WPRFMC Pelagics Reports:

THE INFLUENCE OF INCIDENTAL CATCH AND PROTECTED SPECIES INTERACTIONS ON THE MANAGEMENT OF THE HAWAII-BASED LONGLINE FISHERY

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Abstract

The Hawaii-based pelagic longline fishery is the largest and most valuable domestic commercial fishery in the US Western Pacific Region. The fishery targets primarily swordfish (*Xiphias gladius*), yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*). Longline landings in 1995 amounted to a total of 22.5 million lb of fish worth 42.2 million dollars. Under the provisions of the Magnuson-Stevens Act, the fishery is managed through the Western Pacific Fishery Council's Pelagics Fisheries Management Plan (PFMP). However, the PFMP is not the only article of regulation that has an impact on the management of this fishery. Three other Acts of Congress (Endangered Species Act, Marine Mammal Protection Act, Migratory Bird Treaty Act) have already influenced or have the potential to influence the longline fishery through the interaction with protected species of birds, seals and turtles.

Longline vessels are proscribed from fishing within 50 nautical miles of the mostly uninhabited Northwestern Hawaiian Islands to prevent interactions with the critically endangered monk seals, which have a population of around 1,000 animals. Longline fishermen are also compelled to carry National Marine Fisheries Service observers on fishing trips to record the number of interaction with turtles. Hooking or tangling of turtles in longlines is computed from observer records and should not exceed species maxima thought to be supportable by turtle populations. Populations of albatross nest on the Northwestern Hawaiian Islands. They are vulnerable to longline gear and may become hooked or tangled when they dive on baited hooks. There is no specific legislation regulating this form of interaction and the US Fish and Wildlife Service is hoping that voluntary adoption by longliners of techniques to mitigate bird mortality will reduce the problem. However, if this fails then it is very likely that the Fish and Wildlife Service will advocate some legislated form of compliance.

A substantial fraction of the incidental catch of non-target fish is the blue shark, *Prionace glauca*, of which about 25 percent is finned and the carcasses discarded. This practice has recently attracted criticism and calls for a ban on finning, and unfounded speculation on the overfishing of Pacific blue shark populations from several conservation groups in the USA. More information is required on species interactions and incidental catch to minimize their impacts on the longline fishery, but this is constrained by the present National Marine Fisheries Service Observer Program which has been limited to about a five percent coverage of trips by Hawaii longliners.

Introduction

The American insular Pacific possessions stretch in a huge arc across the northern tropical Pacific, from the western Micronesian island territories of Guam and the Northern Marianas, to the State of Hawaii, and south to American Samoa in the center of Polynesia and includes the atolls of Jarvis Island, Howland & Baker Islands, Palmyra & Kingman Reef, Johnson Island and Wake Island. Although the land area of the American insular Pacific is limited, the marine Exclusive Economic Zones (EEZ from 3-200 nautical miles offshore) surrounding these islands totals about 1.5 million nmi^2 and represents about half of the total EEZ waters under US jurisdiction. In 1976, the US established jurisdiction over fisheries in federal waters through the Magnuson Fishery Conservation and Management Act, which created eight quasi-federal regional councils to oversee fisheries in their respective areas. Under the Magnuson Act, the Western

Pacific Council is the policy making organization for the management of fisheries in the EEZs of the American insular possessions in the tropical Western Pacific.

Table 1. Volume and value of finfish landings from EEZ waters in the Western Pacific Region, 1995

State/territory	Pelagic		Demersal		Total	
	Volume (lb x 10^3)	Value ($ x 10^3)	Volume (lb x 10^3)	Value ($ x 10^3)	Volume (lb x 10^3)	Value ($ x 10^3)
American Samoa	355.7	401.2	30.1	56.3	385.8	457.5
Guam	791.2	537.9	108.7	357.8	899.9	895.7
Hawaii	29,710.0	52,010.0	832.0	2,579.0	30,542.0	54,589.0
Mariana Is	159.5	287.5	30.5	103.0	190.0	390.5
Total	31,016.4	53,236.6	1,001.3	3,096.1	32,017.7	56,332.7

Commercial finfish fisheries in the EEZ waters of Western Pacific Region land about 32 million pounds of fish worth an estimated 56 million dollars (Table 1). Most of the landings (89 %) are from Hawaiian waters and most of this volume (97%) is from pelagic fisheries, principally from longline fishing (Table 2). The principal framework for managing Hawaii's pelagic fisheries is the Pelagic Fisheries Management Plan, first promulgated in 1987 and amended seven times over the last 10 years in response to different management issues. The principal management regulations in the Hawaii-based longline fishery is a limited entry program and a ban on longline fishing within 50 to 75 n.mi of the Main Hawaiian Islands (MHI) and 50 n.mi. of the Northwestern Hawaiian Islands (NWHI). The reason for the ban around the MHI was due to interaction problems with other commercial pelagic fishermen and recreational and charter boat fishermen. The ban around the NWHI was due to interaction problems with endangered species living in this archipelago. Species interaction problems and other by-catch issues are now among the main management issues for the Hawaii-based longline fishery and are the subject of this presentation.

Table 2. Volume and value of finfish landings from EEZ waters in Hawaii, 1995

Fishery	Volume (lbs x 10^3)	Value ($ x 10^3)
Pole & line	1,340.0	1,610.0
Pelagic handline	2,140.0	3,580.0
Longline	22,550.0	42,200.0
Trolling	860.0	4,200.0
Demersal handline	832.0	2,579.0
Total	27,722.0	54,169.0

The Hawaii-based longline fishery

A summary of the history of the Hawaii longline fishery is given by Boggs & Iti (1993). Longline fishing in Hawaii had been conducted for many decades prior to the expansion of the fishery in the late 1980s. Hawaii longline vessels evolved from wooden pole-and-line tuna sampans , employing longlines made from rope and fishing mainly within 2 - 20 nmi of the coast. By the 1930s the longline fishery was second only to the pole-and-line fishery in landed volume of fish, and accounted for most of the yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*) and albacore (*Thunnus alalunga*) landed in Hawaii. The fishery peaked in the mid 1950s with landings exceeding 2000 t and then declined steadily through lack of investment in boats and gear until the late 1980s.

The revitalization of the longline fishery was due to the development of local markets and export markets for fresh tuna non the US mainland and in Japan.

Participation in the longline fishery increased from 37 vessels in 1987 to 75 in 1989, and then doubled again to 156 vessels in 1991 (Figure 1). Further entry to the longline fishery was halted through a moratorium in 1991 under Amendment 3 to the PFMP. Landings increased rapidly and by 1991 had reached 9,000 t, of which 4,400 t was broadbill swordfish (*Xiphias gladius*). The new entrants in the longline fishery were mostly steel hulled vessels up to 33 m in length and their operators were former participants in the U.S east coast tuna and swordfish fisheries. These newer vessels in the fishery were also characterized by a greater reliance on sophisticated electronic gear for navigation, marking deployed longline gear and finding fish. The revitalized fleet also adopted more modern longline gear, using continuous nylon monofilament main lines stored on spools, with snap-on monofilament branch lines .

Table 3. Catch composition of Hawaii longline fishery, by volume and value, computed from mean of 1995 and 1996 data

Species	lbs x 10^3	$ x 10^3	% lbs	% $
Swordfish	5,935	11,053.3	25.99	29.57
Yellowfin	1,880	4,023.3	8.23	10.76
Bigeye	4,735	13,246.7	20.74	35.44
Albacore	2,225	2,406.7	9.74	6.44
Sharks	3,980	2,116.7	17.43	5.66
Billfish	2,225	1,953.3	9.74	5.23
Other	1,855	2,580.0	8.12	6.90
Total	22,835	37,380.0	100	100

Monofilament longline gear is more flexible in configuration and can be used to target various depths more easily than traditional rope longlines. Both daytime and nighttime fishing are practiced using the same monofilament system. In targeting deep swimming bigeye tuna, 12-25 hooks are deployed between floats with lots of sag to reach as deep as 400 m. Only a few hooks are deployed between floats when targeting swordfish and the line is kept relatively taut so that it stays within the first 30-90 m of the water column. Night fishing employs luminescent light sticks which attract swordfish and bigeye tuna, or their prey. The longlines are baited with large imported squid (Illex spp).

Fishing for bigeye tuna requires a line thrower to deploy sufficient line to achieve a sufficiently deep curve or sag in the longline. Many of the new entrants into the longline fishery did not invest in line throwers. These vessels fished shallow even when targeting tuna which led to concern about interactions between the longliners and small handline and troll vessels, as well as recreational fishermen and charter boat operators in the early 1990s. Over the same period, the range of the longline fishery expanded, with some vessel fishing up to 1000 nmi from Hawaii and over half of the longline sets made at distances greater than 50 nmi away from the main Hawaiian Islands (MHI). In early 1991 longline fishing was prohibited within 50 nmi of the Northwestern Hawaiian Islands to prevent interactions between endangered populations of Hawaiin monk seals (see below).

A further longline 50-75 nmi exclusion zone was established in mid 1991 around the Main Hawaiian Islands (MHI) through Amendment 5 of the PFMP. The closure around the MHI was in response to the concern of small boat handline fishermen, charter boat operators and recreational fishermen who felt that the longline boats were depleting tuna stocks around the MHI.. Prior to this exclusion zone an informal agreement was negotiated between the small boat fishermen and the longline fishermen where longliners would remain at least 20 nmi from the coast and 10 nmi from fish aggregating devices (FADs). Some vessels, especially subsequent entrants to the fishery did not comply with the agreement and the Council was forced to establish the exclusion zone around the MHI. Enforcement of the two longline exclusion zones around the MHI and the NWHI is accomplished through the Councils mandatory Vessel Monitoring System (VMS) policy, where longline boats must be equipped with a satellite transponder that provides 'real-time' position updates and the track of the vessel movements.

Longline species interactions

Monk seals

The monk seal (*Monachus schauinslandi*) is a tropical seal once widespread in the Hawaiian Islands but now about 1200 1450 seals are confined mainly to the Northwest Hawaiian Islands (between Nihoa Island to Kure Atoll) with a few seals in the Main Hawaiian Islands. The species was designated as depleted under the Marine Mammal Protection Act in 1976, following a 50 % decline in beach counts from the late 1950s and mid 1970s. This species was also listed as endangered under the Endangered Species Act in 1976. Critical habitat for monk seals was designated in 1988 from beaches to a depth of 20 fathoms (37 m) around breeding islands and at Maro Reef. Evidence of interactions between seals and the longline fishery began to accumulate in 1990, including three hooked seals and 13 unusual seal wounds thought to have resulted from interactions. In October 1991, NMFS established a permanent Protected Species Zone extending 50 nautical miles around the NWHI and the corridors between the islands. Subsequent shore-based observations of seals suggest that interactions decreased substantially after establishment of the Protected Species Zone, although they may still be occurring; at French Frigate Shoals in 1994, a female was observed with a hook in her mouth, and the hook appeared to be from the swordfish fishery

Seabirds

Three species of albatross are distributed in the North Pacific, the Laysan albatross (*Diomedea immutabilis*), Black footed albatross (*Diomedea nigripes*) and the Short-tailed albatross (*Diomedea albatrus*). Albatross feathers were the prefered feather of the milinery trade in the late 19th and early 20th century and feather hunters slaughtered albatross in their millions. Although both Laysan and Black Footed suffered great losses, and were extirpated from many islands, Short-tailed albatrosses were most affected. It is estimated that between 1887 and 1903, more than five million of this species were taken. Egg collecting further accelerated their decline and by the 1940s this species was thought to be extinct until a small nesting colony was discovered on Toroshima Island in the 1950s. The global population of short-tailed albatross now numbers around 600 birds.

The NWHI and particularly Midway Island are the main nesting sites for the Laysan albatross and Black footed albatross. As many as 660,000 pairs of Laysan albatross and 60,000 pairs of Blackfoot albatross nest each year in the NWHI. Three individuals

of the short-tailed albatross have been observed nesting at Midway, but have either not made contact and mated or have laid infertile eggs. Laysan and Black footed Albatross commence nesting in the NWHI in late October and early November, with eggs present from November to February. Incubation lasts aabout 65 days. Chicks are present from the end of January through July with fledging beginign about mid-June. During the breeding season, the albatross spend most of their time at sea, and each bird is on land for a total of only two months

In the early 1990s, NMFS observers deployed mainly to document turtle-longline interactions reported that albatross were diving on longlines as they were deployed and in some instances being hooked and drowning. Initial calculations based on only a few observations suggested that as many as 26,000 birds were killed in a four year period. Later more accurate data suggested a smaller gross mortality (Table 3), but still at a level to generate concern, especially for the less numerous Blackfoot albatross. This bird is larger and more aggressive than the Laysan albatorss and will dive more readily on longline baits. Consequently, hooking rates and mortalities of this bird are similar to the more common Laysan albatross.

No observations have been recorded of Short-tailed albatross being hooked and drowned in the Hawaii-based longline fishery. This species has been known to interact, however, with demersal longliners that harvest groundfish in the waters off Alaska, diving on baited hooks. All three albatross species are protected under the Migratory Bird Treaty Act, but only the Short-tailed albatross is classsed as an endangered species. In the Alaskan fishery there is an annual permisable take of two birds under the provisions of the Endangered Species Act, subject to review if this take is exceeded. The precarious state of the Short-tail population means, however, that even if only a few birds nest in the NWHI, then the species is at a disproportionately higher risk from the Hawaii-based longline fishery than the more common Laysan and Blackfooted albatrosses.

Table 4. Estimated annual fishery induced mortality of albatross in the Hawaii-bas longline fishery

	1994	1995	1996	
Laysan Albatross	1,020	1,942	508	
95% confidence interval.	381 - 1659	0 - 4377	334 - 817	
Blackfoot Albatross	2,135	1,796	991	
95% confidence interval.	1164 - 3105	298 - 3294	718 - 1411	
Total	3,155	3,738	1,499	

Experience from longline fishing in Australia and Japan has shown that a number of different mitigation techniques can markedly reduce the interaction of seabirds with longlines as they are being deployed. Night setting completely when the birds are inactive is the simplest way to prevent interactions. Where night setting is mot desirable, bait can be thawed and the swim bladders puntured to ensure rapid sinking, and devices such as streamers, floats and broomsticks can be towed behind the vessel to discourage birds diving on baited hooks as the longline is deployed. Some fishermen also dye their bait blue to make it more cryptic when it enters the water

The Council and the USFWS have been attempting to have fishermen voluntarily adopt these measures without the need to introduce manadatory compliance. If this does not

work, however, then regulation may be the only available option. Whilst the mortalities of sea birds is unintentional, it is still a crime in contravention of the Migratory Birds Treaty Act and this form of mortality should be eliminated or markedly reduced. At present the law is only enforced within the 3 mile territorial boundary of the United States but pending revisions to the Act suggest that it might be applied to all US citizens beyond the 3 mile limit and which will include fishing vessels operating in the Hawaii EEZ.

Whether or not this is enforceable is clearly open to question but the revision of the Act will increase pressure for the longline fishery to reduce the rate of albatross kills. However use of mitigation techniques have been legislated in the Alaskan demersal longline through the regulatory process of the North Pacific Fishery Management Council, driven in large part by longline fishermen in response to exceeding the prescribed fishery mortality of short-tail albatross in this fishery and the threat of closure of the fishery, Further, the United States is a member of the Commission on the Conservation of Antarctic Living Marine Resources (CCALMR) which has also adopted similar mandatory bird mortality mitigation requirement for vessels fishing in the Southern Ocean. This has led to increased demand from conservation organizations that the Hawaii-based longline fishery be also similarly regulated.

Turtles

The NMFS observer program on the Hawaii-based longliners was established in response to the interaction of turtles and longliners. Turtles encountering longlines may take the baited hook and become snagged and drown or simply tangled in the line. Two species, Greens and Hawksbills, regularly nest in the Hawaiian Islands, although the latter species is very rare, and there has been one record of nesting for the Olive Ridley turtle. A summary of turtle-longline interactions is given in Tables 4 & 5. All turtles that occur in Hawaiian waters are classed as either threatened or endangered under the Endangered Species Act which means that like the Short-tailed albatross, there is a defined limit of the number of turtles that may be killed by the longliners without endangering their populations. However, this fishery induced mortality or take may be exceed in certain years.

Table 5. Summary of information on turtles observed in the Hawaiian longline fishery, 1994-1995

Common name	Scientific name	Endangered Species Act status	Allowable take take	Allowable kills	Nests in Hawaiian Islands
Loggerhead	*Caretta caretta*	Threatened	305	46	No
Leatherback	*Dermochelys coriacea*	Endangered	271	41	No
Olive Ridley	*Chelonia mydas*	Threatened	152	23	Yes, single record
Green turtle	*Lepidochelys olivacea*	Threatened	119	18	Yes
Hawksbill	*Eretmochelys imbricata*	Endangered	2	1	Yes

Most turtles captured on longlines are still alive when brought on deck, however, evidence increasingly suggests that a large percentage of released turtles in the

longline fishery have received fatal injuries and will die within a short time. Upon retrieval of turtles captured through

Table 6. Estimated turtle take in the Hawaii longline fishery, 1994-1996

Species	Allowable take		1994			1995			
		95% cl	Estimated take	95% cl	95% cl	Estimated take	95% cl	95% cl	E
Loggerhead	305	212	301	447	225	339	476	237	
Olive Ridley	152	60	120	179	66	124	184	68	
Leatherback	271	87	132	202	103	156	239	104	
Green	119	15	15	81	18	41	96	18	
Hawksbill	2		0			0			

Table 7. Estimated turtle kill in the Hawaii longline fishery, 1994-1996

Species	Allowable kill	1994			1995				
		95% cl	Estimated kill	95% cl	95% cl	Estimated kill	95% cl	95% cl	E
Loggerhead	46	36	51	75	38	57	80	40	
Olive Ridley	41	16	32	47	18	33	49	18	
Leatherback	23	6	9	14	7	11	16	7	
Green	18	0	1	2	0	1	2	0	
Hawksbill	1		0			0			

an interaction, fishing line has often been reported extending well down the esophagus with no hook visible. The usual practice is to cut the line as close to the mouth as possible an immediately release the turtles overboard. Although active on release the fate of these turtles is unknown with the hook embedded in the gastrointestinal tract. Swallowing of the baited hook into the esophagus or stomach is the most probable manner of capture in the longline fishery. Studies have shown (reference) that swallowing is facilitated by a powerful ‘hydraulic pump’. When the esophagus relaxes, sea water along with the food is propelled down the esophagus. Once there, it is retained by esophageal papillae that are present in all species of sea turtles. Several forceful pumping cycles move the food along the esophagus into the stomach. Following each ingestion of seawater and food, a strong contraction of the esophagus expels the excess water. The result is the separation of food from seawater. In the case of baited hooks, the ‘food’ will usually be sucked in well past the horny structures of the mouth before the hook sticks itself in the soft tissues of the GI tract.

Perforation of the soft tissues of the turtles GI tract resulting from the hook’s penetration can be expected to lead to peritonitis and septicaemia. Other injuries are likely to result from the struggles of hooked turtles which may lead to invagination or telescoping of one segment of the GI tract into the other. Damage to the GI may also result during line retrieval when hooked turtle is dragged through the water column and hoisted aboard, leading to further possible internal injury and hemorrhage. Unlike seabirds there is little that can be done to physically mitigate interactions since these may happen anywhere along the length of the longline. However, there is a need to estimate post-hooking mortality in for species captured in this fishery and NMFS Honolulu Laboratory is

currently marking hooked and released turtles with satellite archival tags in an effort to estimate their survival.

During 1995 and 1996 the take of Loggerhead turtles in the longline fishery exceed the allowable maximum prescribed under Section 7 of the Endangered Species Act, while kill levels were exceeded in all three years. This has triggered a Section 7 consultation under the ESA which will determine whether the allowable take and kill levels need to be adjusted for this species. Both Loggerhead and Olive Ridley populations are thought to be increasing in size as a result of protecting nesting populations, while Leatherback and Hawksbill turtles are believed to be in decline through nesting habitat loss, harvesting of eggs and capture of turtles for food.

Sharks

There is no directed shark fishery in Hawaii, but longliners targeting tunas and swordfish catch a substantial number of sharks. The shark incidental catch is a major component of the overall loingline catch and may amount to between 100,000 and 150,000 fish per year. Statistics on shark catches suggest that this is formed mainly from one species, the blue shark (*Prionaca glauca*) (Table 6). Most shark is caught by swordfish longliners. However, more of the shark catch is retained by the vessels targeting tunas. Fishermen keep very few carcasses taking mainly fins, which when dried, are an additional source of income for fishermen.

This practice has generated a great deal of concern from conservation groups, who believe (erroneously) that the sharks are finned alive and discarded to die in the sea. There is also a belief that blue shark, like some coastal shark populations are in decline, which again is probably erroneous. The total tonnage of blue sharks taken in the Hawaiian fishery, when inflated from fin weight to whole round weight amounts to between 1500-2000 tonnes annually, while pelagic longline fishing throughout the Pacific takes annually in the region of 150,000 tonnes of blue shark. Blue sharks are the most productive of the large sharks with relatively fast growth rates and high fecundity relative to other sharks, and are thus thought to be more resilient to fishing than other shark stocks.

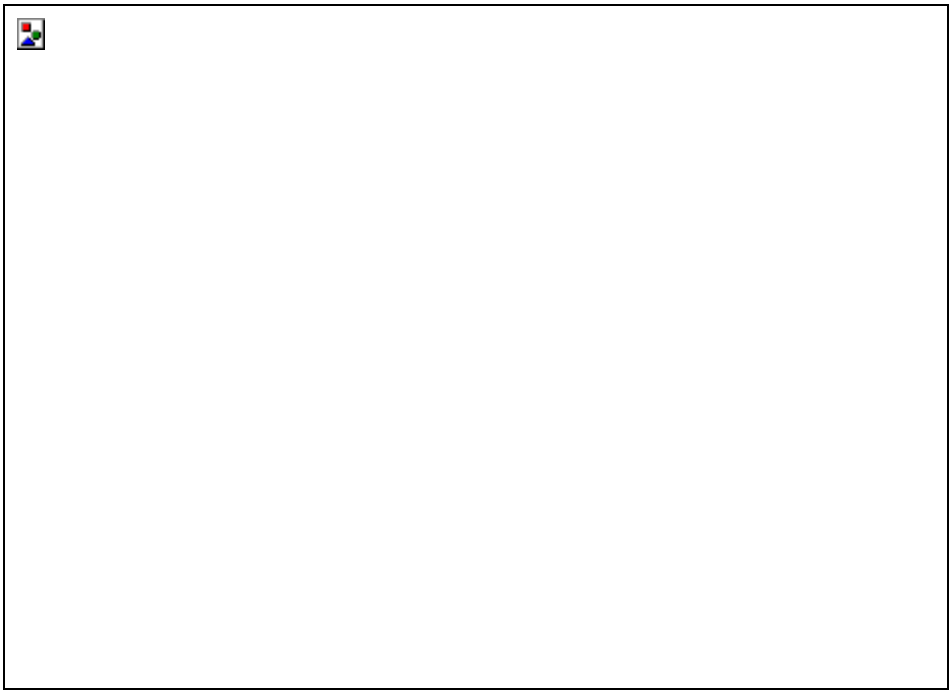

Table 8. Summary of shark catches in the Hawaii longline fishery

Year	No of sharks captured	Percent blue shark	Percent retained[1]
1991	71,183	92.0	3.2
1992	94,897	94.1	3.8
1993	154,608	97.2	10.8
1994	114,656	96.1	14.4
1995	101,773	93.7	33.2
1996	101,017	95.3	43.3

1. Retention in this case refers to fins , only about 0.5% of sharks are landed whole

Discussion

Following the expansion of the Hawaii-based longline fishery there have been two major management problems facing fisheries managers in the Western Pacific Council. The first is the problems of interactions between the longliners and the smaller commercial pelagic fishing vessels (handliners and trollers) and recreational and sports fishermen targeting pelagic fishes. The Councils repsonse to this problem was the creation of a 50-75 nmi longline exclusion zone around the MHI, the implementation of a limited entry scheme for the longline fishery and the mandatory deployment of a vessel monitoring system to police the exclusion zone. Second, has been the interaction between longline vessels and protected species, which has been addressed by a 50 nmi exclusion zone around the NWHI and the deployment of observers on fishing vessels to monitor initially turtle interaction but more latterly seabird interactions are also being recorded in more detail.

Unlike other fisheries in Hawaii such as those on bottomfish and crustacean stocks, resource limitation of the primary target species does not appear to be a problem for the pelagic fisheries. Clearly more information is required on the level of exchange between stocks in Hawaii waters and elsewhere in the Pacific and on factors such as growth, mortality and recruitment, however, stock limitation is not considered to be a serious problem. The main concern for management of the longline fishery are the interactions of protected and endangered species and the issue of shark finning. In essence other legislation such as the Marine Mammal Protection Act, the Endangered Species Act and the Highly Migratory Bird Treaty Act have had and will continue to have a considerable influence on the Hawaii longline fishery.

The issue of blue shark finning is generated by concern over the levels of catch and finning and discarding of live shark, allied to the waste of shark carcases. There is certainly a need to improve information on the size of the shark resource in the Pacific, but like tuna this is a highly migratory species so the influence of localized regulation is debatable. Further, the Hawaiian landings are only a fraction of the total Pacific landings and there appears to be no indication of declines in CPUE in the longline fishery, indeed the reverse is true. Live finning has not, been reported from the Hawaii fishery by observers and is probably an unlikely occurrence. Blue shark flesh is palatable if handled properly but the high urea content makes this an uneconomic proposition and there is a limited market for shark flesh in Hawaii. Other parts of the shark might be removed such as skins for leather and cartilage for medical purposes, but discarding of carcases and keeping only fins are will continue unless finning is prohibited.

The main challenges for management of the longline fishery will be to:

1. ensure the survival and continued productivity of this fishery

2. minimizing the problems with protected species interactions

3. countering misinformation about incidental shark catches and live finning while improving current knowledge of the resource base and productivity

Bullet points

1. Protected species interactions and incidental catch important management issue in Hawaii longline fishery
2. Protected species interactions led to implementation of observer program on longliners to estimate turtle take/kill and to 50 nmi exclusion zone around NWHI to protect Monk seals. Seal problem solved. Other marine mammals not a serious issue, the odd dolphin caught, but dolphins are also a nuisance from stripping bait from longlines.
3. Longline incidental catches of billfish such as marlin were among the reasons for 50/75 n.mi lonmgline exclusion zone around MHI, due to pressure from recreational sports fishermen and charter boat operators.
5. Hooking and killing of Laysan and Blackfoot albatross in longline fishery is a significant problem, birds protected under Migratory Bird Treaty Act. Blackfoot albatross at most risk, but need a proper study to assess fishery impact. Hooking of golden goony would be a disaster. Can however mitigate bird interactions through various methods.
6. Turtle take and kills not thought to have major impact on populations, Interactions rare and kills rare. Mitigation not likely but more information on distribution of turtles might lead to avoidance by longline vessels. Plus accumulation of data on interactions and more information on post-hooking mortality may lead to more precise impact of fishery and estimates of kill rate.
7. Blue shark populations not thought to be at risk but NGOs and public confuse ocean sharks with depleted coastal sharks. Issue in longline fishery is also one of perceived waste of carcasses after fins removed. Permit holders would not be averse to banning finning but fins an additional source of revenue for crews.
8. These ‘bycatch’ issues are currently major priority for management of Hawaii longline fishery, the fishery is not resource limited or we dont know that it is. However managed under precautionary principle. Limited entry program, vessel size limitation, closed area to prevent fishery interactions. Now try to reduce bycatch problems.