LARGE PELAGIC LOGBOOK CATCH RATES FOR SHARKS

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SUMMARY

Indices of abundance from 1986 through 1997 for large coastal and pelagic sharks in the combined areas (Atlantic, Caribbean and Gulf of Mexico) were developed using mandatory reports from longline and bottom longline vessels.

RÉSUMÉ

Des indices de l'abondance des grands requins pélagiques et côtiers dans des zones combinées (Atlantique, mer des Caraïbes et golfe du Mexique) ont été élaborés, pour les années 1986 à 1997, d'après les rapport obligatoires des bateaux de palangre et de pêche de fond.

RESUMEN

Se calcularon índices de abundancia, de 1986 a finales de 1997, para grandes tiburones pelágicos y costeros en zonas combinadas (Atlántico, Caribe y Golfo de México), basados en informes procedentes de barcos de palangre y de palangre profundo

Introduction

Description of data sources used

Large pelagic logbook (LPL):

U.S. Atlantic, Caribbean and Gulf of Mexico fishing vessels which land swordfish have been required to provide daily records of effort and catch since October, 1986. Large coastal and pelagic sharks are caught as bycatch and less frequently as targeted catch by these vessels. Although a variety of gear types are represented, the predominant gear type (over 90% of vessels reporting) is longline gear. Gear type was limited longline or bottom longline by selecting records reporting at least 100 hooks per set. Twelve years of data (1986 to 1997) were available.

Shark categories available for the full time span in the LPL included hammerhead, tiger, white, blue, mako, thresher, and unclassified. A high proportion of the catch of sharks was reported as unclassified. For

these analyzes unclassified sharks are were added to the category large coastals. Due to very low catch rates porbeagle and white shark were dropped as a categories. In 1992 and 1994, the logbook was expanded to include more species of sharks. Data for the following species were analyzed over the last seven years (1992 to 1997): dusky, blacktip, night, silky, sandbar, oceanic whitetip, and porbeagle. Sandbar sharks were analyzed for the last four years (1994 to 1997). In all cases sharks caught equal the sum of sharks reported kept, discarded dead and discarded alive.

Shark Logbook:

For the past five years, (1993-1997), commercial vessels which fish for and sell species in the shark management unit have been required to submit logbooks for all fishing activity where sharks were caught and sold. 189 records of longline or bottom longline sets which targeted swordfish, tuna, or sharks were combined with the data from the large pelagic logbook for these analyses.

Methods

A delta-lognormal approach was also used to estimate indices of abundance from LPL. Standardized indices of abundance were estimated using general linear models (GLM). Log-transformed daily catch rates reported in the logbook data set were modeled as a function of categorical and continuous variables, and in which a constant (a value of 1) was added to each observation to allow log-transformation of the zero catch rates and inclusion of these data into the modeling .

Using the large data set from the LPL we also applied the delta-lognormal approach described by Lo *et al* (1992) in which the log-transformed positive catch rates (without any constant added) and the proportion of observations (days fishing) for which there was a positive catch were modeled separately to produce an index
as:

$$\hat{I} = \ddot{O} \cdot [\emptyset_C e^{\hat{a}_C}][\emptyset_S e^{\hat{a}_S} - 1],$$

where Î represents the estimated annual index value, †, the annual standardized positive catch rate, and Ö the annual standardized proportion of days fished for which there was success in catching sharks. Following Lo *et al* (1992), a value of 1 was added to the observed S values to permit inclusion of 0 values in modelling the log-transformed observations. In the above equation, $\hat{a}_C$ and $\hat{a}_S$, represent the log-scale, standardized GLM estimates of marginal mean (LSMEAN) CPUE and proportion of days fished on which bluefin were caught, and $\emptyset_C$ and $\emptyset_S$, the log-transformation bias adjustments for $\hat{a}_C$ and $\hat{a}_S$, respectively. Variance in Î was estimated via the delta method (Seber 1982). The appropriate equations for estimating this variance and calculating the log-transformation bias adjustment terms are provided in Lo *et.al.* (1992) and are not repeated herein. The log-transform bias adjustment was applied to both the Delta-lognormal and added constant transform methods.

Model variables included year (1986 to 1997), area (Caribbean, Gulf of Mexico, Florida East Coast, South Atlantic Bight, Mid-Atlantic Bight, Northeast Coastal, Northeast Distant, and Offshore South), quarter, gear type (longline or bottom longline),target (swordfish, tuna, shark, or other), light sticks (presence or absence), tuna catch rate, and swordfish catch rate.

Results

The indices of abundance and 80% confidence intervals for pelagic (Table 1, Figure 1) and coastal (Table 2, Figure 2) sharks are similar to those reported in earlier reports (Cramer, 1996). With the exception of the oceanic whitetip index which began in 1992, pelagic shark standardized catch rates decreased in the early years of the series but have remained relatively stabile since 1993. Standardized catch rates of Large coastal and hammerhead sharks decreased across the time series, from 1986 to 1997. Tiger shark catch rate trends were more variable. However, standardized catch rates for tiger sharks were consistently lower from 1992 through 1997 than in earlier years. Time series for blacktip, dusky, night, and silky sharks start in 1992. The sandbar shark time series starts in 1994. These series tend to be relatively flat and exist in a time when the longer time series are less dynamic.

References Cited

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Table 1: Pelagic Shark CPUEs and 80% confidence intervals

	index	cv_i	80% CI upper	lower
			pelagic	
1986	12.3480	0.2285	16.4073	9.2930
1987	8.0534	0.1005	9.1371	7.0982
1988	5.7403	0.1098	6.5891	5.0008
1989	4.9461	0.1013	5.6176	4.3548
1990	5.5825	0.0996	6.3266	4.9259
1991	5.7430	0.0994	6.5074	5.0684
1992	3.8707	0.0683	4.2181	3.5519
1993	3.5614	0.0725	3.9013	3.2511
1994	3.2002	0.0724	3.5054	2.9216
1995	3.0659	0.0687	3.3427	2.8120
1996	3.6553	0.0700	3.9918	3.3472
1997	3.9337	0.0664	4.2766	3.6183
		blue		
1986	8.6888	0.2425	11.7422	6.4293
1987	4.5761	0.1362	5.4284	3.8576
1988	3.3653	0.1426	4.0239	2.8144
1989	2.2518	0.1537	2.7300	1.8573
1990	2.9807	0.1318	3.5165	2.5266
1991	2.9118	0.1341	3.4450	2.4611
1992	1.9599	0.1077	2.2438	1.7119
1993	1.9327	0.1132	2.2279	1.6766
1994	1.8320	0.1079	2.0980	1.5998
1995	1.7009	0.1054	1.9419	1.4899
1996	2.1237	0.1026	2.4159	1.8669
1997	2.2074	0.1030	2.5124	1.9393
	oceanic white tip			
1992	0.0822	0.1987	0.1053	0.0641
1993	0.0794	0.1789	0.0992	0.0635
1994	0.0768	0.1623	0.0941	0.0627
1995	0.0612	0.1480	0.0736	0.0508
1996	0.0817	0.1599	0.0998	0.0669
1997	0.0945	0.1597	0.1154	0.0773

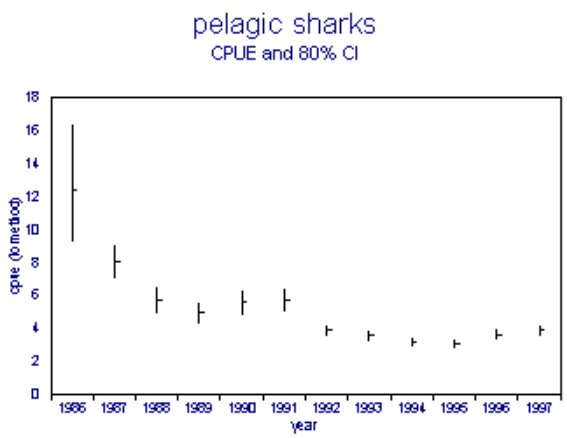
	index	cv_i	80% CI upper	lower
			mako	
1986	1.3853	0.1802	1.7351	1.1060
1987	0.8172	0.1503	0.9865	0.6769
1988	0.5961	0.1775	0.7442	0.4775
1989	0.6999	0.1496	0.8441	0.5803
1990	0.5026	0.1946	0.6407	0.3942
1991	0.5246	0.1741	0.6522	0.4220
1992	0.4931	0.1074	0.5643	0.4308
1993	0.3605	0.1347	0.4268	0.3045
1994	0.3567	0.1274	0.4186	0.3040
1995	0.3629	0.1196	0.4217	0.3123
1996	0.3243	0.1419	0.3874	0.2714
1997	0.3699	0.1221	0.4312	0.3173
		thresher		
1986	0.2843	0.5853	0.5633	0.1435
1987	0.4296	0.2474	0.5840	0.3160
1988	0.3832	0.2872	0.5464	0.2688
1989	0.4143	0.2364	0.5557	0.3088
1990	0.3893	0.2431	0.5265	0.2878
1991	0.3248	0.2701	0.4538	0.2325
1992	0.3476	0.1642	0.4269	0.2830
1993	0.2104	0.2267	0.2790	0.1587
1994	0.1355	0.3126	0.1991	0.0922
1995	0.1504	0.2684	0.2097	0.1079
1996	0.1741	0.2515	0.2379	0.1274
1997	0.1846	0.2351	0.2473	0.1379

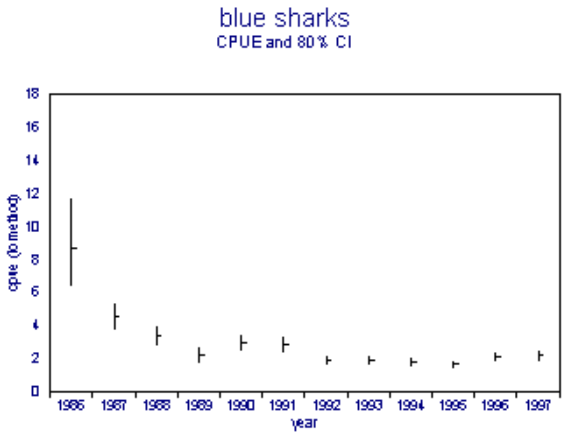
Table 2: Coastal shark CPUEs and 80% confidence intervals.

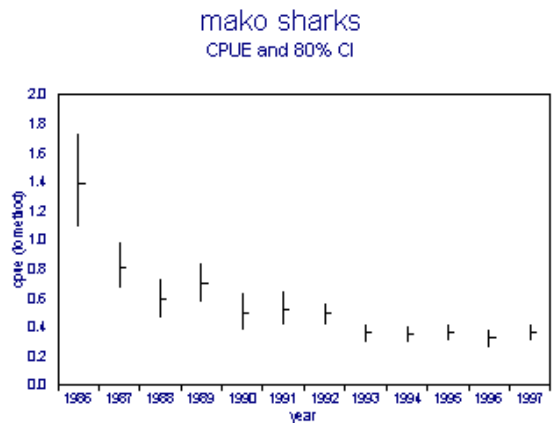
	index	80% CI cv_i	upper	lower
		coastals		
1986	13.2543	0.2233	17.5000	10.0386
1987	8.5057	0.1167	9.8484	7.3461
1988	10.6460	0.1063	12.1666	9.3154
1989	8.5702	0.1011	9.7312	7.5477
1990	10.6772	0.0909	11.9705	9.5236
1991	8.0300	0.1031	9.1413	7.0538
1992	7.9639	0.0603	8.5924	7.3814
1993	7.1437	0.0630	7.7336	6.5988
1994	4.4644	0.0667	4.8554	4.1049
1995	3.6962	0.0739	4.0562	3.3681
1996	3.3833	0.0860	3.7696	3.0366
1997	3.0001	0.0886	3.3536	2.6839
		hammerhead		
1986	2.6338	0.2884	3.7604	1.8447
1987	1.4816	0.2083	1.9210	1.1428
1988	2.2639	0.1603	2.7670	1.8522
1989	1.6209	0.1660	1.9952	1.3168
1990	1.6755	0.1663	2.0632	1.3606
1991	1.0043	0.2259	1.3302	0.7582
1992	1.1943	0.1108	1.3726	1.0391
1993	0.8243	0.1357	0.9772	0.6953
1994	0.6807	0.1353	0.8066	0.5744
1995	0.4949	0.1705	0.6125	0.3998
1996	0.5099	0.1886	0.6453	0.4029
1997	0.3506	0.2272	0.4651	0.2643
		tiger		
1986	0.5818	0.3047	0.8468	0.3997
1987	0.3462	0.2688	0.4829	0.2482
1988	0.3265	0.2859	0.4648	0.2293
1989	0.3884	0.2376	0.5218	0.2891
1990	0.5174	0.1761	0.6449	0.4152
1991	0.4294	0.1900	0.5443	0.3387
1992	0.1925	0.2080	0.2494	0.1485
1993	0.2274	0.1775	0.2839	0.1821
1994	0.2339	0.1614	0.2863	0.1911
1995	0.2266	0.1762	0.2824	0.1818
1996	0.1894	0.2172	0.2482	0.1445
1997	0.1872	0.2064	0.2422	0.1448
		dusky		
1992	1.0967	0.1973	1.4030	0.8573
1993	1.1960	0.1168	1.3850	1.0328
1994	0.7342	0.1205	0.8541	0.6311
1995	0.7076	0.1311	0.8341	0.6003
1996	0.6176	0.1596	0.7542	0.5057
1997	0.5382	0.1772	0.6717	0.4313
		blacktip		
1992	1.6371	0.2508	2.2348	1.1993
1993	2.0080	0.1309	2.3664	1.7039
1994	1.4561	0.1396	1.7346	1.2223
1995	1.1081	0.1654	1.3629	0.9009
1996	1.1183	0.1783	1.3975	0.8948
1997	0.9102	0.2013	1.1701	0.7081

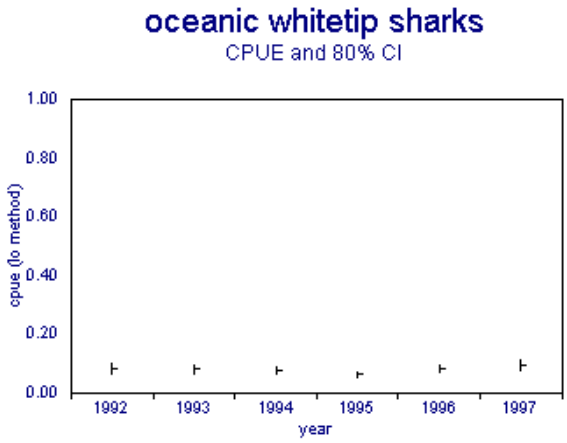
	index	80% CI cv_i	upper	lower
		night		
1992	0.0997	0.3644	0.1556	0.0639
1993	0.1086	0.3455	0.1658	0.0712
1994	0.0608	0.4338	0.1025	0.0360
1995	0.0901	0.2957	0.1298	0.0626
1996	0.0553	0.4553	0.0955	0.0320
1997	0.0863	0.2666	0.1200	0.0620
		silky		
1992	0.3267	0.3589	0.5065	0.2107
1993	0.1999	0.4455	0.3418	0.1170
1994	0.2089	0.4341	0.3526	0.1238
1995	0.2790	0.3208	0.4138	0.1880
1996	0.1807	0.4925	0.3251	0.1005
1997	0.0908	0.8309	0.2262	0.0364
		sandbar		
1994	0.9324	0.2405	1.2572	0.6916
1995	2.5729	0.1671	3.1712	2.0874
1996	2.7664	0.1705	3.4239	2.2351
1997	2.2912	0.1720	2.8410	1.8478

Figure 1: Pelagic Shark CPUEs and 80% confidence intervals.









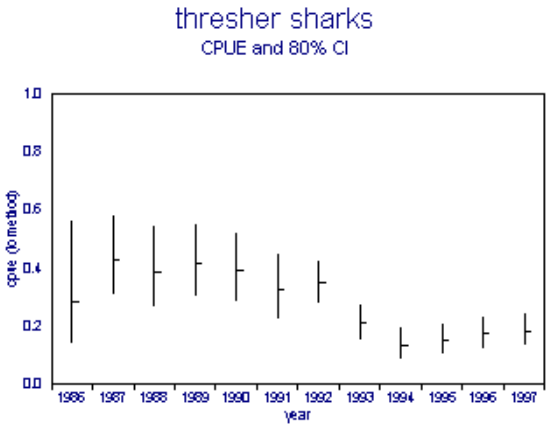


Figure 2: Coastal shark CPUEs and 80% confidence intervals.