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**Shark Capture and Disposition in the
Hawaii Pelagic Longline Swordfish and Tuna Fisheries**

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Shark Capture and Disposition in the Hawaii Pelagic Longline Swordfish and Tuna Fisheries

(Prepared for the Scientific Committee of the Western and Central Pacific Fishery Commission)

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The annual average catch of blue, mako, thresher, and other sharks in Hawaii longline fisheries from 1987-2004 was 1,579,700 lb, 137,700 lb, 114,400 lb, and 101,400 lb, respectively, with a combined annual average weight of 1,933,200 lb (Western Pacific Regional Fishery Management Council, 2005a). In 2001, pelagic sharks comprised about 50% of the catch composition of swordfish longline sets, compared to 16% for tuna sets (Ito and Machado, 2001). Shark CPUE has been about 10 times higher in shallow sets targeting swordfish compared to sets targeting tuna (Ito and Machado, 1999). Since regulations designed to reduce interactions with sea turtles in the Hawaii-based pelagic longline swordfish fishery came into effect in May 2004, which required the fleet to switch from using a 9/0 J hook with squid bait to a wider 18/0 10 degree offset circle hook with fish bait, there has been a significant 36% decrease in shark (combined species) CPUE relative to the period before the sea turtle regulations came into effect (Gilman et al., 2006a). From 1994 – 2002, the period before the sea turtle regulations came into effect, shark CPUE for the Hawaii-based longline swordfish fishery was 21.9 sharks per 1000 hooks (20.4 – 23.5 95% CI). From 2004 – 2006, the period since the sea turtle regulations have been in effect, shark CPUE was 14.0 sharks per 1000 hooks (13.6 – 14.5 95% CI). Based on research conducted in the Azores longline swordfish and blue shark fishery (Bolten and Bjorndal 2002) and U.S. North Atlantic longline swordfish fishery (Watson et al., 2005), this observed decrease in shark CPUE is likely due to the fleet's change from using squid to mackerel for bait.

From 1994 – 2006, observer data show that blue sharks comprised 92.6% of total caught sharks in Hawaii longline swordfish targeting sets. From 1994 – 2006, observer data show that blue sharks comprised 82.2% of total caught sharks in Hawaii longline tuna targeting sets. From 1993 – 2000, logbook data show that blue sharks comprised an average of 87.5% of total reported shark catch, with an average of 3,509 lbs of blue sharks caught annually (Western Pacific Regional Fishery Management Council, 2005a). From 2001 – 2004, blue sharks comprised an average of 18.4% of total reported shark catch, with an average of 65,500 lbs of blue shark caught annually (Western Pacific Regional Fishery Management Council, 2005a). The Hawaii-based longline swordfish fishery was closed from February 2002- May 2004 due to concerns over interactions with sea turtles (Gilman et al., 2006a,b), which explains the substantial drop in weight and proportion of blue shark catch during this period.

Table 1 presents statistics from logbook data on shark bycatch in combined Hawaii-based longline tuna and swordfish fisheries from 1994-1999 and for 2004. Table 2 presents statistics for only observed sets targeting swordfish by Hawaii-based longline vessels on the condition of sharks when hauled to the vessel, condition of discarded sharks, and number and proportion of retained sharks. Table 3 presents similar statistics from observer data for observed sets targeting tuna. An increase in demand for shark fins, resulting from increasing income in China, and increased demand from the U.S. mainland for Hawaii shark fins as the supply from U.S. Atlantic coastal shark fisheries declined due to significant reductions in shark quotas, are believed to explain the gradual increase in percent of caught sharks that were finned from 1994-1999 (McCoy and Ishihara, 1999; U.S. National Marine Fisheries Service, 2001). In 1999, before restrictions on shark finning were instituted, 65.4% of caught sharks were finned while carcasses of only 1.1% of caught sharks were retained for combined Hawaii longline fisheries (U.S. National Marine Fisheries Service, 2001). The Shark Finning Prohibition Act came into effect in March 2002, which explains the sudden drop in retention of only fins from caught sharks. Whole shark carcasses have

been a stable and insignificant component of shark landings, typically representing < 1% of shark catch. Hawaii longliners generally only retain carcasses of mako and thresher sharks as the meat from these species are the only ones that are marketable, although occasionally a vessel will retain carcasses of blue and other shark species. For example, in 2004, 44.7% (830) and 13.7% (717) of the total number of caught mako and thresher sharks were retained, respectively, while only 2.0% (1,303) and 6.9% (210) of the total number of caught blue and 'other' sharks were retained, respectively, in 2004 (Western Pacific Regional Fishery Management Council, 2005a). In 2004 the average price per pound (whole weight) for shark meat was \$0.17, down from \$0.32 in 2003 (Western Pacific Regional Fishery Management Council, 2005a).

Table 2 includes statistics from observer data on the proportion of caught sharks that are alive vs. dead when hauled to the vessel and the condition of discarded sharks in Hawaii-based longline swordfish sets for the period that these data have been collected from 2004-2006, during which time there has been 100% observer coverage. Table 3 provides the same statistics for the Hawaii-based longline tuna fishery, with information on the condition of sharks when hauled to the vessel starting in 2003. Over 89% of sharks caught in swordfish gear and over 93% of sharks caught in tuna gear are alive when the gear is retrieved. In swordfish gear, < 0.82% of sharks that are hauled to the vessel alive are discarded dead, while in tuna gear < 4.3% of sharks hauled alive are discarded dead. Hawaii-based longline crew have not been killing a large proportion of sharks caught alive before discarding them. However, information on the types of injuries of discarded sharks is not available, which might provide an indication of their post release survival prospects.

Table 1 Number caught and disposition of sharks in Hawaii pelagic longline fisheries from logbook data, 1994-1999, 2004 (Ito and Machado, 1999; U.S. National Marine Fisheries Service, 2001; Western Pacific Regional Fishery Management Council, 2005a).

Year	Number sharks caught	Number sharks discarded	Number sharks only fins retained	Number whole sharks retained	Percent sharks retained (any part of individual shark is retained)	Percent sharks finned
1994	114,656	98,119	15,374	1,163	14.4	13.4
1995	101,292	67,760	32,842	690	33.1	32.4
1996	100,992	57,254	43,109	629	43.3	42.7
1997	85,838	36,496	48,552	790	57.5	56.6
1998	99,919	39,062	60,083	774	60.9	60.1
1999	87,576	29,308	57,286	982	66.5	65.4
2004	74,917	71,857	0	3,060	4.1	0

Table 2. Shark capture statistics from onboard observers for the Hawaii-based longline swordfish fishery, 1994-2006 (National Marine Fisheries Service Observer Program unpublished data).

Year a	No. Caught Sharks	CPUE (No. Sharks Per 1000 Hooks)	Condition When Hauled to Vessel b			Retained Fins Only		Retained Carcass Plus Other Parts		Discarded Alive		Discarded Dead		Discarded Unknown Condition		No. Hauled Alive and Discard Dead	% Hauled Alive and Discard Dead
			No. Alive	% Alive	No. Dead	No.	%	No.	%	No.	%	No.	%	No.	%		
1994	3738	19.9		Not Known		206	5.5	29	0.8	2472	66.1	410	11.0	621	16.6	Not Known	
1995	3601	28.7		Not Known		854	23.7	15	0.4	821	22.8	1283	35.6	628	17.4	Not Known	
1996	4100	19.9		Not Known		1675	40.9	18	0.4	1979	48.3	80	2.0	348	8.5	Not Known	
1997	6338	31.6		Not Known		4067	64.2	7	0.1	1613	25.4	295	4.7	356	5.6	Not Known	
1998	3501	24.6		Not Known		1558	44.5	14	0.4	1597	45.6	118	3.4	214	6.1	Not Known	
1999	1946	14.7		Not Known		975	50.1	23	1.2	699	35.9	49	2.5	200	10.3	Not Known	
2000	3098	13.1		Not Known		710	22.9	13	0.4	1785	57.6	336	10.8	254	8.2	Not Known	
2001	482	11.8		Not Known		14	2.9	0	0.0	446	92.5	15	3.1	7	1.5	Not Known	
2002	300	24.8		Not Known		28	9.3	0	0.0	262	87.3	10	3.3	0	0.0	Not Known	
2004	1771	14.8	1586	89.6	185	0	0.0	8	0.5	1570	88.7	182	10.3	11	0.6	9	0.57
2005	17282	12.8	16112	93.2	1170	1	0.0	163	0.9	15907	92.0	1210	7.0	1	0.0	122	0.76
2006	11299	16.7	10675	94.5	624	0	0.0	63	0.56	10548	93.35	688	6.09	0	0.0	88	0.82

^a There were no swordfish sets in 2003.

^b Data on condition of sharks when hauled to the vessel began to be collected by onboard observers in 2004 for the swordfish fishery.

Table 3. Shark capture statistics from onboard observers for the Hawaii-based longline tuna fishery, 1994-2006 (National Marine Fisheries Service Observer Program unpublished data).

Year	No. Caught Sharks	No. Observed Hooks ^a	CPUE (No. Sharks Per 1000 Hooks)	Condition When Hauled to Vessel			Retained Fins Only		Retained Carcass Plus Other Parts		Discarded Alive		Discarded Dead		Discarded Unknown Condition		No. Sharks Hauled Alive and Discard Dead	% of Sharks Hauled Alive and Discard Dead
				No. Alive	% Alive	No. Dead	No.	%	No.	%	No.	%	No.	%	No.	%		
1994	2338	337548	6.9	Not Known			756	32.3	53	2.3	1214	51.9	119	5.1	196	8.4	Not Known	
1995	3103	492110	6.3	Not Known			1381	44.5	76	2.4	1275	41.1	143	4.6	228	7.3	Not Known	
1996	3596	543209	6.6	Not Known			2222	61.8	59	1.6	576	16.0	98	2.7	641	17.8	Not Known	
1997	1700	376528	4.5	Not Known			1379	81.1	23	1.4	245	14.4	34	2.0	19	1.1	Not Known	
1998	3950	625667	6.3	Not Known			2813	71.2	39	1.0	808	20.5	226	5.7	64	1.6	Not Known	
1999	1908	553319	3.4	Not Known			1446	75.8	57	3.0	313	16.4	36	1.9	56	2.9	Not Known	
2000	17714	2096419	8.4	Not Known			141	0.8	733	4.1	14597	82.4	2034	11.5	209	1.2	Not Known	
2001	17302	5072839	3.4	Not Known			473	2.7	484	2.8	14338	82.9	1691	9.8	316	1.8	Not Known	
2002	11100	6683510	1.7	Not Known			2751	24.8	278	2.5	6200	55.9	1340	12.1	531	4.8	Not Known	
2003	21649	6551314	3.3	12940	95.9	554	8	0.0	416	1.9	19310	89.2	1729	8.0	166	0.8	552	4.3
2004	26273	7937327	3.3	24751	94.2	1521	6	0.0	452	1.7	24071	91.6	1631	6.2	113	0.4	342	2.6
2005	23980	9324984	2.6	22928	95.6	1052	2	0.0	434	1.8	22438	93.6	1100	4.6	6	0.0	176	0.8
2006 ^b	14735	6732291	2.2	13767	93.4	968	2	0.0	305	2.1	13454	91.3	971	6.6	2	0.0	94	0.7

^a From 1994-1998 a substantial proportion (19.6%) of the observed hooks in sets targeting tuna were set shallow primarily to target yellowfin tuna, where there were fewer than 8 hooks in a basket, vs. sets targeting bigeye tuna, where gear is set deeper and baskets usually contain about 15 hooks. This dropped to 2.6% of hooks in baskets of < 8 hooks for the period 1999-2001, and 0% after 2001. This may explain the relatively high shark CPUE for the period 1994-1998.

^b 2006 data are through 1 December.