

**U.S. Commercial Fisheries for Marlins
In the North Pacific Ocean¹**

Russell Y. Ito
Pacific Islands Fisheries Science Center
National Marine Fisheries Service, NOAA
Honolulu, Hawaii 96822 U.S.A.

William A. Walsh
Joint Institute for Marine and Atmospheric Research
University of Hawaii
Honolulu, Hawaii 96822 U.S.A.

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INTRODUCTION

This report summarizes historical trends and recent developments for U.S. fisheries catching marlins (Istiophoridae) in the North Pacific Ocean. Although marlins are targeted and taken incidentally by both commercial and recreational fisheries, only the commercial fisheries are discussed herein.

At least five species of marlins are exploited commercially by U.S. fisheries in the North Pacific Ocean. These include striped marlin (*Tetrapturus audax*), blue marlin (*Makaira nigricans*), shortbill spearfish (*T. angustirostris*), sailfish (*Istiophorus platypterus*), and black marlin (*M. indica*). The first two species predominate in the commercial landings (tonnage).

FISHERIES AND CATCHES

U.S. fisheries for marlins in the North Pacific Ocean can be categorized according to three distinct gear types: longline, troll, and handline. The largest is the longline fishery, which for the purposes of this report refers solely to the Hawaii-based longline fishery (Table 1). This fishery takes marlins as incidental catch on sets targeting tuna or swordfish. Troll fisheries in Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) comprise the second largest category for marlins. These fisheries opportunistically target marlins on a seasonal basis. The Hawaii handline fishery represents the third category, with small incidental catches of marlin.

Since 1987, blue marlin, taken by both longline and troll fisheries, typically has been the largest component of the marlin landings (Fig. 1). Striped marlin, landed predominantly by the longline fishery, has been the next largest component (Fig. 2). Landings of shortbill spearfish ranked third among the marlins, at 43 t to 236 t from 1987 through 2005 (Table 2).

² PIFSC Working Paper WP-06-002. Issued 15 March 2006.

Hawaii-based Longline Fishery

Marlins are taken as incidental catch by the Hawaii longline fishery. The gear used consists of a single monofilament mainline about 30 to 80 km in length. Floats are attached to the mainline to support the gear in the water column. Branchlines with baited hooks are attached to the mainline between the floats.

Different gear configurations and operational techniques are used when vessel operators target tunas versus swordfish. Vessels targeting tunas usually set the longline gear in the morning and haul in the afternoon, use saury or sardines for bait, and attach 15-30 (or more) hooks between floats. They use a line thrower, causing the gear to sag between floats and resulting in a “deep set”. In contrast, vessels targeting swordfish typically set in the evening and haul the following morning, use mackerel or mackerel-like bait, attach chemical lightsticks to the branchlines, and attach only 2-5 hooks between floats. Because swordfish gear is set relatively shallow, a line thrower is not needed. Nearly all of the Hawaii-based longline fleet targeted tunas from 2001 to 2004 due to restrictions on the shallow set segment of the longline fishery.

The Hawaii-based longline fishery has operated under a limited entry program since 1994. This program capped participation at 164 vessels; however, the number of vessels has never reached this limit. Vessel participation has ranged from 37 to 141 vessels over the past 19 years, with 124 vessels active in 2005 (Table 3).

Two other important characteristics of this fishery are its geographic range and total annual hook deployment. The Hawaii-based longline fishery ranged from the equator to 40° N latitude and from 135° W to 180° W longitude in 2005. The total range since 1991 extended from the equator to 50° N latitude and from 130° W to 175° E longitude. Effort by the Hawaii-based longline fishery has been increasing, with a record 34.9 million hooks set in 2005. Most of the hooks were deployed on the high seas (49%) and in the Main Hawaiian Islands (MHI) Exclusive Economic Zone (EEZ) (43%).

Longline landings of striped marlin rose rapidly from 1987, peaked in 1991, decreased slowly to a record low in 2000, and varied substantially thereafter (Table 4). The preliminary estimate for striped marlin landings in 2005 is 377 t. Blue marlin landings grew from 1987, reached an apparent peak in 1995 (see Species Identifications, below), then exhibited a slow decline subsequently, with the preliminary estimate of landings at 250 t in 2005. Plots of the geographic distributions in 2005 show that the highest catches for both striped marlin and blue marlin occurred east of Johnston Atoll (Figs. 3 and 4).

Nominal catch per unit effort (CPUE) was computed as number of fish per 1000 hooks. Striped marlin CPUE on tuna targeted trips peaked at 2.2 in 1992 (Table 5, Fig. 5). In general, striped marlin CPUE trended downward from 1992 to 2000 and remained somewhat low thereafter with CPUE at 0.4 in 2005. Blue marlin CPUE exhibited a peak of 0.8 in 1991, dropped off sharply in 1992, and declined slowly subsequently to a record low 0.1 in 2005

(Table 5, Fig. 6). Although CPUE statistics for the two marlin species exhibited declines, this does not necessarily indicate parallel changes in abundance. Some factors that could be related to the decline in CPUE are increased regulations, shifts in targeting strategy, gear modifications, and changes in the areas fished.

Hawaii, Guam, and CNMI Troll Fisheries

The troll fisheries in Hawaii, Guam, and CNMI are hook and line fisheries that use relatively small boats. These fisheries use fishing rods, reels, and artificial lures typically made of resin or chrome metal heads dressed with colored rubber skirts. Live bait bridled with hooks is also used to catch marlins and other pelagic fishes. The most recent fishery statistics available for this fishery are for 2004.

The number of troll fishers peaked at 2,166 in 1996 and was on a declining trend to a low of 1,847 fishers in 2004 (Table 3). The duration of a troll trip is one day. Since this fishery involves small vessels, most trips remain within 50 miles from shore.

Blue marlin landings usually made up more than 80% of the troll marlin landings (Table 6). Blue marlin landings peaked at 434 t in 1996 then fell to 194 t in 2004. Striped marlin landings were relatively low with 56 t recorded in 2004.

Hawaii Handline Fishery

The Hawaii handline fishery targets tunas and is made up of diurnal and nocturnal components known in Hawaii as the *palu ahi* and *ika shibi* fisheries, respectively. The diurnal handline fishery employs the use of chum (“palu” in Hawaiian) to evoke a feeding frenzy in an aggregation of juvenile tuna (“ahi” in Hawaiian) and hooks the catch with a handline. The nocturnal handline fishery has two sets of gear, one used to catch squid (“ika” in Japanese) for bait and the other for catching large tuna (“shibi” in Japanese).

The Hawaii Division of Aquatic Resources (HDAR) asks commercial fishermen to identify their primary fishing method. The number of fishermen who listed handline gear as their primary fishing gear ranged from 150 in 1994 to 199 in 1999. A total of 172 fishermen declared handline gear as their primary fishing method in 2004.

The duration of a handline trip is typically one day for the day handline fishery and overnight for the night handline fishery. As with the troll fisheries, most trips remain within 50 miles of shore inside the EEZ.

The handline fishery landed negligible amounts of striped and blue marlin (Table 7). The highest striped marlin landings were 2 t recorded in 2001 and 2004. Blue marlin landings were slightly higher, with a peak of 9 t in 1997.

DATA SOURCES

Category I: Annual Catch Data

Category I data for the longline, troll, and handline fisheries are collected by fisheries agencies in Hawaii, Guam, and CNMI and by the National Marine Fisheries Service (NMFS). Sources of catch data include Federal logbooks collected by NMFS, State of Hawaii commercial fish catch and marine fish dealer records managed by the Hawaii Division of Aquatic Resources (DAR), market sample data, and creel survey data. These are used in various ways to estimate annual catches. In some instances, data sets are combined to do the estimation. Catch summaries and estimates do not include discards. As indicated in Table 8, the data sets vary with respect to their coverage (percentage of fishing trips or other fishing activity for which records or observations are available). Catch is estimated in terms of round weight. Raising factors are applied to the nominal (observed) processed catch to estimate the total catch, incorporating standard correction factors to convert from processed to whole weight.

An ongoing project at the PIFSC is devoted to improving longline logbook accuracy by correcting billfish misidentifications. Results to date have shown that the nominal blue marlin catch by the Hawaii-based longline fishery from March 1994 through June 2002 was inflated by approximately 29%, caused primarily by misidentification and reporting of striped marlin as blue marlin (Walsh et al. 2005). Current efforts are devoted to correcting catch histories of the other four billfish species and updating the blue marlin records from March 1994 through February 2004. This time span represents the first 10 years of the Hawaii Longline Observer Program conducted by the NMFS Pacific Islands Regional Office in Honolulu.

The analytical procedures used to evaluate and correct species misidentifications of marlin are based upon the integrated application of three data sets. First, a statistical model of blue marlin catch is fitted to longline observer data. The fitted model coefficients are then applied to the logbook data from unobserved longline trips to predict catches for those trips, which then permits comparison of observed and predicted results. Potential outliers and errors are then checked against commercial sales records for each trip as a means of verification.

Category II: Catch and Effort Data by Time and Area

Area fished, catch, and effort are the required data elements for Category II data. Logbook, observer, and fish catch reports contain the necessary data elements to generate catch and effort summaries by time and area. The Hawaii-based longline, Hawaii troll, and Hawaii handline fisheries are the only fisheries with Category II data.

Category III: Biological (size composition) Data

Biological measurements are obtained for the longline, troll, and handline fisheries. Size frequency distributions are produced from market samples, DAR commercial fish dealer records, creel surveys, or observer data.

REFERENCES

Walsh, W. A., R. Y. Ito, K. E. Kawamoto, and M. McCracken. 2005. Analysis of logbook accuracy for blue marlin (*Makaira nigricans*) in the Hawaii-based longline fishery with a generalized additive model and commercial sales data, *Fisheries Research* 75:175-192.

Table 1. -- U.S. commercial marlin landings (estimated whole weight, metric tons), all species combined, from the North Pacific Ocean by gear type, 1987-2005. Estimates for 2005 are based on preliminary data. Does not include discards.

Year	Longline	Troll	Handline	Total catch
1987	368	324	9	701
1988	675	362	7	1,044
1989	1,100	404	6	1,510
1990	973	373	6	1,352
1991	1,029	444	6	1,479
1992	947	351	5	1,303
1993	910	422	6	1,338
1994	787	385	4	1,176
1995	1,295	424	5	1,724
1996	999	504	8	1,511
1997	983	467	10	1,460
1998	945	305	3	1,253
1999	963	387	6	1,356
2000	666	267	3	936
2001	886	367	4	1,257
2002	650	266	3	919
2003	1,153	249	2	1,404
2004	872	282	3	1,157
2005	838	na	na	838

Table 2. -- U.S. commercial marlin landings (estimated whole weight, metric tons), all gear types combined, from the North Pacific Ocean by species, 1987-2005. Estimates for 2005 are based on preliminary data. Does not include discards.

Year	Striped marlin	Blue marlin	Spearfish	Other marlins	Total catch
1987	303	334	43	21	701
1988	559	398	65	22	1,044
1989	636	721	128	25	1,510
1990	565	715	50	22	1,352
1991	703	684	60	32	1,479
1992	498	648	46	111	1,303
1993	540	678	54	66	1,338
1994	360	696	59	61	1,176
1995	595	921	139	69	1,724
1996	473	908	89	41	1,511
1997	391	909	100	60	1,460
1998	404	659	134	56	1,253
1999	393	689	214	60	1,356
2000	215	549	123	49	936
2001	395	694	120	48	1,257
2002	255	493	136	35	919
2003	566	572	236	30	1,404
2004	442	476	186	53	1,157
2005	377	250	196	15	838

Table 3. -- Number of U.S. commercial vessels fishing in the North Pacific that landed marlins, 1987-2005.

Year	Longline	Troll	Handline
1987	37	na	na
1988	50	na	na
1989	88	na	na
1990	138	na	na
1991	141	na	na
1992	123	1,977	156
1993	122	1,987	161
1994	125	1,948	150
1995	110	2,020	151
1996	103	2,166	186
1997	105	2,149	170
1998	114	2,135	180
1999	119	2,127	199
2000	125	1,993	190
2001	101	1,937	163
2002	100	1,916	164
2003	110	1,938	156
2004	125	1,847	172
2005	124	na	na

Table 4. -- The Hawaii-based longline fishery marlin landings (estimated whole weight, metric tons) from the North Pacific Ocean, 1987-2005. Estimates for 2005 are based on preliminary data. Does not include discards.

Year	Species				Total catch
	Striped marlin	Blue marlin	Spearfish	Other marlins	
1987	272	51	43	2	368
1988	504	102	65	4	675
1989	612	356	128	4	1,100
1990	538	378	50	7	973
1991	663	297	60	9	1,029
1992	459	347	46	95	947
1993	471	339	54	46	910
1994	326	362	59	40	787
1995	543	570	139	43	1,295
1996	418	467	89	25	999
1997	352	487	100	44	983
1998	378	395	134	38	945
1999	364	357	214	28	963
2000	200	314	123	29	666
2001	351	399	120	16	886
2002	226	264	136	24	650
2003	538	363	236	16	1,153
2004	384	281	186	21	872
2005	377	250	196	15	838

Table 5. -- Hawaii-based longline fishery marlin nominal CPUE (number of fish per 1000 hooks) in the North Pacific Ocean, 1991-2005. Estimates for 2005 are based on preliminary data.

Year	Striped marlin	Blue marlin
1991	1.9	0.7
1992	2.2	0.4
1993	1.8	0.4
1994	1.2	0.3
1995	1.8	0.5
1996	1.2	0.4
1997	0.8	0.4
1998	0.9	0.3
1999	0.7	0.2
2000	0.3	0.2
2001	0.7	0.3
2002	0.3	0.2
2003	0.9	0.2
2004	0.5	0.2
2005	0.4	0.1

Table 6. -- U.S. troll fishery marlin landings (estimated whole weight, metric tons) from the North Pacific Ocean, 1987-2004. Does not include discards.

Year	Striped marlin	Blue marlin	Spearfish	Other marlins	Total catch
1987	30	275	0	19	324
1988	54	290	0	18	362
1989	24	359	0	21	404
1990	27	331	0	15	373
1991	40	381	0	23	444
1992	38	297	0	16	351
1993	68	334	0	20	422
1994	34	330	0	21	385
1995	52	346	0	26	424
1996	54	434	0	16	504
1997	38	413	0	16	467
1998	26	261	0	18	305
1999	28	327	0	32	387
2000	14	233	0	20	267
2001	42	293	0	32	367
2002	29	226	0	11	266
2003	28	207	0	14	249
2004	56	194	0	32	282

Table 7. -- U.S. handline fishery marlin landings (estimated whole weight, metric tons) from the North Pacific Ocean, 1987-2004. Does not include discards.

Year	Striped marlin	Blue marlin	Spearfish	Other marlins	Total catch
1987	1	8	0	0	9
1988	1	6	0	0	7
1989	0	6	0	0	6
1990	0	6	0	0	6
1991	0	6	0	0	6
1992	1	4	0	0	5
1993	1	5	0	0	6
1994	0	4	0	0	4
1995	0	5	0	0	5
1996	1	7	0	0	8
1997	1	9	0	0	10
1998	0	3	0	0	3
1999	1	5	0	0	6
2000	1	2	0	0	3
2001	2	2	0	0	4
2002	0	3	0	0	3
2003	0	2	0	0	2
2004	2	1	0	0	3

Table 8. -- Data sources for the longline, troll, and handline fisheries, by category.

	Hawaii-based longline	Hawaii troll	Guam troll	CNMI troll	Hawaii handline
Category I: Annual catch data					
Market sample	~33-90%	+++	---	---	+++
Fish dealer	~50-100%	+++	---	+++	+++
Logbook	~100%	---	---	---	---
Fish catch report	---	+++	---	---	+++
Creel survey	---	---	+++	---	---
Observer	NA	NA	NA	NA	NA
Category II: Spatial catch and effort data					
Market sample	NA	NA	NA	NA	NA
Fish dealer	NA	NA	NA	NA	NA
Logbook	~100%	---	---	---	---
Fish catch report	---	+++	---	---	+++
Creel survey	NA	NA	NA	NA	NA
Observer					
Category III: Biological (size composition) data					
Market sample	~33-90%	+++	---	---	+++
Fish dealer	~50-100%	+++	---	+++	+++
Logbook	NA	NA	NA	NA	NA
Fish catch report	NA	NA	NA	NA	NA
Creel survey	---	---	+++	---	---
Observer	3-25%	---	---	---	---

NA - not applicable, +++ - available but coverage unknown, --- - not collected

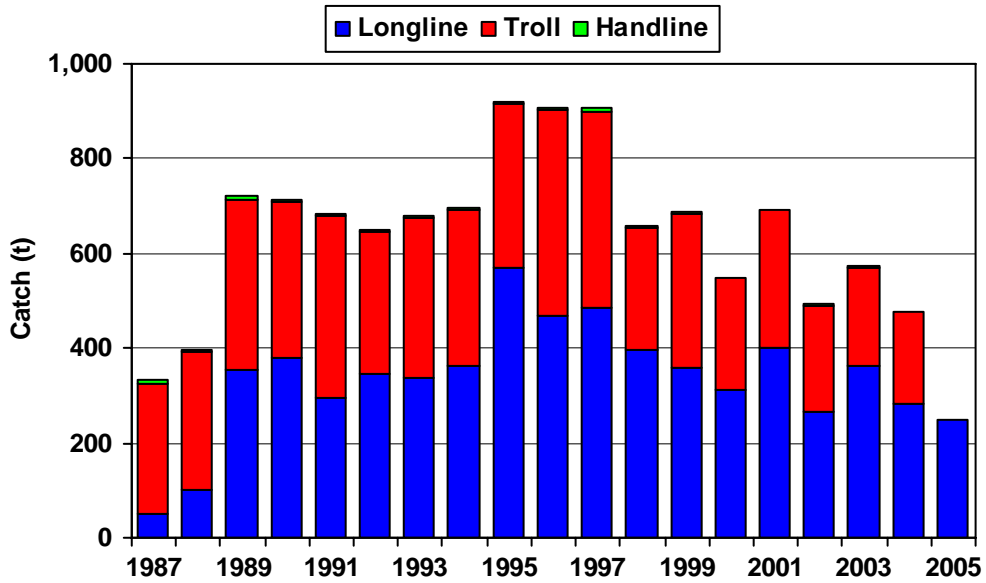


Figure 1. Catch of blue marlin by U.S. fisheries in the North Pacific Ocean, 1987-2005. Value for 2005 is preliminary.

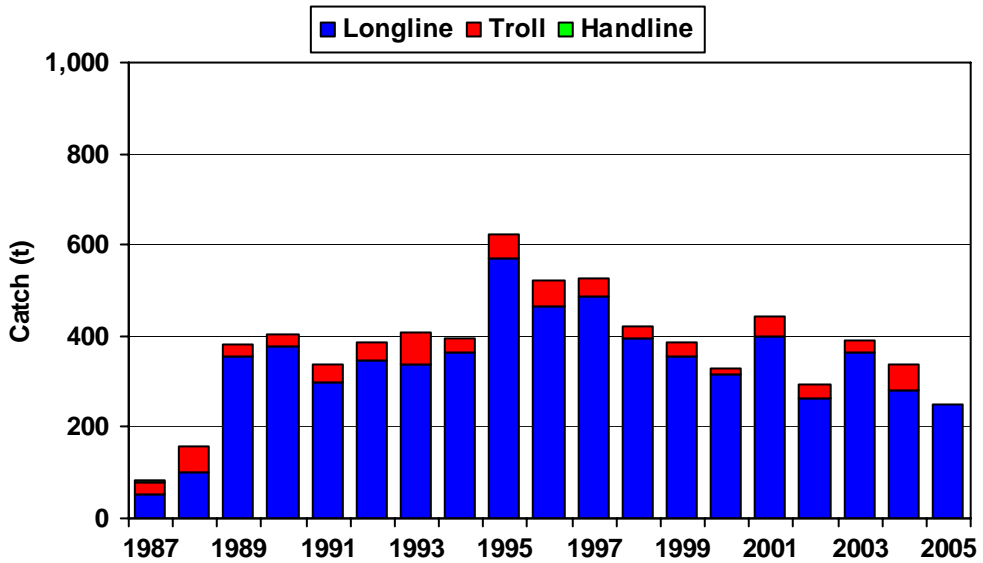


Figure 2. Catch of striped marlin by U.S. fisheries in the North Pacific Ocean, 1987-2005. Value for 2005 is preliminary.

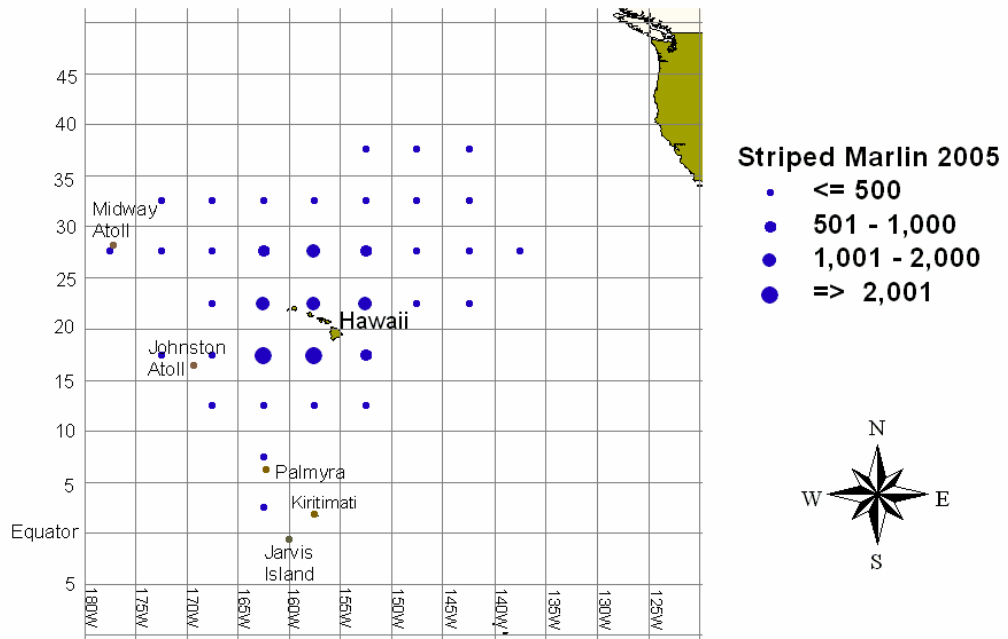


Figure 3. Hawaii-based longline fishery striped marlin catch (numbers of fish) by area, 2005.

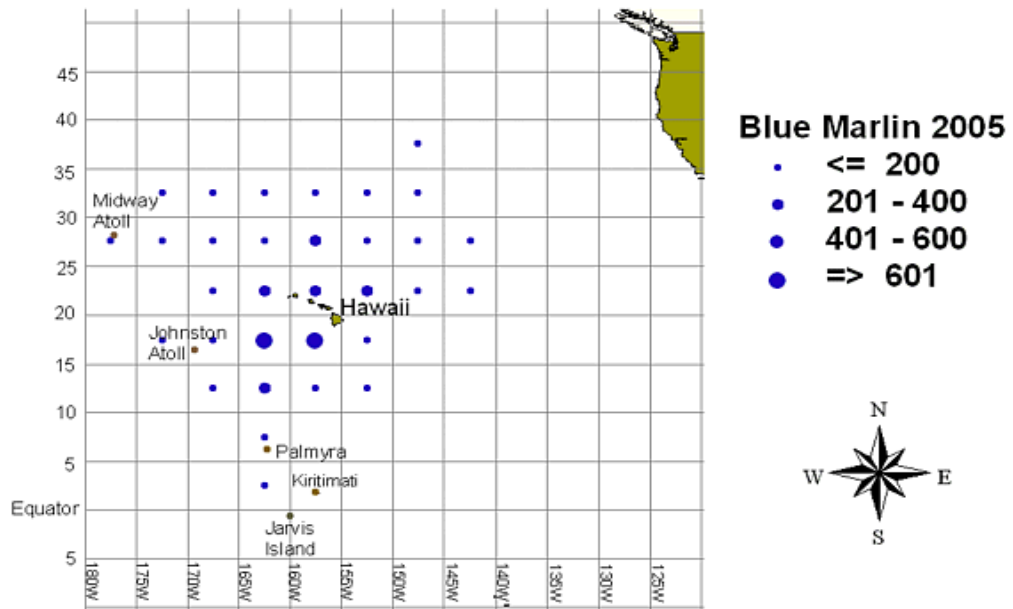


Figure 4. Hawaii-based longline fishery blue marlin catch (numbers of fish) by area, 2005.

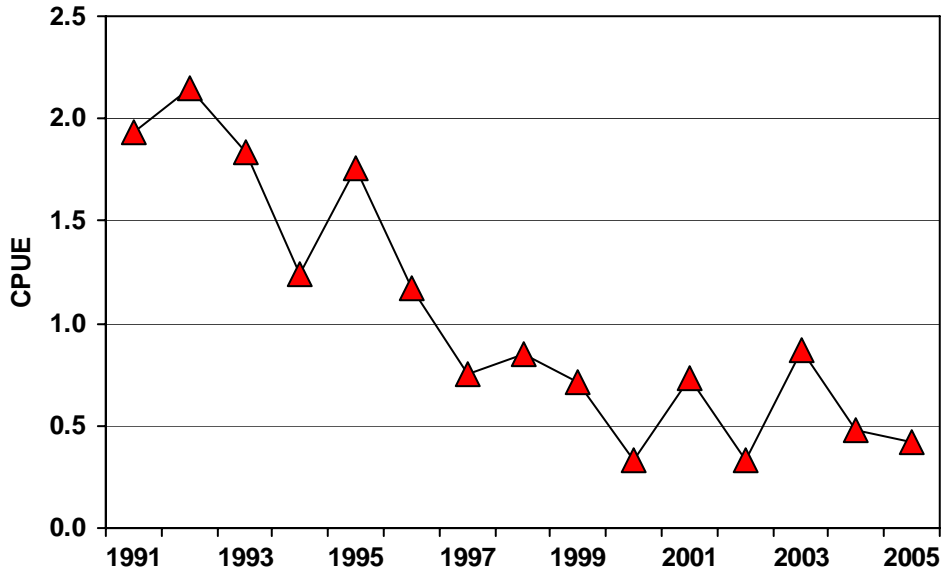


Figure 5. Hawaii-based longline fishery striped marlin nominal CPUE (number of fish per 1000 hooks), 1991-2005. Value for 2005 is preliminary.

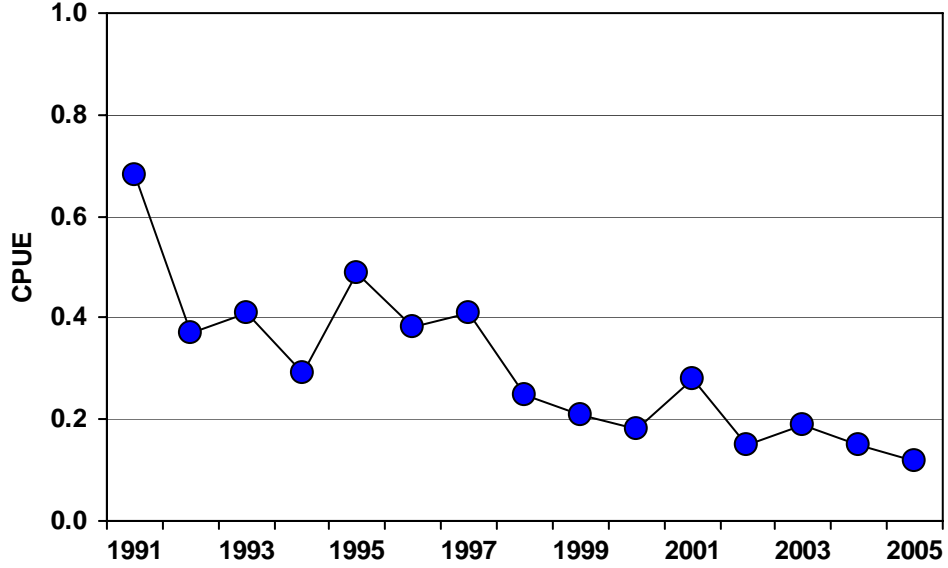


Figure 6. Hawaii-based longline fishery blue marlin nominal CPUE (number of fish per 1000 hooks), 1991-2005. Value for 2005 is preliminary.