

4 Thresher Shark, *Alopias vulpinus*



Thresher shark, *Alopias vulpinus*. Photo credit: Dale Sweetnam.

History of the Fishery

The common thresher shark, *Alopias vulpinus*, is the most common commercially landed shark in California. They are primarily caught using large mesh drift gill nets and hook and line gear, but are also caught incidentally with small mesh gill nets and harpoon. Prior to 1977, all sharks were reported in one market category and not separated by species, and it is assumed threshers were caught as bycatch in gears at levels similar or greater than today. The first significant fishery for thresher sharks began the late 1970s to early 1980s when drift gill net fishers began to target them close to the southern California coastline. The fishery expanded rapidly and, because of overfishing concerns, the California Department of Fish and Game (Department) as mandated by the State Legislature began an observer program, monitored landings and implemented a logbook program. A limited entry permit program for drift gill net gear was initiated in 1982, with permits issued to fishers rather than boats to prevent false inflation in value. The drift gill net fishery for thresher sharks peaked in 1981 when 113

drift gill net boats landed nearly 600 tons (544 metric tons). However, total landings using all gears were highest the following year with a total of more than 1700 tons (1542 metric tons) taken by all gears (Figure 4-1).

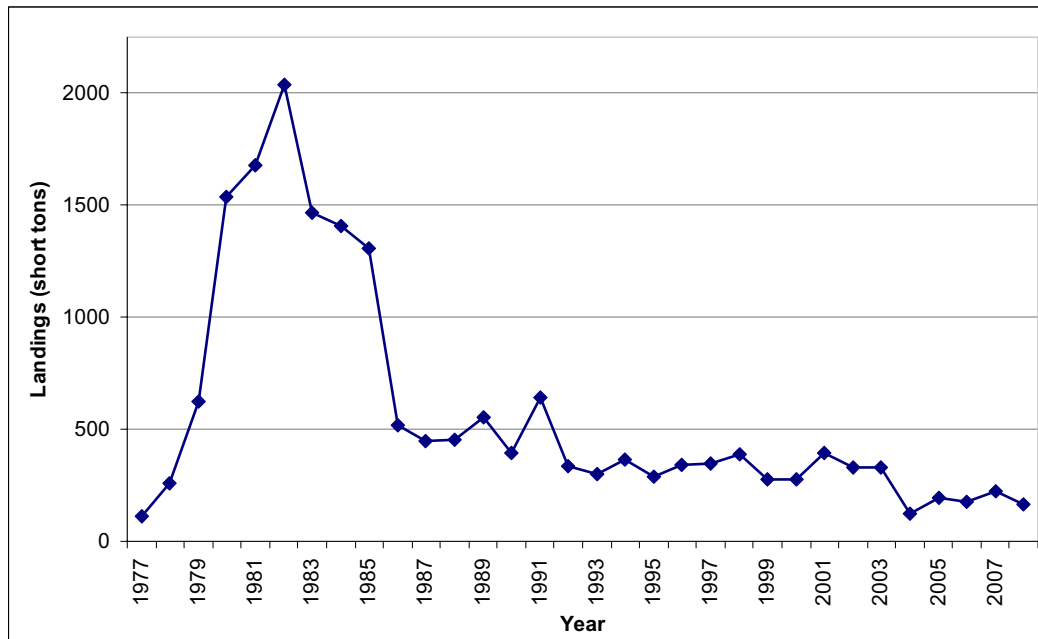


Figure 4-1. Thresher shark commercial landings, 1977-2008. Data source: Department Catch Bulletins (1977-1985) and CFIS data (1986-2008), all gear types combined. Data not available prior to 1977.

By the late 1980s, research monitoring of the commercial landings indicated that entire size classes were no longer being caught. Legislation was enacted establishing a series of time/area closures for the gill net fishery in order to protect the shark resource. The objective of these closures were threefold: 1) to protect large females who moved into the Southern California Bight (SCB) during their pupping season; 2) to prevent interactions with marine mammals, sea turtles and sea birds; and 3) to prevent conflicts with harpoon fisheries. Several revisions to the gill net time and area closures resulted in the fishery being completely closed between February 1 and April 30 and closed within 75 miles (121 kilometers) of the coast from May 1 to August 14 (FGC §8576).

In the early 1980s, drift gill net vessels switched to swordfish as their primary target species. Thresher sharks, along with shortfin mako sharks, were targeted secondarily and landings of threshers began to decline (Figure 4-1). In 1990, a California voter referendum banned gill nets in state waters (within 3 nautical miles; 5.6 kilometers) of shore south of Point Arguello (Santa Barbara County)] in southern California (FGC§8610.2). In 2001, a federal gill net closure was enacted to protect leatherback sea turtles from Point Conception to central Oregon from August 15 through October 31. In addition, during El Niño conditions, the area south of Point Conception is closed to drift gill net fishing August 15 through August 31 and in January to protect loggerhead turtles. These closures have further reduced thresher shark landings, with landings totaling less than 200 short tons (181 metric tons) each year since 2004 (Figure 4-1). At present, the only requirement for purchasing a drift gill net permit is

possession of one for the preceding season; there is no landing requirement. Currently, there are 83 drift gill net permittees; however, only about half of those are actively fishing.

Thresher sharks are also taken by other commercial gears including hook and line, small mesh gill nets and harpoon. Small mesh gill nets include set nets targeting California halibut and drift nets targeting barracuda and white seabass. Small mesh drift gill nets [mesh 8 inches (20 centimeters) or smaller] targeting white seabass and barracuda are not required to have a drift gill net permit, however state regulations limit possession to no more than two thresher sharks along with ten barracuda or five white seabass, while federal regulations have a limit of ten highly migratory species (HMS) excepting swordfish (HMS includes albacore, bigeye, bluefin, skipjack and yellowfin tunas; common, big eye and pelagic thresher sharks; shortfin mako shark; blue shark; striped marlin; swordfish; and dorado). In 1996, a state ban on landing detached shark fins became effective for all commercial fishing gears (FGC §7704). Because of their size, threshers are the only exception to this rule; however, the fins must match a corresponding carcass on the vessel.

Thresher sharks have long been a desired species for recreational anglers and are considered a prized fighting fish. California recreational regulations impose a two fish bag limit on thresher sharks. This is cumulative for multi-day trips and most anglers seldom fill bag limits. Boat limits are in effect for multiple anglers per boat; with no more than the bag limit for each of the number of licensed anglers per boat. Again, these limits are seldom filled. If filleted at sea, a one inch patch of skin must be left on the fillets. In recent years, interest in thresher shark has increased as other recreational species become more heavily regulated, and some fishing areas are closed to protect other fish species. Many shark anglers practice a catch and release ethic. However, the survival of these released fish, often caught using a species specific tactic of tail hooking, may be much lower than previously thought. Research is currently underway to determine specific survival rates of tail hooked sharks.

There are two different recreational sampling programs: the Marine Recreational Fisheries Statistical Survey (MRFSS) which sampled from 1980 to 2003 and the California Recreational Fisheries Survey (CRFS) which was initiated by the Department in 2004. Due to changes in the sampling protocol and how the data are used to estimate catch these two surveys are not comparable. The recreational catch of thresher shark, all species combined, from 1980-2003 has been variable; ranging from a high of 4829 fish in 1987 to 461 fish in 1997 (Figure 4-2). This trend has continued during the 2004-2008 period, ranging from 306 fish in 2005 to 4554 fish in 2004 according to CRFS data (Figure 4-3). Recreational thresher shark catches are highest May through August, for both kept and released fish. Most recreational thresher shark catch occurs in the private/rental boat mode [90 percent for the years 1980-2003 (MRFSS data); 84 percent for the years 2004-2008 (CRFS data)] (Figure 4-4). In 58 percent (14/21) of the sampling years between 1980 and 2003, the estimated number of threshers released alive have been greater or equivalent to those kept. Since 2004, estimates of the metric tonnage of fish released alive have been available; in four of the five sampling years the estimated tonnage of those fish released has also been greater

or equivalent. Threshers are often taken incidentally while anglers are targeting other species. Those taken in northern California were all incidental to salmon or halibut recreational fishing trips, while in southern California, 69 percent were caught on trips targeting threshers and the rest were caught incidentally on halibut, yellowtail and barred sand bass trips. Commercial passenger fishing vessel (CPFV) logs indicate that the take of thresher sharks aboard their vessels is much less than that taken by anglers fishing from private boats. For the last fifteen years, the take of thresher sharks by CPFV averaged about 40 fish a year with a high of 163 fish during the El Niño of 1993.

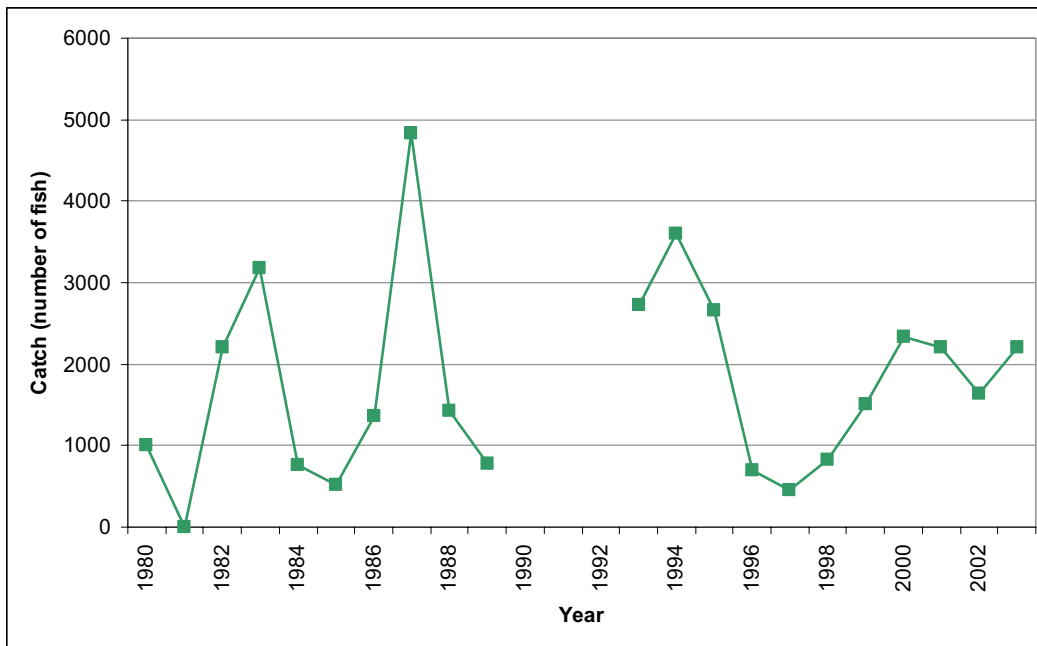


Figure 4-2. Thresher shark recreational catch, 1980-2003. Data source: MRFSS data, all fishing modes and gear types combined. Data not available from 1990-1992. CPFV data not available for central and northern California for 1993-1995.

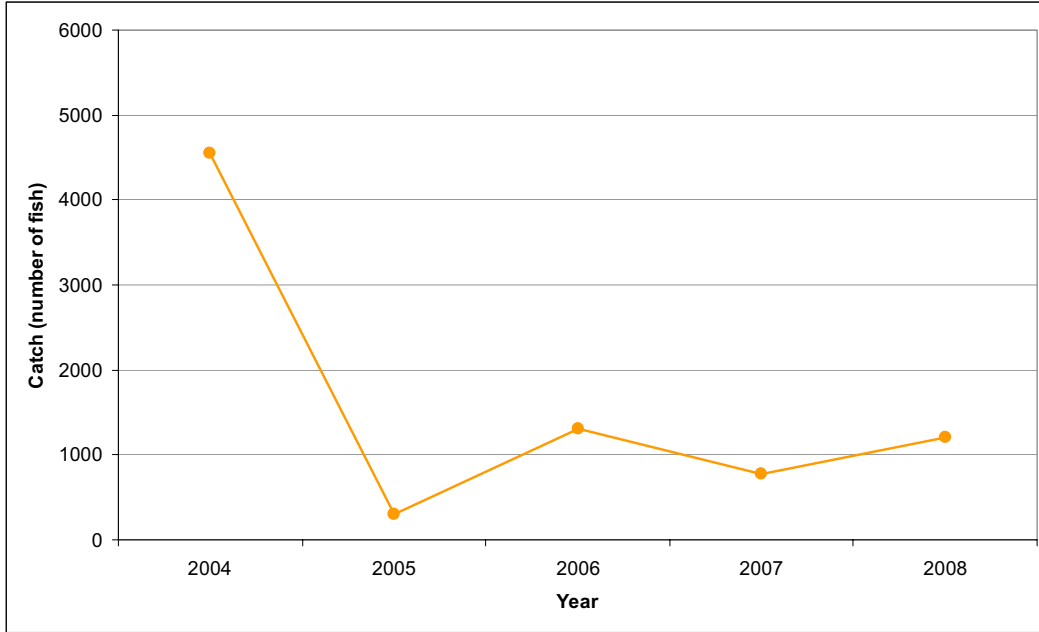


Figure 4-3. Thresher shark recreational catch, 2004-2008. Data source: CRFS data, all fishing modes and gear types combined.

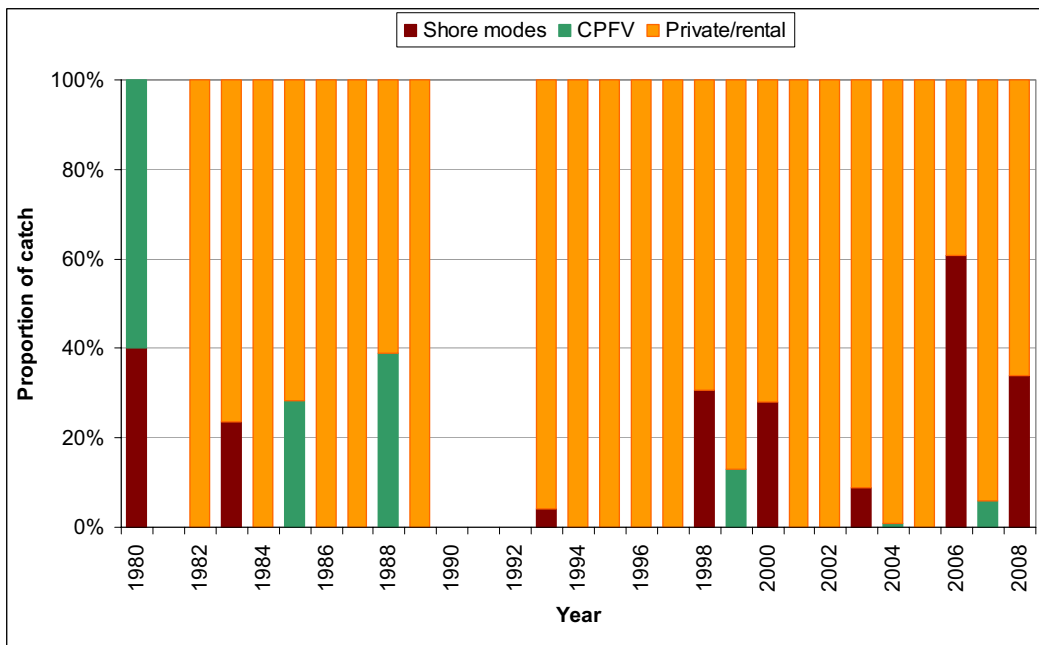


Figure 4-4. Thresher shark recreational catch by fishing mode, 1980-2008. Data source: MRFSS data (1980-2003) and CRFS data (2004-2008), all gear types combined. Data not available from 1990-1992, CPFV data not available for central and northern California for 1993-1995.

Status of Biological Knowledge

Thresher sharks are large pelagic sharks whose most defining characteristic is the enormous upper lobe of the tail, which can be up to half their total length, and is used to stun their prey. Common thresher sharks are dark brown to dark grey dorsally, fading to tan to gold on the sides, and a distinct demarcation to white on the belly. They can be differentiated from two other thresher sharks that occur in California (the bigeye thresher and the pelagic thresher) by the white belly markings extending over the top of the large pectoral fins and a slight bronzy-green iridescence to the skin, which leads markets to sometimes record the species on fish receipts as “green thresher” (as opposed to “brown thresher,” which refers to bigeye). Some also have small white spots on the tips of the pectoral and pelvic fins.

Common thresher sharks have a worldwide distribution in temperate seas and are found in the Mediterranean Sea and the Atlantic, Pacific and Indian Oceans. They tend to be most common over continental shelves, preferring areas of high productivity where concentrations of the small schooling organisms that make up most of their diet are found. Young threshers tend to remain within 3 miles (5 kilometers) of the coast in their early years and as they grow larger, range much farther offshore. Migratory patterns inferred by seasonal catches seem to indicate that adult threshers move north from Baja California in the spring, into the SCB, where “pupping” is thought to occur. The adults then continue north as far as Oregon and Washington by late summer, followed by subadults later in the season. Subadults are known to migrate south again in the wintertime, but it is not known what route is taken south by large adults. The National Marine Fisheries Service-Southwest Fisheries Science Center (NMFS-SWFSC), in cooperation with the Tagging of Pacific Predators program has been conducting a tagging study annually since 2003 using satellite tags on large threshers caught during its annual survey of thresher shark pup abundance. Adults and subadults tagged with conventional and pop off satellite tags have shown a preference for coastal waters, but occasionally venture into offshore waters to depths of more than 1600 feet (500 meters) or greater. Nine of eleven satellite tags deployed during the last 2 years popped up in the SCB within 6 to 8 months.

Thresher shark size at birth has been estimated to be 62 inches (158 centimeters) total length, and can reach a maximum size of 250 inches (636 centimeters) for females and 194 inches (493 centimeters) for males. Recently published work estimates both sexes to reach sexual maturity at an age of 5 years and a length of 119 inches (303 centimeters). The oldest thresher reported was 50 years old.

Thresher sharks feed mostly on small schooling pelagic organisms. A recent study of stomachs from threshers taken in the California drift gill net fishery found that they consumed food from 20 different taxa; including anchovies, Pacific whiting, Pacific mackerel, Pacific sardine, squid and pelagic red crabs. Pacific whiting were the most common food item for thresher sharks caught north of Point Conception, while anchovies were the most common for thresher sharks caught south of Point Conception, especially for juveniles. They are thought to use their large upper lobe of

the caudal fin to stun their prey before eating it; this is corroborated by the fact that most threshers caught by conventional hook and line gear are snagged by the tail.

Like other large pelagic sharks, common threshers have been shown to be warm blooded. Thresher sharks caught by long line and by rod and reel were shown to have elevated temperatures in their aerobic swimming musculature, as much as 3 degrees higher than surrounding sea surface temperatures. They are also obligate ram ventilators, meaning that they require forward motion to keep oxygenated water flowing over their gills. They do not survive well on fishing gear which restricts their movement or drags them backwards through the water. The NMFS-SWFSC and the Pflieger Institute of Environmental Research are currently collaborating on research studying thresher shark mortality when taken on conventional hook and line gear using satellite tagging methods. Alternative gears, which have a higher probability of hooking the shark in mouth rather than the tail, are also being studied.

Threshers are ovoviviparous, with gestation period of about 9 months. Eggs are retained in the uterus, where they hatch; the newly-hatched fetuses are oophagous, meaning they feed on excess intrauterine eggs prior to birth. The mother shark then gives live birth to a litter of two to four pups, although in some areas the number may be as high as seven. In the eastern Pacific, the SCB is thought to be a nursery area for thresher sharks. Observers sampling adult females taken in the commercial fishery in early spring found all to be pregnant. The pupping season takes place from April to June, and mating season is thought to follow in late summer to fall. In 2003, the NMFS-SWFSC began investigating the range of thresher shark pup distribution along the coast of southern California, in an attempt to clarify borders of nursery areas and establish an index of juvenile thresher shark abundance. While it is still too early in the study to establish trends in abundance, the juvenile thresher's patchy distribution makes identifying the nursery areas difficult even though they have been shown to prefer nearshore waters at depths 0 to 150 feet (0 to 46 meters) and nearly all were caught in depths less than 295 feet (90 meters).

The Pacific Fisheries Management Council (PFMC) has identified priority research needs for additional life history information for HMS included in the Highly Migratory Species Fishery Management Plan (HMS FMP). For thresher shark, the research priorities are: 1) identify stock structure and boundaries of the populations, and where they interact with other populations, the seasonal migration patterns for feeding and reproduction and life stages vulnerable to fisheries; 2) determine ages and growth rates, including comparisons to other areas; and 3) determine maturity and reproductive schedules.

Status of Population

Stock assessments for all HMS sharks, including thresher, are also needed but are problematic; fisheries data for sharks are often collected in a manner not suited for use in assessments. Regional Fishery Management Organizations have tended to make tunas and billfish the priority while sharks, even though they are more vulnerable to overfishing because of their slow growth and low reproductive rates, have not

received the same attention. This is primarily because of their status as bycatch in other fisheries or that data on sharks are often not separated by species, but lumped together in one market category. Even in California, thresher sharks were not identified by species until 1977. In addition, significant catches of thresher sharks occur in Mexico, and as for all shark fisheries, sample data are scarce and incomplete.

Preliminary assessment analyses indicated west coast drift gill net fishery catch and catch-per-unit-effort were increasing from the lows of the early 1990s; from this it was inferred that the population was recovering. The most recent assessment of thresher shark in 2002 indicated that thresher shark is no longer overfished and recent average landings are about 75 percent of maximum sustainable yield. However the PFMC has recommended that a new stock assessment be a priority.

Management Considerations

The HMS FMP became effective in February 2005, putting thresher shark under federal management, although California regulations were used as a model for most HMS species. The HMS FMP establishes a biennial management cycle, in which measures to be implemented are introduced in June and, if approved, implemented the following April. For thresher sharks, a harvest guideline of 375 short tons (340 metric tons) was established for total commercial and recreational catch.

In June 2008, recommendations were made by the PFMC's HMS Management Team to limit the recreational take of common thresher sharks. Recreational catch had been increasing, due to the recreational public becoming more educated on how to target them, and increasing use of internet websites to disseminate information on fishing areas and thresher shark occurrence. Concerns were raised because much of this catch was occurring during the spring thresher shark pupping season, and many of the fish caught appeared to be pregnant females. Additionally, although many thresher shark anglers advocate catch and release fishing methods, a preliminary study indicated that thresher sharks caught by tail hooking had poor survival rates when released. When added to commercial landings, recreational catches were thought to be approaching the harvest guideline. Prior to PFMC decision making, a series of seminars were conducted to educate anglers on best ways to catch and release thresher sharks. Alternatives proposed included closing the recreational fishery for the same period as the commercial fishery, changing bag limits to one shark per day (thresher only or all HMS sharks), seasonal bag limits using harvest cards or gear modifications.

On further examination of the recent CRFS data, estimates of recreational thresher shark catches were found not to be causing cumulative landings to exceed the harvest guideline (Figure 4-5). Further, an analysis of bag limits showed that few anglers caught limits and a change in the bag limit would likely have little effect on recreational catch. The PFMC decided not to make changes to thresher shark regulations for the 2009-2010 management cycle, but did make a number of recommendations including: 1) continuing outreach to anglers regarding best practices to increase survival of released animals; 2) improving data collection on thresher sharks

(especially for private access marinas, and in commercial hook and line and non HMS fisheries); 3) initiating a new stock assessment that incorporates data from Mexico; 4) improving estimates of the number and condition of released fish; 5) investigating further the use of recreational gear modifications to increase survival; and 6) identifying thresher shark nursery areas. CRFS is currently conducting a study involving panels of anglers based in private marinas, and funding for proposals to carry out the other recommendations is currently being pursued from the Marine Recreational Information Program and the California Ocean Protection Council.

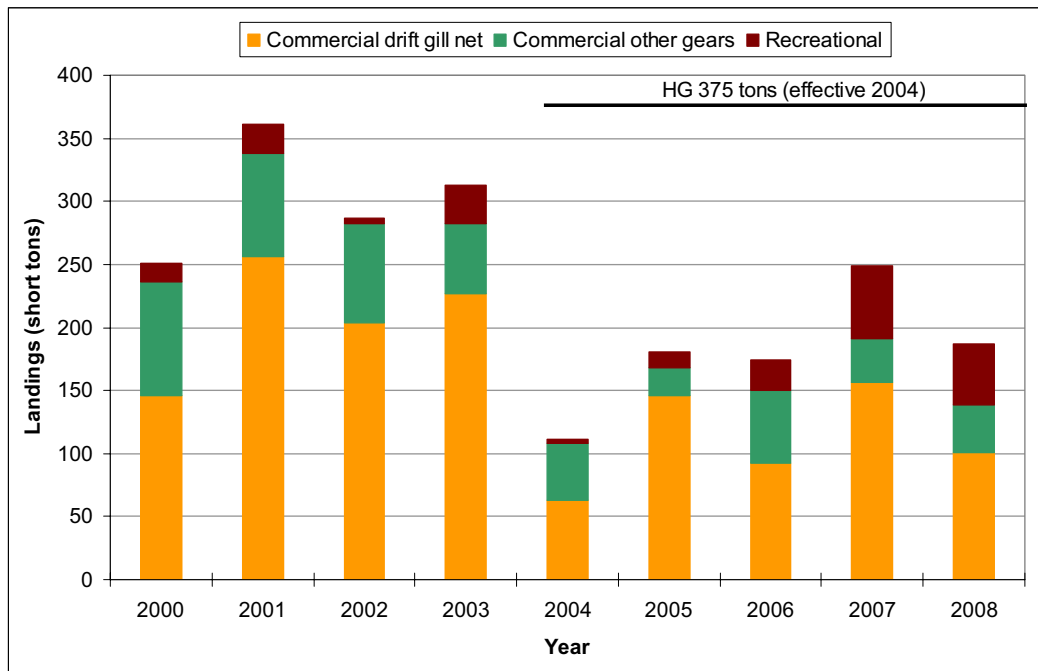


Figure 4-5. Thresher shark landings compared to the harvest guideline (HG), 2000-2008. Commercial drift gill net includes both large mesh offshore drift gill nets targeting swordfish and small mesh drift gill nets targeting white seabass and barracuda. The HG for commercial and recreational fisheries (combined) is 375 short tons (340 metric tons). Data source: Commercial - CFIS data (2000-2008); Recreational - MRFSS (2000-2003) and CRFS (2004-2008), all fishing modes and gear types combined.

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Further Reading

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Thresher shark commercial landings, 1977-2008.					
Year	Short tons	Year	Short tons	Year	Short tons
1977	94	1988	389	1999	238
1978	219	1989	471	2000	236
1979	533	1990	335	2001	338
1980	1,309	1991	550	2002	283
1981	1,431	1992	286	2003	283
1982	1,738	1993	258	2004	108
1983	1,252	1994	310	2005	168
1984	1,203	1995	248	2006	150
1985	1,117	1996	294	2007	191
1986	440	1997	298	2008	138
1987	381	1998	333		

Data source: Department Catch Bulletins (1977-1985) and CFIS data (1986-2008), all gear types combined. Data not available prior to 1977.

Thresher shark recreational catch (number of fish) by fishing mode, 1980-2003.					
Year	Shore modes	CPFV	Private/ rental	Total of all modes	Percent private/ rental
1980	406	607	0	1013	0%
1981	0	0	0	0	--
1982	0	0	2205	2205	100%
1983	747	0	2436	3182	77%
1984	0	0	769	769	100%
1985	0	147	375	523	72%
1986	0	0	1359	1359	100%
1987	0	0	4829	4829	100%
1988	0	554	872	1426	61%
1989	0	0	776	776	100%
1990	--	--	--	--	--
1991	--	--	--	--	--
1992	--	--	--	--	--
1993	116	0	2610	2726	96%
1994	0	0	3600	3600	100%
1995	0	0	2654	2654	100%
1996	0	0	703	703	100%
1997	0	0	461	461	100%
1998	254	0	576	829	69%
1999	0	195	1307	1502	87%
2000	656	0	1685	2341	72%
2001	0	0	2204	2204	100%
2002	0	0	1644	1644	100%
2003	195	0	2012	2207	91%
Average 1980-2003	113	72	1575	1760	90%

Data source: MRFSS data, all gear types combined. Data not available from 1990-1992. CPFV data not available for central and northern California for 1993-1995.

Thresher shark recreational catch by fishing mode, 2004-2008.					
Year	Shore modes	CPFV	Private/rental	Total of all modes	Percent private/rental
2004	0	36	4518	4554	99%
2005	0	0	306	306	100%
2006	797	0	516	1313	39%
2007	0	45	731	776	94%
2008	410	0	708	1118	63%
Average 2004-2008	241	16	1356	1613	84%

Data source: CRFS data, all gear types combined.

Thresher shark commercial and recreational catch (short tons), 2000-2008, compared to the 375 short ton (340 metric ton) harvest guideline (HG).								
Year	Commercial DGN (all sizes)		Commercial Other Gears		Recreational (all modes)		Total	
	Tons	Percent HG	Tons	Percent HG	Tons	Percent HG	Tons	Percent HG
2000	146.2	39.0%	89.7	23.9%	15.0	4.0%	250.9	66.9%
2001	256.4	68.4%	81.6	21.8%	22.7	6.1%	360.8	96.2%
2002	203.3	54.2%	79.4	21.2%	3.5	0.9%	286.2	76.3%
2003	226.9	60.5%	55.8	14.9%	30.2	8.1%	312.8	83.4%
2004	63.4	16.9%	44.5	11.9%	3.6	1.0%	111.6	29.7%
2005	145.8	38.9%	21.7	5.8%	12.8	3.4%	180.3	48.1%
2006	92.5	24.7%	57.3	15.3%	25.0	6.7%	174.8	46.6%
2007	156.8	41.8%	34.4	9.2%	57.1	15.2%	248.3	66.2%
2008	100.5	26.8%	37.7	10.1%	39.2	10.5%	177.4	47.3%
Average 2000-2008	154.6	41.2%	55.8	14.9%	24.3	6.5%	234.7	62.6%

Data sources: Commercial - CFIS data (2000-2008). Recreational - MRFSS data (2000-2003) and CRFS data (2004-2008), all fishing modes and gear types combined.