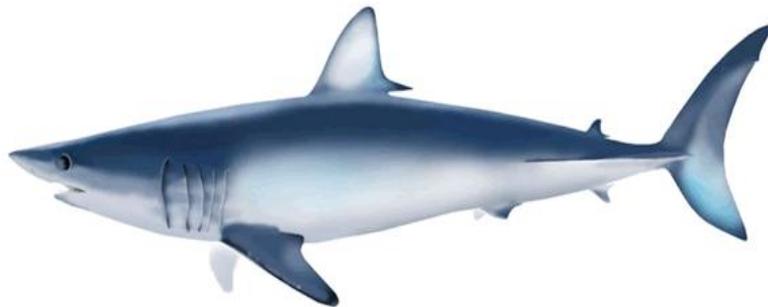


Catches of blue sharks from U.S. West Coast recreational fisheries during 1971-2011¹

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INTRODUCTION

Recreational fishing is popular in the USA, and effort is directed at many of the same species targeted in commercial fisheries. Various fishing modes contribute to both targeted and non-targeted catch of mako and blue sharks, but the predominant method used by recreational anglers is rod and reel fishing with trolling lures. Recreational fishing activity is monitored and regulated at the state-level, but surveys, data collection, and catch and effort estimation are also coordinated at the Federal-level. Surveys are conducted across many species, fishing modes, locations and times. This is an update to preliminary estimates of blue shark catches from recreational fisheries on the US West Coast provided in 2012 to the ISC Shark WG (Sippel and Kohin 2012) to provide a US recreational catch time series for the upcoming ISC North Pacific blue shark assessment.

MATERIALS AND METHODS

Catches

As in the previous document, catch estimates are derived from two sources: 1) the 'RecFIN' database (www.recfin.org) of marine recreational fishery survey data; and 2) Commercial Passenger Fishing Vessel "CPFV" logbooks (Hill & Schneider 1999).

The RecFIN database is managed by the Pacific States Marine Fisheries Commission (PSMFC) and contains an estimated catch time-series from 1981-2011 that is based on two separate scientific surveys. The Marine Recreational Fisheries Statistics Survey (MRFSS) is a national recreational fishery survey run by NOAA to provide fishing and socio-economic data for fishery management activities. It was initiated in 1979 and for the US West Coast, data collected through 2003 were considered the best available information on angler effort and catch in California, Oregon and Washington. The California Recreational Fisheries Survey (CRFS) began in January 2004 and implemented new sampling and estimation techniques that are considered to be more statistically robust and reliable than MRFSS. For the 2004 period forward, RecFIN also includes catch estimates from surveys in Oregon and Washington. The California Commercial Passenger Fishing Vessel database (CPFV) was developed by the California Department of Fish and Game to maintain vessel logbooks from commercially operated, or 'chartered' recreational fishing vessels within the state. RecFIN estimates prior to 1981 when the survey was just starting up are considered unreliable (PSMFC pers. comm.) and were thus excluded from these analyses. Three categories of records were extracted from RecFIN; observed catch (i.e. surveyor witnessed at the docks); reported kept catch (i.e. anglers reported during telephone surveys), reported released alive (i.e. anglers reported during telephone or dockside surveys). Estimates of total catch were derived using an algorithm based on estimates of total effort across all areas and fishery sectors to inflate the observed and reported catch data from the surveys. RecFIN estimates were not available from 1990-1992 because the MRFSS surveys were not conducted.

Current CPFV records (1980-present) include catch that is kept, discarded, and lost to pinnipeds (i.e. sea lions), but pinniped depredation is apparently rare for blue sharks as there were no records of blue shark catch lost to pinnipeds. Prior to 1980, CPFV records only include a single category for catches (no discard data) and are based on historical records which were collated as described by Hill and Schneider (1999).

RecFIN categorizes species-specific fishing catch and effort by different fishing sectors including private fishing vessels, shore-based fishing, and chartered vessels. Of the available fishing sectors in RecFIN, blue shark catch was included in private and chartered vessel records. However, catch estimates were taken from CPFV logbooks and only private vessel catch was used from RecFIN. This is because CPFV data are based on vessel logbooks, the submission of which has been mandatory since 1935 (Hill and Schneider 1999), but RecFIN data are estimated from surveys; the logbook data are considered to be more complete and reliable.

Data preparation

Missing RecFIN estimates (observed kept, reported kept, and reported released) from 1990-1992 were imputed as the averages from 1993-1996, and estimates from 1971-1980 were imputed as averages of 1981-1984. CPFV data were updated only through 2010 at the time of this writing, so 2010 values were carried forward to 2011.

RecFIN and CPFV both provide catches in numbers of animals, so the average length of blue sharks caught in the California drift gillnet (DGN) fishery, that operates in a time and area largely overlapping with the recreational fishery, was used to convert numbers to biomass using the SHARKWG agreed upon relationship:

$$Wt=4.2 \times 10^{-6} * PCL^{3.1635}$$

The average weight estimated from the DGN data combined across sexes (male, female and unknown sex) from 1990-2010 was 10.55 kg.

Total dead removals were estimated for the base case time series as the number of sharks kept or reported released dead, plus 6.3% of blue sharks reported released alive. The post-release mortality rate assumed is based on the study of Musyl et al. (2011) for longline caught blue sharks in the central North Pacific. For the recreational fishery, the majority of blue sharks are brought to the vessel alive, like in the longline fishery, and the survivorship is thus similarly believed to be high. For the CPFV fishery prior to 1980, all catch was assumed to be kept since discard information was not available. In addition to estimating total fishing mortality for the base case assessment models, high and low catch time series were estimated for sensitivity runs based on 100% and 0% mortality of all blue sharks released alive, respectively.

Results and Discussion

Total dead removals for the base case and high/low sensitivity alternatives are in Table 1.

Table 1. Estimated blue shark catches from US West Coast recreational fisheries 1971-2011.

Year	Total dead removals - Base (mt)	Total Dead Removals - Low (mt)	Total Dead Removals - High (mt)
1971	29.6	27.6	89.0
1972	29.5	27.6	89.0
1973	29.8	27.9	89.2
1974	30.3	28.4	89.7
1975	33.1	31.2	92.5
1976	30.5	28.6	89.9
1977	29.2	27.3	88.6
1978	32.9	31.0	92.3
1979	32.7	30.8	92.1
1980	29.0	27.1	88.4
1981	27.5	26.1	70.4
1982	15.1	12.1	106.8
1983	46.0	44.6	89.7
1984	96.3	92.8	206.1
1985	192.6	185.7	406.9
1986	43.0	33.8	325.2
1987	181.2	153.7	1027.1
1988	346.1	329.2	868.3
1989	99.1	74.7	848.9
1990	63.7	47.5	560.1
1991	96.6	80.5	593.0
1992	47.2	31.0	543.5
1993	47.5	37.5	353.7
1994	43.2	24.4	620.3
1995	49.7	25.4	799.4
1996	25.6	13.4	402.4
1997	61.4	47.0	504.5
1998	11.4	5.7	188.3
1999	19.8	7.5	399.9
2000	35.6	2.4	1054.6
2001	13.2	2.8	333.6
2002	5.4	0.8	147.1
2003	11.3	2.7	275.2
2004	4.1	2.8	41.4
2005	3.1	1.2	63.0
2006	3.6	1.6	64.3
2007	5.2	3.7	50.8
2008	2.7	1.0	57.1
2009	2.8	1.4	45.0
2010	2.5	1.7	28.0
2011	2.2	1.7	15.3

Current estimates of blue shark catch along the U.S. West Coast between 1971-2011 indicate much higher catches in the 1980s with generally declining catch levels from 1990-present. As noted in the original working paper, RecFIN data prior to 2004 are subject to greater uncertainty due to non-random sampling of angler catch and effort during surveys. A comprehensive redesign of sampling and estimation methods has led to more reliable estimates since 2004.

Targeting and retention of blue sharks by recreational as well as commercial fishers was encouraged during the second half of the 1980's in an attempt to establish a new market. Interest in targeting was brief, but did have a noticeable effect on recreational catch as seen in these estimates.

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