

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
University of Hawaii
Joint Institute for Marine and Atmospheric Research
Pelagic Fisheries Research Program
Honolulu, Hawaii 96822 U.S.A.

April 2010

¹ PIFSC Working Paper WP-10-003, Issued 9 April 2010

Working document submitted to an Intersessional Meeting of the Billfish Working Group, International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, 21-28 April 2010, Hakodate, Japan.
Document not to be cited without authors' permission.

U.S. COMMERCIAL FISHERIES FOR MARLINS IN THE NORTH PACIFIC OCEAN

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

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

INTRODUCTION

This report summarizes historical trends and recent developments for all U.S. fisheries taking 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 the U.S. fisheries in the North Pacific Ocean. These are 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 the commercial landings (tonnage).

1. 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 Commonwealth of the Northern Mariana Islands (CNMI) constitute 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.

Longline logbook data suggest blue marlin landings taken by both longline and troll fisheries (Fig. 1), was typically the largest component of the marlin landings (Table 2) followed by striped marlin, landed primarily by the longline fishery (Fig. 2) and landings of shortbill spearfish ranking third. However, a study investigating

misidentification of marlins show striped marlin was usually the largest component of the longline landings followed by blue marlin, and shortbill spearfish (Walsh et al. 2007).

Hawaii-based Longline Fishery

The longline gear consists of a single monofilament mainline about 30 to 80 km in length. Floats attached to the mainline support the gear in the water column. Branchlines with baited hooks are attached to the mainline between the floats. Gear configurations and operational techniques differ according to target species (i.e., tunas, *Thunnus* spp., and swordfish, *Xiphias gladius*). Vessels targeting tunas usually set the longline gear in the morning and haul in the afternoon, use saury or sardine for bait, set 15-30 (or more) hooks between floats, and employ a line thrower. The latter creates slack in the mainline and causes the gear to sag between floats as it sinks and results in a “deep set”. In contrast, vessels targeting swordfish typically set gear in the evening and haul the following morning, use mackerel or mackerel-like bait, attach chemical lightsticks to the branchlines, and set only 2-5 hooks between floats. Because swordfish gear is set relatively shallow, a line thrower is not needed. Most of the Hawaii-based longline fleet targeted tunas from 1987 to 1990 before widespread interest in targeting swordfish. 2000 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 although the number of active vessels has never reached this limit. Vessel participation ranged from 37 to 141 vessels over the past 22 years, with 129 vessels active in 2008.

Two other important characteristics of this fishery are its geographic range and total annual hook deployment. The Hawaii-based longline fishery ranged from the 5° N to 40° N latitude and from 130° to 175° W longitude in 2008. The total range exploited since 1991 extends from 5°S to 50° N latitude and from 130° W to 175° E longitude. Effort by the the Hawaii-based longline fishery has been on an increasing trend with a record 41.6 million hooks set in 2008. Most of the hooks were deployed on the high seas (59%) and in the Main Hawaiian Islands (MHI) Exclusive Economic Zone (EEZ) (27%) and the Northwestern Hawaiian Islands (11%).

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 3). The preliminary estimate for striped marlin landings in 2008 was 436 t, up 58% from 2007. Blue marlin landings grew from 1987, reached a peak in 1995, then exhibited a slow decline subsequently with the preliminary estimate of landings at 349 t in 2008, up 33% from the previous year.

Plots of the geographic distributions in 2008 show that the highest catches (in number of fish) for striped marlin were between 20°N to 30° N latitude and 155° W to

165° W longitude (Fig. 3). The highest blue marlin catches occurred southwest of the main Hawaiian Islands between 15°N to 20° N latitude and 160° W to 165° W longitude (Fig. 4). There was seasonality in marlin catches. Striped marlin catches were typically highest in the first and fourth quarters while blue marlin catches were usually highest in the second and third quarters.

Nominal catch per unit effort (CPUE) was measured as number of fish per 1000 hooks. Striped marlin CPUE on tuna targeted trips peaked at 2.2 in 1992 and trended downward to 2000, then remained low with CPUE at a record low 0.20 in 2007 (Fig. 5). Striped marlin nominal CPUE increased slightly to 0.34 in 2008. Blue marlin CPUE exhibited an apparent peak of 0.68 in 1991 (see Species Identifications, below), dropped off sharply in 1992, declined slowly subsequently to a record low 0.08 in 2007, and remained low at 0.10 in 2008 (Fig. 6). The CPUE for the two marlin species exhibited declines over time. There are no agreed upon reference points by the Regional Fishery Management Organizations with respect to overfishing or overfished for striped and blue marlin but the International Scientific Committee Billfish Working Group has evidence that the striped marlin stock is depleted or rapidly approaching depleted and the stock has been experiencing excessive fishing mortality .

The weight frequency histogram for longline caught striped marlin showed a bimodal distribution. The mean weight for striped marlin was 30.3 kg in 2008 (Figure 7A). The blue marlin weight frequency distribution was unimodal with a mean weight 82.9 kg in 2008 (Figure 7B).

Hawaii, Guam, and CNMI Troll Fisheries

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

The number of troll fishers peaked at 2,367 in 1999, declined to 1,837 fishermen in 2005, and was 1,944 in 2008. The duration of a troll trip is one day. Since this fishery employs small vessels, most trips remain within 50 miles from shore, inside the 200 mile EEZ.

Blue marlin landings usually made up more than 80% of the troll marlin landings. Blue marlin landings peaked at 434 t in 1996, declined to a record low 128 t in 2007, and increased to 173 t in 2008 (Table 4). Striped marlin made up a small proportion of the landings at 14 t in 2008.

Hawaii Handline Fishery

The Hawaii handline fishery, which targets tunas, includes diurnal and nocturnal components known as the *palu ahi* and *ika shibi* fisheries in Hawaii, respectively. The

diurnal handline fishery employs “palu” (chum 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 the “ika” (squid in Japanese) for bait and the other for catching “shibi” (large tuna in Japanese).

The number of handline fishers peaked at 693 in 1987, declined to a low of 375 fishermen in 2006, and increased to 470 in 2008. 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 handline trips remain within 50 miles from shore inside the EEZ although some handline fishers operating far offshore by seamounts and weather buoys make trips longer than one day.

The handline fishery landed small amounts of striped and blue marlin. The highest striped marlin landings were 2 t in 2001 (Table 5). The highest blue marlin landings were slightly higher peaking at 9 t in 1997.

The weight frequency histogram for troll and handline caught striped marlin showed a bimodal distribution (Figure 8A). The mean weight for striped marlin was 30.3 kg in 2008. The blue marlin weight frequency distribution was unimodal with a mean weight 93.0 kg in 2008 (Figure 8B).

2. DATA SOURCES

Category I: Annual Catch Data

Category I data for the longline, troll, and handline fisheries are collected by federal (NOAA Fisheries), state (Hawaii), and Pacific Island (Guam and CNMI) agencies. Federal logbook, market sample, creel survey data and State of Hawaii Division of Aquatic Resources (DAR) Commercial fish catch and marine dealer data were used to estimate annual catches (Table 6). In some instances, data sets were combined to estimate annual catches. Catch summaries and estimates do not include discards. The coverage and duration for each of the data sets vary. Raising factors were applied to the weight of processed catch to increase nominal weight to an estimated whole weight. Data were extrapolated when necessary to represent full coverage and complete landing estimates. Category I data summaries are accessible on the internet at:

<http://www.pifsc.noaa.gov/fmsd/>

Species Identifications

NOAA Fisheries PIFSC is devoted to improving the accuracy of longline logbook data. A longstanding problem in monitoring the Hawaii-based longline fishery has been the accuracy of species identifications for the istiophorid billfishes. This problem has primarily affected logbook data, but some fishery observers, particularly newly-hired

individuals, have also erred in species identifications. A long-term project to correct these problems has been completed. Its principal output consisted of one paper emphasizing blue marlin that was published in a peer-reviewed scientific journal (“Analysis of logbook accuracy for blue marlin (*Makaira nigricans*) in the Hawaii-based longline fishery with a generalized additive model and commercial sales data” by W.A. Walsh, R.Y. Ito, K.E. Kawamoto, and M. McCracken, 2005, *Fisheries Research* 75:175–192) and a technical memorandum that dealt with the five istiophorid species (“Corrected Catch Histories and Logbook Accuracy for Billfishes (Istiophoridae) in the Hawaii-based Longline Fishery” by William A. Walsh, Keith A. Bigelow and Russell Y. Ito, 2007). This TM showed the overall marlin counts in the Hawaii-based longline logbook data were reasonably accurate but blue marlin was overlogged by 18% while striped marlin was underlogged 11% during the study period (Figure 9). Either or both can be obtained as a PDF file upon request from the PIFSC.

Category II: Spatial Catch and Effort Data

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

Category III: Biological (size composition) Data

Biological measurements were obtained for the Hawaii longline, troll, and handline fisheries. Weight frequency distributions for striped marlin and blue marlin were produced from DAR Commercial fish dealer data.

Table 1.--U.S. commercial marlin landings* (metric tons) from the North Pacific Ocean by gear type, 1987-2008.

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	1,000	504	8	1,512
1997	983	467	10	1,460
1998	945	305	3	1,253
1999	963	387	6	1,356
2000	666	269	3	938
2001	886	368	4	1,258
2002	650	269	3	922
2003	1,155	255	2	1,412
2004	859	243	4	1,106
2005	1,063	220	2	1,285
2006	1,194	193	2	1,389
2007	697	153	1	851
2008	1,025	202	3	1,230

* Based on estimated whole weight and does not include discards.

Table 2.--U.S. commercial marlin landings* (metric tons) by species from the North Pacific Ocean, 1987-2008.

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	474	908	89	41	1,512
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	51	938
2001	395	693	120	50	1,258
2002	256	495	136	35	922
2003	567	569	241	35	1,412
2004	411	471	186	38	1,106
2005	531	524	207	23	1,285
2006	632	569	161	27	1,389
2007	289	391	148	23	851
2008	451	524	227	28	1,230

* Based on estimated whole weight and does not include discards.

Table 3.—The Hawaii-based longline fishery marlin landings* (metric tons) from the North Pacific Ocean, 1987-2008.

Year	Striped marlin	Blue marlin	Spearfish	Other marlins	Total catch
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	419	467	89	25	1,000
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	359	241	17	1,155
2004	376	283	186	14	859
2005	511	337	207	8	1,063
2006	611	409	161	13	1,194
2007	276	262	148	11	697
2008	436	349	227	13	1,025

* Based on estimated whole weight and does not include discards.

Table 4.—The U.S. troll fishery marlin landings* (metric tons) from the North Pacific Ocean, 1987-2008.

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	22	269
2001	42	292	0	34	368
2002	30	228	0	11	269
2003	29	208	0	18	255
2004	34	186	0	23	243
2005	20	185	0	15	220
2006	21	158	0	14	193
2007	13	128	0	12	153
2008	14	173	0	15	202

* Based on estimated whole weight and does not include discards.

Table 5.—The U.S. handline fishery marlin landings* (metric tons) from the North Pacific Ocean, 1987-2008.

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	1	2	0	1	4
2005	0	2	0	0	2
2006	0	2	0	0	2
2007	0	1	0	0	1
2008	1	2	0	0	3

* Based on estimated whole weight and does not include discards.

Table 6.—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.—Landings of blue marlin by U.S. fisheries in the North Pacific Ocean, 1987-2008.

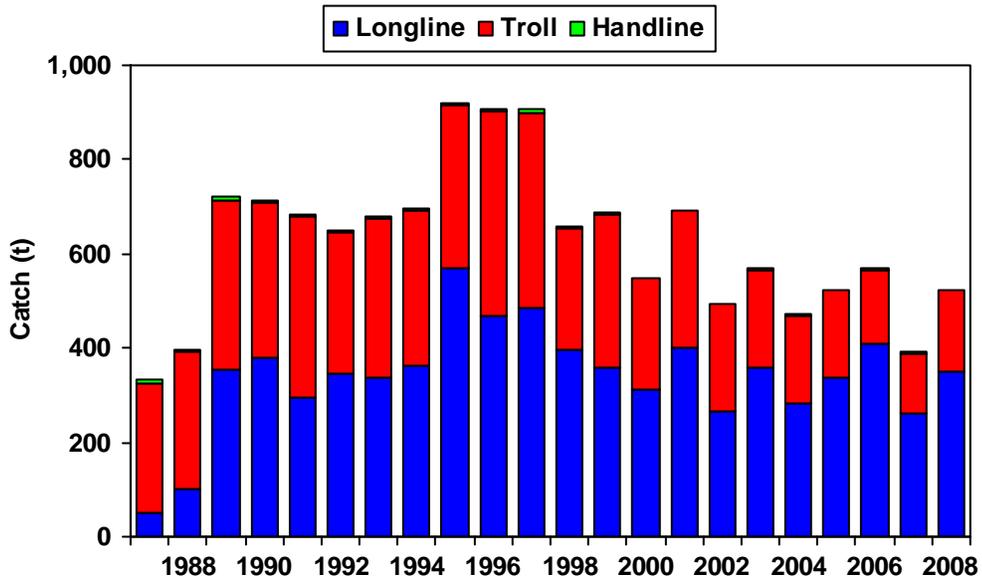


Figure 2.—Landings of striped marlin by U.S. fisheries in the North Pacific Ocean, 1987-2008.

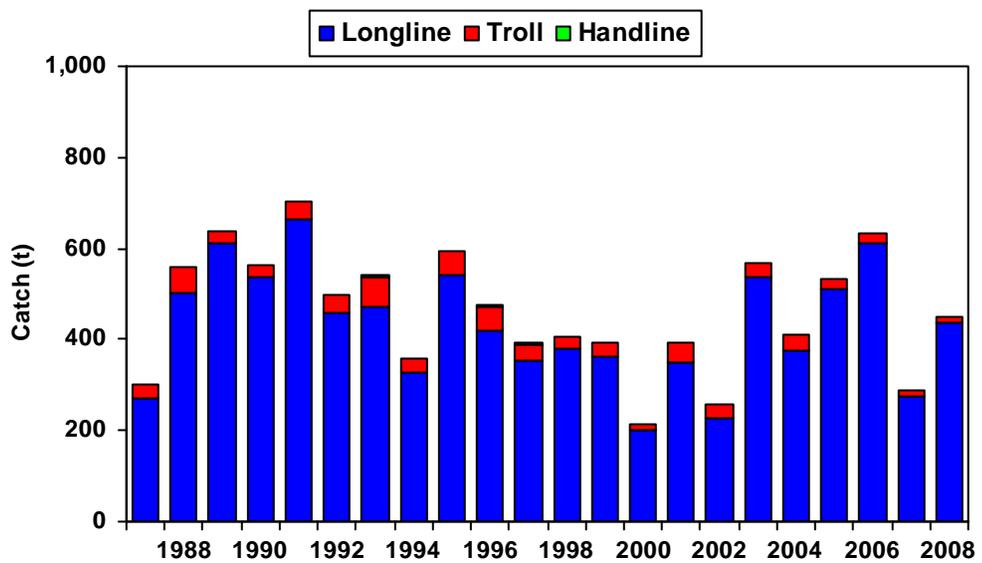
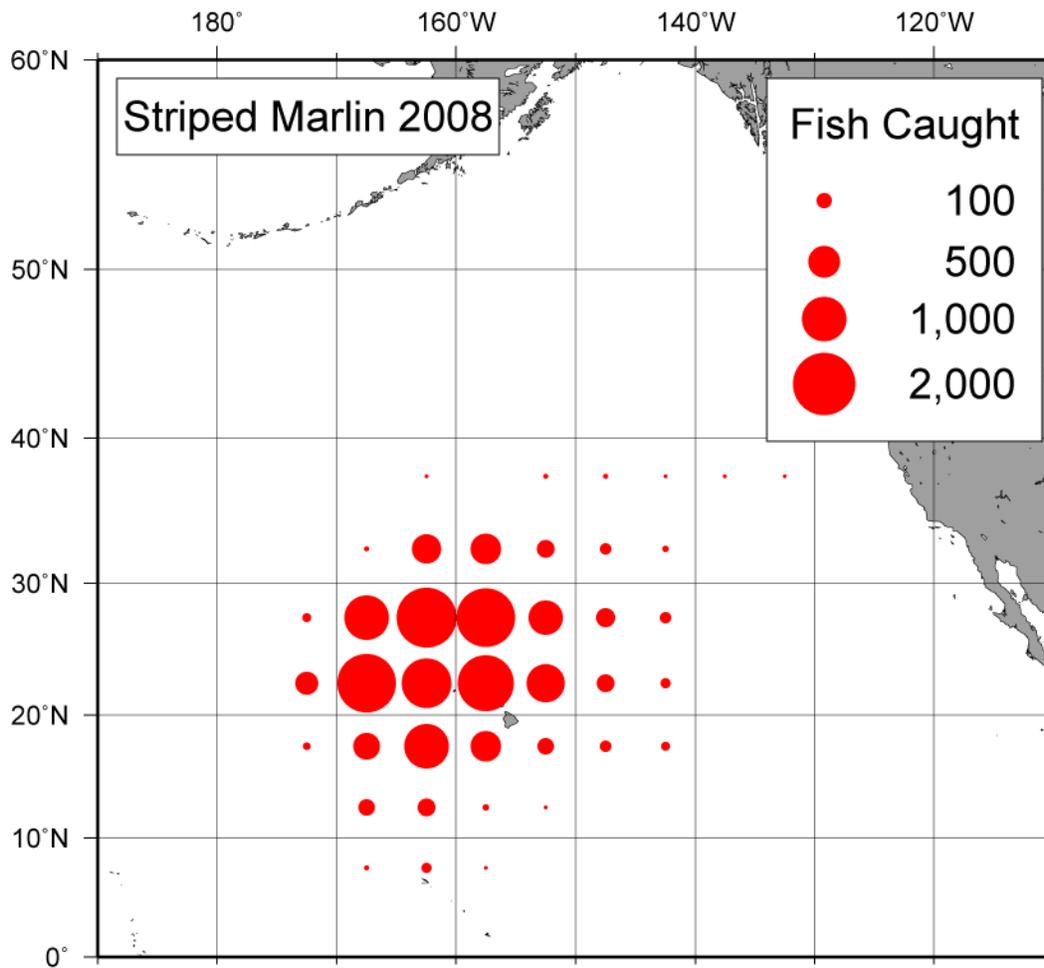
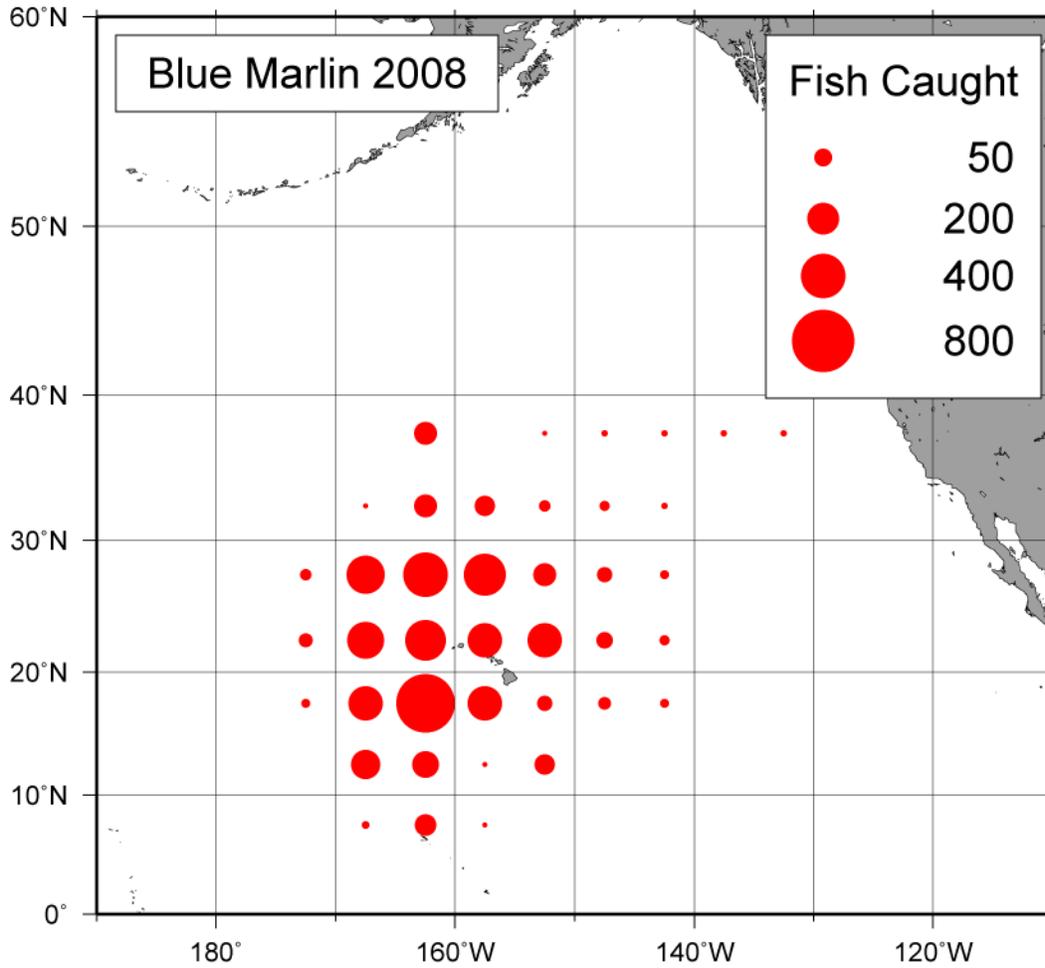


Figure 3.—Hawaii-based longline striped marlin catch (numbers of fish) by area, 2008.



NOAA Fisheries/Pacific Islands Fisheries Science Center
Mercator Projection Scale = 0.0625000000 inches/degree
Data as of 2009-08-21 gridded 5 deg x 5 deg x year

Figure 4.—Hawaii-based longline blue marlin catch (numbers of fish) by area, 2008.



NOAA Fisheries/Pacific Islands Fisheries Science Center
Mercator Projection Scale = 0.062500000 inches/degree
Data as of 2009-08-21 gridded 5 deg x 5 deg x year

Figure 5.—Hawaii-based longline striped marlin CPUE* on tuna-targeted deep sets, 1991-2008.

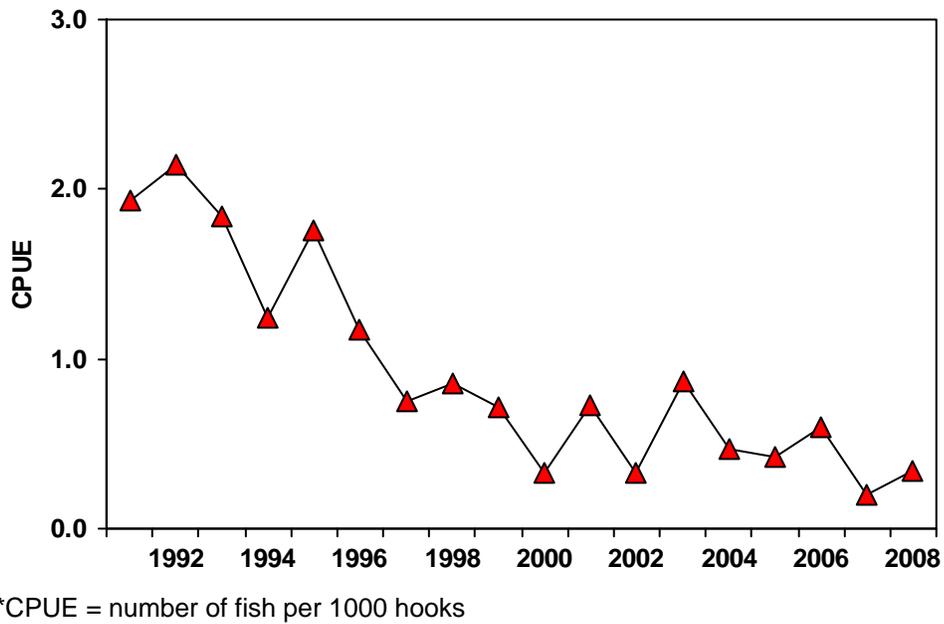


Figure 6.—Hawaii-based longline blue marlin CPUE* on tuna-targeted deep sets, 1991-2008.

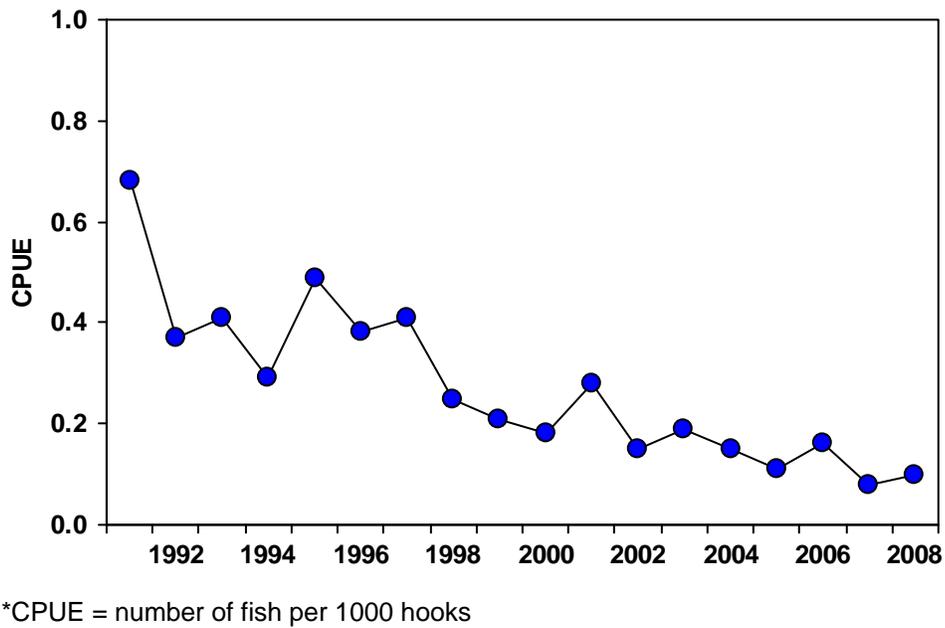


Figure 7.--Hawaii longline A) striped marlin and B) blue marlin weight-frequency, 2008.

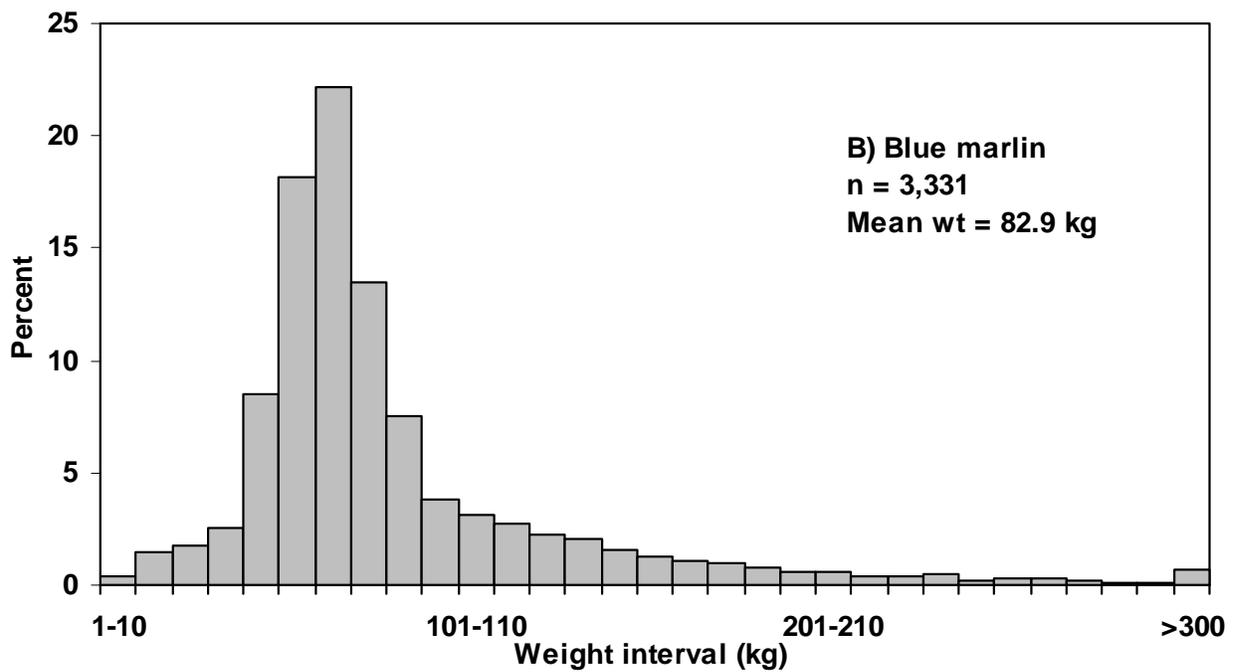
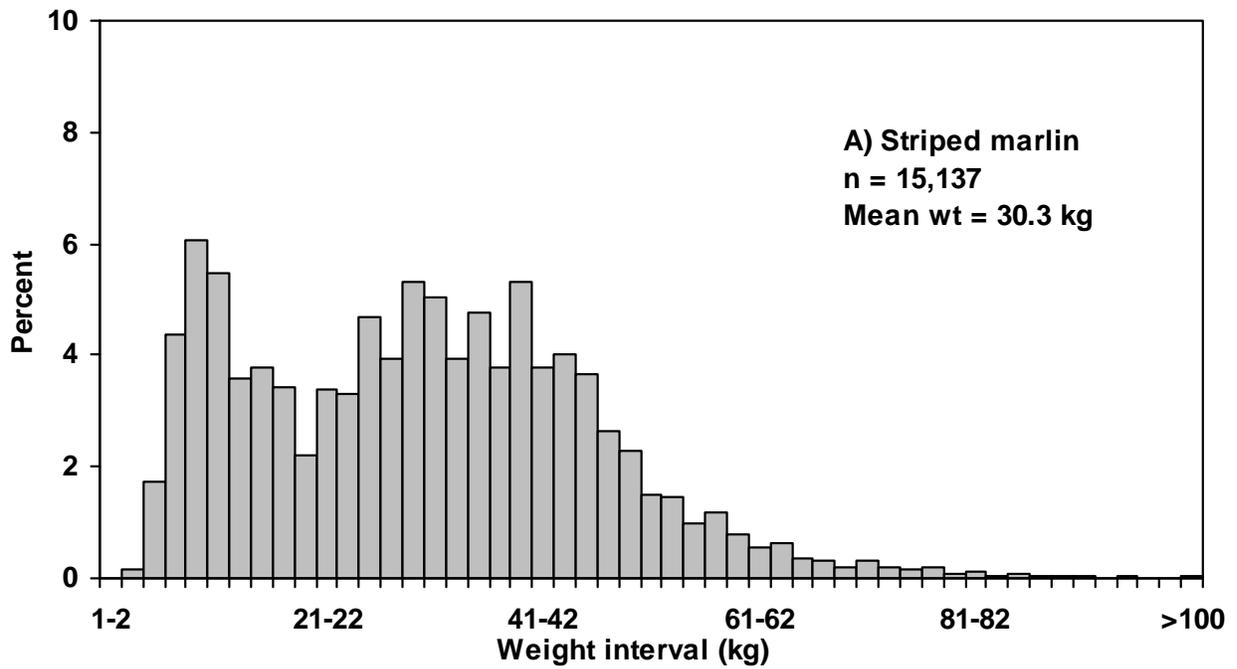


Figure 8.—Hawaii troll and handline A) striped marlin and B) blue marlin weight-frequency, 2008.

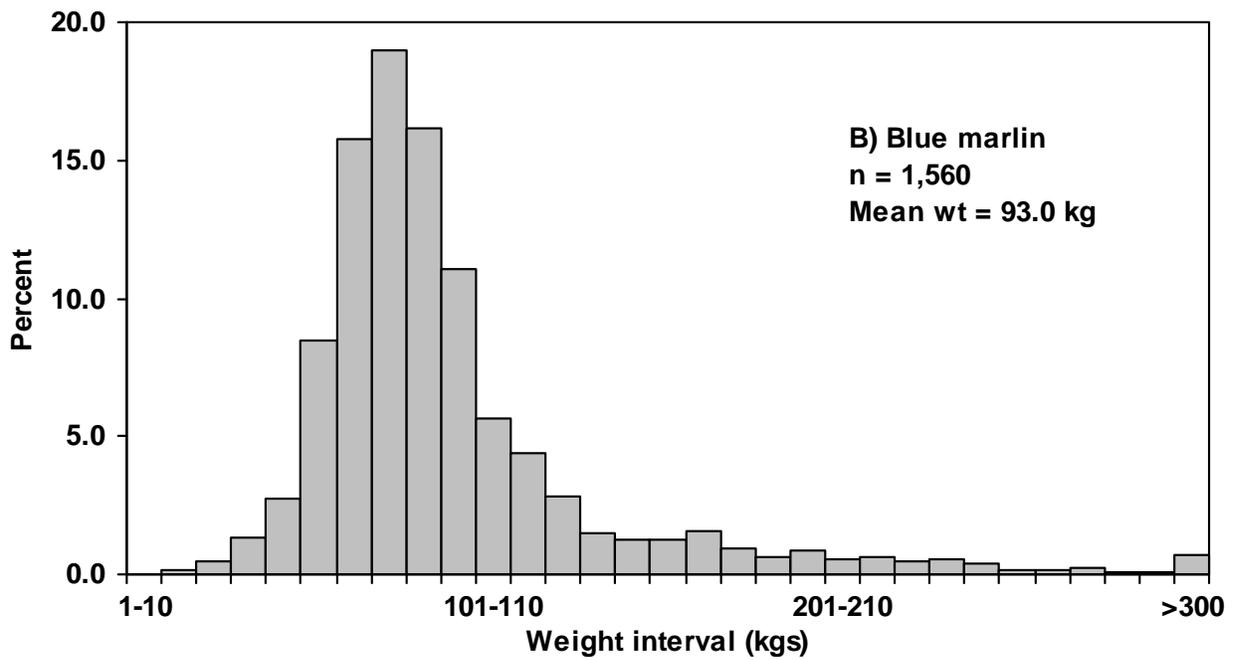
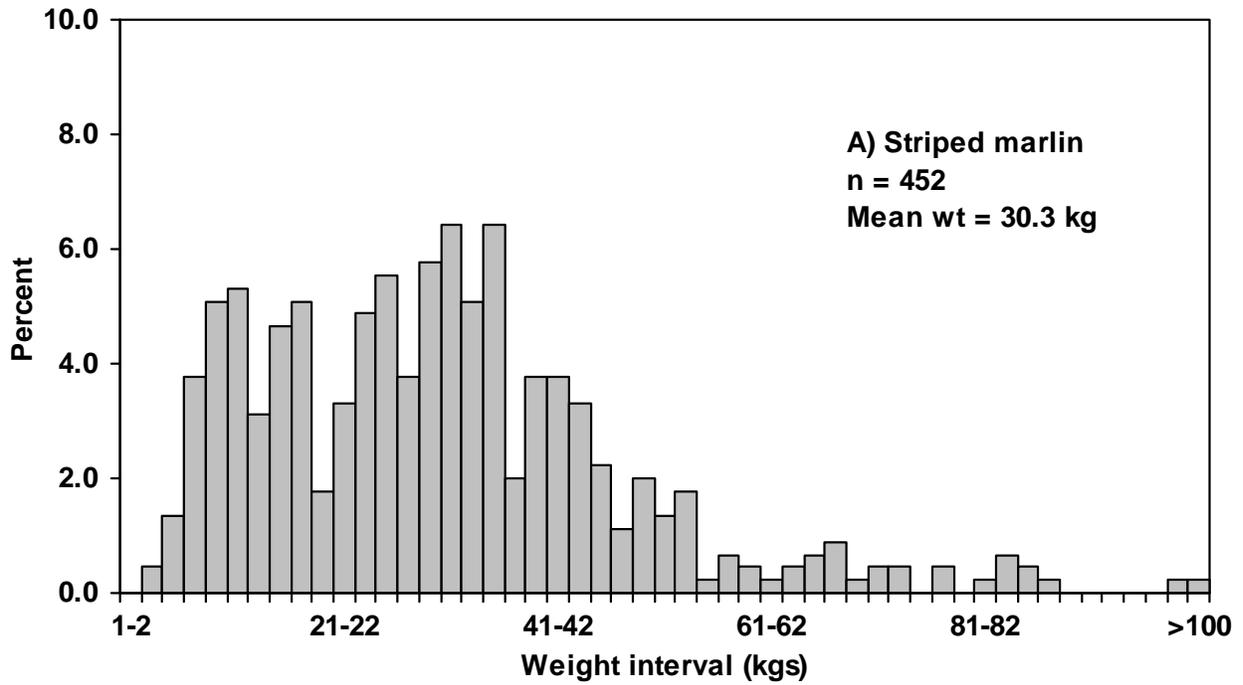


Figure 9. Nominal and corrected marlin catches for the Hawaii-based longline fishery, 1995-2003.

