Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

December 5, 2007
ABR-AE-07000017

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
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Rockville MD 20852-2738

South Texas Project
Units 3 and 4
Docket Numbers: 52-012 and 52-013
Resubmitted Aquatic Ecology Monitoring: Six-Month Interim Report

References: (1) Letter, G. T. Gibson to W. F. Burton (NRC), "Environmental Report Acceptance Review: Outstanding Issues," dated November 8, 2007 (ABR-AE-07000010)

(2) Letter, G. T. Gibson to Document Control Desk, "Aquatic Ecology Monitoring: Six-Month Interim Report," dated November 29, 2007 (ABR-AE-07000016)

Reference 1 committed to provide updated aquatic ecology monitoring information to the NRC. Reference 2 provided that update in electronic form. This letter transmits the same information in hard-copy form.

There are no commitments in this letter.

Please feel free to call me at (361) 972-4626 or Bill Mookhoek at (361) 972-7274 should you have any questions regarding this report.

Gregory T. Gibson
Manager, Regulatory Affairs

rwk

Attachment: Aquatic Ecology Monitoring Program – Interim Report: Six-Month Summary

D079
NRO

STI: 32234910

cc: w/o attachment except *

(paper copy)

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South Texas Project Units 3 & 4

Aquatic Ecology Monitoring Program

Interim Report: Six-Month Summary

June – November 2007

November 29, 2007

INTRODUCTION

Aquatic monitoring and ecological sampling on the Colorado River in the vicinity of the Main Cooling Reservoir (MCR) intake structure was conducted in 1983 and 1984 as a license requirement for STP Units 1 & 2.

The current licensing effort is for the construction and operation of two additional units at the same site as STP Units 1 & 2. To support the licensing effort, a current monitoring program was developed to confirm that hydrological and ecological conditions on the Colorado River in the vicinity of the MCR intake and discharge structures have not changed significantly since the original studies were conducted. The confirmatory monitoring program includes assessments of hydrology, species abundance, and species richness.

This interim report summarizes activities to date for the aquatic ecology monitoring program after six months. Additional updates will be prepared after the nine-month and 12-month sampling intervals have been completed.

METHODOLOGY

The aquatic ecology monitoring program includes sample collection along the Colorado River from the Gulf Intracoastal Waterway (ICWW) upstream to the Farm-to-Market (FM) 521 crossing (Figures 1-A and 1-B). Both ecological and hydrological sampling was conducted. Samples were collected monthly and this interim report describes the results from the period of June through November 2007. Samples were not collected during July due to inordinately high river flow.

Hydrological data collection included water temperature, salinity, and dissolved oxygen (DO) concentration. Ecological sampling consisted of fish and invertebrate collection using four gear types that included trawls, gill nets, bag seines, and hoop nets. Data were collected to determine catch per unit effort, species richness, and species abundance for each gear type. Descriptions of the sample protocol and specific sampling methodologies are in Appendix 1.

RESULTS

A total of 79 samples were collected from June through November 2007. This included 30 samples from trawls, 19 from bag seines, and 15 each from hoop nets and gill nets. Sample locations are depicted in Figures 1-A and 1-B. A total of 6,696 organisms from 56 species (46 fish species and 10 invertebrate species) were collected (Table 1). Trawl sampling resulted in the largest number of organisms caught (5,627) and the highest level of species richness (39 species) when compared to other gear types utilized. Bag seine sampling collected the second highest abundance of organisms (974 organisms) and species richness (30 species). Forty-five organisms from 12 species were captured in hoop nets while gill nets captured a total of 50 organisms of 15 species.

Trawl samples resulted in the most comprehensive characterization of species assemblages in the sampled portions of the Colorado River with 30 fish species and nine invertebrate species captured. Total abundance of organisms increased each month during the sampling period. Species abundance ranged from 70 organisms in June to 2,636 in November (Figure 2). Species abundance was analyzed further based on the proportion of species that comprise greater than 1% of the total catch (Figures 3-7). Based on this approach, species abundance varied in proportion by species for each month sampled. For example, species abundance during June was fairly evenly distributed while the later species abundances became more dominated by a few select species. June samples had five species comprising approximately 80% while August, September, October, and November had two, three, four and two species comprising 80%, respectively. June samples were dominated by Atlantic croaker, blue crab, brown shrimp, hardhead catfish, and sheepshead minnows. August samples were dominated by blue catfish and white shrimp. September samples were dominated by blue catfish, menhaden, and white shrimp. October samples were dominated by white shrimp, silver perch, menhaden, and black drum. November samples were dominated by white shrimp and menhaden. All of these species are indicative of estuarine ecosystems located on the upper and central Texas coast.

Bag seine samples represented the second most comprehensive characterization in terms of species assemblages. Thirty species including four invertebrate and 26 fish species were captured using bag seines. The total abundance of organisms increased over the study period, however lower abundance was observed during the August and September samples (Figure 8). Species abundance ranged from 178 organisms in June to 526 in November, while August and September had lows of 48 and 11 organisms. Species abundances based on proportion of species comprising greater than 1% of the total catch revealed similar trends to the trawl data (Figures 9-13). Species abundances were comprised proportionally by fewer species representing 80% of the catch each month. June had one species, August had seven species, September had four species, October had one specie, and November had four species. The June sample was dominated by Gulf menhaden. August samples were dominated by rough silversides, gizzard shad, bay anchovy, white shrimp, blue catfish, channel catfish, and sand seatrout. September samples were dominated by striped mullet, white mullet, brown shrimp, and violet goby. October samples were dominated by white shrimp, and November's samples were dominated by white shrimp, sailfin molly, white mullet, and blue crab.

Hoop net samples resulted in a total of 12 fish species. No invertebrates were captured. Hoop net data followed similar trends compared to trawls and bag seine data with species abundance increasing over the sampling period (Figure 14). June samples contained seven organisms and November samples had 17 organisms. Both August and September samples demonstrated a reduction in organism abundance with only three organisms captured during each month. All hoop nets samples were proportional in percentage of organisms dominating the catch. June samples were dominated by sheepshead, spotted gar, alligator gar, southern flounder, and smallmouth buffalo. August samples were dominated by smallmouth buffalo, red drum, and alligator gar. September samples were

dominated by red drum, spotted gar and longnose gar. October samples were dominated by red drum, menhaden, spotted gar, and alligator gar. November samples were dominated by red drum, sheepshead, and alligator gar.

Gill net samples resulted in the capture of 14 species of fish and one invertebrate species during the sample period. Gill net data demonstrated an overall increase in abundance over the five sample periods with total number of organisms leveling after September (Figure 15). Four organisms were captured in June while September peaked at 17 organisms captured. These numbers dropped to 13 and 14 organisms during October and November respectively. June samples were dominated by sheepshead and blue crab. August samples were dominated by red drum and spotted gar. September samples were dominated by gaftopsail catfish, lady fish, and bull shark. October samples were dominated by blue catfish and sand seatrout. November samples were dominated by red drum, and smallmouth buffalo.

Trend analyses were performed to evaluate potential correlations between species abundances and hydrologic conditions such as river flow, salinity, temperature, and DO concentration. Based on this analysis, several ecological trends or relationships were identified in response to hydrologic conditions. First, species abundance increased as river flow decreased (Figures 16 and 17). Second, species abundance increased as salinity increased in the river (Figures 18 and 19). Third, species abundance varied with DO concentration in the river (Figures 20 and 21). Fourth, no discernable correlations were identified between temperatures and species abundance because water temperatures remained constant throughout the study period.

Fish and invertebrate species collected were consistent with those species commonly occurring in tidal and estuarine systems associated with the upper Texas coast. These species assemblages demonstrate that the lower Colorado River from FM 521 to the ICWW is a minor estuarine system similar to the East Matagorda Bay and Matagorda Bay systems. The occurrence of episodic flooding (as occurred in June through early August) is the only variable that produced a divergent affect in species assemblages when compared to typical estuarine systems. During this period, river flow was well above normal at more than 33,000 cubic feet per second (cfs). Once the river returned to normal flow rates below 5,000 cfs, species assemblages reverted to those more representative of a tidal estuarine system. Monitoring data demonstrated that this normalization occurred in less than one month.

The greatest abundance of organisms and species richness for all gear types was found closest to the ICWW. Species distribution within the river is dependent upon flow rate and water level within the river. Species abundance and richness in this portion of the river are influenced by the movement of a saltwater wedge upstream and by a lack of available habitat and cover used by aquatic organisms to avoid the high river flow rates. Once river flows return to normal (post-flood) conditions, fish return in response to the mixing saltwater conditions and newly available shoreline habitats.

Hydrological data collected were analyzed to identify spatial distributions in salinity, temperature, and DO concentration for surface, mid-depth, and bottom profiles. Freshwater conditions, measured at less than 1 part per thousand (ppt) salinity, dominated the data for all sample depths and all locations on the river during the month of June (Figures 22-25). These conditions remained consistent during the August sampling with a slight increase (5 ppt) in salinities in the lower river segment. Salinities began to increase with downstream movement in September with proportional increases being demonstrated for bottom samples. For example, at navigational mile markers (NMM) -8 and -9, salinity measured less than 1 ppt on the bottom, while at NMM-7, the reading was 5 ppt and continued to increase until NMM-1 where salinities were 18 ppt. Mid-depth and surface samples demonstrated increased salinities only in those samples downstream of NMM-2. October samples demonstrated similar trends; however, increased mixing of the saltwater wedge became more apparent upstream. Bottom salinities ranged from 25 ppt at NMM-1 to 18 ppt at NMM-9. Mid-depth samples ranged from 21 ppt at NMM-1 to 17 ppt at NMM-9. Mid-depth salinities dropped to 6 ppt at NMM-3 but subsequently increased downstream. Surface salinities ranged from 3 ppt at NMM-1 to 1 ppt at NMM-9. November salinities dropped very little for all depths; however, the trend from more saline to freshwater with upstream movement remained consistent. Bottom salinities ranged from 18 ppt at NMM-1 to 9 ppt at NMM-9. Mid-depth salinities ranged from 9 ppt at NMM-1 to 1 ppt at NMM-9. Surface salinities ranged from 2.5 ppt at NMM-1 to 1 ppt at NMM-9.

DO levels in the river varied both temporally and spatially over the study period (Figures 26-29). DO was higher on the surface, and DO at mid-depth was higher than at bottom levels. These findings were consistent over the sample period and were consistent from NMM-1 upstream to NMM-9. DO concentration also fluctuated inversely with salinity (Figure 30).

Water temperature remained reasonably constant throughout the sample period (Figures 31-33). A seasonal trend was established with a slight decrease from warmer water temperatures to cooler water temperatures from June to November. June samples had an average temperature of 29.7°C and November had an average temperatures of 22.6°C. The lowest average temperature was recorded in October at 20.3°C shortly after a cold front had moved through the region.

Water levels on the river fluctuated dramatically over the sampling period (Figure 34). River flows ranged from 3,800 cfs in June to 33,000 cfs in July, gradually decreasing to below 1,000 cfs during November. Sampling protocols for this study dictated that all samples be collected when river flows were below 5,000 cfs. Subsequently, samples were not collected during the month of July due to the greatly increased flow of the river.

DISCUSSION

Comparisons between current and historical data to determine differences in species assemblages were conducted. The variables considered included species abundance, species richness, and when available, catch per unit of effort. For this analysis, samples

from similar gear types were compared. Environmental conditions such as river flow, water temperature, salinity, DO, and temperature were quantified in an effort to evaluate the effect these parameters may have on species abundances and distribution in the river.

Table 2 provides a summary, by gear type, for three different years of data collected. The proportion of organisms collected comprising >1% of the total catch for each year and by gear are very similar. Bag seine samples for the three sample periods (Figures 35-37) indicate that in 1983 the dominant species were white shrimp, blue crab, white mullet, river shrimp, bay whiff, and bay anchovy (85%). Dominant species collected in 1984 were white shrimp, bay anchovy, and grass shrimp (95%). Dominant species in 2007 were white shrimp, sailfin molly, Gulf menhaden, white mullet, blue crab, and bay whiff (82%). Trawl samples for the three study periods (Figures 38-39) indicate that in 1983 the dominant species were bay anchovy and river shrimp (92%). No trawl data were collected in 1984. Dominant species in 2007 were white shrimp, Gulf menhaden, blue catfish, and silver perch (81%).

Total numbers of organisms by gear and sample year appear to be very similar with 1,167 in 1983, 987 in 1984, and 987 in 2007. Similarly, trawl samples had total number of organisms of 4,940 in 1983 and 5,627 in 2007. A breakdown of these numbers indicates that samples in 1983 and 1984 had a greater number of organisms collected per sample as compared to the 2007 samples. Fourteen trawl samples were collected in 1983 resulting in an average of 353 organisms per sample as compared to the 2007 period when 30 samples with an average number of 188 organisms per sample were collected. Bag seine samples averaged 116, 246, and 51 organisms per sample for 1983, 1984 and 2007, respectively.

Species richness is a valuable tool for evaluating the condition of the species communities within ecosystems. Data analyzed for the three study periods indicates that species richness was similar for each gear for each of the study years. Species richness was 24 and 39 for trawl data in 1983 and 2007, and 25, 26, and 30 for bag seine data from 1983, 1984, and 2007.

CONCLUSIONS

The biological data collected thus far are adequate to determine species richness and abundance and support a comparative review between current and historical data. The proportion of species comprising >1% of the total abundance by gear type for each sample period is very similar and consistent with historical data reviewed. This confirms (to date) that species abundances remain fairly constant from year to year with normal river conditions. Shifts in proportions that may occur are associated with seasonal changes or representative of very brief fluctuations associated with the highly dynamic nature of a riverine tidal/estuarine system. This is evident in abundance shifts from brown shrimp in the spring to white shrimp in the fall. Other examples include the recruitment of many species into the river based upon species-specific spawning patterns throughout the year. Other fluctuations are associated with episodic events such as flooding which pushes organisms out of the river and into the bays. This type of event

was documented during the 2007 study when river flows exceeded 30,000 cfs during the month of July and remained above 5,000 cfs well into August. Species abundance in August dropped during the flood event and remained low in September, recovering in October and November when river flows normalized to around 1,000cfs.

Total abundance of organisms varied by gear type for each of the samples analyzed. This trend supports the basis that the riverine tidal/estuarine system is highly dynamic and can vary from sample to sample within a sample day, week, month and year. This is common when the number of organisms collected in one sample is weighted toward one species when compared to a smaller number in other samples. This was evident for several species between bag seine samples and trawl samples. Trawl data for the four samples collected in 1983 indicated that a total of 3,617 bay anchovies were collected. Of this total 3,612 were collected in one sample. Similar examples were identified for river shrimp and blue crab in trawl data and white shrimp in bag seine data for 1983 and white shrimp in bag seine and white shrimp in trawl data for 2007. Because these high abundances occur sporadically across the sample collections, they provide a good indication of the maximum potential that a particular species may have in a given season or year.

Species richness data analyzed indicates that the overall species community condition for the Colorado River is very robust. The number of species documented and the range of species documented indicates that the proportion and abundances of organisms supports a healthy predator-prey structure within the river system. This healthy structure was documented in the data from the original permitting studies and remains consistent.

In summary, based on the data collected during the current aquatic monitoring program, species abundance and richness appear consistent with historic data collected from previous studies. The data support the assumption that current river conditions and the aquatic populations supported do not vary significantly from conditions previously assessed during the permitting of STP Units 1 & 2. STPNOC will continue to conduct aquatic monitoring and will compare results at the nine-month and 12-month intervals.

Table 1: Cumulative Catch by Gear for the Colorado River Study 2007

Common Name	Scientific Name	Sampling Gear Utilized				Total
		Bag Seine	Gill Net	Hoop Net	Trawl	
Alligator Gar	*Lepisosteus spatula*			9		9
Atlantic Brief squid	*Lolliguncula brevis*				11	11
Atlantic Croaker	*Micropogonias undulatus*	2			91	93
Atlantic Cutlassfish	*Trichiurus lepturus*				1	1
Atlantic Threadfin	*Polydactylus octonemus*				1	1
Bay Anchovy	*Anchoa mitchilli*	26			22	48
Bay Whiff	*Citharichthys spilopterus*	10			12	22
Bayou Killifish	*Fundulus pulvereus*	1				1
Black Drum	*Pogonias cromis*	1			206	207
Blue Catfish	*Ictalurus furcatus*	10	7		468	485
Blue Crab	*Callinectes sapidus*	62	2	1	16	81
Brown Shrimp	*Farfantepenaeus aztecus*	21			8	29
Bull Shark	*Carcharhinus leucas*		3			3
Channel Catfish	*Ictalurus punctatus*	14		1	5	20
Crawfish	*Procamburus spp.*				1	1
Cyprinid Spp.	*Cyprinid spp.*	1				1
Diamond Killifish	*Adinia xenica*	8				8
Freshwater Goby	*Ctenogobius shufeldti*	6				6
Gafftopsail Catfish	*Bagre marinus*		7		165	172
Gizzard Shad	*Dorosoma cepedianum*	8		2	11	21
Grass Carp	*Ctenopharyngodon idella*		2			2
Grass Shrimp	*Palaemonetes pugio*	29				29
Gulf Menhaden	*Brevoortia patronus*	137	1	2	1019	1159
Hardhead Catfish	*Ariopsis felis*		1	1	232	234
Ladyfish	*Elops saurus*		2		1	3
Lesser Blue Crab	*Callinectes similis*				2	2
Lined Sole	*Achirus lineatus*				2	2
Longnose Gar	*Lepisosteus osseus*			1		1
Naked Goby	*Gobiosoma bosci*	2				2
Pigfish	*Orthopristis chrysoptera*				1	1
Pinfish	*Lagodon rhomboides*				2	2
Rainwater Killifish	*Lucania parva*	2				2
Red Drum	*Sciaenops ocellatus*		6	14	12	32
River Shrimp	*Macrobrachium ohione*				5	5
Rough Silverside	*Membras martinica*	17				17
Roughback Shrimp	*Trachypenaeus similis*				1	1
Sailfin Molly	*Poecilia latipinna*	149				149
Sand Trout	*Cynoscion arenarius*	5	5		181	191
Sharptail Goby	*Oligolepis acutipennis*	1				1

Table 1 continued.

Common Name	Scientific Name	Sampling Gear Utilized				Total
		Bag Seine	Gill Net	Hoop Net	Trawl	
Sheepshead	*Archosargus probatocephalus*		1	4		5
Sheepshead Minnow	*Cyprinodon variegatus*	11			7	18
Silver Jenny	*Eucinostomus gula*				1	1
Silver Perch	*Bairdiella chrysoura*				337	337
Smallmouth Buffalo	*Ictiobus bubalus*		9	3		12
Southern Flounder	*Paralichthys lethostigma*		2	2	8	12
Southern Stingray	*Dasyatis americana*				1	1
Speckled Trout	*Cynoscion nebulosus*		1		6	7
Spot croaker	*Leiostomus xanthurus*				78	78
Spotfin mojarra	*Eucinostomus argenteus*	3			2	5
Spotted Gar	*Lepisosteus oculatus*	1	1	5	1	8
Star Drum	*Stellifer lanceolatus*				42	42
Striped Mullet	*Mugil cephalus*	13			118	131
Threadfin Shad	*Dorosoma petenense*	3			2	5
Violet Goby	*Gobioides broussonnetii*	1				1
White Mullet	*Mugil curema*	72			2	74
White Shrimp	*Litopenaeus setiferus*	358			2546	2904
	Total	974	50	45	5627	**6696**

Table 2: Cumulative Catch by Gear for the Colorado River near the South Texas Project 1983, 1984, and 2007

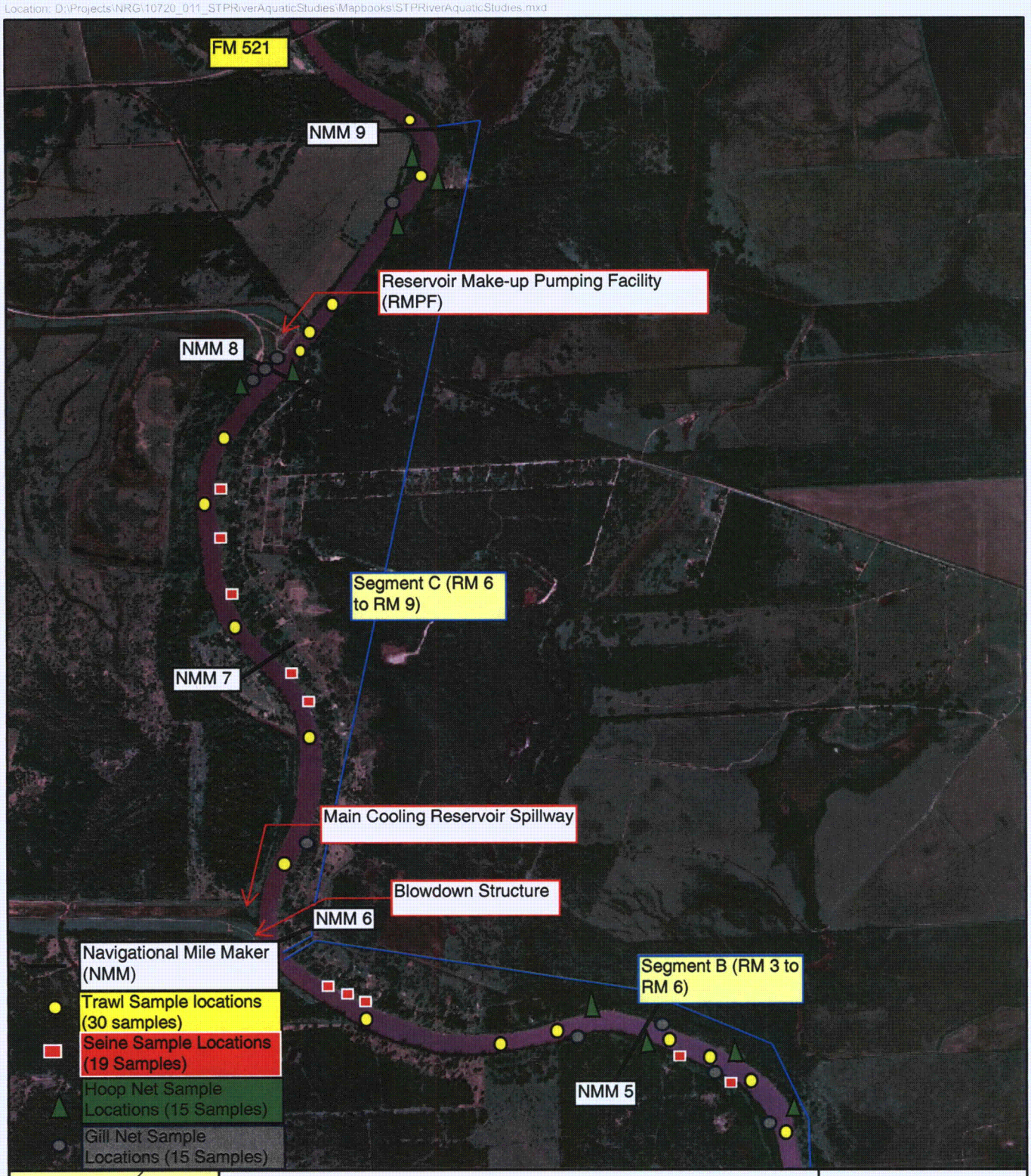
		Trawls			Seines			
Common Name	**Scientific Name**	**1983[a]**	**1984[b]**	**2007[c]**	**1983[d]**	**1984[e]**	**2007[f]**	**Totals**
Alligator Gar	*Lepisosteus spatula*							0
Atlantic Brief Squid	*Lolliguncula brevis*			11				11
Atlantic Croaker	*Micropogonias undulatus*	37		91			2	130
Atlantic Cutlassfish	*Trichiurus lepturus*			1				1
Atlantic Threadfin	*Polydactylus octonemus*			1				1
Bay Anchovy	*Anchoa mitchilli*	3617		22	73	170	26	3908
Bay Whiff	*Citharichthys spilopterus*	15		12	67	1	10	105
Bayou Killifish	*Fundulus pulvereus*						1	1
Black Drum	*Pogonias cromis*			206			1	207
Blue Catfish	*Ictalurus furcatus*	15		468			10	493
Blue Crab	*Callinectes sapidus*	264		16	110	9	62	461
Bluntnose Jack	*Hemicaranx amblyrhynchus*					5		5
Brown Shrimp	*Farfantepenaeus aztecus*			8	1	5	21	35
Bull Shark	*Carcharhinus leucas*							0
Channel Catfish	*Ictalurus punctatus*			5			14	19
Crawfish	*Procamburus spp.*			1	1			2
Crevalle Jack	*Caranx hippos*				13			13
Cyprinid Spp.	*Cyprinid spp.*						1	1
Darter Goby	*Gobionellus boleosoma*	10			42	10		62
Diamond Killifish	*Adinia xenica*						8	8
Fat Sleeper	*Dormitator maculatus*				20			20
Freshwater Goby	*Ctenogobius shufeldti*				2		6	8
Gafftopsail Catfish	*Bagre marinus*	9		165				174
Gizzard Shad	*Dorosoma cepedianum*	2		11			8	21
Grass Carp	*Ctenopharyngodon idella*				2			2
Grass Shrimp	*Palaemonetes pugio*	2				65	29	96
Gulf Killifish	*Fundulus grandis*					2		2
Gulf Menhaden	*Brevoortia patronus*	3		1019	29	24	137	1212
Hardhead Catfish	*Ariopsis felis*	40		232				272
Inland Silverside	*Menidia beryllina*				9	3		12
Ladyfish	*Elops saurus*			1		1		2
Leatherjacket	*Oligoplites saurus*					1		1
Lesser Blue Crab	*Callinectes similis*			2				2
Lined Sole	*Achirus lineatus*	3		2				5
Longnose Gar	*Lepisosteus osseus*							0
Lyre Goby	*Evorthodus lyricus*				2	1		3
Mosquitofish	*Gambusia affinis*				1			1
Mottled Mojarra	*Eucinostomus lefroyi*				2			2
Mud Crab	*Rhithropanopeus harrisii*	1						1

Table 2 continued

Common Name	Scientific Name	Trawls 1983[a]	Trawls 1984[b]	Trawls 2007[c]	Seines 1983[d]	Seines 1984[e]	Seines 2007[f]	Totals
Naked Goby	*Gobiosoma bosci*	2					2	4
Pigfish	*Orthopristis chrysoptera*			1				1
Pinfish	*Lagodon rhomboides*	2		2		9		13
Rainwater Killifish	*Lucania parva*						2	2
Red Drum	*Sciaenops ocellatus*			12				12
River Shrimp	*Macrobrachium ohione*	747		5	52	1		805
Rough Silverside	*Membras martinica*						17	17
Roughback Shrimp	*Trachypenaeus similis*			1				1
Roughneck Shrimp	*Trachypenaeus constrictus*	1				1		2
Sailfin Molly	*Poecilia latipinna*				2	1	149	152
Sand Trout	*Cynoscion arenarius*	29		181	9	3	5	227
Sharptail Goby	*Oligolepis acutipennis*						1	1
Sheepshead	*Archosargus probatocephalus*				1			1
Sheepshead Minnow	*Cyprinodon variegatus*			7			11	18
Silver Jenny	*Eucinostomus gula*			1				1
Silver Perch	*Bairdiella chrysoura*	1		337				338
Skipjack Herring	*Alosa chysochloris*					1		1
Smallmouth Buffalo	*Ictiobus bubalus*							0
Southern Flounder	*Paralichthys lethostigma*	4		8	2	1		15
Southern Stingray	*Dasyatis americana*			1				1
Speckled Trout	*Cynoscion nebulosus*			6				6
Spot Croaker	*Leiostomus xanthurus*	18		78	1	9		106
Spotfin mojarra	*Eucinostomus argenteus*			2	2	9	3	16
Spotted Gar	*Lepisosteus oculatus*	2		1	4	1	1	9
Star Drum	*Stellifer lanceolatus*			42				42
Striped Anchovy	*Anchoa hepsetus*					1		1
Striped Mullet	*Mugil cephalus*			118			13	131
Threadfin Shad	*Dorosoma petenense*			2			3	5
Violet Goby	*Gobioides broussonnetii*	1					1	2
White Mullet	*Mugil curema*			2	68	10	72	152
White Shrimp	*Litopenaeus setiferus*	115		2546	652	643	358	4314
	Totals	4940	0	5627	1167	987	974	13695

a - 14 trawls were conducted
b - No trawls were conducted
c - 30 trawls were conducted
d - 10 seines were conducted
e - 4 seines were conducted
f - 19 seines were conducted

Location: D:\Projects\NRG\10720_011_STPRiverAquaticStudies\Mapbooks\STPRiverAquaticStudies.mxd



Colorado River Aquatic Sampling Program
South Texas Project Electric Generating Station
Matagorda County, Tx

N W E S

0 0.25 0.5 1 Miles

Coordinate System: Texas State Plane, South Central Zone, NAD 1983, US Feet
Image Source: 2004 NAIP (1m Color InfraRed)

STP Nuclear Operating Company

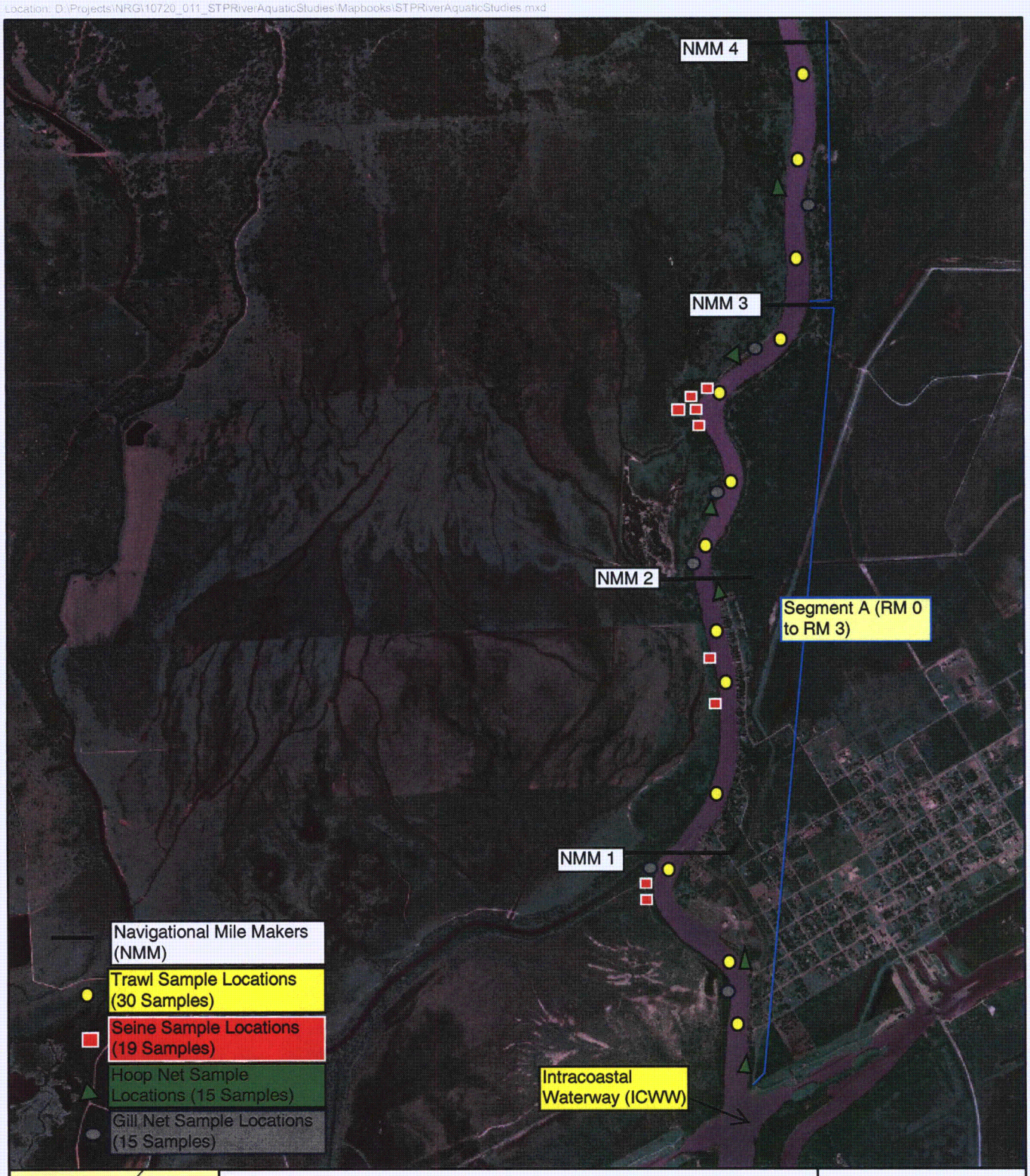
ENSR | AECOM

Date: November 21, 2007

Project No.: 10720-011

Figure 1A

Location: D:\Projects\NRG\10720_011_STPRiverAquaticStudies\Mapbooks\STPRiverAquaticStudies.mxd



Colorado River Aquatic Sampling Program
South Texas Project Electric Generating Station
Matagorda County, Tx

N W E S

0 0.25 0.5 1 Miles

Coordinate System: Texas State Plane, South Central Zone, NAD 1983, US Feet
Image Source: 2004 NAIP (1m Color InfraRed)

STP Nuclear Operating Company

ENSR | AECOM

Date: November 21, 2007

Project No.: 10720-011

Figure 1B

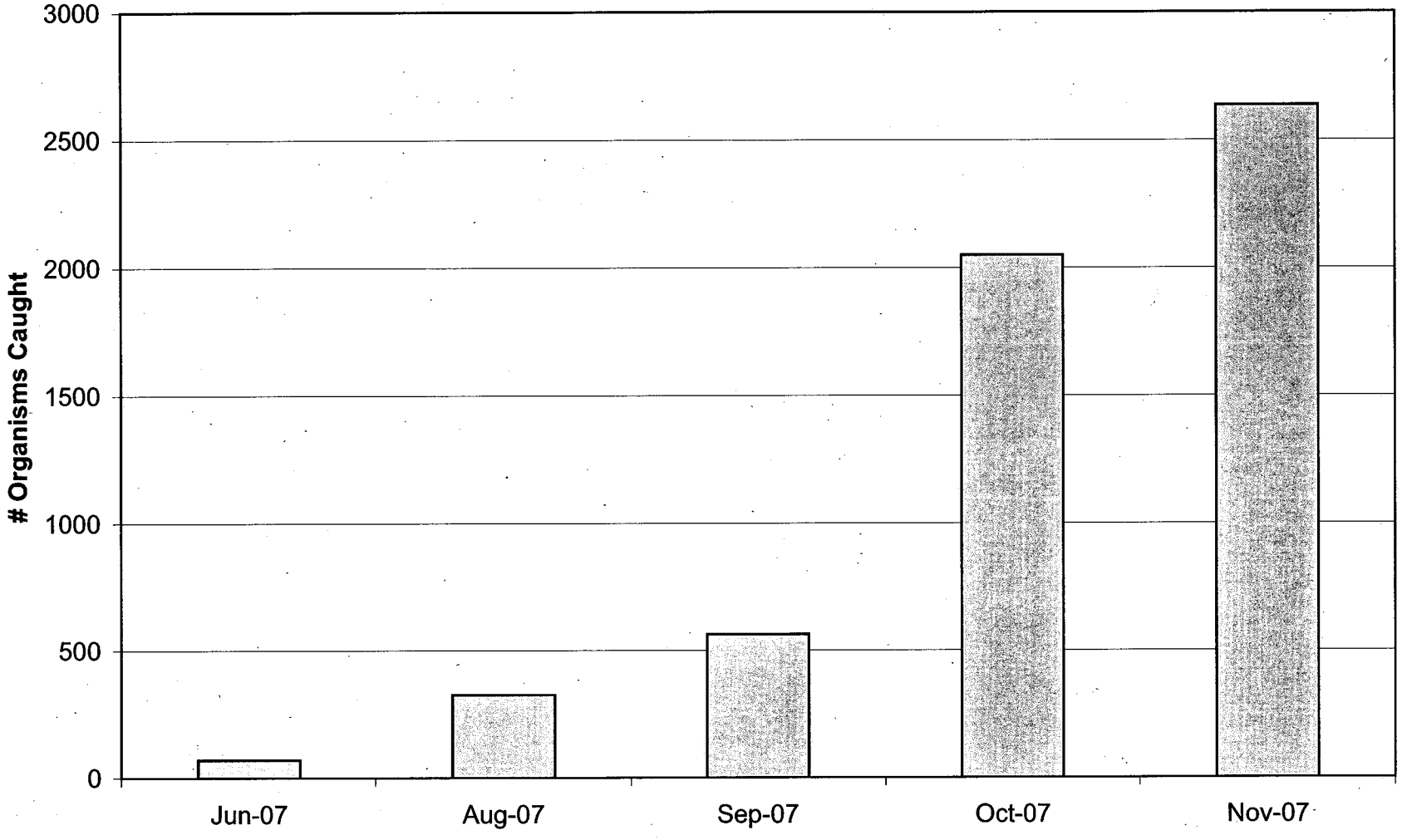


Figure 2. Abundance of Organisms In Trawl Samples Colorado River.

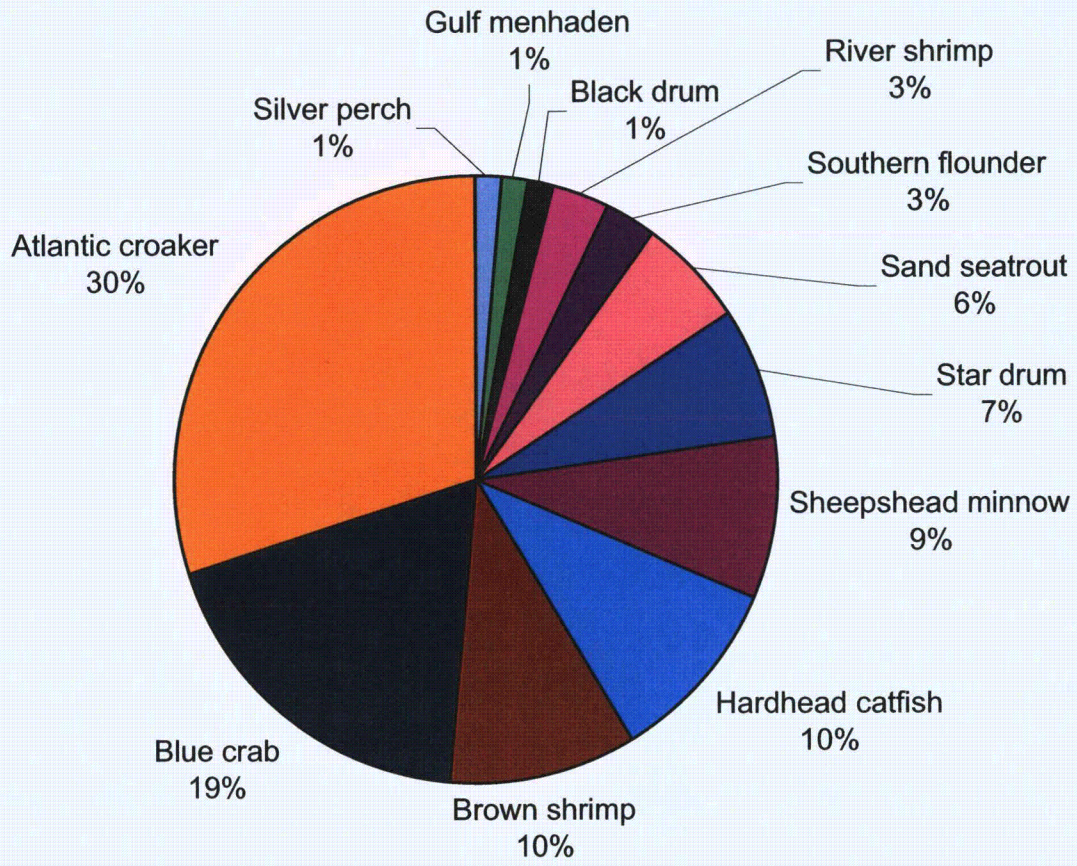


Figure 3. Percentage of Organisms >1% in Trawl Samples, June 2007

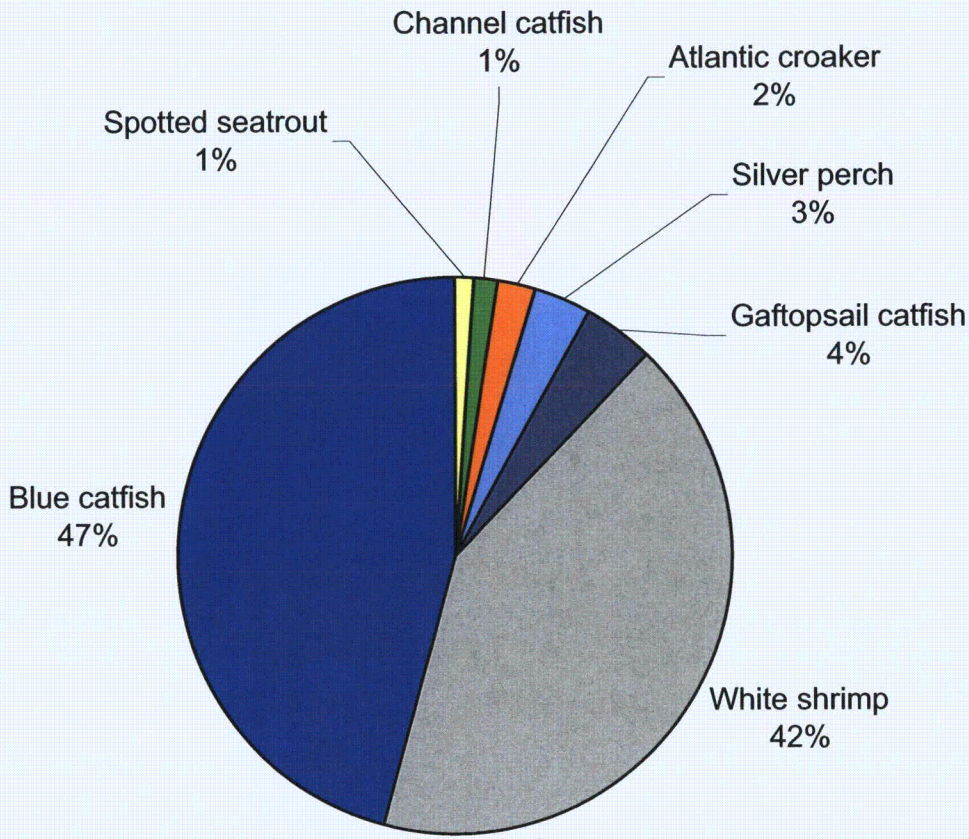


Figure 4. Percentage of Organsisms >1% in Trawl Samples, August 2007

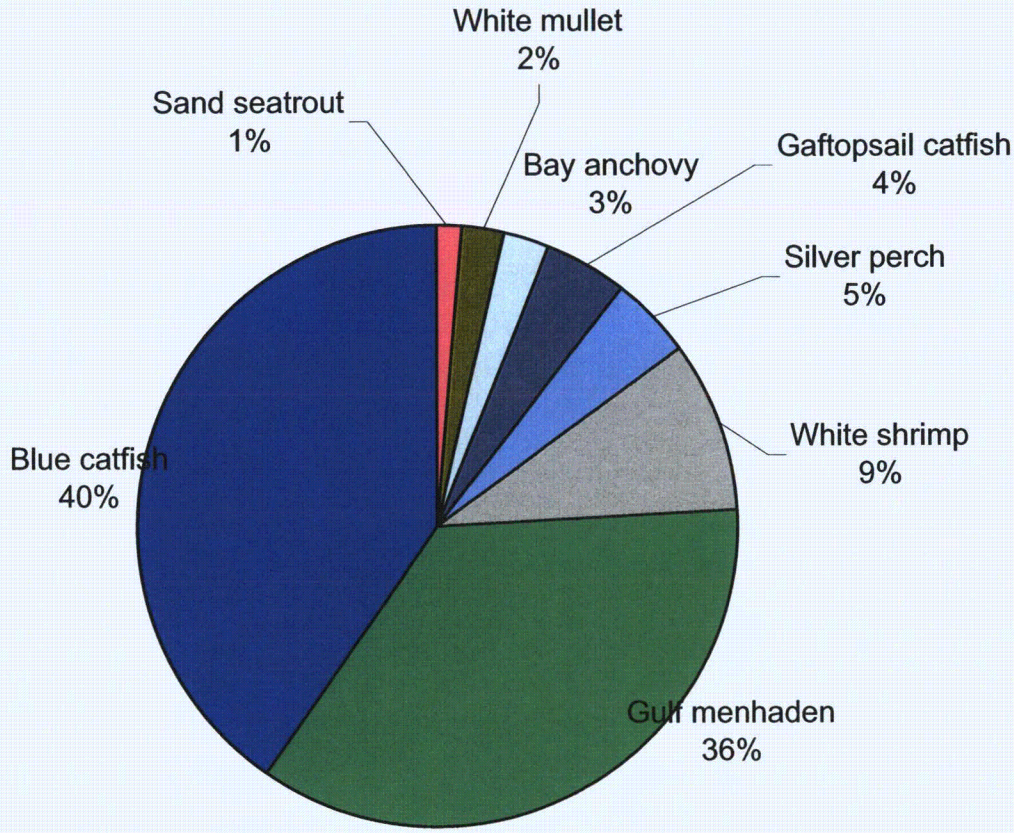


Figure 5. Percentage of Organisms >1% in Trawl Samples, September 2008

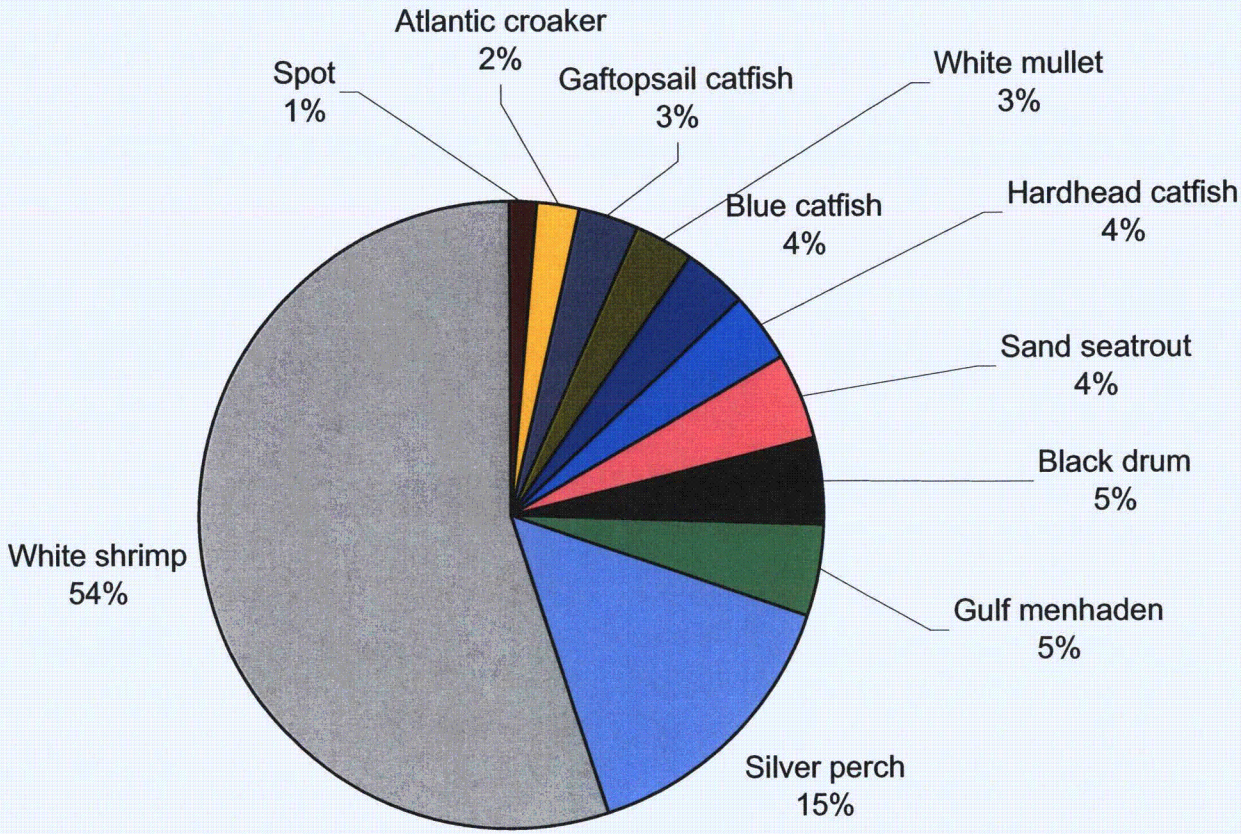


Figure 6. Percentage of Organisms >1% in Trawl Samples, October 2007

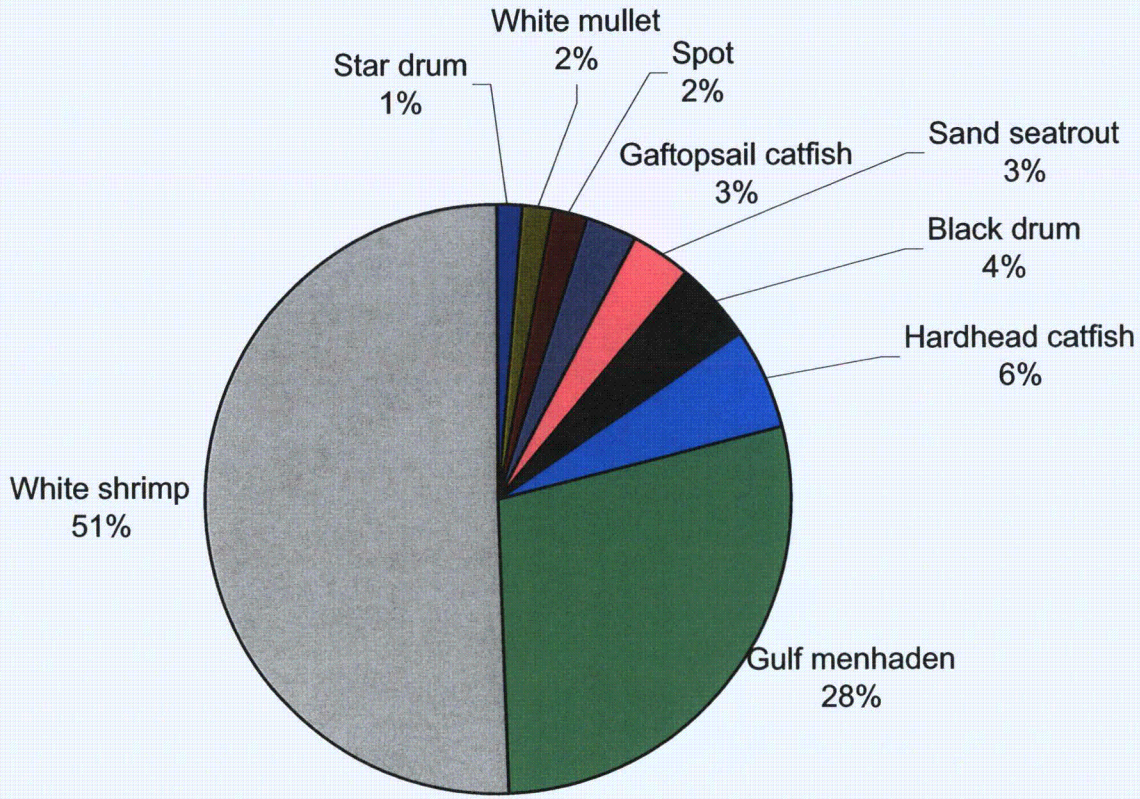


Figure 7. Percentage of Organisms >1% in Trawl Samples, November 2007

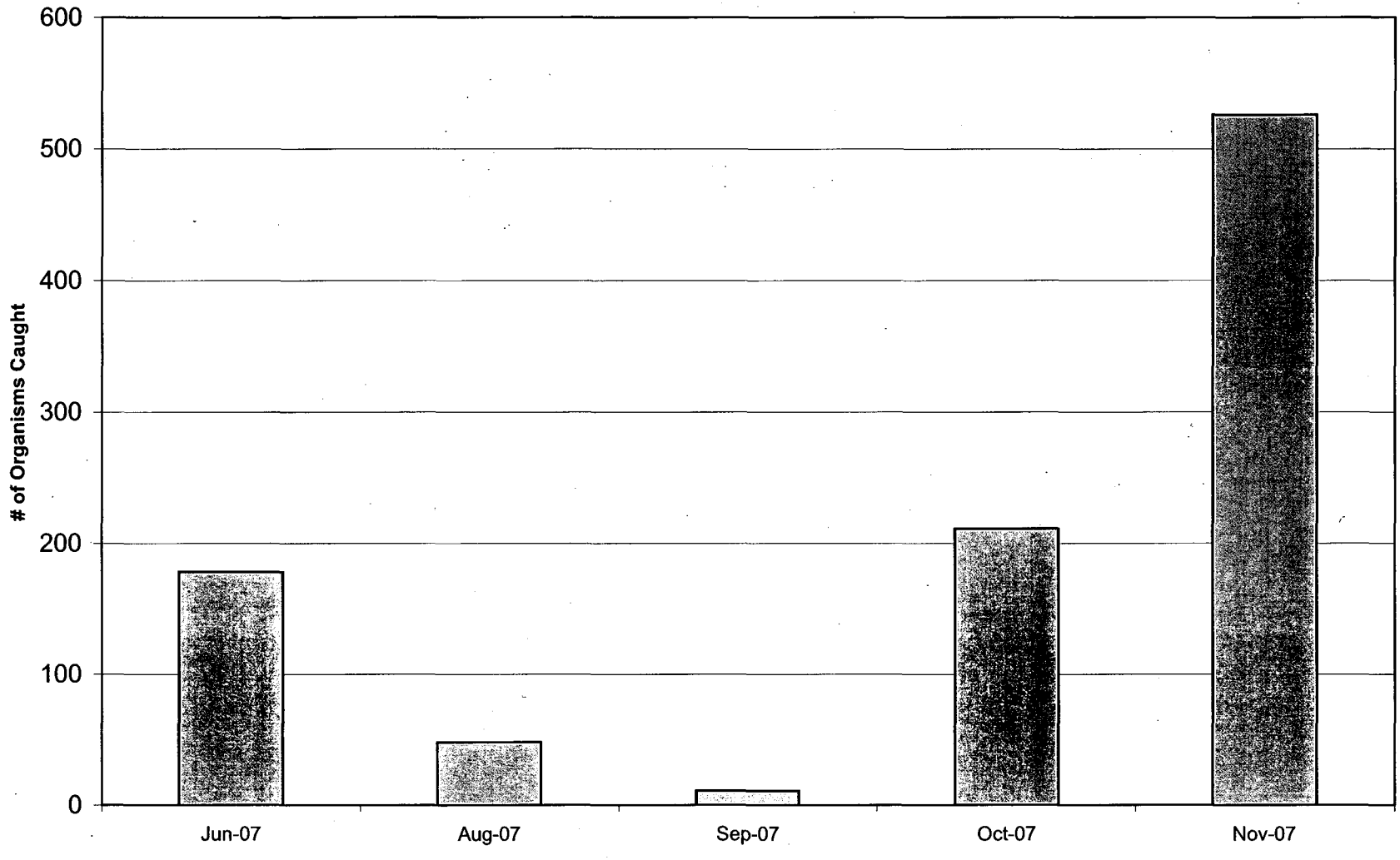


Figure 8. Abundance of Organisms In Seine Samples Colorado River.

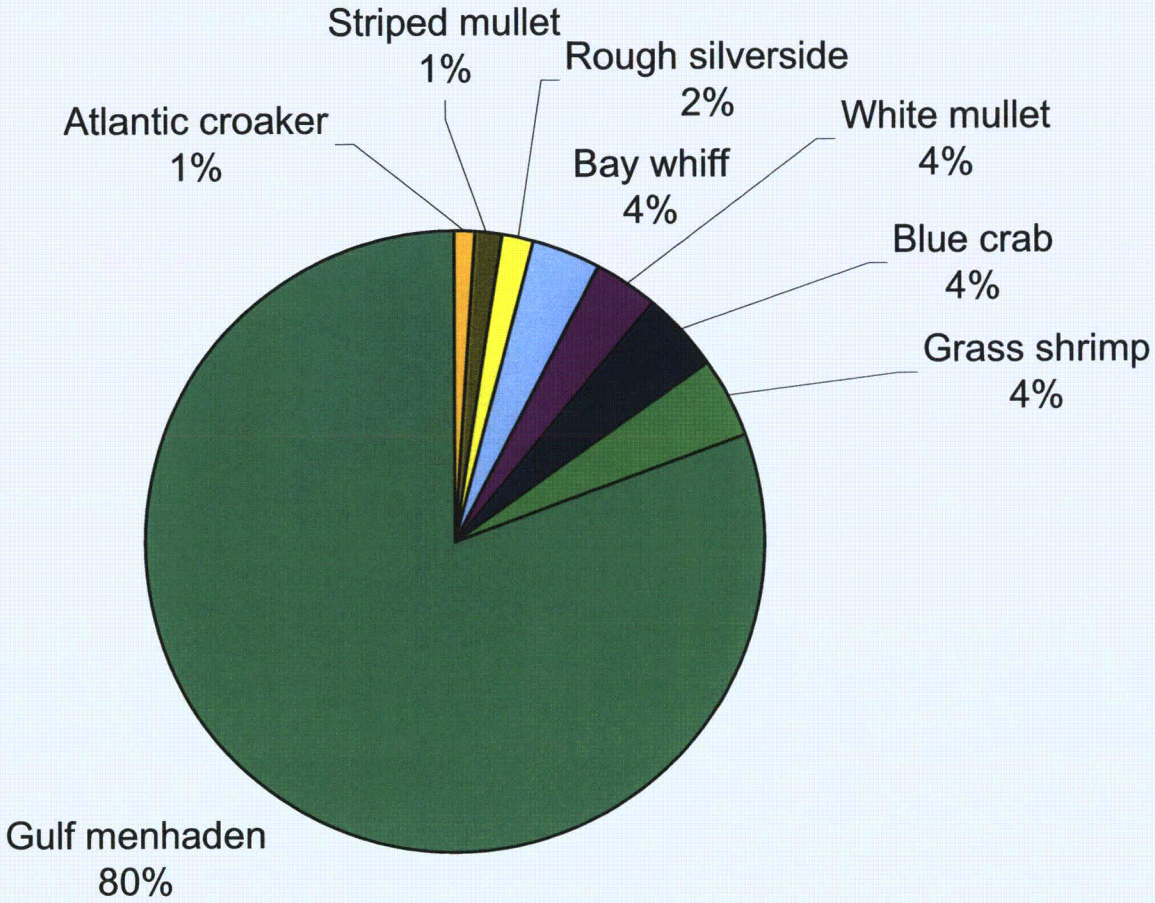


Figure 9. Percentage of Organisms >1% in Bag Seine Samples, June 2007

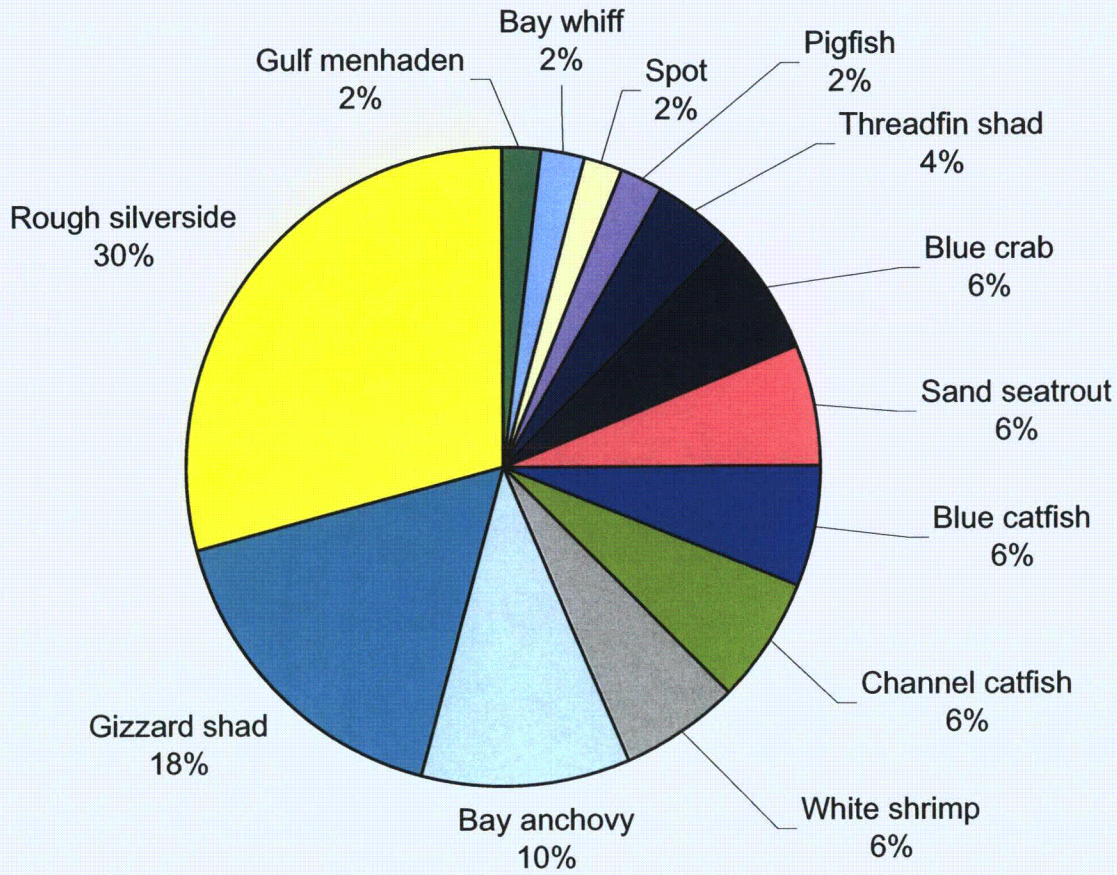


Figure 10. Percentage of Organisms >1% in Bag Seine Samples, August 2007

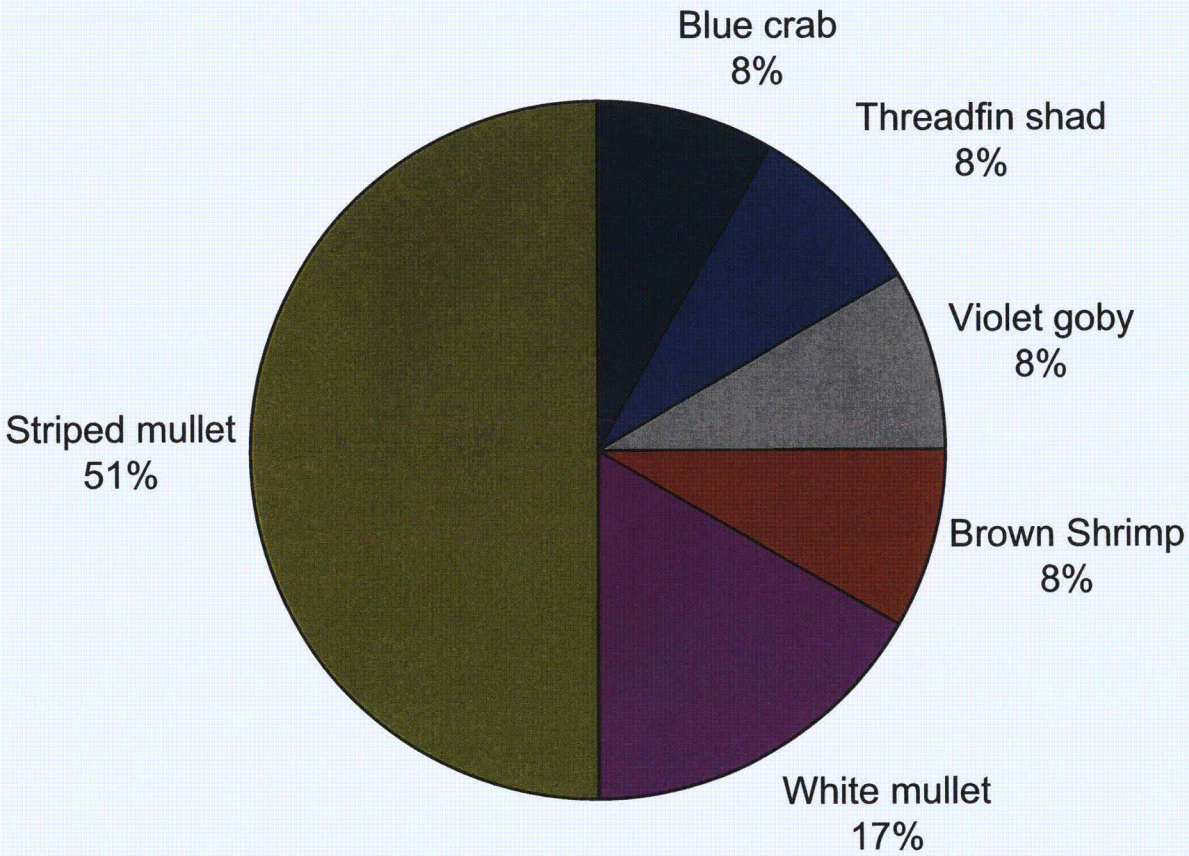


Figure 11. Percentage of Organisms >1% in Bag Seine Samples, September 2007

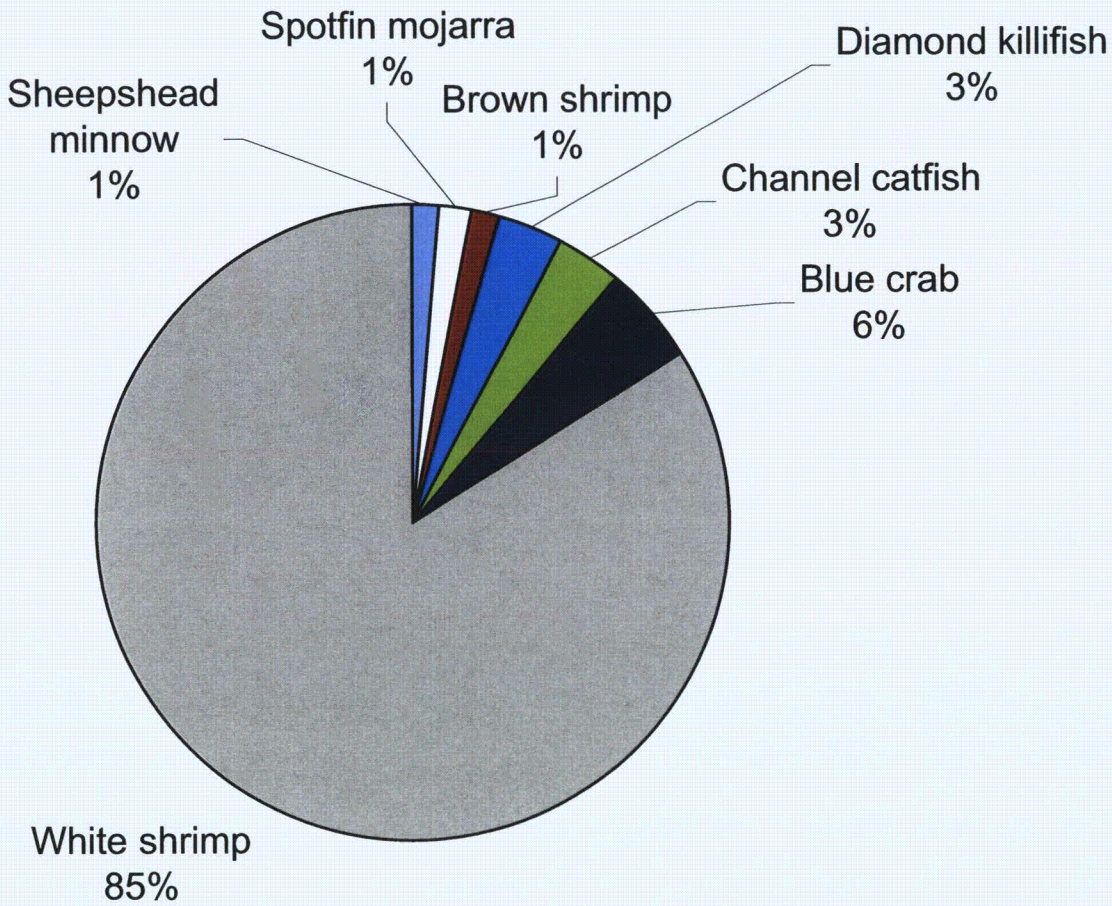


Figure 12. Percentage of Organisms >1% in Bag Seine Samples, October 2007

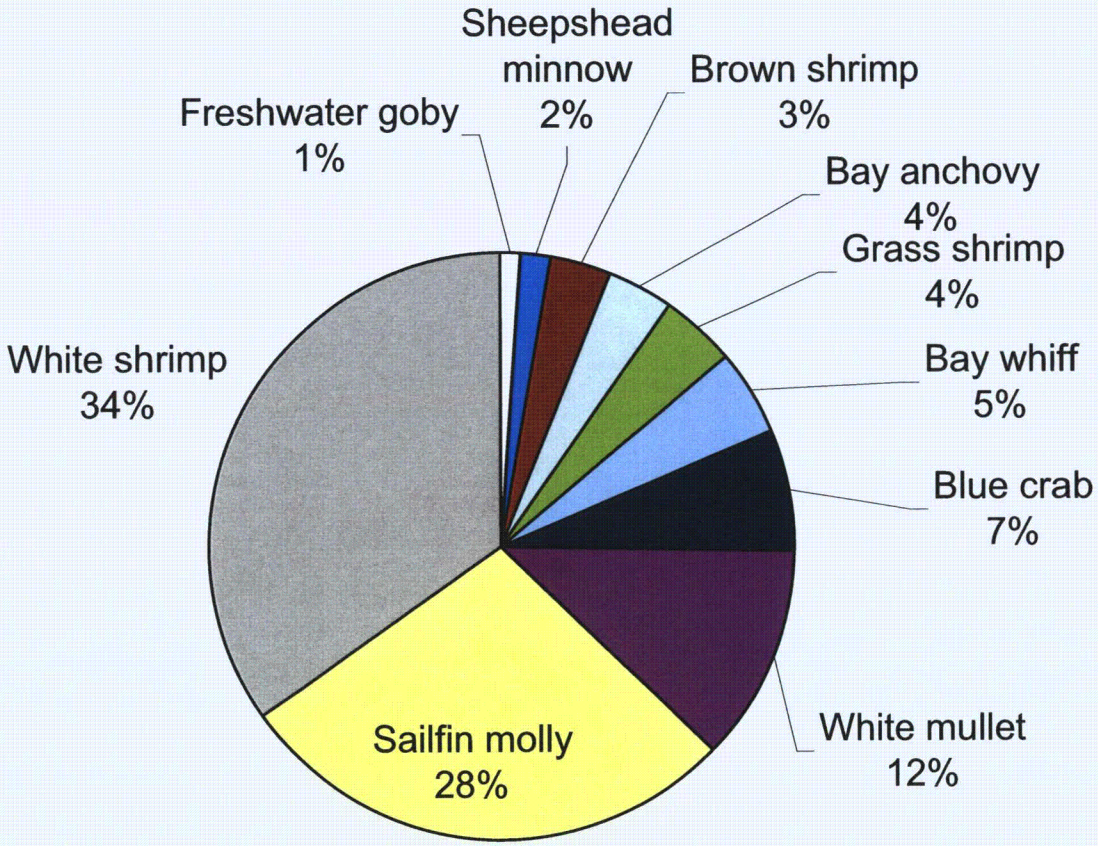


Figure 13. Percentage of Organisms >1% in Bag Seine Samples, November 2007

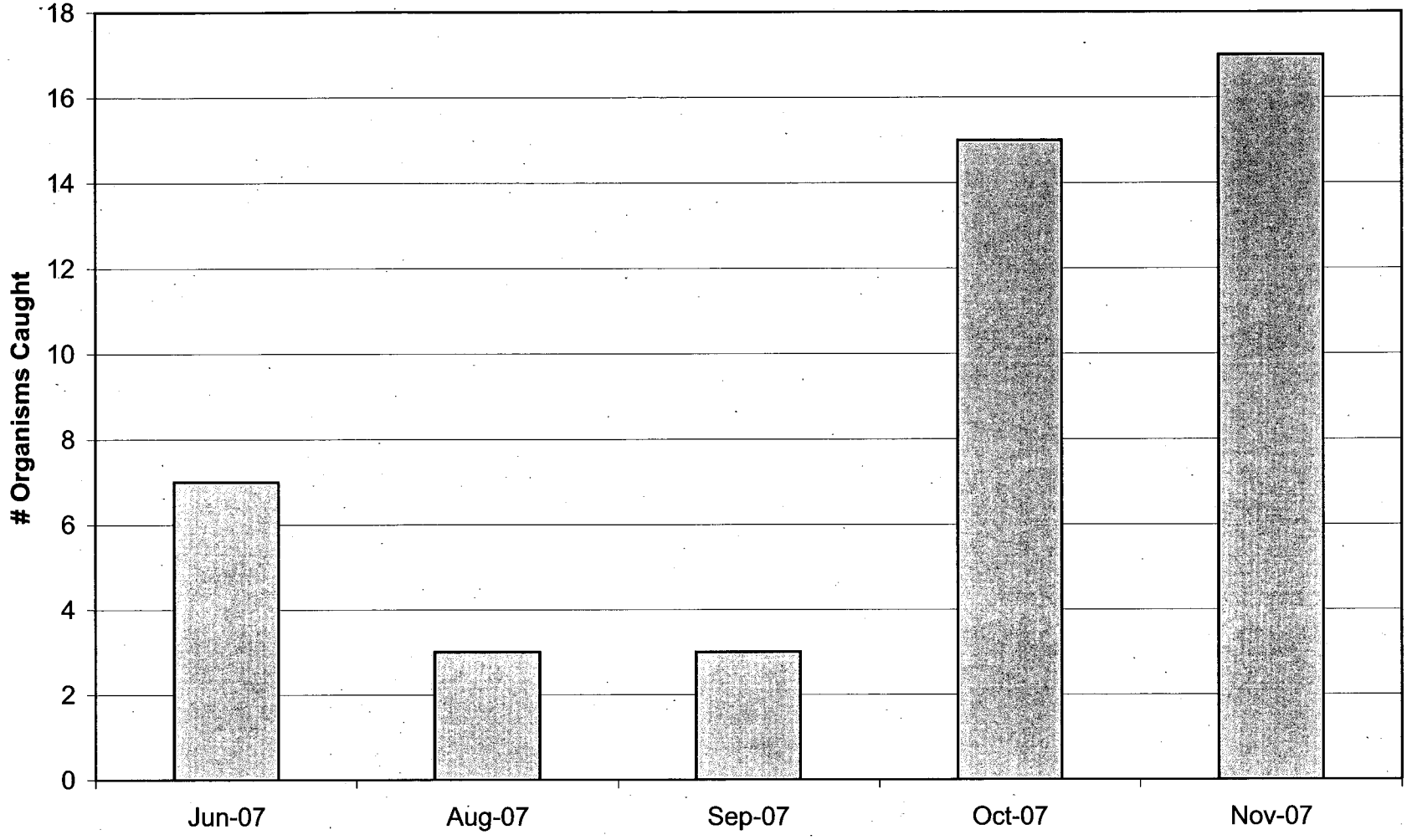


Figure 14. Abundance of Organisms in Hoop Net Samples Colorado River.

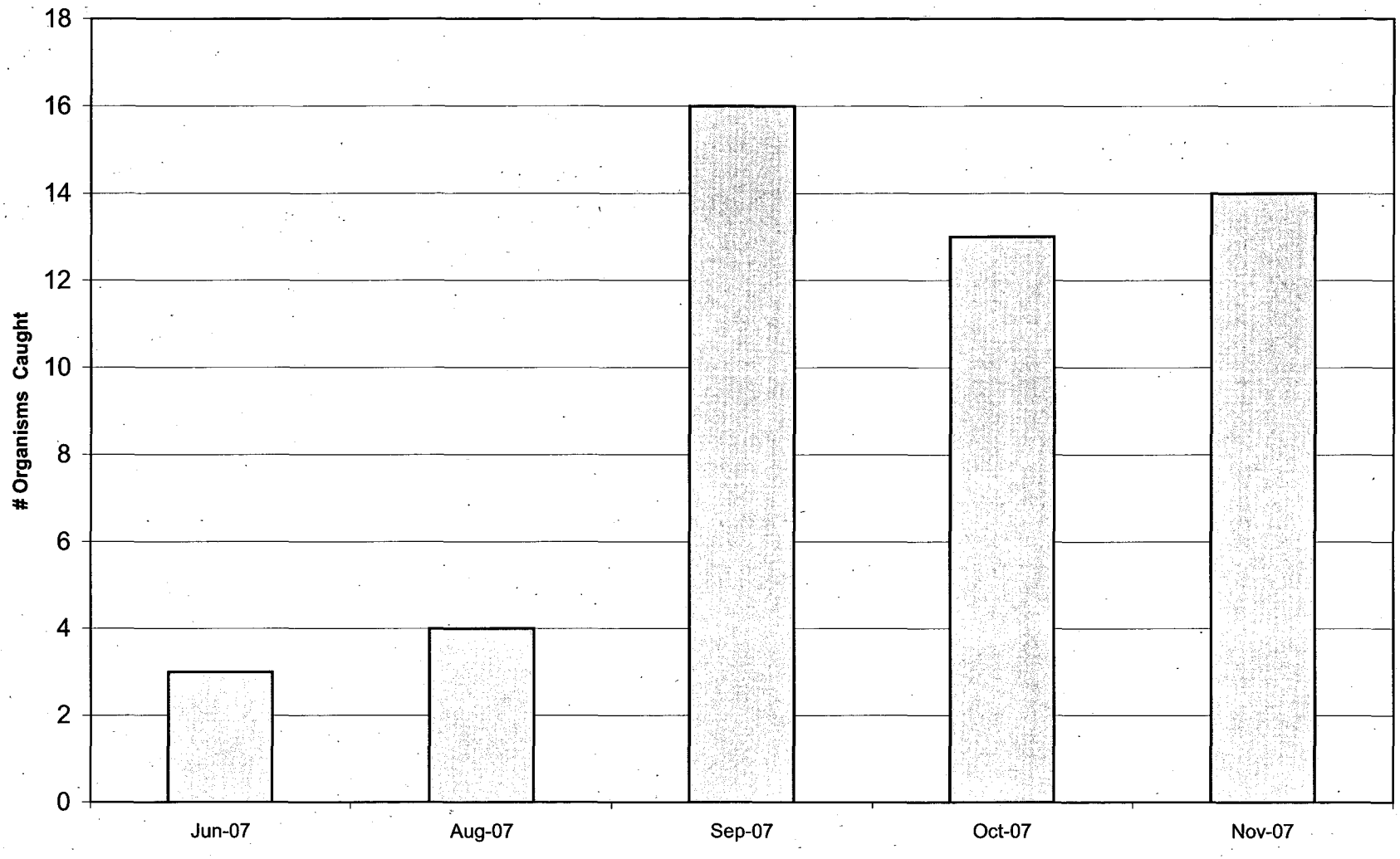


Figure 15. Abundance of Organisms in Gill Net Samples Colorado River.

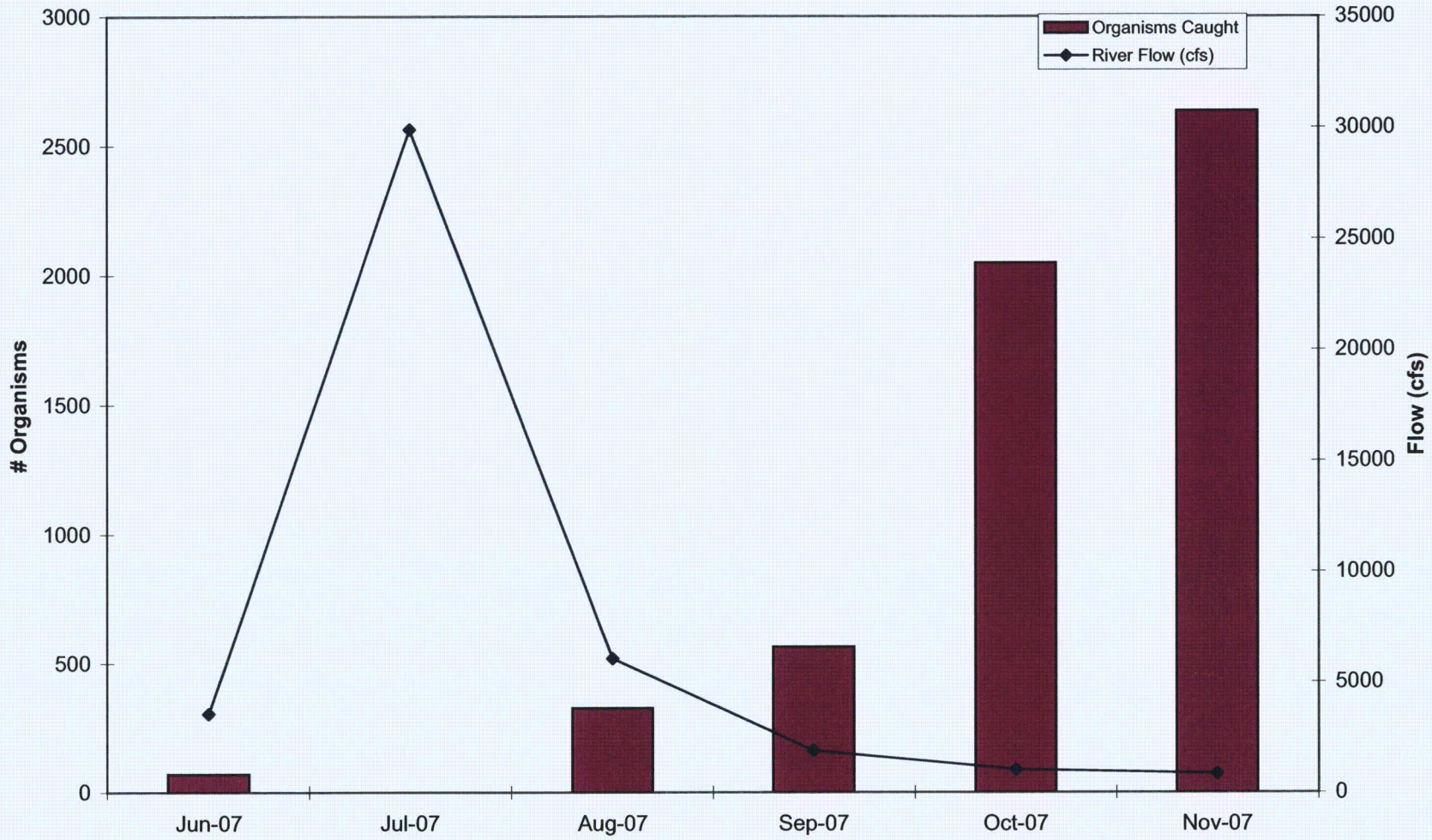


Figure 16. Comparison of Trawl Abundance vs. River Flow

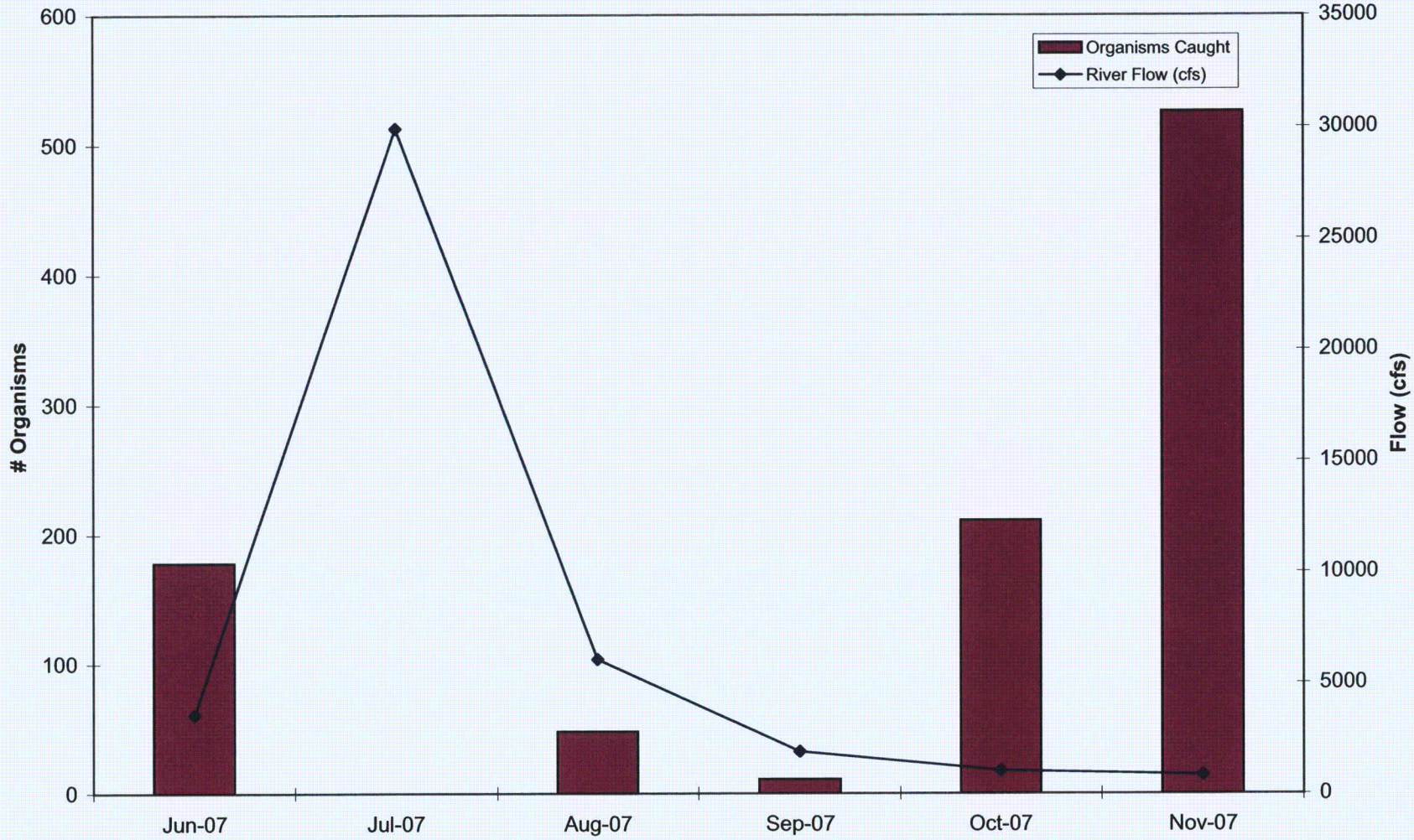


Figure 17. Comparison of Bag Seine Abundance vs. River Flow

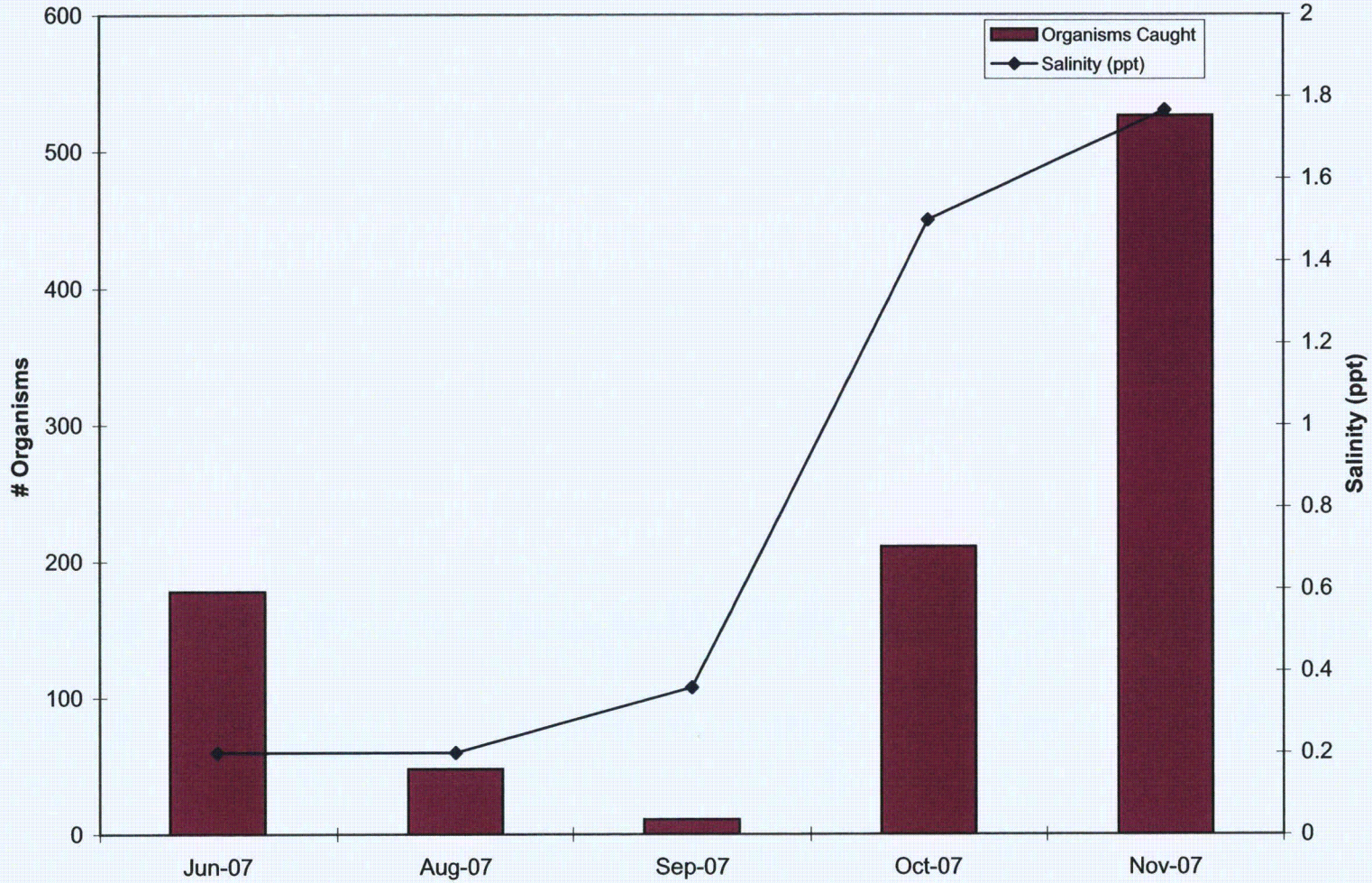


Figure 18. Comparison of Bag Seine Abundance vs. Monthly Salinity

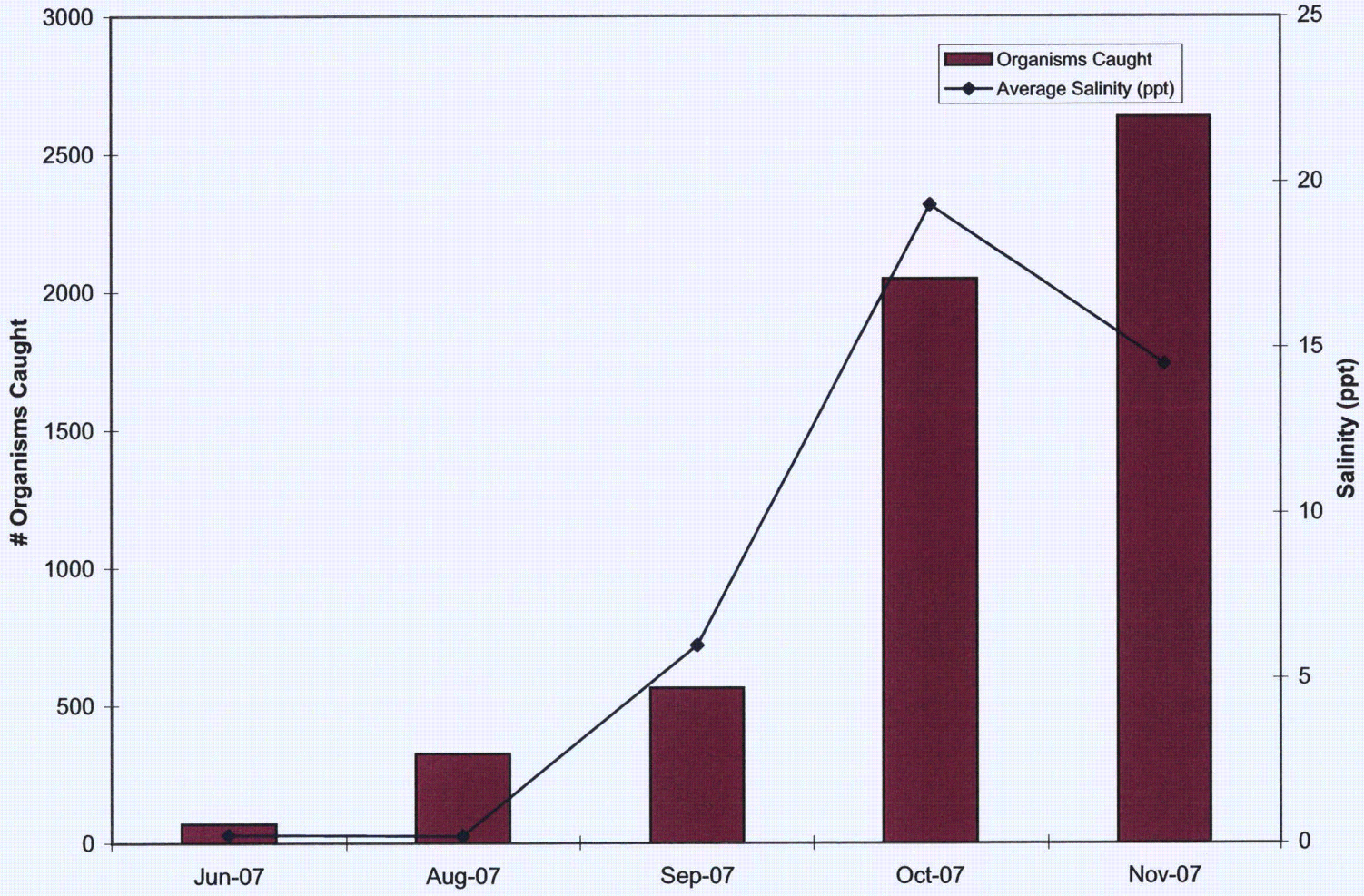


Figure 19. Comparison of Trawl Abundance vs. Monthly Salinity

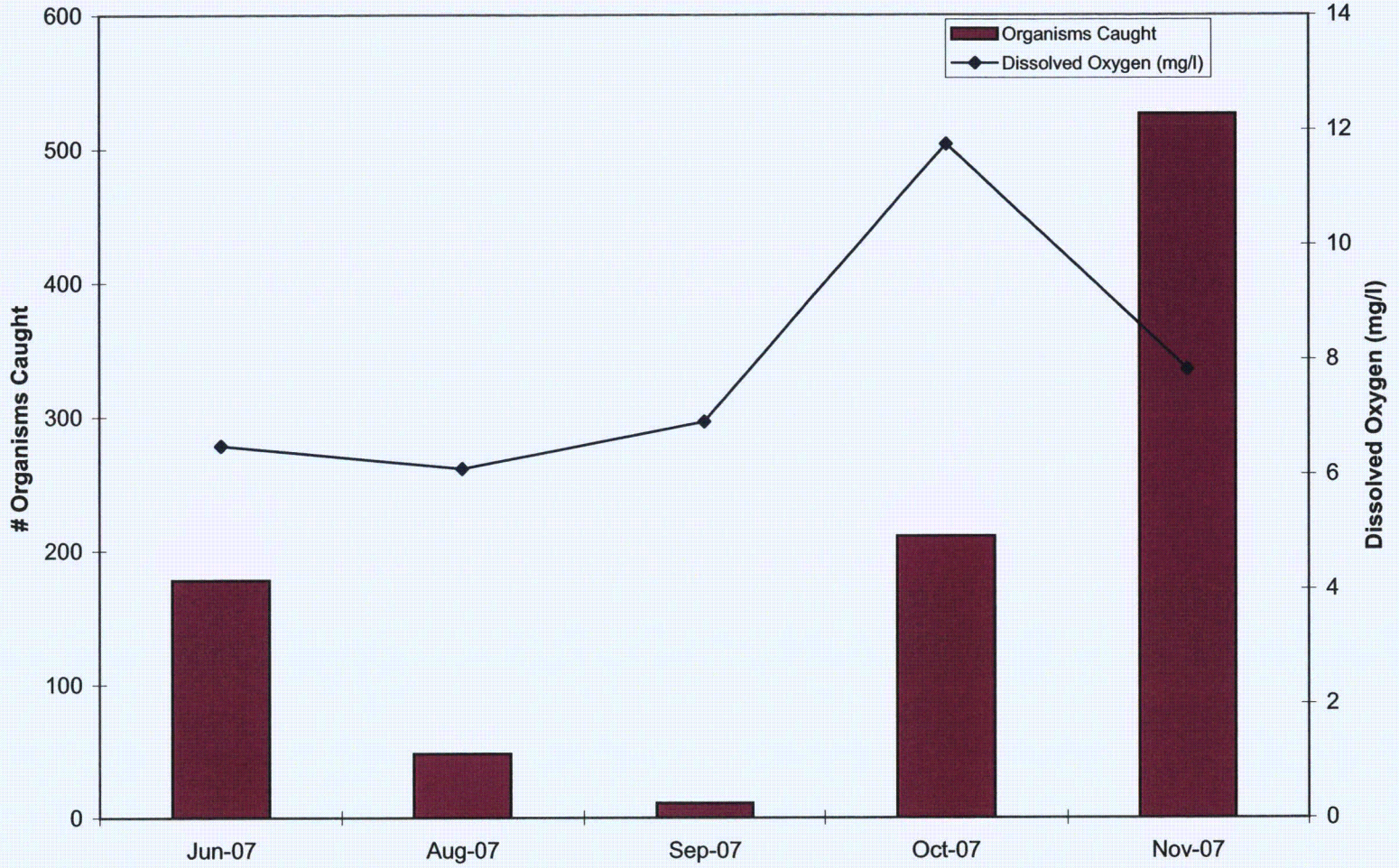


Figure 20. Comparison of Bag Seine Abundance vs. Average Dissolved Oxygen

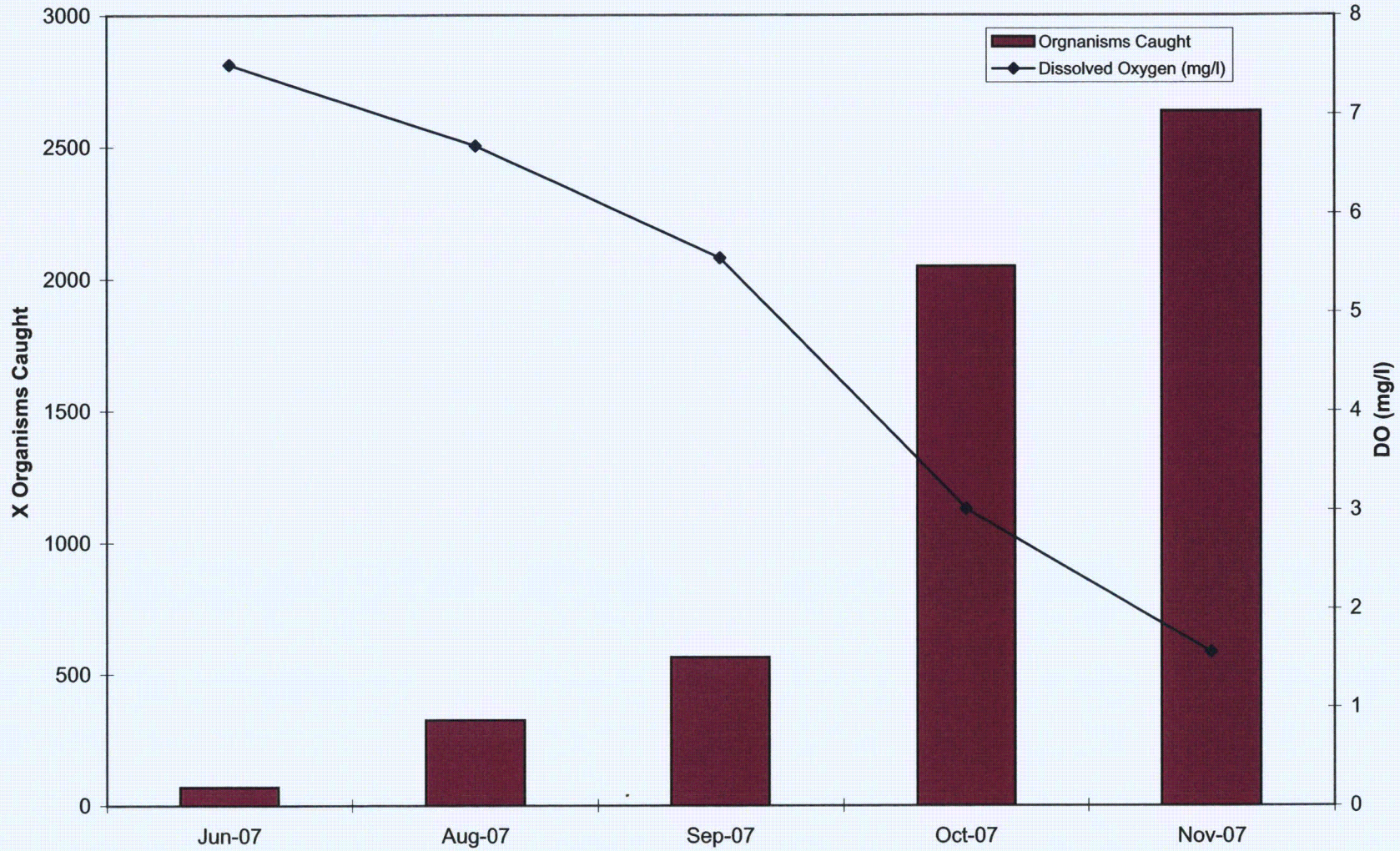


Figure 21. Comparison of Trawl Abundance vs. Monthly Dissolved Oxygen

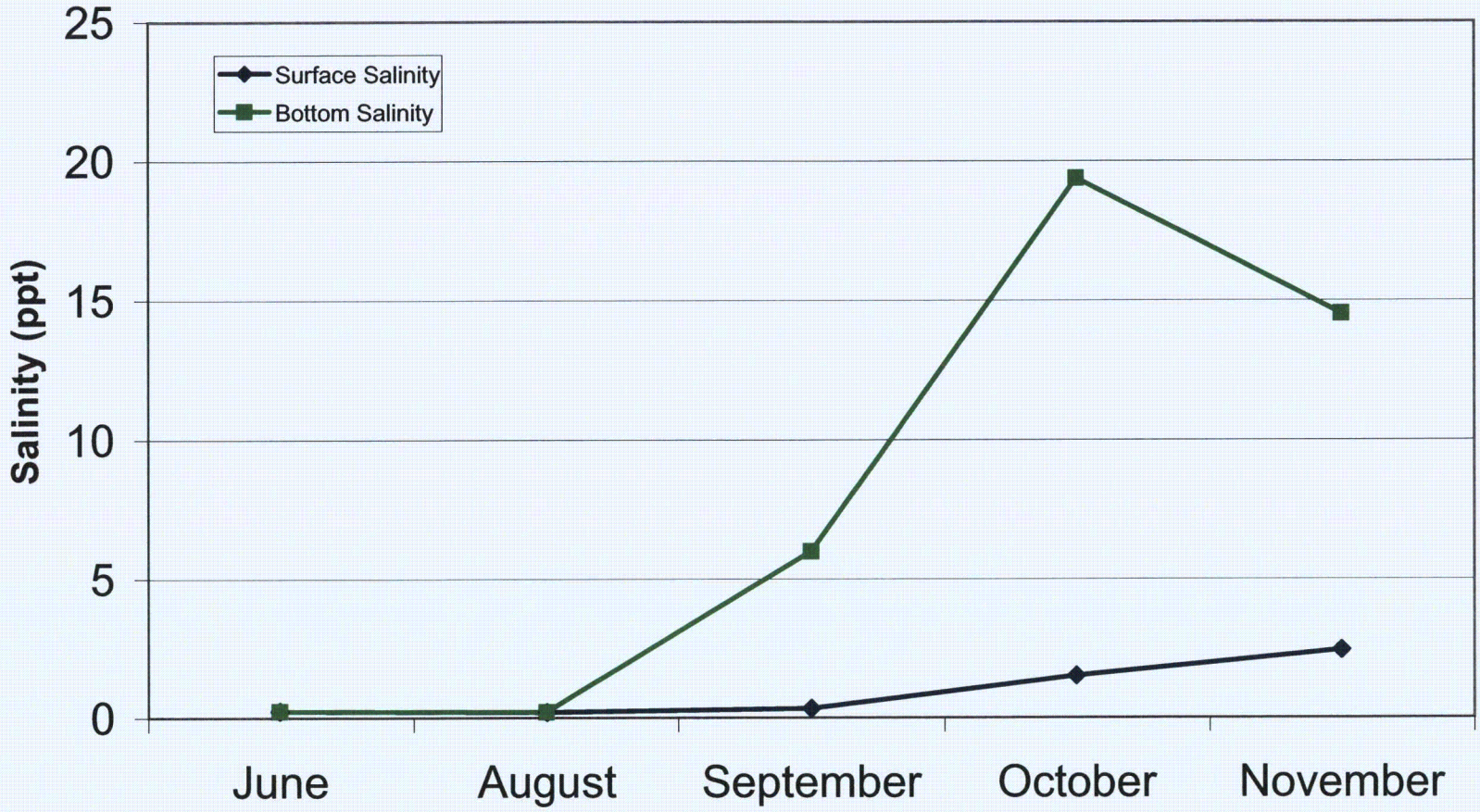


Figure 22. Average Monthly Salinity Readings from Trawl Data.

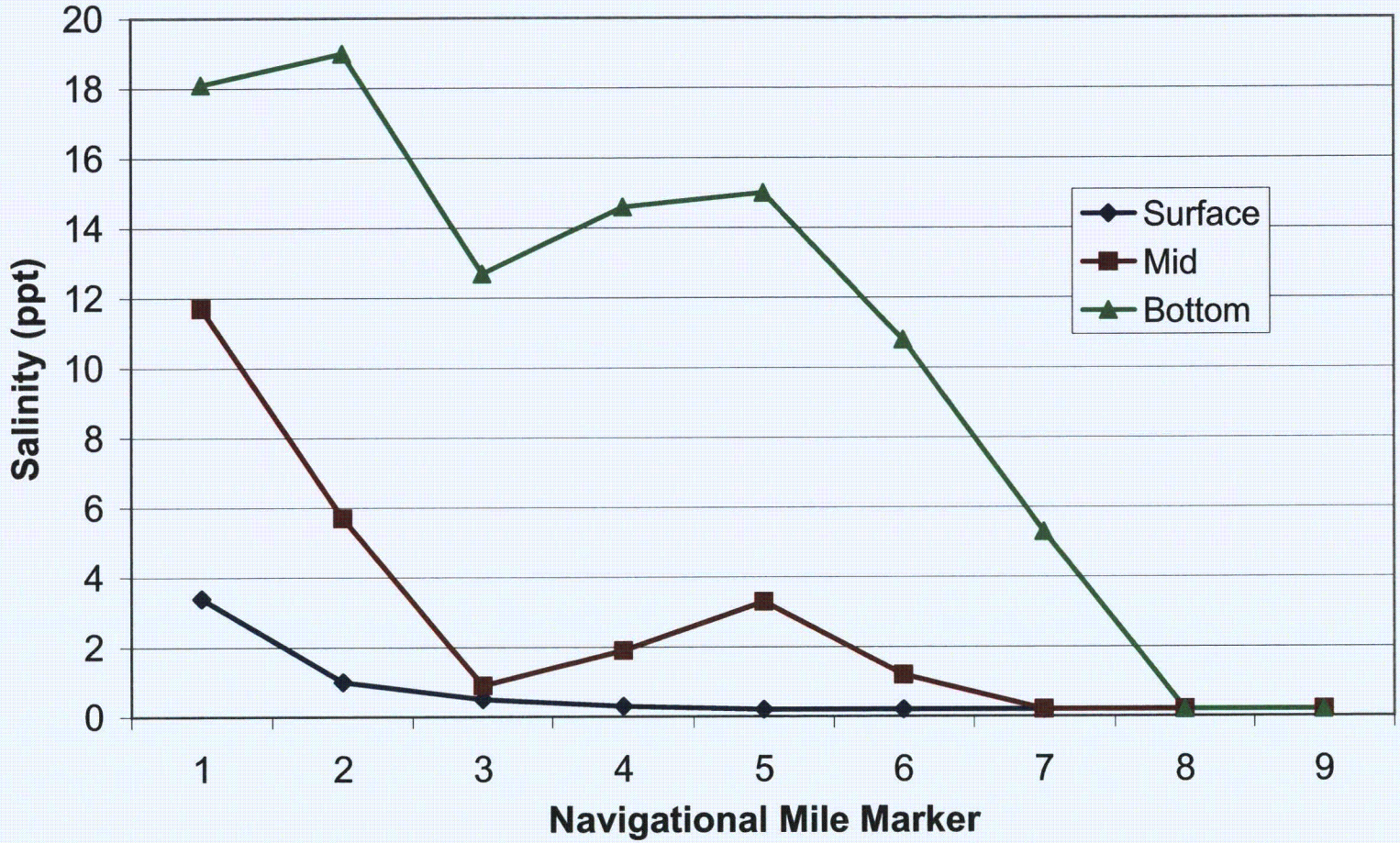


Figure 23. Monthly Salinity Readings for the Colorado River, September 2007.

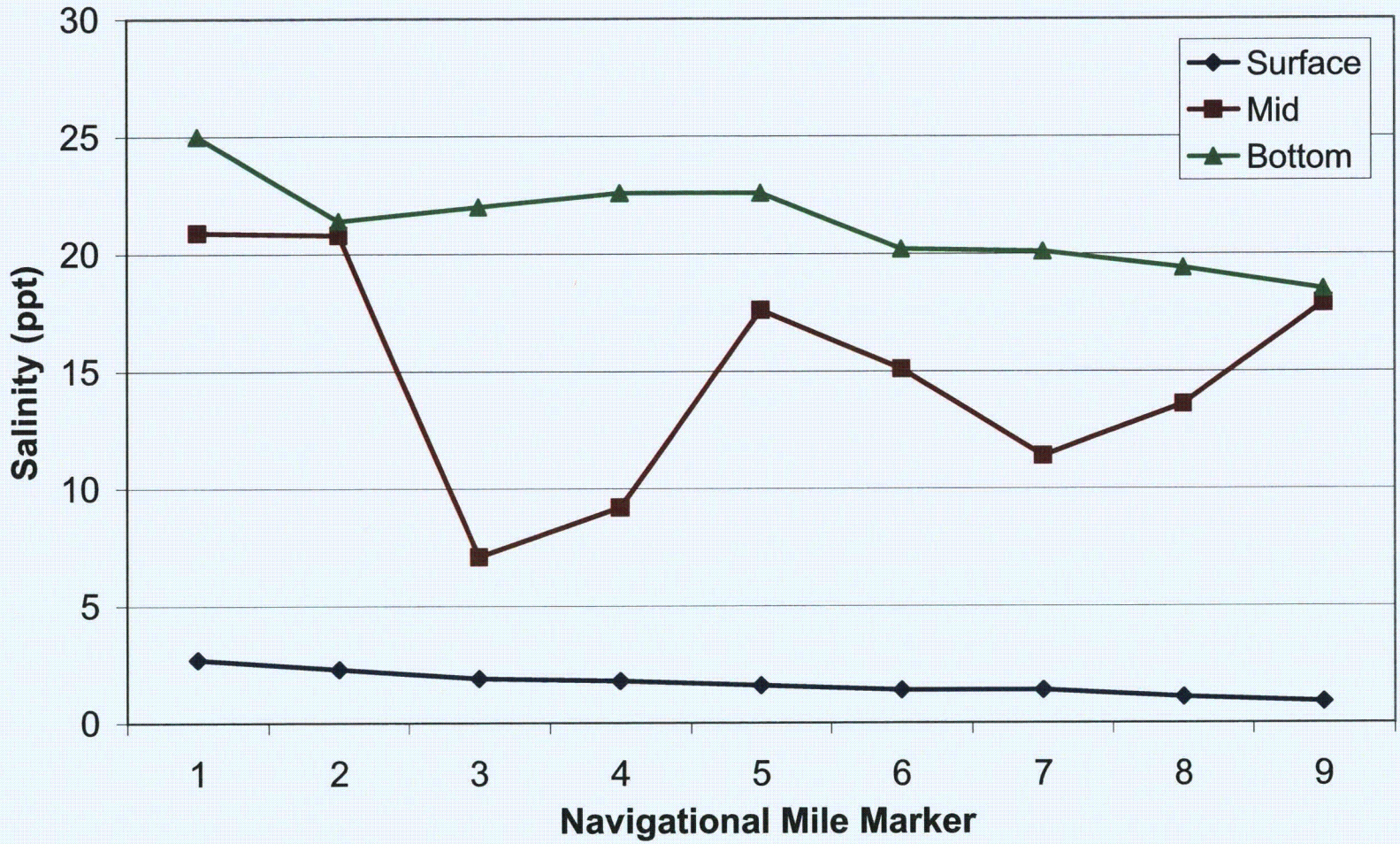


Figure 24. Monthly Salinity Readings for the Colorado River, October 2007.

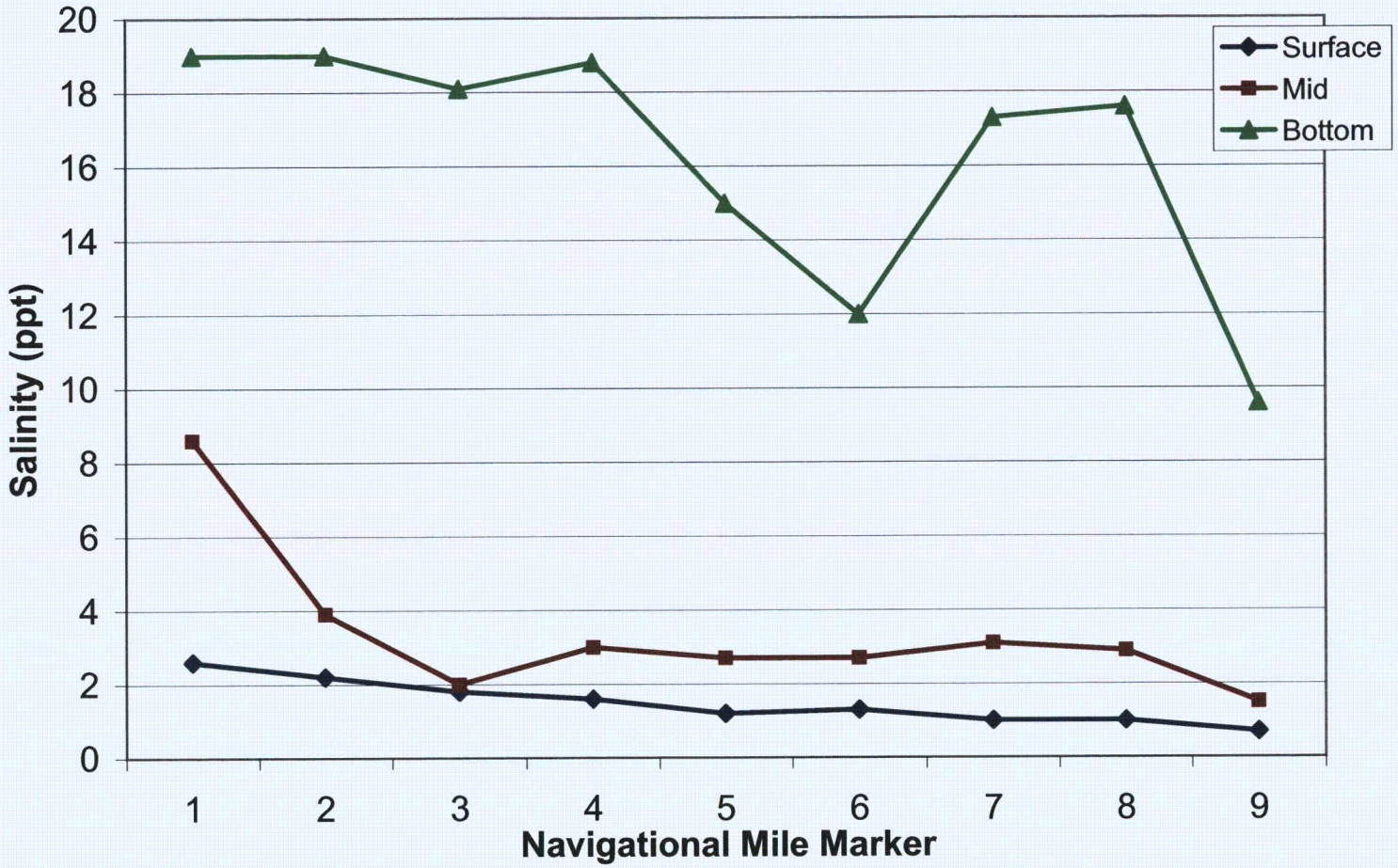


Figure 25. Monthly Salinity Readings for the Colorado River, November 2007.

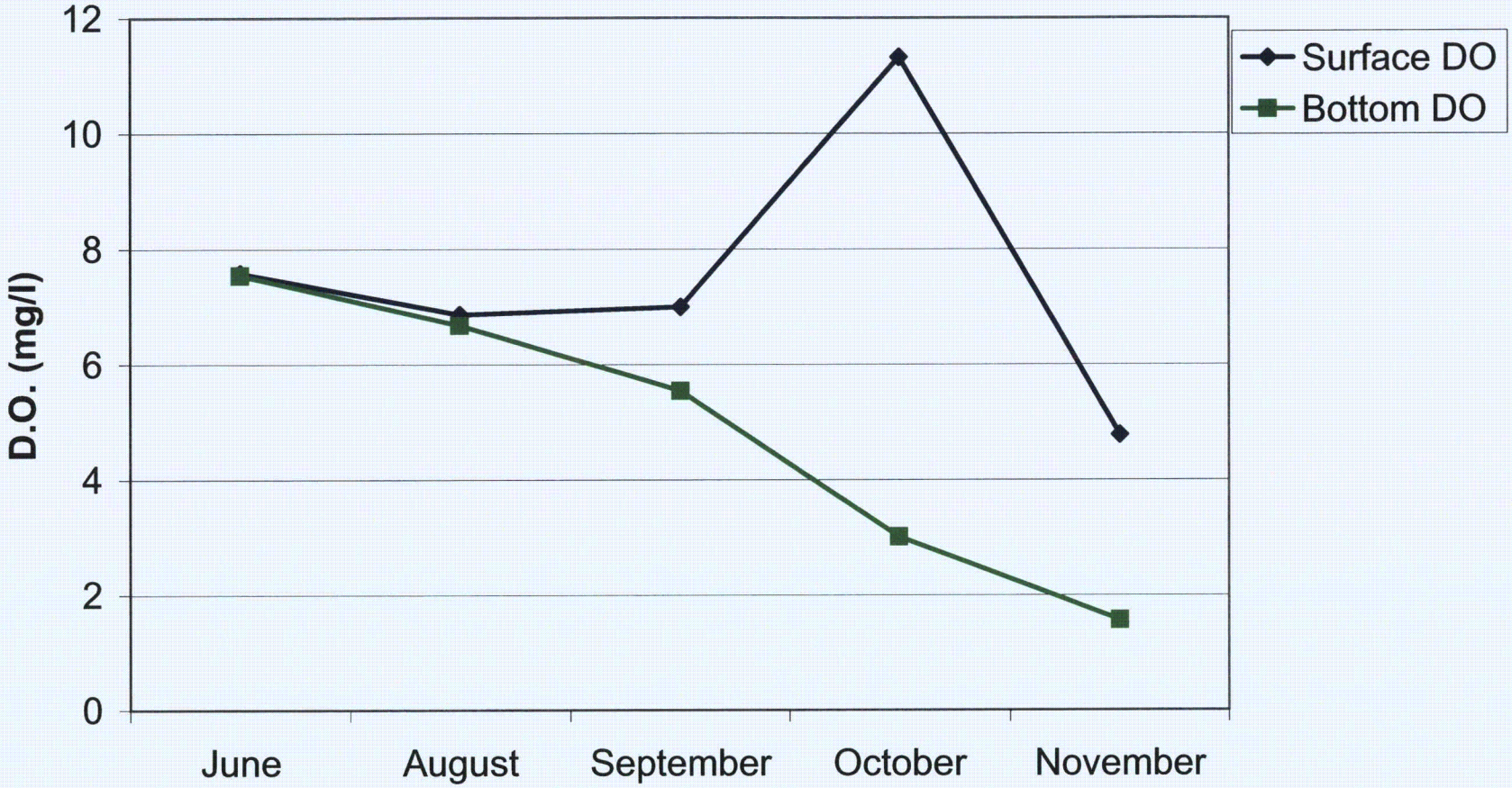


Figure 26. Average Monthly Dissolved Oxygen Readings from Trawl Data.

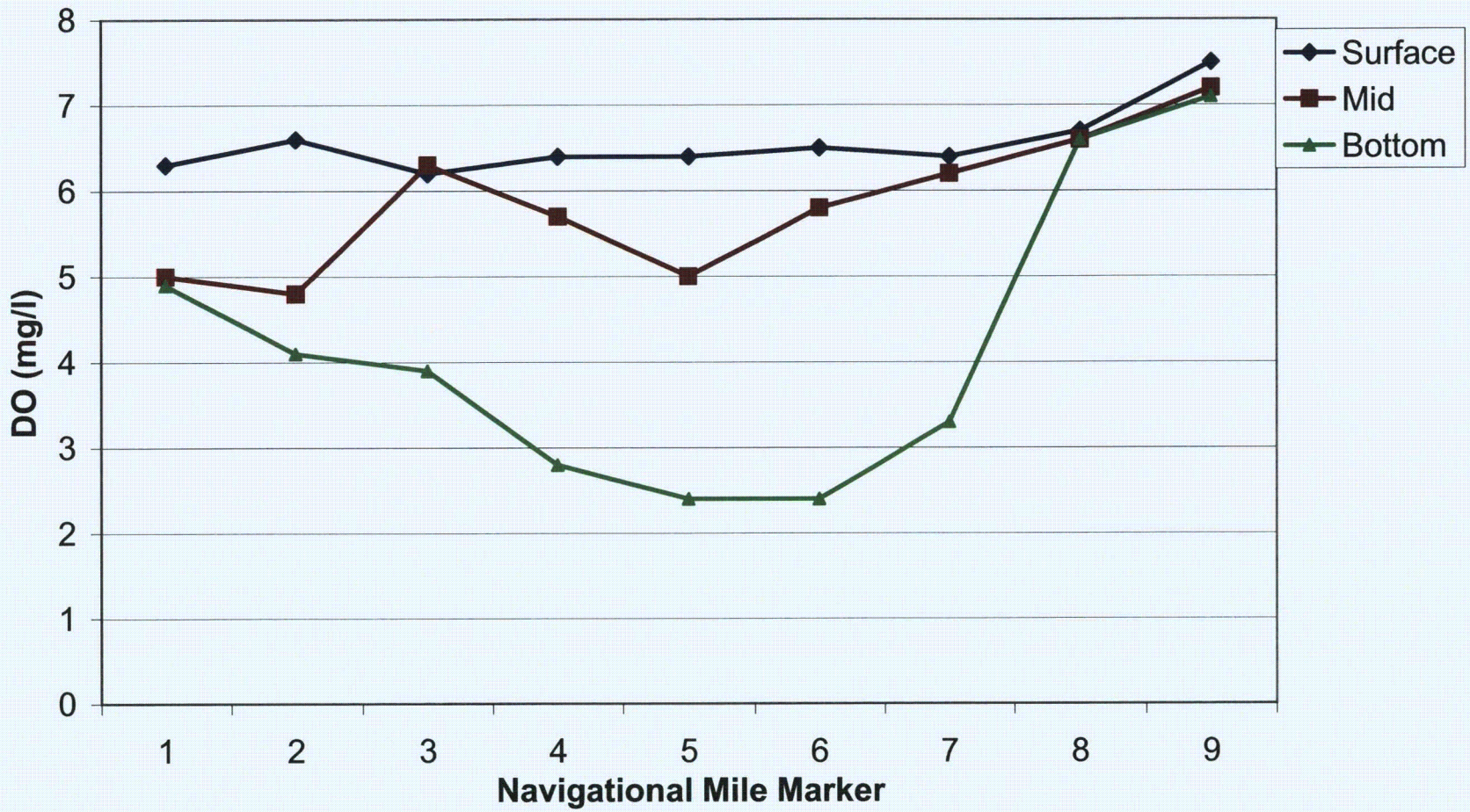


Figure 27. Monthly Dissolved Oxygen Readings for the Colorado River, September 2007.

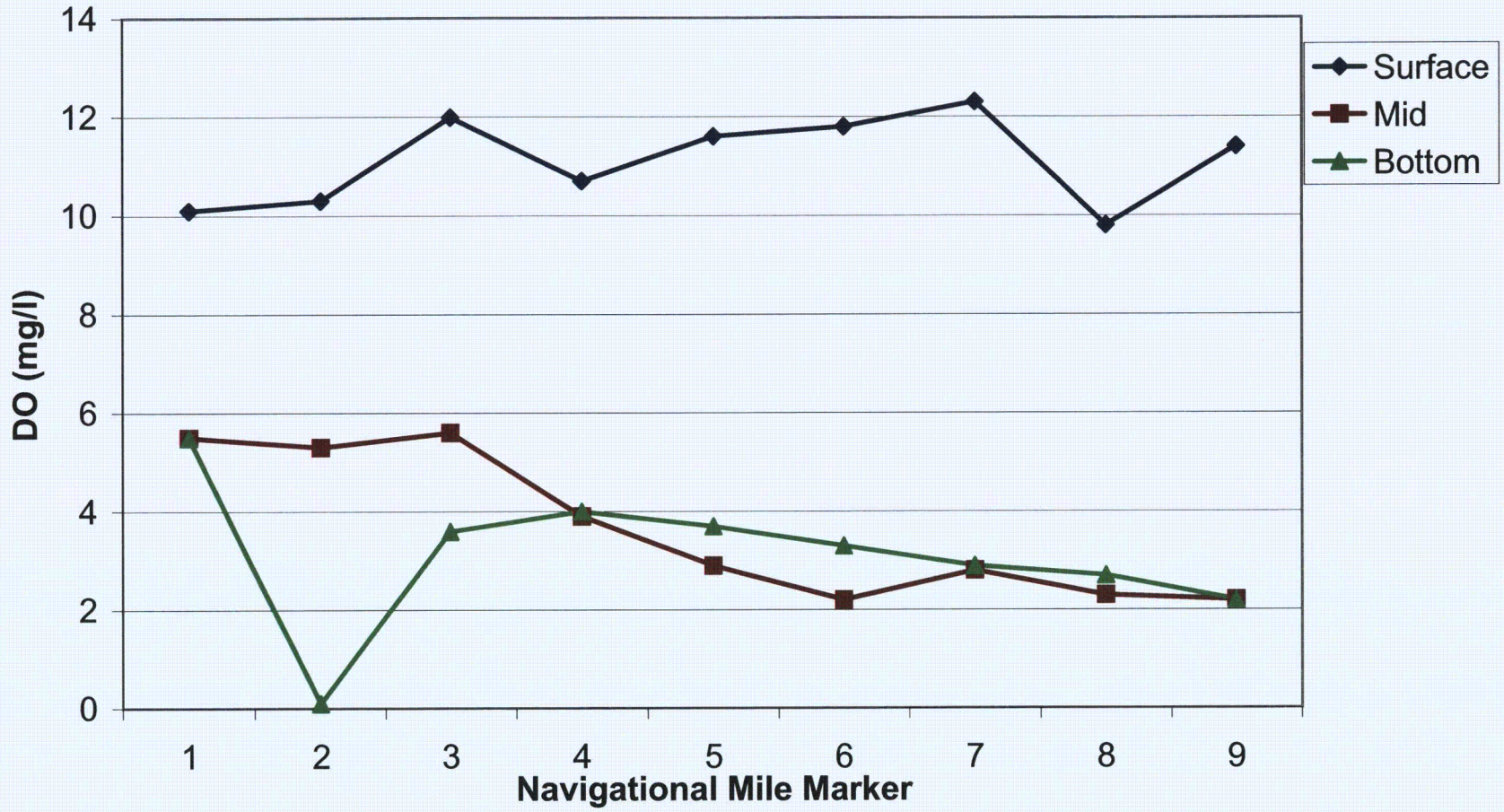


Figure 28. Monthly Dissolved Oxygen Readings for the Colorado River, October 2007.

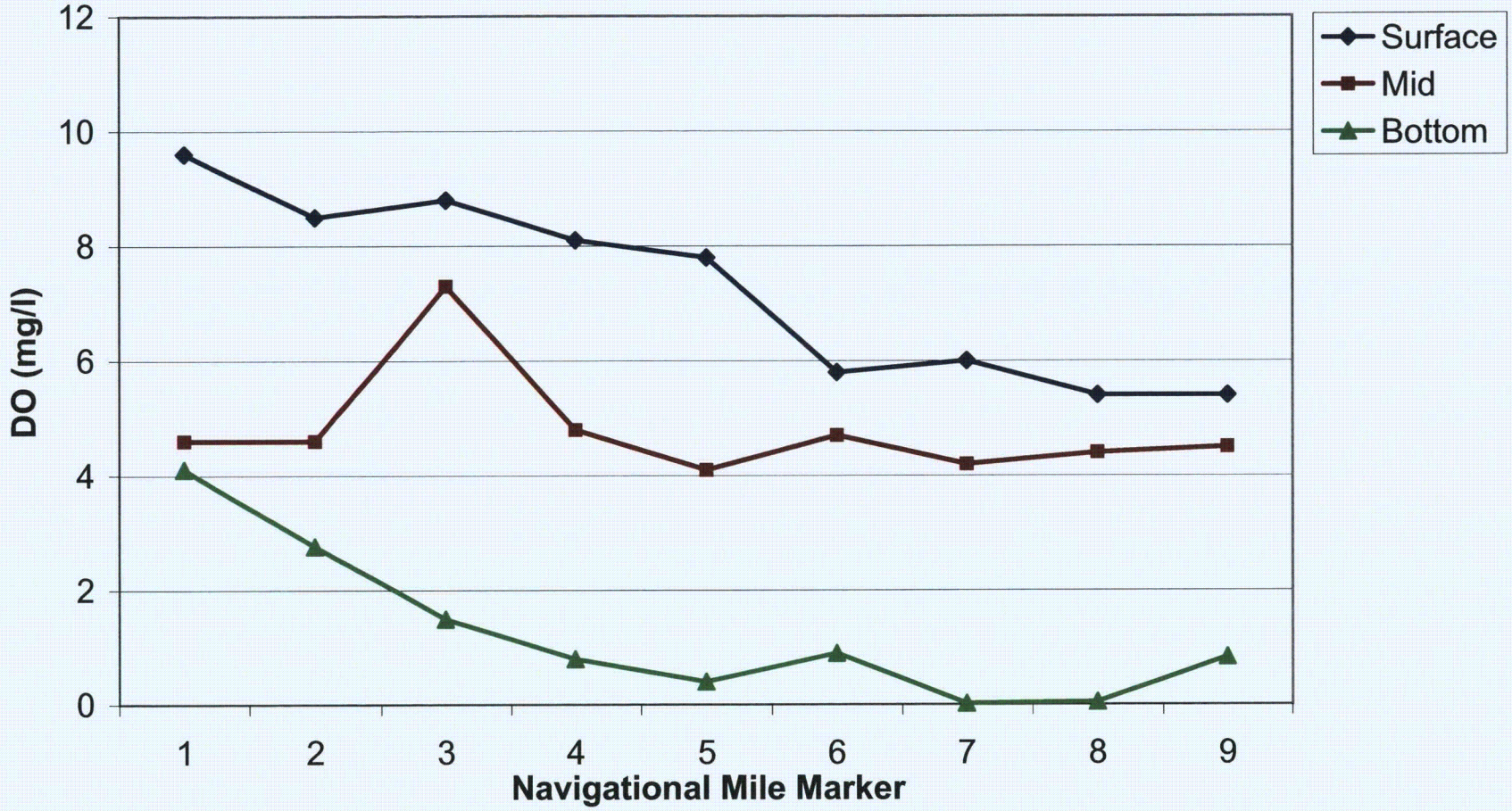


Figure 29. Monthly Dissolved Oxygen Readings for the Colorado River, November 2007.

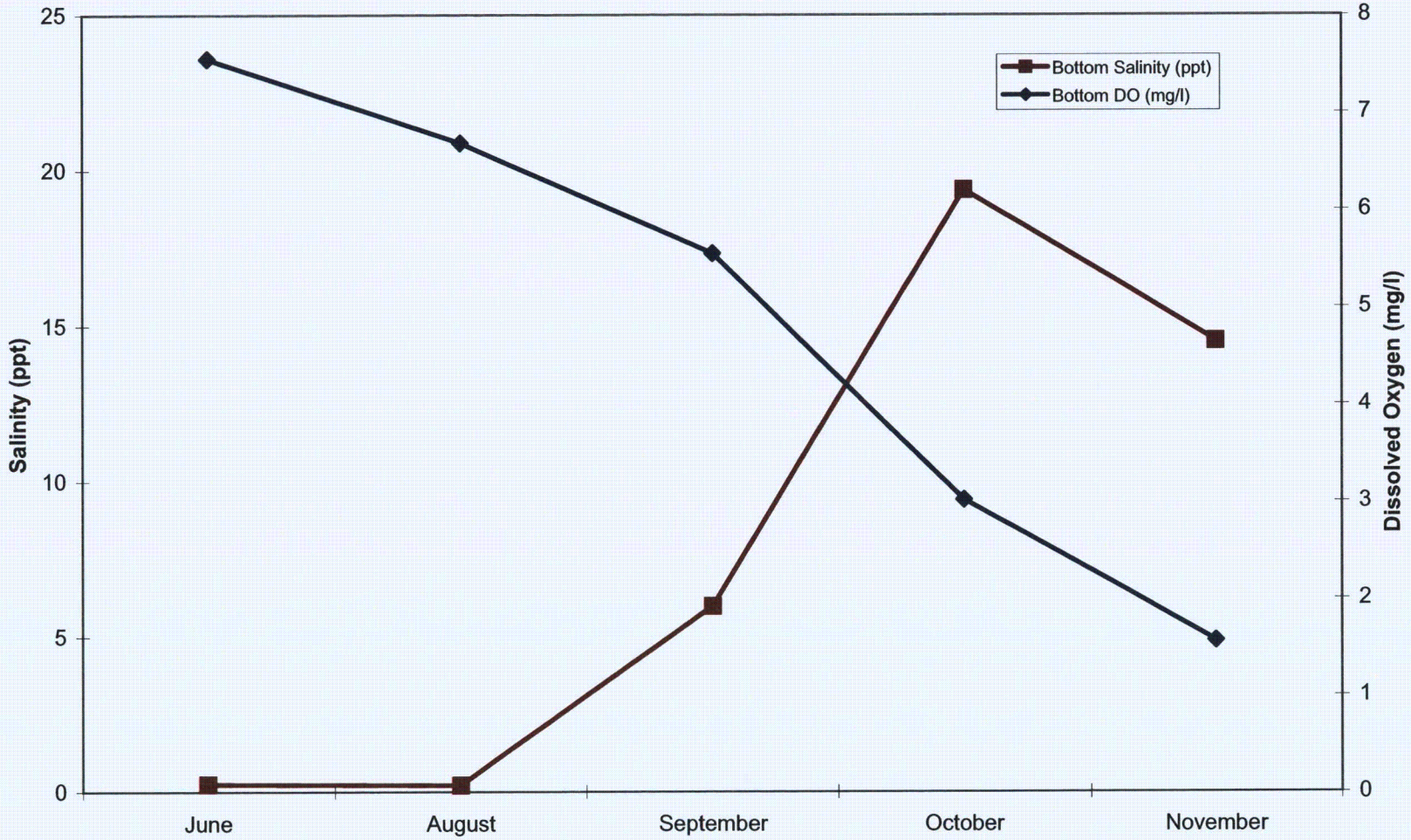


Figure 30. Comparison of Salinity vs Dissolved Oxygen During the Sampling Study.

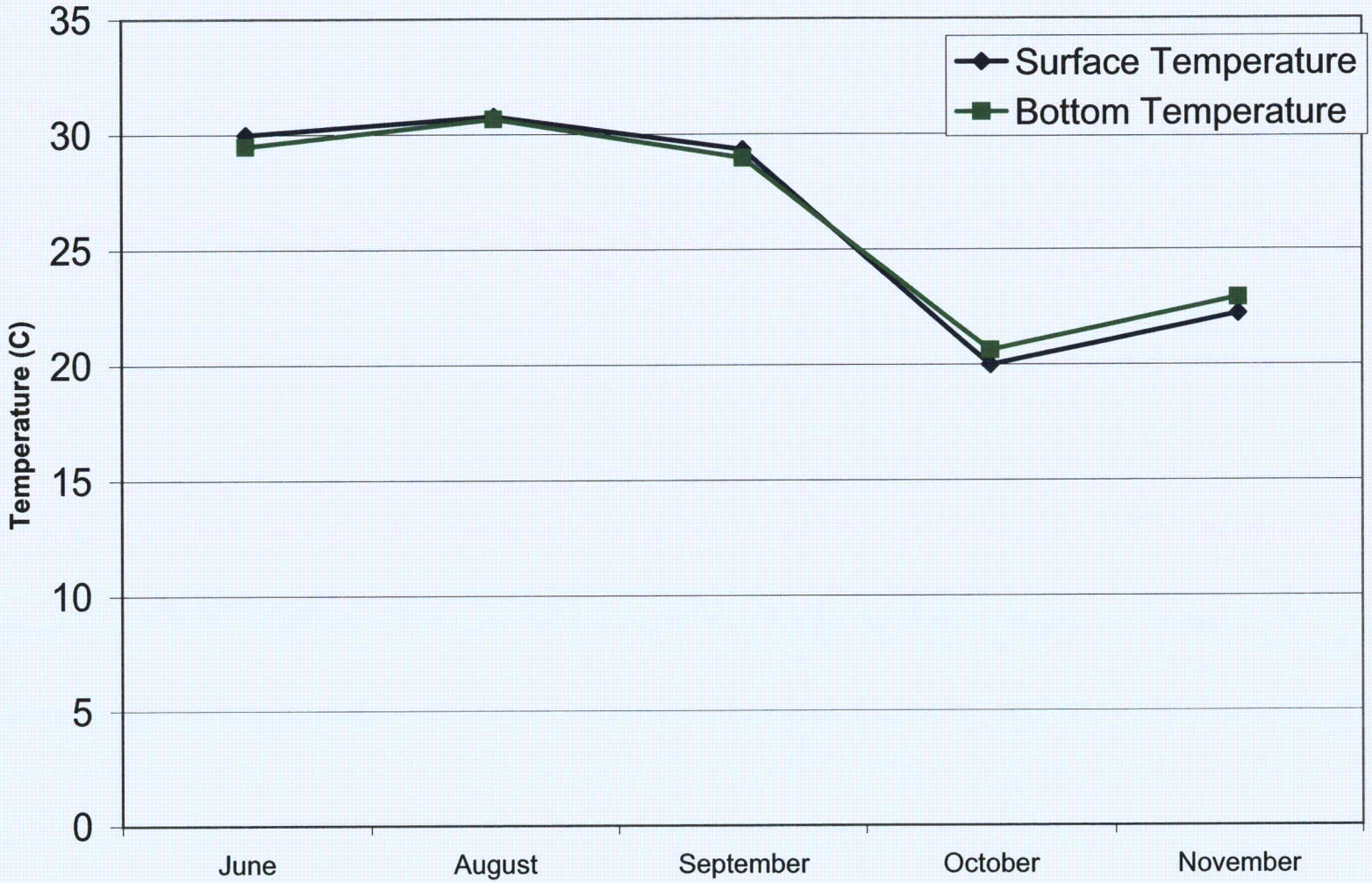


Figure 31. Average Monthly Temperature Readings from Trawl Data.

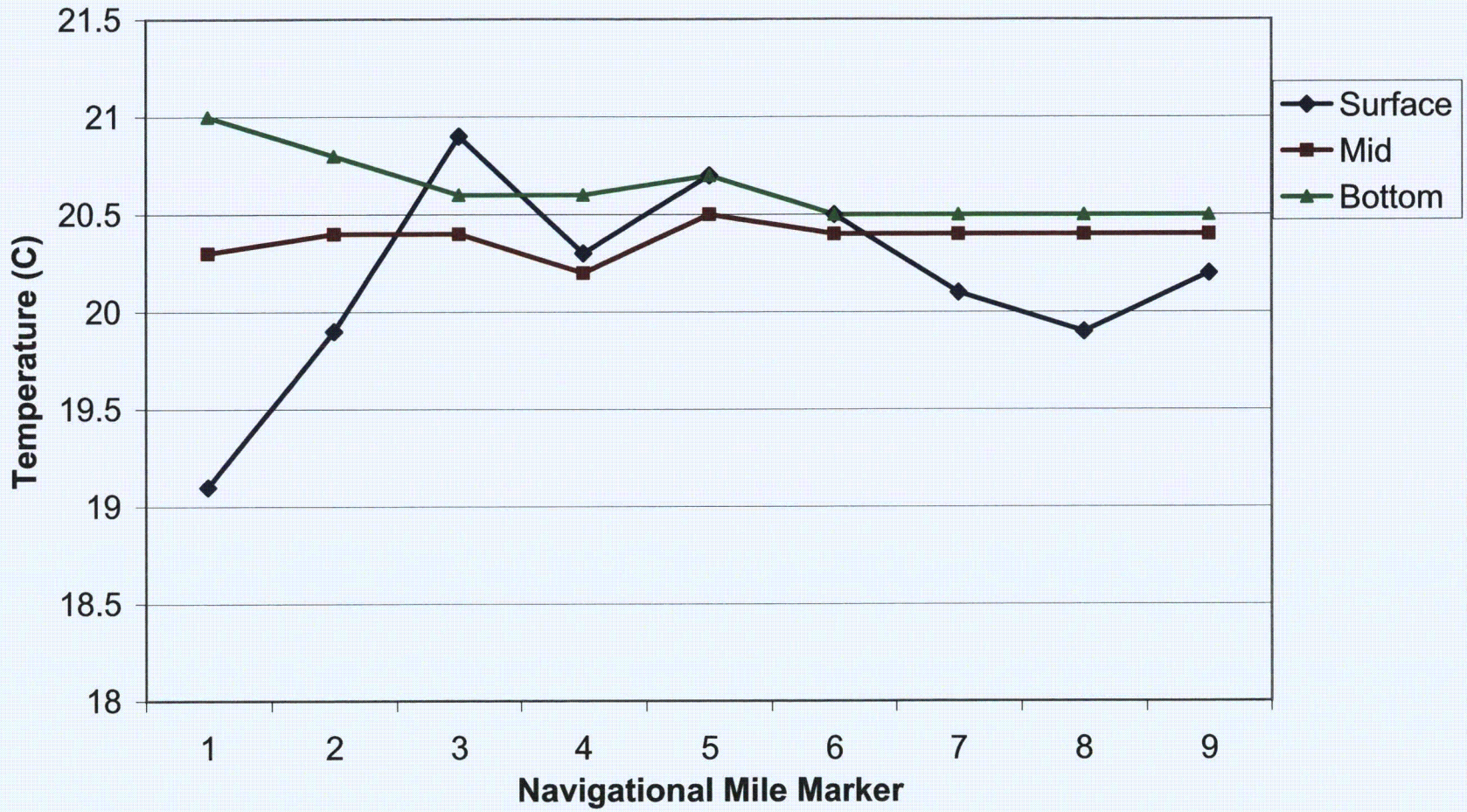


Figure 32. Monthly Temperature Readings for the Colorado River, September 2007.

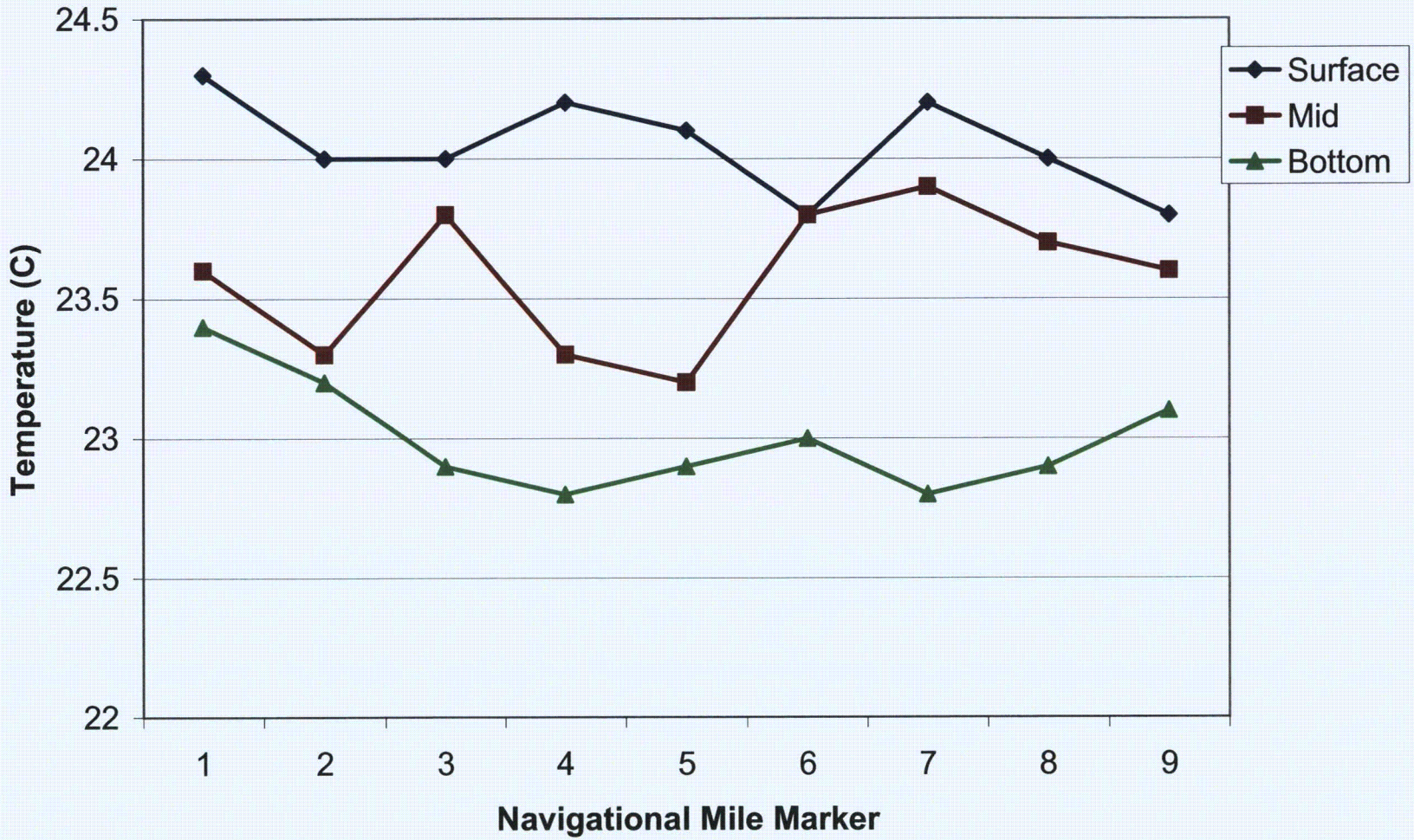


Figure 33. Monthly Temperature Readings for the Colorado River, October 2007.

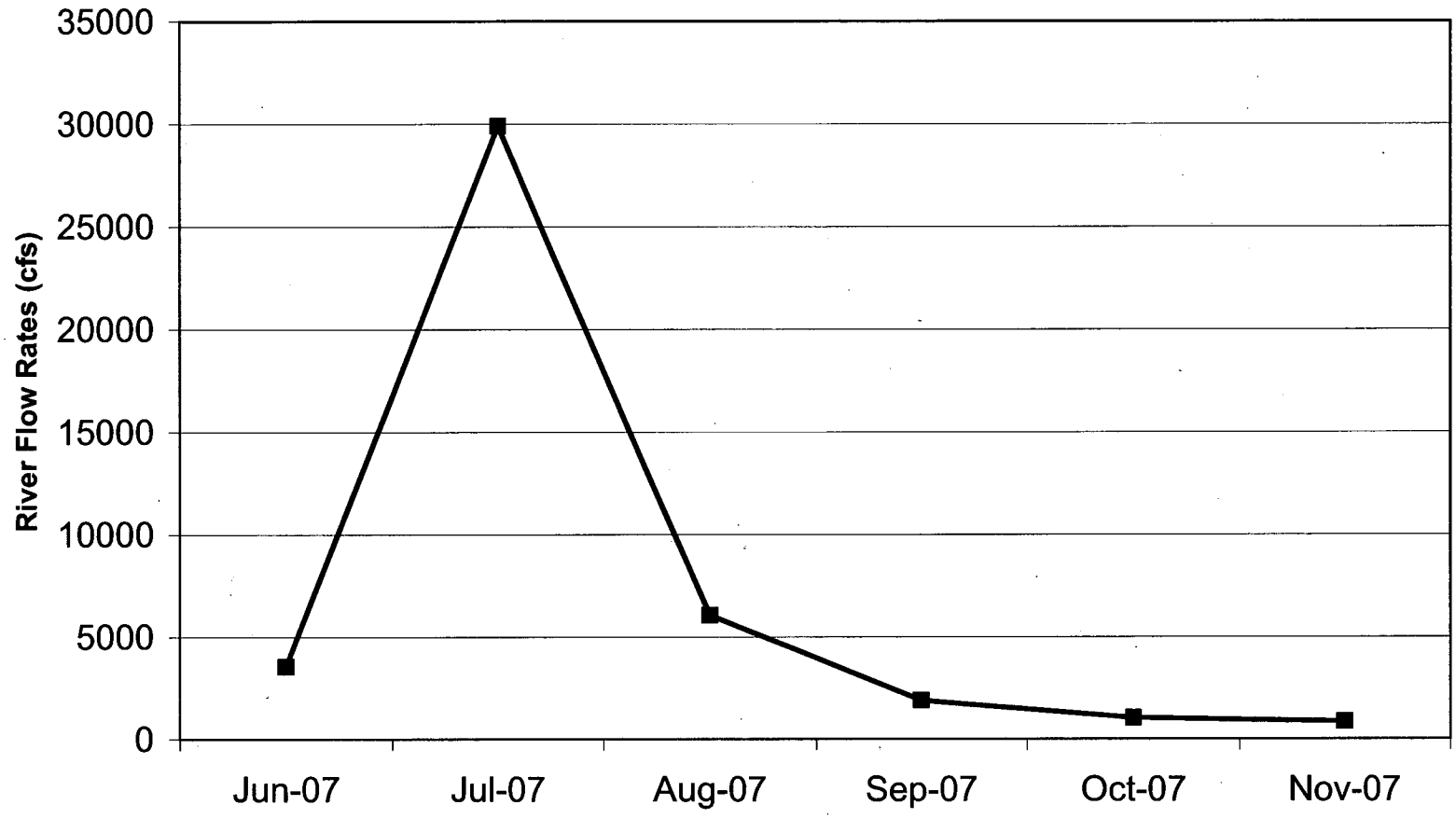


Figure 34. Monthly River Flow Rates

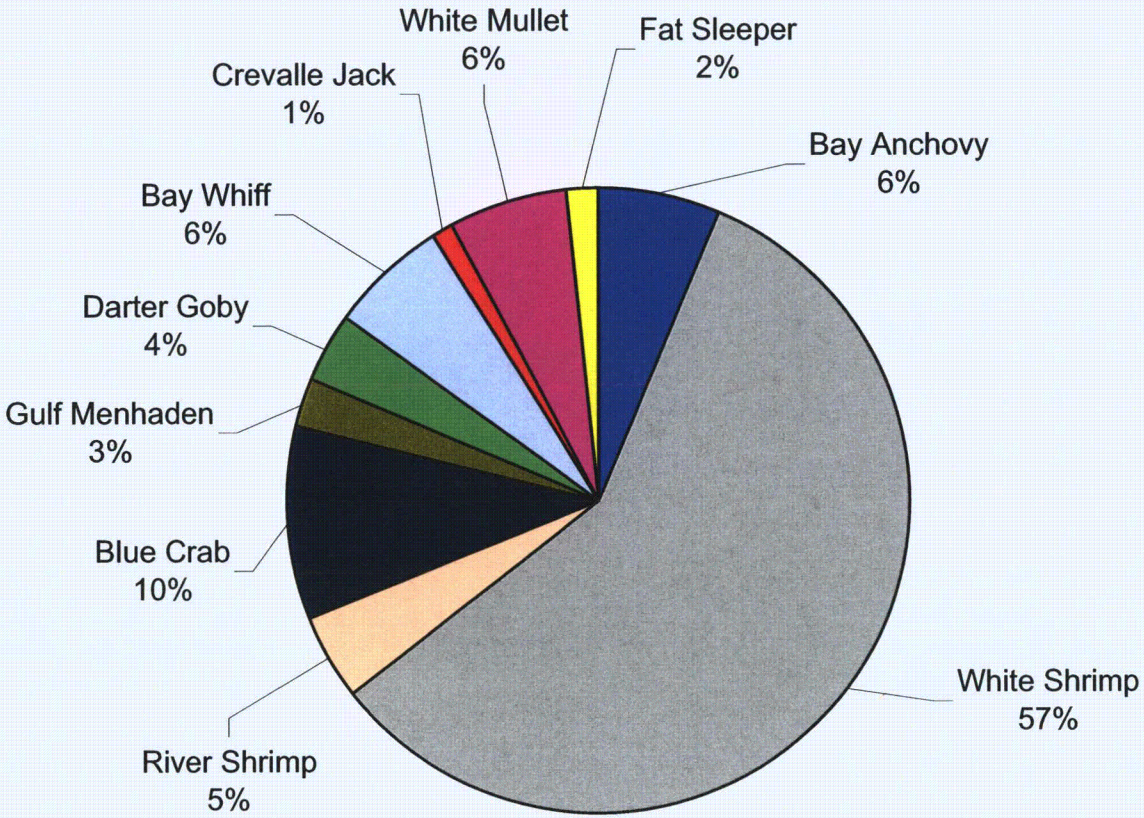


Figure 35. Percentage of Organisms >1% in Seine Samples 1983

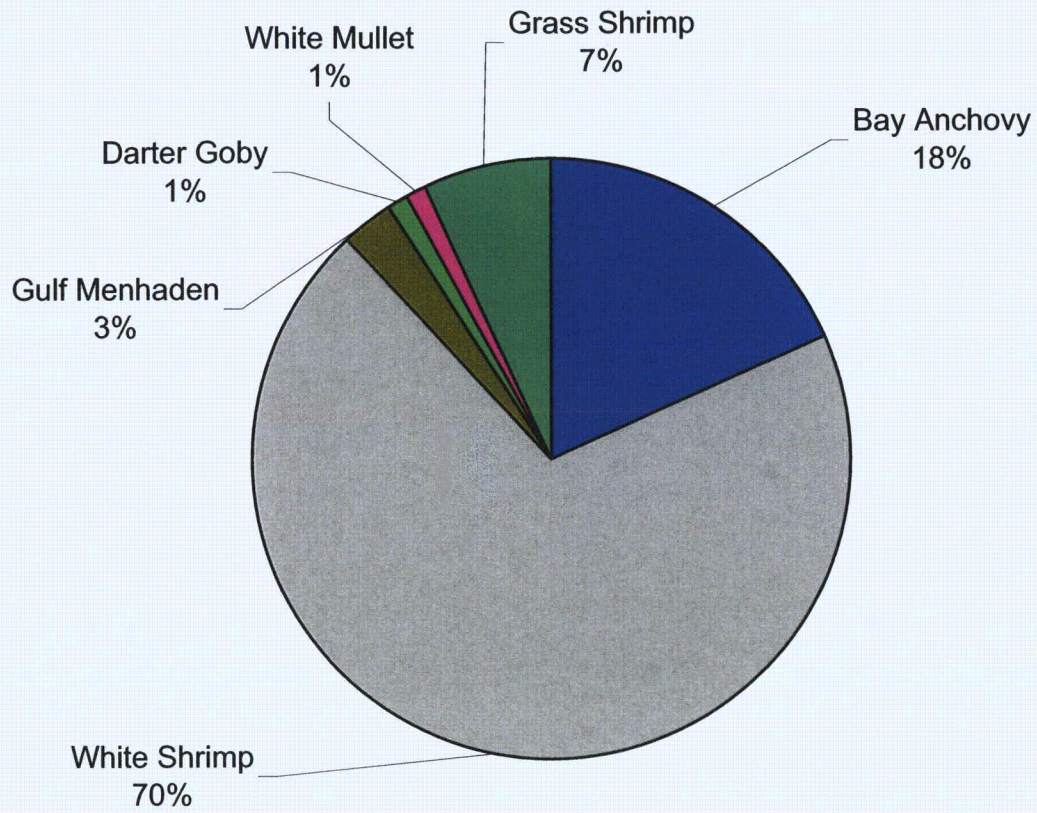


Figure 36. Percentage of Organisms >1% in Seine Samples 1984

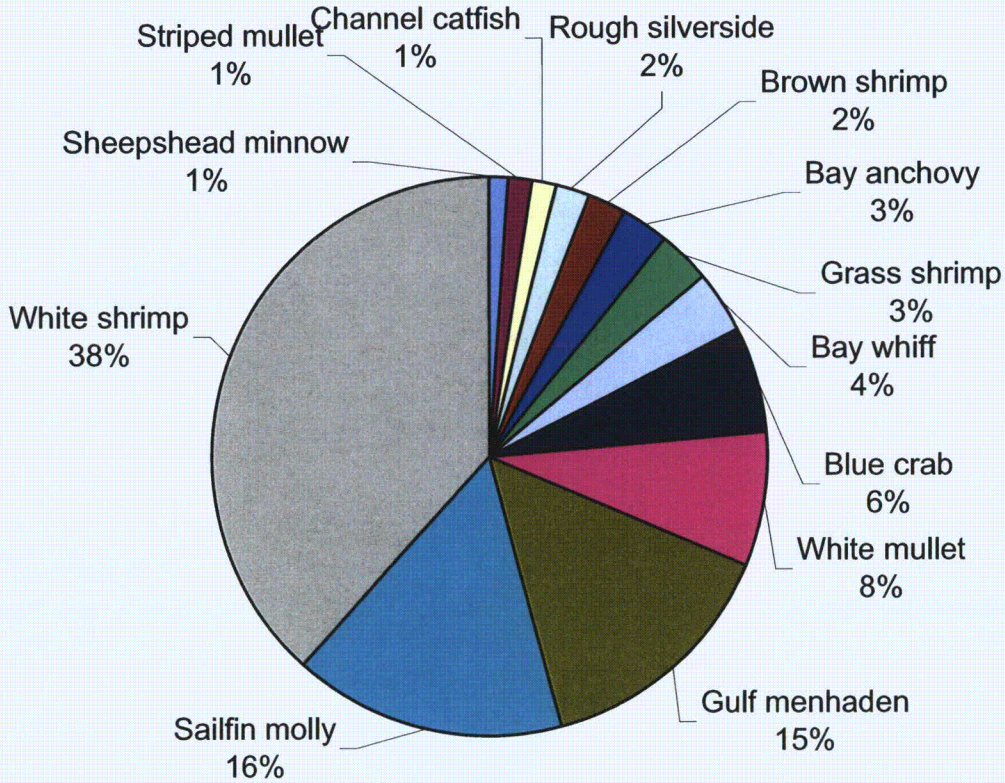


Figure 37. Percentage of Organisms >1% in Bag Seine Samples 2007

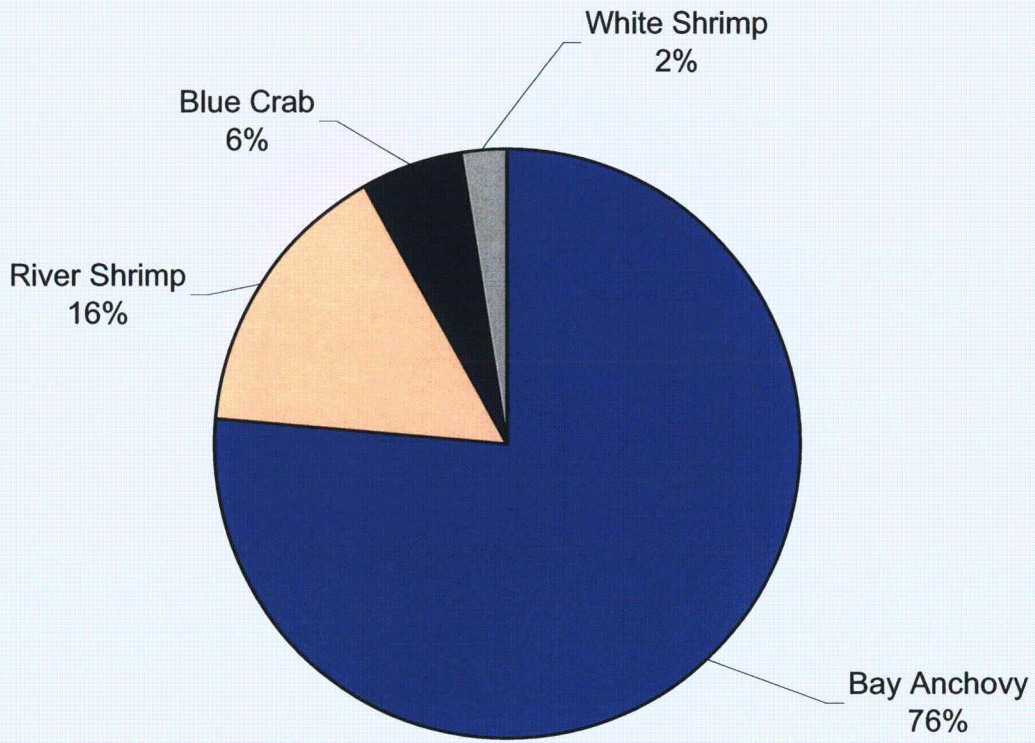


Figure 38. Percentage of Organisms >1% In Trawl Samples 1983

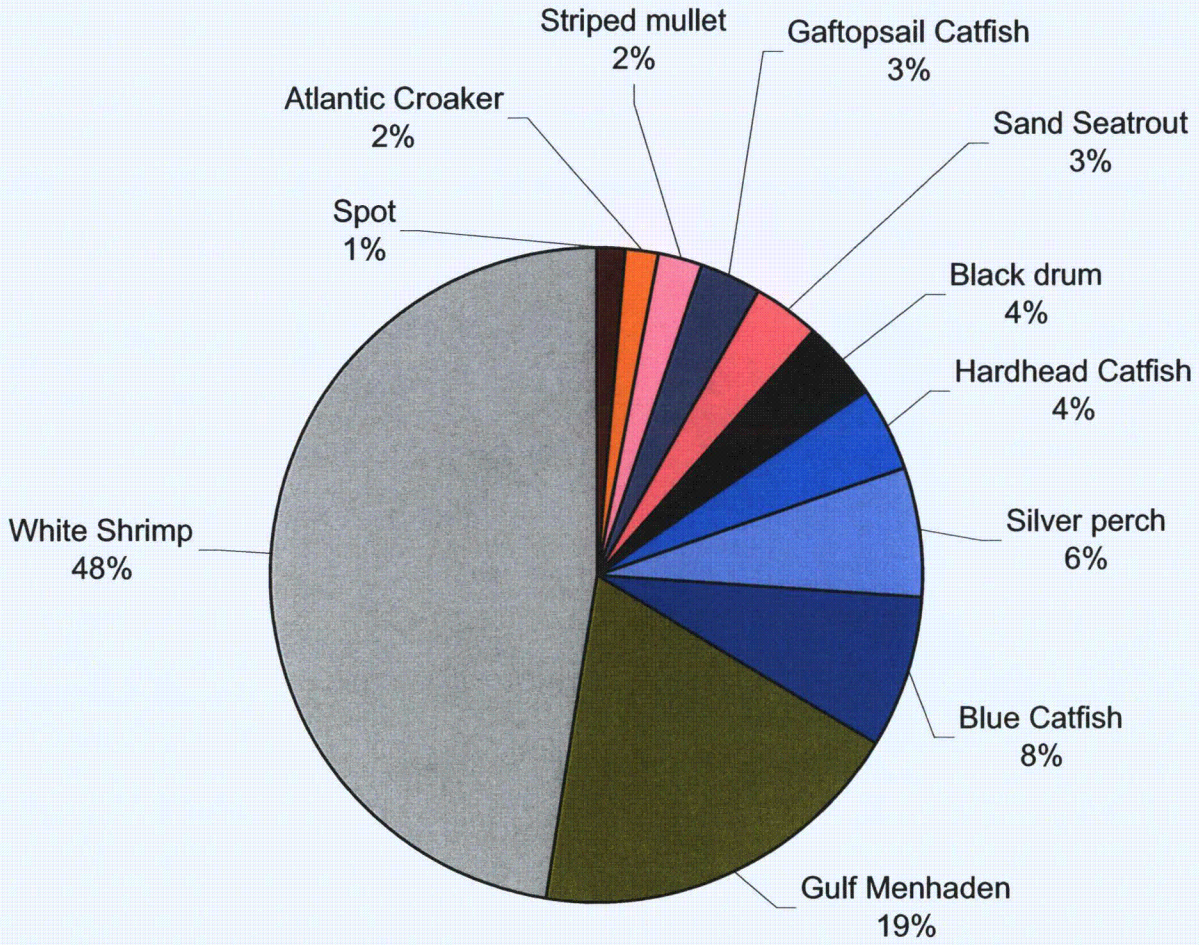


Figure 39. Percentage of Organisms >1% in Trawl Samples 2007

Appendix 1

Colorado River Sampling Protocol

- Fish population assessment will be conducted in accordance with techniques described in Fisheries Techniques by Nielson and Johnson (1983) and published by the American Fisheries Society.

- Fish population assessments are necessary to determine the status and health of a given fishery and are essential to formulating and meeting management goals. An estimate of relative abundance can be determined by counting the number of fish caught by an amount of effort. Effort is a combination of gear type, gear size, and length of time gear is used.

- The Colorado River will be sampled based on establishing three equal river segments that extend from the Intercoastal Waterway (ICWW) up to FM 521. Each river segment will be sampled equally with four sample gears. Each sample location will be verified with Global Positioning Satellite (GPS) and will provide exact location for sample replication.

- Four gear types will be utilized to collectively address diversity of species and habitat requirements for fish population assessments. The gear types include trawls, gill nets, bag seines, and hoop nets.

- *1) Trawls* are bag-shaped nets, which are towed or dragged along the bottom or through the water column to collect fish and other aquatic organisms. The use of a trawl requires mechanical devices to actively move the net through the water. Trawls vary in size and can be operated behind small to large vessels. The function of trawls is determined by the part of the water column that is sampled. Trawls are held open by doors, frames, beams, and tension asserted by towing cables. Trawls are sampling gears used to sample the composition, distribution, and abundance of fishes and aquatic organisms. They are used primarily in marine environments; however, their uses in fresh water are documented (Nielson and Johnson, 1983).

  - ENSR staff will use 6.1 m (20 ft) otter trawls to sample each of five fixed and five random station locations. The otter trawl has a 6.1 m (20 ft) head rope measured from shackle to shackle across the head-rope and foot-rope.

  - Two doors measuring 46 cm (18") x 91 cm (36") will be attached to each wing of the net. Each door will then be attached to a 30.5 m (100 ft) long bridal attached to the stern of the towing vessel. The net will be comprised of 3.5 cm (1 3/8 in) stretched mesh throughout.

  - Nets will be towed for ten-minute intervals behind a 6.4 m (21-ft) center console boat with a 125-hp engine. The tow speed will be set at 3 knots for all samples and occur in a circular fashion within a one mile square grid.

- Two, 10-minute samples will be collected during daylight hours for each river segment during each biweekly period for a total of 12 samples per month (48 samples total). Data collected from the trawls will be used to determine species composition, length frequencies by species and estimate of relative abundance by species for the entire population. Relative abundance will be calculated by counting the number of individuals and dividing by the amount of time for each tow.

- *2) Gill nets* are single walls of netting which are comprised of different shapes and sizes of mesh. Standard gill nets used by commercial and recreational fishermen are typically uniform in mesh size and pattern of mesh material (Nielson and Johnson, 1983). Experimental gill nets are typically comprised of several mesh panels, each panel having different mesh sizes and all made of the same material. Mesh materials usually consist of nylon, cotton, or monofilament line.
  - Gill nets are typically set in a straight line, perpendicular to shore and are held vertically in the water by weights and floats. Gill nets are a passive capture gear designed to capture fish by entanglement. Capture is dependent upon the fish encountering the net and either becoming wedged, gilled or tangled in the net material.
  - Gill nets are used to sample fish in a wide range of habitats and are effective in capturing many different species of fish. They are especially selective for species that move appreciable distances in their daily patterns. Gill nets are most effective when set overnight and are selective for certain species, sizes and sexes. Experimental gill nets built with multiple panels of different size meshes are very effective in reducing the effects of size selectivity.
  - ENSR staff will use [three] experimental gill nets constructed of monofilament mesh. Each net will be 33.3 m (100 ft) long, 1.2 m (4 ft) deep and will have 10.2 cm (4 inch) stretched mesh.
  - One gill net set in each river segment will be placed at sunset and retrieved at sunrise on the following morning during each of the biweekly sample periods for a total of 6 samples per month (24 samples total). All fish captured in the nets will be sorted according to each section of mesh, then identified by species, and measured to the nearest millimeter total length (TL). Data collected from the experimental gill nets will be used to evaluate species distribution, species composition, length frequencies by species, and estimates of relative abundance for each species, by mesh size. Relative abundance will be calculated by counting the number of fish per each mesh, per net and dividing by the amount of fishing time for each net in each site.

- *3) Bag seines* are an active fishing gear designed to trap fish by enclosing them with a long fencelike wall of webbing. Bag seines are used in shallow waters where the net wall extends from the surface to the bottom. They are selective for small fish and invertebrate species that are slow moving and utilize shoreline habitats. Bag seines are most effective when pulled over smooth substrate. .
  - ENSR staff will use a bag seine that is 18.3 m (60 ft) long, 1.8 m (6 ft) deep, with 19-mm (0.75-in) stretched nylon multifilament in the wings and 13-mm (0.50-in) stretched

nylon multifilament mesh in the bag. A 12.2-m (40-ft) rope will be hung between the two bridal poles to maintain equal distance in net spread. A pre-measured 15.2 m (50 ft) rope will be used to mark the area of shoreline to be covered during the seine collection.

- Two bag seine samples will be collected near shore from each river segment during each biweekly sampling period for a total of 12 samples per month (48 samples total). Nets will be deployed and retrieved during daylight hours. Relative abundance will be a function of the area (number per hectare) and the number of fish captured in the seine haul.

4) Hoop nets are entrapment nets. They are cylindrical or conical in shape and are distended by a series of hoops or frames covered by netting. Hoop nets are selective for fish species that are attracted by cover, bait, or other fish. Their ability to capture fish is influenced by the hoop diameter, mesh dimensions, baiting of the net, and by turbidity. Standardization of the net design, sample regime and location will help reduce sampling variability.

- ENSR staff will use two hoop nets per river segment during each biweekly period for a total of 12 samples per month (48 samples total). Each net will be 12 ft in length, will have a hoop diameter of 3 ft, and will have 1 in. stretched mesh cotton netting (dipped in nylon coating). Nets will be placed at randomly selected locations at sunrise and soaked for three hours during each sampling period. Since this is a passive assessment of the fish present, it will support a qualitative assessment of fish taxa richness.
- A suite of standard water quality measurements will be collected in the field during each sampling event to assist in the analysis of the biological data, specifically for episodic events. Data will be collected at the beginning and end of each sampling event, and more often if obvious environmental factors change such as a passing cold front or an excessive rainfall event. ENSR will use a YSI 85 water quality instrument to measure temperature, dissolved oxygen (DO), and salinity. Meters will be field calibrated prior to data collection.

Reference:

Nielsen, L.A. and D.L. Johnson. 1983. Fisheries Techniques. American Fisheries Soc. Publication, Bethesda, Maryland, U.S.A. 468 p.