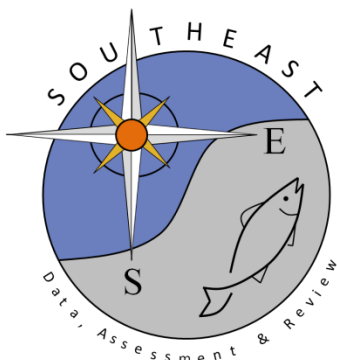


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Preliminary catches of blacktip sharks in the U.S. Atlantic ocean

Enric Cortés¹ and Heather Balchowsky Baertlein²

¹ NOAA Fisheries
Southeast Fisheries Science Center
Panama City Laboratory
3500 Delwood Beach Drive,
Panama City, FL 32408, USA

² NOAA Fisheries
Office of Sustainable Fisheries
Highly Migratory Species Division
Silver Spring, MD

ABSTRACT

This document presents commercial landings, commercial discard estimates, and recreational catch estimates of blacktip sharks (*Carcharhinus limbatus*) in the U.S. Atlantic coast for 1981-2018. Information on the geographical distribution of both commercial landings and recreational catches is presented along with gear-specific information of commercial landings and information on recreational catches by fishing mode and fishing area. Length composition information from recreational sources is also presented.

KEYWORDS

Catch, Landings, Discards, Commercial fishing, Long lining, Shark fisheries, Bycatch, Observer programs, Blacktip sharks, Carcharhinus limbatus

National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, 3500 Delwood Beach Road, Panama City, Florida 32408, U.S.A. E-mail: Enric.Cortes@noaa.gov; ² National Oceanic and Atmospheric Administration, National Marine Fisheries Service, 1315 East West Highway, Silver Spring, MD 20910, U.S.A. E-mail: Heather.Baertlein@noaa.gov.

1. Background

The status of Atlantic blacktip sharks (*Carcharhinus limbatus*) was last assessed in 2006 ([SEDAR 11](#); NMFS 2006). That assessment included commercial landings for 1981-2004 (and unreported commercial catches for 1988 and 1989) and recreational catches for 1981-2004. In preparation for the SEDAR 65 Data Workshop, preliminary catch series incorporating updated and new information for input into the stock assessment is presented. An additional 14 years of data (2005-2018) are available since SEDAR 11. Information on the geographical distribution (state of landing) and gear-specific information of commercial landings, as well as recreational catches by state, fishing mode, and fishing area is presented. Length-frequency distributions from several recreational sources are also compiled and analyzed.

2. Catch streams

2.1. Commercial landings

An additional 14 years of commercial landings data were available since the last Atlantic blacktip shark assessment. U.S. commercial landings in weight were thus available for the period 1981-2018.

These data were gathered from different sources over the time series. As in SEDAR 11, landings for 1981-1985 were assumed to be equal to the average for 1986-1988. The 1986-1990 landings were a legacy data set from the 1996 Stock Evaluation Workshop (NMFS 1996), which included shark landings from longlines and gillnets for the Florida East coast, Georgia and South Carolina, and North Carolina (see Appendix 3 of 1996 SEW). Specifically, the members of the catch subgroup at this workshop compiled a table that represented the available data, observations and/or perceptions on the proportion of large coastal shark landings represented by sandbar and blacktip sharks. Sources of this legacy data included observer data and observations of biologists and fin dealers. Available data were often applied across un-sampled years when the general perceptions of the fishery supported this. Gillnet landings estimates for Large Coastal sharks in North Carolina were prorated by the North Carolina Division of Marine Fisheries. These estimates of the North Carolina data set reflect the exclusion of all sharks other than the Large Coastal species from the North Carolina database, wherever possible. Commercial landings for 1991-2012 come from the Atlantic portion of the FINS database (Atlantic Coastal Cooperative Statistics Program [ACCSP]). No data from the FINS database (Gulf Fisheries Information Network [GulfFIN]) representing the Gulf of Mexico region were included. Landings for 2013-2018 landings come from the NOAA Fisheries Highly Migratory Species commercial landings (eDealer) database. Total commercial landings of Atlantic blacktip sharks showed a decreasing trend from 1981 to 2018 (Table 1 and Table 2; Figure 1 and Figure 2).

Commercial landings of Atlantic blacktip shark by gear from the ACCSP for 1981-2018 were dominated by longlines (56%), followed by gillnets (33%), with the remaining 11% consisting of a “not coded” category (6%), hook and line (4%), and an assortment of other gears that contributed minimally (Table 3; Figure 3, top). The relative importance of

longlines and gillnets varied through time with longlines and gillnets having a similar contribution to total landings in the 2000s and gillnets becoming proportionally less important since 2009 (Figure 3, bottom). Similarly, commercial landings by gear from eDealer for 2014-2018 were dominated by longlines (76%) and gillnets (22%), with the remaining 2% consisting mostly of hook and line (1%).

Blacktip landings by state were dominated by Florida (63.3%), North Carolina (16.7%), New Jersey (6.5%), Virginia (6.3%), and South Carolina (4.3%) (Table 4; Figure 4, top), with Florida consistently dominating through time (Figure 4, bottom).

Commercial landings in numbers were calculated by dividing annual landings in weight by average weights from the Southeast Gillnet Observer Program (GNOP) and the Reef Fish and Shark Bottom Longline Observer Programs (collectively referred to as BLLOP hereforth) as appropriate. All weights from the GNOP and BLLOP were predicted from fork length measurements taken by observers in gillnet and longline fisheries, respectively, using a weight-length regression. Average weights were available for 1999-2018 from the GNOP and for 1993-2018 from the BLLOP. For the GNOP, the average weight for 1986-1998 was taken as the average for the first 5 years of data (1999-2003); for the BLLOP, the average weight for 1986-1992 came from Parrack (1990).

2.2 Bottom longline and gillnet dead discards and live post-release mortality

Dead discard estimates for the South Atlantic coastal gillnet fishery and the shark bottom longline fishery were generated by Carlson et al. (2019a,b) based on the Coastal Fishery Logbook Program and GNOP and BLLOP, respectively (SEDAR65-DW-03 and SEDAR65-DW-04). Estimates from the Northeast Fishery Observer Program for 1995-2018 were not yet available at the time of this writing but will be incorporated when available.

Live post-release mortality (the proportion of sharks released alive that die) was also accounted for in commercial gears by multiplying estimated blacktip sharks released alive in gillnets and longlines (SEDAR65-DW03 and SEDAR65-DW04) by a post-release mortality rate of 0.31 derived for gillnets (Hueter et al. 2006) and 0.097 derived for hook and line (taken as a proxy for bottom longline gear; Whitney et al. 2017).

2.3 Recreational catches

Recreational catches of Atlantic blacktip sharks are the sum of estimates from the Marine Recreational Information Program (MRIP) and the Southeast Region Headboat Survey (SRHS) operated by the SEFSC Beaufort Laboratory. The MRIP estimates include Access Point Angler Intercept Survey (APAIS) and Fishing Effort Survey (FES) calibrations. Annual recreational catch estimates of blacktip sharks in the Atlantic were computed as the sum of type A (number of fish killed or kept seen by the interviewer), type B1 (number of fish killed or kept reported to the interviewer by the angler), and type B2 (number of fish released alive reported by the fisher) estimated to have died (by applying a post-release mortality rate of 0.097 from Whitney et al. (2017). Type B2 estimates for SRHS became available in 2004.

Catches are reported in both numbers and weight for types A and B1, but only in numbers for type B2. Annual weight estimates for type B2 were computed by multiplying B2 catches in numbers by an average weight obtained by dividing AB1 catch in weight by catch in numbers.

The overwhelming majority of Atlantic blacktip shark catches were reported in MRIP. Catches showed a generally decreasing trend from 1981 to 2018, punctuated by several peaks, most notably in 1985, 1990, 1997, and 2004 (for A, B1, and B2), and in 1993, 2009, and 2015 (for B2 only) (Table 1 and Table 2; Figure 1 and Figure 2).

By fishing mode, most AB1 Atlantic blacktip shark catches were from shore (49%) and by private boats (45%), with charter boats and headboats contributing very little (Table 5; Figure 5). By fishing area, most blacktip catches occurred less than 3 miles from shore (44%) and in inshore waters (42%), with the remaining 14% of catches in waters over three miles from shore (Table 6; Figure 6). Most of the catches were in the southeast region, with Florida-East coast (50%), South Carolina (31%), and Georgia (13%) accounting for 94% of all blacktips (Table 7; Figure 7).

2.4 Recreational length compositions

Lengths were available from the MRIP (cm FL; n=781) and the SRHS (mm TL; n=107). Total lengths in the SRHS were converted to fork lengths with the equation ($TL_{cm}=4.89349+1.15734FL_{cm}$). Length-frequency distributions show that mostly immature individuals are caught as determined by comparing to the median sizes at maturity for males and females (115 cm FL and 123 cm FL, respectively; SEDAR 65-DW-01) (Figure 8; top). The mean fork length from MRIP (75.4 cm) was not significantly smaller than that from SRHS (78.0 cm) (Welch two sample t-test data: $t = 0.85821$, $df = 141.58$, $P = 0.3922$; Figure 8; bottom).

There were, however, significant differences in the size of blacktip sharks caught by fishing mode (Anova: $F = 7.05$, $df = 3$, $P = 0.00011$), with blacktips caught from shore being significantly smaller than those caught by private boats, charter boats, or headboats (Multiple comparison test of means for unbalanced data: contrasts fit: Shore – Cbt, $P < 0.001$; Shore – Hbt, $P < 0.00797$; Shore – Pri, $P < 0.00802$; Figure 9). Similarly, there were significant differences in the size of blacktip sharks caught by fishing area (Anova: $F = 11.99$, $df = 3$, $P = 1.07E-07$), with blacktips caught inshore being significantly smaller than those caught in the ocean (≤ 3 miles), ocean (> 3 miles), or in headboats (Multiple comparison test of means for unbalanced data: contrasts fit: Inshore – Hbt, $P < 0.0272$; Inshore – Ocean (≤ 3 mi), $P < 0.001$; Inshore – Ocean (> 3 mi), $P < 0.0014$; Figure 10). No differences in the size of blacktip sharks by state were found (Anova: $F = 1.462$, $df = 7$, $P = 0.177$; Figure 11).

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Table 1. Catches of blacktip sharks in the U.S. Atlantic in weight (lb whole).

Year	Commercial Landings	Unreported catches	Bottom longlines	Gillnets	Other gears	Recreational catches (A+B1)	Recreational catches (B2 dead)	Total
1981	822679		352963	469716	0	47092	124833	994604
1982	822679		352963	469716	0	569953	50677	1443310
1983	822679		352963	469716	0	82381	49043	954103
1984	822679		352963	469716	0	199303	118464	1140447
1985	822679		352963	469716	0	762918	16776	1602373
1986	899075		546144	352931	0	297951	43040	1240067
1987	807516		175361	632155	0	55275	6374	869165
1988	761447	95172	337384	424063	0	71937	7885	936441
1989	729400	80892	370196	359204	0	89949	6236	906477
1990	659008		283349	375659	0	81405	4682	745095
1991	698021		212125	354837	491096	425427	14834	1498319
1992	760855		756923	87757	234581	168986	241262	1489509
1993	1134981		889888	335794	99764	122848	41912	1490206
1994	492151		505131	20022	33314	247415	591373	1397256
1995	673530		619141	62577	41805	93396	69560	886478
1996	773458		377628	404648	24586	346024	98548	1251434
1997	334867		204482	112990	11594	126472	56404	511942
1998	334418		218067	68892	9432	350837	351040	998267
1999	322802		217050	119496	9297	379853	87316	813012
2000	383830		276046	96767	7682	181959	668466	1230921
2001	371409		207131	191145	5082	130166	519857	1053381
2002	626895		312413	337835	13940	61461	407806	1133455
2003	592414		343414	287517	12878	86251	116097	846156
2004	448506		188600	201335	11657	37998	346069	785658
2005	333214		179434	115514	5810	969412	679606	1949776
2006	371151		118166	231111	4751	68666	363864	786557
2007	86483		31162	49515	2155	118436	192263	393531
2008	324569		143551	166528	4434	48109	1824889	2187511
2009	304659		236595	35069	38086	17426	2482028	2809205
2010	325636		215186	90587	17814	11900	326923	662410
2011	225076		175706	40411	7655	12930	11066	247768
2012	224251		115966	69803	40171	38694	4570	269204
2013	284635		186488	82610	25843	14760	39833	349534
2014	308658		233038	66335	10592	15093	412716	737775
2015	297556		261005	36708	528	36147	714752	1049141
2016	279141		206301	72533	1907	44281	113508	438530
2017	241848		197662	42433	1753	10016	118935	370799
2018	140845		109229	30584	1661	2807	1034032	1178313

Table 2. Catches of blacktip sharks in the U.S. Atlantic in numbers.

Year	Commercial Landings	Unreported catches	Bottom longlines	Gillnets	Other gears	Recreational catches (A+B1)	Recreational catches (B2 dead)	Total
1981	34278		14707	10705	0	6827	45299	77538
1982	34278		14707	10705	0	57164	5083	87659
1983	34278		14707	10705	0	33139	19728	78279
1984	34278		14707	10705	0	28894	15714	70020
1985	34278		14707	10705	0	137138	2858	165408
1986	37461		22756	8044	0	19913	3419	54132
1987	33647		7307	14407	0	40660	3776	66150
1988	31727	3966	14058	9665	0	21595	2348	51631
1989	30392	3371	15425	8187	0	27132	2424	56538
1990	27459		11806	8562	0	12135	1059	33562
1991	29084		8839	8087	20462	96461	3337	137186
1992	31702		31538	2000	9774	30414	34289	108016
1993	34623		27146	7653	3043	25395	8437	71675
1994	23334		23948	456	1576	30597	75400	131977
1995	28899		26567	1426	1793	21950	11854	63590
1996	30376		14860	9222	964	62069	15624	102739
1997	10992		6722	2575	380	30336	13572	53585
1998	10281		6715	1570	289	113397	50530	172500
1999	10315		6945	12514	296	49380	11251	80385
2000	11735		8447	3978	234	26758	33399	72817
2001	11083		6194	4590	151	19283	47165	77383
2002	22054		11010	16278	490	9466	31089	68334
2003	19830		11512	10710	430	31811	42780	97244
2004	15163		6393	11309	393	5986	60935	85017
2005	12051		6501	16369	210	87462	60755	171296
2006	14402		4585	7039	184	10280	22571	44659
2007	3978		1433	11742	99	17576	22753	53603
2008	10179		4506	6772	139	7168	91012	109598
2009	8043		6250	1605	1003	2792	239393	251044
2010	9112		6027	3165	498	2283	24643	36615
2011	8813		6882	2118	299	2055	12549	23903
2012	8867		4585	4758	1588	5846	10365	27143
2013	9911		6493	5180	900	2727	30886	46186
2014	12503		9441	3864	429	2278	40146	56158
2015	9529		8360	3170	17	5306	57653	74506
2016	9449		6984	1291	65	6520	9546	24406
2017	9390		7682	6583	68	1527	14418	30278
2018	4317		3349	2018	51	500	30095	36012

Table 3. Commercial landings (lb dw) by gear type, ACCSP (1991-2018).

Gear type	Weight (lb dw)	Percent
BY HAND, DIVING GEAR	44	4.0E-06
DIP NETS	43	3.9E-06
DREDGE	817	7.5E-05
FYKE NETS	1	1.3E-07
GILL NETS	3599256	0.33
HAND LINE	14476	1.3E-03
HAUL SEINES	4653	4.3E-04
HOOK AND LINE	383591	0.04
LONG LINES	6111466	0.56
NOT CODED	641689	0.06
OTHER FIXED NETS	160	1.5E-05
OTHER GEARS	5660	5.2E-04
OTHER SEINES	1768	1.6E-04
OTHER TRAWLS	61475	5.6E-03
OTTER TRAWLS	26231	2.4E-03
POTS AND TRAPS	384	3.5E-05
POUND NETS	387	3.6E-05
PURSE SEINE	223	2.1E-05
SPEARS	270	2.5E-05
TRAMMEL NETS	6093	5.6E-04
TROLL LINES	22634	2.1E-03
	10881321	1
GILL NETS + LONGLINES		0.89

Table 4. Commercial landings (lb dw) by state, ACCSP (1991-2018).

State	Weight (lb dw)	Percent
CT	12	1.07E-06
FL	6892785	0.6335
GA	207094	0.0190
MA	580	5.33E-05
MD	100988	0.0093
NC	1812974	0.1666
NJ	704663	0.0648
NY	2936	0.0003
RI	113	1.04E-05
SC	469940	0.0432
VA	689107	0.0633
	10881191	1
	Northeast	0.07
	Southeast	0.93

Table 5. Recreational catches (AB1) of Atlantic blacktip sharks in numbers by fishing mode.

Year	Charterboat/	Charterboat/	Headboat	Private	Shore	Total
		Headboat				
1981				6827	0	6827
1982				32590	24574	57164
1983	1295		1209	21254	10589	34348
1984	1089		975	27806		29870
1985	11198		10448	69140	56800	147586
1986	1282	4	2	18625	0	19913
1987	3133		184	35021	2322	40660
1988	512		32	21051	0	21595
1989	662		488	25982	0	27132
1990	1072	49	333	10681		12135
1991	86		1089	16175	79111	96461
1992	518	0	1273	17690	10933	30414
1993	313		664	14690	9728	25395
1994	2219		559	13353	14466	30597
1995	3220		245	15766	2719	21950
1996	1091		214	27787	32977	62069
1997	153		519	19260	10405	30336
1998	1540	0	612	14935	96310	113397
1999	532		436	5939	42473	49380
2000	28		378	5027	21325	26758
2001	139		416	13753	4975	19283
2002	294		556	6929	1688	9466
2003	1920		29	2865	26998	31811
2004	874		476	4633	0	5982
2005	1129		786	14860	70674	87449
2006	451		323	1179	8325	10278
2007	509		413	11790	4863	17576
2008	560		194	6415	0	7168
2009	123		248	2403	0	2774
2010	357		557	1368	0	2282
2011	0		180	1875	0	2055
2012	0		230	0	5610	5840
2013	0		587	0	2140	2727
2014	1324		90	864	0	2278
2015	301		65	4939	0	5306
2016	55		100	6365	0	6520
2017	103		75	1349	0	1527
2018	407		94	0	0	501

Table 6. Recreational catches (AB1) of Atlantic blacktip sharks in numbers by fishing area.

Year	Inshore	Ocean<=3mi	Ocean>3mi	Headboat	Total
1981	0	6827			6827
1982	17869	11517	27778		57164
1983	19124	14419	805		34348
1984	0	19291	10579		29870
1985	36024	106162	5400		147586
1986	11907	4242	3762	2	19913
1987	24439	2938	13099	184	40660
1988	4888	1785	14890	32	21595
1989	9315	11786	5543	488	27132
1990	0	6080	5722	333	12135
1991	20214	71198	3960	1089	96461
1992	9932	16487	2722	1273	30414
1993	1311	9728	13693	664	25395
1994	6780	13776	9482	559	30597
1995	13313	4366	4027	245	21950
1996	38302	19371	4183	214	62069
1997	19342	10411	64	519	30336
1998	94971	12225	5589	612	113397
1999	39574	8096	1274	436	49380
2000	18240	5166	2974	378	26758
2001	9881	5114	3873	416	19283
2002	2243	4633	2035	556	9466
2003	25469	5840	473	29	31811
2004	1381	1893	2232	476	5982
2005	7862	78605	196	786	87449
2006	2850	6013	1092	323	10278
2007	8083	7922	1158	413	17576
2008	0	3801	3173	194	7168
2009	2419	108	0	248	2774
2010	183	635	908	557	2282
2011	1875	0	0	180	2055
2012	0	5610	0	230	5840
2013	1160	980	0	587	2727
2014	329	1261	598	90	2278
2015	3171	1841	228	65	5306
2016	6420	0	0	100	6520
2017	0	1349	103	75	1527
2018	0	407	0	94	501

Table 7. Recreational catches (AB1) of Atlantic blacktip sharks in numbers by state.

Year	CT	DE	FLE	FLE/GA	GA	MD	NC	NJ	SC	VA	Total
1981			6827				0		0		6827
1982			41759		7250				8155		57164
1983			10568		21427				2354		34348
1984			29616		253		0				29870
1985			100015		7767		5916		33888		147586
1986			6383	2	6691		0		6833	4	19913
1987			15523	157	5941		2895		16143		40660
1988			17047	21	3323		429		775		21595
1989		4356	15798	382	2918		1722		1956		27132
1990			5502	183	4892	49	1033		476		12135
1991			89088	696	4400		1028		674	575	96461
1992			19330	1051	4691	0	186		5157		30414
1993			22301	510	1311		972		302	0	25395
1994			14898	211	4112		9105		407	1863	30597
1995			0	159	11863		5716		2861	1351	21950
1996			18124	92	18815		3323		21716		62069
1997			3284	190	0		254		26608		30336
1998		0	20560	217	6219		1020		85381		113397
1999			8877	147	3545		682		36128	0	49380
2000			19524	96	5935		938		265		26758
2001		0	6761	68	3766		151		6040	2497	19283
2002			6277	112	783		464		1831		9466
2003			4616	19	2571		1249		23357		31811
2004			1648	200	1381		50		1100	1603	5982
2005			53115	654	1690		872		31118		87449
2006			9418	158	11		204		487		10278
2007		0	2851	178	2752		1024		5908	4863	17576
2008			1415	64	2138		57		3297	197	7168
2009		0	108	76	1443				1148	0	2774
2010		0	627	31	925		120		579	0	2282
2011			1875	56	0		0		124	0	2055
2012			0	85	0	0	1279		4476	0	5840
2013			980	563	0		0	0	1184		2727
2014	0		1098	32	0		536		612	0	2278
2015		0	249	49	2796	0	0	0	2212	0	5306
2016		0	0	7	2270		0		4243	0	6520
2017		0	1349	3	103	0	0		72	0	1527
2018		0	0	18	117	0	0	0	366	0	501

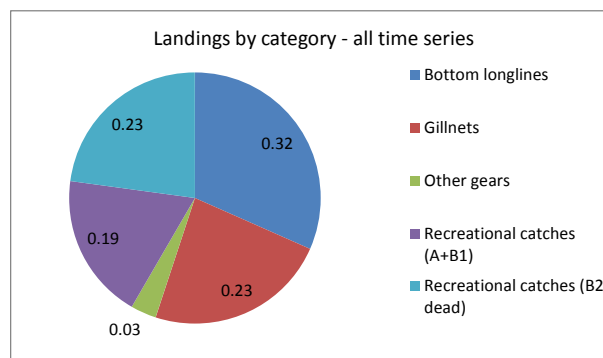
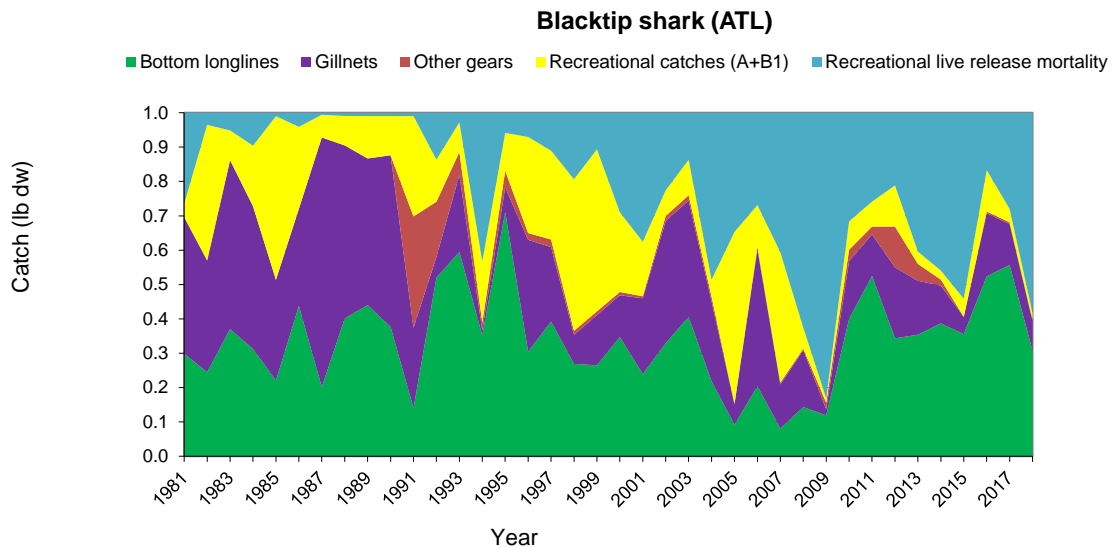
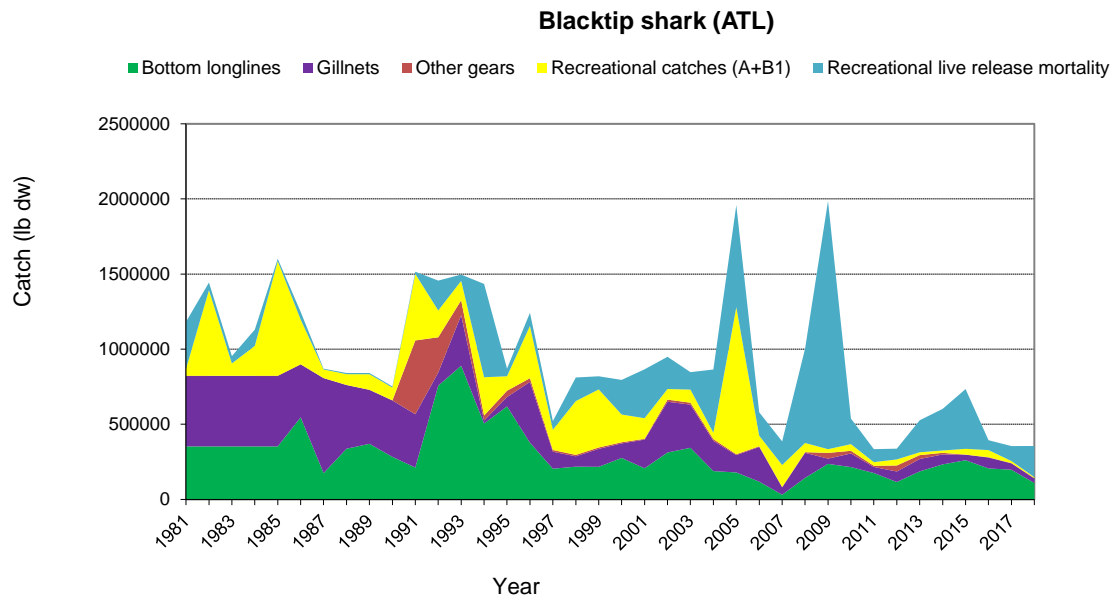


Figure 1. Commercial and recreational catches of Atlantic blacktip sharks in weight (lb dw), 1981-2018. Top panel: stacked catches by year; middle panel: proportions by year; bottom panel: proportions over entire time series.

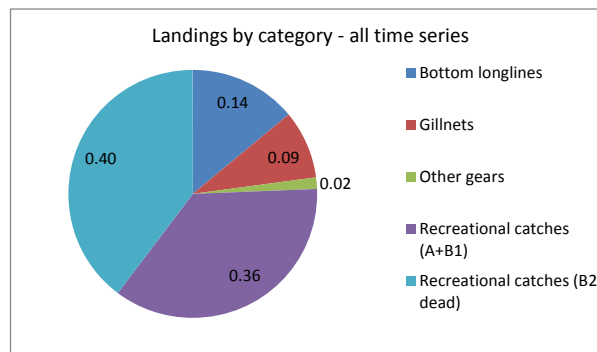
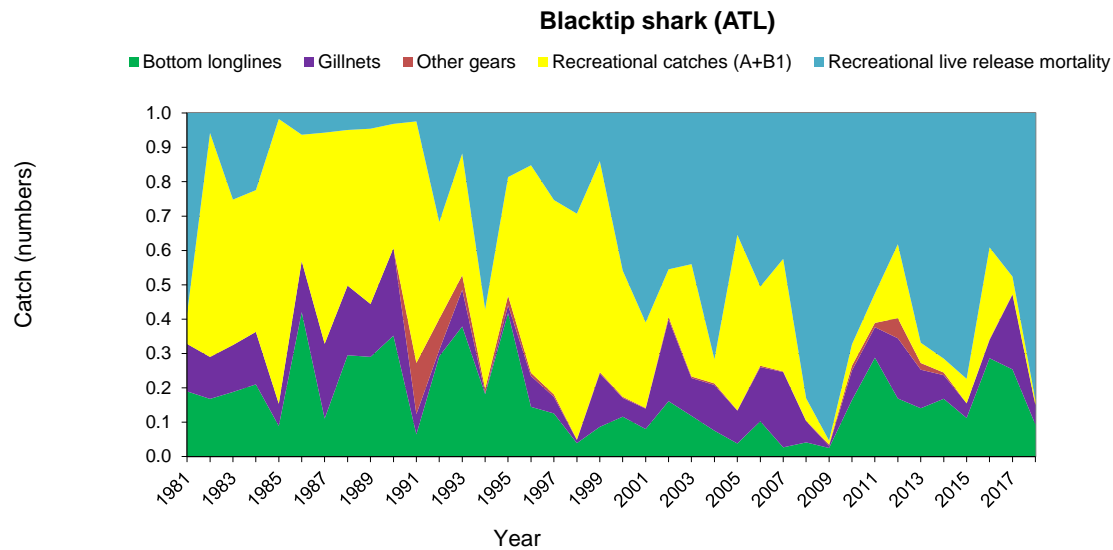
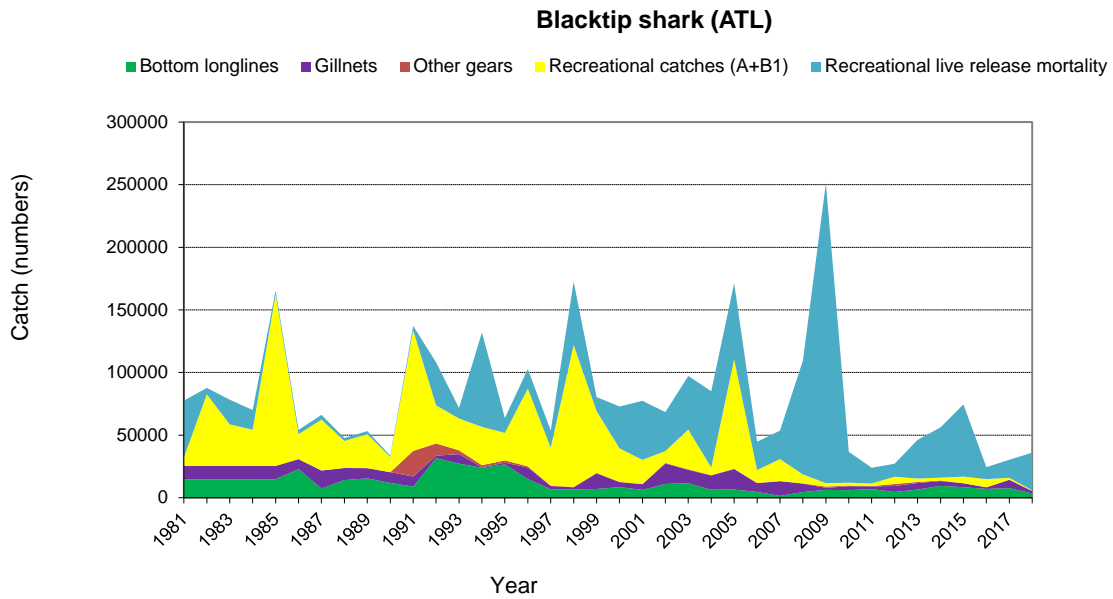


Figure 2. Commercial and recreational catches of Atlantic blacktip sharks in numbers, 1981-2018. Top panel: stacked catches by year; middle panel: as a proportion by year; bottom panel: proportion for the entire time series.

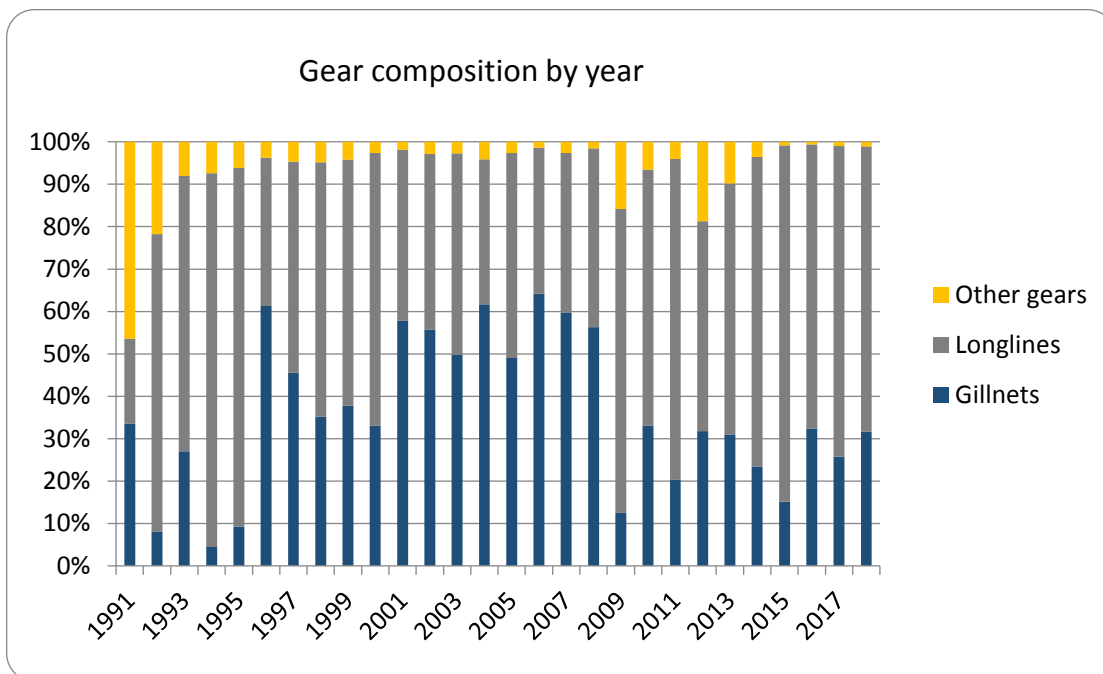
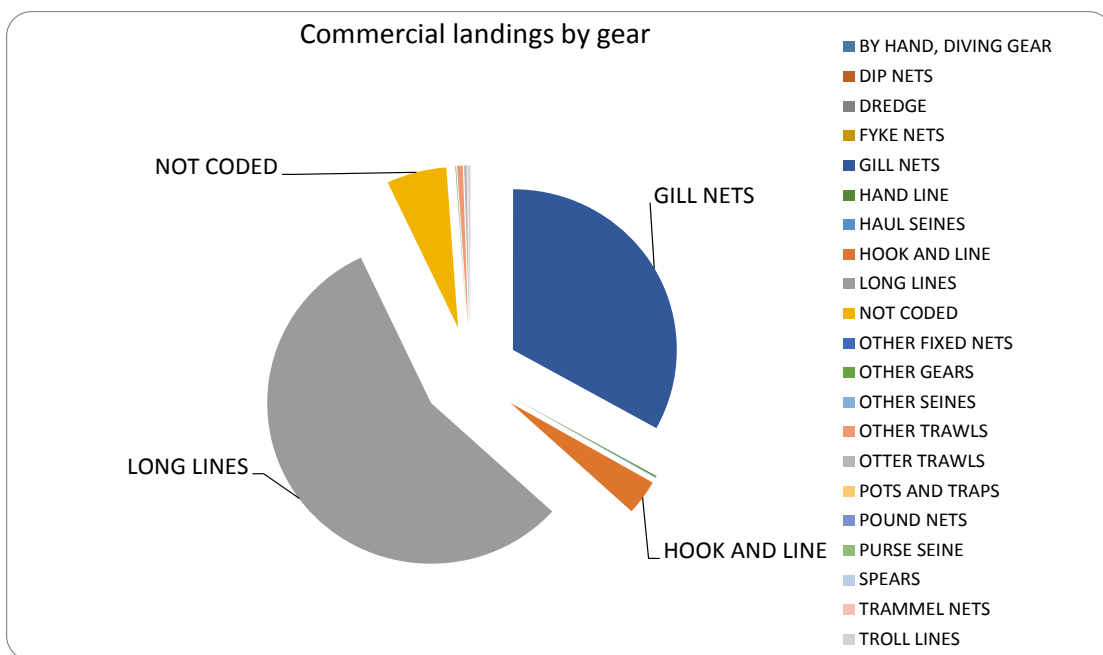


Figure 3. Commercial landings (lb dw) by gear type from the ACCSP for 1991-2018. Top panel: relative contribution for the entire time period; bottom panel: annual composition of the main gears by year.

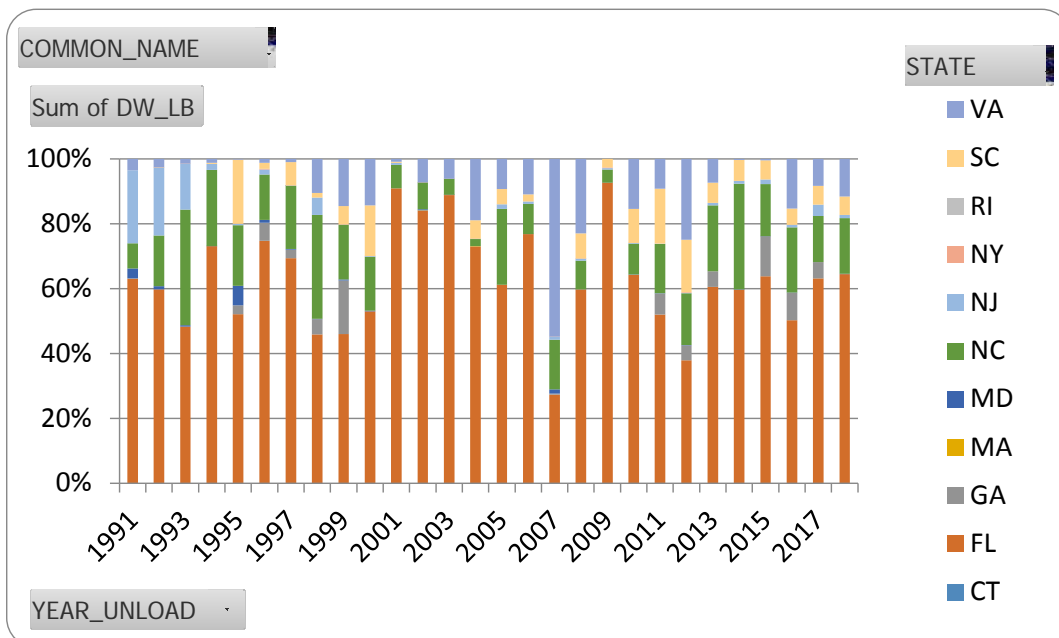
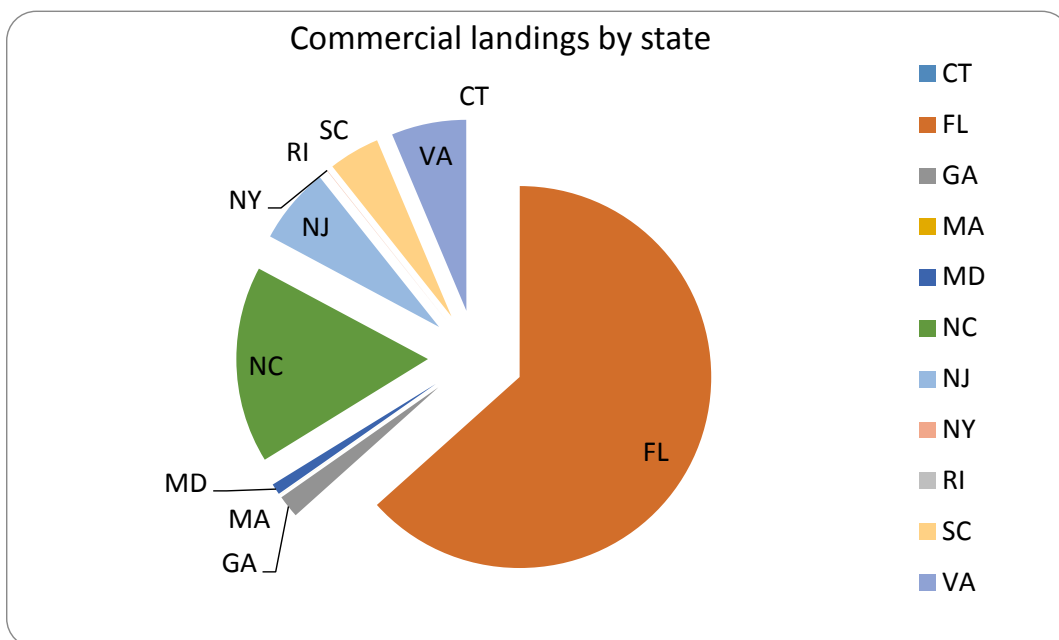


Figure 4. Commercial landings (lb dw) by state from the ACCSP for 1991-2018. Top panel: relative contribution for the entire time period; bottom panel: annual composition of the main gears by year.

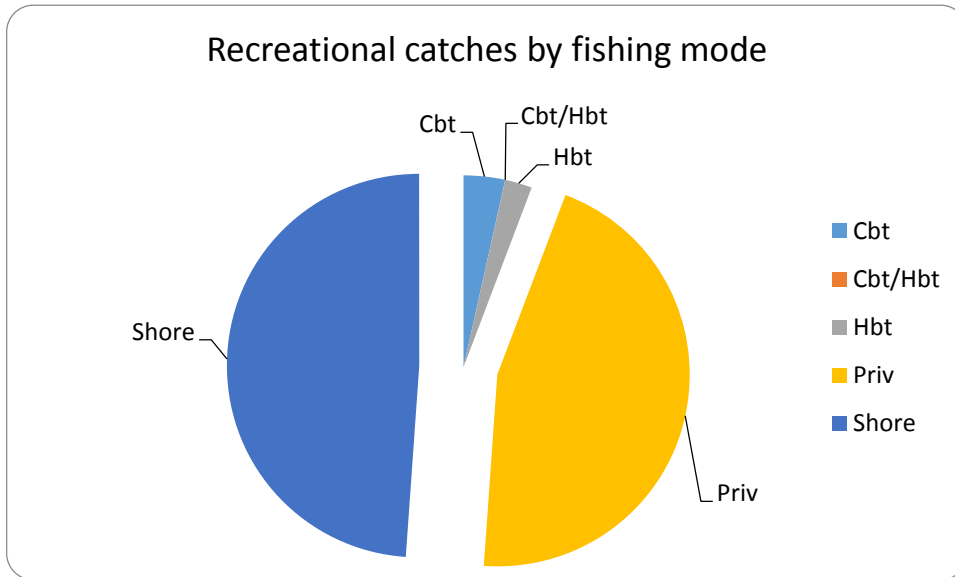


Figure 5. Recreational catches (AB1, numbers) of Atlantic blacktip sharks by fishing mode, 1981 – 2018. Shore=fishing from shore; Private= private boats; Hbt=headboats; Cbt=charterboats.

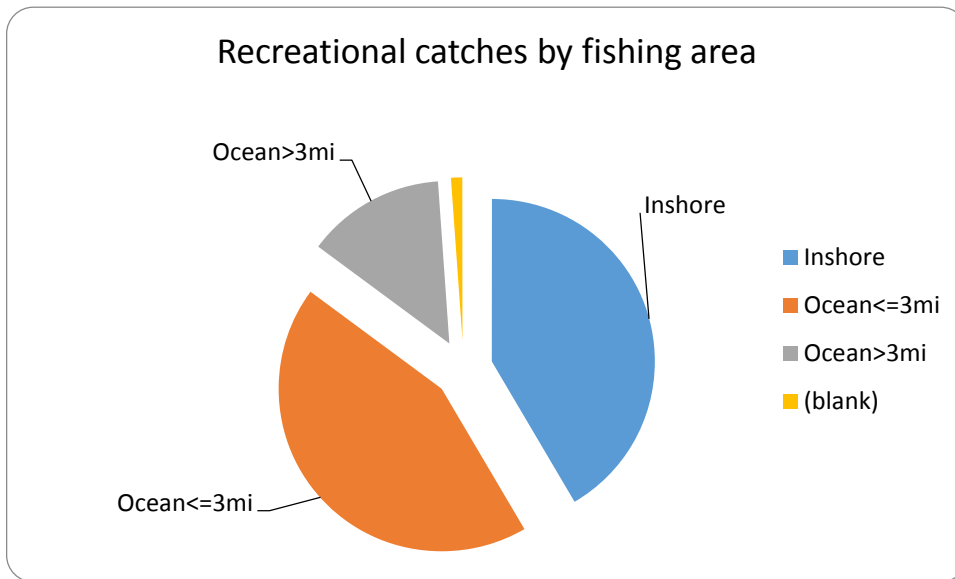


Figure 6. Recreational catches (AB1, numbers) of Atlantic blacktip sharks by fishing area, 1981-2018. Note: “Blank” indicates catches reported in the SRHS.

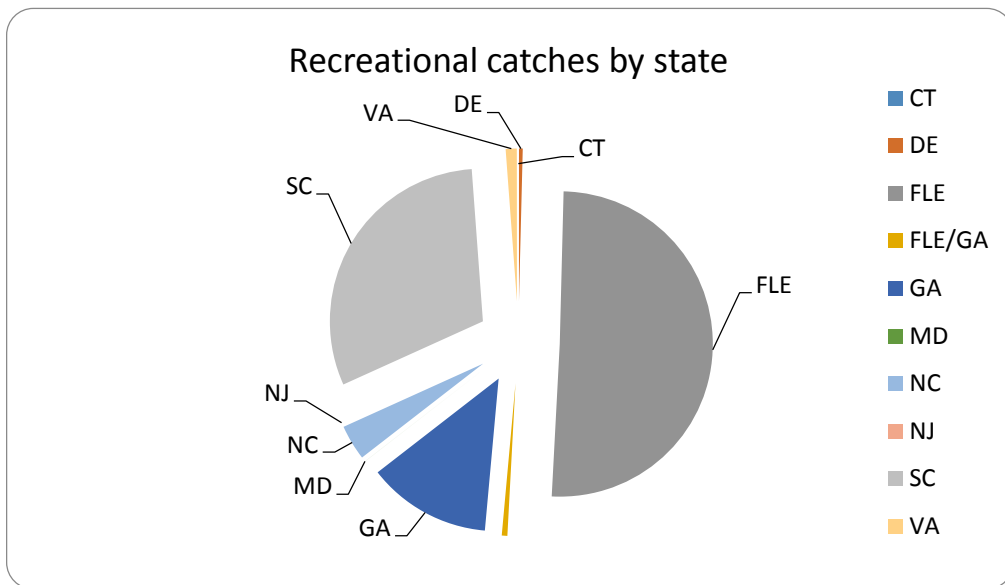


Figure 7. Recreational catches (AB1, numbers) of Atlantic blacktip sharks by state, 1981-2018.

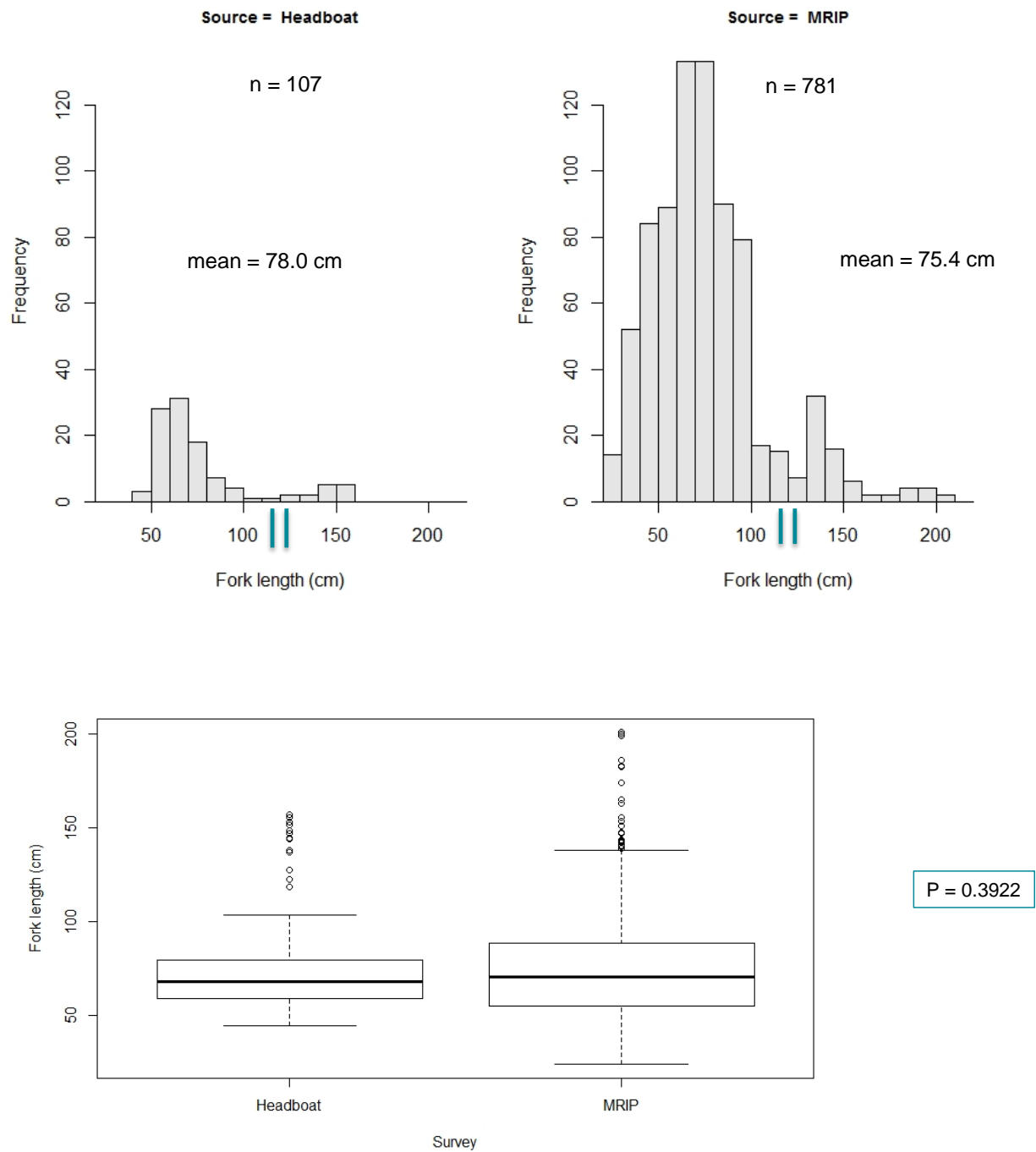


Figure 8. Length-frequency histograms of Atlantic blacktip sharks from the MRIP and SRHS surveys (top panel) and boxplot of fork length by survey (bottom panel). Vertical bars in the top panel denote median length at maturity for males (115 cm FL) and females (123 cm FL), respectively.

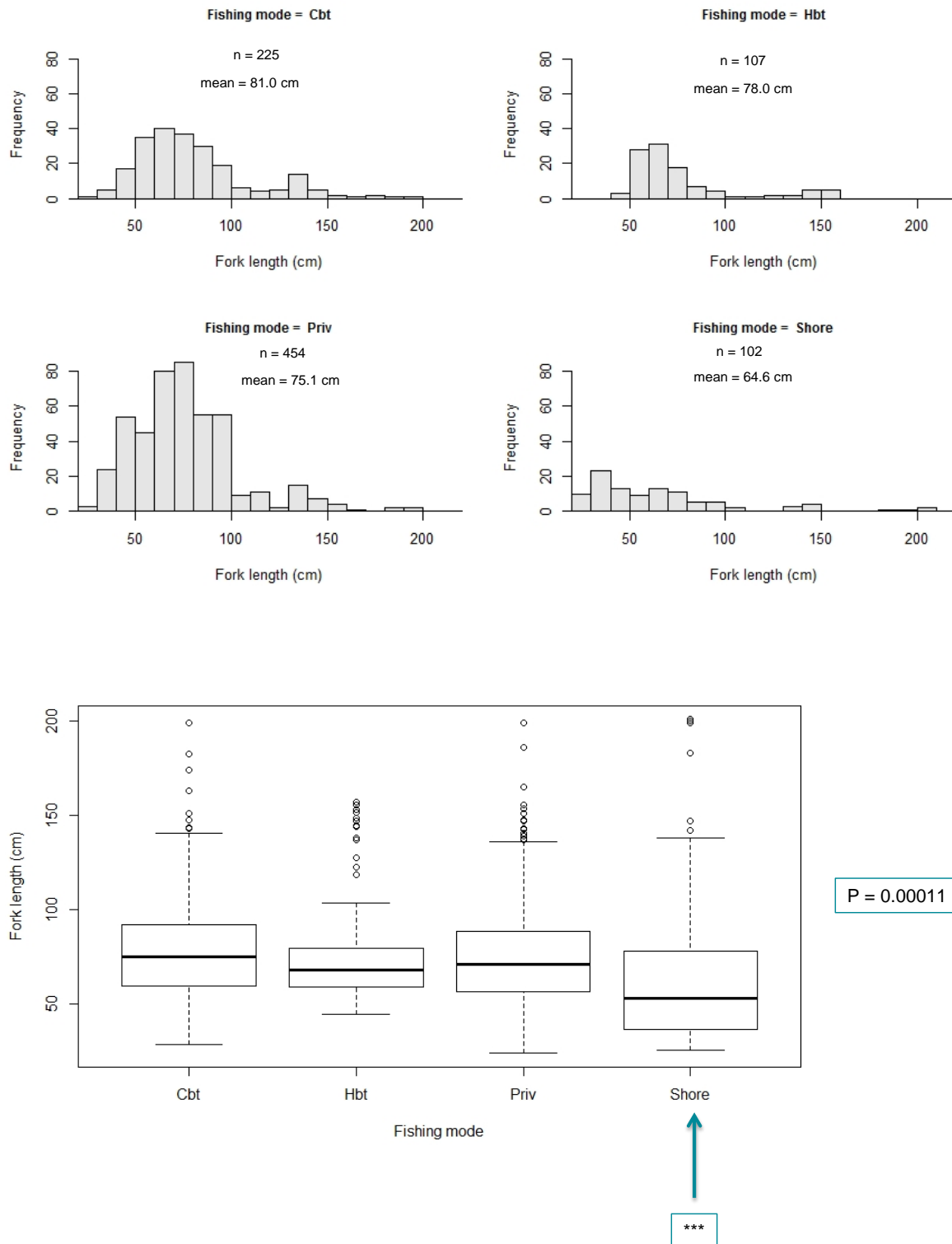


Figure 9. Length-frequency histograms of Atlantic blacktip sharks from the MRIP and SRHS surveys by fishing mode (top panel) and boxplot of fork length by fishing mode (bottom panel).

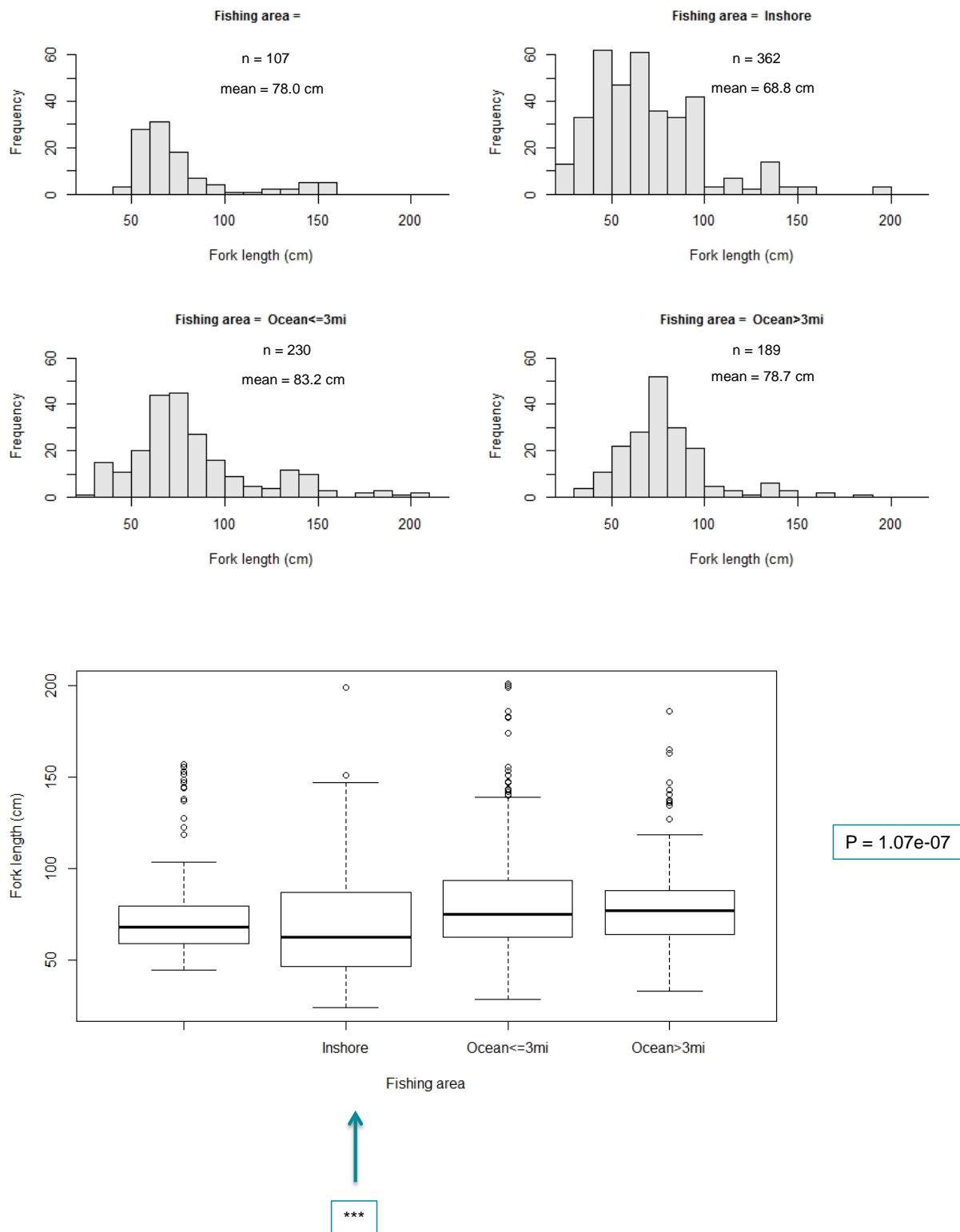


Figure 10. Length-frequency histograms of Atlantic blacktip sharks from the MRIP and SRHS surveys by fishing area (top panel) and boxplot of fork length by fishing area (bottom panel). Blank fishing area denotes lengths from the SRHS.

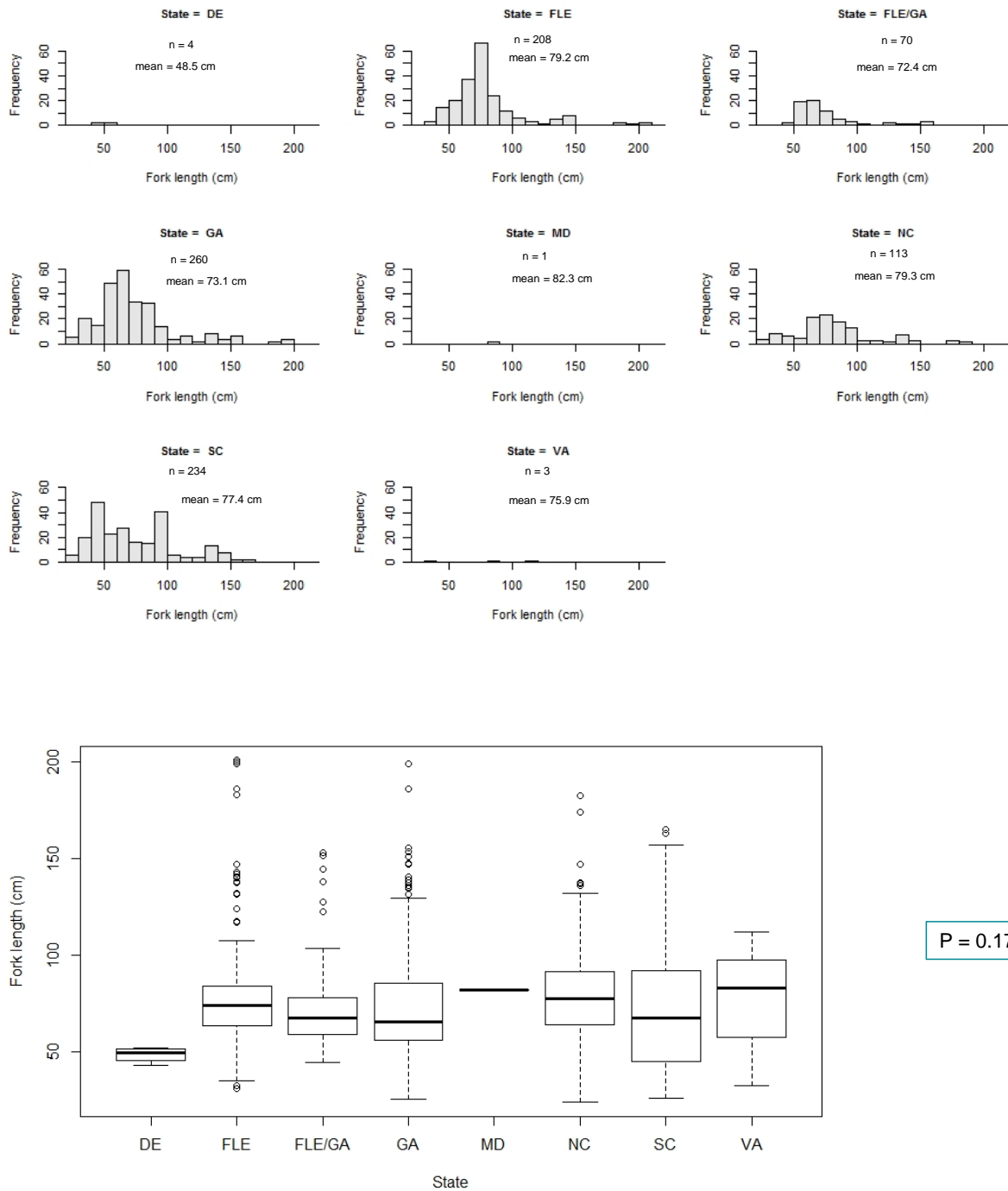


Figure 11. Length-frequency histograms of Atlantic blacktip sharks from the MRIP and SRHS surveys by state (top panel) and boxplot of fork length by state (bottom panel).