

HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM REPORT ON CHANGES TO ROUTINE MANAGEMENT MEASURES FOR 2009-2010 SEASONS

The common thresher shark is one of 13 highly migratory species (HMS) actively managed under the Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species (HMS FMP). The landings of thresher shark are monitored under a precautionary annual harvest guideline currently set at 340 metric tons (mt). This precautionary management approach reflects, among other things, the low fecundity and productivity of thresher sharks coupled with their low resiliency to overexploitation.

During the early spring through summer months, thresher sharks migrate to the waters of the Southern California Bight to feed on concentrations of bait fish and for pregnant females to pup. Commercial and recreational fisheries targeted this annual aggregation and the resulting catch of both pregnant and recently pupped animals contributed to the overexploitation of the population. Due to this overexploitation, the commercial fishery was regulated to mitigate the targeting of mother and pups by establishing a time/area closure. At that time, the recreational fishery, which is primarily a private boat fishery, was believed to be a relatively minor component of the total thresher shark landings and comparable time/area regulations were not imposed. Current California state recreational regulations allow the harvest of two HMS sharks per person per day with no season, size, or area restrictions.

In recent years, the recreational fishery for thresher sharks has experienced a significant increase in effort and landings, including both mothers and pups. Additionally, a second window of opportunity for recreational catch and effort on thresher sharks has surfaced during the fall, and raises concerns in regards to the cumulative impacts on the species when added to the existing spring fishery.

Although only limited data are available on the total recreational fishing mortality, it is thought to be substantial and perhaps comparable to catch in commercial fisheries, which was approximately 100 mt in 2006. In 2007, the total harvest of thresher shark from both commercial and recreational fisheries may have approached or, due to the level of uncertainty in the landings data, may have exceeded, the 340 mt harvest guideline.

Highly Migratory Species Management Team Recommendation

The Highly Migratory Species Management Team (HMSMT) is concerned that existing management measures and regulations may not be adequate to keep the landings of thresher shark under the prescribed harvest guideline and recommends that a suite of potential recreational fishing management measures be developed for Council consideration.

The Southern California Recreational Thresher Shark Fishery

Consideration of Regulatory Changes for 2009-2010 HMS FMP Biennial Management Measures Cycle

HMSMT Supplemental Report
Pacific Fishery Management Council
June 8-14, 2008
Foster City, California

Executive Summary

The Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species (HMS FMP) implements a biennial management cycle to establish or adjust harvest specifications for a 2-year period. The specifications become effective on April 1 of the following year which coincides with the start of the next fishing year. The Pacific Council targets the June, September, and November Council meetings for review and decision making of proposed management cycle changes. At the June 2008 meeting, the Council will consider the need for recreational fishing regulatory changes for the conservation and sustainable management of common thresher sharks as proposed by the HMS Management Team (HMSMT). This supplemental report provides background information on the current status of the southern California recreational thresher shark fishery to help guide Council deliberation on this agenda item.

Background

The common thresher shark (*Alopias vulpinus*), is one of 13 highly migratory species actively managed under the HMS FMP. The landings of thresher shark are monitored under a precautionary annual harvest guideline currently set at 340 metric tons (mt). This precautionary management approach reflects, among other things, the low fecundity and productivity of thresher sharks coupled with their low resiliency to overexploitation. The main commercial fishery harvesting thresher shark on the west coast is the swordfish large mesh drift gillnet fishery (DGN). This fishery has been heavily regulated since the early 1980s due to bycatch and protected species concerns, as well as the over-exploitation of thresher sharks. The past commercial catch history depressed the thresher shark population status to a critically low level necessitating establishment of conservation and management measures (Hanan et al., 1993; Smith and Aseltine-Neilson, 2001). Based in part on the apparent success of these measures, the thresher shark landings were substantially reduced (Figure 1) and the population now appears to be in a rebounding phase.

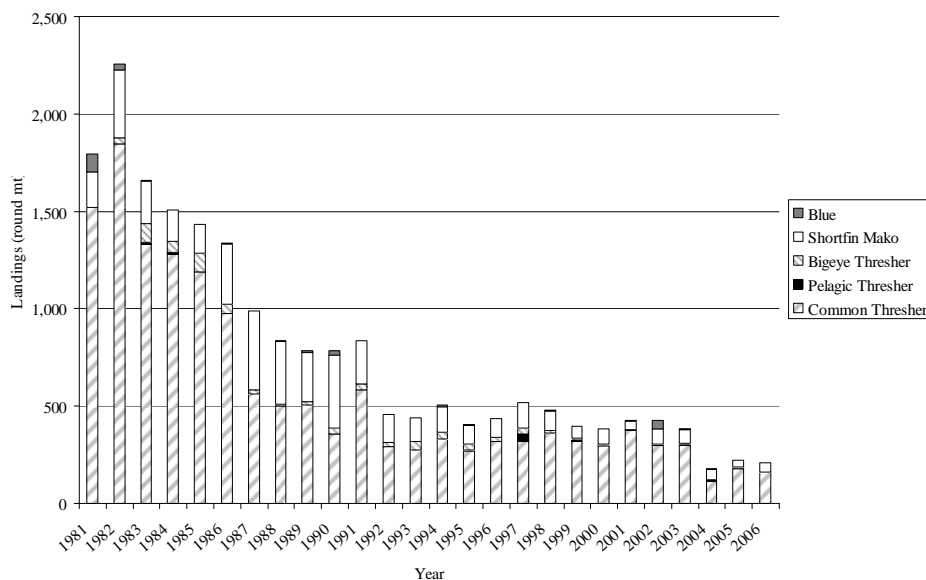


Figure 1. West Coast landings of HMS sharks, 1981-2007. (PFMC SAFE, 2007).

During the early spring through summer months, thresher sharks migrate to the waters of the Southern California Bight (SCB) to feed on concentrations of bait fish and for pregnant females to pup (Smith and Aseltine-Neilson, 2001; DePriest, 2004). Commercial and recreational fisheries targeted this annual aggregation and the resulting catch of both pregnant and recently pupped animals contributed to the overexploitation of the population. Due to this overexploitation, the commercial fishery was regulated to mitigate the targeting of mother and pups by establishing a time/area closure. At that time, the SCB recreational fishery, which is primarily a private boat fishery, was believed to be a relatively very minor component of the total thresher shark landings and comparable time/area regulations were not imposed. The California Commercial Passenger Fishing Vessel (CPFV) fleet has a minor history of participation in the recreational thresher shark fishery (Tables 3-4).

Current California state recreational regulations¹ allow the harvest of two HMS sharks in combination (thresher, mako, and blue sharks) per person per day with no season, size, or area restrictions.

In recent years, the SCB recreational fishery for thresher sharks has experienced a significant increase in effort and landings, including harvest of both mothers and pups (Table 1). Additionally, a second window of opportunity for recreational catch and effort on thresher sharks has recently surfaced during the fall period in the SCB (WON, 2007). Historically, fishing effort during this fall period was very minor but the increased effort now raises concerns in regards to the cumulative impacts on the species when added to the existing spring fishery.

Although only limited data are available on the total recreational fishing mortality, it is thought to be substantial and perhaps comparable to catch in commercial fisheries, which was

¹ The state regulation was adopted without change as a management measure under the HMS FMP.

approximately 100 mt in 2006 (PFMC, 2007 SAFE)². In 2007, the total harvest of thresher shark from both commercial and recreational fisheries may have approached or, due to the level of uncertainty in the landings data, may have exceeded, the 340 mt harvest guideline.

Table 1. Estimated Catch (numbers) of Common Thresher Shark by Marine Recreational Anglers in California from January 2005 - December 2007³

	Estimate	PSE*
2005	275	21
2006	635	33
2007	1,544	52

*PSE = percent standard error as calculated by RecFIN query

The primary techniques developed in the SCB recreational thresher shark fishery entail trolling heavy (1-2 lb) baited lures (DePriest, 2004). Since this species uses its elongate upper caudal lobe to stun prey before it is consumed, thresher sharks are typically foul-hooked by the tail and subsequently hauled in backwards during the fight (Sepulveda et al., 2007). Like most pelagic species, the common thresher relies on obligate ram ventilation and thus requires forward momentum to extract oxygen from the water. A pilot study last year estimated approximately 25 percent of the released tail-hooked animals did not survive. The results of the pilot study led to the funding of a larger scale post-release survivorship study which is currently underway. This study is a cooperative effort amongst researchers from the Pflieger Institute of Environmental Research, NMFS Southwest Region, and NMFS Southwest Fisheries Science Center.

Although accurate and comprehensive recreational landings data are lacking for this species, including the level and impact of catch-and-release fishing, direct observations,⁴ fishing tackle sales,⁵ and weigh-station records⁶ all suggest a dramatic expansion of this fishery in recent years. Increased effort can likely be attributed to a series of factors including: the rebuilding of an overexploited population; educational seminars on thresher shark fishing techniques; information sharing on the internet and through popular literature publications; the high cost of fuel making near shore fishing options more attractive; and the possible re-allocation of effort once directed at fisheries that are now restricted (i.e., groundfish).

Because the common thresher shark is well known for its susceptibility to over-exploitation, advocating the practice of catch and release remains a primary conservation tool proposed by managers and recreational groups alike. However, in order for catch-and-release techniques to be an effective management tool, the fate of released sharks must be known.

² Commercial fishermen did not aggressively target thresher sharks in 2006 or 2007 given the low ex-vessel prices being offered (Pers. comm., Jeremiah O'Brien, President, Morro Bay Commercial Fishermen's Association).

³ Recreational Fisheries Information Network (RecFIN) sampler examined catch for all modes of fishing in all marine areas

⁴ Observations made by C. Sepulveda and S. Aalbers during Scipps Institute of Oceanography thresher shark field studies 2000-2004.

⁵ D. Primrose, Owner, Ballyhood International Fishing Lures, Santa Ana, CA. Pers. comm.

⁶ J. White, Manager, Dana Landing Market and Fuel Dock, Mission Bay, CA. Pers. comm.

Thresher Shark Fishing Seminars

With assistance from the NMFS Pacific Coast Recreational Fisheries Coordinator and the United Anglers of Southern California, a series of educational seminars was conducted in the spring of 2008 at three key locations in southern California (Newport, Oceanside, and San Diego). The seminars were intended to increase angler awareness, keep stakeholders abreast of the status of thresher shark conservation and management efforts, and to engage experienced shark anglers on innovative gear modifications and potential techniques to reduce the proportion of tail-hooked sharks. Anglers were given the opportunity to complete a voluntary questionnaire at the seminars. The results are summarized in Table 2.

In general, 60 percent of the anglers surveyed started fishing thresher sharks after 2005 and landed approximately 1-5 sharks per season. Roughly 50% of anglers released 1-5 sharks per season with trolling baited lures identified as the most popular way to target threshers (75 percent). A large percentage of surveyed anglers favored a season limit of 1-2 sharks per season (47 percent).

Table 2. Summary Statistics for a Voluntary Thresher Shark Questionnaire based on approximately 125 angler responses.

What year did you first start fishing for thresher sharks?			
a. < 1980's	b. 1980 – 2000	c. 2000 - 2005	d. 2005 - present
8%	20%	13%	59%
How many thresher sharks do you harvest per year?			
a. 0	b. 1 - 5	c. 6 - 10	d. > 11
39%	58%	3%	
How many thresher sharks do you catch and release per year?			
a. 0	b. 1 - 5	c. 6 - 10	d. > 11
42%	50%	7%	
What is the fishing technique that you typically use for thresher sharks?			
a. Slow-trolling lures 73%	b. Slow-trolling live bait (no lure) 15%		
c. Chumming 12%			
What percentages of the sharks that you catch are tail-hooked?			
a. 0 – 25%	b. 26 – 50%	c. 51 – 75%	d. 76 – 100%
24%	9%	24%	42%
What percentage of thresher sharks do you lose with trailing gear?			
a. 0 – 25%	b. 26 – 50%	c. 51 – 75%	d. 76 – 100%
62%	23%	13%	2%
What would you consider a reasonable limit for common thresher sharks?			
a. Status quo (no change) = 5%	b. 1 shark / person / day = 16%		
c. 1 shark / boat / day = 31%		d. Season limit = 47%	

Table 3. Estimated thresher shark catch (numbers) 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 4. 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

Literature Cited

- DePriest, B. 2004. Thresher Tactics, How to take one without losing your teeth. *Pacific Coast SportFishing*. July: 80-85.
- Hanan, D.A., D.B. Holts, and A.L. Coan Jr. 1993. The California drift gill net fishery for sharks and swordfish during the seasons 1981-82 through 1990-1991. *Cal. Fish and Game Bull.* No. 175. 97p.
- Holts, D.B., A. Juliana, O. Sosa-Nishizaki and N.W. Bartoo. 1998. Pelagic shark fisheries along the west coast of the United States and Baja California, Mexico. *Fish. Res.* 39, 115-125.
- PFMC, 2003. Fishery Management Plan and Environmental Impact Statement for U.S. West Coast Fisheries for Highly Migratory Species. Pacific Fishery Management Council.
- PFMC, SAFE 2007. Status of the U.S. West Coast Fisheries for Highly Migratory Species through 2006. Stock Assessment and Fishery Evaluation, September 2007. Pacific Fishery Management Council.
- Sepulveda, C.A., S.A. Aalbers and C. Heberer. 2007. Tagging Threshers. *Pacific Coast SportFishing*. July: 32-41.
- Smith, S.E. and D. Aseltine-Neilson. 2001. *Thresher shark*. In: W.S. Leet, C.M. Dewees, R. Klingbeil, and E.J. Johnson eds. California's Living Marine Resources: A status report. ANR Publ. SG01-11. Calif. Dep. Fish Game and Univ. Calif. Agric. Nat. Res. pp. 339-341.
- Western Outdoor News. *A Fall Filled with Threshers*. Volume 55, Number 44. November 2, 2007.

Draft 2008 HMS SAFE Report Outline

Main Body

1 Introduction

- 1.1 Goals and Objectives of the Fishery Management Plan
- 1.2 Purpose of the SAFE Report
- 1.3 The Management Cycle
- 1.4 Highly Migratory Species Management Team

2 Description of the Fisheries

- 2.1 Description of West Coast Commercial Fisheries
 - 2.1.1 California
 - 2.1.1.1 Surface Hook-and-Line Fishery for Albacore
 - 2.1.1.2 Coastal Purse Seine Fishery for Yellowfin, Skipjack, and Bluefin Tunas
 - 2.1.1.3 Harpoon Fishery for Swordfish
 - 2.1.1.4 Drift Gillnet Fishery for Swordfish and Thresher Shark
 - 2.1.1.5 High Seas Longline Fishery for Swordfish
 - 2.1.2 Oregon
 - 2.1.2.1 Surface Hook-and-Line Fishery for Albacore
 - 2.1.2.2 Drift Gillnet Fishery for Swordfish and Thresher Shark
 - 2.1.3 Washington
 - 2.1.3.1 Surface Hook-and-Line Fishery for Albacore
- 2.2 Description of West Coast Recreational Fisheries
 - 2.2.1 California
 - 2.2.2 Oregon
 - 2.2.3 Washington
- 2.3 Highly Migratory Species taken in Non-HMS Fisheries
 - 2.3.1 California
 - 2.3.2 Oregon
 - 2.3.3 Washington
- 2.4 Description of Tuna Pen Project in Mexico

3 Regulations Currently in Place

- 3.1 Summary of the HMS FMP Management Measures and Regulations
 - 3.1.1 HMS Commercial Gear
 - 3.1.2 HMS Recreational Gear
 - 3.1.3 Landings and Gear Use Regulations
 - 3.1.4 Incidental Landings
 - 3.1.5 HMS Data Collection
 - 3.1.6 Observer Requirements
 - 3.1.7 Enforcement of Regulations
 - 3.1.8 Changes in State HMS Regulations
- 3.2 Protected Resources Regulations
 - 3.2.1 Drift Gillnet Fishery

- 3.2.2 Shallow-set Longline Fishery
- 3.2.3 Deep-set Tuna Longline Fishery
- 3.3 International Regulatory Aspects of the HMS FMP
 - 3.3.1 The Inter-American Tropical Tuna Commission
 - 3.3.1.1 Summary of IATTC Resolutions with Implications for the HMS FMP
 - 3.3.2 Western and Central Pacific Fishery Commission
 - 3.3.3 International Scientific Committee
 - 3.3.4 The U.S.-Canada Albacore Treaty
 - 3.3.5 Illegal, Unreported and Unregulated Fishing
- 3.4 Bycatch and other monitored species
 - 3.4.1 Finfish
 - 3.4.2 Protected Resources

4 Statistical Summaries of Catch, Revenue, and Effort

- 4.1 Commercial Fisheries
- 4.2 Recreational Fisheries
- 4.3 Information and Sources

5 Updated Status of the Highly Migratory Species Management Unit Species

- 5.1 Control Rules for Management
- 5.2 Recent and Projected Assessment Schedule
- 5.3 Conclusions from 2007 Pacific HMS stock assessments
- 5.3.(X) (List based on 2007 stock assessments)
- 5.4 Links to Information on More Recent Pacific HMS Stock Assessments Through August 2008

6 Research and Data Needs and Monitoring Reports

- 6.1 Research and Data Needs
 - 6.1.1 Stock Status and Distribution
 - 6.1.2 Management Unit Species Catch Data
 - 6.1.3 Survivability of Released Fish
 - 6.1.4 Essential Fish Habitat (EFH)
 - 6.1.5 Interactions with Protected Species and Prohibited Species
 - 6.1.6 Effects of Management Measures
 - 6.1.7 Economic Information
- 6.2 Research Updates
- 6.3 Monitoring Reports

7 References

8 Web Links for HMS Management and Research

List of Tables

- Table 1–1 HMS FMP management unit species.
- Table 2–1 Annual commercial landings (round mt) and number of deliveries for albacore landed in California’s major port complexes by the surface hook-and-line fleet, 2006–2007.
- Table 2–2 Monthly commercial landings (round mt) and ex-vessel revenue for albacore landed in California ports by the surface hook-and-line fleet, 2006–2007.

- Table 2-3 Monthly commercial landings (round mt), number of deliveries, and ex-vessel revenue for yellowfin tuna landed at sites within the Los Angeles port complex by California's purse seine fleet, 2006-2007.
- Table 2-4 Monthly commercial landings (round mt), number of deliveries, and ex-vessel revenue for skipjack tuna landed at sites within the Los Angeles port complex by California's purse seine fleet, 2006-2007.
- Table 2-5 Monthly commercial landings (round mt), number of deliveries, and ex-vessel revenue for bluefin tuna landed at sites within the Los Angeles port complex by California's purse seine fleet, 2006-2007.
- Table 2-6 Annual commercial landings (round mt) and number of deliveries for swordfish landed in California's major port complexes by the harpoon fleet, 2006-2007.
- Table 2-7 Monthly commercial landings (round mt) and ex-vessel revenue (dollars) for swordfish landed in California by the harpoon fleet, 2006-2007.
- Table 2-8 Historical number of annual drift gillnet permits issued and number of active vessels, 1981-2007.
- Table 2-9 Annual commercial landings (round mt) and number of deliveries for swordfish landed in California's major port complexes by the drift gillnet fleet, 2006-2007.
- Table 2-10 Monthly commercial landings (round mt) and ex-vessel revenue for swordfish landed in California by the drift gillnet fleet, 2006-2007.
- Table 2-11 Annual commercial landings (round mt) and number of deliveries for common thresher shark landed in California's major port complexes by the drift.
- Table 2-12 Monthly commercial landings (round mt) and ex-vessel revenue for common thresher shark landed in California ports by the drift gillnet fleet, 2006-2007.
- Table 2-13 Annual commercial landings (round mt) and number of deliveries for swordfish landed in California's major port complexes by the longline fleet, 2006-2007.
- Table 2-14 Monthly commercial landings (round mt) and ex-vessel revenue for swordfish landed in California ports by the longline fleet, 2006-2007.
- Table 2-15 Oregon commercial albacore landings (mt) by month, 2006-2007.
- Table 2-16 Oregon commercial albacore landings (mt) by port, 2006-2007.
- Table 2-17 Ex-vessel price-per-pound for albacore tuna in Oregon, 2006-2007.
- Table 2-18 Oregon landings (mt) with drift gillnet gear, 2006-2007.
- Table 2-19 Washington commercial albacore landings (mt) by port, 2006-2007.
- Table 2-20 U.S. and Canadian albacore landings into Washington, 2006-2007.
- Table 2-21 California's recreational daily possession limits for highly migratory MUS included within the fishery management plan.
- Table 2-22 Annual number of highly migratory MUS kept and thrown back by recreational anglers fishing from commercial passenger fishing vessels (CPFV) in U.S. EEZ Waters 2006-2007.
- Table 2-23 Estimated number of highly migratory MUS kept and thrown back alive by recreational anglers fishing from private vessels in U.S. EEZ waters, 2006-2007.
- Table 2-24 Oregon albacore fishing effort (angler trips) for charter and private boats, and combined, by year and port, 2006-2007.
- Table 2-25 Oregon albacore catch (number of fish) for charter and private boats, and combined, by year and port, 2006-2007.
- Table 2-26 Oregon albacore catch per unit of effort (number of fish/angler trip), for charter and private boats, and combined, by year, by port, 2006-2007.
- Table 2-27 Washington albacore fishing effort (angler trips) for charter and private boats, and combined, by year and port area, 2006-2007.
- Table 2-28 Washington albacore catch per unit of effort (number of fish/angler trip) for charter and private boats, and combined, by year and port, 2006-2007.

Table 2-29	Washington albacore catch (number of fish) for charter and private boats, and combined, by year and port area, 2006-2007.
Table 2-30	Landings (mt) of HMS species in non-HMS fisheries.
Table 3-1	Prohibited Species covered under the HMS FMP final rule.
Table 3-2	HMS permits that have been issued since the regulation became effective on February 10, 2005.
Table 3-3	Anticipated incidental takes of listed species in the HMS fisheries.
Table 4-1	West Coast commercial HMS landings, revenues, and average price by species, 2006-2007.
Table 4-2	West Coast commercial Highly Migratory Species landings, revenues, and average prices by fishery, 2006-2007.
Table 4-3	West Coast commercial HMS landings and revenues, 1981-2007.
Table 4-4	West Coast commercial landings of HMS by all HMS and non-HMS gears, 1981-2007.
Table 4-5	West Coast nominal commercial ex-vessel revenues from HMS landings by all HMS and non-HMS gears, 1981-2007.
Table 4-6	West Coast real commercial ex-vessel revenues (2007 \$) from HMS landings by all HMS and non-HMS gears, 1981-2007.
Table 4-7	West Coast commercial landings of albacore, other tunas, swordfish, and sharks, 1981-2007.
Table 4-8	West Coast commercial revenues for albacore, other tunas, swordfish, and sharks, 1981-2007.
Table 4-9	Commercial landings (round mt) in the West Coast albacore surface hook-and-line (troll and baitboat) fishery, with Canadian vessels excluded, 1981-2007.
Table 4-10	Commercial landings (round mt) in the West Coast albacore surface hook-and-line (troll and baitboat) fishery, 1981-2007.
Table 4-11	Commercial landings (round mt) in the West Coast drift gillnet fishery, 1981-2007.
Table 4-12	Commercial landings (round mt) in the West Coast harpoon fishery, 1981-2007.
Table 4-13	Commercial landings (round mt) in the West Coast longline fishery, 1981-2007.
Table 4-14	Commercial landings (round mt) in the West Coast purse seine fishery, 1981-2007.
Table 4-15	Nominal commercial ex-vessel revenues (\$) for the West Coast albacore surface hook-and-line (troll and baitboat) fishery, with Canadian vessels excluded, 1981-2007.
Table 4-16	Nominal commercial ex-vessel revenues (\$) for the West Coast albacore surface hook-and-line (troll and baitboat) fishery, 1981-2007.
Table 4-17	Nominal commercial ex-vessel revenues (\$) for the West Coast drift gillnet fishery, 1981-2007.
Table 4-18	Nominal commercial ex-vessel revenues (\$) for the West Coast harpoon fishery, 1981-2007.
Table 4-19	Nominal commercial ex-vessel revenues (\$) for the West Coast longline fishery, 1981-2007.
Table 4-20	Nominal commercial ex-vessel revenues (\$) for the West Coast purse seine fishery, 1981-2007.
Table 4-21	Real commercial ex-vessel revenues (2007 \$) for the West Coast albacore surface hook-and-line (troll and baitboat) fishery, with Canadian vessels excluded, 1981-2007.
Table 4-22	Real commercial ex-vessel revenues (2007 \$) for the West Coast albacore surface hook-and-line (troll and baitboat) fishery, 1981-2007.

- Table 4–23 Real commercial ex-vessel revenues (2007 \$) for the West Coast drift gillnet fishery, 1981–2007.
- Table 4–24 Real commercial ex-vessel revenues (2007 \$) for the West Coast harpoon fishery, 1981–2007.
- Table 4–25 Real commercial ex-vessel revenues (2007 \$) for the West Coast longline fishery, 1981–2007.
- Table 4–26 Real commercial ex-vessel revenues (2007 \$) for the West Coast purse seine fishery, 1981–2007.
- Table 4–27 West Coast commercial tuna landings by fishery, 1981–2007.
- Table 4–28 West Coast commercial tuna revenues by fishery, 1981–2007.
- Table 4–29 Species composition of coastwide commercial tuna landings, 1981–2007.
- Table 4–30 Species composition of coastwide commercial tuna revenues, 1981–2007.
- Table 4–31 West Coast commercial swordfish landings by fishery, 1981–2007.
- Table 4–32 West Coast commercial swordfish revenues by fishery, 1981–2007.
- Table 4–33 Species composition of coastwide commercial shark landings, 1981–2007.
- Table 4–34 Species composition of coastwide commercial shark revenues, 1981–2007.
- Table 4–35 Commercial landings (round mt) of the albacore surface hook-and-line (troll and baitboat) fishery in California, with Canadian vessels excluded, 1981–2007.
- Table 4–36 Commercial landings (round mt) of the albacore surface hook-and-line (troll and baitboat) fishery in California, 1981–2007.
- Table 4–37 Commercial landings (round mt) of the albacore surface hook-and-line (troll and baitboat) fishery in Oregon, 1981–2007.
- Table 4–38 Commercial landings (round mt) of the albacore surface hook-and-line (troll and baitboat) fishery in Washington, 1981–2007.
- Table 4–39 Commercial catch and effort fishery statistics for the U.S. South Pacific albacore troll fishery, 1981-2007.
- Table 4–40 Percentages of commercial catch and effort by fishing areas for U.S. albacore troll vessels, 1981–2007.
- Table 4–41 Number of vessels with West Coast commercial HMS landings by fishery (HMS gear & species), 1981-2007.
- Table 4–42 Number of vessels with commercial HMS landings in California by fishery (HMS gear & species), 1981-2007.
- Table 4–43 Number of vessels with commercial HMS landings in Oregon by fishery (HMS gear & species), 1981-2007.
- Table 4–44 Number of vessels with commercial HMS landings in Washington by fishery (HMS gear & species), 1981-2007.
- Table 4–45 Catches by species (thousands of fish) for the West Coast recreational private sport fishing fleet, 1981–2007.
- Table 4–46 Albacore fishing hours for the California CPFV fleet, 1981–2007.
- Table 4–47 Number of vessels targeting HMS in California waters, 1981–2007.
- Table 4–48 Number of angler hours for the California CPFV Fleet, 1981–2007.
- Table 4–49 Catch by species for the California Commercial Passenger Fishing Vessel fleet in California and Mexico waters, 1981–2007.
- Table 4–50 PacFIN species codes used to extract commercial fisheries data for this HMS SAFE report.
- Table 4–51 PacFIN gear codes used to extract commercial fisheries data for this HMS SAFE report.
- Table 5-1 Recent stock status with respect to management criteria.
- Table 5-2 Stockwide and regional catches for HMS management unit species (x1,000 mt round weight), 2001–2007.

List of Figures

- Figure 4–1 West Coast commercial HMS landings and revenues, 1981–2007.
 - Figure 4–2 West Coast commercial landings of albacore, other tunas, swordfish, and sharks, 1981–2007.
 - Figure 4–3 West Coast commercial revenues for albacore, other tunas, swordfish, and sharks, 1981–2007.
 - Figure 4–4 West Coast commercial tuna landings by fishery, 1981–2007.
 - Figure 4–5 West Coast commercial tuna revenues by fishery, 1981–2007.
 - Figure 4–6 Species composition of coastwide commercial tuna landings, 1981–2007.
 - Figure 4–7 Species composition of coastwide commercial tuna revenues, 1981–2007.
 - Figure 4–8 West Coast commercial swordfish landings by fishery, 1981–2007.
 - Figure 4–9 West Coast commercial swordfish revenues by fishery, 1981–2007.
 - Figure 4–10 Species composition of coastwide commercial shark landings, 1981–2007.
 - Figure 4–11 Species composition of coastwide commercial shark revenues, 1981–2007.
 - Figure 4–12 Catches by species (thousands of fish) for the West Coast recreational private sport fishing fleet, 1981–2007.
 - Figure 4–13 Albacore fishing hours for the California CPFV fleet, 1981–2007.
 - Figure 4–14 Number of vessels targeting HMS in California waters, 1981–2007.
 - Figure 4–15 Number of angler hours for the California CPFV Fleet, 1981–2007.
 - Figure 4–16 Catch by species for the California CPFV fleet in California waters, 1981–2007.
 - Figure 4–17 Catch by species for the California CPFV fleet in Mexico waters, 1981–2007.
 - Figure 5–1 General model of MSY and OY Control Rules, from Restrepo, et al. 1998.
- Acronyms Used in HMS Management