Lengths of 24 Saltwater Fishes Caught In Trammel Nets in Texas Bays

by Gary C. Matlock

Management Data Series Number 83
1985

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4200 Smith School Road
Austin, Texas 78744

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ABSTRACT

Size (length) composition data for fishes caught in trammel nets in Texas bays are useful to estimate yield model parameters, regulate net fisheries, and assess temporal changes in size distributions of population. Total length (TL) frequency histograms, mean TL (± 1SD), and maximum TL are presented for 24 fishes most commonly caught during a 40-month period in 7.6-cm (3-inch) stretched mesh trammel nets fished in eight Texas bays. Size of fish caught varied among species from 119 ± 34 mm (4.7 ± 1.3 inches) TL for Atlantic spadefish (Chaetodipterus faber) to 1066 ± 307 mm (42.0 ± 12.1 inches) TL for alligator gar (Lepisosteus spatula). As mean TL of fishes (Y) increased so did SD and maximum TL. The relationships could be expressed as $Y = -28 + 0.27 X$ and $Y = -11 + 1.66 X$ for SD (X) and maximum TL (X), respectively. Length distributions appeared to be normal for five species, negatively skewed for one, and positively skewed for four species. Distributions appeared to be bimodal for two species, multimodal and positively skewed for eight species, and multimodal and negatively skewed for two species. Distributions were platykurtic for two species. Trammel nets are less selective than gill nets for size of each species because more fish are caught by entanglement in trammel nets.

INTRODUCTION

Many estuarine-dependent fishes support important fisheries throughout the Gulf of Mexico during their estuarine phase (McHugh 1966). Fishery-independent stock assessments are needed to determine the capacity to sustain optimum yields as demand for seafood and quality fishing increases. However, assessments are difficult because size (length) composition information for many species is lacking. Trammel nets have historically been used in Texas bays to gather availability information (Hegen et al. 1983) but primarily for only five fishes, black drum (Pogonias cromis), red drum (Sciaenops ocellatus), sheepshead (Archosargus probatocephalus), southern flounder (Paralichthys lethostigma), and spotted seatrout (Cynoscion nebulosus). However, length data are generally unavailable, inconsistently collected, or summarized as means (Matlock 1984a).

This study presents total length data for the fishes most commonly caught in trammel nets in Texas bays. These data can be used to estimate parameters in yield models, regulate trammel net fisheries, and assess temporal changes in size composition and availability of estuarine fishes.

MATERIALS AND METHODS

Multifiliament trammel nets were set in Galveston, East Matagorda, Matagorda, San Antonio, Aransas, and Corpus Christi Bays and upper and lower Laguna Madre (Figure 1) in water $\leq$ 1.2 m during the period October 1976 through May 1980. Nets were set during the day at 6 to 14 randomly selected sites in each bay each month following procedures described by Matlock and Weaver (1978), Matlock (1982), Hegen et al. (1983), and Matlock (1984b). Generally, nets were set in a rectangular shape with the shoreline as one side or in a square without regard to shore and the enclosed area struck. The same number of sites were sampled in each bay; no sets were made during June-August in 1978 and 1979. Nets were either 366 or 732 m long and 1.2 m deep with two 30.5-cm stretched mesh outer walls and a 7.6-cm stretched mesh inside wall.

All fish were identified to species (Gallaway et al. 1972, Hoese and Moore 1977, Robins et al. 1980), counted, and no more than 19 in each set were measured to the nearest 1 mm total length (TL). Atlantic stingray (Dasyatis sabina) widths (wing tip to wing tip) were measured instead of TL. Length frequency histograms were constructed using 10-mm groups except that 20-mm groups were used for alligator gar (Lepisosteus spatula). Mean total length, standard deviation (Sokal and Rohlf 1969) and maximum length (Alverson and Carney 1975) were calculated for each species. Length frequency histograms were examined visually to determine apparent type of distribution.

RESULTS

Size of fish caught in a 7.6-cm stretched mesh trammel net varied among species. The size range of trammel netted fish equaled or exceeded 300 mm except for finescale menhaden, Brevoortia gunteri (250 mm), gulf flounder, P.

albigutta (240 mm), harvest fish, Peprilus alepidotus (170 mm), pinfish, Lagodon rhomboides (290 mm), and striped burrfish, Chilomycterus schoepfi (240 mm) (Table 1). The mean total length (±1 SD) of 24 species varied from 120 (±34 mm) for Atlantic spadefish Chaetodipterus faber to 1065 (±307 mm) for alligator gar. As the mean size (Y) increased so did the standard deviation (X); the relationship could be expressed as Y = - 28 + 0.27 X (r=0.89; s_b=0.03). The maximum total length of fishes (Y) caught in trammel nets also increased linearly as the mean length (X) increased; the relationship could be expressed as Y= -11+ 1.66 X (r=0.94; s_b=0.13).

The length distributions appeared to be normal for spot, Leiostomus xanthurus (Figure 1), pinfish (Figure 2), pigfish, Orthopristis chrysoptera (Figure 2), gulf menhaden, Brevoortia patronus (Figure 3), and hardhead catfish Arius felis (Figure 4) while gafftopsail catfish, Bagre marinus (Figure 4) lengths were unimodal and negatively skewed. Species with unimodal and positively skewed distributions included Atlantic spadefish (Figure 1), gizzard shad, Dorosoma cepedianum (Figure 5), striped mullte, Mugil cephalus (Figure 6), and Atlantic croaker, Micropogonias undulatus (Figure 7). Atlantic stingray (Figure 8) and sheepshead (Figure 9) distributions were bimodal while alligator gar (Figure 10), southern flounder (Figure 8), gulf flounder (Figure 8), red drum (Figure 11), black drum (Figure 11), blue catfish, Ictalurus furcatus (Figure 6), striped burrfish, (Figure 9), and spotted seatrout (Figure 7) distributions were multimodal and positively skewed. Ladyfish, Elops saurus (Figure 9) and spotted gar, Lepisosteus oculatus (Figure 10) distributions were multimodal and negatively skewed. Finescale menhaden (Figure 3) and harvest fish (Figure 3) distributions were platykurtic.

DISCUSSION

Trammel nets are selective for species and size of fish caught. However, trammel nets are less selective than gill nets because they increase the probability of capture due to entanglement. The standard deviations and skewed distributions observed in this study support this conclusion. The lengths of gill net caught fish are usually normally distributed because their capture depends primarily on becoming tightly wedged in the webbing (Hamley 1975). Fish that are not fusiform or that have stiff projecting appendages or spines are frequently entangled in the webbing which causes skewed or multimodal length distributions. Standard deviations for gulf menhaden, spot, hardhead catfish, pinfish, Atlantic croaker, pigfish, spotted seatrout, and gulf flounder caught in 7.6-cm stretched mesh gill nets in Florida bays (Trent and Pristas 1977) were always less than the SD for fish caught in trammel nets in Texas (Table 2). The SD for the two catfishes in each net were the most similar. As with any gear, trammel net catches depend on the abundance of each size class of fish in the area fished. Additional factors affecting net selectivity include mesh size, net twine, net construction, and method of fishing (Hamley 1975). If similarly constructed nets are fished similarly then trends in the relative abundance and size composition fish within the susceptible size range can be determined. Data presented in this report can be used as a base for comparison to future collections to determine changes in size composition for assessing changes in availability and the effects of fishing mortality.

If nets are fished throughout the geographic range of all life stages of fish, if the population is not over-fished, and if the susceptibility to capture is the same for all fish larger than some minimum, then the maximum length estimated in this study becomes an estimate of the average maximum length (L_∞) as defined by Ricker (1975). For example, Chittenden (1977) estimated L_∞ for Atlantic croaker as 590 mm (TL) based on scale data. The maximum TL of Atlantic croaker caught in trammel nets in bays was 415 mm. If croaker larger than 415 mm occur only in the Gulf of Mexico, net collections in bays would underestimate L_∞, as demonstrated for red drum (Matlock 1984). However, croaker larger than 415 mm were not caught in fish trawls (Cody et al. 1977) or on longlines (Cody et al. 1981). The state record for croaker is 514 mm and was caught in East Galveston Bay in 1971 (Anonymous 1985). Chittenden's estimate of L_∞ may have been overestimated because of his assumption that growth throughout life is described by the Von Bertalanffy equation. Additional growth information is needed to determine which estimate of L_∞ is most reasonable. Fish could be tagged and scales removed at release and recapture to verify ages used in estimating the von Bertalanffy equation parameters.

LITERATURE CITED

Alverson, D. L. and M. J. Carney. 1975. A graphic review of the growth and decay of population cohorts. J. Cons. Int. Explor. Mer. 36:133-143.

Anonymous. 1985. Texas state fish records. Texas Parks Wildl. PWD Leaflet 9000-5, 2 p.

Chittenden, M. E., Jr. 1977. Simulations of the effects of fishing on the Atlantic croaker, Micropogon undulatus. Proc. 29th Annu. Gulf Carib. Fish. Inst., p. 68-86.

Cody, T. J., B. E. Fuls, G. C. Matlock, and C. E. Bryan. 1981. Assessment of bottom longline fishing off the central Texas coast, a completion report. Tex. Parks Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Series 22, 51 p.

Cody, T. J., K. W. Rice, and C. E. Bryan. 1977. Foodfish and potential foodfish captured in a large-mesh fish trawl along the central Texas coast. Tex. Parks Wildl. Dep., Coast. Fish. Branch, 49 p. (Unpublished manuscript).

Gallaway, B. J., J. C. Parker, and D. Moore. 1972. Key to the estuarine and marine fishes of Texas. Tex. Agricult. Extension Svc., Tex. A&M Univ., Sea Grant Pub. No. 72-402. 177 p.

Hamley, J. M. 1975. Review of gill net selectivity. J. Fish. Res. Board Canada 32:1943-1969.

Hegen, H. E., G. C. Matlock, and A. W. Green. 1983. Evaluation of gill and trammel net sampling strategies for monitoring finfish activity in Texas bays. Tex. Parks Wildl. Dep. Tech. Series 33. 24 p.

Hoese, H. D. and R. H. Moore. 1977. Fishes of the Gulf of Mexico, Texas, Louisiana, and adjacent waters. Texas A&M Univ. Press, College Station, TX. 327 p.

McHugh, J. L. 1966. Management of estuarine fisheries. p. 133-154. In: R. F. Smith, A. H. Swart, and W. H. Massman (editors) A symposium on estuarine fisheries. Amer. Fish. Soc. Spec. Pub. No. 3, Allen Press, Inc. Lawrence, KA. 154 p.

Matlock, G. C. 1984a. A basis for the development of a management plan for red drum in Texas Ph.D. Dissertation, Texas A&M Univ., College Station, TX. 267 p.

_____. 1984b. Relative efficiencies of three trammel net striking methods. Estuaries 7(2): 185-189.

_____. 1982. Evaluation of 732-m trammel net for estimating finfish abundance in Texas bays. Tex. Parks Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Series 34, 121 p.

_____ and J. E. Weaver. 1978 Assessment and monitoring of Texas coastal finfish resources. Tex. Parks Wildl. Dep., Coast. Fish. Branch Report, 247 p.

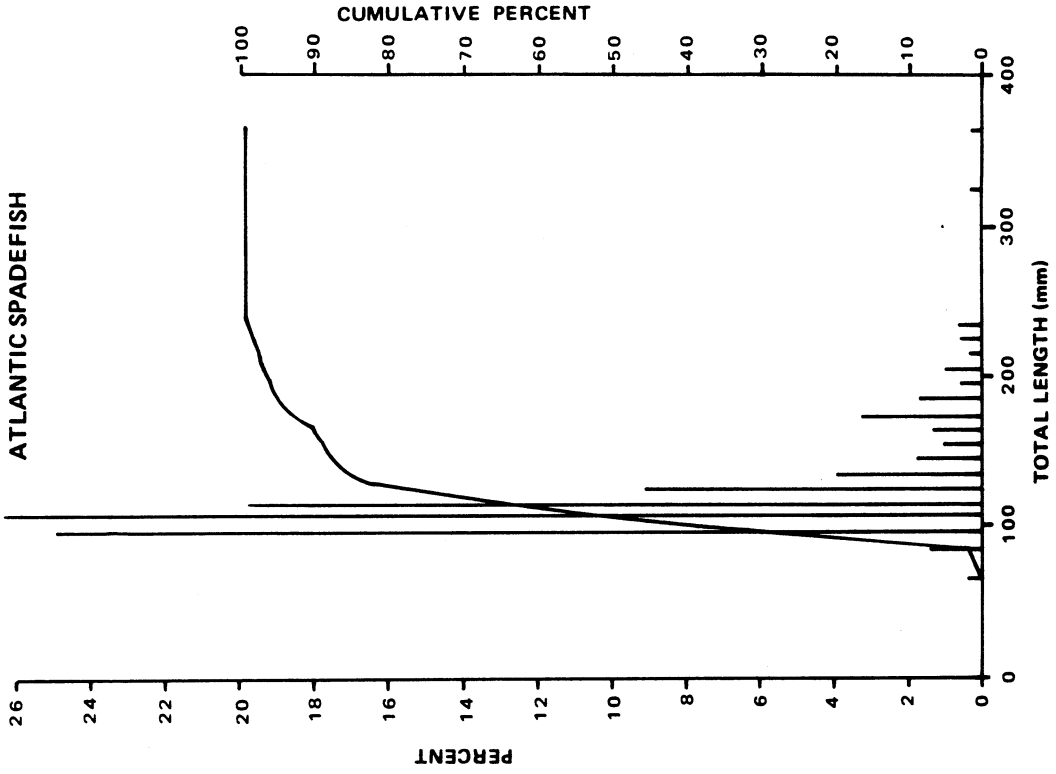
Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fish. Res. Board Canada, Bull. 191, 382 p.

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Leas, and W. B. Scott, 1980. A list of common and scientific names of fishes from the United States and Canada. (4th ed.) Amer. Fish. Soc. Spec. Pub. No. 12, Bethesda, MD. 174 p.

Sokal, R. R. and F. J. Rohlf. 1969. Biometry. W.H. Freeman and Co., San Francisco, CA. 776 p.

Trent, L. and P. J. Pristas. 1977. Selectivity of gill nets on estuarine and coastal fishes from St. Andrew Bay, Florida. Fish. Bull. 75:185-198.

Figure 1. Length frequency and cummulative percentage of 3661 spot and 276 Atlantic spadefish collected in trammel nets in Texas bays, October 1976-April 1980.


ATLANTIC SPADEFISH
CUMULATIVE PERCENT
PERCENT
TOTAL LENGTH (mm)

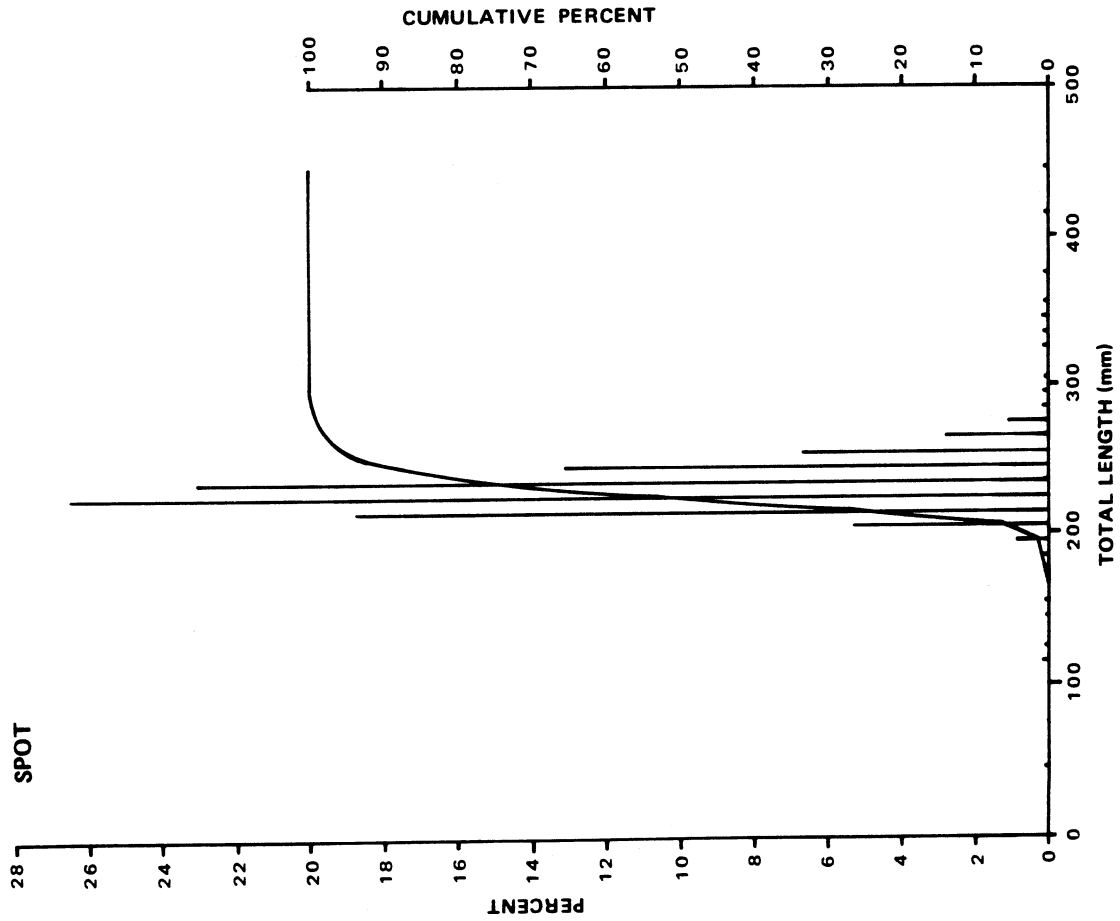
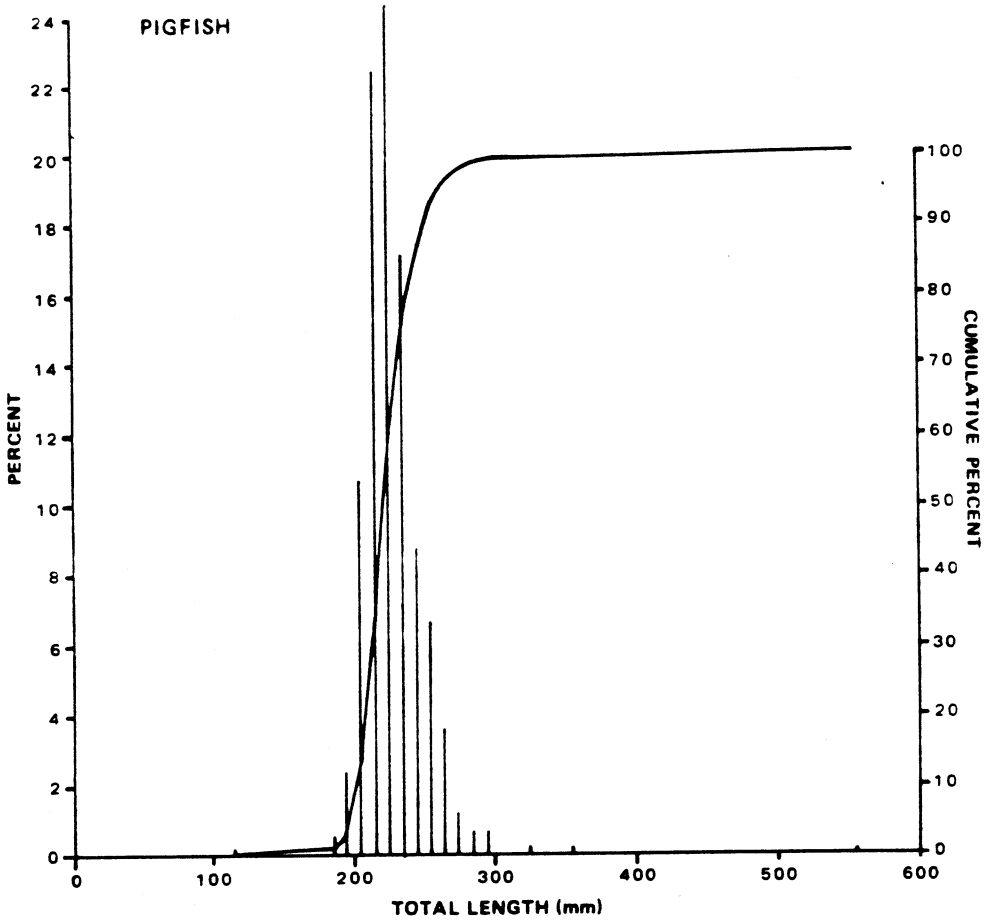

SPOT
CUMULATIVE PERCENT
PERCENT
TOTAL LENGTH (mm)

Figure 2. Length frequency and cumulative percentage of 1441 pinfish and 420 pigfish collected in trammel nets in Texas bays, October 1976 April 1980.


PIGFISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
22
24
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600

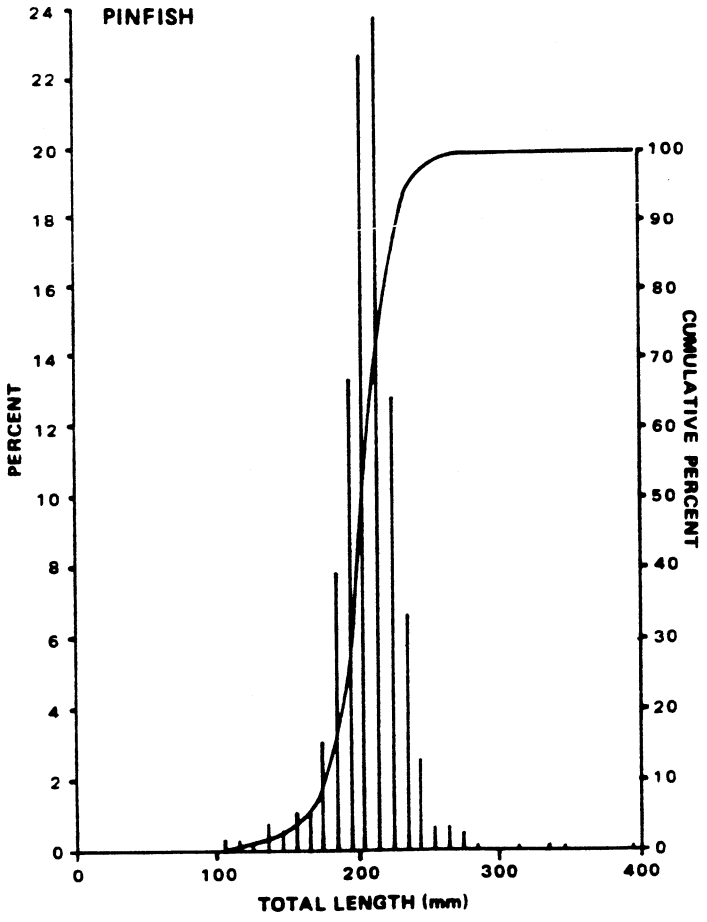
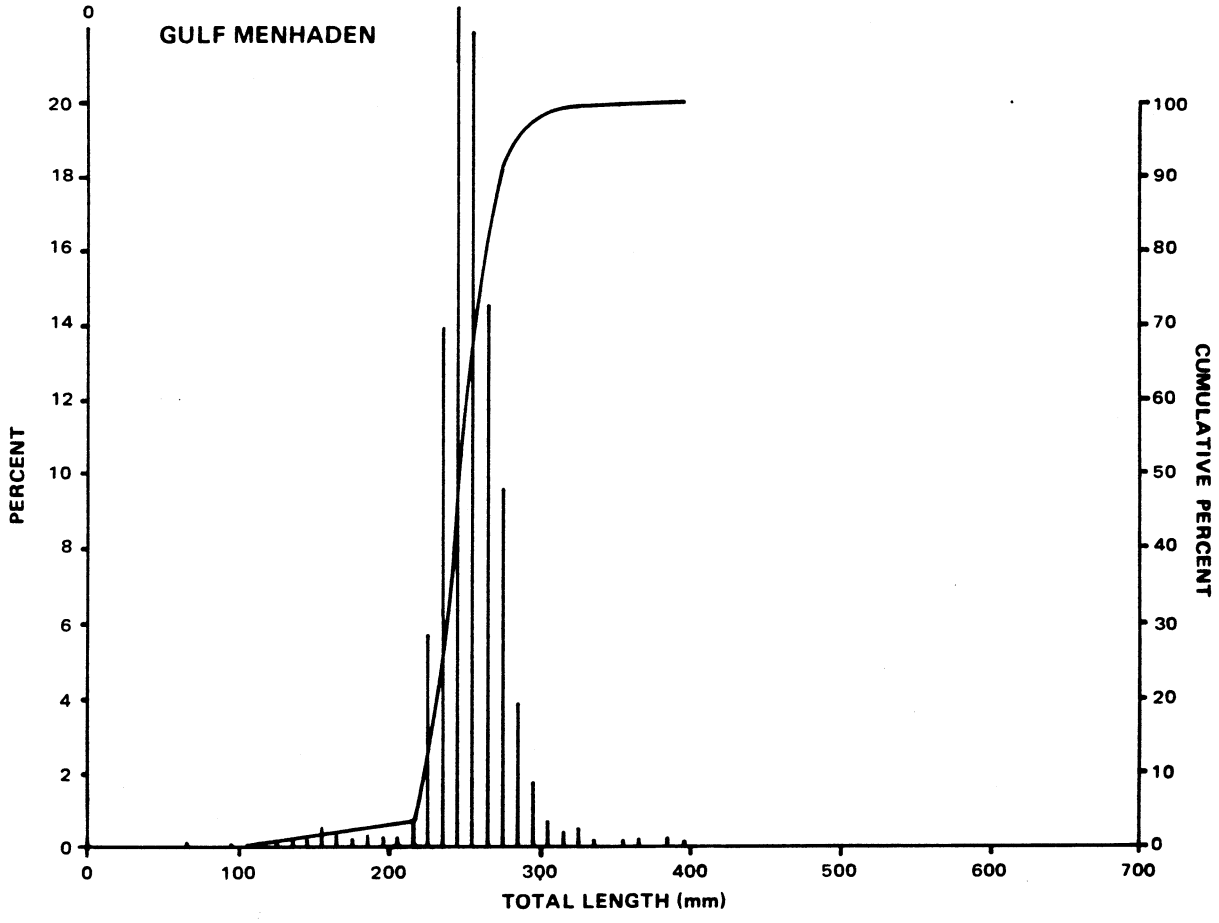
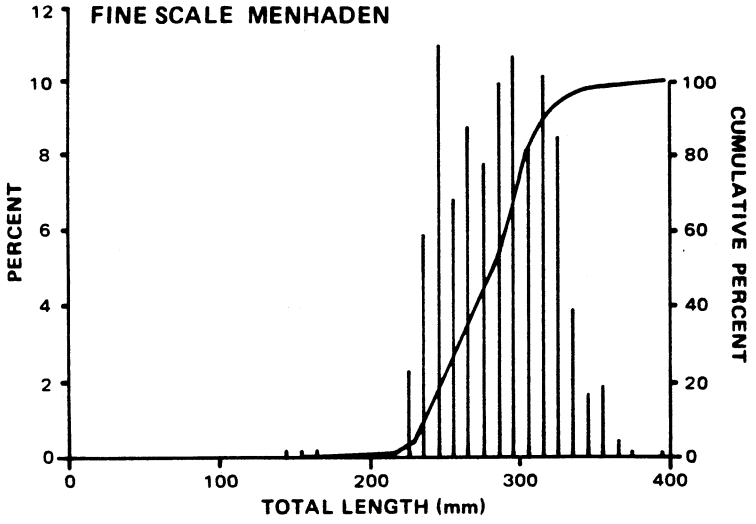

PINFISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
22
24
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400

Figure 3. Length frequency and cumulative percentage of 410 finescale menhaden and 103 harvest fish and 1960 gulf menhaden collected in trammel nets in Texas bays, October 1976-April 1980.


GULF MENHADEN
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700


FINE SCALE MENHADEN
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
0
20
40
60
80
100
0
100
200
300
400

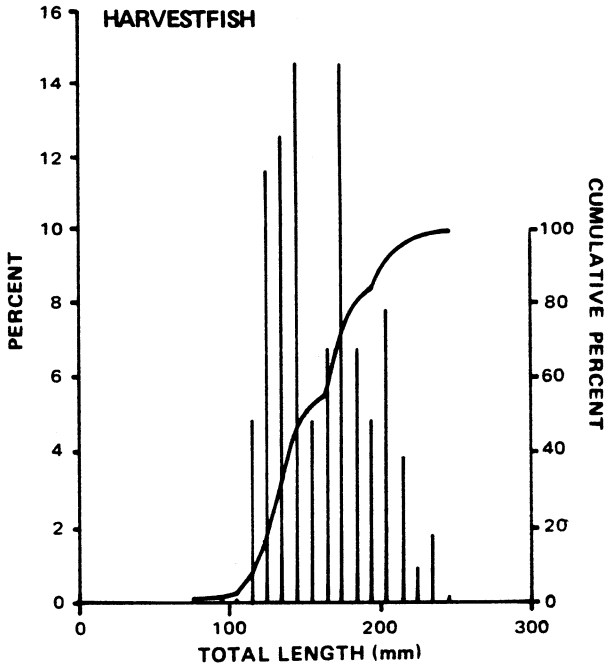
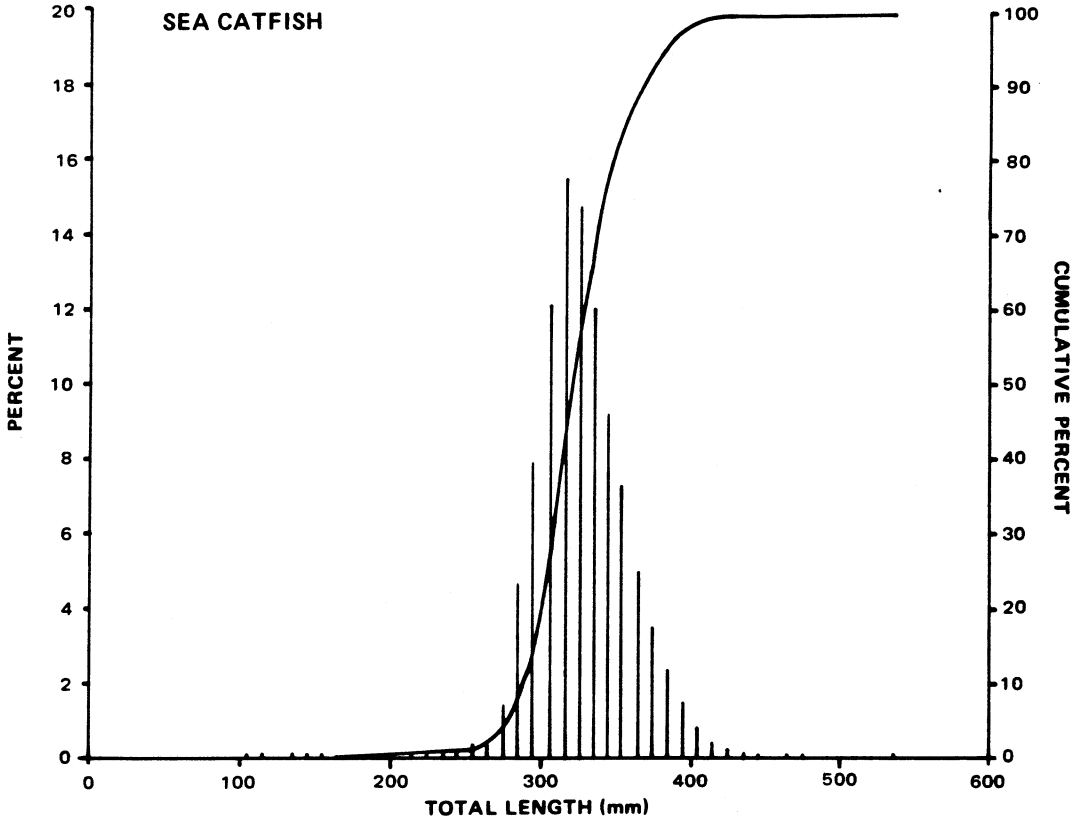

HARVESTFISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
0
20
40
60
80
100
0
100
200
300

Figure 4. Length frequency and cumulative percentage of 128 gafftopsail catfish and 8107 hardhard catfish collected in trammel nets in Texas bays, October 1976-April 1980.


SEA CATFISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600

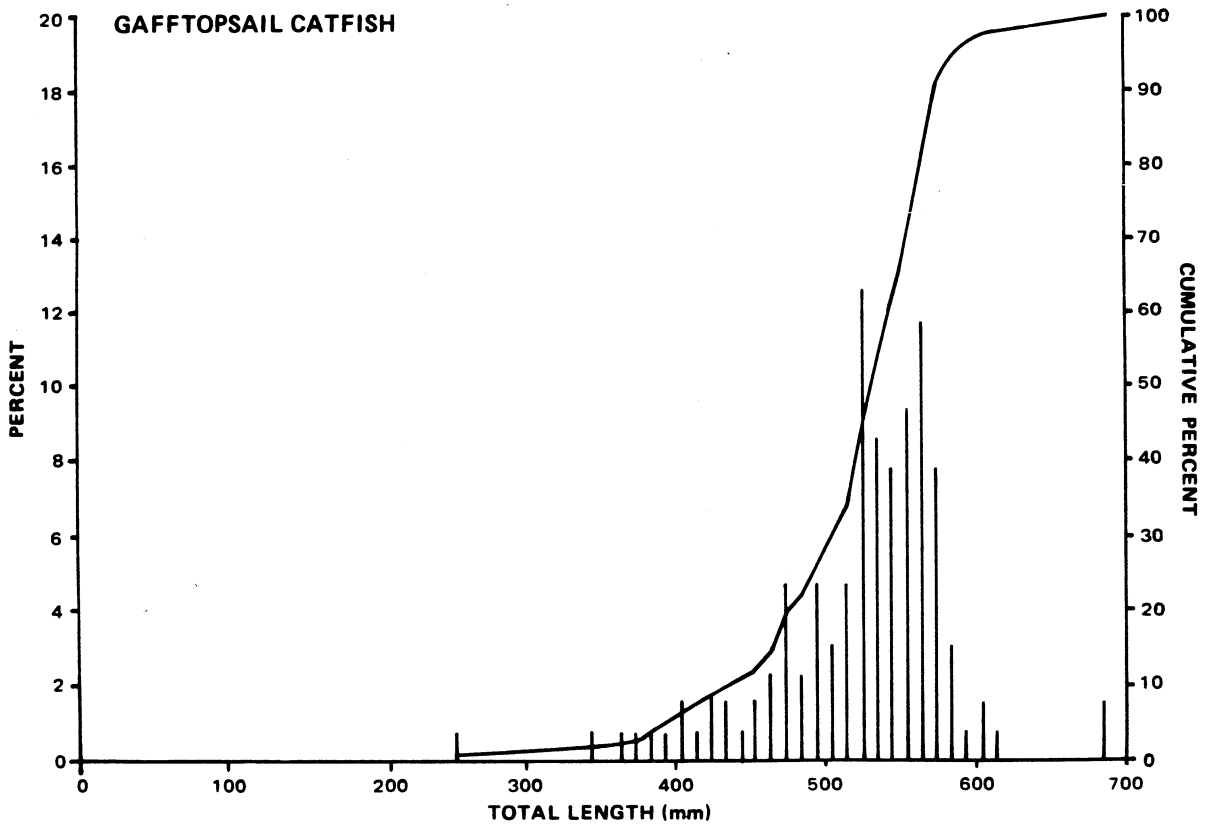

GAFFTOPSAIL CATFISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700

Figure 5. Length frequency and cumulative percentage of 4211 gizzard shad collected in trammel nets in Texas bays, October 1976-April 1980.

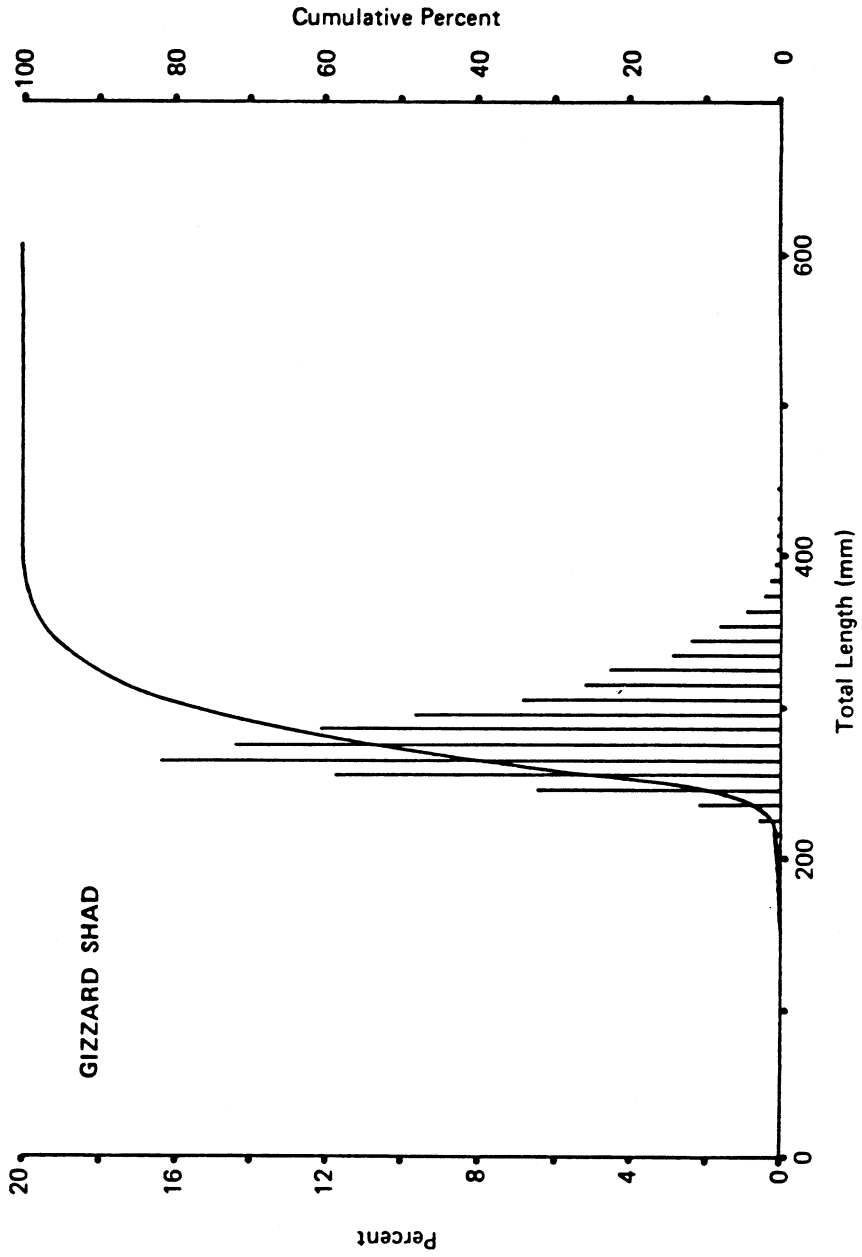
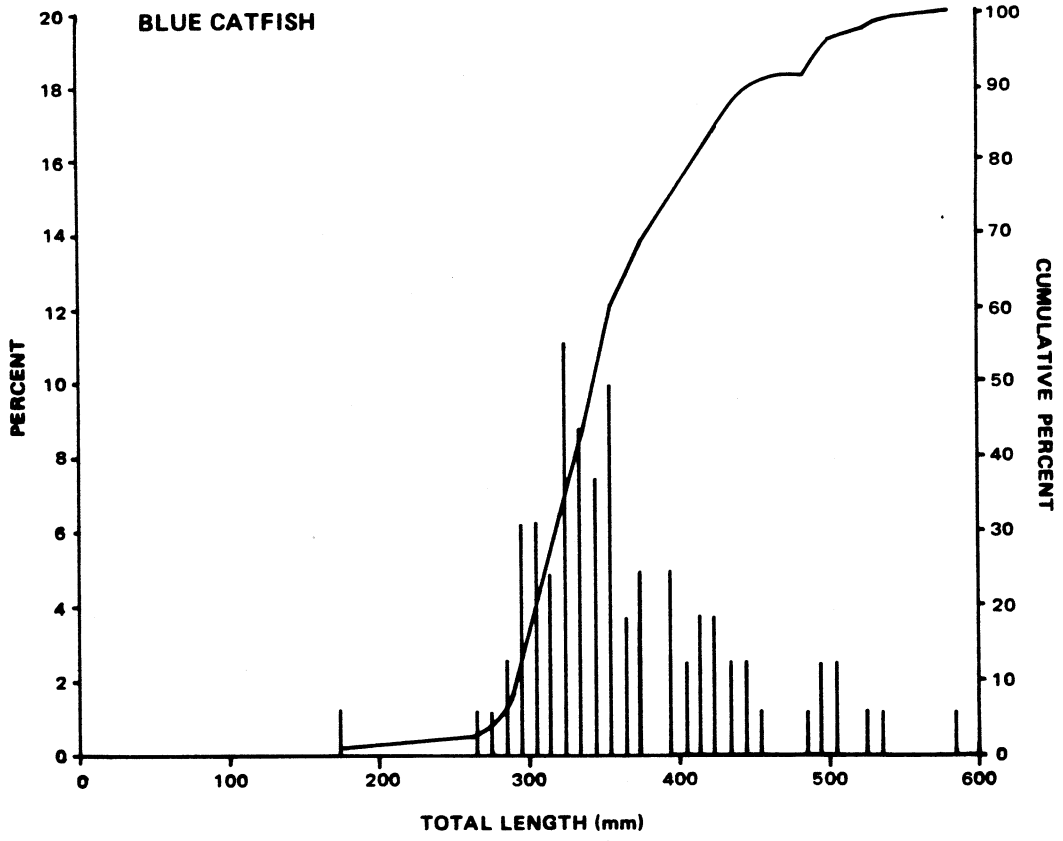

Cumulative Percent
100
80
60
40
20
0
GIZZARD SHAD
Percent
20
16
12
8
4
0
0
200
400
600
Total Length (mm)

Figure 6. Length frequency and cumulative percentage of 11,082 striped mullet and 81 blue catfish collected in trammel nets in Texas bays, October 1976-April 1980.


BLUE CATFISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600

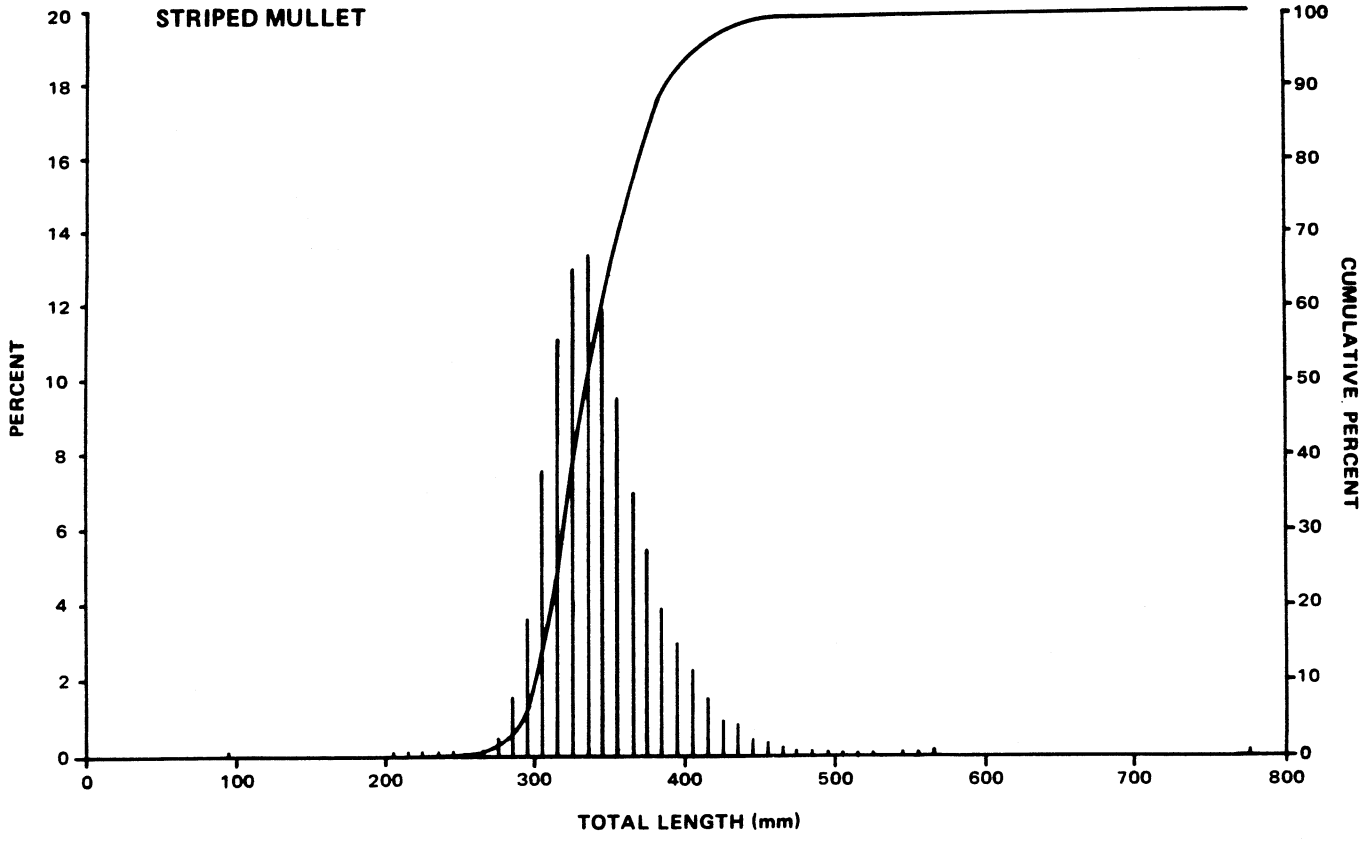
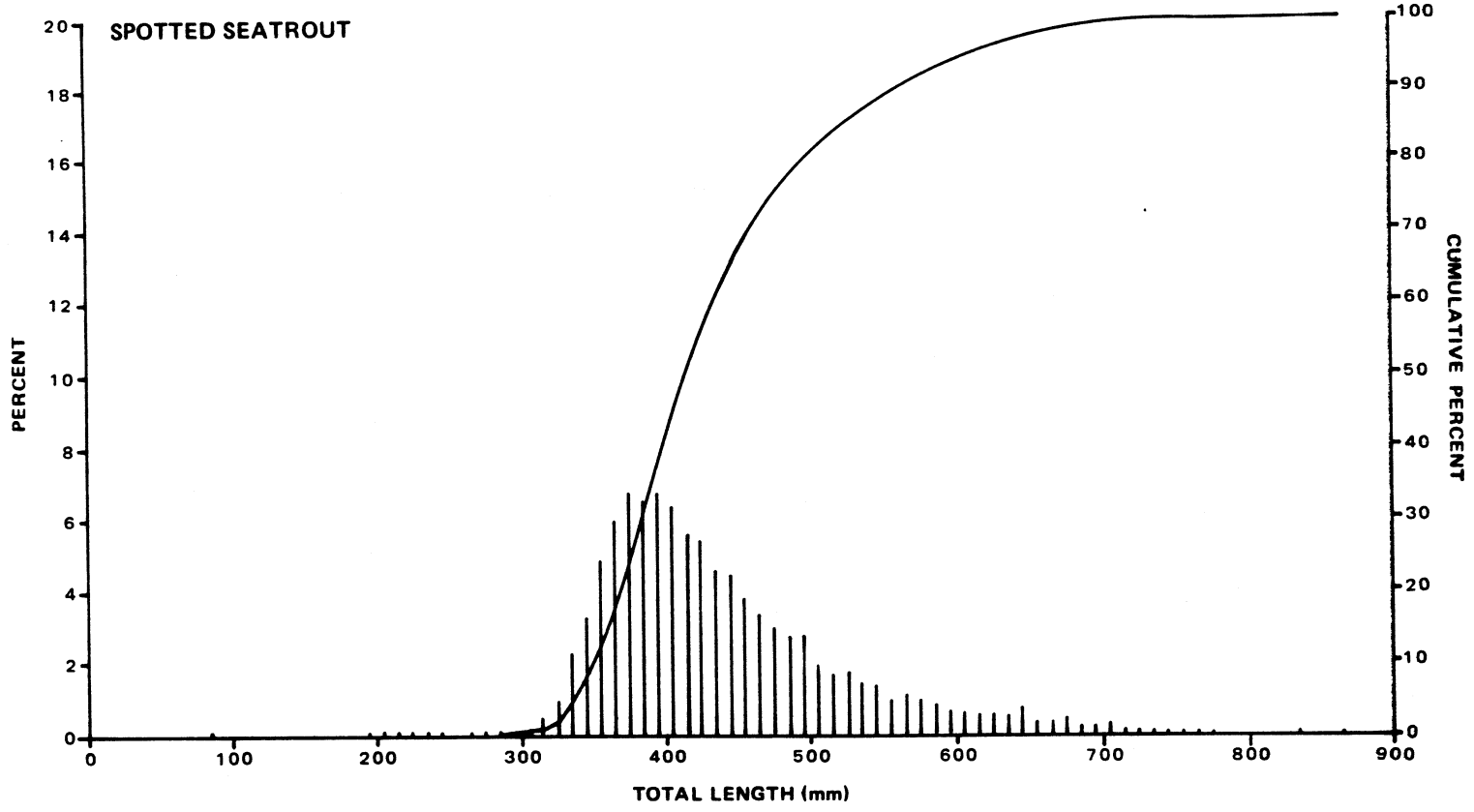

STRIPED MULLET
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800

Figure 7. Length frequency and cumulative percentage of 4653 Atlantic croaker and 6769 spotted seatrout collected in trammel nets in Texas bays, October 1976-April 1980.


SPOTTED SEATROUT
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900

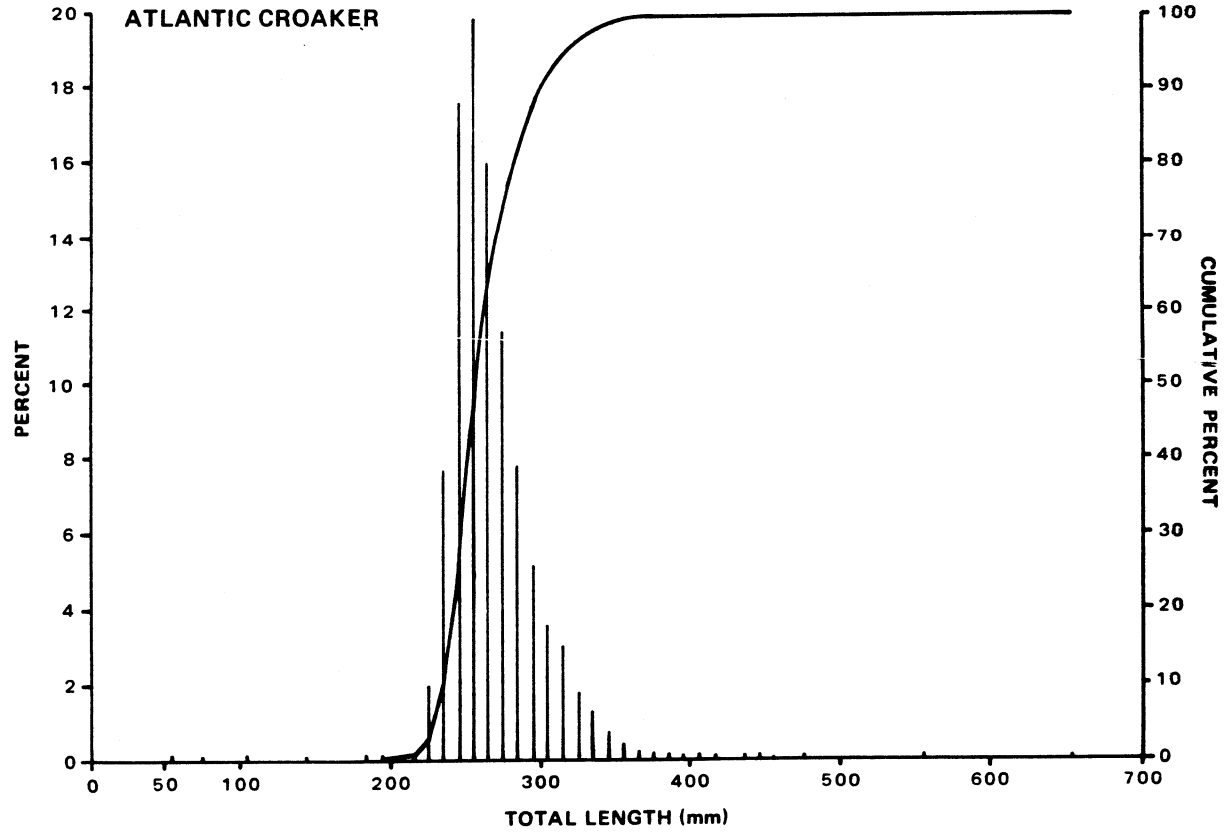
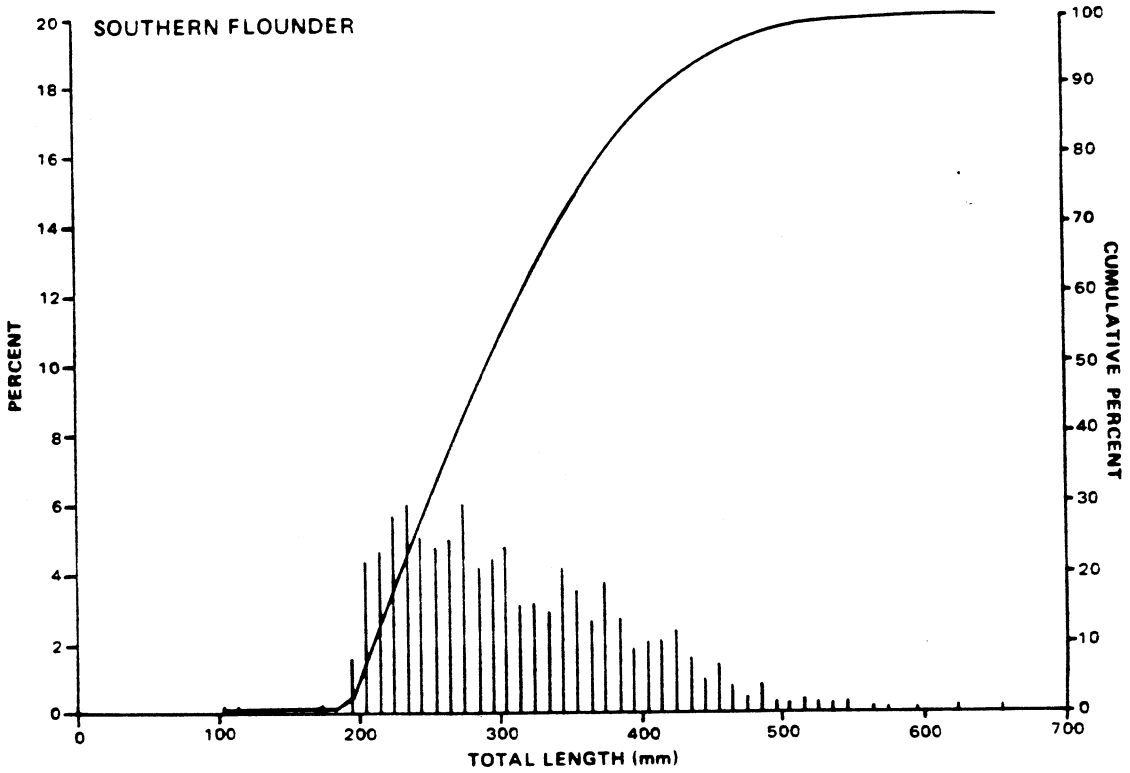
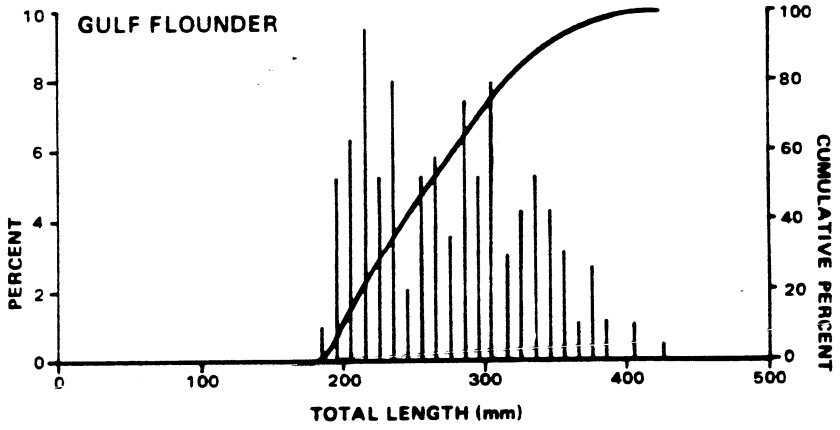

ATLANTIC CROAKER
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
50
100
200
300
400
500
600
700

Figure 8. Length frequency and cumulative percentage of 2932 Atlantic stingray, 187 Gulf flounder, 1388 southern flounder collected in trammel nets in Texas bays, October 1976-April 1980.


SOUTHERN FLOUNDER
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700


GULF FLOUNDER
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
0
20
40
60
80
100
0
100
200
300
400
500

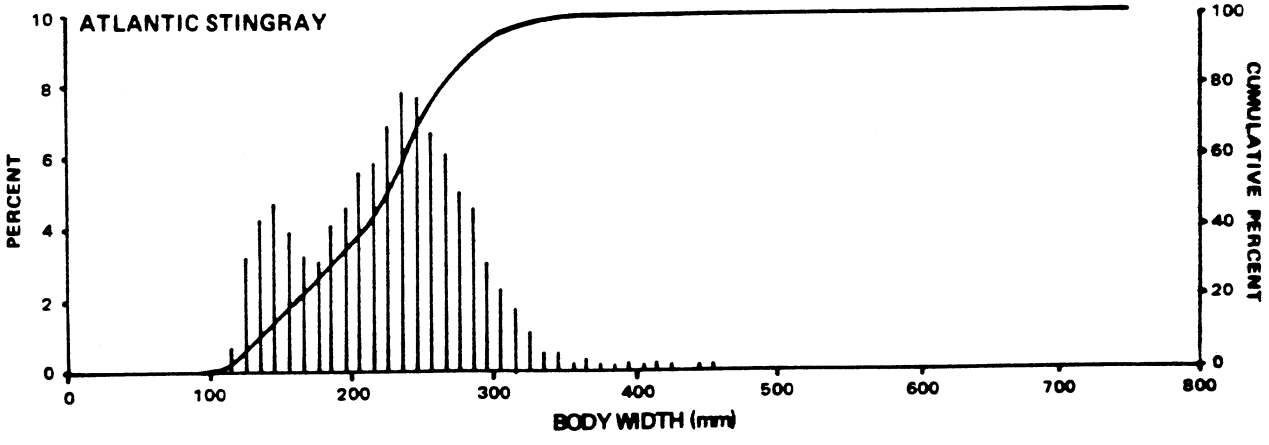
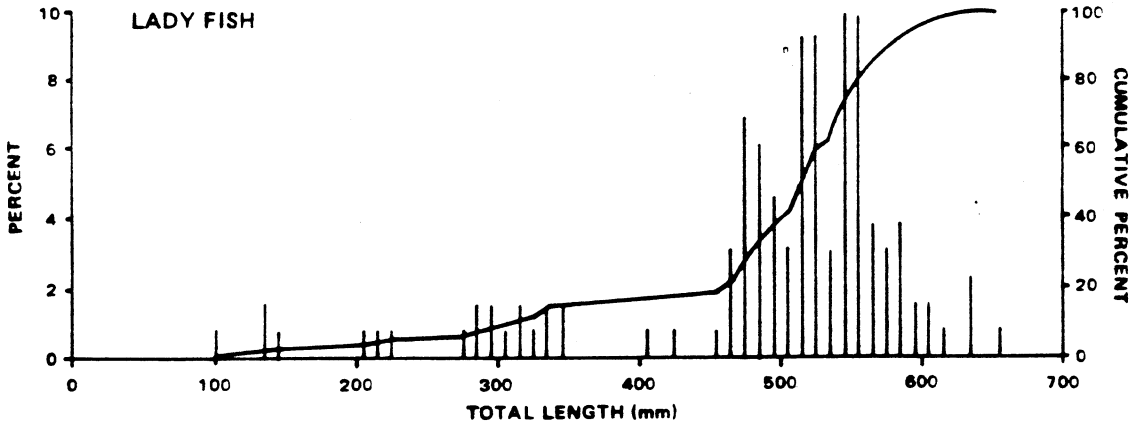
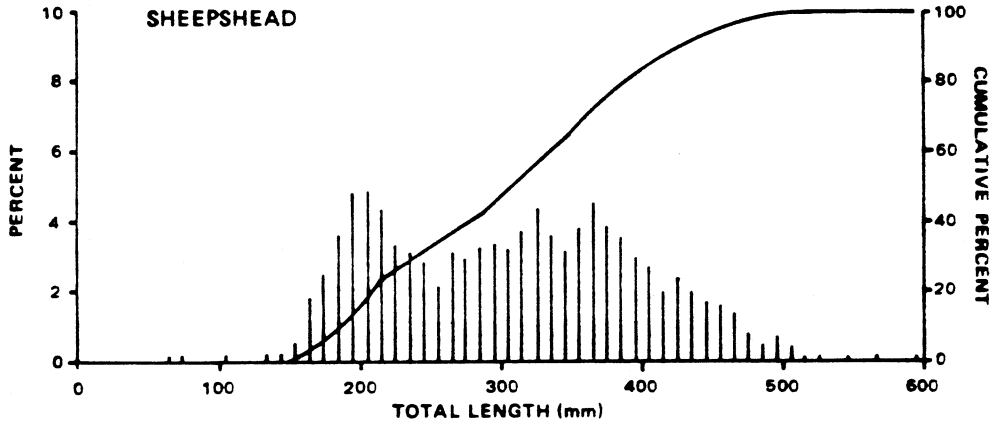

ATLANTIC STINGRAY
PERCENT
CUMULATIVE PERCENT
BODY WIDTH (mm)
0
2
4
6
8
10
0
20
40
60
80
100
0
100
200
300
400
500
600
700
800

Figure 9. Length frequency and cumulative percentage of 276 striped burrfish and 2834 sheepshead and 131 ladyfish collected in trammel nets in Texas bays, October 1976-April 1980.


LADY FISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
0
20
40
60
80
100
0
100
200
300
400
500
600
700


SHEEPSHEAD
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
0
20
40
60
80
100
0
100
200
300
400
500
600

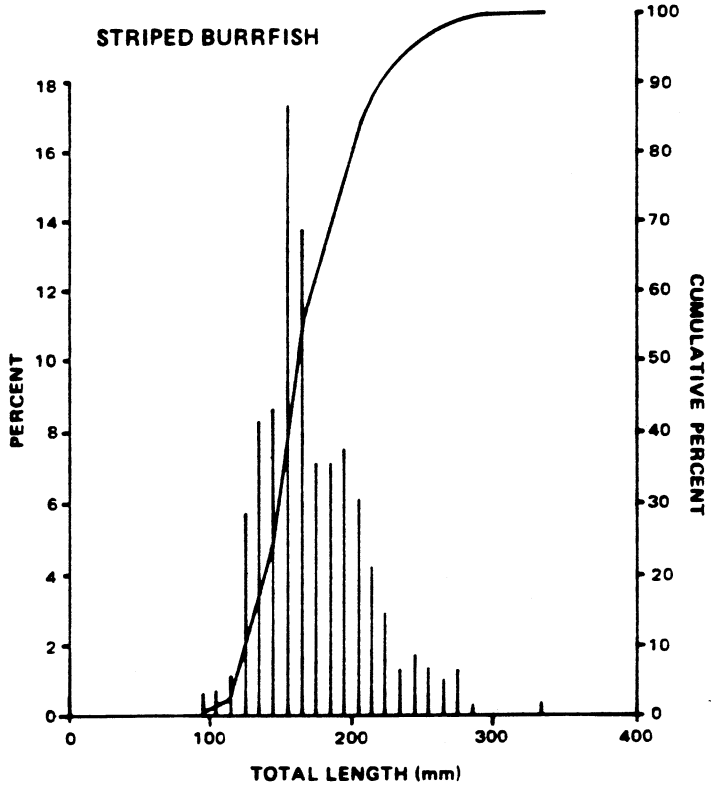
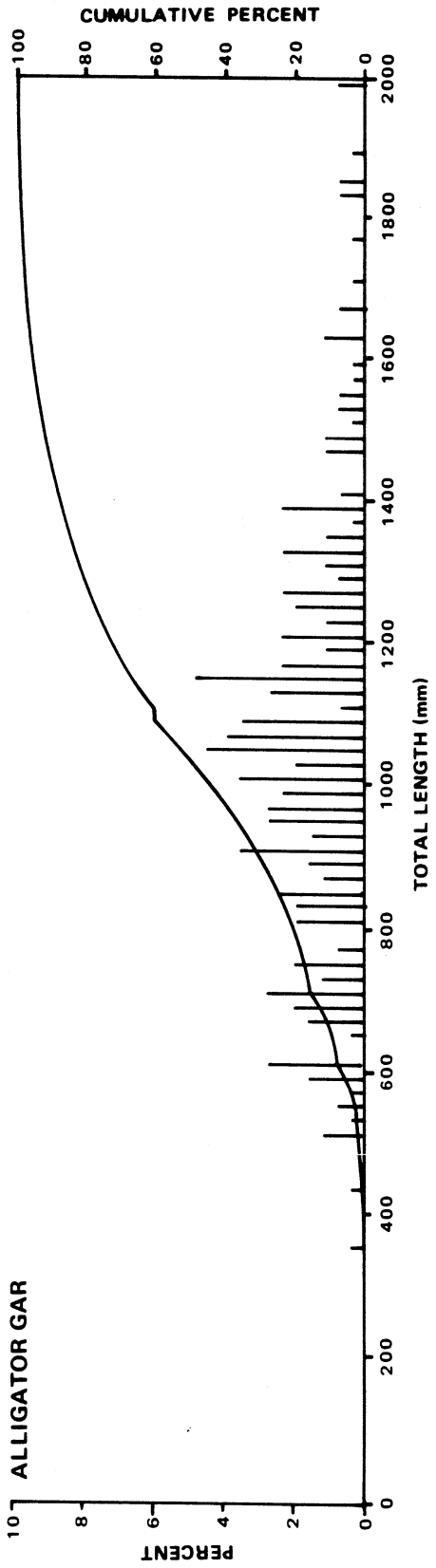

STRIPED BURRFISH
PERCENT
CUMULATIVE PERCENT
TOTAL LENGTH (mm)
0
2
4
6
8
10
12
14
16
18
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400

Figure 10. Length frequency and cumulative percentage of 247 alligator gar and 84 spotted gar collected in trammel nets in Texas bays, October 1976-April 1980.


CUMULATIVE PERCENT
100
80
60
40
20
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
TOTAL LENGTH (mm)
ALLIGATOR GAR
10
8
6
4
2
0
PERCENT

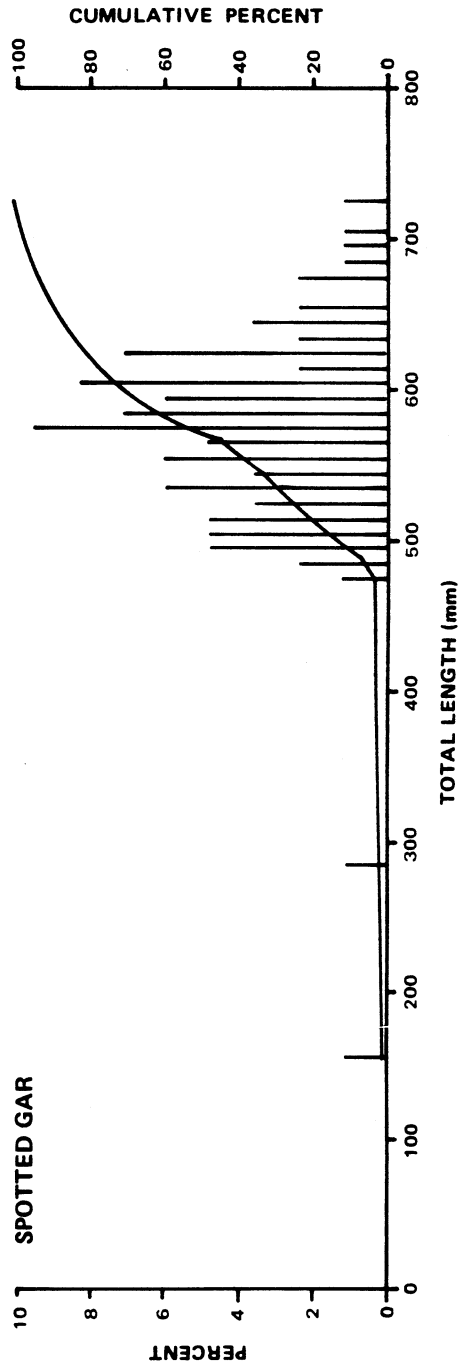
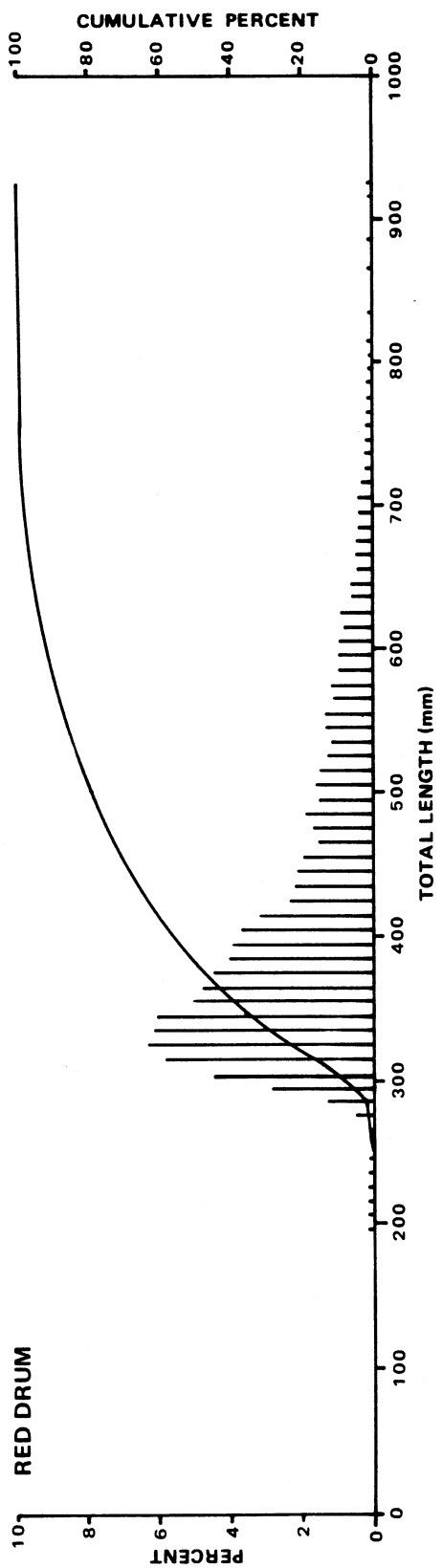

CUMULATIVE PERCENT
100
80
60
40
20
0
800
700
600
500
400
300
200
100
0
TOTAL LENGTH (mm)
SPOTTED GAR
10
8
6
4
2
0
PERCENT

Figure 11. Length frequency and cumulative percentage of 8519 red drum and 7244 black drum collected in trammel nets in Texas bays, October 1976-April 1980.


CUMULATIVE PERCENT
100
80
60
40
20
0
1000
900
800
700
600
500
400
300
200
100
0
TOTAL LENGTH (mm)
RED DRUM
10
8
6
4
2
0
PERCENT

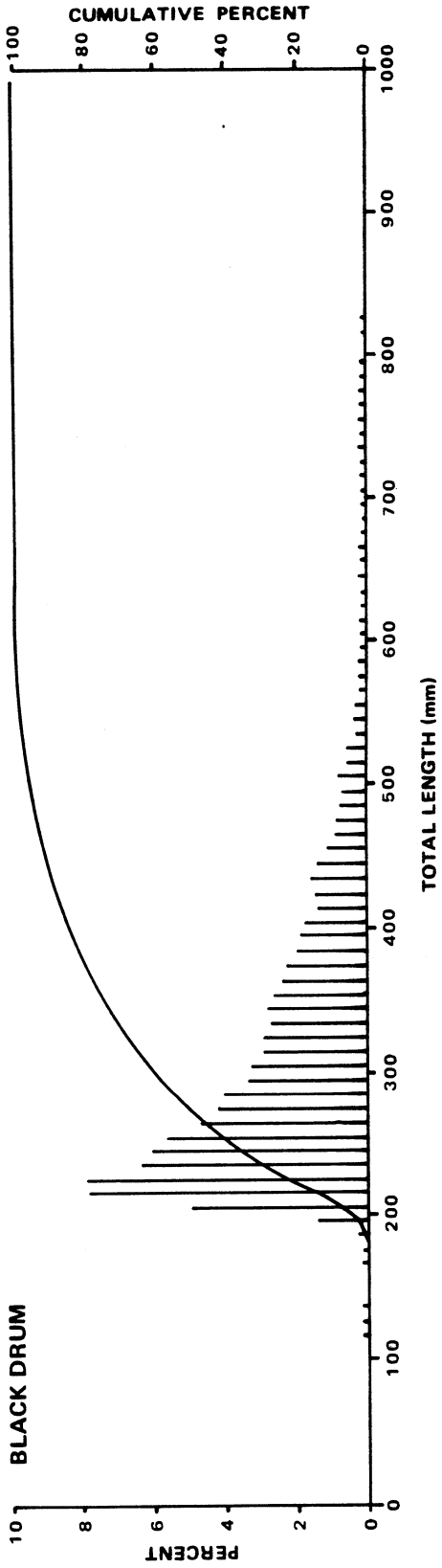

CUMULATIVE PERCENT
100
80
60
40
20
0
1000
900
800
700
600
500
400
300
200
100
0
TOTAL LENGTH (mm)
BLACK DRUM
10
8
6
4
2
0
PERCENT

Table 1. Mean total lengths (mm) of 24 species caught in 7.6-cm stretched mesh trammel nets in Texas bays during the period October 1977 through April 1980.

Species	Total length (mm) N	Range	Mean	1 SD	Maximum total length for 99.9% of the catch
Alligator gar	247	350-1990	1065	307	1950
Atlantic croaker	4653	55-655	270	29	415
Atlantic spadefish	276	65-365	120	34	335
Atlantic stingray	2932	95-755	225	58	445
Black drum	7244	115-995	310	99	755
Blue catfish	81	175-585	365	70	580
Finescale menhaden	410	145-395	285	36	385
Gafftopsail catfish	128	255-685	525	61	655
Gizzard shad	4211	135-605	285	31	405
Gulf flounder	187	185-425	275	55	425
Gulf menhaden	1960	65-395	255	26	385
Harvest fish	103	75-245	160	34	245
Ladyfish	131	105-655	490	109	655
Pigfish	420	115-555	230	26	365
Pinfish	1441	105-395	210	31	335
Red drum	8519	195-925	415	107	805
Sea catfish	8107	105-535	330	30	435
Sheepshead	2834	65-595	310	88	525
Southern flounder	1388	105-655	310	80	595
Spot	3661	45-445	230	19	345
Spotted gar	84	155-725	570	78	725
Spotted seatrout	6769	85-865	440	84	755
Striped burrfish	276	95-335	175	37	335
Striped mullet	11,082	95-775	345	35	495

Table 2. Comparison of standard deviations of mean lengths of eight species caught in 7.6-cm gill nets in Florida bays (Trent and Pristas 1977) and 7.6-cm trammel nets in Texas bays.

Species	Gill net	Trammel net
Gulf menhaden	11	26
Spot	10	19
Hardhead catfish	26	30
Pinfish	21	31
Atlantic croaker	18	29
Pigfish	9	26
Gafftopsail catfish	53	61
Spotted seatrout	31	84

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