

Catch rates, distribution and size composition of blacknose, sandbar and dusky sharks collected during NOAA Fisheries Bottom Longline Surveys from the U.S. Gulf of Mexico and U.S. Atlantic Ocean.

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Introduction and Survey Design

The Southeast Fisheries Science Center (SEFSC) Mississippi Laboratories has conducted standardized bottom longline surveys in the Gulf of Mexico, Caribbean Sea, and Western North Atlantic Ocean since 1995 (Figure 1). The objective of this longline survey is to provide fisheries independent data for stock assessment for as many species as possible. This survey, which is conducted annually in U.S. waters of the Gulf of Mexico (GOM) and/or the western north Atlantic Ocean (Atlantic) (Table 1), provides an important source of fisheries independent information on dusky shark in the GOM and Atlantic. Details concerning methodologies and evolution of this survey have been covered in previous documents (most recently LCS05/06-DW-27, SEDAR 13-DW-22) and will not be repeated in this document.

Uses of Longline Data for the HMS Sandbar, Dusky, And Blacknose Sharks SEDAR 21

For shark SEDAR 21, we used the entire time series of data to develop abundance indices for blacknose, sandbar and dusky sharks for both the GOM and Atlantic. The locations of all stations and stations where blacknose, sandbar and dusky sharks were caught were plotted by year and all years combined (Figures 2 – 32). Survey coverage area varied during the time series due to weather, mechanical problems, and mission objectives (LCS05/06-DW-27, SEDAR 13-DW-22).

To develop standardized indices of annual average CPUE for blacknose and sandbar sharks for both the GOM and Atlantic, a delta-lognormal model, as described by Lo et al. (1992), was employed. This index is a mathematical combination of yearly CPUE estimates from two distinct generalized linear models: a binomial (logistic) model which describes proportion of positive CPUE values (i.e., presence/absence) and lognormal model which describes variability in only the nonzero CPUE data. A backward selection approach, while using the GLMMIX and MIXED procedures (Patetta, 2002) in SAS, was employed to provide yearly index values for both the binomial and lognormal sub-models, respectively. The parameters tested for inclusion in each sub-model were survey year, area, hook type, depth, bottom temperature, and bottom salinity; and separate covariance structures were developed for each survey year. For this study there were two major area demarcations: Atlantic (south of 37° north latitude) and the U.S. GOM; and three minor area demarcations in the GOM: Eastern Gulf (east of 88° west longitude); Central Gulf (between 88° and 93° west longitude); and Western Gulf (west of 93° west longitude). Also, as described in previous documents (most recently LCS05/06-DW-27, SEDAR 13-DW-22), hook-type changed over time from J to circle-hooks (C-hooks). Due to the extremely low catches of dusky shark, no abundance indices were developed for this species.

Figures 33 – 41 summarize annual abundance indices for blacknose and sandbar sharks, and mean CPUE for dusky shark for the Atlantic, GOM and both areas combined.

Fork length frequency histograms were constructed for blacknose, sandbar, and dusky sharks for the Atlantic and GOM (Figures 42 – 46). These indicated possible differences in size distributions of blacknose shark and sandbar shark between the Atlantic and GOM.

Literature Cited

- Ingram, Walter, Terry Henwood, Mark Grace, Lisa Jones, William Driggers, and Karen Mitchell. 2005. Catch rates, distribution and size composition of large coastal sharks collected during NOAA Fisheries Bottom Longline Surveys from the U.S. Gulf of Mexico and U.S. Atlantic Ocean. LCS05/06-DW-27.
- Ingram, Walter, William Driggers, Mark Grace, Terry Henwood, Lisa Jones, and Karen Mitchell. 2007. Catch rates, distribution and size composition of small coastal sharks collected during NOAA Fisheries Bottom Longline Surveys from the U.S. Gulf of Mexico and U.S. Atlantic Ocean. SEDAR 13-DW-22.
- Lo, N. C. H., L.D. Jacobson, and J.L. Squire. 1992. Indices of relative abundance from fish spotter data based on delta-lognormal models. Can. J. Fish. Aquat. Sci. 49: 2515-1526.
- Patetta, M. 2002. *Longitudinal Data Analysis with Discrete and Continuous Responses Course Notes*. SAS Institute Inc., Cary, North Carolina. 326 p.

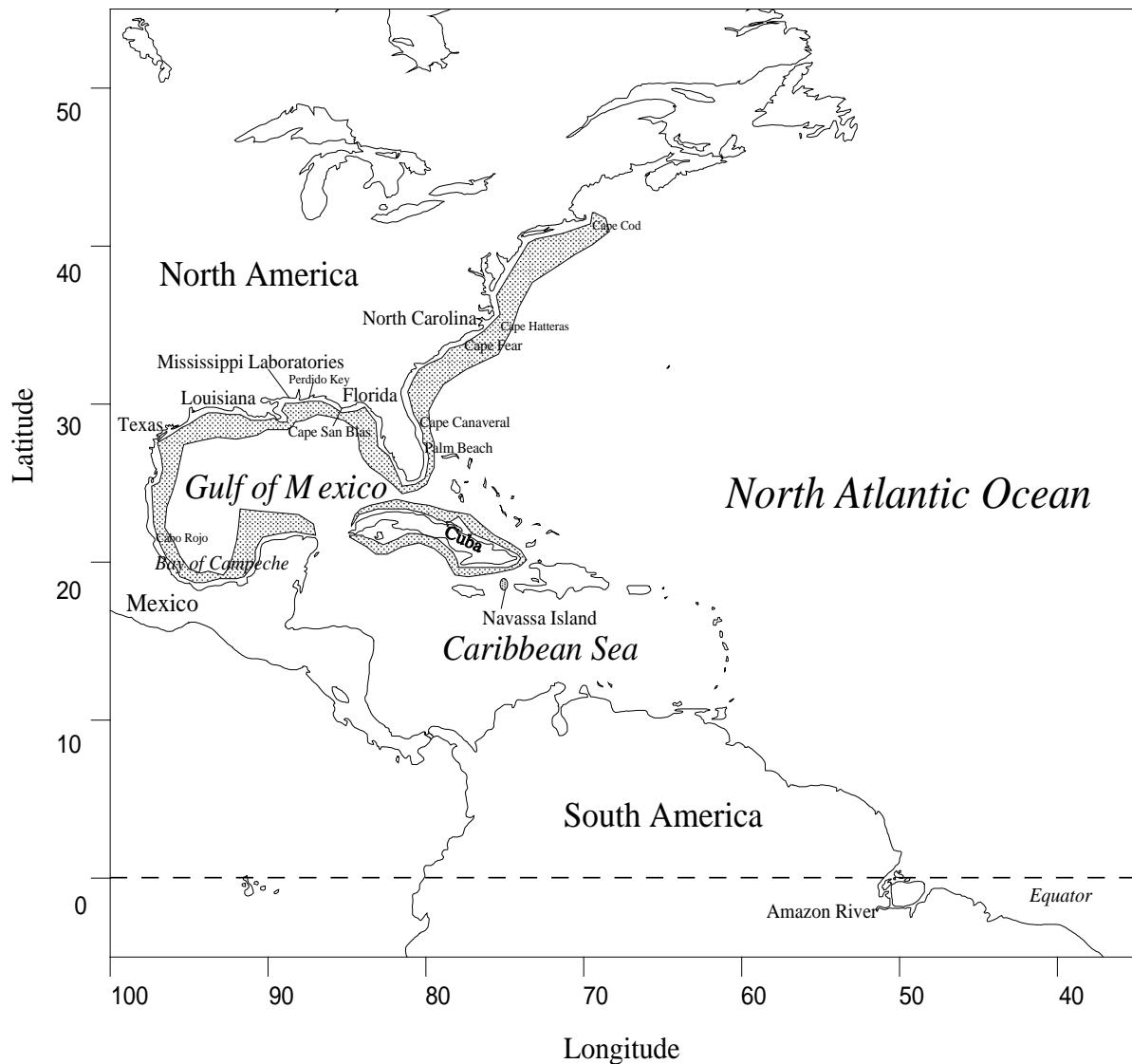


Figure 1. Survey areas for NMFS MS Laboratories longline projects (1995-2009) in the western North Atlantic Ocean. Stippled areas indicate where survey effort occurred.

Table 1. NMFS MS Laboratory longline projects, 1995 - 2009. Shaded rows indicate cruises from which data was used in this document. For surveys that occurred in both the Atlantic and Gulf of Mexico within a single survey, only data from the Gulf was used.

Survey	Date	Location	Depth range (m)	Effort (# sets)	Random station selection description.
OT-95-04 (218)	7/23 - 8/17/95	GOM ¹	18 m - 73 m	82	Stations depth stratified and equally allocated within statistical zones; depth strata 18 m - 37 m, 37 m - 55 m, 55 m - 73 m; J hooks.
RS-95-03 (2)	8/10 - 8/24/95	Atlantic ²	18 m - 73 m	45	Stations depth stratified and equally allocated within statistical zones; depth strata 18 m - 37 m, 37 m - 55 m, 55 m - 73 m; J hooks.
OT-96-04 (222)	7/31 - 9/13/96	GOM and Atlantic	18 m - 73 m	151	Stations depth stratified and equally allocated within statistical zones; depth strata 18 m - 37 m, 37 m - 55 m, 55 m - 73 m; J hooks.
OT-97-04 (227)	7/25 - 9/24/97	Mexican GOM, GOM and Atlantic	9 m - 55 m	259	Stations not depth stratified but equally allocated within 60 linear n. mile zones or statistical zones; J hooks.
OT-98-02 (231)	7/24 - 9/22/98	Mexican GOM, Cuba ³ , GOM	9 m - 413 m	216	Stations not depth stratified but equally allocated within 60 linear n. mile zones or statistical zones; J hooks.
OT-99-02 (233)	2/16 - 3/2/99	Atlantic	9 m - 55 m	29	Stations not depth stratified but equally allocated within statistical zones; J hooks.
FE-99-10 SEF	5/6 - 5/19/99	GOM	64 m - 146 m	60	Station coordinates by random longitude and random depth and equally allocated within 10 linear n. mile contiguous sampling blocks; circle hooks.
CARETTA 99-01	8/4 - 9/28/99	GOM	9 m - 55 m	161	Proportional allocation based on continental shelf width within statistical zones; sampling density experiment; hook comparison experiment with 75% J hooks, 25% circle hooks.
GU-00-03 (8)	6/6 - 6/19/00	GOM	64 m - 146 m	59	Station coordinates by random longitude and random depth and equally allocated within 20 linear n. mile contiguous sampling blocks; hook comparison experiment with 75% circle hooks, 25% J hooks.
OT-00-04 (241)	8/3 - 8/28/00	GOM	9 m - 183 m	137	Proportional allocation based on continental shelf width within statistical zones; sampling density experiment; hook comparison experiment with 75% J hooks, 25% circle hooks.
FE-00-12 (2)	9/6 - 10/16/00	Atlantic	9 m - 183 m	105	Proportional allocation based on continental shelf width within statistical zones; sampling density experiment; hook comparison experiment with 75% J hooks, 25% circle hooks.
OT-00-08 (244)	12/6 - 12/12/00	GOM	55 m - 366 m	41	Station coordinates by random longitude and random depth and equally allocated within 10 linear n. mile contiguous sampling blocks; stations depth stratified with 4 stations each block 55 m - 183 m, 2 stations each block 183 m - 366 m; hook comparison experiment with 75% circle hooks, 25% J hooks.
ONJUKU-01	6/1 - 6/20/01	Mexican GOM ⁴	9 m - 50 m	38	Proportional allocation based on continental shelf width within 60 linear n. mile sampling zones; circle hooks, Atlantic bonito for bait.
OT-01-04 (247)	7/31 - 9/30/01	GOM	9 m - 366 m	277	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
ONJUKU-01	6/28 - 7/5/02	Mexican GOM ⁴	18 m - 217 m	30	Proportional allocation based on continental shelf width within 60 linear n. mile sampling zones; circle hooks, Atlantic bonito for bait
OT-02-04 (251)	7/31 - 9/21/02	GOM and Atlantic	9 m - 366 m	212	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
OT-03-04 (255)	7/29 - 9/29/03	GOM	9 m - 366 m	280	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
GANDY 72-043	07/25 - 08/28/04	Atlantic	8 m - 34 m	40	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
OT-04-04 (260)	7/31 - 9/29/04	GOM	9 m - 366 m	232	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
GANDY 72-044	10/06 - 10/23/04	GOM	7 m - 92 m	17	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
OT-05-04 (266)	8/5 - 8/25/05	GOM and Atlantic	9 m - 366 m	74	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
OT-06-04 (272)	7/29 - 9/24/06	GOM and Atlantic	9 m - 366 m	208	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
OT-07-04 (277)	8/10 - 8/24/07	GOM	9 m - 366 m	156	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
OT-08-04 (283)	8/2 - 9/29/08	GOM and Atlantic	9 m - 366 m	145	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.

OT-09-04 (288)	7/30 - 9/29/09	GOM and Atlantic	9 m - 366 m	211	Proportional allocation based on continental shelf width within statistical zones; depth stratified, 50% allocation 9 m - 55 m, 40% allocation 55 m - 183 m, 10% allocation 183 m - 366 m; circle hooks.
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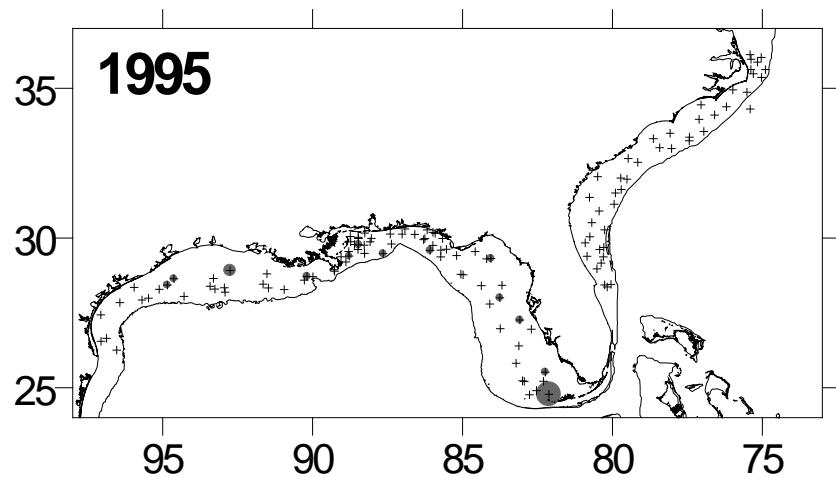


Figure 2. Survey effort (crosses) and positive CPUE (gray circles, range: 1 to 5 sharks per 100 hook hours) for blacknose sharks from 1995. X and Y axes represent degrees west longitude and degrees north latitude, respectively.

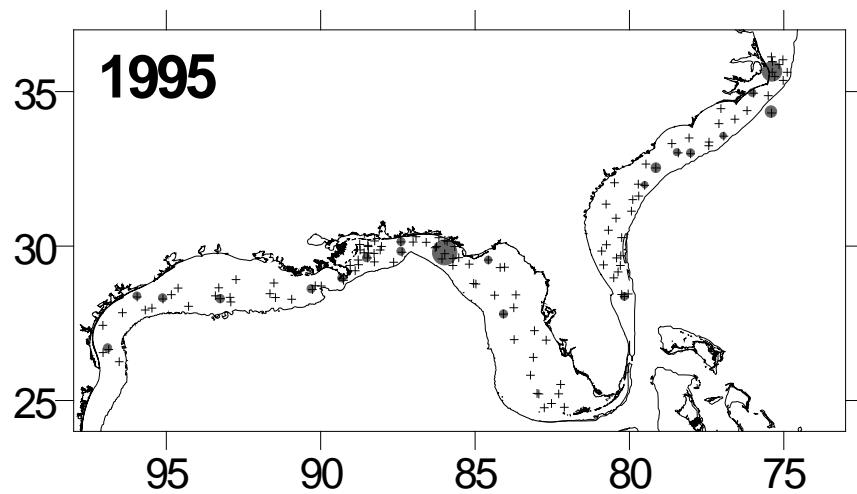


Figure 3. Survey effort and positive CPUE (range: 1 to 5 sharks per 100 hook hours) for sandbar shark from 1995.

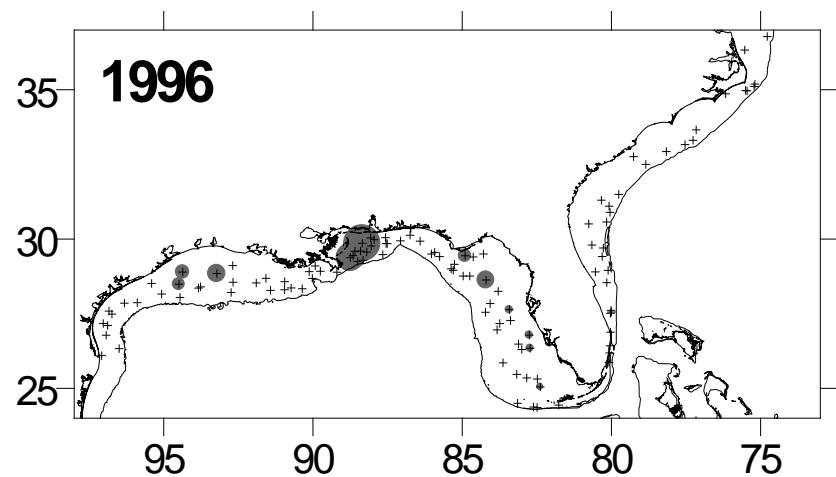


Figure 4. Survey effort and positive CPUE (range: 1 to 6 sharks per 100 hook hours) for blacknose sharks from 1996.

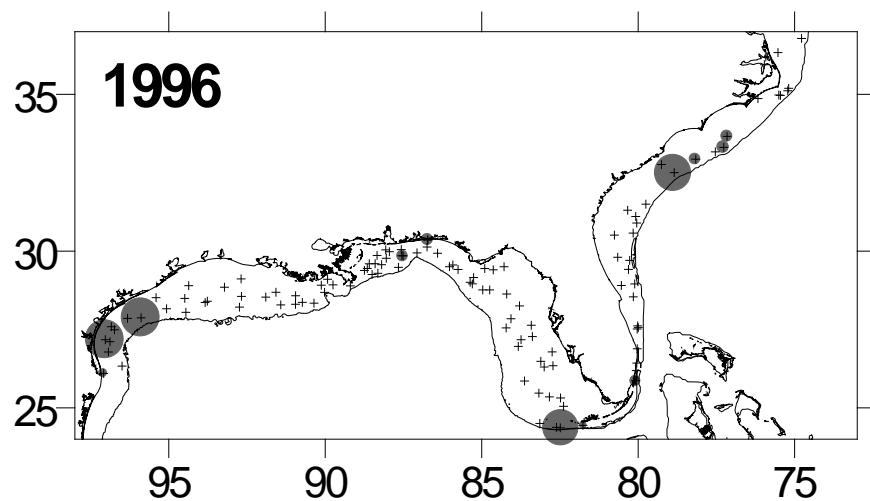


Figure 5. Survey effort and positive CPUE (range: 1 to 2 sharks per 100 hook hours) for sandbar shark from 1996.

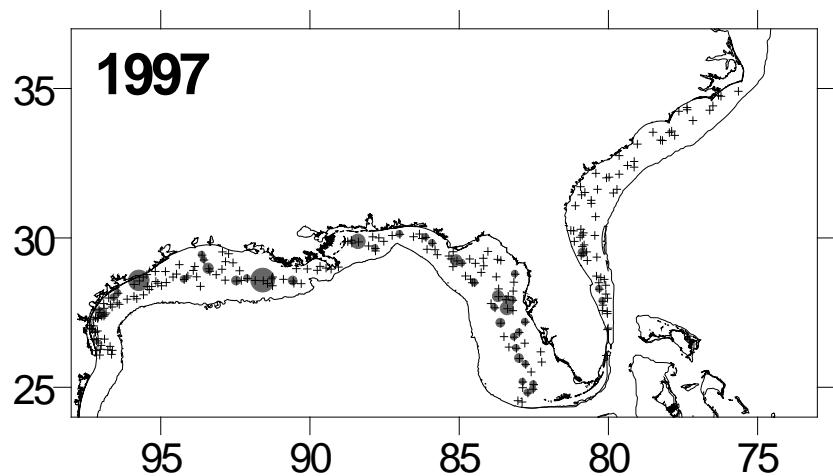


Figure 6. Survey effort and positive CPUE (range: 1 to 9 sharks per 100 hook hours) for blacknose sharks from 1997.

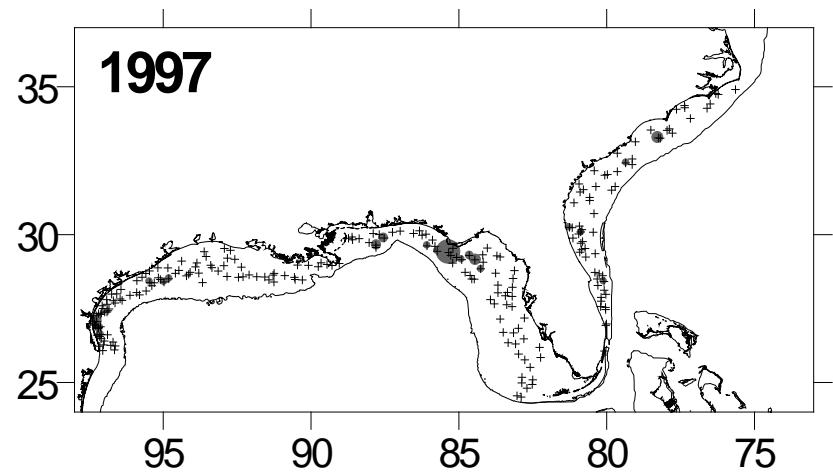


Figure 7. Survey effort and positive CPUE (range: 1 to 13 sharks per 100 hook hours) for sandbar shark from 1997.

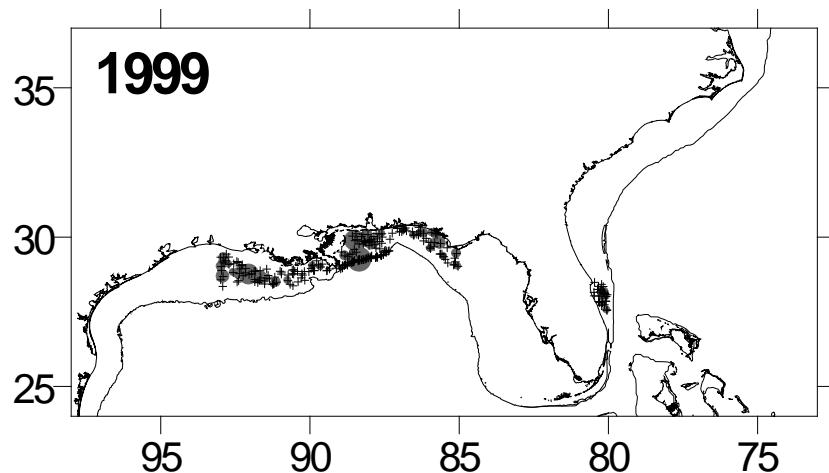


Figure 8. Survey effort and positive CPUE (range: 1 to 9 sharks per 100 hook hours) for blacknose sharks from 1999.

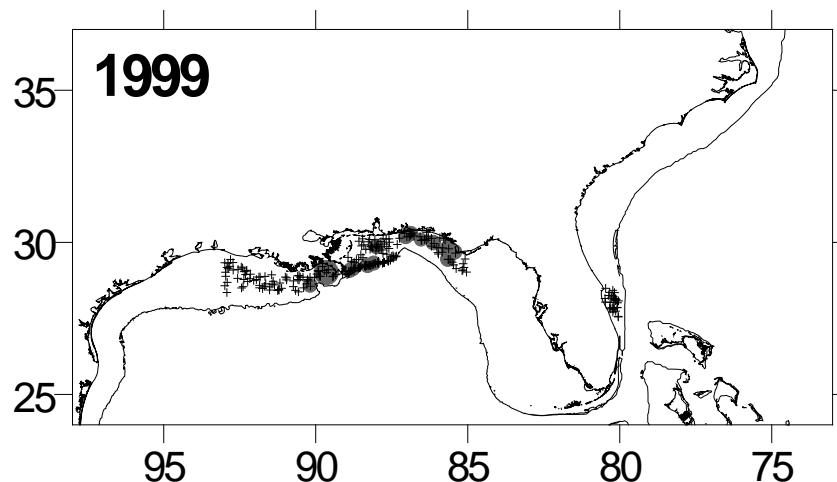


Figure 9. Survey effort and positive CPUE (range: 1 to 2 sharks per 100 hook hours) for sandbar shark from 1999.

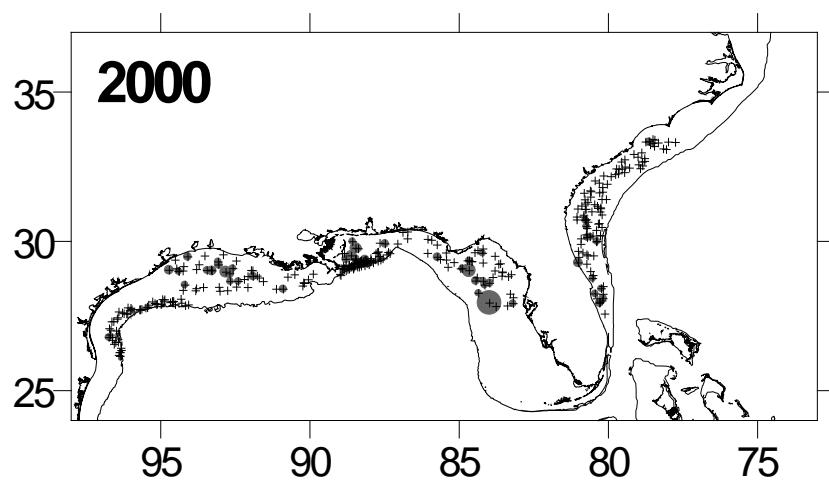


Figure 10. Survey effort and positive CPUE (range: 1 to 18 sharks per 100 hook hours) for blacknose sharks from 2000.

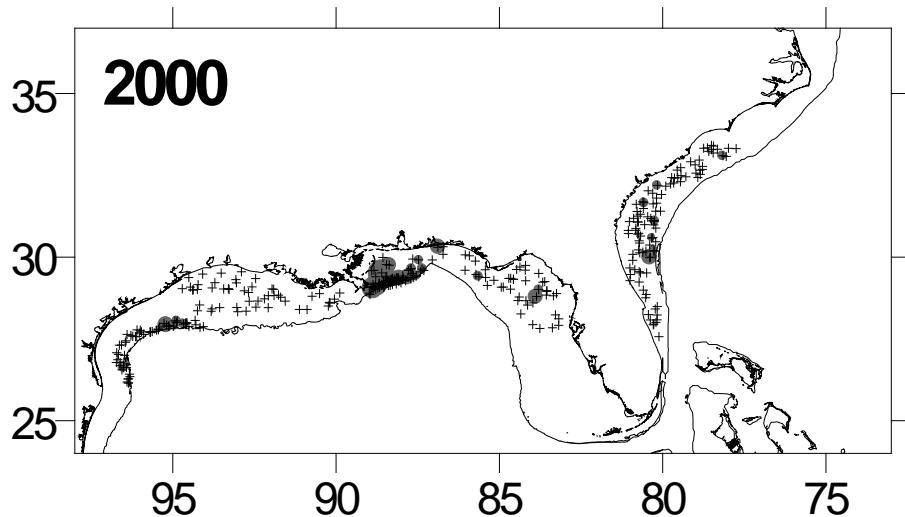


Figure 11. Survey effort and positive CPUE (range: 1 to 4 sharks per 100 hook hours) for sandbar shark from 2000.

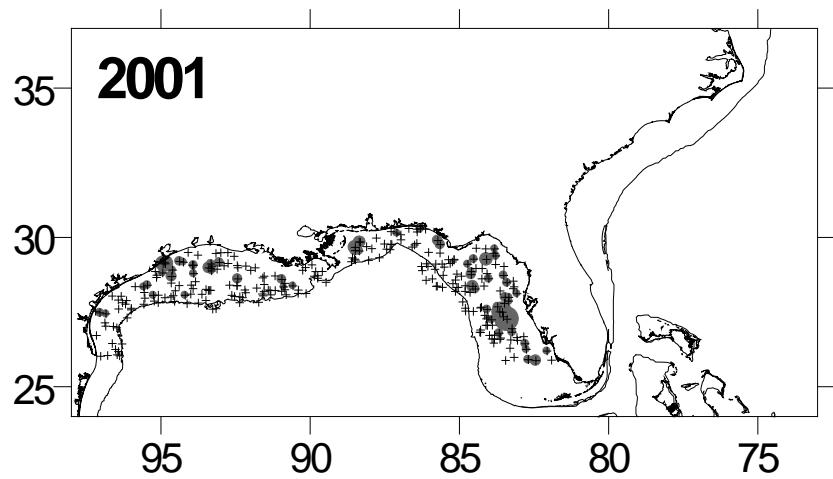


Figure 12. Survey effort and positive CPUE (range: 1 to 20 sharks per 100 hook hours) for blacknose sharks from 2001.

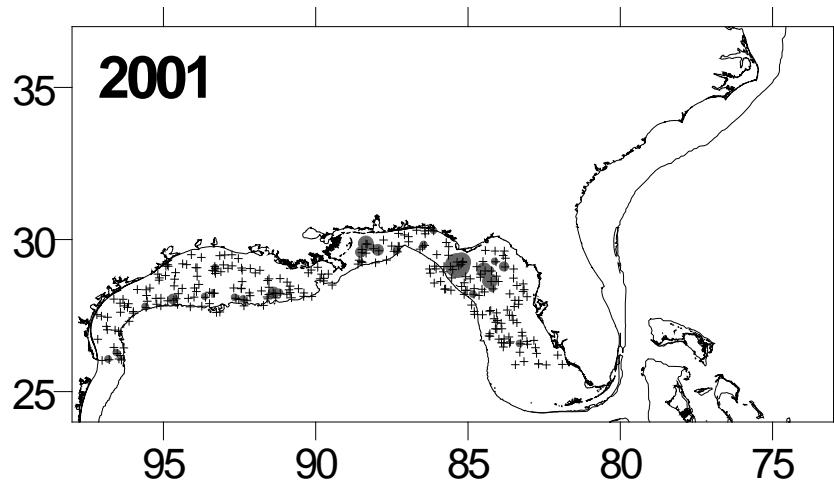


Figure 13. Survey effort and positive CPUE (range: 1 to 6 sharks per 100 hook hours) for sandbar shark from 2001.

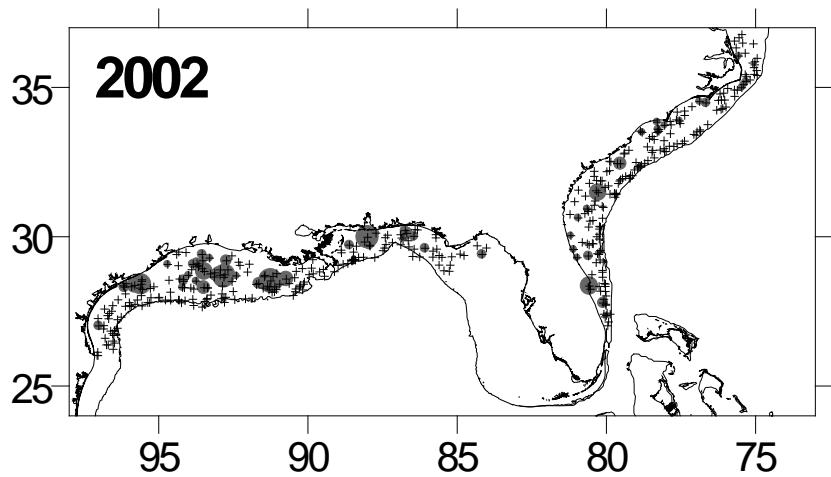


Figure 14. Survey effort and positive CPUE (range: 1 to 10 sharks per 100 hook hours) for blacknose sharks from 2002.

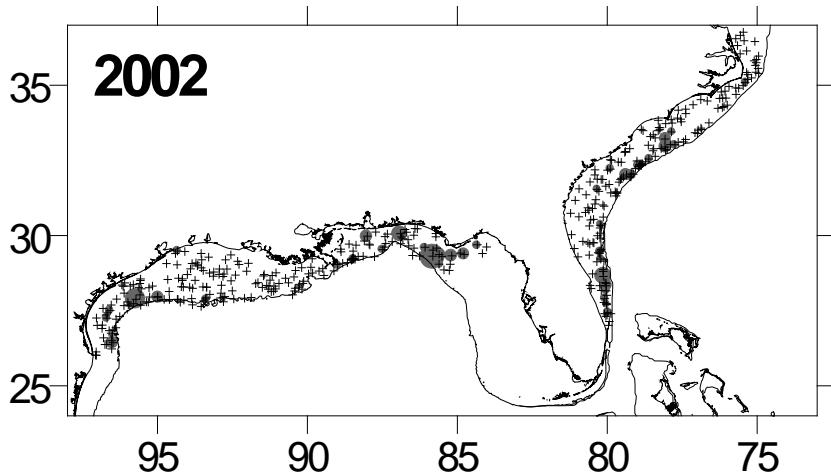


Figure 15. Survey effort and positive CPUE (range: 1 to 5 sharks per 100 hook hours) for sandbar shark from 2002.

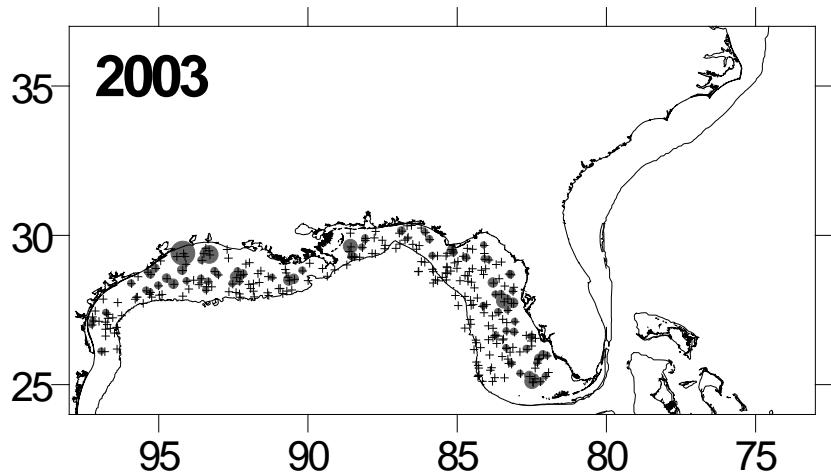


Figure 16. Survey effort and positive CPUE (range: 1 to 39 sharks per 100 hook hours) for blacknose sharks from 2003.

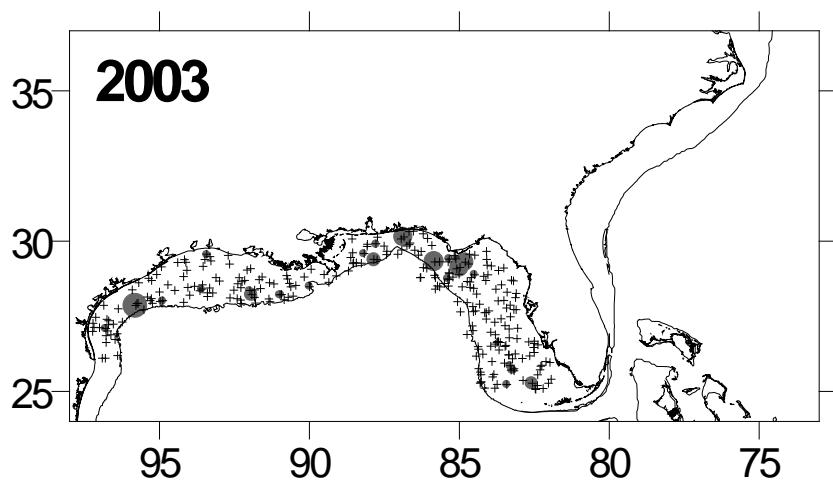


Figure 17. Survey effort and positive CPUE (range: 1 to 4 sharks per 100 hook hours) for sandbar shark from 2003.

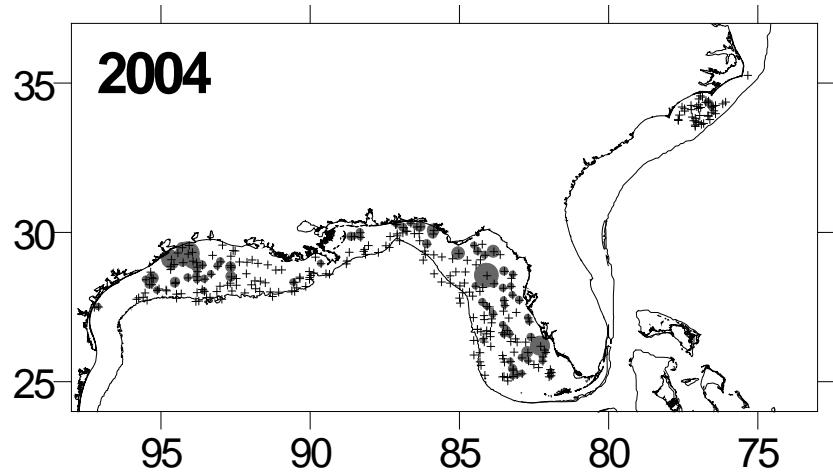


Figure 18. Survey effort and positive CPUE (range: 1 to 20 sharks per 100 hook hours) for blacknose sharks from 2004.

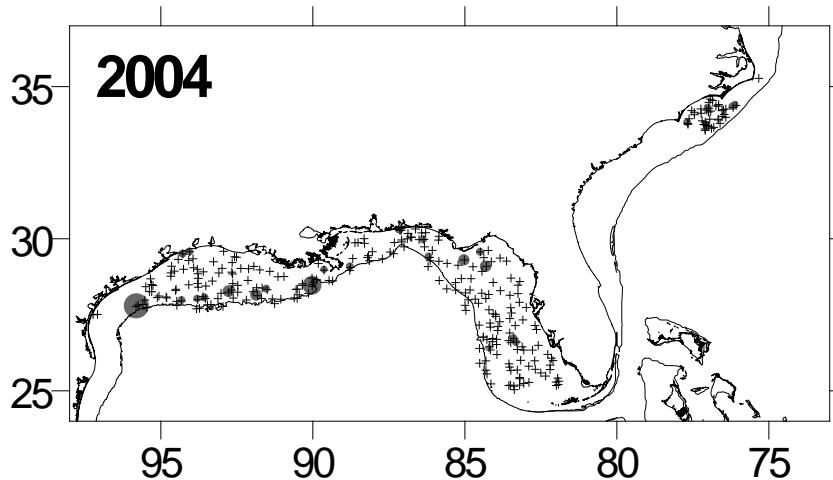


Figure 19. Survey effort and positive CPUE (range: 1 to 6 sharks per 100 hook hours) for sandbar shark from 2004.

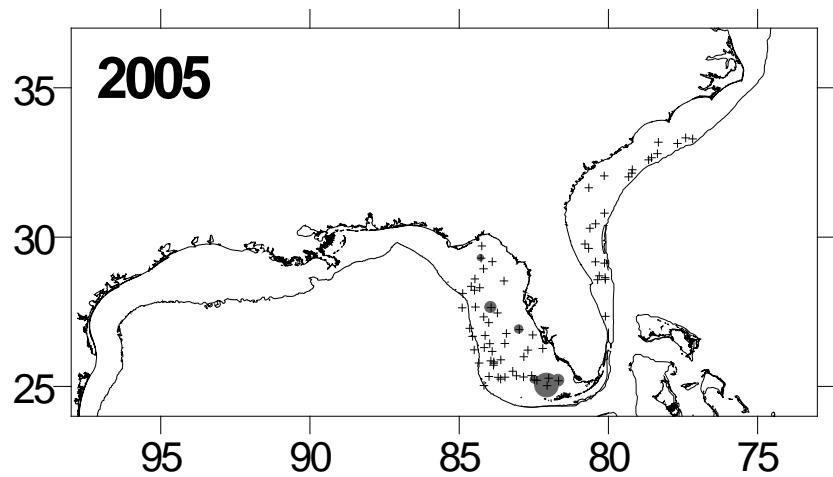


Figure 20. Survey effort and positive CPUE (range: 1 to 15 sharks per 100 hook hours) for blacknose sharks from 2005.

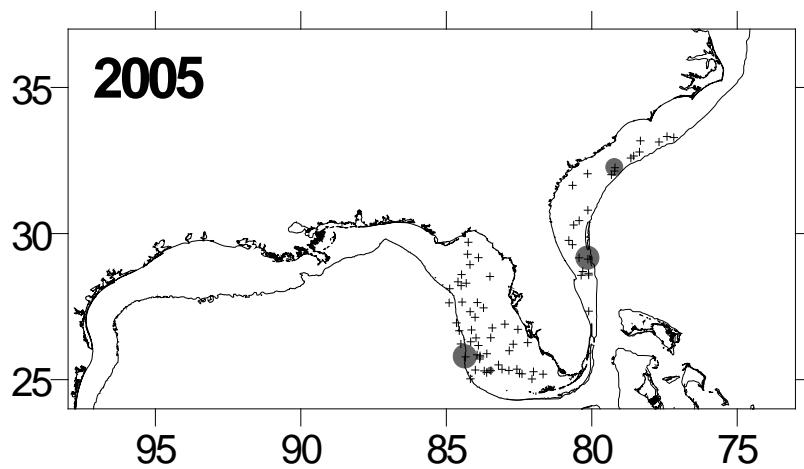


Figure 21. Survey effort and positive CPUE (range: 1 shark per 100 hook hours) for sandbar shark from 2005.

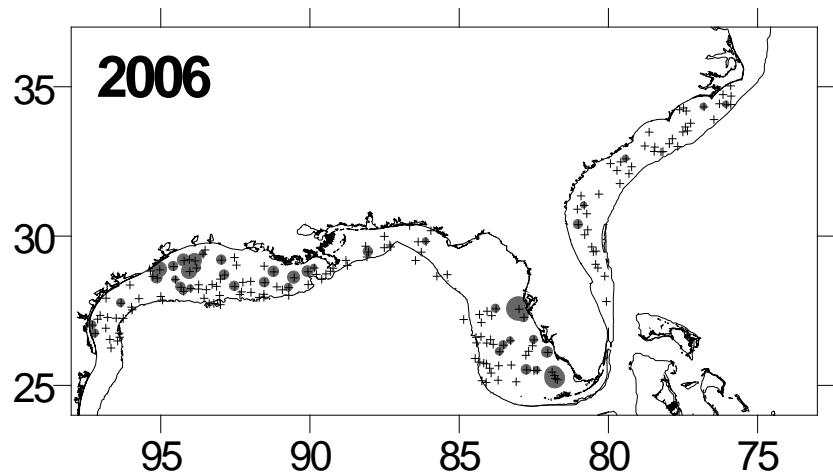


Figure 22. Survey effort and positive CPUE (range: 1 to 12 sharks per 100 hook hours) for blacknose sharks from 2006.

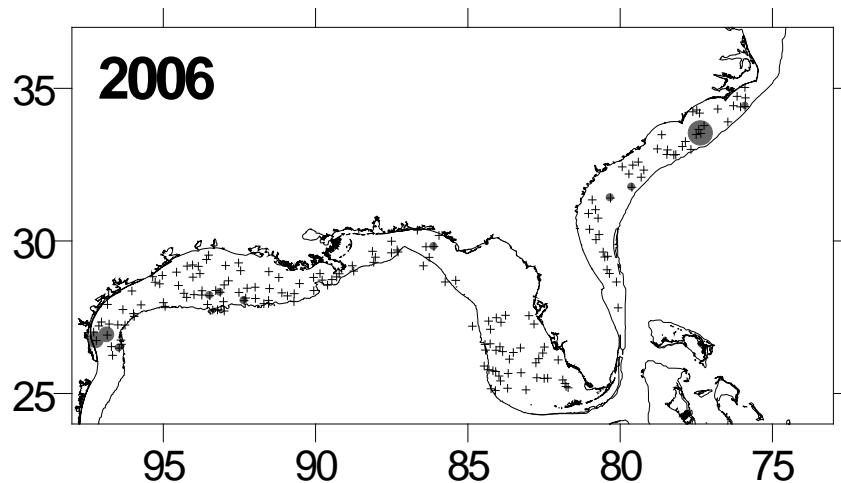


Figure 23. Survey effort and positive CPUE (range: 1 to 3 sharks per 100 hook hours) for sandbar shark from 2006.

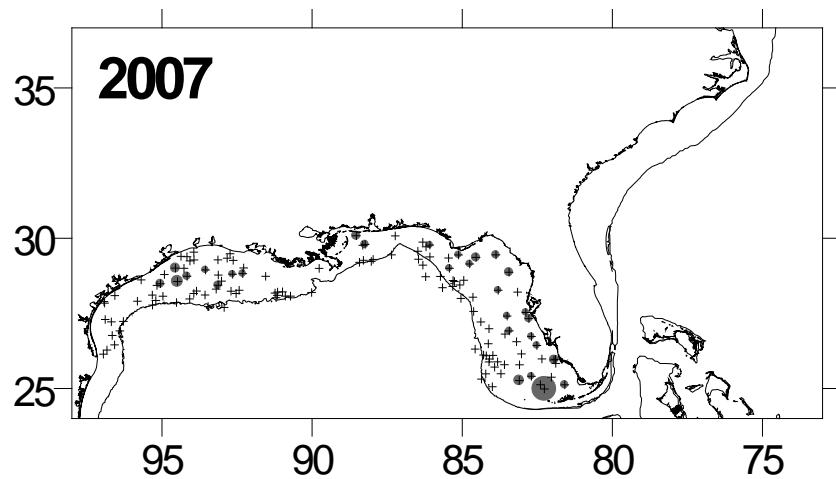


Figure 24. Survey effort and positive CPUE (range: 1 to 20 sharks per 100 hook hours) for blacknose sharks from 2007.

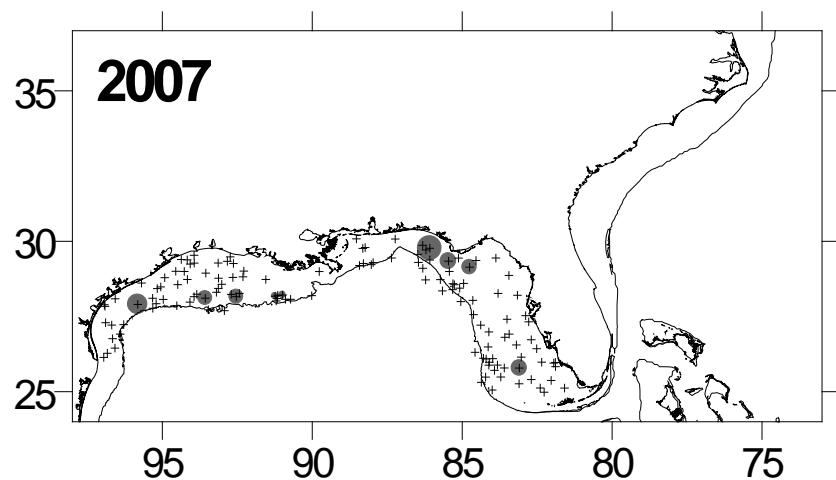


Figure 25. Survey effort and positive CPUE (range: 1 to 3 sharks per 100 hook hours) for sandbar shark from 2007.

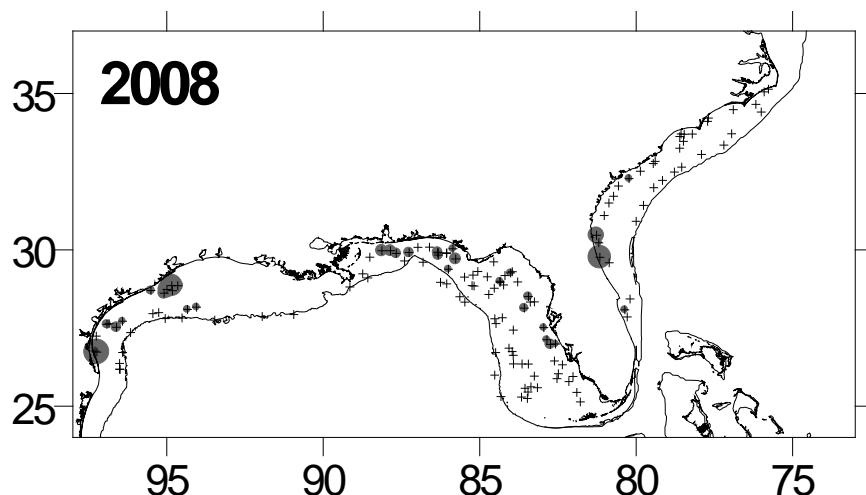


Figure 26. Survey effort and positive CPUE (range: 1 to 13 sharks per 100 hook hours) for blacknose sharks from 2008.

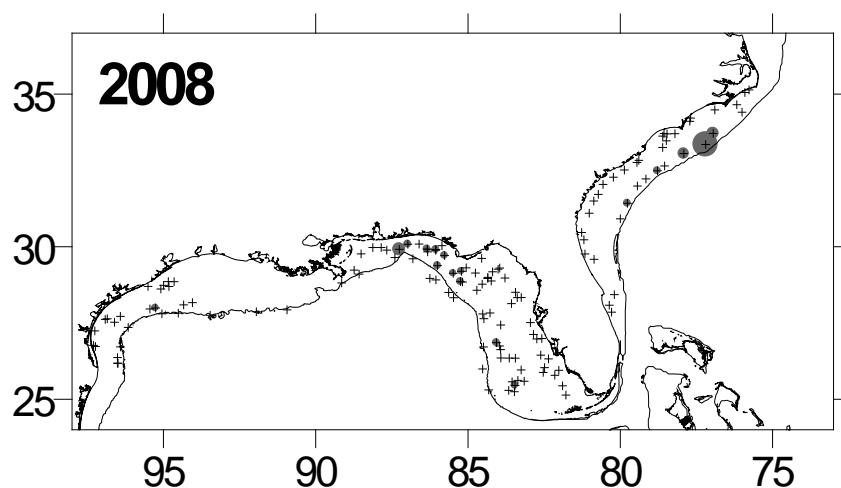


Figure 27. Survey effort and positive CPUE (range: 1 to 4 sharks per 100 hook hours) for sandbar shark from 2008.

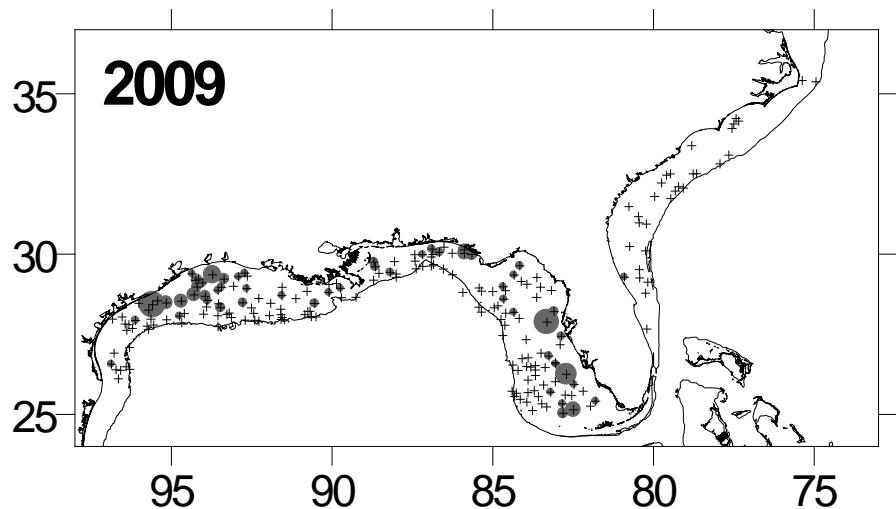


Figure 28. Survey effort and positive CPUE (range: 1 to 25 sharks per 100 hook hours) for blacknose sharks from 2009.

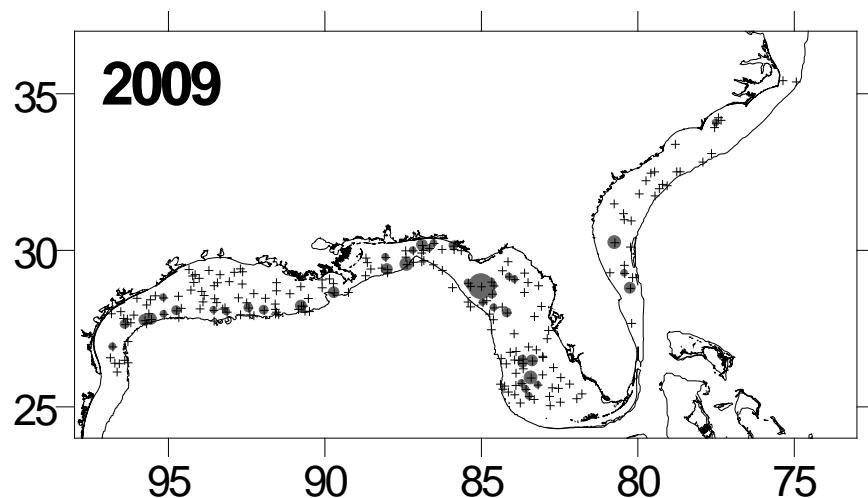


Figure 29. Survey effort and positive CPUE (range: 1 to 10 sharks per 100 hook hours) for sandbar shark from 2009.

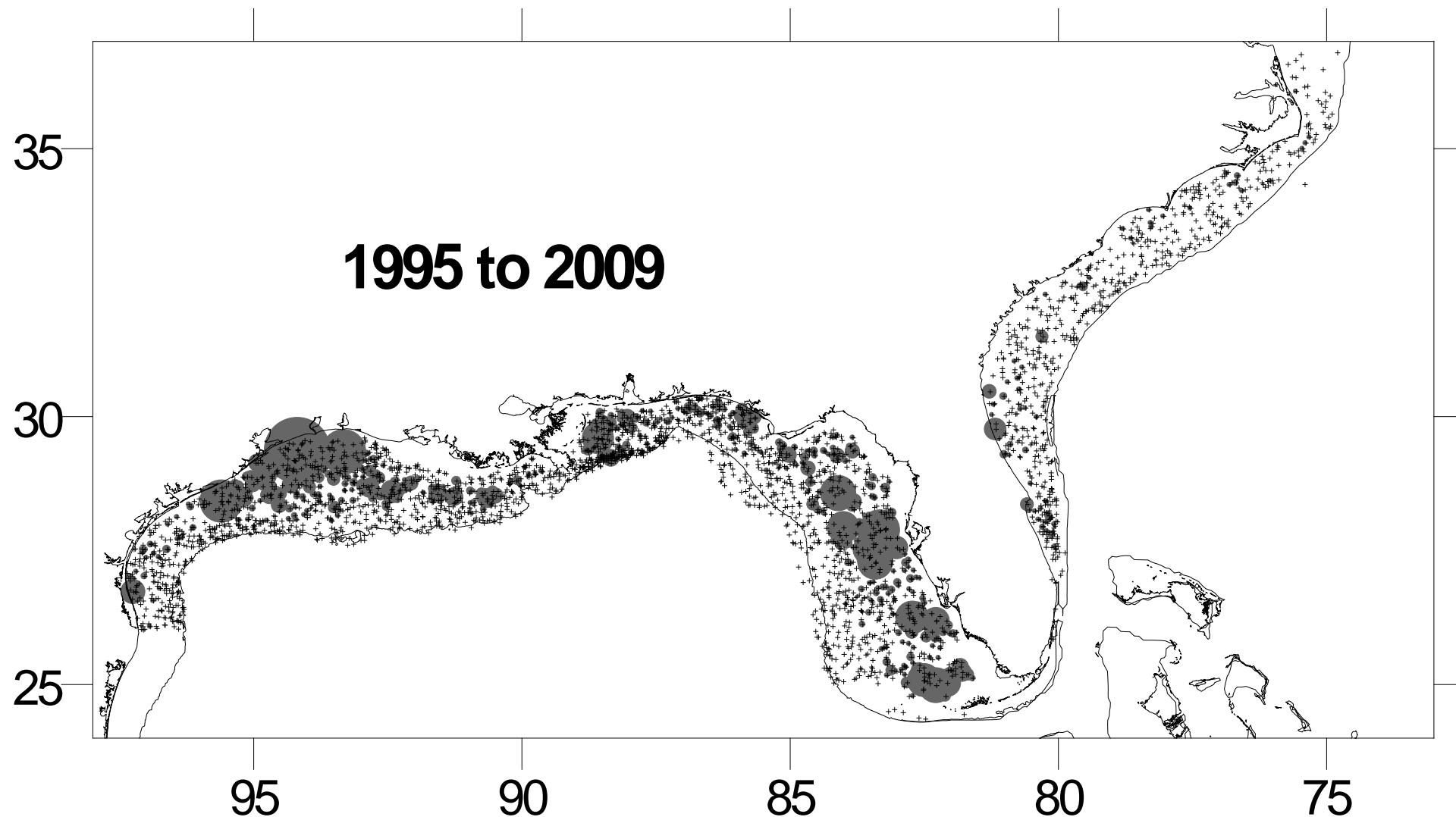


Figure 30. Survey effort and CPUE (range: 1 to 39 sharks per 100 hook hours) for blacknose sharks from 1995 through 2009.

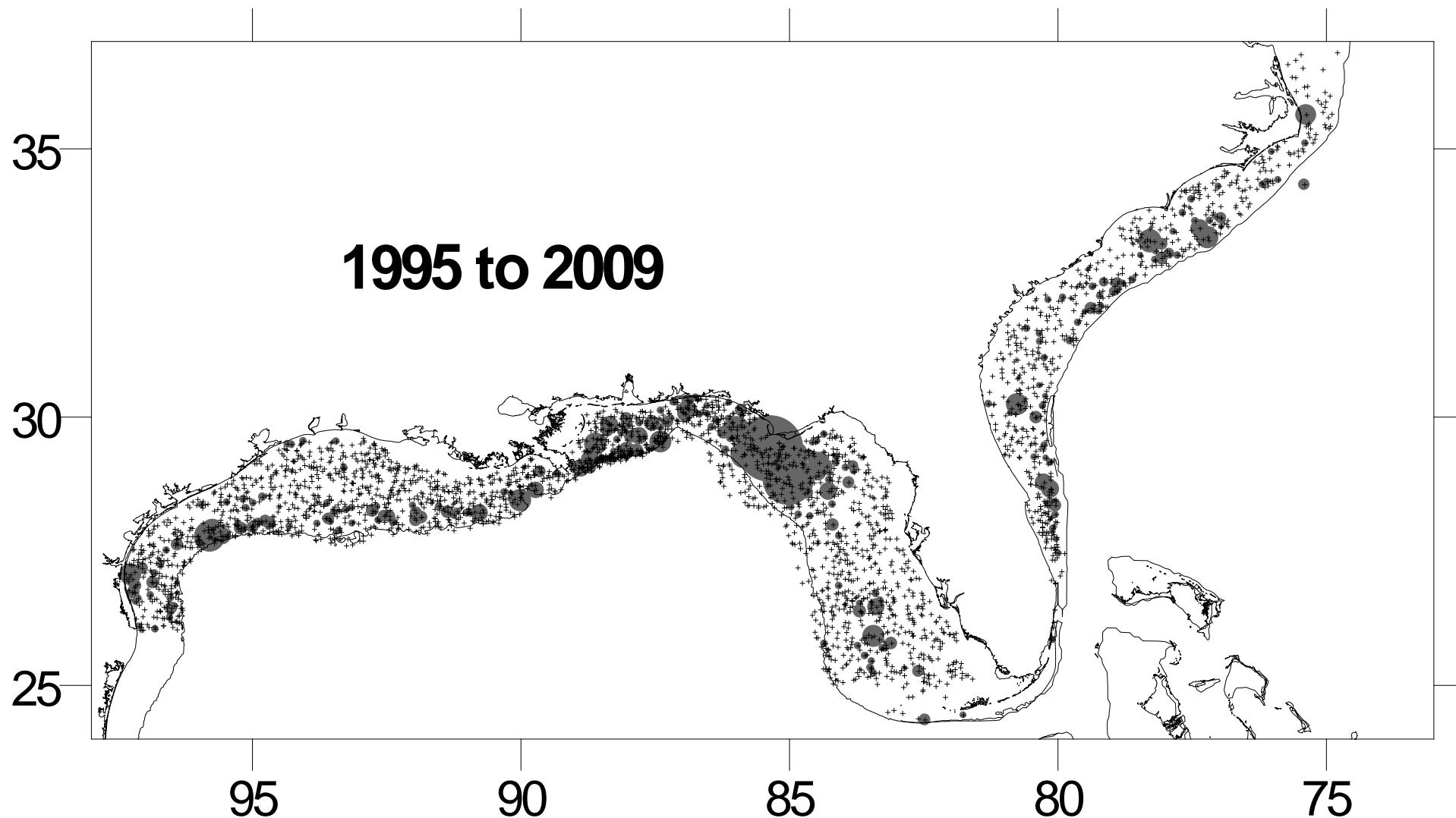


Figure 31. Survey effort and CPUE (range: 1 to 13 sharks per 100 hook hours) for sandbar shark from 1995 through 2009.

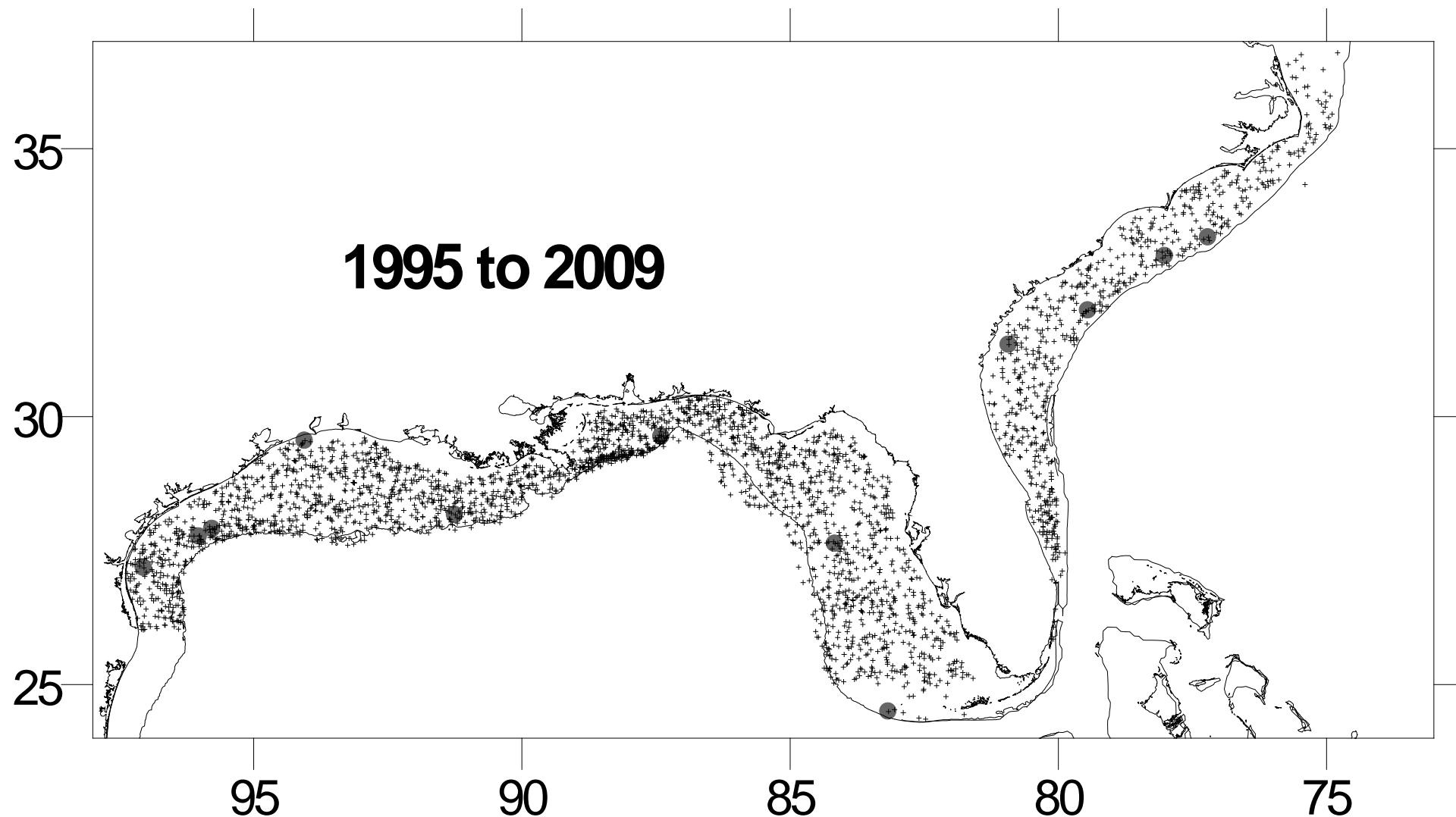
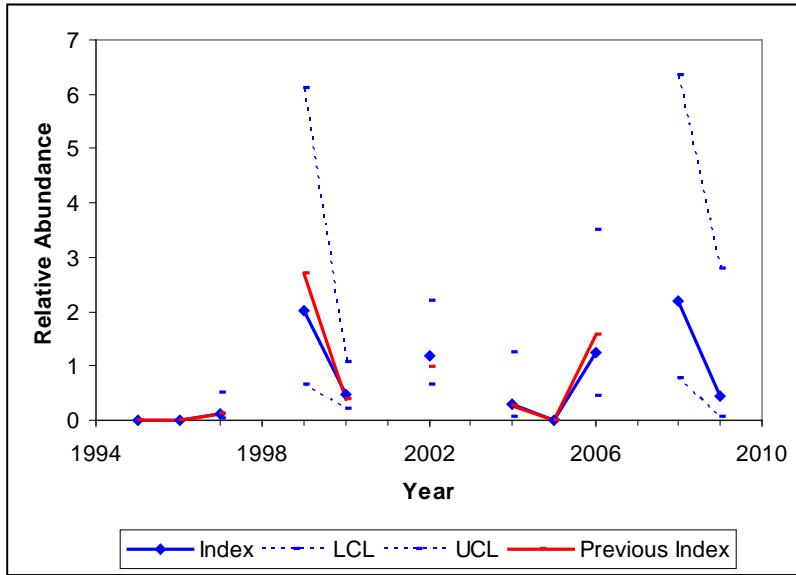


Figure 32. Survey effort and CPUE (range: 1 shark per 100 hook hours) for dusky sharks from 1995 through 2009.



Survey Year	Frequency	N	Index	Scaled Index	CV	LCL	UCL
1995	0	45	0	0			
1996	0	57	0	0			
1997	0.04615	65	0.01606	0.13106	0.74952	0.03448	0.49823
1998		0					
1999	0.13793	29	0.24712	2.01673	0.6003	0.66496	6.11648
2000	0.11538	104	0.05795	0.47296	0.42504	0.20934	1.06856
2001		0					
2002	0.13043	184	0.14587	1.19046	0.3121	0.647	2.19042
2003		0					
2004	0.05	40	0.03574	0.29163	0.84049	0.06759	1.25834
2005		0	0	0			
2006	0.1087	46	0.1532	1.25023	0.5494	0.4476	3.49212
2007		0					
2008	0.13514	37	0.27004	2.20375	0.56699	0.76662	6.33499
2009	0.03226	31	0.0543	0.44317	1.15715	0.07013	2.80053

Type 3 Tests of Fixed Effects of Variables Retained in Binomial Sub-model

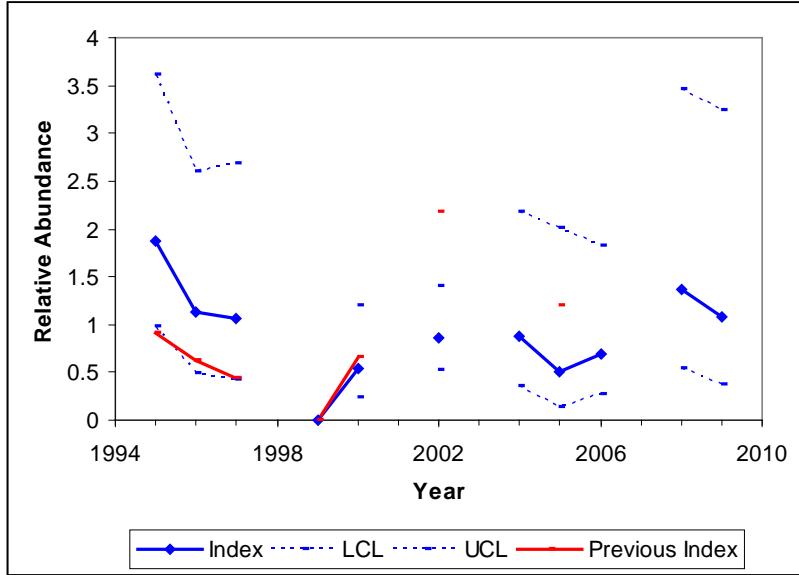
Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
YEAR	7	524	20.14	2.88	0.0053	0.0059
DEPTH	1	524	3.05	3.05	0.0807	0.0813
TEMPMAX	1	524	11.79	11.79	0.0006	0.0006

Type 3 Tests of Fixed Effects of Variables Retained in Non-zero Sub-model

Effect	Num DF	Den DF	F Value	Pr > F
YEAR	7	48	0.85	0.5534

Figure 33. Standardized annual abundance indices for blacknose sharks collected during bottom longline surveys from the U.S. Atlantic Ocean south of 37° north latitude. Type 3 analyses results for those variables retained in sub-models. Legend for this and following figures: N =

sample size; Scaled Index = index standardized to the time series mean of one; CV = coefficient of variation on the mean; and LCL and UCL = lower and upper 95% confidence intervals.



Survey Year	Frequency	N	Index	Scaled Index	CV	LCL	UCL
1995	0.2	45	0.27365	1.87299	0.33685	0.97226	3.60822
1996	0.12281	57	0.16481	1.12803	0.43606	0.48969	2.59848
1997	0.07692	65	0.1551	1.06158	0.49018	0.41966	2.6854
1998		0					
1999	0	29	0	0			
2000	0.06731	104	0.07866	0.53835	0.41944	0.24066	1.20428
2001		0					
2002	0.125	184	0.12539	0.85822	0.24639	0.52812	1.39466
2003		0					
2004	0.125	40	0.12851	0.87961	0.47878	0.35456	2.18218
2005	0.08333	24	0.07413	0.50741	0.77681	0.12839	2.00536
2006	0.1087	46	0.10173	0.69631	0.51157	0.26547	1.82637
2007		0					
2008	0.13514	37	0.20005	1.36922	0.48986	0.54156	3.46178
2009	0.12903	31	0.159	1.08828	0.58985	0.36487	3.24596

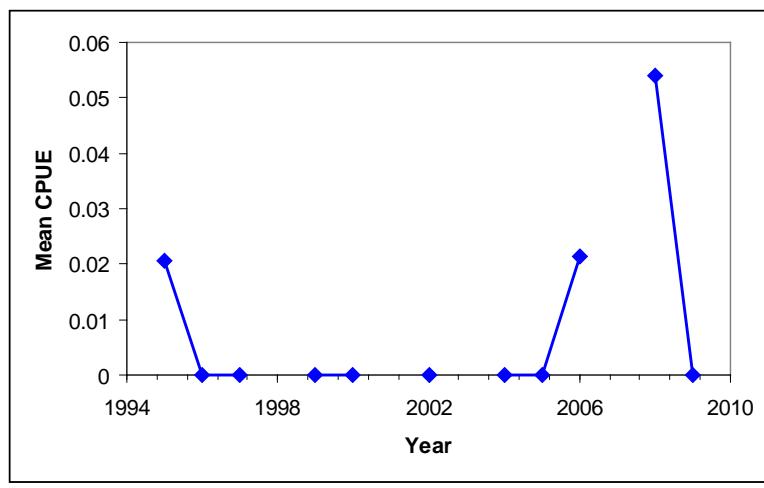
Type 3 Tests of Fixed Effects of Variables Retained in Binomial Sub-model

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
YEAR	9	621	8.17	0.91	0.5173	0.5181
TEMPMAX	1	621	5.23	5.23	0.0223	0.0226
SALMAX	1	621	5.56	5.56	0.0183	0.0187

Type 3 Tests of Fixed Effects of Variables Retained in Non-zero Sub-model

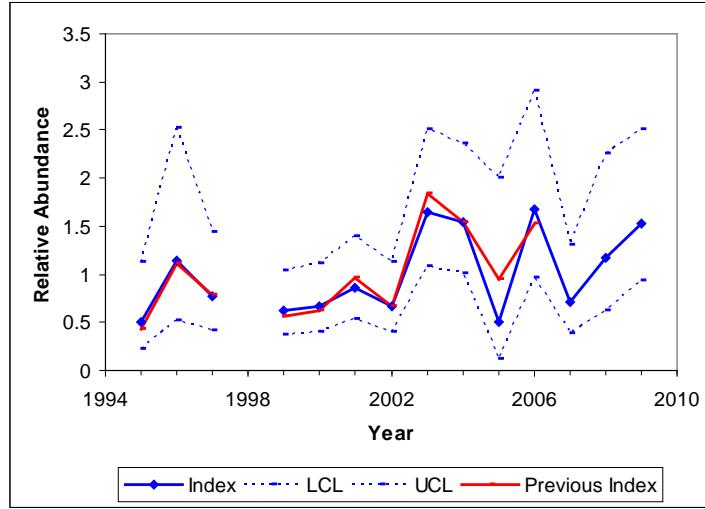
Effect	Num DF	Den DF	F Value	Pr > F
YEAR	9	62	1.09	0.3820

Figure 34. Standardized abundance indices for sandbar shark collected during bottom longline surveys from the U.S. Atlantic Ocean south of 37° north latitude. Type 3 analyses results for those variables retained in sub-models.



YEAR	Frequency	N	Index	Standard Error	CV
1995	0.022222	45	0.020513	0.020513	1
1996	0	57	0	0	
1997	0	65	0	0	
1998		0			
1999	0	29	0	0	
2000	0	104	0	0	
2001		0			
2002	0	184	0	0	
2003		0			
2004	0	40	0	0	
2005	0	24	0	0	
2006	0.021739	46	0.021383	0.021383	1
2007		0			
2008	0.054054	37	0.054054	0.037687	0.69722
2009	0	31	0	0	

Figure 35. Mean annual CPUE (number per 100 hook hours) for dusky shark collected during bottom longline surveys from the U.S. Atlantic Ocean south of 37° north latitude.



<i>Survey Year</i>	<i>Frequency</i>	<i>N</i>	<i>Index</i>	<i>Scaled Index</i>	<i>CV</i>	<i>LCL</i>	<i>UCL</i>
1995	0.15854	82	0.13599	0.49843	0.42835	0.21933	1.13267
1996	0.16667	84	0.31007	1.13646	0.41434	0.51265	2.51936
1997	0.23669	169	0.2095	0.76784	0.32307	0.40887	1.44196
1998		0					
1999	0.19005	221	0.17092	0.62643	0.25831	0.37681	1.04142
2000	0.15612	237	0.18041	0.66121	0.26186	0.39505	1.10669
2001	0.22826	276	0.23484	0.86073	0.24244	0.53368	1.38818
2002	0.20362	221	0.18332	0.67189	0.26621	0.39812	1.1339
2003	0.3	280	0.44848	1.64375	0.21178	1.08119	2.49901
2004	0.3494	248	0.41957	1.53777	0.21511	1.00498	2.35304
2005	0.16	50	0.13646	0.50016	0.78751	0.12467	2.00664
2006	0.28889	135	0.45839	1.68007	0.27942	0.97089	2.90727
2007	0.23308	133	0.19454	0.71301	0.31226	0.38739	1.31231
2008	0.28431	102	0.32122	1.17732	0.33208	0.61654	2.24818
2009	0.3	180	0.41606	1.52493	0.25081	0.93049	2.49911

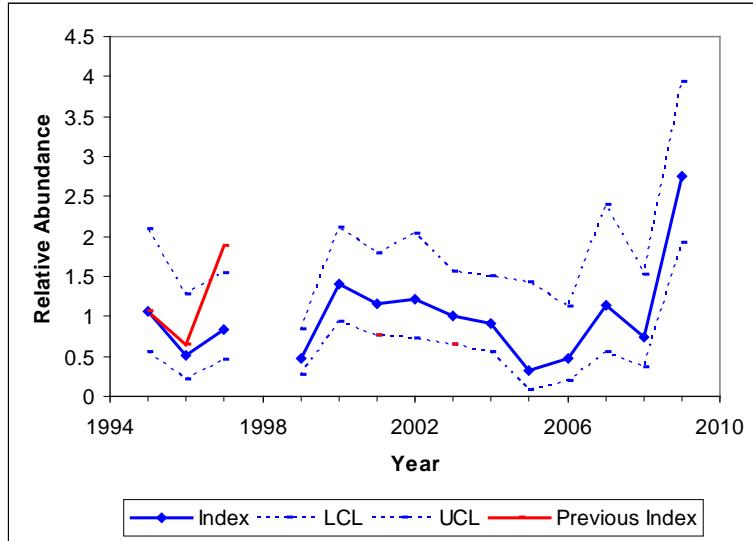
Type 3 Tests of Fixed Effects of Variables Retained in Binomial Sub-model

<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr > ChiSq</i>	<i>Pr > F</i>
<i>YEAR</i>	13	2368	46.93	3.61	<.0001	<.0001
<i>HOOK TYPE</i>	1	2368	7.85	7.85	0.0051	0.0051
<i>DEPTH</i>	1	2368	83.20	83.20	<.0001	<.0001
<i>TEMPMAX</i>	1	2368	7.43	7.43	0.0064	0.0065
<i>SALMAX</i>	1	2368	41.84	41.84	<.0001	<.0001

Type 3 Tests of Fixed Effects of Variables Retained in Non-zero Sub-model

<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr > F</i>
<i>YEAR</i>	13	557	1.37	0.1673
<i>AREA</i>	2	557	1.58	0.2068
<i>HOOK TYPE</i>	1	557	3.23	0.0729
<i>DEPTH</i>	1	557	9.64	0.0020

Figure 36. Standardized abundance indices for blacknose sharks collected during bottom longline surveys from the U.S. Gulf of Mexico. Type 3 analyses results for those variables retained in sub-models.



Survey Year	Frequency	N	Index	Scaled Index	CV	LCL	UCL
1995	0.14634	82	0.1515	1.07048	0.34573	0.54666	2.09624
1996	0.08333	84	0.07357	0.51987	0.46809	0.21344	1.26622
1997	0.10651	169	0.11861	0.83812	0.30923	0.45795	1.53388
1998	0						
1999	0.08145	221	0.06612	0.46718	0.29277	0.26326	0.82903
2000	0.13502	237	0.19817	1.40029	0.20839	0.92712	2.11494
2001	0.1087	276	0.16419	1.16015	0.2195	0.75179	1.79033
2002	0.0905	221	0.17153	1.21204	0.26376	0.72153	2.03599
2003	0.10714	280	0.142	1.00338	0.22492	0.64343	1.56467
2004	0.09237	248	0.12783	0.90324	0.25719	0.54448	1.4984
2005	0.04	50	0.04555	0.32187	0.86147	0.07253	1.42831
2006	0.05185	135	0.06692	0.47284	0.45561	0.19837	1.12705
2007	0.07519	133	0.16223	1.14634	0.37912	0.55081	2.38572
2008	0.11765	102	0.10439	0.73762	0.37007	0.36029	1.51014
2009	0.22222	180	0.38871	2.7466	0.18123	1.91713	3.93494

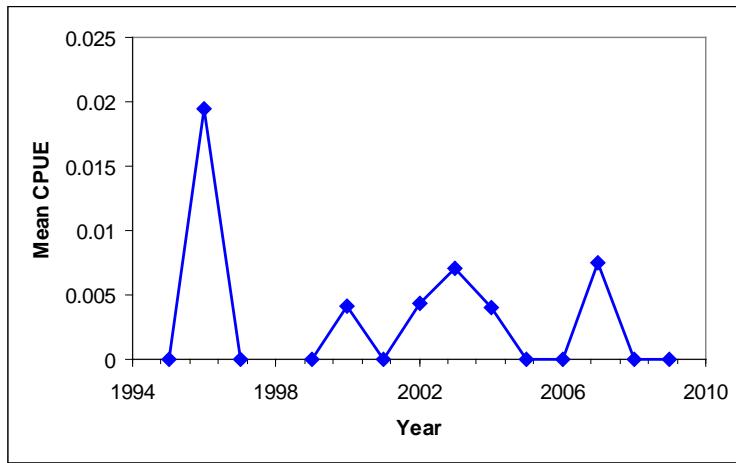
Type 3 Tests of Fixed Effects of Variables Retained in Binomial Sub-model

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
YEAR	13	2368	41.93	3.23	<.0001	<.0001
AREA	2	2368	6.30	3.15	0.0429	0.0431
DEPTH	1	2368	29.29	29.29	<.0001	<.0001
TEMPMAX	1	2368	28.69	28.69	<.0001	<.0001

Type 3 Tests of Fixed Effects of Variables Retained in Non-zero Sub-model

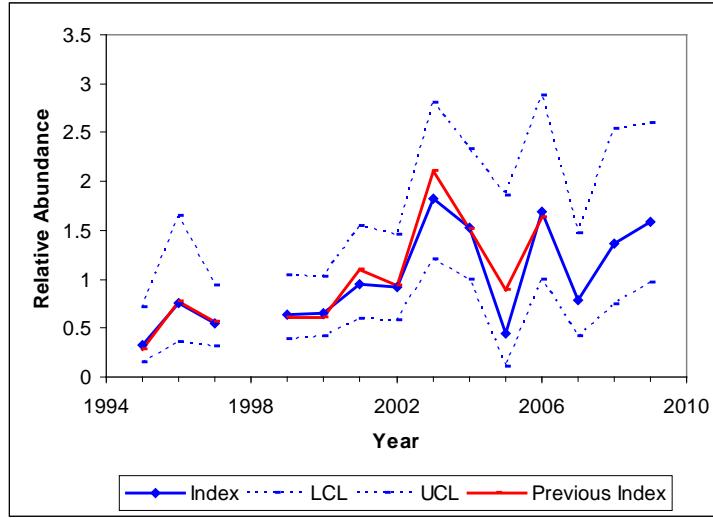
Effect	Num DF	Den DF	F Value	Pr > F
YEAR	13	244	2.38	0.0051
DEPTH	1	244	7.23	0.0077
SALMAX	1	244	5.07	0.0252

Figure 37. Standardized abundance indices for sandbar shark collected during bottom longline surveys from the U.S. Gulf of Mexico. Type 3 analyses results for those variables retained in sub-models.



YEAR	Frequency	N	Index	Standard Error	CV
1995	0.022222	45	0.020513	0.020513	1
1996	0	57	0	0	
1997	0	65	0	0	
1998		0			
1999	0	29	0	0	
2000	0	104	0	0	
2001		0			
2002	0	184	0	0	
2003		0			
2004	0	40	0	0	
2005	0	24	0	0	
2006	0.021739	46	0.021383	0.021383	1
2007		0			
2008	0.054054	37	0.054054	0.037687	0.69722
2009	0	31	0	0	

Figure 38. Mean annual CPUE (number per 100 hook hours) for dusky shark collected during bottom longline surveys from the U.S. Gulf of Mexico.



Survey Year	Frequency	N	Index	Scaled Index	CV	LCL	UCL
1995	0.10236	127	0.07097	0.32121	0.41558	0.14457	0.71363
1996	0.09929	141	0.16847	0.76246	0.40148	0.35192	1.65194
1997	0.18376	234	0.12021	0.54406	0.27351	0.31794	0.93098
1998	0						
1999	0.184	250	0.14079	0.63719	0.24833	0.39065	1.0393
2000	0.1437	341	0.14297	0.64706	0.22875	0.41189	1.01649
2001	0.22826	276	0.20988	0.94988	0.24483	0.58627	1.53901
2002	0.17037	405	0.2028	0.91781	0.23353	0.57889	1.45516
2003	0.3	280	0.4046	1.83109	0.21592	1.19481	2.8062
2004	0.30796	288	0.33747	1.5273	0.21426	0.99977	2.33317
2005	0.10811	74	0.09764	0.44189	0.82136	0.1051	1.85781
2006	0.24309	181	0.37326	1.68925	0.27076	0.99234	2.87562
2007	0.23308	133	0.17308	0.7833	0.32259	0.41748	1.46967
2008	0.2446	139	0.30221	1.36771	0.31518	0.73908	2.53104
2009	0.26066	211	0.34907	1.5798	0.25325	0.95948	2.60115

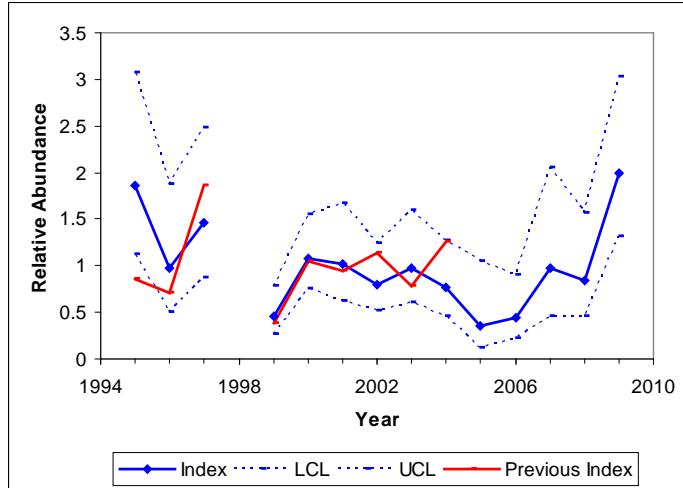
Type 3 Tests of Fixed Effects of Variables Retained in Binomial Sub-model

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
YEAR	13	3024	38.68	2.98	0.0002	0.0002
AREA	3	3024	116.41	38.80	<.0001	<.0001
HOOK TYPE	1	3024	6.51	6.51	0.0107	0.0107
DEPTH	1	3024	94.46	94.46	<.0001	<.0001
TEMPMAX	1	3024	12.50	12.50	0.0004	0.0004
SALMAX	1	3024	40.79	40.79	<.0001	<.0001

Type 3 Tests of Fixed Effects of Variables Retained in Non-zero Sub-model

Effect	Num DF	Den DF	F Value	Pr > F
YEAR	13	613	3.44	<.0001
AREA	3	613	5.88	0.0006
DEPTH	1	613	8.72	0.0033

Figure 39. Standardized abundance indices for blacknose sharks collected during bottom longline surveys from the Gulf of Mexico and Atlantic combined. Type 3 analyses results for those variables retained in sub-models.



Survey Year	Frequency	N	Index	Scaled Index	CV	LCL	UCL
1995	0.16535	127	0.25813	1.85454	0.25711	1.1181	3.07604
1996	0.09929	141	0.13525	0.9717	0.33861	0.50276	1.87801
1997	0.09829	234	0.20402	1.46577	0.26883	0.86421	2.48605
1998		0					
1999	0.072	250	0.06429	0.46191	0.27042	0.27152	0.7858
2000	0.11437	341	0.15083	1.08365	0.18204	0.75519	1.55497
2001	0.1087	276	0.14182	1.0189	0.24836	0.62463	1.66202
2002	0.10617	405	0.11112	0.79831	0.22223	0.5146	1.23844
2003	0.10714	280	0.13632	0.97937	0.24629	0.60278	1.59123
2004	0.09689	288	0.10677	0.76709	0.25598	0.46347	1.2696
2005	0.05405	74	0.04851	0.34851	0.593	0.11625	1.04474
2006	0.0663	181	0.0621	0.44615	0.36378	0.22043	0.90302
2007	0.07519	133	0.13501	0.96994	0.38803	0.45862	2.05134
2008	0.1223	139	0.11682	0.83927	0.31767	0.45142	1.56034
2009	0.20853	211	0.27767	1.9949	0.21121	1.3136	3.02956

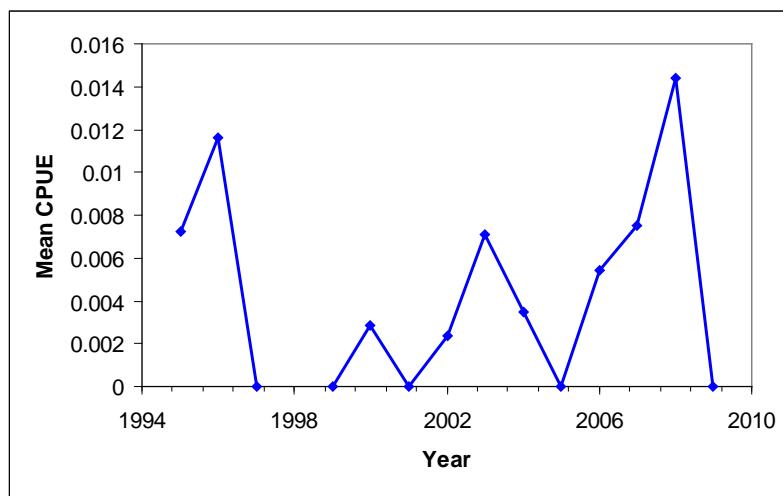
Type 3 Tests of Fixed Effects of Variables Retained in Binomial Sub-model

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
YEAR	13	3027	37.21	2.86	0.0004	0.0004
HOOK TYPE	1	3027	3.97	3.97	0.0463	0.0464
DEPTH	1	3027	17.33	17.33	<.0001	<.0001
TEMPMAX	1	3027	14.54	14.54	0.0001	0.0001
SALMAX	1	3027	9.09	9.09	0.0026	0.0026

Type 3 Tests of Fixed Effects of Variables Retained in Non-zero Sub-model

Effect	Num DF	Den DF	F Value	Pr > F
YEAR	13	319	2.81	0.0008

Figure 40. Standardized abundance indices for sandbar shark collected during bottom longline surveys from the Gulf of Mexico and Atlantic combined. Type 3 analyses results for those variables retained in sub-models.



YEAR	Frequency	N	Index	Standard Error	CV
1995	0.007874	127	0.007268	0.007268	1
1996	0.014184	141	0.011592	0.008307	0.7166
1997	0	234	0	0	
1998		0			
1999	0	250	0	0	
2000	0.002933	341	0.002838	0.002838	1
2001	0	276	0	0	
2002	0.002469	405	0.002352	0.002352	1
2003	0.007143	280	0.007088	0.005005	0.70606
2004	0.00346	288	0.003472	0.003472	1
2005	0	74	0	0	
2006	0.005525	181	0.005434	0.005434	1
2007	0.007519	133	0.007519	0.007519	1
2008	0.014388	139	0.014388	0.010137	0.70454
2009	0	211	0	0	

Figure 41. Annual mean CPUE for dusky shark collected during bottom longline surveys from the Gulf of Mexico and Atlantic combined.

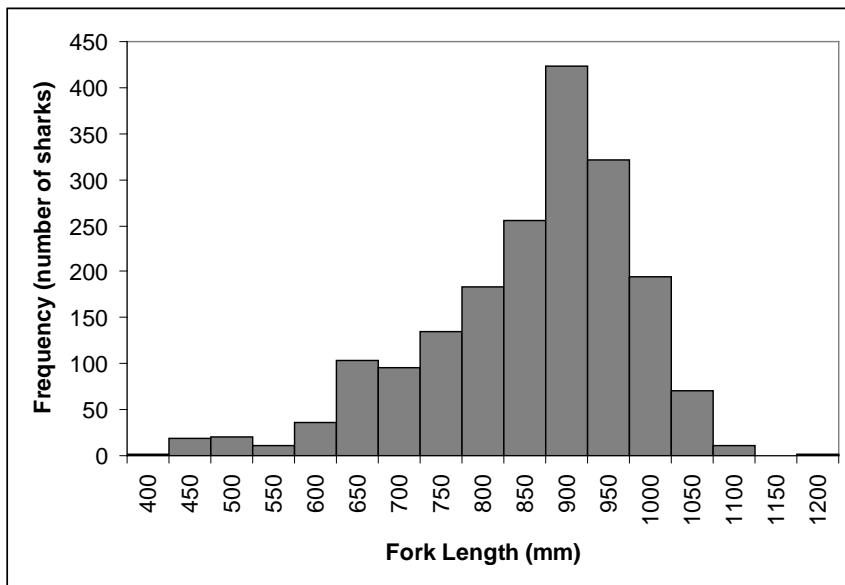


Figure 42. Length frequency histograms of blacknose shark fork lengths collected during bottom longline surveys ($N = 1885$) for all areas combined.

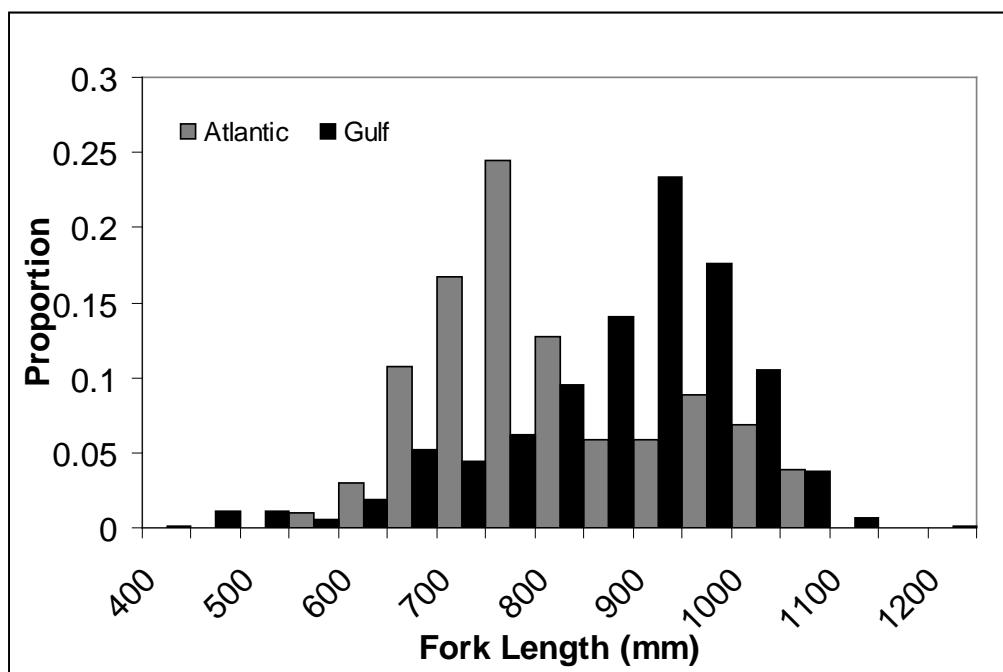


Figure 43. Length frequency histograms of blacknose shark fork lengths collected during bottom longline surveys in the Atlantic ($N = 102$) and the Gulf of Mexico ($N = 1783$).

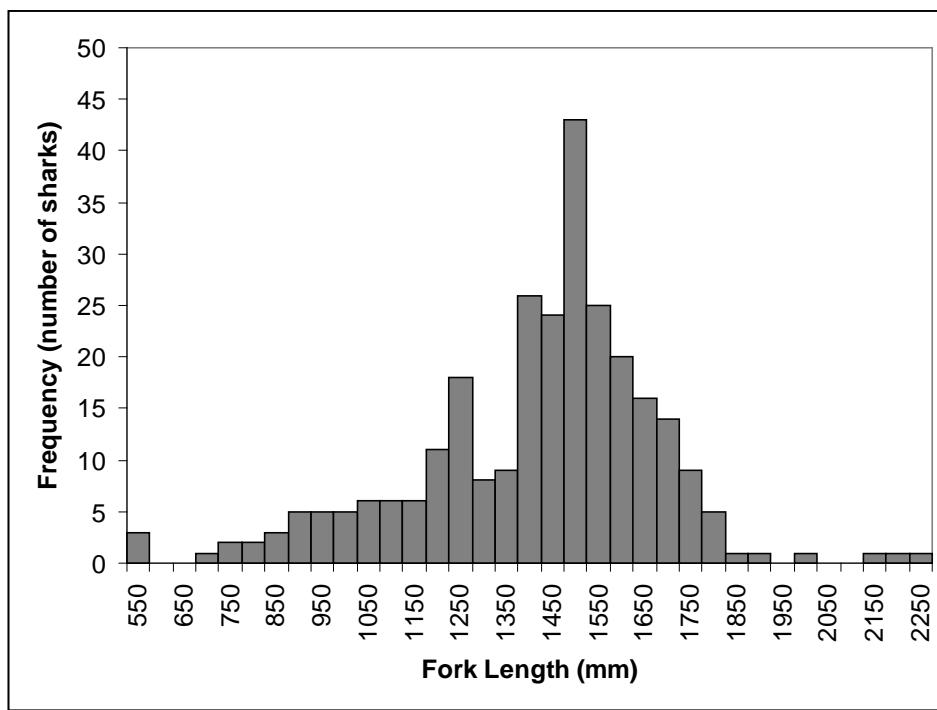


Figure 44. Length frequency histograms of sandbar shark fork lengths collected during bottom longline surveys ($N = 278$) for all areas combined.

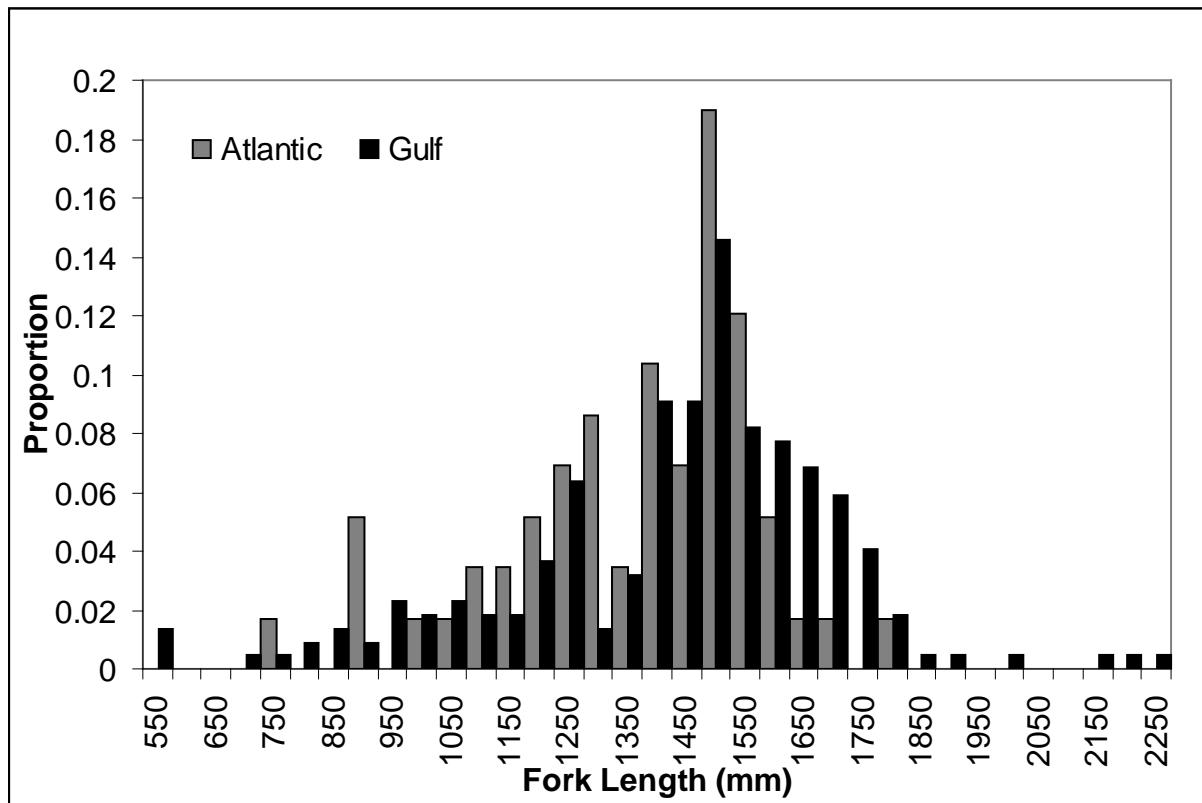


Figure 45. Length frequency histograms of sandbar shark fork lengths collected during bottom longline surveys in the Atlantic ($N = 58$) and the Gulf of Mexico ($N = 220$).

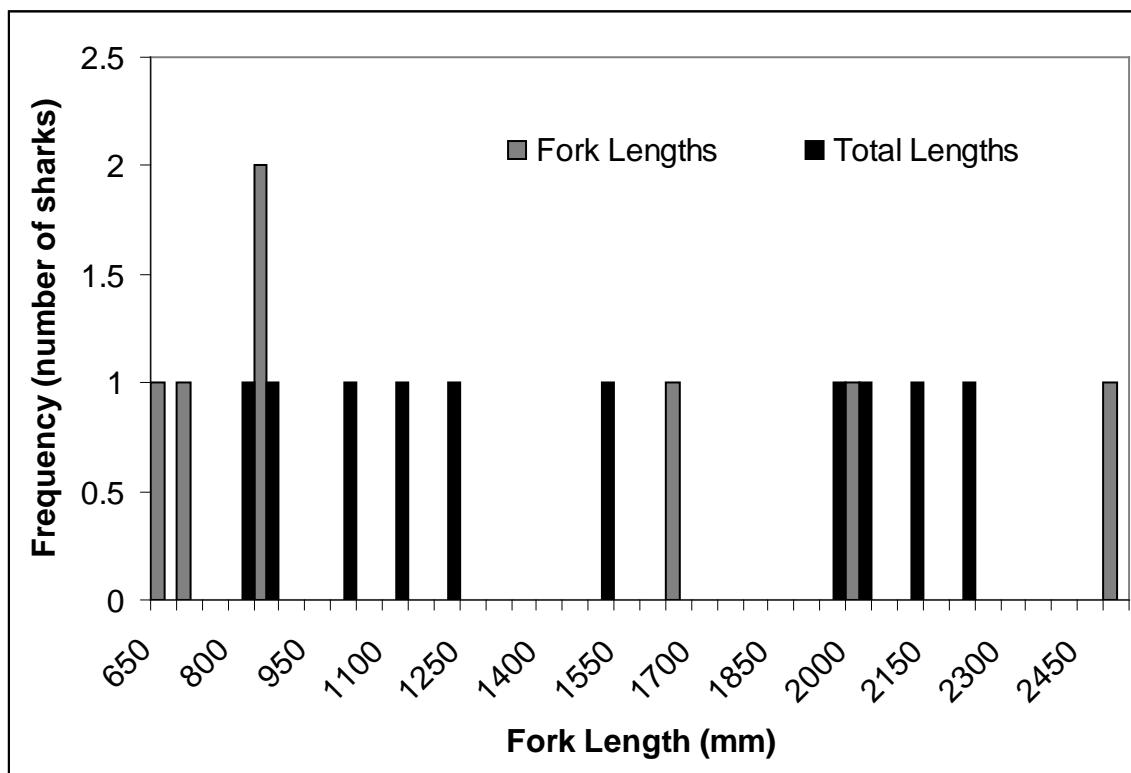


Figure 46. Length frequency histograms of dusky shark fork lengths ($N = 7$) and total lengths ($N = 10$) collected during bottom longline surveys for all areas combined.