

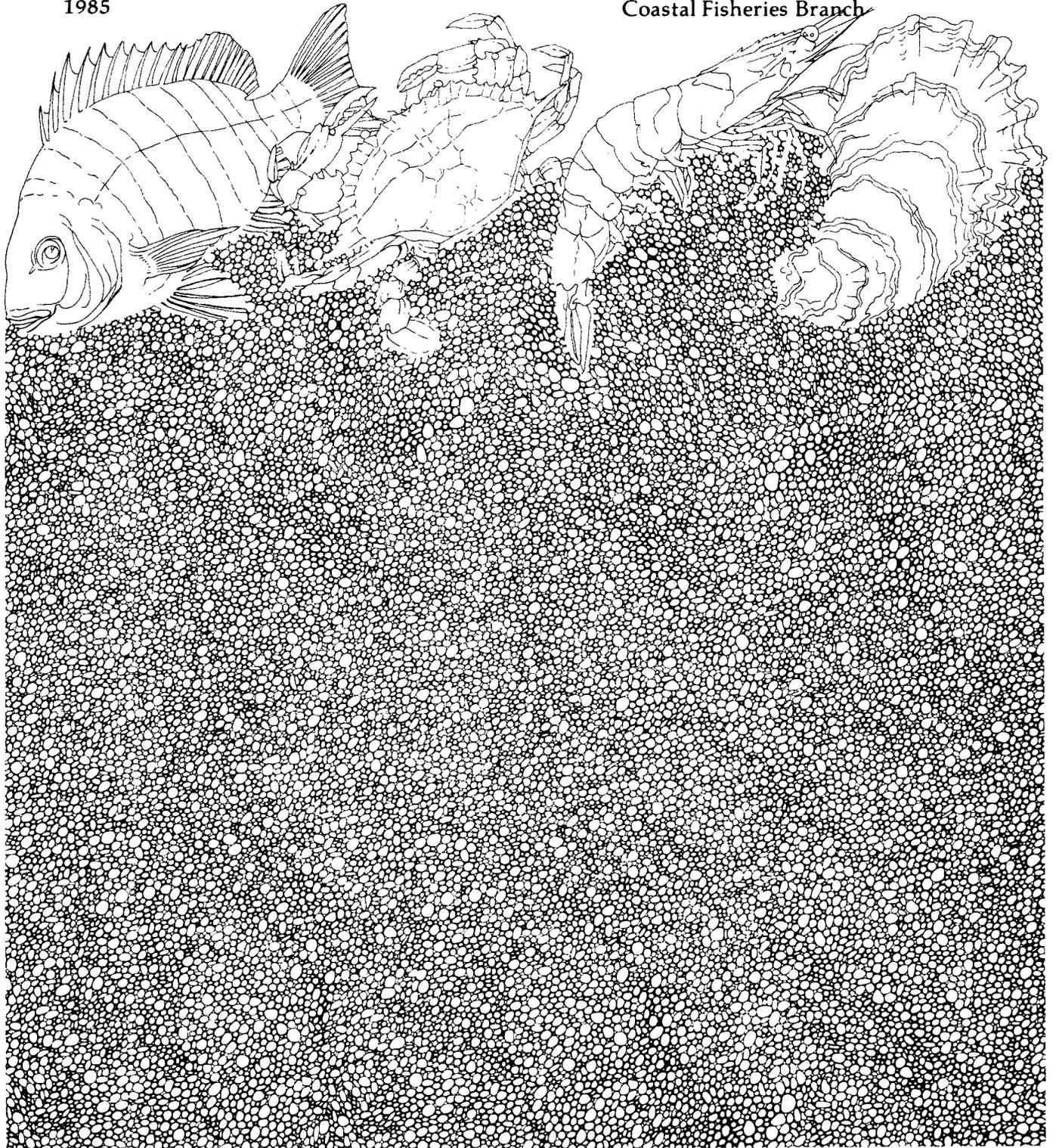
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# Potential Catch in Sport Beach Seines On the Upper Texas Coast

by William B. Kittrell, Gary E. Saul, Roy B. Johnson  
and Gary C. Matlock

Management Data Series Number 74  
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## ABSTRACT

Mean monthly catch rates of animals in a 91.4 m seine pulled at six randomly selected sites between Sea Rim State Park and Bolivar Roads were determined. The potential catch in sport beach seines was then determined by multiplying mean catch rates by the estimated sport seining effort. The estimated annual sport beach seine catch of the 45 species captured in this study ranged from 463,000 to 89,000,000 animals. The harvest by 1,800 net fishermen could equal or exceed the harvest of 93,000 weekend sport-boat fishermen using hook and line in Galveston Bay.

## INTRODUCTION

Beach seines are a historical method of harvesting fish on the Texas coast. Farley (1974) stated that an increase in commercial landings of spotted seatrout (Cynoscion nebulosus) from 118,752 kg in 1972 to 240,907 kg in 1973 "resulted largely from beach seine catches on the upper Texas coast." Beach seines were also used by sport fishermen to harvest fish prior to Legislative actions protecting overfished populations of red drum and spotted seatrout (Johnson et al. 1985). These actions prohibited the use of nets by sport and commercial fishermen (Anonymous 1983). Although the primary food fish caught by sport beach seiners was spotted seatrout (Johnson et al. 1985), a considerable by-catch of other finfish and shellfish could be expected because it typically occurs in net fisheries. McFarland (1963) found that striped mullet (Mugil cephalus), Atlantic threadfin (Polydactylus octonemus), Gulf kingfish (Menticirrhus littoralis), barred grunt (Conodon nobilis), and Florida pompano (Trachinotus carolinus) were the most abundant (by weight) of 47 species caught in beach seine collections at Mustang Island, Texas.

Johnson et al. (1985) determined the impacts of estimated catch of spotted seatrout in sport beach seines on the upper Texas coast. The objective of this study was to determine species composition and estimated catch of all species captured in sport beach seines operated by Texas Parks and Wildlife Department (TPWD).

## MATERIALS AND METHODS

Beach seines used and methods of pulling the net were described by Johnson et al. (1985). From April 1983 to March 1984, a 91.4 m long seine with 3 meshes/15.2 cm was pulled each month at six randomly selected stations from Sea Rim State Park to the southwest tip of the Bolivar Peninsula (Figure 1). The seine was pulled parallel to the beach with one end on shore. All specimens collected were counted by species.

Mean monthly catch rates (No./drag) of marine organisms caught in > 6 samples were compared ( $P < 0.05$ ) using a one-way analysis of variance (Sokal and Rohlf 1981). Catch rates (No./drag + 1) were transformed to  $\log_{10}$  prior to analysis to reduce variance heterogeneity. Comparisons among monthly means by species were made using the Duncan multiple range test (Sokal and Rohlf 1981).

Potential catch of marine organisms by sport seines with appropriate standard errors (Sokal and Rohlf 1981) was estimated by multiplying mean monthly catch/effort times effort. Assumptions regarding the fishery were the same as made by Johnson et al. (1985): 1) all 1854 people signing a petition opposing the prohibition of sport beach seining in 1982 were

seiners; 2) 3 people were required to operate a seine (TPWD used 3 people); 3) each drag required 1 hour (TPWD took  $43.4 \pm 2.3$  minutes); 4) 2 hours/day were spent in non-seining activities; 5) there was no night seining; and 6) there was no illegal seining (i.e., no seines were pulled on weekends). The best estimate of effort was assumed to be from 100 to 600 seines operated annually with the same number of trips/year (18) and monthly distribution of trips (0.5 to 2.8 trips/month) as that of saltwater boat anglers (Ferguson and Green in preparation). The average trip length of 3.5 hours equals the average trip length of saltwater boat anglers (McEachron et al. 1981). Data for months with statistically similar catches/effort were combined to estimate a single mean prior to multiplying by the fishing effort for those months.

## RESULTS

The best estimate of the annual sport beach seine catch ranges from 463,000 to 2,780,000 animals (Table 1). Potential annual catch in 600 sport beach seines could exceed 89,000,000 organisms including 37,000,000 striped mullet, 22,000,000 blue crabs (Callinectes sapidus), 7,000,000 Atlantic threadfin, 5,000,000 hardhead catfish (Arius felis), 4,000,000 spotted seatrout, 3,000,000 spot (Leiostomus xanthurus) and 3,000,000 cabbagehead (Stomolophus meleagris) (Table 2). The catch of black drum (Pogonias cromis), red drum (Scianops ocellatus), sheepshead (Archosargus probatocephalus), Atlantic croaker (Micropogonias undulatus), sand seatrout (C. arenarius), Florida pompano, and southern kingfish (M. americanus) could be 500,000 to 1,600,000 organisms.

Our beach seine catch consisted of 4,242 fish and shellfish representing 45 species (Table 3). Seven species (striped mullet, blue crab, Atlantic threadfin, hardhead catfish, spotted seatrout, cabbagehead and spot) were represented by  $\geq 100$  specimens. Of the 17 most frequently caught species, 13 had catch rates which varied significantly among months (Table 4). Nine species (Atlantic croaker, Atlantic threadfin, black drum, blue crab, Florida pompano, hardhead catfish, sand seatrout, southern kingfish and spotted seatrout) had highest catch rates during summer (Table 2, Figure 2). Red drum, spot and striped mullet had high catch rates during fall (Table 2, Figure 2).

## DISCUSSION

Projected best estimates of fishes caught in beach seines indicate that harvest of some species by a relatively small net fishery could equal or exceed the landings by weekend sport-boat fishermen in Galveston Bay. In 1982-83, 93,000 sport-boat fishermen (Ditton and Fedler 1983) spent 788,000 man-hours on weekends alone to harvest 14,700 red drum and 34,500

black drum (McEachron and Green 1984). This compares to an estimated catch of 15,548 red drum and 47,533 black drum in 600 seines (1800 fishermen) fished 113,400 man-hours. A similar result was found for spotted seatrout (Johnson et al. 1985). Therefore, prohibition of beach seining has distributed the available resource to the greatest number of users.

Impacts of the estimated catch on animals depends on existing population levels, fisherman compliance with bag, possession and size limits and differential survival rates of released animals. The 1983-84 red drum limit of 10 fish per fisherman per day, for instance, would not be exceeded by estimated beach seine catches. However, since only 42% of the red drum caught would be of the 1983 legal size limit, it would be necessary to return fish to the water. Not all fishes (and presumably other animals) would survive after release. Survival rates vary among species (Hegen et al. 1984). Colura (1974) found no difference in survival of netted and control black drum in pond studies, but Hegen et al. (1982) reported that return rates of net-caught spotted seatrout were too low for use in tagging studies. The mortality of organisms caught in beach seines will vary according to species, handling procedures, exposure during netting activities, and physical stress and damage to the organism (such as that caused when fish are gilled).

The impacts of overfishing (Matlock 1982) and the loss of over 15 million animals during the freeze of December 1983 (McEachron et al. 1984) have resulted in fewer fish being available for capture. The prohibition of the use of nets by sport beach seiners has distributed the available catch to the greatest number of users.

## LITERATURE CITED

- Anonymous. 1983. Saltwater finfish research and management in Texas. A report to the Governor and the 68th Legislature. Tex. Pks. Wildl. Dep., PWD Rpt 3000-154. 48 p.
- Colura, Robert L. 1974. Survival of selected species of fish released after capture with commercial fishing gear. Tex. Pks. Wildl. Dep., Saltwater Pond Res. Study No. 2, Job 4. 7 p.
- Ditton, Robert B., and Anthony J. Fedler. 1983. A statewide survey of boatowners in Texas and their saltwater activity. Tex. A&M Univ., Sea Grant Prog., TAMU-SG-83-205. 65 p.
- Farley, O. H. 1974. Fisheries of Texas, 1973. Texas Landings, Annual Summary 1973. Current Fish. Stat. No. 6423. U.S. Dep. of Comm., NOAA, NMFS. 7 p.
- Ferguson, M. O., and A. W. Green (In preparation). Sport fishing boat trips missed by the Texas coastwide sport fishery survey. Tex. Pks. Wildl. Dep., Coast. Fish. Branch.
- Hegen, H. E., G. E. Saul, and G. C. Matlock. 1984. Survival of handled and tagged spotted seatrout held in wood and wire cages. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 61. 13 p.
- \_\_\_\_\_, G. C. Matlock, and A. W. Green. 1982. Handling and tagging survival of hook-caught spotted seatrout held in cages. Proc. Tex. Chap. Am. Fish. Soc. 5:39-53.
- Johnson, R. B., G. C. Matlock, W. B. Kittrell, G. E. Saul. 1985. Spotted seatrout catches in beach seines on the upper Texas coast. Proc. 7th Annu. Meet., Tex. Chap. Am. Fish. Soc., Sep. 13-14, 1984, Port Aransas, Tex. \_ \_ p. (In press).
- Matlock, G. C. 1982. The conflict between user groups of red drum and spotted seatrout in Texas. Pages 101-108 in: R. H. Stroud (ed.). Proc. Seventh Ann. Meet., Marine Recr. Sym.
- McEachron, L. W., A. W. Green, L. Z. Barrington, M. G. Weixelman, P. Campbell-Hostettler, R. A. Spaw, K. W. Spiller and J. P. Breuer. 1981. Survey of finfish harvest of sport fishermen in selected Texas bays, September-August 1974-76 and 1979-80. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 24. 221. p.
- \_\_\_\_\_, and A. W. Green. 1984. Weekend sport boat fishermen finfish catch statistics for Texas bay systems, May 1974-may 1983. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 59. 138 p.
- \_\_\_\_\_, G. Saul, J. Cox, C. E. Bryan and G. Matlock. 1984. Fish kill. Tex. Parks and Wildl. Mag. 42(4):11-13.

McFarland, W. N. 1963. Seasonal change in the number and the biomass of fishes in the surf at Mustang Island, Texas. Publ. Inst. Mar. Sci., Univ. Texas. 9:91-105.

Sokal, R. R., and F. J. Rohlf. 1981. Biometry. W. H. Freeman and Co., San Francisco, Ca, USA. 859 p.

Table 1. Best estimate of potential sport beach seine catches by species in 100 to 600 seines in 18 annual fishing trips at 3.5 hours per trip<sup>a,b</sup>. Months with statistically similar ( $P > 0.05$ ) catch rates were combined.

Species	Period	Seines		
		100	300	600
<u>FISH</u>				
Atlantic croaker	Jul	2,377	7,132	14,263
	Aug-Jun	2,239	6,716	13,432
	Annual	4,616	13,848	27,695
Atlantic threadfin	Jun-Jul	43,186	129,559	259,119
	Aug-May	1,276	3,827	7,654
	Annual	44,462	133,386	266,773
Black drum	Jun-Jul	4,993	14,978	29,956
	Aug-May	2,929	8,788	17,577
	Annual	7,922	23,766	47,533
Florida pompano	Jul	2,243	6,728	13,457
	Aug-Jun	1,420	4,259	8,518
	Annual	3,663	10,987	21,975
Hardhead catfish	Jun-Jul	21,262	63,787	127,575
	Aug-May	5,103	15,309	30,618
	Annual	26,365	79,096	158,193
Red drum	Sep	1,117	3,352	6,703
	Oct-Aug	1,474	4,423	8,845
	Annual	2,591	7,775	15,548
Sand seatrout	Jun-Jul	3,544	10,631	21,262
	Aug-May	472	1,417	2,835
	Annual	4,016	12,048	24,097
Sheepshead	Annual	4,095	12,285	24,570
Southern flounder	Annual	1,512	4,536	9,072
Southern kingfish	Jul	3,503	10,508	21,017
	Aug-Jun	764	2,293	4,586
	Annual	4,267	12,801	25,603
Spot	Jul/Oct	12,474	37,422	74,844
	Remainder of year	2,315	6,946	13,891
	Annual	14,789	44,368	88,735
Spotted seatrout	Jun-Jul	17,057	51,171	102,343
	Aug-May	4,252	12,757	25,515
	Annual	21,309	63,928	127,858

Table 1. (Cont'd.).

Species	Period	Seines		
		100	300	600
Striped mullet	May/Oct	126,844	380,533	761,065
	Remainder of year	40,673	122,018	244,037
	Annual	167,517	502,551	1,005,102
White mullet	Annual	1,638	4,914	9,828
<u>INVERTEBRATES</u>				
Blue crab	Jul-Aug	116,025	348,075	696,150
	Sep-Jun	18,726	56,179	112,358
	Annual	134,751	404,254	808,508
Cabbagehead	Jun/Sep	16,411	49,234	98,469
	Remainder of year	1,654	4,961	9,922
	Annual	18,065	54,195	108,391
Speckled crab	Annual	1,638	4,914	9,828
Other species <sup>c</sup>	Annual	504	1,512	3,024
Total annual catch		463,720	1,391,164	2,782,333

<sup>a</sup>Number of trips per year and seasonality from Ferguson and Green (In preparation).

<sup>b</sup>Mean trip length from McEachron et al. (1981)

<sup>c</sup>Other species includes 28 species (see Table 3).

Table 2. Potential annual catch of species in 100 to 600 seines in 10 drags per day, 22 days fished per month. A seine is a 91.4 m beach seine operated by 3 persons.

Species	Periods <sup>a</sup>	Days fished <sup>b</sup>	Catch/drag	Seines	
				100	600
<u>FISH</u>					
Atlantic croaker	Jul	22	2.83	62,260	373,560
	Aug-Jun	242	0.41	99,220	595,320
	Annual	264		161,480	968,880
Atlantic threadfin	Jun-Jul	44	27.42	1,206,480	7,238,880
	Aug-May	220	0.27	59,400	356,400
	Annual	264		1,265,880	7,595,280
Black drum	Jun-Jul	44	3.17	139,480	836,880
	Aug-May	220	0.62	136,400	818,400
	Annual	264		275,880	1,655,280
Florida pompano	Jul	22	2.67	58,740	352,440
	Aug-Jun	242	0.26	62,920	377,520
	Annual	264		121,660	729,960
Hardhead catfish	Jun-Jul	44	13.50	594,000	3,564,000
	Aug-May	220	1.08	237,600	1,425,600
	Annual	264		831,600	4,989,600
Red drum	Sep	22	1.33	29,260	175,560
	Oct-Aug	242	0.27	65,340	392,040
	Annual	264		94,600	567,600
Sand seatrout	Jun-Jul	44	2.25	99,000	594,000
	Aug-May	220	0.10	22,000	132,000
	Annual	264		121,000	726,000
Sheepshead	Annual	264	0.65	171,600	1,029,600
Southern flounder	Annual	264	0.24	63,360	380,160
Southern kingfish	Jul	22	4.17	91,740	550,440
	Aug-Jun	242	0.14	33,880	203,280
	Annual	264		125,620	753,720
Spot	Jul/Oct	44	7.92	348,480	2,090,880
	Remainder of year	220	0.49	107,800	646,800
	Annual	264		456,280	2,737,680
Spotted seatrout	Jun-Jul	44	10.83	476,520	2,859,120
	Aug-May	220	0.90	198,000	1,188,000
	Annual	264		674,520	4,047,120

Table 2. (Cont'd.).

Species	Periods <sup>a</sup>	Days fished <sup>b</sup>	Catch/drag	Seines	
				100	600
Striped mullet	May/Oct	44	100.67	4,429,480	26,576,880
	Remainder of year	220	8.07	1,775,400	10,652,400
	Annual	264		6,204,880	37,229,280
White mullet	Annual	264	0.26	68,640	411,840
<u>INVERTEBRATES</u>					
Blue crab	Jul-Aug	44	63.75	2,805,000	16,830,000
	Sep-Jun	220	4.18	919,600	5,517,600
	Annual	264		3,724,600	22,347,600
Cabbagehead	Jun/Sep	44	10.42	458,480	2,750,880
	Remainder of year	220	0.35	77,000	462,000
	Annual	264		535,480	3,212,880
Speckled crab	Annual	264	0.26	68,640	411,840
Other species	Annual	264	0.08	21,120	126,720
Total annual catch				14,986,840	89,921,040

<sup>a</sup>Months with significantly different catch rates ( $P \leq .05$ ) are presented separately.

<sup>b</sup>Days fished calculated according to the methods used by Johnson et al. 1985.

Table 3. Number, frequency of catch, and annual catch per drag of species captured in beach seines during April 1983-March 1984.

Common name	Species	Number caught	Samples containing organisms	Catch/drag $\pm$ 1 SE
	Scientific name			
<u>FISH</u>				
Atlantic bumper	<u>Chloroscombrus chrysurus</u>	71	3	0.99 $\pm$ 0.90
Atlantic croaker	<u>Micropogonias undulatus</u>	44	13	0.61 $\pm$ 0.20
Atlantic needlefish	<u>Strongylura marina</u>	1	1	0.01 $\pm$ 0.01
Atlantic spadefish	<u>Chaetodipterus faber</u>	9	5	0.12 $\pm$ 0.06
Atlantic stingray	<u>Dasyatis sabina</u>	3	3	0.04 $\pm$ 0.02
Atlantic threadfin	<u>Polydactylus octonemus</u>	345	13	4.79 $\pm$ 2.28
Bay anchovy	<u>Anchoa mitchilli</u>	2	2	0.03 $\pm$ 0.02
Bighead searobin	<u>Prionotus tribulus</u>	1	1	0.01 $\pm$ 0.01
Black drum	<u>Pogonias cromis</u>	75	31	1.04 $\pm$ 0.19
Blackcheek tonguefish	<u>Symphurus plagiusa</u>	1	1	0.01 $\pm$ 0.01
Blacktip shark	<u>Carcharhinus limbatus</u>	22	1	0.30 $\pm$ 0.30
Bluefish	<u>Pomatomus saltatrix</u>	3	1	0.04 $\pm$ 0.04
Bluntnose jack	<u>Hemicaranx amblyrhynchus</u>	2	2	0.03 $\pm$ 0.02
Crevalle jack	<u>Caranx hippos</u>	1	1	0.01 $\pm$ 0.01
Florida pompano	<u>Trachinotus carolinus</u>	33	12	0.46 $\pm$ 0.15
Gizzard shad	<u>Dorosoma cepedianum</u>	4	3	0.05 $\pm$ 0.03
Gulf butterfish	<u>Peprilus burti</u>	1	1	0.01 $\pm$ 0.01
Gulf kingfish	<u>Menticirrhus littoralis</u>	2	2	0.03 $\pm$ 0.02
Gulf menhaden	<u>Brevoortia patronus</u>	9	4	0.12 $\pm$ 0.08
Hardhead catfish	<u>Arius felis</u>	227	25	3.15 $\pm$ 1.03
Harvestfish	<u>Peprilus alepidotus</u>	3	2	0.04 $\pm$ 0.03
Lookdown	<u>Selene vomer</u>	7	1	0.10 $\pm$ 0.10
Pigfish	<u>Orthopristis chrysoptera</u>	2	2	0.03 $\pm$ 0.02
Pinfish	<u>Lagodon rhomboides</u>	1	1	0.01 $\pm$ 0.01
Red drum	<u>Sciaenops ocellatus</u>	26	12	0.36 $\pm$ 0.15
Sand seatrout	<u>Cynoscion arenarius</u>	33	11	0.46 $\pm$ 0.17
Sheepshead	<u>Archosargus probatocephalus</u>	47	16	0.65 $\pm$ 0.21
Skipjack herring	<u>Alosa chrysochloris</u>	3	1	0.04 $\pm$ 0.04
Southern flounder	<u>Paralichthys lethostigma</u>	17	11	0.24 $\pm$ 0.08
Southern kingfish	<u>Menticirrhus americanus</u>	34	9	0.47 $\pm$ 0.30
Southern stargazer	<u>Astroscopus y-graecum</u>	1	1	0.01 $\pm$ 0.01
Spanish sardine	<u>Sardinella aurita</u>	3	1	0.04 $\pm$ 0.04
Spot	<u>Leiostomus xanthurus</u>	125	21	1.74 $\pm$ 0.51
Spotted seatrout	<u>Cynoscion nebulosus</u>	184	31	2.55 $\pm$ 0.18
Star drum	<u>Stellifer lanceolatus</u>	9	2	0.12 $\pm$ 0.10
Striped mullet	<u>Mugil cephalus</u>	1692	61	23.50 $\pm$ 7.42
Tripletail	<u>Lobotes surinamensis</u>	1	1	0.01 $\pm$ 0.01
White mullet	<u>Mugil curema</u>	19	8	0.26 $\pm$ 0.10

Table 3. (Cont'd.).

Common name	Species	Number caught	Samples containing organisms	Catch/drag $\pm$ 1 SE
	Scientific name			
<u>INVERTEBRATES</u>				
Blue crab	<u>Callinectes</u> <u>sapidus</u>	1003	39	14.1 $\pm$ 4.96
Cabbagehead	<u>Stomolophus</u> <u>meleagris</u>	146	14	2.03 $\pm$ 1.08
Lesser blue crab	<u>Callinectes</u> <u>similis</u>	1	1	0.01 $\pm$ 0.01
Speckled crab	<u>Arenaeus</u> <u>cribrarius</u>	19	12	0.26 $\pm$ 0.09
Spider crab	<u>Libinia</u> <u>emarginata</u>	1	1	0.01 $\pm$ 0.01
Stone crab	<u>Menippe</u> <u>mercenaria</u>	3	3	0.04 $\pm$ 0.02
White shrimp	<u>Penaeus</u> <u>setiferus</u>	6	2	0.08 $\pm$ 0.05

Table 4. Summary of one-way analyses of variance of mean monthly catches (catch/drag + 1,  $\log_{10}$  transformed) for the most frequently caught species during April 1983-March 1984.

Group	Source of variation	Degrees of freedom	Mean square	F
<u>FISH</u>				
Atlantic croaker	Total	71		
	Months	11	0.109	2.14*
	Error	60	0.051	
Atlantic threadfin	Total	71		
	Months	11	0.793	6.43*
	Error	60	0.123	
Black drum	Total	71		
	Months	11	0.217	4.47*
	Error	60	0.048	
Florida pompano	Total	71		
	Months	11	0.133	4.50*
	Error	60	0.030	
Hardhead catfish	Total	71		
	Months	11	0.562	4.32*
	Error	60	0.130	
Red drum	Total	71		
	Months	11	0.065	2.31*
	Error	60	0.028	
Sand seatrout	Total	71		
	Months	11	0.136	4.68*
	Error	60	0.029	
Sheepshead	Total	71		
	Months	11	0.064	1.08
	Error	60	0.048	
Southern flounder	Total	71		
	Months	11	0.028	1.35
	Error	60	0.021	
Southern kingfish	Total	71		
	Months	11	0.080	2.36*
	Error	60	0.034	

Table 4. (Cont'd.).

Group	Source of variation	Degrees of freedom	Mean square	F
Spot	Total	71		
	Months	11	0.390	4.30*
	Error	60	0.091	
Spotted seatrout	Total	71		
	Months	11	0.546	5.85*
	Error	60	0.093	
Striped mullet	Total	71		
	Months	11	1.001	3.17*
	Error	60	0.316	
White mullet	Total	71		
	Months	11	0.032	1.18
	Error	60	0.027	
<u>INVERTEBRATES</u>				
Blue crab	Total	71		
	Months	11	1.320	5.22*
	Error	60	0.253	
Cabbagehead	Total	71		
	Months	11	0.250	2.38*
	Error	60	0.105	
Speckled crab	Total	71		
	Months	11	0.025	1.06
	Error	60	0.024	

\*P  $\leq$  0.05

Figure 1. Area in which beach seine samples were collected, April 1983-March 1984.

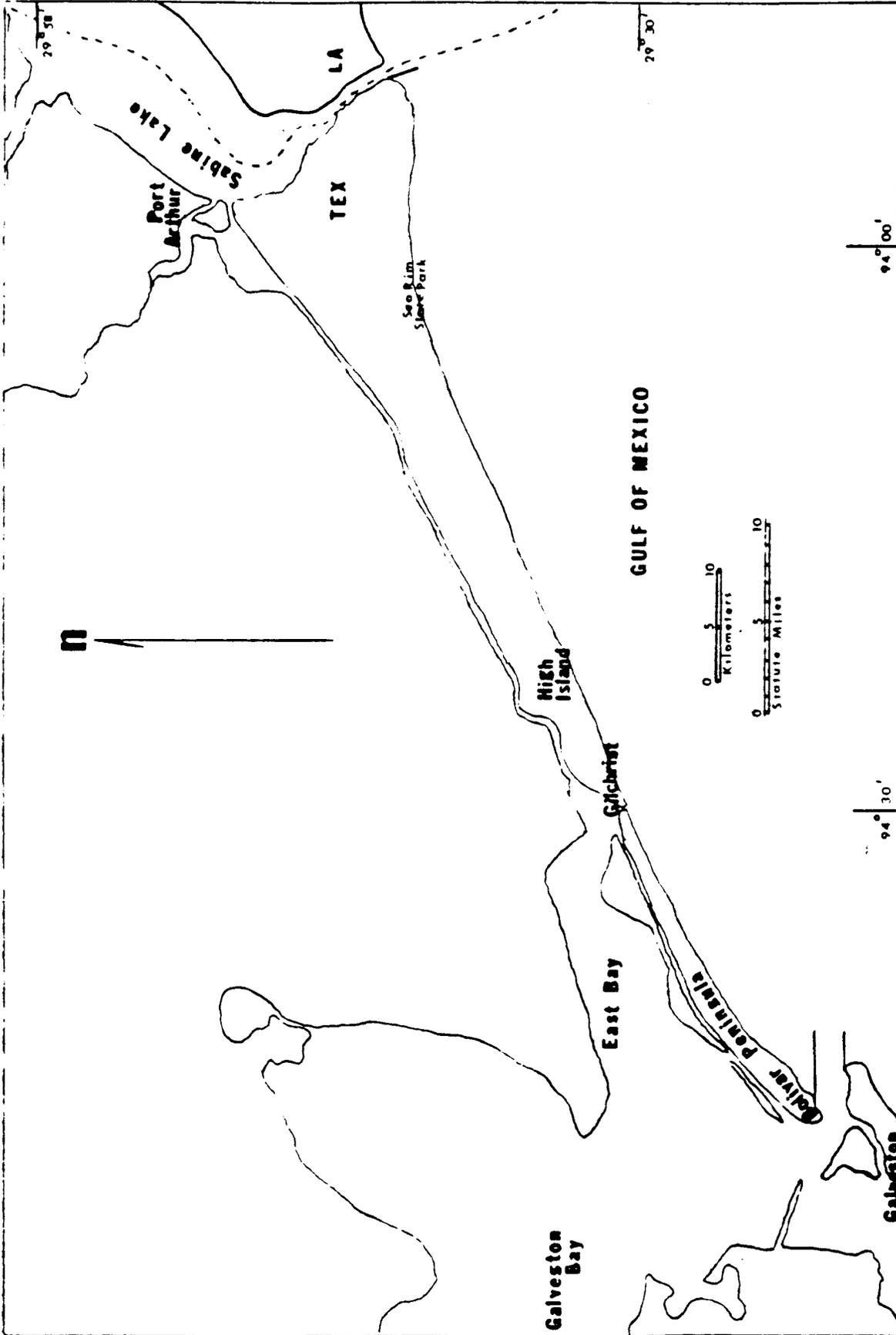
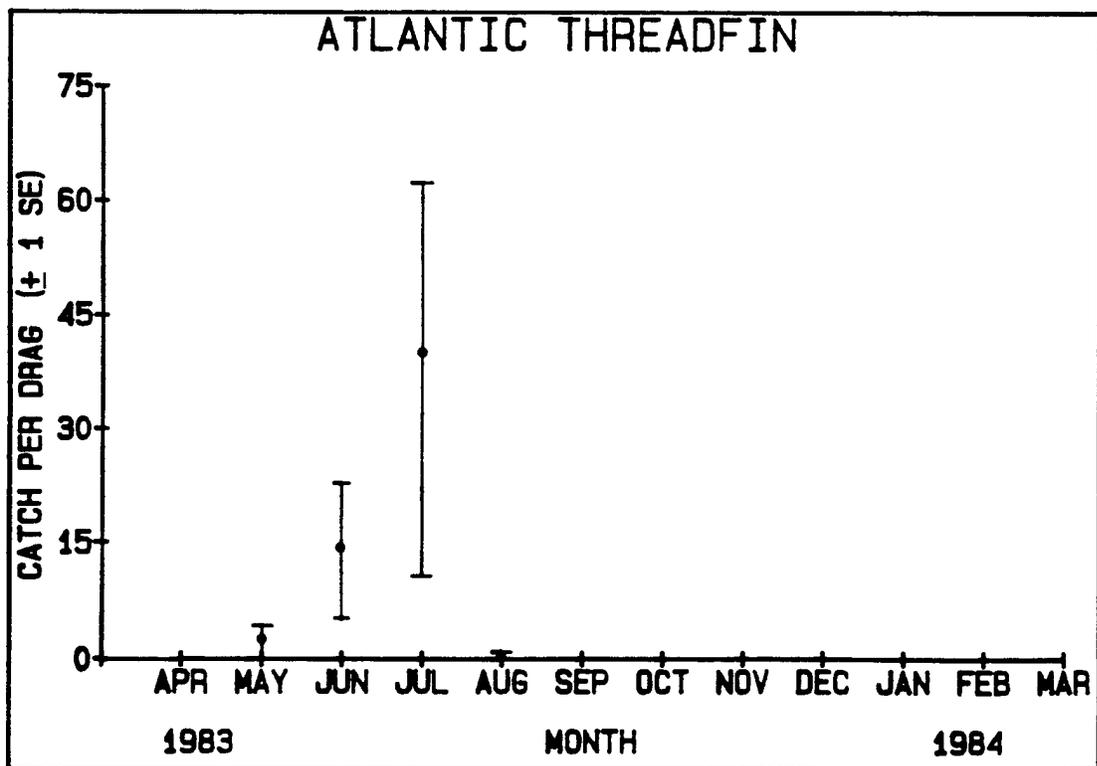
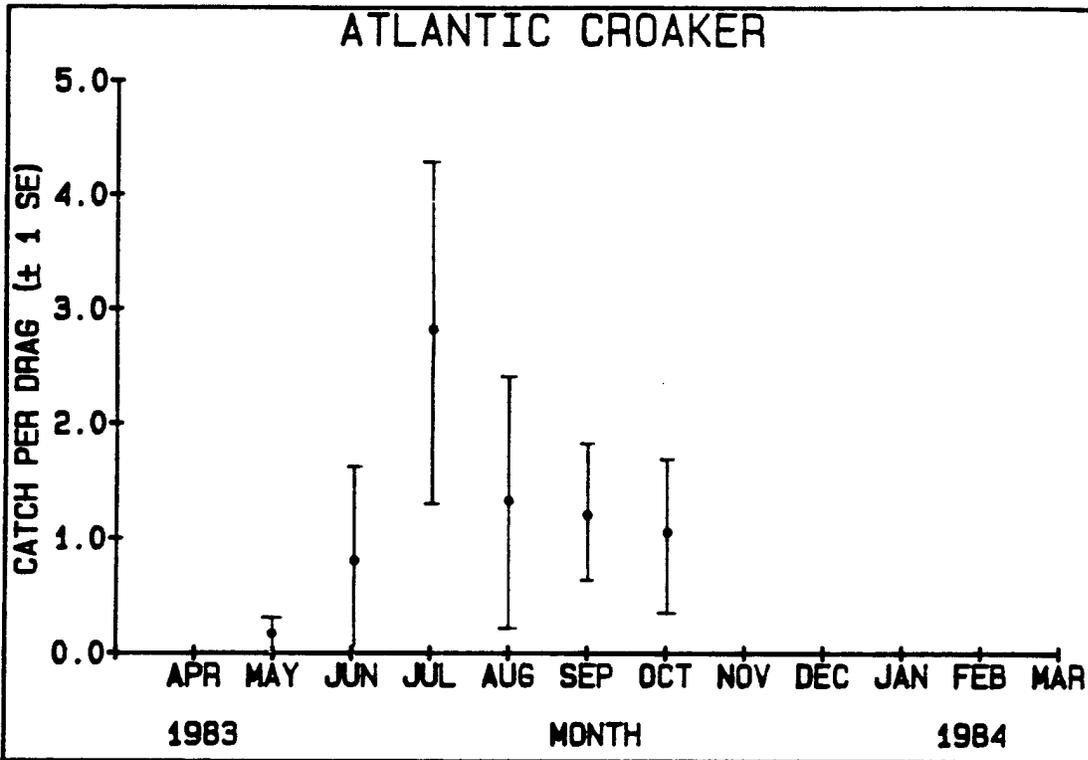
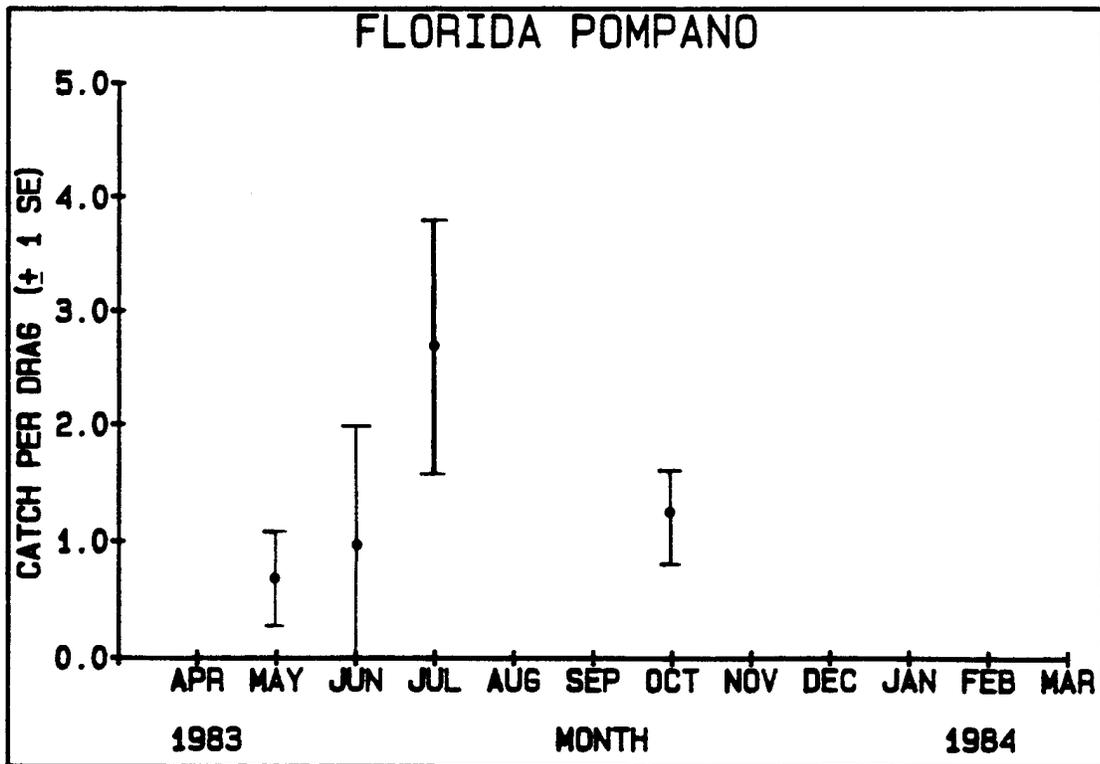
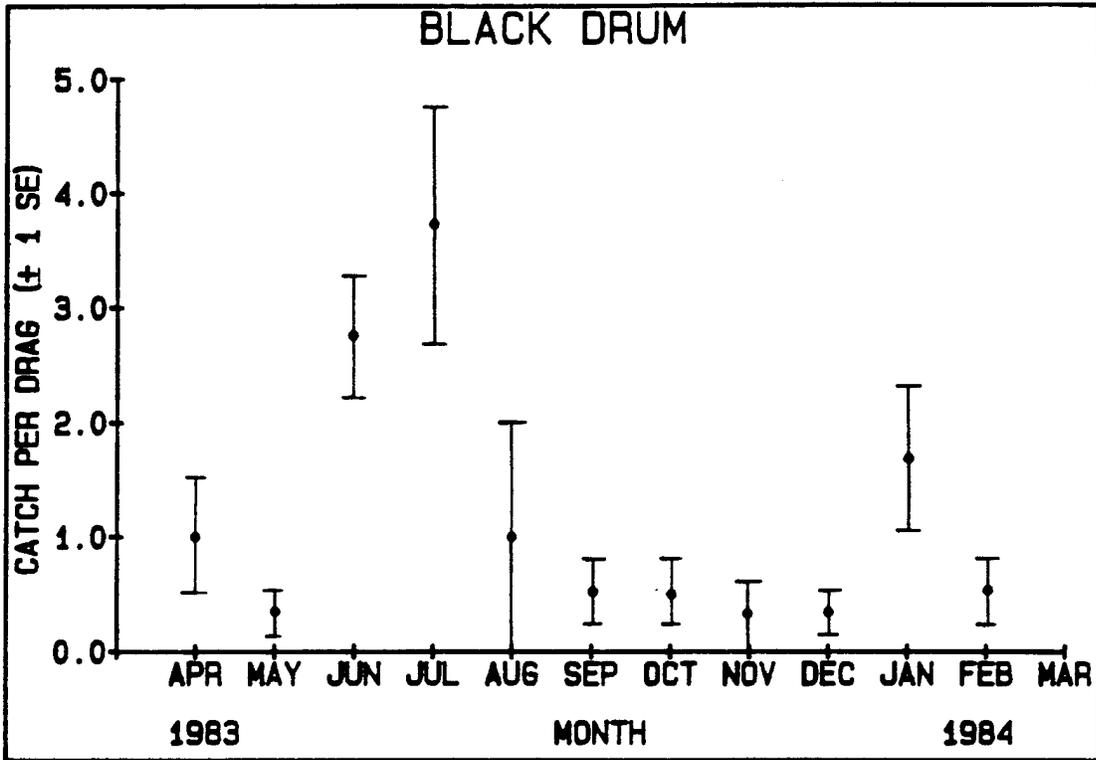
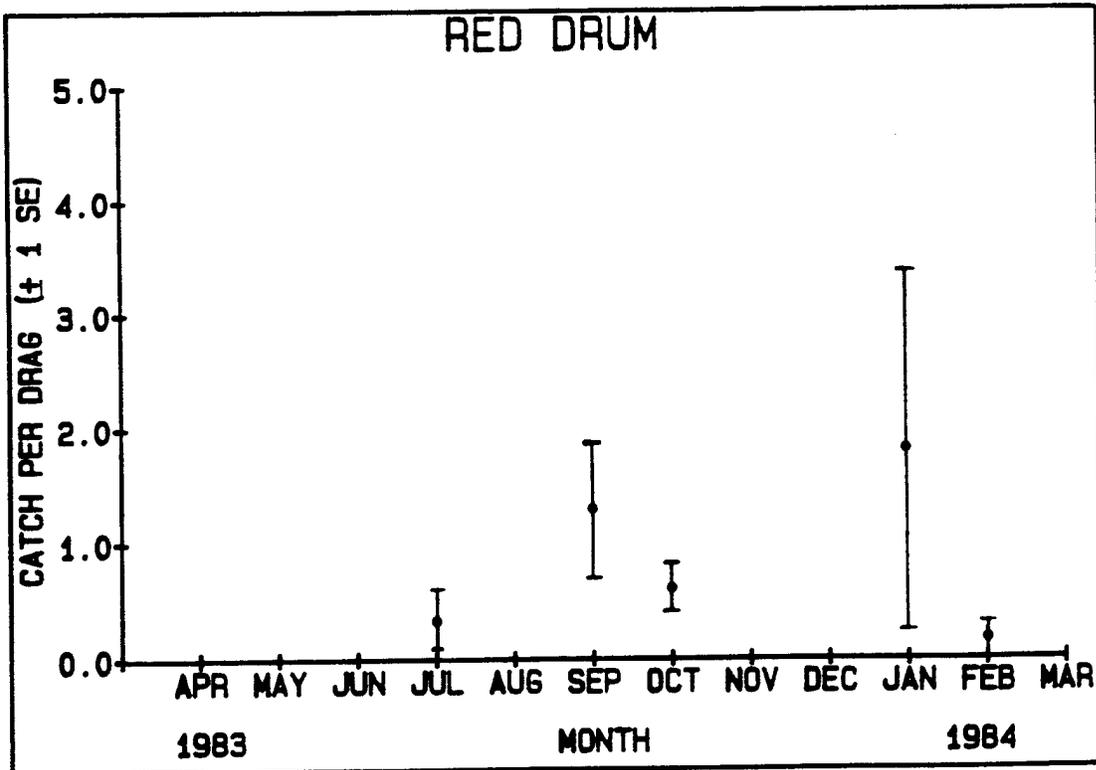
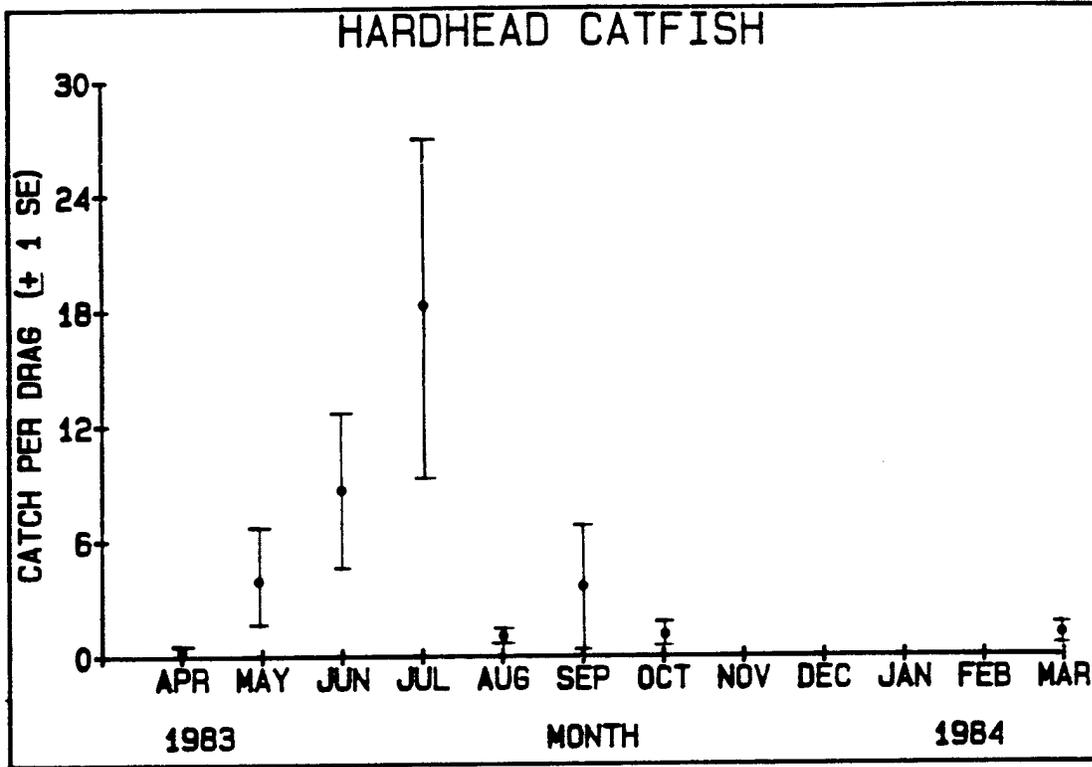
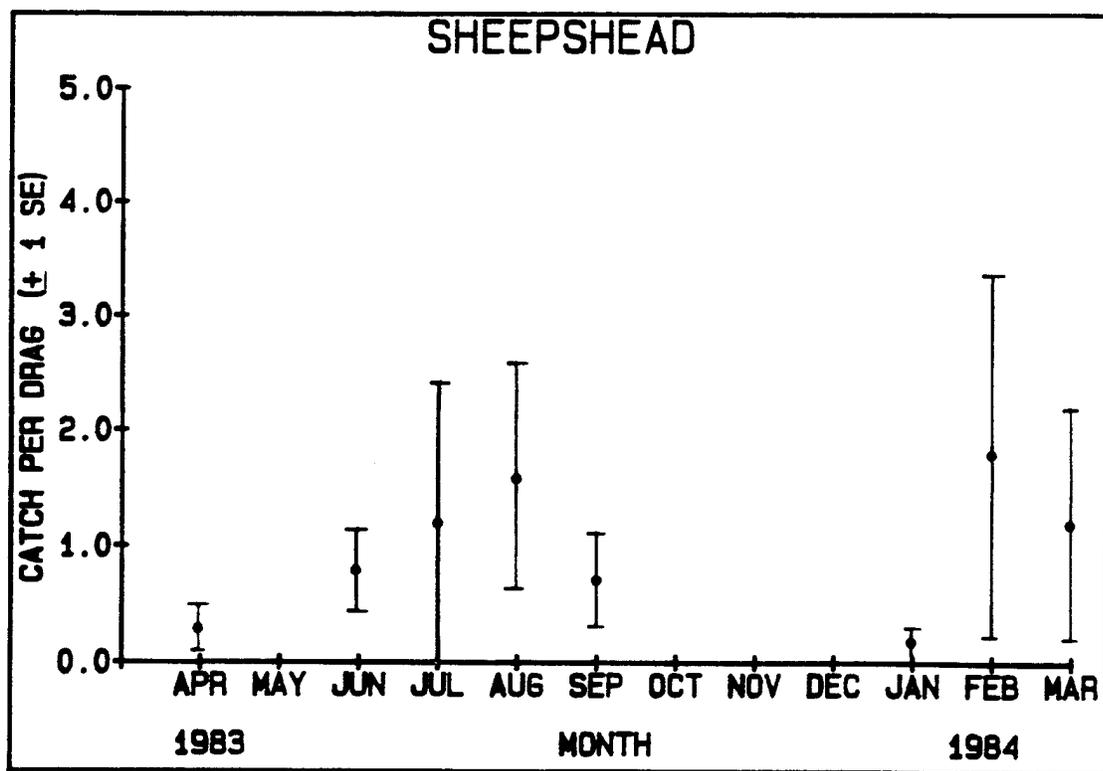
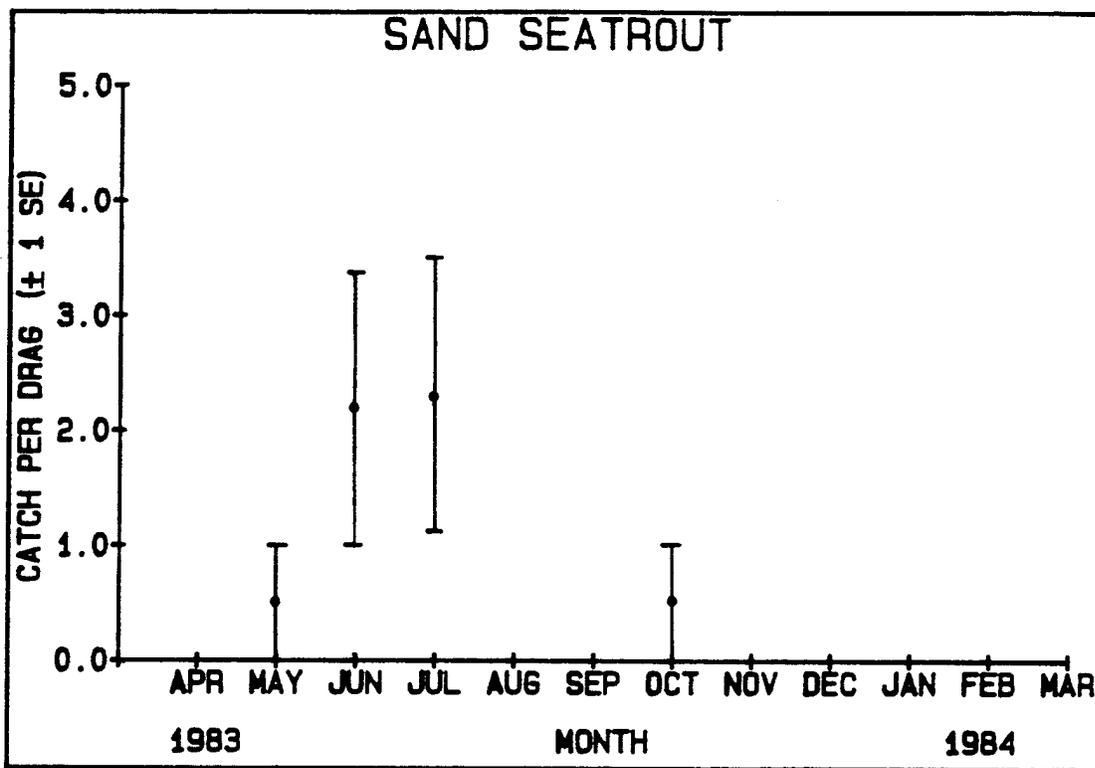


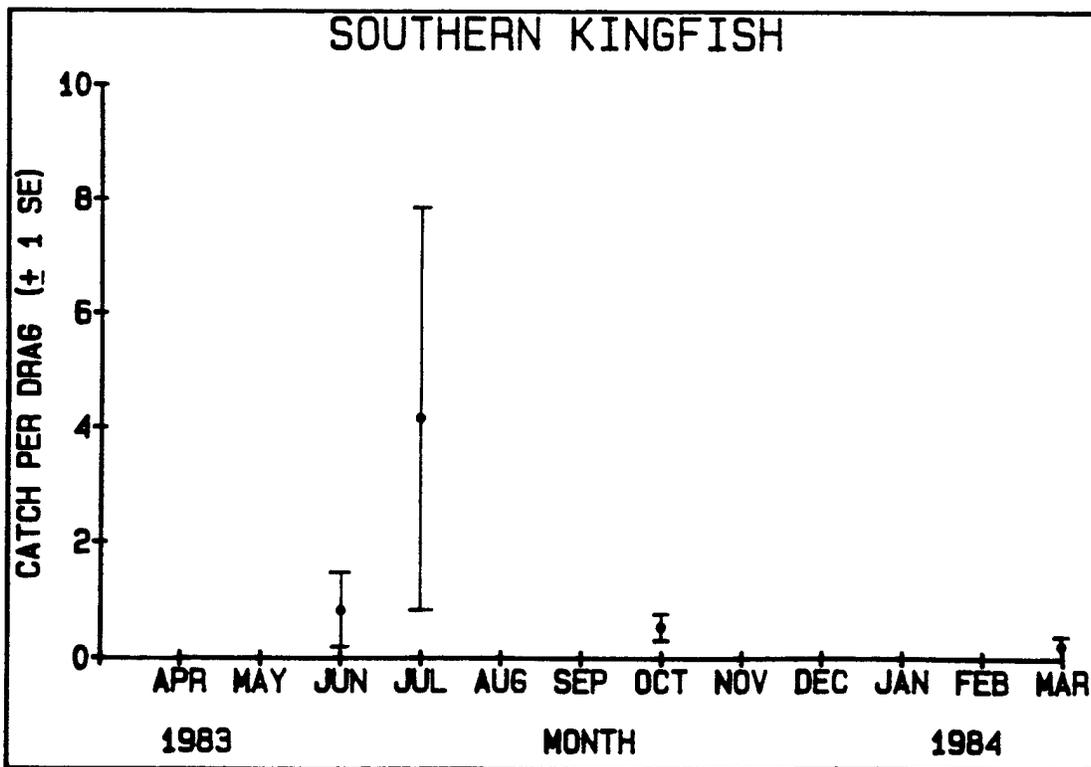
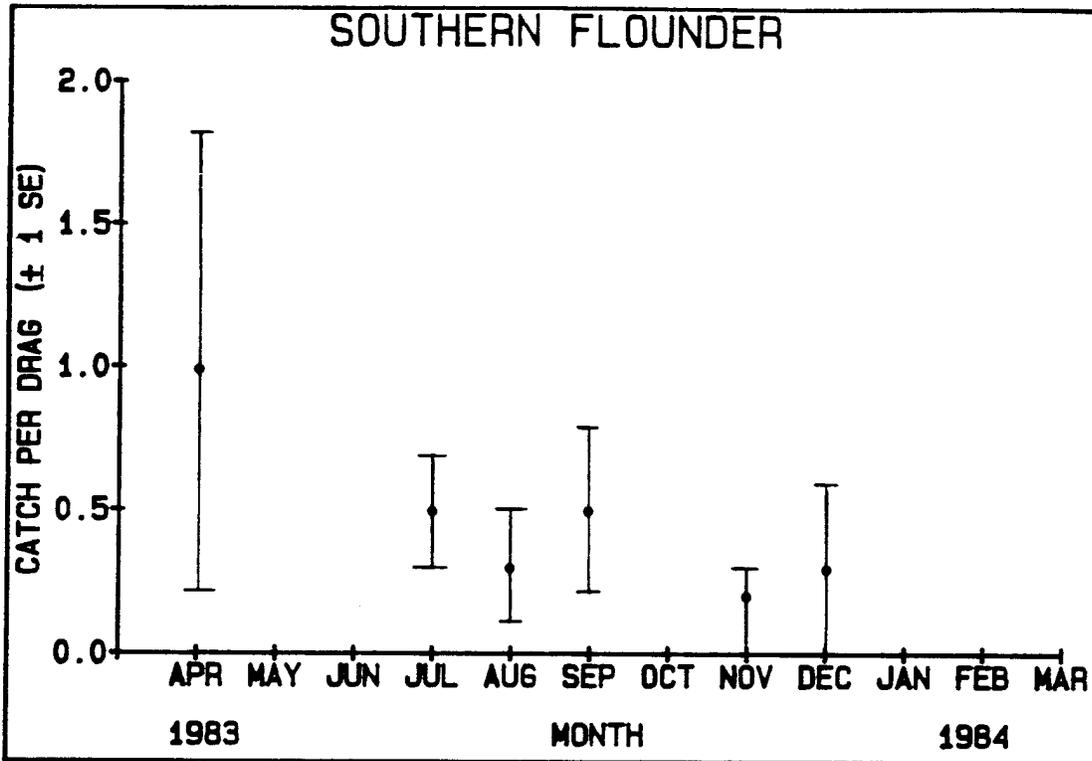
Figure 2. Mean monthly catch rates (No./drag  $\pm$  1 SE) of 17 most frequently caught species in beach seines during April 1983-March 1984.

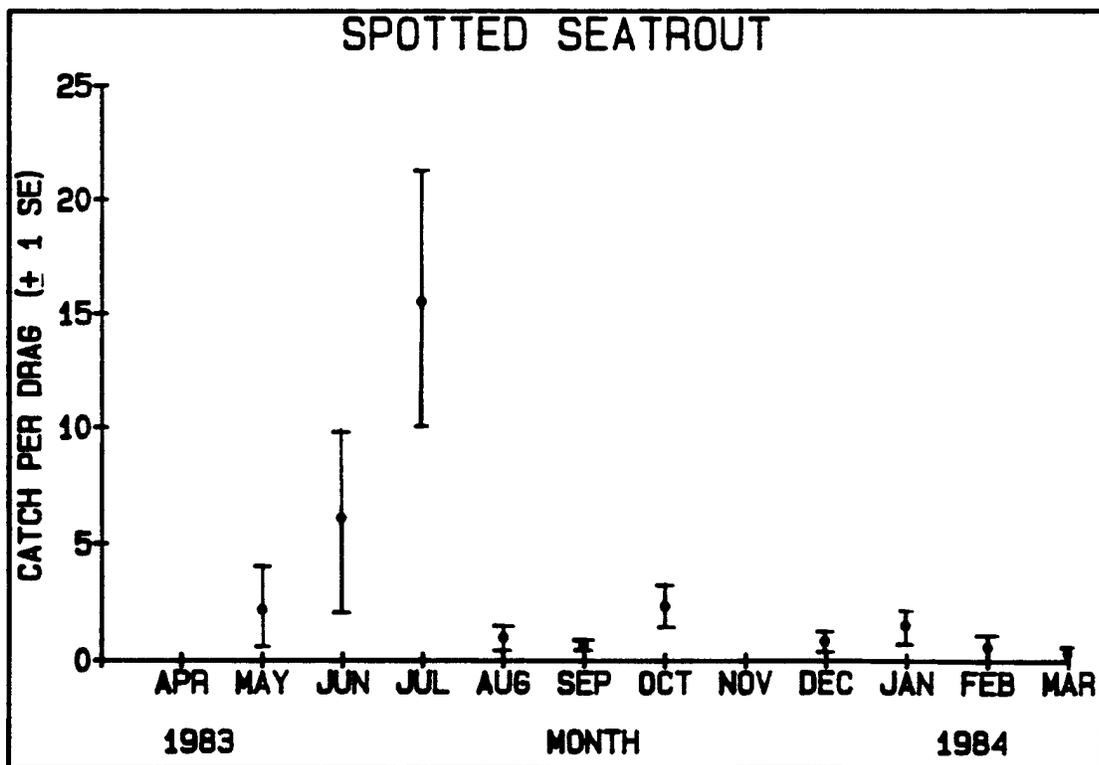
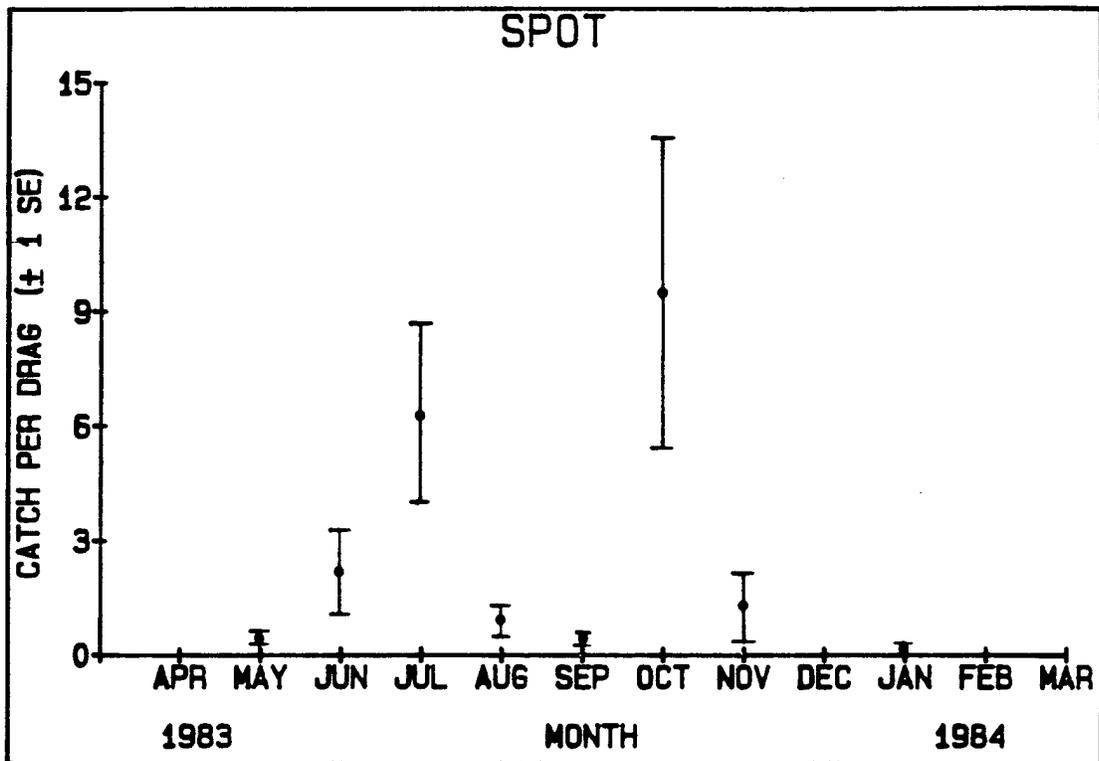


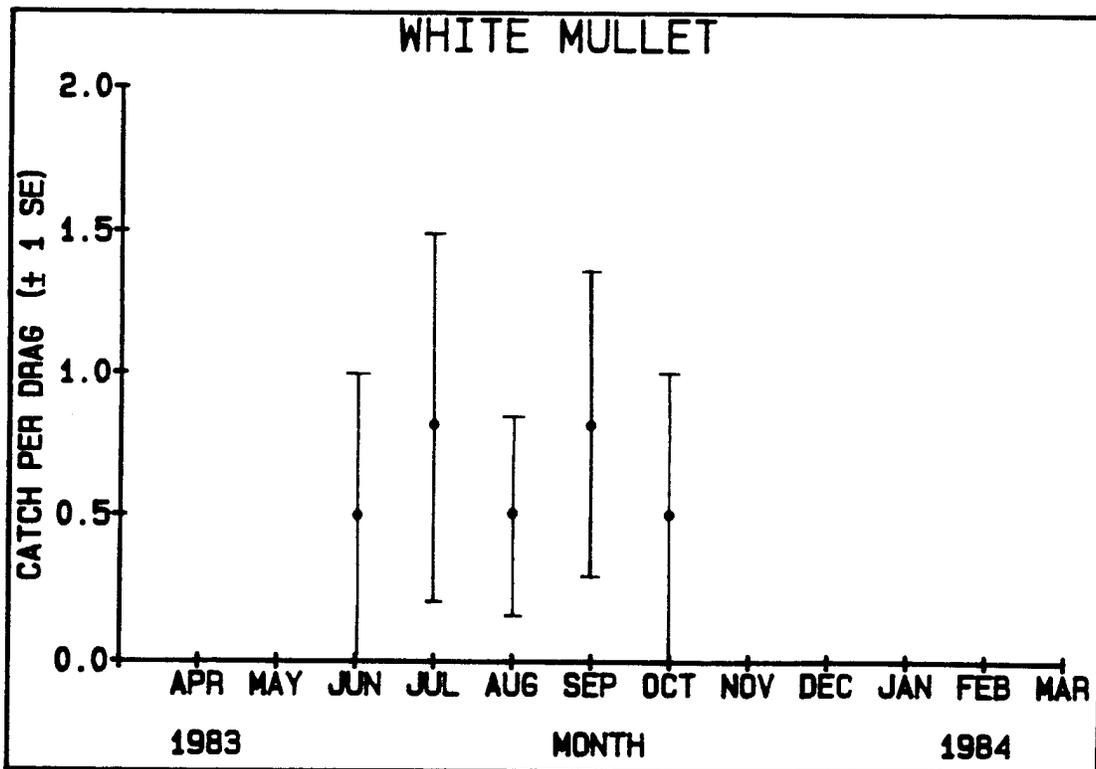
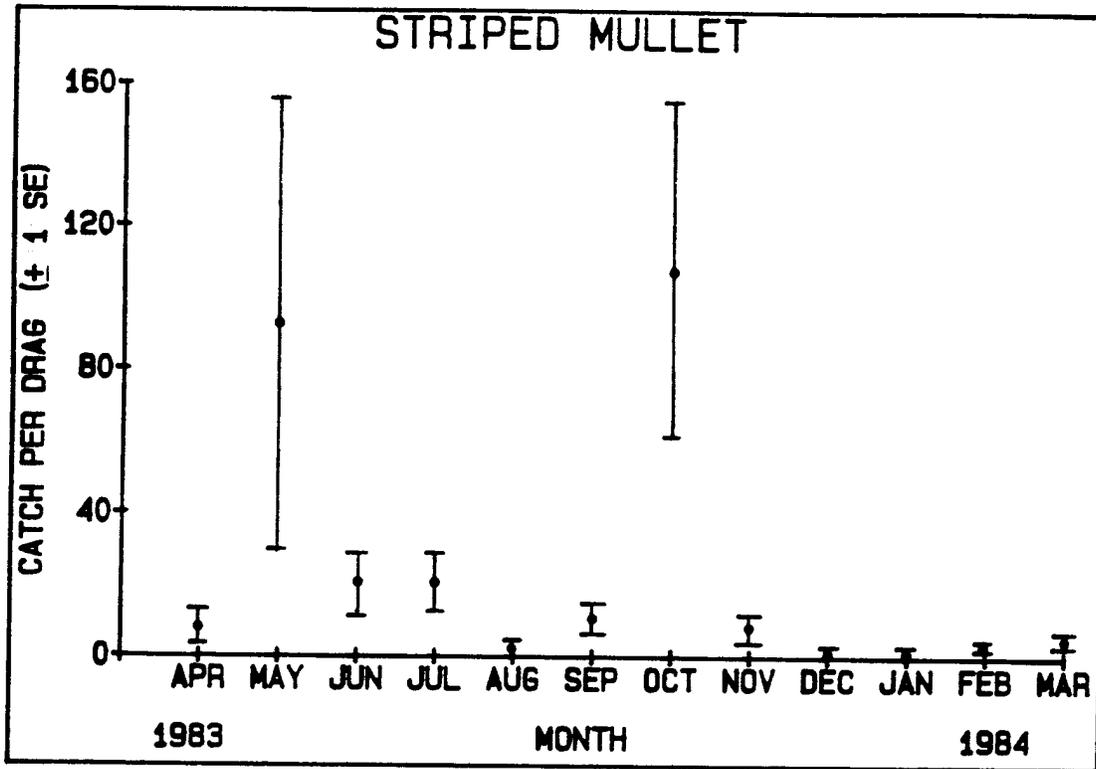


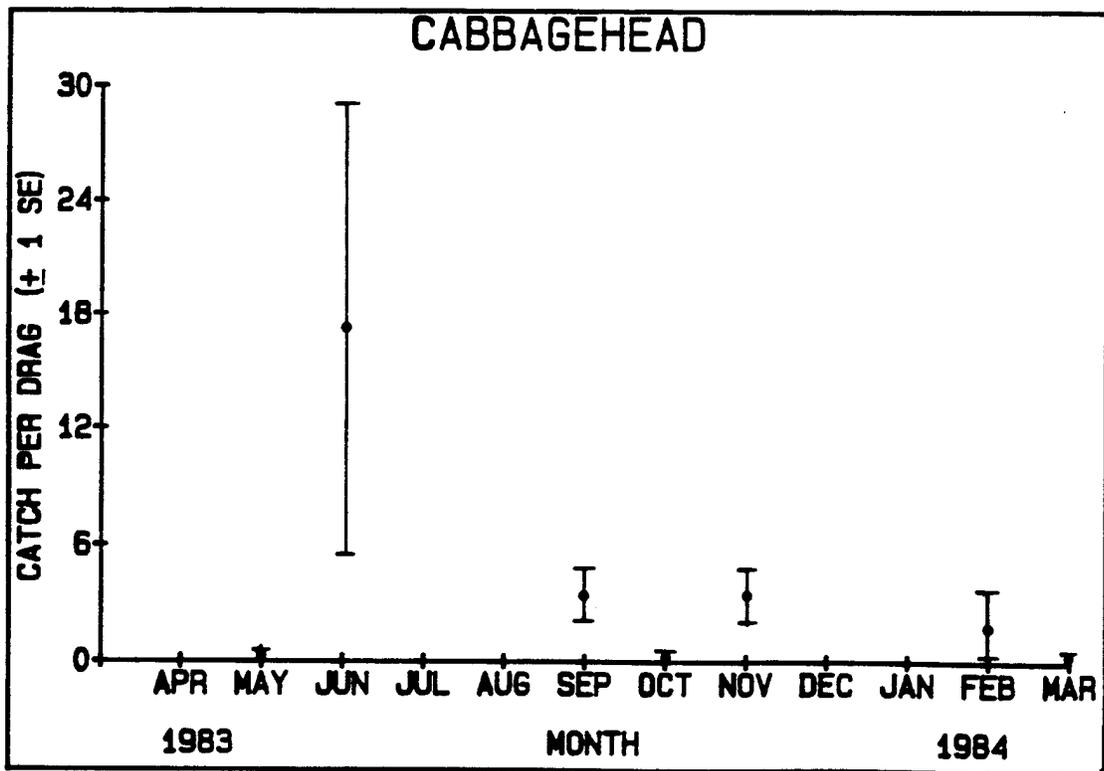
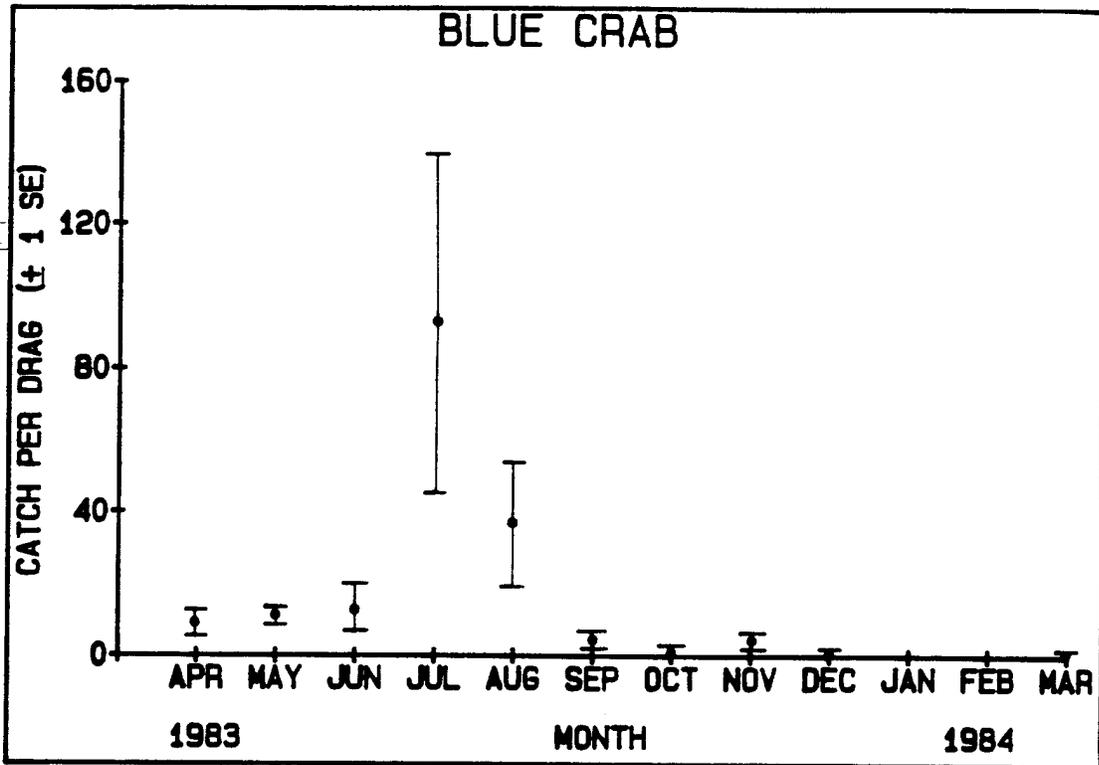


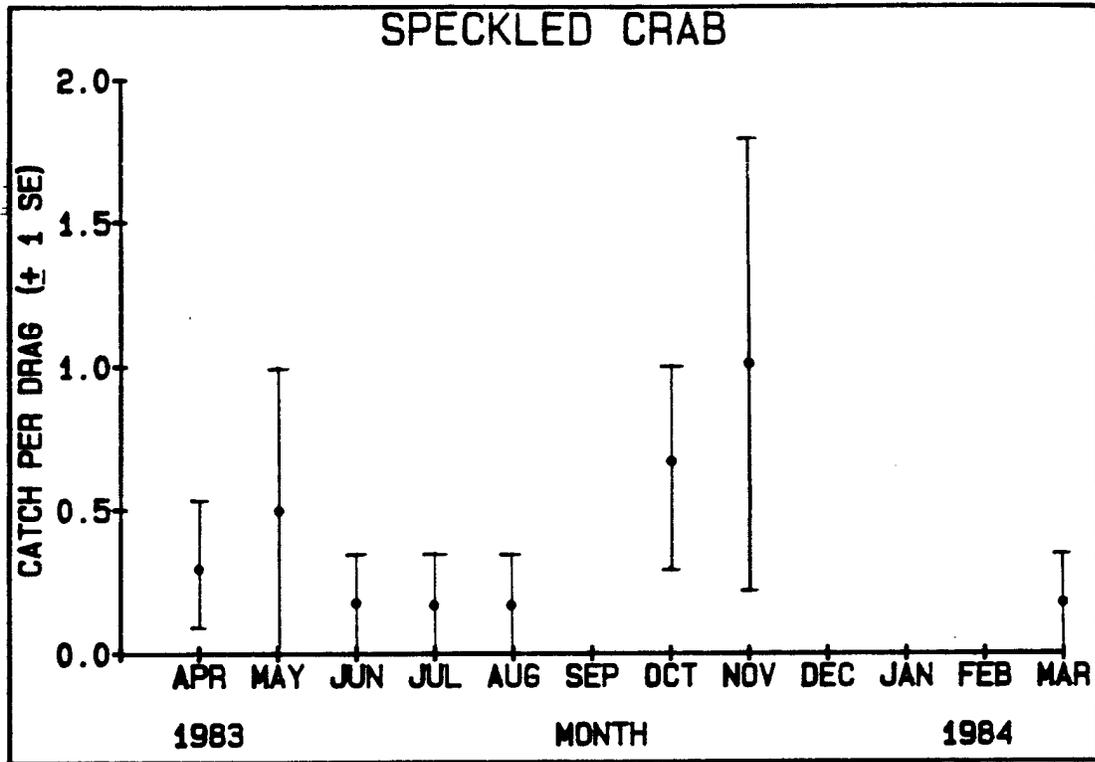












PWD Rpt 3000-196  
April 1985