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U.S. SWORDFISH FISHERIES OF THE NORTH PACIFIC OCEAN[1]

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INTRODUCTION

The United States is a major consuming and harvesting nation for swordfish (*Xiphias gladius*). U.S. swordfish fisheries harvested 6,163 metric tons (mt) of swordfish in 1997, with approximately 64% (3,932 mt) of the total U.S. domestic production from the north Pacific Ocean. The U.S. swordfish fisheries in the north Pacific Ocean operate from waters just west of the date line to areas along the West Coast of the continental U.S.

1. FISHERIES AND CATCHES

Three gear types (harpoon, drift gill net, and longline) are employed in the U.S. swordfish fisheries of the North Pacific. Harpoon fishing for swordfish in the North Pacific dates back to the early 1900s. The harpoon fishery primarily supplied the local California market for swordfish until the late 1970s. Harpoon catch peaked at 1,699 mt in 1978 and has since declined (Fig. 1). The California drift gill net fishery, which began in 1980, replaced the harpoon fishery as the dominant swordfish fishery on the West Coast. Its catch peaked at 2,400 mt in 1985. It was not always possible to determine whether harpoon or drift gill net gear was used, therefore, catch from such records was represented as from unknown fishing gear. In certain years, this unknown catch was substantial; it was equivalent to 69% of the sum of drift gill net and harpoon catches in 1989. Longlining for swordfish in Hawaii began in 1988, grew rapidly with catch peaking at 5,942 mt in 1993, and is currently the largest U.S. swordfish fishery in the North Pacific Ocean. California has a smaller fleet of longline vessels most of which originated from the Hawaii longline fishery.

Hawaii-Based Longline Fishery. The number of Hawaii-based longline vessels increased rapidly in the late 1980s as U.S. longliners from the Gulf of Mexico and the Atlantic swordfish fisheries joined the Hawaii-based longline fishery. Longline techniques used to target swordfish were introduced to Hawaii by this group of longline fishermen and helped establish Hawaii as a major producer of swordfish. The number of active Hawaii-based longline vessels

rose from 37 vessels in 1987 and peaked at 141 vessels in 1991 (Fig. 2). One hundred fourteen of those vessels elected to fish for swordfish as their primary or secondary target. A federal moratorium implemented in 1991 limited the number of longline vessels to 167 in light of this rapid expansion. Some of the longline vessels during that time fished exclusively for swordfish throughout the entire year, but activity directed towards swordfish has since declined. The moratorium was replaced with a limited entry program in 1994 which capped participation in Hawaii's longline fishery at 164 vessels. There were 105 active longline vessels in 1997 of which 49 vessels fished for swordfish as their primary or secondary target species.

The Hawaii-based longline fishery is the largest of all the U.S. North Pacific swordfish fisheries. Swordfish catch from this fishery began to increase in 1989 when a few vessels successfully targeted swordfish off Hawaii. Swordfish catch increased rapidly, peaking at 5,942 mt in 1993, and declined to 2,504 mt in 1996. Swordfish catch increased slightly to 2,880 mt in 1997 (Table 1). Although swordfish catch has decreased substantially from 1993, swordfish remains the largest catch component in Hawaii's longline fishery. Other species caught by the Hawaii-based longline fishery included sharks, bigeye tuna (*Thunnus obesus*), albacore (*T. alalunga*), yellowfin tuna (*T. albacares*), bluefin tuna (*T. thynnus*), marlins (Istiophoridae), mahimahi (*Coryphaena hippurus*), moonfish (*Lampris guttatus*), ono (*Acanthocybium solandri*), and oilfish (Gempylidae).

Swordfish CPUE (swordfish per 1,000 hooks) varies substantially depending on targeting practices (Fig. 3). Swordfish CPUE for trips specifically targeting swordfish peaked at 15.4 fish in 1991, dropped to 10.3 fish in 1994, and increased back to 15.4 fish in 1997. Tuna-targeted trips had the lowest swordfish CPUE while mixed target trips had intermediate swordfish CPUE throughout 1991-97.[2] Swordfish-targeted trips usually have the highest swordfish CPUE during the first and second quarters and lowest CPUE in the third quarter.

California-Based Longline Fishery. The California-based longline fishery began in 1991 when 3 vessels based in San Pedro fished waters outside the U.S. Exclusive Economic Zone (EEZ). The longline fleet peaked at 31 vessels in 1994. There were 17 longline vessels fishing in 1997; up slightly from 14 vessels in 1996 (Fig. 4). The California-based longline fleet includes some vessels that also participate in the Hawaii-based longline fleet.

The longline swordfish catch rose from 41 mt in 1991 and peaked at 760 mt in 1994 (Table 1). Swordfish catch was 389 mt in 1997. Incidental catches in the longline fishery include: sharks, yellowfin tuna, bluefin tuna, bigeye tuna, albacore, mahimahi, moonfish, and oilfish. Marlins are also caught but California Department of Fish and Game (CDFG) regulations prohibit landing these species caught with longline gear.

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[2]Hawaii-based longline trips are categorized as swordfish, tuna, and mixed targets based on information provided by vessel captains or by operational characteristics.

California-based longline CPUE is measured as swordfish per 1,000 hooks. CPUE averaged 7 fish per 1,000 hooks in 1994 and 1995 (Fig. 5). CPUE increased to 13.8 in 1996 and 28.2 in 1997.

California Drift Gill Net Fishery. The California drift gill net fishery for sharks (thresher shark, *Alopias vulpinus,* and shortfin mako shark, *Isurus oxyrinchus*) and swordfish developed in the late 1970s. The fishery was originally directed toward sharks, but changed in the early 1980s when regulations allowed for greater landings of swordfish. Incidental catches include tunas and other pelagic fish. The drift gill net fishery is seasonal and extends from approximately May of one year to February of the next. The number of drift gill net vessels that participated in the fishery and landed swordfish peaked at 220 during the 1985-86 fishing season (Fig. 6). Since then, the number of vessels in the fishery has declined to 86 during the 1997-98 fishing season.

The drift gill net fishery swordfish catch increased 15-fold from 1980 to 1985 (Table 1). Catch then exhibited an apparent decline each year to 873 mt in 1991, increased to 1,400 mt in 1992 and 1993 then dropped in 1994. Swordfish catch was 557 mt in 1997.

Drift gill net swordfish CPUE (number of swordfish caught per set) for vessels that targeted swordfish, rose from 0.6 swordfish per set in the 1981-82 fishing season to 2.7 swordfish per set in the 1984-85 season and fluctuated between 1.5 swordfish per set and 2.8 swordfish per set since then (Fig. 7). The 1997-98 fishing season CPUE of 2.8 swordfish per set in the highest recorded since the start of the fishery.

California Harpoon Fishery. The California harpoon fishery began in the early 1900s. The number of vessels peaked in 1978 and 1980 at 309 and 305 vessels, respectively (Fig. 8). Participation in the fishery dropped below 200 vessels in the early 1980s, dropped to approximately 100 vessels in the mid and late 1980s and dropped again to less than 50 vessels in the 1990s. The number of vessels fishing in 1997 reached a record low of 19.

Harpoon catches have been recorded since 1918. Swordfish catches peaked in 1978 at 1,699 mt, then decreased, averaging about 230 mt during the period 1979-88, and about 80 mt during 1989-95 (Table 1). The harpoon catch of swordfish in 1997 was 84 mt.

Seventy-three percent of the swordfish pursued were actually harpooned. Of theses, 91% were actually landed. Harpoon fishery CPUE (fish per day fished) was higher for vessels that used spotter aircraft than for vessels that did not, except for 1978 through 1983 when spotter aircraft use was limited by regulations (Fig. 9). Combined CPUE (with and without aircraft) varied from a peak of 0.93 fish per day in 1978 to a low of 0.14 fish per day fished in 1983. The combined CPUE in 1997 was 0.74 fish per day fished.

2. FISHERY MONITORING, DATA COLLECTION AND DATA ARCHIVING

Hawaii-based Longline Fishery. Data on the Hawaii-based longline fishery are available from six sources: Federal longline logbooks; market sampling; State of Hawaii

commercial catch reports; at-sea observer trips; NOAA ship *Townsend Cromwell* research cruises; and voluntary tag, release, and recovery information from fishermen (Tables 2 and 3). Each of the six data sets contain unique information that provides insight on the performance of the fishery and the biology and ecology of swordfish as well as other pelagic species caught. Linking the data sets also allows NMFS scientists to evaluate the accuracy of the data.

Since November 1990, all U.S. longline vessels based in Hawaii have been required to maintain a daily Federal longline logbook and submit it after each trip. Federal longline logbook data submission represents the most complete coverage on the Hawaii-based longline fishery. Data recorded in the logbooks include: fishing effort, number of fish caught by species, location, gear configuration, oceanographic observations, and interactions with protected species. Number of vessels, effort (hooks), catch (in numbers of fish) and CPUE (expressed as number of fish per 1000 hooks) are provided in quarterly and annual longline logbook summaries.

Market data on longline catch was first collected by the NMFS in 1987 and contains detailed biological and economic information at the wholesale level. Fish are sampled at the market and individual fish weights are recorded to the nearest half pound. Weights are raised to an estimated whole weight when processing or damage is observed. Average size, size frequency, and average ex-vessel price by species are summarized from this data set. Sex of fish is not available as most swordfish are landed in processed form (headed, finned, and gutted). Coverage of the market sample has ranged from 25% to 90% of the total number of fish landed over time.

The State of Hawaii Division of Aquatic Resources (HDAR) commercial fisheries data date from 1948 to the present. The HDAR requires longline fishermen to submit longline trip reports which list the pelagic species caught. The HDAR longline data includes: number, pounds caught, pounds sold and total value for each species as well as fishing location. State of Hawaii catch reports are also mandatory but may not be as complete as the federal logbooks.

The observer program began in 1990 when Hawaii-based longline vessels volunteered to take NMFS observers to investigate longline fishery interactions with Hawaiian monk seals (*Monachus schauinslandi*). A mandatory observer program began in February 1994 to improve the estimates of incidental take of sea turtles. Data collected are similar to logbook data but contain more detailed observations. These data are used to assess the fleet-wide impact of longlining on protected and endangered species. The mandatory observer program covers about 5% of the total longline trips.

Since 1991, the NOAA research vessel *Townsend Cromwell* has dedicated one or two research cruises a year to collecting detailed data on swordfish biology and ecology. The cruises deploy standard monofilament longline gear to catch swordfish. Hook timers and time-depth recorders (TDRs) are used to collect information on fishing depth of the gear and on swordfish behavior. Observations on condition of the catch and biological measurements are recorded. Biological samples such as muscle tissue, gonads, stomach, otoliths, and anal fin rays are collected. Live swordfish specimens are tagged and released. Oceanographic conditions are

monitored with expendable bathythermographs (XBTs), conductivity-temperature depth (CTD) casts, thermosalinograph (TSG), and acoustic Doppler current profile (ACDP) transects.

Swordfish tagging is conducted by the NMFS Honolulu Laboratory on research cruises and on commercial vessels with the voluntary participation of longline fishermen. and on research cruises. Tag release and recapture information such as names of fishermen, gear type, tagging and recovery location, and size estimates of fish are collected.

California-based Longline Fishery. The California-based longline fishery is monitored through landing receipts, vessel logbooks, and landings sampling by the CDFG. Landing receipts have been collected since the start of the fishery through a landings receipt system (Table 2). Vessel logbook data were collected on a voluntary basis from 1993 to 1994 before being replaced by a mandatory logbook system in 1995. Logbook information is recorded by fishermen daily. Positions are by degree and minute at the start and finish of the set. Hooks, catch, and bycatch are recorded for tunas, billfish, sharks, and other fish, as well as interactions with marine mammals, turtles, and seabirds. Other information on gear configuration, weather, and sea conditions are also collected. However, few logbooks have been submitted to date. Sampling of landings to measure the size of longline-caught swordfish began in 1991 in conjunction with the drift gill net fishery (Table 3).

California Drift Gill Net Fishery. The California drift gill net fishery is monitored by landing receipts, vessel logbooks, landings sampling by the CDFG, and a observer program. Landing receipts and a mandatory logbook have been collected since the fishery's inception in 1980 (Table 2). Fishermen are required to record daily operations and catch. Location of operations and catch are recorded in 10 minute squares. Landings sampling to measure size of catch at local markets began in 1981 (Table 3). A observer program to monitor the drift gill net fishery was initiated and maintained by CDFG from 1980 to 1989 and has continued from 1990 under NMFS. The observer program is used to monitor bycatches, especially of marine mammals.

California Harpoon Fishery. The California harpoon fishery is also monitored by landing receipts, vessel logbook, and landings sampling by the CDFG. Landings have been collected since the early 1900s through a landings receipt system (Table 2). A mandatory vessel logbook system for the harpoon fishery started in 1974. These logbooks are completed daily and allow recording of catches by location using CDFG 10-minute square codes. Information on aircraft assistance, water color, sea surface temperature and condition, harpooning success, and areas searched is also included. Landings sampling of swordfish began in 1981 in conjunction with the drift gill net sampling (Table 3).

Data Archiving. The Southwest Fisheries Science Center (SWFSC) maintains several data bases pertaining to U.S. domestic North Pacific swordfish fisheries. These data bases contain statistics on effort, catch, landings, size composition of the catch, as well as other biological, oceanographic, operational, and economic information. The SWFSC also maintains the Hawaii-based longline observer data which has more detailed and comprehensive data with

respect to vessel operations, discards, and interactions with sea turtles, sea birds, and marine mammals.

Table 1.--U.S. North Pacific swordfish catch * (metric tons).

	Hawaii	California			
Year CA	Longline	Longline	Gill net	Harpoon	Unknown
1970	5	-	-	612	10
1971	1	-	-	99	3
1972	0	-	-	171	4
1973	0	-	-	399	4
1974	0	-	-	406	22
1975	<1	-	-	557	13
1976	<1	-	-	42	13
1977	17	-	-	318	19
1978	9	-	-	1,699	13
1979	7	-	-	329	57
1980	<1	-	160	566	62
1981	<1	-	464	260	28
1982	<1	-	919	158	35
1983	2	-	1,372	59	328
1984	1	-	2,137	104	648
1985	2	-	2,400	210	808
1986	3	-	1,695	236	605
1987	23	-	1,299	210	297
1988	23	-	1,101	180	357
1989	281	-	1,059	54	767
1990	1,901	-	1,040	51	144
1991	4,590	41	873	16	101
1992	5,702	77	1,393	78	0
1993	5,942	177	1,449	141	0
1994	3,175	760	760	152	17
1995	2,726	277	750	93	35
1996	2,504	256	815	93	0
1997	2,880	389	557	84	22

Dashes indicate no fishery.

* Catch is based on estimated whole weight and does not include discards.

Table 2.--U.S. North Pacific swordfish catch-effort data catalog.

Year	Country/State	Gear	Data set*	Measurement of catch	Type of effort	Time strata	Geographic resolution
1974	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1975	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1976	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1977	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1978	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1979	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1980	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1981	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1982	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1983	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1984	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1985	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1986	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
1987	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1988	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1989	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
1990	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	OBS(V)	NO. FISH	NO. HOOKS	DAY	1 DEG
1991	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	LB	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	OBS(V)	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	RC	NO. FISH	NO. HOOKS	DAY	1 DEG

Table 2 (continued).--U.S. North Pacific swordfish catch-effort data catalog.

Year	Country/State	Gear	Data Set*	Measurement of catch	Type of effort	Time strata	Geographic resolution
1992	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	LB	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	OBS(V)	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	RC	NO. FISH	NO. HOOKS	DAY	1 DEG
1993	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	LB	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	OBS(V)	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	RC	NO. FISH	NO. HOOKS	DAY	1 DEG
1994	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/CA	LL	LB	NO. FISH	SETS/HOOKS	DAY	1 DEG
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	LB	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	OBS(M)	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	RC	NO. FISH	NO. HOOKS	DAY	1 DEG
1995	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/CA	LL	LB	NO. FISH	SETS/HOOKS	DAY	1 DEG
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	LB	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	OBS(M)	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	RC	NO. FISH	NO. HOOKS	DAY	1 DEG
1996	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/CA	LL	LB	NO. FISH	SETS/HOOKS	DAY	1 DEG
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	LB	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	OBS(M)	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	RC	NO. FISH	NO. HOOKS	DAY	1 DEG
1997	USA/CA	GN	LB	NO. FISH	SETS/DAYS	DAY	10 MIN
	USA/CA	GN	OBS(M)	NO. FISH	SETS/DAYS	DAY	1 DEG
	USA/CA	HP	LB	NO. FISH	PURSUITS/DAY	DAY	10 MIN
	USA/CA	LL	LB	NO. FISH	SETS/HOOKS	DAY	1 DEG
	USA/HI	LL	CR	NO.&WT. FISH	DAYS/TRIP	TRIP	---
	USA/HI	LL	LB	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	OBS(M)	NO. FISH	NO. HOOKS	DAY	1 DEG
	USA/HI	LL	RC	NO. FISH	NO. HOOKS	DAY	1 DEG

*CR=STATE CATCH REPORT DATA, LB=LOGBOOK DATA, OBS=OBSERVER DATA (V=VOLUNTARY, M=MANDATORY), RC=RESEARCH CRUISE DATA

Table 3.--U.S. North Pacific swordfish size frequency data catalog.

Year	Country/State	Gear	Data set*	Time strata	Geographic resolution	Length	Interval	Weight	Interval
1981	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
1982	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
1983	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
1984	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
1985	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
1986	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
1987	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
1988	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
1989	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
1990	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	OBS(V)	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
1991	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	LL	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	RC	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	TAG	DAY FISH	1 DEG	Y	EST	Y	EST/0.5LB
1992	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	LL	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	OBS(V)	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	RC	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	TAG	DAY FISH	1 DEG	Y	EST	Y	EST/0.5LB
1993	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	LL	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	OBS(V)	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	RC	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	TAG	DAY FISH	1 DEG	Y	EST	Y	EST/0.5LB

Table 3 (continued).--U.S. North Pacific swordfish size frequency data catalog.

Year	Country/State	gear	Data set*	Time strata	Geographic resolution	Length	Interval	Weight	Interval
1994	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	LL	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	OBS(M)	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	RC	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	TAG	DAY FISH	1 DEG	Y	EST	Y	EST/0.5LB
1995	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	LL	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	OBS(M)	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	RC	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	TAG	DAY FISH	1 DEG	Y	EST	Y	EST/0.5LB
1996	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	LL	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	OBS(M)	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	RC	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	TAG	DAY FISH	1 DEG	Y	EST	Y	EST/0.5LB
1997	USA/CA	GN	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	HP	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/CA	LL	MKT	LAND DATE	10 MIN	Y	1 MM	Y	LB
	USA/HI	LL	CR	LAND DATE	—	N	—	Y	LB
	USA/HI	LL	MKT	LAND DATE	---	N	---	Y	0.5 LB
	USA/HI	LL	OBS(M)	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	RC	DAY FISH	1 DEG	Y	1 MM	Y	0.5 LB
	USA/HI	LL	TAG	DAY FISH	1 DEG	Y	EST	Y	EST/0.5LB

*CR=STATE CATCH REPORT DATA, MKT=MARKET DATA, OBS=OBSERVER DATA (V=VOLUNTARY, M=MANDATORY), RC=RESEARCH CRUISE DATA, TAG=TAGGING STUDIES

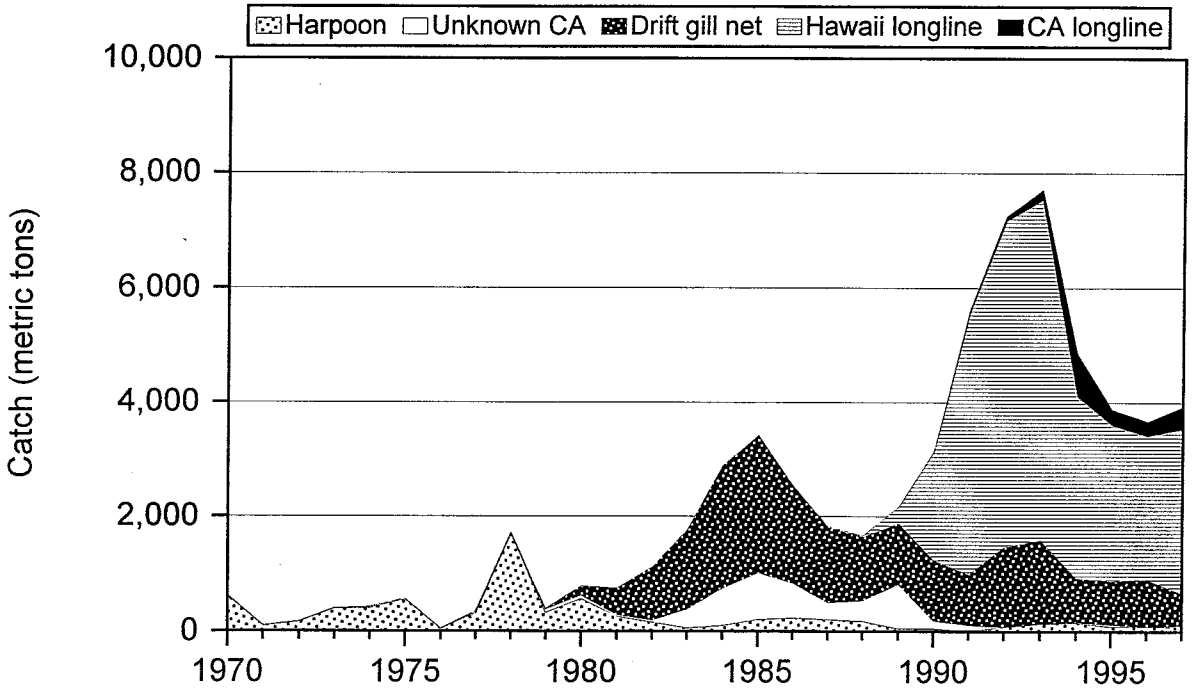

Figure 1.--Catch by the U.S. swordfish fisheries of the North Pacific Ocean, 1970-97.

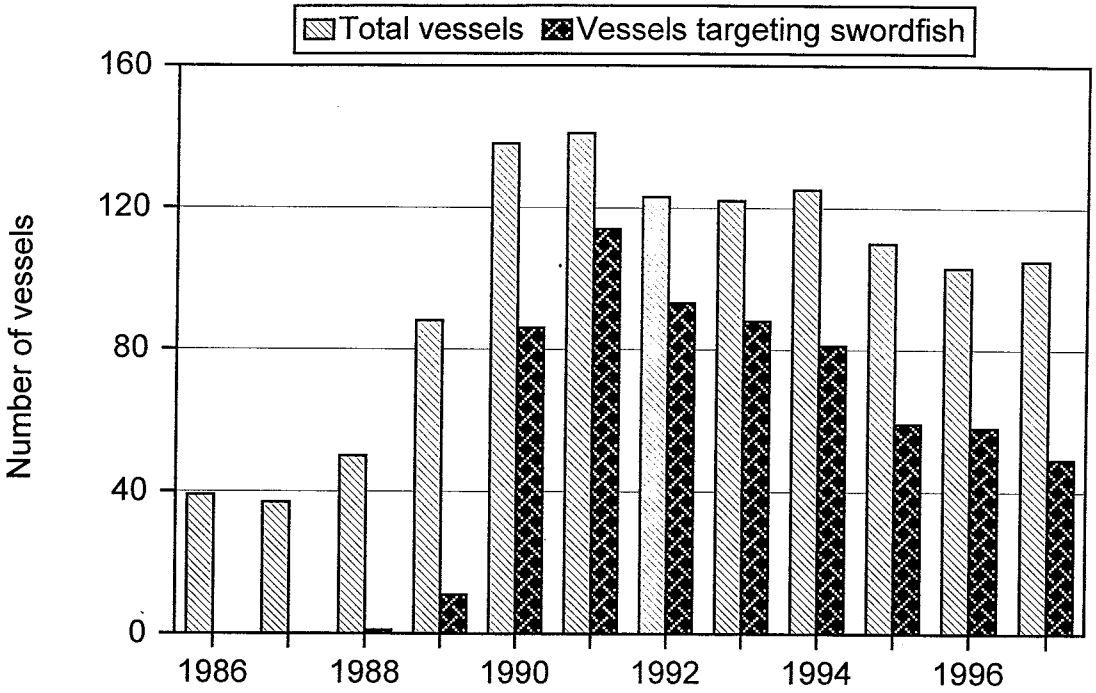

Figure 2.--Total number of active Hawaii-based longline vessels and longliners targeting swordfish, 1986-97.

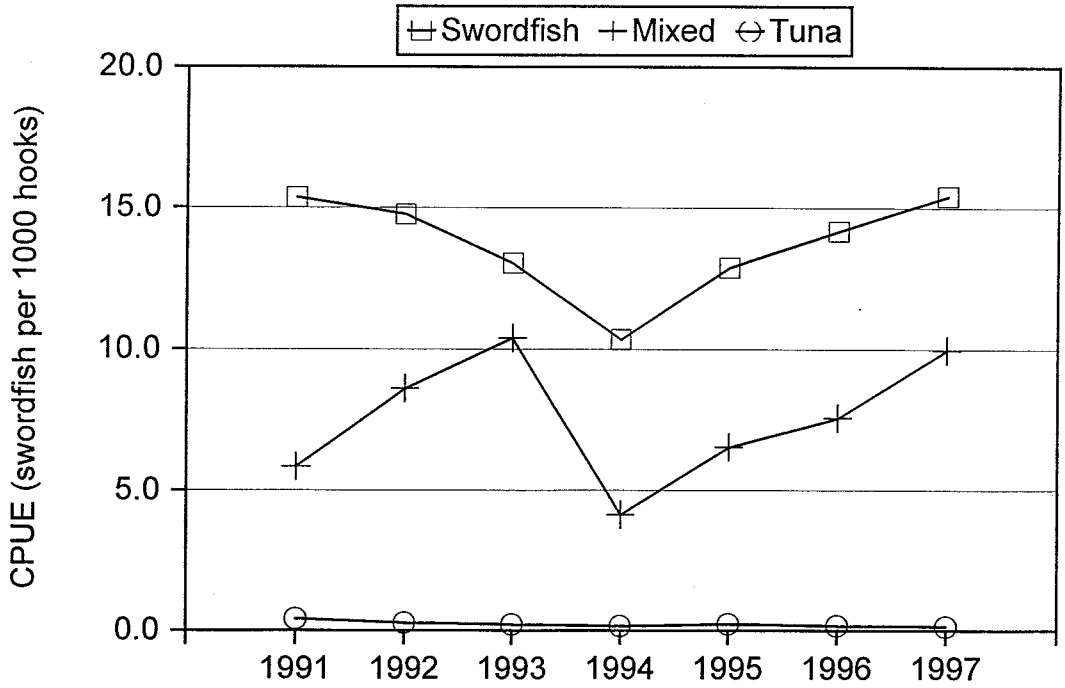

Figure 3.--Hawaii-based longline catch-per-unit-effort (CPUE) for swordfish by trip type, 1991-97.

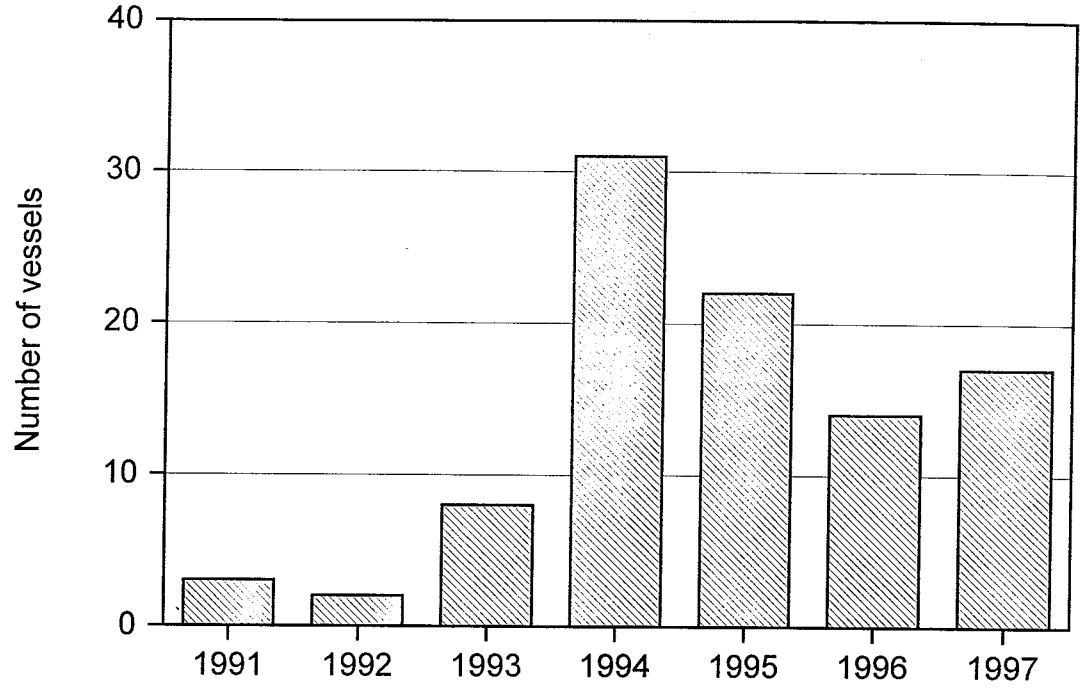

Figure 4.--California-based longline vessels, 1991-97.

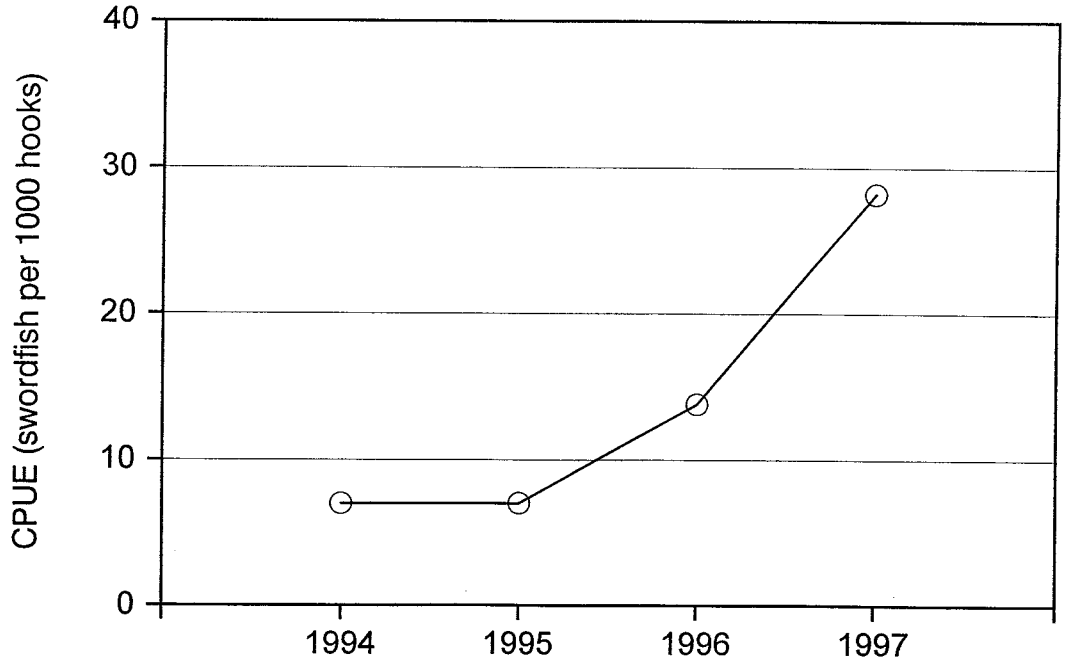

Figure 5.--California-based longline catch-per-unit-effort (CPUE) for swordfish, 1994-97.

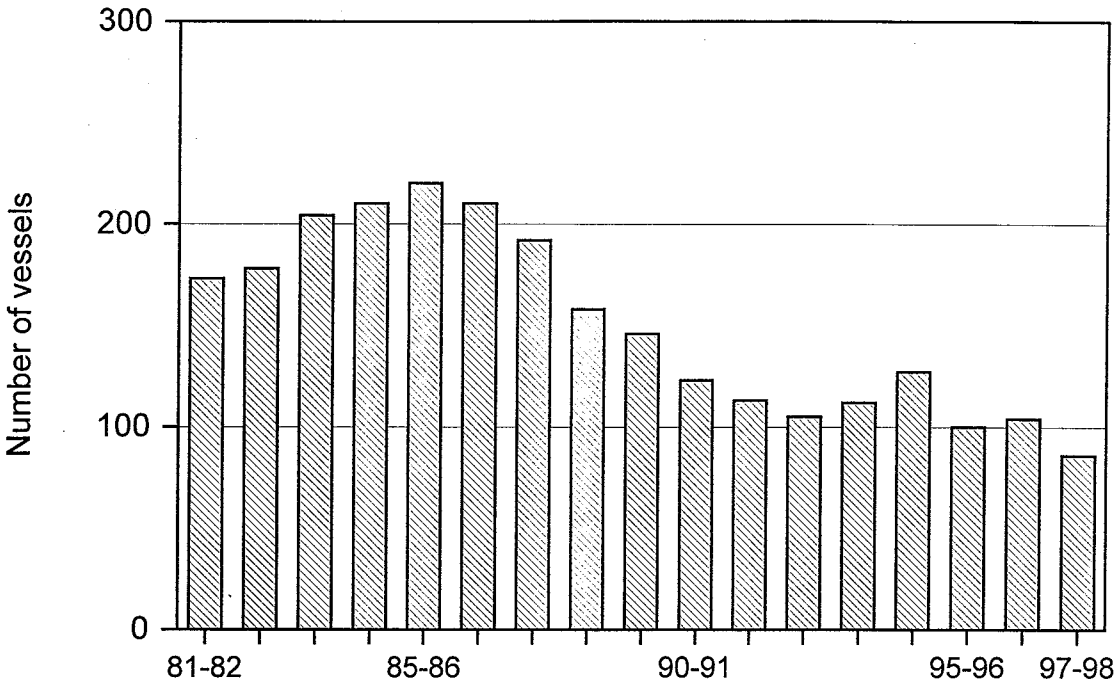

Figure 6.--Number of California drift gill net vessels, 1981-82 through 1997-98.

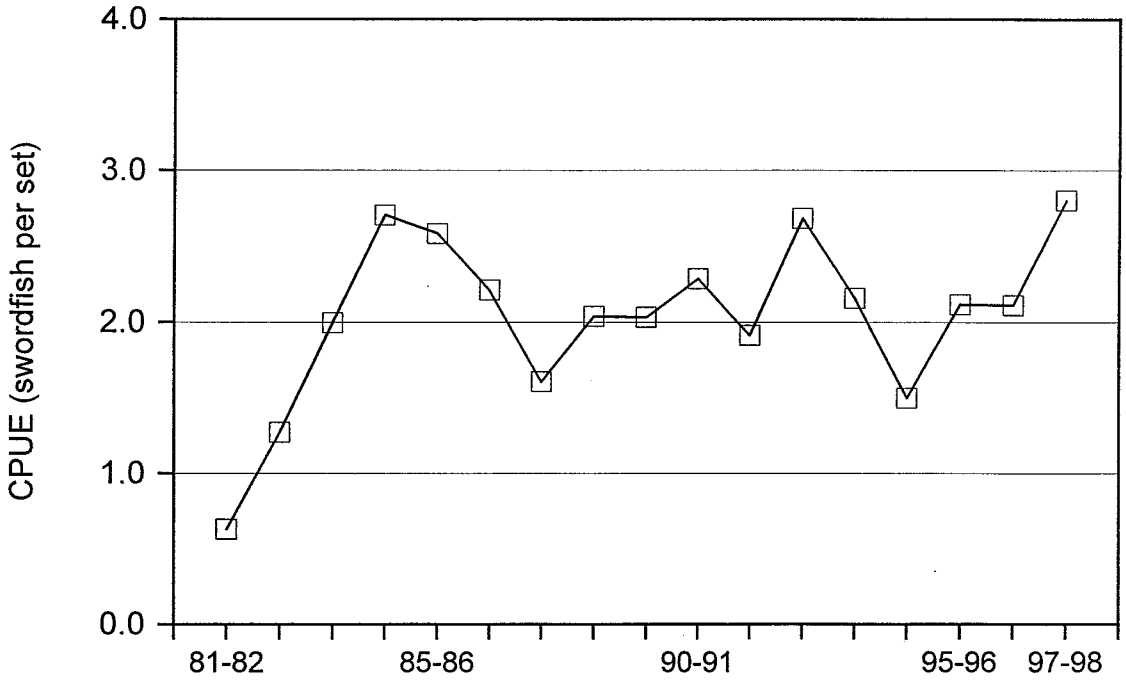

Figure 7.--California drift gill net fishery swordfish catch-per-unit-effort (CPUE), 1981-82 through 1997-98.

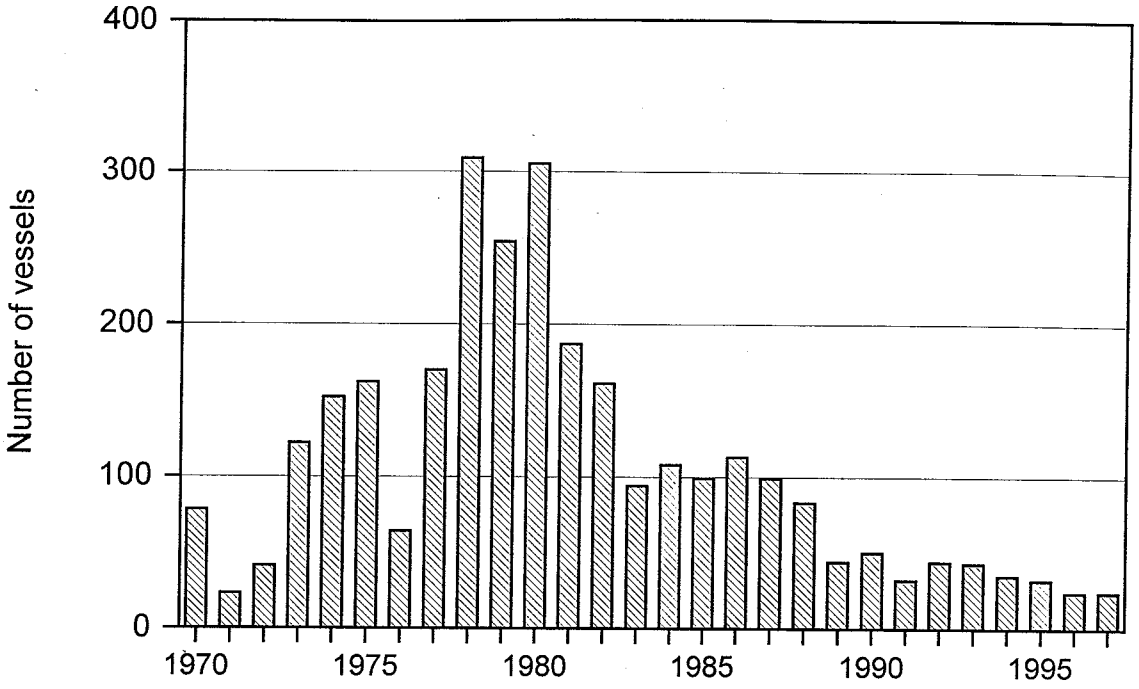

Figure 8.--Number of California harpoon vessels, 1970--97.

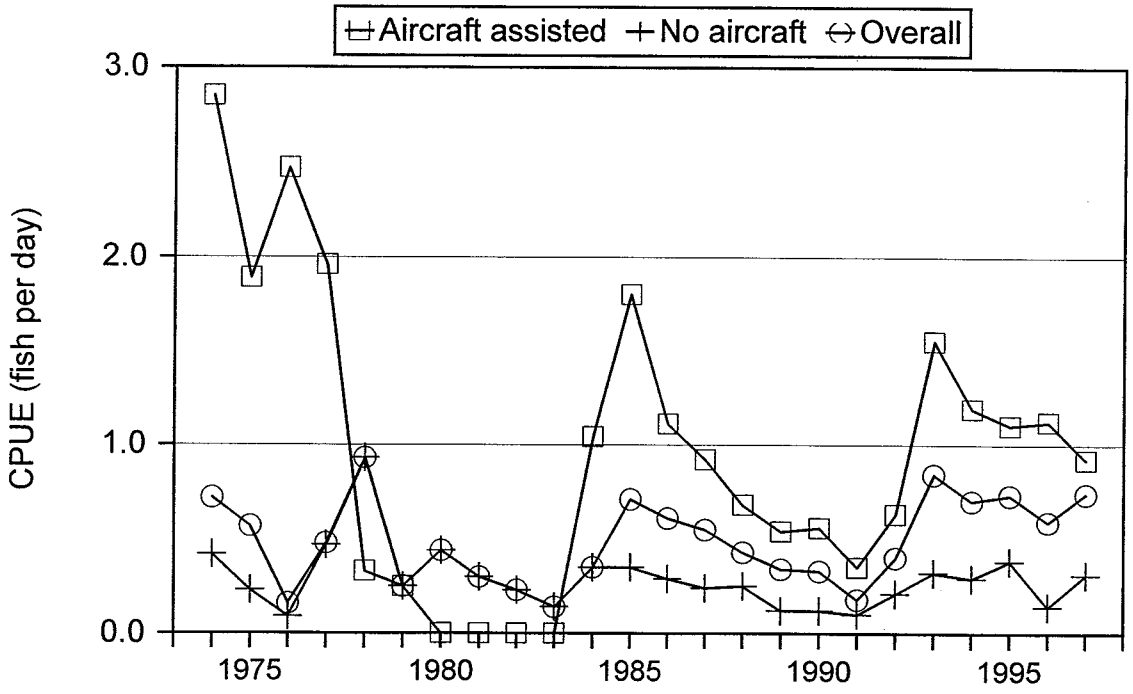

Figure 9.--California harpoon fishery catch-per-unit-effort (CPUE) with aircraft assistance, without aircraft, and overall CPUE, 1974-97.