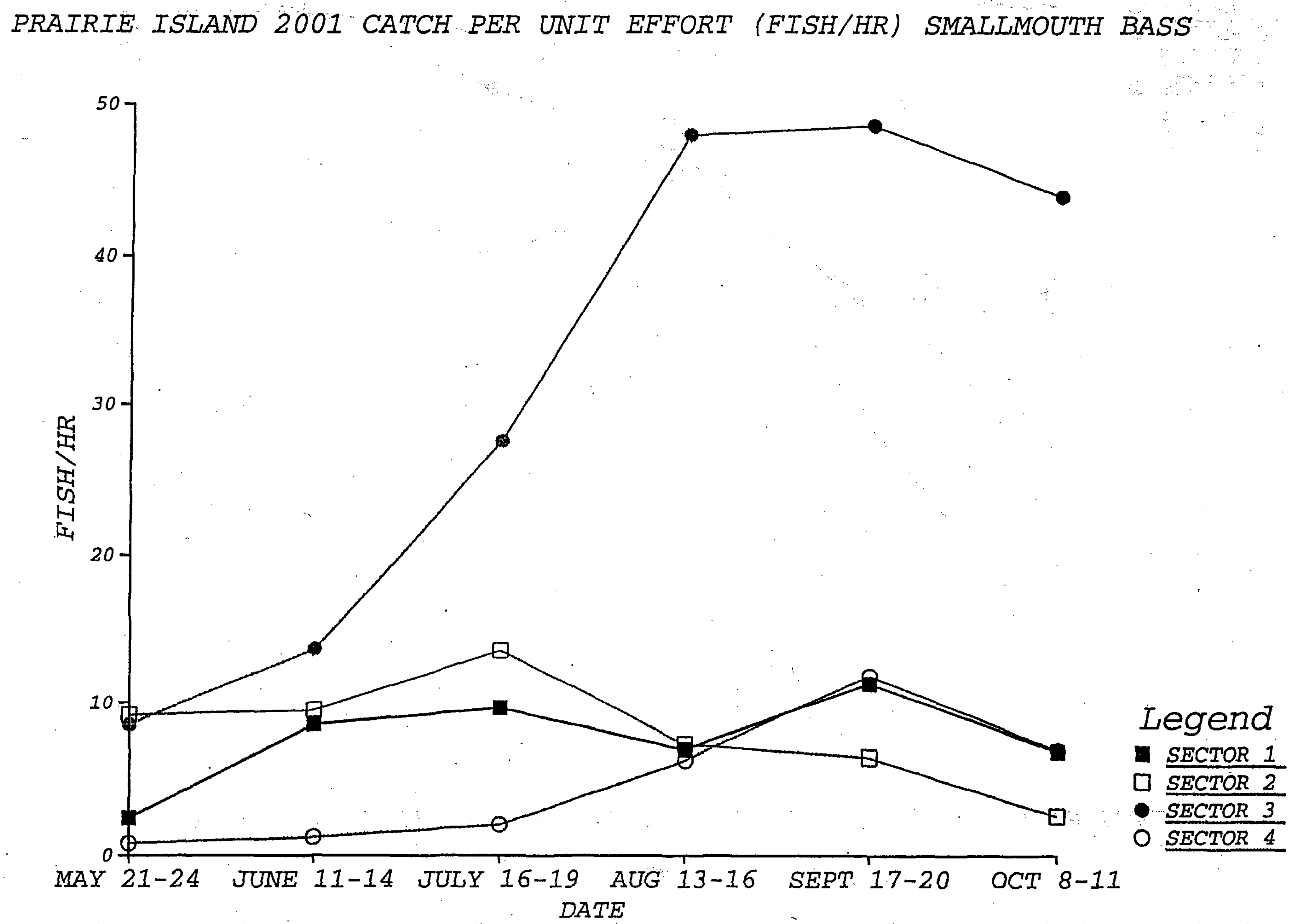

PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) SMALLMOUTH BASS
50
40
30
20
10
0
FISH/HR
MAY 21-24
JUNE 11-14
JULY 16-19
AUG 13-16
SEPT 17-20
OCT 8-11
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 38

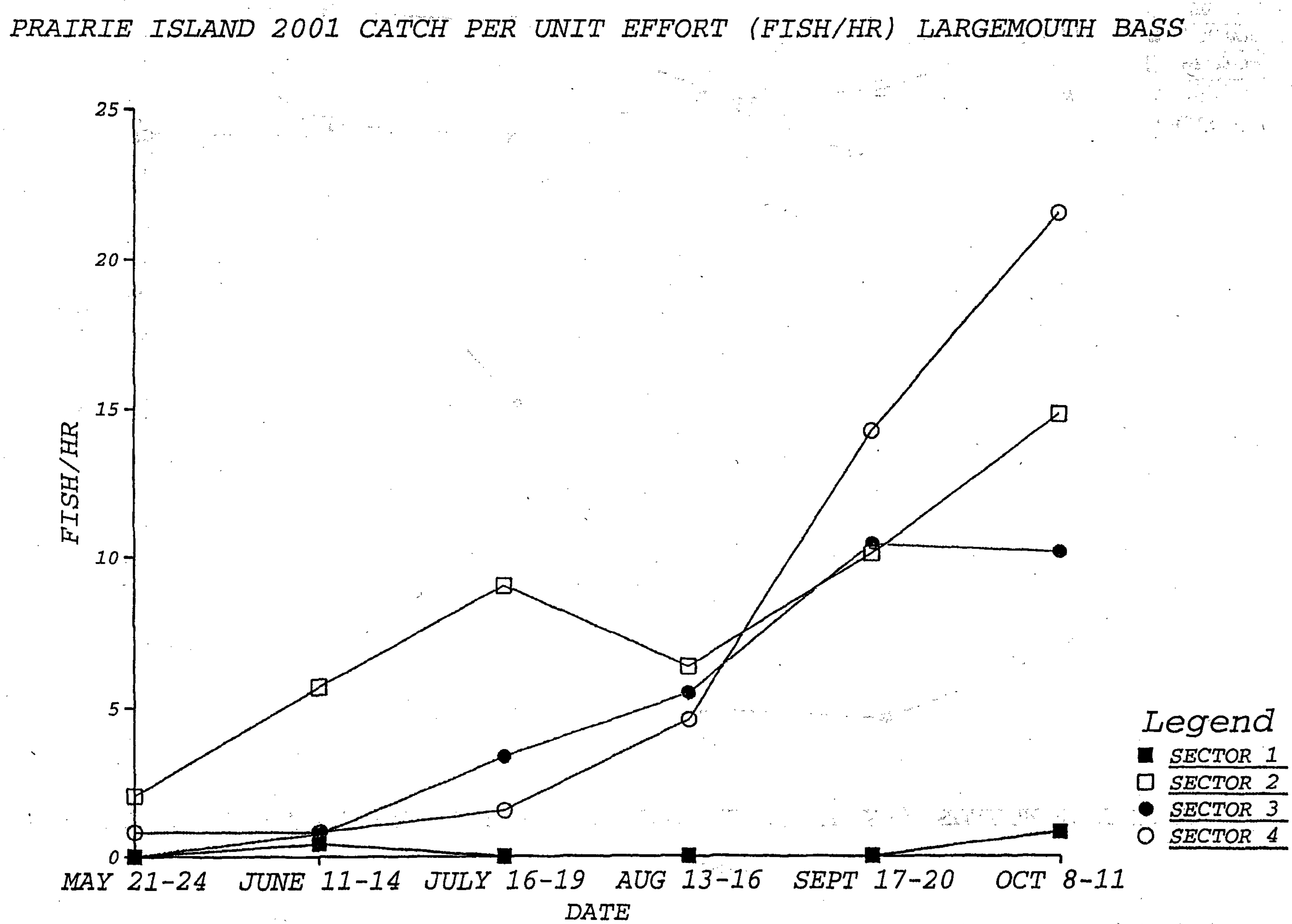

PRAIRIE ISLAND 2001 CATCH PER UNIT EFFORT (FISH/HR) LARGEMOUTH BASS
25
20
15
10
5
0
FISH/HR
MAY 21-24
JUNE 11-14
JULY 16-19
AUG 13-16
SEPT 17-20
OCT 8-11
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Table 1. 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
Chestnut lamprey Ichthyomyzon castaneus	x	x							x	x			x			x	x		x
Silver lamprey Icthyomyzon unicuspus					x	x	x	x	x	x		x	x	x	x	x	x	x	x
Paddlefish Polyodon spathula															x				
Longnose gar Lepisosteus osseus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shortnose gar Lepisosteus platostomus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bowfin Amia calva	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American eel Anguilla rostrata	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x	
Gizzard shad Dorosoma cepedianum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Goldeye Hiodon alosoides	x		x		x	x					x			x	x	x	x		
Mooneye Hiodon tergisus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brown trout Salmo trutta				x									x		x		x		x
Northern pike Esox lucius	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Musky Esox masquinongy																		x	x
Carp Cyprinus carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carpsucker Species Carpiodes species		x					x												
River carpsucker Carpiodes carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Quillback Carpiodes cyprinus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Highfin carpsucker Carpiodes velifer			x	x	x	x	x	x	x	x	x	x	x	x	x				
White sucker Catostomus commersoni	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x

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 Cycleptus elongatus	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Northern hogsucker Hypentelium nigricans	x														x			x	
Smallmouth buffalo Ictiobus bubalus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bigmouth buffalo Ictiobus cyprinellus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Spotted sucker Minytrema melanops	x	x		x		x	x			x									
Silver redhorse Moxostoma anisurum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
River redhorse Moxostoma carinatum		x	x		x		x	x	x	x		x	x			x	x	x	x
Golden redhorse Moxostoma erythrurum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Greater redhorse Moxostoma valenciennesi		x		x		x		x							x	x			x
Shorthead redhorse M.macrolepidotum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black bullhead Ictalurus melas	x	x	x	x	x	x				x							x	x	
Yellow bullhead Ictalurus natalis					x	x	x					x	x						
Brown bullhead Ictalurus nebulosus	x																		
Channel catfish Ictalurus punctatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Flathead catfish Pylodictus olivaris	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Burbot Lota lota	x	x			x					x	x	x	x	x	x	x	x	x	x
White bass Morone chrysops	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock bass Ambloplites rupestris	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Green sunfish Lepommis cyanellus	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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
Pumpkinseed Lepomis macrochirus							x	x	x	x	x	x	x	x	x	x	x	x	x
Orangespotted sunfish Lepomis humilis																x		x	x
Bluegill Lepomis macrochirus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Smallmouth bass Micropterus dolomieui	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Largemouth bass Micropterus salmoides	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
White crappie Pomoxis annularis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black crappie Pomoxis nigromaculatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Yellow perch Perca flavens	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x		x
Sauger Stizostedion canadense	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Walleye Stizostedion vitreum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Saugeye S. vitreum x S. canadense															x	x	x		x
Freshwater drum Aplodinotus grunniens	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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	6.89	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	0.54
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 summary for Gizzard shad 1977-2001.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	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

Table 4. Fisheries summary for Freshwater drum 1977-2001.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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

Table 5. Fisheries summary for Shorthead redhorse 1977-2001.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	370	LOG W=3.039 LOG L-5.101

Table 6. Fisheries summary for White bass 1977-2001.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	20.16	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

Table 7. Fisheries summary for Walleye 1977-2001.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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

Table 8. Fisheries summary for Sauger 1977-2001.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	NA	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

Table 9. Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and rank, 1981-2001.

	Smallmouth 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

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.

Year	Carp	White bass	Freshwater Drum	Sauger	Black Crappie	Shorthead Redhorse	Walleye	Gizzard 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
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	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

SECTION III

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
ENVIRONMENTAL MONITORING PROGRAM
2001 ANNUAL REPORT

FINE-MESH VERTICAL TRAVELING SCREENS
FISH IMPINGEMENT STUDY

Study and Report

by

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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.

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.

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.

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.

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 1adult). 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

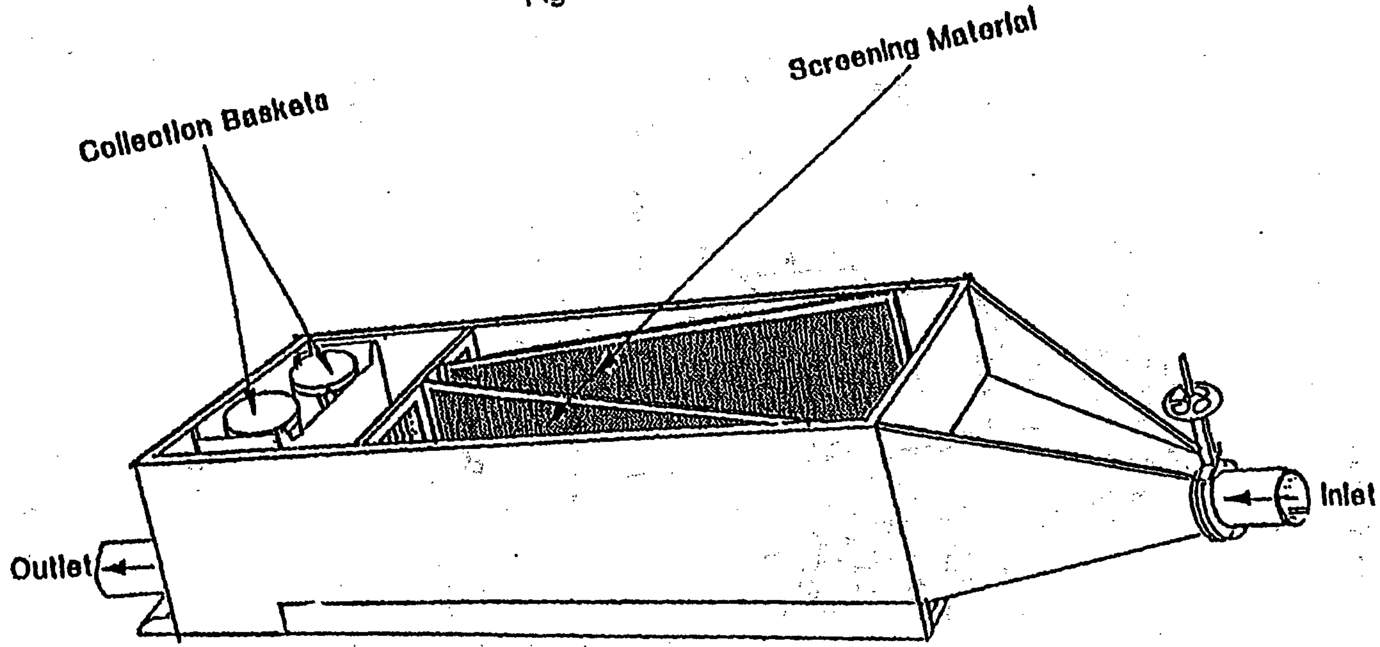
SUMMARY

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.

LITERATURE CITED

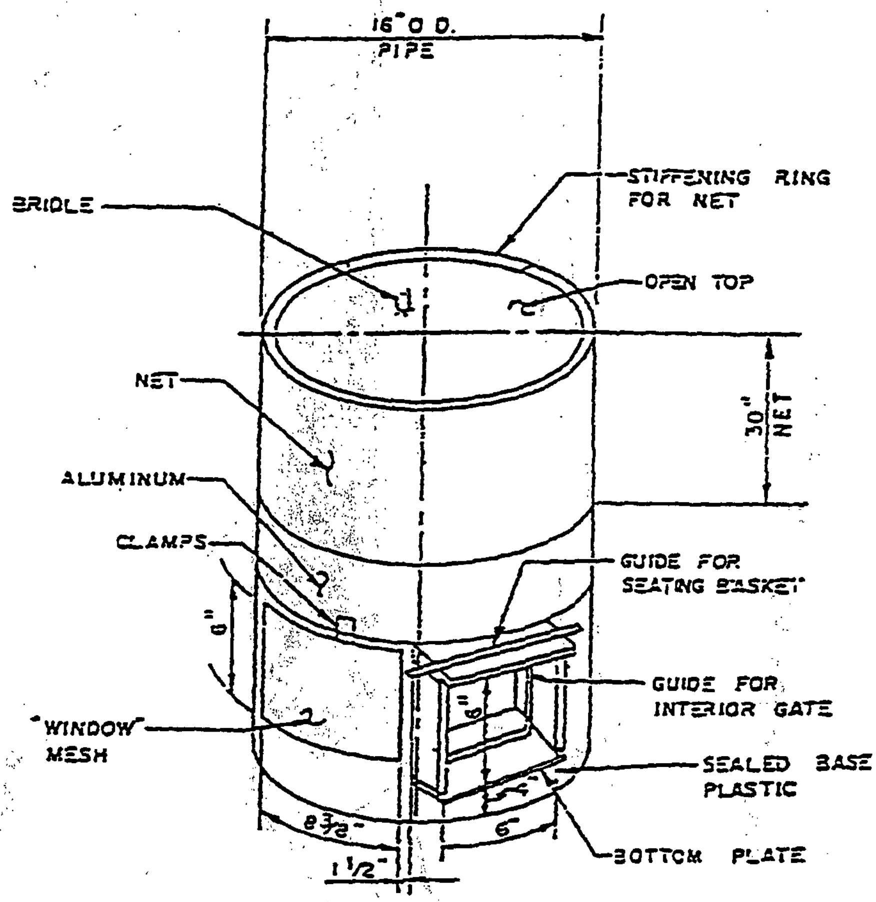
Auer, N.A. (ed.) 1982. Identification of Larval Fish of the Great Lakes Basin with Emphasis on the Lake Michigan Drainage. Great Lakes Fishery Commission, Ann Arbor, Michigan. Special Pub. 8203; 744 pp.

Figure 1



Larval Fish Collection Tank

Figure 2



DETAIL A

COLLECTION BASKET

NO SCALE

LAWLER, MATUSKY & SKELLY ENGINEERS 6/83

Appendix

Monthly Discharge Monitoring Reports for May & June 2001

NSP

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-001) temperature 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
- 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 flood-related 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 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.

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".

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

Sincerely,

Jim Bodensteiner
Senior Environmental Analyst
Northern States Power Company d/b/a Xcel Energy

Enclosures

c: Terry Coss
Kevin Holstrom
Gerald Joachim
Gary Kolle
Katherine Logan (MPCA Rochester)
Ken Mueller
Steve Schaefer
ES Record Center

w:jjb/rpts/mpraire.doc

NMC
Committed to Nuclear Excellence

Nuclear Management Company, LLC
Prairie Island Nuclear Generating Plant
1717 Wakonade Dr. East • Welch MN 55089

DATE MAY 01,2001

NAME JIM BODENSTEINER
ADDRESS XCEL ENERGY ENVIROMENTAL SERVICES

SUBJECT: APRIL 2001 NPDES RELATED ITEMS

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.

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.

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.

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.

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 O.O.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 Enviromental 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 conditons 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 Enviromental Services sent an e-mail update to MPCA Water Quality on flood conditions at the Xcel power plants.

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.

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

Attention: Mary Hayes

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

Dear: Ms. Hayes

Xcel Energy – Environmental Services department is providing notice and explanation to MPCA of temporary non-compliance issues, thus utilizing the Upset Defense provision in 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".

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'.

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:

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

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.

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.

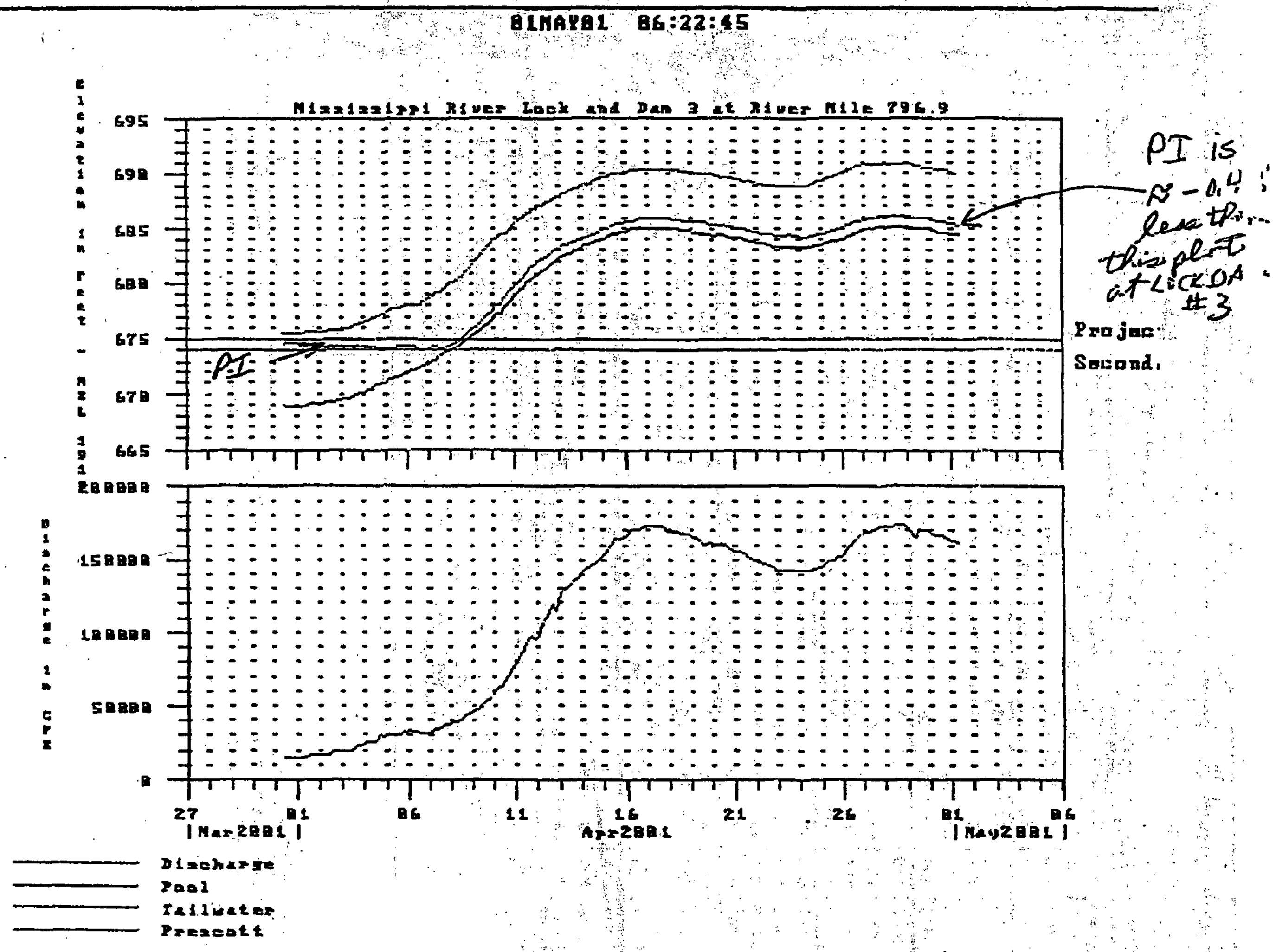
The discharge sampling point for weekly pH at NPDES outfall SD-001 (sluice gates) was suspended for personnel safety. Samples are now collected at the discharge gates which is a representative sample point of the discharged water and allows access without wading through flood-water.

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

Sincerely,

Ken Mueller, Environmental Analyst
Xcel - Environmental Services
e-mail address: kenneth.n.mueller@xcelenergy.com

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



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April 2001 River level and flow at Prairie Island
Prairie Island is ≈0.48' less than the middle plot which is Lock and Dam #3

F... IE ISL... RIVE.. ..MPERATURE REPORT

Month - Year: April-2001

POINT ID	DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1T2570A	MAX	79.0	45.0	45.0	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1
SL1	AVG	78.6	45.0	45.0	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1
	MIN	77.0	45.0	45.0	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1
Data	%	76	53	35	26	100	100	100	100	100	100	100	100	100	100	100	100
1T2571A	MAX	0.0	0.0	0.0	72.8	73.4	74.1	74.3	75.2	74.7	75.4	74.6	73.3	51.5	51.5	51.5	51.5
SL2	AVG	####	####	####	72.4	72.7	72.9	72.8	72.3	73.6	73.8	73.7	63.4	47.1	51.5	51.5	51.5
	MIN	0.0	0.0	0.0	72.0	71.9	72.6	70.3	70.3	72.9	72.8	72.2	46.0	35.3	51.5	51.5	51.5
Data	%	[illegible]	[illegible]	[illegible]	24	100	100	100	100	100	100	100	100	100	100	100	100
1T2572A	MAX	41.9	42.2	42.3	42.4	41.0	39.6	41.1	41.6	41.2	40.7	39.8	39.7	40.9	41.1	42.2	41.2
DB	AVG	38.4	39.2	39.4	39.9	40.2	38.8	40.0	39.6	39.8	39.3	39.2	39.2	39.0	39.4	40.5	41
	MIN	34.8	36.6	36.5	37.7	38.8	37.1	39.4	37.2	38.3	36.6	38.6	38.3	36.5	37.1	38.4	39.4
Data	%	100	100	97	100	100	100	100	100	100	100	100	100	100	100	100	100
1T2573A	MAX	40.1	40.1	40.7	41.1	42.[illegible]	39.2	39.8	40.3	40.9	40.2	40.6	41.1	42.0	42.9	43.9	43.6
LD1	AVG	38.1	38.7	39.2	39.3	[illegible]	38.4	39.5	39.5	39.8	39.8	40.4	40.6	41.2	42.1	43.3	43.2
	MIN	35.0	36.0	35.7	36.2	36.5	35.5	38.8	39.0	38.0	39.1	40.1	39.7	40.1	41.4	42.6	42.9
Data	%	100	100	97	95	[illegible]	100	100	100	100	100	100	100	100	100	100	100
1T2574A	MAX	42.6	42.3	41.9	42.4	43.0	40.3	40.8	41.2	41.5	41.7	41.9	42.2	43.2	44.1	45.1	44.7
LD2	AVG	39.3	40.1	40.0	40.2	[illegible]	39.2	40.2	40.2	40.6	40.6	41.4	41.6	42.2	43.1	44.3	43.9
	MIN	34.7	36.7	35.7	36.3	[illegible]	36.2	39.4	38.8	39.4	38.4	40.9	40.1	41.3	42.3	43.5	43.4
Data	%	100	100	97	97	[illegible]	100	100	100	100	100	100	100	100	100	100	100
1T2575A	MAX	44.5	44.2	44.7	45.0	[illegible]	42.8	42.4	42.5	42.5	42.7	42.6	42.9	43.7	44.8	45.6	45.1
LD3	AVG	41.5	42.6	42.5	42.3	[illegible]	41.1	41.5	41.4	41.6	41.5	42.1	42.3	42.9	43.7	44.8	44.4
	MIN	37.1	39.3	38.2	38.3	[illegible]	38.1	40.6	40.5	39.5	40.3	41.5	41.6	41.8	42.9	38.1	43.8
Data	%	100	100	97	98	94	100	100	100	100	100	100	100	100	100	100	100
1T2527A	MAX	39.8	39.9	40.5	41.3	40.9	40.1	40.7	41.4	40.8	41.4	41.3	41.3	0.0	0.0	40.1	0.0
SHI	AVG	38.0	39.1	39.4	40.1	40.0	39.4	40.2	40.2	40.5	40.4	41.2	40.9	####	####	39.4	####
	MIN	37.1	38.1	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
Data	%	100	100	97	100	100	100	100	100	100	100	100	41	[illegible]	[illegible]	[illegible]	[illegible]
1T2530A	MAX	80.7	81.5	82.4	83.7	82.7	96.5	98.[illegible]	80.2	79.0	79.8	80.7	80.9	77.7	75.6	96.5	60.2
DC	AVG	74.8	80.5	80.9	81.4	79.9	81.6	[illegible]	77.3	77.6	77.8	79.8	79.6	75.4	70.8	81.6	53.8
	MIN	67.4	77.6	78.8	76.1	72.8	79.8	[illegible]	70.5	77.0	75.4	76.0	77.7	73.9	50.4	79.8	50.9
Data	%	100	100	97	100	100	97	[illegible]	100	100	100	100	100	100	100	100	100
	ΔT	2.6	2.3	1.9	1.5	2.6	0.7	0.3	0.0	0.8	0.2	0.4	0.7	2.1	2.8	2.7	3.3
	Date	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17

POINT ID	DAY	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Month	Max-Avg-Min Max Value
1T2570A	MAX	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	79.0	79.0
SL1	AVG	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	55.6	57.[illegible]	57.0
	MIN	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	[illegible]	45.0	45.0
Data	%	100	100	100	99	100	100	100	100	83	100	42	37	65	94	72	[illegible]	
1T2571A	MAX	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	75.4	75.4
SL2	AVG	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	50.4	####	53.1
	MIN	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5	47.5	0.0	0.0
Data	%	100	100	100	99	100	100	100	100	83	100	42	37	[illegible]	94	72	81	
1T2572A	MAX	43.6	44.2	44.8	46.4	46.6	47.4	46.8	48.1	48.1	49.9	50.0	49.3	50.3	51.8	54.[illegible]	54.4	54.4
DB	AVG	41.3	42.0	43.2	44.2	45.6	45.8	46.0	45.5	45.9	47.3	48.0	47.9	48.5	50.3	52.2	42.8	44.5
	MIN	39.4	39.3	41.7	41.3	44.5	45.5	44.0	43.0	43.6	44.6	45.2	46.3	46.5	48.1	49.5	34.8	39.6
Data	%	100	100	100	99	100	100	100	100	98	100	99	100	99	96	74	99	
1T2573A	MAX	44.1	44.5	45.2	46.8	47.6	47.6	47.6	47.7	48.1	49.7	51.2	52.7	55.1	56.1	[illegible]	58.4	58.4
LD1	AVG	43.3	44.0	44.7	45.9	47.2	47.5	47.4	46.9	47.5	48.6	50.2	51.8	53.6	55.6	[illegible]	44.3	45.2
	MIN	42.8	43.5	44.2	45.0	46.6	47.4	46.9	45.5	47.0	47.8	49.3	51.1	52.6	55.0	[illegible]	35.0	39.2
Data	%	100	100	100	99	100	100	100	100	99	100	99	100	99	96	73	98	
1T2574A	MAX	45.0	45.3	46.1	47.7	48.7	48.8	48.6	48.7	49.2	50.5	52.1	53.8	55.9	[illegible]	[illegible]	59.5	59.5
LD2	AVG	44.0	44.6	45.4	46.7	48.1	48.4	48.1	47.7	48.4	49.5	51.0	52.7	54.5	[illegible]	[illegible]	45.2	46.3
	MIN	43.2	44.0	44.8	45.7	47.5	48.0	47.6	46.7	47.7	48.7	50.0	51.7	53.4	[illegible]	[illegible]	34.7	40.3
Data	%	100	100	100	99	100	100	100	100	99	100	99	100	99	[illegible]	74	99	
1T2575A	MAX	45.6	46.2	46.7	48.5	49.3	49.2	49.2	49.2	49.9	51.1	52.8	54.2	56.4	57.6	60.0	60.0	60.0
LD3	AVG	44.5	45.2	46.0	47.3	48.6	48.9	48.7	48.2	49.0	49.9	51.5	53.2	55.0	56.8	58.[illegible]	46.1	47.3
	MIN	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
Data	%	100	100	100	99	100	100	100	100	99	100	99	100	99	96	74	99	
1T2527A	MAX	0.0	0.0	0.0	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	[illegible]	41.4	41.4
SHI	AVG	####	####	####	41.3	41.3	41.3	41.3	41.3	[illegible]	41.3	41.3	41.3	41.3	37.0	####	####	31.7
	MIN	0.0	0.0	0.0	[illegible]	41.3	41.3	41.3	41.3	[illegible]	41.3	41.3	41.3	41.3	31.7	0.0	0.0	0.0
Data	%	[illegible]	[illegible]	[illegible]	61	100	100	100	100	83	100	42	37	100	[illegible]	[illegible]	63	
1T2530A	MAX	52.8	54.6	57.1	82.6	75.0	78.8	79.3	80.3	78.9	65.9	58.5	60.0	62.7	64.9	68.0	98.7	98.7
DC	AVG	50.8	52.4	54.7	58.9	62.9	77.8	77.9	77.9	59.4	60.5	57.0	58.6	60.1	63.3	[illegible]	70.0	74.7
	MIN	49.5	49.8	53.1	56.0	53.3	64.4	76.5	76.1	48.8	57.2	54.8	57.2	58.1	61.9	[illegible]	48.8	52.8
Data	%	100	100	100	99	100	100	100	100	100	100	100	100	100	97	[illegible]	98	
	ΔT	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	1.9	
	Date	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/[illegible]		

UPSTREAM = INTAKE S.H.I → UPSTREAM = DIAMOND BLUFF

[initials] 5/14/2001

SL1 = Sturgeon Lake Temp 1
SL2 = Sturgeon Lake Temp 2
DB = Diamond Bluff Temp
LD1 = Lock & Dam Temp 1
LD2 = Lock & Dam Temp 2
LD3 = Lock & Dam Temp 3
SHI = Screenhouse Inlet Temp
DC = Discharge Canal Ave. Temp
96% or greater is < 1 hour data loss
95% or less is >= 1 hour data loss

EQUIPMENT OOS > 1HR/DAY IS HIGHLIGHTED. MOST OOS DUE TO FLOOD. NO ESTIMATES MADE.

BROMINATION/CHLORINATION REPORT

From: 01-APR-01   To: 30-APR-01

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
6	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
				0.10		
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

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	828
April 13	828
April 14	828
April 15	828
April 16	828
April 17	828
April 18	828
April 19	828
April 20	828
April 21	828
April 22	828
April 23	828
April 24	828
April 25	828
April 26	828
April 27	828
April 28	828
April 29	828
April 30	828
TOTAL	16560 million gallons

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	010M 1

PERMITTEE NAME/ADDRESS:
NSP
414 Nicollet Mall
Minneapolis, MN 554011993

STATION INFORMATION:
SD-001 (Combined Effluent)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD (YEAR MO. DAY)
FROM 2001/04/01 TO 2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow 50050	SAMPLE VALUE	******	* 4794	MG	******	* 479.4	******	mgd	* 10/30	EST
	PERMIT REQ	******	REPORT CalMoTot		******	REPORT DailyAve	******		1 x Day	MeaCon
pH 00400	SAMPLE VALUE	******	******	****	7.8	******	8.1	SU	1/7	GRAB
	PERMIT REQ	******	******		6.0 CalMoMin	******	9.0 CalMoMax		1 x Week	Grab
Phosphorus Total (as P) 00665 *	SAMPLE VALUE	******	******	****	******	******	NR	mg/L		
	PERMIT REQ	******	******		******	******	REPORT DailyMax		1 x Week	Grab
Chlorine Rate 50059	SAMPLE VALUE	******	89.5	kg/day	******	******	******		1/30	CALC
	PERMIT REQ	******	REPORT DailyMax		******	******	******		1 x Day	Calcul
Oxidants (Bromine) Tot Residual Interm 34046	SAMPLE VALUE	******	******	****	******	******		mg/L		
	PERMIT REQ	******	******		******	******	.05 InstantMax		1 x Day	Grab
Oxidants (Bromine) Tot Residual Contin 04223	SAMPLE VALUE	******	******	****	******	******	<0.001	mg/L	30/30	CALC
	PERMIT REQ	******	******		******	******	.001 DailyMax		1 x Day	Calcul
Oxidants (Chlorine) Tot Residual Interm 03775	SAMPLE VALUE	******	******	****	******	******		mg/L		
	PERMIT REQ	******	******		******	******	.2 InstantMax		1 x Day	Grab

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 5-15-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS: * see attached sheet with flow estimates during [illegible] [illegible] from 11-20

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
NSP
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	010M 1

STATION INFORMATION:
SD-001 (Combined Effluent)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD (YEAR/MO./DAY)
FROM 2001/04/01 TO 2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Oxidants (Chlorine) Tot Residual Contin 03774	SAMPLE VALUE	******	******		******	******	<0.001	mg/L	25/30	CALC
	PERMIT REQ	******	******		******	******	.04 DailyMax		1 x Day	Calcul
Plant Capacity Fctr % of Capacity 00180	SAMPLE VALUE	******	******		******	102.4	******	%	Cont	MEAS
	PERMIT REQ	******	******		******	REPORT CalMoAvg	******		1 x Day	Measur

* Phosphate based descaler injection has been terminated

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520 LAFAYETTE RD
ST. PAUL, MN 55155-4194
ATTN: Discharge Monitoring Report

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[signature] 5-15-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	011M 1

STATION INFORMATION:
SD-002 (Steam Generator Blowdown Discharge)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD (YEAR/MO./DAY) FROM 2001/04/01 TO 2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.372	MG	******	0.012	******	mgd	1/30	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	<0.005	<0.005	kg/day	******	<0.1	<0.1	mg/L	1/30	GRAB
00530	PERMIT	65.3 CalMoAvg	217.0 DailyMax			30 CalMoAvg	100 DailyMax		1 X Month	Grab

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 55155-4194
ATTN: Dis[illegible] Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 5-15-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT DATE

SIGNATURE OF CHIEF OPERATOR PHONE DATE CERTIFICATION#

COMMENTS

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	012M 1

STATION INFORMATION:
SD-003 (Radwaste Treatment Effluent)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD (YEAR/MO/DAY)
FROM	2001/04/01
TO	2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS		SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.033	MG	******	0.001	******	mgd	1/30		EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x	Month	Estima
TSS	SAMPLE VALUE	0.002	0.002	kg/day	******	0.4	0.4	mg/L	1/30		GRAB
00530	PERMIT	26.0 CalMoAvg	86.9 DailyMax			30 CalMoAvg	100 DailyMax		1 x	Month	Grab

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MINNESOTA POLLUTION CONTROL AGENCY
520 LAFAYETTE RD
ST. PAUL, MN 55155-4194
ATTN: Discharge Monitoring Report

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SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE: 5-15-01

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	013M 1

STATION INFORMATION:
SD-004 (Neutralizer + Resin Rinse Discharge)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD (YEAR/MO./DAY)
FROM	2001/04/01
TO	2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.256	MG	******	0.009	******	mgd	9/30	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	0.1	0.7	kg/day	******	2.9	6.4	mg/L	9/30	GRAB
00530	PERMIT	97.9 CalMoAvg	326.0 DailyMax			30 CalMoAvg	100 DailyMax		1 x Month	Grab

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MINNESOTA POLLUTION CONTROL AGENCY
520 LAFAYETTE RD
ST. PAUL, MN 55155-4194
ATTN: Disch[illegible] Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 5-15-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	014M 1

STATION INFORMATION:
SD-005 (Unit 1 Turbine Bldg Sump Dschg)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD

	YEAR/MO/DAY		YEAR/MO/DAY
FROM	2001/04/01	TO	2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	1,801	MG	******	0.060	******	mgd	1/30	EST
50050	PERMIT	-----	REPORT CalMoTot		-----	REPORT CalMoAvg	-----		1 x Month	Estima
TSS	SAMPLE VALUE	******	******	****	******	4.3	7.7	mg/L	2/30	GRAB
00530	PERMIT	-----	-----		-----	30 CalMoAvg	100 DailyMax		1 x Month	Grab
Oil Total Recoverable	SAMPLE VALUE	******	******	****	******	<1.0	<1.0	mg/L	1/30	GRAB
00552	PERMIT	-----	-----		-----	10 CalMoAvg	15 DailyMax		1 x Month	Grab

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE: 5-15-01

SIGNATURE OF CHIEF OPERATOR | PHONE | DATE | CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	015M 1

STATION INFORMATION:
SD-006 (Unit 2 Turbine Bldg Sump Dschg)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD

FROM YEAR MO DAY 2001/04/01 TO YEAR MO DAY 2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.872	MG	******	0.029	******	mgd	1/30	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	******	******	****	******	4.0	4.0	mg/L	1/30	GRAB
00530	PERMIT					30 CalMoAvg	100 DailyMax		1 x Month	Grab
Oil Total Recoverable	SAMPLE VALUE	******	******	****	******	<1.0	<1.0	mg/L	1/30	GRAB
00552	PERMIT					10 CalMoAvg	15 DailyMax		1 x Month	Grab

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, M[illegible]155-4194
ATTN: Dis[illegible] Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 5-15-01

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT DATE

SIGNATURE OF CHIEF OPERATOR PHONE DATE CERTIFICATION#

COMMENT

1D18

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	016M 1

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

STATION INFORMATION:
SD-007 (Metal Cleaning Effluent Discharge)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD YEAR/MO./DAY		MONITORING PERIOD YEAR/MO./DAY
FROM	2001/04/01	TO	2001/04/30

[X] No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******		MG	******		******	mgd		
50050	PERMIT	------	REPORT CalMoTot		------	REPORT CalMoAvg	------		1 x Day	Estima
TSS	SAMPLE VALUE			kg/day	******			mg/L		
00530	PERMIT	.6 CalMoAvg	1.9 DailyMax		------	30 CalMoAvg	100 DailyMax		1 x Day	Grab
pH	SAMPLE VALUE	******	******	****		******		SU		
00400	PERMIT	------	------		6.0 CalMoMin	------	9.0 CalMoMax		1 x Week	Grab
Copper Total (as Cu)	SAMPLE VALUE			kg/day	******			mg/L		
01042	PERMIT	.02 CalMoAvg	.02 DailyMax		------	1.0 CalMoAvg	1.0 DailyMax		1 x Day	Grab
Iron Total (as Fe)	SAMPLE VALUE			kg/day	******			mg/L		
01045	PERMIT	.02 CalMoAvg	.02 DailyMax		------	1.0 CalMoAvg	1.0 DailyMax		1 x Day	Grab
Oil Total Recoverable	SAMPLE VALUE			kg/day	******			mg/L		
00552	PERMIT	.2 CalMoAvg	.3 DailyMax		------	10 CalMoAvg	15 DailyMax		1 x Day	Grab

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 55155-4194	*I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.*	[signature] SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	5-15-01 DATE
		SIGNATURE OF CHIEF OPERATOR / PHONE / DATE	CERTIFICATION#

ATTN: Discharge Monitoring Report
COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	030M 1

STATION INFORMATION:
SD-012 (Intake Screen Backwash + Fish Retn)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD (YEAR MO. DAY)
FROM	2001/04/01
TO	2001/04/30

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	24	MG	******	2	******	mgd	12/30	EST *
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima

* Screens were only running 12 days because of plant response to flood conditions

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 55155-4194 ATTN: Disc... Monitoring Report	*I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.*	[signature] SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	5-15-01 DATE
		SIGNATURE OF CHIEF OPERATOR / PHONE / DATE	CERTIFICATION#

COMMENTS

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	

STATION INFORMATION:
WS-001 (Unit 1 Plant Cooling Water Dschg)
Waste Stream, Internal Waste Stream

MONITORING PERIOD

	YEAR/MO/DAY		YEAR/MO/DAY
FROM	2001/04/01	TO	2001/04/30

☐ No Flow

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow 50050	SAMPLE VALUE	******	807.8	MG	******	26.9	******	mgd	30/30	EST
	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Day	MeaCon
Oxidants Total Residual 34044	SAMPLE VALUE	******	******		******	******	0.24	mg/L	30/30	GRAB
	PERMIT						2.0 DailyMax		1 x Day	Grab

NOTE: FLOW IS A TOTAL OF WS001 & WS002

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 5-15-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	022M 8

STATION INFORMATION:
WS-002 (Unit 2 Plant Cooling Water Dschg)
Waste Stream, Internal Waste Stream

MONITORING PERIOD (YEAR/MO./DAY)
FROM 2001/04/01 TO 2001/04/30

☐ No Flow

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow 50050	SAMPLE VALUE	******	807.8	MG	******	26.9	******	mgd	30/30	EST
	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Day	MeaCor
Oxidants Total Residual 34044	SAMPLE VALUE	******	******	****	******	******	0.21	mg/L	30/30	GRAB
	PERMIT						2.0 DailyMax		1 x Day	Grab

NOTE: FLOW IS A TOTAL OF WS001 & WS002

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 55-4194
ATTN: Disc Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE 5-15-01

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

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 until May 25 when normal upstream 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 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
- 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.

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 Related Issues".

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

Sincerely,

Jim Bodensteiner
Senior Environmental Analyst
Northern States Power Company d/b/a Xcel Energy

Enclosures

c: Terry Coss
Kevin Holstrom
Gerald Joachim
Gary Kolle
Katherine Logan (MPCA Rochester)
Ken Mueller
Steve Schaefer
ES Record Center

w:jjb/rpts/mpraire.doc

DATE JUNE 01,2001

NAME JIM BODENSTEINER
ADDRESS XCEL ENERGY ENVIROMENTAL SERVICES

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.

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.

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.

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.

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.

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.

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 89.5 on May 7th and continued downward trend.

Early morning on May 8th river level was 681 feet. #126 screen had tripped so #126 and #127 are O.O.S. 2 fans on #123 tower and 1 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 canl 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.

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.

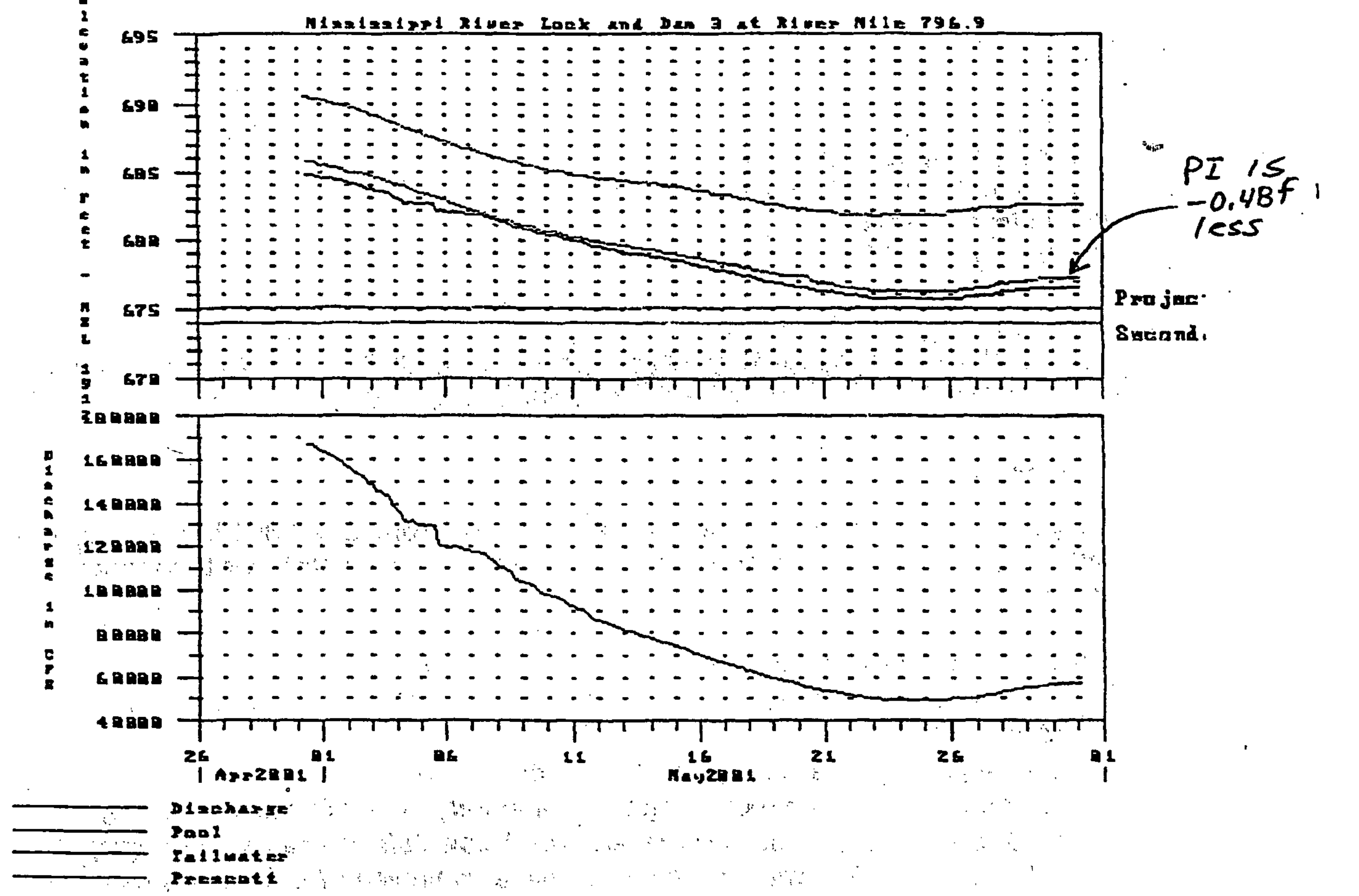
On June 2nd blowdown 396 CFS. canal 67. ALL screens running with a total of 6 fans off. Both Unit 2 circ pumps running. condenser inlets 66.5

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

Sincerely yours,

Gerald Joachim
Senior Radiation Protection Specialist

31MAY01 05:52:43



Back Home Print http://www.mvp-wc.usace.army.mil

Prairie Island is -0.48 feet less than middle plot which is Lock and Dam #3 in regard to site drawings and reference due to a difference in the datum reference year

NSP

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 control-structures,
- 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.

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,

Kenneth L. Mueller

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

NSP

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	Numbers
Gizzard shad	153
Carp	136
Green sunfish	80
Channel catfish	36
Freshwater drum	25
Bigmouth buffalo	12
Smallmouth buffalo	6
Quillback carpsucker	5
Gar species	4
Largemouth bass	2
Northern pike	1
Bowfin	1
Black bullhead	1
Flathead catfish	1
Black crappie	1
Total	464

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

Carp	12
Channel catfish	6
Gizzard shad	6
Unidentified	4
Smallmouth buffalo	1
Bigmouth buffalo	1
Total	30

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 Range (mmTL)							
	yoy	< 99	100-199	200-299	300-399	400-499	other	total
Freshwater drum	607	5	306	217	63	-	-	1198
White bass	57	-	233	2	8	-	-	300
Black bullhead	-	32	66	22	-	-	-	120
Gizzard shad	-	-	1	19	47	1	-	68
Bluegill	-	18	16	-	-	-	-	34
Channel catfish	-	11	10	7	2	-	1 at 690	31
Green sunfish	-	9	6	-	-	-	-	15
Shiner/minnow spp.	-	12	-	-	-	-	-	12
Black crappie	-	1	6	1	1	-	-	9
White crappie	-	3	-	1	-	-	-	4
Quillback	-	-	2	1	-	1	-	4
Northern pike	-	-	-	1	-	1	1 at 550	3
Smallmouth buffalo	-	1	2	-	-	-	-	3
Sauger	-	-	-	-	2	-	-	2
Shorthead redhorse	-	-	2	-	-	-	-	2
Bigmouth buffalo	-	-	-	-	-	-	1 at 540	1
Rock bass	-	-	1	-	-	-	-	1
Mooneye	-	-	-	-	1	-	-	1
Bowfin	-	-	-	-	-	-	1 at 685	1
Walleye	-	-	-	-	-	1	-	1
Shortnose gar	-	-	-	-	-	-	1 at 660	1
Carp	-	-	1	-	-	-	1 at 560	1
							Total	1812

Summation

Discharge canal	464
Outside of canal	30
Recirc/intake	1812
Grand total =	2306

KNM 6/15/01

PF ISL/ ER ...'ERA.URE REPO..

Month - Year: May-2001

POINT ID	DAY	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	31	Month	Max-Avg-Min Max Value
1T2570A	MAX	79.0	51.8	38.9	41.6	49.4	57.2	65.0	72.7	80.5	88.3	96.0	99.0	0.0	0.0	0.0	0.0	0.0	99.0	98.7	92.5	86.3	80.1	73.8	67.6	61.4	59.0	60.0	62.0	62.8	63.8	63.3	99.0	99.0
SL1	AVG	57.9	45.4	34.0	37.8	45.5	53.3	61.1	68.8	76.6	84.4	92.1	97.5	####	####	####	####	####	98.9	95.6	89.4	83.2	76.9	70.7	64.5	58.6	58.0	58.3	60.6	62.0	62.7	63.1	####	59.7
	MIN	52.7	38.9	31.0	33.9	41.6	49.4	57.2	65.0	72.7	80.5	88.3	96.0	0.0	0.0	0.0	0.0	0.0	98.7	92.5	86.3	80.1	73.8	67.6	61.4	57.1	57.5	57.2	59.2	61.3	62.0	62.5	[illegible]	0.0
Data	%	72	100	97	100	100	100	100	100	100	100	100	38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	100	100	100	100	100	100	100	100	100	100	100	100	[illegible]	
1T2571A	MAX	51.5	47.5	37.8	43.4	50.9	58.5	66.0	73.6	81.1	88.6	96.2	99.0	0.0	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	59.3	60.3	61.6	62.4	63.0	99.0	99.0
SL2	AVG	50.4	42.7	34.7	39.6	47.2	54.7	62.2	69.8	77.3	84.9	92.4	97.6	####	####	####	####	####	98.9	95.8	89.8	83.8	77.8	71.9	65.9	60.0	57.8	58.1	59.8	60.6	61.9	62.6	####	58.8
	MIN	47.5	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	62.9	57.8	57.5	57.2	58.9	60.2	61.1	62.3	0.0	0.0
Data	%	72	100	100	100	100	100	100	100	100	100	100	37	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	100	100	100	100	100	100	100	100	100	100	100	100	78	
1T2572A	MAX	[illegible]	54.6	55.8	57.7	57.8	58.9	59.8	60.0	59.9	59.9	60.5	61.3	62.3	63.6	65.8	66.9	67.1	68.2	68.2	68.5	66.7	65.4	62.6	62.3	60.6	59.7	60.8	62.2	62.9	63.8	63.9	68.5	68.5
DB	AVG	52.2	53.8	55.1	56.5	57.3	57.8	58.4	58.5	58.8	59.5	59.8	60.2	61.0	61.9	64.0	66	66.2	66.8	67.6	67.5	66.0	63.6	61.9	61.0	59.9	59.4	59.5	60.8	62.0	62.9	63.3	60.9	62.0
	MIN	49.5	52.4	54.3	54.8	56.7	56.5	56.7	56.2	57.6	59.2	59.1	59.0	59.6	60.9	62.7	64.4	64.9	65.5	66.2	66.6	65.0	62.2	61.1	59.7	59.0	58.2	58.7	59.6	61.0	61.9	61.8	49.5	54.4
Data	%	74	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	
1T2573A	MAX	58.4	58.6	59.3	59.8	59.7	59.7	59.9	59.7	59.7	60.1	60.3	61.1	62.3	63.4	65.7	66.9	67.2	67.9	68.4	68.7	66.9	65.4	62.1	61.6	60.0	59.2	59.6	60.8	62.0	62.9	63.5	68.7	68.7
LD1	AVG	57.2	58.3	59.0	59.5	59.1	59.0	59.4	59.0	59.3	59.8	59.8	60.3	61.3	62.4	64.5	66.0	66.8	67.1	68.0	67.8	66.0	63.6	61.6	60.6	59.6	58.8	59.0	60.3	61.4	62.5	63.1	61.6	62.3
	MIN	56.0	58.0	58.5	59.1	58.7	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	62.5	56.0	58.4
Data	%	70	100	100	95	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	
1T2574A	MAX	59.5	59.7	60.6	61.0	60.6	60.4	61.0	60.4	60.3	61.0	61.4	62.1	63.3	64.8	66.9	67.8	68.5	68.9	69.4	69.4	67.6	65.4	62.0	61.6	60.1	59.5	60.3	61.6	62.5	63.5	64.0	69.4	69.4
LD2	AVG	58.2	59.4	60.0	60.4	59.9	59.6	60.1	59.7	59.9	60.4	60.4	60.9	62.0	63.1	65.6	67.1	67.8	68.2	68.9	68.5	66.5	63.7	61.4	60.6	59.6	59.1	59.2	60.7	61.9	62.9	63.6	62.2	63.1
	MIN	56.6	58.8	59.3	60.0	59.3	59.0	59.6	58.9	59.2	59.9	59.6	60.0	60.9	62.1	64.4	66.7	67.3	67.5	67.8	67.6	65.0	61.6	60.5	59.8	58.9	58.4	57.9	59.7	60.6	61.9	62.8	56.8	59.5
Data	%	74	100	100	97	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	
1T2575A	MAX	60.0	60.1	61.0	61.5	61.1	60.9	61.2	60.7	60.7	61.0	61.6	62.3	63.8	65.3	68.1	68.6	68.9	69.6	69.9	69.5	67.9	65.4	61.8	61.5	60.0	59.6	60.6	62.1	63.0	64.1	64.4	69.9	69.9
LD3	AVG	58.6	59.9	60.4	60.9	60.3	60.0	60.6	59.9	60.1	60.5	60.6	61.1	62.3	63.5	66.3	67.8	68.2	68.6	69.3	68.7	66.6	63.6	61.4	60.6	59.5	59.0	59.3	60.9	62.2	63.2	63.6	62.5	63.4
	MIN	57.2	59.5	59.9	60.5	59.6	59.4	60.0	59.2	59.5	60.0	59.9	60.0	60.1	62.1	59.4	67.1	67.5	67.8	66.4	67.7	65.4	61.8	60.4	59.3	57.7	58.0	58.1	59.9	60.8	62.2	62.6	57.2	59.6
Data	%	74	100	100	98	[illegible]	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	
1T2527A	MAX	0.0	0.0	60.8	61.1	61.3	60.5	60.8	60.4	60.3	60.7	61.1	62.1	63.4	65.0	60.5	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	64.7	64.6	69.9	69.9
SHI	AVG	####	####	59.3	60.4	60.8	59.7	60.1	59.9	59.9	60.3	60.4	60.9	62.1	63.2	59.7	68.0	68.1	68.7	69.6	69.0	66.8	63.6	60.7	60.0	59.5	59.6	59.8	61.8	63.2	64.0	64.4	####	59.3
	MIN	0.0	0.0	57.6	59.9	60.3	59.4	59.6	59.4	59.4	60.0	59.8	59.8	61.0	62.1	59.4	67.0	67.3	67.9	69.3	68.0	65.8	61.3	60.2	59.7	59.4	59.0	59.0	60.7	62.6	63.3	64.0	0.0	0.0
Data	%	[illegible]	[illegible]	[illegible]	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	92	
1T2530A	MAX	68.0	61.6	93.9	95.3	95.9	95.8	89.1	84.1	85.0	83.1	75.9	72.9	76.8	82.7	95.8	85.1	78.9	78.5	79.4	79.3	78.5	73.6	70.9	72.6	72.4	73.4	74.5	76.8	77.6	76.4	75.5	95.9	95.9
DC	AVG	64.6	60.7	76.2	93.8	94.6	92.6	85.4	80.9	81.9	78.2	73.6	70.2	72.9	76.3	92.6	79.2	77.3	75.4	76.9	77.7	75.4	70.9	68.2	70.5	71.8	71.5	71.3	73.1	74.8	74.0	73.6	76.7	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	74.5	73.6	72.2	72.3	76.5	71.5	69.1	65.6	68.9	70.7	68.3	67.5	69.0	71.4	69.5	71.2	59.9	61.6
Data	%	81	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	
	ΔT	2.3	5.9	8.3	8.4	4.3	1.7	-0.3	-2.6	-4.3	-5.5	-7.2	-7.6	14.5	14.9	15.0	15.0	15.0	-0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	Date	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1		6/7/2001

SL1 = Sturgeon Lake Temp 1 | SL2 = Sturgeon Lake Temp 2 | DB = Diamond Bluff Temp | LD1 = Lock & Dam Temp 1 | LD2 = Lock & Dam Temp 2 | LD3 = Lock & Dam Temp 3 | SHI = Screenhouse Inlet Temp | DC = Discharge Canal Ave. Temp | 96% or greater is < 1 hour data loss | 95% or less is >= 1 hour data loss

ΔT=0.4

INTAKE SENSORS SL1 & SL2 OOS DUE TO FLOOD.

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
				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
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.

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.

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 - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
NSP
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	010M 1

STATION INFORMATION:
SD-001 (Combined Effluent)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD (YEAR/MO./DAY)
FROM	2001/05/01
TO	2001/05/31

☐ No Discharge

PARAMETER		QUANTITY			UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow 50050	SAMPLE VALUE	******	* 4162		MG	******	* 173.0	******	mgd	24/31	EST
	PERMIT REQ	******	REPORT CalMoTot			******	REPORT DailyAve	******		1 x Day	MeaCon
pH 00400	SAMPLE VALUE	******	******		****	8.2	******	8.4	SU	1/7	Grab
	PERMIT REQ	******	******			6.0 CalMoMin	******	9.0 CalMoMax		1 x Week	Grab
Phosphorus Total (as P) 00665	SAMPLE VALUE	******	******		****	******	******	NR **	mg/L		
	PERMIT REQ	******	******			******	******	REPORT DailyMax		1 x Week	Grab
Chlorine Rate 50059	SAMPLE VALUE	******	114.8		kg/day	******	******	******		1/31	Calc
	PERMIT REQ	******	REPORT DailyMax			******	******	******		1 x Day	Calcul
Oxidants (Bromine) Tot Residual Interm 34046	SAMPLE VALUE	******	******		****	******	******		mg/L		
	PERMIT REQ	******	******			******	******	.05 InstantMax		1 x Day	Grab
Oxidants (Bromine) Tot Residual Contin 04223	SAMPLE VALUE	******	******		****	******	******	<0.001	mg/L	31/31	Calc
	PERMIT REQ	******	******			******	******	.001 DailyMax		1 x Day	Calcul
Oxidants (Chlorine) Tot Residual Interm 03775	SAMPLE VALUE	******	******		****	******	******		mg/L		
	PERMIT REQ	******	******			******	******	.2 InstantMax		1 x Day	Grab

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 6-14-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS: *see attached sheet for flow estimates days 1-7

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
NSP
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	010M 1

STATION INFORMATION:
SD-001 (Combined Effluent)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD

	YEAR/MO./DAY		YEAR/MO./DAY
FROM	2001/05/01	TO	2001/05/31

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Oxidants (Chlorine) Tot Residual Contin 03774	SAMPLE VALUE	******	******	****	******	******		mg/L		
	PERMIT REQ	******	******		******	******	.04 DailyMax		1 x Day	Calcul
Plant Capacity Fctr % of Capacity 00180	SAMPLE VALUE	******	******	****	******	64.6	******	%	Cont	meas
	PERMIT REQ	******	******		******	REPORT CalMoAvg	******		1 x Day	Measur

** phosphate descaler addition was termined.

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 55155-4194 ATTN: Discharge Monitoring Report	*I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.*	[signature] 6-14-01 SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	011M 1

STATION INFORMATION:
SD-002 (Steam Generator Blowdown Discharge)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD

	YEAR MO. DAY		YEAR MO. DAY
FROM	2001/05/01	TO	2001/05/31

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.316	MG	******	0.010	******	mgd	5/31	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	<0.004	<0.004	kg/day	******	<0.1	<0.1	mg/L	1/31	Grab
00530	PERMIT	65.3 CalMoAvg	217.0 DailyMax			30 CalMoAvg	100 DailyMax		1 x Month	Grab

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 55155-4194
ATTN: Disch[illegible]onitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 6-14-01

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	012M 1

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

STATION INFORMATION:
SD-003 (Radwaste Treatment Effluent)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD YEAR/MO/DAY
FROM	2001/05/01
TO	2001/05/31

No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.090	MG	******	0.003	******	mgd	5/31	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	0.001	0.003	kg/day	******	0.1	0.3	mg/L	2/31	Grab
00530	PERMIT	26.0 CalMoAvg	86.9 DailyMax			30 CalMoAvg	100 DailyMax		1 x Month	Grab

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 6-14-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT DATE

SIGNATURE OF CHIEF OPERATOR PHONE DATE CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	013M 1

STATION INFORMATION:
SD-004 (Neutralizer + Resin Rinse Discharge)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD (YEAR/MO./DAY)
FROM	2001/05/01
TO	2001/05/31

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.512	MG	******	0.016	******	mgd	15/31	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	0.3	2.7	kg/day	******	4.4	18.5	mg/L	15/31	EST
00530	PERMIT	97.9 CalMoAvg	326.0 DailyMax			30 CalMoAvg	100 DailyMax		1 x Month	Grab

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 55155-4194
ATTN: Discha[illegible]nitoring Report

COMMENTS:

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT: [signature] DATE: 6-14-01

SIGNATURE OF CHIEF OPERATOR | PHONE | DATE | CERTI[illegible]CATION#

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	014M 1

STATION INFORMATION:
SD-005 (Unit 1 Turbine Bldg Sump Dschg)
Surface Discharge, Effluent To Surface Water

	MONITORING PERIOD (YEAR/MO/DAY)
FROM	2001/05/01
TO	2001/05/31

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	1.861	MG	******	0.060	******	mgd	5/31	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	******	******	****	******	5.3	5.3	mg/L	1/31	Grab
00530	PERMIT					30 CalMoAvg	100 DailyMax		1 x Month	Grab
Oil Total Recoverable	SAMPLE VALUE	******	******	****	******	<1.0	<1.0	mg/L	1/31	Grab
00552	PERMIT					10 CalMoAvg	15 DailyMax		1 x Month	Grab

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 6-14-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT DATE

SIGNATURE OF CHIEF OPERATOR PHONE DATE CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	015M 1

STATION INFORMATION:
SD-006 (Unit 2 Turbine Bldg Sump Dschg)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD (YEAR MO. DAY)
FROM 2001/05/01 TO 2001/05/31

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	0.647	MG	******	0.021	******	mgd	5/31	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Month	Estima
TSS	SAMPLE VALUE	******	******	****	******	12.7	12.7	mg/L	1/31	Grab
00530	PERMIT					30 CalMoAvg	100 DailyMax		1 x Month	Grab
Oil Total Recoverable	SAMPLE VALUE	******	******	****	******	1.0	1.0	mg/L	1/31	Grab
00552	PERMIT					10 CalMoAvg	15 DailyMax		1 x Month	Grab

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

[signature] 6-14-01
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	016M 1

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

STATION INFORMATION:
SD-007 (Metal Cleaning Effluent Discharge)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD

	YEAR/MO./DAY		YEAR/MO./DAY
FROM	2001/05/01	TO	2001/05/31

☒ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******		MG	******		******	mgd		
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Day	Estima
TSS	SAMPLE VALUE			kg/day	******			mg/L		
00530	PERMIT	6 CalMoAvg	1.9 DailyMax			30 CalMoAvg	100 DailyMax		1 x Day	Grab
pH	SAMPLE VALUE	******	******	****		******		SU		
00400	PERMIT				6.0 CalMoMin		9.0 CalMoMax		1 x Week	Grab
Copper Total (as Cu)	SAMPLE VALUE			kg/day	******			mg/L		
01042	PERMIT	.02 CalMoAvg	.02 DailyMax			1.0 CalMoAvg	1.0 DailyMax		1 x Day	Grab
Iron Total (as Fe)	SAMPLE VALUE			kg/day	******			mg/L		
01045	PERMIT	.02 CalMoAvg	.02 DailyMax			1.0 CalMoAvg	1.0 DailyMax		1 x Day	Grab
Oil Total Recoverable	SAMPLE VALUE			kg/day	******			mg/L		
00552	PERMIT	2 CalMoAvg	3 DailyMax			10 CalMoAvg	15 DailyMax		1 x Day	Grab

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 55155-4194
ATTN: Discharge Monitoring Report

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT — DATE 6-14-01

SIGNATURE OF CHIEF OPERATOR — PHONE — DATE — CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	030M 1

STATION INFORMATION:
SD-012 (Intake Screen Backwash + Fish Retn)
Surface Discharge, Effluent To Surface Water

MONITORING PERIOD

FROM YEAR/MO./DAY 2001/05/01 TO YEAR/MO./DAY 2001/05/31

☐ No Discharge

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	48	MG	******	2	******	mgd	24/31	EST*
50050	PERMIT	——	REPORT CalMoTot		——	REPORT CalMoAvg	——		1 x Month	Estima

*Screens operating 24 of 31 days due to flood conditions

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 55155-4194 ATTN: Discharge Monitoring Report	*I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.*	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT: [signature] DATE: 6-19-01 SIGNATURE OF CHIEF OPERATOR / PHONE / DATE / CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co.
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	

STATION INFORMATION:
WS-001 (Unit 1 Plant Cooling Water Dschg)
Waste Stream, Internal Waste Stream

	MONITORING PERIOD (YEAR/MO./DAY)
FROM	2001/05/01
TO	2001/05/31

☐ No Flow

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	* 819.1	MG	******	26.4	******	mgd	31/31	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 X Day	MeaCon
Oxidants Total Residual	SAMPLE VALUE	******	******	****	******	******	0.18	mg/L	31/31	Grab
34044	PERMIT						2.0 DailyMax		1 X Day	Grab

* Flow is a total of WS 001 + WS 002

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 55155-4194 ATTN: Discharge Monitoring Report	*I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.*	[signature] SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	6-14-01 DATE
		SIGNATURE OF CHIEF OPERATOR / PHONE / DATE	CERTIFICATION#

COMMENTS:

FACILITY NAME/ADDRESS:
NSP - Prairie Island Nuclear Power Plant
1717 Wakonade Dr E
Welch, MN 55089

WASTEWATER TREATMENT
DISCHARGE MONITORING REPORT

PERMITTEE NAME/ADDRESS:
Northern States Power Co
414 Nicollet Mall
Minneapolis, MN 554011993

PERMIT #	LIMIT STATUS	FORMER #
MN0004006	FINAL	022M 8

STATION INFORMATION:
WS-002 (Unit 2 Plant Cooling Water Dschg)
Waste Stream, Internal Waste Stream

MONITORING PERIOD

	YEAR/MO/DAY		YEAR/MO/DAY
FROM	2001/05/01	TO	2001/05/31

☐ No Flow

PARAMETER		QUANTITY		UNITS	CONCENTRATION			UNITS	FREQUENCY OF ANALYSIS	SAMPLE TYPE
Flow	SAMPLE VALUE	******	*819.1	MG	******	26.4	******	mgd	31/31	EST
50050	PERMIT		REPORT CalMoTot			REPORT CalMoAvg			1 x Day	MeaCon
Oxidants Total Residual	SAMPLE VALUE	******	******		******	******	0.20	mg/L	31/31	Grab
34044	PERMIT						2.0 DailyMax		1 x Day	Grab

* Flow is a total of WS001 + WS002

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 55155-4194 ATTN: Dischar[illegible]itoring Report	*I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief the information is true, complete, and accurate.*	[signature] SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	6-14-01 DATE
		SIGNATURE OF CHIEF OPERATOR / PHONE / DATE	CERT[illegible]TION#

COMMENTS:

PINGP-017

Xcel Energy℠

414 Nicollet Mall
Minneapolis, Minnesota 55401-1993

Return to: Environmental
Jill
Jeanne
mpa
Mary
Bert

JUN 30 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,

Kenneth N. Mueller

To Bert Flynn

Kenneth N. Mueller
Environmental Analyst III, Environmental Services

cc: Distribution

TABLE OF CONTENTS

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, with recorded operating hours for Units 1 and 2 at PINGP in 2002

DATE **JANUARY**	OPERATING HOURS UNIT 1	 UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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
15	24	24	33.1	35.7	961
16	24	24	32.3	35.3	961
17	24	24	32.4	35.5	961
18	24	24	32.3	35.4	961
19	24	24	29.7	35.5	961
20	24	24	32.6	35.7	961
21	24	24	31.4	35.9	961
22	24	24	32.7	35.5	961
23	24	24	33.5	35.6	961
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	955
31	24	24	33.1	36.3	955
	MONTHLY MINIMUM		31.3	34.9	955
	MONTHLY MAXIMUM		34.5	37.1	961
	MONTHLY 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

DATE FEBRUARY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	21	32.8	36.1	955
2	24	0	32.9	33.9	955
3	24	0	32.8	33.7	500
4	24	0	32.0	34.1	525
5	24	0	32.4	34.2	412
6	24	0	32.6	34.9	450
7	24	0	33.4	34.9	450
8	24	0	33.6	35.3	381
9	24	0	34.2	35.9	392
10	24	0	34.1	35.0	392
11	24	0	32.9	35.4	392
12	24	0	34.1	35.3	392
13	24	0	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	0	36.7	37.8	402
19	24	0	37.5	38.1	402
20	24	0	37.6	38.3	402
21	24	0	36.4	37.3	402
22	24	0	35.7	36.9	402
23	24	0	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	36.0	402
27	24	0	32.5	33.8	575
28	24	0	33.5	35.0	550
	MONTHLY MINIMUM		32.0	33.7	381
	MONTHLY MAXIMUM		37.6	38.3	955
	MONTHLY MEAN		34.5	36.0	460

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	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	0	32.6	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	855
7	24	24	32.5	36.5	855
8	24	24	32.4	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	36.8	855
15	24	24	33.5	35.4	855
16	24	24	36.0	33.5	855
17	24	24	35.7	38.8	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	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	39.9	42.9	925
31	24	24	40.0	42.7	932
		MONTHLY MINIMUM	30.0	33.5	550
		MONTHLY MAXIMUM	40.0	43.3	932
		MONTHLY MEAN	34.4	37.4	857

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 APRIL	OPERATING HOURS UNIT 1	OPERATING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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
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	997
10	24	24	*45.7	43.9	997
11	24	24	43.2	45.7	997
12	24	24	42.1	44.3	997
13	24	24	41.3	44.3	997
14	24	24	41.3	44.0	488
15	24	24	42.7	45.3	291
16	24	24	53.5	48.0	291
17	24	24	55.5	50.8	291
18	24	24	48.8	51.6	155
19	24	24	51.7	53.9	275
20	24	24	56.6	53.4	291
21	24	24	56.5	53.8	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
26	24	24	50.8	50.3	299
27	24	24	52.1	51.9	299
28	24	24	49.2	49.1	283
29	24	24	48.8	47.9	283
30	24	24	49.2	50.2	291
		MONTHLY MINIMUM	34.8	37.4	155
		MONTHLY MAXIMUM	45.7	53.9	997
		MONTHLY 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	OPERATING HOURS UNIT 1	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
6	24	24	53.5	54.4	299
7	24	24	51.7	53.1	299
8	24	24	51.3	52.2	299
9	24	24	51.0	52.1	299
10	24	24	49.6	50.6	299
11	24	24	51.1	51.1	299
12	24	24	49.9	50.9	299
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
	MONTHLY MINIMUM		49.2	49.1	283
	MONTHLY MAXIMUM		67.2	67.4	407
	MONTHLY MEAN		54.8	55.7	304

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 JUNE	OPERATING HOURS UNIT 1	OPERATING 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
14	24	24	69.7	70.3	392
15	24	24	70.5	71.1	402
16	24	24	70.6	71.3	768
17	24	24	71.3	71.5	468
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
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
26	24	24	75.3	76.0	791
27	24	24	75.9	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
	MONTHLY MINIMUM		63.8	64.6	392
	MONTHLY MAXIMUM		79.1	79.6	991
	MONTHLY MEAN		70.6	71.8	591

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 JULY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	80.1	80.2	1194
2	24	24	80.5	81.3	1229
3	24	24	81.3	82.1	1229
4	24	24	81.1	82.0	1229
5	24	24	80.3	81.0	1229
6	24	24	79.8	80.7	1229
7	24	24	80.5	81.2	1229
8	24	24	82.1	82.5	1250
9	24	24	81.6	82.3	1250
10	24	24	81.9	82.2	1250
11	24	24	76.2	76.7	1229
12	24	24	77.4	77.9	1250
13	24	24	77.3	77.8	1250
14	24	24	76.1	77.8	1229
15	24	24	77.3	77.8	1229
16	24	24	77.1	77.7	1229
17	24	24	77.9	78.5	1229
18	24	24	79.0	79.6	1229
19	24	24	78.8	79.5	1229
20	24	24	78.5	78.8	1229
21	24	24	78.2	79.0	1229
22	24	24	79.4	80.3	1229
23	24	24	77.0	78.1	1229
24	24	24	77.5	78.0	1229
25	24	24	74.9	75.9	1229
26	24	24	75.1	75.5	1229
27	24	24	77.9	78.5	1229
28	24	24	76.6	77.4	1229
29	24	24	77.5	78.0	1205
30	24	24	79.0	79.9	1250
31	24	24	78.0	79.0	1187
		MONTHLY MINIMUM	74.9	75.5	1187
		MONTHLY MAXIMUM	82.1	82.5	1250
		MONTHLY MEAN	78.6	79.3	1230

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 **AUGUST**	OPERATING HOURS UNIT 1	OPERATING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	79.7	80.1	1187
2	24	24	77.2	78.2	1187
3	24	24	77.9	78.3	1187
4	24	24	76.0	76.9	1187
5	24	24	75.8	76.7	1208
6	24	24	74.9	75.6	1187
7	24	24	73.2	74.4	1166
8	24	24	74.1	75.1	1166
9	24	24	74.5	75.7	1208
10	24	24	75.4	76.2	1208
11	24	24	75.5	76.6	1187
12	24	24	76.4	77.9	1187
13	24	24	74.7	76.0	1187
14	24	24	73.8	75.4	1187
15	24	24	74.0	75.3	1187
16	24	24	73.7	75.0	1187
17	24	24	72.6	73.9	1187
18	24	24	70.8	72.1	1187
19	24	24	71.4	72.4	1187
20	24	24	72.2	73.7	1187
21	24	24	71.9	73.4	1187
22	24	24	71.0	72.2	1187
23	24	24	71.4	73.1	1187
24	24	24	71.5	73.0	1187
25	24	24	72.5	73.8	1187
26	24	24	73.3	74.2	1187
27	24	24	74.1	75.4	1187
28	24	24	74.3	75.8	1208
29	24	24	74.6	76.2	1208
30	24	24	74.1	76.0	1187
31	24	24	74.2	76.0	1208
		MONTHLY MINIMUM	70.8	72.1	1166
		MONTHLY MAXIMUM	79.7	80.1	1208
		MONTHLY MEAN	74.1	75.3	1190

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	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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
15	24	24	70.1	71.6	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
25	24	24	61.5	64.7	1103
26	24	24	61.7	63.6	1145
27	24	24	60.0	61.6	1145
28	24	24	60.0	62.8	1145
29	24	24	61.0	63.5	1145
30	24	24	61.0	64.0	1145
		MONTHLY MINIMUM	60.0	61.6	1103
		MONTHLY MAXIMUM	76.0	77.2	1208
		MONTHLY MEAN	69.3	71.2	1169

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 OCTOBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (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
	MONTHLY MINIMUM		41.9	42.2	937
	MONTHLY MAXIMUM		62.3	64.5	1166
	MONTHLY MEAN		50.7	51.8	1060

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 NOVEMBER	OPERATING HOURS UNIT 1	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	24	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	0	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	0	24	37.1	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 MINIMUM	34.7	35.0	292
		MONTHLY MAXIMUM	43.4	47.5	955
		MONTHLY MEAN	38.2	39.1	662

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

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 DECEMBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	0	24	33.7	34.0	338
2	0	24	33.4	34.0	372
3	0	24	32.5	33.3	327
4	0	24	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	24	33.5	36.0	684
12	24	24	33.8	34.7	612
13	24	24	32.9	34.9	612
14	24	24	33.8	35.4	600
15	24	24	34.9	36.8	650
16	24	24	33.8	35.3	708
17	24	24	34.1	35.5	708
18	24	24	34.6	35.7	708
19	24	24	35.3	36.2	720
20	24	24	34.7	35.1	708
21	24	24	33.7	34.8	660
22	24	24	33.5	34.8	660
23	24	24	32.3	34.6	720
24	24	24	32.5	34.7	660
25	24	24	32.8	34.8	672
26	24	24	32.8	35.2	672
27	24	24	33.0	35.1	672
28	24	24	33.5	36.1	708
29	24	24	33.5	35.3	708
30	24	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

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	11600	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	19700	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
YEAR MIN	8000

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

Month	Mean Plant Flow (cfs)	Mean River Flow (cfs)	Percentage of Mean River Flow 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 %

Table 4. Mean Monthly Mississippi River Flow for 1983 - 2002, in cubic feet per second (cfs).

Month	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992
January	10,932	11,271	8,974	10,790	9,806	14,823	14,826	11,365	13,090	9,326	15,658
February	10,104	10,471	9,548	12,589	14,911	13,954	15,041	9,371	12,611	8,936	13,978
March	11,497	10,948	22,219	17,897	26,574	24,177	24,474	29,061	28,542	12,513	43,661
April	40,657	112,703	15,570	42,013	51,477	106,073	57,517	48,507	40,830	55,473	32,668
May	33,974	82,661	18,839	47,426	22,681	39,316	46,535	45,135	47,548	48,571	25,474
June	26,323	53,177	22,070	34,423	25,690	19,487	33,790	30,667	26,913	65,377	17,920
July	34,597	23,981	21,052	27,548	26,477	36,119	23,732	27,323	29,403	84,123	28,985
August	29,065	12,164	10,026	24,432	10,742	28,074	13,303	29,129	19,971	41,135	14,532
September	24,513	9,193	6,687	18,013	7,060	16,663	9,300	19,860	21,203	30,717	15,686
October	28,600	9,577	6,790	14,200	12,597	14,155	11,403	31,061	25,581	19,516	15,374
November	18,467	11,040	17,463	13,243	19,773	14,160	23,353	30,703	20,173	18,773	19,076
December	12,135	13,813	9,558	9,671	15,645	12,694	18,716	17,494	14,432	16,490	12,126
Averages	**23,405**	**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	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**

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 anode 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

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 bass
Sector Two;	carp, white bass and bluegill
Sector Three;	white bass, carp and smallmouth bass
Sector Four;	white bass, freshwater drum and carp
Overall 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

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).

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).

WHITE BASS

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).

WALLEYE

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).

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).

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).

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).

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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Figure 1 PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA

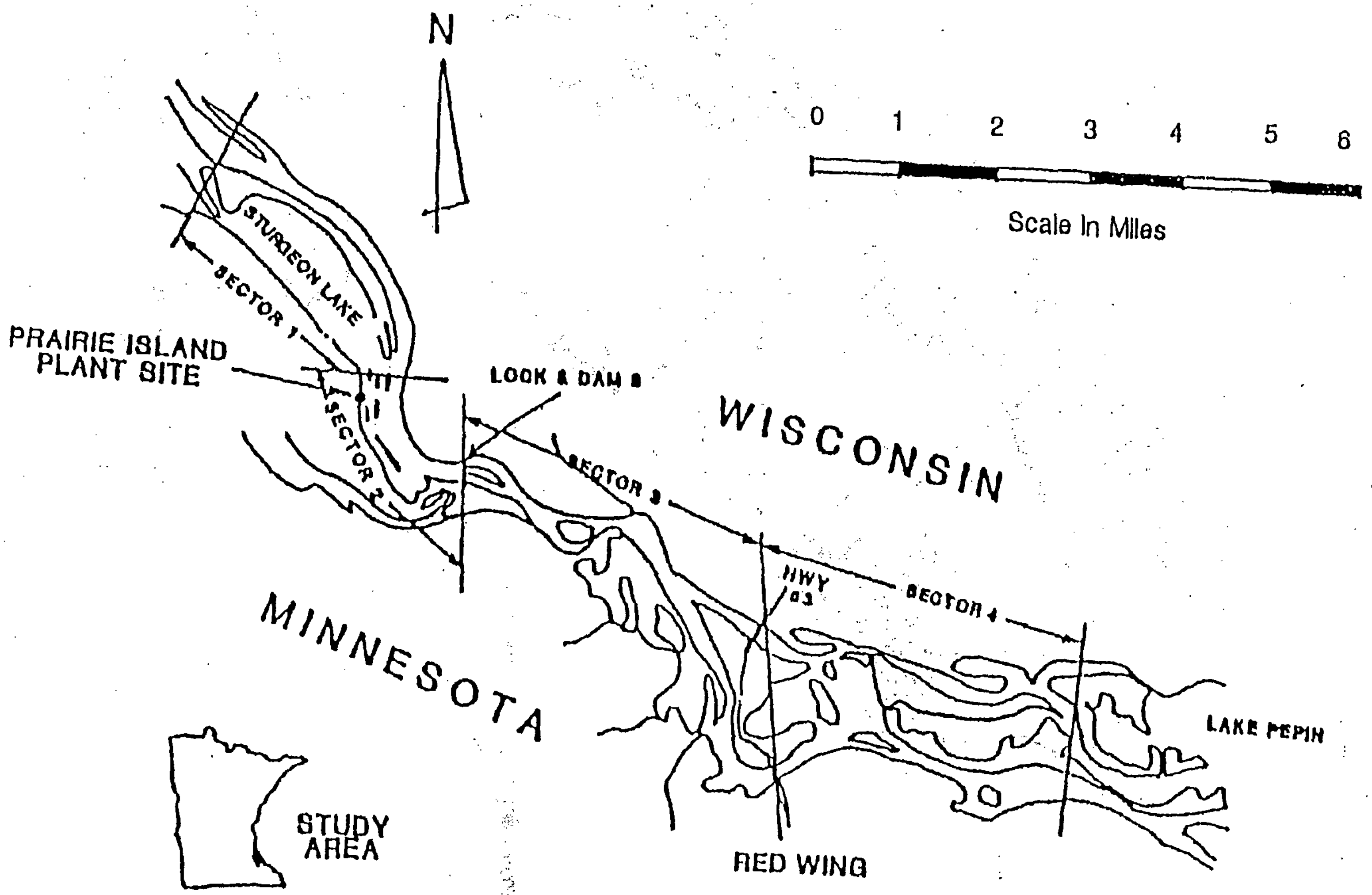
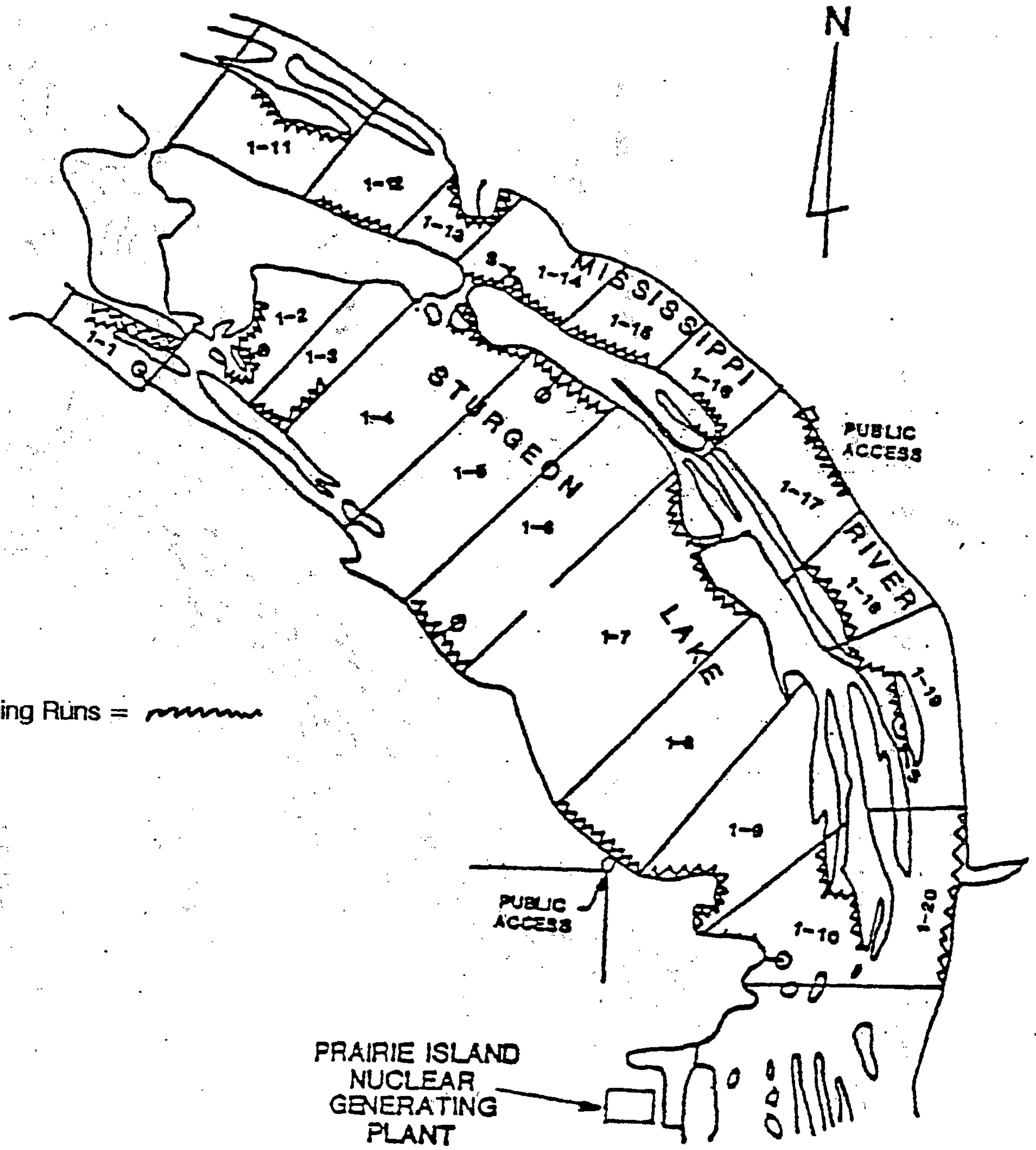


Figure 2.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Upstream
(Sec 1 Runs 1-20)



Electrofishing Runs =

Figure 3.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

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

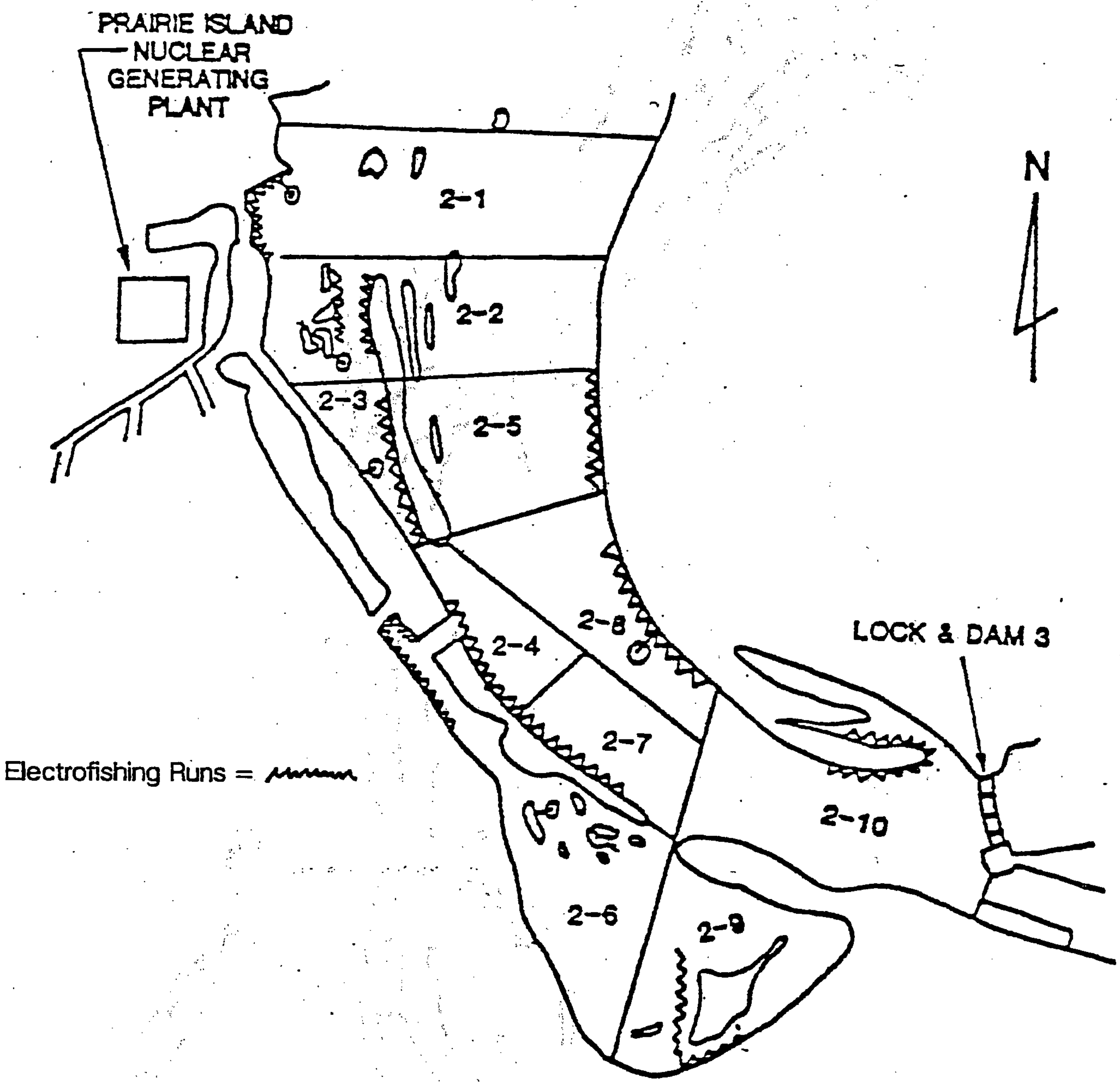


Figure 4.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 3 Runs 1-10)

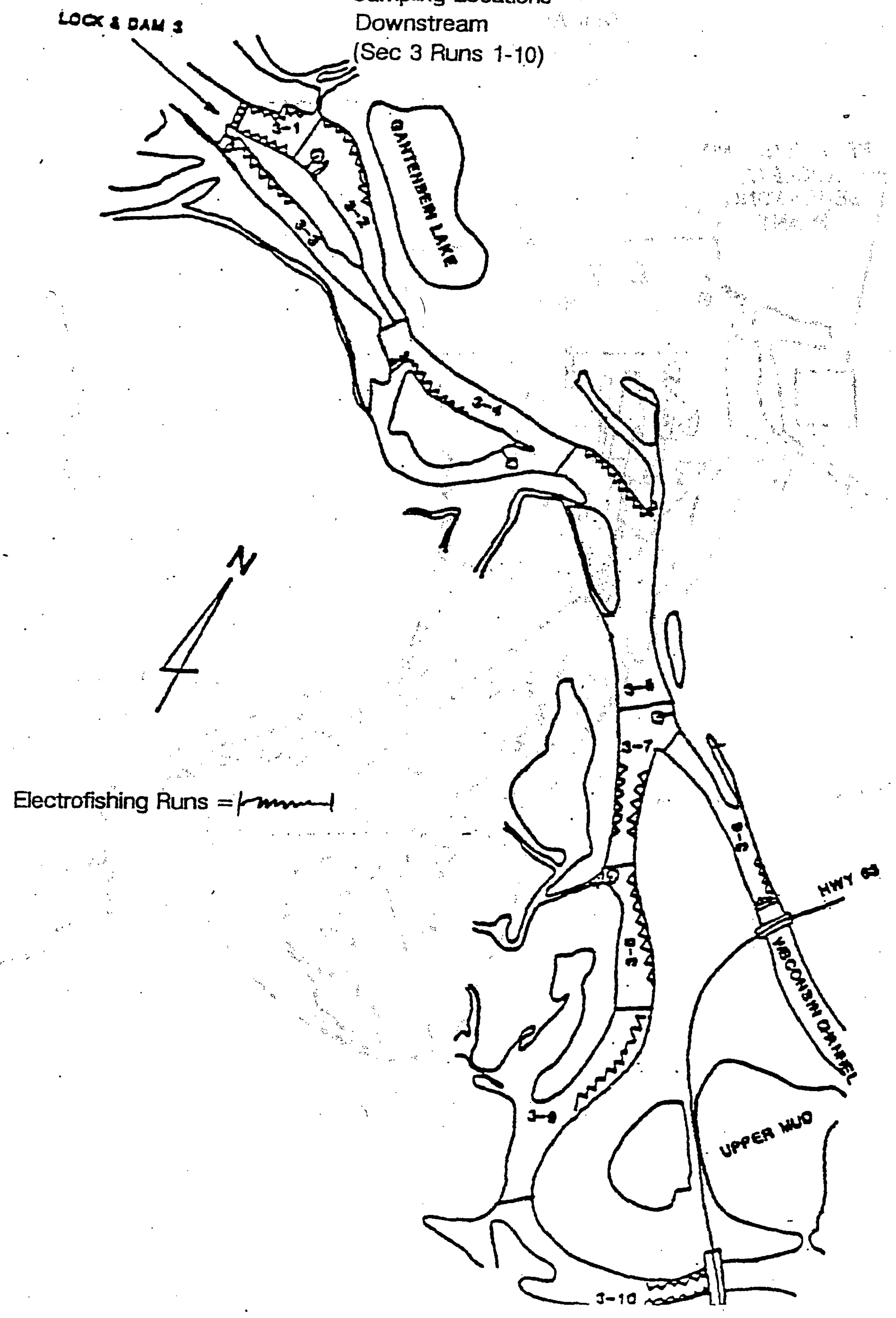
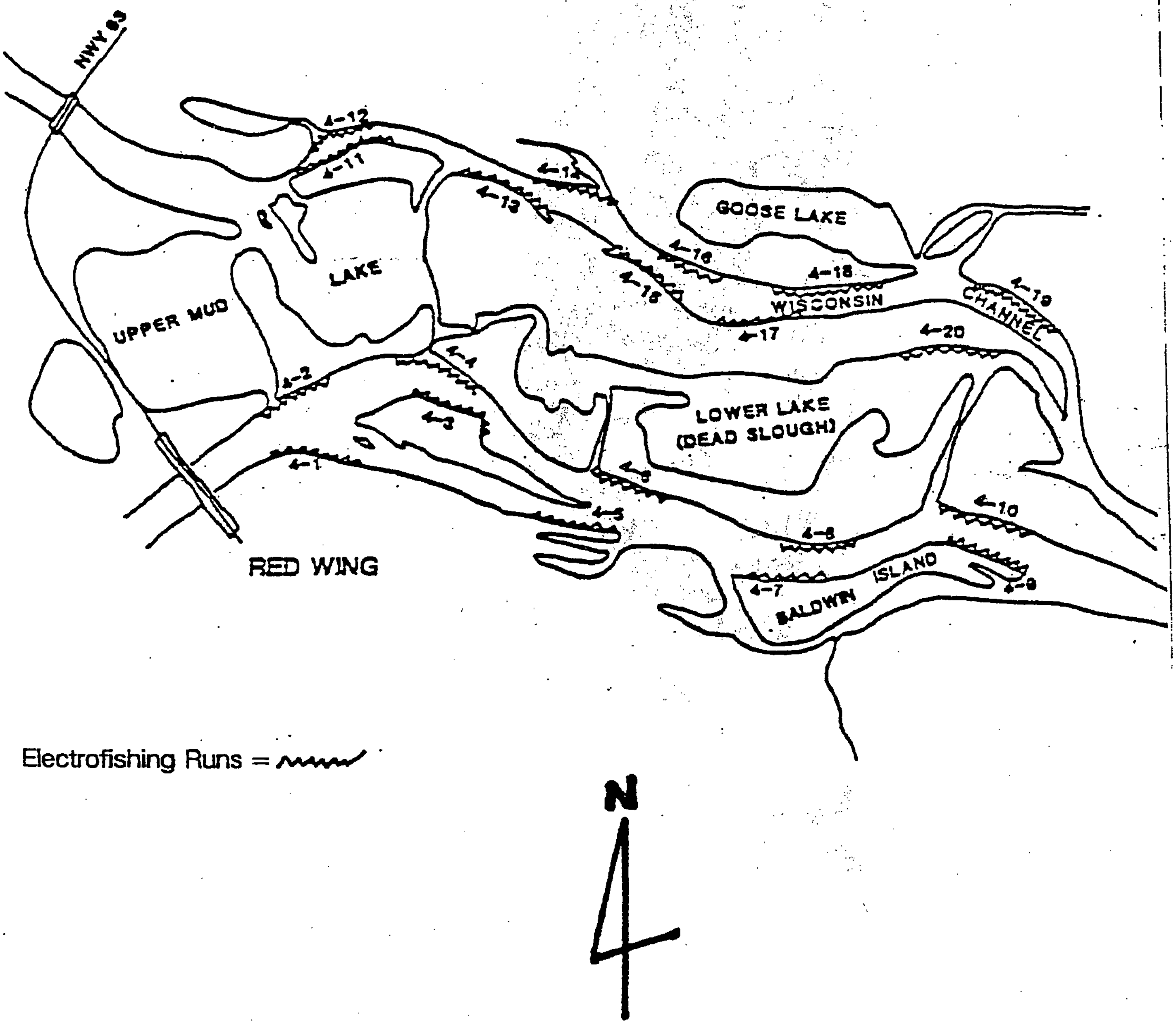


Figure 5.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 4 Runs 1-20)



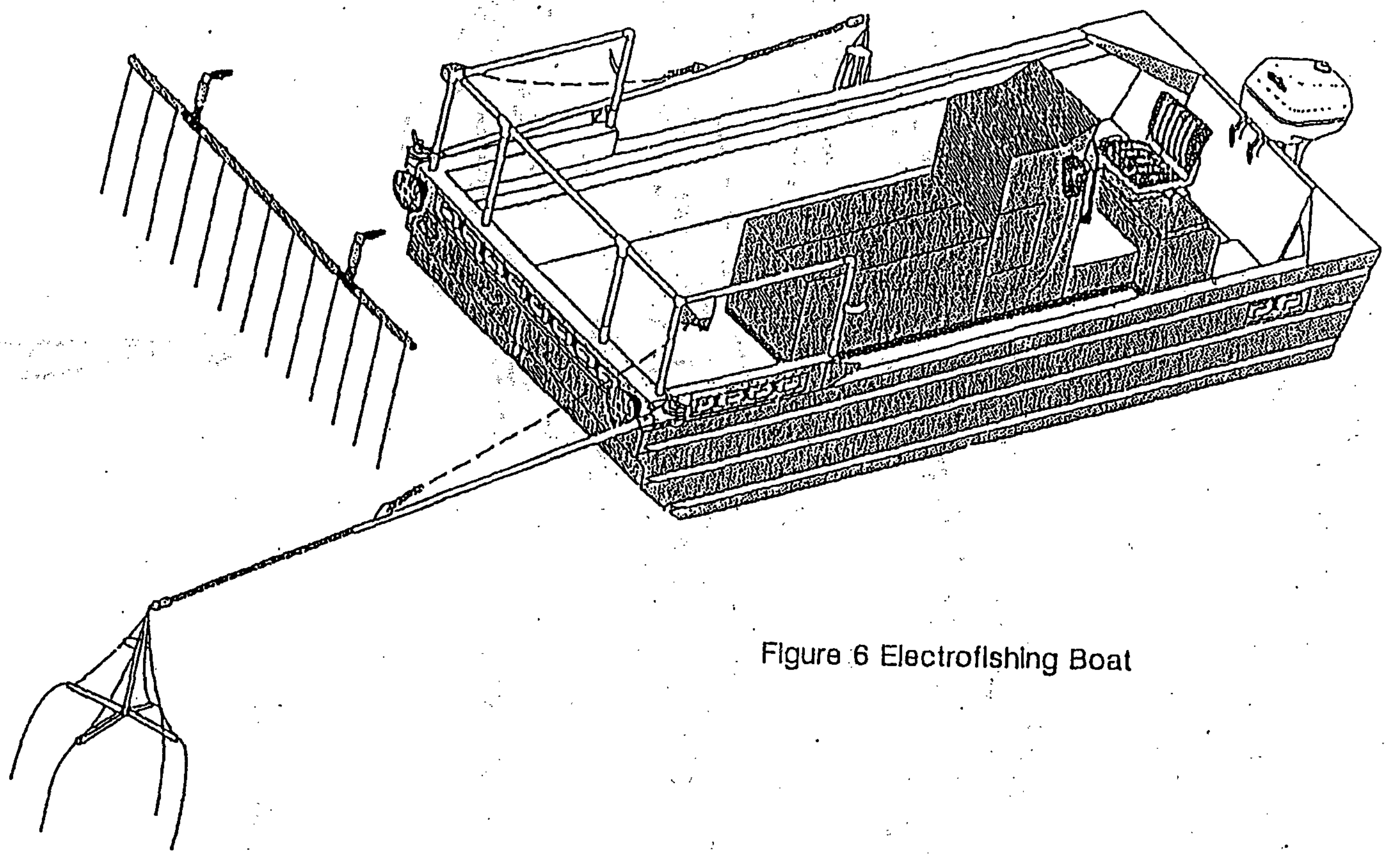


Figure 6 Electrofishing Boat

Figure 7

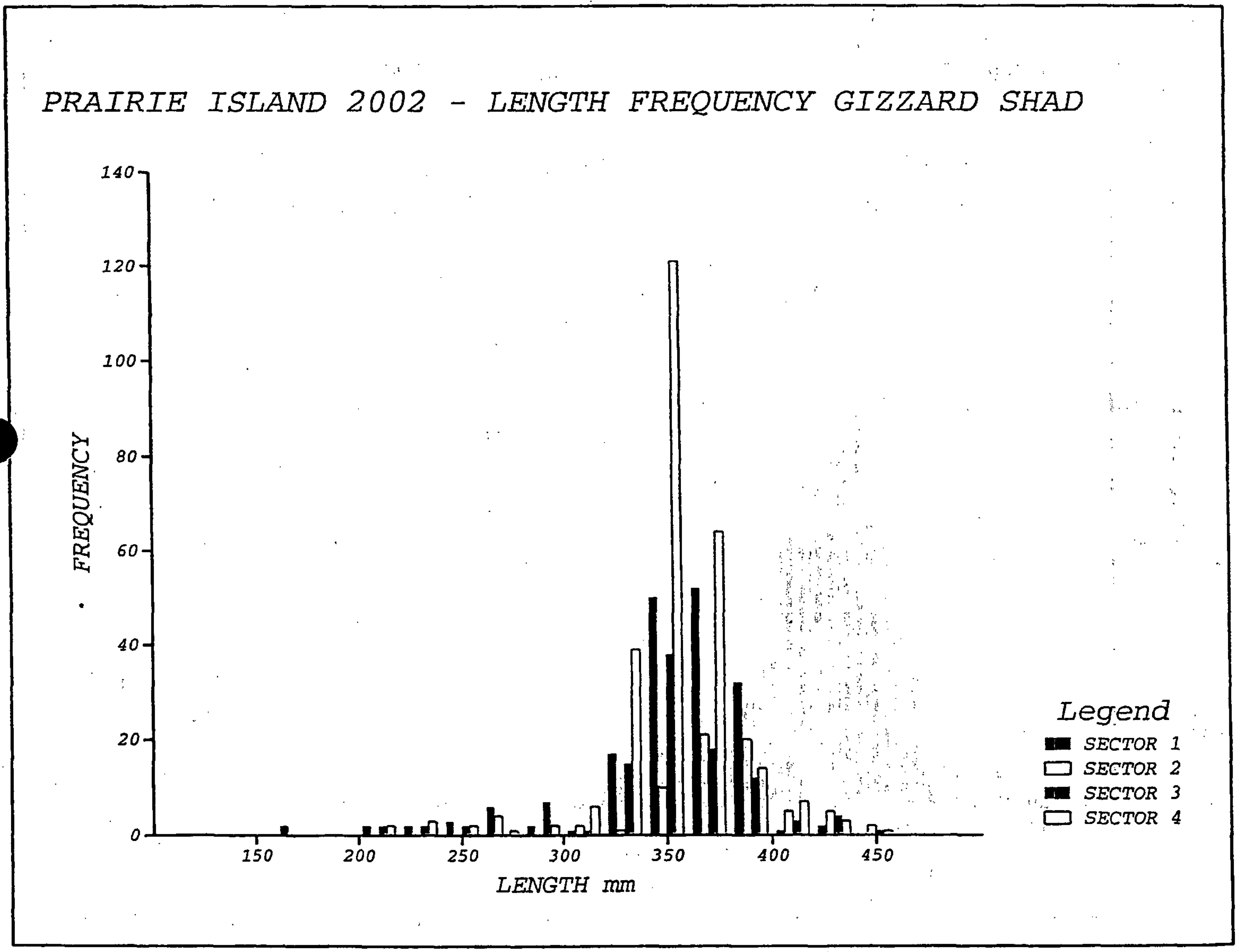
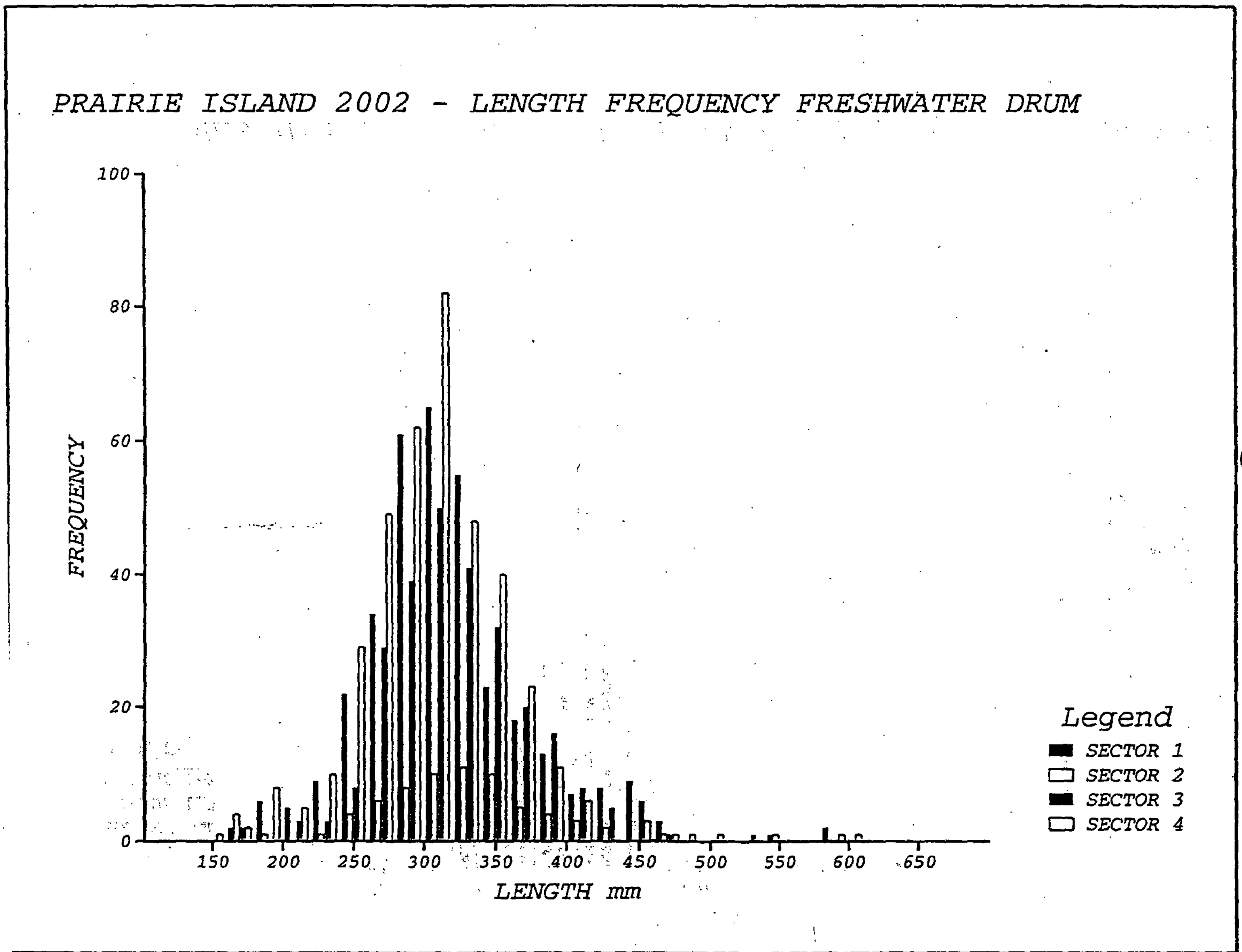
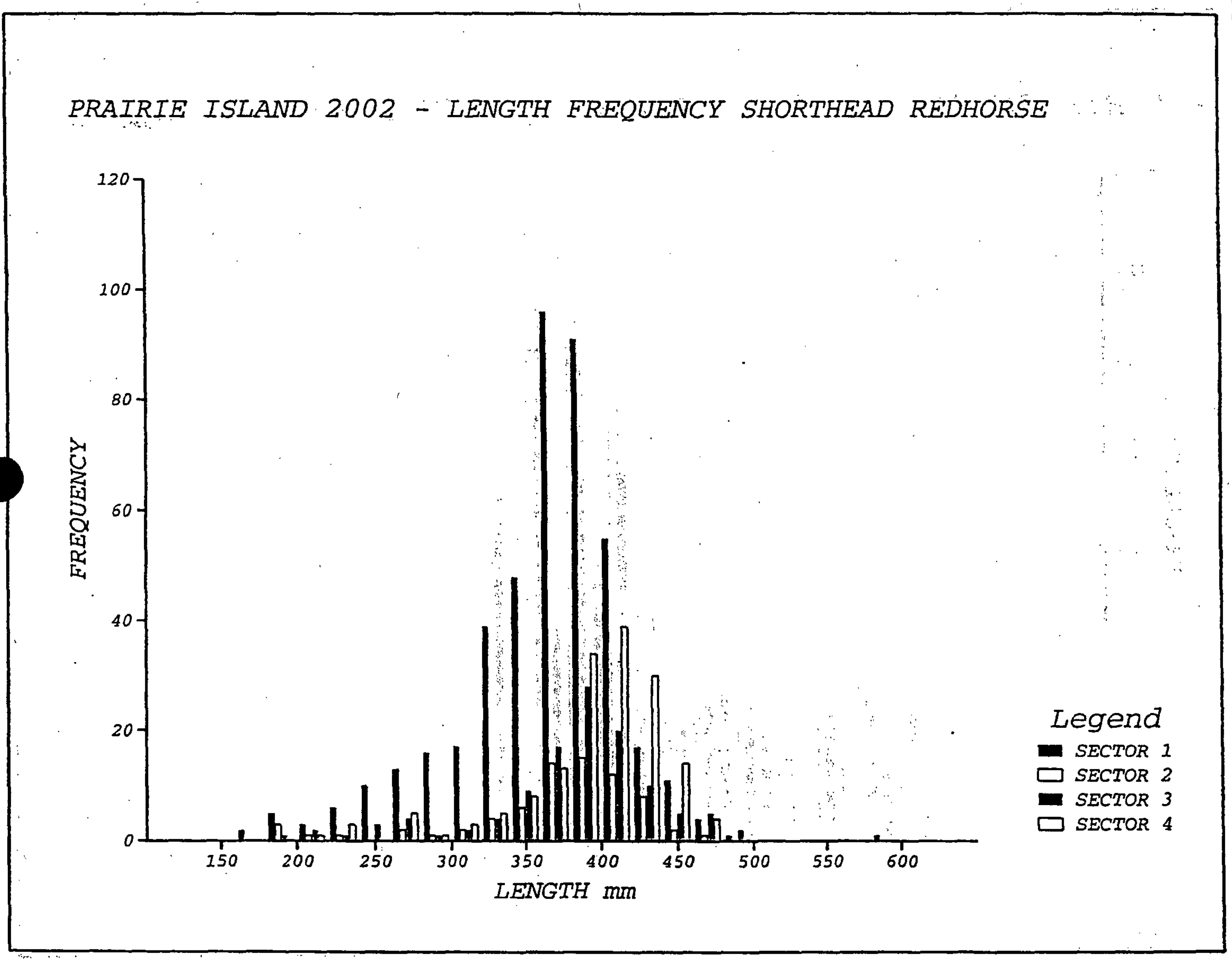

PRAIRIE ISLAND 2002 - LENGTH FREQUENCY GIZZARD SHAD
FREQUENCY
140
120
100
80
60
40
20
0
150
200
250
300
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 8



PRAIRIE ISLAND 2002 - LENGTH FREQUENCY FRESHWATER DRUM
100
80
60
40
20
0
FREQUENCY
150
200
250
300
350
400
450
500
550
600
650
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 9



PRAIRIE ISLAND 2002 - LENGTH FREQUENCY SHORTHEAD REDHORSE
FREQUENCY
120
100
80
60
40
20
0
150
200
250
300
350
400
450
500
550
600
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 10

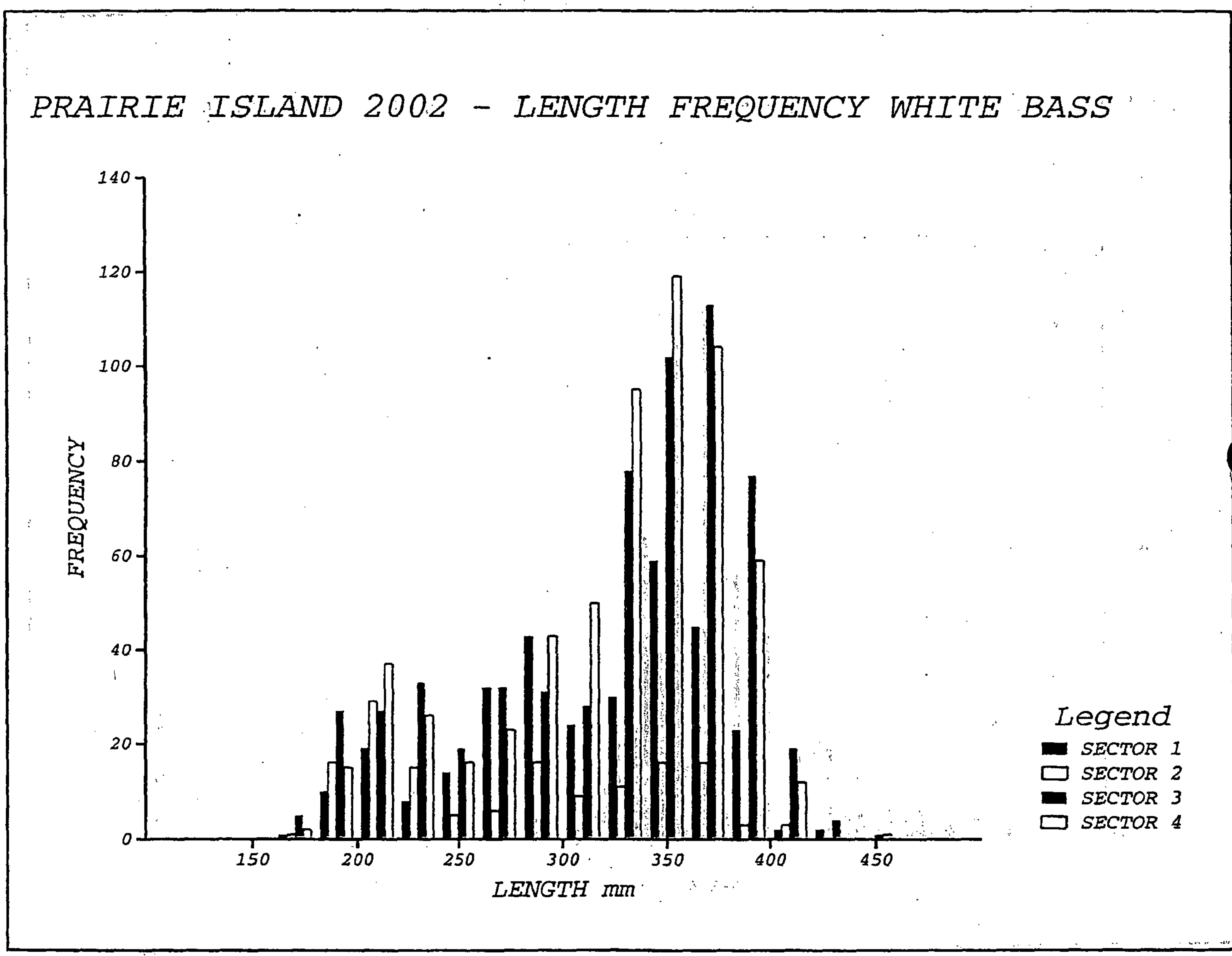
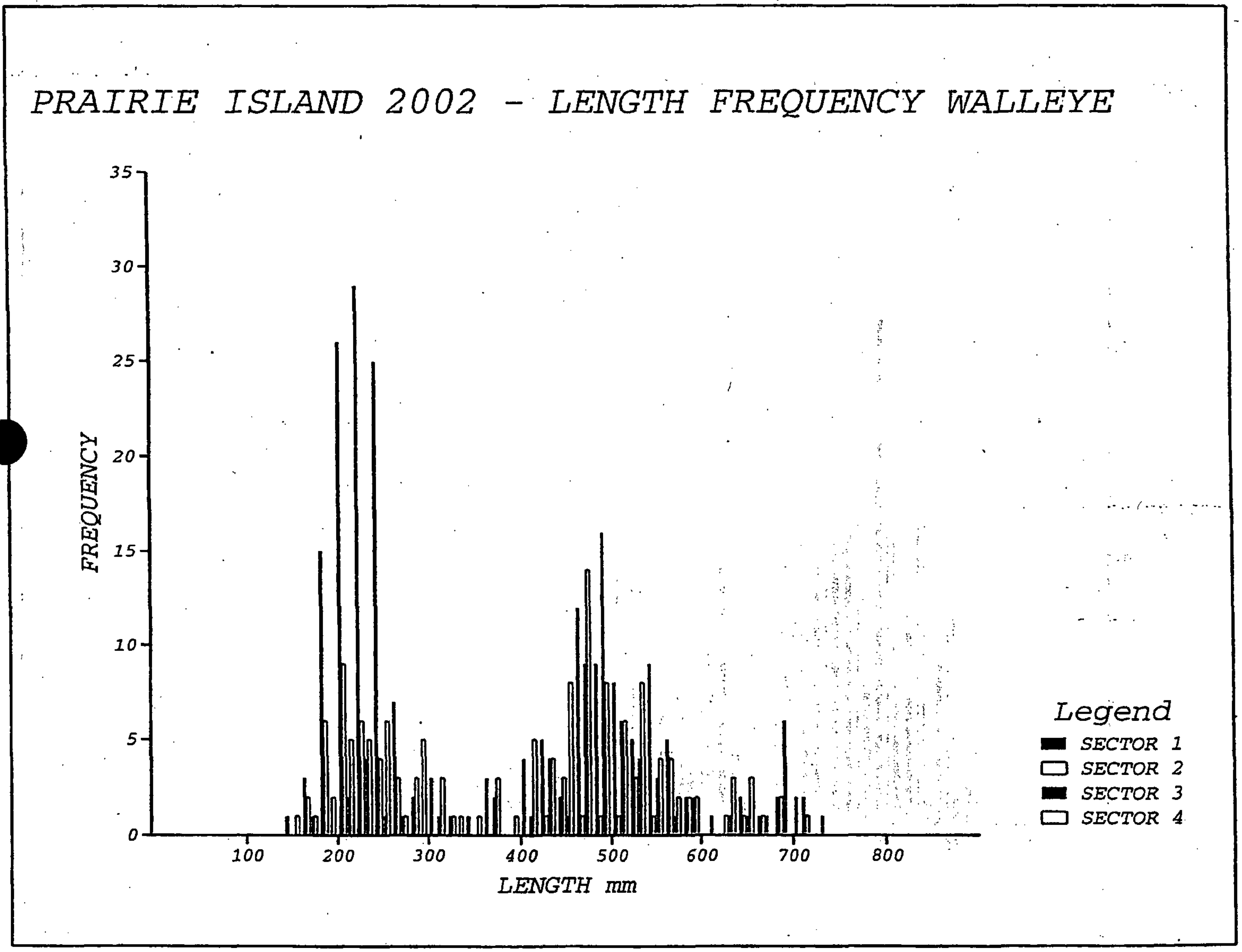
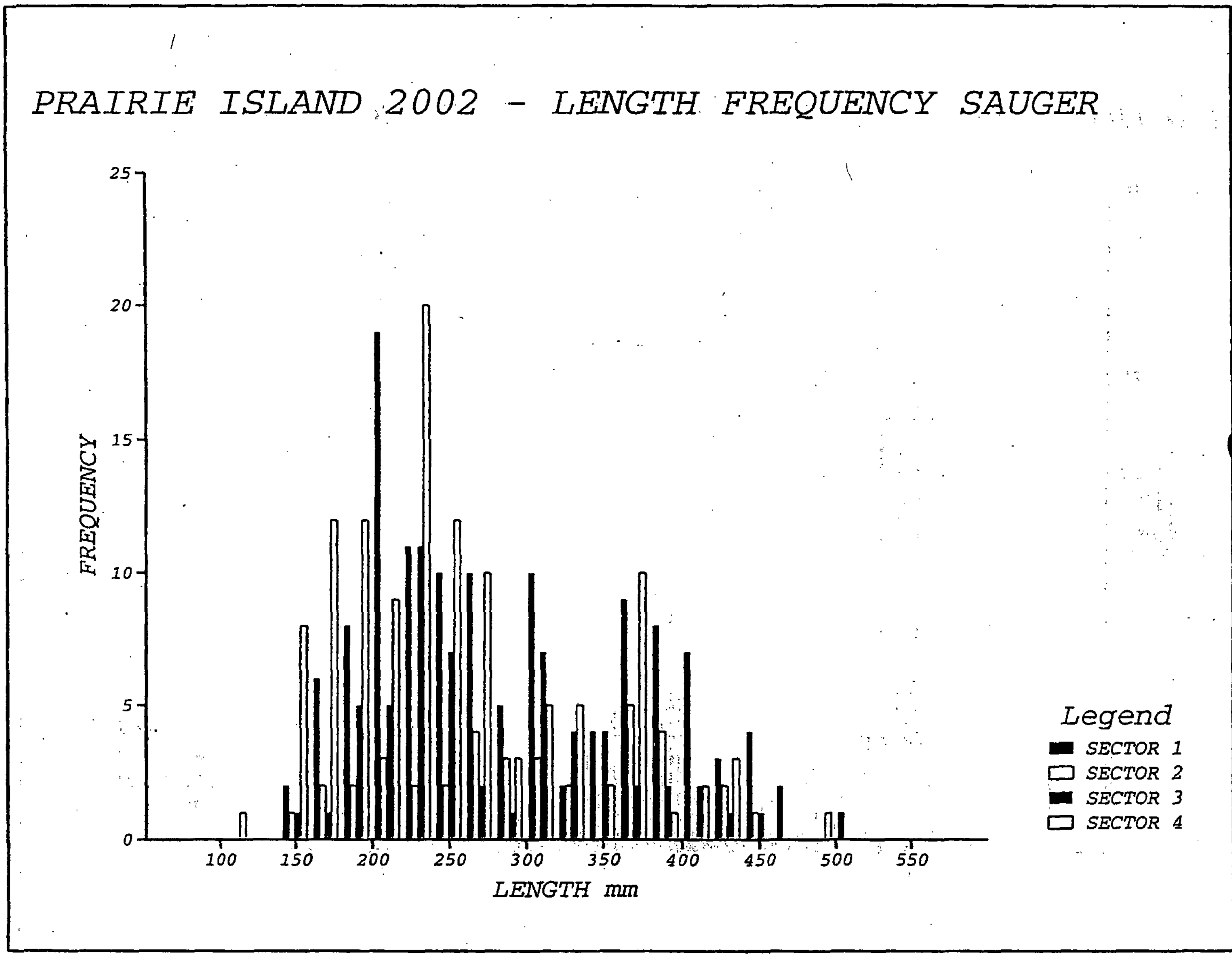

PRAIRIE ISLAND 2002 - LENGTH FREQUENCY WHITE BASS
FREQUENCY
0
20
40
60
80
100
120
140
150
200
250
300
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 11



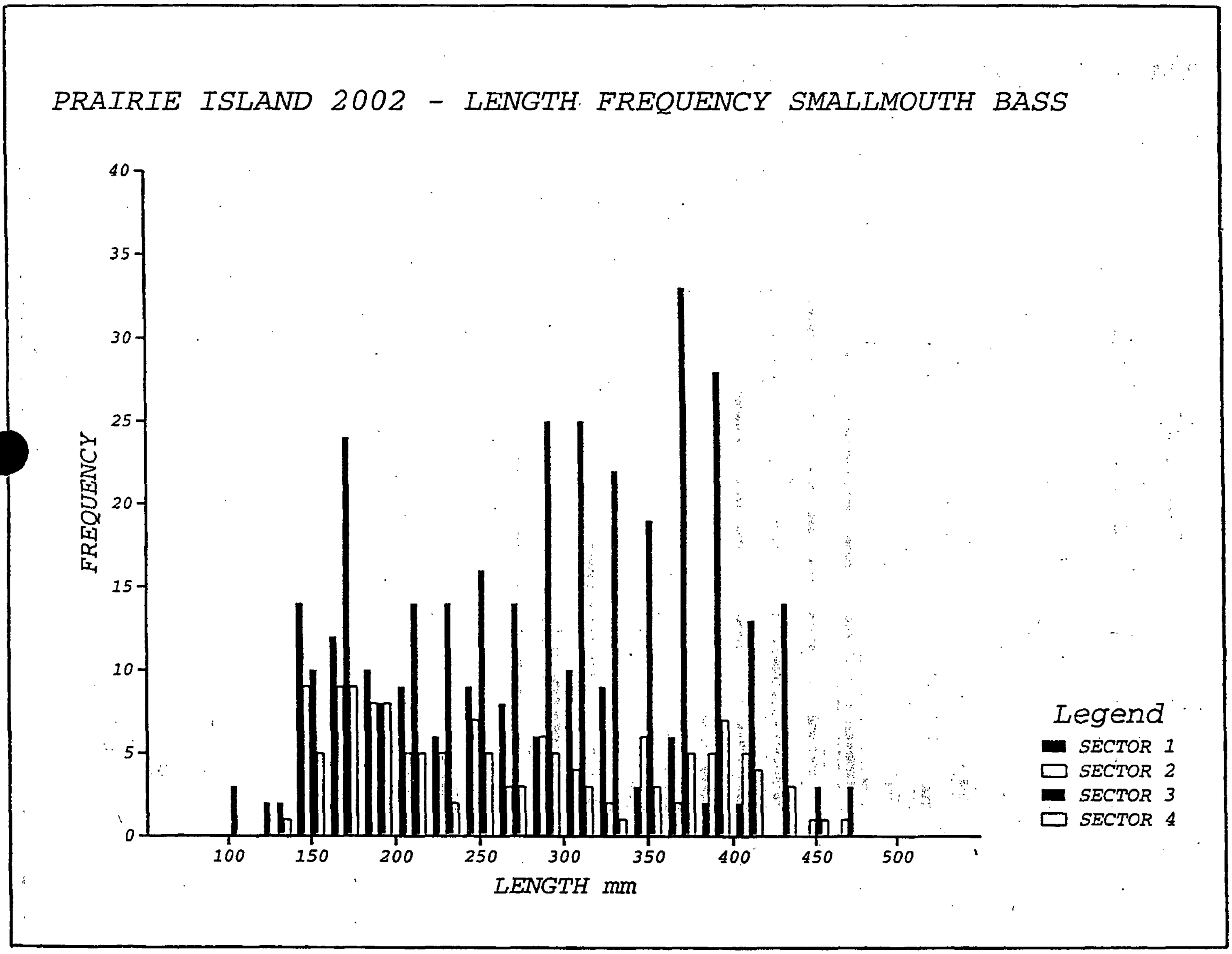
PRAIRIE ISLAND 2002 - LENGTH FREQUENCY WALLEYE
FREQUENCY
35
30
25
20
15
10
5
0
100
200
300
400
500
600
700
800
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 12



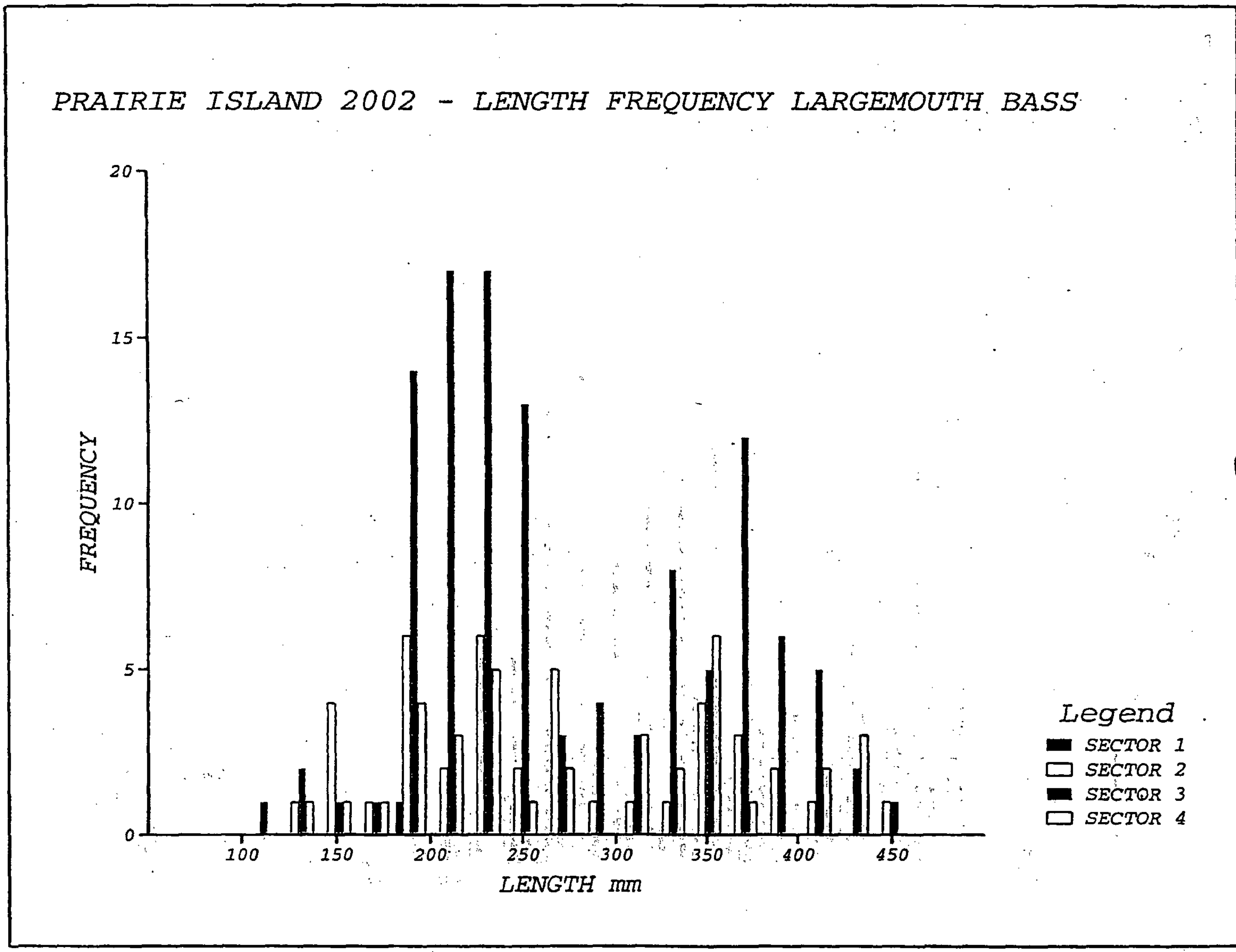
PRAIRIE ISLAND 2002 - LENGTH FREQUENCY SAUGER
FREQUENCY
25
20
15
10
5
0
100
150
200
250
300
350
400
450
500
550
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 13



PRAIRIE ISLAND 2002 - LENGTH FREQUENCY SMALLMOUTH BASS
40
35
30
25
20
15
10
5
0
FREQUENCY
100
150
200
250
300
350
400
450
500
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 14



PRAIRIE ISLAND 2002 - LENGTH FREQUENCY LARGEMOUTH BASS
FREQUENCY
0
5
10
15
20
100
150
200
250
300
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

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

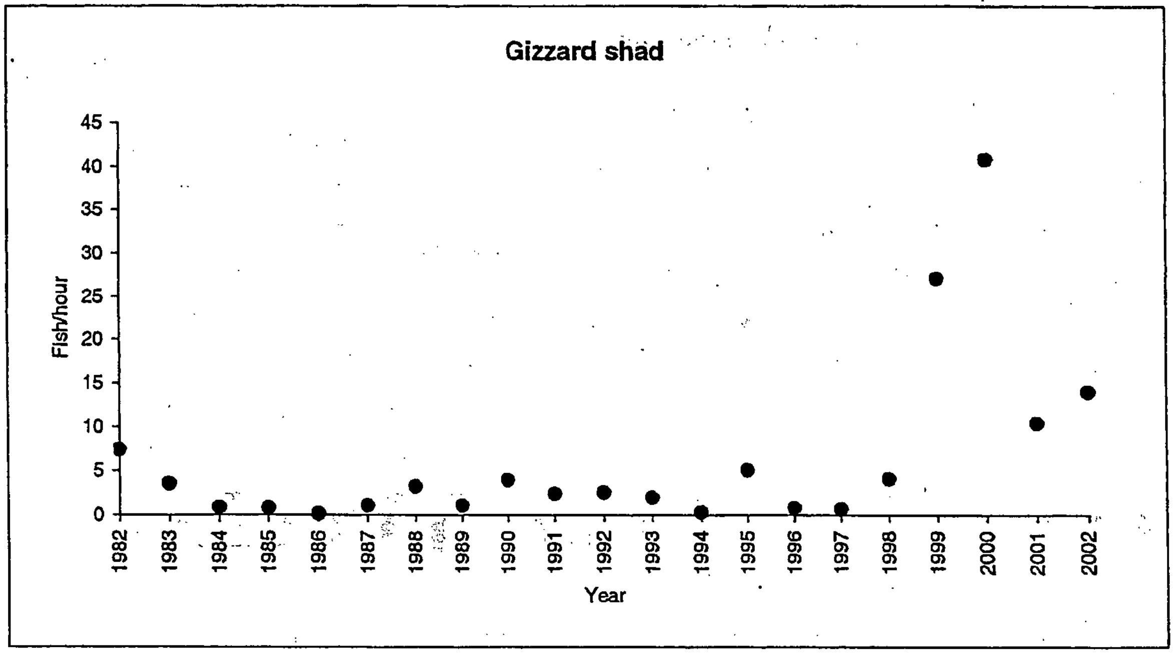


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2002 in the vicinity of PINGP.

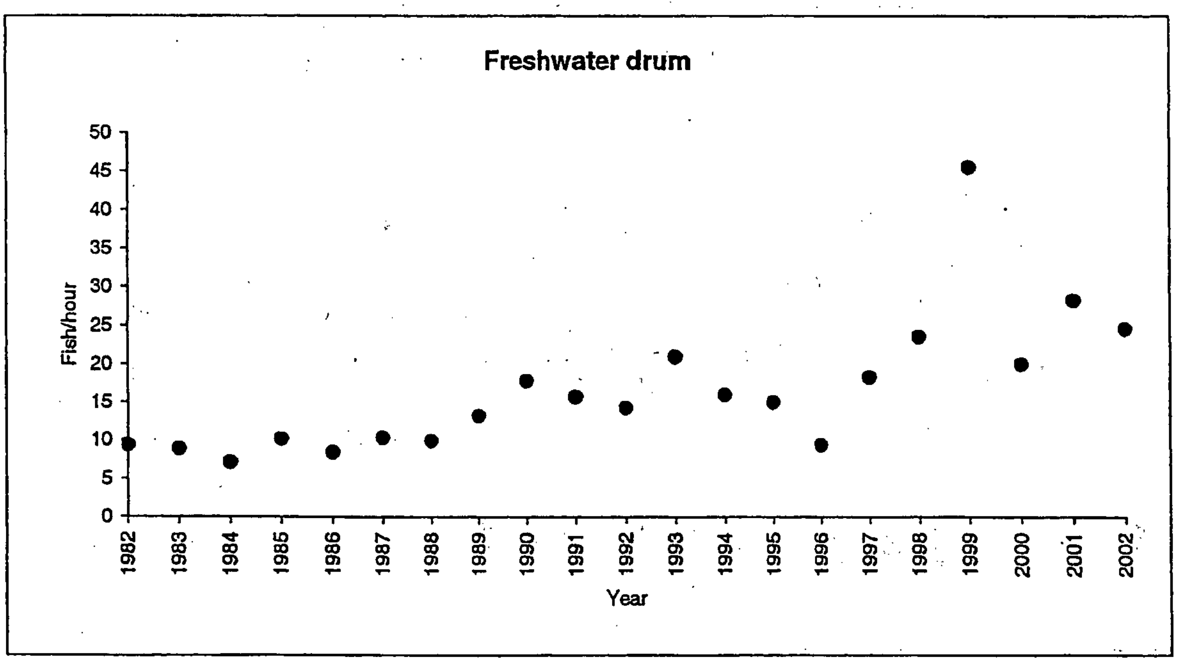


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2002 in the vicinity of PINGP.

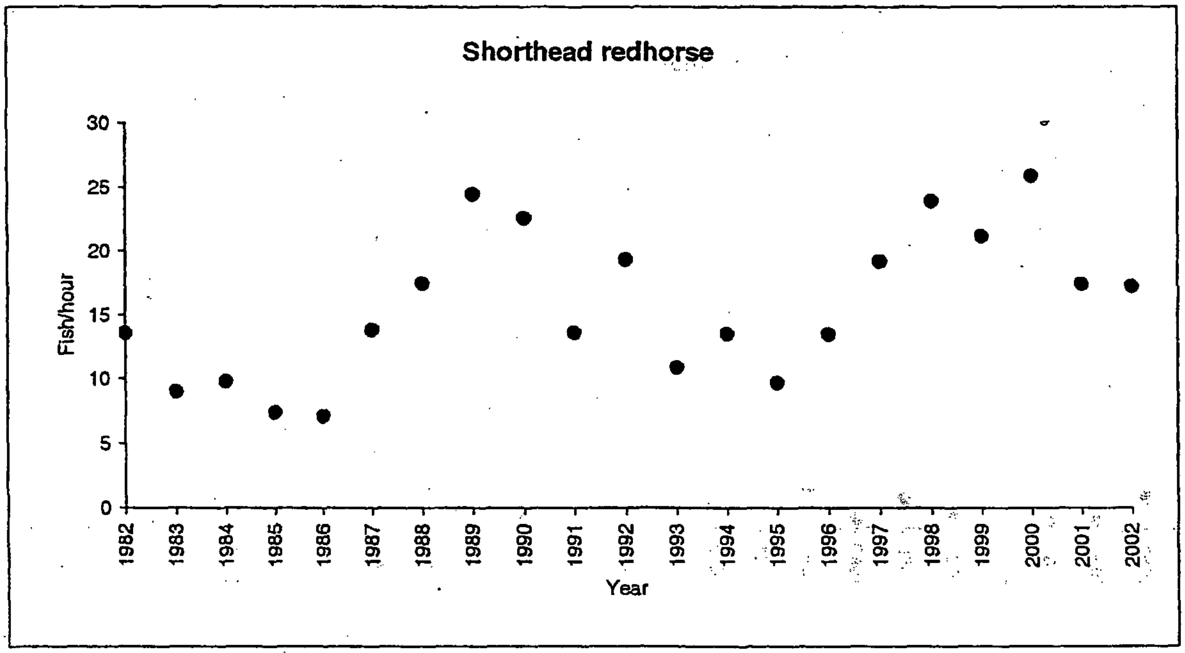


Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2002 in the vicinity of PINGP.

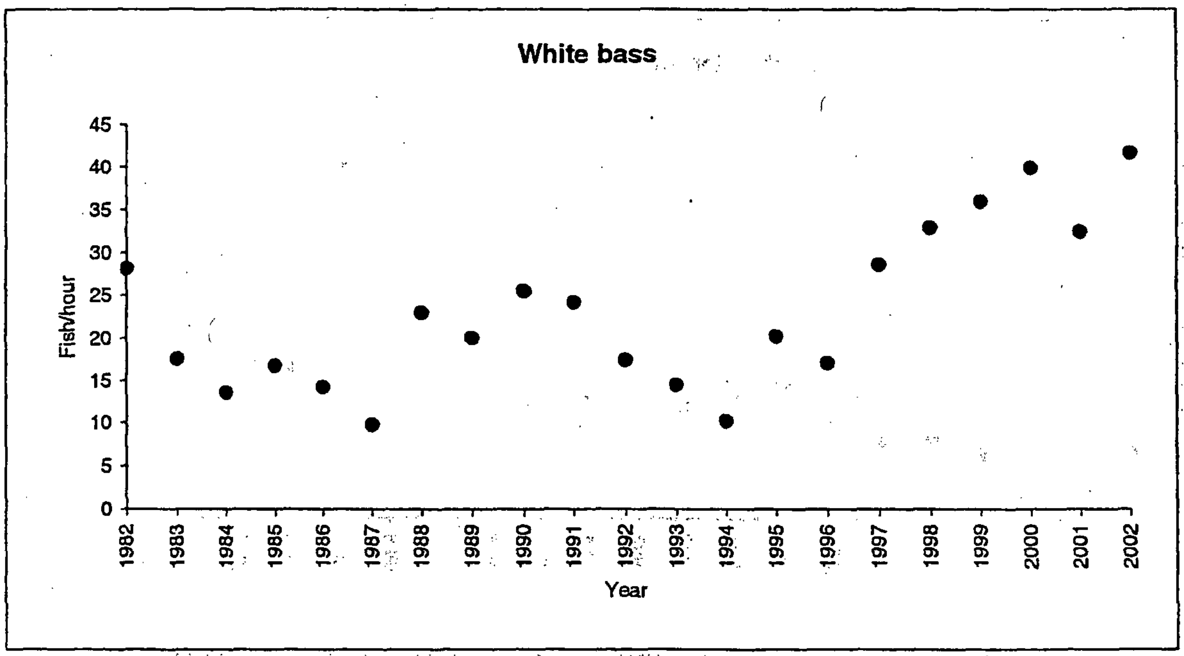


Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2002 in the vicinity of PINGP.

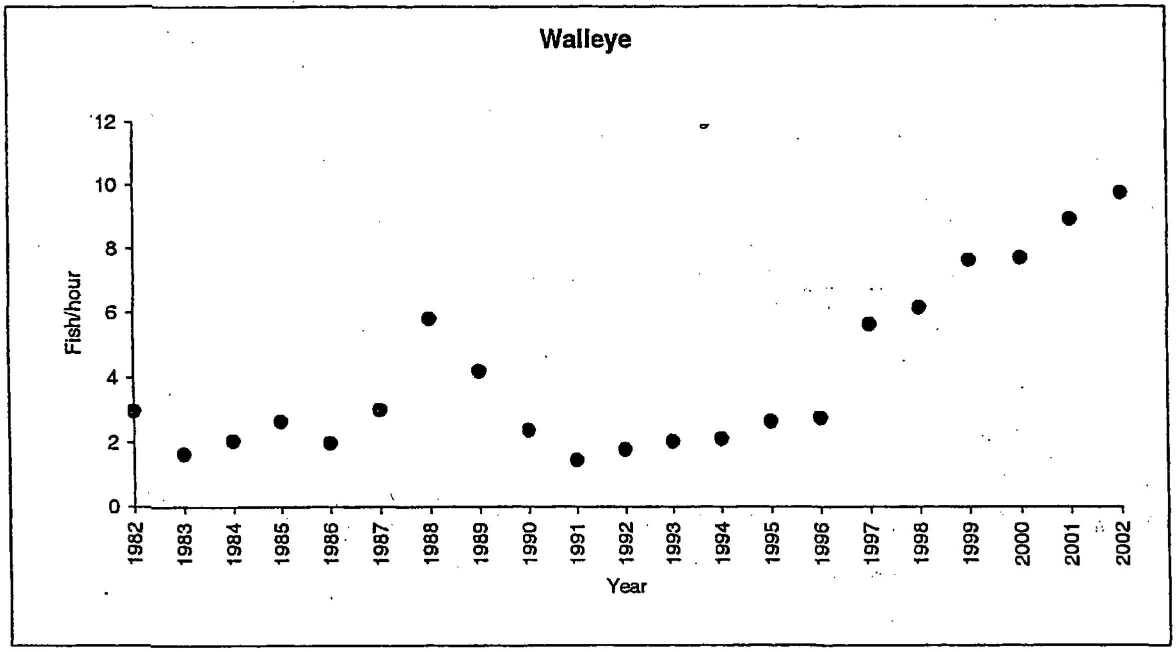


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2002 in the vicinity of PINGP.

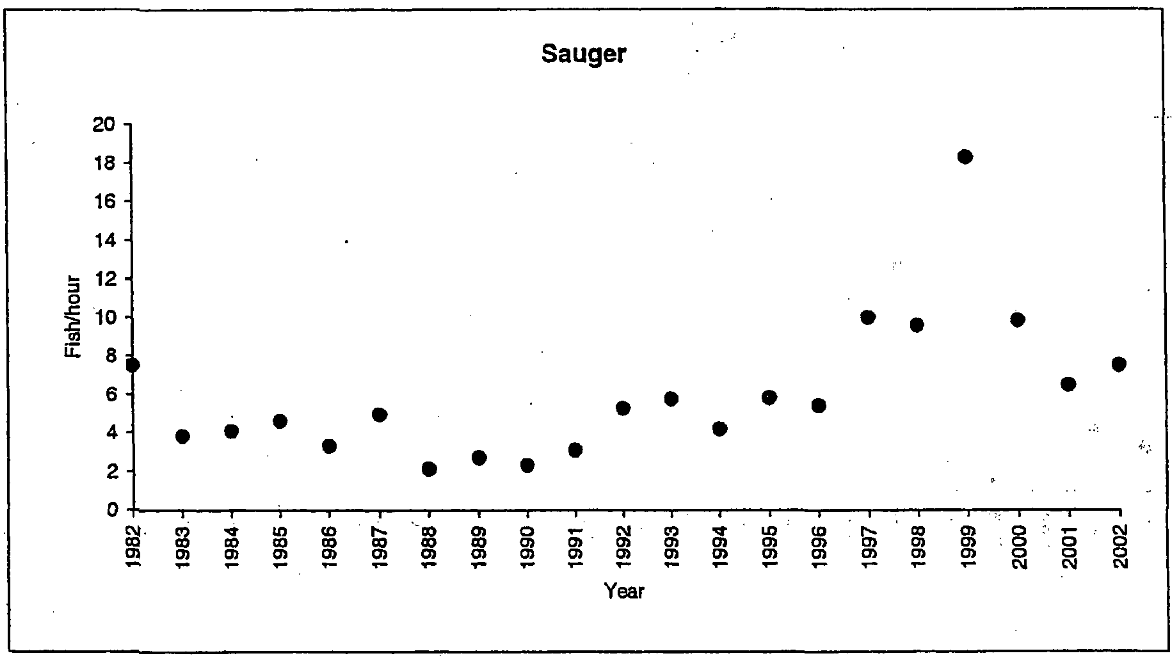


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2002 in the vicinity of PINGP.

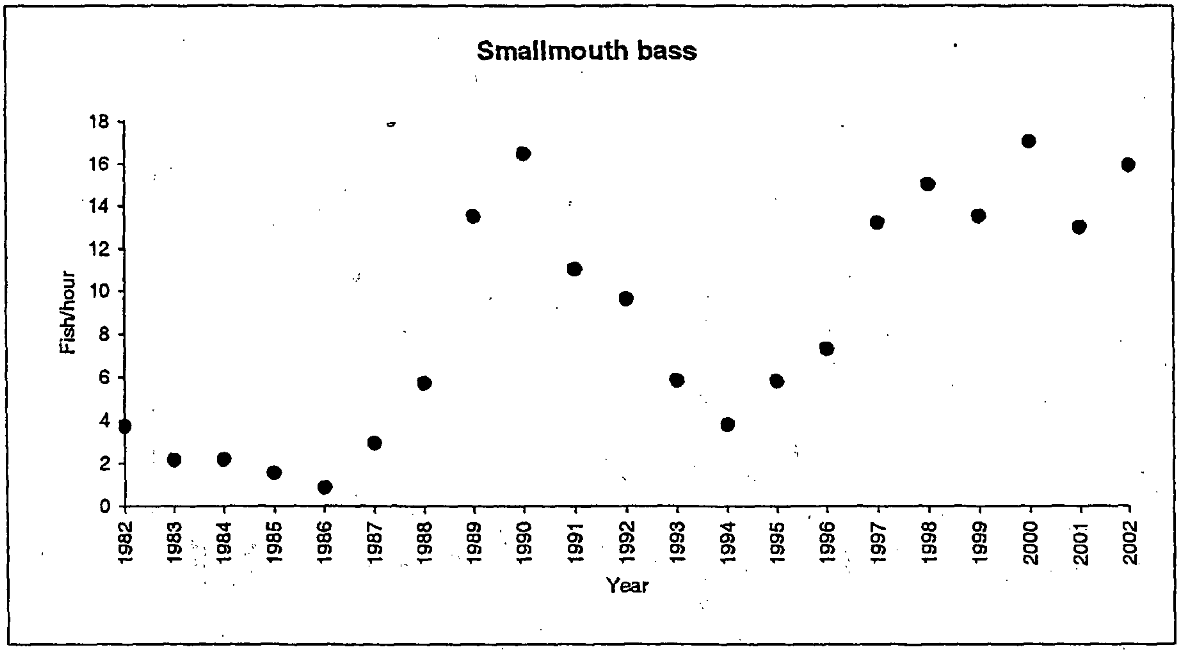


Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2002 in the vicinity of PINGP.

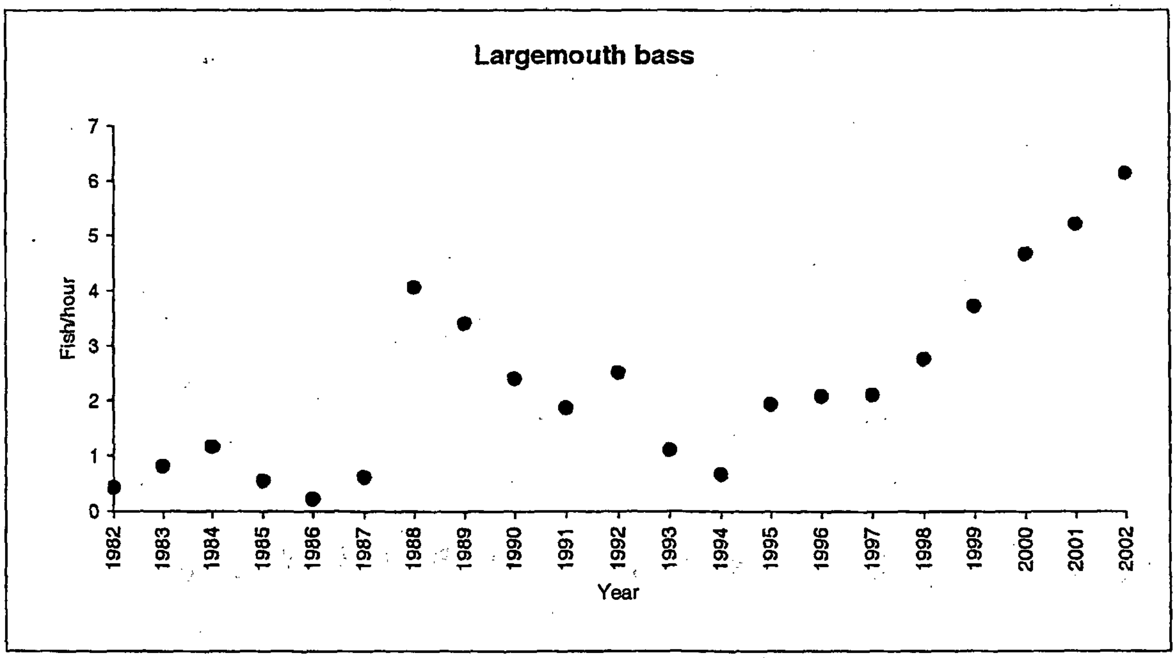


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2002 in the vicinity of PINGP.

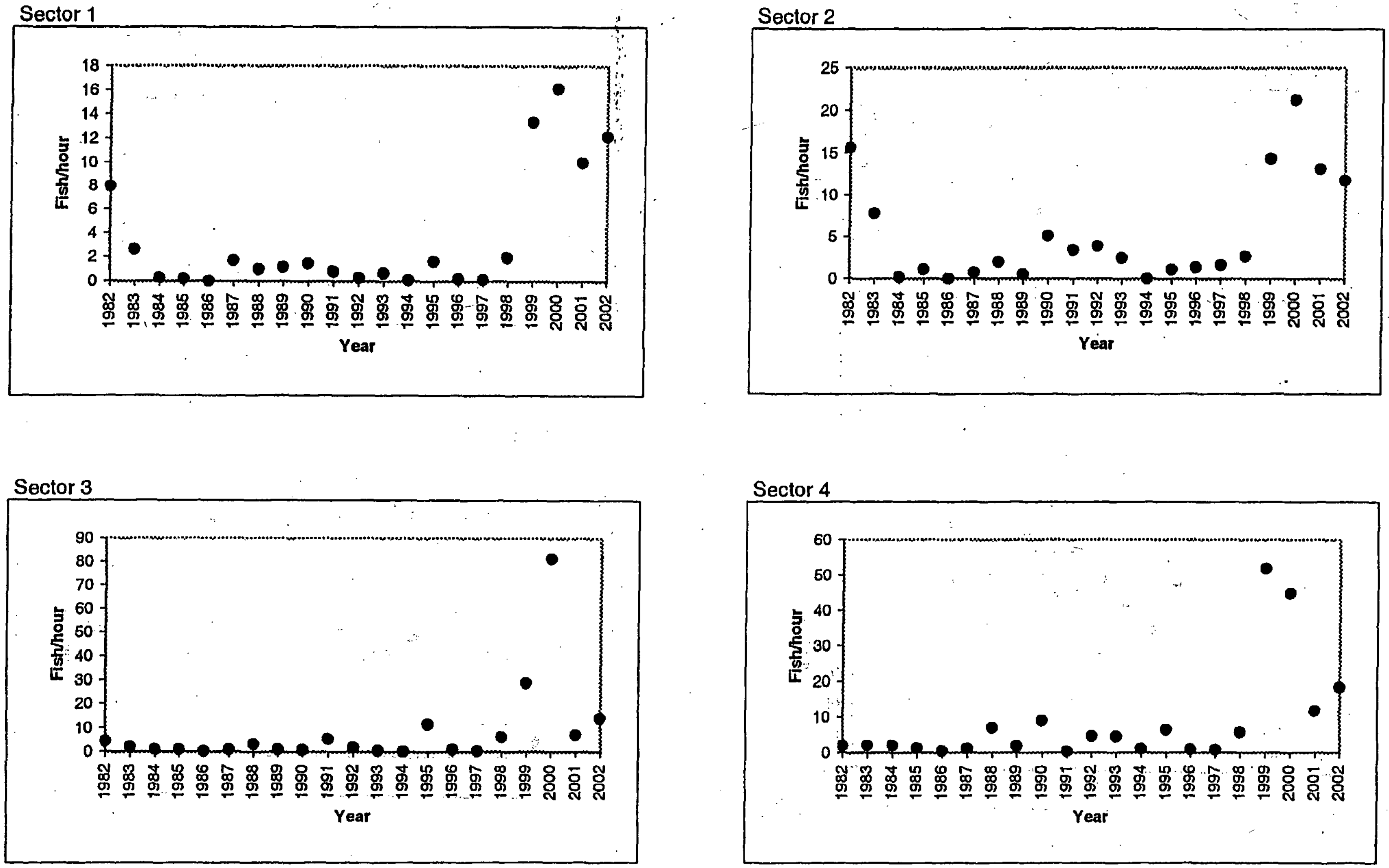


Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2002 in the vicinity of PINGP.

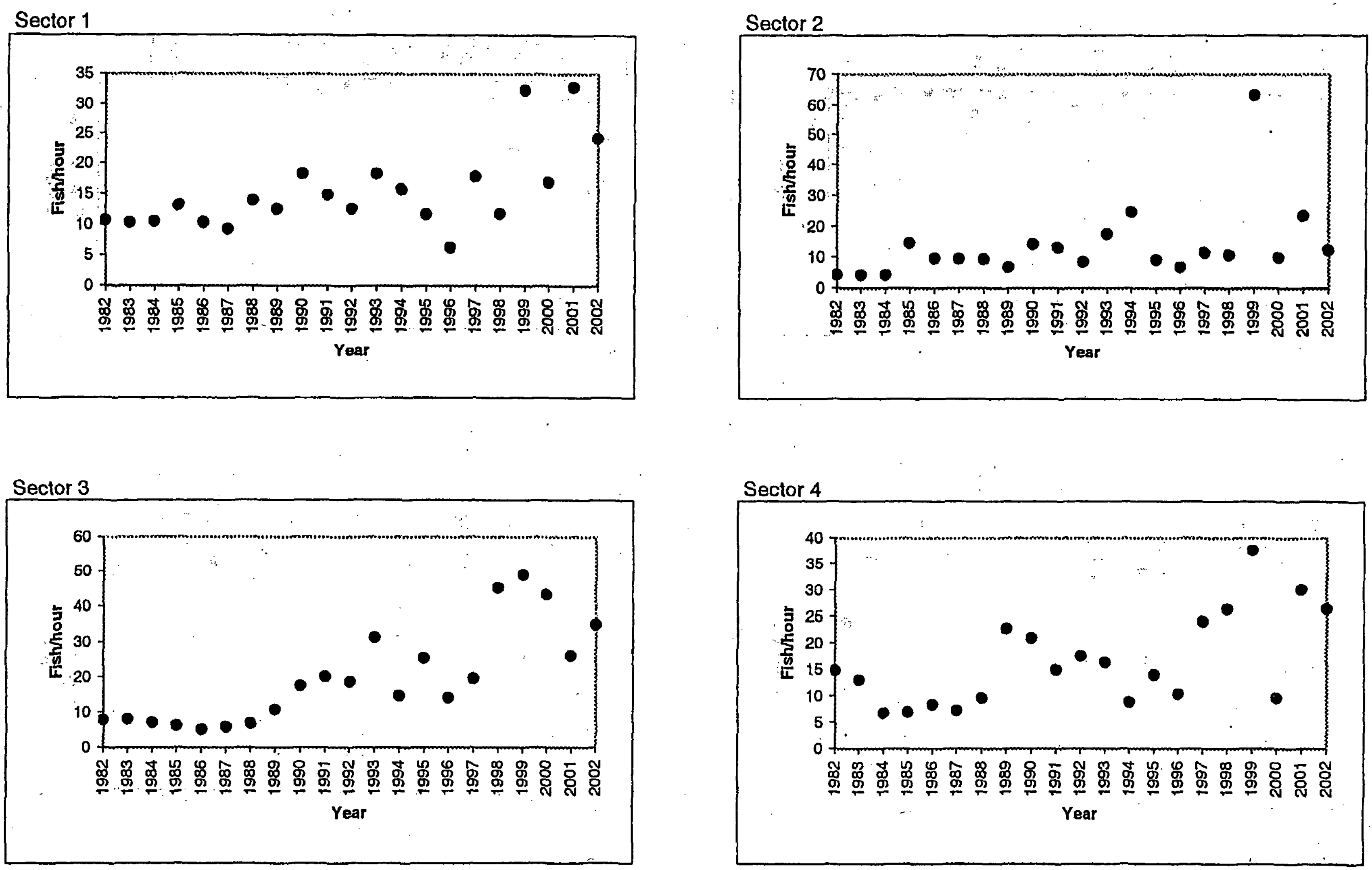


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2002 in the vicinity of PINGP.

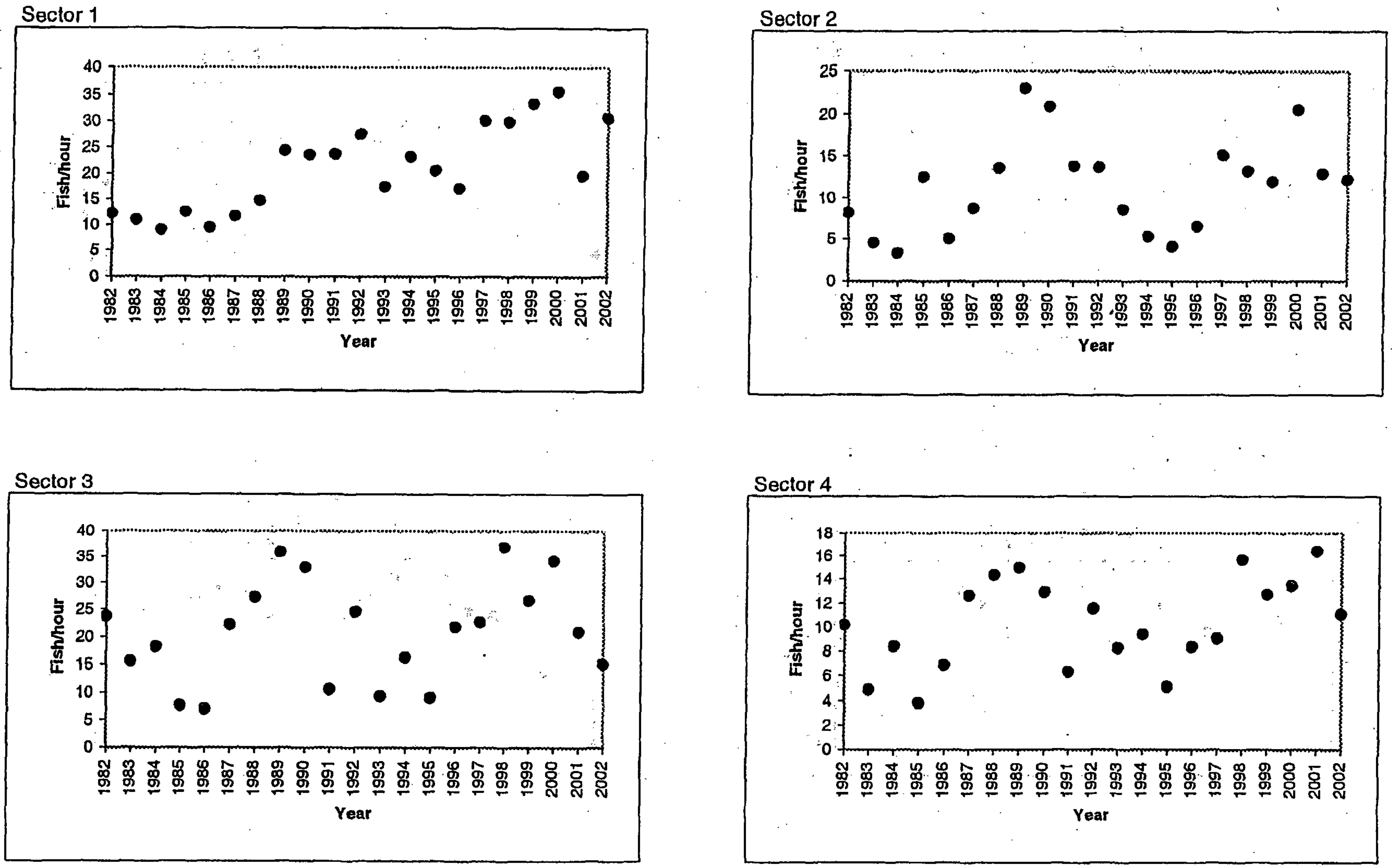


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2002 in the vicinity of PINGP.

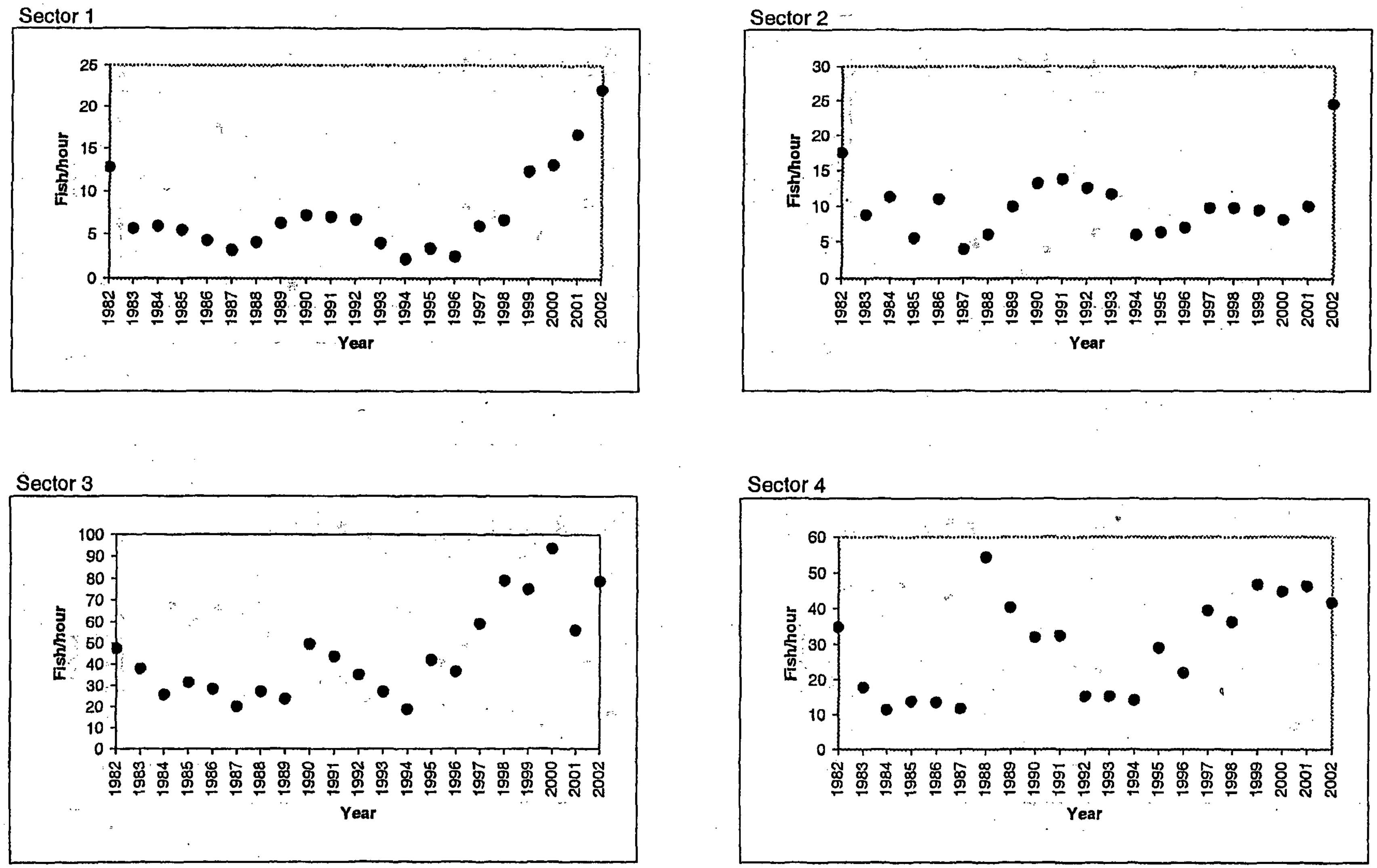


Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2002 in the vicinity of PINGP.

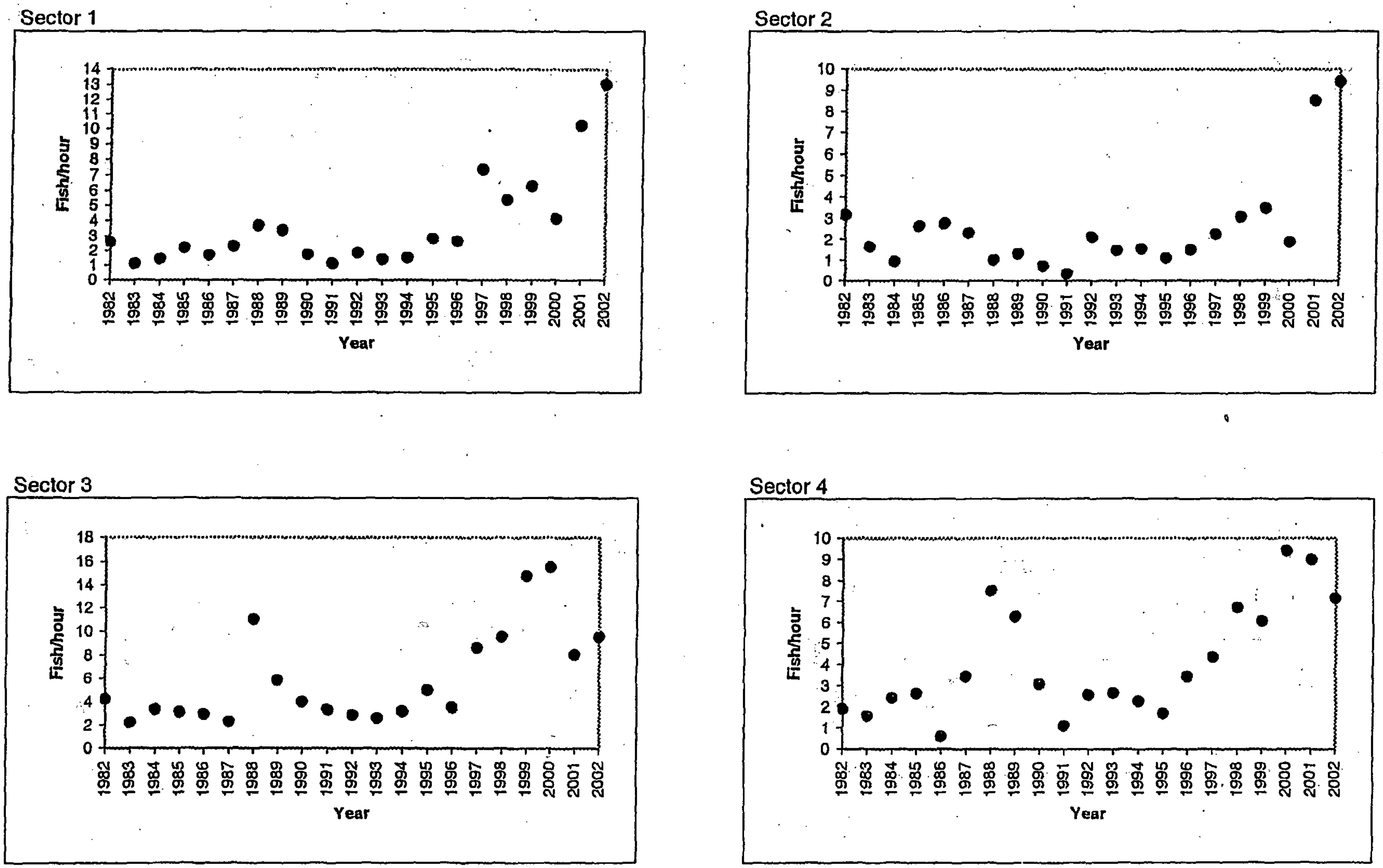
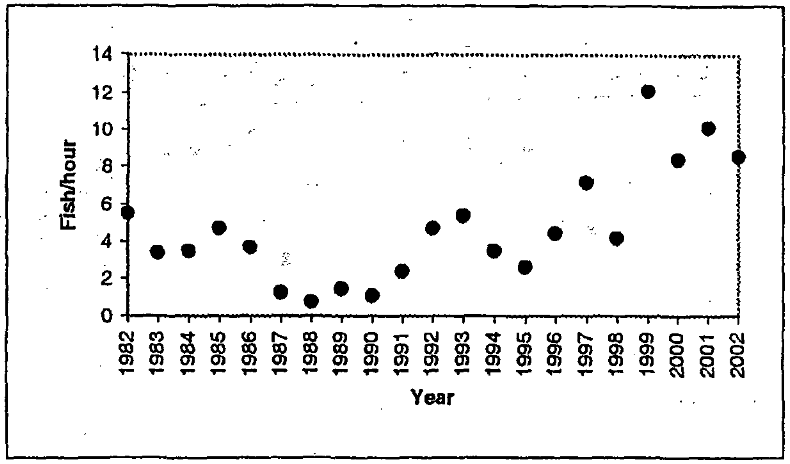
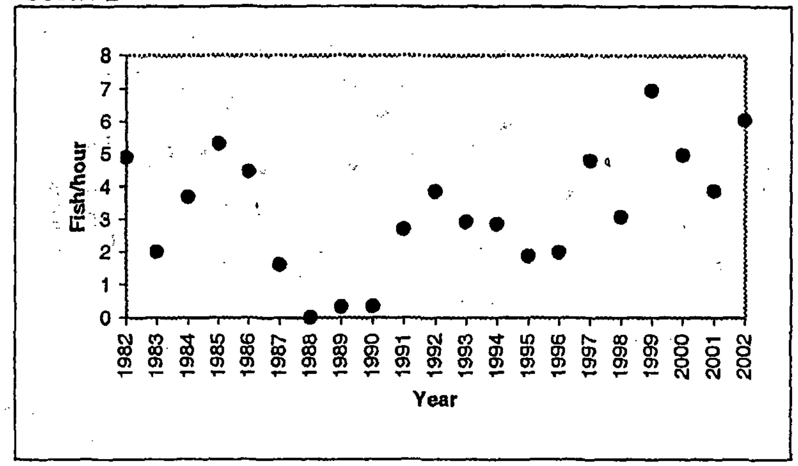


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2002 in the vicinity of PINGP

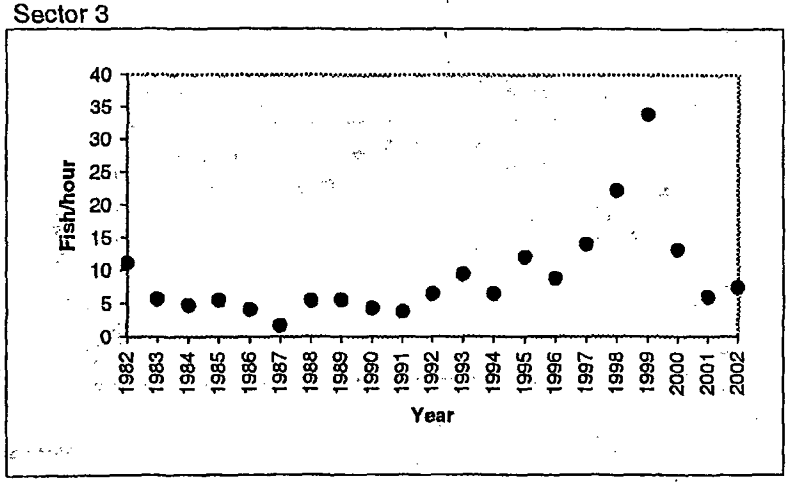
Sector 1



Sector 2



Sector 3



Sector 4

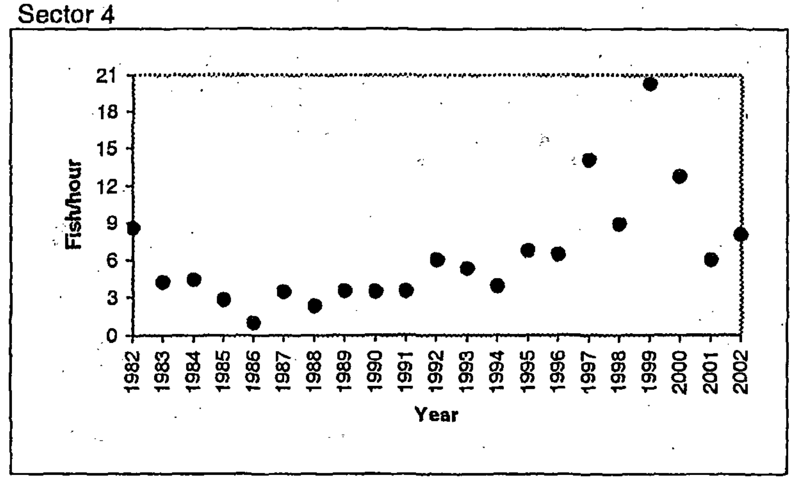
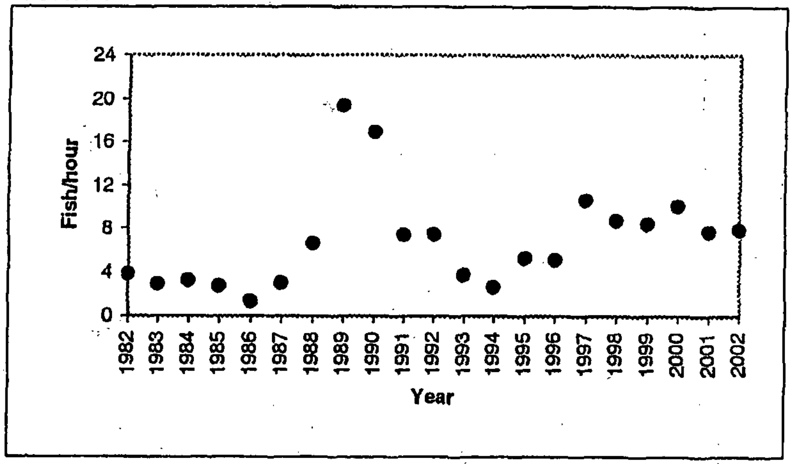
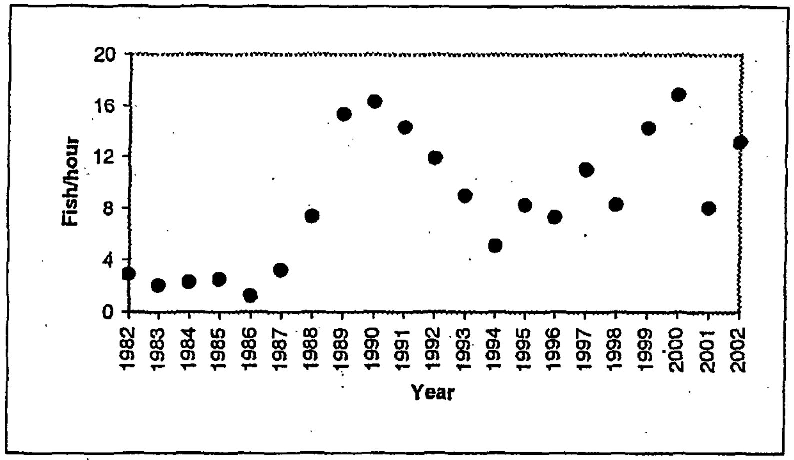


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2002 in the vicinity of PINGP.

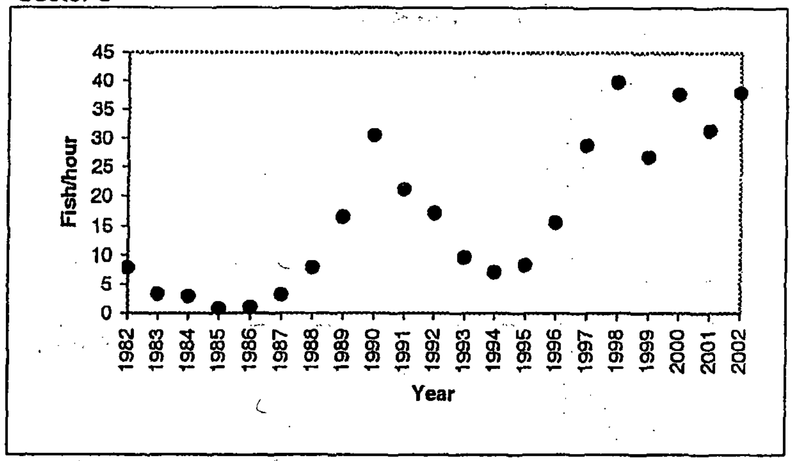
Sector 1



Sector 2



Sector 3



Sector 4

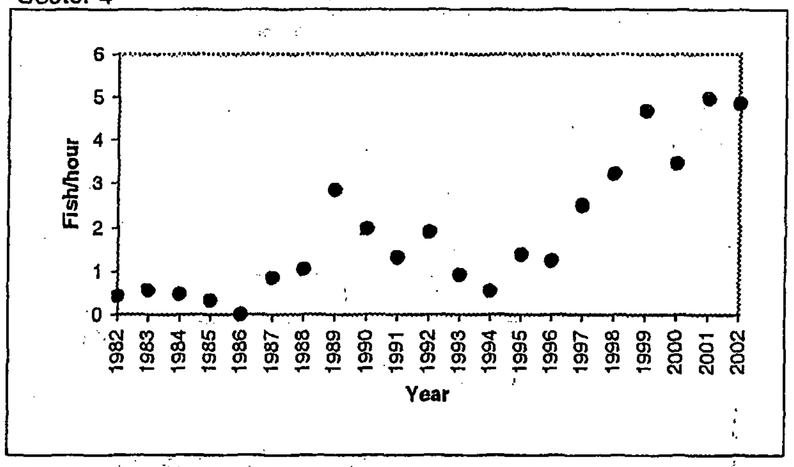


Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2002 in the vicinity of PINGP.

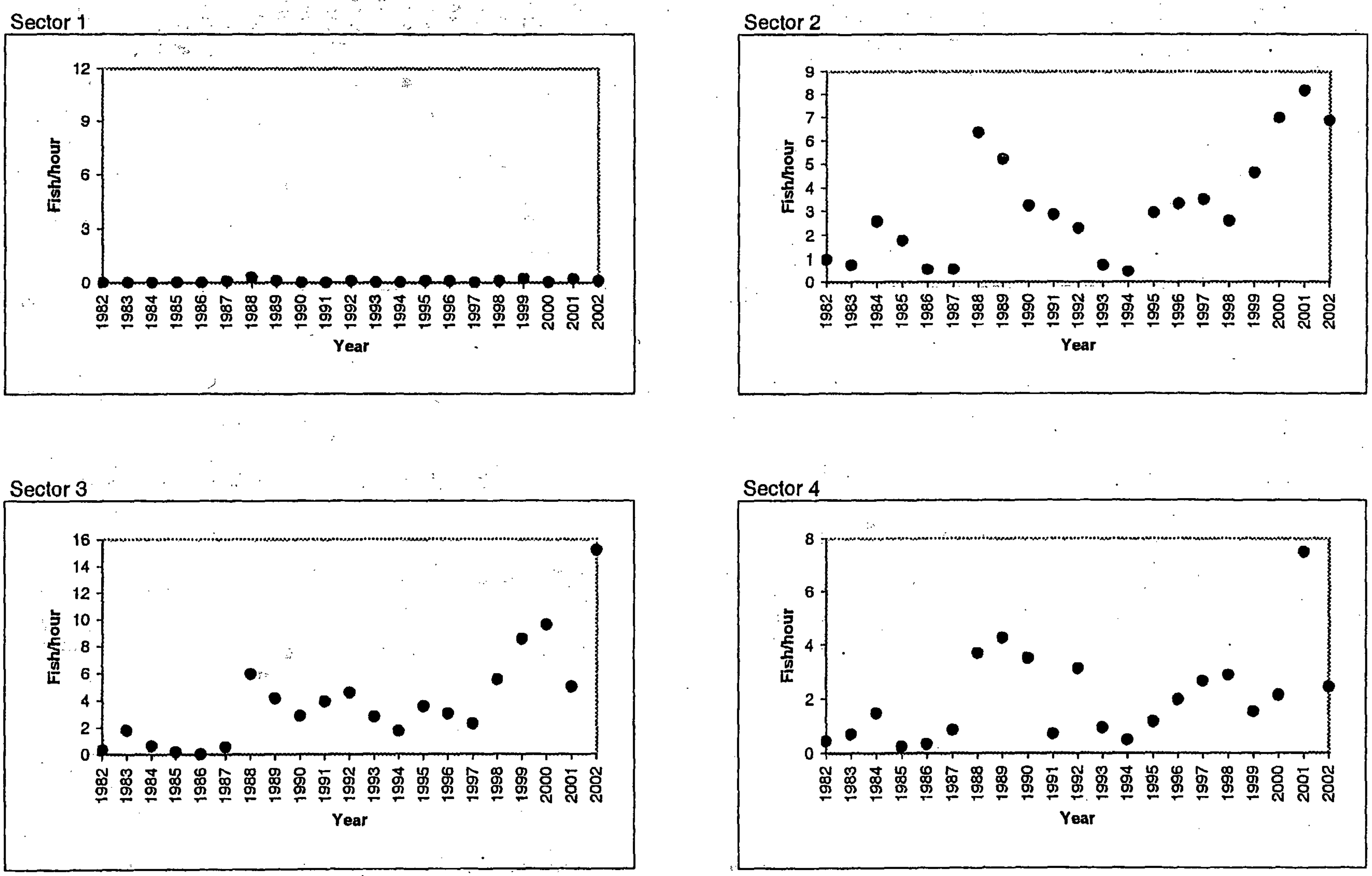


Figure 31

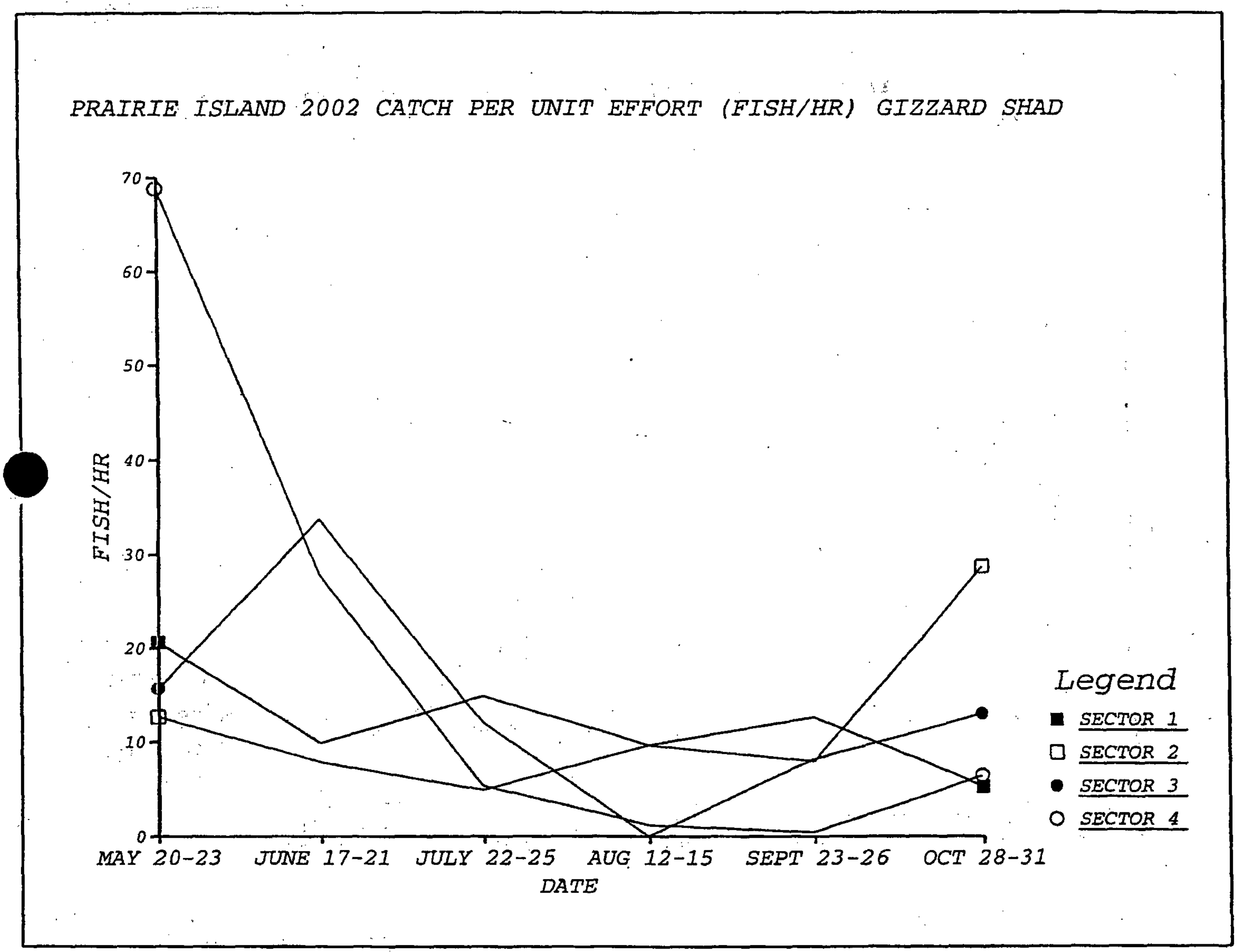
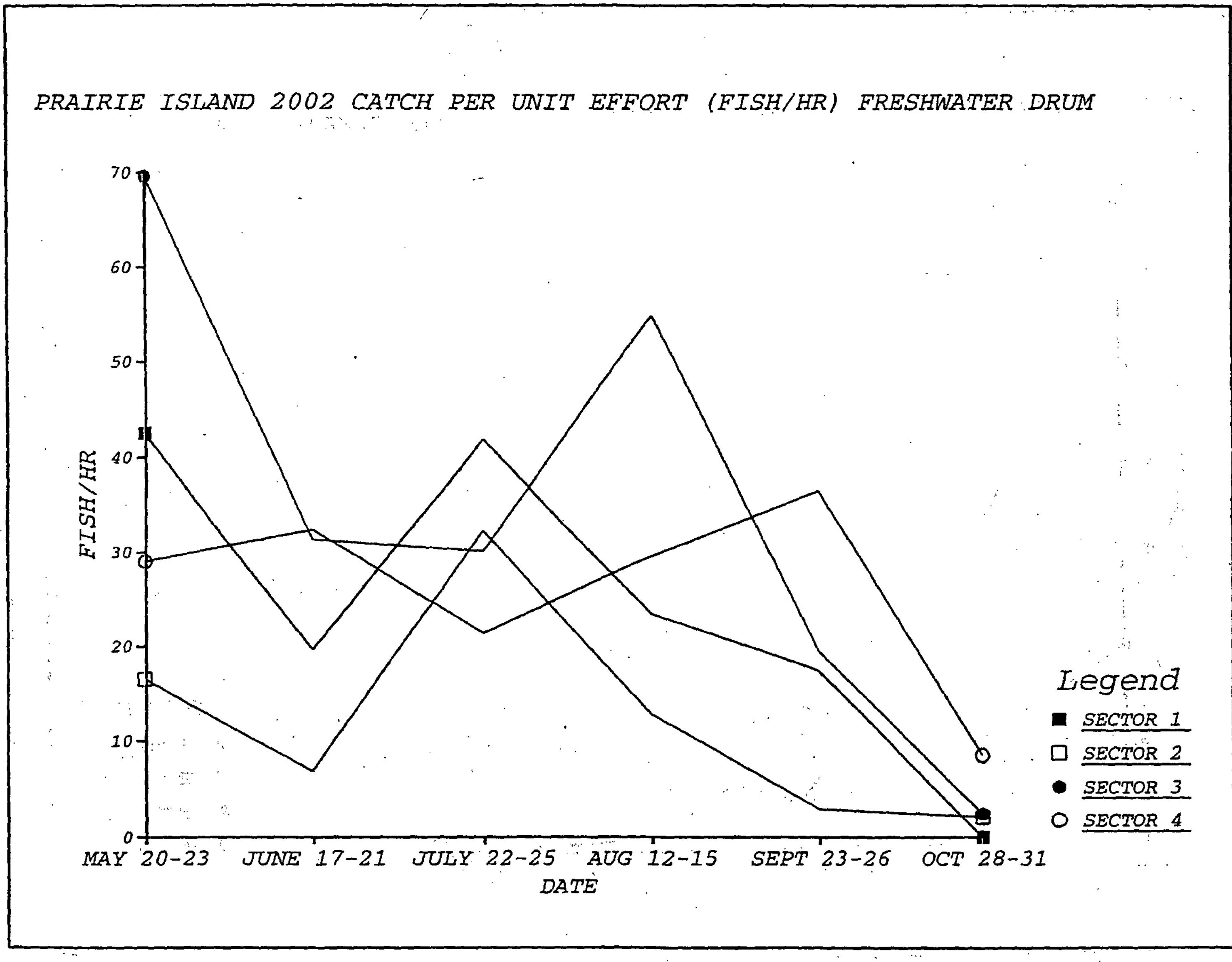
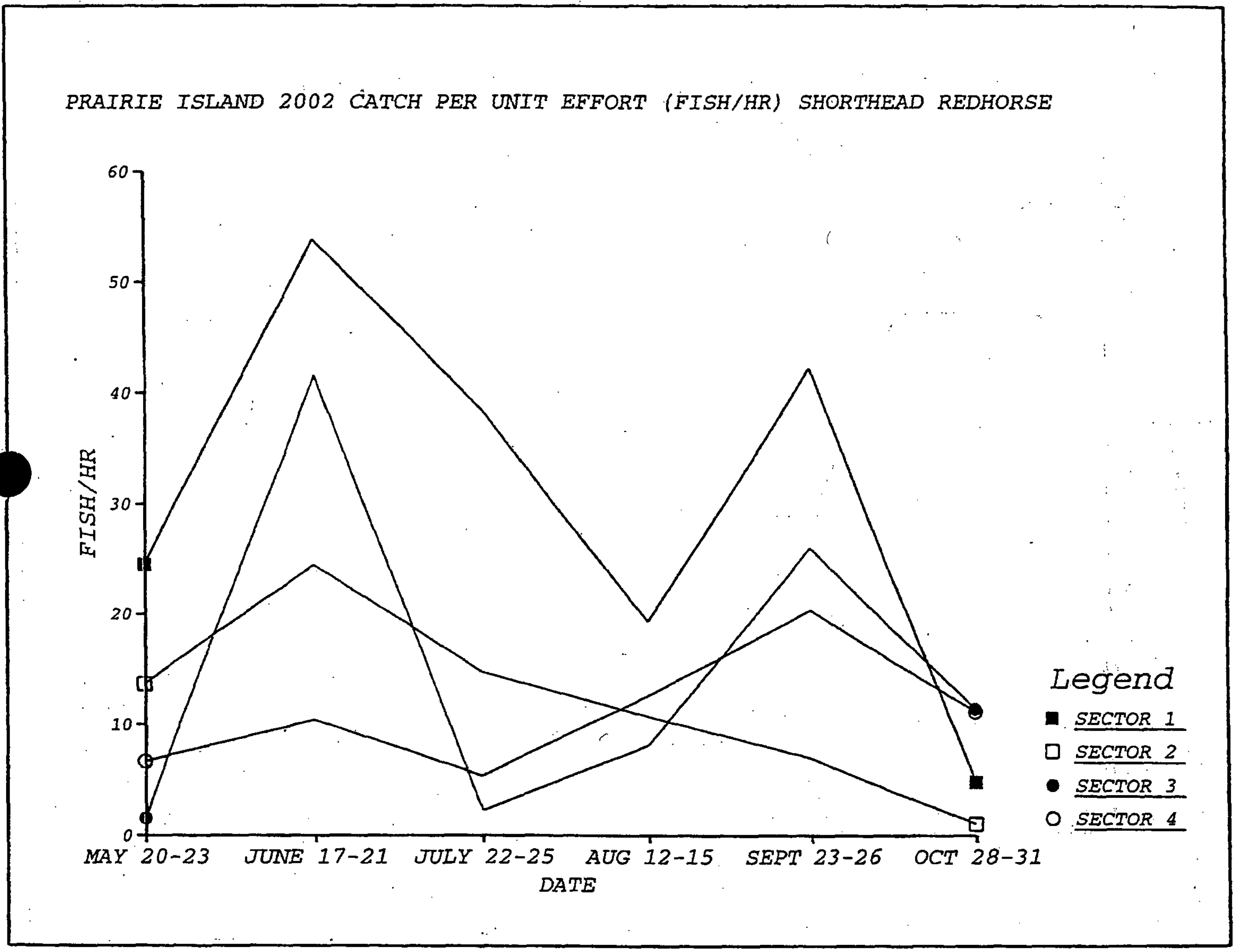

PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) GIZZARD SHAD
FISH/HR
70
60
50
40
30
20
10
0
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 32



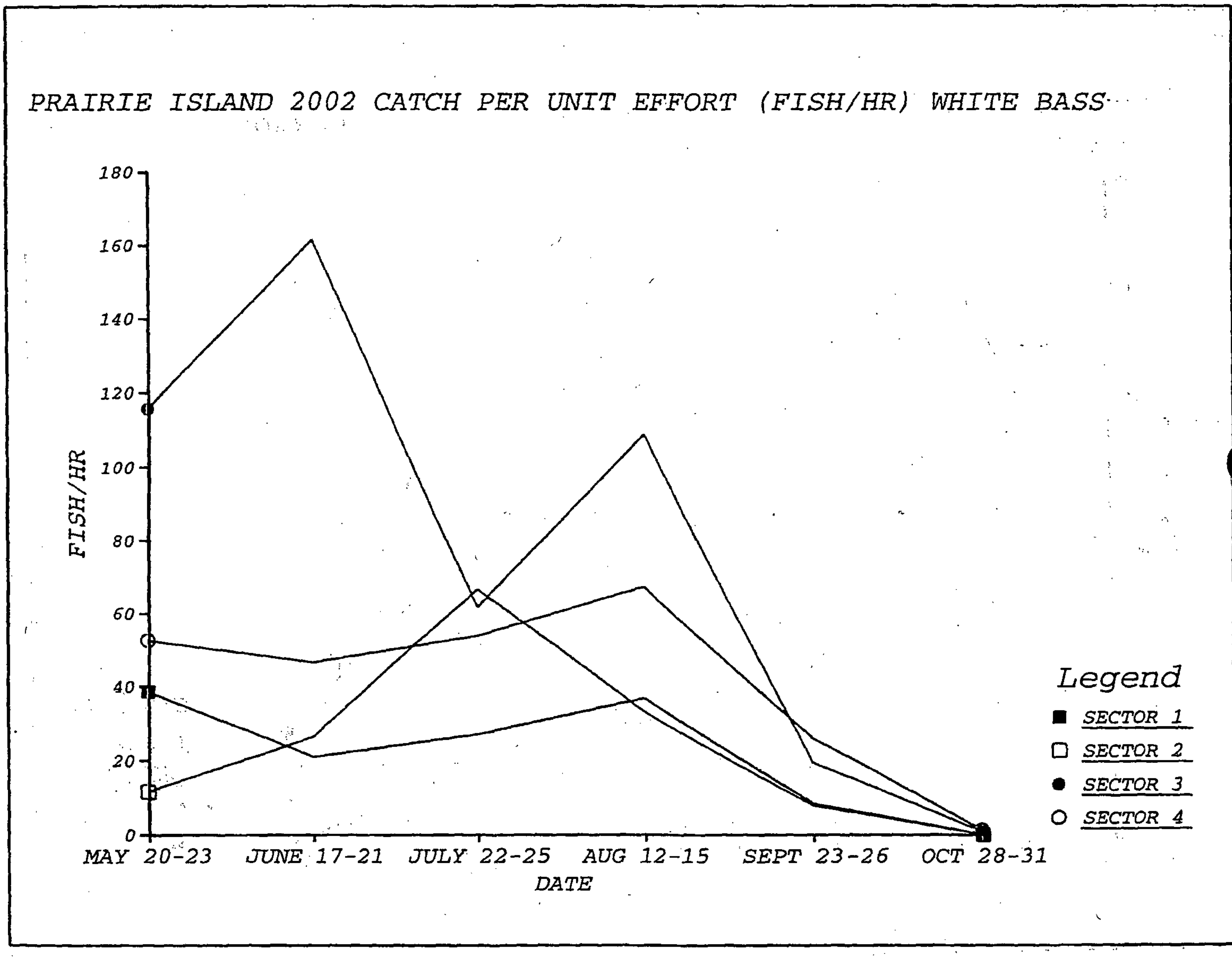
PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) FRESHWATER DRUM
FISH/HR
70
60
50
40
30
20
10
0
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 33



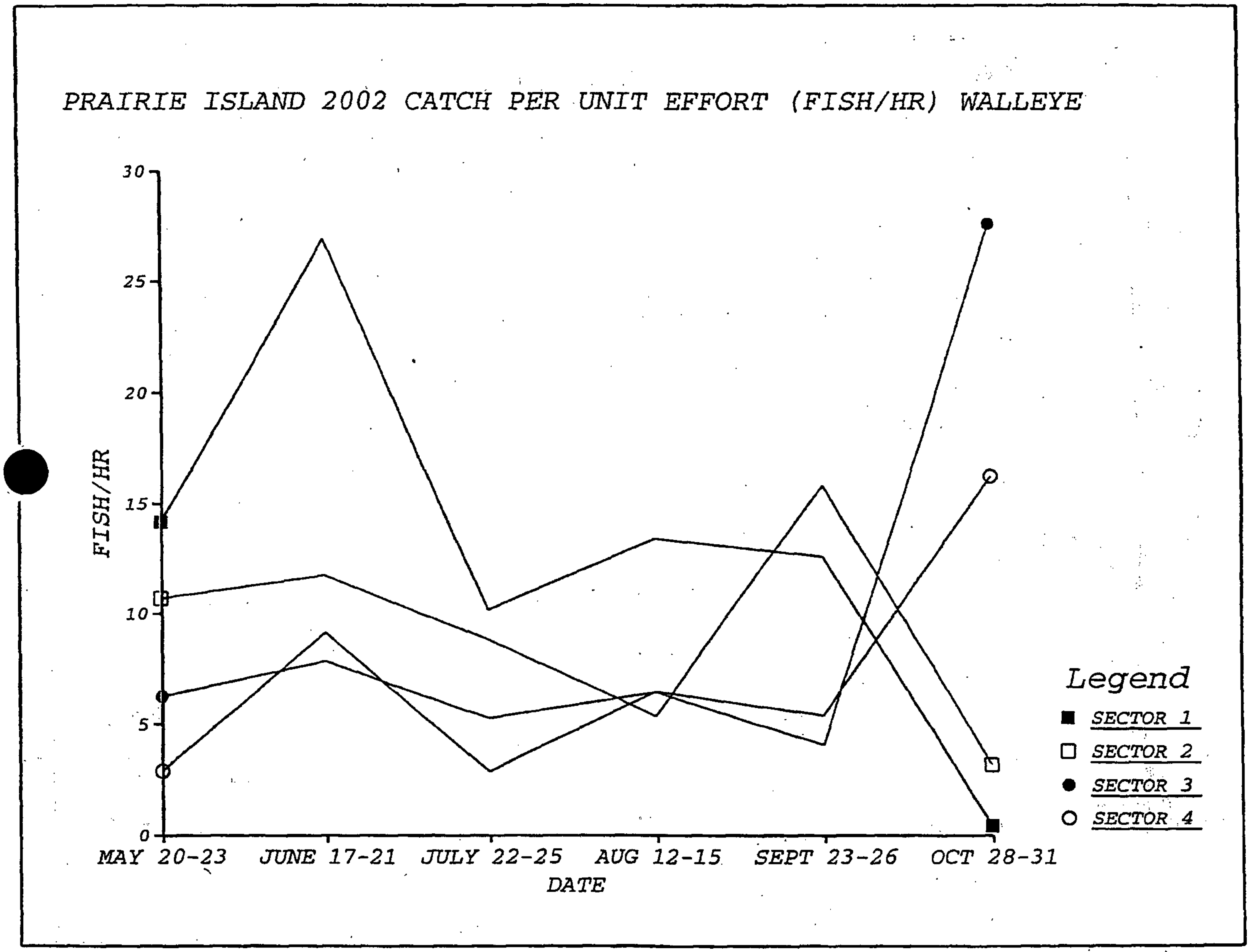
PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) SHORTHEAD REDHORSE
FISH/HR
0
10
20
30
40
50
60
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 34



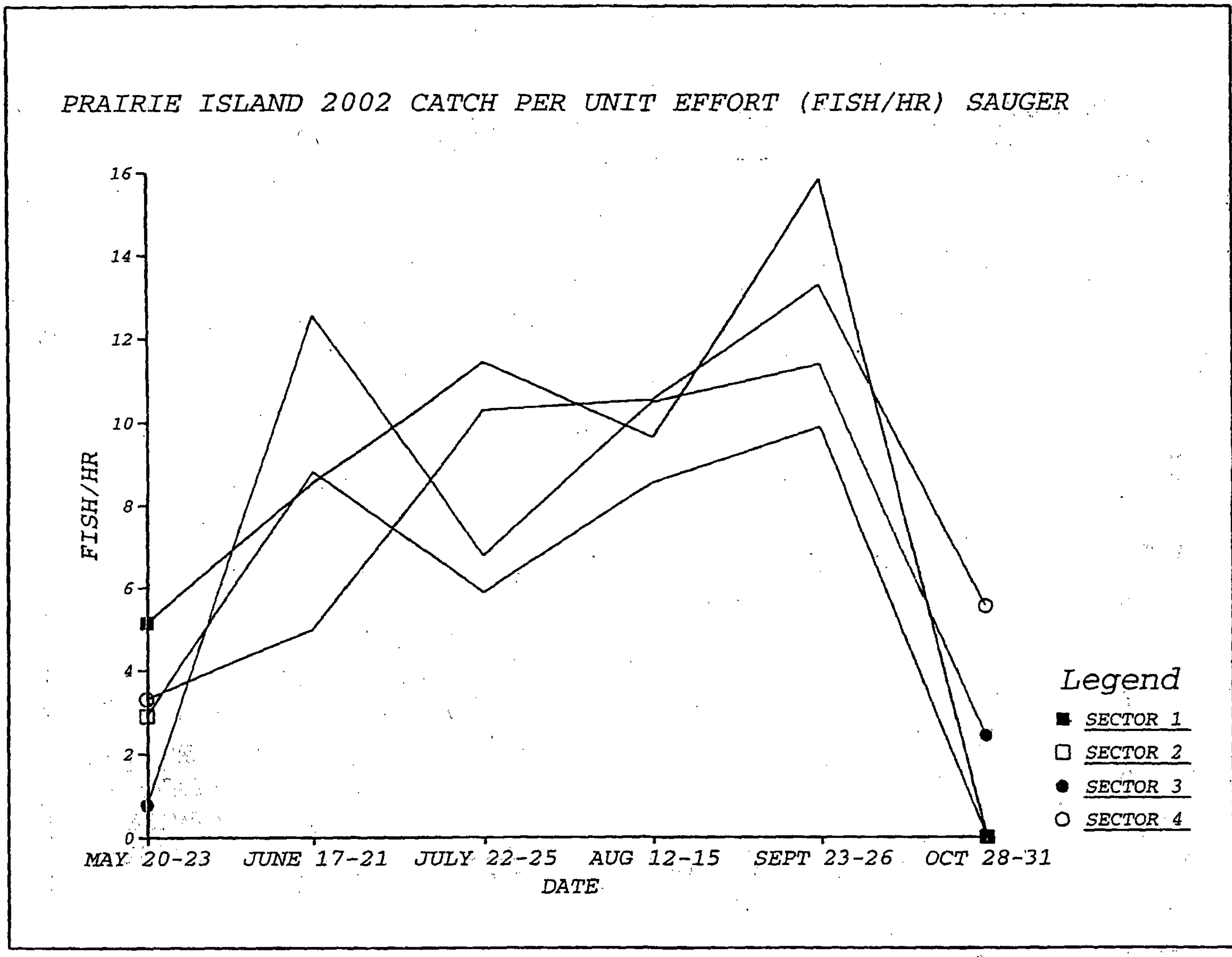
PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) WHITE BASS
FISH/HR
180
160
140
120
100
80
60
40
20
0
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 35



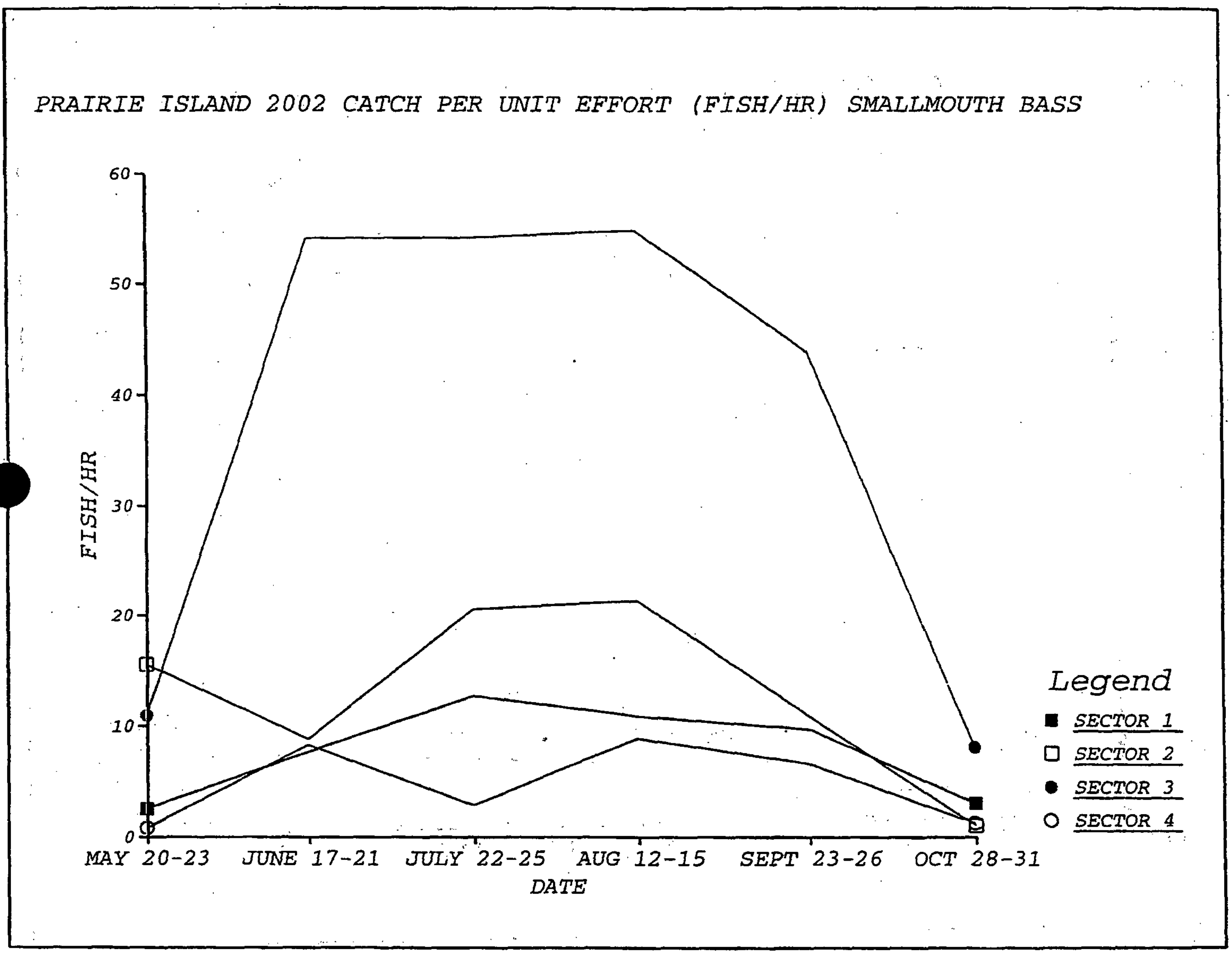
PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) WALLEYE
30
25
20
15
10
5
0
FISH/HR
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 36



PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) SAUGER
FISH/HR
0
2
4
6
8
10
12
14
16
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 37



PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) SMALLMOUTH BASS
60
50
40
30
20
10
0
FISH/HR
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 38

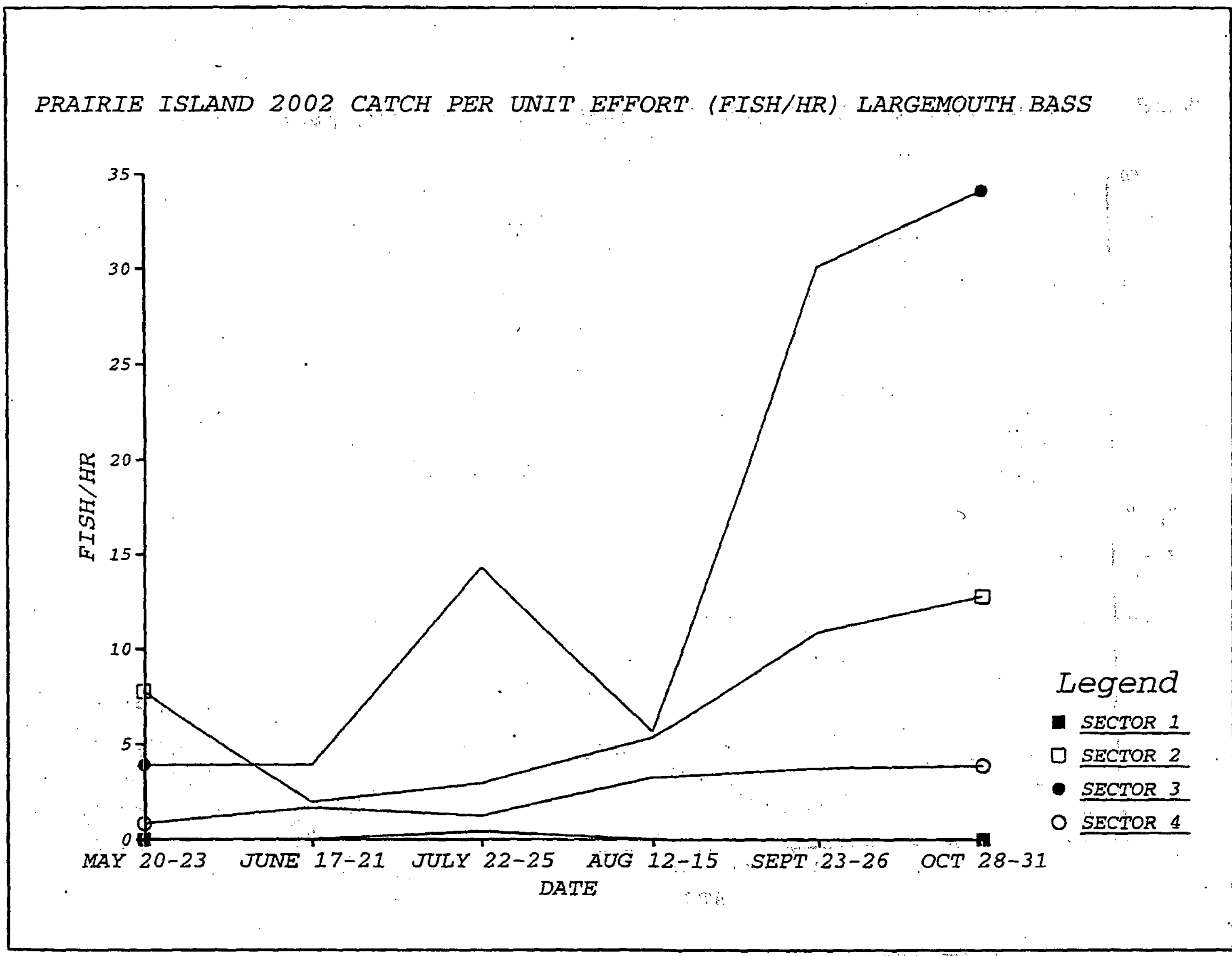

PRAIRIE ISLAND 2002 CATCH PER UNIT EFFORT (FISH/HR) LARGEMOUTH BASS
35
30
25
20
15
10
5
0
FISH/HR
MAY 20-23
JUNE 17-21
JULY 22-25
AUG 12-15
SEPT 23-26
OCT 28-31
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Table 1. Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2002.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
Chestnut lamprey Ichthyomyzon castaneus	x	x							x	x			x			x	x		x	x
Silver lamprey Icthyomyzon unicuspus					x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Paddlefish Polyodon spathula															x					
Longnose gar Lepisosteus osseus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shortnose gar Lepisosteus platostomus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bowfin Amia calva	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American eel Anguilla rostrata	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x		x
Gizzard shad Dorosoma cepedianum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Goldeye Hiodon alosoides	x		x		x	x					x			x	x	x	x			
Mooneye Hiodon tergisus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brown trout Salmo trutta				x									x		x		x		x	x
Northern pike Esox lucius	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Musky Esox masquinongy																		x	x	
Carp Cyprinus carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carpsucker Species Carpiodes species		x					x													
River carpsucker Carpiodes carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Quillback Carpiodes cyprinus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Highfin carpsucker Carpiodes velifer			x	x	x	x	x	x	x	x	x	x	x	x	x					x
White sucker Catostomus commersoni	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x

Table 1(cont) Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2002.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
Blue sucker Cycleptus elongatus	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Northern hogsucker Hypentelium nigricans	x														x			x		
Smallmouth buffalo Ictiobus bubalus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bigmouth buffalo Ictiobus cyprinellus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Spotted sucker Minytrema melanops	x	x		x		x	x			x										
Silver redhorse Moxostoma anisurum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
River redhorse Moxostoma carinatum		x	x		x		x	x	x	x		x	x			x	x	x	x	x
Golden redhorse Moxostoma erythrurum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Greater redhorse Moxostoma valenciennesi		x		x		x		x							x	x			x	
Shorthead redhorse M.macrolepidotum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black bullhead Ictalurus melas	x	x	x	x	x	x				x							x	x		x
Yellow bullhead Ictalurus natalis					x	x	x					x	x							
Brown bullhead Ictalurus nebulosus	x																			
Channel catfish Ictalurus punctatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Flathead catfish Pylodictus olivaris	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Burbot Lota lota	x	x			x					x	x	x	x	x	x	x	x	x	x	x
White bass Morone chrysops	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock bass Ambloplites rupestris	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Green sunfish Lepommis cyanellus	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 1(cont) Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2002.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
Pumpkinseed Lepomis macrochirus							x	x	x	x	x	x	x	x	x	x	x	x	x	x
Orangespotted sunfish Lepomis humilis																x		x	x	
Bluegill Lepomis macrochirus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Smallmouth bass Micropterus dolomieui	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Largemouth bass Micropterus salmoides	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
White crappie Pomoxis annularis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black crappie Pomoxis nigromaculatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Yellow perch Perca flavens	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x		x	x
Sauger Stizostedion canadense	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Walleye Stizostedion vitreum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Saugeye S. vitreum x S. canadense															x	x	x		x	x
Freshwater drum Aplodinotus grunniens	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	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.

Rank	Species	Sector 1	Sector 2	Sector 3	Sector 4	Average
1	White bass	22.04	24.51	78.60	41.63	41.69
2	Carp	16.67	29.04	39.96	24.28	27.49
3	Freshwater drum	24.23	12.42	34.82	26.35	24.45
4	Shorthead redhorse	30.73	12.09	15.03	11.07	17.23
5	Smallmouth bass	7.84	13.09	37.85	4.84	15.91
6	Gizzard shad	12.15	11.75	13.85	18.33	14.02
7	Walleye	13.00	9.40	9.50	7.12	9.75
8	Sauger	8.55	6.04	7.39	8.02	7.50
9	Quillback carpsucker	8.19	11.25	1.45	4.01	6.23
10	Bluegill	0.42	15.95	5.80	2.63	6.20
11	Largemouth bass	0.07	6.88	15.17	2.42	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	2.01	0.66	2.49	2.76
16	Channel catfish	1.77	7.55	0.79	0.48	2.65
17	Green sunfish	0.07	2.18	1.19	0.00	0.86
18	Blue sucker	1.70	0.50	0.40	0.69	0.82
19	Bowfin	0.00	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	0.79	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

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	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

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	370	LOG W=3.039 LOG L-5.101
2002	17.23	NA	9	781	370	LOG W=2.954 LOG L-4.892

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	20.16	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	41.69	NA	21	1656	320	LOG W=3.042 LOG L-5.013

Table 7. Fisheries summary for Walleye 1977-2002.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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

Table 8. Fisheries summary for Sauger 1977-2002.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	NA	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	7.50	NA	4	329	280	LOG W=3.350 LOG L-6.018

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

	Smallmouth 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

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.

Year	Carp	White bass	Freshwater Drum	Sauger	Black Crappie	Shorthead Redhorse	Walleye	Gizzard 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
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	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

*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
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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 inititated 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.

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 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 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 Results and Discussion 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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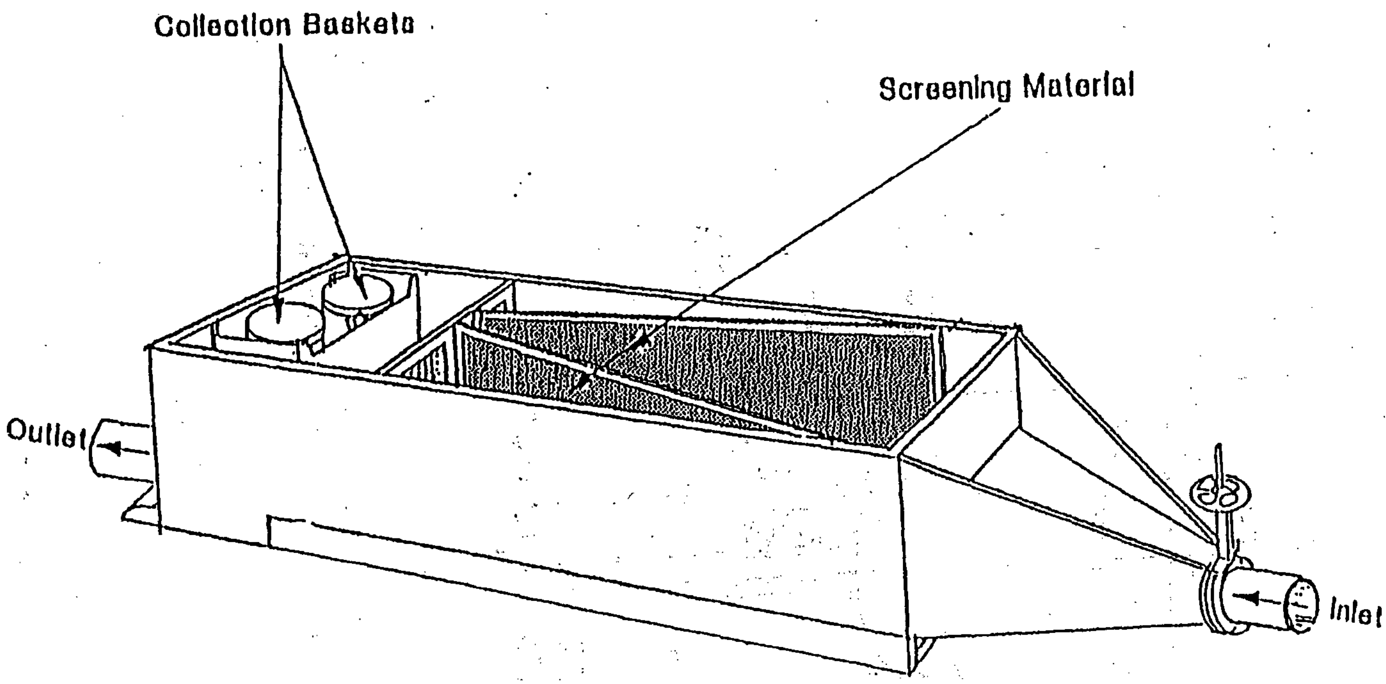
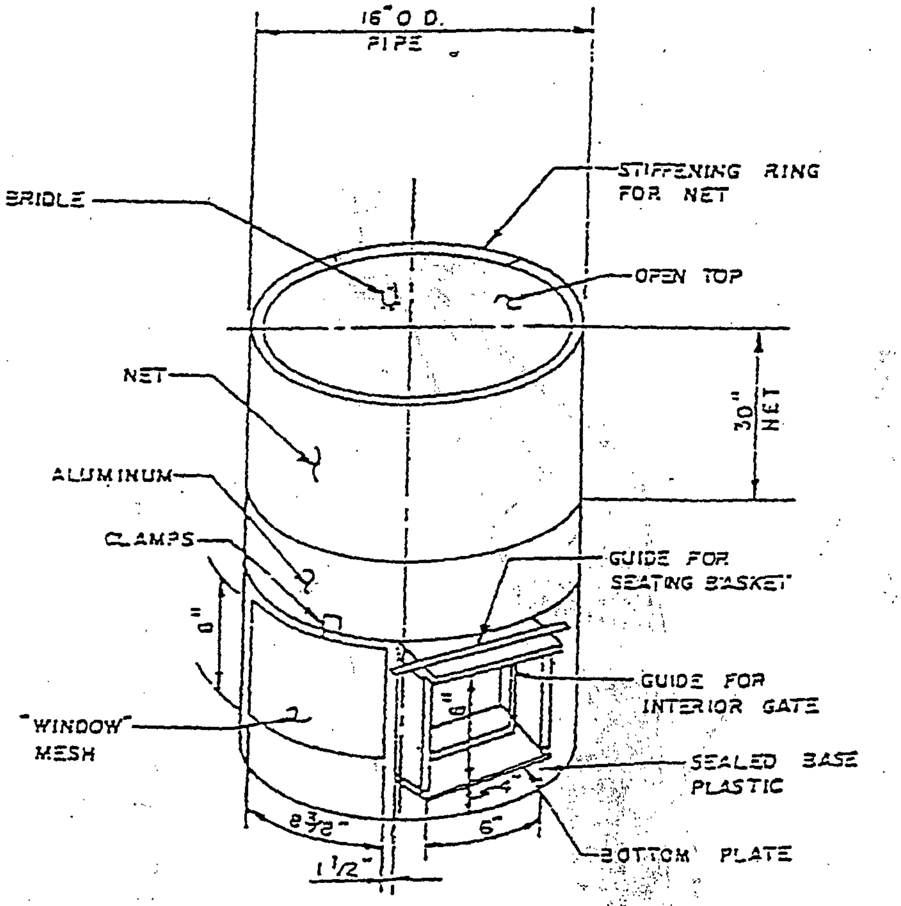
Scott, W. B. and E. J. Crossman. 1973. Freshwater Fishes of Canada. Department of the Environment, Fisheries Research Board of Canada. Ottawa, Canada..

Figure 1



Larval Fish Collection Tank

Figure 2



DETAIL A
COLLECTION BASKET
NO SCALE

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.

Date	Taxa	Lifestage	Density	Percent Live	Number of 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	JUV	0.029468	100	1
4-Apr-2002	UNID	EG	0.088403	0	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	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	JUV	0.148464	60	5
11-Apr-2002	Cyprinid species	JUV	0.029693	100	1
16-Apr-2002	Emerald shiner	JUV	0.094378	100	1
16-Apr-2002	Gizzard shad	JUV	0.094378	0	1
18-Apr-2002	Emerald shiner	JUV	0.178337	100	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 Density	Daylight 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.		x		
Sauger			x	x
Burbot			x	x,o
Catostomid		x		x
Stizostedion spp.				x
White bass		x		
Gizzard shad		x,o		
Freshwater drum		x		
Johnny darter	x			
Shiner spp.		x,o		
Emerald shiner	x	x,o		
Bluegill		x		
Mooneye				x
Golden redhorse		x		
Unidentified				x
Log perch	x			x

Legend: x = previous years data
o = 2002 data

Table 3. Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2002.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1984														
16-Apr-84	UNID	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	14-Apr-89	X	UN	0	0
23-Apr-84	UNID	EG	3840	10	28-Apr-86	UNID	EG	480	1	18-Apr-89	X	UN	0	0
25-Apr-84	CC	JU	384	1	29-Apr-86	PERC	PR	864	3	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	UNID	EG	3840	10	29-Apr-86	WE	PR	288	1	25-Apr-89	X	UN	0	0
27-Apr-84	CC	JU	384	1	**1987**					27-Apr-89	BUR	PR	1152	3
27-Apr-84	CYPR	JU	384	1	6-Apr-87	BUR	PR	1536	4	**1992**				
27-Apr-84	UNID	EG	2304	6	8-Apr-87	CARP	PR	576	1	1-Apr-92	CYPR	PR	288	1
30-Apr-84	CC	JU	384	21	10-Apr-87	BUR	PR	2304	4	1-Apr-92	CYPR	PO	288	1
30-Apr-84	CYPR	AD	384	1	13-Apr-87	BUR	PR	2304	4	1-Apr-92	CARP	PO	576	2
30-Apr-84	FHC	JU	192	1	15-Apr-87	BUR	PR	3456	6	2-Apr-92	X	UN	0	0
30-Apr-84	PERC	PR	1152	6	16-Apr-87	BUR	PR	576	1	8-Apr-92	X	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	WE	PR	768	4	22-Apr-87	X	UN	0	0	14-Apr-92	X	UN	0	0
1985					24-Apr-87	X	UN	0	0	16-Apr-92	X	UN	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	UNID	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	SA	PR	1344	7	**1988**					30-Apr-92	PERC	AD	288	1
24-Apr-85	UNID	EG	384	2	8-Apr-88	BUR	PR	768	2	**1993**				
24-Apr-85	WE	PR	1536	8	11-Apr-88	X	UN	0	0	2-Apr-93	UN	X	0	0
25-Apr-85	PERC	PR	192	1	13-Apr-88	UNID	EG	384	1	6-Apr-93	BUR	PR	288	1
25-Apr-85	SA	PR	1536	8	15-Apr-88	BUR	PR	768	2	8-Apr-93	UN	EG	288	1
25-Apr-85	STIZ	PR	384	2	18-Apr-88	X	UN	0	0	8-Apr-93	BUR	PR	288	1
25-Apr-85	WE	PR	576	3	20-Apr-88	BUR	PR	768	2	13-Apr-93	UN	X	0	0
26-Apr-85	SA	PR	192	1	22-Apr-88	BUR	PR	1920	5	15-Apr-93	BUR	PR	288	1
26-Apr-85	STIZ	PR	192	1	25-Apr-88	BUR	PR	1152	3	19-Apr-93	UN	EG	1152	2
29-Apr-85	BUR	PO	96	1	27-Apr-88	BUR	PR	1152	3	21-Apr-93	UN	X	0	0
29-Apr-85	CARP	PR	192	2	28-Apr-88	BUR	PR	384	1	27-Apr-93	UN	X	0	0
29-Apr-85	CATO	PR	288	3	29-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	X	UN	0	0	5-Apr-94	UNID	EG	384	1
18-Apr-86	CARP	PR	288	1	6-Apr-89	PERC	AD	384	1	5-Apr-94	CC	JU	384	1
18-Apr-86	CYPR	PR	288	1	7-Apr-89	X	UN	0	0	5-Apr-94	CARP	PR	384	1
23-Apr-86	CYPR	PO	288	1	11-Apr-89	X	UN	0	0	5-Apr-94	BUR	PR	384	1
23-Apr-86	PERC	PR	288	1	13-Apr-89	BUR	PR	384	1	7-Apr-94	BUR	PR	288	1

Table 3. (cont)	Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2002.													
Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1994 (cont)					**1996 (cont)**					**1999 (cont)**				
12-Apr-94	SA	PR	288	1	25-Apr-96	BURB	PR	504	2	9-Apr-99	CC	JU	288	1
12-Apr-94	CARP	PR	288	1	25-Apr-96	BURB	PR	252	1	9-Apr-99	BURB	PR	576	2
14-Apr-94	X	X	0	0	30-Apr-96	X	X	0	0	9-Apr-99	CC	JU	288	1
19-Apr-94	CYPR	JU	288	1	**1997**					13-Apr-99	UNID	EG	288	1
21-Apr-94	X	X	0	0	3-Apr-97	UNID	EG	17,280	30	13-Apr-99	UNID	EG	288	1
26-Apr-94	CARP	PR	1152	4	4-Apr-97	BG	JU	1152	2	15-Apr-99	BURB	PR	288	1
26-Apr-94	BUR	PR	288	1	4-Apr-97	UNID	PR	576	1	22-Apr-99	BURB	PR	576	2
28-Apr-94	SA	PR	288	1	25-Apr-97	BURB	PR	2304	4	27-Apr-99	PERC	PR	288	1
28-Apr-94	BUR	PR	288	1	29-Apr-97	CYPR	JU	864	2	27-Apr-99	CC	JU	288	1
1995					30-Apr-97	BLBH	JU	432	1	27-Apr-99	PERC	PR	288	1
3-Apr-95	CATO	JU	288	1	30-Apr-97	CC	JU	432	1	30-Apr-97	PERC	PO	288	1
4-Apr-95	BUR	PR	288	1	30-Apr-97	CYPR	JU	432	1	30-Apr-97	PERC	PR	576	2
4-Apr-95	CC	JU	576	1	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	GIZ	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	4-Apr-2000	UNID	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	CATO	PR	288	1	9-Apr-1998	EMSH	AD	229	1	6-Apr-2000	Log P	AD	288	1
17-Apr-95	UNID	EG	13248	46	14-Apr-1998	CC	JU	252	1	6-Apr-2000	UNID	EG	8023	39
20-Apr-95	UNID	EG	2880	10	16-Apr-1998	CYPR	JU	229	1	6-Apr-2000	Carp	PRO	206	1
24-Apr-95	UNID	EG	1152	4	16-Apr-1998	BURB	PR	229	1	13-Apr-2000	Burb	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	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	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	WAE	PRO	288	1
9-Apr-96	UNID	EG	252	1	28-Apr-1998	CARP	PR	1512	6	**2001**	No values calculated~flood			
11-Apr-96	FWD	JU	252	1	28-Apr-1998	UNID	PR	252	1	**2002**				
11-Apr-96	BURB	PR	252	1	30-Apr-1998	STIZ	PR	2016	8	4/2/2002	EMSH	JU	672	2
11-Apr-96	EMSH	JU	504	2	30-Apr-1998	CARP	PR	14364	57	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	PERC	PR	2268	9	4/4/2002	Carp	EG	672	2
11-Apr-96	BURB	PR	252	1	30-Apr-1998	MOON	PR	252	1	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	GORH	JU	252	1	4/4/2002	GIZ	JU	336	1
16-Apr-96	X	X	0	0	**1999**					4/4/2002	Carp	EG	1008	3
18-Apr-96	X	X	0	0	6-Apr-99	BURB	PR	522	2	4/4/2002	BURB	PR	1008	3
23-Apr-96	EMSH	JU	504	2	6-Apr-99	UNID	EG	4032	14	4/9/2002	GIZ	JU	336	1
23-Apr-96	UNID	EG	1008	4	9-Apr-99	GIZ	JU	288	1	4/9/2002	EMSH	JU	1008	3

Table 3. (cont) Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2002.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
2002 (cont)				
4/9/2002	BURB	PRO	672	2
4/9/2002	Carp	EG	288	1
4/11/2002	EMSH	JU	288	1
4/11/2002	BURB	PRO	864	3
4/11/2002	BURB	PRO	1800	5
4/11/2002	EMSH	JU	1800	5
4/11/2002	Cypr	JU	360	1
4/16/2002	EMSH	JU	336	1
4/16/2002	GIZ	JU	336	1
4/18/2002	EMSH	JU	336	1
4/23/2002	BURB	PRO	672	2
4/23/2002	BURB	PRO	1008	3
4/25/2002	BURB	PRO	672	2
4/25/2002	BURB	PRO	336	1

Table 4.	Estimated fish and fish egg impingement data for dates sampled (when fish and/or eggs were collected) in April 2002 with corresponding blowdown, river flow and temperatures.			
Date	Blowdown (cfs)	Average Daily R. Flow (cfs)	Avg. daily Inlet Temp. (F)	Est.avg daily 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

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	=	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

PINGP-019

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
ENVIRONMENTAL MONITORING
AND
ECOLOGICAL STUDIES PROGRAM

2003 ANNUAL REPORT

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

By
Environmental Services
Water Quality Department

TABLE OF CONTENTS

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

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 JANUARY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (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
		MONTHLY MINIMUM	32.0	34.5	612
		MONTHLY MAXIMUM	34.8	38.3	720
		MONTHLY MEAN	32.9	35.8	672

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**	OPERATING HOURS UNIT 1	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	33.3	36.8	720
3	24	24	33.3	37.1	720
4	24	24	32.4	36.6	648
5	24	24	33.6	36.3	648
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
	MONTHLY MINIMUM		31.9	35.2	588
	MONTHLY MAXIMUM		34.2	37.1	720
	MONTHLY MEAN		32.9	36.2	633

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 **MARCH**	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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	696
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	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
	MONTHLY MINIMUM		32.1	34.7	540
	MONTHLY MAXIMUM		41.5	42.5	875
	MONTHLY MEAN		36.2	38.2	722

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 **APRIL**	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	42.0	42.4	940
2	24	24	42.0	42.9	940
3	24	24	42.0	43.9	948
4	24	24	40.5	41.1	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	0	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

	RIVER INLET TEMP.	SITE DISCHARGE TEMP.	MEAN SITE DISCHARGE FLOW
MONTHLY MINIMUM	38.3	39.3	144
MONTHLY MAXIMUM	53.9	55.5	948
MONTHLY MEAN	46.6	47.8	525

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**	OPERATING HOURS UNIT 1	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
	MONTHLY MINIMUM		54.3	55.3	259
	MONTHLY MAXIMUM		65.1	66.4	291
	MONTHLY MEAN		58.2	59.5	283

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 JUNE	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°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	73.3	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
	MONTHLY MINIMUM		63.7	64.6	350
	MONTHLY MAXIMUM		74.1	75.0	835
	MONTHLY MEAN		69.3	70.1	566

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 JULY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	72.6	72.8	760
2	24	24	73.0	73.9	1138
3	24	24	72.8	74.4	1166
4	24	24	75.4	76.7	1166
5	24	24	75.1	76.6	1166
6	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
	MONTHLY MINIMUM		72.6	72.8	760
	MONTHLY MAXIMUM		77.2	80.1	1194
	MONTHLY 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 **AUGUST**	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (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	76.5	78.8	1194
10	24	24	76.8	79.2	1194
11	24	24	77.2	79.8	1194
12	24	24	76.9	79.3	1180
13	24	24	77.3	79.8	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
	MONTHLY MINIMUM		73.9	76.5	1124
	MONTHLY MAXIMUM		79.8	82.3	1208
	MONTHLY MEAN		77.3	79.7	1185

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	OPERATING HOURS UNIT 1	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
	MONTHLY MINIMUM		56.1	58.0	600
	MONTHLY MAXIMUM		73.7	77.5	1166
	MONTHLY MEAN		68.0	70.3	857

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 OCTOBER	OPERATING HOURS UNIT 1	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
3	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	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	51.8	1116
* Daylight savings					
	MONTHLY MINIMUM		48.2	51.8	600
	MONTHLY MAXIMUM		61.2	64.3	1165
	MONTHLY MEAN		55.7	59.4	1001

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 NOVEMBER	OPERATING HOURS UNIT 1	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	822
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
	MONTHLY MINIMUM		35.4	39.0	815
	MONTHLY MAXIMUM		47.0	50.8	1100
	MONTHLY MEAN		40.9	44.4	898

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	OPERATING HOURS UNIT 1	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	35.8	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
	MONTHLY MINIMUM		33.1	36.4	808
	MONTHLY MAXIMUM		36.5	39.4	828
	MONTHLY MEAN		35.0	37.7	817

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	9700	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		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	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 61100
YEA[illegible] 3900

Table 3 2003 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

Month	Mean Plant Flow (cfs)	Mean River Flow (cfs)	Percentage of Mean River Flow 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%

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

Month	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
January	9,229	10,932	11,271	8,974	10,790	9,806	14,823	14,826	11,365	13,090	9,326
February	7,871	10,104	10,471	9,548	12,589	14,911	13,954	15,041	9,371	12,611	8,936
March	13,210	11,497	10,948	22,219	17,897	26,574	24,177	24,474	29,061	28,542	12,513
April	25,613	40,657	112,703	15,570	42,013	51,477	106,073	57,517	48,507	40,830	55,473
May	42,194	33,974	82,661	18,839	47,426	22,681	39,316	46,535	45,135	47,548	48,571
June	27,413	26,323	53,177	22,070	34,423	25,690	19,487	33,790	30,667	26,913	65,377
July	32,739	34,597	23,981	21,052	27,548	26,477	36,119	23,732	27,323	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	20,173	18,773
December	8,310	12,135	13,813	9,558	9,671	15,645	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	1989	1988	1987	1986	1985	1984	1983
January	15,658	5,542	4,965	6,294	7,303	13,758	13,710	12,526	13,375	14,260
February	13,978	5,879	4,889	6,529	7,634	12,586	12,804	10,239	18,557	13,375
March	43,661	15,081	17,484	11,300	14,810	17,287	24,790	32,265	27,290	55,276
April	32,668	34,268	12,842	33,264	21,463	20,267	84,870	45,317	56,277	56,239
May	25,474	44,753	22,310	24,287	13,119	13,655	81,242	43,518	49,528	38,155
June	17,920	44,960	31,610	13,237	4,667	14,573	37,043	30,105	55,613	24,404
July	28,985	33,856	20,323	7,690	2,903	11,674	34,684	25,676	37,165	36,353
August	14,532	21,535	16,322	4,658	5,103	10,477	30,813	18,226	13,826	14,141
September	15,686	25,182	9,923	8,307	6,080	7,183	41,957	29,665	9,678	14,213
October	15,374	15,458	11,135	6,358	7,019	7,771	49,319	39,590	23,866	17,536
November	19,076	22,467	9,903	6,793	7,919	8,693	24,260	21,337	21,157	18,108
December	12,126	20,503	6,184	4,961	6,487	9,016	17,774	16,094	15,903	16,729
Averages	**21,262**	**24,124**	**13,991**	**11,140**	**8,709**	**12,245**	**37,787**	**27,047**	**28,519**	**26,566**

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 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

SUMMARY OF THE 2003 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, 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.

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

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 redhorse
Sector Two;	freshwater drum, carp, and smallmouth bass
Sector Three;	white bass, freshwater drum and smallmouth bass
Sector Four;	white bass, freshwater drum and shorthead redhorse
Overall 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).

WALLEYE

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

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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Figure 1

PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA

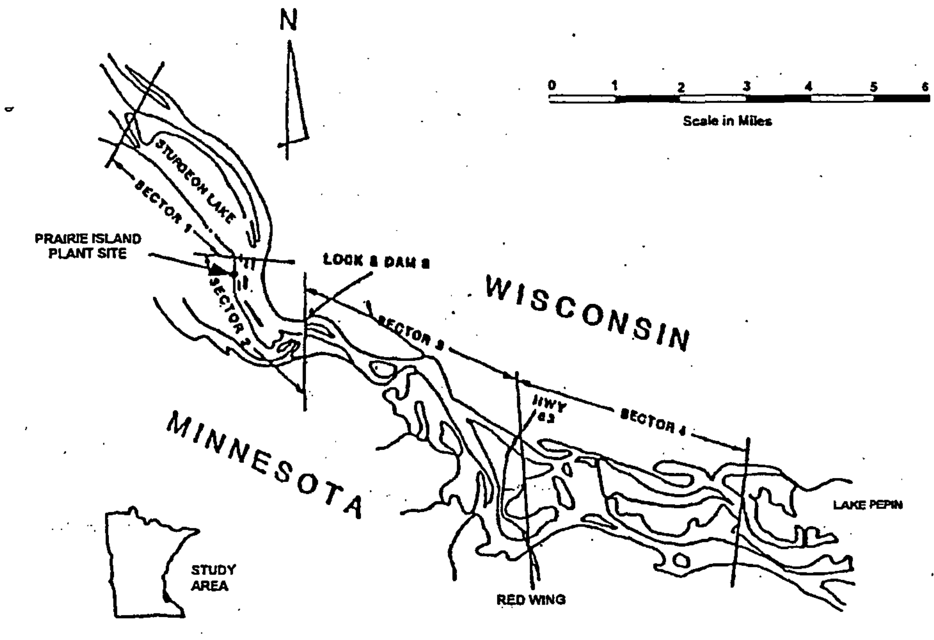


FIGURE 2.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Upstream
Sec 1 Runs 1-20

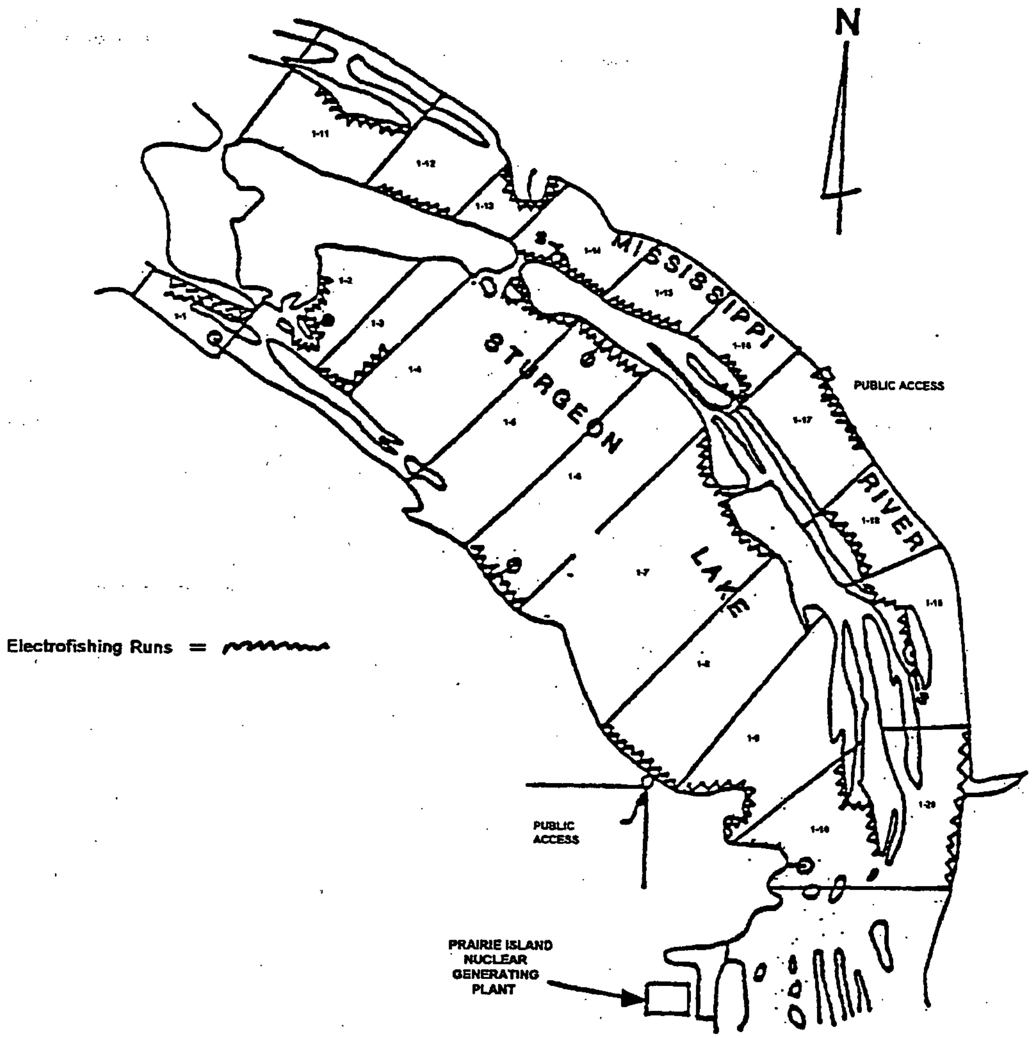


Figure 3.

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

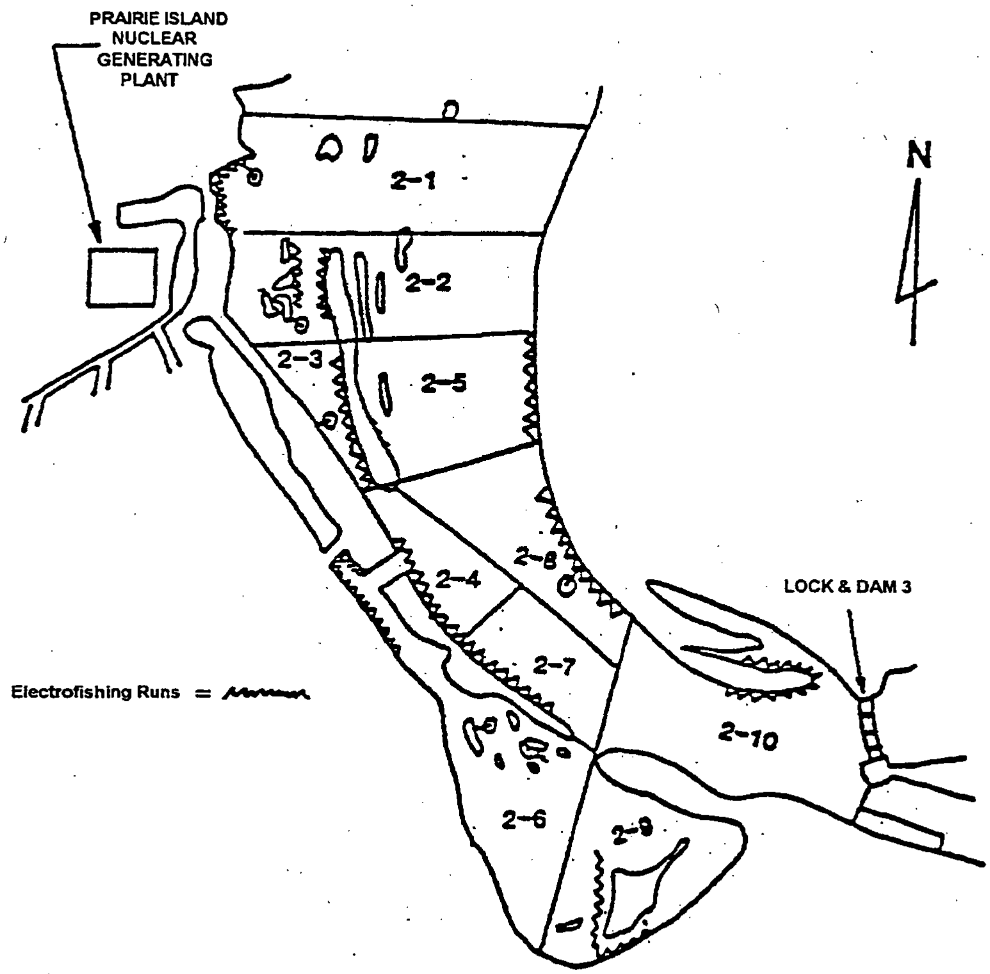


Figure 4.

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

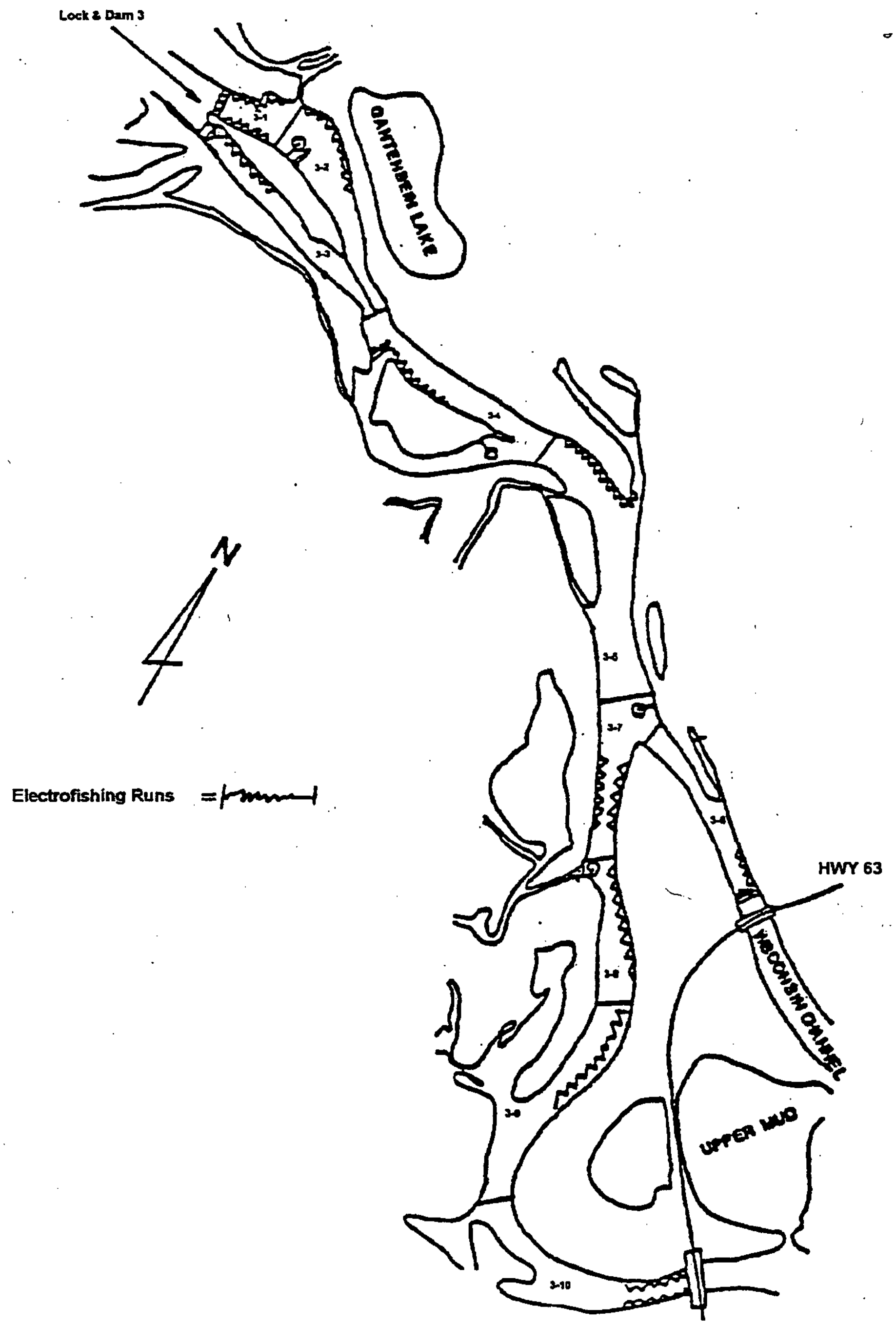
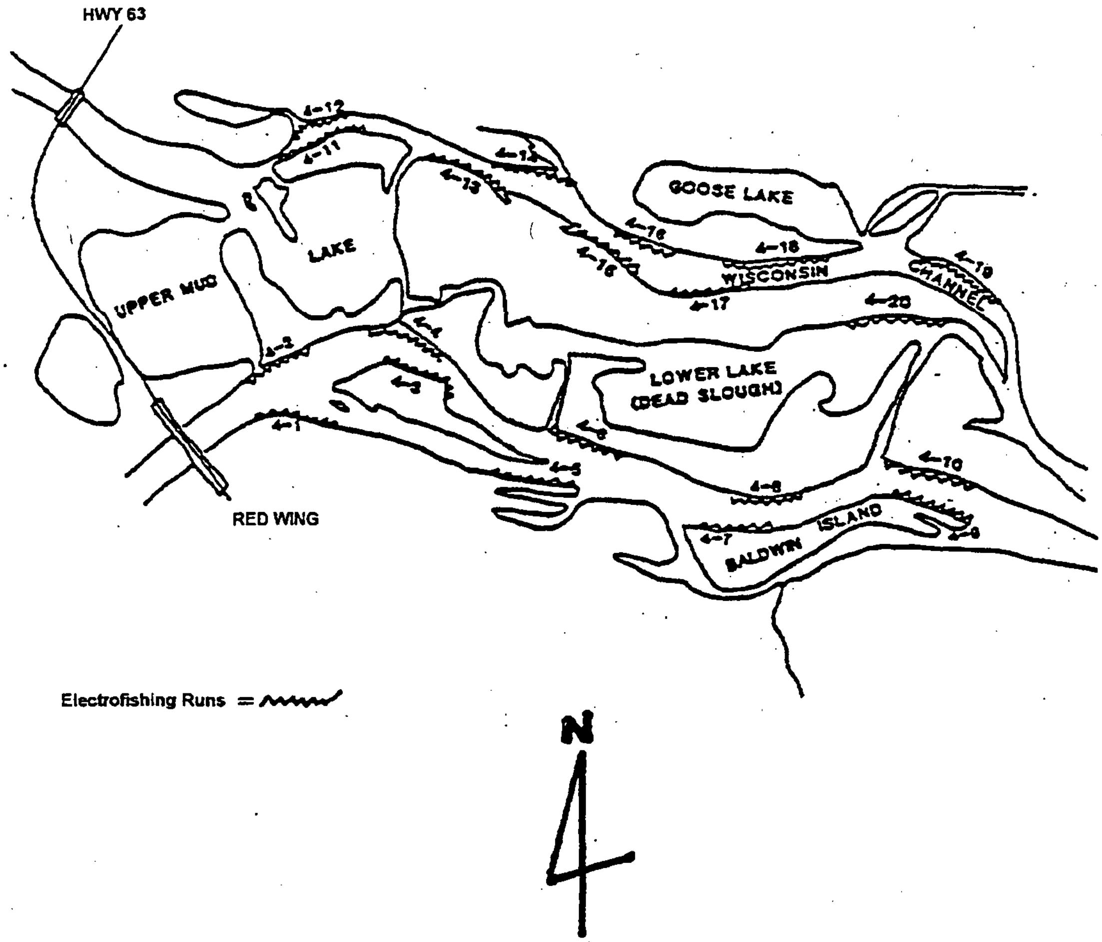


Figure 5.

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



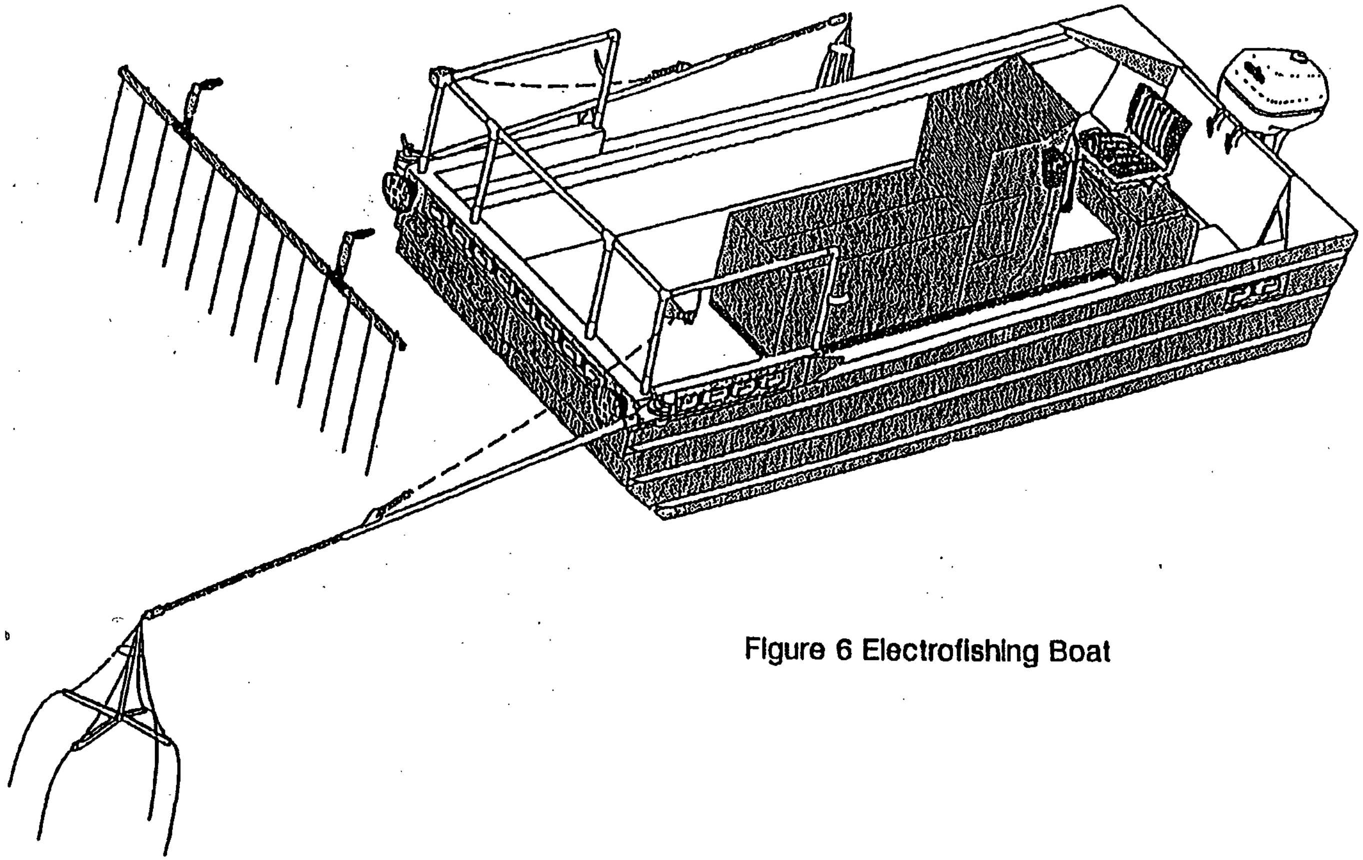


Figure 6 Electrofishing Boat

Figure 7

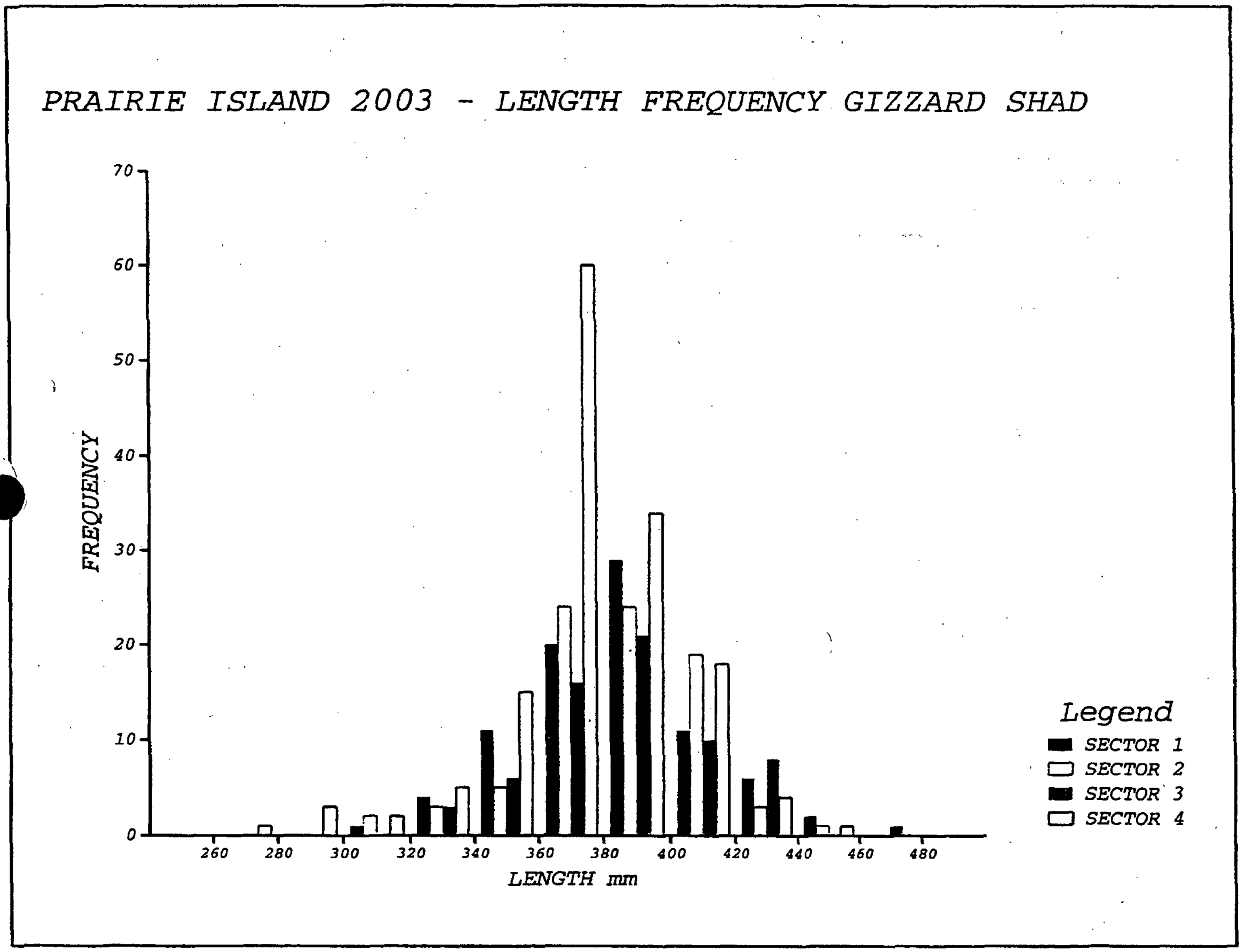
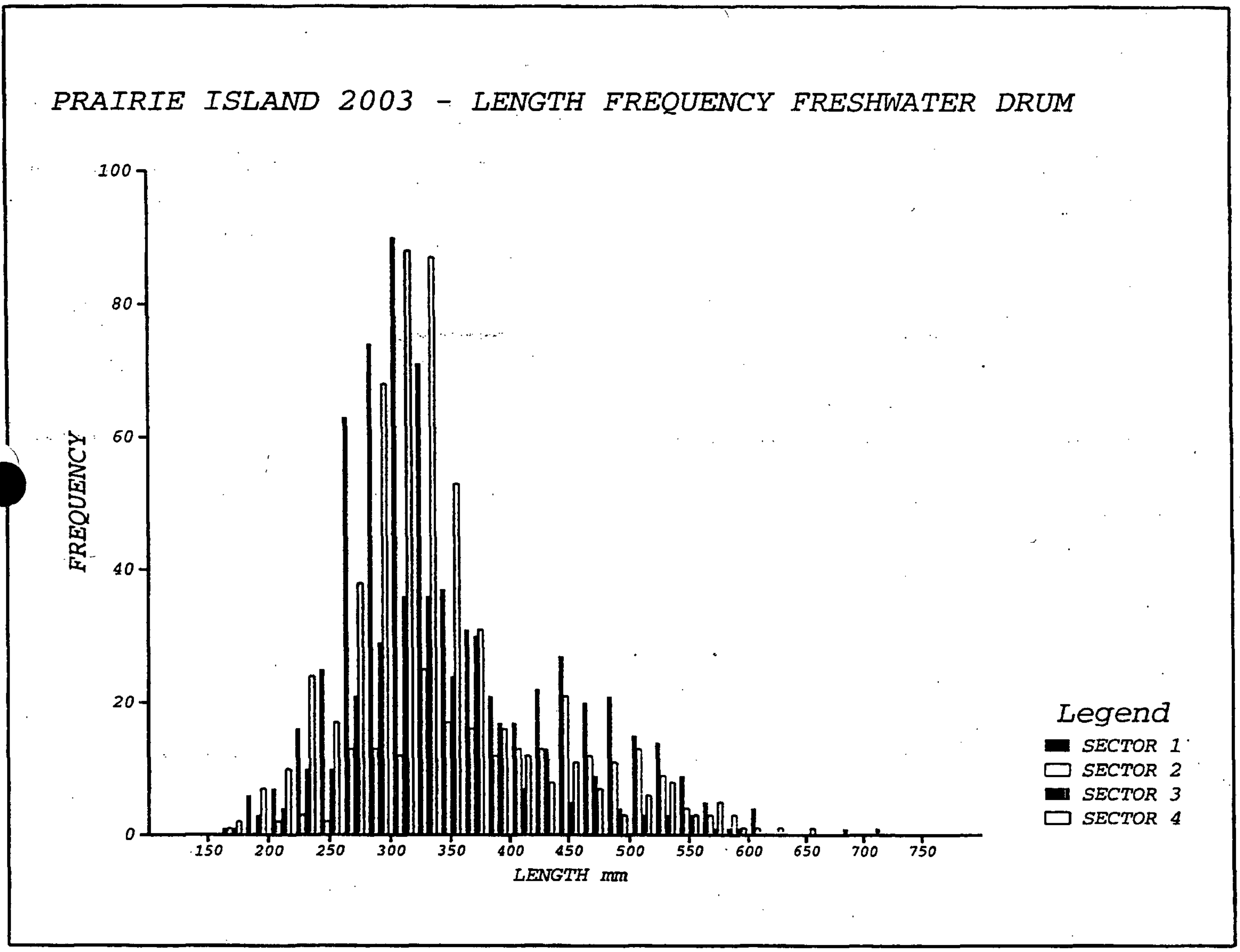

PRAIRIE ISLAND 2003 - LENGTH FREQUENCY GIZZARD SHAD
70
60
50
40
30
20
10
0
FREQUENCY
260
280
300
320
340
360
380
400
420
440
460
480
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 8



PRAIRIE ISLAND 2003 - LENGTH FREQUENCY FRESHWATER DRUM
FREQUENCY
100
80
60
40
20
0
150
200
250
300
350
400
450
500
550
600
650
700
750
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 9

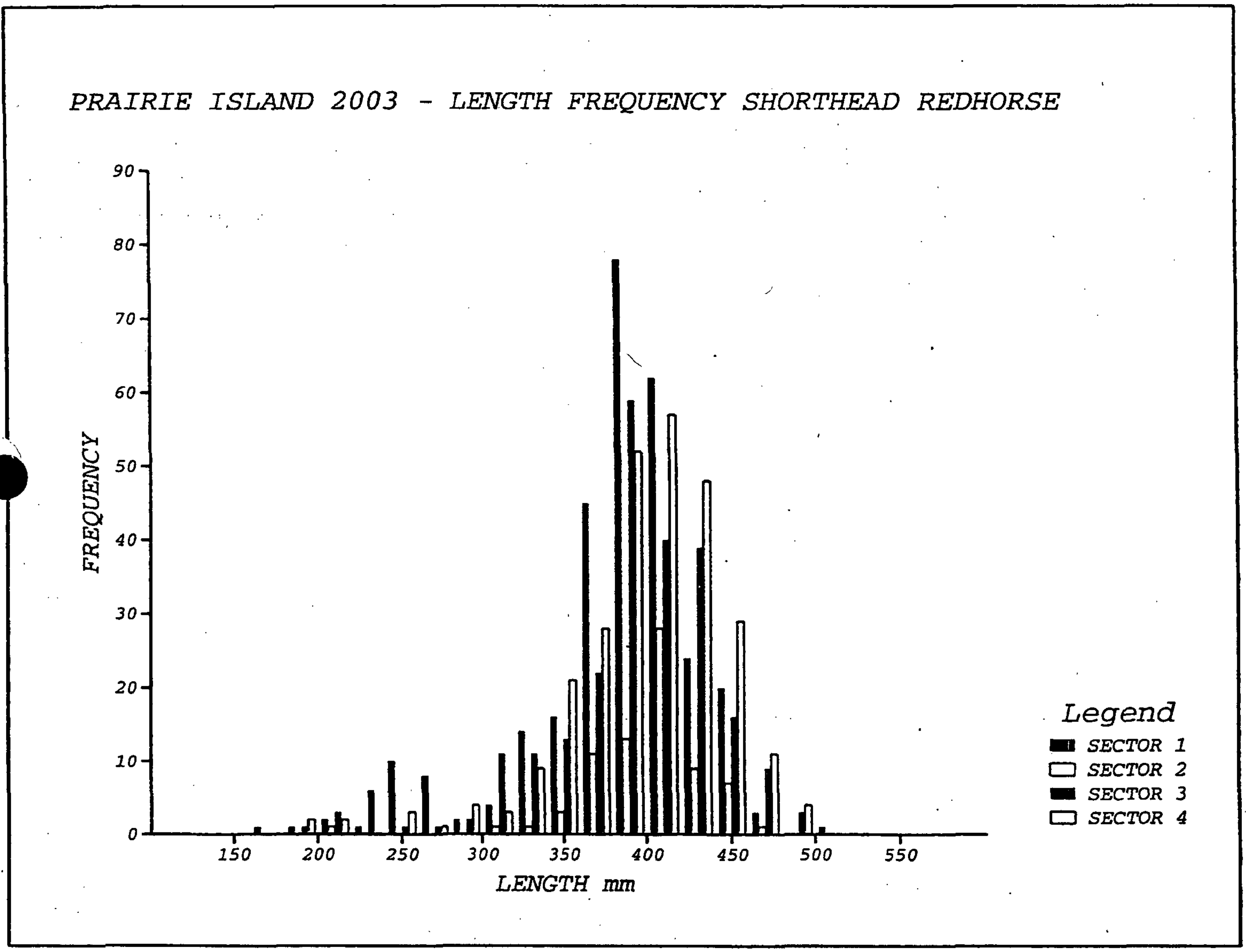

PRAIRIE ISLAND 2003 - LENGTH FREQUENCY SHORTHEAD REDHORSE
FREQUENCY
90
80
70
60
50
40
30
20
10
0
150
200
250
300
350
400
450
500
550
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 10

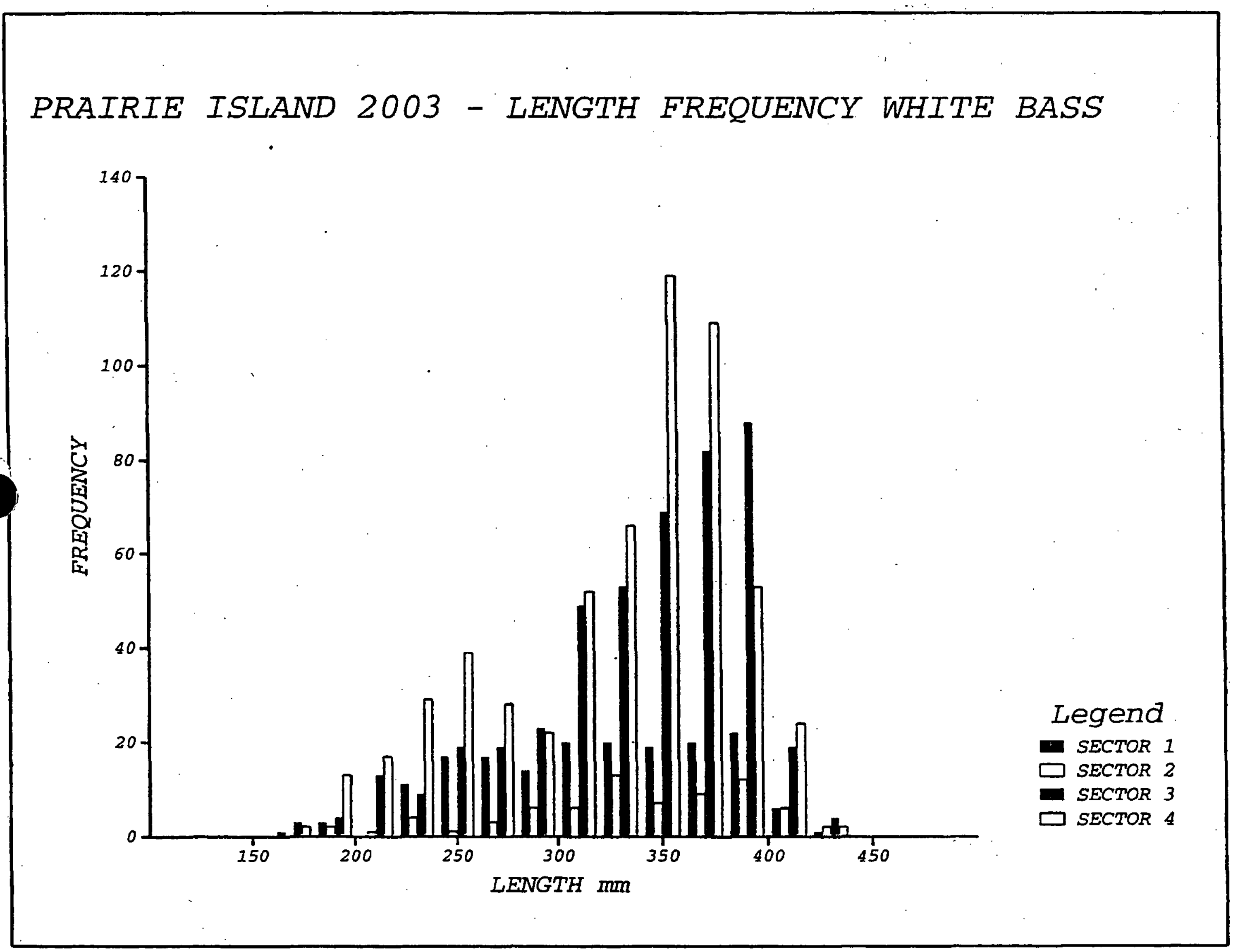

PRAIRIE ISLAND 2003 - LENGTH FREQUENCY WHITE BASS
140
120
100
80
60
40
20
0
FREQUENCY
150
200
250
300
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 11

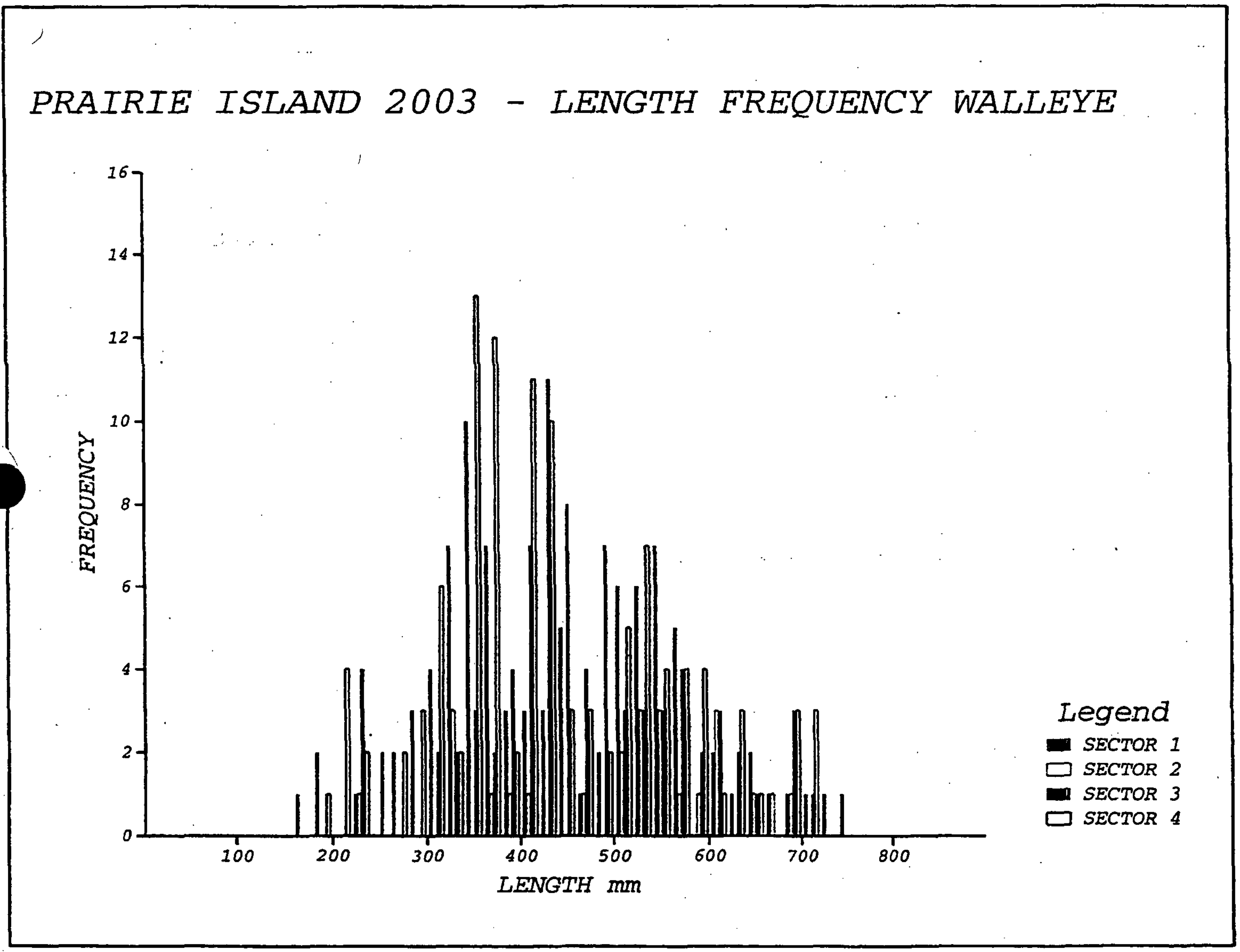

PRAIRIE ISLAND 2003 - LENGTH FREQUENCY WALLEYE
FREQUENCY
0
2
4
6
8
10
12
14
16
100
200
300
400
500
600
700
800
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 12

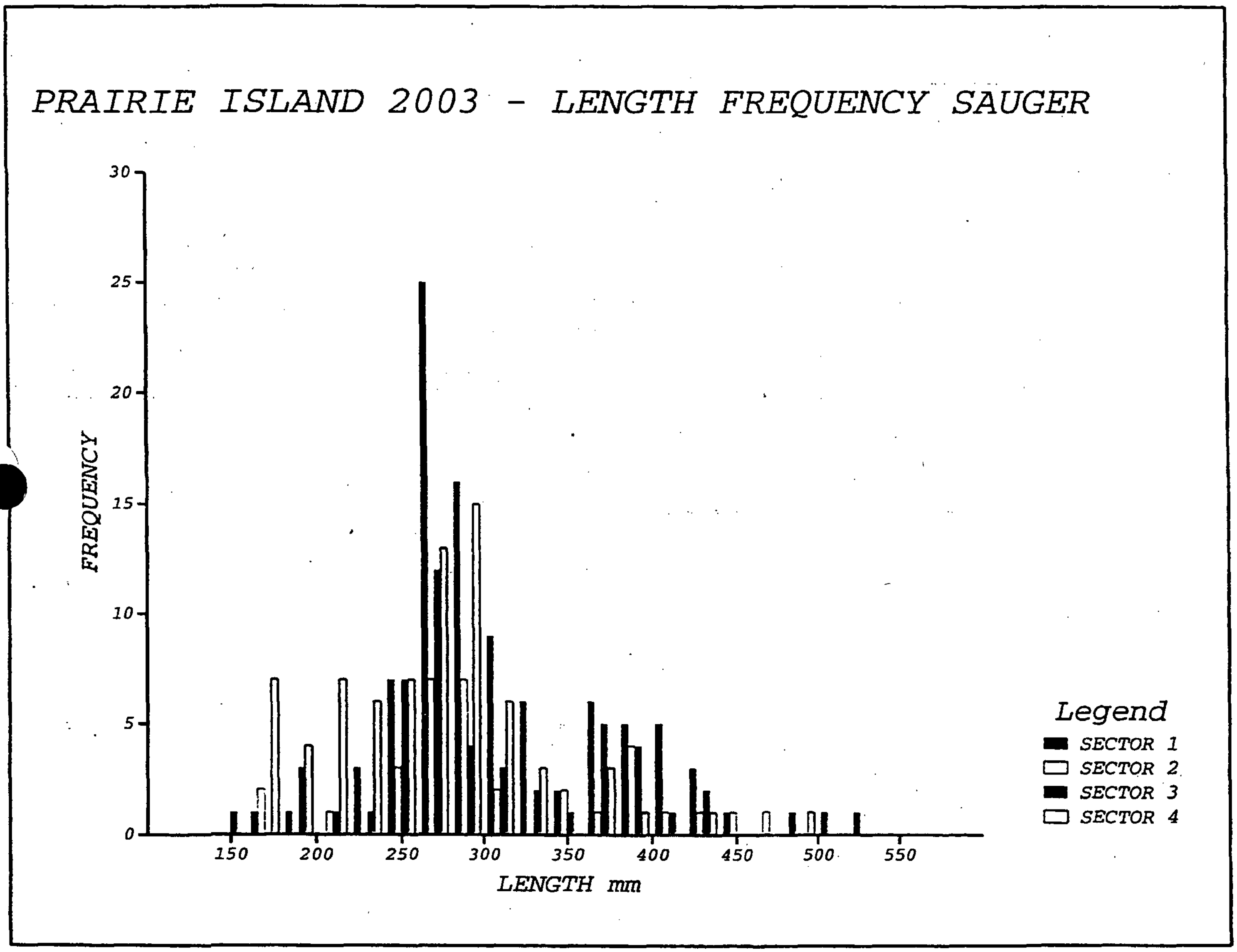

PRAIRIE ISLAND 2003 - LENGTH FREQUENCY SAUGER
30
25
20
15
10
5
0
FREQUENCY
150
200
250
300
350
400
450
500
550
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 13

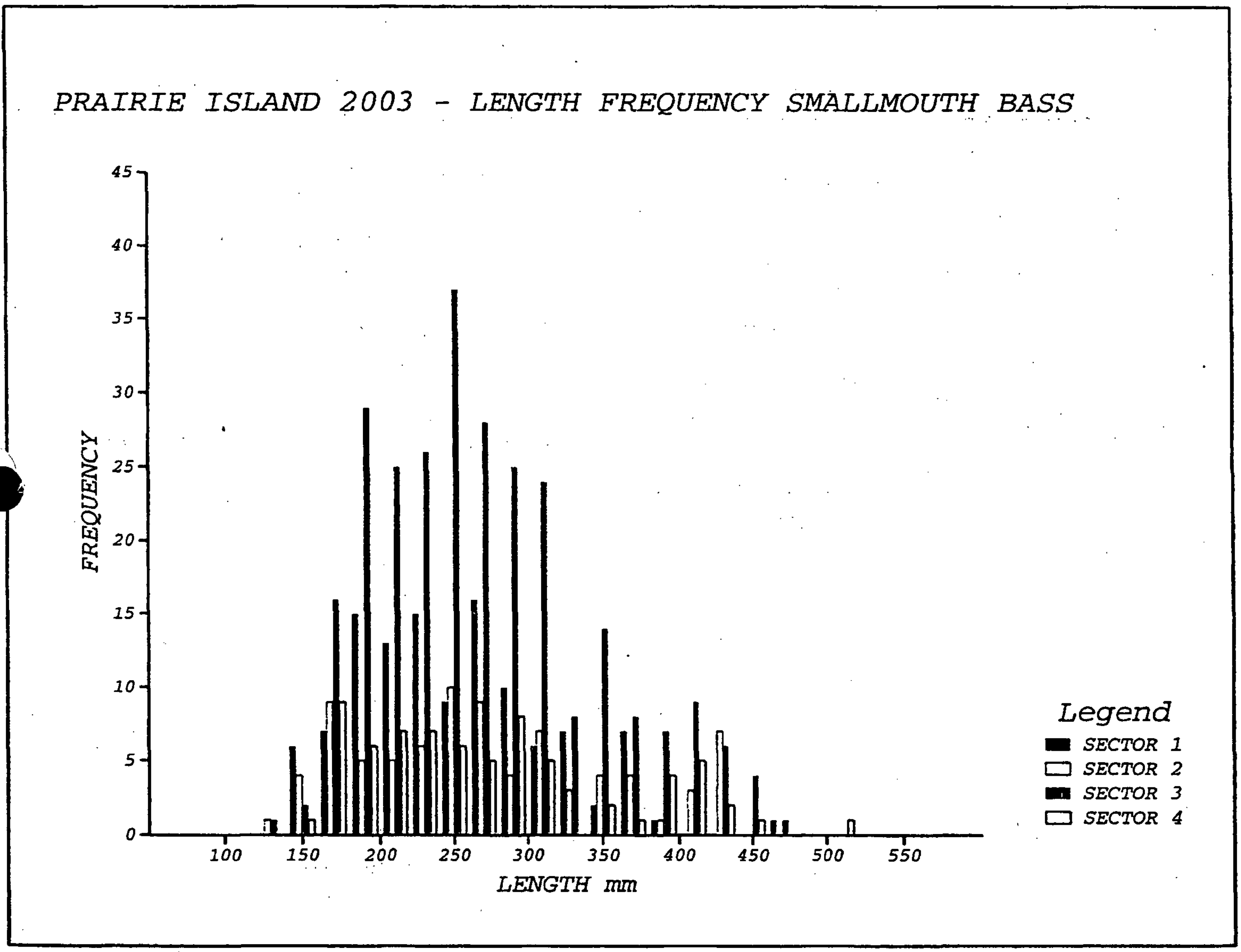

PRAIRIE ISLAND 2003 - LENGTH FREQUENCY SMALLMOUTH BASS
FREQUENCY
0
5
10
15
20
25
30
35
40
45
100
150
200
250
300
350
400
450
500
550
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 14

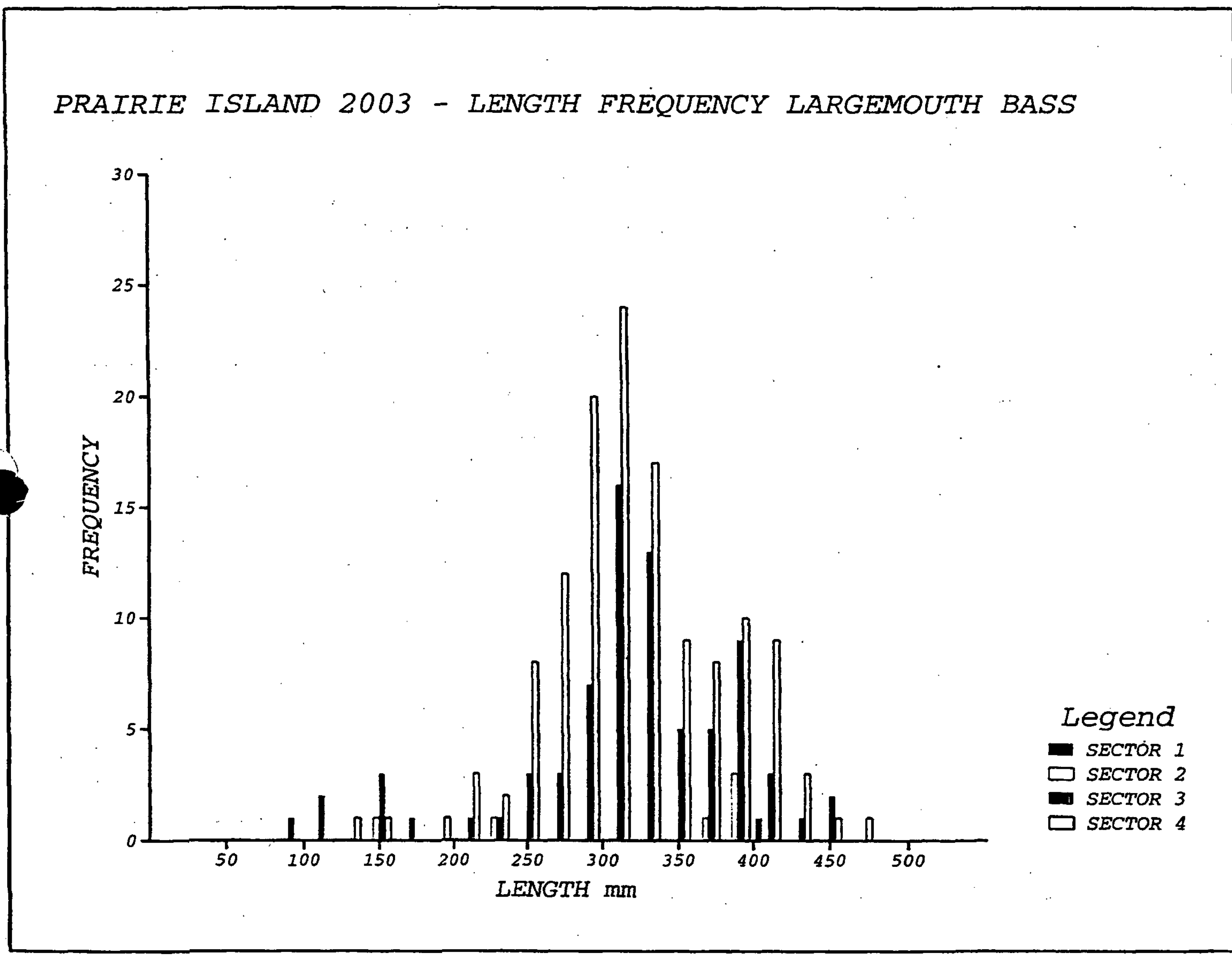

PRAIRIE ISLAND 2003 - LENGTH FREQUENCY LARGEMOUTH BASS
FREQUENCY
30
25
20
15
10
5
0
50
100
150
200
250
300
350
400
450
500
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

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

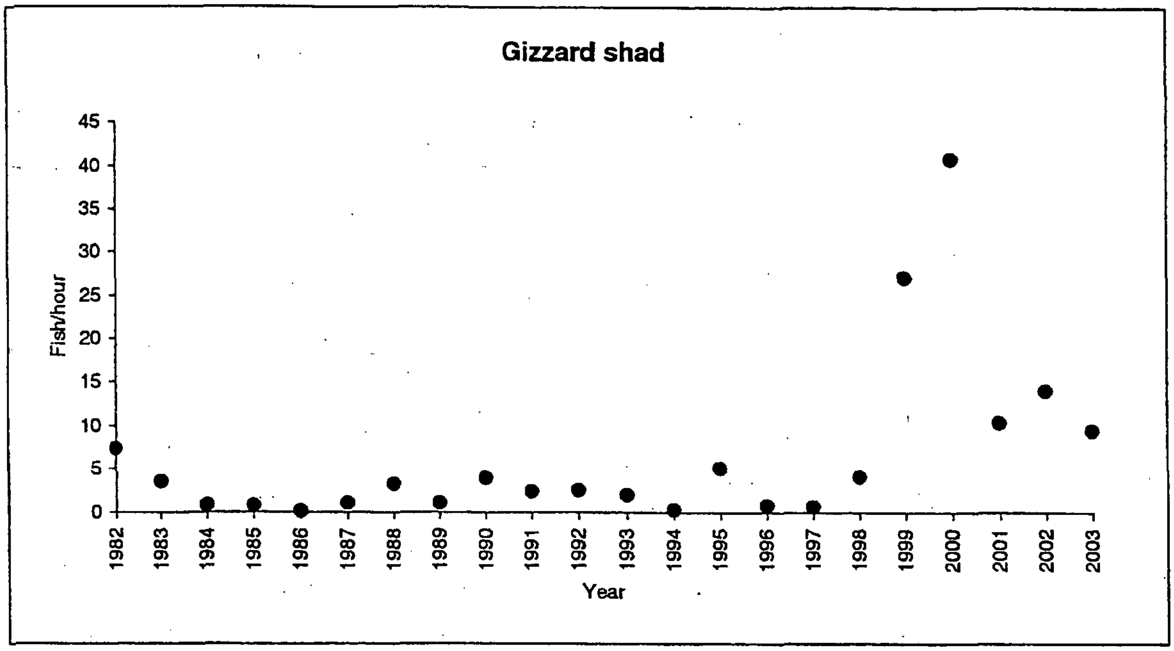


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2003 in the vicinity of PINGP.

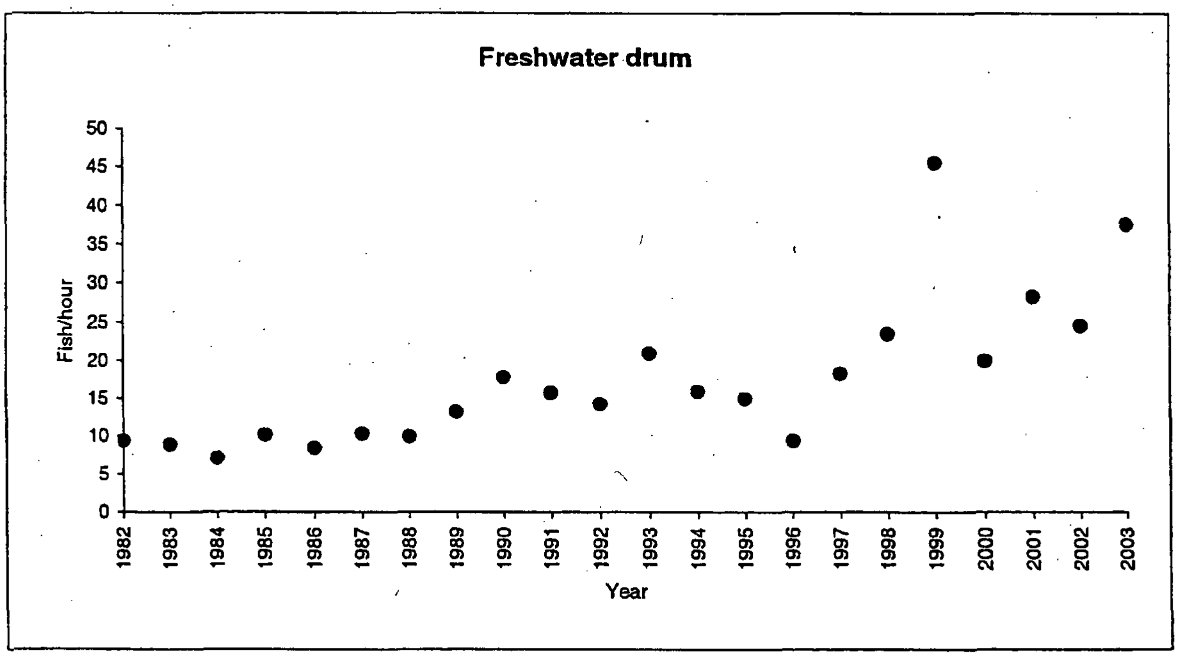


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2003 in the vicinity of PINGP.

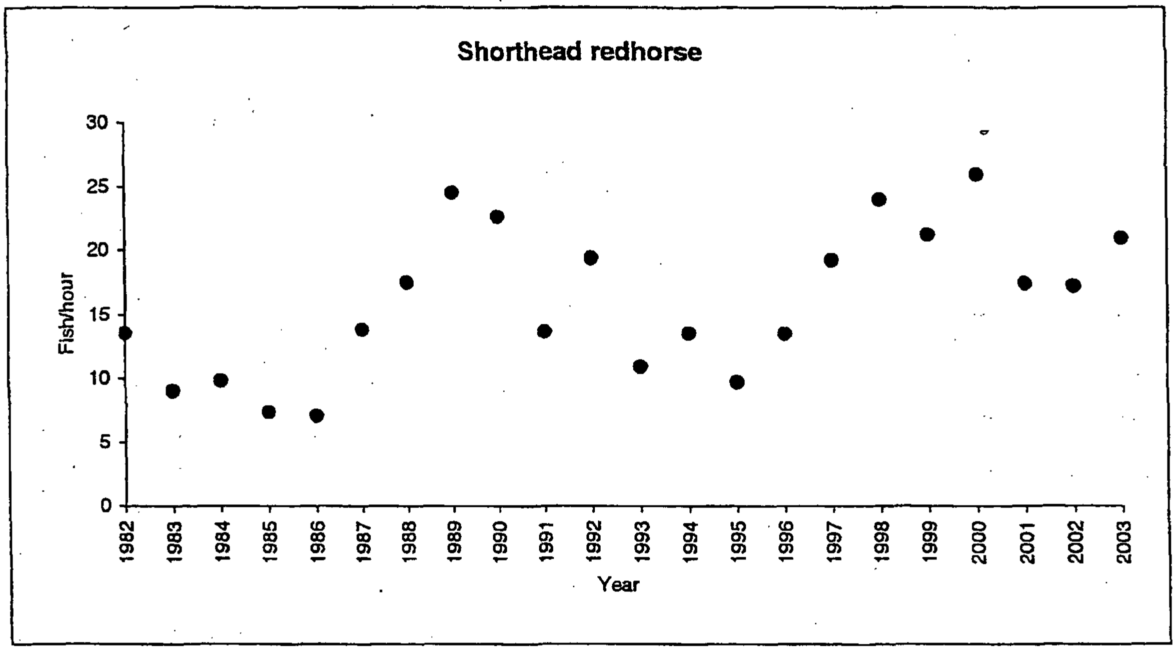


Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2003 in the vicinity of PINGP.

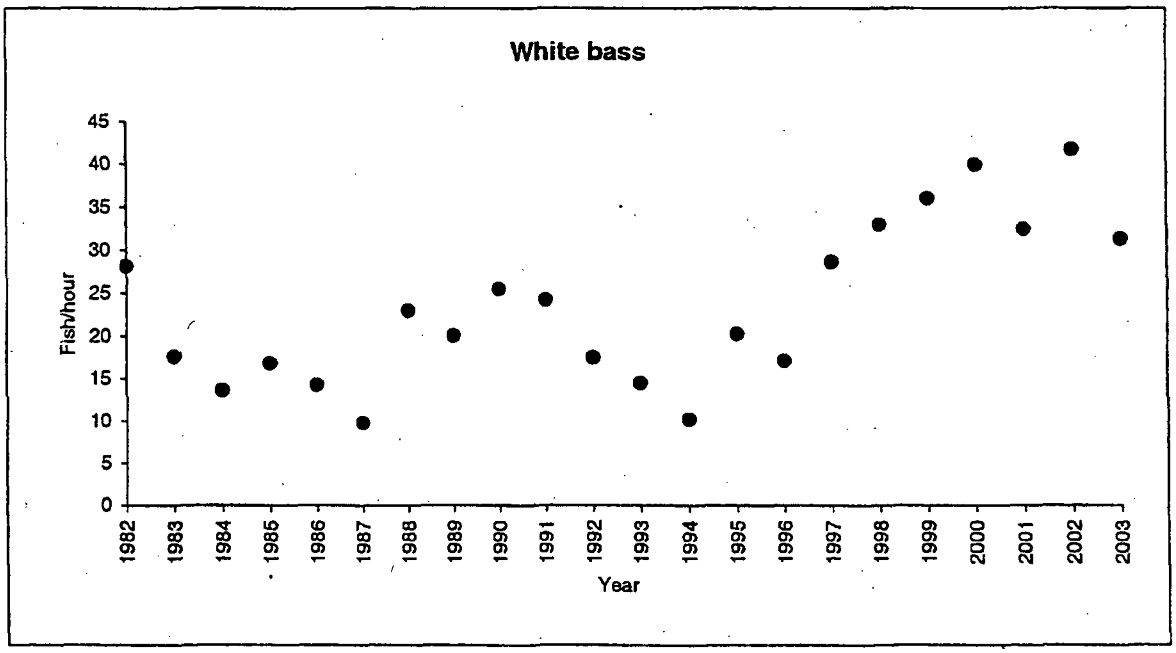


Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2003 in the vicinity of PINGP.

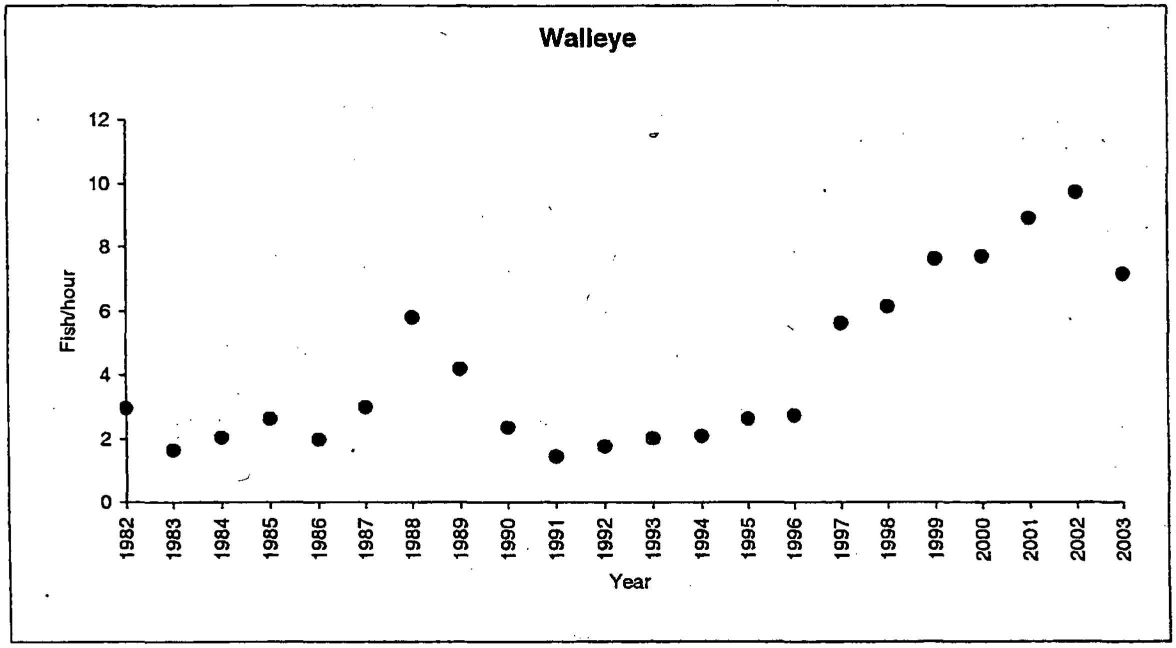


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2003 in the vicinity of PINGP.

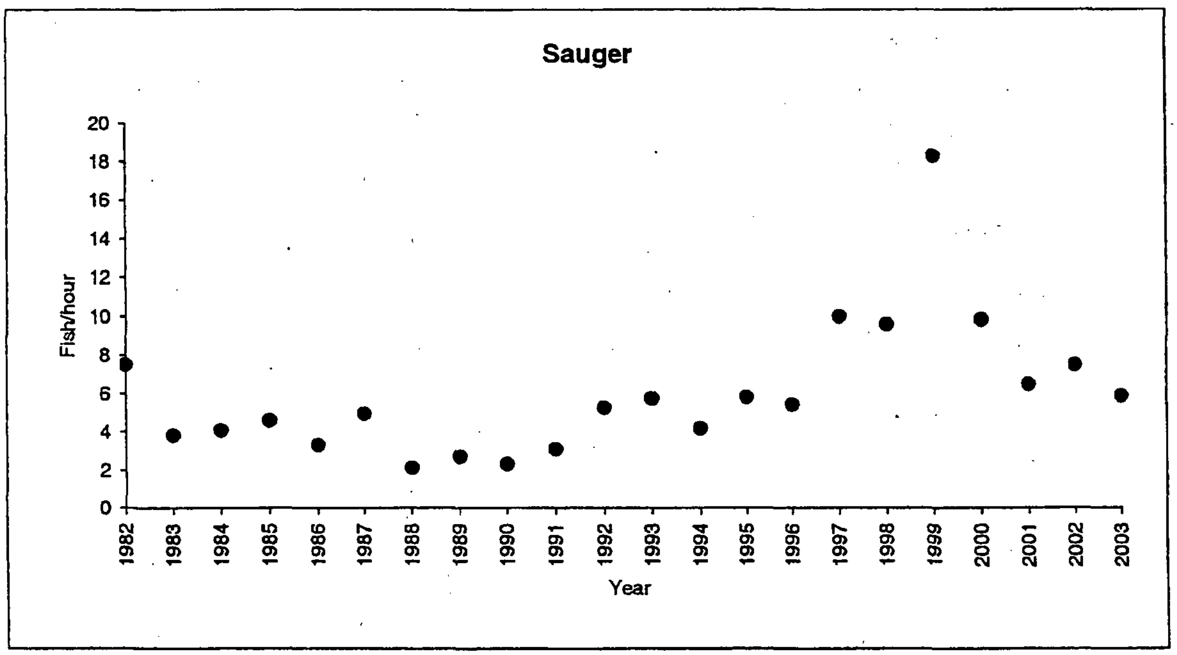


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2003 in the vicinity of PINGP.

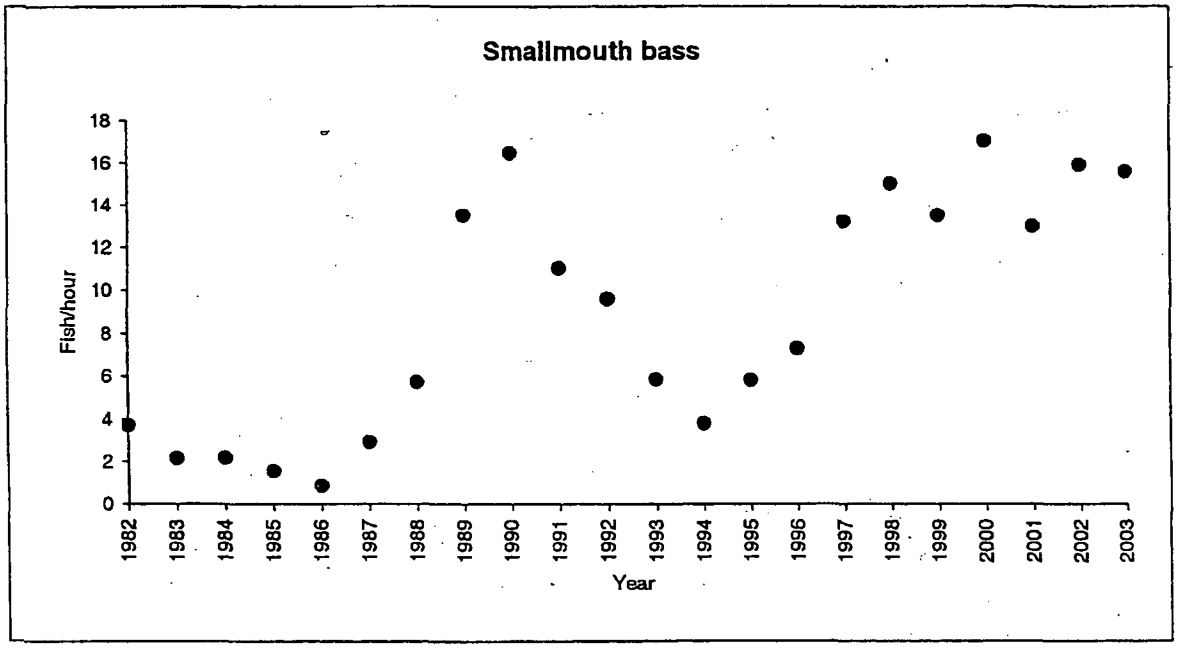


Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2003 in the vicinity of PINGP.

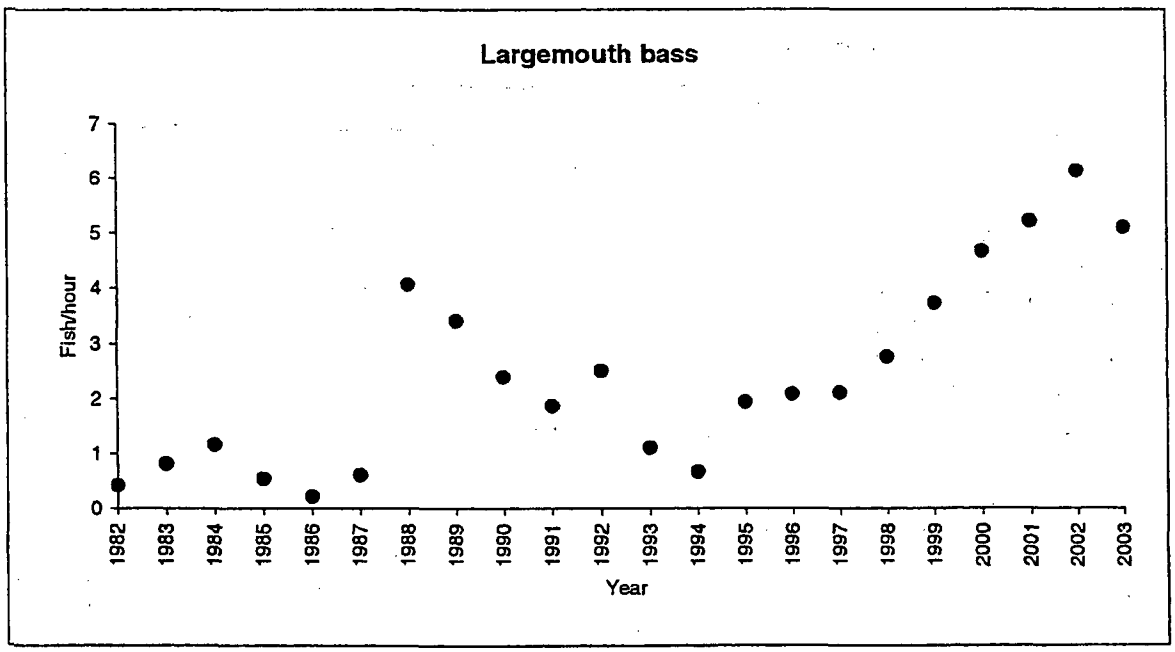
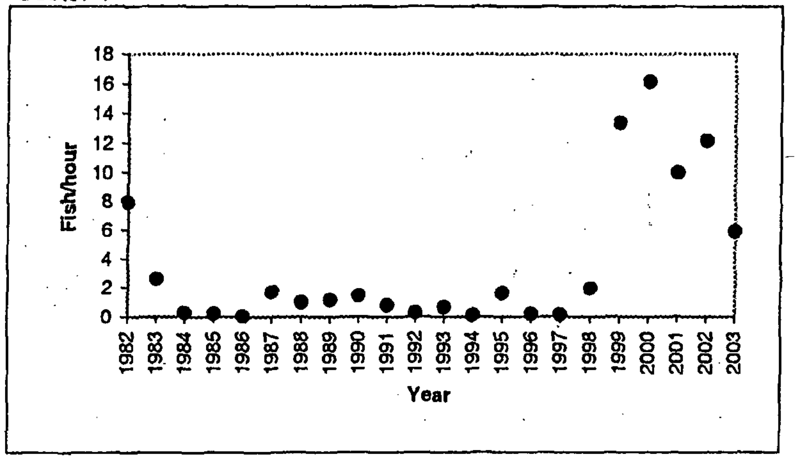
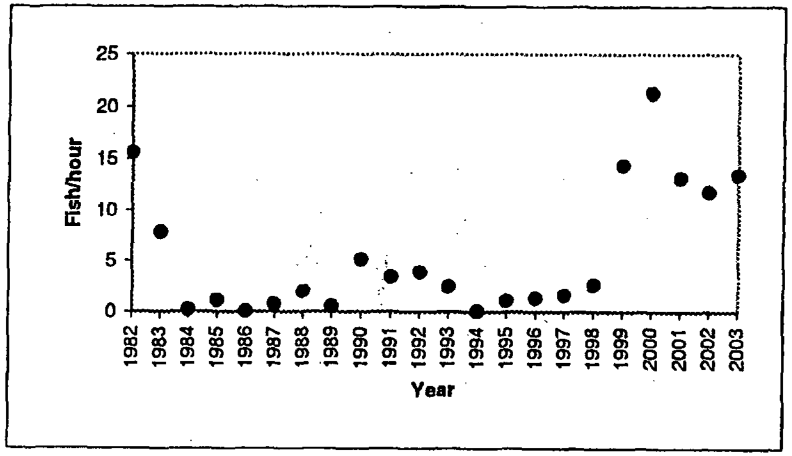


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2003 in the vicinity of PINGP.

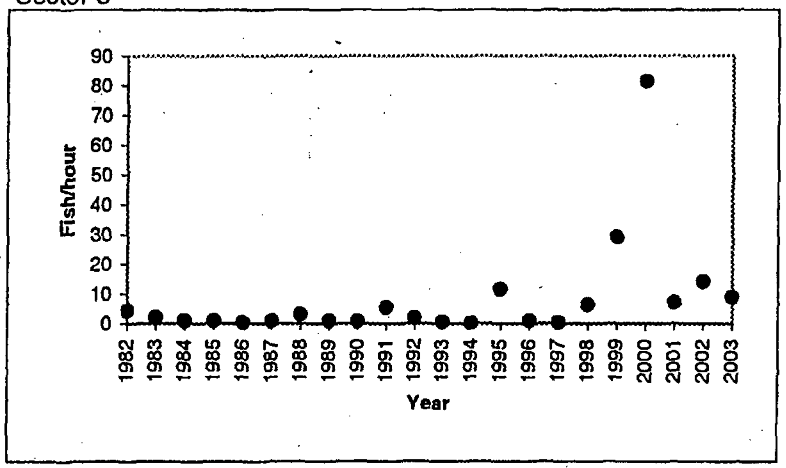
Sector 1



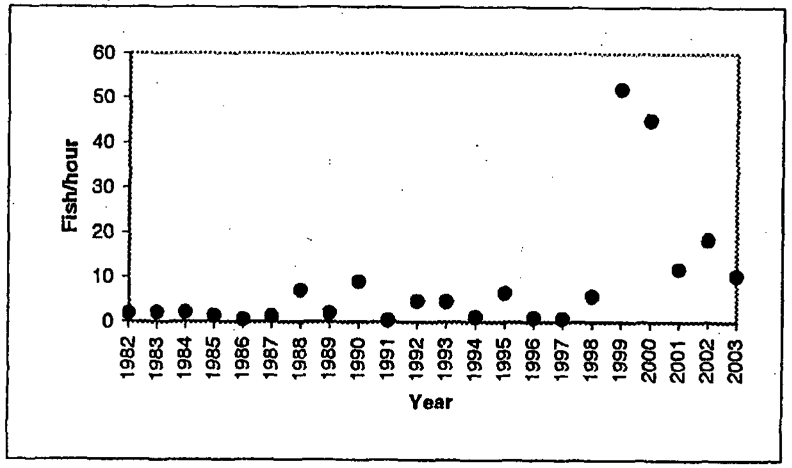
Sector 2



Sector 3



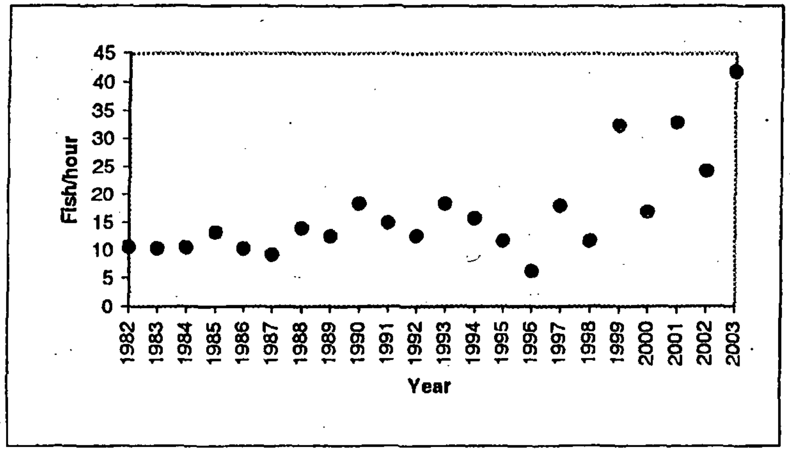
Sector 4



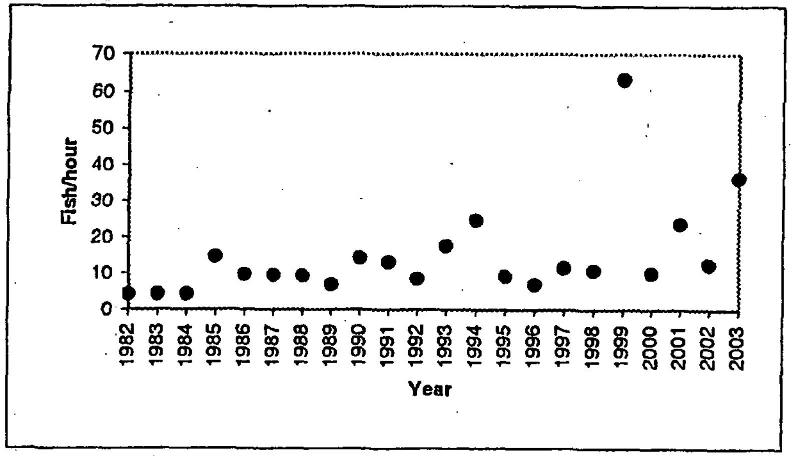
2003FIGUR.XLS

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

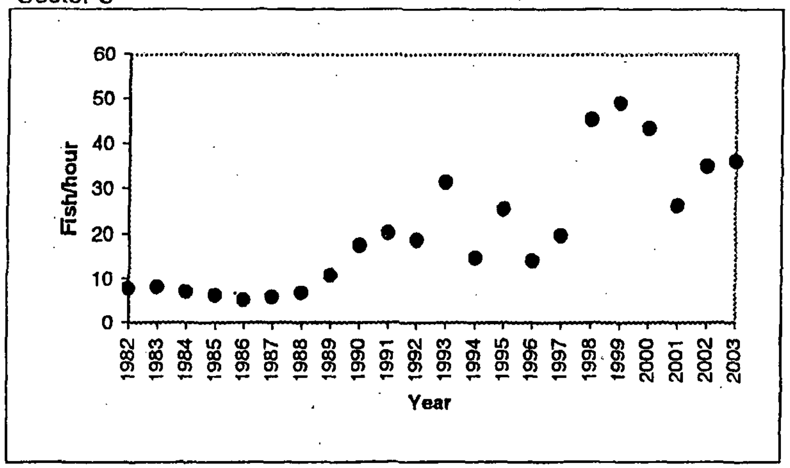
Sector 1



Sector 2



Sector 3



Sector 4

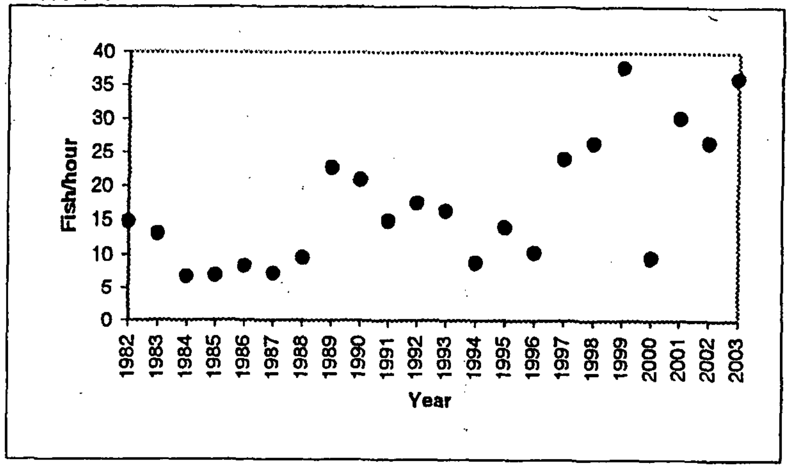


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2003 in the vicinity of PINGP.

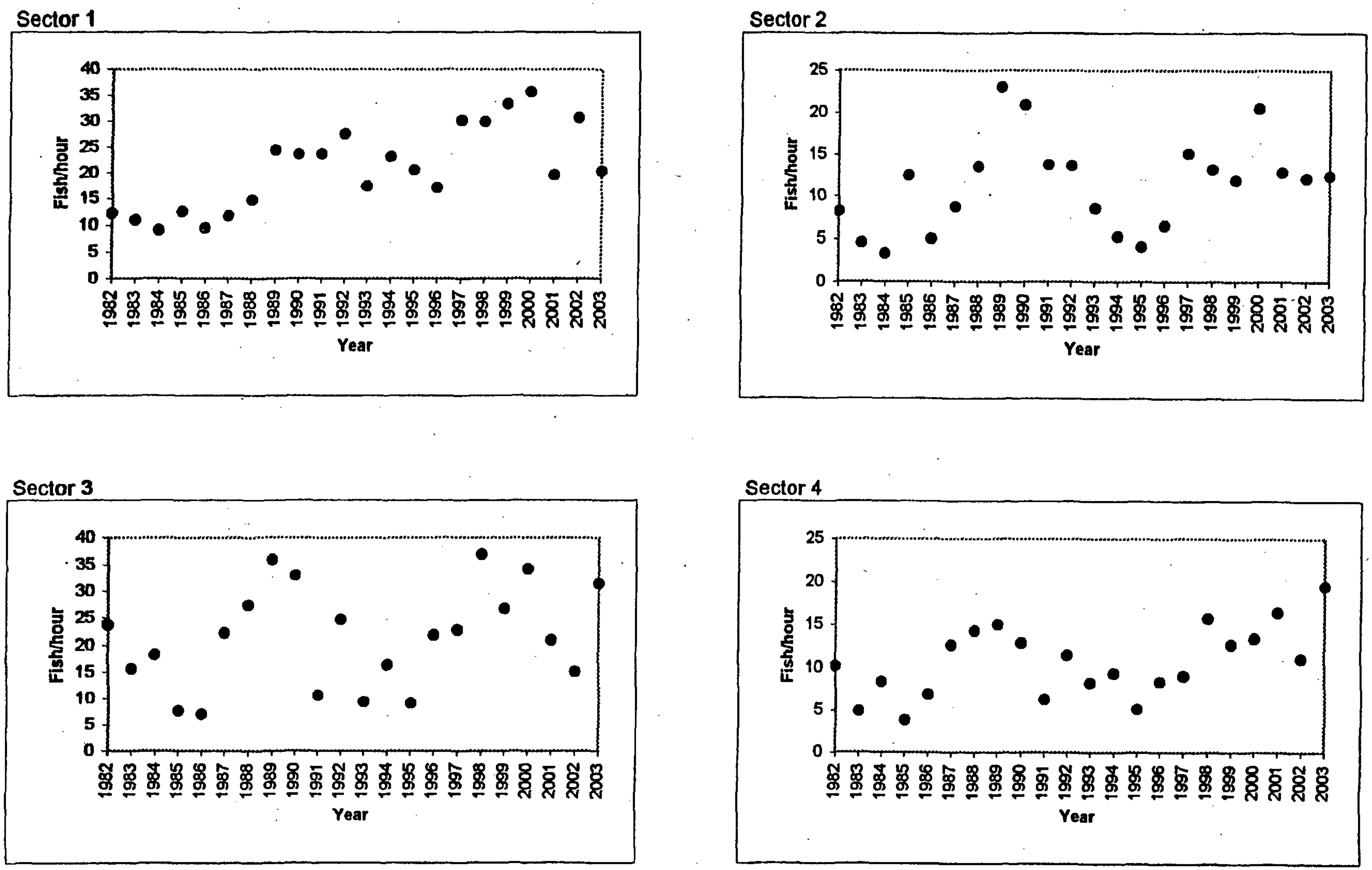


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2003 in the vicinity of PINGP.

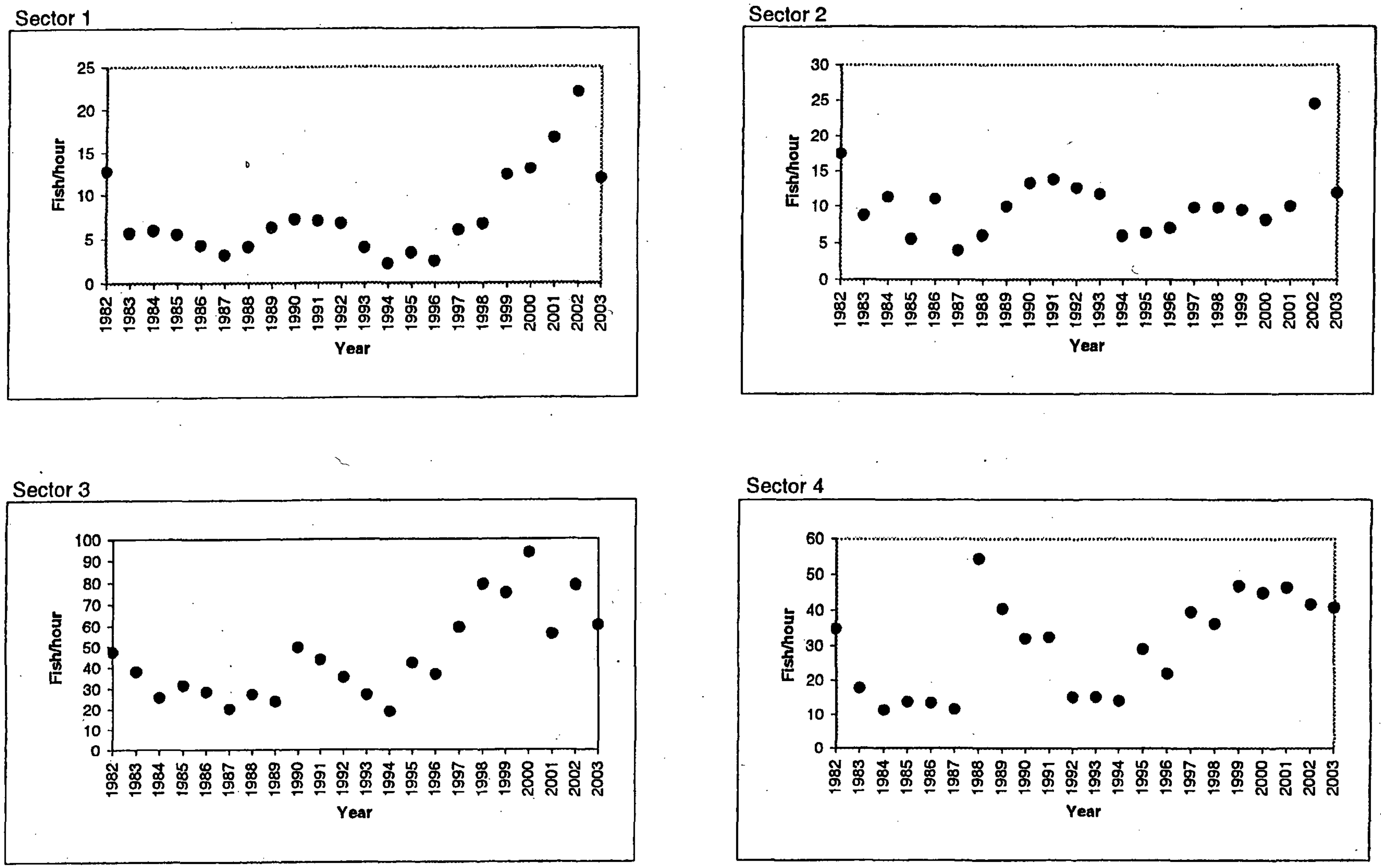
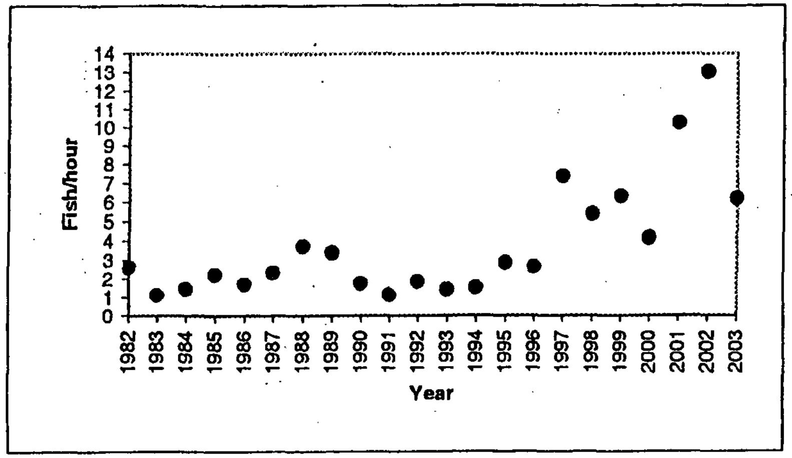
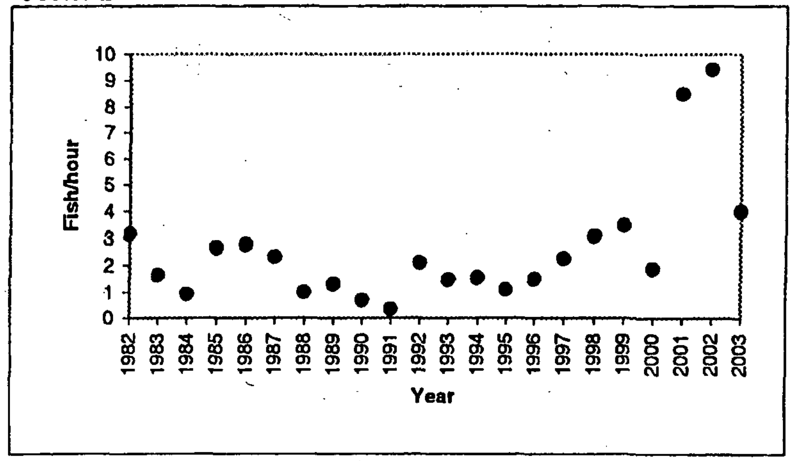


Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2003 in the vicinity of PINGP.

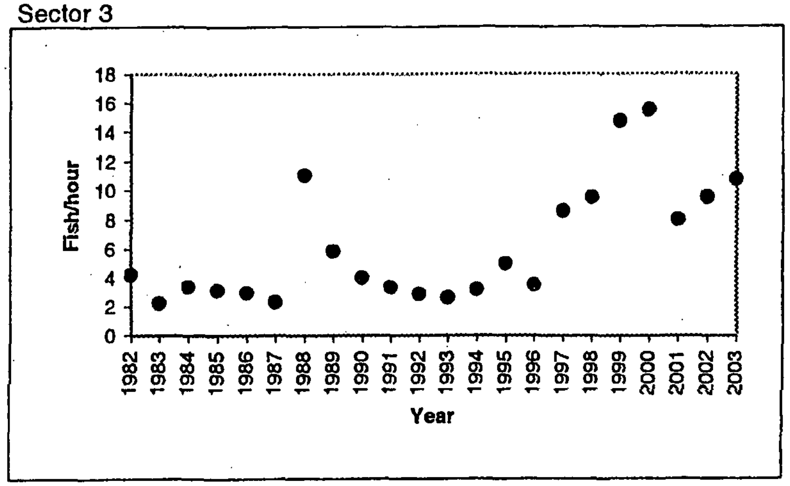
Sector 1



Sector 2



Sector 3



Sector 4

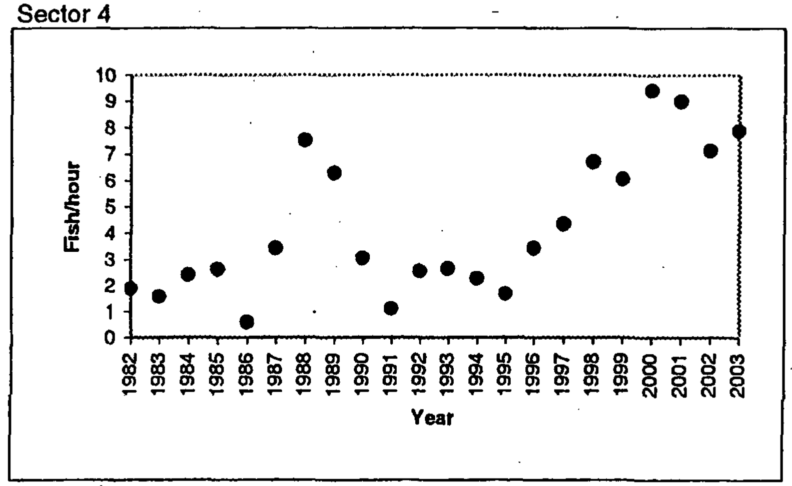


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2003 in the vicinity of PINGP

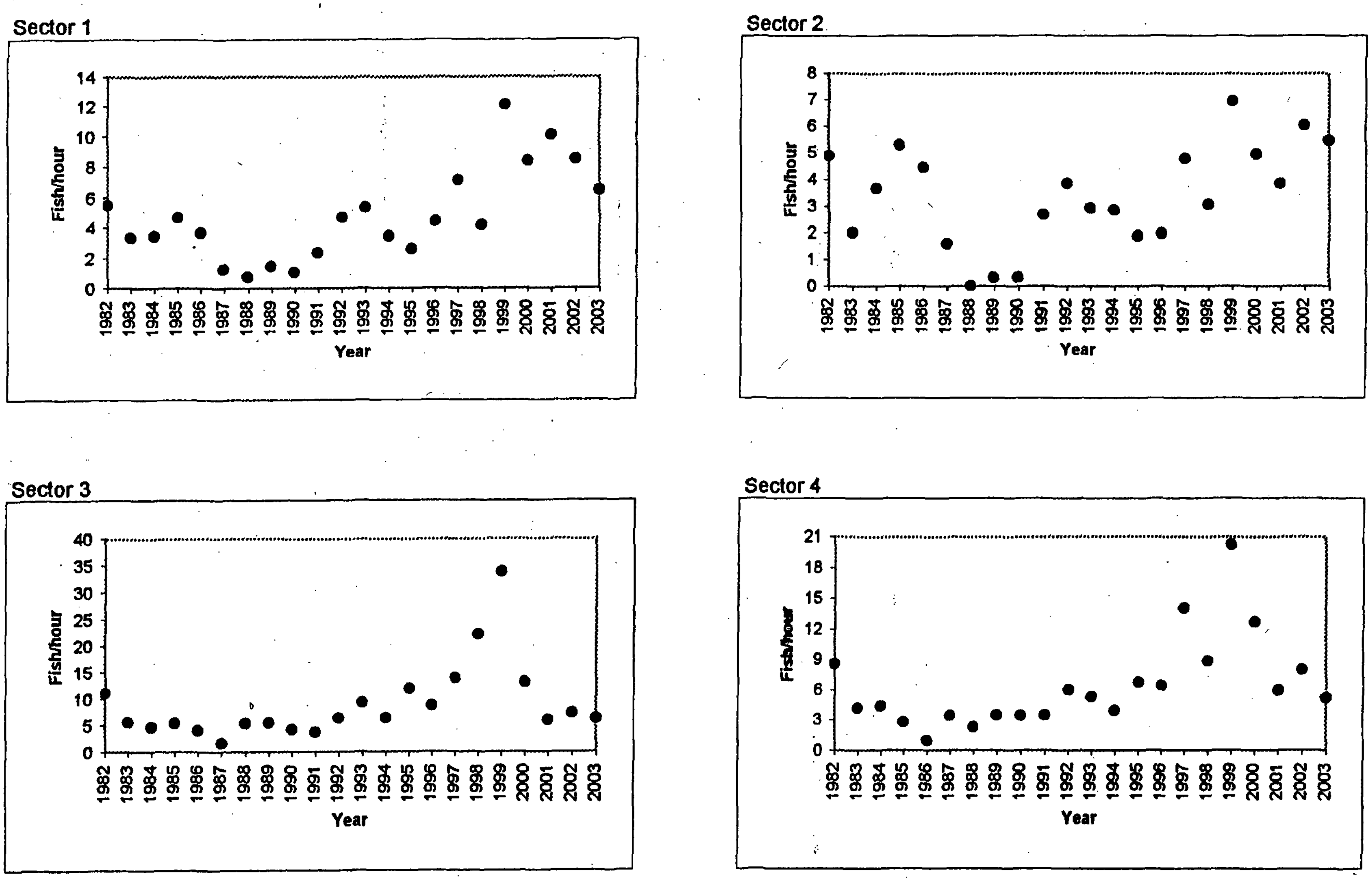
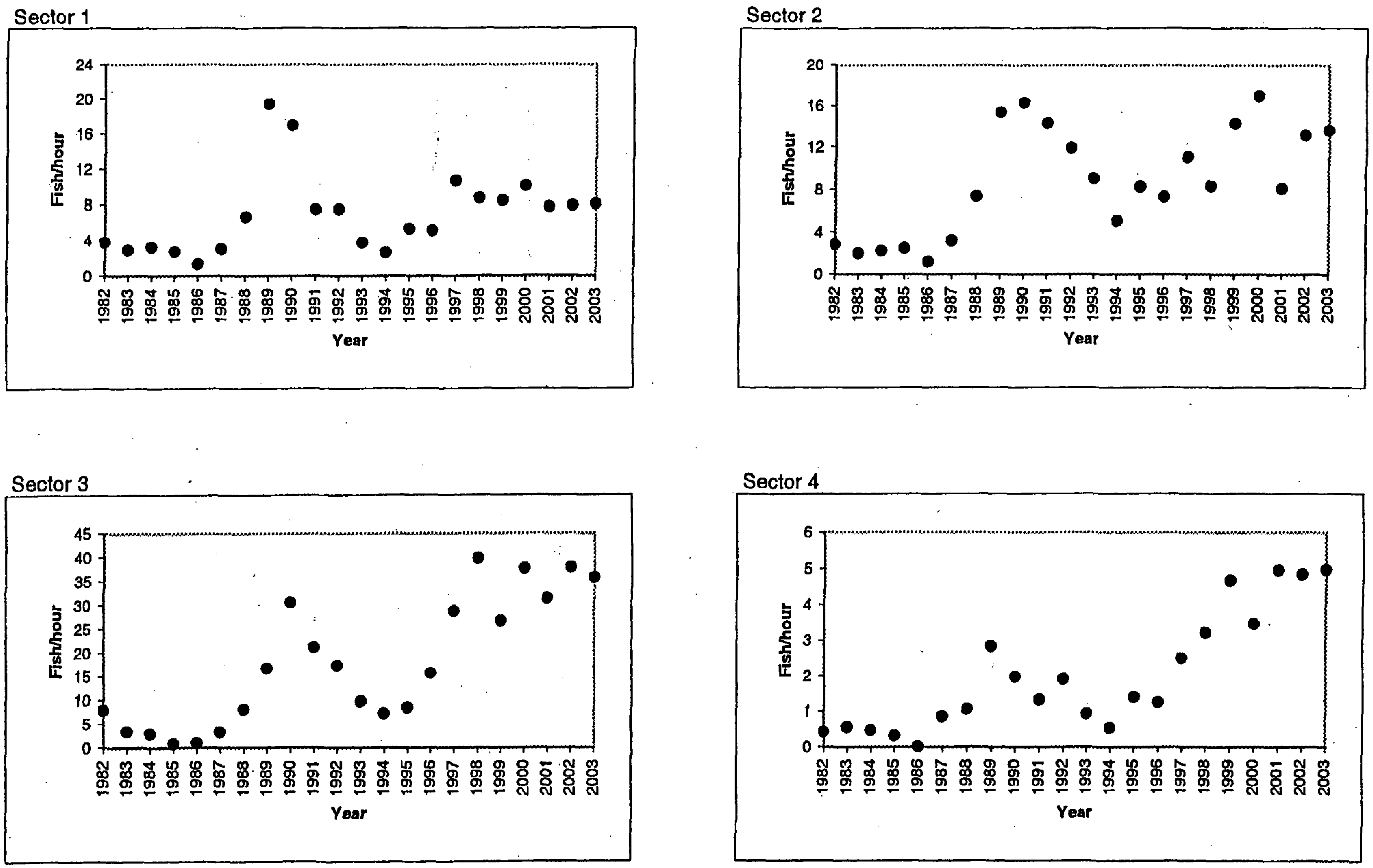
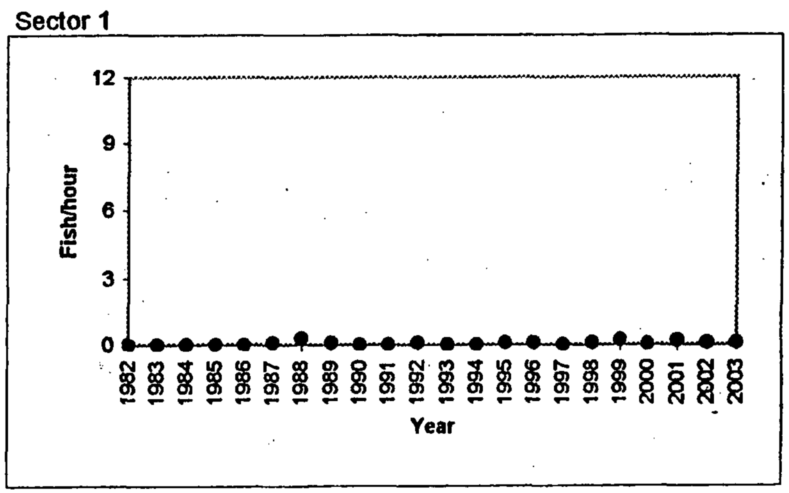


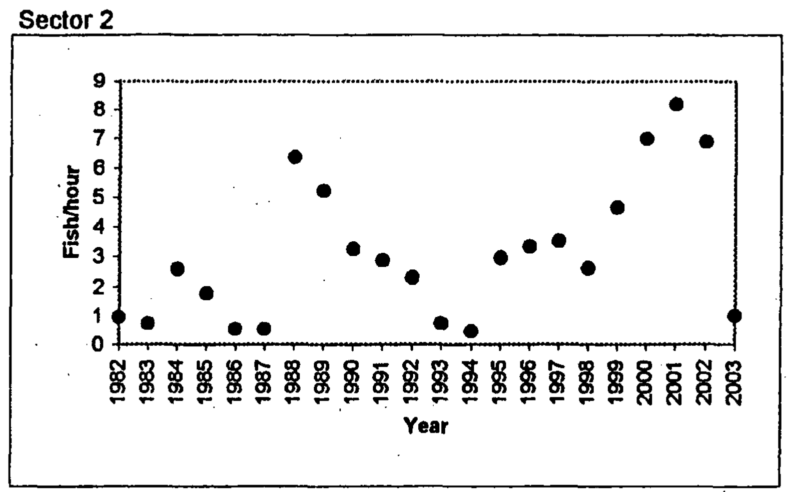
Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2003 in the vicinity of PINGP.

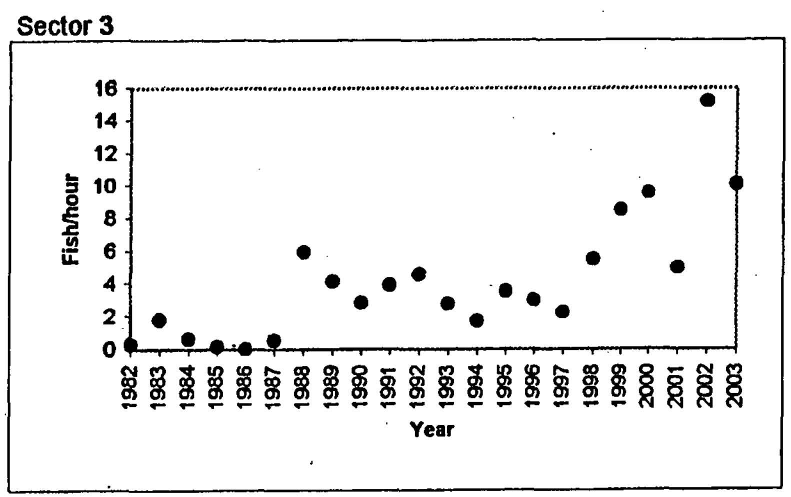


2003FIGUR.XLS

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







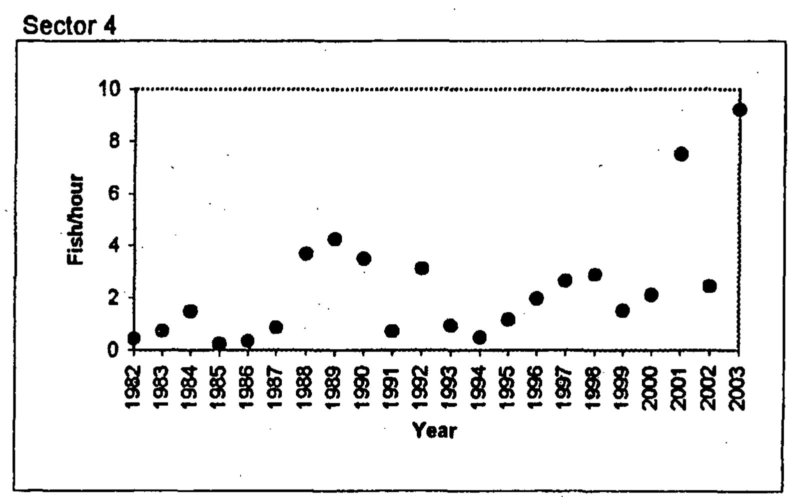
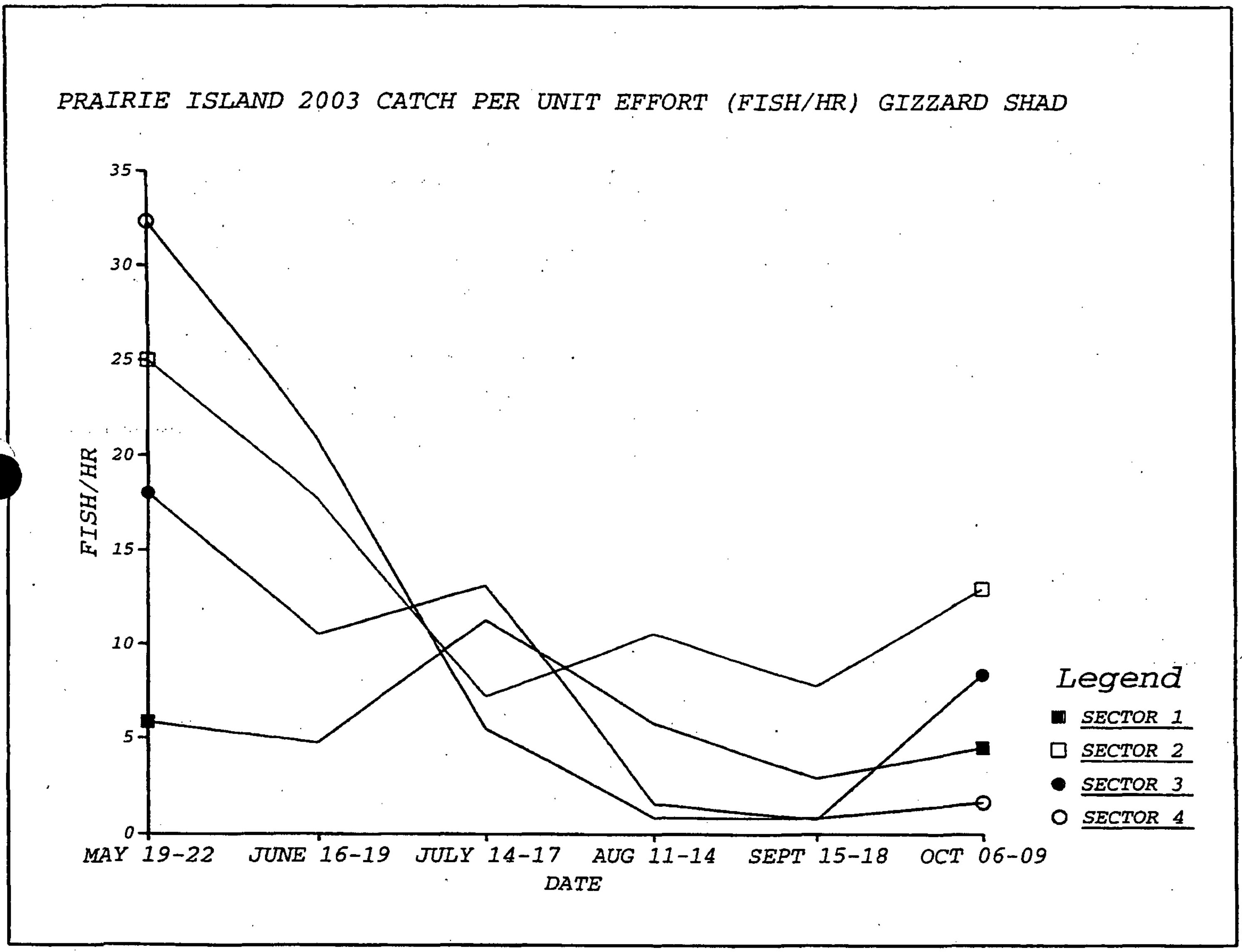
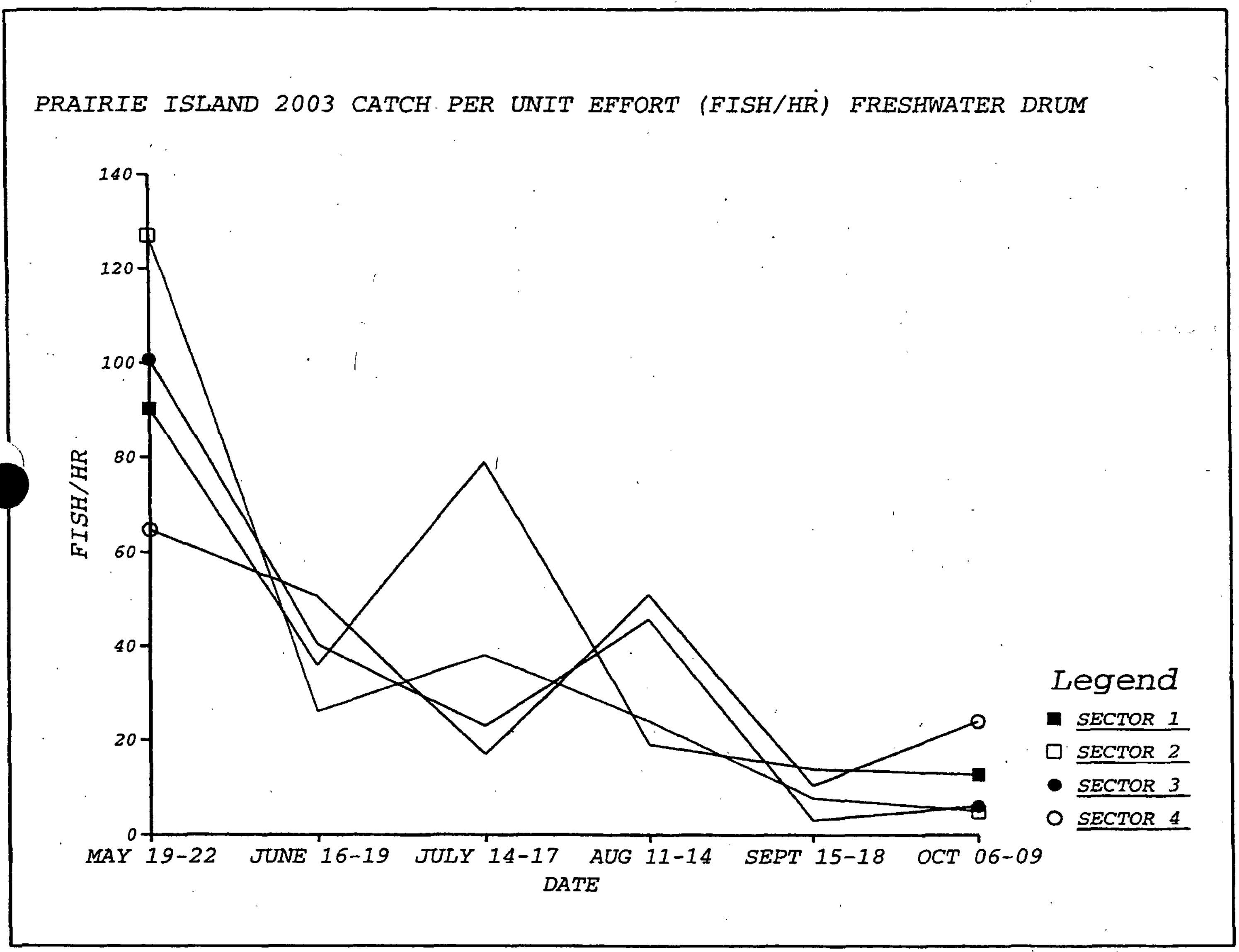


Figure 31



PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) GIZZARD SHAD
FISH/HR
35
30
25
20
15
10
5
0
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 32



PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) FRESHWATER DRUM
140
120
100
80
60
40
20
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 33

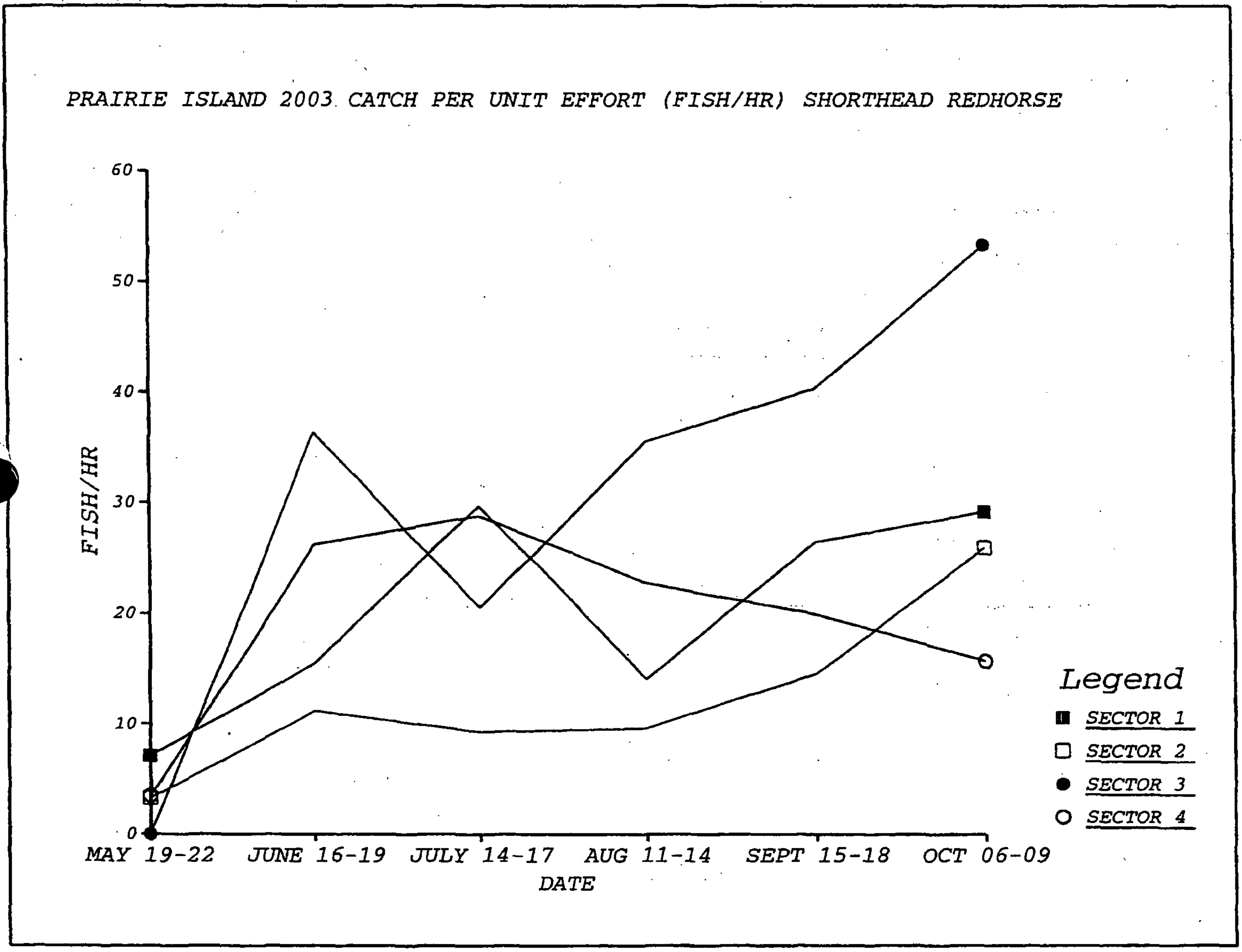

PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) SHORTHEAD REDHORSE
60
50
40
30
20
10
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 34

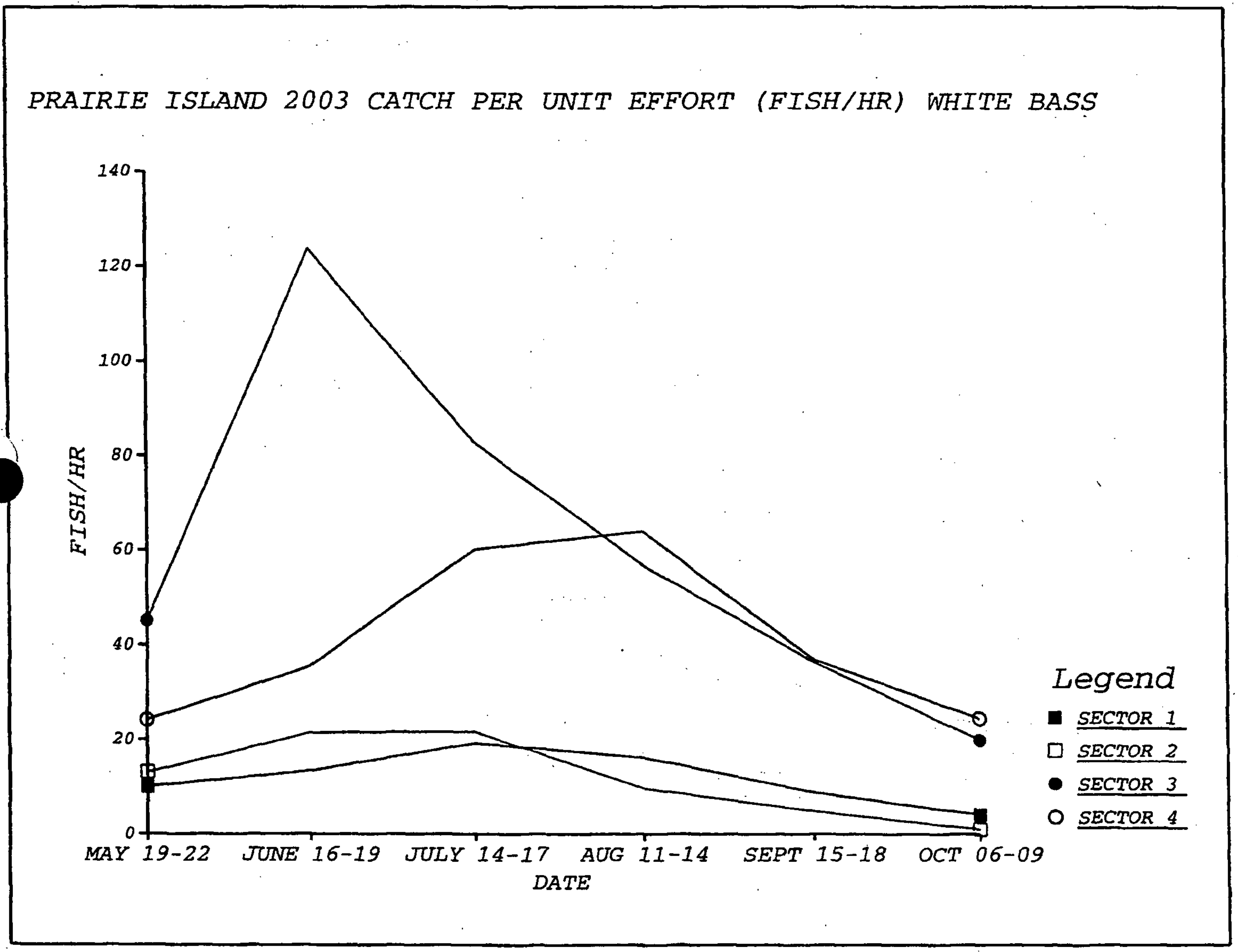
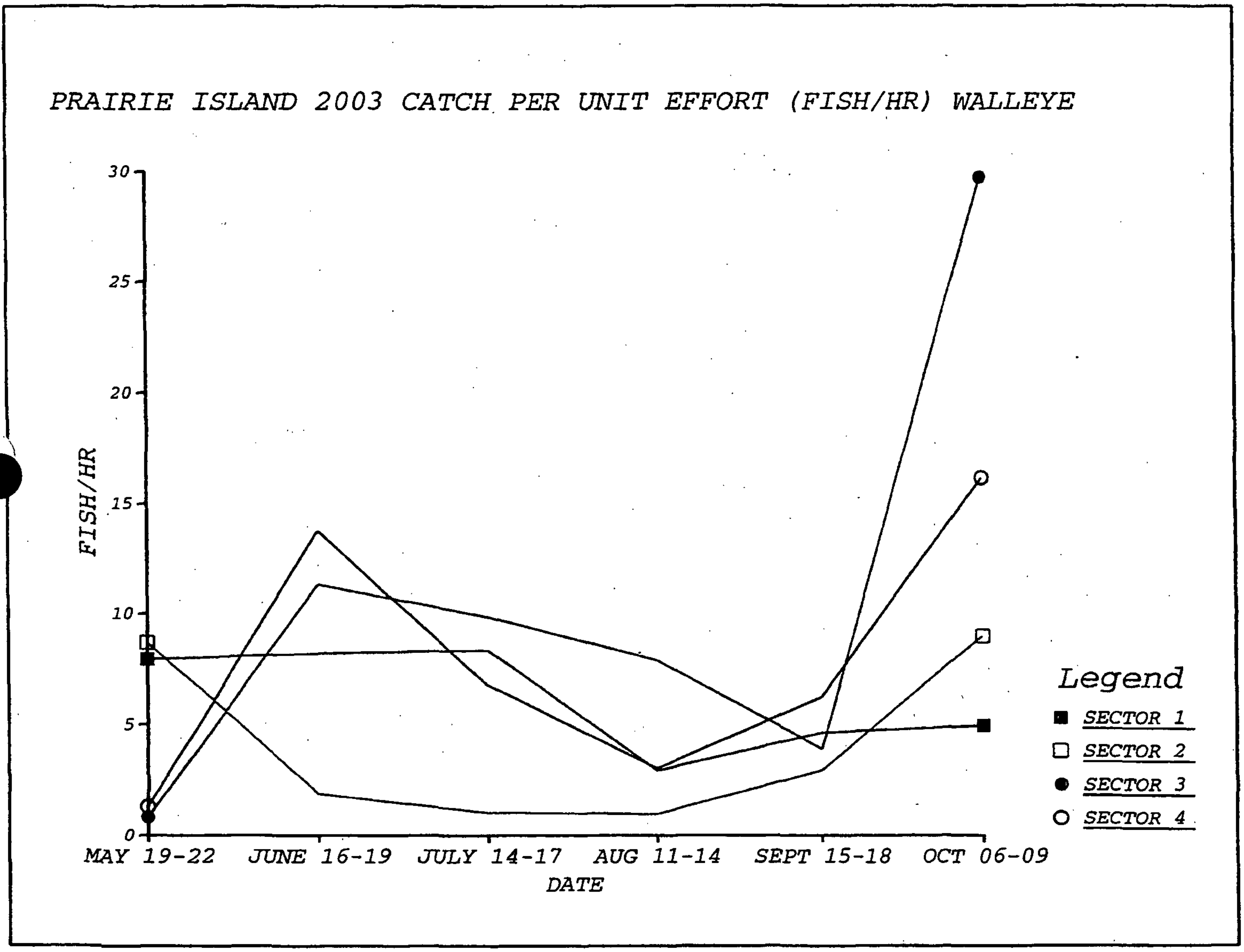

PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) WHITE BASS
140
120
100
80
60
40
20
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 35



PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) WALLEYE
30
25
20
15
10
5
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 36

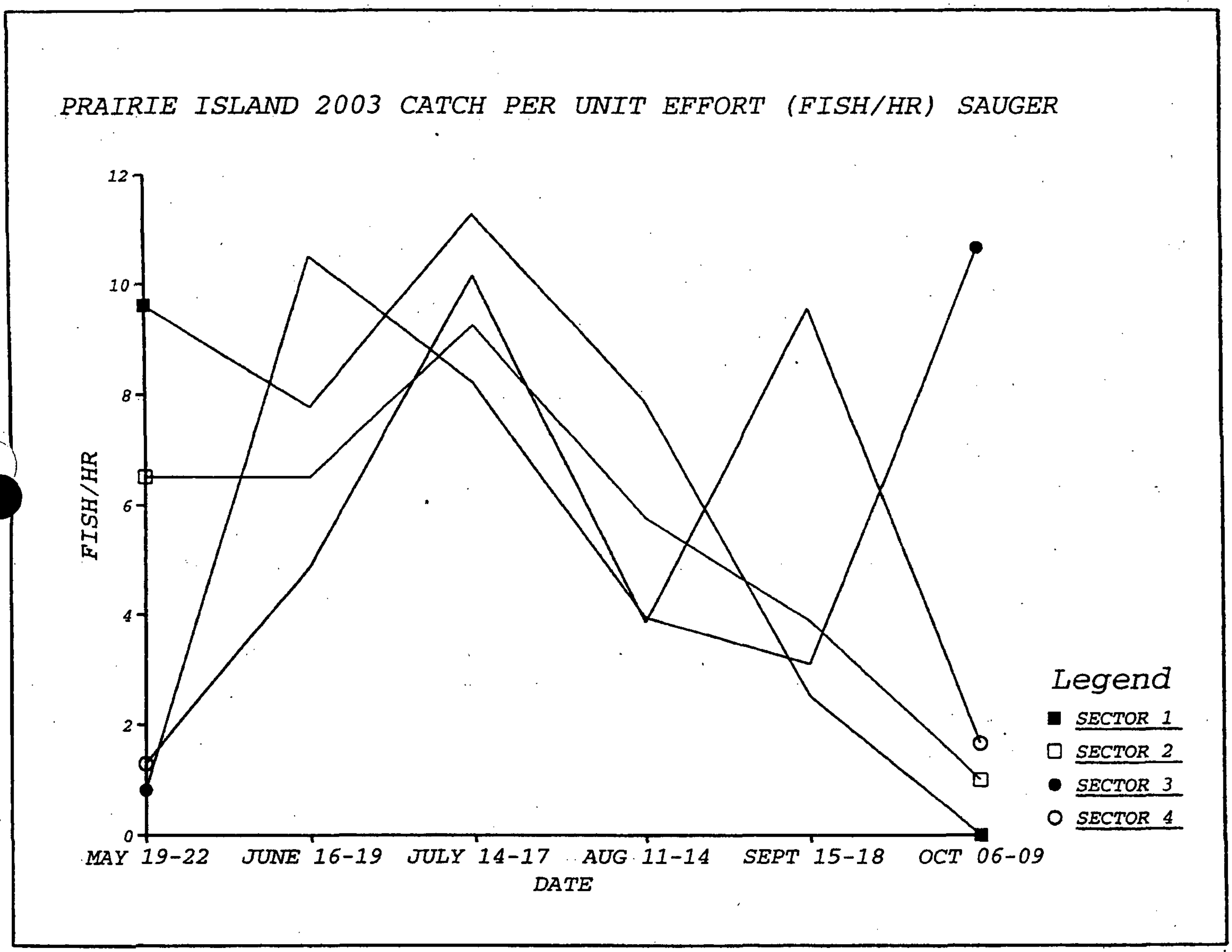
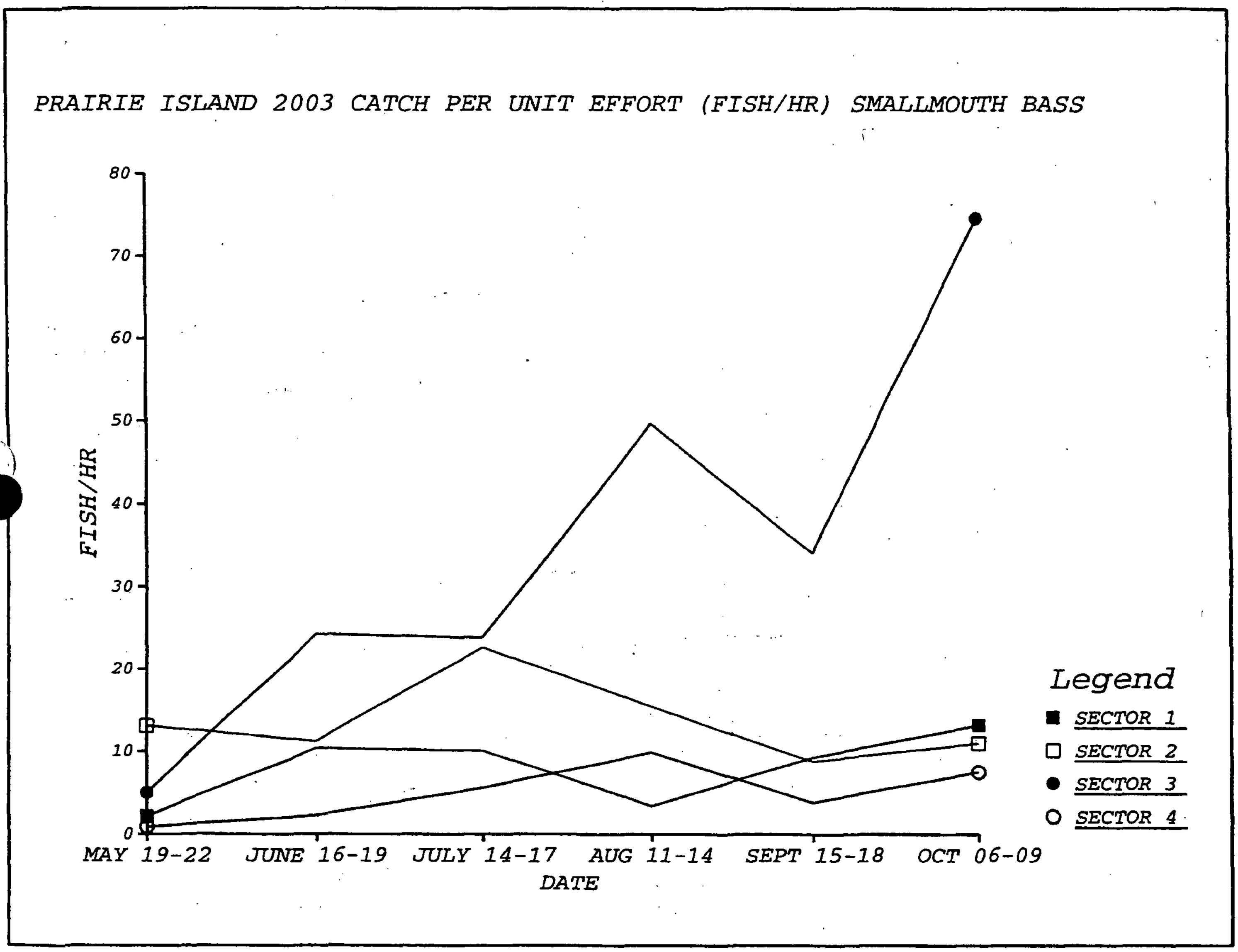
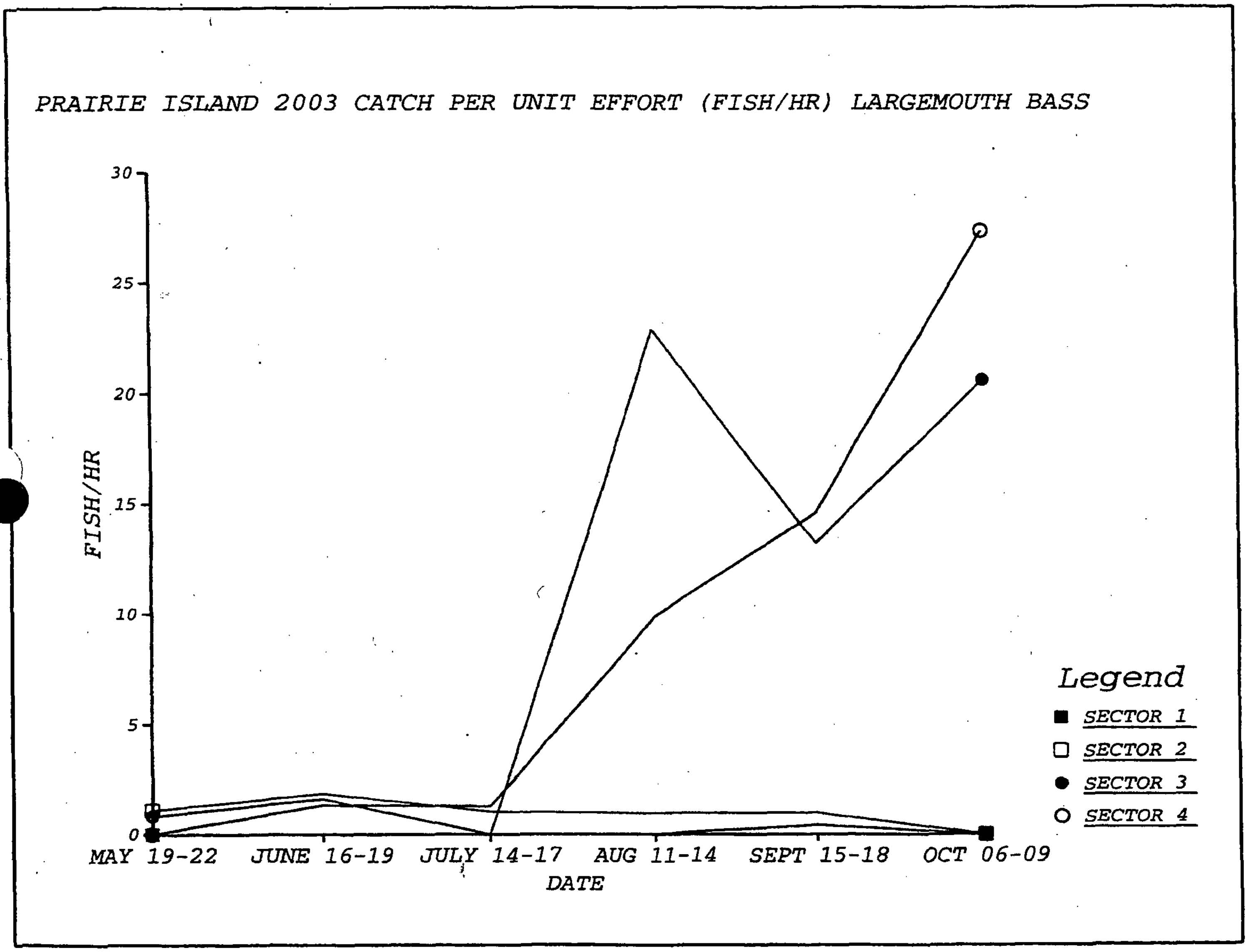

PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) SAUGER
FISH/HR
0
2
4
6
8
10
12
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 37



PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) SMALLMOUTH BASS
FISH/HR
0
10
20
30
40
50
60
70
80
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 38



PRAIRIE ISLAND 2003 CATCH PER UNIT EFFORT (FISH/HR) LARGEMOUTH BASS
30
25
20
15
10
5
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Table 1. Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2003.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	OO	O1	O2	O3
Chestnut lamprey Ichthyomyzon castaneus	x	x							x	x			x			x	x		x	x	x
Silver lamprey Icthyomyzon unicuspus					x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Paddlefish Polyodon spathula															x						
Longnose gar Lepisosteus osseus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shortnose gar Lepisosteus platostomus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bowfin Amia calva	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American eel Anguilla rostrata	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x		x	
Gizzard shad Dorosoma cepedianum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Goldeye Hiodon alosoides	x		x		x	x					x			x	x	x	x				x
Mooneye Hiodon tergisus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brown trout Salmo trutta				x									x		x		x		x	x	x
Northern pike Esox lucius	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Musky Esox masquinongy																		x	x		
Carp Cyprinus carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carpsucker Species Carpiodes species		x					x														
River carpsucker Carpiodes carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Quillback Carpiodes cyprinus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Highfin carpsucker Carpiodes velifer			x	x	x	x	x	x	x	x	x	x	x	x	x					x	x
White sucker Catostomus commersoni	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x

Table 1 (cont.) Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2003.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	OO	O1	O2	O3
Blue sucker _Cycleptus elongatus_	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Northern hogsucker _Hypentelium nigricans_	x														x			x			
Smallmouth buffalo _Ictiobus bubalus_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bigmouth buffalo _Ictiobus cyprinellus_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Spotted sucker _Minytrema melanops_	x	x		x		x	x			x											
Silver redhorse _Moxostoma anisurum_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
River redhorse _Moxostoma carinatum_		x	x		x		x	x	x	x		x	x			x	x	x	x	x	x
Golden redhorse _Moxostoma erythrurum_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Greater redhorse _Moxostoma valenciennesi_		x		x		x		x							x	x			x		x
Shorthead redhorse _Moxostoma macrolepidotum_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black bullhead _Ictalurus melas_	x	x	x	x	x	x				x							x	x		x	
Yellow bullhead _Ictalurus natalis_					x	x	x					x	x								
Brown bullhead _Ictalurus nebulosus_	x																				
Channel catfish _Ictalurus punctatus_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Flathead catfish _Pylodictus olivaris_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Burbot _Lota lota_	x	x			x					x	x	x	x	x	x	x	x	x	x	x	x
White bass _Marone chrysops_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock bass _Ambloplites rupestris_	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Green sunfish _Lepommis cyanellus_	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 1 (cont.) Species of fish captured in the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2003.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	OO	O1	O2	O3
Pumpkinseed Lepomis gibbosus							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Orangespotted sunfish Lepomis humilis																x		x	x		
Bluegill Lepomis macrochirus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Smallmouth bass Micropterus dolomieui	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Largemouth bass Micropterus salmoides	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
White crappie Pomoxis annularis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black crappie Pomoxis nigromaculatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Yellow perch Perca flavens	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x		x	x	x
Sauger Stizostedion canadense	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Walleye Stizostedion vitreum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Saugeye S. vitreum x S. canadense															x	x	x		x	x	x
Freshwater drum Aplodinotus grunniens	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lake sturgeon Acipenser fulvescens																					x

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.

Rank	Species	Sector 1	Sector 2	Sector 3	Sector 4	Average	number 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
4	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
9	Quillback carpsucker	5.30	8.45	3.05	6.32	5.78	239
10	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
12	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
14	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
16	Channel catfish	1.54	4.80	0.27	0.36	1.74	58
17	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
19	Longnose gar	0.63	1.16	0.80	0.43	0.75	28
20	Northern pike	0.07	0.50	1.33	0.64	0.63	23
21	Mooneye	1.12	0.00	0.53	0.50	0.54	27
22	White crappie	0.00	1.16	0.00	0.78	0.49	18
23	River carpsucker	0.77	0.17	0.40	0.36	0.42	20
24	Blue sucker	0.70	0.17	0.40	0.36	0.40	19
25	Shortnose gar	0.42	0.17	0.80	0.14	0.38	15
26	Golden redhorse	0.49	0.17	0.27	0.43	0.34	16
27	Green sunfish	0.00	0.99	0.13	0.00	0.28	7
28	Rock bass	0.35	0.00	0.27	0.43	0.26	13
29	Silver lamprey	0.28	0.00	0.27	0.14	0.17	8
30	Saugeye	0.00	0.33	0.13	0.07	0.13	4
31	Pumpkinseed	0.00	0.17	0.13	0.07	0.09	3
32	Goldeye	0.00	0.17	0.13	0.07	0.09	3
33	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	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
37	Highfin carpsucker	0.00	0.00	0.13	0.00	0.03	1
38	Greater redhorse	0.00	0.00	0.13	0.00	0.03	1
39	Lake sturgeon	0.00	0.00	0.13	0.00	0.03	1
40	Yellow perch	0.00	0.00	0.00	0.07	0.02	1
41	Brown trout	0.00	0.00	0.00	0.07	0.02	1
	Totals	148.87	170.14	267.53	189.00	193.89	7845

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	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

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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

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

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	20.16	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	41.69	NA	21	1656	320	LOG W=3.042 LOG L-5.013
2003	31.22	NA	16	1272	330	LOG W=2.977 LOG L-4.829

Table 7. Fisheries summary for Walleye 1977-2003.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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

Table 8. Fisheries summary for Sauger 1977-2003.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	NA	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	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

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

	Smallmouth 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 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 2003.

Year	Carp	White bass	Freshwater Drum	Sauger	Black Crappie	Shorthead Redhorse	Walleye	Gizzard 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
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	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

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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 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 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 Results and Discussion 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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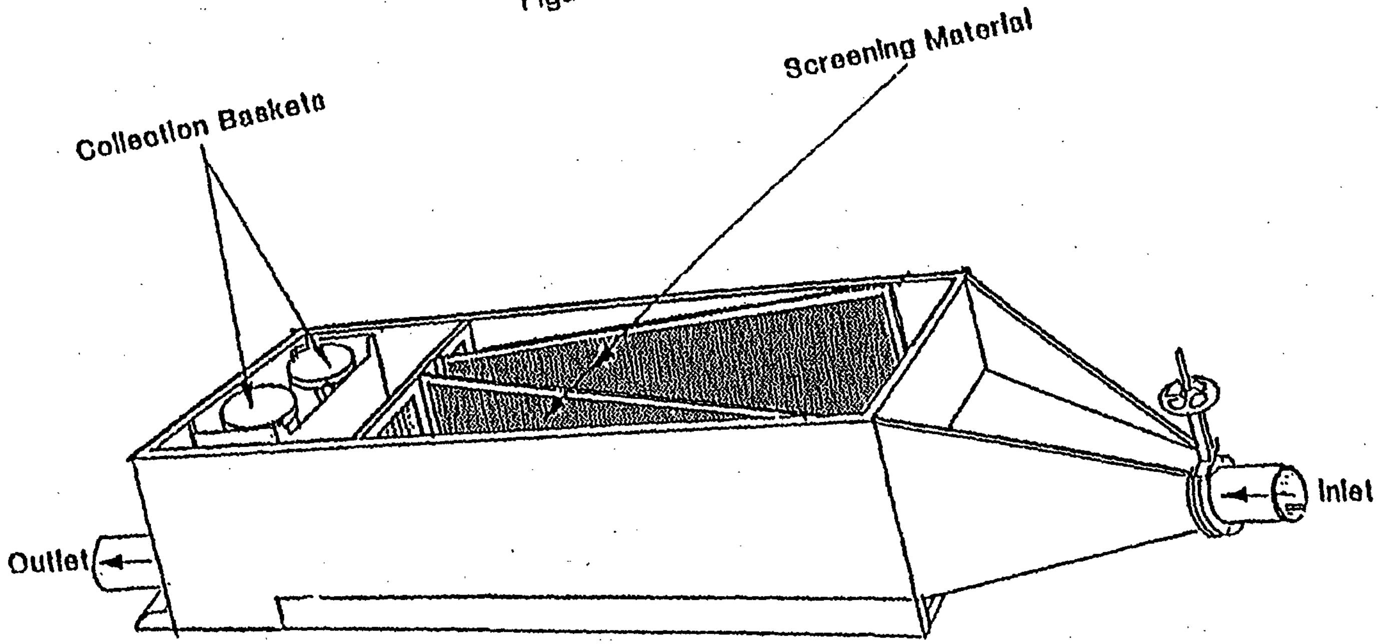
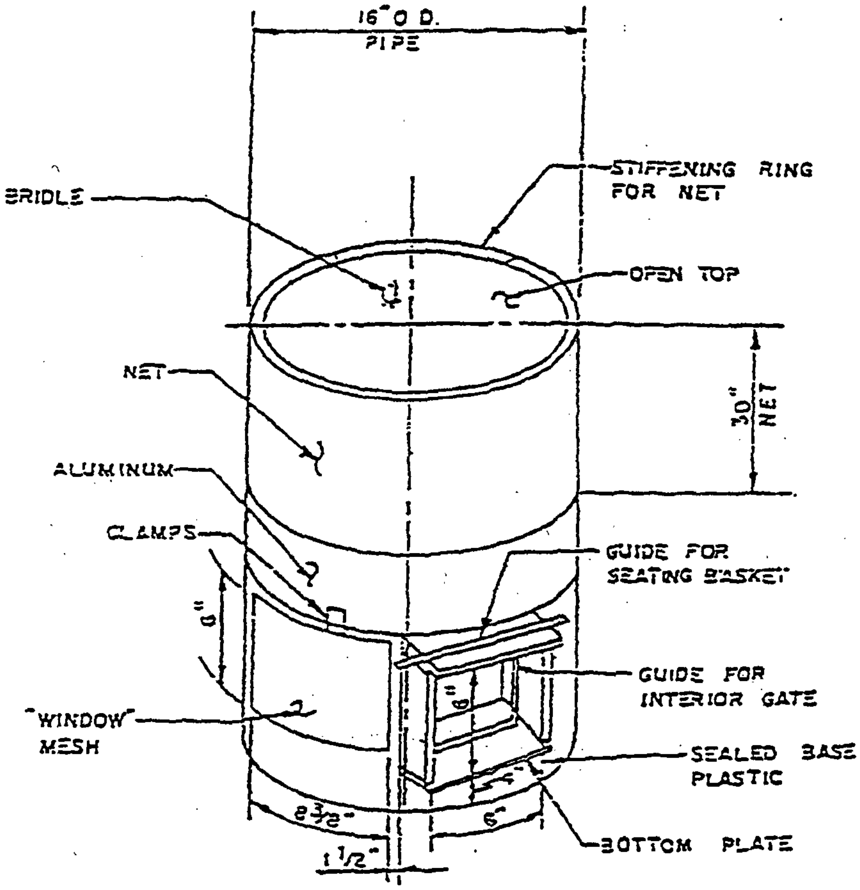
Figure 1



Larval Fish Collection Tank

Figure 2



DETAIL A

COLLECTION BASKET

NO SCALE

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 2003.

Date	Taxa	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-Apr-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	Burbot	PRO	0.161790	100	1
24-Apr-2004	Burbot	PRO	0.323581	50	2
29-Apr-2004	Sau	PRO	0.166364	100	1

Table 1b. Density of fish and eggs (fish/100 cubic meters) collected in pre-dawn and daylight samples in 2003.

Date	Pre-dawn Density	Daylight 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	Postlarvae	Prolarvae
Carp			x	x
Channel catfish		x		
Cyprinid	x	x	x	x
Flathead catfish		x		
Percid	x		x	x
Walleye				x
Bullhead sp.		x		
Sauger			x	x,o
Burbot			x	x,o
Catostomid		x		x
Stizostedion spp.				x
White bass		x		
Gizzard shad		x		
Freshwater drum		x,o		
Johnny darter	x			
Shiner spp.		x		
Emerald shiner	x	x		
Bluegill		x		
Mooneye				x
Golden redhorse		x		
Unidentified				x
Log perch	x			x

Legend: x = previous years data
o = 2003 data

Table 3. Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2003.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1984														
16-Apr-84	UNID	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	14-Apr-89	X	UN	0	0
23-Apr-84	UNID	EG	3840	10	28-Apr-86	UNID	EG	480	1	18-Apr-89	X	UN	0	0
25-Apr-84	CC	JU	384	1	29-Apr-86	PERC	PR	864	3	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	UNID	EG	3840	10	29-Apr-86	WE	PR	288	1	25-Apr-89	X	UN	0	0
27-Apr-84	CC	JU	384	1	**1987**					27-Apr-89	BUR	PR	1152	3
27-Apr-84	CYPR	JU	384	1	6-Apr-87	BUR	PR	1536	4	**1992**				
27-Apr-84	UNID	EG	2304	6	8-Apr-87	CARP	PR	576	1	1-Apr-92	CYPR	PR	288	1
30-Apr-84	CC	JU	384	21	10-Apr-87	BUR	PR	2304	4	1-Apr-92	CYPR	PO	288	1
30-Apr-84	CYPR	AD	384	1	13-Apr-87	BUR	PR	2304	4	1-Apr-92	CARP	PO	576	2
30-Apr-84	FHC	JU	192	1	15-Apr-87	BUR	PR	3456	6	2-Apr-92	X	UN	0	0
30-Apr-84	PERC	PR	1152	6	16-Apr-87	BUR	PR	576	1	8-Apr-92	X	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	WE	PR	768	4	22-Apr-87	X	UN	0	0	14-Apr-92	X	UN	0	0
1985					24-Apr-87	X	UN	0	0	16-Apr-92	X	UN	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	UNID	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	SA	PR	1344	7	**1988**					30-Apr-92	PERC	AD	288	1
24-Apr-85	UNID	EG	384	2	8-Apr-88	BUR	PR	768	2	**1993**				
24-Apr-85	WE	PR	1536	8	11-Apr-88	X	UN	0	0	2-Apr-93	UN	X	0	0
25-Apr-85	PERC	PR	192	1	13-Apr-88	UNID	EG	384	1	6-Apr-93	BUR	PR	288	1
25-Apr-85	SA	PR	1536	8	15-Apr-88	BUR	PR	768	2	8-Apr-93	UN	EG	288	1
25-Apr-85	STIZ	PR	384	2	18-Apr-88	X	UN	0	0	8-Apr-93	BUR	PR	288	1
25-Apr-85	WE	PR	576	3	20-Apr-88	BUR	PR	768	2	13-Apr-93	UN	X	0	0
26-Apr-85	SA	PR	192	1	22-Apr-88	BUR	PR	1920	5	15-Apr-93	BUR	PR	288	1
26-Apr-85	STIZ	PR	192	1	25-Apr-88	BUR	PR	1152	3	19-Apr-93	UN	EG	1152	2
29-Apr-85	BUR	PO	96	1	27-Apr-88	BUR	PR	1152	3	21-Apr-93	UN	X	0	0
29-Apr-85	CARP	PR	192	2	28-Apr-88	BUR	PR	384	1	27-Apr-93	UN	X	0	0
29-Apr-85	CATO	PR	288	3	29-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	X	UN	0	0	5-Apr-94	UNID	EG	384	1
18-Apr-86	CARP	PR	288	1	6-Apr-89	PERC	AD	384	1	5-Apr-94	CC	JU	384	1
18-Apr-86	CYPR	PR	288	1	7-Apr-89	X	UN	0	0	5-Apr-94	CARP	PR	384	1
23-Apr-86	CYPR	PO	288	1	11-Apr-89	X	UN	0	0	5-Apr-94	BUR	PR	384	1
23-Apr-86	PERC	PR	288	1	13-Apr-89	BUR	PR	384	1	7-Apr-94	BUR	PR	288	1

Table 3. (cont) Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2003.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1994 (cont)					**1996 (cont)**					**1999 (cont)**				
12-Apr-94	SA	PR	288	1	25-Apr-96	BURB	PR	504	2	9-Apr-99	CC	JU	288	1
12-Apr-94	CARP	PR	288	1	25-Apr-96	BURB	PR	252	1	9-Apr-99	BURB	PR	576	2
14-Apr-94	X	X	0	0	30-Apr-96	X	X	0	0	9-Apr-99	CC	JU	288	1
19-Apr-94	CYPR	JU	288	1	**1997**					13-Apr-99	UNID	EG	288	1
21-Apr-94	X	X	0	0	3-Apr-97	UNID	EG	17,280	30	13-Apr-99	UNID	EG	288	1
26-Apr-94	CARP	PR	1152	4	4-Apr-97	BG	JU	1152	2	15-Apr-99	BURB	PR	288	1
26-Apr-94	BUR	PR	288	1	4-Apr-97	UNID	PR	576	1	22-Apr-99	BURB	PR	576	2
28-Apr-94	SA	PR	288	1	25-Apr-97	BURB	PR	2304	4	27-Apr-99	PERC	PR	288	1
28-Apr-94	BUR	PR	288	1	29-Apr-97	CYPR	JU	864	2	27-Apr-99	CC	JU	288	1
1995					30-Apr-97	BLBH	JU	432	1	27-Apr-99	PERC	PR	288	1
3-Apr-95	CATO	JU	288	1	30-Apr-97	CC	JU	432	1	30-Apr-97	PERC	PO	288	1
4-Apr-95	BUR	PR	288	1	30-Apr-97	CYPR	JU	432	1	30-Apr-97	PERC	PR	576	2
4-Apr-95	CC	JU	576	1	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	GIZ	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	4-Apr-2000	UNID	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	CATO	PR	288	1	9-Apr-1998	EMSH	AD	229	1	6-Apr-2000	Log P	AD	288	1
17-Apr-95	UNID	EG	13248	46	14-Apr-1998	CC	JU	252	1	6-Apr-2000	UNID	EG	8023	39
20-Apr-95	UNID	EG	2880	10	16-Apr-1998	CYPR	JU	229	1	6-Apr-2000	Carp	PRO	206	1
24-Apr-95	UNID	EG	1152	4	16-Apr-1998	BURB	PR	229	1	13-Apr-2000	Burb	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	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	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	WAE	PRO	288	1
9-Apr-96	UNID	EG	252	1	28-Apr-1998	CARP	PR	1512	6	**2001**	No values calculated~flood			
11-Apr-96	FWD	JU	252	1	28-Apr-1998	UNID	PR	252	1	**2002**				
11-Apr-96	BURB	PR	252	1	30-Apr-1998	STIZ	PR	2016	8	4/2/2002	EMSH	JU	672	2
11-Apr-96	EMSH	JU	504	2	30-Apr-1998	CARP	PR	14364	57	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	PERC	PR	2268	9	4/4/2002	Carp	EG	672	2
11-Apr-96	BURB	PR	252	1	30-Apr-1998	MOON	PR	252	1	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	GORH	JU	252	1	4/4/2002	GIZ	JU	336	1
16-Apr-96	X	X	0	0	**1999**					4/4/2002	Carp	EG	1008	3
18-Apr-96	X	X	0	0	6-Apr-99	BURB	PR	522	2	4/4/2002	BURB	PR	1008	3
23-Apr-96	EMSH	JU	504	2	6-Apr-99	UNID	EG	4032	14	4/9/2002	GIZ	JU	336	1
23-Apr-96	UNID	EG	1008	4	9-Apr-99	GIZ	JU	288	1	4/9/2002	EMSH	JU	1008	3

Table 3. (cont)		Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2003.		
Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
2002 (cont)				
4/9/2002	BURB	PRO	672	2
4/9/2002	Carp	EG	288	1
4/11/2002	EMSH	JU	288	1
4/11/2002	BURB	PRO	864	3
4/11/2002	BURB	PRO	1800	5
4/11/2002	EMSH	JU	1800	5
4/11/2002	Cypr	JU	360	1
4/16/2002	EMSH	JU	336	1
4/16/2002	GIZ	JU	336	1
4/18/2002	EMSH	JU	336	1
4/23/2002	BURB	PRO	672	2
4/23/2002	BURB	PRO	1008	3
4/25/2002	BURB	PRO	672	2
4/25/2002	BURB	PRO	336	1
2003				
4/1/2004	BURB	PRO	504	1
4/3/2004	BURB	PRO	504	1
4/3/2004	BURB	PRO	2016	4
4/3/2004	FWD	JU	1512	3
4/8/2004	BURB	PRO	576	1
4/8/2004	BURB	PRO	576	1
4/10/2004	BURB	PRO	2304	8
4/10/2004	BURB	PRO	1152	2
4/10/2004	Carp	EG	576	1
4/15/2004	Carp	EG	13248	23
4/17/2004	Carp	EG	1728	3
4/17/2004	Carp	EG	576	1
4/22/2004	Carp	EG	576	1
4/24/2004	BURB	PRO	576	1
4/24/2004	BURB	PRO	1152	2
4/29/2004	SAU	PRO	576	1

Table 4.	Estimated fish and fish egg impingement data for dates sampled (when fish and/or eggs were collected) in April 2003 with corresponding blowdown, river flow and temperatures.			
Date	Blowdown (cfs)	Average Daily R. Flow (cfs)	Avg. daily Inlet Temp. (F)	Est.avg daily impingement.
4/1/2004	940	18,600	42.0	504
4/3/2004	948	18,400	42.0	4,032
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

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	=	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

PINGP-018

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
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

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.

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 JANUARY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	34.4	37.0	815
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
11	24	24	34.4	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	802
15	24	24	34.5	37.3	802
16	24	24	34.3	37.2	802
17	24	24	34.3	37.3	802
18	24	24	34.4	37.3	795
19	24	24	34.1	37.3	795
20	24	24	34.1	37.5	802
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
31	24	24	33.5	37.3	795
		MONTHLY MINIMUM	33.5	36.4	788
		MONTHLY MAXIMUM	34.7	37.7	822
		MONTHLY MEAN	34.2	37.2	804

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 FEBRUARY	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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	24	33.5	36.9	795
7	24	24	33.5	36.8	795
8	24	24	33.4	36.7	795
9	24	24	33.5	36.8	795
10	24	24	33.5	36.8	795
11	24	24	33.4	36.9	795
12	24	24	33.4	37.0	795
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	795
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
23	24	24	34.2	37.9	537
24	24	24	34.2	38.3	730
25	24	24	34.6	38.7	730
26	24	24	34.7	38.9	730
27	24	24	34.9	39.4	730
28	24	24	35.5	40.1	730
29	24	24	36.4	40.7	730
	MONTHLY MINIMUM		33.4	36.7	440
	MONTHLY MAXIMUM		36.4	40.7	802
	MONTHLY MEAN		33.9	37.6	749

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 MARCH	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	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	24	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
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	39.7	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	855
30	24	24	43.1	42.3	855
31	24	24	42.5	42.9	855
	MONTHLY MINIMUM		34.8	36.5	730
	MONTHLY MAXIMUM		46.2	47.1	862
	MONTHLY MEAN		38.5	40.5	759

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 APRIL	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	42.7	41.3	848
2	24	24	43.3	42.4	848
3	24	24	45.0	43.3	692
4	23*	23*	41.1	42.5	652
5	24	24	45.3	44.4	842
6	24	24	47.1	45.4	842
7	24	24	48.3	47.3	842
8	24	24	48.2	46.8	849
9	24	24	48.4	46.8	875
10	24	24	48.1	47.3	889
11	24	24	45.6	45.2	979
12	24	24	46.2	45.3	979
13	24	24	47.8	47.9	835
14	24	24	49.0	49.1	315
15	24	24	48.5	50.5	259
16	24	24	49.0	51.0	283
17	24	24	50.6	52.8	283
18	24	24	52.0	54.6	283
19	24	24	57.4	59.0	148
20	24	24	54.9	56.6	283
21	24	24	52.2	52.9	283
22	24	24	51.7	53.1	267
23	24	24	52.6	53.9	267
24	24	24	52.6	53.7	267
25	24	24	52.3	53.0	267
26	24	24	52.6	53.5	291
27	24	24	50.9	52.5	283
28	24	24	51.8	52.4	291
29	24	24	54.5	55.5	291
30	24	24	54.5	55.9	291

* Daylight savings

MONTHLY MINIMUM	41.1	41.3	148
MONTHLY MAXIMUM	57.4	59.0	979
MONTHLY MEAN	49.5	49.9	521

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 MAY	OPERATING HOURS UNIT 1	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
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
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
18	24	24	59.5	60.8	283
19	24	24	61.1	63.0	283
20	24	24	62.7	64.8	291
21	24	24	62.9	64.1	291
22	24	24	61.6	62.5	291
23	24	24	60.4	62.1	291
24	24	24	59.4	59.9	291
25	24	24	59.5	59.8	291
26	24	24	58.9	59.8	291
27	24	24	60.1	60.3	291
28	24	24	60.1	60.6	291
29	24	24	61.5	61.5	291
30	24	24	60.5	60.6	291
31	24	24	61.5	62.0	291
		MONTHLY MINIMUM	53.1	55.2	275
		MONTHLY MAXIMUM	62.9	65.1	291
		MONTHLY MEAN	58.7	60.1	285

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 JUNE	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (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	66.0	407
6	24	24	63.8	65.7	384
7	24	24	66.1	68.3	384
8	24	24	68.3	70.3	516
9	24	24	69.2	70.7	516
10	24	24	67.4	69.4	381
11	24	24	66.2	67.1	381
12	24	24	66.6	68.0	381
13	24	24	68.0	69.3	381
14	24	24	68.6	70.1	381
15	24	24	69.1	70.8	381
16	24	24	71.0	71.8	381
17	24	24	70.8	71.4	768
18	24	24	70.4	71.9	760
19	24	24	69.1	69.3	760
20	24	24	69.6	70.8	760
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	692
27	24	24	68.7	69.7	730
28	24	24	67.3	68.5	768
29	24	24	68.1	69.4	760
30	24	24	69.9	71.4	760
	MONTHLY MINIMUM		61.6	62.4	275
	MONTHLY MAXIMUM		71.0	71.9	776
	MONTHLY 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

DATE JULY	OPERATING HOURS UNIT 1	OPERATING HOURS UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
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
5	24	24	74.7	76.9	1166
6	24	24	73.7	72.3	1180
7	24	24	72.0	73.6	1166
8	24	24	70.9	71.7	1166
9	24	24	72.0	73.9	1166
10	24	24	70.6	72.9	1166
11	24	24	72.1	73.6	1180
12	24	24	73.2	74.6	1166
13	24	24	75.4	76.9	1166
14	24	24	75.8	76.7	1166
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
19	24	24	76.1	77.7	1166
20	24	24	77.5	79.3	1166
21	24	24	78.1	79.9	1166
22	24	24	78.4	80.2	1166
23	24	24	77.6	79.0	1166
24	24	24	75.7	77.6	1180
25	24	24	74.9	77.3	1166
26	24	24	76.7	78.5	1180
27	24	24	75.4	78.4	1166
28	24	24	76.0	78.1	1180
29	24	24	75.6	78.0	1180
30	24	24	74.7	77.4	1180
31	24	24	73.7	76.5	1180
		MONTHLY MINIMUM	70.6	71.7	768
		MONTHLY MAXIMUM	78.4	80.2	1180
		MONTHLY MEAN	74.7	76.5	1156

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 AUGUST	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	74.9	77.3	1180
2	24	24	75.8	78.1	1180
3	24	24	76.3	79.1	1194
4	24	24	75.6	77.6	1180
5	24	24	74.2	76.7	1180
6	24	24	73.9	76.4	1180
7	24	24	74.4	77.1	1194
8	24	24	73.5	76.1	1194
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
14	24	24	68.3	70.1	1166
15	24	24	69.7	72.0	1180
16	24	24	69.7	72.5	1180
17	24	24	69.1	72.4	1180
18	24	24	70.0	73.2	1166
19	24	24	68.6	71.2	1180
20	24	24	69.2	70.9	1180
21	24	24	67.1	69.7	1180
22	24	24	67.9	70.8	1180
23	24	24	69.5	71.6	1180
24	24	24	69.2	71.4	1180
25	24	24	69.4	72.5	1180
26	24	24	70.1	73.2	1180
27	24	24	70.2	73.0	1180
28	24	24	70.4	72.6	1180
29	24	24	69.2	71.0	1180
30	24	24	69.2	71.8	1180
31	24	24	69.0	71.9	1180
	MONTHLY MINIMUM		66.9	68.8	1166
	MONTHLY MAXIMUM		76.3	79.1	1194
	MONTHLY MEAN		70.8	73.2	1180

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 SEPTEMBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-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
11	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	69.1	550
21	0	24	67.8	68.6	550
22	0	24	67.2	68.4	538
23	0	24	68.4	69.4	538
24	0	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
	MONTHLY MINIMUM		63.5	64.3	525
	MONTHLY MAXIMUM		73.4	77.1	1208
	MONTHLY MEAN		68.8	70.5	801

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 OCTOBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	0	24	63.7	63.0	525
2	0	24	59.4	60.3	512
3	0	24	58.7	59.3	512
4	0	24	57.8	58.9	512
5	0	24	56.3	57.0	525
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
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	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	600
19	0	24	50.0	51.1	600
20	0	24	50.6	51.6	600
21	0	24	50.2	52.2	600
22	0	24	50.8	51.8	600
23	0	24	52.6	53.3	600
24	0	24	51.5	52.6	600
25	0	24	52.4	53.4	600
26	0	24	51.9	54.6	600
27	0	24	50.6	52.2	612
28	0	24	51.5	52.3	612
29	0	24	52.9	53.1	612
30	0	24	53.4	54.9	600
31	0	25*	52.1	53.2	600
* Daylight savings					
	MONTHLY MINIMUM		48.8	50.0	512
	MONTHLY MAXIMUM		63.7	63.0	648
	MONTHLY MEAN		54.6	55.7	577

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	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	0	24	51.0	51.9	600
2	0	24	51.3	52.1	600
3	0	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
8	0	24	46.6	47.3	588
9	0	24	45.0	45.8	483
10	0	24	46.5	46.8	483
11	0	24	44.8	45.9	483
12	0	24	43.3	43.7	483
13	0	24	41.3	43.9	815
14	0	24	42.2	42.9	815
15	0	24	42.1	42.9	815
16	0	24	43.0	43.0	815
17	0	17.4	42.5	43.4	815
18	0	0	43.1	43.5	808
19	0	17.4	43.6	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
24	24	24	40.2	41.5	808
25	24	24	39.1	40.1	828
26	24	24	39.3	40.2	835
27	24	24	39.1	40.1	835
28	24	24	37.6	38.3	828
29	24	24	37.7	38.8	828
30	24	24	36.5	37.9	835
		MONTHLY MINIMUM	36.5	37.9	483
		MONTHLY MAXIMUM	51.3	52.1	835
		MONTHLY MEAN	43.5	44.3	713

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 DECEMBER	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (BLOWDOWN-CFS)
1	24	24	35.7	35.9	835
2	24	24	37.4	37.3	835
3	24	24	36.5	37.0	835
4	24	24	37.7	37.5	835
5	24	24	37.7	37.3	835
6	24	24	37.2	36.7	835
7	24	24	37.6	37.1	828
8	24	24	37.8	37.4	835
9	24	24	38.4	38.5	828
10	24	24	38.4	38.1	828
11	24	24	38.3	38.3	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	600
18	24	24	33.3	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	720
22	24	24	34.7	36.1	696
23	24	24	34.7	36.5	696
24	24	24	34.7	36.3	696
25	24	24	34.7	36.0	732
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
	MONTHLY MINIMUM		33.3	34.6	576
	MONTHLY MAXIMUM		38.4	38.5	835
	MONTHLY MEAN		35.8	36.3	749

Table 2 Daily 2004 Mississippi River Discharge Flow rate (cfs) at Lock Dam 3

	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	7900	6300	11100	34700	14700	46500	18600	12100	7600	22800	29900	12200
5	7600	6400	11300	33300	16400	50700	16700	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
20	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
22	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	22700	16500	11600
31	5800		32400		34000		11600	8300		22900		12000
MIN	5500	5800	9400	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
YE[illegible]IN 5500

Table 3 — 2004 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

Month	Mean Plant Flow (cfs)	Mean River Flow (cfs)	Percentage of Mean River Flow 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%

Table 4. Mean Monthly Mississippi River Flow for 1984 - 2004, in cubic feet per second (cfs).

Month	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
January	6700	9,229	10,932	11,271	8,974	10,790	9,806	14,823	14,826	11,365	13,090
February	6700	7,871	10,104	10,471	9,548	12,589	14,911	13,954	15,041	9,371	12,611
March	15000	13,210	11,497	10,948	22,219	17,897	26,574	24,177	24,474	29,061	28,542
April	24700	25,613	40,657	112,703	15,570	42,013	51,477	106,073	57,517	48,507	40,830
May	19400	42,194	33,974	82,661	18,839	47,426	22,681	39,316	46,535	45,135	47,548
June	46000	27,413	26,323	53,177	22,070	34,423	25,690	19,487	33,790	30,667	26,913
July	19500	32,739	34,597	23,981	21,052	27,548	26,477	36,119	23,732	27,323	29,403
August	10600	10,084	29,065	12,164	10,026	24,432	10,742	28,074	13,303	29,129	19,971
September	19200	7,087	24,513	9,193	6,687	18,013	7,060	16,663	9,300	19,860	21,203
October	19500	6,771	28,600	9,577	6,790	14,200	12,597	14,155	11,403	31,061	25,581
November	21900	8,167	18,467	11,040	17,463	13,243	19,773	14,160	23,353	30,703	20,173
December	12300	8,310	12,135	13,813	9,558	9,671	15,645	12,694	18,716	17,494	14,432
Averages	**26,566**	**16,557**	**23,405**	**30,083**	**14,066**	**22,687**	**20,286**	**28,308**	**24,333**	**26,710**	**25,025**

Month	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984
January	9,326	15,658	5,542	4,965	6,294	7,303	13,758	13,710	12,526	13,375
February	8,936	13,978	5,879	4,889	6,529	7,634	12,586	12,804	10,239	18,557
March	12,513	43,661	15,081	17,484	11,300	14,810	17,287	24,790	32,265	27,290
April	55,473	32,668	34,268	12,842	33,264	21,463	20,267	84,870	45,317	56,277
May	48,571	25,474	44,753	22,310	24,287	13,119	13,655	81,242	43,518	49,528
June	65,377	17,920	44,960	31,610	13,237	4,667	14,573	37,043	30,105	55,613
July	84,123	28,985	33,856	20,323	7,690	2,903	11,674	34,684	25,676	37,165
August	41,135	14,532	21,535	16,322	4,658	5,103	10,477	30,813	18,226	13,826
September	30,717	15,686	25,182	9,923	8,307	6,080	7,183	41,957	29,665	9,678
October	19,516	15,374	15,458	11,135	6,358	7,019	7,771	49,319	39,590	23,866
November	18,773	19,076	22,467	9,903	6,793	7,919	8,693	24,260	21,337	21,157
December	16,490	12,126	20,503	6,184	4,961	6,487	9,016	17,774	16,094	15,903
Averages	**34,246**	**21,262**	**24,124**	**13,991**	**11,140**	**8,709**	**12,245**	**37,787**	**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 2004 ANNUAL REPORT

SUMMARY OF THE 2004 FISH POPULATION STUDY

Study and Report
by
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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 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 7,381 fish, comprising 40 species, was collected in the 2004 survey (Table 2).

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;	shorthead redhorse, gizzard shad, freshwater drum
Sector Two;	carp, shorthead redhorse, gizzard shad
Sector Three;	white bass, smallmouth bass, carp
Sector Four;	white bass, freshwater drum, carp
Overall CPUE Average;	shorthead redhorse, 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.

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).

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).

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).

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 mm, 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).

GENERAL

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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Figure 1

PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA

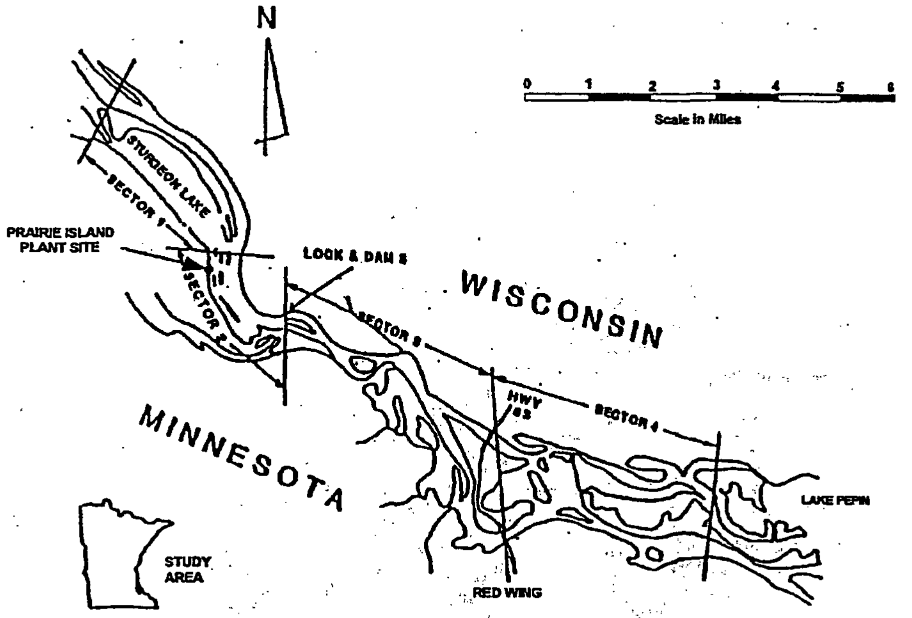


FIGURE 2.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Upstream
Sec 1 Runs 1-20

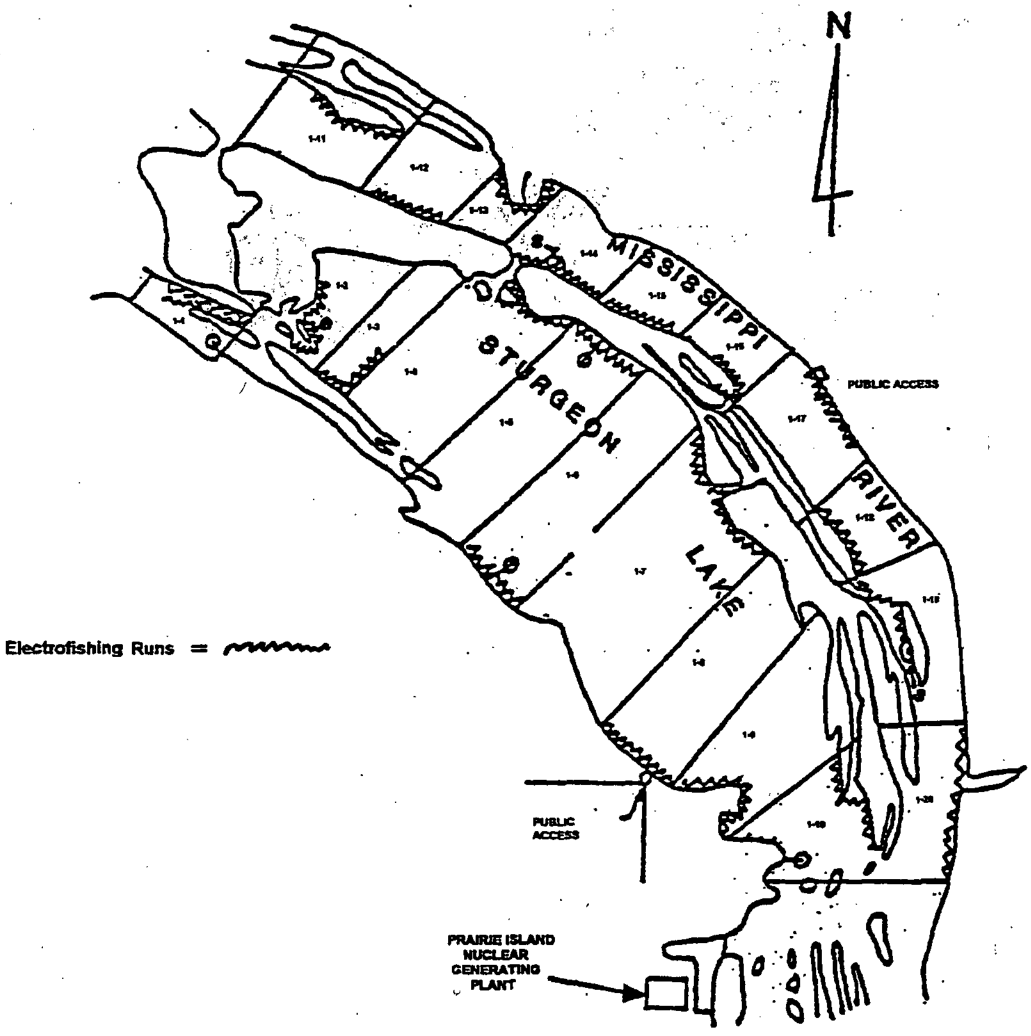


Figure 3.

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

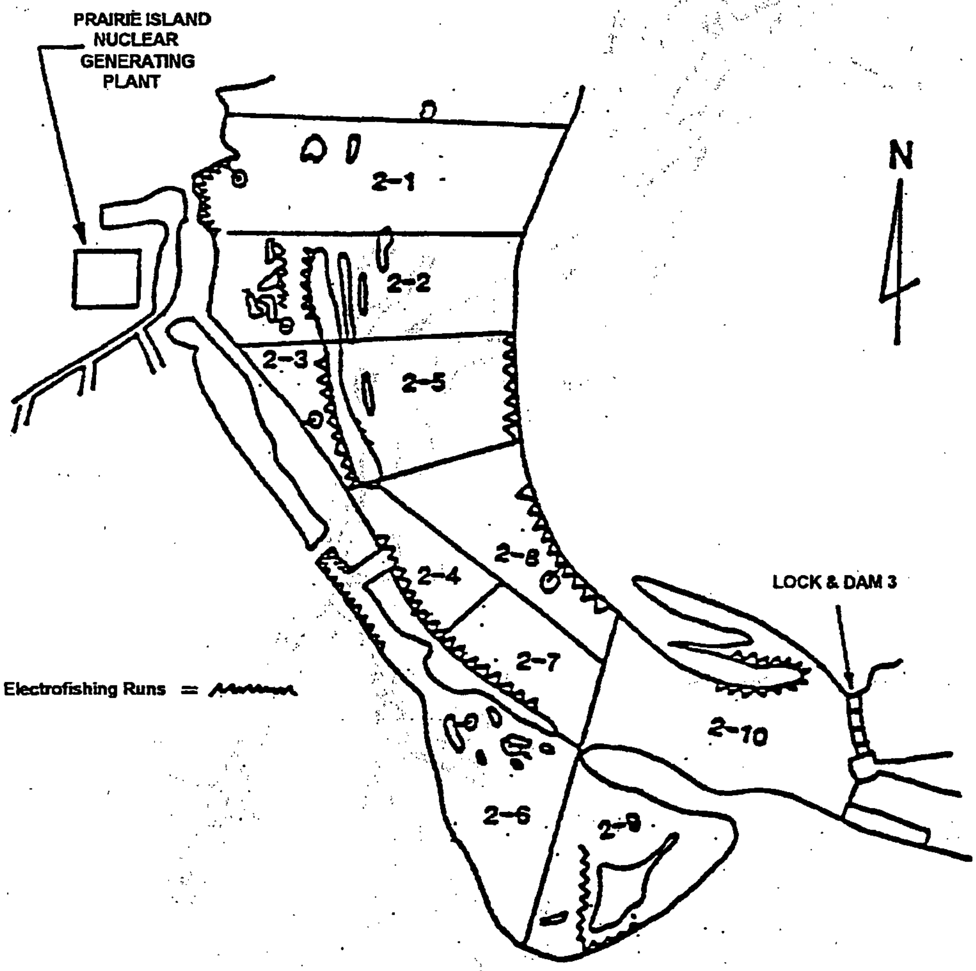


Figure 4.

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

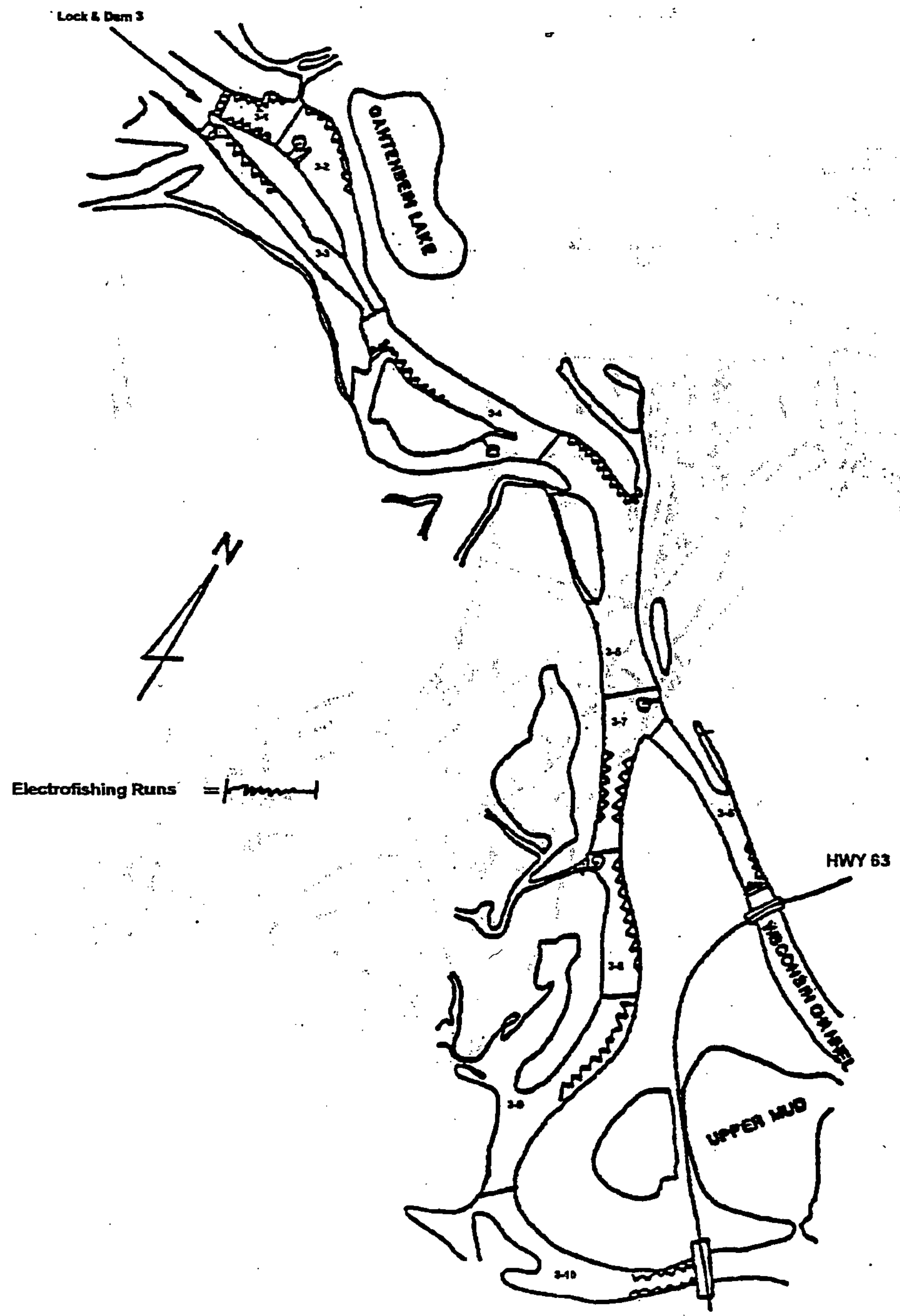
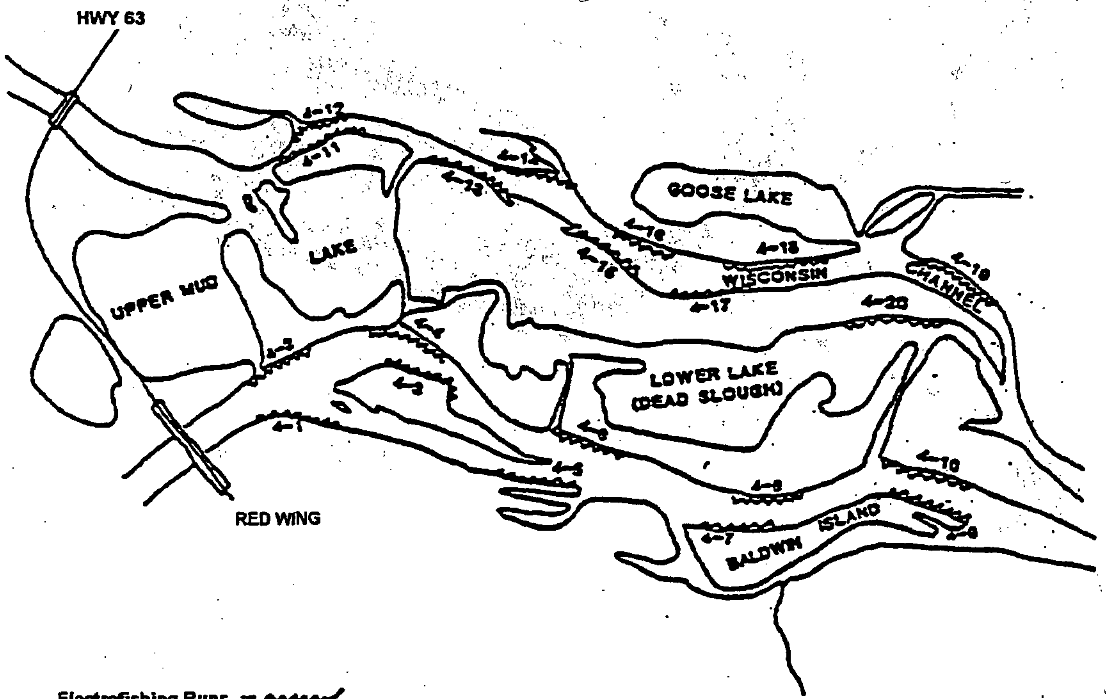


Figure 5.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 4 Runs 1-20)



Electrofishing Runs =

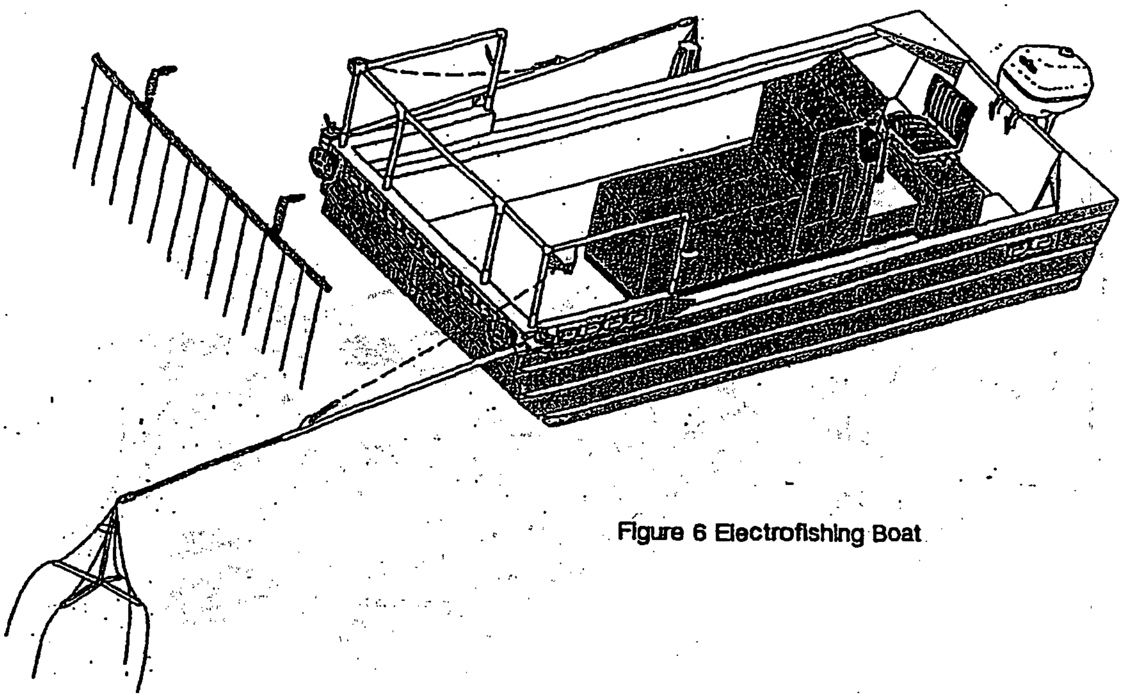
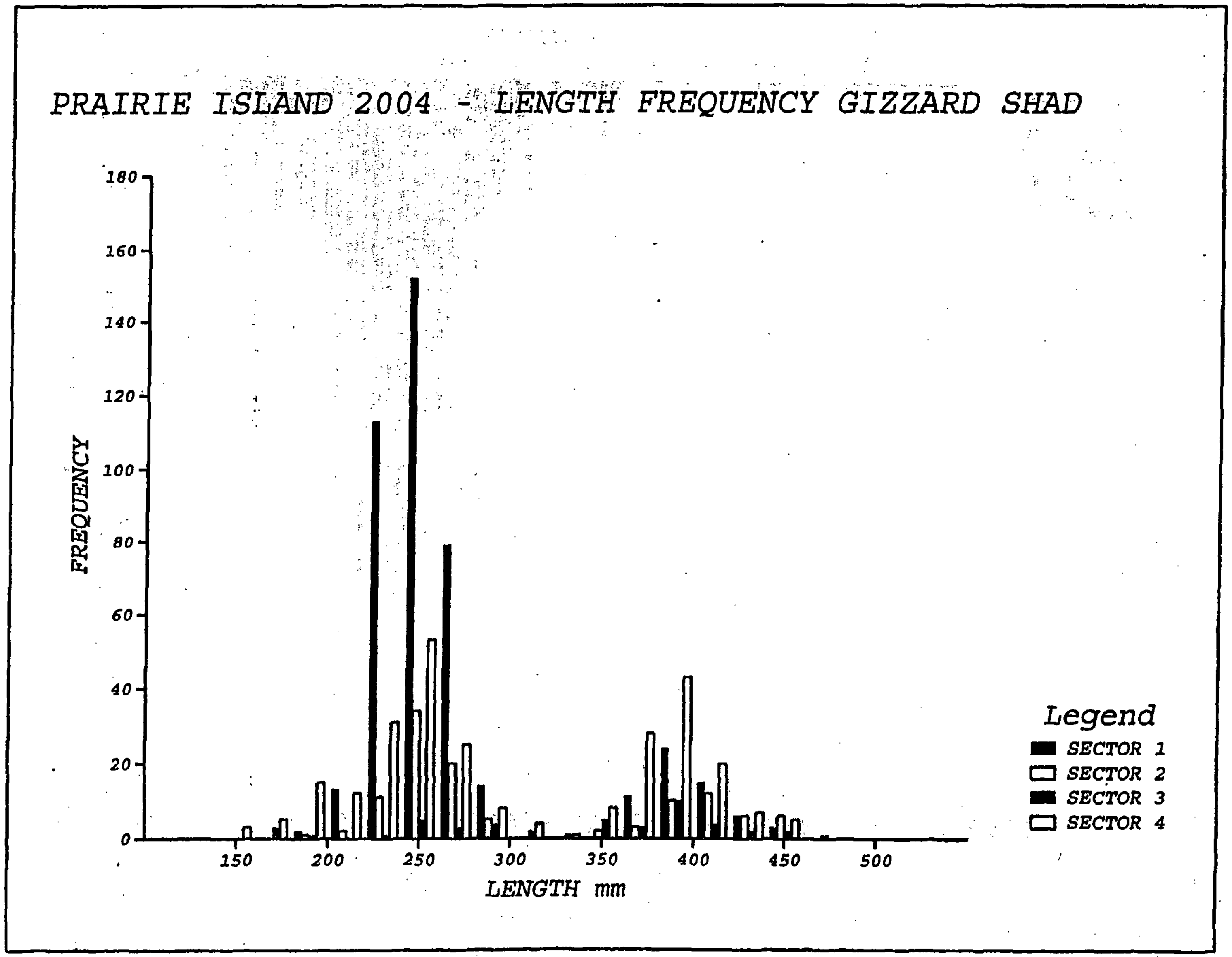
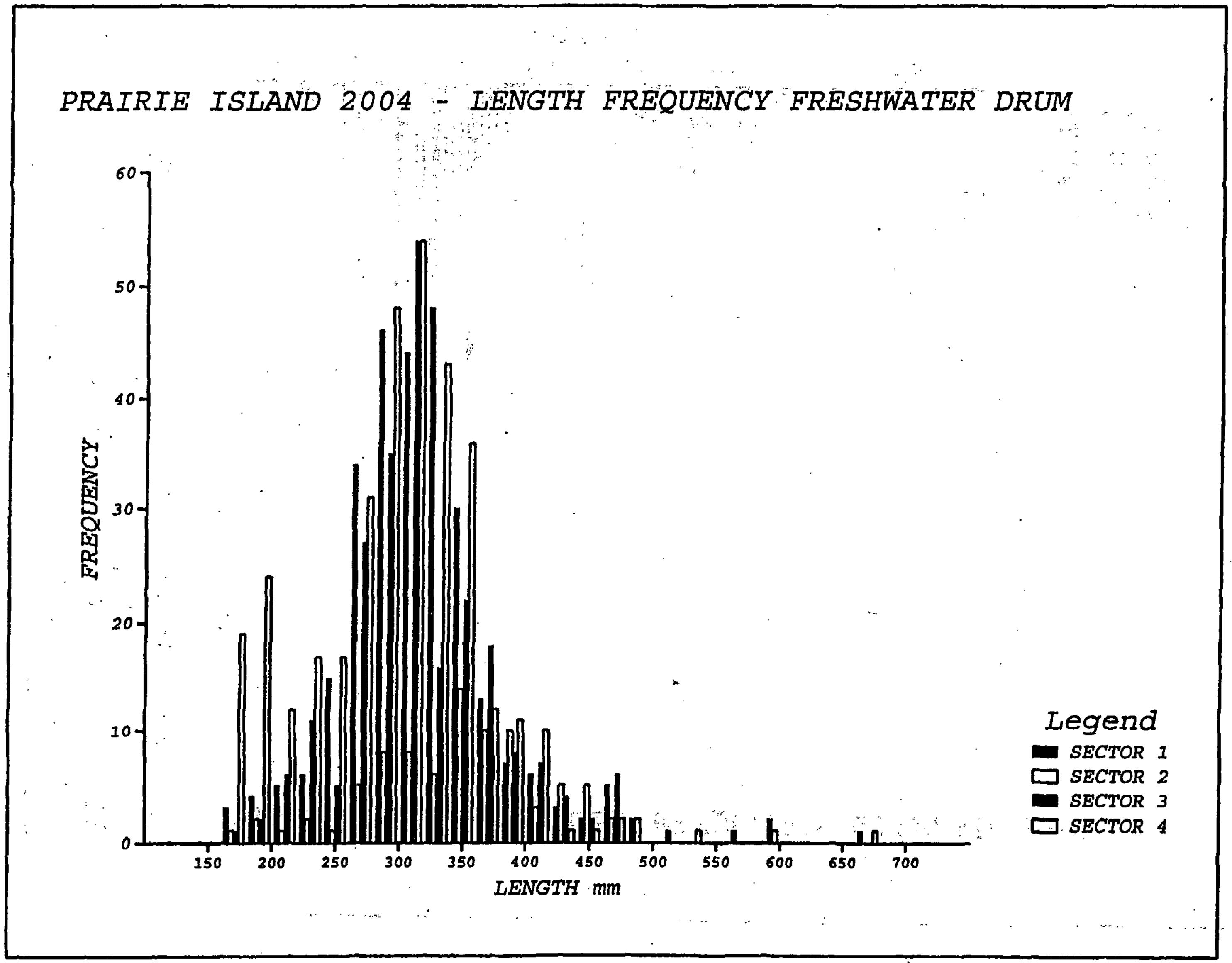


Figure 6 Electrofishing Boat

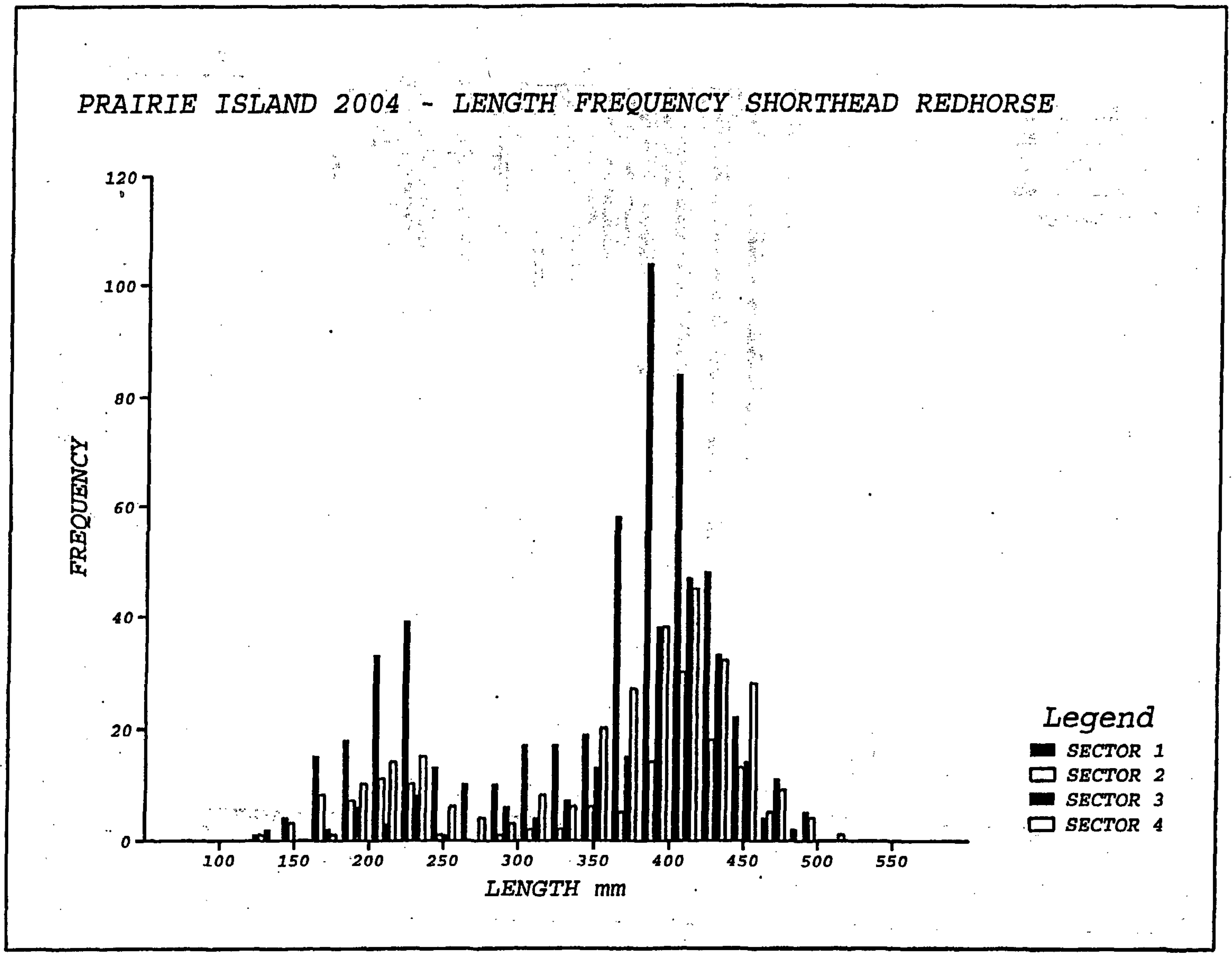


PRAIRIE ISLAND 2004 - LENGTH FREQUENCY GIZZARD SHAD
FREQUENCY
180
160
140
120
100
80
60
40
20
0
150
200
250
300
350
400
450
500
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

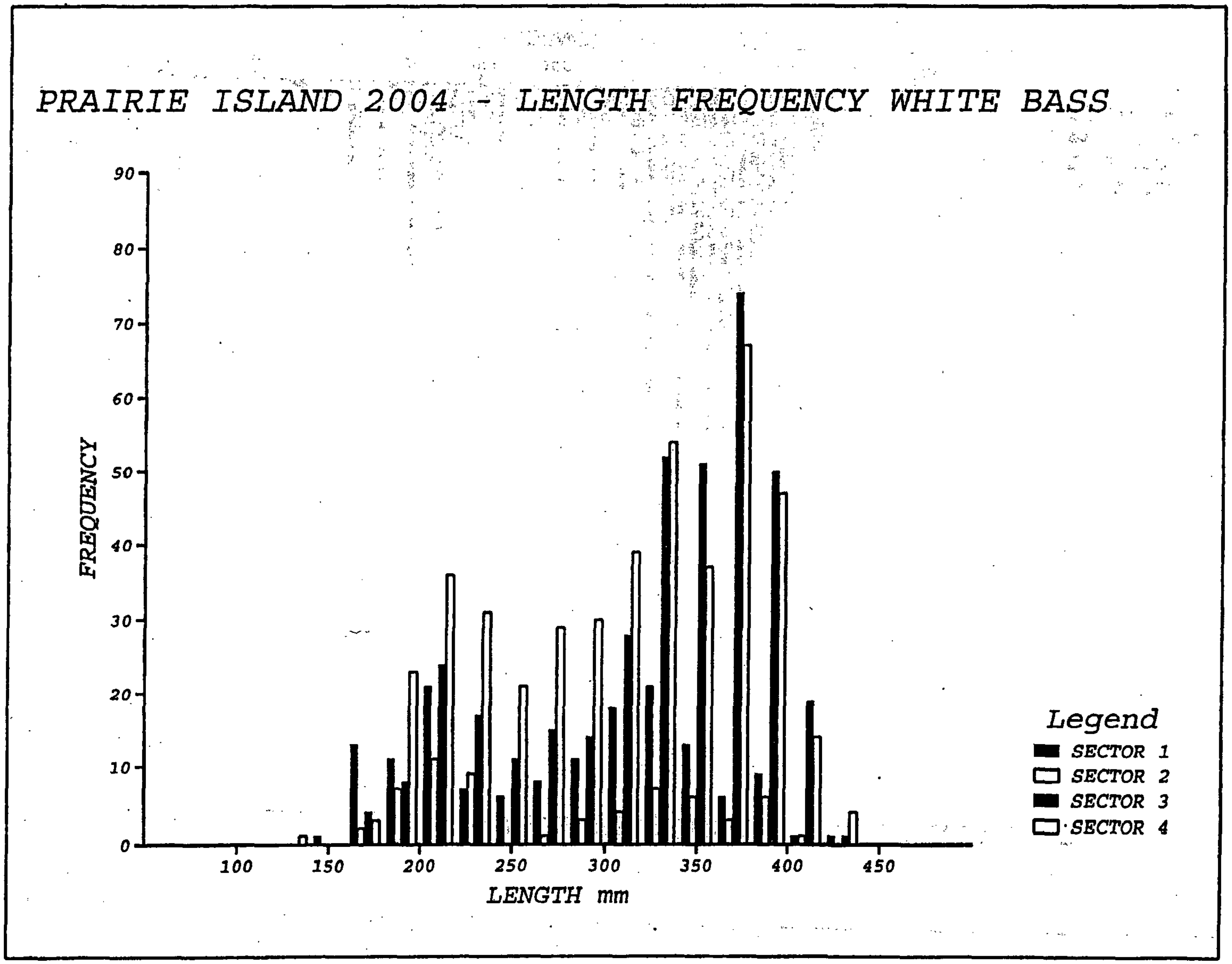
Figure 7


PRAIRIE ISLAND 2004 - LENGTH FREQUENCY FRESHWATER DRUM
FREQUENCY
60
50
40
30
20
10
0
150
200
250
300
350
400
450
500
550
600
650
700
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

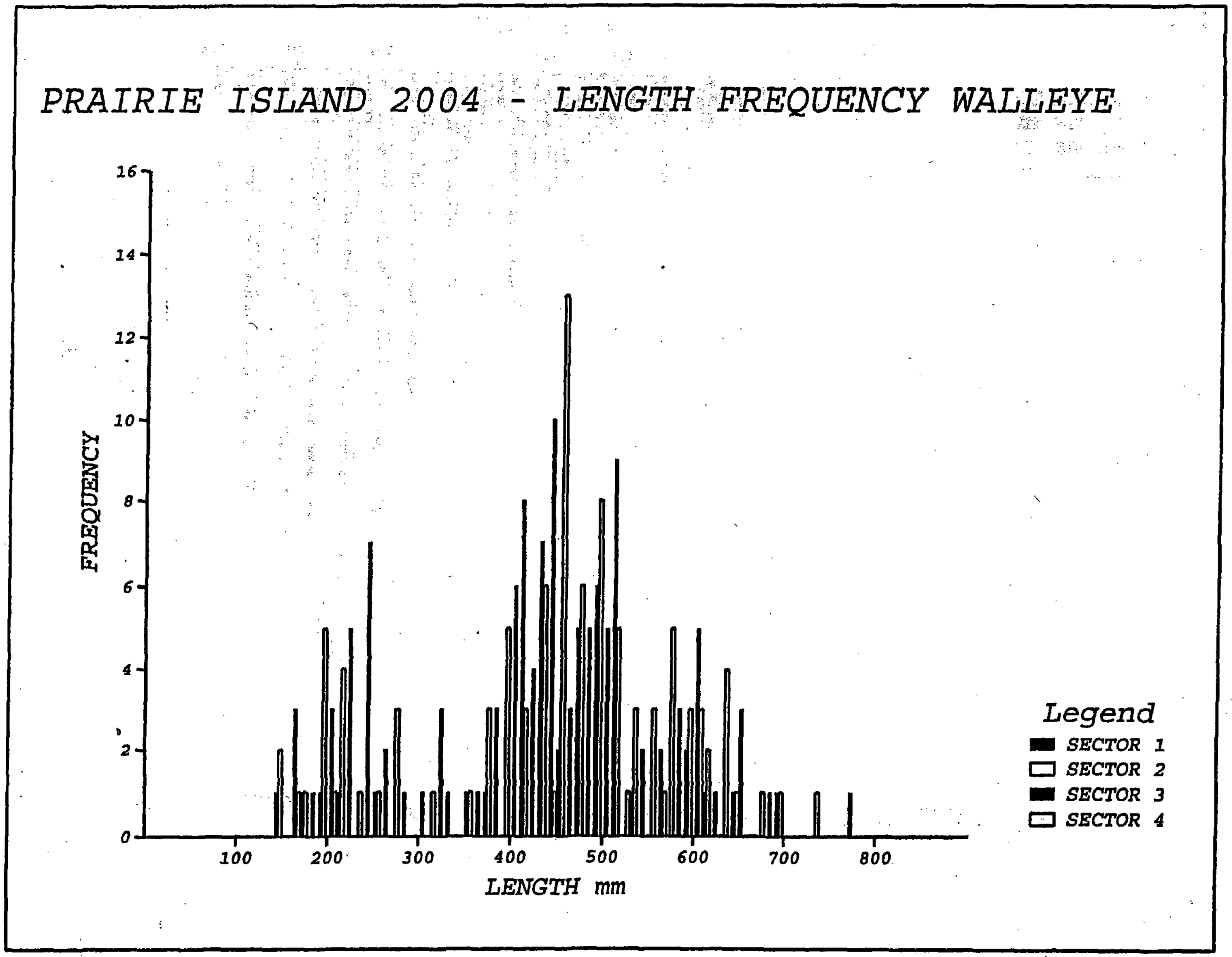
FWD Figure 8



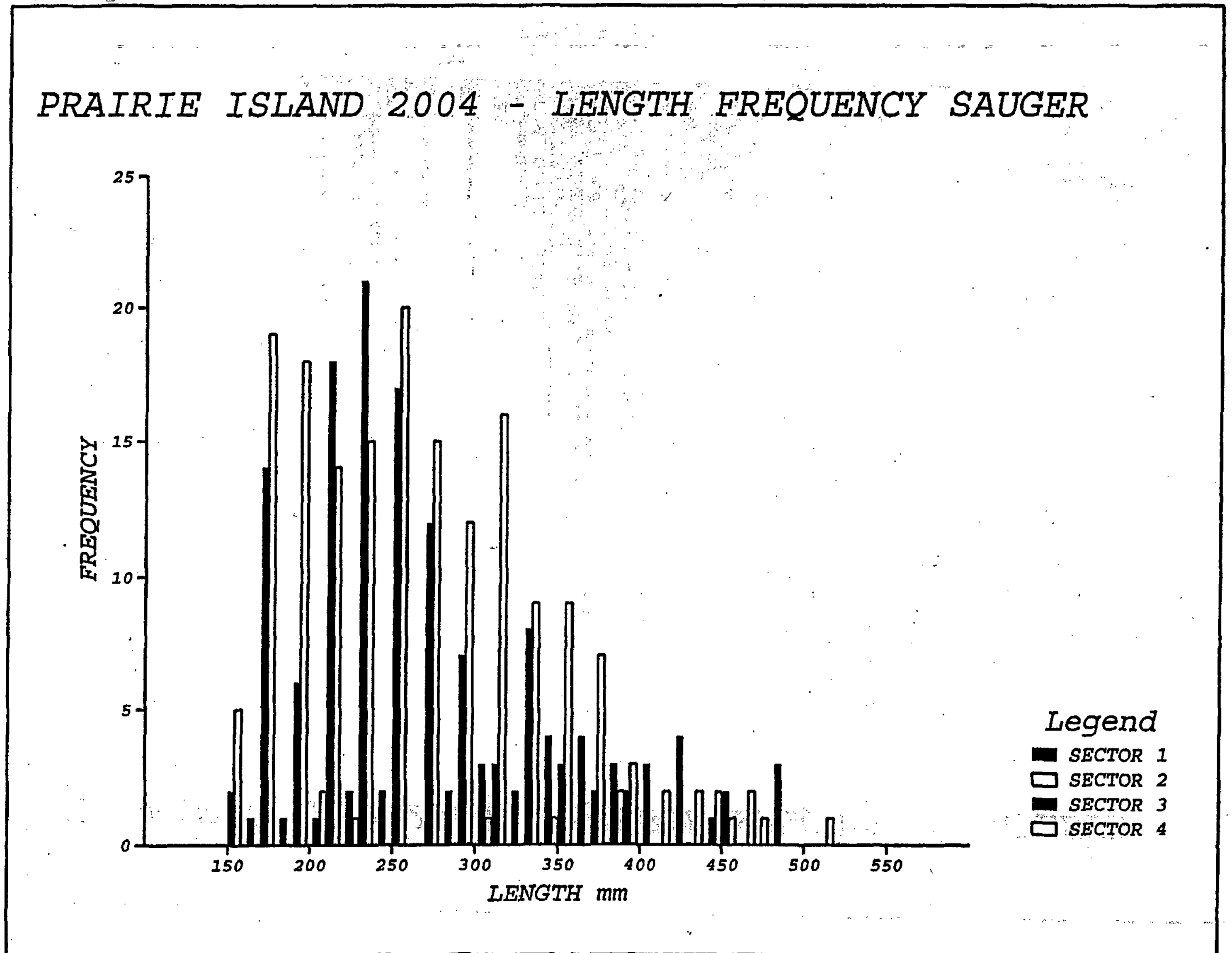
SHRH Figure 9


PRAIRIE ISLAND 2004 - LENGTH FREQUENCY WHITE BASS
FREQUENCY
90
80
70
60
50
40
30
20
10
0
100
150
200
250
300
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

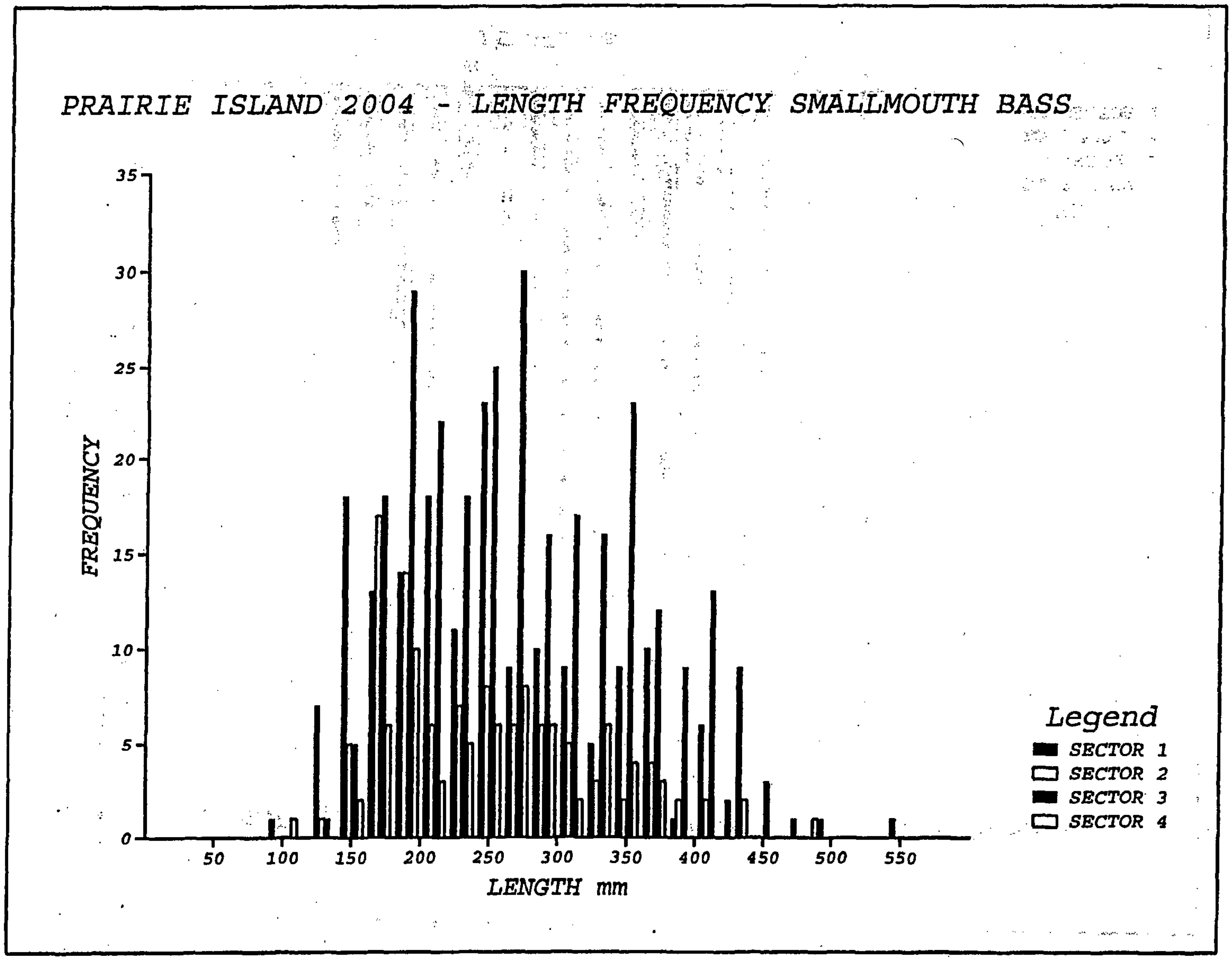
WB Figure 10



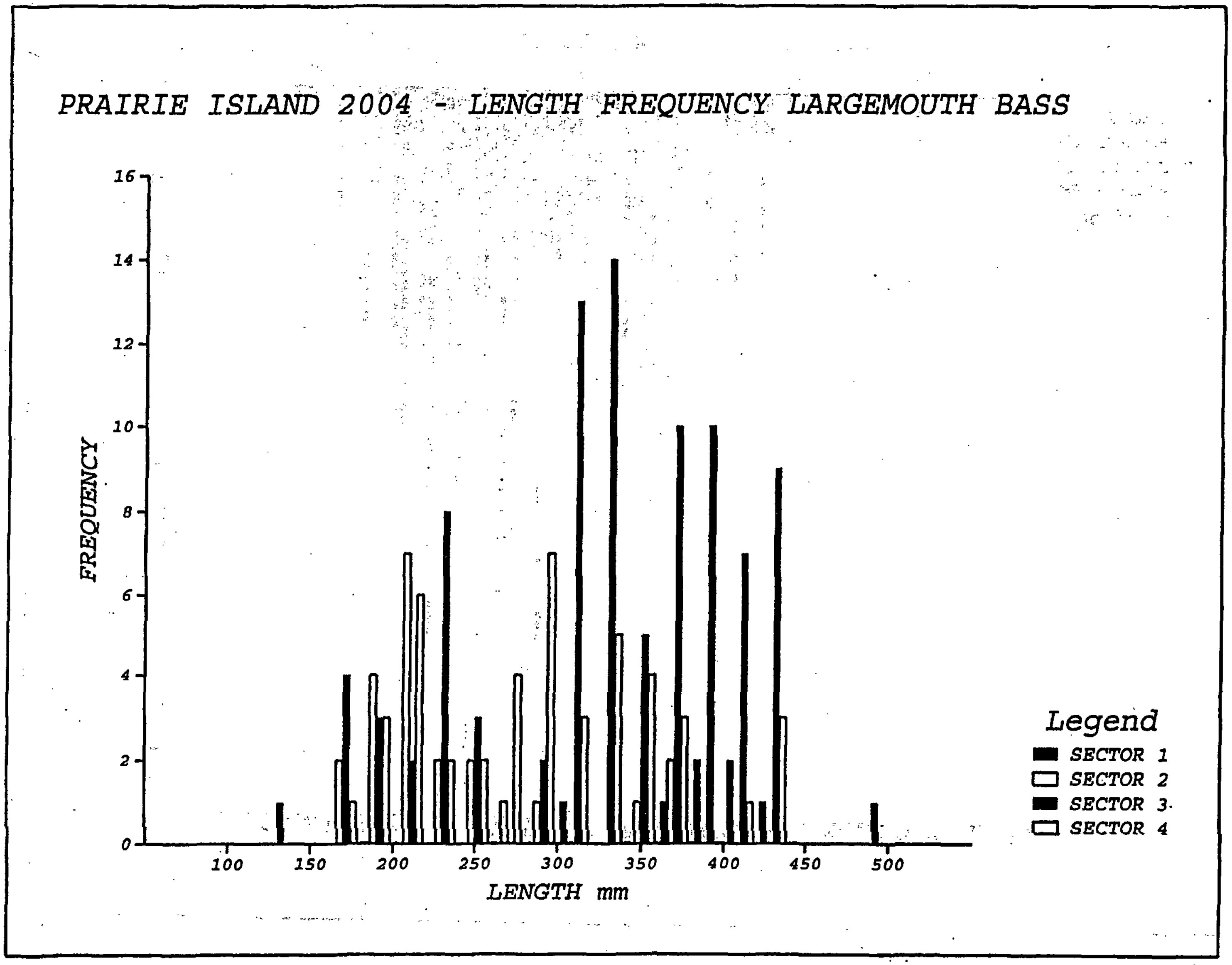
WAE Figure 11



SAU Figure 12



SMB Figure 13



LMB Figure 14

Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2004 in the vicinity of PINGP.

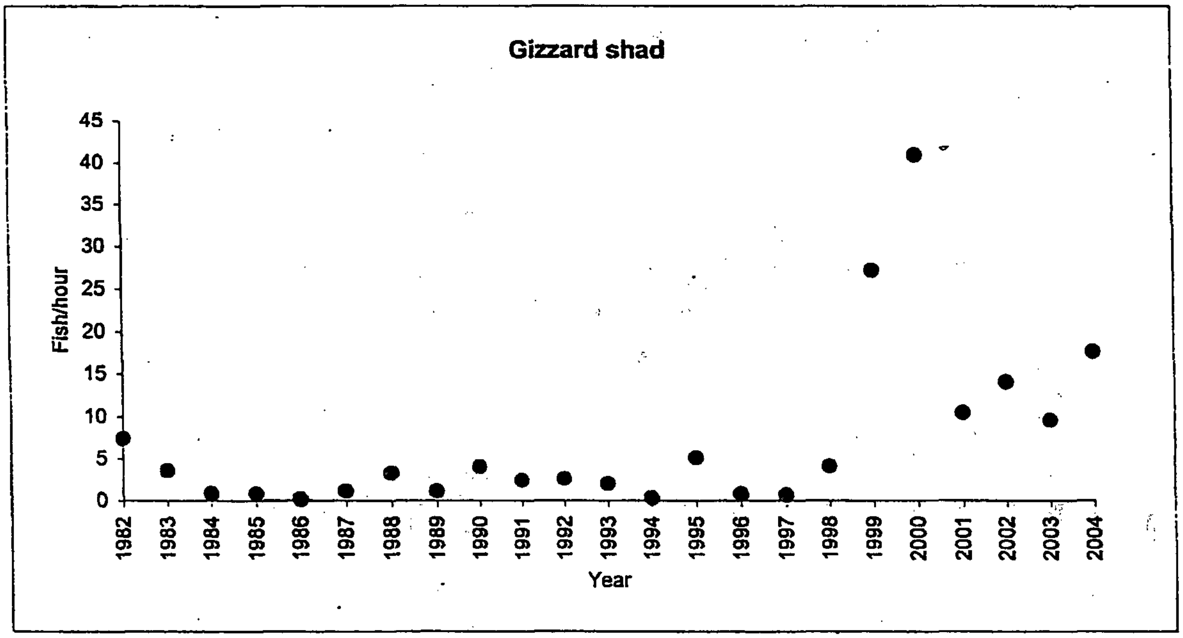


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2004 in the vicinity of PINGP.

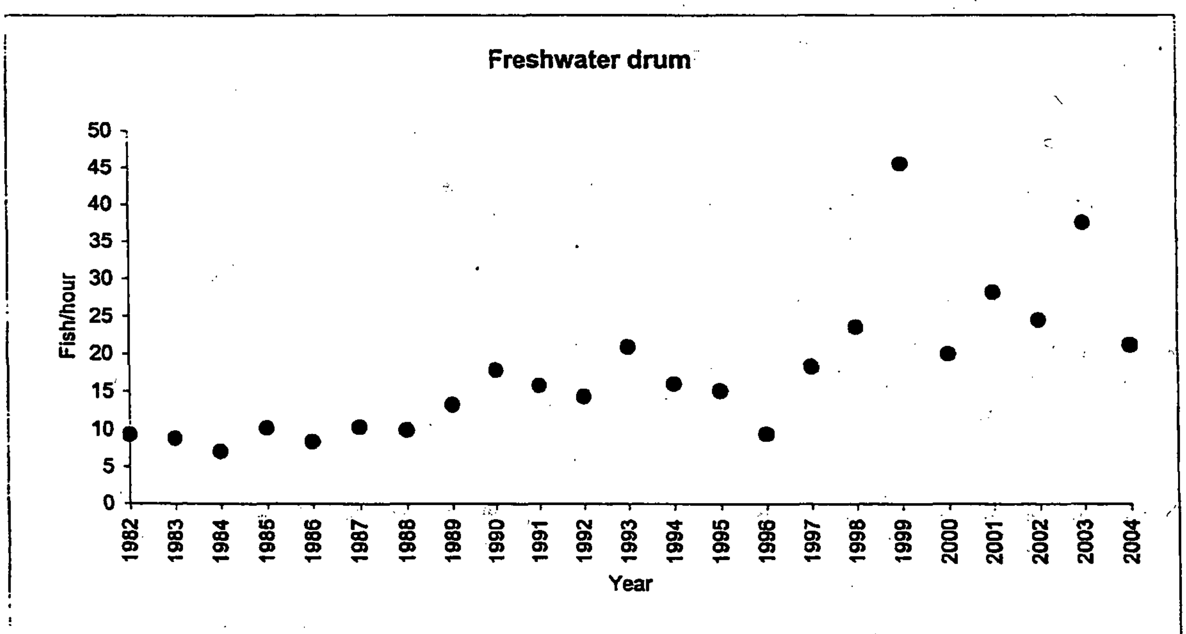


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2004 in the vicinity of PINGP.

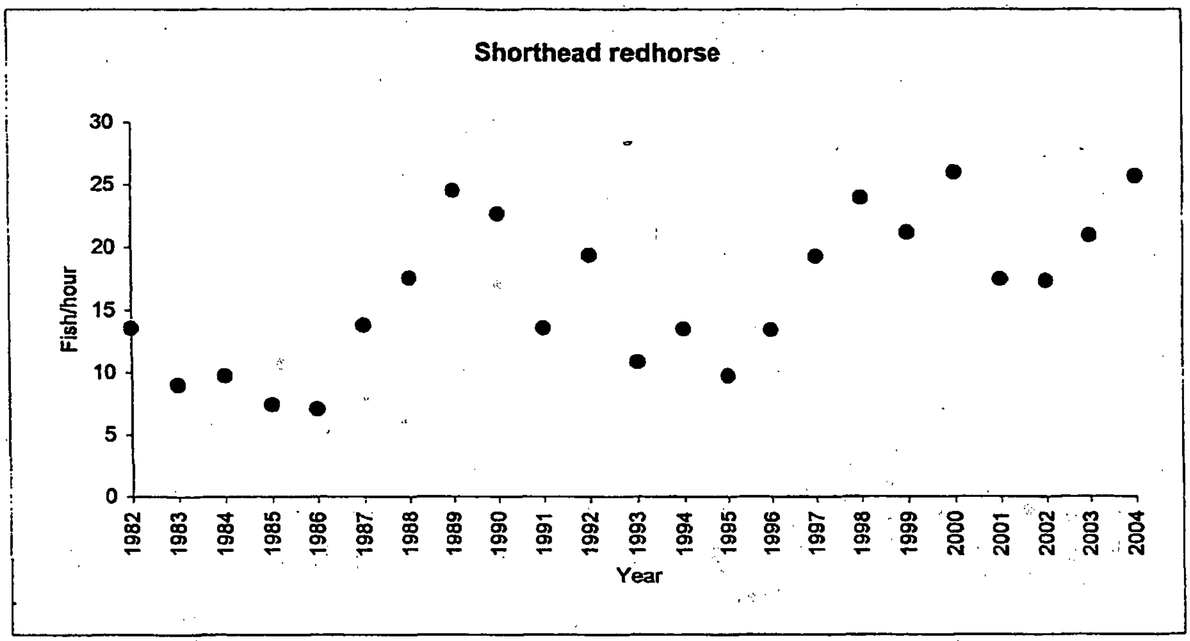


Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2004 in the vicinity of PINGP.

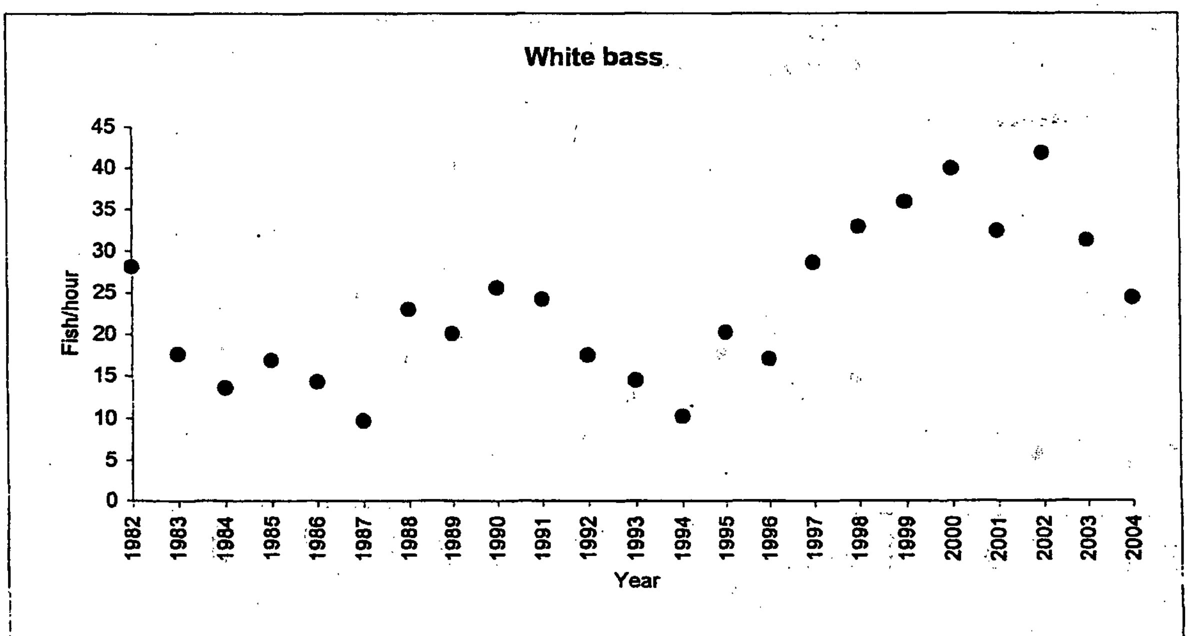


Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2004 in the vicinity of PINGP.

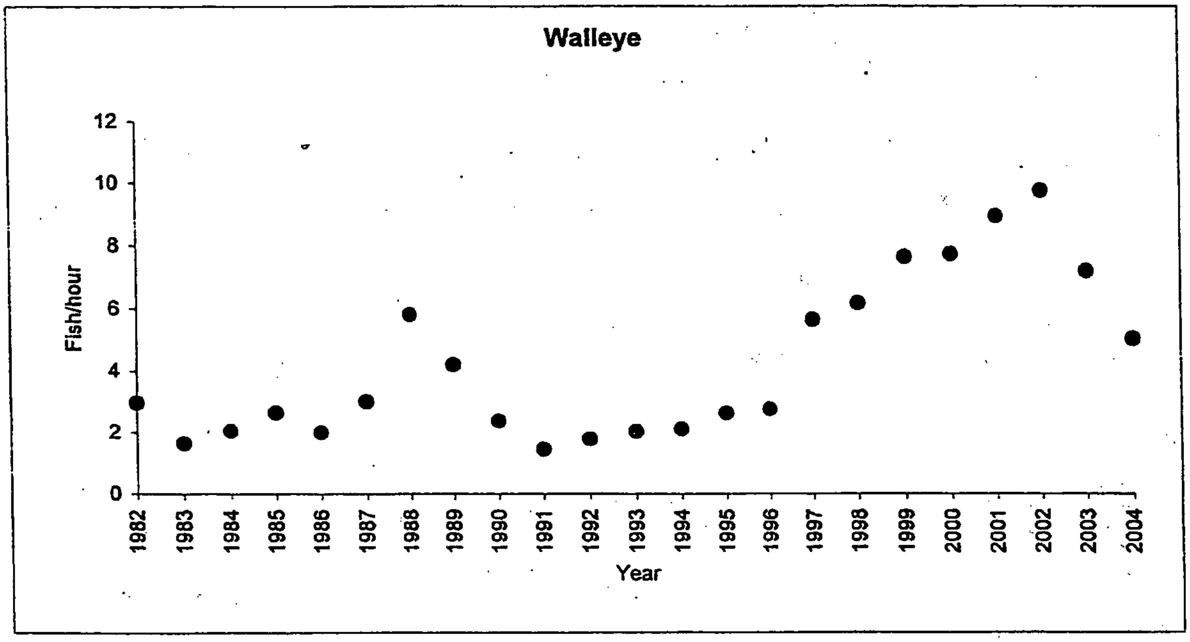


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2004 in the vicinity of PINGP.

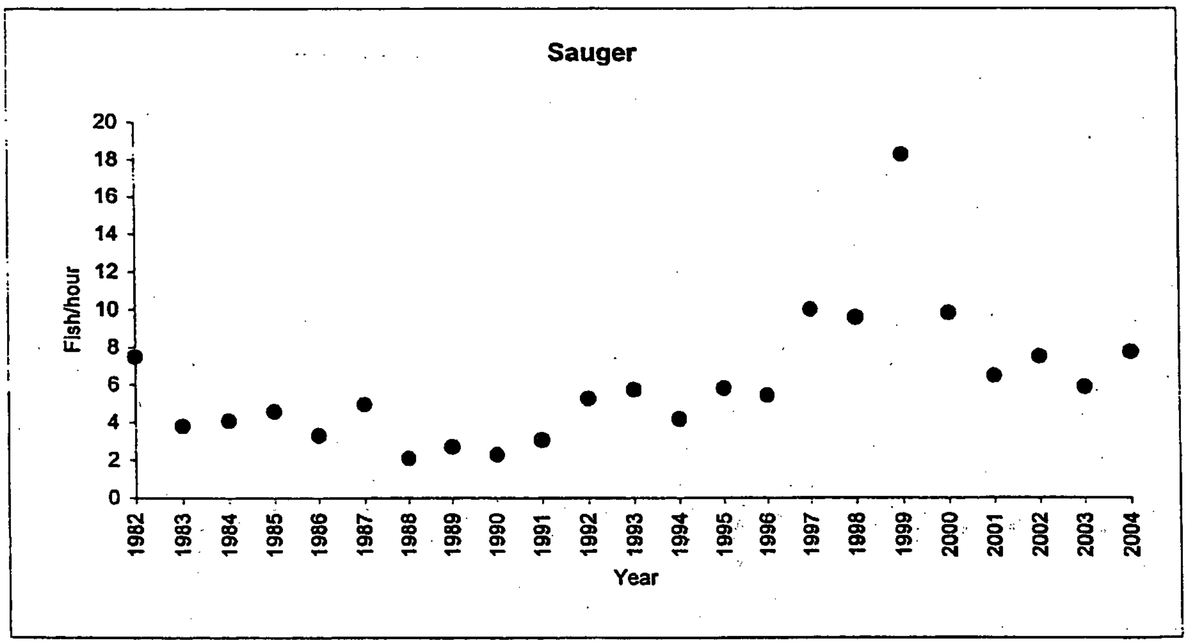


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2004 in the vicinity of PINGP.

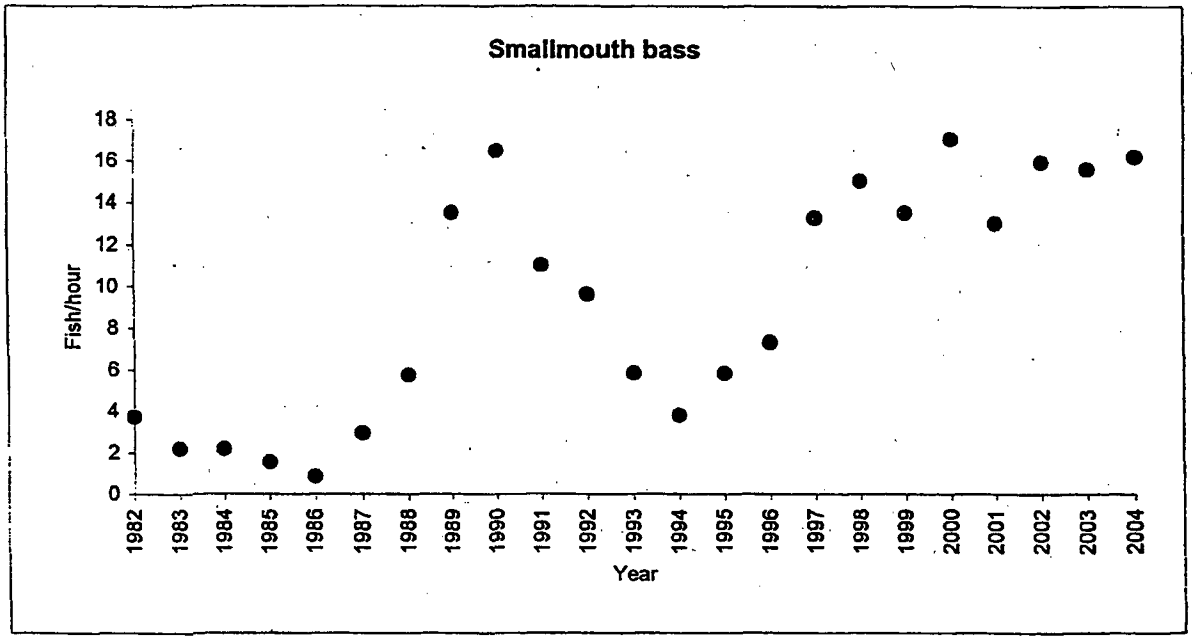


Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2004 in the vicinity of PINGP.

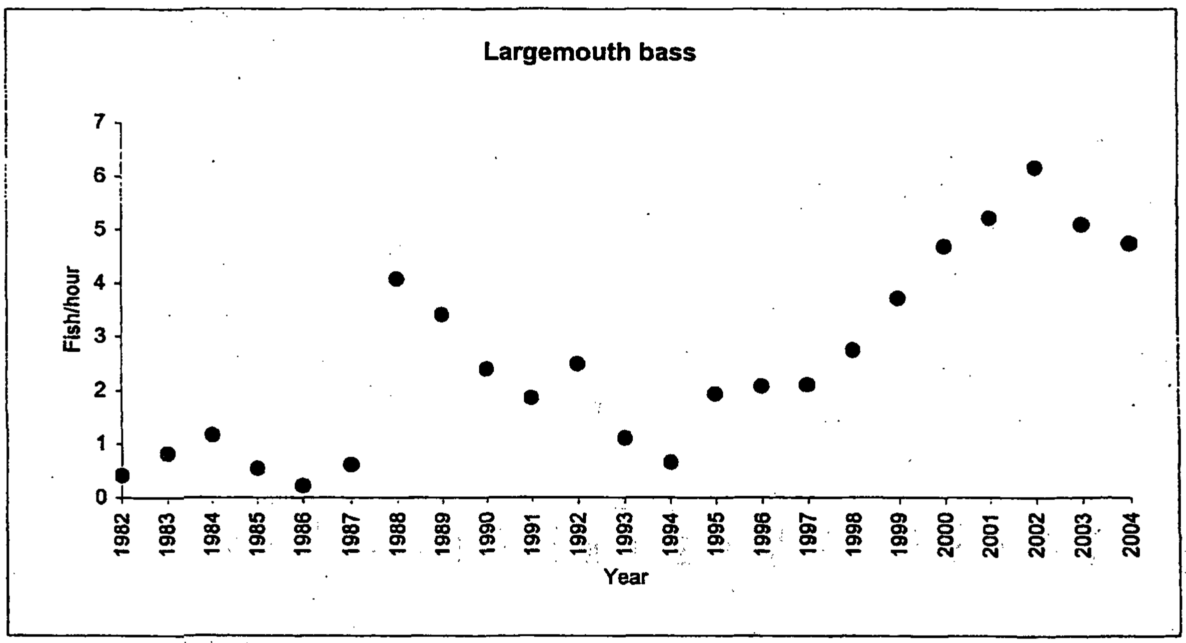
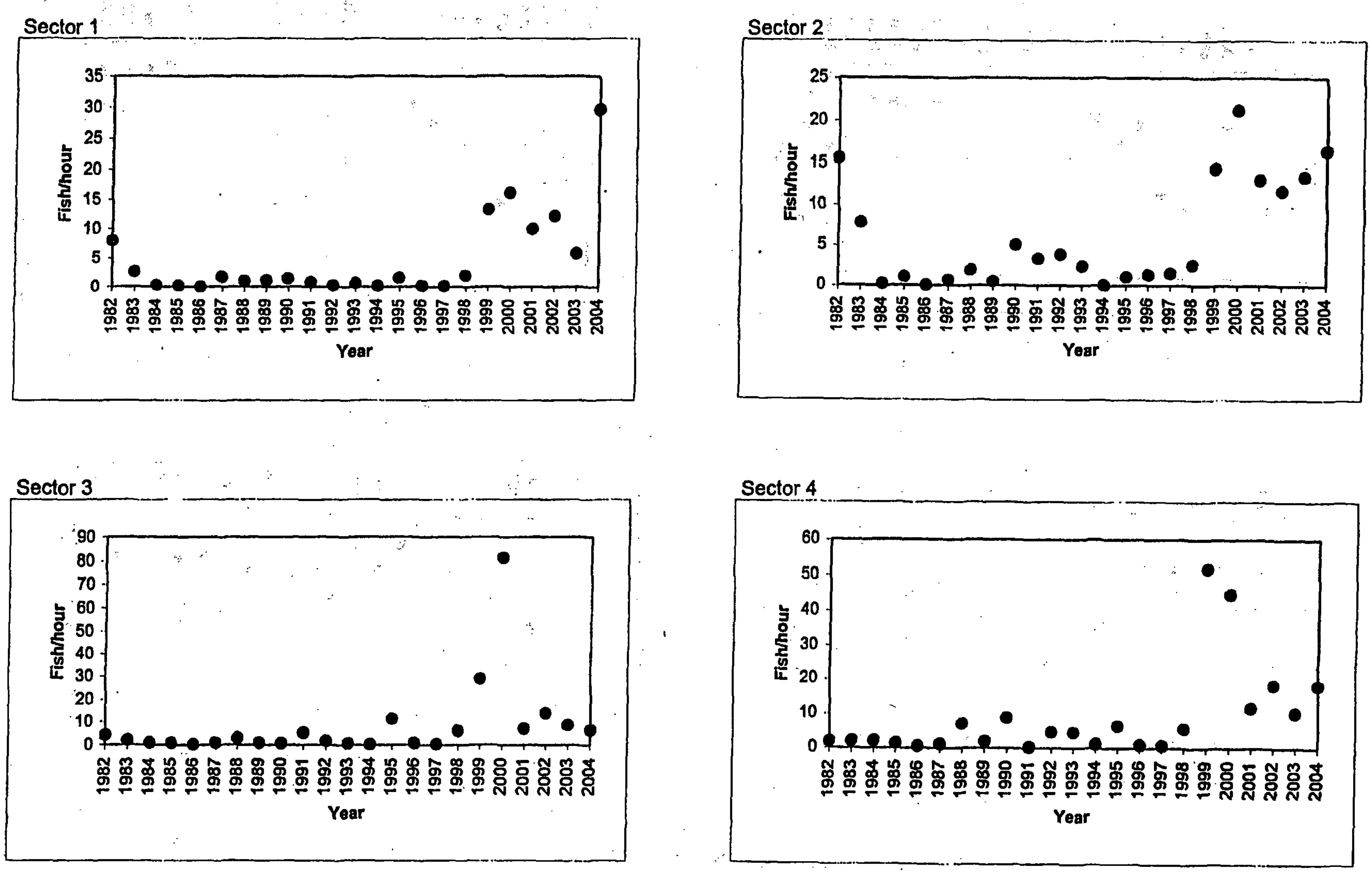
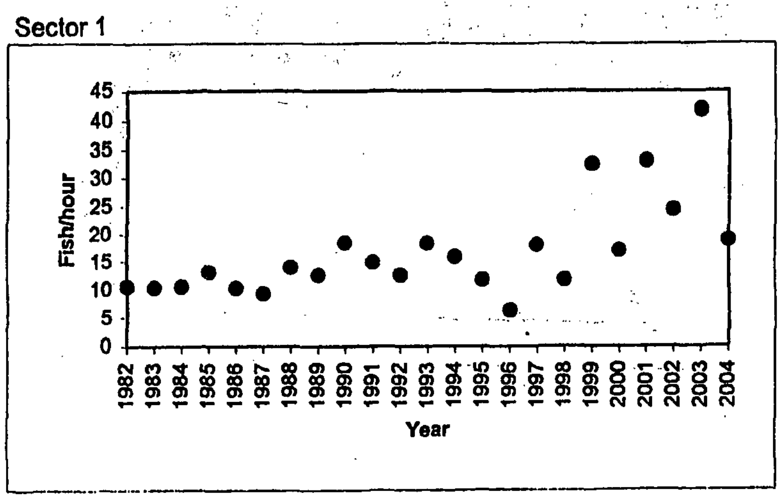


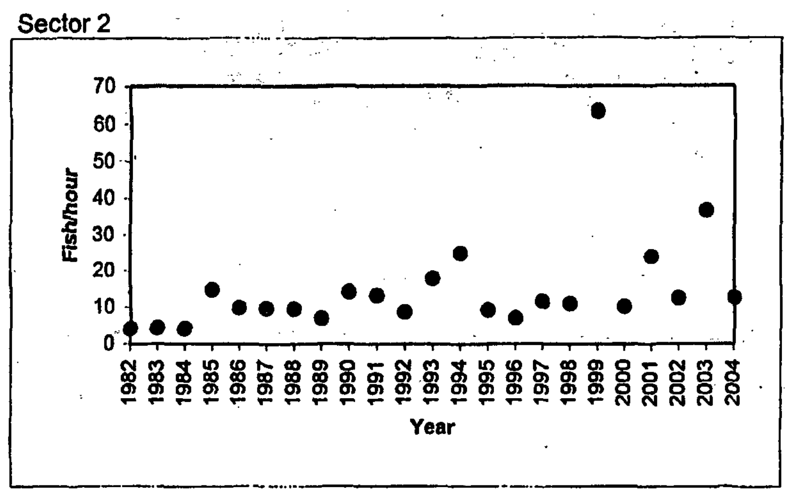
Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2004 in the vicinity of PINGP.

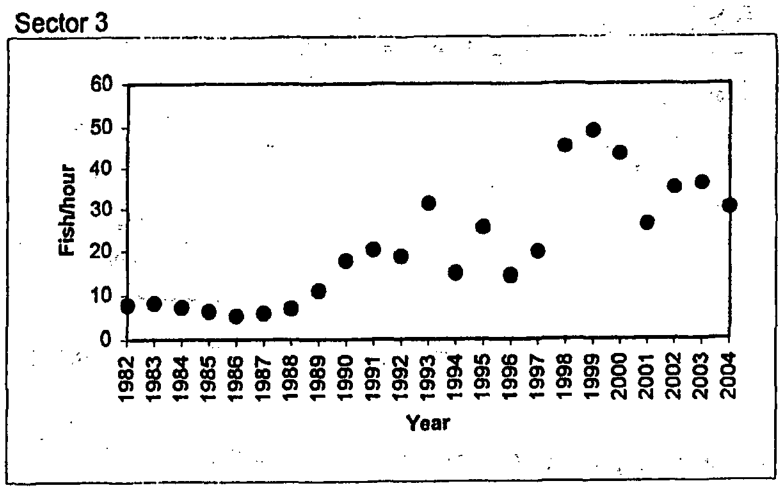


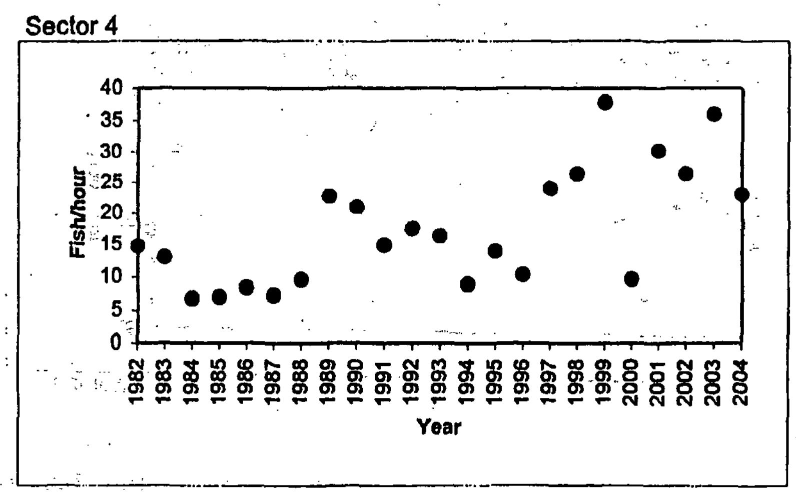
2004FIGUR.XLS

Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2004 in the vicinity of PINGP.





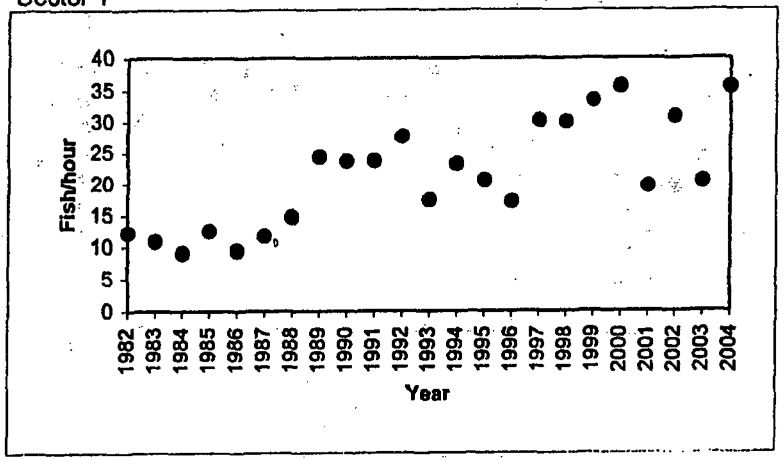




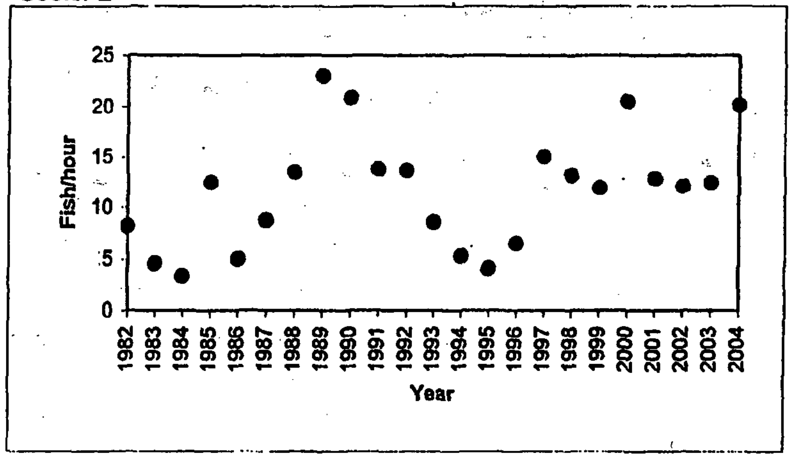
2004FIGUR.XLS

Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2004 in the vicinity of PINGP.

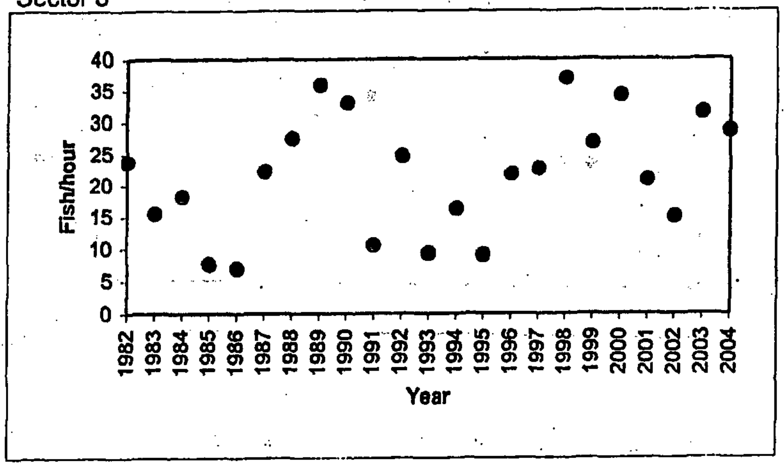
Sector 1



Sector 2



Sector 3



Sector 4

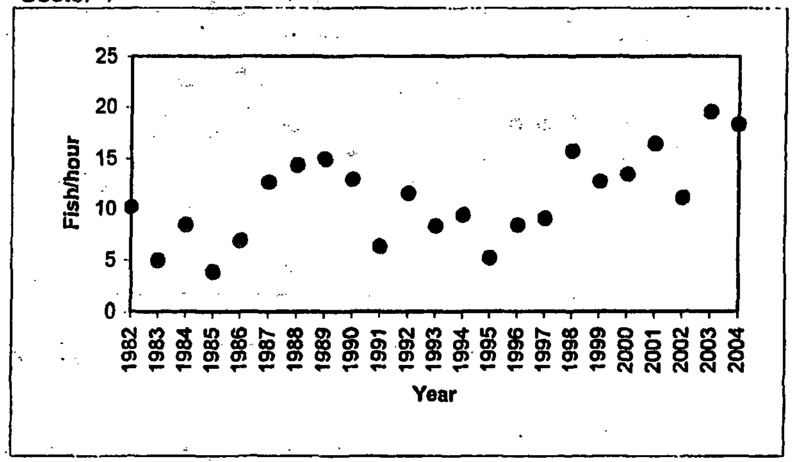
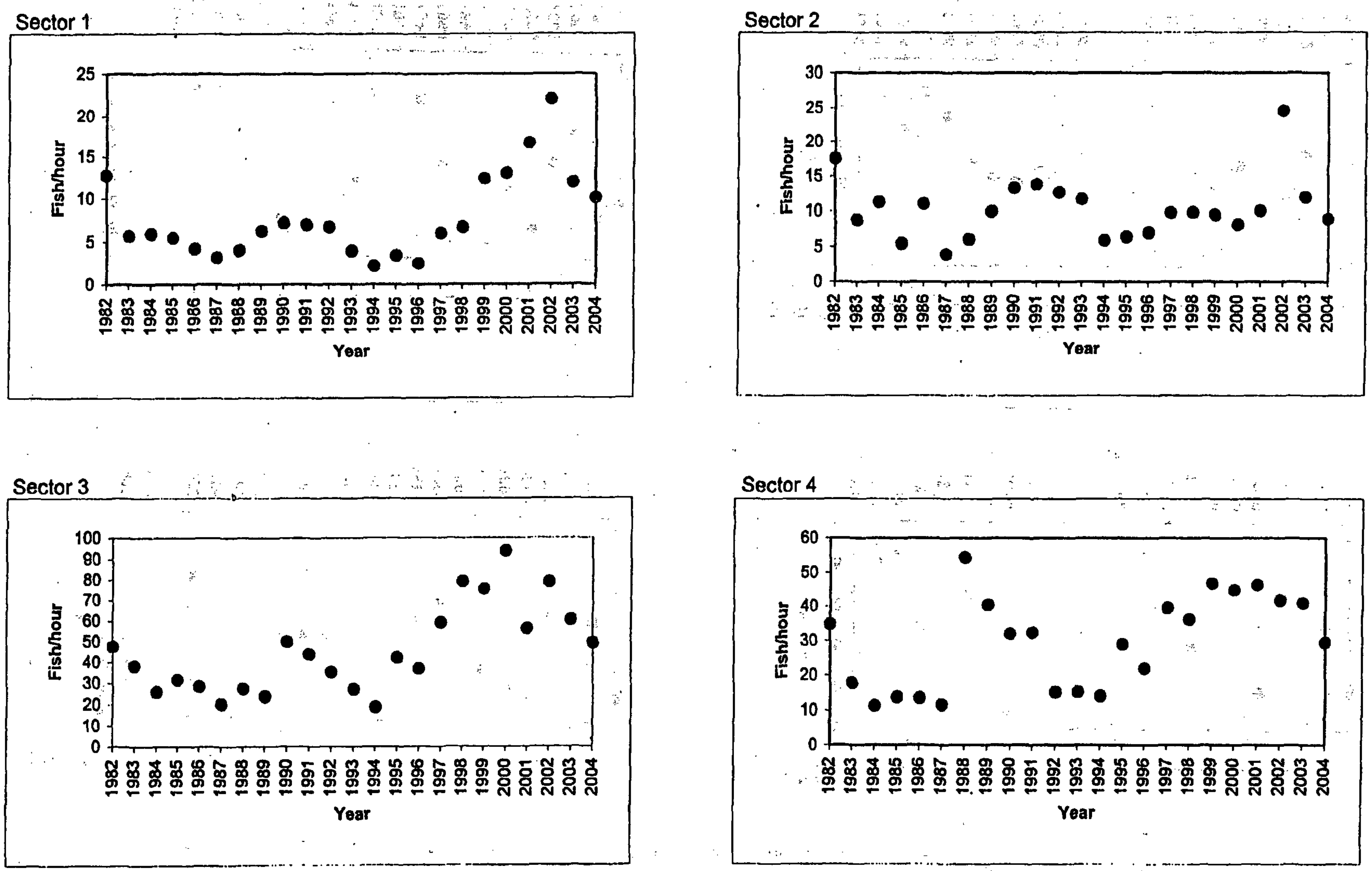


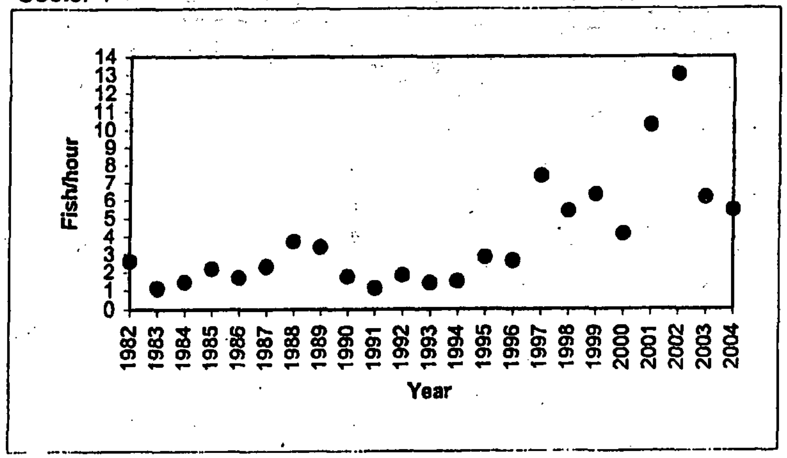
Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2004 in the vicinity of PINGP.



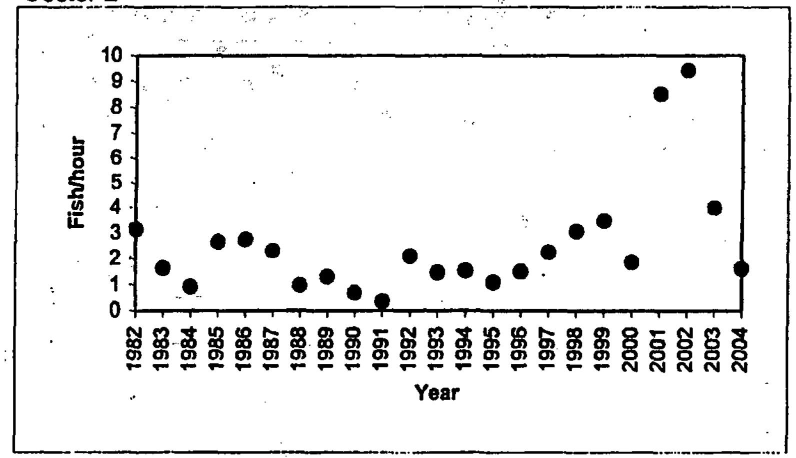
2004FIGUR.XLS

Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2004 in the vicinity of PINGP.

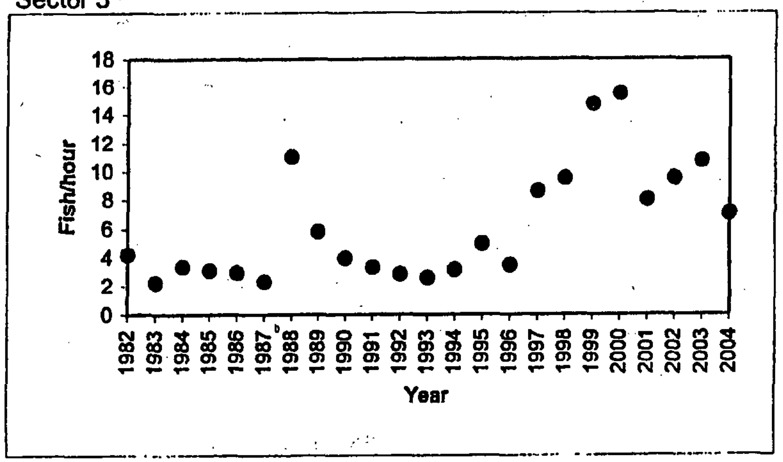
Sector 1



Sector 2



Sector 3



Sector 4

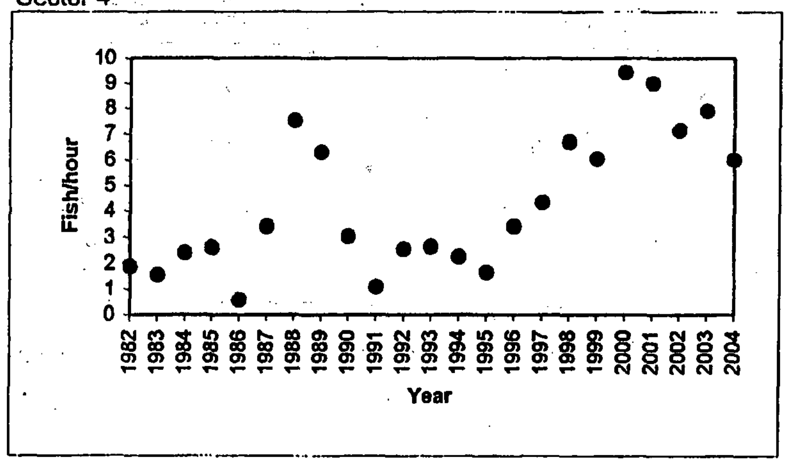


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2004 in the vicinity of PINGP

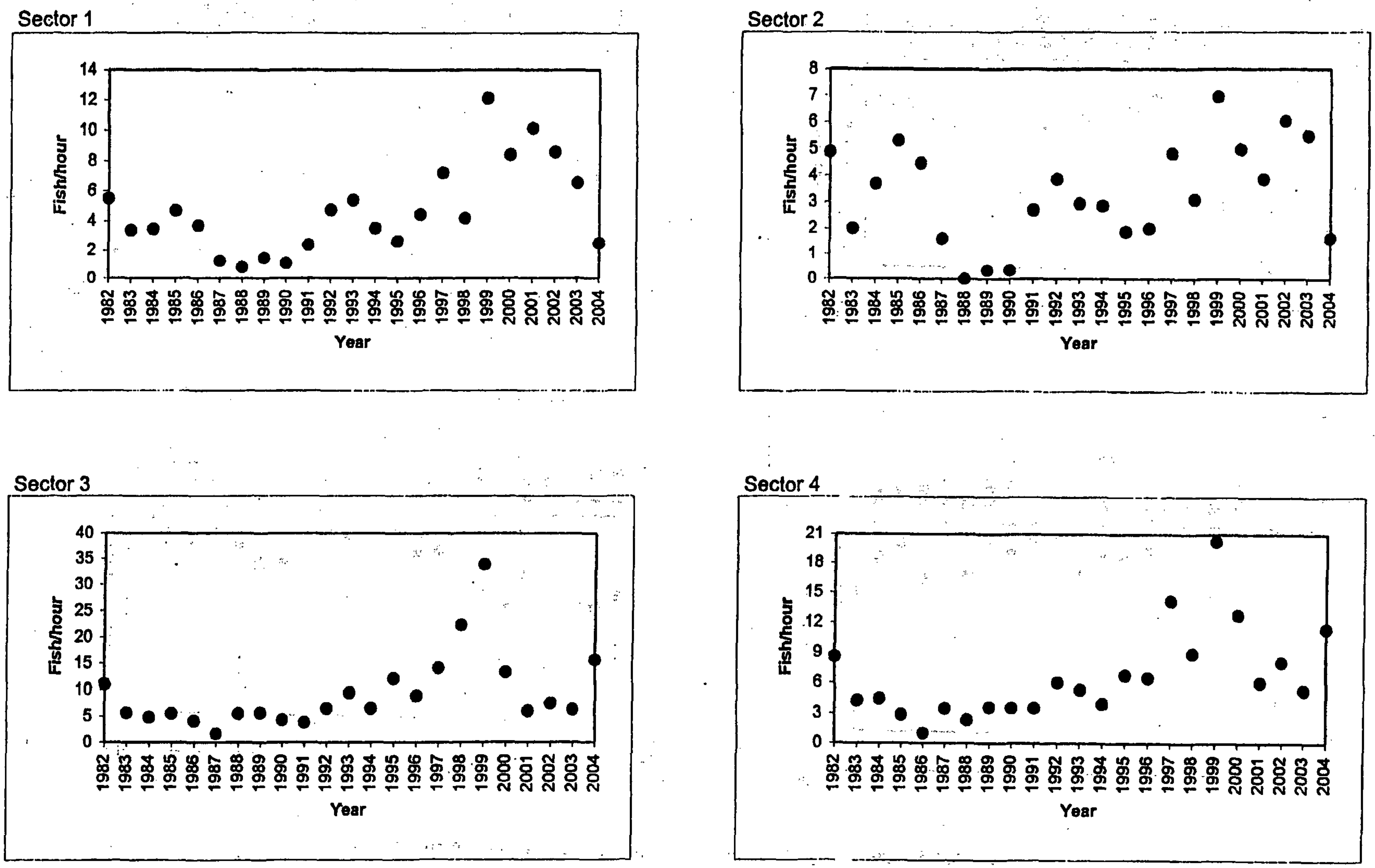


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2004 in the vicinity of PINGP.

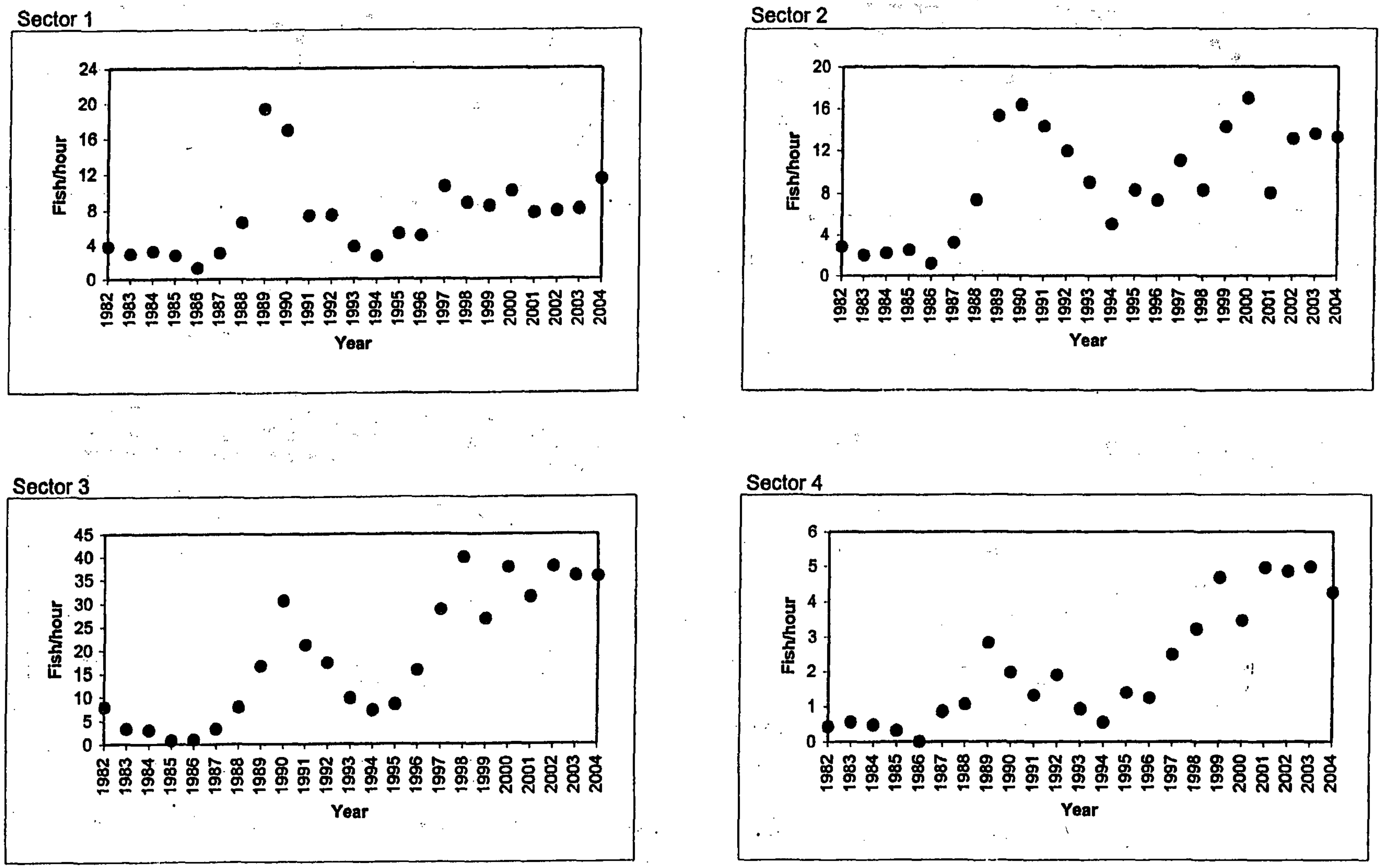
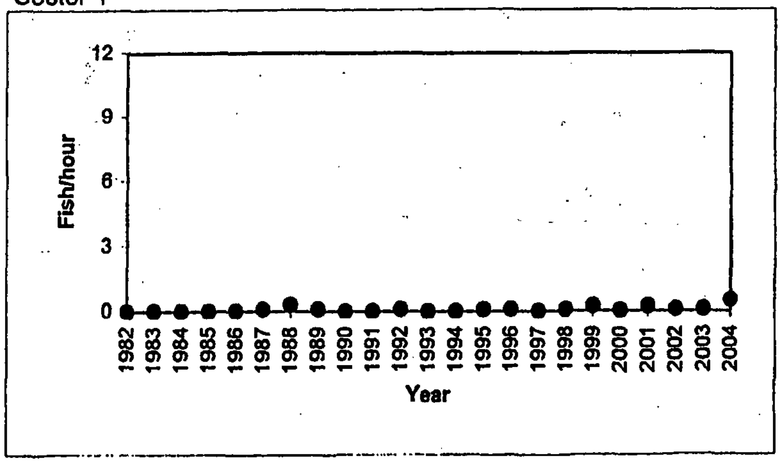
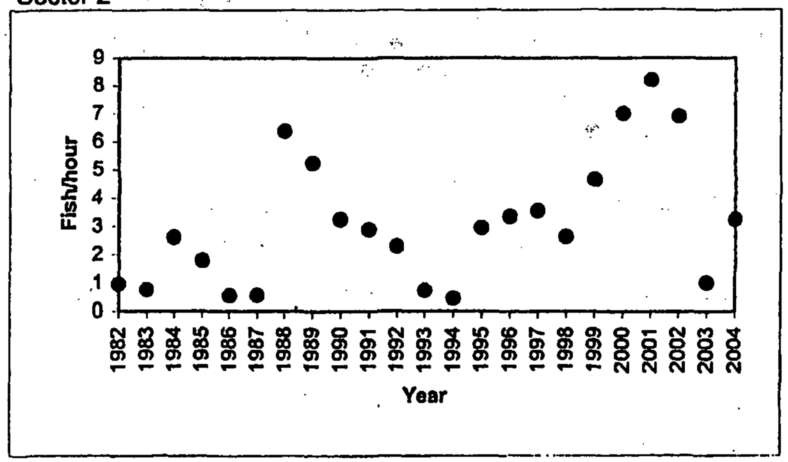


Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2004 in the vicinity of PINGP.

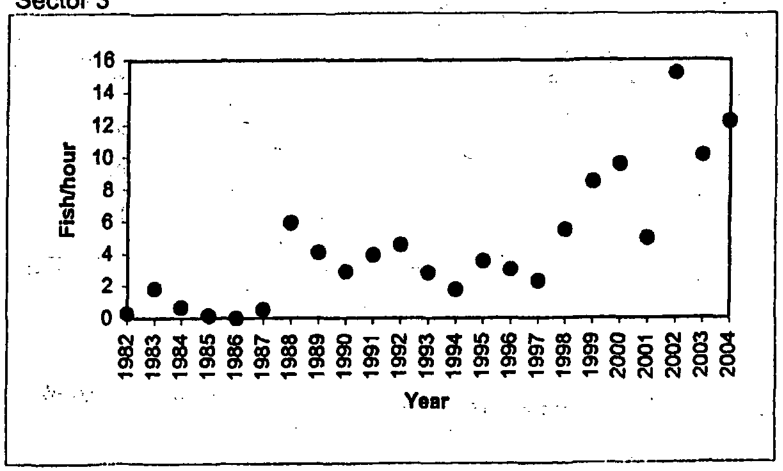
Sector 1



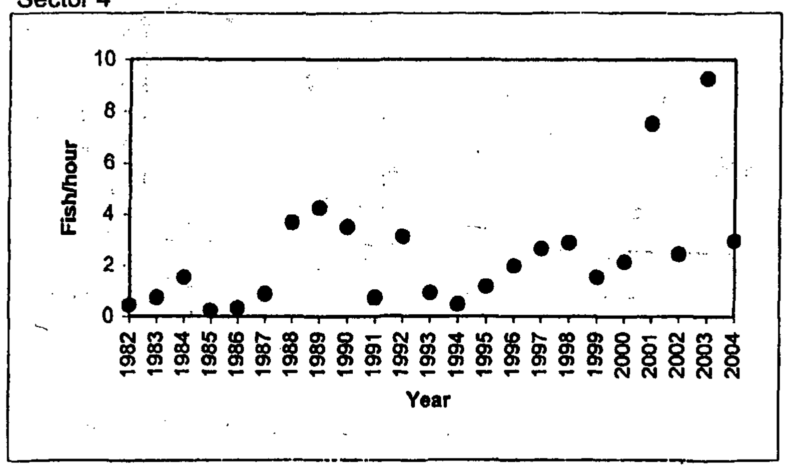
Sector 2



Sector 3



Sector 4



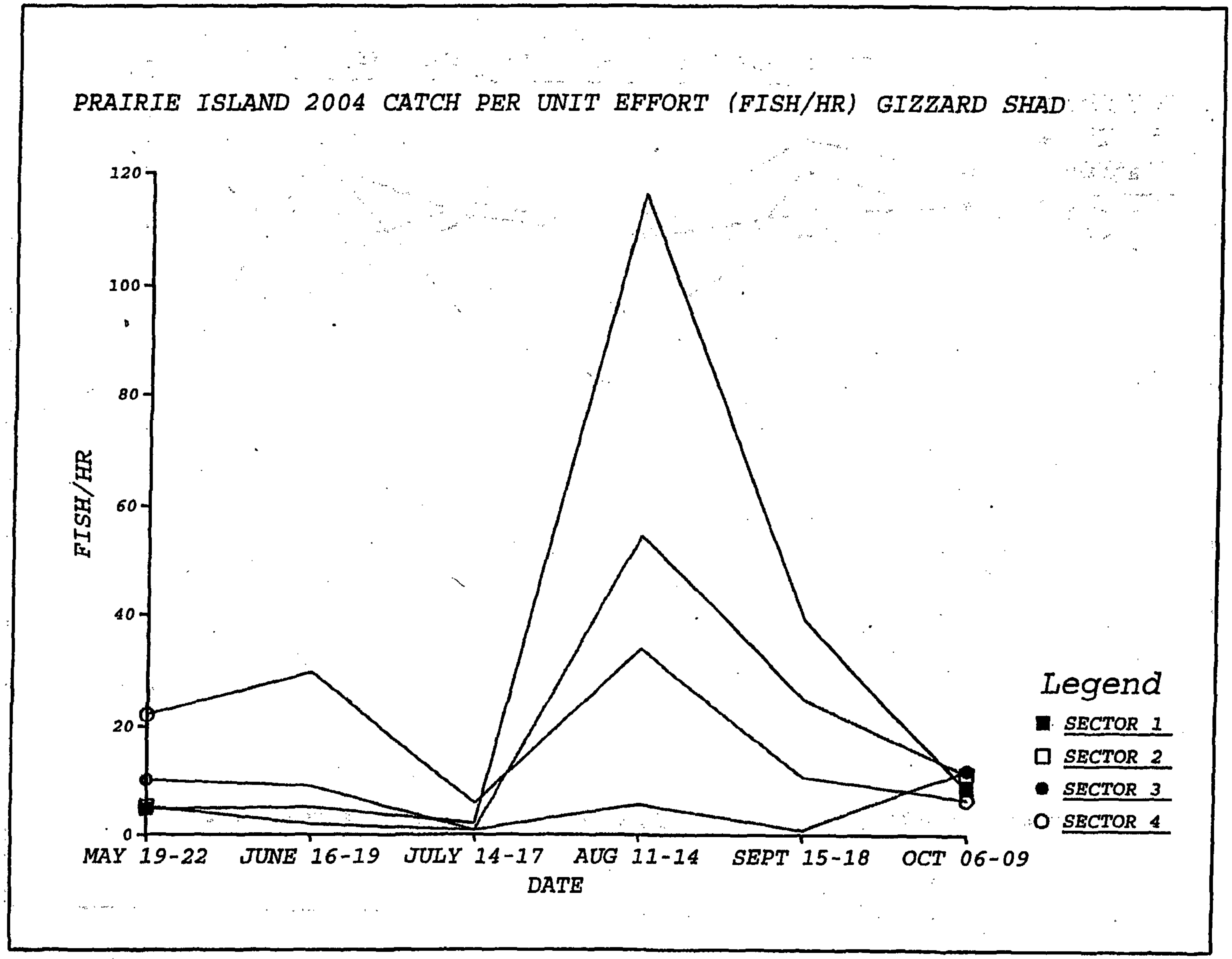
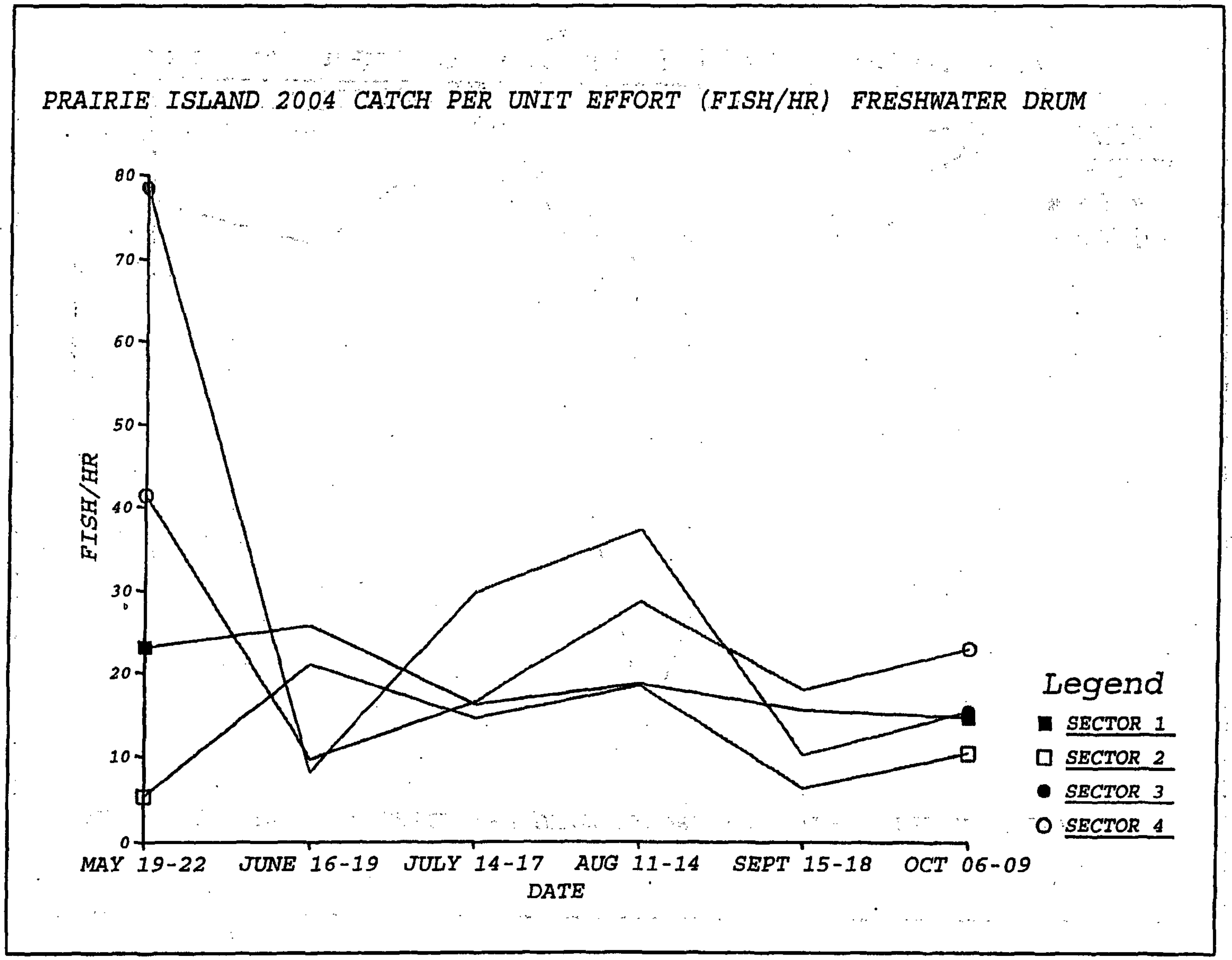
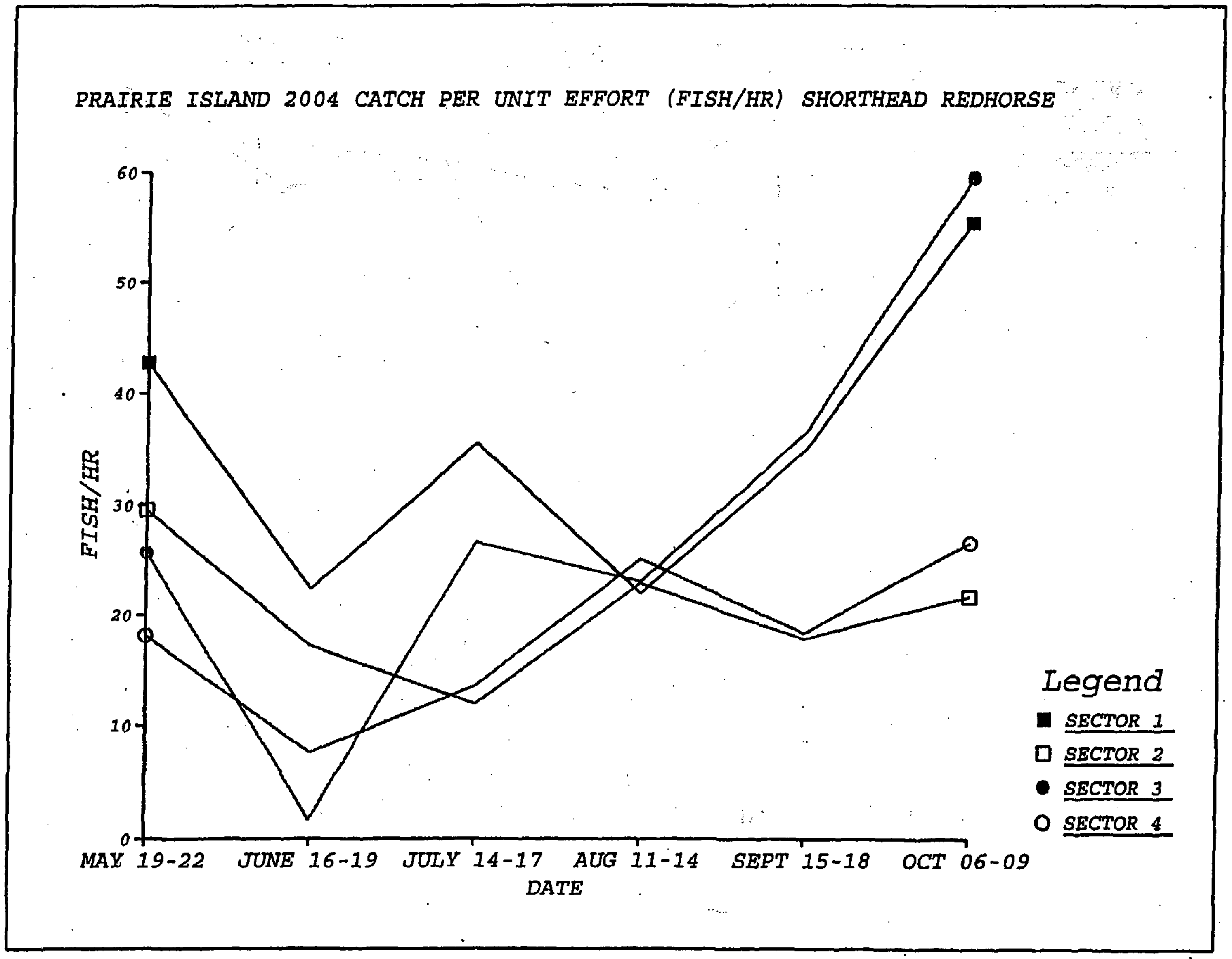

PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) GIZZARD SHAD
FISH/HR
120
100
80
60
40
20
0
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 31



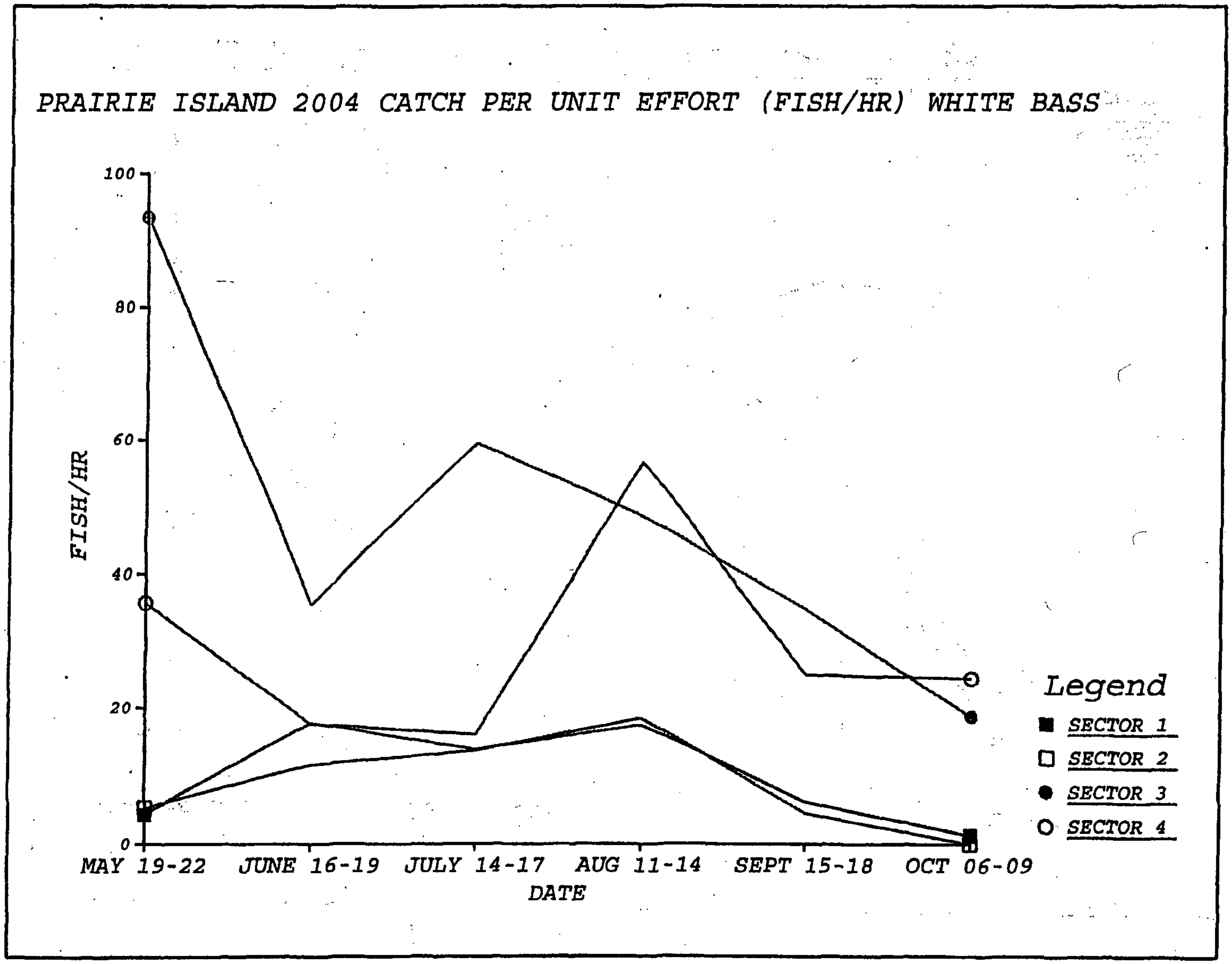
PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) FRESHWATER DRUM
FISH/HR
80
70
60
50
40
30
20
10
0
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 32



PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) SHORTHEAD REDHORSE
60
50
40
30
20
10
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 33



PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) WHITE BASS
FISH/HR
100
80
60
40
20
0
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 34

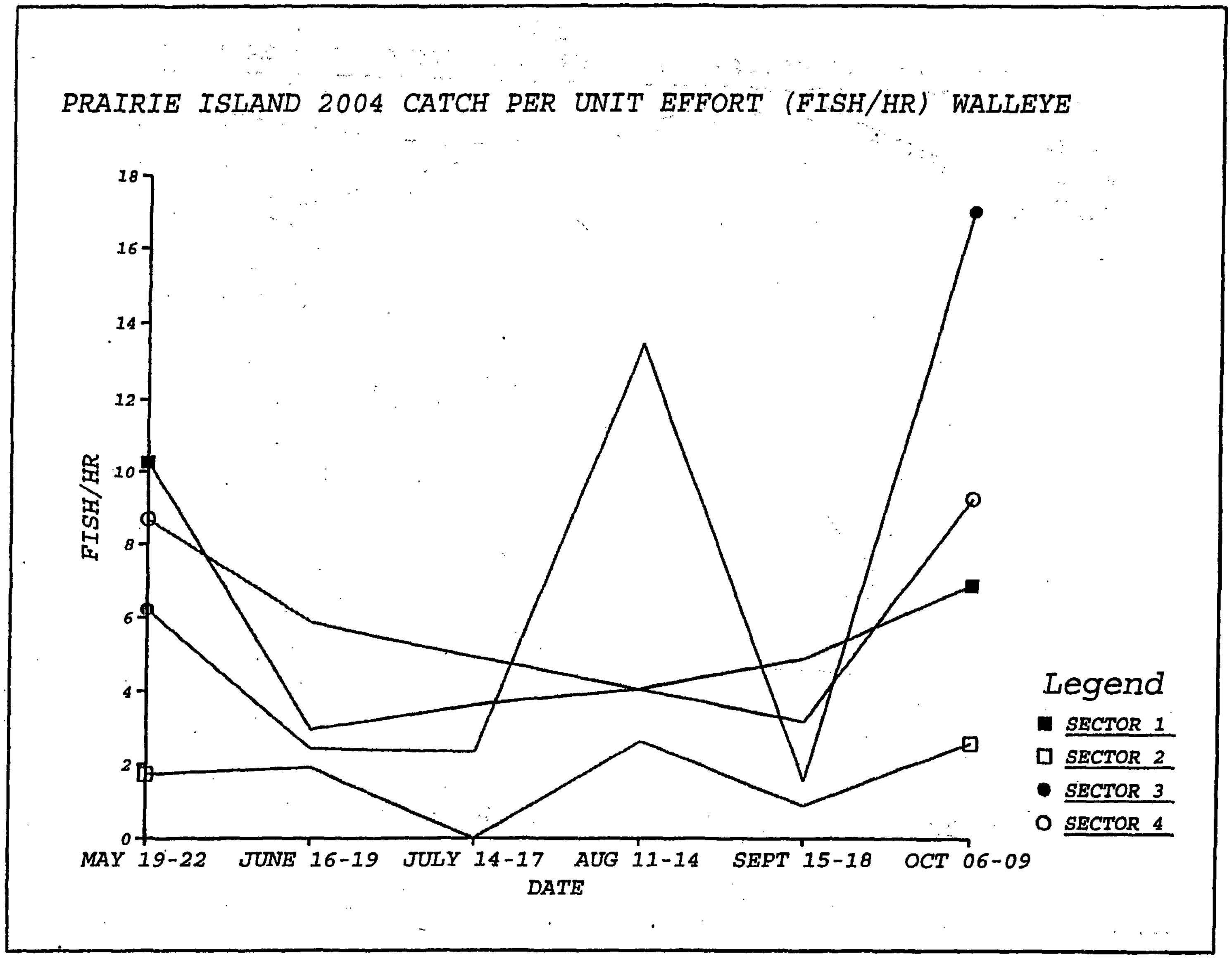

PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) WALLEYE
FISH/HR
0
2
4
6
8
10
12
14
16
18
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 35

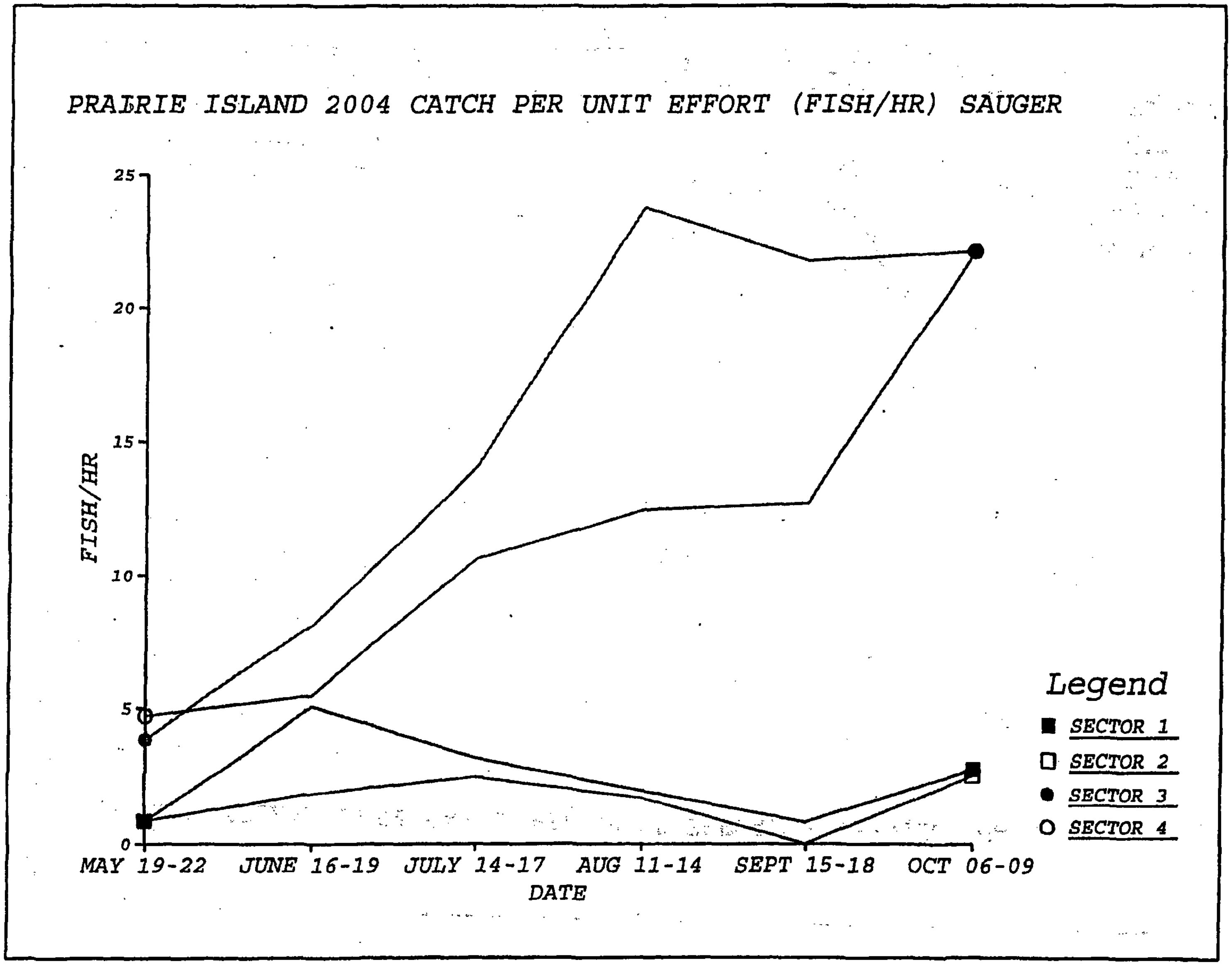
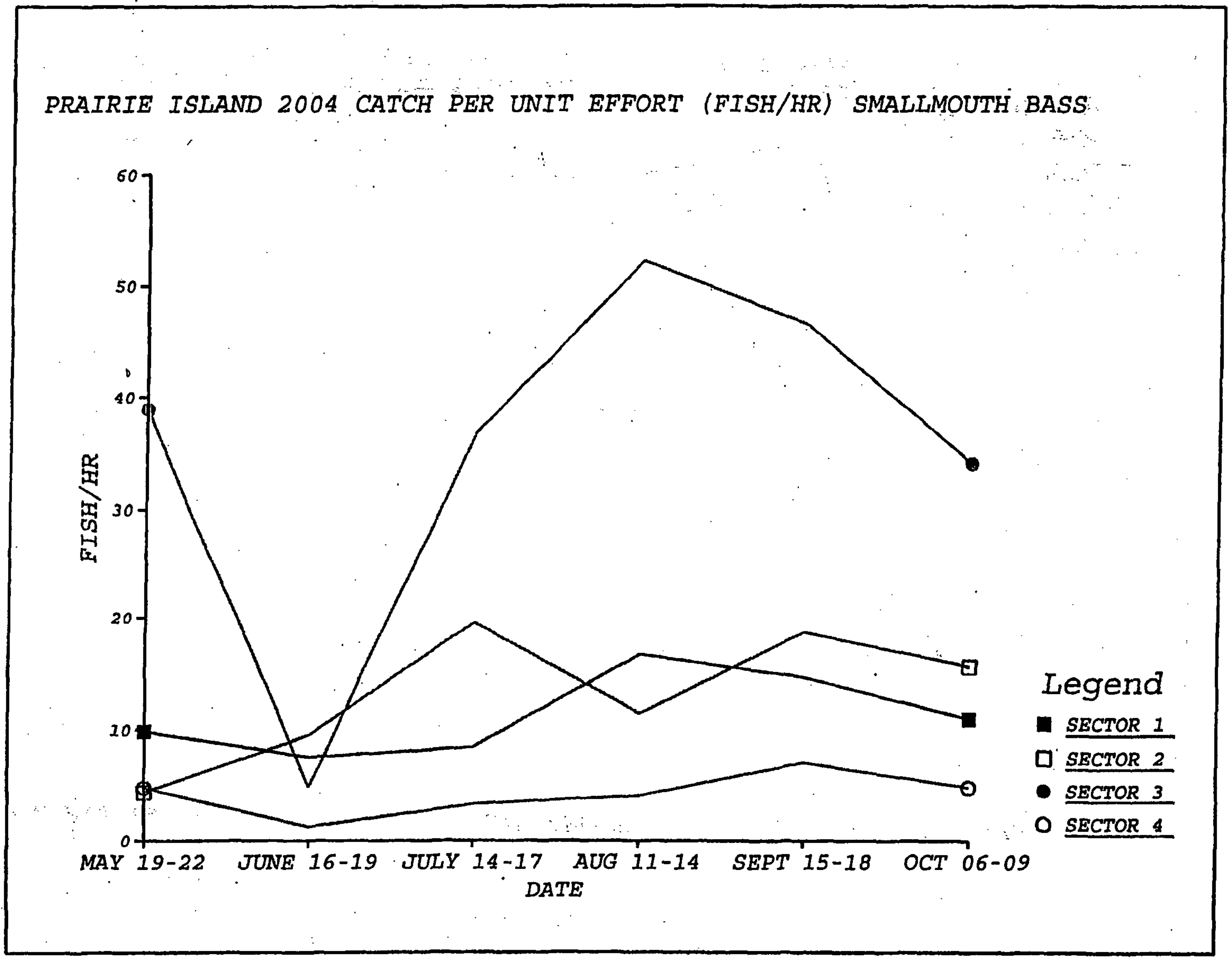
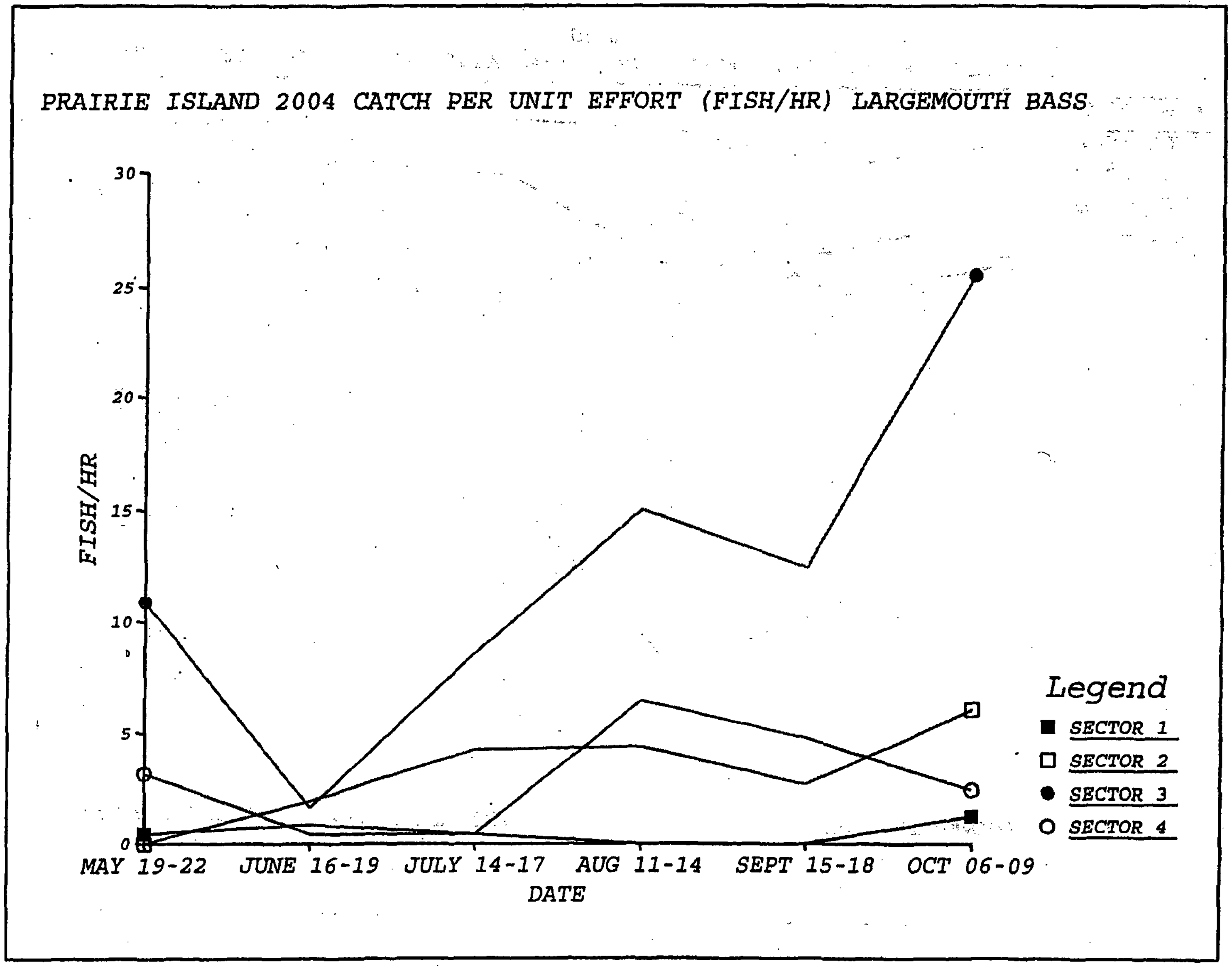

PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) SAUGER
25
20
15
10
5
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 36



PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) SMALLMOUTH BASS
FISH/HR
60
50
40
30
20
10
0
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 37


PRAIRIE ISLAND 2004 CATCH PER UNIT EFFORT (FISH/HR) LARGEMOUTH BASS
30
25
20
15
10
5
0
FISH/HR
MAY 19-22
JUNE 16-19
JULY 14-17
AUG 11-14
SEPT 15-18
OCT 06-09
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

nFigure 38

Table 1. 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	O4
Chestnut lamprey Ichthyomyzon castaneus	x	x							x	x			x			x	x		x	x	x	
Silver lamprey Icthyomyzon unicuspus					x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Paddlefish Polyodon spathula															x							
Longnose gar Lepisosteus osseus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shortnose gar Lepisosteus platostomus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bowfin Amia calva	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American eel Anguilla rostrata	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x		x		
Gizzard shad Dorosoma cepedianum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Goldeye Hiodon alosoides	x		x		x	x					x			x	x	x	x				x	x
Mooneye Hiodon tergisus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brown trout Salmo trutta				x									x		x		x		x	x	x	
Northern pike Esox lucius	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Musky Esox masquinongy																		x	x			x
Carp Cyprinus carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carpsucker Species Carpiodes species		x					x															
River carpsucker Carpiodes carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Quillback Carpiodes cyprinus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Highfin carpsucker Carpiodes velifer			x	x	x	x	x	x	x	x	x	x	x	x	x					x	x	x
White sucker Catostomus commersoni	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x

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	O4
Blue sucker Cycleptus elongatus	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Northern hogsucker Hypentelium nigricans	x														x			x				
Smallmouth buffalo Ictiobus bubalus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bigmouth buffalo Ictiobus cyprinellus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Spotted sucker Minytrema melanops	x	x		x		x	x			x												x
Silver redhorse Moxostoma anisurum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
River redhorse Moxostoma carinatum		x	x		x		x	x	x	x		x	x			x	x	x	x	x	x	x
Golden redhorse Moxostoma erythrurum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Greater redhorse Moxostoma valenciennesi		x		x		x		x							x	x			x		x	
Shorthead redhorse Moxostoma macrolepidotum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black bullhead Ictalurus melas	x	x	x	x	x	x				x							x	x		x		
Yellow bullhead Ictalurus natalis					x	x	x					x	x									
Brown bullhead Ictalurus nebulosus	x																					
Channel catfish Ictalurus punctatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Flathead catfish Pylodictus olivaris	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Burbot Lota lota	x	x			x					x	x	x	x	x	x	x	x	x	x	x	x	x
White bass Marone chrysops	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock bass Ambloplites rupestris	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Green sunfish Lepommis cyanellus	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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	00	01	02	03	04
Pumpkinseed Lepomis gibbosus							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Orangespotted sunfish Lepomis humilis																x		x	x			x
Bluegill Lepomis macrochirus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Smallmouth bass Micropterus dolomieui	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Largemouth bass Micropterus salmoides	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
White crappie Pomoxis annularis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black crappie Pomoxis nigromaculatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Yellow perch Perca flavens	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x		x	x	x	x
Sauger Sander canadense	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Walleye Sander vitreum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Saugeye S. vitreum x S. canadense															x	x	x		x	x	x	x
Freshwater drum Aplodinotus grunniens	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lake sturgeon Acipenser fulvescens																					x	

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.

Rank	Species	Sector 1	Sector 2	Sector 3	Sector 4	Average	Number collected
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	1.62	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
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	0.13	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	10
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	12
28	Rock bass	0.00	0.00	0.40	0.54	0.23	11
29	Silver lamprey	0.07	0.59	0.27	0.00	0.23	7
30	Yellow perch	0.00	0.88	0.00	0.00	0.22	6
31	Golden redhorse	0.14	0.15	0.13	0.00	0.10	4
32	River redhorse	0.00	0.00	0.40	0.00	0.10	3
33	Saugeye	0.07	0.00	0.27	0.00	0.08	3
34	Musky	0.00	0.00	0.13	0.14	0.07	3
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	0.00	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.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	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

Table 4. Fisheries summary for Freshwater drum 1977-2004.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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

Table 5. Fisheries summary for Shorthead redhorse 1977-2004.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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

Table 6. Fisheries summary for White bass 1977-2004.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	20.16	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	41.69	NA	21	1656	320	LOG W=3.042 LOG L-5.013
2003	31.22	NA	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

Table 7. Fisheries summary for Walleye 1977-2004.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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

Table 8. Fisheries summary for Sauger 1977-2004.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	NA	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	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
2004	7.75	NA	4	333	270	LOG W=3.232 LOG L-5.678

Table 9. Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and rank, 1981-2004.

	Smallmouth 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
2004	16.15	6	4.73	10

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.

Year	Carp	White bass	Freshwater Drum	Sauger	Black Crapple	Shorthead Redhorse	Walleye	Gizzard 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
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	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

*Electrofishing only

SECTION III

PRAIRIE ISLAND NUCLEAR GENERATING PLANT ENVIRONMENTAL MONITORING PROGRAM 2004 ANNUAL REPORT

FINE-MESH VERTICAL TRAVELING SCREENS FISH IMPINGEMENT STUDY

Study and Report
by
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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 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. 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).

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

- 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 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).

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.

Survival estimates

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 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 2002-2004 (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 fine-mesh screens during the first half of April with unlimited blowdown, but the total numbers are still low.

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 Results and Discussion 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.

LITERATURE CITED

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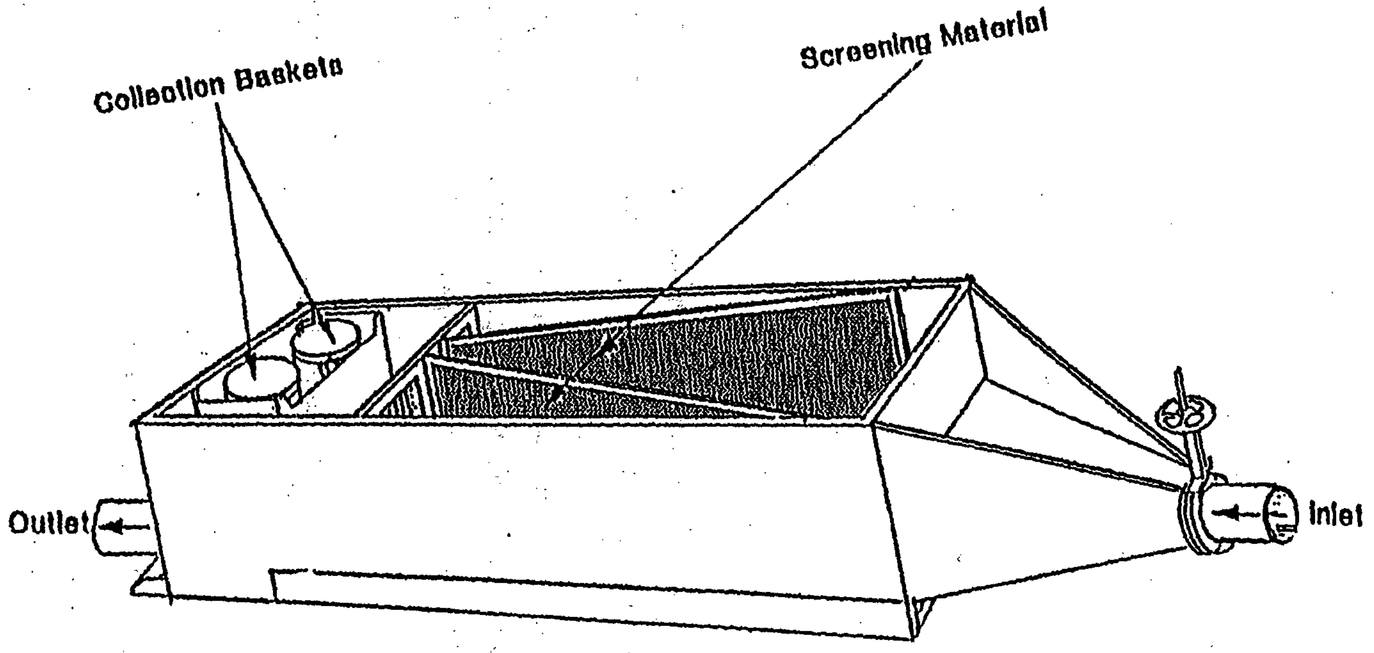
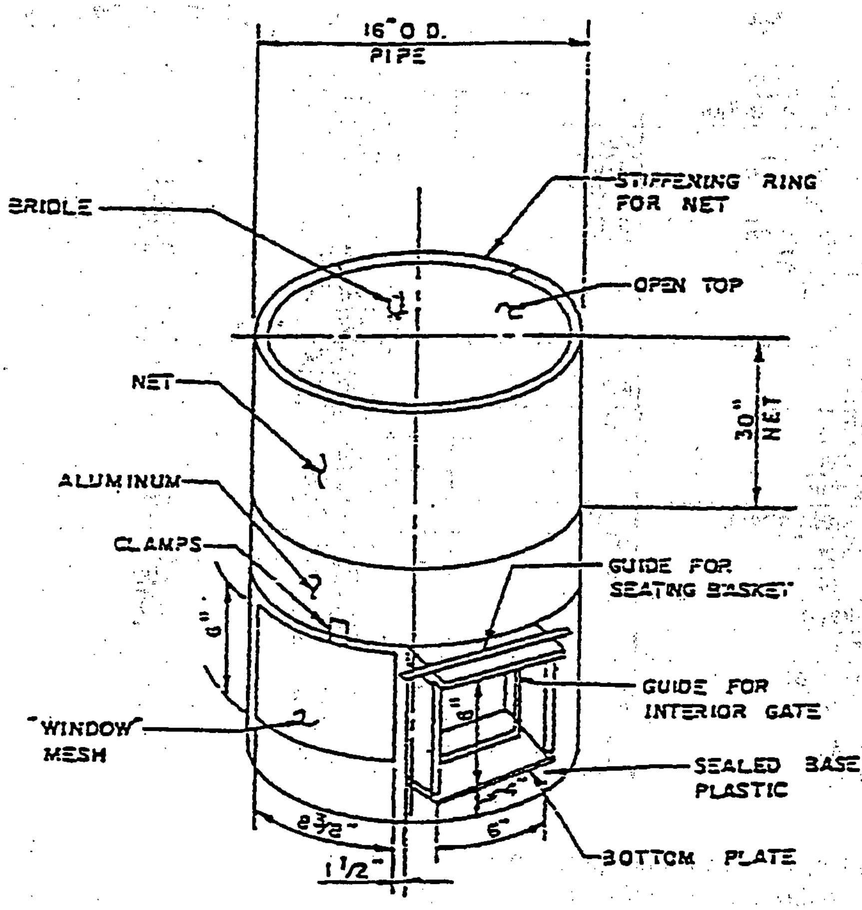
Figure 1



Larval Fish Collection Tank

Figure 2



DETAIL A
COLLECTION BASKET
NO SCALE

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 2004.

Date	Taxa	Lifestage	Density	Percent Live	Number of Fish/Egg
1-Apr-2004	Gizzard shad	JUV	0.083280	66	3
1-Apr-2004	Shorthead redhorse	JUV	0.027760	100	1
6-Apr-2004	Cyprinid	JUV	0.167747	83	6
6-Apr-2004	Gizzard shad	JUV	0.027958	100	1
8-Apr-2004	Cyprinid	JUV	0.305000	100	11
8-Apr-2004	Gizzard shad	JUV	0.027727	100	1
13-Apr-2004	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	14	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 Density	Daylight 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.

Taxa	Adult	Juvenile	Postlarvae	Prolarvae
Carp			x	x
Channel catfish		x		
Cyprinid	x	x,o	x	x
Flathead catfish		x		
Percid	x		x	x,o
Walleye				x,o
Bullhead sp.		x		
Sauger			x	x
Burbot			x	x,o
Catostomid		x		x
Sander spp.				x
White bass		x		
Gizzard shad		x,o		
Freshwater drum		x		
Johnny darter	x			
Shiner spp.		x		
Emerald shiner	x,o	x		
Bluegill		x		
Mooneye				x
Golden redhorse		x		
Unidentified				x
Log perch	x			x
Shorthead redhorse		o		
Yellow perch				o

Legend: x = previous years data
o = 2004 data

Table 3. Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2004.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1984														
16-Apr-84	UNID	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	14-Apr-89	X	UN	0	0
23-Apr-84	UNID	EG	3840	10	28-Apr-86	UNID	EG	480	1	18-Apr-89	X	UN	0	0
25-Apr-84	CC	JU	384	1	29-Apr-86	PERC	PR	864	3	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	UNID	EG	3840	10	29-Apr-86	WE	PR	288	1	25-Apr-89	X	UN	0	0
27-Apr-84	CC	JU	384	1	**1987**					27-Apr-89	BUR	PR	1152	3
27-Apr-84	CYPR	JU	384	1	6-Apr-87	BUR	PR	1536	4	**1992**				
27-Apr-84	UNID	EG	2304	6	8-Apr-87	CARP	PR	576	1	1-Apr-92	CYPR	PR	288	1
30-Apr-84	CC	JU	384	21	10-Apr-87	BUR	PR	2304	4	1-Apr-92	CYPR	PO	288	1
30-Apr-84	CYPR	AD	384	1	13-Apr-87	BUR	PR	2304	4	1-Apr-92	CARP	PO	576	2
30-Apr-84	FHC	JU	192	1	15-Apr-87	BUR	PR	3456	6	2-Apr-92	X	UN	0	0
30-Apr-84	PERC	PR	1152	6	16-Apr-87	BUR	PR	576	1	8-Apr-92	X	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	WE	PR	768	4	22-Apr-87	X	UN	0	0	14-Apr-92	X	UN	0	0
1985					24-Apr-87	X	UN	0	0	16-Apr-92	X	UN	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	UNID	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	SA	PR	1344	7	**1988**					30-Apr-92	PERC	AD	288	1
24-Apr-85	UNID	EG	384	2	8-Apr-88	BUR	PR	768	2	**1993**				
24-Apr-85	WE	PR	1536	8	11-Apr-88	X	UN	0	0	2-Apr-93	UN	X	0	0
25-Apr-85	PERC	PR	192	1	13-Apr-88	UNID	EG	384	1	6-Apr-93	BUR	PR	288	1
25-Apr-85	SA	PR	1536	8	15-Apr-88	BUR	PR	768	2	8-Apr-93	UN	EG	288	1
25-Apr-85	STIZ	PR	384	2	18-Apr-88	X	UN	0	0	8-Apr-93	BUR	PR	288	1
25-Apr-85	WE	PR	576	3	20-Apr-88	BUR	PR	768	2	13-Apr-93	UN	X	0	0
26-Apr-85	SA	PR	192	1	22-Apr-88	BUR	PR	1920	5	15-Apr-93	BUR	PR	288	1
26-Apr-85	STIZ	PR	192	1	25-Apr-88	BUR	PR	1152	3	19-Apr-93	UN	EG	1152	2
29-Apr-85	BUR	PO	96	1	27-Apr-88	BUR	PR	1152	3	21-Apr-93	UN	X	0	0
29-Apr-85	CARP	PR	192	2	28-Apr-88	BUR	PR	384	1	27-Apr-93	UN	X	0	0
29-Apr-85	CATO	PR	288	3	29-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	X	UN	0	0	5-Apr-94	UNID	EG	384	1
18-Apr-86	CARP	PR	288	1	6-Apr-89	PERC	AD	384	1	5-Apr-94	CC	JU	384	1
18-Apr-86	CYPR	PR	288	1	7-Apr-89	X	UN	0	0	5-Apr-94	CARP	PR	384	1
23-Apr-86	CYPR	PO	288	1	11-Apr-89	X	UN	0	0	5-Apr-94	BUR	PR	384	1
23-Apr-86	PERC	PR	288	1	13-Apr-89	BUR	PR	384	1	7-Apr-94	BUR	PR	288	1

Table 3. (cont) Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2004.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1994 (cont)					**1996 (cont)**					**1999 (cont)**				
12-Apr-94	SA	PR	288	1	25-Apr-96	BURB	PR	504	2	9-Apr-99	CC	JU	288	1
12-Apr-94	CARP	PR	288	1	25-Apr-96	BURB	PR	252	1	9-Apr-99	BURB	PR	576	2
14-Apr-94	X	X	0	0	30-Apr-96	X	X	0	0	9-Apr-99	CC	JU	288	1
19-Apr-94	CYPR	JU	288	1	**1997**					13-Apr-99	UNID	EG	288	1
21-Apr-94	X	X	0	0	3-Apr-97	UNID	EG	17,280	30	13-Apr-99	UNID	EG	288	1
26-Apr-94	CARP	PR	1152	4	4-Apr-97	BG	JU	1152	2	15-Apr-99	BURB	PR	288	1
26-Apr-94	BUR	PR	288	1	4-Apr-97	UNID	PR	576	1	22-Apr-99	BURB	PR	576	2
28-Apr-94	SA	PR	288	1	25-Apr-97	BURB	PR	2304	4	27-Apr-99	PERC	PR	288	1
28-Apr-94	BUR	PR	288	1	29-Apr-97	CYPR	JU	864	2	27-Apr-99	CC	JU	288	1
1995					30-Apr-97	BLBH	JU	432	1	27-Apr-99	PERC	PR	288	1
3-Apr-95	CATO	JU	288	1	30-Apr-97	CC	JU	432	1	30-Apr-97	PERC	PO	288	1
4-Apr-95	BUR	PR	288	1	30-Apr-97	CYPR	JU	432	1	30-Apr-97	PERC	PR	576	2
4-Apr-95	CC	JU	576	1	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	GIZ	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	262	1	4-Apr-2000	UNID	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	CATO	PR	288	1	9-Apr-1998	EMSH	AD	229	1	6-Apr-2000	Log P	AD	288	1
17-Apr-95	UNID	EG	13248	46	14-Apr-1998	CC	JU	252	1	6-Apr-2000	UNID	EG	8023	39
20-Apr-95	UNID	EG	2880	10	16-Apr-1998	CYPR	JU	229	1	6-Apr-2000	Carp	PRO	206	1
24-Apr-95	UNID	EG	1152	4	16-Apr-1998	BURB	PR	229	1	13-Apr-2000	Burb	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	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	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	WAE	PRO	288	1
9-Apr-96	UNID	EG	252	1	28-Apr-1998	CARP	PR	1512	6	**2001**	No values calculated~flood			
11-Apr-96	FWD	JU	252	1	28-Apr-1998	UNID	PR	252	1	**2002**				
11-Apr-96	BURB	PR	252	1	30-Apr-1998	STIZ	PR	2016	8	4/2/2002	EMSH	JU	672	2
11-Apr-96	EMSH	JU	504	2	30-Apr-1998	CARP	PR	14364	57	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	PERC	PR	2268	9	4/4/2002	Carp	EG	672	2
11-Apr-96	BURB	PR	252	1	30-Apr-1998	MOON	PR	252	1	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	GORH	JU	252	1	4/4/2002	GIZ	JU	336	1
16-Apr-96	X	X	0	0	**1999**					4/4/2002	Carp	EG	1008	3
18-Apr-96	X	X	0	0	6-Apr-99	BURB	PR	522	2	4/4/2002	BURB	PR	1008	3
23-Apr-96	EMSH	JU	504	2	6-Apr-99	UNID	EG	4032	14	4/9/2002	GIZ	JU	336	1
23-Apr-96	UNID	EG	1008	4	9-Apr-99	GIZ	JU	288	1	4/9/2002	EMSH	JU	1008	3

Table 3. (cont) Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2004.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
2002 (cont)				
4/9/2002	BURB	PRO	672	2
4/9/2002	Carp	EG	288	1
4/11/2002	EMSH	JU	288	1
4/11/2002	BURB	PRO	864	3
4/11/2002	BURB	PRO	1800	5
4/11/2002	EMSH	JU	1800	5
4/11/2002	Cypr	JU	360	1
4/16/2002	EMSH	JU	336	1
4/16/2002	GIZ	JU	336	1
4/18/2002	EMSH	JU	336	1
4/23/2002	BURB	PRO	672	2
4/23/2002	BURB	PRO	1008	3
4/25/2002	BURB	PRO	672	2
4/25/2002	BURB	PRO	336	1
2003				
4/1/2003	BURB	PRO	504	1
4/3/2003	BURB	PRO	504	1
4/3/2003	BURB	PRO	2016	4
4/3/2003	FWD	JU	1512	3
4/8/2003	BURB	PRO	576	1
4/8/2003	BURB	PRO	576	1
4/10/2003	BURB	PRO	2304	8
4/10/2003	BURB	PRO	1152	2
4/10/2003	Carp	EG	576	1
4/15/2003	Carp	EG	13248	23
4/17/2003	Carp	EG	1728	3
4/17/2003	Carp	EG	576	1
4/22/2003	Carp	EG	576	1
4/24/2003	BURB	PRO	576	1
4/24/2003	BURB	PRO	1152	2
4/29/2003	SAU	PRO	576	1
2004				
4/1/2004	GIZ	JU	576	2
4/1/2004	SHRH	JU	288	1
4/1/2004	GIZ	JU	288	1
4/6/2004	Cypr	JU	864	3
4/6/2004	GIZ	JU	288	1
4/6/2004	Cypr	JU	864	3
2004 (cont)				
4/8/2004	GIZ	JU	288	1
4/8/2004	Cypr	JU	3168	11
4/13/2004	GIZ	JU	288	1
4/13/2004	Cypr	JU	288	1
4/13/2004	BURB	PRO	1440	5
4/13/2004	BURB	PRO	2304	8
4/15/2004	Cypr	JU	288	1
4/15/2004	UNID	EG	288	1
4/15/2004	BURB	PRO	288	1
4/20/2004	BURB	PRO	288	1
4/20/2004	EMSH	AD	288	1
4/20/2004	EMSH	AD	288	1
4/20/2004	Cypr	JU	288	1
4/22/2004	BURB	PRO	2016	7
4/27/2004	YP	PRO	864	3
4/27/2004	BURB	PRO	576	2
4/27/2004	WAE	PRO	576	2
4/27/2004	PERC	PRO	576	2
4/29/2004	YP	PRO	1152	4
4/29/2004	PERC	PRO	288	1
4/29/2004	YP	PRO	576	2
4/29/2004	WAE	PRO	288	1

Table 4.	Estimated fish and fish egg impingement data for dates sampled (when fish and/or eggs were collected) in April 2004 with corresponding blowdown, river flow and temperatures.						
Date	Blowdown (cfs)	Average Daily R. Flow (cfs)	Avg. daily Inlet Temp. (F)	Est.avg daily impingement.			
4/1/2004	848	33600	42.7	2304			
4/6/2004	842	31800	47.1	4032			
4/8/2004	849	27600	48.2	6912			
4/13/2004	835	19200	47.8	8640			
4/15/2004	259	18400	48.5	1728			
4/20/2004	283	17300	54.9	2304			
4/22/2004	267	22200	51.7	4032			
4/27/2004	283	26000	50.9	5184			
4/29/2004	291	23900	54.5	4608			

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	=	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
ENVIRONMENTAL MONITORING
AND
ECOLOGICAL STUDIES PROGRAM

2005 ANNUAL REPORT

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

By
Environmental Services
Water Quality Department

TABLE OF CONTENTS

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.

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 2005**

DATE **JANUARY**	OPERATING HOURS UNIT 1	 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	34.0	35.6	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	24	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
		MONTHLY MINIMUM	31.9	34.9	684
		MONTHLY MAXIMUM	34.3	37.3	720
		MONTHLY MEAN	33.8	35.8	707

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 2005**

DATE FEBRUARY	OPERATING HOURS UNIT 1	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
10	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
	MONTHLY MINIMUM		33.9	33.9	418
	MONTHLY MAXIMUM		35.1	37.1	720
	MONTHLY MEAN		34.3	35.8	621

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 2005**

DATE MARCH	OPERATING HOURS UNIT 1	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
	MONTHLY MINIMUM		34.2	34.9	407
	MONTHLY MAXIMUM		42.8	44.4	1009
	MONTHLY MEAN		36.9	38.4	767

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 2005**

DATE APRIL	OPERATING HOURS UNIT 1	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

MONTHLY MINIMUM	38.9	41.2	203
MONTHLY MAXIMUM	55.9	58.2	1165
MONTHLY MEAN	50.1	50.5	605

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 2005

DATE **MAY**	OPERATING HOURS UNIT 1	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	275
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	259
31	24	0	64.0	65.0	267
	MONTHLY MINIMUM		47.4	47.8	251
	MONTHLY MAXIMUM		64.0	65.0	283
	MONTHLY MEAN		56.5	57.2	265

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 2005

DATE JUNE	OPERATING HOURS UNIT 1	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
27	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
	MONTHLY MINIMUM		64.9	65.7	267
	MONTHLY MAXIMUM		77.2	78.7	859
	MONTHLY MEAN		72.0	73.0	591

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 2005

DATE **JULY**	OPERATING HOURS UNIT 1	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
	MONTHLY MINIMUM		73.5	74.6	1124
	MONTHLY MAXIMUM		82.7	84.7	1222
	MONTHLY MEAN		78.0	79.4	1186

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 2005**

DATE AUGUST	OPERATING HOURS UNIT 1	UNIT 2	RIVER INLET TEMP. (°F)	SITE DISCHARGE TEMP. (°F)	MEAN SITE DISCHARGE FLOW (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
	MONTHLY MINIMUM		71.7	74.8	1166
	MONTHLY MAXIMUM		80.5	82.4	1213
	MONTHLY MEAN		76.2	78.5	1191

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 2005**

DATE **SEPTEMBER**	OPERATING HOURS UNIT 1	 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
	MONTHLY MINIMUM		61.0	62.3	1144
	MONTHLY MAXIMUM		74.2	77.3	1208
	MONTHLY MEAN		70.0	72.1	1172

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 2005**

DATE OCTOBER	OPERATING HOURS UNIT 1	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	56.9	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	49.8	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
MONTHLY MINIMUM			49.6	50.9	1145
MONTHLY MAXIMUM			65.8	67.4	1187
MONTHLY MEAN			55.7	57.0	1150

* Daylight savings

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 2005**

DATE NOVEMBER	OPERATING HOURS UNIT 1	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
	MONTHLY MINIMUM		37.0	35.8	828
	MONTHLY MAXIMUM		50.0	52.2	1166
	MONTHLY MEAN		43.7	44.3	1016

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 2005**

DATE DECEMBER	OPERATING HOURS UNIT 1	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
	MONTHLY MINIMUM		32.2	32.2	795
	MONTHLY MAXIMUM		37.2	35.7	842
	MONTHLY 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	OCT	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	50300	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	16500	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 MAX 54900
YEAR MIN 7600

Table 3 2005 Percentage of mean monthly Mississippi River flow entering the Xcel Energy Prairie Island Generating Plant intake

Month	Mean Plant Flow (cfs)	Mean River Flow (cfs)	Percentage of Mean River Flow 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%

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**

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 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.

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).

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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Figure 1

PRAIRIE ISLAND FISHERIES POPULATION - STUDY AREA

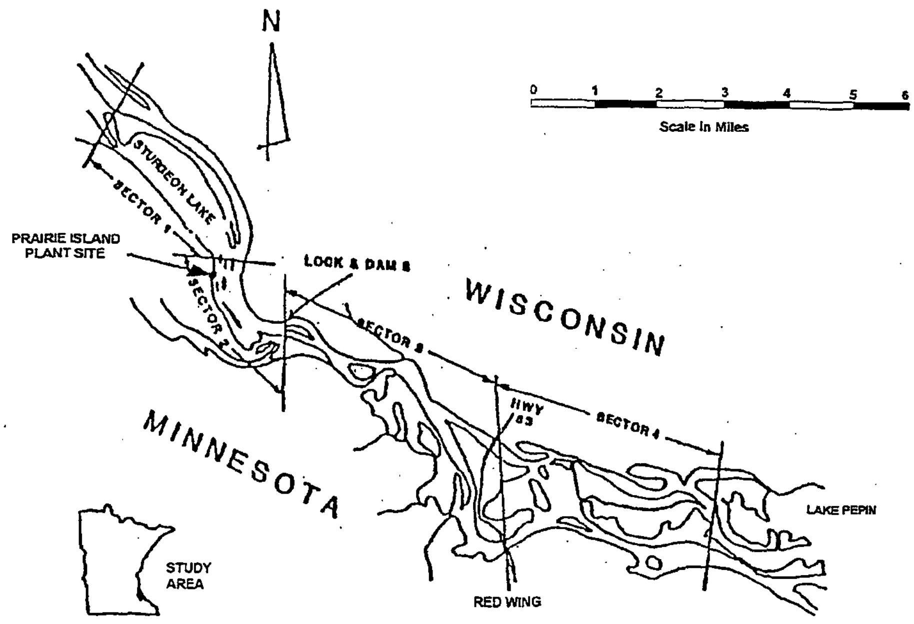


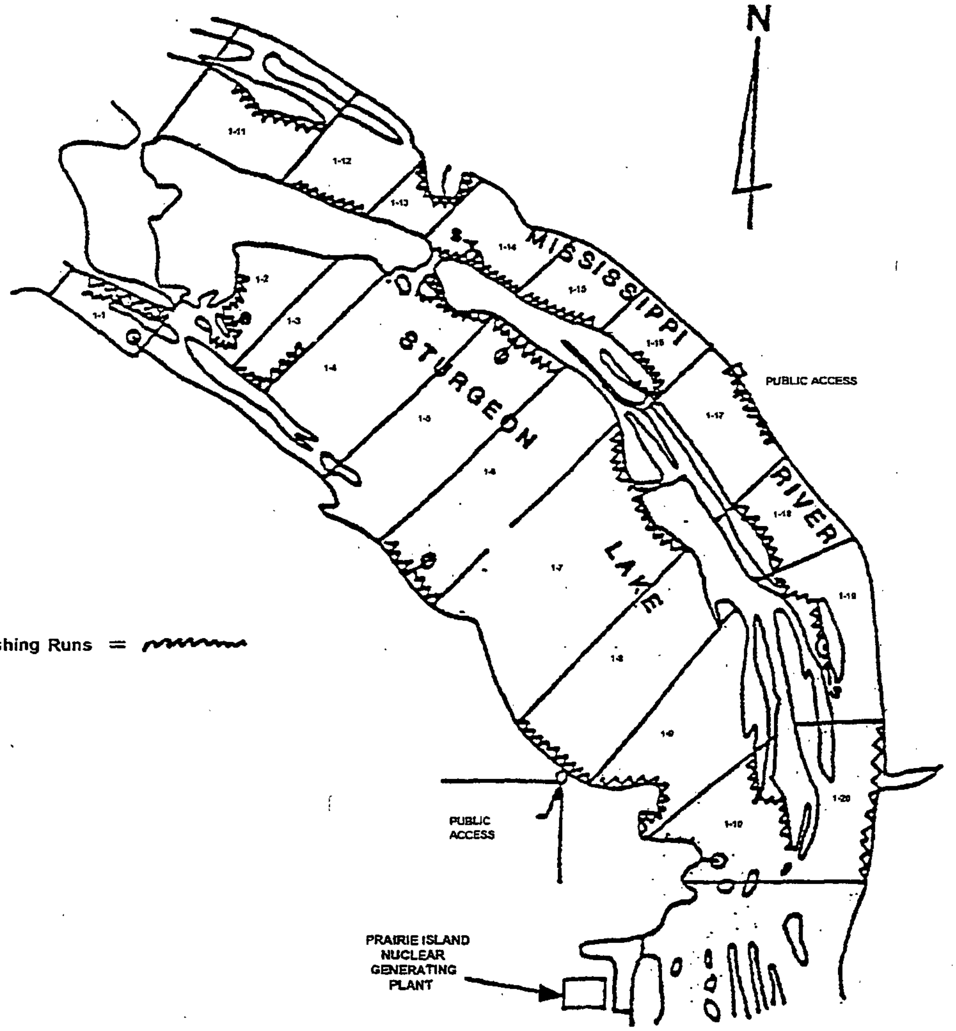
FIGURE 2.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations

Upstream

Sec 1 Runs 1-20



Electrofishing Runs =

Figure 3.

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

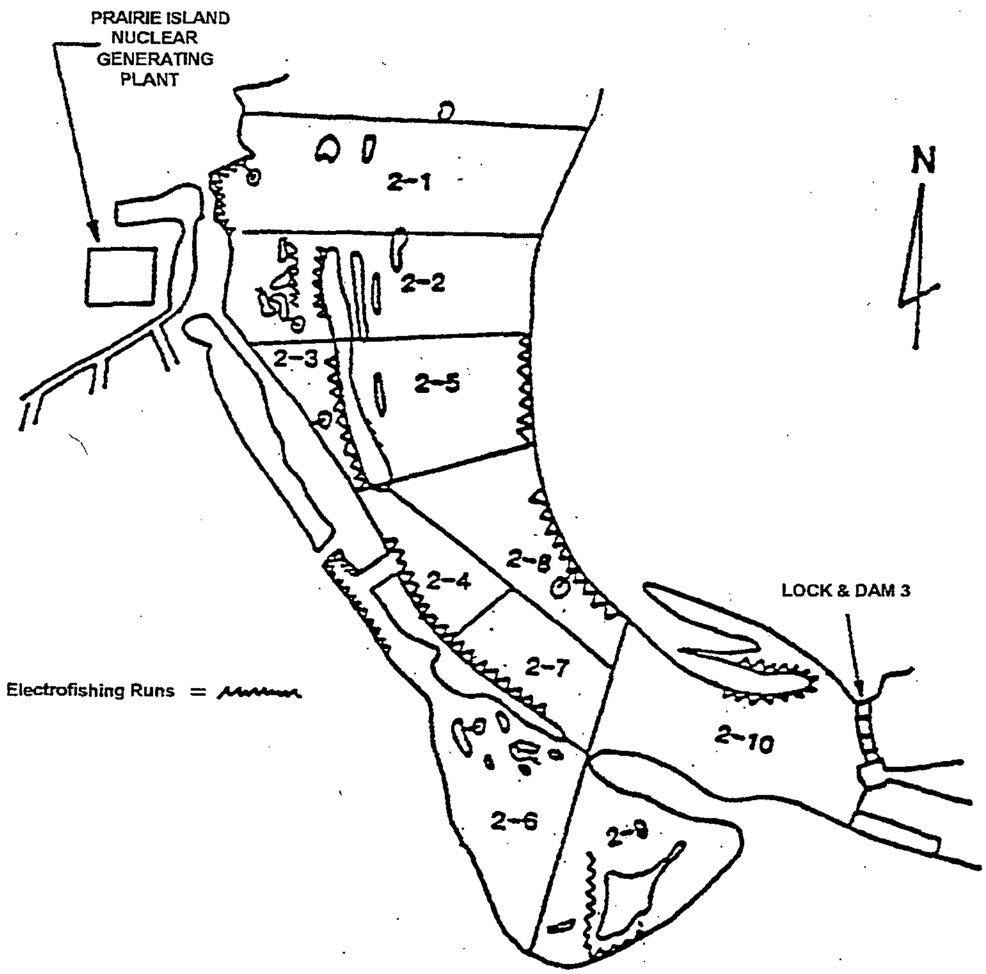
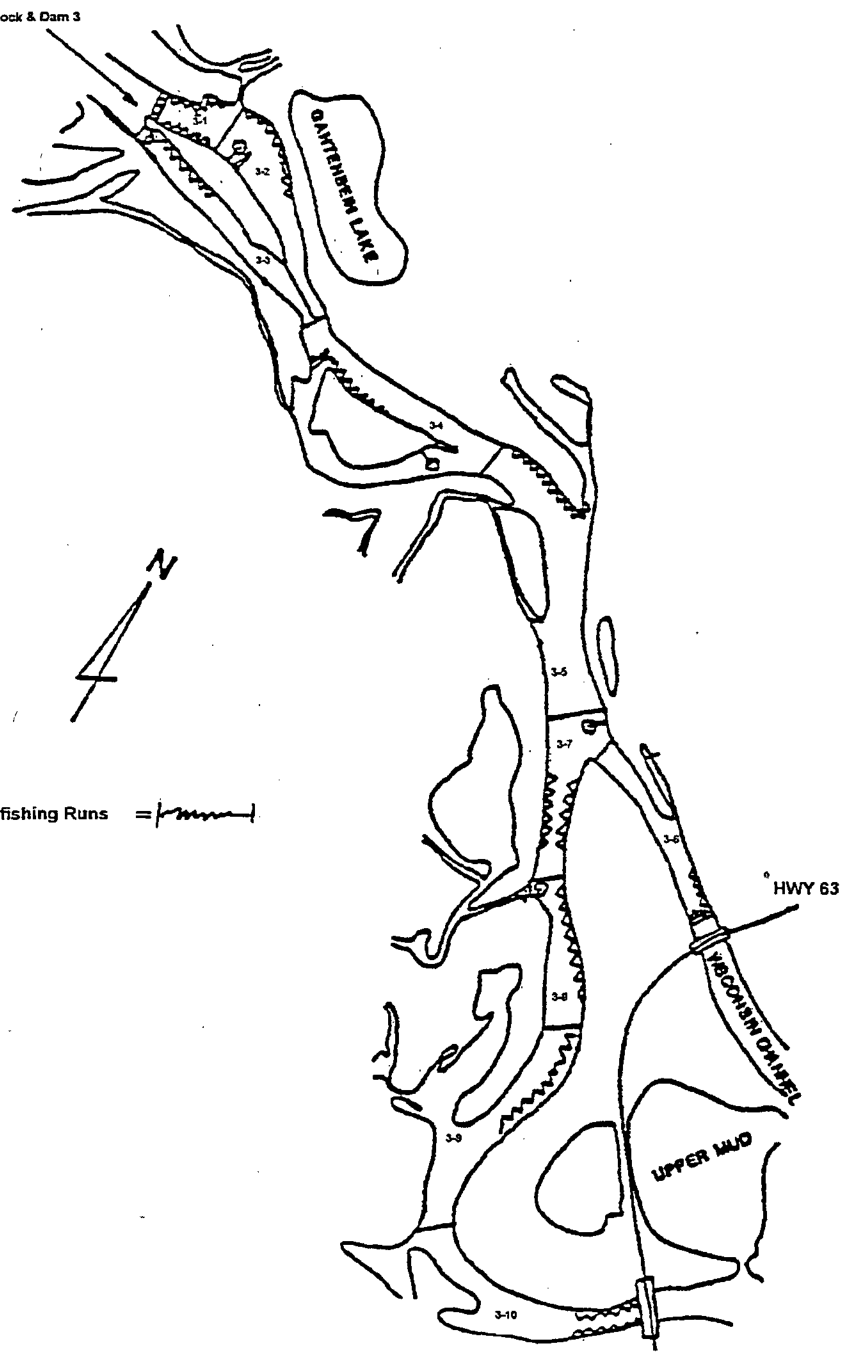


Figure 4.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 3 Runs 1-10)

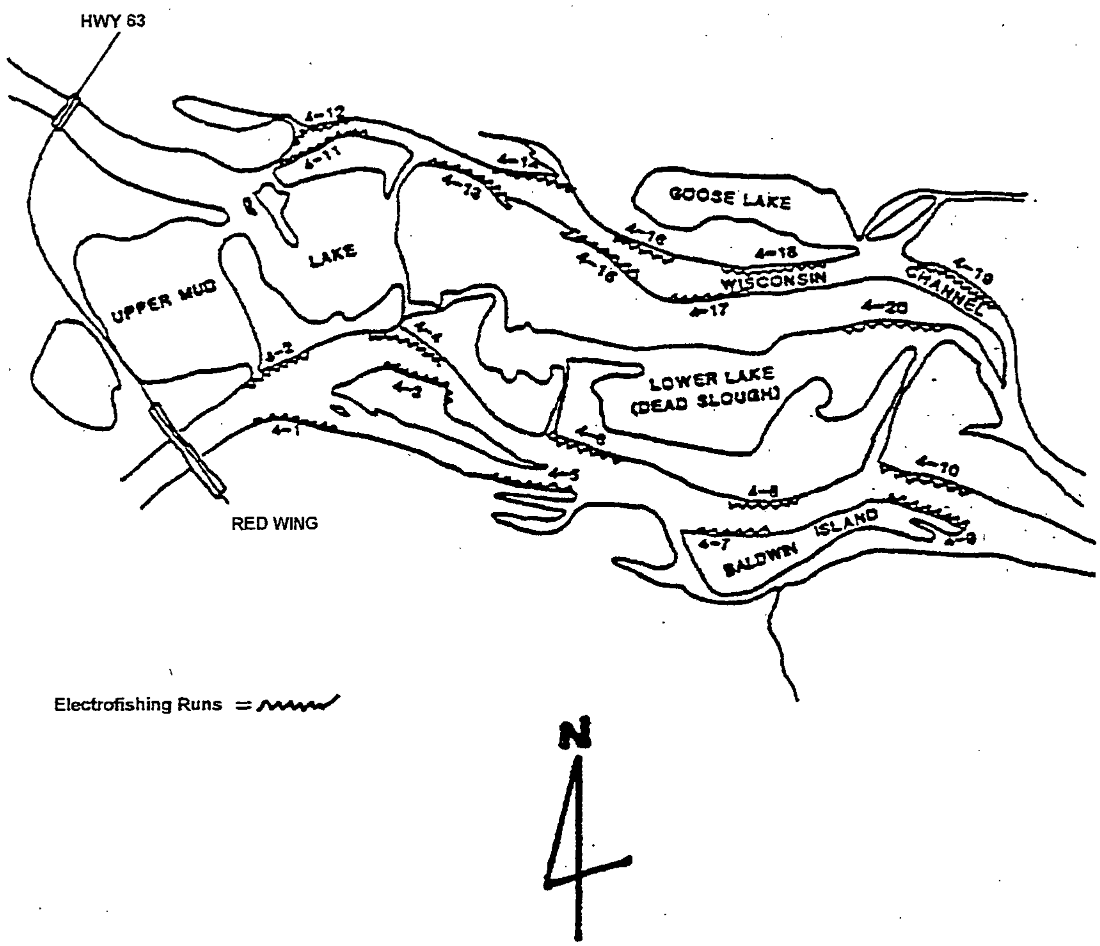


Electrofishing Runs =

Figure 5.

PRAIRIE ISLAND FISHERIES POPULATION STUDY

Sampling Locations
Downstream
(Sec 4 Runs 1-20)



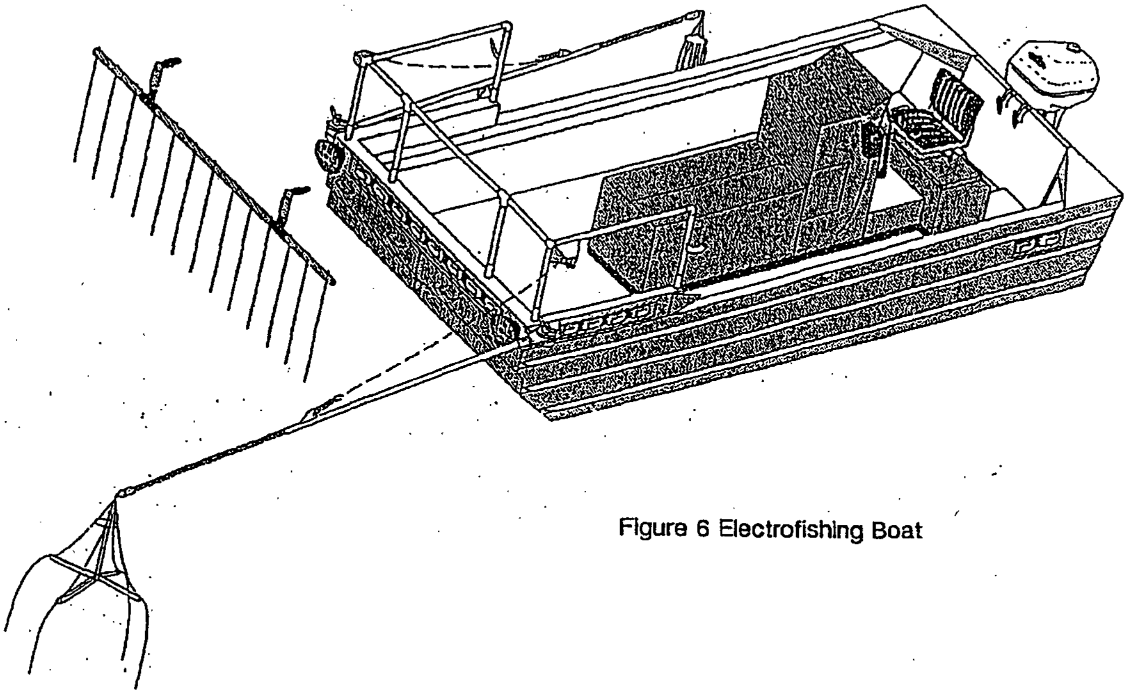
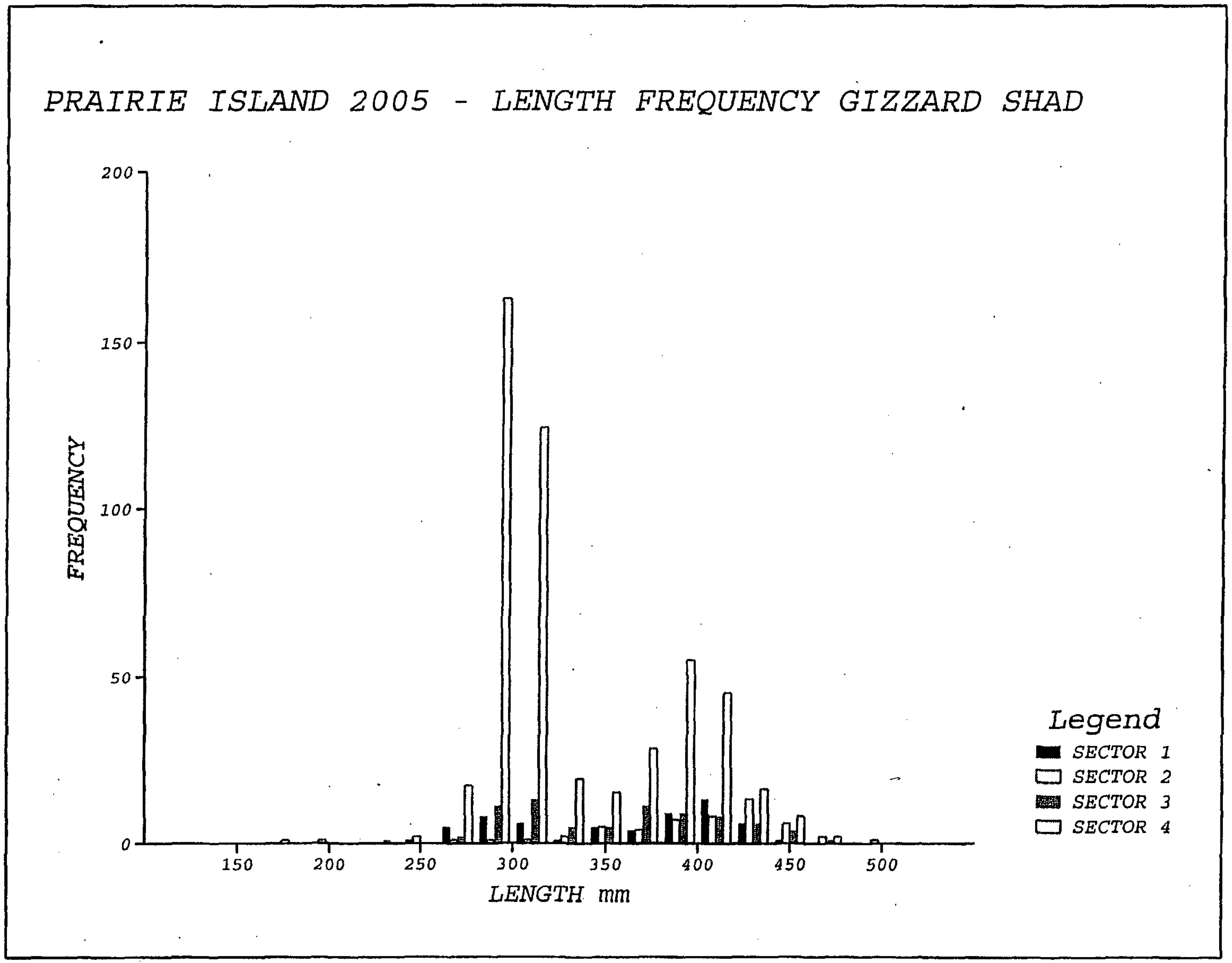
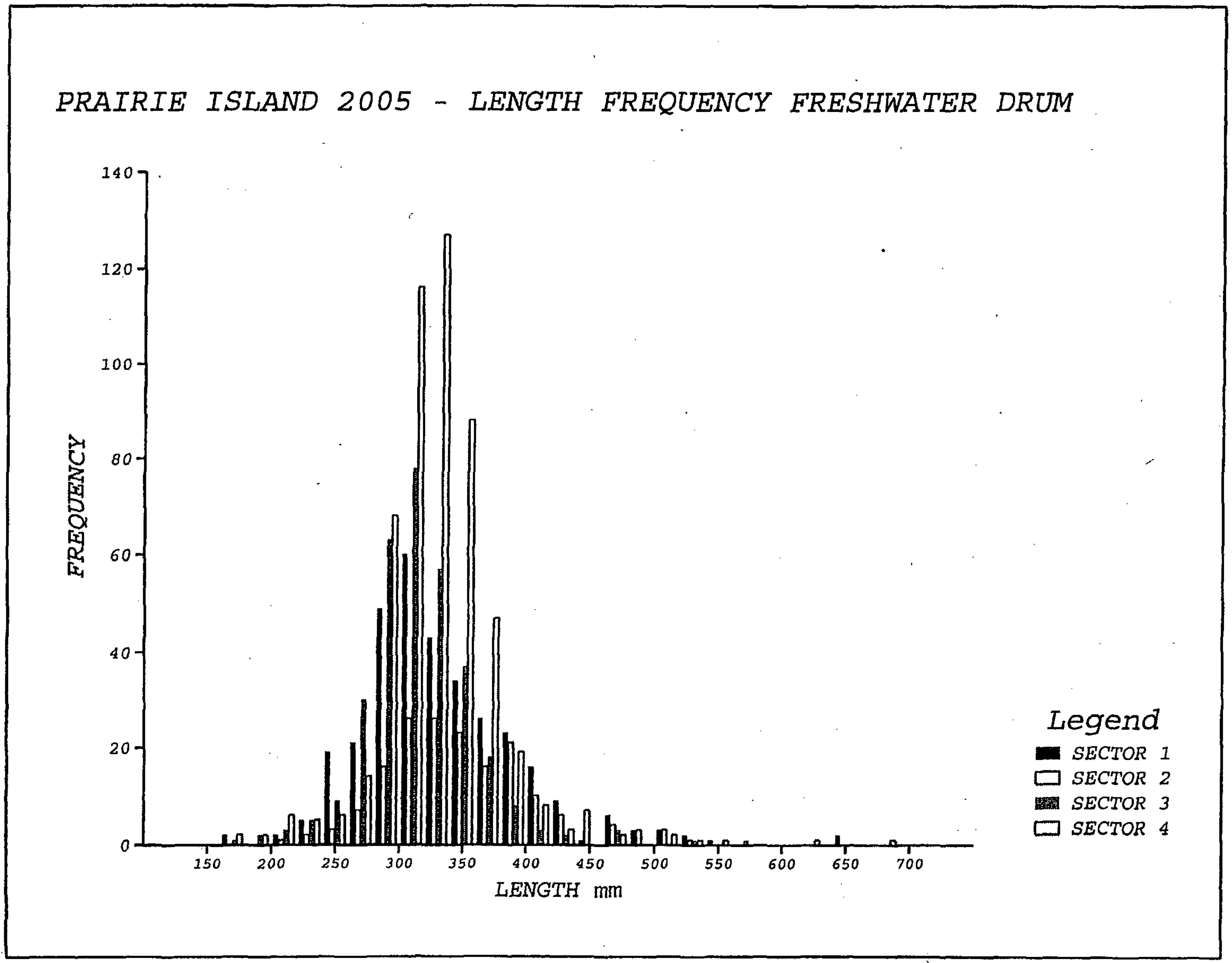


Figure 6 Electrofishing Boat



PRAIRIE ISLAND 2005 - LENGTH FREQUENCY GIZZARD SHAD
200
150
100
50
0
FREQUENCY
150
200
250
300
350
400
450
500
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4



PRAIRIE ISLAND 2005 - LENGTH FREQUENCY FRESHWATER DRUM
FREQUENCY
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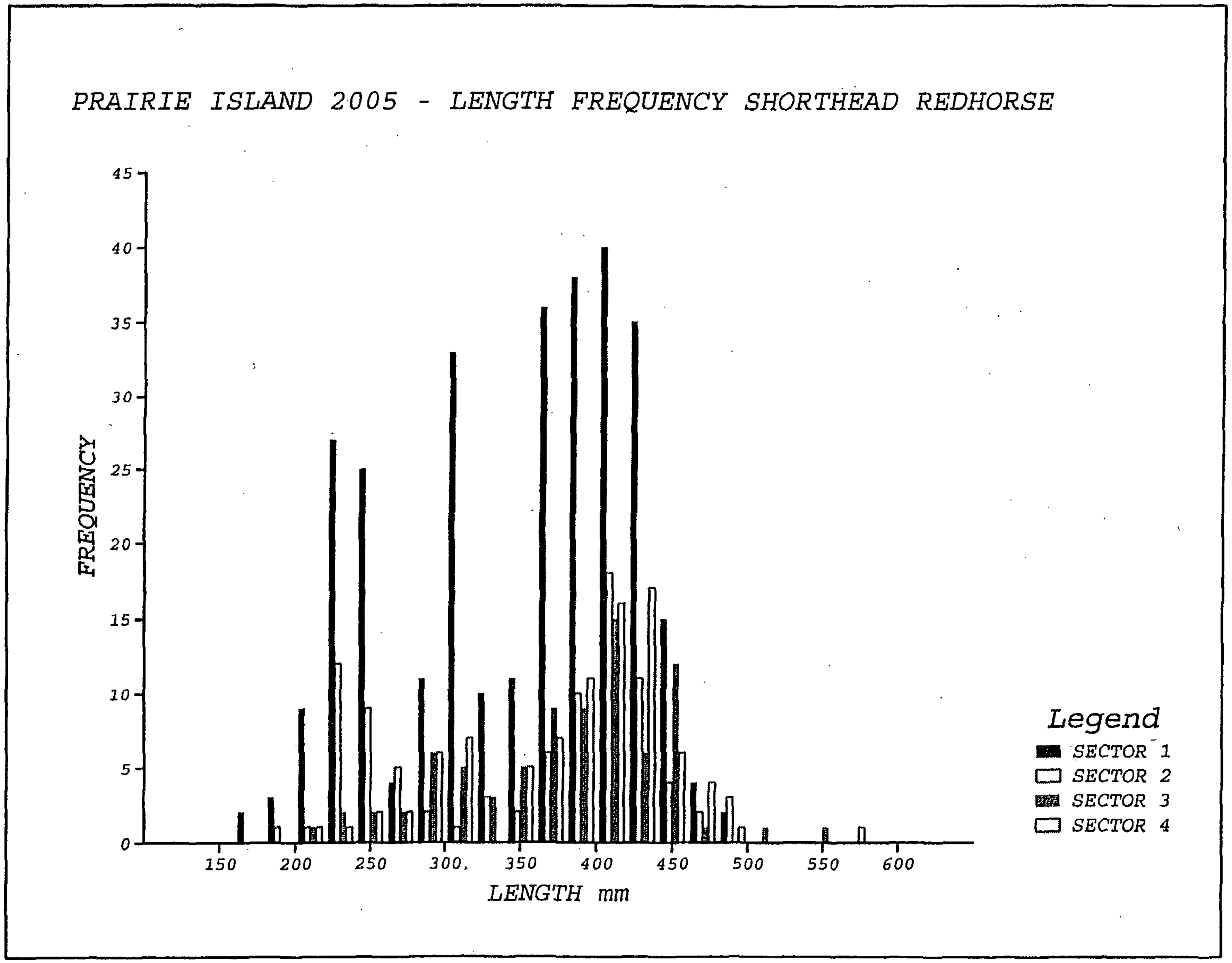
20
40
60
80
100
120
140
150
200
250
300
350
400
450
500
550
600
650
700
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4


PRAIRIE ISLAND 2005 - LENGTH FREQUENCY SHORTHEAD REDHORSE
FREQUENCY
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40
35
30
25
20
15
10
5
0
150
200
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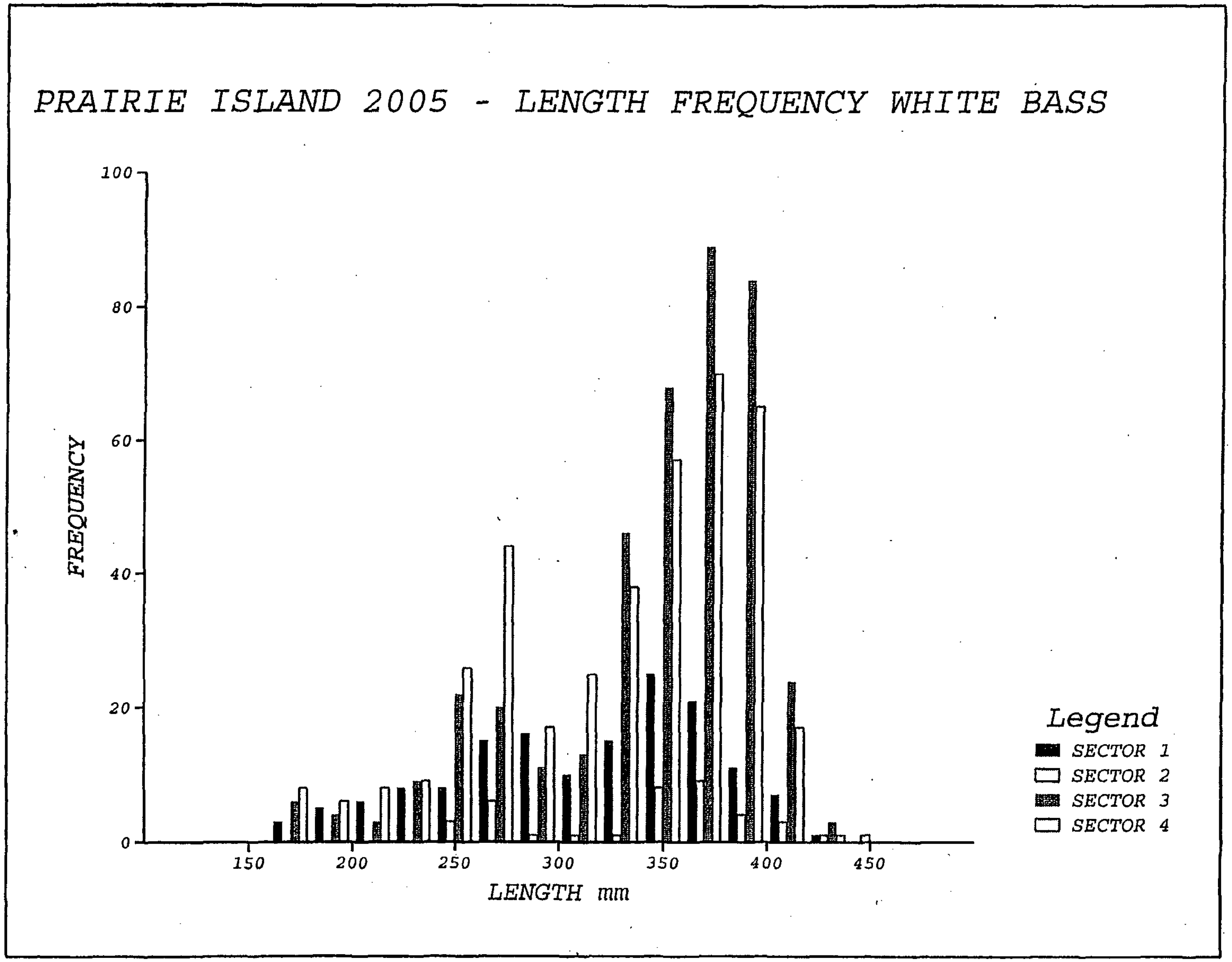
300
350
400
450
500
550
600
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4


PRAIRIE ISLAND 2005 - LENGTH FREQUENCY WHITE BASS
FREQUENCY
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60
80
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150
200
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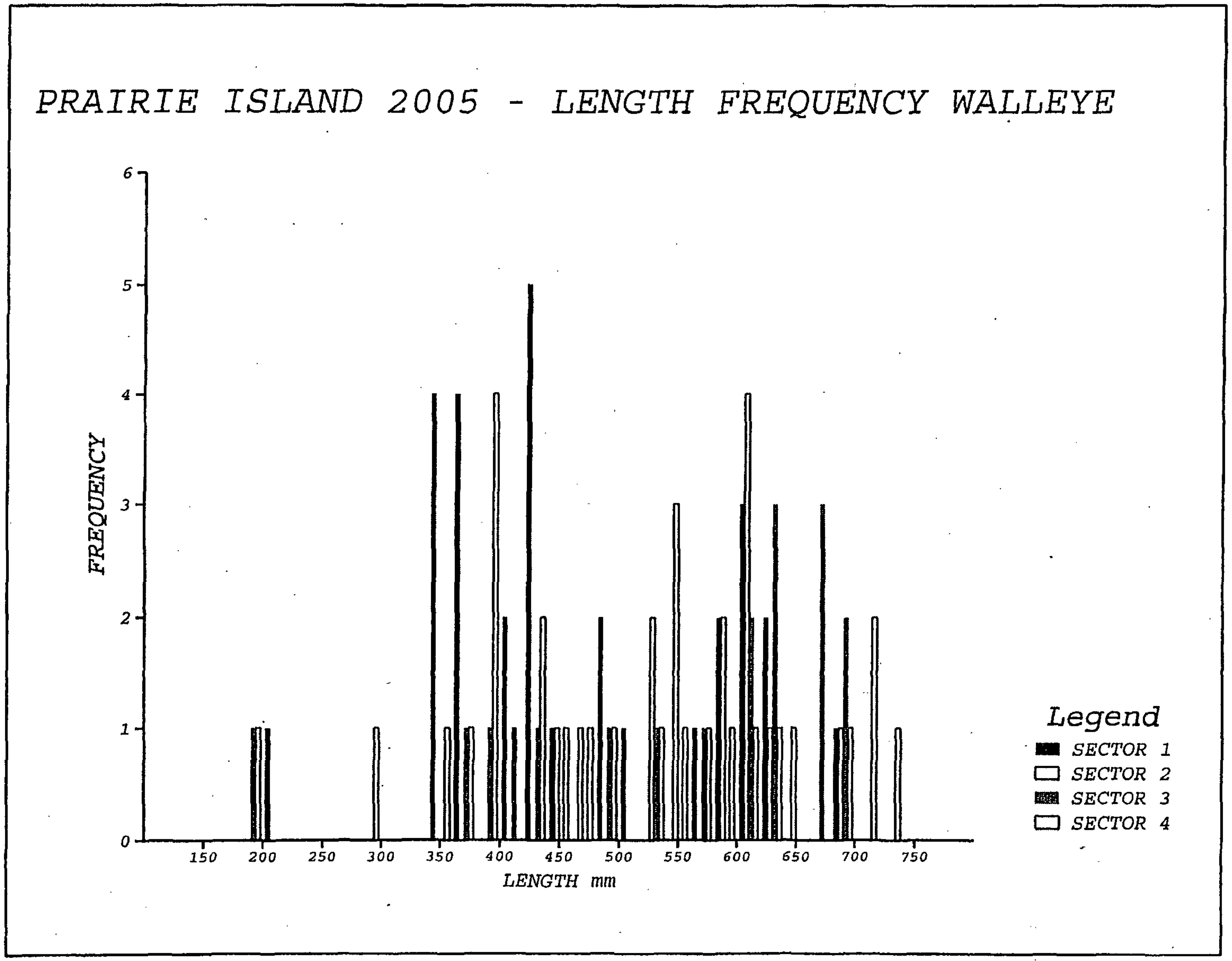
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4


PRAIRIE ISLAND 2005 - LENGTH FREQUENCY WALLEYE
FREQUENCY
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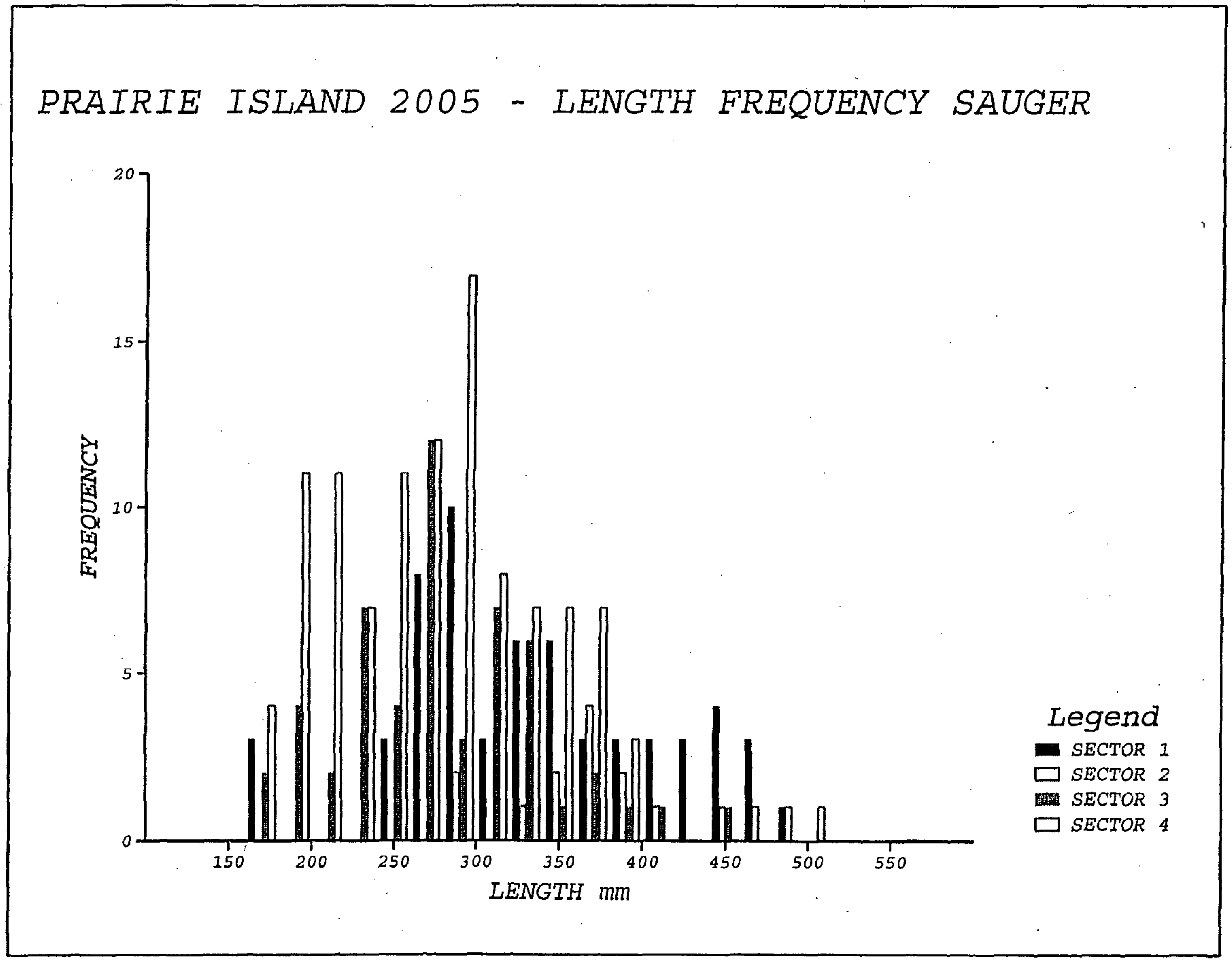
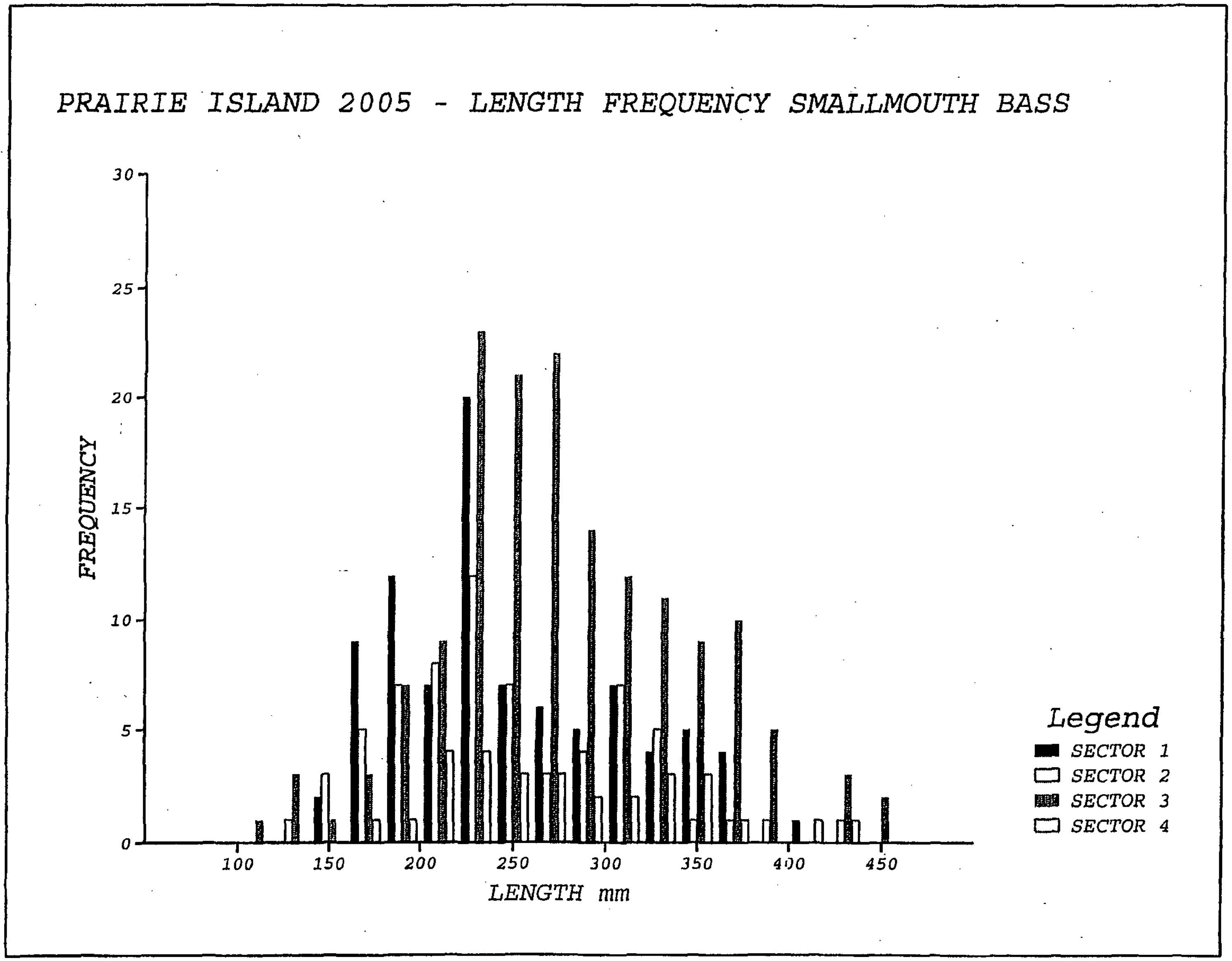
1
2
3
4
5
6
150
200
250
300
350
400
450
500
550
600
650
700
750
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4



PRAIRIE ISLAND 2005 - LENGTH FREQUENCY SAUGER
FREQUENCY
20
15
10
5
0
150
200
250
300
350
400
450
500
550
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4


PRAIRIE ISLAND 2005 - LENGTH FREQUENCY SMALLMOUTH BASS
FREQUENCY
30
25
20
15
10
5
0
100
150
200
250
300
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

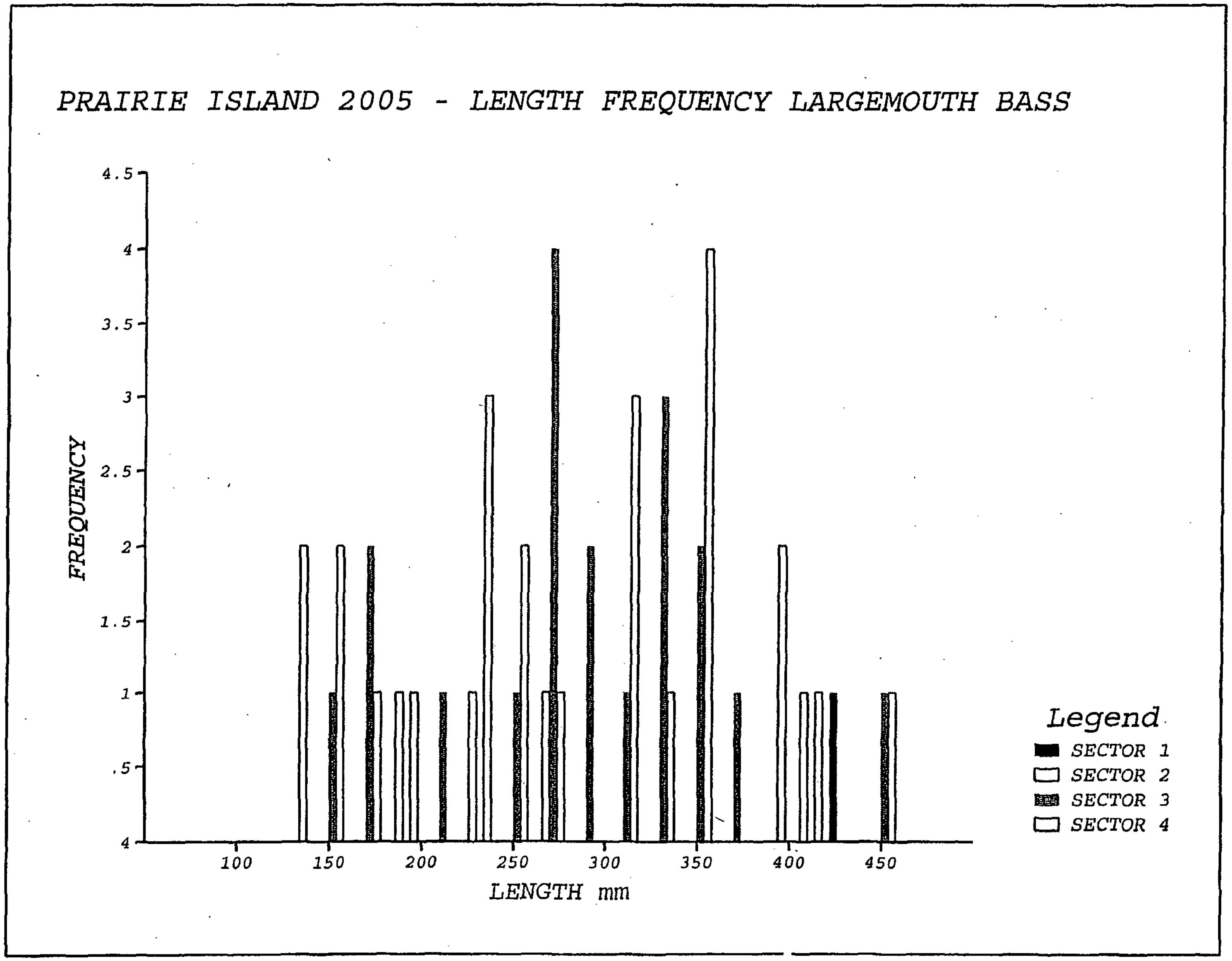

PRAIRIE ISLAND 2005 - LENGTH FREQUENCY LARGEMOUTH BASS
FREQUENCY
4.5
4
3.5
3
2.5
2
1.5
1
.5
4
100
150
200
250
300
350
400
450
LENGTH mm
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Figure 15. Electrofishing CPUE (fish/hour) for Gizzard shad for years 1982-2005 in the vicinity of PINGP.

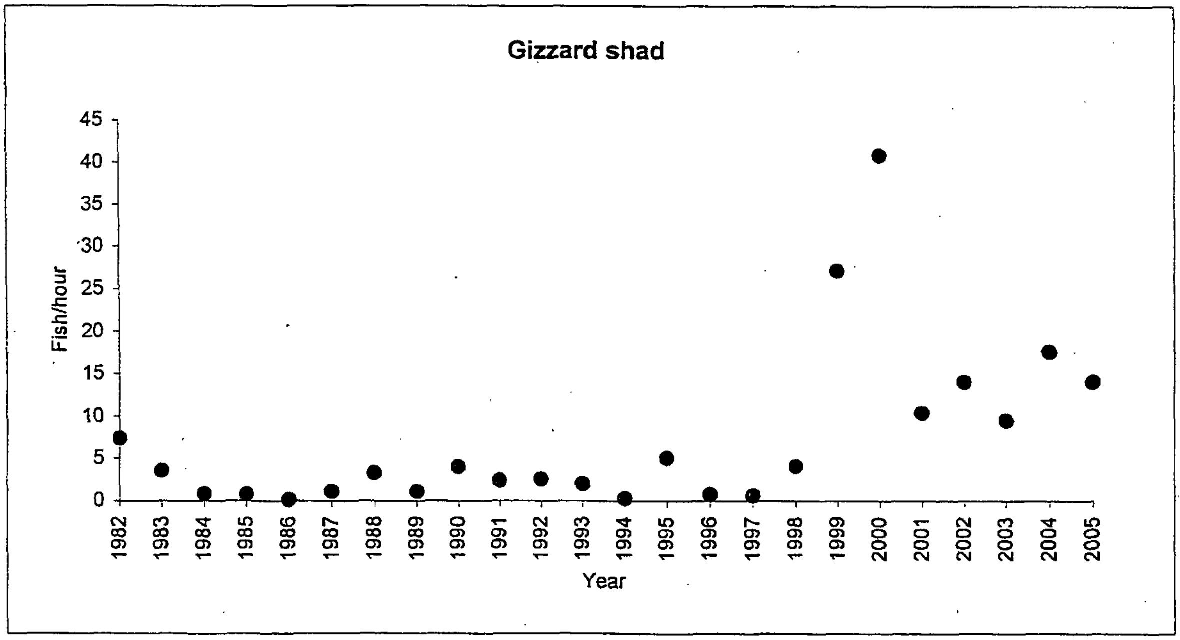


Figure 16. Electrofishing CPUE (fish/hour) for Freshwater drum for years 1982-2005 in the vicinity of PINGP.

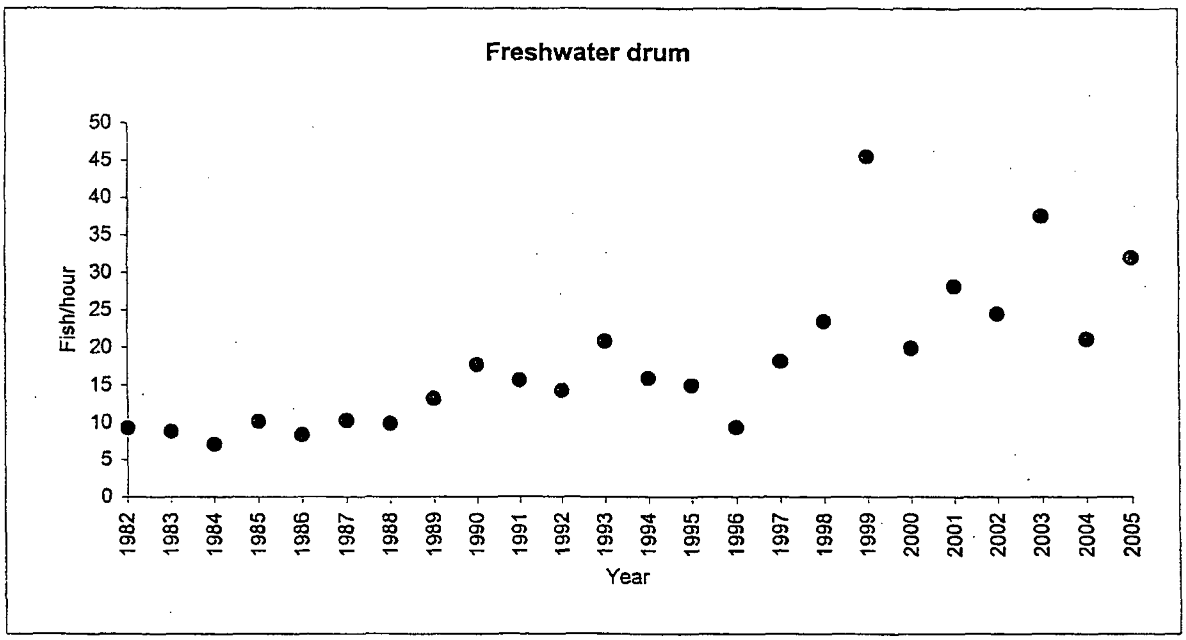


Figure 17. Electrofishing CPUE (fish/hour) for Shorthead redhorse for years 1982-2005 in the vicinity of PINGP.

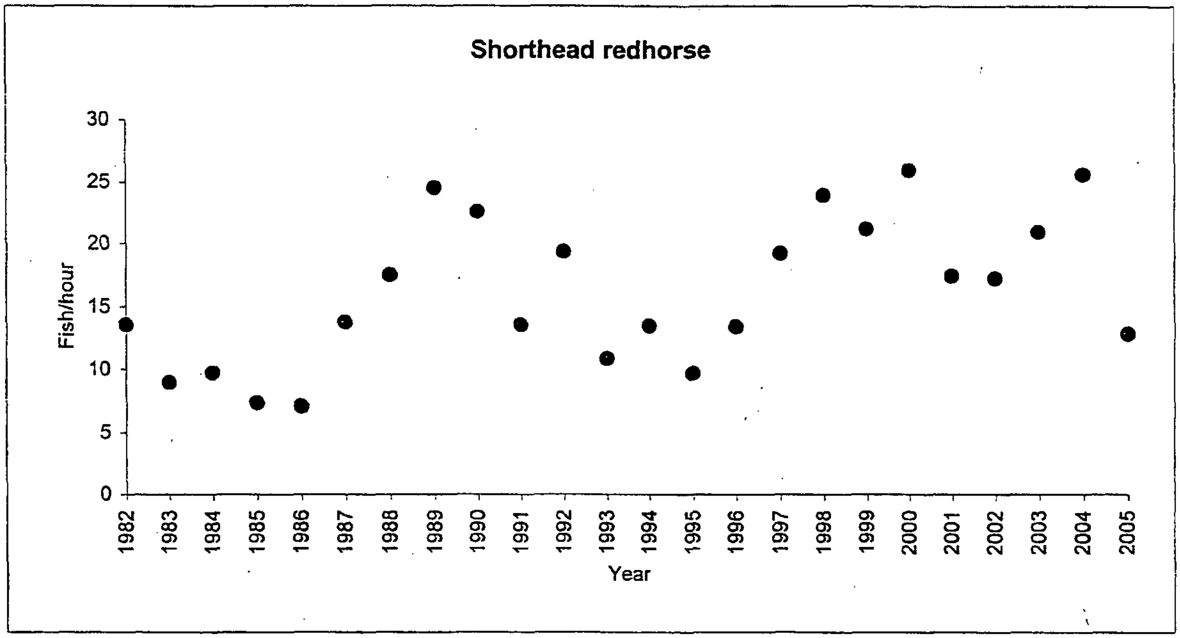


Figure 18. Electrofishing CPUE (fish/hour) for White bass for years 1982-2005 in the vicinity of PINGP.

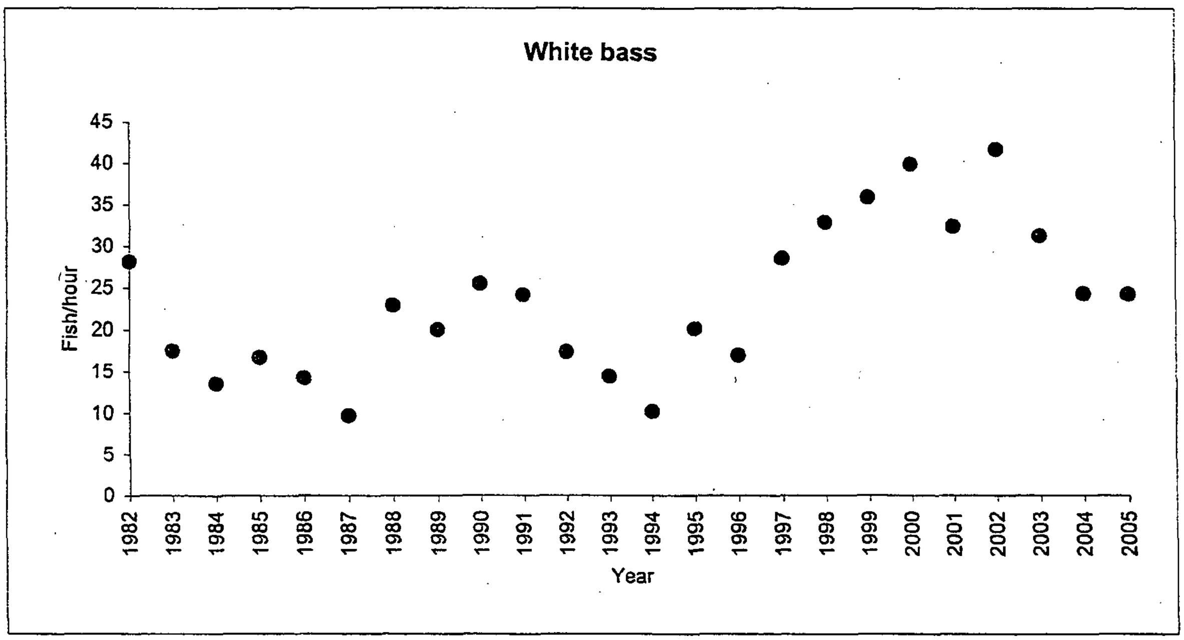


Figure 19. Electrofishing CPUE (fish/hour) for Walleye for years 1982-2005 in the vicinity of PINGP.

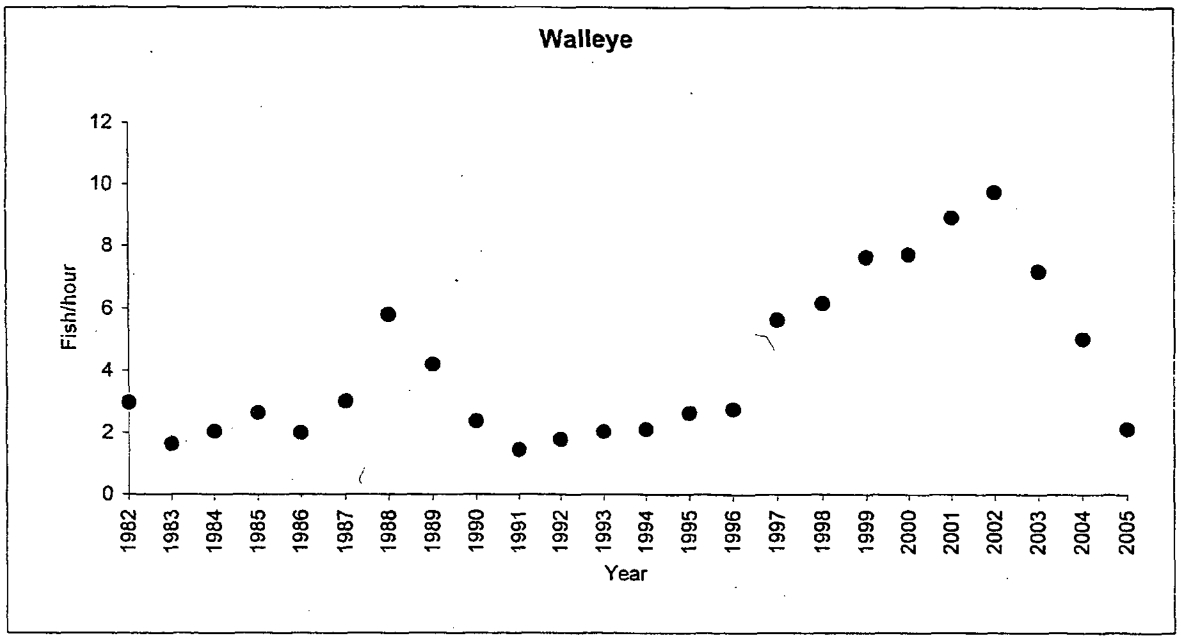


Figure 20. Electrofishing CPUE (fish/hour) for Sauger for years 1982-2005 in the vicinity of PINGP.

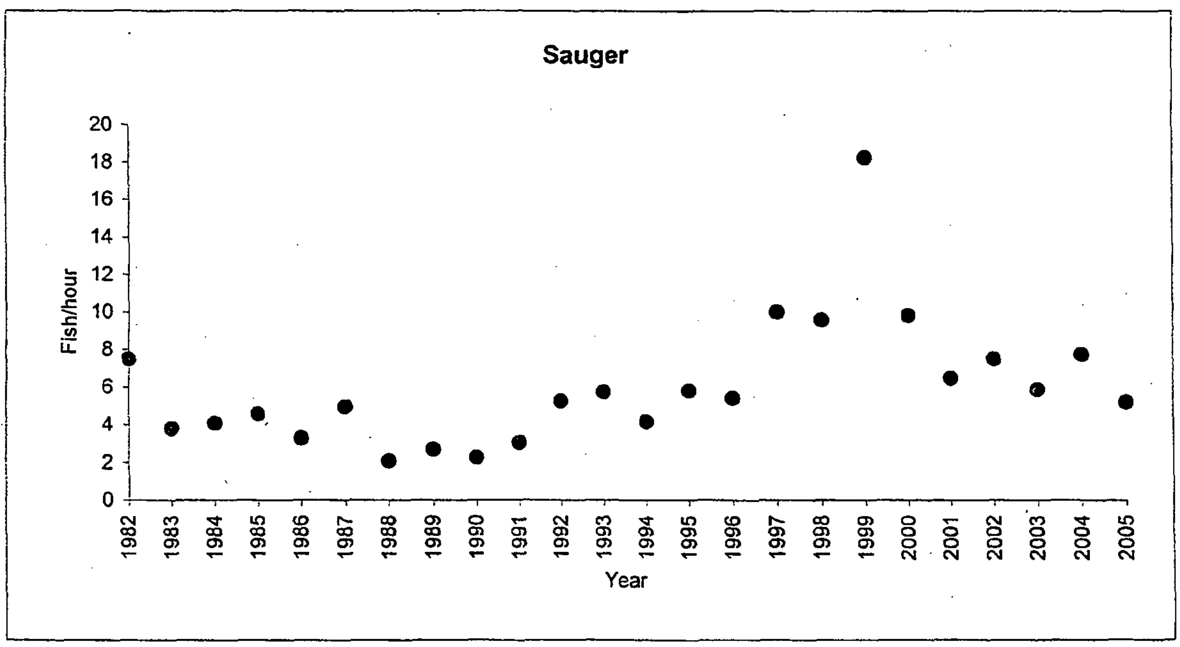


Figure 21. Electrofishing CPUE (fish/hour) for Smallmouth bass for years 1982-2005 in the vicinity of PINGP.

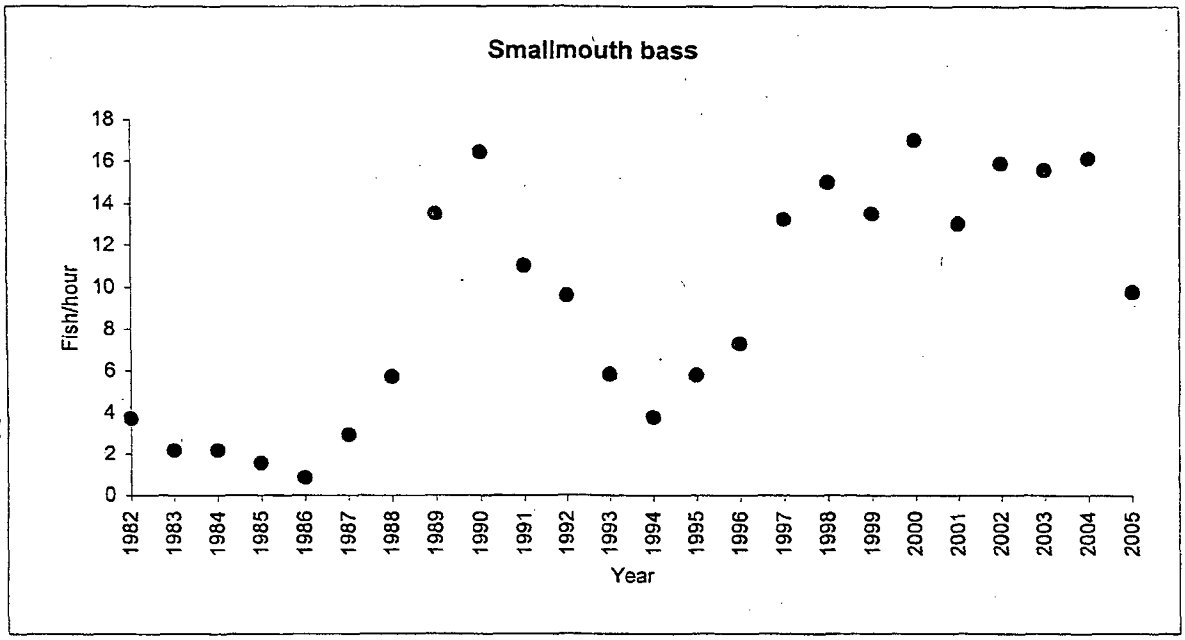


Figure 22. Electrofishing CPUE (fish/hour) for Largemouth bass for years 1982-2005 in the vicinity of PINGP.

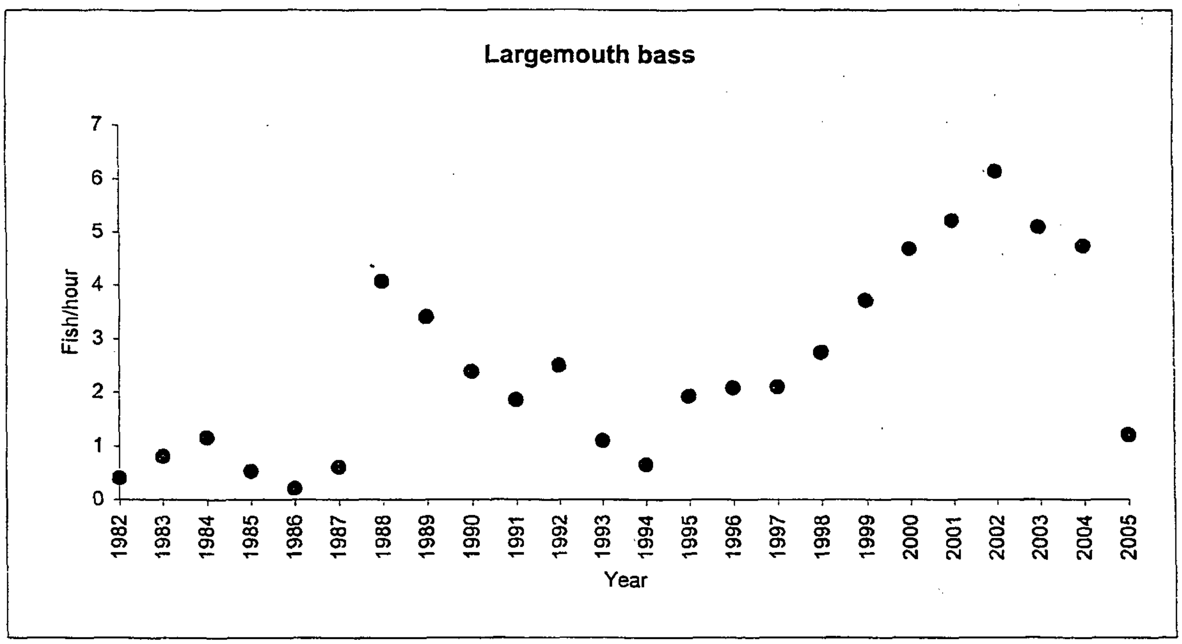


Figure 23. Electrofishing CPUE (fish/hour) by sector for Gizzard shad for years 1982-2005 in the vicinity of PINGP.

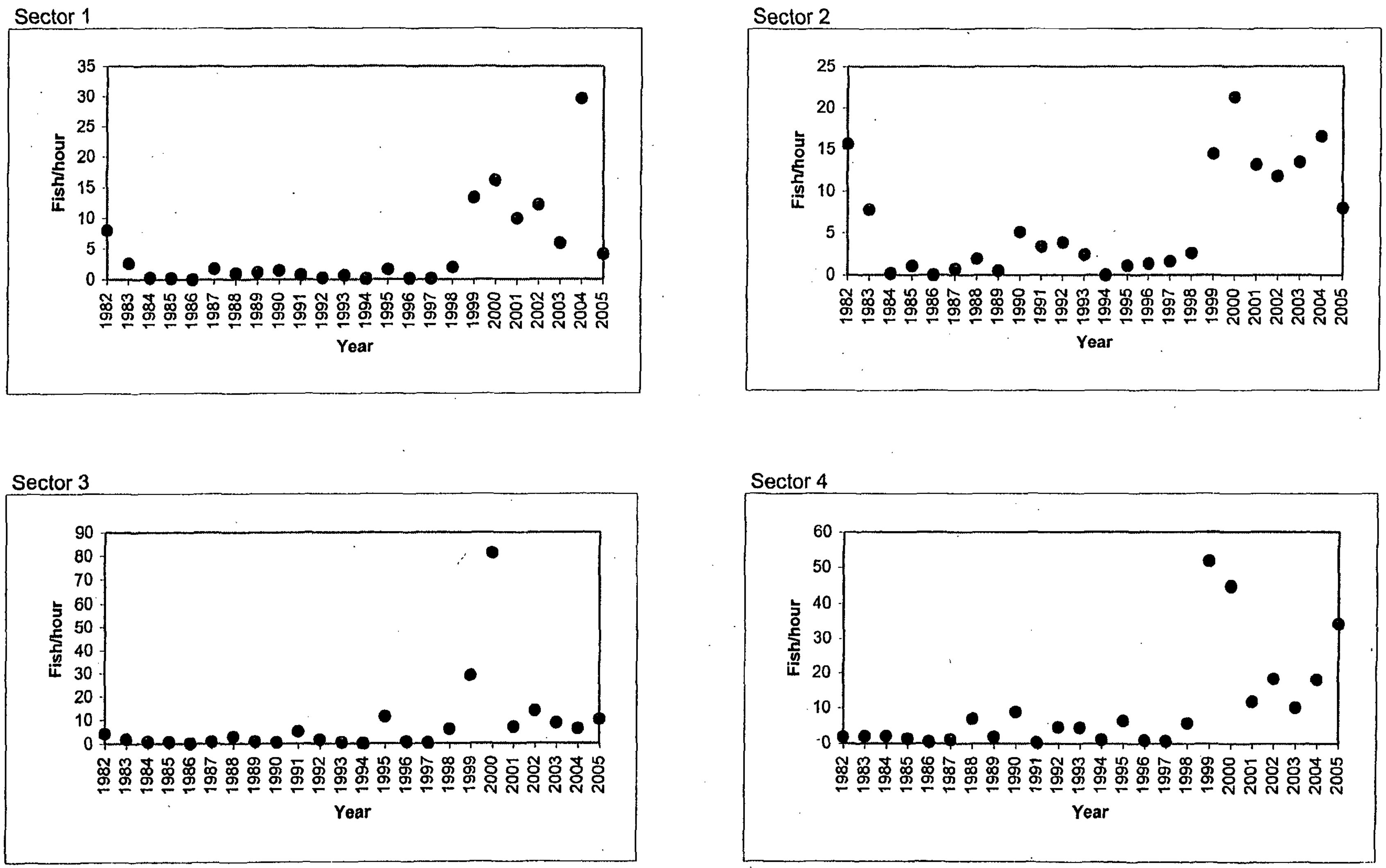
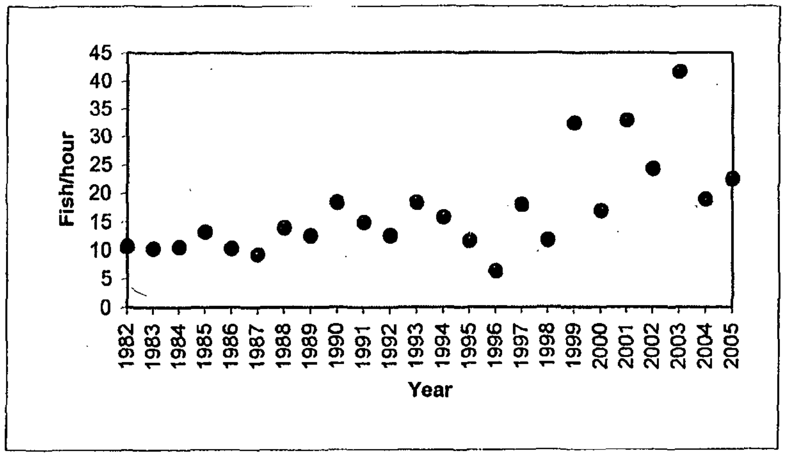
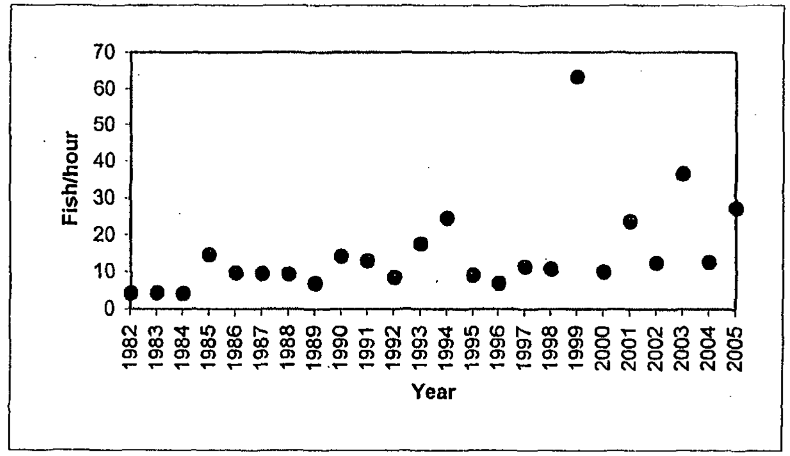


Figure 24. Electrofishing CPUE (fish/hour) by sector for Freshwater drum for years 1982-2005 in the vicinity of PINGP.

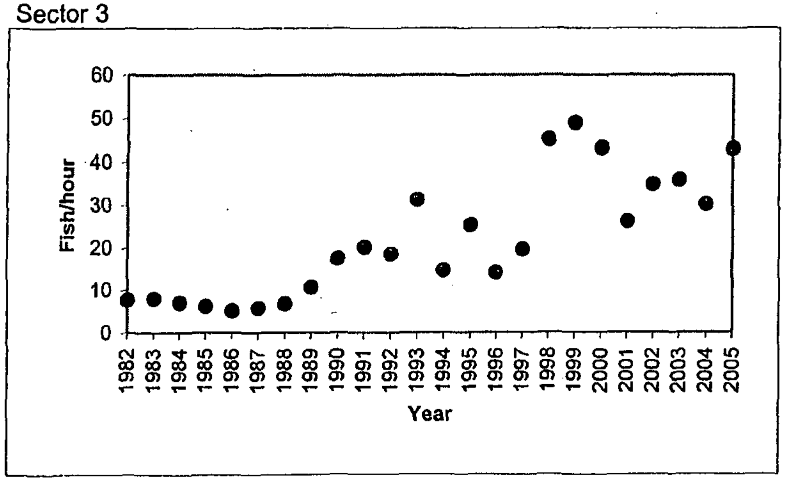
Sector 1



Sector 2



Sector 3



Sector 4

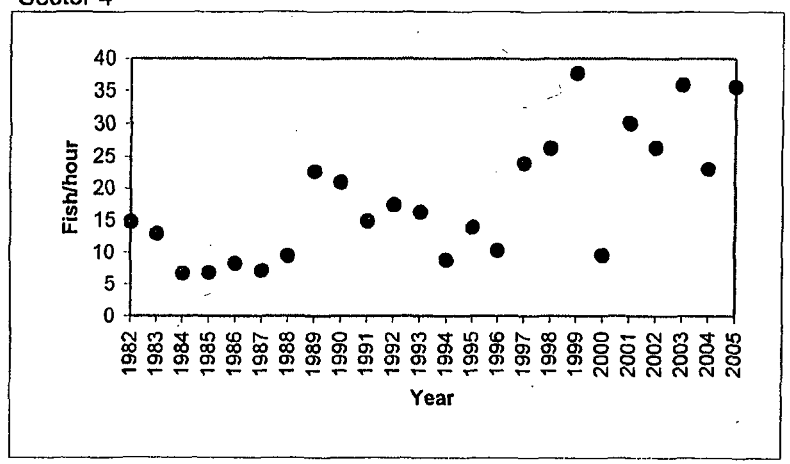
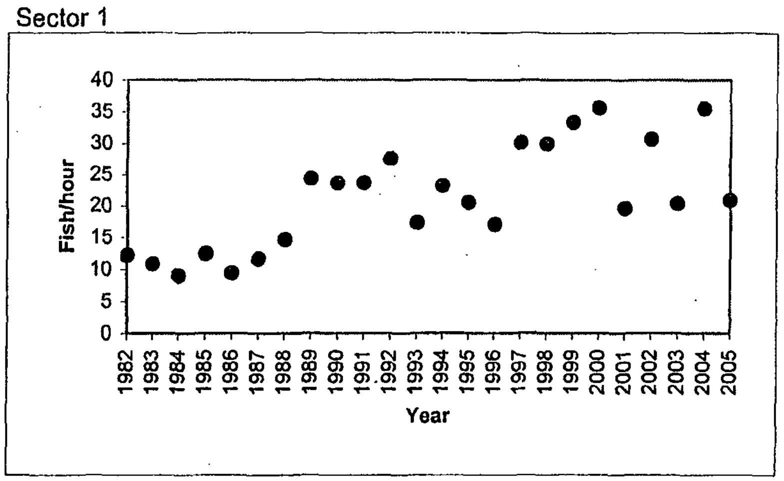
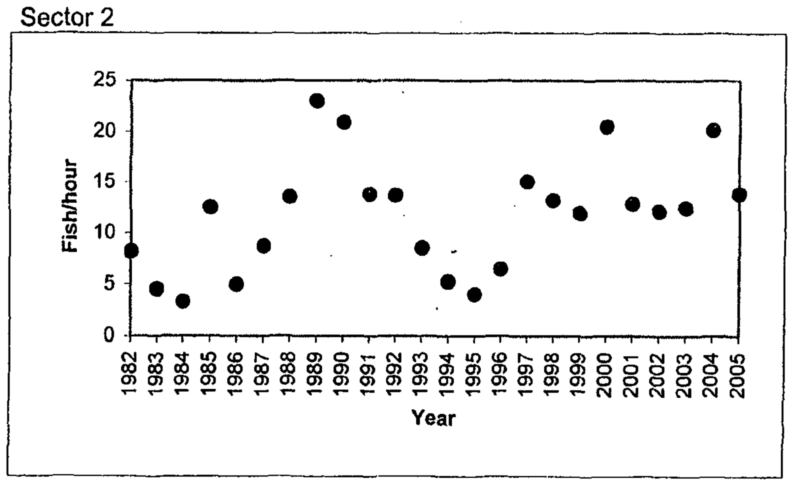
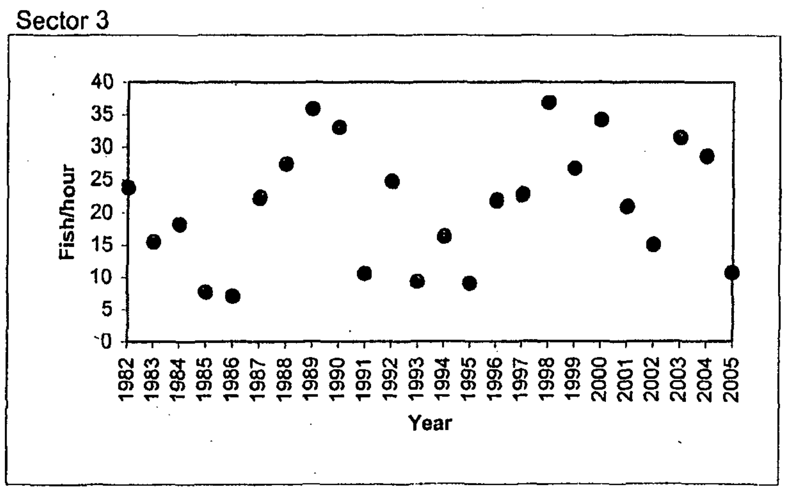


Figure 25. Electrofishing CPUE (fish/hour) by sector for Shorthead redhorse for the years 1982-2005 in the vicinity of PINGP.







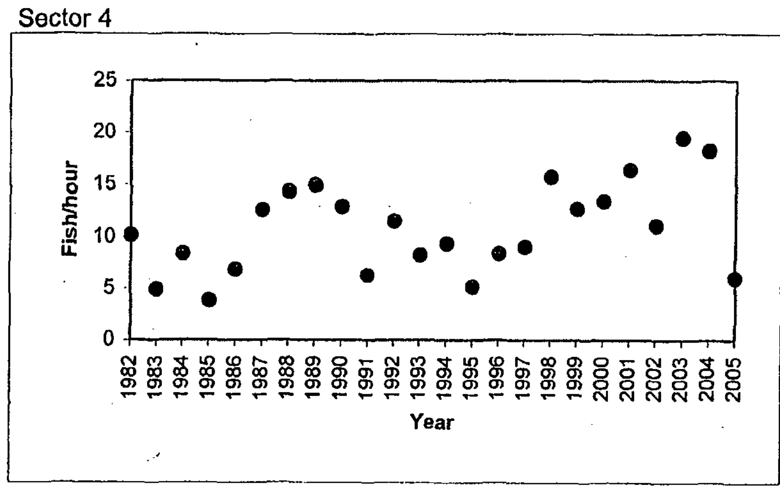
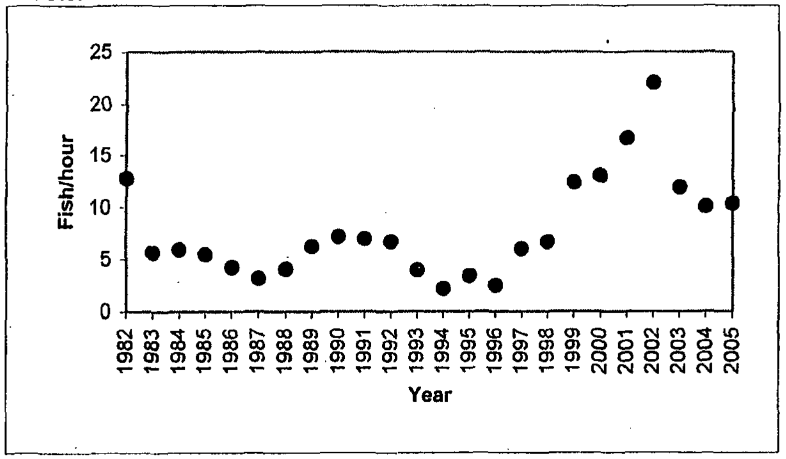
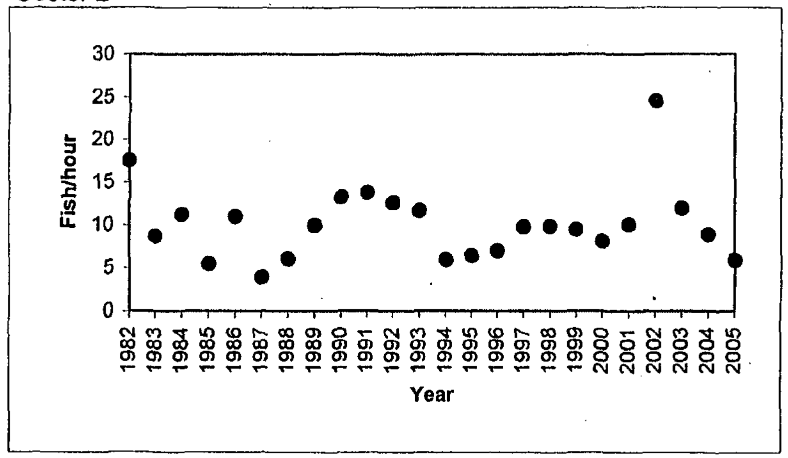


Figure 26. Electrofishing CPUE (fish/hour) by sector for White bass for years 1982-2005 in the vicinity of PINGP.

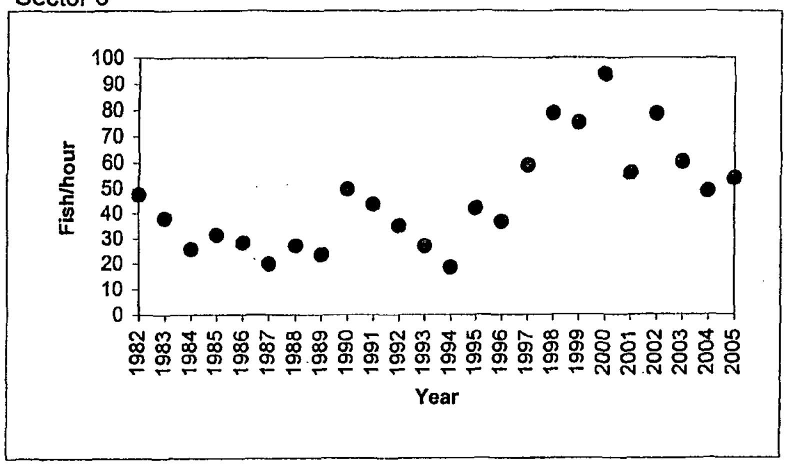
Sector 1



Sector 2



Sector 3



Sector 4

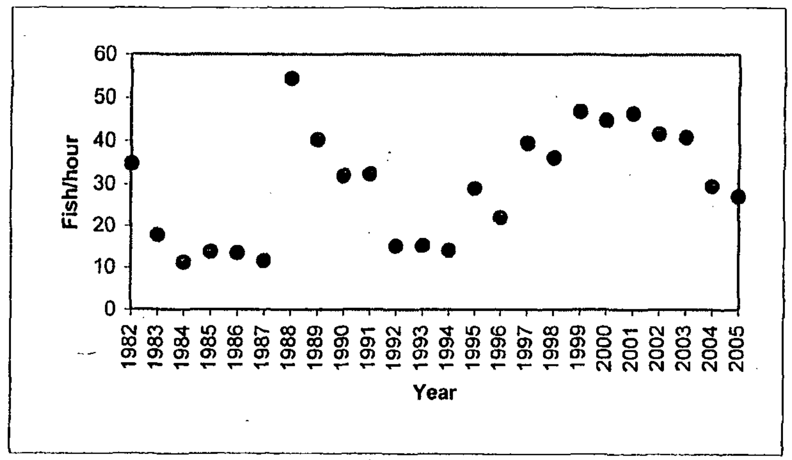
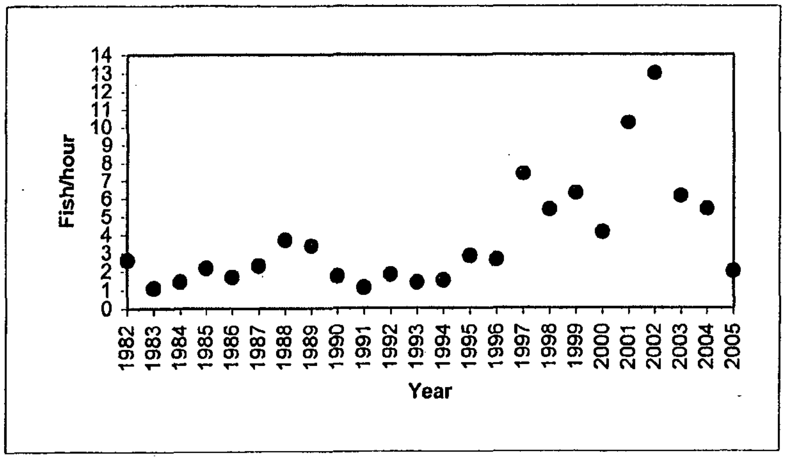
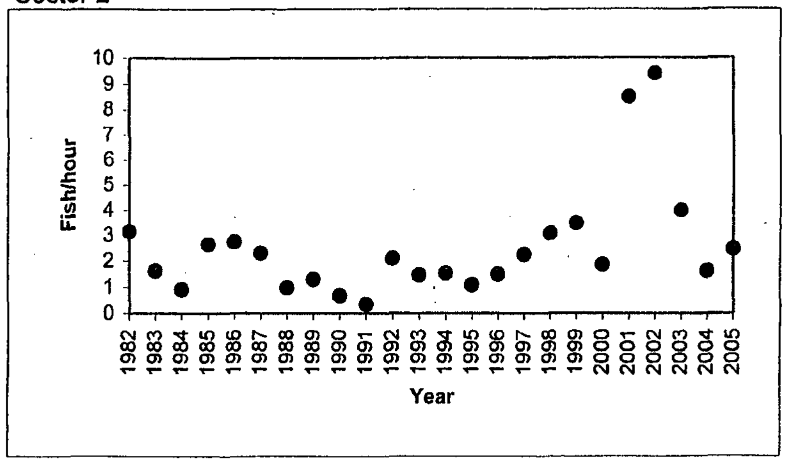


Figure 27. Electrofishing CPUE (fish/hour) by sector for Walleye for years 1982-2005 in the vicinity of PINGP.

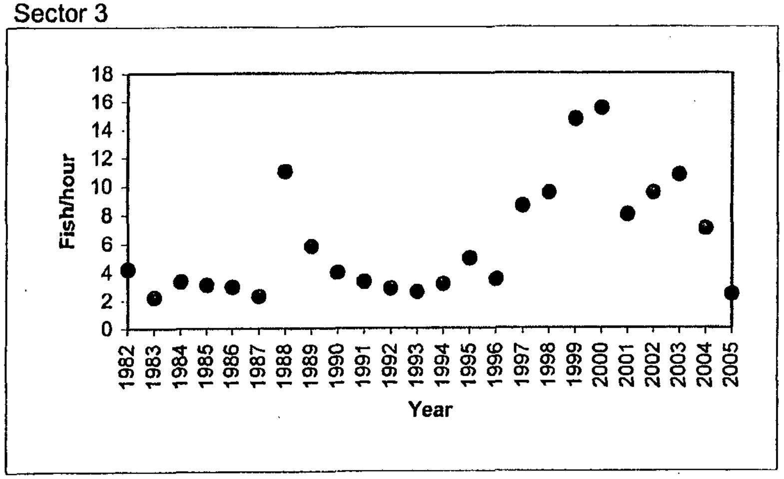
Sector 1



Sector 2



Sector 3



Sector 4

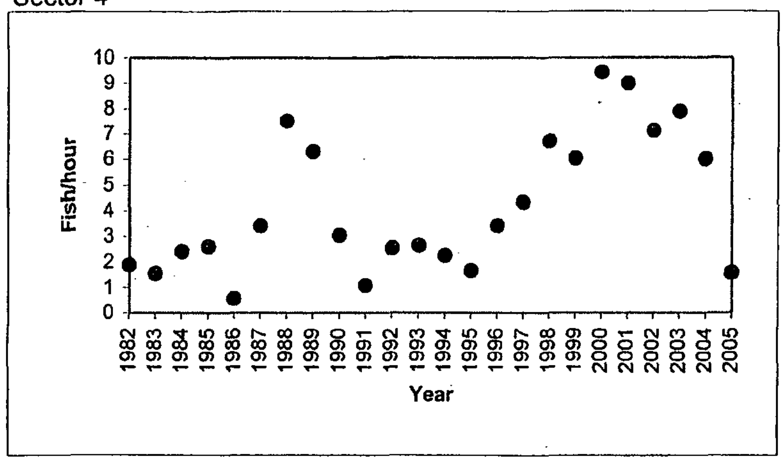
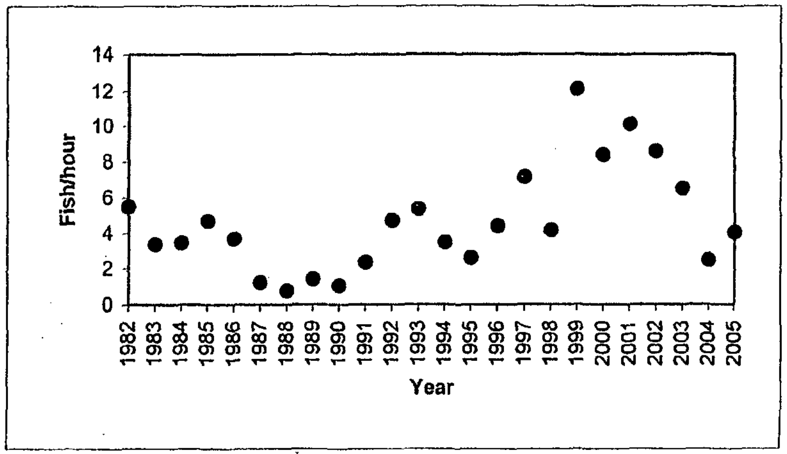
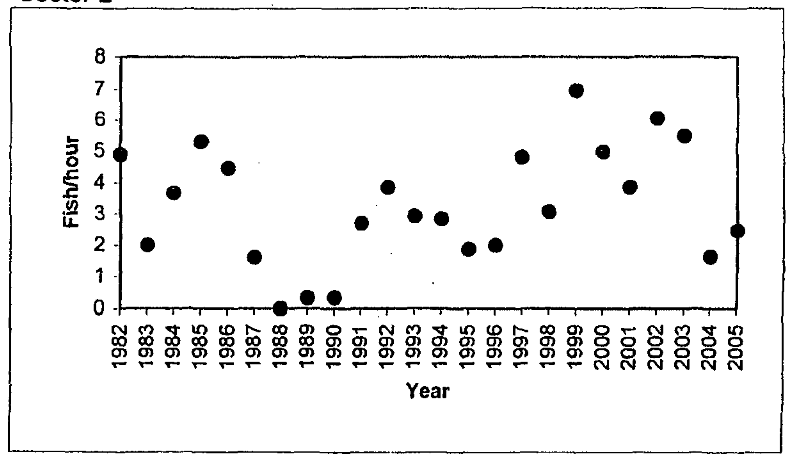


Figure 28. Electrofishing CPUE (fish/hour) by sector for Sauger for years 1982-2005 in the vicinity of PINGP

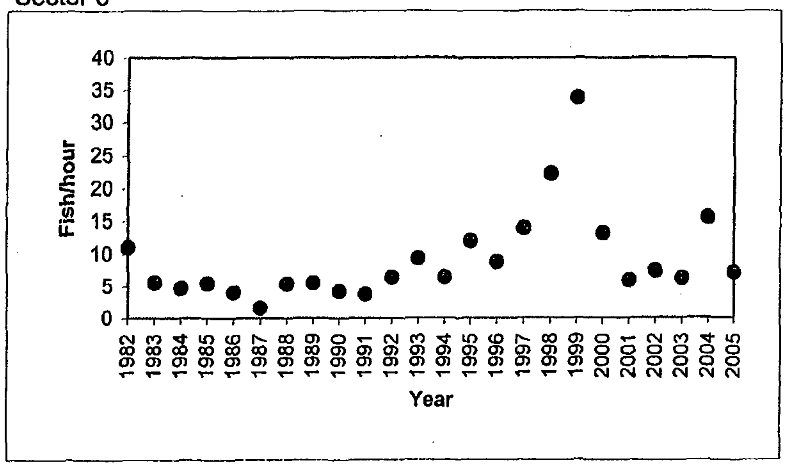
Sector 1



Sector 2



Sector 3



Sector 4

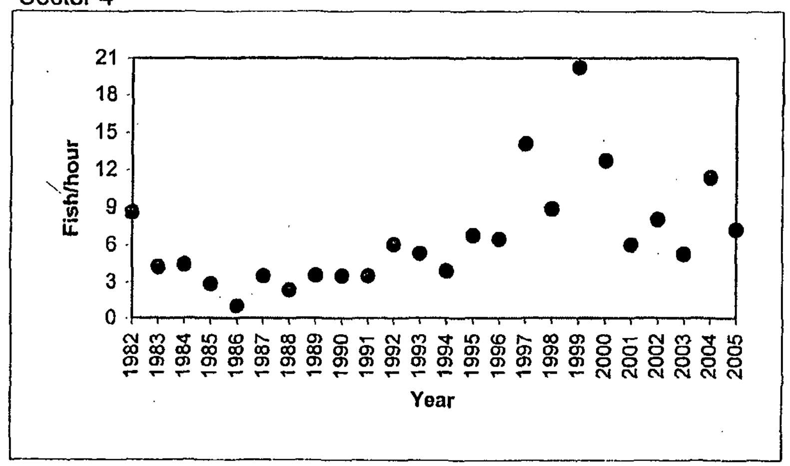


Figure 29. Electrofishing CPUE (fish/hour) by sector for Smallmouth bass for years 1982-2005 in the vicinity of PINGP.

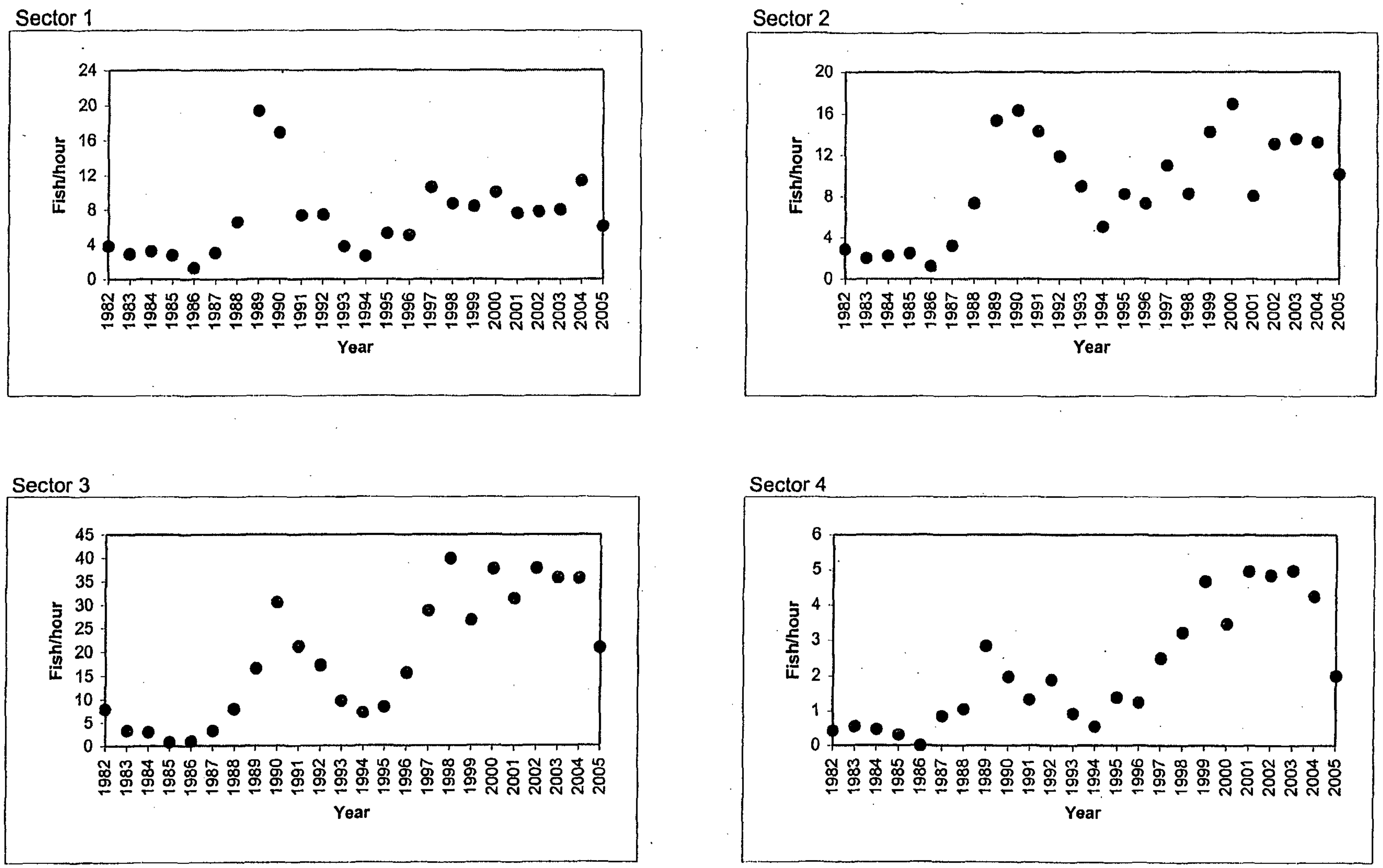
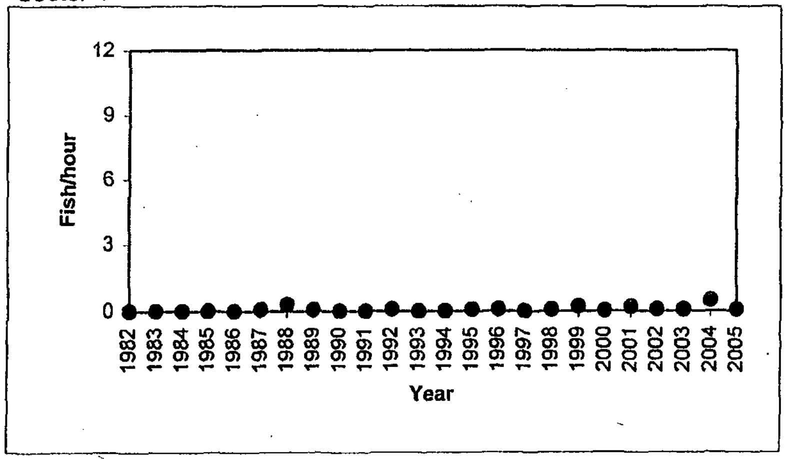
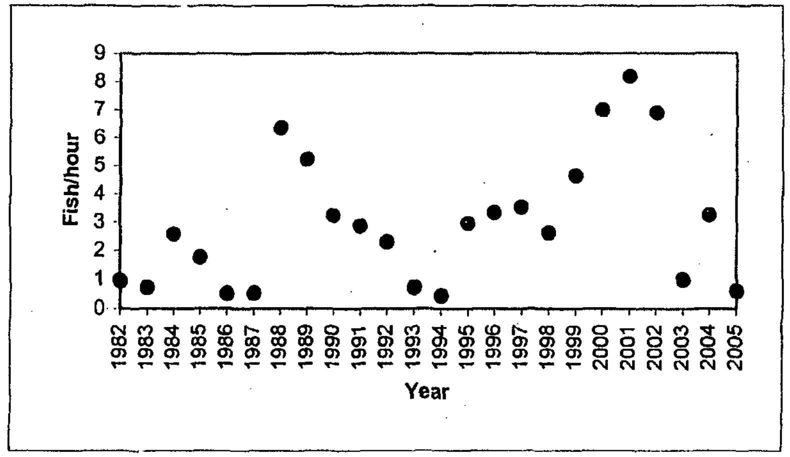


Figure 30. Electrofishing CPUE (fish/hour) by sector for Largemouth bass for years 1982-2005 in the vicinity of PINGP.

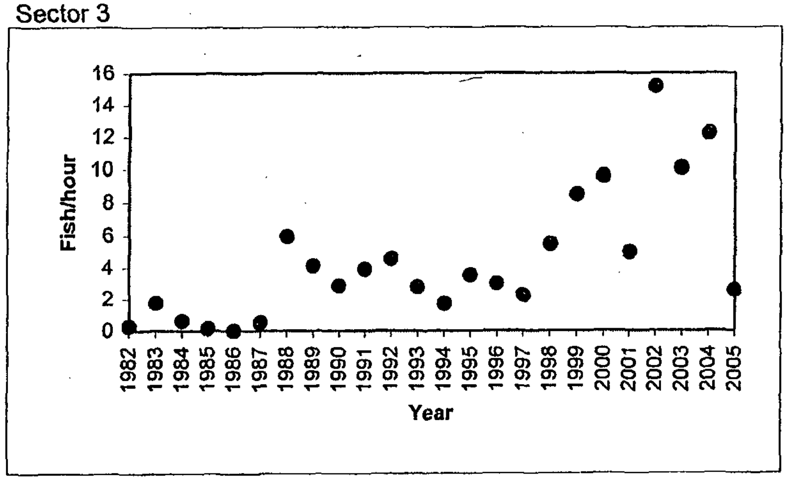
Sector 1



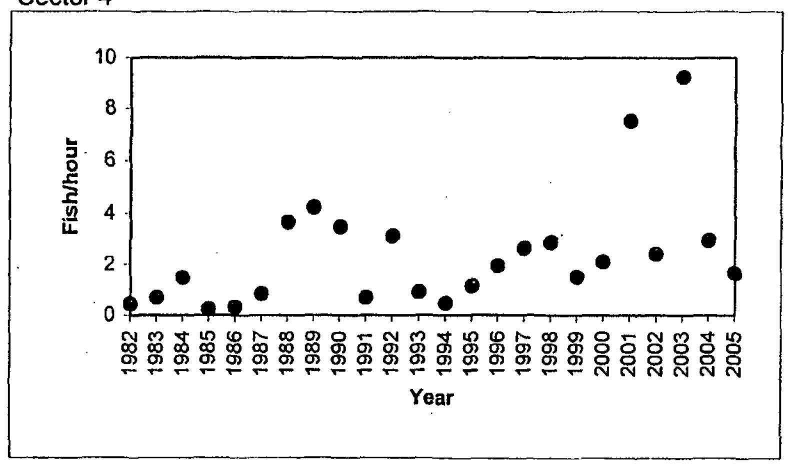
Sector 2



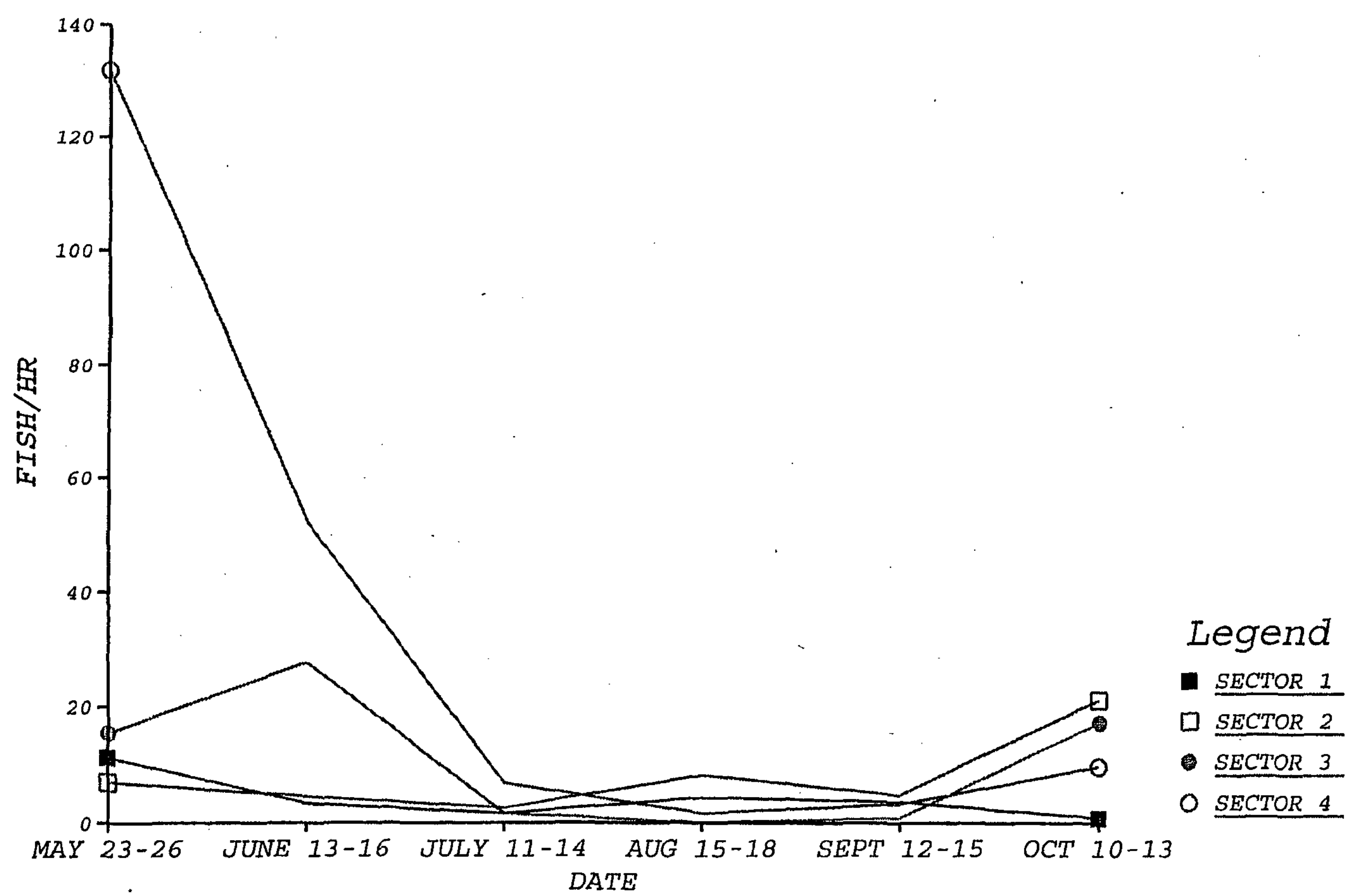
Sector 3



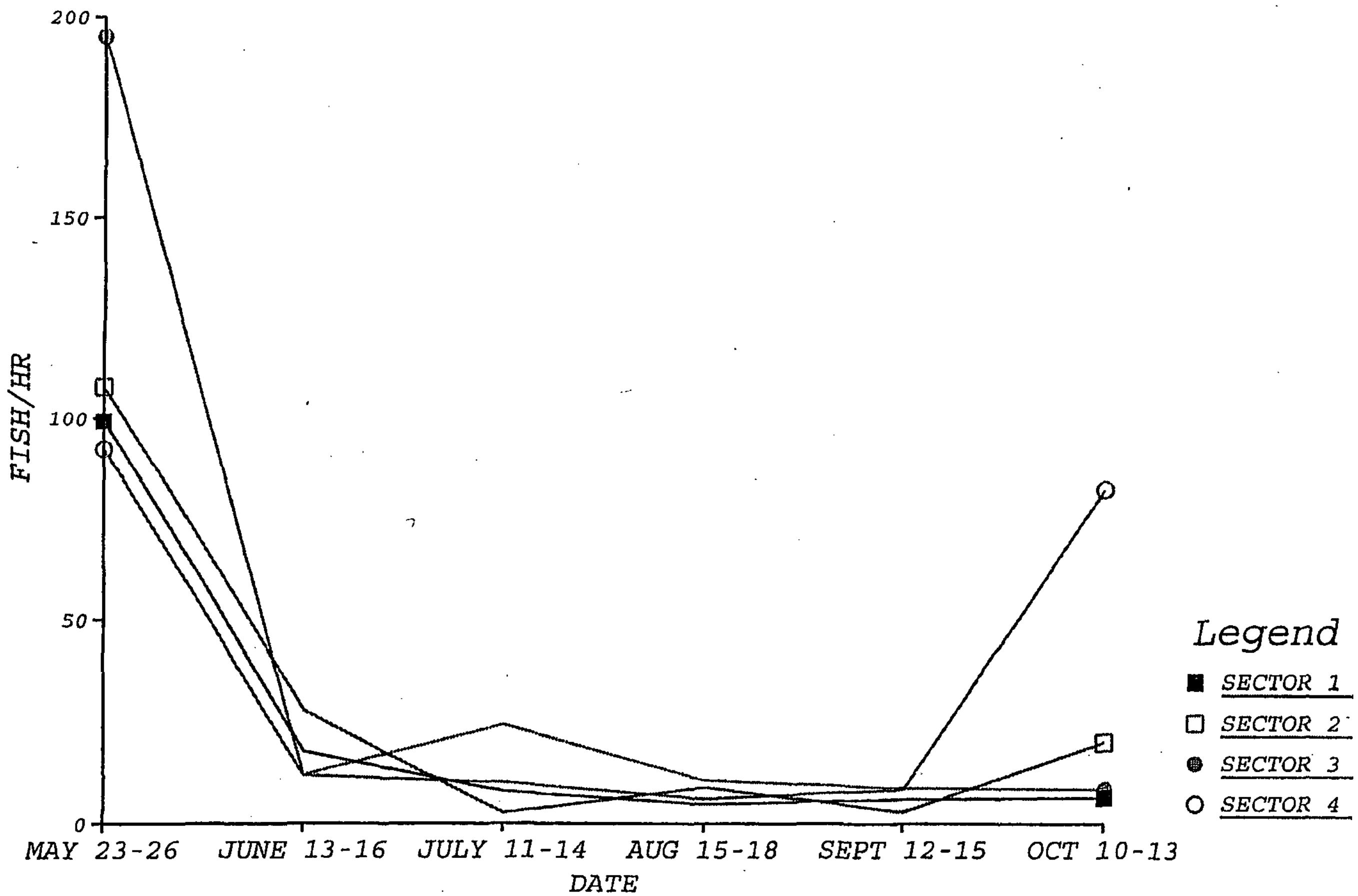
Sector 4

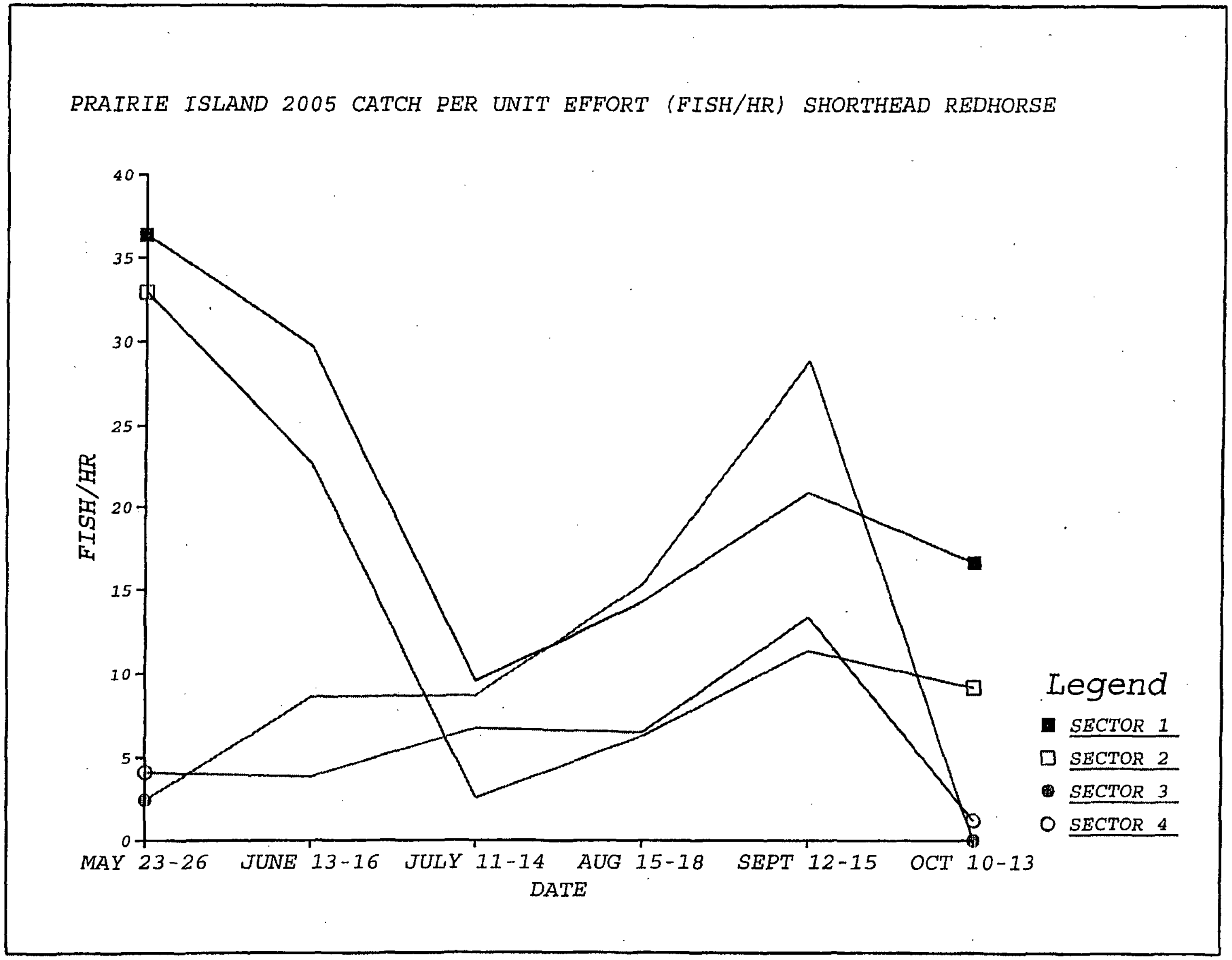


PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) GIZZARD SHAD

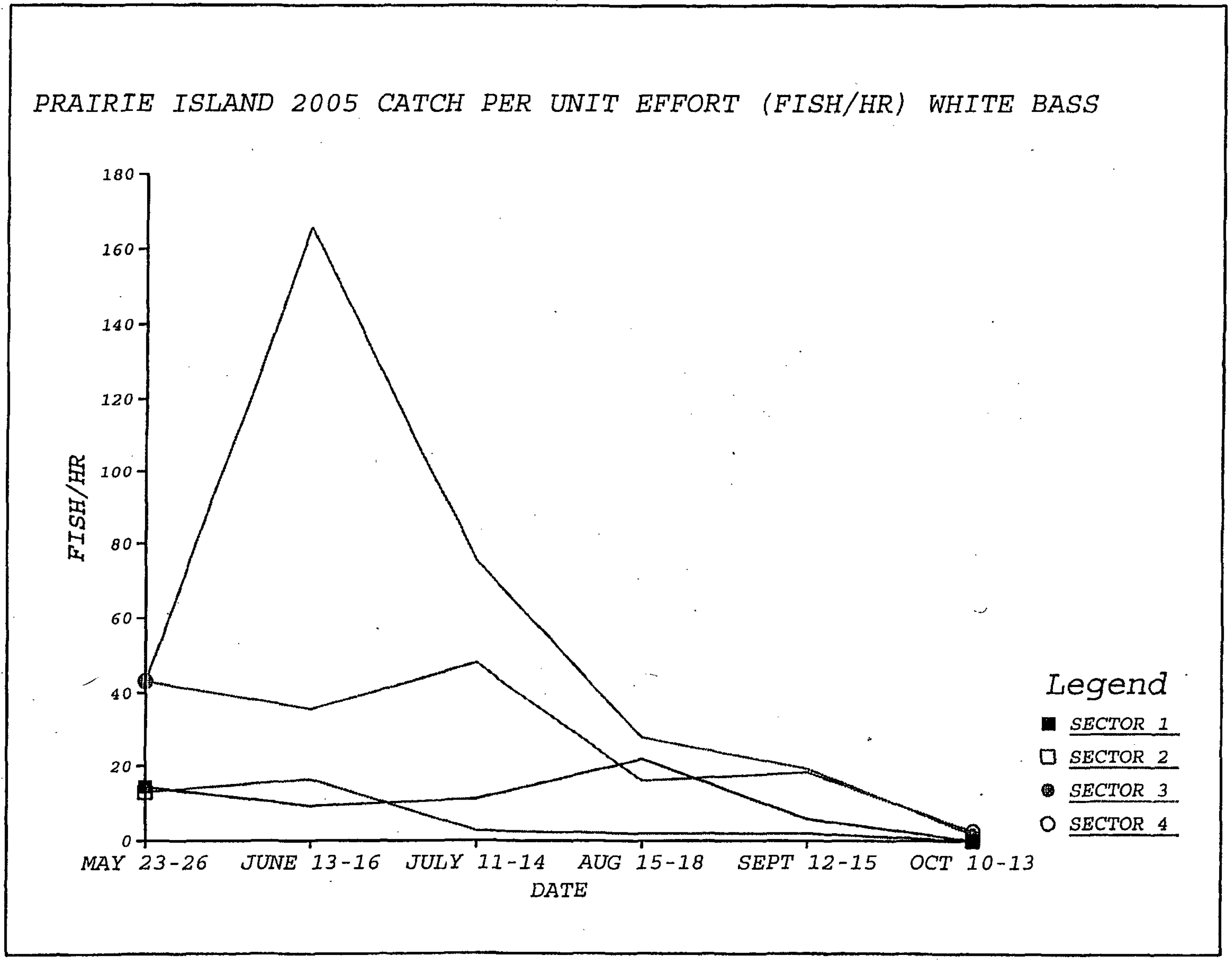


PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) FRESHWATER DRUM

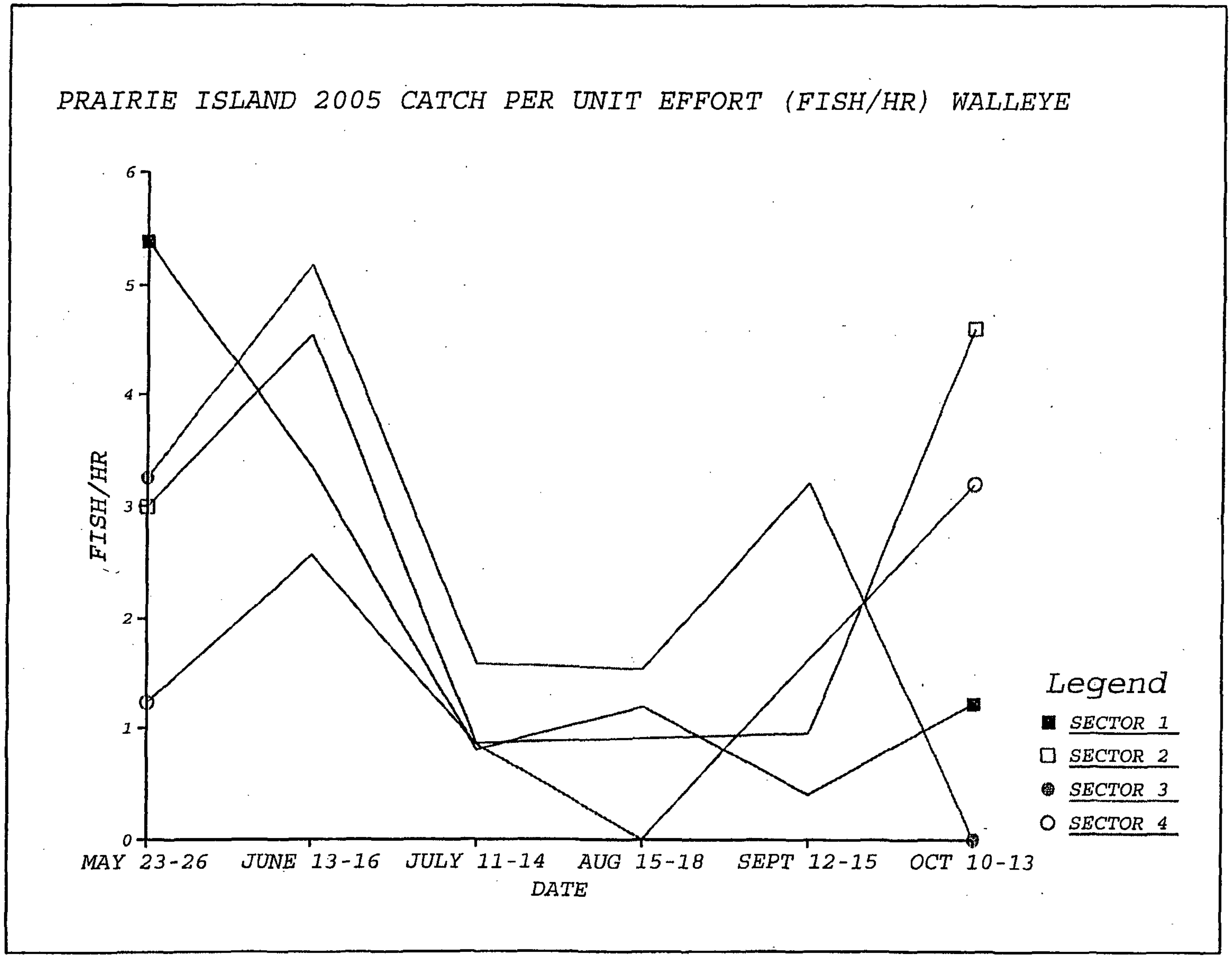




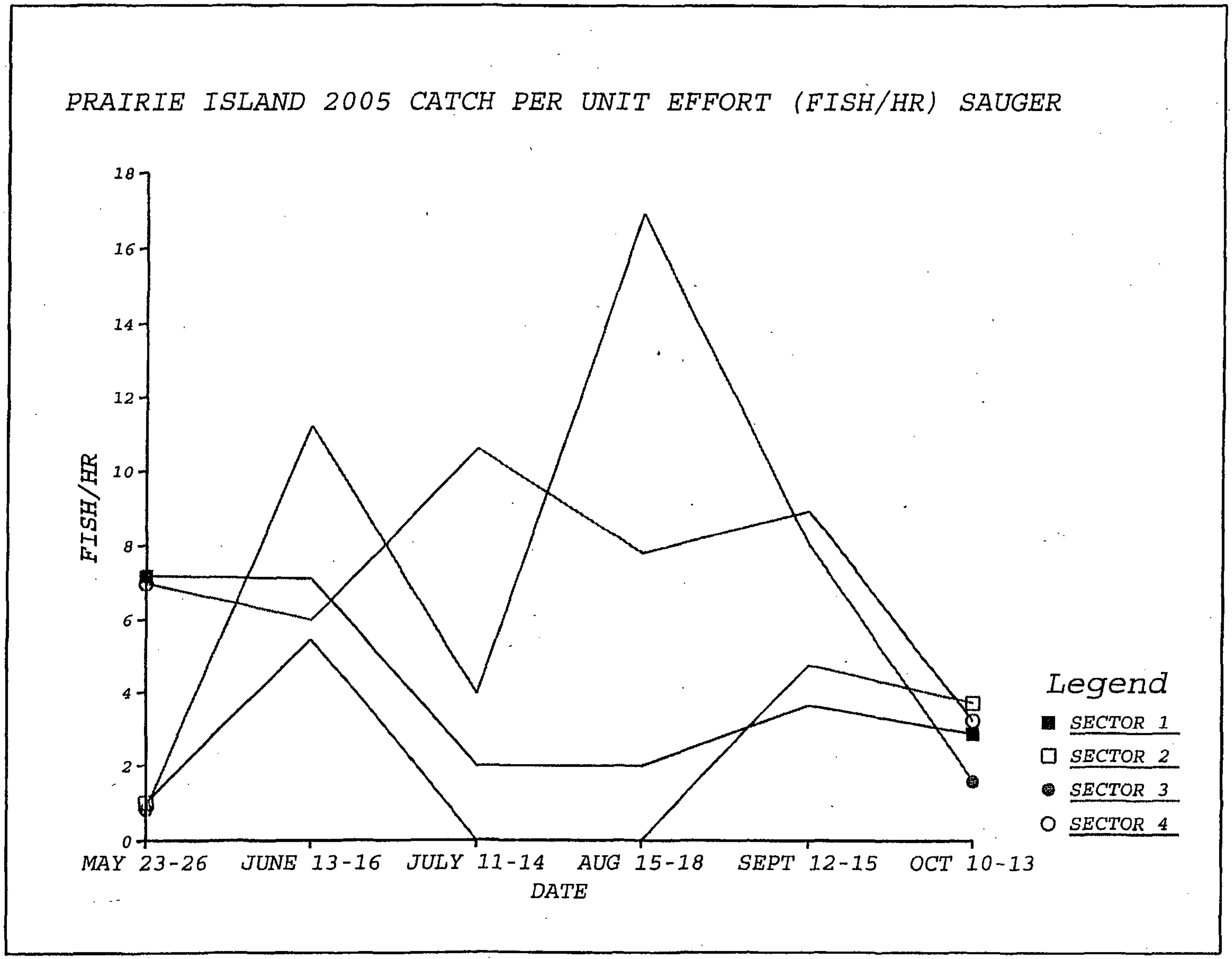
PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) SHORTHEAD REDHORSE
FISH/HR
40
35
30
25
20
15
10
5
0
MAY 23-26
JUNE 13-16
JULY 11-14
AUG 15-18
SEPT 12-15
OCT 10-13
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4



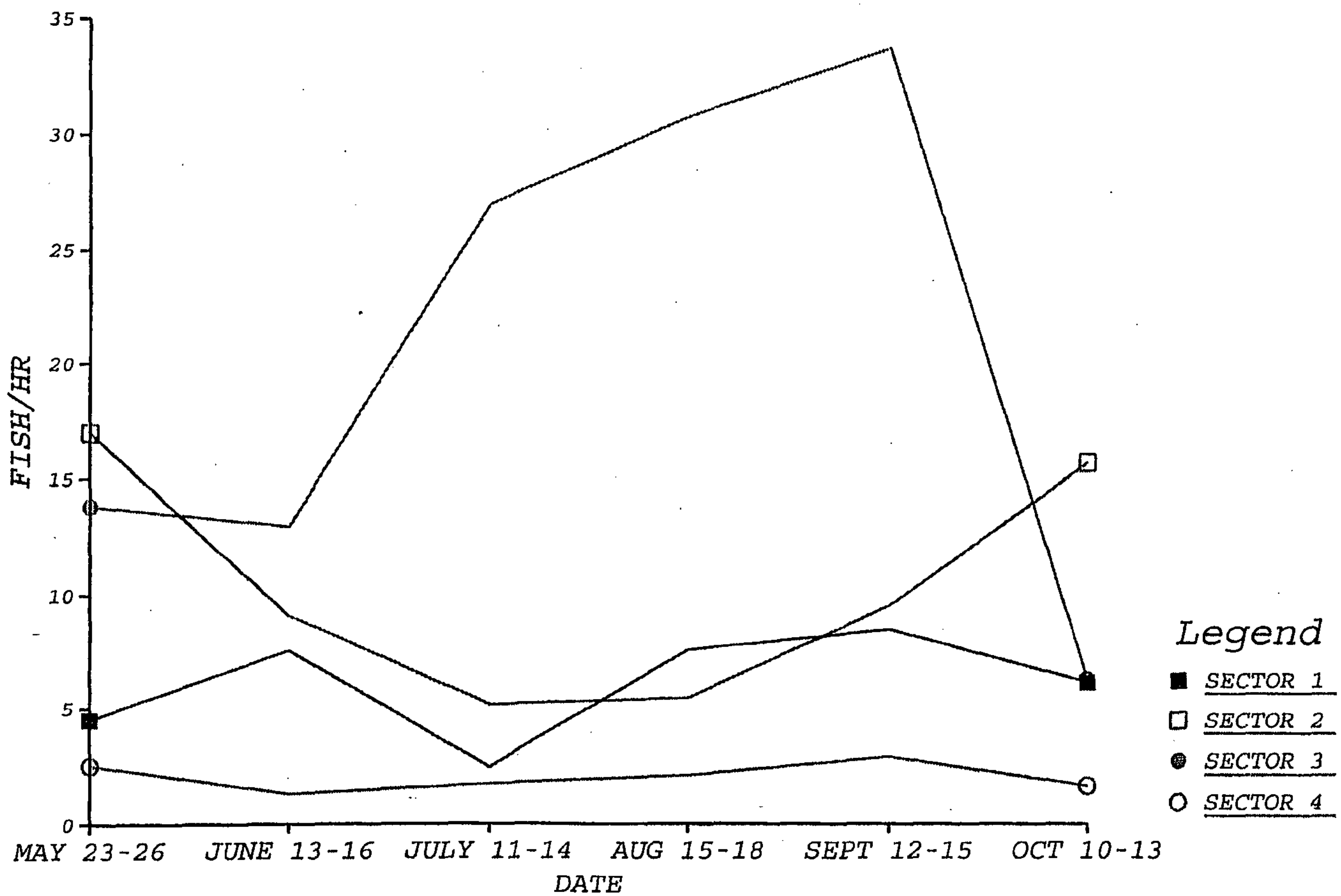
PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) WHITE BASS
FISH/HR
180
160
140
120
100
80
60
40
20
0
MAY 23-26
JUNE 13-16
JULY 11-14
AUG 15-18
SEPT 12-15
OCT 10-13
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

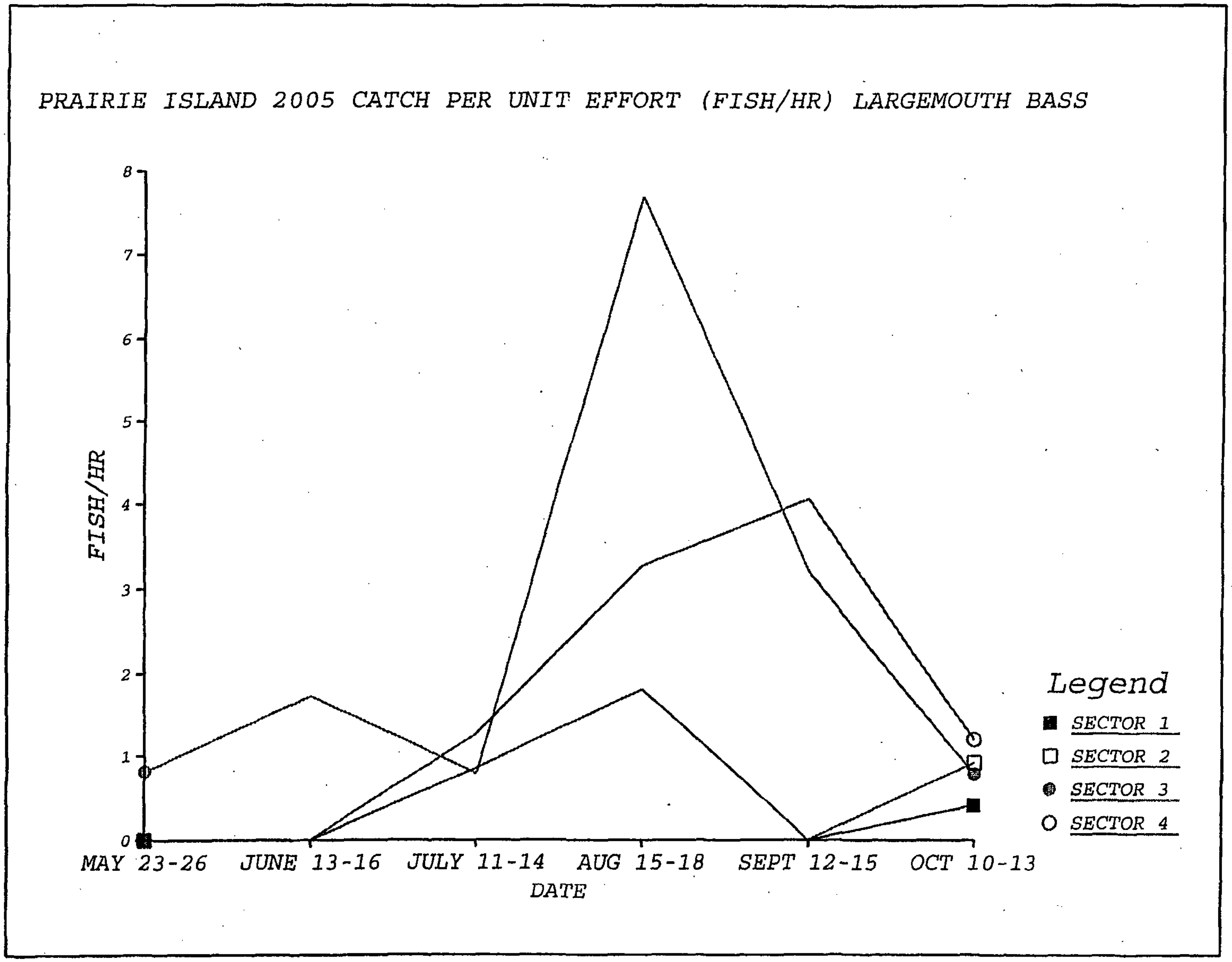


PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) WALLEYE
FISH/HR
0
1
2
3
4
5
6
MAY 23-26
JUNE 13-16
JULY 11-14
AUG 15-18
SEPT 12-15
OCT 10-13
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4


PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) SAUGER
FISH/HR
0
2
4
6
8
10
12
14
16
18
MAY 23-26
JUNE 13-16
JULY 11-14
AUG 15-18
SEPT 12-15
OCT 10-13
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) SMALLMOUTH BASS





PRAIRIE ISLAND 2005 CATCH PER UNIT EFFORT (FISH/HR) LARGEMOUTH BASS
FISH/HR
0
1
2
3
4
5
6
7
8
MAY 23-26
JUNE 13-16
JULY 11-14
AUG 15-18
SEPT 12-15
OCT 10-13
DATE
Legend
SECTOR 1
SECTOR 2
SECTOR 3
SECTOR 4

Table 1. Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2005.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Chestnut lamprey	x	x							x	x			x			x	x		x	x	x		
Ichthyomyzon castaneus																							
Silver lamprey					x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Icthyomyzon unicuspus																							
Paddlefish															x								x
Polyodon spathula																							
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
Lepisosteus osseus																							
Shortnose gar	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																							
Bowfin	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Amia calva																							
American eel	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x		x			x
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
Dorosoma cepedianum																							
Goldeye	x		x		x	x					x			x	x	x	x				x	x	x
Hiodon alosoides																							
Mooneye	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hiodon tergisus																							
Brown trout				x									x		x		x		x	x	x		x
Salmo trutta																							
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
Esox lucius																							
Musky																		x	x			x	
Esox masquinongy																							
Carp	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cyprinus carpio																							
Carpsucker Species		x					x																
Carpiodes species																							
River carpsucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carpiodes carpio																							
Quillback	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carpiodes cyprinus																							
Highfin carpsucker			x	x	x	x	x	x	x	x	x	x	x	x	x					x	x	x	x
Carpiodes velifer																							
White sucker	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	
Catostomus commersoni																							

Table 1 (cont.) Species of fish captured In the Mississippi River in the vicinity of the Prairie Island Nuclear Generating Plant 1983-2005.

Species	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	OO	O1	O2	O3	O4	O5
Blue sucker	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
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	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	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	x	x	x	x
Moxostoma anisurum																							
River redhorse		x	x		x		x	x	x	x		x	x			x	x	x	x	x	x	x	x
Moxostoma carinatum																							
Golden redhorse	x	x	x	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		
Moxostoma valenciennesi																							
Shorthead redhorse	x	x	x	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			
Ictalurus melas																							
Yellow bullhead					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	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	x	x	x
Pylodictus olivaris																							
Burbot	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	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	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	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	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	OO	O1	O2	O3	O4	O5
Pumpkinseed							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lepomis gibbosus																							
Orangespotted sunfish																X		X	X			X	
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
Lepomis macrochirus																							
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
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
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
Pomoxis annularis																							
Black crappie	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	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
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
Sander 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
Sander vitreum																							
Saugeye															X	X	X		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	X	X	X	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 2005.
Species are listed in descending order according to average CPUE.

Rank	Species	Sector 1	Sector 2	Sector 3	Sector 4	Average	Number 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
7	Sauger	4.04	2.46	7.09	7.22	5.20	233
8	Silver redhorse	5.55	3.84	1.47	4.95	3.95	189
9	Quillback carpsucker	5.07	4.76	2.01	3.78	3.91	175
10	Flathead catfish	0.75	2.92	6.42	1.10	2.80	94
11	Smallmouth buffalo	2.19	4.61	2.54	1.72	2.77	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	1
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	1
38	River redhorse	0.07	0.00	0.00	0.00	0.02	1
39	Saugeye	0.07	0.00	0.00	0.00	0.02	1
40	Spotted sucker	0.00	0.00	0.00	0.07	0.02	1
	Totals	101.58	125.59	212.61	154.86	148.66	6141

Table 3. Fisheries summary for Gizzard shad 1977-2005.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	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. Fisheries summary for Freshwater drum 1977-2005.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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. Fisheries summary for Shorthead redhorse 1977-2005.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	20.16	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	41.69	NA	21	1656	320	LOG W=3.042 LOG L-5.013
2003	31.22	NA	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.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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

Table 8. Fisheries summary for Sauger 1977-2005.

YEAR	ELECTRO CPUE Fish/hr	TRAPNET CPUE Fish/hr	CATCH COMP (%)	N	MEAN 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	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	NA	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	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
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

Table 9. Smallmouth and largemouth bass electrofishing CPUE (fish/hr) and rank, 1981-2005.

	Smallmouth 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
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.

Year	Carp	White bass	Freshwater Drum	Sauger	Black Crappie	Shorthead Redhorse	Walleye	Gizzard 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
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	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
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Environmental Services
Water Quality Department

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 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. 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).

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 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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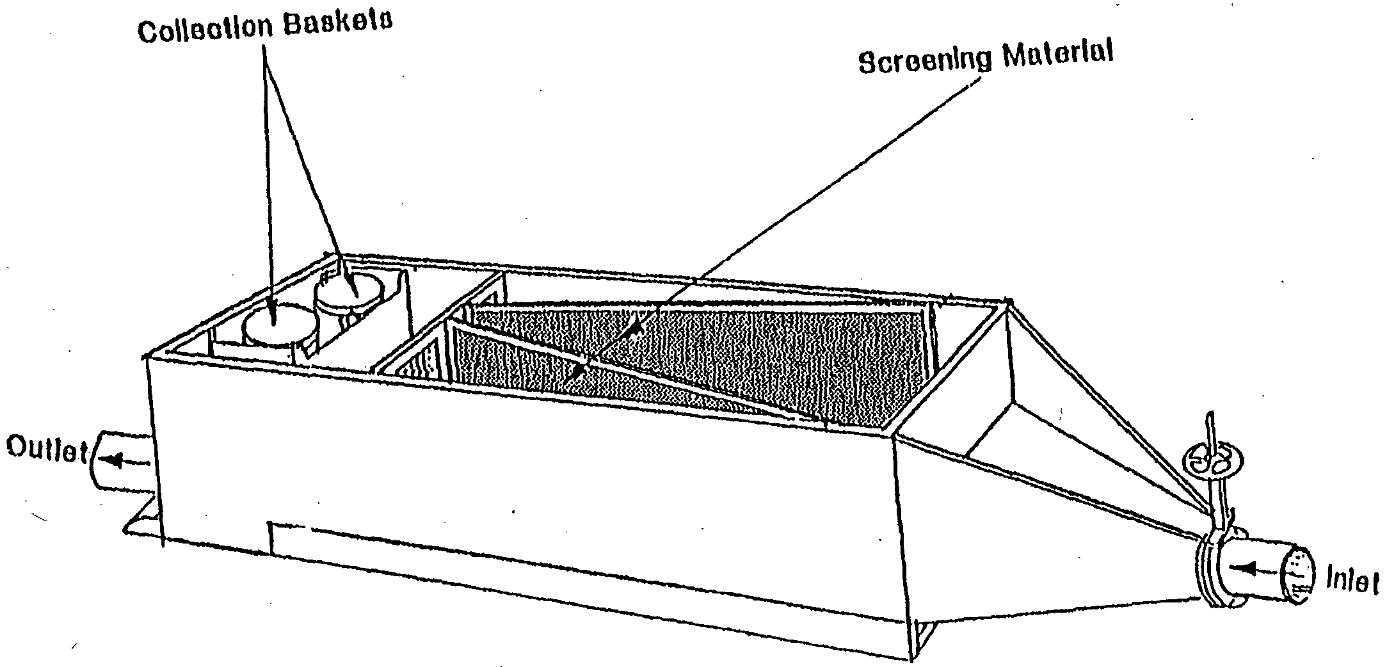
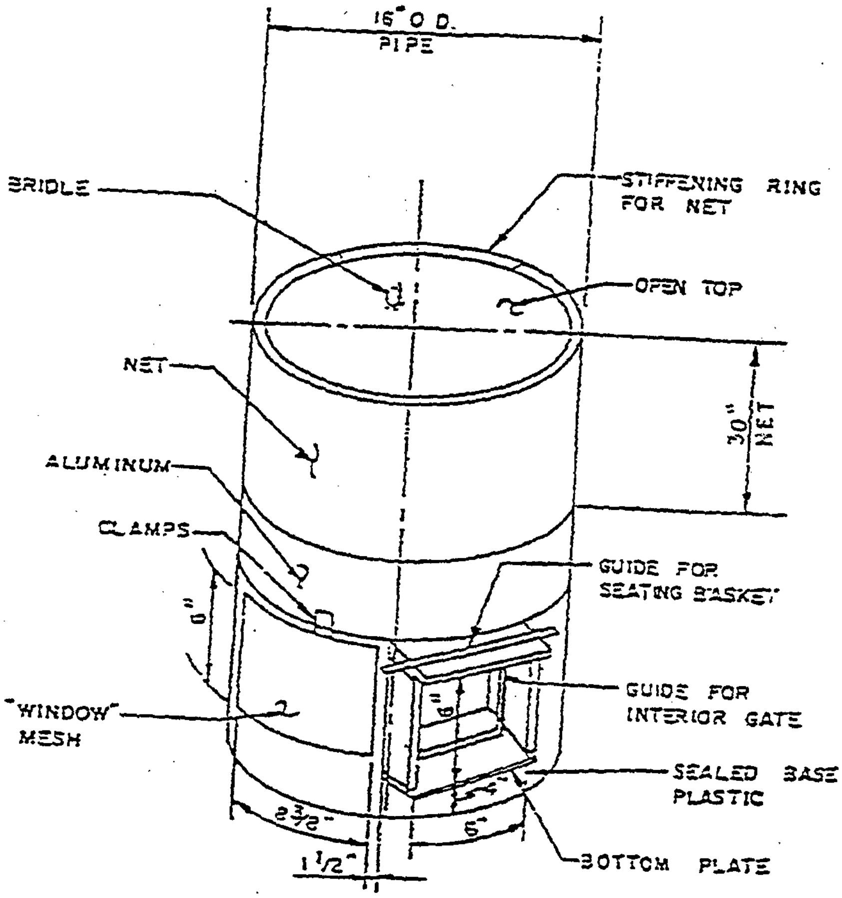
Figure 1



Larval Fish Collection Tank

Figure 2



DETAIL A

COLLECTION BASKET

NO SCALE

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 2005.

Date	Taxa	Lifestage	Density	Percent Live	Number of Fish/Egg
5-Apr-2005	Freshwater drum	JUV	0.047798	100	1
5-Apr-2005	Burbot	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-Apr-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 Density	Daylight 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.

Taxa	Adult	Juvenile	Postlarvae	Prolarvae
Carp			x	x
Channel catfish		x		
Cyprinid	x	x	x	x
Flathead catfish		x		
Percid	x		x	x,o
Walleye				x
Bullhead sp.		x		
Sauger			x	x
Burbot			x	x,o
Catostomid		x		x,o
Sander spp.				x,o
White bass		x		
Gizzard shad		x		o
Freshwater drum		x,o		
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				x,o

Legend: x = previous years data
o = 2005 data

Table 3. Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2005.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1984														
16-Apr-84	UNID	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	14-Apr-89	X	UN	0	0
23-Apr-84	UNID	EG	3840	10	28-Apr-86	UNID	EG	480	1	18-Apr-89	X	UN	0	0
25-Apr-84	CC	JU	384	1	29-Apr-86	PERC	PR	864	3	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	UNID	EG	3840	10	29-Apr-86	WE	PR	288	1	25-Apr-89	X	UN	0	0
27-Apr-84	CC	JU	384	1	**1987**					27-Apr-89	BUR	PR	1152	3
27-Apr-84	CYPR	JU	384	1	6-Apr-87	BUR	PR	1536	4	**1992**				
27-Apr-84	UNID	EG	2304	6	8-Apr-87	CARP	PR	576	1	1-Apr-92	CYPR	PR	288	1
30-Apr-84	CC	JU	384	21	10-Apr-87	BUR	PR	2304	4	1-Apr-92	CYPR	PO	288	1
30-Apr-84	CYPR	AD	384	1	13-Apr-87	BUR	PR	2304	4	1-Apr-92	CARP	PO	576	2
30-Apr-84	FHC	JU	192	1	15-Apr-87	BUR	PR	3456	6	2-Apr-92	X	UN	0	0
30-Apr-84	PERC	PR	1152	6	16-Apr-87	BUR	PR	576	1	8-Apr-92	X	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	WE	PR	768	4	22-Apr-87	X	UN	0	0	14-Apr-92	X	UN	0	0
1985					24-Apr-87	X	UN	0	0	16-Apr-92	X	UN	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	UNID	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	SA	PR	1344	7	**1988**					30-Apr-92	PERC	AD	288	1
24-Apr-85	UNID	EG	384	2	8-Apr-88	BUR	PR	768	2	**1993**				
24-Apr-85	WE	PR	1536	8	11-Apr-88	X	UN	0	0	2-Apr-93	UN	X	0	0
25-Apr-85	PERC	PR	192	1	13-Apr-88	UNID	EG	384	1	6-Apr-93	BUR	PR	288	1
25-Apr-85	SA	PR	1536	8	15-Apr-88	BUR	PR	768	2	8-Apr-93	UN	EG	288	1
25-Apr-85	STIZ	PR	384	2	18-Apr-88	X	UN	0	0	8-Apr-93	BUR	PR	288	1
25-Apr-85	WE	PR	576	3	20-Apr-88	BUR	PR	768	2	13-Apr-93	UN	X	0	0
26-Apr-85	SA	PR	192	1	22-Apr-88	BUR	PR	1920	5	15-Apr-93	BUR	PR	288	1
26-Apr-85	STIZ	PR	192	1	25-Apr-88	BUR	PR	1152	3	19-Apr-93	UN	EG	1152	2
29-Apr-85	BUR	PO	96	1	27-Apr-88	BUR	PR	1152	3	21-Apr-93	UN	X	0	0
29-Apr-85	CARP	PR	192	2	28-Apr-88	BUR	PR	384	1	27-Apr-93	UN	X	0	0
29-Apr-85	CATO	PR	288	3	29-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	X	UN	0	0	5-Apr-94	UNID	EG	384	1
18-Apr-86	CARP	PR	288	1	6-Apr-89	PERC	AD	384	1	5-Apr-94	CC	JU	384	1
18-Apr-86	CYPR	PR	288	1	7-Apr-89	X	UN	0	0	5-Apr-94	CARP	PR	384	1
23-Apr-86	CYPR	PO	288	1	11-Apr-89	X	UN	0	0	5-Apr-94	BUR	PR	384	1
23-Apr-86	PERC	PR	288	1	13-Apr-89	BUR	PR	384	1	7-Apr-94	BUR	PR	288	1

Table 3. (cont) Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2005.

Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected	Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
1994 (cont)					**1996 (cont)**					**1999 (cont)**				
12-Apr-94	SA	PR	288	1	25-Apr-96	BURB	PR	504	2	9-Apr-99	CC	JU	288	1
12-Apr-94	CARP	PR	288	1	25-Apr-96	BURB	PR	252	1	9-Apr-99	BURB	PR	576	2
14-Apr-94	X	X	0	0	30-Apr-96	X	X	0	0	9-Apr-99	CC	JU	288	1
19-Apr-94	CYPR	JU	288	1	**1997**					13-Apr-99	UNID	EG	288	1
21-Apr-94	X	X	0	0	3-Apr-97	UNID	EG	17,280	30	13-Apr-99	UNID	EG	288	1
26-Apr-94	CARP	PR	1152	4	4-Apr-97	BG	JU	1152	2	15-Apr-99	BURB	PR	288	1
26-Apr-94	BUR	PR	288	1	4-Apr-97	UNID	PR	576	1	22-Apr-99	BURB	PR	576	2
28-Apr-94	SA	PR	288	1	25-Apr-97	BURB	PR	2304	4	27-Apr-99	PERC	PR	288	1
28-Apr-94	BUR	PR	288	1	29-Apr-97	CYPR	JU	864	2	27-Apr-99	CC	JU	288	1
1995					30-Apr-97	BLBH	JU	432	1	27-Apr-99	PERC	PR	288	1
3-Apr-95	CATO	JU	288	1	30-Apr-97	CC	JU	432	1	30-Apr-97	PERC	PO	288	1
4-Apr-95	BUR	PR	288	1	30-Apr-97	CYPR	JU	432	1	30-Apr-97	PERC	PR	576	2
4-Apr-95	CC	JU	576	1	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	GIZ	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	4-Apr-2000	UNID	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	CATO	PR	288	1	9-Apr-1998	EMSH	AD	229	1	6-Apr-2000	Log P	AD	288	1
17-Apr-95	UNID	EG	13248	46	14-Apr-1998	CC	JU	252	1	6-Apr-2000	UNID	EG	8023	39
20-Apr-95	UNID	EG	2880	10	16-Apr-1998	CYPR	JU	229	1	6-Apr-2000	Carp	PRO	206	1
24-Apr-95	UNID	EG	1152	4	16-Apr-1998	BURB	PR	229	1	13-Apr-2000	Burb	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	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	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	WAE	PRO	288	1
9-Apr-96	UNID	EG	252	1	28-Apr-1998	CARP	PR	1512	6	**2001**	No values calculated~flood			
11-Apr-96	FWD	JU	252	1	28-Apr-1998	UNID	PR	252	1	**2002**				
11-Apr-96	BURB	PR	252	1	30-Apr-1998	STIZ	PR	2016	8	4/2/2002	EMSH	JU	672	2
11-Apr-96	EMSH	JU	504	2	30-Apr-1998	CARP	PR	14364	57	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	PERC	PR	2268	9	4/4/2002	Carp	EG	672	2
11-Apr-96	BURB	PR	252	1	30-Apr-1998	MOON	PR	252	1	4/4/2002	EMSH	JU	1680	5
11-Apr-96	CARP	PR	252	1	30-Apr-1998	GORH	JU	252	1	4/4/2002	GIZ	JU	336	1
16-Apr-96	X	X	0	0	**1999**					4/4/2002	Carp	EG	1008	3
18-Apr-96	X	X	0	0	6-Apr-99	BURB	PR	522	2	4/4/2002	BURB	PR	1008	3
23-Apr-96	EMSH	JU	504	2	6-Apr-99	UNID	EG	4032	14	4/9/2002	GIZ	JU	336	1
23-Apr-96	UNID	EG	1008	4	9-Apr-99	GIZ	JU	288	1	4/9/2002	EMSH	JU	1008	3

Table 3. (cont)		Estimated impingement of fish collected on PINGP fine-mesh screens during April, 1984-1989 and 1992-2005.														
Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected		Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected		Date	Taxa	Life Stage	Estimated Impingement	No of Fish Collected
2002 (cont)						**2004 (cont)**						**2005 (cont)**				
4/9/2002	BURB	PRO	672	2		4/8/2004	GIZ	JU	288	1		4/28/2005	GIZ	PRO	864	3
4/9/2002	Carp	EG	288	1		4/8/2004	Cypr	JU	3168	11		4/28/2005	CATO	PRO	288	1
4/11/2002	EMSH	JU	288	1		4/13/2004	GIZ	JU	288	1		4/28/2005	Sander	PRO	288	1
4/11/2002	BURB	PRO	864	3		4/13/2004	Cypr	JU	288	1		4/28/2005	PERC	PRO	1152	4
4/11/2002	BURB	PRO	1800	5		4/13/2004	BURB	PRO	1440	5						
4/11/2002	EMSH	JU	1800	5		4/13/2004	BURB	PRO	2304	8						
4/11/2002	Cypr	JU	360	1		4/15/2004	Cypr	JU	288	1						
4/16/2002	EMSH	JU	336	1		4/15/2004	UNID	EG	288	1						
4/16/2002	GIZ	JU	336	1		4/15/2004	BURB	PRO	288	1						
4/18/2002	EMSH	JU	336	1		4/20/2004	BURB	PRO	288	1						
4/23/2002	BURB	PRO	672	2		4/20/2004	EMSH	AD	288	1						
4/23/2002	BURB	PRO	1008	3		4/20/2004	EMSH	AD	288	1						
4/25/2002	BURB	PRO	672	2		4/20/2004	Cypr	JU	288	1						
4/25/2002	BURB	PRO	336	1		4/22/2004	BURB	PRO	2016	7						
2003						4/27/2004	YP	PRO	864	3						
4/1/2003	BURB	PRO	504	1		4/27/2004	BURB	PRO	576	2						
4/3/2003	BURB	PRO	504	1		4/27/2004	WAE	PRO	576	2						
4/3/2003	BURB	PRO	2016	4		4/27/2004	PERC	PRO	576	2						
4/3/2003	FWD	JU	1512	3		4/29/2004	YP	PRO	1152	4						
4/8/2003	BURB	PRO	576	1		4/29/2004	PERC	PRO	288	1						
4/8/2003	BURB	PRO	576	1		4/29/2004	YP	PRO	576	2						
4/10/2003	BURB	PRO	2304	8		4/29/2004	WAE	PRO	288	1						
4/10/2003	BURB	PRO	1152	2		**2005**										
4/10/2003	Carp	EG	576	1		4/5/2005	FWD	JU	288	1						
4/15/2003	Carp	EG	13248	23		4/5/2005	BURB	PRO	288	1						
4/17/2003	Carp	EG	1728	3		4/5/2005	BURB	PRO	288	1						
4/17/2003	Carp	EG	576	1		4/7/2005	BURB	PRO	576	2						
4/22/2003	Carp	EG	576	1		4/7/2005	BURB	PRO	288	1						
4/24/2003	BURB	PRO	576	1		4/12/2005	BURB	PRO	1728	6						
4/24/2003	BURB	PRO	1152	2		4/12/2005	CATO	PRO	288	1						
4/29/2003	SAU	PRO	576	1		4/12/2005	BURB	PRO	8352	29						
2004						4/14/2005	BURB	PRO	1152	4						
4/1/2004	GIZ	JU	576	2		4/19/2005	BURB	PRO	288	1						
4/1/2004	SHRH	JU	288	1		4/21/2005	BURB	PRO	576	2						
4/1/2004	GIZ	JU	288	1		4/27/2005	YP	PRO	288	1						
4/6/2004	Cypr	JU	864	3		4/27/2005	Sander	PRO	288	1						
4/6/2004	GIZ	JU	288	1		4/27/2005	GIZ	PRO	288	1						
4/6/2004	Cypr	JU	864	3		4/27/2005	CATO	PRO	576	2						

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.						
Date	Blowdown (cfs)	Average Daily R. Flow (cfs)	Avg. daily Inlet Temp. (F)	Est.avg daily impingement.			
4/5/2005	985	50900	44.1	864			
4/7/2005	985	52300	46.6	864			
4/12/2005	1165	47500	51.7	10368			
4/14/2005	483	36900	52.0	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			
4/28/2005	275	38300	51.3	2592			

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	=	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