

HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM REPORT ON PROPOSED
THRESHER SHARK MANAGEMENT MEASURES FOR RECREATIONAL FISHING

REGULATORY CHANGES FOR 2009-2010
HMS FMP BIENNIAL MANAGEMENT MEASURES CYCLE

At the June 2008 meeting, the Council directed the Highly Migratory Species Management Team (HMSMT) to develop a suite of potential management measures to regulate the harvest of common thresher shark, *Alopias vulpinus*, by recreational anglers in California waters. The HMSMT met at the Southwest Fisheries Science Center in La Jolla, California on July 31-August 1, 2008, to begin work on this assignment. The Team decided to focus on two main goals under this task: (1) an initial short-term goal of gathering and assessing the available data in order to develop management options to limit the recent increase in recreational thresher shark catch and effort, with emphasis on protecting pregnant and pupping sharks in the springtime, and (2) a longer-term goal of identifying research, monitoring and assessment needs in regards to the stock status and efficacy of the current harvest guideline of 340 metric tons (mt) for common thresher shark. This longer term goal will be important for the future task of establishing annual catch limits (ACLs) and accountability measures (AMs) for this and other HMS Fishery Management Plan (FMP) shark species as mandated under the Magnuson-Stevens Fisheries Conservation and Management Reauthorization Act of 2006 (MSRA).

In regards to the initial short-term goal, the HMSMT recommends that the Council adopt a suite of management measures for public review to limit or reduce the harvest of thresher shark in the California recreational fishery. This recommendation is based in part on the HMS FMP's emphasis on using a precautionary management approach for HMS shark fisheries (e.g., adopting an optimal yield versus maximum yield harvest guideline), due to the low productivity and low resiliency of thresher sharks to exploitation. Sufficient information exists to indicate a dramatic increase in the recreational catch and directed effort for thresher sharks throughout Southern California; however, a lack of pertinent biological information (i.e., pupping times and locations) and limitations in recreational catch data (e.g., uncertain estimates for private access fleet and catch-and-release mortality) suggest that precautionary measures be taken to limit catch before harvest guidelines are exceeded. The HMSMT and the HMS Advisory Subpanel (HMSAS) are scheduled to meet jointly on Monday, September 8 to review the HMSMT's proposed suite of management options. The HMSMT may provide a Supplemental Report with additional recommendations, based on this discussion.

In regards to the longer term goal, the HMSMT acknowledged the lack of pertinent biological information and recommends that an updated thresher shark stock assessment be conducted as a high priority (the previous assessment was conducted in 2000 using data through 1999). An updated assessment would provide the foundation for determining whether the current harvest guideline is valid given the changes that have occurred in HMS fisheries for thresher shark since Council adoption of the original guideline. Additional management measures could be considered if an updated assessment indicates the need to further curtail the harvest of thresher shark in HMS and non-HMS fisheries.

The HMSMT further recommends that additional research and monitoring efforts be undertaken to gather sufficient data to more effectively manage the thresher shark resource in the future. These efforts should include, but are not limited to:

- Research on gear modifications to minimize or eliminate tail-hooking in the recreational fishery (e.g., potential switch from J-hooks to circle hooks in combination with teaser lures)
- Continued post-release survivorship studies to determine the appropriate mortality rates for catch-and-release fishing with current and/or modified gear
- Mandatory data reporting requirement for all west coast HMS shark fishing tournaments (this requirement is in effect for Atlantic HMS recreational fisheries; see pg. 11 for more details)
- Identification of the spatial/temporal extent of thresher shark pupping grounds and nursery areas
- Improved collection of recreational data, including catch-and-effort estimates from vessels departing from private access marinas and better estimates of the number and condition of sharks released
- Improved monitoring and data collection for the commercial shark hook and line fishery and for non-HMS fisheries such as bottom set net and small mesh drift gillnet
- An enhanced outreach and education component to engage anglers in adoption of best practice and ethical angling incentives and to involve them in data collection efforts such as angler-based conventional tagging programs.

Current Catch Estimates for Thresher Shark

Based on the available commercial and recreational fisheries data, the estimate of thresher shark catch for 2007 is approximately 308 mt. The annual average catch for thresher shark for the time period 2005-07 is approximately 258 mt. Both of these estimates are less than the established harvest guideline of 340 mt. It should be noted, however, that the lack of accurate catch data for some of the HMS fisheries in question creates a high level of uncertainty in that determination. The time period 2005-07 was selected based on the assumption that the California Recreational Fisheries Survey (CRFS) program, implemented in 2005, is more accurate than the old Marine Recreational Fisheries Statistical Survey (MRFSS) data. The commercial landings for this time period may be viewed as conservative in nature as HMS fishermen did not aggressively target thresher sharks in 2006 or 2007 given the low ex-vessel prices being offered (personal communication, Jeremiah O'Brien, President, Morro Bay Commercial Fishermen's Association).

Table 1. Catch Estimates (metric tons) for thresher shark harvested by HMS and non-HMS commercial and recreational fisheries for the period 2005-2007.

	Large mesh DGN (a)	Comm. Hook & Line (b)	Private Rec (c)	Charter Rec (c)	Non-HMS gears (d)	Total
2005	155	0.7	55	2.2	11.5	224.4
2006	99	3.4	95	2.4	41.6	241.4
2007	98	3.8	182	3.8	20.8	308.4
Total	352	7.9	332	8.4	73.9	774.2
Avg.	117.3	2.6	110.7	2.8	24.6	258.1

(a) PacFIN database query

(b) California Fisheries Information System (CFIS) fish landing ticket query.

(c) RecFIN database query, number of sharks converted to weight using average estimate of 85 kg per shark (n=37, from spring 2008 dockside weights reported on www.bloodydecks.com).

(d) CFIS logbook and fish ticket landings query for small mesh drift gillnet, bottom set net, trawl, and bottom longline (set line) gears. Numbers of sharks converted to weight using average estimate of 35 kg per shark (n=26, fork length estimates from NMFS observer data and L-W conversion chart).

HMS Shark Hook-and-Line Fishery - There were approximately 23 fishing vessels that commercially fished for thresher shark in 2007 utilizing hook-and-line gear. The primary fishing methods include trolling lures and whole baits, and working chum lines with chunk baits on rod and reel. The logbook records for this fishery are incomplete and may be confounded as the vessels are involved in mixed fishery operations (e.g., lobster, live fish market, albacore troll). Unlike the large mesh drift gillnet (DGN) fishery, there are no time/area closures in effect to regulate the harvest of pregnant and pupping thresher sharks by this fishery.

Table 2. Catch Estimates (metric tons) for thresher shark harvested by the California HMS hook-and-line fishery for the period 2005-2007 (CFIS fish landing ticket database).

	# boats SCB	# boats CA total	Metric tons in SCB	Metric tons CA total
2005	10	11	0.54	0.65
2006	21	25	3.31	3.38
2007	21	23	3.79	3.82
Total	52	59	7.64	7.85
Avg.	17	20	2.55	2.62

SCB = Southern California Bight

Private Recreational Fishery

The recreational fishing effort for the common thresher shark is rapidly expanding throughout Southern California with estimates for recreational landings for 2007 surpassing the commercial landings (186 mt vs. 122 mt). Once rarely targeted by the recreational fleet, this species is now

the main target of a springtime fishery on a stock of reproductively active sharks that has already been shown to be vulnerable to intense fishing operations.

For the purposes of this exercise, an average weight for thresher shark captured in the private boat recreational fishery was estimated to be roughly 85 kg. This estimate is based on the average of 37 sharks weighed at selected Southern California marina docks in the spring of 2008 as reported on the popular internet fishing blog site www.bloodydecks.com. Therefore, a rough estimate of landed weight of thresher shark by the recreational fishery during 2007 would equal 135 mt (1,598 sharks x 85 kg. per shark/1000 kg.). A growing catch-and-release ethic has been practiced amongst private boat anglers and many sharks are now released alive. Estimates of post-release mortality percentages are not known with any certainty as research into post-release survivorship for rod-and-reel captured thresher sharks is ongoing. If, however, we use the preliminary estimate from the NMFS/PIER study now in progress, which demonstrated approximately 33 percent post-release mortality (2 sharks died out of 6 tagged), then an additional 47 mt would be added to the take totals (1,672 sharks x 85 kg/1000 kg. x .33) giving a total estimated take of 182 mt. These take estimates are most likely conservative based on the data uncertainty issues raised earlier.

Table 3. Estimated Number of Thresher Shark Caught by Recreational Anglers in California Waters (All Fishing Modes), 2005-2007 (query run by Connie Ryan, CDFG).

California Recreational Fisheries Survey
 Extracted from RecFIN on 6/6/08
<http://www.recfin.org/forms/est2004.html>

Year	A fish (angler observed catch)	PSE	B1 fish (angler reported dead fish)	PSE	B2 fish (angler reported released alive)	PSE	Total A + B1	Total A+B1+B2
2005	275	21	30	55	1,141	30	305	1,446
2006	635	33	304	72	620	12	939	1,559
2007	1,544	52	54	31	1,672	50	1,598	3,271

PSE = percent standard error
 A = a landed shark that was sampled/observed by a CRFS sampler
 B1 = angler reported the catch and harvest of a shark to a CRFS sampler
 B2 = angler reported the catch and release of a shark to a CRFS sampler

Charter Recreational Fishery

The charter recreational fishery comprises a minor component of the total thresher shark catch and effort. A majority of the charter trips take place from ports located in southern California.

Table 4. Estimated catch (numbers) of thresher shark by anglers fishing on California Commercial Passenger Fishing Vessels (CPFVs). (CDFG logbook data)

Year	No. Trips	Kept	Thrown Back
1997	34	49	0
1998	27	28	2
1999	37	47	13
2000	39	40	4
2001	14	14	1
2002	15	11	4
2003	25	26	1
2004	20	18	3
2005	24	23	9
2006	24	27	4
2007	34	40	14

Table 5. Estimated number of yearly CPFV thresher shark trips made by port. (CDFG logbook data).

Year	Eureka	Bay Area	Monterey Area	SB/Ventura	LA/OC	San Diego Area
1997		12		6	12	4
1998		5	2	1	12	7
1999		3		2	17	15
2000		8	1	7	19	4
2001		4		3	6	1
2002		2	1	3	8	1
2003		3	4		12	6
2004		12			2	6
2005	1	4	3	1	9	6
2006		2		3	10	9
2007		1		8	14	11

SB = Santa Barbara; LA = Los Angeles; OC = Orange County

Non-HMS fisheries with thresher shark bycatch

Regulations implemented as part of the HMS FMP established harvest limits for HMS¹, including thresher sharks, taken by fisheries utilizing non-HMS gear. The limits are:

1. Bottom-set gillnet and small-mesh drift gillnet – ten fish per landing of each non-swordfish HMS (i.e., up to ten thresher sharks per day may be landed).
2. Bottom longline (set line) – three HMS sharks, or 20 percent of total landings by weight of HMS sharks, whichever is greater.
3. For trawl, pot gear, and other non-HMS gear - a maximum of 1 percent of total weight per landing for all HMS shark species combined is allowed (i.e., blue shark, shortfin

¹ It should be noted that State and Federal bycatch limitation regulations are not consistent in regards to HMS sharks

mako shark, and bigeye, pelagic, and common thresher sharks) or two HMS sharks, whichever is greater.

Based on California Department of Fish and game (CDFG) logbook records for the period 2005-07, the bottom set gillnet fishery captured an average of 563 thresher sharks per year (19 mt) and the small mesh drift gillnet fishery captured an average of 138 thresher sharks per year (4.7 mt). Based on observer estimates, the average fork length for threshers captured in these fisheries was around 100 centimeters which equates to an average weight of approximately 34 kilograms².

A small amount of thresher shark is captured incidentally in the trawl and bottom longline (set line) fisheries. The average annual estimate for the 2005-07 time period is less than 1 mt in aggregate (included in total non-HMS landings in table 1).

Table 6. Catch Estimates (metric tons) for thresher shark harvested by the California small mesh drift gillnet and bottom set gillnet fisheries for the period 2005-2007 (CFIS logbook and fish ticket landings database).

	Small mesh drift gillnet		Bottom set gillnet	
	# boats (sets)	# sharks (mt)	# boats (sets)	# sharks (mt)
2005	12 (254)	42 (1.4)	38 (2508)	294 (10.0)
2006	19 (289)	277 (9.4)	41 (2159)	921 (31.3)
2007	23 (266)	96 (3.3)	42 (1967)	474 (16.1)
Total	54 (809)	415 (14.1)	121 (6634)	1689 (57.4)
Avg	18 (270)	138 (4.7)	40 (2211)	563 (19.1)

Pelagic Longline Fishery

Currently only one vessel is using deep-set pelagic longline gear to target tunas outside of the west coast EEZ. This vessel catches common thresher sharks incidentally; however, these catches cannot be reported due to data confidentiality requirements. These catches are uncommon and would add an insignificant amount to the overall estimate of thresher shark catches.

Management Options for the Recreational Thresher Shark Fishery

(1) No Action

Current California state recreational regulations allow the harvest of 2 HMS sharks per species (thresher, shortfin mako, blue) per person per day (i.e., up to 6 HMS sharks per person per day) with no season, size, or area restrictions. The combined recreational and commercial catch is approaching or may exceed the established harvest guideline but lack of confidence in the recreational data makes that determination uncertain. The harvest of thresher shark in the DGN fishery peaked in 1985 with approximately 250 boats making

² Based on length-weight conversion chart from the North Atlantic (Kohler et al., 1996) and verified for southern California using NMFS SWFSC survey data (S. Kohin, personal communication).

11,000 sets landing an estimated 1,000 mt of thresher sharks. With the implementation of time/area closures to regulate the DGN fishery, landings dropped by almost an order of magnitude with anecdotal evidence suggesting that the thresher shark population may be in a rebuilding phase as a result. Since it has been documented that this stock of mature thresher sharks is vulnerable to over-exploitation, the HMSMT recommends a proactive management approach and does not support the option for no action.

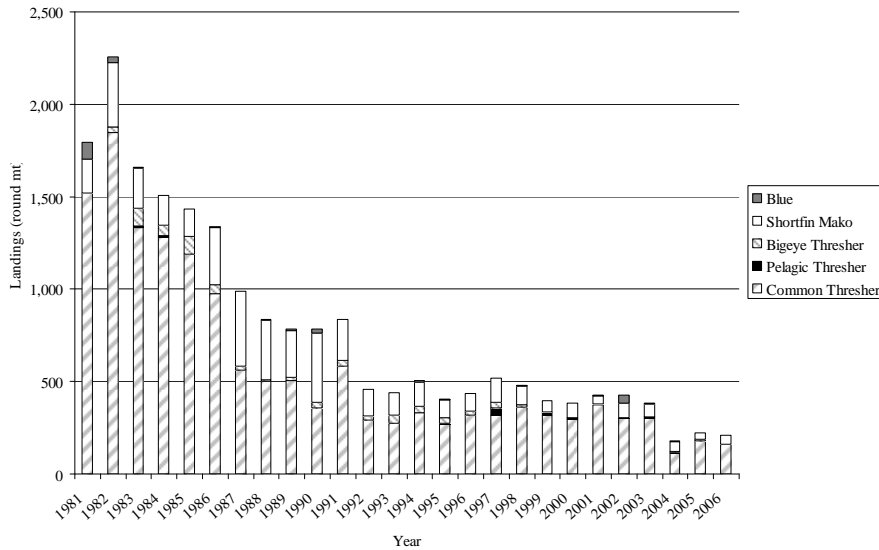


Figure 1. West Coast landings of HMS sharks, 1981-2007 (PFMC SAFE, 2007).

(2) Recreational Thresher Shark Fishing Time/Area Closures – In 1990, the California Legislature prohibited commercial DGN fishing within 75 miles of the mainland from May 1 through August 14 and continued a previously enacted prohibition from February 1 through April 30 to conserve pregnant and pupping thresher shark throughout the region. Implementation of a companion recreational fishery closure consistent with the commercial closure is one viable option. The regulatory text for any proposed closure would need to include prohibition on fishing for and possession of thresher shark during this period to make the rule enforceable.

- Spring/Summer closure option – Mimic the current commercial closure which covers early spring to mid-August period. As a practical matter this option would close the west coast EEZ to recreational fishing for thresher sharks February-August 15.
 - February 1 to April 30 closure out to 200 nm
 - May 1 to August 15 closure out to 75 nm
- Spring only closure option – Implement a closure during the spring months (April-June) when large numbers of gravid females enter the southern California Bight to pup.
 - Southern California Bight focus; no fishing for or possession of thresher sharks south of Point Conception (out to 200 nm), April 1-June 30.



Figure 3. Principal fishing areas for the southern California recreational thresher shark fishery (map courtesy of Scott Aalbers, PIER).

(3) Bag Limits

- **Daily limit option** - A voluntary shark angler survey distributed by NMFS-PIER at a series of spring 2008 thresher shark seminars revealed nearly unanimous support to reduce the current daily bag limit for HMS sharks. Options for reducing the limit include:
 - 1 shark/day (all HMS species combined).
 - 1 shark/HMS species/day (1 each including mako, thresher, and blue shark; 3 in total).
- **Seasonal limit option**
 - Choose within the range of 1-5 thresher sharks/angler/calendar year. A majority of the anglers who completed the NMFS-PIER voluntary angler survey said they catch between 1-5 threshers per season and many favor a 1-2 shark seasonal bag limit.

For any seasonal option to be effective there will need to be adequate monitoring and enforcement capabilities in place. These capabilities would present a good opportunity to collect needed data for management

purposes (e.g., catch, effort, size, location, sex ratio) as well as providing outreach and education materials to anglers involved in the fishery. A punch card program is one way to collect data on the catch and effort for thresher shark fishing within a seasonal limit approach. The State of California currently manages punch card programs for steelhead trout, sturgeon, abalone, and beginning this fall, for spiny lobster harvest.

Big-game harvest tags are another option that have successfully been used in the management of fishing and hunting activities. The primary goal of a harvest tag program includes (1) limiting harvest; (2) providing data to enhance management efforts; (3) promoting effective monitoring and enforcement, and; (4) ensuring equitable distribution of harvest opportunity. Existing programs require tags to be affixed to a conspicuous area on the fish as soon as it is caught and retained.

If this option is to be seriously considered, attention must be paid to educating the public and generating stakeholder support. While most existing programs have been generally well received, some managers have reported angler resistance based on the cost of tags, the inconvenience of using them, or other aspects of the program (Johnston et al., 2007). Harvest tags do not eliminate difficulties with monitoring, enforcement and compliance; however, there are aspects of tag programs which can address some of these challenges. For example, a requirement that physical tags be attached to harvested fish, together with random checks or check-points, can facilitate monitoring and enforcement during routine or random bag checks. Harvest reporting requirements associated with tags (particularly if required in order to obtain additional tags or tags in subsequent years) may lead to better compliance and more accurate harvest monitoring.

- **Combination of daily bag limit with seasonal limit**
 - 1 thresher shark/day coupled with a 1-5 thresher shark/season limit might be an effective strategy to limit out of state or one day permit holders from harvesting more than one individual while still effectively reducing the take of anglers that frequently target thresher sharks.

(4) Gear Modifications

- Implement mandatory circle hook use when targeting HMS sharks
 - Potential modifications include substituting circle hooks for the currently used J-hooks to minimize the incidence of foul-hooking (tail-hooking). Several innovative anglers are currently using circle hooks, teaser lures, and alternative weighting systems that effectively reduce the proportion of tail-hooked sharks (Bob Osborne, UASC, personal communication). If future research suggests that these techniques are effective, this option holds promise as a management option for increasing catch-and-release survivorship.

(5) Other Options Considered But Not Included

- Depth-based restrictions - Regulations promulgated under the Council's Groundfish FMP have included depth-based restrictions based on the life history and habitat use of exploited stocks. Researchers from the Scripps Institute of Oceanography have been tracking juvenile and adult thresher sharks in the Southern California Bight and some apparent segregation by depth signals can be seen with adult sharks preferring deeper water habitat (>100 m depth) and juveniles staying coastal over the shelf (<100 m depth). This management option was thoroughly discussed but not included because of perceived difficulties with enforcement.
- Male only harvest – Sharks are one of few commercially important game fish for which sex of captured animal is relatively easy to determine. Males have very distinctive reproductive organs called claspers. By regulating a male-only harvest, pregnant females will be allowed to carry out their pupping activities. There are, however, post-release survivorship issues with releasing females that have been tail-hooked and fought to exhaustion. Without gear modifications to eliminate tail-hooking, requiring male-only harvest will not solve the problem of the larger reproductively active females suffering high post-release mortality levels. If future data supports male-only harvest as a viable management option, this approach may be worth revisiting.
- Size/slot limits – Lack of consideration based on same rationale as above.

Conventional Shark Tagging Program

Many of the anglers attending the NMFS/PIER Thresher Shark Seminars requested the reconstitution of an angler-based conventional shark tagging program. On a national level, marine recreational anglers caught more than 468 million fish in 2007, the second highest recreational catch total in the last ten years. The 2007 data demonstrates a widespread turn toward "catch and release" among recreational anglers. While anglers are catching about 27 percent more fish than a decade ago, they are also releasing more fish than they keep. Of the 468 million fish caught by anglers in 2007, 272 million or 58 percent were released alive (Annual Report on the Status of U.S. Fisheries, NOAA, 2007).

In order to secure the necessary support to successfully implement an angler-based conventional shark tagging program, the sampling design and scientific merits need to be clearly defined and articulated. The value of conventional tag data has been questioned in regards to its ultimate utility for stock assessment work. However, in addition to fostering the increasing trend toward catch and release angling, the data gathered from a conventional program could shed light on key life history questions such as species composition, size, sex ratio, recapture rates, mixing into other fisheries, as well as provide available tissue samples for genetic and molecular research needs.

Mandatory Data Reporting Requirement for all West Coast HMS Shark Fishing tournaments

The following description of how the CRFS is set up to sample HMS shark tournaments was provided by Russell Porter, Senior Program Manager for the Pacific States Marine Fisheries Commission. He concurs with the HMSMT's recommendation to institute a mandatory data reporting requirement for all west coast HMS shark fishing tournaments. In addition to enhancing the accuracy and reliability of the CRFS estimates, the tournament data would be reported as a separate line item in the annual HMS Stock Assessment and Fishery Evaluation Reports (HMS SAFE).

California Recreational Fisheries Survey – Sampling of HMS Shark Tournaments

Recreational fishing in HMS shark tournaments is captured by CRFS as a random survey element however, since there is a potential for unreasonable inferences to all recreational trips, especially in the low sample rate surveys at smaller boat ramps, CRFS flags the data and may elect to exclude data from a particular tournament at some point in the future.

The tournament trips emanating from private access sites are not sampled for catch-per-unit-effort (CPUE), since no private access catch is sampled. The effort from these private access sites is sampled in the angler license survey. That effort currently has the CPUE from similar targeting trips at public sites applied to it to make an estimate of catch. Catch estimates by trip type and mode are completed every month. "Coastal pelagics" is the trip type set up for tunas and sharks. If all the effort for the month for tunas and sharks left from private access sites, and we saw none at the public site sampling of anglers, then there would be a catch estimate of zero for those species (that would be the extreme). We usually see some at the public sites, but the CPUE may not be as high as the CPUE for effort from private sites targeting just those species, thus true catch would be underestimated to some degree. We think it would be good to have all tournaments report, as we would then have an exact tally as well as date and location.

Literature Cited

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