

REVISION OF U.S. SHARK DEAD DISCARD ESTIMATES FOR THE PELAGIC LONGLINE FISHERY 1987-2000

Guillermo A. Diaz¹

SUMMARY

A U.S. revision of shark dead discards reported during 1987-2000 was conducted. During that period, three different statistical approaches were used to estimate dead discards. For the period 1987-1995, dead discards of unclassified sharks were reported as 'coastal' shark dead discards. From 1996-2000, dead discards reported as 'Coastal' and Pelagic' sharks corresponded to species with low representation in the data and they were re-estimated to the species level using the latest methodology used by the U.S. to estimate dead and live discards of a variety of species.

RÉSUMÉ

Une révision des rejets morts de requins des États-Unis déclarés en 1987-2000 a été réalisée. Au cours de cette période, trois approches statistiques différentes ont été employées pour estimer les rejets morts. Pour la période 1987-1995, les rejets morts de requins non classés ont été déclarés en tant que rejets morts de requins « côtiers ». De 1996 à 2000, les rejets morts déclarés en tant que requins « côtiers » et « pélagiques » correspondaient aux espèces ayant une faible représentation dans les données et ont été réestimés au niveau des espèces en utilisant la méthodologie la plus récente utilisée par les États-Unis afin d'estimer les rejets morts et vivants de plusieurs espèces.

RESUMEN

En Estados Unidos se llevó a cabo una revisión de los descartes de tiburones muertos comunicados entre 1987 y 2000. Durante dicho período, se utilizaron tres enfoques estadísticos diferentes para estimar los descartes de ejemplares muertos. Para el periodo 1987-1995, los descartes de ejemplares muertos de tiburones no clasificados se declararon como descartes muertos de tiburones "costeros". Entre 1996 y 2000, los descartes muertos declarados como tiburones "costeros" y "pelágicos" correspondían a especies con escasa representación en los datos, y fueron reestimados a nivel de especie utilizando la metodología más reciente utilizada por Estados Unidos para estimar los descartes de ejemplares muertos y vivos de diversas especies.

KEYWORDS

Pelagic longline, dead discards, sharks

¹ U.S. NOAA Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Dr. Miami, FL 33149. guillermo.diaz@noaa.gov

Introduction

During the period 1987-2000, the U.S. submitted to ICCAT estimates of dead discards for a variety of shark species by-caught by the U.S. pelagic longline fishery. Some of those dead discards were not estimated at the species level and were reported as the shark species complexes 'Pelagic' sharks and 'Coastal' sharks. In an effort to re-estimate shark dead discards to the species level, the U.S. conducted a revision of the reported shark dead discards for 1987-2000. This revision had the goal of:

- 1) identifying the statistical approaches used to estimate shark dead discards for years 1987-2000.
- 2) identifying the years where shark dead discards were reported as 'coastal' and 'pelagic' sharks.
- 3) where possible apply an appropriate statistical method to estimate species-specific dead discards.

Materials and Methods

With the assistance of the ICCAT Secretariat, a revision of the U.S. longline shark dead discards was conducted to identify those years where some shark dead discards were reported as part of the species complexes 'Pelagic' and 'Coastal' sharks. Once the data that needed correction was identified, a review of SCRS documents was conducted to identify the methodology(ies) used to estimate the dead discards. While no attempt was made to reproduce the reported dead discards that needed correction, a careful review of the available literature was conducted to ensure that the statistics reported in the mentioned documents coincided with the dead discards in the ICCAT-DB. This last step was necessary to identify the methodology(ies) used to estimate dead discards. Once the data that needed correction and the methodology used to estimate them were identified, it was assessed if the reported 'Pelagic' and 'Coastal' shark dead discards could be re-estimated to the species level given the available data. For those cases where re-estimating the dead discards was feasible, such re-estimation was conducted using the methodology developed by Brown (2001) which is the current methodology used by the U.S. to estimate all dead and live discards for a variety of species.

Results

The literature review identified 3 specific SCRS documents that provided information regarding the methodology used to estimate dead discards for the period 1987-2000 and the amounts reported to ICCAT (Cramer 1997, 1998; Cramer et. al 2000).

Years 1987-1991:

Cramer (1997) provided a summary of shark dead discard estimates submitted to ICCAT for 1987-1995. Dead discard estimates for 1987-1991 were obtained by multiplying the number of dead discards reported by the pelagic longline vessels through the mandatory logbooks by the average weight (1987-1991) of landed sharks. Cramer (1997) indicated that dead discard estimates of unclassified sharks for 1987-1991 were all included in the 'Coastal' shark category. A close examination of the summary of dead discard estimates submitted to ICCAT up to 1991 as reported by Cramer (1997) and Cramer et al. (2000) confirmed that the estimates of dead discards reported as 'Coastal' sharks were entirely comprised of unclassified sharks without including any other species.

Years 1992-1995:

For the period 1992-1995 a different methodology was applied. Nominal shark catch rates were estimated using scientific observer records which were then multiplied by the total fishing effort (in number of hooks) reported through the logbooks (Cramer, 1997) to obtain the total number of dead discards. The number of dead discards were transformed into weight by using length-weight relationship and lengths taken by the scientific observers. The use of scientific observer information starting in year 1992 resulted in increased reporting of species-specific dead discard estimates and a decrease in the amount of unidentified shark dead discards. However, the dead discard estimates of unidentified sharks were still reported as 'Coastal' sharks.

Years 1996-2000:

Dead discards after 1995 were estimated using a General Linear Model (GLM) approach described by Cramer (1998). In this latter approach, shark species with limited representation were grouped into two categories: 1) Pelagic sharks (longfin mako, shortfin mako, oceanic whitetip, porbeagle, and identified pelagic sharks) and 2) Coastal sharks (bignose, blacktip, night, sandbar, tiger, white, spinner, and unidentified coastal sharks). Therefore, no species-specific dead discards were estimated for the species that were included in the pelagic and coastal shark groups. This resulted in an increase in the estimated 'Coastal' shark dead discards compared to the previous period

of 1992-1995, and the first reports of dead discards for the 'Pelagic' shark complex (**Figure 1**). The only available option to obtain dead discard estimates for the species included in these two complexes was to re-estimate the discards applying the Brown (2001) estimation methodology. One of the improvements of Brown's (2001) estimation approach is that for those strata with low number of observations, the methodology pools data across strata to increase the sample sizes. As a result, the methodology does not require to group data from several species to increase sample size like the Cramer's method.

The annual amount of shark dead discards reported as the species complex 'Coastal' sharks for 1987-1991 ranged from 146 t to 251 t. These estimates greatly decreased from 1992 through 1995 (ranging from 1 t to 5 t) and then increased again for 1996-2000, ranging from 3 t to 39 t.

Because the reported dead discards of 'Coastal' sharks for the periods 1987-1991 and 1992-1995 were solely comprised of unidentified sharks, there was not direct way to re-estimate those dead discards to the species level. For the dead discards reported as part of the 'Coastal' and 'Pelagic' species complexes for the period 1996-2000, Cramer (1998) provided a list of the species that were included within each one of those species groups. Therefore, it was possible to re-estimate most of the 'pelagic' and 'coastal' shark dead discards to the species level using the methodology described by Brown (2001). **Table 1** shows the species-specific dead discards for 1996-2000 estimated using the methodology developed by Brown (2001). Note that the new estimates include species that do not meet the current definition of 'pelagic, oceanic, and highly migratory' species adopted by ICCAT and, therefore, are not currently considered ICCAT species. Non ICCAT shark species are not included in the revised shark dead discards that is being reported to ICCAT.

Figure 2 shows the total re-estimated shark dead discards ('new estimates'), the shark dead discards in the ICCAT-DB ('old estimates'), and the 'new estimates' excluding non ICCAT shark species. The newly estimated total annual shark dead discards resulted in larger estimates than the previous estimates except for 1996. The large difference in total dead discards in 1996 is mostly due to the estimates of BSH dead discards. The old estimate for 1996 was 608 t while for the rest of the years in the time series (1997-2000) it ranged from 97 t to 185 t. In the case of the new BSH discard estimates, they ranged from 42 t to 166 t (**Table 1**). **Figure 3** shows the graphical comparison of BSH dead discards between the old and new estimates. A comparison of some of the species-specific new and old dead discard estimates did not show any consistent patterns. While the old BSH dead discard estimates for the period 1996-2000 were higher compared to the new estimates, the opposite was true for silky shark; while for dusky sharks it was year dependent.

Discussion

The trends in the estimated dead discards reported as 'pelagic' and 'coastal' sharks (**Figure 1**) were the result of the different methodologies used. For the period 1987-1991, all estimated dead discards of 'unclassified' sharks were reported as 'coastal' sharks. These estimates were based on self-reported logbook reports that included significant numbers of discards reported as 'unclassified sharks' that ranged between 10% and 19% of the total estimated dead discards in numbers. During that period, the U.S. did not report any estimates of dead discards as part of the 'pelagic' shark complex (**Figure 1**). During the period 1992-1995, dead discard estimates were based on observations recorded by trained scientific observers as part of the U.S. Pelagic Observer Program. Therefore, the proportion of unidentified sharks that were discarded dead and reported as 'coastal' sharks was small and ranged between 0.9 t and 4.7 t (**Figure 1**). It is recommended that the U.S. shark dead discards reported for 1987-1995 as 'coastal' sharks be changed to 'unclassified' sharks. There is no direct way to produce species-specific dead discard estimates for these 'unclassified' sharks. However, some statistical approaches using catch ratios from observer-collected data could be explored as an alternative technique to produce species-specific estimates.

The change in methodology to estimate dead discards after 1995 (Cramer 1998) resulted in an increase of dead discards reported as 'coastal' sharks and in the first estimates of 'pelagic' shark dead discards. This increase was not the result of an increase in the number of discards of 'unidentified' sharks, but from grouping sharks into these 2 categories for those species that had low representation in the data. **Figure 1** clearly shows the impact of the 3 different methodological approaches used in the reporting of 'pelagic' and 'coastal' shark dead discards.

The methodology applied to estimate species-specific shark dead discards for 1996-2000 (Brown 2001) has been reviewed by the SCRS. This statistical methodology is currently used to estimate U.S. dead and live discards for a variety of species and it is considered to be more scientifically sound than the methods previously reported by Cramer (1997, 1998).

References

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Table 1. U.S. pelagic longline fleet shark dead discards (whole weight in tons) for the period 1996-2000 estimated with the methodology developed by Brown (2001). Species codes with an asterisk (*) identify species that do not meet the current definition of 'oceanic, pelagic, and highly migratory' species adopted by ICCAT and, therefore, are not part of the list of ICCAT species any longer.

Code	Scientific name	Common name	1996	1997	1998	1999	2000
ALV	<i>Alopias vulpinus</i>	Common thresher					7.6
BSH	<i>Prionace glauca</i>	Blue shark	43.5	165.9	93.6	41.8	112.7
BTH	<i>Alopias superciliosus</i>	Bigeye thresher	119.9	70.7	13.7	32.9	28.8
	<i>Carcharhinus</i>						
DUS	<i>obscurus</i>	Dusky	35.6	18.0	144.9	3.0	56.6
	<i>Carcharhinus</i>						
FAL	<i>falciformis</i>	Silky	49.8	65.3	52.1	131.9	88.9
LMA	<i>Isurus paucus</i>	Longfin mako	12.8	14.3	5.7	7.3	30.0
MAK	<i>Isurus spp.</i>	Mako shark				0.4	0.6
	<i>Carcharhinus</i>						
OCS	<i>longimanus</i>	Oceanic whitetip	2.1	3.3	1.8	3.3	0.2
SHX	<i>Squaliformes</i>	Unidentified shark	4.2	1.6	4.9	6.9	11.2
SMA	<i>Isurus oxyrinchus</i>	Shortfin mako	0.3	2.3		0.8	7.3
SPK	<i>Sphyrna mokarran</i>	Great hammerhead	12.3	2.7	1.5	5.4	8.8
SPL	<i>Sphyrna lewini</i>	Scalloped hammerhead	6.6	93.0	167.1	32.2	32.7
SPN	<i>Sphyrna spp.</i>	Unidentified hammerhe		0.9	7.3		0.5
SPZ	<i>Sphyrna zygaena</i>	Smooth hammerhead	1.7		0.5		
THR	<i>Alopias spp.</i>	Unidentified thresher	6.6	22.0	4.5	19.1	12.8
TIG	<i>Galeocerdo cuvier</i>	Tiger		15.1	7.7	8.3	8.3
CCA*	<i>Carcharinus altimus</i>	Bignose	1.2				0.2
CCE*	<i>Carcharhinus leucas</i>	Bull				13.4	
CCL*	<i>Carcharinus limbatus</i>	Blacktip	0.0		0.0	0.0	
	<i>Carcharhinus</i>						
CCP*	<i>plumbeus</i>	Sandbar	1.8	4.5	3.3	8.2	8.5
	<i>Carcharhinus</i>						
CCS*	<i>signatus</i>	Night	5.7	47.0	32.8	22.0	122.6
	<i>Rhizoprionodon</i>						
SAS*	<i>terraenoave</i>	Atlantic sharpnose	0.4				

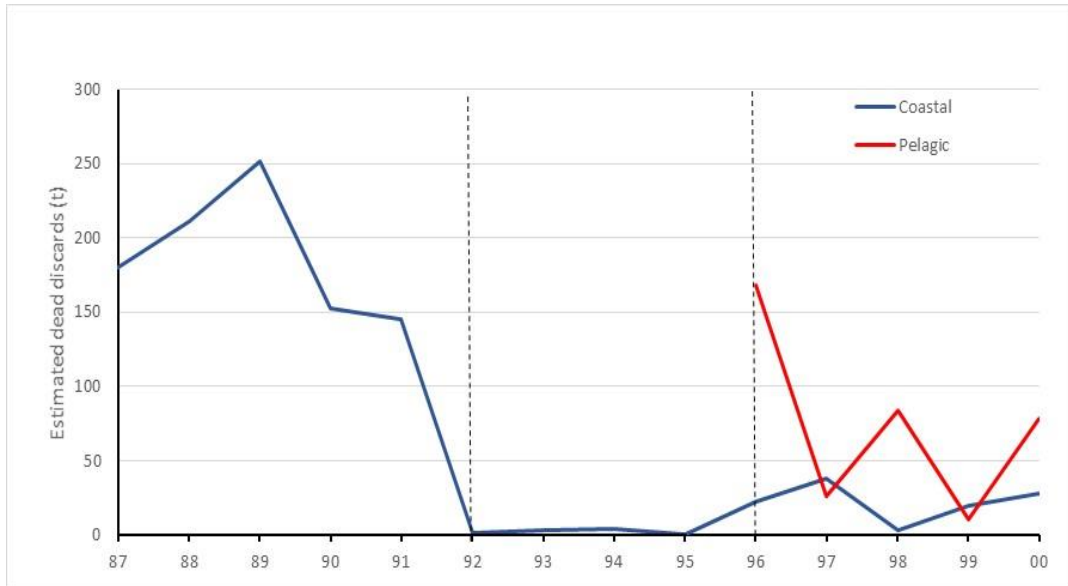


Figure 1. U.S. reported pelagic longline ‘coastal’ and pelagic’ shark dead discard estimates. The vertical dashed lines show the years for which each of the 3 estimation procedures explained in the text were used.

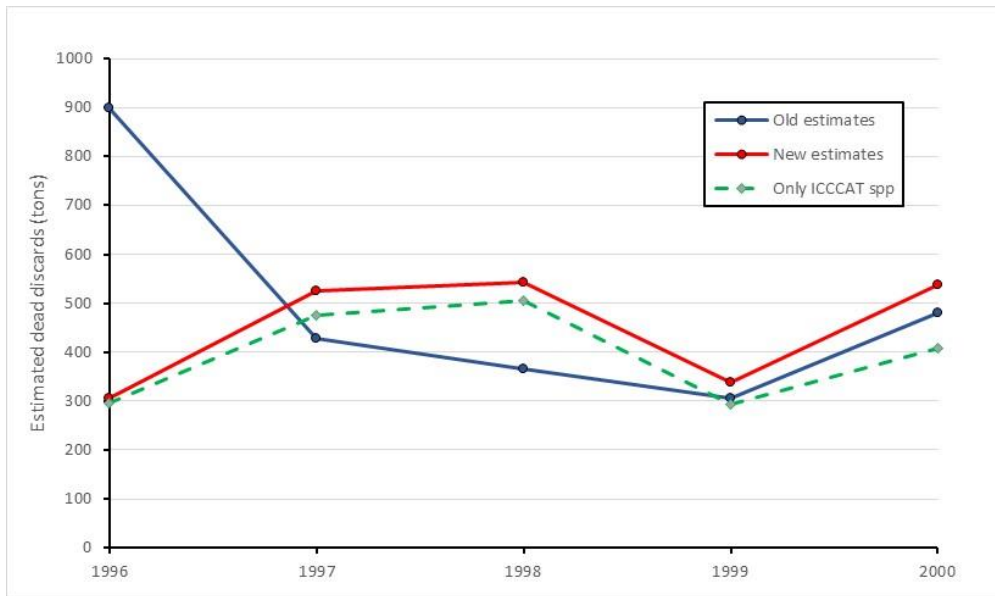


Figure 2. Total estimated shark dead discards previously reported by the U.S. (‘old estimates’) and revised total dead discard estimates obtained using the methodology developed by Brown (2001) (‘new estimates’). Dashed green line shows ‘new estimates’ excluding shark species that are not considered ICCAT species (See **Table 1** and text for an explanation).

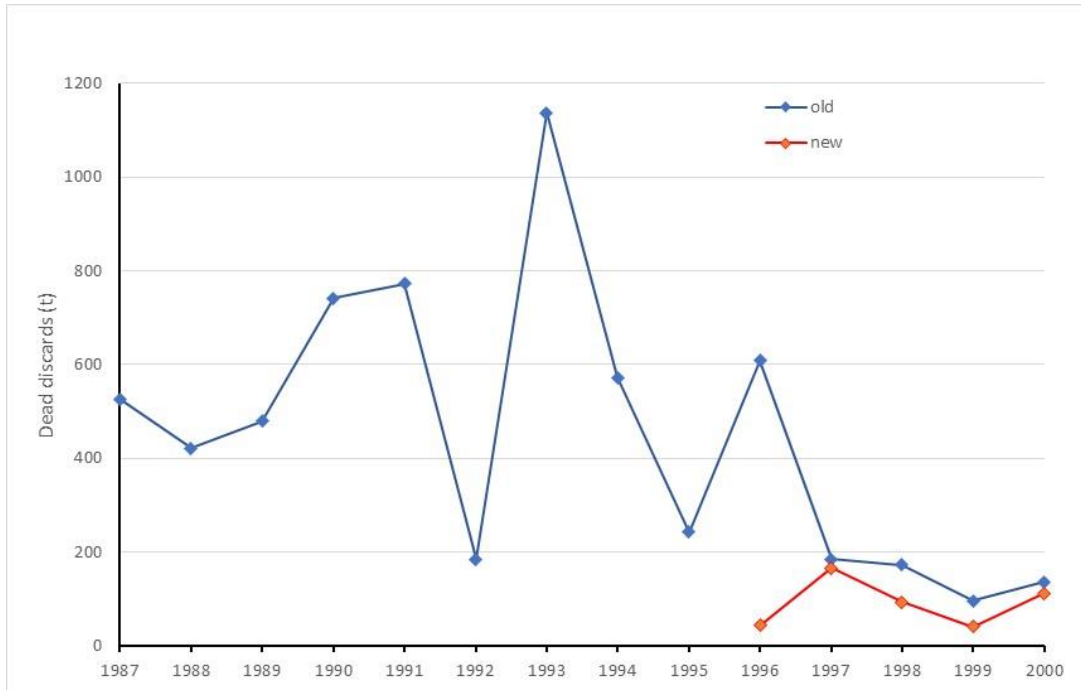


Figure 3. Total estimated blue shark dead discards previously reported by the U.S. ('old estimates') and revised total blue shark dead discard estimates obtained using the methodology developed by Brown (2001) ('new estimates').