

# 2000 SHARK EVALUATION ANNUAL REPORT

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## SUMMARY

*The Atlantic Shark Fishery Management Plan requires an annual report evaluating the status of shark fishery resources. The information presented herein is an update of shark landings and catches up to 1999. Data on average size, catches, landings, and CPUE of the small coastal shark management group are also presented.*

## BACKGROUND

The original Fishery Management Plan (FMP) for Sharks of the Atlantic Ocean was first implemented on 26 April 1993. Its main objectives were to: 1) prevent overfishing of shark resources; 2) encourage management of shark resources throughout their range; 3) establish a shark resource data collection, research, and monitoring program; and 4) increase the benefits from shark resources to the U.S. while reducing waste, consistent with the other objectives. During preparation of the FMP, it was determined that stocks of Atlantic large coastal sharks were below the level required to produce the maximum sustainable yield (MSY). In addition, the FMP called for an annual evaluation of information on shark landings, current stock condition, and information on which to base the total allowable catch (TAC).

After implementation of the FMP, NMFS convened three Shark Evaluation Workshops (SEW 1994, 1996, and 1998) as a mechanism to examine the available shark data and provide scientific advice to facilitate the evaluation of Atlantic shark resources. The 1998 Shark Evaluation Workshop was held at the Southeast Fisheries Science Center (SEFSC), Panama City Facility in June 1998. The report developed on the basis of the Workshop discussions reported that:

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**A** *The most recent catch rate data corresponding to 1996 and 1997 continue to show inconsistent trends either upward or downward, and many of these trends are statistically*

*insignificant. However, this is expected: although the fishery has now been regulated for five years, given that the expected rates of change in shark abundance are low and that the measures of stock abundance used are uncertain, a longer time series of catch rate estimates will be required to detect significant changes in stock size since implementation of the most recent management measures.*

*YProduction model analyses utilizing catch, catch rate and demographic data were integrated using Bayesian statistical techniques. For the large coastal aggregation: current (1998) stock size was estimated to be between 30 and 36% of MSY levels, and 1997 catch was estimated to be 218-233% of MSY (the ranges are defined by the mean values from two alternative catch scenarios). When analyses were disaggregated into sandbar and blacktip sharks, then for sandbar current stock size was estimated to be between 58 and 70% of MSY levels, and 1997 catch was estimated to be 85-134% of MSY. For blacktip, current stock size was estimated to be between 44 and 50% of MSY levels, and 1997 catch was estimated to be 163-184% of MSY. Thus, projections indicated that the large coastal aggregate complex might still require additional reductions in effective fishing mortality rate in order to ensure increases of this resource toward MSY. For the blacktip shark, projections also indicated a need for additional reductions, but it is unclear whether reductions in the U.S. alone would achieve the intended goals. Projections for sandbar were more optimistic, suggesting that current catches are closer to replacement levels.*

*On the basis of recent life history analyses of the sandbar shark showing that large juvenile and subadult individuals are likely to be the most sensitive stages in this species, it was concluded that management approaches should be aimed at reducing fishing mortality in these stages. A minimum size limit of about 140 cm fork length on the sandbar-like ridgeback sharks was identified as a possible strategy to reduce mortality in juvenile and subadult stages of sandbar sharks. Additionally, using similar life history arguments, a minimum size was also suggested for the blacktip-like non-ridgeback sharks as a strategy for reducing fishing mortality. However, in the case of blacktip, it is expected that a commercial minimum size might not achieve desired results due to mortality of undersized blacktips during normal fishing operations.*

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Atlantic shark resources are now being managed under the new Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP), which was implemented in July 1999. One of the main objectives of the HMS FMP is to prevent or end overfishing of Atlantic tunas, swordfish and sharks and adopt the precautionary approach to fisheries management. To achieve this and other objectives, after consideration of the 1998 SEW Report and other pertinent factors, NMFS implemented the following management measures (as well as others not listed below) for Atlantic shark resources under the HMS FMP: 1) reduce the recreational bag limit to 1 shark per vessel per trip, with a minimum size of 137 cm fork length for all sharks, and an additional 1 Atlantic sharpnose shark per person per trip; 2) prohibit possession of 19 species of sharks (Atlantic angel, basking, bigeye sand tiger, bigeye sixgill, bigeye thresher, bignose, Caribbean reef, Caribbean sharpnose, dusky, Galapagos, longfin mako, narrowtooth, night, sand tiger, sevengill, sixgill, smalltail, whale and white); and 3) limited access. Additionally, NMFS finalized the following measures in the HMS FMP: 1) reduce the annual commercial quota for large coastal sharks to 816 mt dw, apportioned between ridgeback (620 mt) and non-ridgeback (196 mt) sharks; 2) reduce the annual commercial quota for small coastal sharks to 359 mt dw; 3) reduce the annual commercial quota for pelagic sharks to 488 mt dw and establish a separate annual commercial quota of 92 mt dw for the porbeagle

and an annual dead discard quota for blue sharks of 273 mt dw; and 4) establish a minimum size of 137 cm fork length for ridgeback sharks. However, due to a court order these measures have not been implemented.

A Shark Evaluation Workshop was not reconvened in 1999 or 2000 because the amount of new information collected is insufficient to warrant a full new evaluation. This report represents the 2000 annual evaluation required by the FMP, and is focused on updating commercial and recreational landings, bycatch, and average weights up to 1998 and providing estimates for 1999 of Atlantic sharks harvested by US fishers. In addition, an evaluation of the small coastal shark (SCS) complex is being prepared for 2001. In preparation for that assessment, this report presents an update of commercial landings, recreational harvest and effort, and average size information for small coastal sharks.

## CATCH AND LANDINGS

U.S. Atlantic shark catches increased rapidly during the late 1980's and early 1990's to more than 9,500 mt, but were limited by a suite of regulations including commercial quotas and recreational bag limits. Because species-specific catches of sharks were generally not documented by all states until 1994, they were grouped by similar life-history and habitat characteristics for the purpose of management. Most of the recent U.S. catch of sharks for the market is of species grouped as large coastal sharks (LCS), both ridgeback (e.g., sandbar, dusky, silky, tiger) and non-ridgeback (e.g., blacktip, bull, lemon, spinner). Some pelagic sharks (e.g., mako, thresher, porbeagle) are also valued by U.S. fishers targeting tunas and swordfish. Four species of small coastal sharks (Atlantic sharpnose, bonnethead, blacknose, and finetooth) are also regularly landed in commercial fisheries and caught by recreational fishers.

Estimates of total catch and dead discarded large coastal sharks for the period 1981-1997 were summarized in Table 2 of the 1998 Report of the Shark Evaluation Workshop (NMFS 1998) and updated and extended to include 1998 in Table 1 of the 1999 Shark Evaluation Annual Report (Cortés 1999). The present report provides updated catch information for 1998 and estimated catches for 1999, which are presented in Table 1 herein. Species-specific commercial and recreational landings are also presented for the three management groups as well as average weights for large coastal sharks and species-specific catch histories for the blacktip and sandbar sharks.

### *1. Commercial Landings*

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As has been reported previously, the U.S. commercial shark fishery is primarily a southern coastal fishery extending from North Carolina to Texas. About 90% of 1998 and 1999 U.S. Atlantic shark landings, excluding dogfish, came from the southeastern region. Approximately 90% of large coastal sharks, two thirds of pelagic sharks, and the totality of small coastal sharks came from the southeastern region, whereas about 90% of all dogfish were landed in the northeastern region. Among large coastal sharks, the most sought-after species in this fishery are blacktip and sandbar sharks, although others are also taken (NMFS 1998, Cortés 1999). Shortfin mako and thresher

sharks are the two pelagic species more frequently landed, and among small coastal sharks, four species (Atlantic sharpnose, blacknose, finetooth, and bonnetheads) are regularly harvested.

U.S. commercial landings of Atlantic sharks in 1996-1999 were compiled based on Northeast Regional and Southeast Regional general canvass landings data, and the SEFSC quota monitoring data based on southeastern region permitted shark dealer reports. Landings prior to 1996 were taken as reported in NMFS (1998). Landings in southeastern states reported in the general canvass and quota monitoring data files were combined to define the species composition and volume of landings.

**Table 1.** Estimates of total landings and dead discards for large coastal sharks (numbers of fish in thousands), modified from 1998 Report of the Shark Evaluation Workshop (NMFS 1998) and 1999 Shark Evaluation Annual Report (Cortés 1999).

Year	Col 1 Commercial Landings	Col 2 Longline Discards	Col 3 Rec. Catches	Col 4 Unre- ported	Col 5 Coastal Discards	Col 6 Menhaden Fishery Bycatch	Col 7 Total
81	16.2	0.9	265.0				282.1
82	16.2	0.9	413.9				431.0
83	17.5	0.9	746.6				765.0
84	23.9	1.3	254.6				279.8
85	22.2	1.2	365.6				389.0
86	54.0	2.9	426.1	24.9			507.9
87	104.7	9.7	314.4	70.3			499.0
88	274.6	11.4	300.6	113.3			699.9
89	351.0	10.5	221.1	96.3			678.8
90	267.5	8.0	213.2	52.1			540.8
91	200.2	7.5	293.4	11.3			512.4
92	215.2	20.9	304.9				541.1
93	169.4	7.3	249.0		17.6		443.3
94	228.0	8.8	160.9		22.8	26.2	446.7
95	222.4	6.1	176.3		22.2	24.0	451.0
96	160.6	5.7	188.5		16.1	25.1	396.0
97	130.6	5.9	165.1		13.2	25.1	339.9
98	174.9	4.3	169.8		11.2	25.1	385.3
99	113.1	9.0	94.1		3.0	25.1	244.3

Column 1, commercial landings - These data are the landings reported under the established NMFS cooperative statistics program. (See document SB-III-6 for a description of this data collection program.) The data are collected in landed or dressed weight. Various sources of weight per fish estimates were used to convert pounds to numbers of fish. For the period 1981 through 1985, a generic factor of 45 pounds dressed weight per fish was used. For 1986 through 1991, an average weight for all species was used. These

averages are the ones that were used in the 1992 assessment. For 1992 and 1993, average weights for coastal species observed in longline catches were used in document SB-III-6, but the group felt that these weights were too high to apply to fish caught nearer shore in the directed large coastal fishery. Therefore, a weight of 40 pounds per fish was used for these two years. For 1994 and 1995, predicted weights from lengths based on the observer program (Branstetter and Burgess 1997) and data from the pelagic longline database were used. Average weights used for 1996-1999 came from the observer program and are given in the text.

Column 2, pelagic longline discards - The data for this column are from the analyses of the discards by pelagic longline vessels (see document SB-III-4). The estimates prior to 1987 are calculated using the average ratio of the discards to commercial landings for the data for 1987 through 1992 (discards as a fraction of combined landings and discards averaged 5.12% over this period). Estimates for 1993-1999 are from SB-III-4, SB-IV-22, SB-IV-33, and Cramer (1999, 2000).

Column 3, recreational harvest - These data are updated from data originally reported in document SB-III-5 and include estimated catches from the NMFS MRFSS, Headboat and charter boat surveys and the Texas Parks and Wildlife (TPWD) recreational creel survey. The estimate for 1999 is based on catches reported from MRFSS and assuming that catches from the Headboat and TPWD surveys were the same as those reported for 1998 since catches from these two sources were not yet available for 1999.

Column 4, unreported catches - These data are from a single source, which owned a fleet of vessels that fished in the Gulf of Mexico and off the coast of North Carolina. The estimate for 1988 was determined from company landings records. The estimates for other years were prorated based on the 1988 landings record and financial statements indexing income from shark fishing (SB-III-30). The Working Group did not have any way of determining the amount, if any, of these catches that were included. Therefore, the Working Group made the assumption that none of the catches were included and kept these data separate, listing them as unreported. The implicit assumption in doing this is that the landings were off-loaded in Alabama docks, but not sold to Alabama dealers.

Column 5, discards by coastal fishery - These data are from the Gulf and South Atlantic Fisheries Development Foundation/University of Florida observer program (SB-IV-1.2,3) and show that slightly more than 10% of large coastal species were discarded by the directed fishery in 1994 and 1995. The calculated percentages for 1994 and 1995 were averaged and applied to the recorded landings for 1993 to give an estimate of the discards in 1993. A 10% discard fraction was also assumed for 1996 and 1997, and a 6.4% and 2.7% discard rate was applied in 1998 and 1999, respectively, based on data from Florida's East and West coasts and North Carolina (K. Coyne, U. of Florida, pers. comm.). The discarded species are non-marketable animals that are included in the LCS management unit.

Column 6, bycatch by menhaden fishery - These data are bycatch estimates of large coastal sharks in the US Gulf of Mexico menhaden fishery for 1994-95 (de Silva et al. in review). It was estimated that 75% of the sharks encountered died and that about 97% of all sharks observed were large coastal sharks. The average for 1994 and 1995 was used as an estimate for 1996-99.

Column 7, total - The numbers in this column are the sum of columns 1-6.

The quota monitoring data provide a more diverse species listing than the general canvass data, whereas the general canvass data apportion a higher volume of shark landings as unclassified. The larger reported landing of a given species in the two data sets was taken as the actual landed volume for that species. The positive difference between the quota monitoring data and the general canvass data was then subtracted from the unclassified sharks category of the general canvass data to maintain the total landings volume equal to that reported in the general canvass data files. For the state of North Carolina (NC), it was believed that some dogfish may have also been assigned to the unclassified sharks category. To adjust for this possibility for the state of NC, the NC unclassified sharks were first apportioned between the large coastal, small coastal, pelagic and dogfish categories based on the reported distribution of landings by species and gear for that state. For states other than NC, the remainder of unclassified shark landings was assigned to the large coastal group unless the harvesting gear was pelagic longline, in which case the landings were assigned to the pelagic group. The updated commercial landings estimates for 1998 and current estimates for 1999 are shown in Table 2 below. Note that estimates for 1999 do not include landings in December for Florida as the estimate for that month was not yet available. Puerto Rico landings are included in both the 1998 and 1999 estimates from the Southeast general canvass data.

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Data from the quota monitoring system reveal that in 1998 about 50% of large coastal sharks were landed in Louisiana and about one third in Florida (east and west coasts), while North Carolina accounted for 11% of total LCS landings. In 1999, LCS landings in Louisiana made up about one third of the total, Florida landings accounted for 45%, and North Carolina for about 18% of the total LCS landings. Pelagic sharks were mostly landed in North Carolina in 1998 and 1999 (57% and 50%, respectively), east and west coasts of Florida (23% and 40%, respectively), and Louisiana (15% and 7%, respectively). Almost all small coastal sharks were landed in Florida's east coast in 1998 and 1999 (93% and 90%, respectively), the majority of which were caught with drift gillnet gear.

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Total commercial landings in 1998 and 1999 exceeded the allowed quotas. This can be attributed to state landings occurring after each of the two federal semi-annual season closures. For example, according to SE general canvass data, 1998 Louisiana landings (mostly of unclassified sharks likely to belong to the LCS complex) after the first semi-annual season closure amounted to about 679,000 lb dw (308 mt dw). Total landings of large coastal and pelagic sharks in 1999 were lower, whereas landings of small coastal sharks were higher, than in 1998. Lower LCS landings in 1999 can be due, at least in part, to a closed season for the commercial harvest of sharks in waters of the state of Louisiana between April 1 and June 30, which was implemented in 1999.

## 2. Bottom-Longline Shark Fishery Observer Program Information

As has been reported previously (NMFS 1996, 1998; Cortés 1999) information from observer sampling on board directed effort commercial shark vessels (formerly run jointly by the Gulf and South Atlantic Fisheries Development Foundation and the University of Florida [SB-IV-1,2,3] and presently by the University of Florida alone) was summarized to obtain estimates of the average size of sharks harvested by the commercial fleet. Differences in predicted (obtained by back-transforming from fork lengths) and observed sample weights were reported previously and attributed mainly to the opportunistic nature of weight measures taken during the observer program. This generally resulted in drastically fewer direct weight measurements than length measurements, and no weights being taken starting in 1999 (G. Burgess, U. of Florida, pers. comm.). For this evaluation update, average weights were calculated from lengths of sharks measured during the survey by applying length-weight regressions summarized in SB-III-5 and in other published and unpublished sources. The predicted average weight for the LCS grouping was 32.76 lb dw (14.86 kg, n=2,912) in 1996, 30.53 lb (13.85 kg, n=2,238) in 1997, 26.21 lb (11.89 kg, n=4,451) in 1998, 34.66 lb (15.72 kg, n=2,856) in 1999, and 33.38 lb (15.14 kg, n=513) in 2000. It is assumed that average weights predicted from length are a closer approximation to the actual dressed weights of sharks caught in the commercial fishery and thus the estimates in Table 1 are calculated based on predicted weights.

Using this updated average size information, the estimated U.S. commercial landings of Atlantic LCS were 2,387 mt dw (about 160,600) in 1996, 1,809 mt (130,600 fish) in 1997, 2,080 mt (174,900 fish) in 1998, and 1,778 mt (113,100 fish) in 1999. These levels represent a reduction from peak recorded commercial landings (about 4,600 mt, approximately 350,000 fish in 1989; SB-III-6) of this grouping of sharks. Commercial catches of LCS in numbers in 1996, 1997, 1998, and 1999 are estimated to be about 72%, 59%, 79%, and 51%, respectively, of those in 1995 (Table 1). Catches in numbers for 1999 are estimated to be about 35% lower than 1998 catches.

**Table 2.** Estimated U.S. Atlantic shark landings in 1998 and 1999 for the Large and Small Coastal and Pelagic Management Groups. All landings are dressed weights.

Large Coastal Sharks	Landed lbs	Small Coastal Sharks	Landed lbs	Pelagic Sharks	Landed lbs
<b>1998:</b>		<b>1998:</b>		<b>1998:</b>	
Shark, bignose	50	Shark, Atlantic sharpnose	230,920	Shark, bigeye thresher	1,403
Shark, blacktip	1,893,805	Shark, blacknose	119,689	Shark, blue	706
Shark, bull	27,389	Shark, bonnethead	13,949	Shark, shortfin mako	224,421
Shark, dusky	81,124	Shark, finetooth	267,224	Shark, longfin mako	4,971

Shark, hammerhead	59,802	Shark, unc	82	Shark, mako	79,773
Shark, lemon	23,232			Shark, oceanic whitetip	22,049
Shark, night	3,289			Shark, porbeagle	19,795
Shark, nurse	2,846			Shark, thresher	102,531
Shark, reef	100			Shark, pelagic	111
Shark, sand tiger	38,791			Shark, unc	49,515
Shark, sandbar	1,077,161				
Shark, silky	13,615				
Shark, spinner	16,900				
Shark, tiger	12,174				
Shark, large coastal	172,038				
Shark, unc	1,085,989				
Shark, unc, fins	76,588				
Total:	4,584,893	Total:	631,864	Total:	505,275
	(2,080 mt)		(287 mt)		(229 mt)
<b>1999:</b>		<b>1999:</b>		<b>1999:</b>	
Shark, bignose	9,035	Shark, Caribbean sharpnose	2,039	Shark, bigeye thresher	17,759
Shark, blacktip	1,286,979	Shark, Atlantic sharpnose	239,647	Shark, blue	1,111
Shark, bull	25,426	Shark, blacknose	130,317	Shark, shortfin mako	170,860
Shark, dusky	110,950	Shark, bonnethead	53,702	Shark, longfin mako	4,619
Shark, hammerhead	53,394	Shark, finetooth	246,404	Shark, mako	58,344
Shark, lemon	23,604	Shark, unc	136	Shark, oceanic whitetip	698
Shark, night	4,287			Shark, porbeagle	5,362
Shark, nurse	1,168			Shark, thresher	96,012
Shark, sand tiger	6,401			Shark, unc	46,056
Shark, sandbar	1,299,987				
Shark, silky	8,649				
Shark, spinner	629				
Shark, tiger	30,274				
Shark, large coastal	67,197				
Shark, unc	911,115				
Shark, unc, fins	80,393				
Shark, white	82				
Total:	3,919,570	Total:	672,245	Total:	400,821
	(1,778 mt)		(305 mt)		(182 mt)

### 3. *Recreational Harvest Estimates*

Recreational fishing for sharks also results in significant harvests of large coastal and other shark species (SB-III-5). Recreational harvest of sharks occurs all along the U.S. Atlantic and Gulf of Mexico coasts. Recreational fishing estimates were obtained, as previously reported, from three data collection programs: the Marine Recreational Fishing Statistics Survey (MRFSS), the NMFS Headboat Survey (HBOAT) operated by the SEFSC Beaufort Laboratory, and the Texas Parks and Wildlife Recreational Fishing Survey (TXPWD). In 1998, 94% and 99% of the total recreational reported harvest of large coastal and pelagic sharks, respectively, came from MRFSS, whereas for small coastal sharks, 47% of the reported harvest came from MRFSS, 36% from TXPWD, and 17%

from HBOAT. MRFSS statistics from 1981-1998 reveal that about 81% of all LCS were caught in the Gulf of Mexico (45%) and South Atlantic (36%) regions, with only 18% being caught in the Mid-Atlantic region. Pelagic sharks were caught mostly in the Mid-Atlantic (64%) and to a lesser extent in the Gulf of Mexico (18%), North Atlantic (11%), and South Atlantic (7%) during that period. The vast majority of SCS were caught in the Gulf of Mexico (54%) and South Atlantic (43%) regions, and only 3% in the Mid-Atlantic region.

Recreational harvests of LCS were estimated to be on the order of 176,000, 188,500, and 165,000 fish in 1995, 1996, and 1997, respectively (Table 1). In 1998, including catches from the HBOAT and TXPWD surveys which were not available for the 1999 evaluation, an estimated 170,000 LCS were landed by the recreational sector. In 1999, only an estimated 84,000 LCS were reported by MRFSS, in contrast to almost 160,000 reported in this survey in 1998. Assuming that LCS catches from the HBOAT and TXPWD surveys were equal to those reported in 1998 (about 2,900 and 7,300, respectively), the total estimated recreational catches for 1999 are on the order of 94,000 LCS (Table 1). The more recent estimates (1994-1999) are considerably lower than those from 1981-1993. Additionally, from 1995 to 1999, about 23,000, 27,000, 15,000, 9,000, and 7,000 unidentified sharks, respectively, were estimated to have been

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**Table 3.** Recreational harvest estimates of U.S. Atlantic sharks for 1998 and 1999. Data for 1998 are from MRFSS, the Headboat Survey, and the Texas Parks & Wildlife Survey; data for 1999 are only from MRFSS as estimates from the other two surveys were not yet available. All catches are in numbers.

Large Coastal Sharks	Catch	Small Coastal Sharks	Catch	Pelagic Sharks	Catch
<b>1998:</b>		<b>1998:</b>		<b>1998:</b>	
Shark, blacktip	82,310	Shark, Atlantic angel	109	Shark, blue	6,085
Shark, bull	1,745	Shark, Atlantic sharpnose	129,315	Shark, shortfin mako	5,633
Shark, dusky	4,499	Shark, blacknose	10,523	Shark, mako	8
Shark, great hammerhead	494	Shark, bonnethead	29,692	Shark, thresher	36
Shark, hammerhead genus	389	Shark, finetooth	139		
Shark, lemon	2,303			Total:	11,762
Shark, night	133				
Shark, nurse	2,455				
Shark, requiem family	15,496				
Shark, requiem genus	3,643				
Shark, sandbar	35,766				
Shark, scalloped hammerhead	2,575				
Shark, silky	5,376				
Shark, smooth hammerhead	375			<b>Unknown Sharks</b>	
Shark, spinner	10,836				
Shark, tiger	1,380			Shark, unc.	8,685
Total:	169,776	Total:	169,779	Total:	8,685
<b>1999:</b>		<b>1999:</b>		<b>1999:</b>	
Shark, blacktip	30,961	Shark, Atlantic sharpnose	40,291	Shark, blue	5,218
Shark, bull	2,832	Shark, blacknose	5,957	Shark, shortfin mako	1,383
Shark, dusky	5,186	Shark, bonnethead	36,664	Shark, thresher	4,512
Shark, great hammerhead	346	Shark, finetooth	69		
Shark, hammerhead genus	75			Total:	11,113
Shark, lemon	131				
Shark, nurse	1,489				
Shark, requiem family	3,975				
Shark, requiem genus	8,978				
Shark, sandbar	18,882				
Shark, scalloped hammerhead	1,329				
Shark, silky	3,834			<b>Unknown Sharks</b>	
Shark, spinner	5,738				
Shark, tiger	146			Shark, unc.	6,859
Total:	83,901	Total:	82,891	Total:	6,859

harvested by the recreational fishery, some of which might have been large coastal sharks. Recreational catches of large coastal sharks in numbers in 1999 are estimated to be 53%, 50%, 57%,

and 55% of those in 1995, 1996, 1997, and 1998, respectively. The 1996, 1997, and 1998 recreational catches in numbers were greater than those from the commercial sector, whereas the 1999 catches were lower (Table 1). Recreational harvest estimates are shown in Table 3 above.

#### ***4. Bycatch and Discard of Sharks***

As reported in NMFS (1996, 1998) and Cortés (1999), bycatch of sharks occurs in many fisheries, including trawl, set-net, and hook and line fisheries. For instance, in the Gulf of Mexico, shark bycatch by the U.S. shrimp trawl fleet consists mainly of sharks too small to be highly valued in the commercial market (SB-III-23). Bycatch of sharks in trawl and other fisheries outside of the Gulf of Mexico also likely occurs with regularity.

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Pelagic longline fisheries targeting swordfish and tunas can, at times, have shark bycatches that exceed the targeted species catch. In the U.S. longline and drift gillnet fisheries, logbook and scientific observer reports indicate shark bycatch varies with target species (e.g., yellowfin tuna, bigeye tuna or swordfish), gear characteristics and fishing season. Estimates of the annual dead discarded tonnage of large coastal sharks by U.S. pelagic longline fisheries between 1987 and 1995 range from about 140-875 mt (approximately 6,000-21,000 fish; SB-III-4). For 1996 and 1997, approximately 5,700 and 5,900 large coastal sharks, respectively, were estimated to have been discarded dead by these fleets (SB-IV-22, SB-IV-33). In 1998 and 1999, 4,300 and 9,000 fish, respectively, were estimated as dead bycatch (Cramer 1999, 2000).

Observer data collected from the directed bottom-longline shark fishery (SB-IV-1, 2, 3 and G. Burgess and K. Coyne, U. of Florida, pers. comm.) indicate that large coastal sharks discarded dead from the fishery represented about 10% of the total mortality attributable to the LCS grouping harvested by the fishery from 1994 to 1997, about 6.4% for 1998, and about 2.7% for 1999. Observer data collected from the Gulf of Mexico menhaden fishery operating mainly off Louisiana for the period 1994-1995 (de Silva et al., in review) indicated that 75% of the sharks encountered in this fishery died; 97% were large coastal and 3% were small coastal sharks. The total number of sharks caught by this fishery was estimated to be about 36,000 in 1994 and 33,000 in 1995, or about 26,200 ( $36,000 \times 0.75 \times 0.97$ ) and 24,000 large coastal sharks discarded dead in 1994 and 1995, respectively. The average number of large coastal sharks caught in this fishery during 1994-95 (25,100 fish) was used as an estimate for subsequent years (1996-99; Table 1).

#### ***5. Species-Specific Catch Histories***

For the purpose of development of species-specific assessments, estimates of the historical catch time series for blacktip and sandbar sharks were prepared based on estimated area and gear specific landings by year. Estimated catches of blacktip (Table 4) and sandbar (Table 5) sharks were based on the proportional allocation of commercial landings of unclassified sharks by gear type and region defined in SB-IV-31 for the period 1986-1995 and using the species breakouts defined in SB-IV-12 for 1996, in Table 2 of Cortés (1999) for 1997, and in Table 2 herein for 1998 and 1999. Unclassified sharks in 1996-99 attributed to the LCS grouping were proportionally allocated to

sandbar and blacktip sharks, respectively, based on the species-specific landings identified in SB-IV-12, Table 2 in Cortés (1999), and Table 2 herein.

As in previous reports, unreported landings were based on the assumed proportions of the values reported in Table 1 of SB-IV-12: 75% blacktip and 25% sandbar for the period 1986-1987, and 50% blacktip, 50% sandbar for the period 1988-1991. Species-specific recreational catches are as reported in SB-III-7, SB-IV-12, Cortés (1999), and in Table 3 herein for 1998 and 1999. Levels of dead discarded blacktip and sandbar sharks are assumed to be negligible for U.S. pelagic longline fisheries. Average weights for these species caught in commercial fisheries are taken as predicted weights from length measures from revised estimates of observer data in the directed longline fishery for the period 1994-1997. Prior to 1994, values assumed are indicated (Tables 4 and 5). Estimates of numbers of sharks caught and landed by the directed commercial fleet are taken as estimates of lb (dressed) landed/average wt (dressed lb). Mexican catches are as reported in Table 4 of the 1998 SEW report, with catches for 1998 and 1999 assumed to be equal to those in 1993-1997.

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Bycatch of blacktip and sandbar sharks in the Gulf of Mexico menhaden fishery (de Silva et al., in review) was also incorporated in this assessment following the rationale presented in Cortés (1999), in which blacktip sharks were assumed to represent 45.3% and sandbar sharks 1.8% of the total bycatch observed during 1994-95. Considering the reported 75% mortality rate among all sharks, this results in an estimated bycatch of 12,200 ( $36,000 \times 0.453 \times 0.75$ ) and 11,200 dead blacktip sharks, and 486 and 445 sandbar sharks, in 1994 and 1995, respectively. The averages of the 1994 and 1995 values (11,700 fish for blacktip sharks and 465 fish for sandbar sharks) were used as estimated dead bycatch for 1996-99.

## **6. Small Coastal Sharks**

### *Recent Trends in Catch and Landings*

The 1993 FMP determined that small coastal sharks were fully fished. In preparation for an assessment of the SCS complex in 2001, recent trends in commercial and recreational landings of this grouping and of the four commonly caught species comprising it are presented below. It is important to note that landings probably represent only a small fraction of all catches as small coastal sharks are caught as bycatch and discarded in a variety of fisheries. For example, estimates of SCS discards in the shrimp trawl fishery from 1972-1994 ranged from 1.6 to 3.3 million individuals (SB-III-23). Data from the directed shark fishery observer program targeting large coastal sharks indicate that sharks in the SCS complex are generally not landed but used for bait.

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**Table 4.** Estimates of the annual catches of blacktip sharks based on area-gear definitions described in SB-IV-31 and species breakouts in SB-IV-12, Cortés (1999), and Table 2 of this report.

Year	Blacktip lb landed	Average Wt	lb landed/ Ave Wt	Recreational Harvest	Rec+Com	Unreported	Mexico small fish	Menhaden Fishery bycatch	Total
1986	1,213,040	20.5	59,173	162,402	221,575	18,675	15,642	?	255,892
1987	1,463,544	20.5	71,392	129,551	200,943	52,725	22,346	?	276,014
1988	3,300,321	20.5	160,991	139,806	300,797	56,650	29,050	?	386,497
1989	3,832,421	20.5	186,947	111,368	298,315	48,150	35,754	?	382,219
1990	2,052,287	20.5	100,112	94,136	194,248	26,050	42,458	?	262,756
1991	2,744,292	20.5	133,868	150,794	284,662	5,650	49,161	?	339,473
1992	3,610,218	20.5	176,108	157,663	333,771		55,865	?	389,636
1993	3,086,965	20.5	150,584	109,057	259,641		62,569	?	322,210
1994	3,829,364	19.3	198,413	66,106	264,519		62,569	12,200	339,288
1995	2,915,797	20.5	142,234	59,892	202,126		62,569	11,200	275,895
1996	2,121,714	21.8	97,326	79,753	177,079		62,569	11,700	251,348
1997	2,170,597	23.6	91,974	70,963	162,937		62,569	11,700	237,206
1998	2,626,806	25.5	103,012	82,310	185,322		62,569	11,700	259,591
1999	1,809,972	29.4	61,564	30,961	92,525		62,569	11,700	166,794

**Table 5.** Estimates of the annual catches of sandbar sharks based on area-gear definitions described in SB-IV-31 and species breakouts in SB-IV-12, Cortés (1999), and Table 2 of this report.

Year	Sandbar lb landed	Average Wt	lb landed/ Ave wt	Recreational Harvest	Rec+Com	Unreported	Menhaden Fishery bycatch	Total
1986	796,509	35.9	22,187	123,660	145,847	6,225	?	152,072
1987	2,285,644	35.9	63,667	32,551	96,218	17,575	?	113,793
1988	2,737,938	35.9	76,266	64,792	141,058	56,650	?	197,708
1989	4,215,657	35.9	117,428	27,417	144,845	48,150	?	192,995
1990	4,026,470	35.9	112,158	58,814	170,972	26,050	?	197,022
1991	3,292,594	35.9	91,716	36,794	128,510	5,650	?	134,160
1992	3,470,449	35.9	96,670	36,294	132,964		?	132,964
1993	2,483,235	35.9	69,171	26,607	95,778		?	95,778
1994	4,691,470	37.1	126,455	14,974	141,429		486	141,915
1995	3,012,065	35.7	84,372	24,906	109,278		445	109,723
1996	2,004,759	30.6	65,515	35,711	101,226		465	101,691
1997	1,283,871	31.0	41,415	41,618	83,033		465	83,498
1998	1,494,078	23.8	62,776	35,766	98,542		465	99,007
1999	1,828,266	32.5	56,254	18,882	75,136		465	75,601

Commercial landings are reported for the period 1995-99 as the higher of the two estimates from the general canvass program and the southeast quota monitoring system. Prior to 1995, landings were only reported in the general canvass program, but were insignificant (<1 mt for 1991 and 1993, about 7 mt in 1994). Commercial landings in numbers exceed recreational harvest in all years since the quota monitoring system was implemented (Table 6). Commercial landings peaked at 320 mt dw in 1997 or about 214,000 fish (calculated using average weights predicted from lengths measured in the directed shark fishery observer program). Recreational catches and total landings peaked at about 170,000 and 358,000 fish, respectively, in 1998.

**Table 6.** Estimates of total landings for Small Coastal Sharks.

Year	Col 1 Commercial (mt landed)	Col 2 Av. Wt (lb dw)	Col 3 Mt landed/ Av. wt	Col 4 Rec. Catches	Col 5 Total
95	244.2	3.858	139.6	61.6	201.2
96	219.9	4.094	118.4	113.5	231.9
97	319.7	3.291	214.2	98.5	312.7
98	286.6	3.362	187.9	169.8	357.7
99	304.9	3.267	205.8	83.0	288.8

Column 1, commercial landings in mt dw - These data are the landings reported under the established NMFS Cooperative statistics program. (See document SB-III-6 for a description of this data collection program.) The data are collected in landed or dressed weight. Values updated from SB-IV-12, Table 2 in Cortés (1999) and Table 2 herein.

Column 2, average weights in lb dw - The data for this column are predicted weights from lengths based on the directed shark fishery observer program (Branstetter and Burgess 1997; G. Burgess, U. of Florida, pers. comm.)

Column 3, number of sharks caught and landed commercially (in thousands) - Data in this column are calculated as the ratio of column 1 (mt landed) and column 2 (average weight in lb dw).

Column 4, recreational harvest B Estimated catches in numbers (in thousands) updated from the NMFS MRFSS, Headboat and charter boat surveys and the Texas Parks and Wildlife (TPWD) recreational creel survey. The estimate for 1999 is based on catches reported from MRFSS and assuming that catches from the Headboat and TPWD surveys were the same as those reported for 1998 since catches from these two sources were not yet available for 1999.

Column 5, total - The numbers in this column are the sum of columns 3-4.

By species, bonnetheads made up over 50% of all SCS commercial landings in 1995, but were the least important species represented in commercial landings for the remaining years, 1996-99 (Table 7). Except for 1995, Atlantic sharpnose sharks accounted for over one third of all SCS commercial landings from 1996-99, whereas finetooth sharks accounted for over one third of the landings in 1998-99 only. The recreational catches were dominated by the Atlantic sharpnose shark in 1996-99 (about two thirds of the total catches in 1996-97, three quarters in 1998, and half in 1999), whereas bonnetheads made up over 50% of the catches in 1995 and were the second-most important species caught recreationally from 1996-99. For commercial and recreational landings combined, the Atlantic sharpnose shark was also the predominant species landed from 1996-99, with the bonnethead accounting for over 50% of the total landings in 1995.

**Table 7.** Estimates of total landings for Atlantic sharpnose, blacknose, bonnethead, and finetooth sharks.

Year	Col 1 Commercial (lb landed)	Col 2 Av. Wt (lb dw)	Col 3 Mt landed/ Av. wt	Col 4 Rec. Catches	Col 5 Total
<b>Atlantic Sharpnose</b>					
95	93,663	3.41	27,437	27,068	54,505
96	165,406	3.37	49,113	73,626	122,739
97	256,562	3.26	78,777	67,726	146,503
98	230,920	3.16	72,977	129,315	202,292
99	239,647	3.18	75,328	40,291	115,619
<b>Blacknose</b>					
95	96,487	6.16	15,672	85	15,757
96	144,433	6.02	23,981	11,831	35,812
97	202,781	4.63	43,792	10,705	54,497
98	119,689	5.13	23,345	10,523	33,868
99	130,317	4.74	27,515	5,957	33,472
<b>Bonnethead</b>					
95	295,026	4.28	68,964	32,318	101,282
96	78,638	6.15	12,796	22,142	34,938
97	75,787	4.81	15,752	15,307	31,059
98	13,949	5.26	2,650	29,692	32,342
99	53,702	5.07	10,593	36,664	47,257
<b>Finetooth</b>					
95	50,193	14.31	3,508	1,203	4,711
96	94,134	11.42	8,240	1,605	9,845
97	169,733	11.42	14,857	4,763	19,620
98	267,224	11.42	23,390	139	23,529
99	246,404	11.42	21,568	69	21,637

Column 1, commercial landings in lb dw- These data are the landings reported under the established NMFS cooperative statistics program. (See document SB-III-6 for a description of this data collection program.) The data are collected in landed or dressed weight. Values updated from SB-IV-12, Table 2 in Cortés (1999) and Table 2 herein.

Column 2, average weights in lb dw - The data for this column are predicted weights from lengths based on the directed shark fishery observer program (Branstetter and Burgess 1997; G. Burgess, U. of Florida, pers. comm.) For the finetooth shark, average weights were not available for 1997-99 and the value for 1996 was assumed for those years.

Column 3, number of sharks caught and landed commercially - Data in this column are calculated as the ratio of column 1 (lb landed) and column 2 (average weight in lb dw).

Column 4, recreational harvest **B** Estimated catches in numbers updated from the NMFS MRFSS, Headboat and charter boat surveys and the Texas Parks and Wildlife (TPWD) recreational creel survey. The estimate for 1999 is based on catches reported from MRFSS and assuming that catches from the Headboat and TPWD surveys were the same as those reported for 1998 since catches from these two sources were not yet available for 1999.

Column 5, total - The numbers in this column are the sum of columns 3-4.

### *Recreational Catch and Effort*

Recreational catch and effort information for sharks, including small coastal sharks, in the Atlantic and Gulf of Mexico is collected by the three surveys described earlier (MRFSS, HBOAT, and TXPWD) and was reported in SB-III-5. Revised catch estimates for the SCS complex and for individual species, and estimates of non-targeted effort are included herein. MRFSS catch (type A and B1) and effort estimates are for 1981-98, whereas those from HBOAT and TXPWD are for 1986-98. Thus, for 1981-85, catch and effort estimates are from MRFSS only, and from 1986-98, the estimates are the sum of estimates from the three surveys. Effort estimates are reported as angler trips by MRFSS, angler days by HBOAT, and angler hours by TXPWD; angler hours were converted to angler days assuming 8 angler hours per angler day. For 1986-98, total effort was thus calculated as the sum of annual angler days across the three surveys.

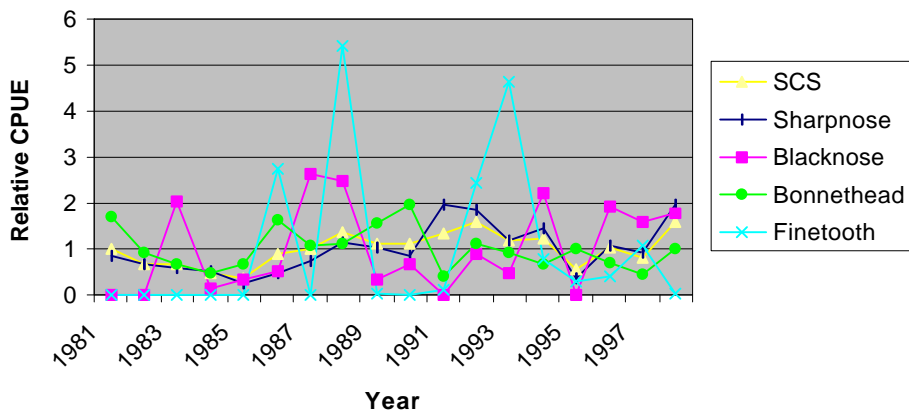
Recreational catches of the SCS complex peaked at almost 170,000 fish in 1998 (Table 8). Except for 1985, 1986, 1990, and 1995, when the bonnethead was the most frequently caught species, the Atlantic sharpnose shark was consistently the main species landed by recreational fishers, peaking at about 137,000 and 129,000 fish in 1991 and 1998, respectively. The bonnethead was also consistently the second-most caught species, with the importance of the blacknose and finetooth sharks alternating throughout the time series of catches. Recreational effort ranged from about 43 million angler days in 1981 to a maximum of over 64 million angler days in 1983, with the level of effort in the 1990s ranging from about 54 to 63 million angler days (Table 8).

Catch rates based on the highly aggregated measures of effort used show a generally increasing trend for the SCS complex and the Atlantic sharpnose shark (Fig. 1). The SCS complex time series showed an increase from 1981-92, followed by a decline from 1992 to 1995, and a recovery to a maximum in 1998. The time series for the Atlantic sharpnose shark followed the same general trend with a peak in 1991, followed by a low in 1995 and another peak in 1998. The time series for the bonnethead, blacknose shark, and especially the finetooth shark, were much more cyclical, showing no clear pattern.

**Table 8.** *Estimates of total annual recreational catches of small coastal sharks (as a complex and by species) and of total annual effort (measured as angler days) estimated from MRFSS, HBOAT, and TXPWD.*

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Year	All SCS	Atlantic sharpnose	Blacknose	Bonnethead	Finetooth	Effort
1981	82,759	43,490		39,269		43,494,044
1982	67,647	40,656		26,115		52,384,610
1983	81,839	45,208	13,936	22,695		64,190,589
1984	51,828	34,781	844	14,317		57,875,519
1985	40,304	17,829	1,918	20,557		56,464,096
1986	103,833	34,923	3,308	53,386	11,819	61,694,805
1987	105,899	48,750	15,382	31,521	17	55,178,341
1988	156,835	82,375	15,971	35,650	22,839	60,688,085
1989	106,064	62,332	1,793	41,782	157	50,808,151
1990	99,990	47,283	3,345	49,308	54	47,143,256
1991	150,132	137,018	8	12,595	511	59,640,302
1992	163,202	116,162	5,199	32,498	9,321	54,244,385
1993	128,851	78,679	3,024	28,648	18,500	57,257,462
1994	143,186	103,194	14,464	21,573	3,347	61,456,295
1995	61,601	27,068	85	32,318	1,203	59,952,066
1996	113,493	73,626	11,831	22,142	1,605	58,215,367
1997	98,501	67,726	10,705	15,307	4,763	63,159,477
1998	169,779	129,315	10,523	29,692	139	56,250,521



**Figure 1.** Relative catch rates of small coastal sharks estimated from the recreational fishery.

*Average Size Information*



Average size information for the SCS complex and for the four main species of SCS was obtained from several sources: the bottom-longline shark fishery observer program (BLLOP) mentioned earlier, the SEFSC's Trip Interview Program (TIP), and length frequency data from the three recreational surveys also discussed earlier (MRFSS, HBOAT, TXPWD). Weights were predicted from lengths recorded in these surveys through the length-weight relationships referred to earlier and were transformed from whole to dressed by applying a conversion factor of 2. Average weights are presented in Tables 9-13.

Size information from the five surveys was generally dominated by data from Atlantic sharpnose shark. The directed shark fishery observer program (BLLOP) was available for 1993-2000 and primarily contained species-specific information for the Atlantic sharpnose and blacknose sharks (Tables 10 and 11). Size information from TIP's data collection program initiated in the mid-1980s aimed primarily at collecting size frequency data from a variety of fisheries for stock assessment purposes was available essentially for 1990-95, and contained little data for the bonnethead and blacknose shark and no data for the finetooth shark (Tables 11-13). Average weights predicted from MRFSS length data (1981-99) were also dominated by Atlantic sharpnose shark and tended to be the lowest of all estimates for the SCS complex and for individual species (Tables 9-13). Observed weights, which were also available for most years, were always higher than predicted weights from this survey. In contrast, observed weights from the headboat survey (HBOAT) were in good agreement with the length-predicted weights for most years of observations (1986-98) for Atlantic sharpnose shark (which also made up the bulk of the observations) and the SCS complex. Finally, length-predicted average weights from TXPWD (1983-98) generally fell between those from MRFSS and HBOAT. This survey contained more length data for the bonnethead and the finetooth shark but virtually no data for the blacknose shark.

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**Table 9.** Average weights (lb dw) of the SCS complex predicted from lengths recorded in the bottom-longline observer program (BLLOP), Trip Interview Program (TIP), and MRFSS, HBOAT, and TXPWD surveys. Standard errors of the mean (SE) and sample size (n) are indicated. Data for sample sizes <10 are in italics.

	BLLOP			TIP			MRFSS			HBOAT			TXPWD		
Year	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n
1981							1.68	0.17	18						
1982							1.83	0.33	36						
1983							1.67	0.57	14				2.85	0.14	157
1984				<i>2.34</i>	<i>0.22</i>	<i>3</i>	1.49	0.56	16	<i>3.36</i>	<i>0.69</i>	<i>2</i>	3.14	0.11	261
1985				<i>5.34</i>	<i>0.27</i>	<i>4</i>	1.87	0.23	19				3.20	0.09	323
1986				<i>4.23</i>	<i>0.16</i>	<i>6</i>	1.96	0.13	68	3.94	0.08	251	2.98	0.11	223
1987				<i>3.93</i>	<i>0.38</i>	<i>5</i>	2.11	0.13	53	4.71	0.03	759	2.29	0.10	312
1988							2.17	0.11	83	4.60	0.02	1031	2.85	0.08	425
1989							1.99	0.25	31	4.61	0.04	612	2.28	0.10	271
1990				3.46	0.05	356	1.98	0.14	44	4.51	0.06	468	2.32	0.10	203
1991				3.41	0.07	216	1.91	0.10	66	4.01	0.07	259	2.37	0.12	149
1992				3.92	0.13	56	2.01	0.06	220	3.36	0.05	603	3.03	0.16	176
1993	3.43	0.08	16	3.52	0.04	301	1.90	0.10	74	3.61	0.05	521	2.95	0.16	102
1994	4.58	0.13	242	2.34	0.18	106	2.49	0.16	128	3.78	0.05	512	2.68	0.13	165
1995	3.86	0.03	2605	1.20	0.24	81	2.32	0.14	91	3.65	0.05	715	3.55	0.18	120
1996	4.09	0.04	1674				1.70	0.10	74	4.25	0.04	540	3.21	0.13	160
1997	3.29	0.16	1589				2.23	0.14	92	3.87	0.05	444	3.94	0.22	161
1998	3.36	0.02	1996	<i>4.96</i>	<i>0.04</i>	<i>2</i>	1.97	0.14	97	3.94	0.03	903	3.20	0.22	105
1999	3.27	0.02	2159				2.06	0.09	170						
2000	3.52	0.02	698												

**Table 10.** Average weights (lb dw) of *Atlantic sharpnose sharks* predicted from lengths recorded in the bottom-longline observer program (BLLOP), Trip Interview Program (TIP), and MRFSS, HBOAT, and TXPWD surveys. Standard errors of the mean (SE) and sample size (n) are indicated. Data for sample sizes <10 are in italics.

	BLLOP			TIP			MRFSS			HBOAT			TXPWD		
Year	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n
1981							2.08	0.08	13						
1982							1.13	0.20	17						
1983							<i>1.57</i>	<i>0.39</i>	2				3.17	0.15	120
1984				<i>2.34</i>	<i>0.22</i>	3	1.18	0.58	10				3.44	0.13	197
1985				<i>5.34</i>	<i>0.28</i>	4	2.06	<i>0.34</i>	6				3.58	0.10	263
1986				<i>4.23</i>	<i>0.16</i>	6	2.17	0.13	35	3.90	0.08	244	3.28	0.13	167
1987				<i>3.93</i>	<i>0.38</i>	5	2.26	0.13	42	4.69	0.03	753	2.34	0.11	234
1988							2.23	0.10	59	4.60	0.02	1031	3.30	0.08	286
1989							1.84	0.27	25	4.72	0.03	578	2.40	0.13	194
1990				3.47	0.06	342	1.87	0.13	19	4.47	0.05	464	2.22	0.11	144
1991				3.42	0.07	210	1.91	0.09	62	4.02	0.07	254	2.43	0.18	84
1992				3.80	0.11	52	1.97	0.07	167	3.32	0.05	588	3.50	0.14	133
1993	3.43	0.08	16	3.51	0.04	290	1.86	0.13	44	3.58	0.05	508	3.65	0.20	64
1994	2.95	0.07	109	2.71	0.26	43	2.26	0.08	91	3.78	0.05	504	2.84	0.17	109
1995	3.41	0.01	2184				2.56	0.14	62	3.64	0.05	703	3.81	0.17	72
1996	3.37	0.01	1224				1.93	0.10	46	4.26	0.04	537	3.54	0.14	112
1997	3.26	0.01	1550				2.34	0.16	65	3.83	0.05	437	3.81	0.13	119
1998	3.16	0.02	1795				2.08	0.15	59	3.95	0.03	899	3.86	0.18	63
1999	3.18	0.01	2040				2.15	0.08	130						
2000	3.50	0.01	650												

**Table 11.** Average weights (lb dw) of *blacknose sharks* predicted from lengths recorded in the bottom-longline observer program (BLLOP), Trip Interview Program (TIP), and MRFSS, HBOAT, and TXPWD surveys. Standard errors of the mean (SE) and sample size (n) are indicated. Data for sample sizes <10 are in italics.

	BLLOP			TIP			MRFSS			HBOAT			TXPWD		
Year	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n
1981															
1982															
1983							<i>2.13</i>	<i>1.29</i>	<i>6</i>						
1984															
1985															
1986							<i>1.26</i>	<i>0.27</i>	<i>11</i>	<i>3.89</i>	<i>0.14</i>	<i>2</i>			
1987							<i>0.73</i>	<i>0.24</i>	<i>4</i>						
1988							<i>1.03</i>	<i>0.26</i>	<i>9</i>						
1989										<i>1.32</i>	<i>0.13</i>	<i>14</i>			
1990				<i>3.15</i>	<i>0.15</i>	<i>13</i>									
1991				<i>2.85</i>	<i>0.23</i>	<i>6</i>									
1992							<i>1.64</i>	<i>0.33</i>	<i>8</i>						
1993				<i>3.98</i>	<i>0.51</i>	<i>8</i>	<i>1.64</i>	<i>0.31</i>	<i>6</i>						
1994	5.92	0.16	132				<i>2.77</i>	<i>0.52</i>	<i>13</i>						
1995	6.16	0.12	406	<i>0.92</i>	<i>0.05</i>	<i>79</i>	<i>2.98</i>	<i>0.96</i>	<i>4</i>				<i>5.17</i>	<i>1.03</i>	<i>2</i>
1996	6.02	0.08	414				<i>1.29</i>	<i>0.32</i>	<i>10</i>						
1997	4.63	0.36	38				<i>1.78</i>	<i>0.47</i>	<i>8</i>						
1998	5.13	0.14	197				<i>2.20</i>	<i>0.47</i>	<i>11</i>	<i>2.29</i>	<i>0.51</i>	<i>4</i>			
1999	4.74	0.23	116				<i>0.90</i>	<i>0.25</i>	<i>12</i>						
2000	3.82	0.13	48												

**Table 12.** Average weights (lb dw) of *bonnetheads* predicted from lengths recorded in the bottom-longline observer program (BLLOP), Trip Interview Program (TIP), and MRFSS, HBOAT, and TXPWD surveys. Standard errors of the mean (SE) and sample size (n) are indicated. Data for sample sizes <10 are in italics.

	BLLOP			TIP			MRFSS			HBOAT			TXPWD		
Year	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n
1981							<i>0.64</i>	<i>0.19</i>	5						
1982							2.46	0.58	19						
1983							<i>1.24</i>	<i>0.47</i>	6				1.41	0.14	30
1984							<i>2.29</i>	<i>1.41</i>	5	<i>3.36</i>	<i>0.69</i>	2	2.13	0.26	41
1985							<i>1.72</i>	<i>0.32</i>	12				1.47	0.11	55
1986							<i>3.18</i>	<i>0.64</i>	8	<i>3.99</i>	<i>0.77</i>	3	2.01	0.19	54
1987							<i>1.98</i>	<i>0.38</i>	7	<i>2.36</i>	<i>0.16</i>	2	2.13	0.22	78
1988							<i>1.66</i>	<i>0.60</i>	5				1.75	0.10	118
1989							<i>2.63</i>	<i>0.63</i>	6	<i>1.99</i>	<i>0.76</i>	3	2.02	0.14	72
1990							<i>2.05</i>	<i>0.23</i>	25	<i>6.73</i>	<i>2.11</i>	3	2.60	0.21	58
1991							<i>1.88</i>	<i>0.89</i>	4	<i>4.25</i>	<i>1.64</i>	4	2.25	0.19	59
1992				<i>6.09</i>	<i>1.21</i>	3	2.28	0.16	42	4.80	0.24	14	1.12	0.09	33
1993				<i>4.00</i>	<i>0.70</i>	3	1.95	0.32	12	4.63	0.49	13	1.93	0.18	22
1994				2.08	0.24	63	2.28	0.43	16	3.29	0.15	6	2.55	0.24	42
1995	4.28	0.66	12				1.25	0.27	20	4.69	0.59	11	2.02	0.20	31
1996	6.15	0.26	33				1.39	0.32	16				2.52	0.26	38
1997							<i>2.04</i>	<i>0.62</i>	9				2.42	0.28	34
1998	5.26	0.93	4	<i>4.96</i>	<i>0.04</i>	2	1.65	0.32	27				1.70	0.28	39
1999	<i>5.07</i>	<i>1.26</i>	3				2.01	0.35	26						
2000															

**Table 13.** Average weights (lb dw) of *finetooth sharks* predicted from lengths recorded in the bottom-longline observer program (BLLOP), Trip Interview Program (TIP), and MRFSS, HBOAT, and TXPWD surveys. Standard errors of the mean (SE) and sample size (n) are indicated. Data for sample sizes <10 are in italics.

	BLLOP			TIP			MRFSS			HBOAT			TXPWD		
Year	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n	Av. wt	SE	n
1981															
1982															
1983													<i>3.62</i>	<i>1.20</i>	<i>7</i>
1984													<i>2.36</i>	<i>0.45</i>	<i>23</i>
1985													<i>2.23</i>	<i>0.66</i>	<i>5</i>
1986							<i>1.29</i>	<i>0.20</i>	<i>14</i>	<i>8.79</i>	<i>2.56</i>	<i>2</i>	<i>4.72</i>	<i>2.88</i>	<i>2</i>
1987										<i>9.35</i>	<i>1.01</i>	<i>4</i>			
1988							<i>3.05</i>	<i>0.53</i>	<i>10</i>				<i>2.94</i>	<i>0.64</i>	<i>21</i>
1989										<i>3.84</i>	<i>0.63</i>	<i>17</i>	<i>1.41</i>	<i>0.33</i>	<i>5</i>
1990															
1991													<i>2.66</i>	<i>0.29</i>	<i>6</i>
1992							<i>1.58</i>	<i>0.72</i>	<i>3</i>				<i>3.13</i>	<i>1.91</i>	<i>10</i>
1993							<i>2.09</i>	<i>0.24</i>	<i>12</i>				<i>1.32</i>	<i>0.13</i>	<i>15</i>
1994							<i>5.02</i>	<i>1.89</i>	<i>8</i>	<i>6.70</i>	<i>0.19</i>	<i>2</i>	<i>1.86</i>	<i>0.15</i>	<i>14</i>
1995	<i>14.31</i>	<i>6.14</i>	<i>3</i>				<i>3.01</i>	<i>0.50</i>	<i>5</i>				<i>5.26</i>	<i>0.75</i>	<i>15</i>
1996	<i>11.42</i>	<i>4.23</i>	<i>3</i>				<i>1.16</i>	<i>0.12</i>	<i>2</i>				<i>2.11</i>	<i>0.53</i>	<i>10</i>
1997							<i>2.02</i>	<i>0.19</i>	<i>10</i>	<i>5.99</i>	<i>0.59</i>	<i>7</i>	<i>12.31</i>	<i>2.44</i>	<i>8</i>
1998													<i>8.9</i>	<i>3.00</i>	<i>3</i>
1999							<i>4.08</i>	<i>0.13</i>	<i>2</i>						
2000															

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