

# **U.S. COMMERCIAL FISHERIES FOR MARLINS IN THE NORTH PACIFIC OCEAN<sup>1</sup>**

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## 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 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 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) comprise the second largest category for marlins. These fisheries opportunistically target marlins on a seasonal basis. The Hawaii handline fishery represented the third category, with small incidental catches of marlin.

Blue marlin, taken by both longline and troll fisheries (Figure 1), typically was the largest component of the marlin landings (Table 2). Striped marlin, landed primarily by

the longline fishery, was the next largest component. Landings of shortbill spearfish ranked third among the marlins, ranging from 21 t to 241 t during 1987-2007.

### **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 sardines for bait, attach 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 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 1987 to 1990 before widespread interest in targeting swordfish and 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, however, the number of vessels has never reached this limit. Vessel participation ranged from 100 to 141 vessels over the past 21 years, with 129 vessels active in 2007.

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 140° to 180° W longitude in 2007. 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 a increasing trend with a record 40 million hooks set in 2007. Most of the hooks were deployed on the high seas (59%) and in the Main Hawaiian Islands (MHI) Exclusive Economic Zone (EEZ) (29%).

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 2007 is 274 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 264 t in 2007. Plots of the geographic distributions in 2007 show that the highest catches for both striped marlin and blue marlin occurred east of Johnston Island (Figs. 3 and 4).

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 (Fig. 5). In general, striped marlin CPUE trended downward from 1992 to 2000 and remained low thereafter with CPUE at a record low 0.2 in 2007. Blue marlin CPUE exhibited a peak of 0.7 in 1991, dropped off sharply in 1992, and declined slowly subsequently to a record low 0.1 in 2007 (Fig. 6). Though CPUE for the two marlin species exhibited declines, this does not necessarily indicate decreased apparent abundance. Some factors that could be related to the decline in CPUE are increased regulations, shift in targeting strategy, gear modification, and area fished.

The weight frequency histogram for longline caught striped marlin showed a bimodal distribution. The mean weight for striped marlin was 33.5 kg in 2007 (Figure 7A). The blue marlin weight frequency distribution was unimodal with a mean weight 79.7 kg in 2007 (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 with hooks is also used to catch marlins and other pelagic fishes.

The number of troll fishers peaked at 2,367 in 1999, and has since declined to a low of 1,816 fishermen in 2007. 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. Landings fell to a record low 122 t in 2007 (Table 4). Striped marlin made up a small proportion of the landings at 13 t in 2007.

### **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 large tuna “shibi” (tuna in Japanese).

The number of handline fishers peaked at 693 in 1987, declined to a low of 376 fishermen in 2006, and increased slightly to 401 in 2007. 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 do 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). Blue marlin landings were slightly higher with a peak of 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 37.8 kg in 2007. The blue marlin weight frequency distribution was unimodal with a mean weight 121.3 kg in 2007 (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). Either or both can be obtained as a 'pdf' 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 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, 1987-2007.

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	269	3	938
2001	886	368	4	1,258
2002	650	269	3	922
2003	1,169	254	2	1,425
2004	859	237	4	1,100
2005	1,027	220	2	1,249
2006	1,191	193	2	1,386
2007	674	147	1	822

\* 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, 1987-2007.

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	51	938
2001	395	693	120	50	1,258
2002	256	495	136	35	922
2003	581	569	241	34	1,425
2004	411	465	186	38	1,100
2005	513	513	201	22	1,249
2006	630	569	160	27	1,386
2007	278	379	141	24	822

\* 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, 1987-2007.

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	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	552	359	241	17	1,169
2004	376	283	186	14	859
2005	511	337	207	9	1,064
2006	611	410	61	13	1,095
2007	274	264	148	12	698

\* 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, 1987-2007.

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	17	254
2004	34	180	0	23	237
2005	20	185	0	15	220
2006	21	158	0	14	193
2007	13	122	0	12	147

\* 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, 1987-2007.

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

\* 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, 1987-2007.

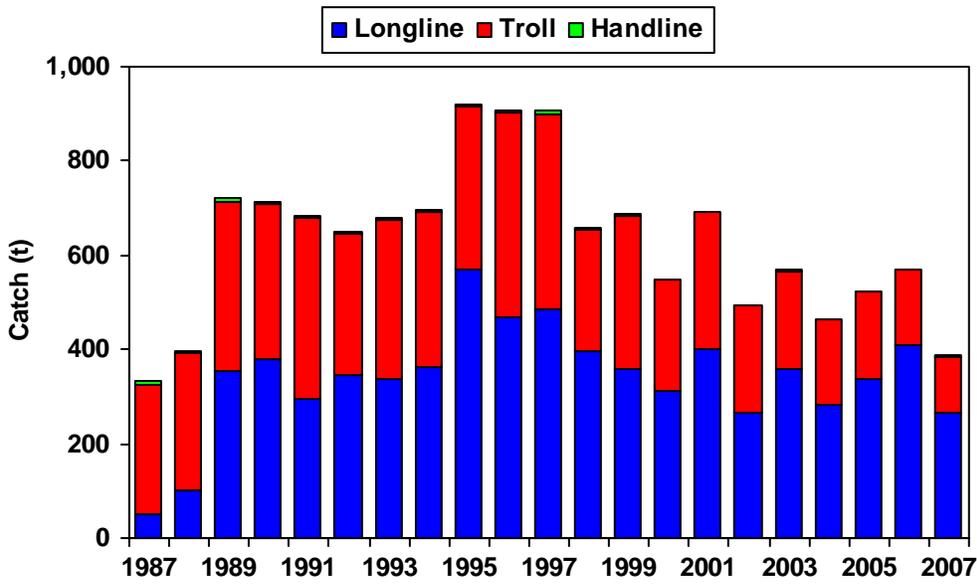


Figure 2.—Landings of striped marlin by U.S. fisheries in the North Pacific Ocean, 1987-2007.

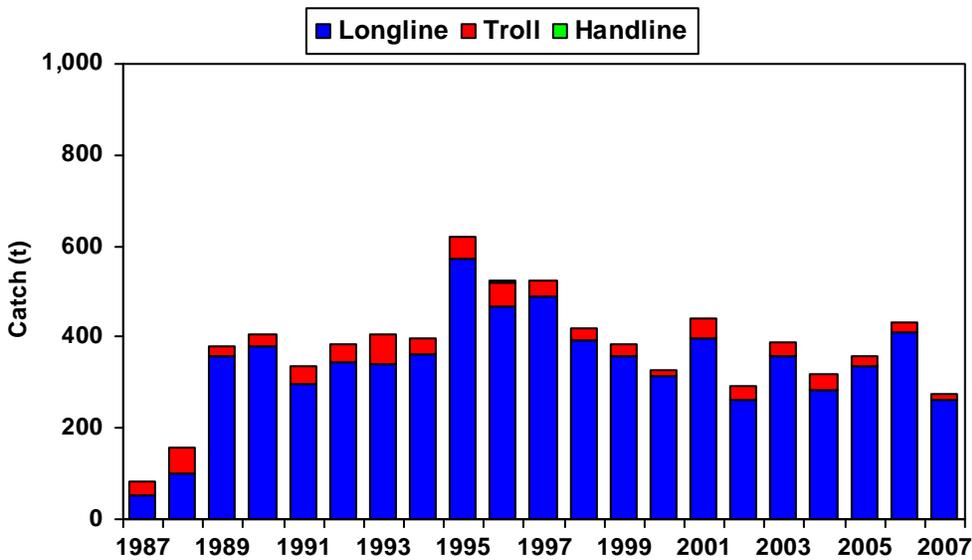


Figure 3.—Hawaii-based longline striped marlin catch (numbers of fish) by area, 2007.

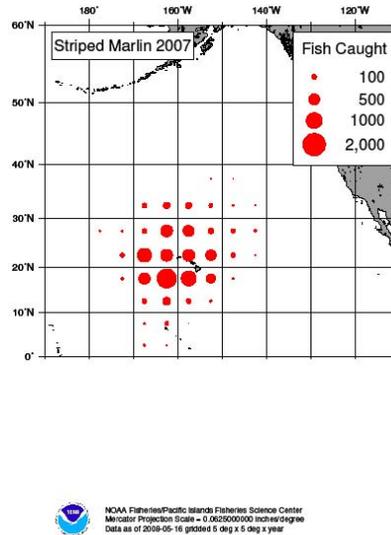


Figure 4.—Hawaii-based longline blue marlin catch (numbers of fish) by area, 2007.

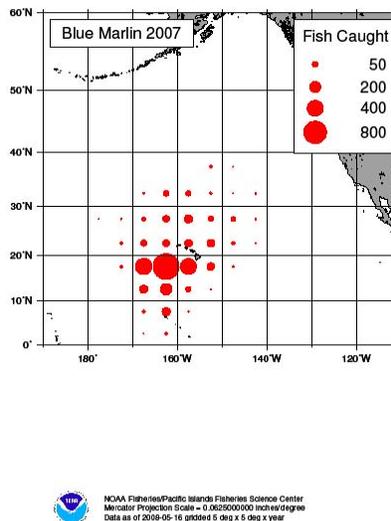
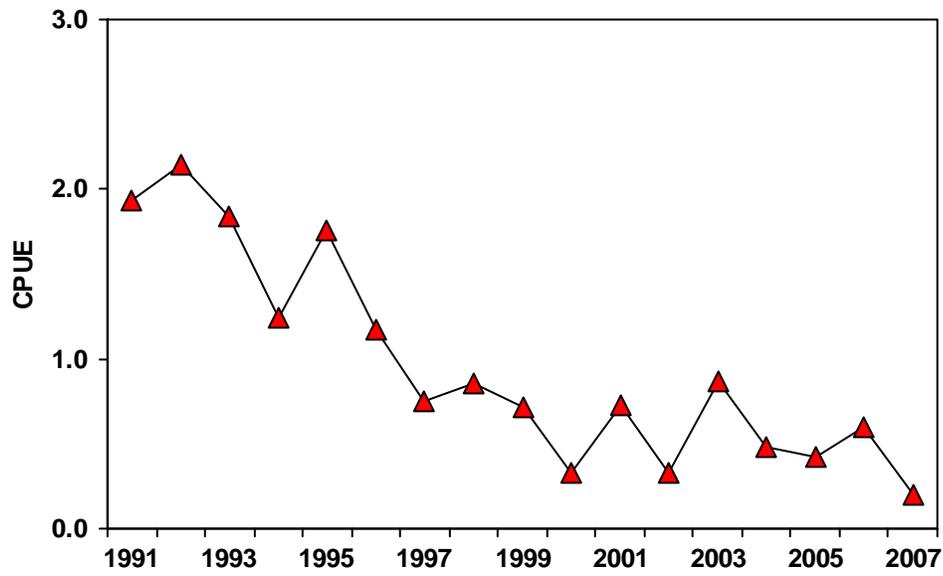
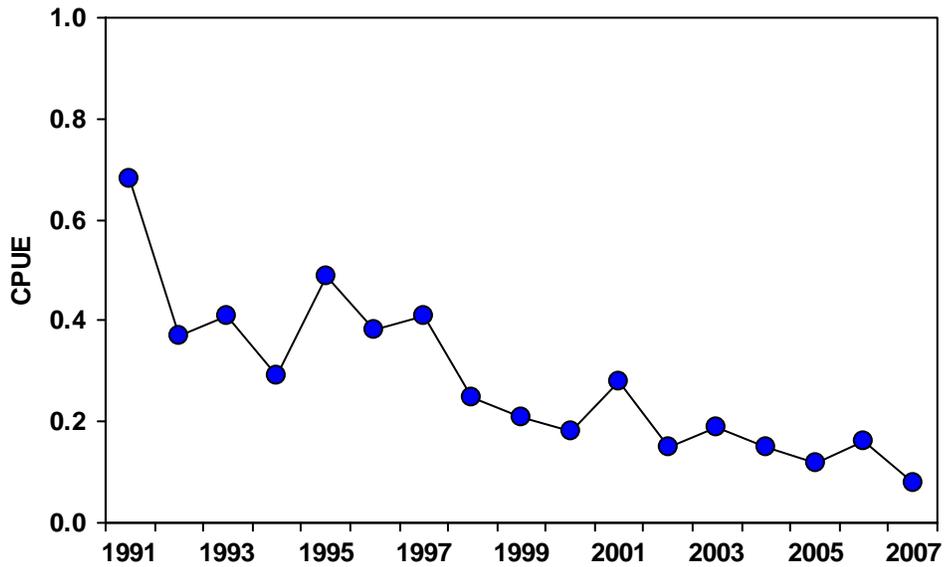


Figure 5.—Hawaii-based longline striped marlin CPUE\* on tuna-targeted deep sets, 1991-2007.



\*CPUE = number of fish per 1000 hooks

Figure 6.—Hawaii-based longline blue marlin CPUE\* on tuna-targeted deepsets, 1991-2007.



\*CPUE = number of fish per 1000 hooks

Figure 7.--Hawaii longline A) striped marlin and B) blue marlin weight-frequency, 2007.

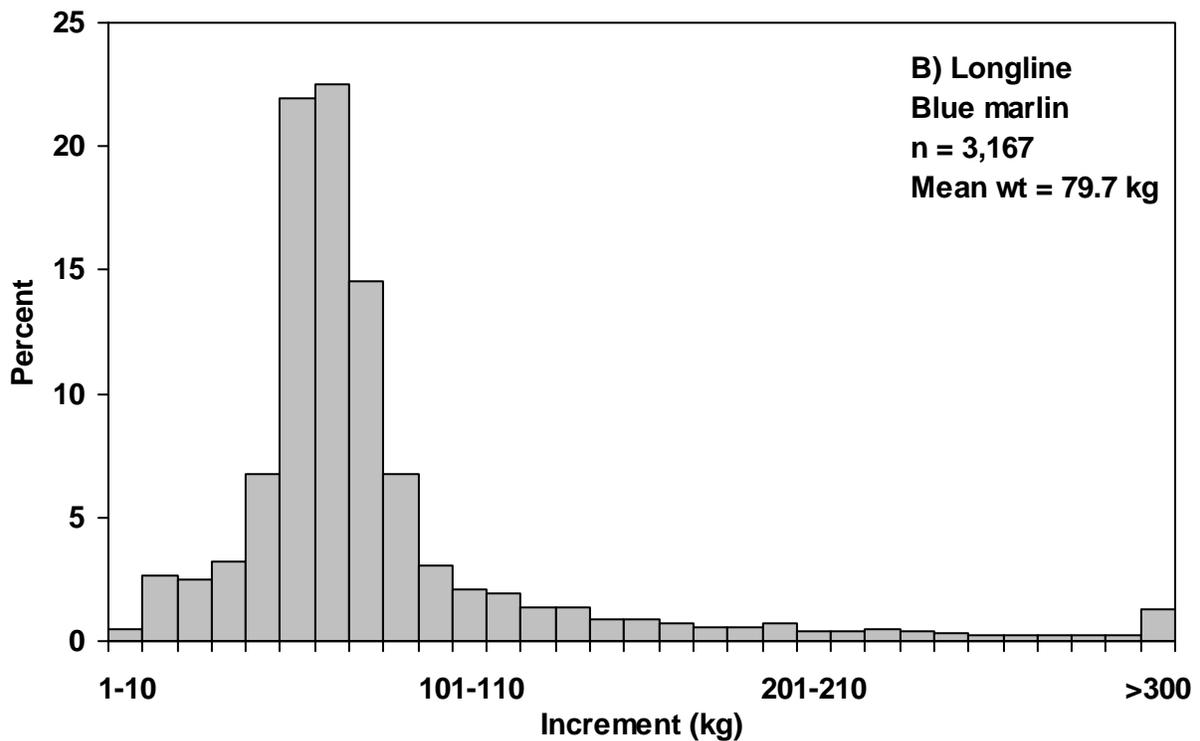
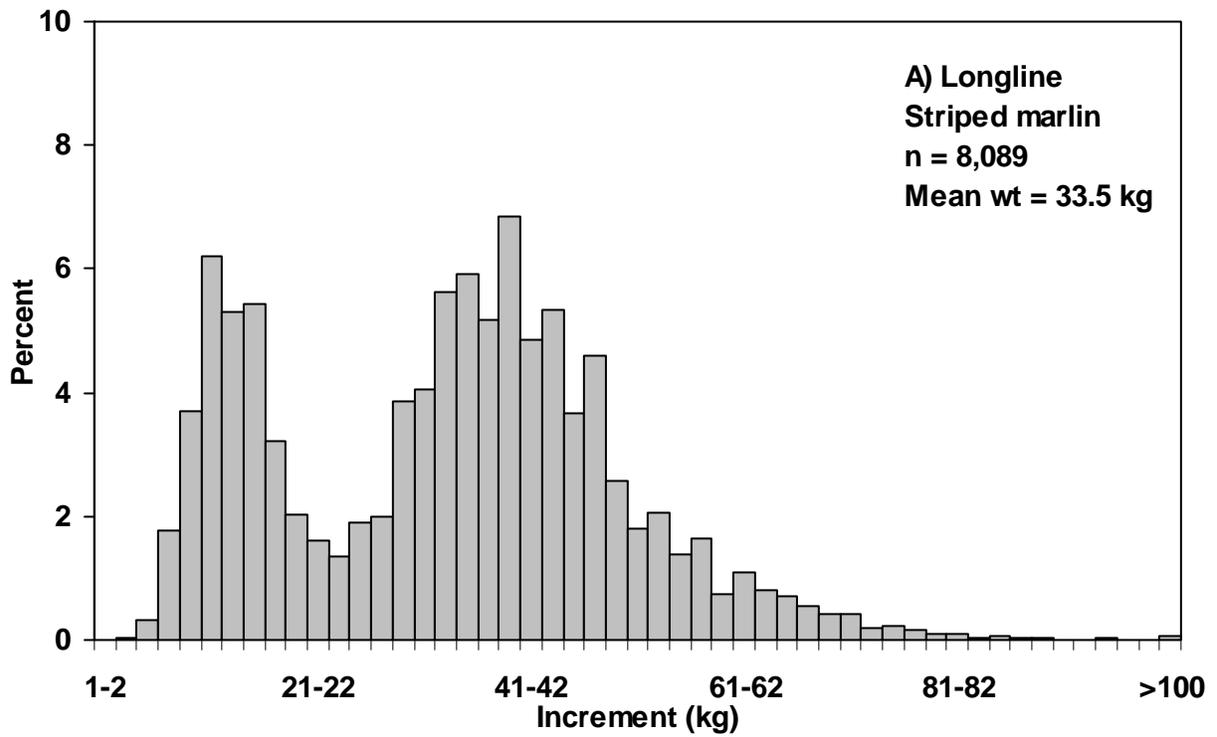


Figure 8.—Hawaii troll and handline A) striped marlin and B) blue marlin weight-frequency, 2007.

