Analysis of Commercial Fish Trap Data in Hawaii

A Report for the Western Pacific Regional Fishery Management Council

Hawaii Pacific University

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I. Introduction

The Data

The goal of this project was to use the Hawaii Division of Aquatic Resources (HDAR) commercial catch data for fish traps from 1948 through the 2011 fiscal year to assess the feasibility of using fish traps as an ecosystem indicator to understand coral reef fish dynamics in the Main Hawaiian Islands (MHI). In comparison to fisheries using other gear types, the trap fishery is assumed to have fluctuated less than other fisheries, in terms fisher effort, specifically with respect to catchability changes and changes in areas fished across time. In fisheries using other gear types the catchability has been changing due to advances in fishing technology and strategies, whereas the trap fishery is assumed to have been relatively static in these aspects over time. The fish trap fishery is characterized by territorial fishers, who continue fishing in the same areas from generation to generation. Traps are placed in specific areas in the natural habitat where they are most efficient, and typically traps will not be relocated unless fishing in the area is no longer effective for the fisher. The overriding assumption about this method is that traps are not selectively targeting specific species. Trap placement and the size of the trap opening and mesh are the known ways to deter or attract certain species or sizes of fish. Traps will catch species in the environment that are attracted to the introduced shelter; therefore species composition of the trap catch would be indicative of the diversity and possibly abundance in those areas. If traps can be shown to be consistent through time in terms of catch and effort using the data from HDAR, then this data can be used interpret ecosystem changes from 1948-2011.

Trap data begins from 1948 and is continuous to the present. The data are subject to a strict confidentially agreement; therefore, all analysis and data queries were done on site at the HDAR office. All data points are required to be composed of records from a minimum of three fishers,

and nothing could be exported from the office until data has been reviewed and approved by Reginald Kokubun. Looking at the catch and effort of individual fishers, who have consistently contributed to the fishery through time, while insightful, cannot be reported without a waiver of the right to confidentiality.

Traps as a Gear Type

From fiscal year 1948 until 1985, one gear code accounted for all types of traps (except for gear code 24, bullpen trap) in the fishing reports, regardless if fish or invertebrate species were targeted; this code was number 11. Gear code 11 was defined in the logbook as follows: 'Fishing with any of various fishing devices made into the shape of a box, container, or enclosure, with one or more openings that allow marine life to get inside but keep them from leaving, typically various fish and crustaceans.' Also, bullpen traps, gear code 24, used to catch fish, were recorded starting from the 1948 fishing reports. Bullpen traps are defined as: 'Fishing with net(s) fixed in position to form a large stationary enclosure.' Starting from fiscal year 1986, trap code 11 was replaced with codes 51 (crab trap), 52 (fish trap), 53 (lobster trap), and 54 (shrimp trap), identifying the primary target of each trap type. Trap code 11 still appears in records until 1999, and this is attributed to misreporting and slow adjustment to the new gear codes. The trap types replacing code 11 are not completely discriminating in terms of species captured, and there are several reports of fish caught in traps targeting crustaceans and vice versa.

Trap Regulations

The trap fishery has been regulated by established mesh size and trap dimension. In 1925, the first regulation of a minimum mesh size of 2 inches stretched was established. In 1989, the trap dimensions of 6' x 6' x 10' were established along with a trap minimum mesh size of 2" x 1" for hard material (fishers already registered were exempted from the new minimums until 1994).

Most species minimum sizes were put into effect in 1945, prior to commercial reporting in 1948. There have been some amendments and additions of minimum sizes through time. In 1949, *Parupeneus multifasciatus, Parupeneus porphyreus, Naso unicornis, Naso hexicanthus,* and *Albula glossodonta* minimum sizes were first added. In 1958, Carangidae was managed with a minimum size. In 1998, minimum sizes that were first put into effect in 1945 or later in 1949 were changed. The species affected were: *Kuhlia xenura* and *sandvicensis, Acanthurus triostegus, Parupeneus multifasciatus, Parupeneus porphyreus, Mugil cephalus, Chanos chanos, Albula glossodonta, Naso unicornis, Naso hexicanthus, Etelis coruscans, Pristopomoides filamentosis, Aprion virescens, Thunnus albacares, Decapterus macarellus, Selar crumenopthalmus,* Atherinidae, and Engraulidae. In 2002, new minimum size changes for fish species already regulated went into effect. The species affected by this regulation were *Selar crumenopthalmus*, *Parupeneus porphyreus*, *Acanthurus triostegus*, *Kuhlia xenura* and *sandvicensis*, *Parupeneus multifasciatus*, *Mugil cephalus*, *Chanos chanos*, *Albula glossodonta*, *Naso unicornis*, *Naso hexicanthus*, *Scarus* spp., *Polydactylus sexfilis*, *Mulloidichthys flavolineatus* and *vanicolensis*, and Carangidae. The trap fishery might have been affected by these minimum size changes, necessitating more releases of undersized fish (more bycatch that may not be reported). Reports of releases do not begin until the logbook was changed in 2002, and even with the addition of this data field, it is rarely filled out. Also, changes in area regulations can affect landings by area over time.

Also, species codes have been added and have changed in meaning through time. Most codes have appeared since 1948, but some were added later as the need arose. The changes in species codes relevant to fish traps are: species code 114, *Lutjanus kasmira*, which was added in 1970, after its introduction to the Hawaiian islands in the 1950s; species code 124, *Naso hexicanthus*,

which was added in 1985; species code 205, *Caranx ignobilis*, which was added in 1981; and species codes 127 and 128, *Mulloidichthys vanicolensis* and *flavolineatu*s respectively, which were added in 2002. Species code 103, Mullidae, has changed in terms of reporting and disappears as a code in the data after 2003. The logbook change in 2002 was accompanied by information sessions on reporting, which may have caused fishers previously lumping all goatfish under Mullidae, to start reporting more accurately to the species level.

Fisher Effort

Effort in the trap fishery can be defined in number of trips, and can be obtained for all years from 1948 until 2011. Effort was found by summing the 'trip end' per license. The 'Trip end' is recorded as the date that the catch was collected. From 1948 until 2002, neither the soak time of the traps, nor the number of traps per set was recorded. When the logbook was changed in 2002, number of hours fished and number of traps set were added. The field 'hours' and 'no_gears' are filled out for greater than 99% of the records from October 2002 until the end of June 2011, so for this time period more detailed effort was available. Hours fished and number of gears used is variable among trap fishers, therefore trips as a unit of effort is not standard among fishers.

II. Methods

Data Preparation

The data used, was extracted by Reginald Kokubun from the database containing all catch records starting from 1948. All records pertaining to catch landed in trap gear types (gear codes 11, 24, 51, 52, 53, and 54) resulted in two files: Trap4802.dbf, which was data from fiscal years 1948-2002, and Trap0211.dbf, which was data from fiscal years 2003-2011. The data was separated into two files because of the logbook change in 2003, which resulted in a few changes

of what was required of fishermen in terms of reporting. The two data sets were imported into MS Access, and then merged to create a single file.

Data quality checks were performed in order to identify potential errors. Records with zero or error values (usually 99999) in data fields such as 'license' and 'area,' were identified and removed from the data set. Diagnostics such as range checks, standard deviations, scatterplots, and frequency distributions were performed on each data field. All outliers were identified, and verified with the original records by Reginald Kokubun. As a result, some data was modified and some records were removed before analyses. The records found to be a keypunch error, as well as records misreporting gear code 24, bullpen trap, where it should have been code 23, seine net, were removed.

Records were also removed in order to focus on fish species landed in traps targeting fish for the time period of 1948-2011. Therefore, the following records were removed: all of fiscal year 2012 (because it is only a portion of the current fiscal year); species codes greater than 366 (removing all invertebrates caught in traps); and gear codes 51, 53, and 54 (gears targeting invertebrates but had fish bycatch; removing 5346.5 lbs. or 0.12% of the total fish landed). After the removal of those records, there were a total of 235,521 records. The data field 'pieces' was assessed in terms of how often it was reported, since it could have been used to verify 'lbs caught.' By dividing 'lbs caught' by 'pieces,' inaccurate reports of landings could be identified with prior knowledge of the average weight per species. However, 82% of the records had 'pieces' equaling zero, when pounds did not equal zero (192,248/235,521 records).

Next, a separate data set was created for analyses of more detailed effort from October 2002 through the end of fiscal year 2011. The new reporting requirements in the updated logbooks beginning in October 2002 included recording the number of sets, the number of gears, and the

number of hours fished. These were the data fields considered as detailed effort, and therefore ‘sets,’ ‘hours,’ and ‘no_gears’ (number of gears) were assessed in terms of how often they were reported. The number of records with ‘sets’ not equal to zero was 347 or 3.4% of records. Therefore, ‘sets’ as a unit of effort was not used. The number of records with ‘hours’ not equal to zero was 10,214 or 99.9% of records, and the number of records with ‘no_gears’ not equal to zero were 10,198 or 99.7% of records. As a result, the measures of effort ‘hours’ and ‘no_gears’ could be used for more detailed effort analyses. Also, these two fields were analyzed to see how often they were not recorded despite pounds being caught. Fourteen records or 0.14% of all records were found, where ‘lbs caught’ did not equal zero, but ‘hours’ did equal zero. Thirty records or 0.29% of all records were found, where ‘lbs caught’ did not equal zero, but ‘no_gears’ did equal zero. These 44 records mentioned were removed from this data set considering detailed effort. A total of 3,498.1 lbs. were removed as a result, which was 1.64% of the total pounds caught from Oct. 2003-2011.

Data Analyses

Figures and tables were generated from the two data sets mentioned, using pivot tables and filters in order to summarize the data. Each data point was verified to make sure that it had at least three licenses, abiding by the confidentiality agreement. Some blanks in the tables and gaps in the figures, as well as some aggregations were necessary for this reason.

Analyses through time

Catch in pounds, effort in trips, and catch-per-unit effort (CPUE) in pounds per trip was analyzed considering all trap types targeting fish species, which included gear code 11 (general code for traps used prior to 1986), gear code 24 (bullpen traps), and gear code 52 (fish trap gear code added in 1986), from 1948 to 2011. Also, gear code 52 (fish trap) was considered on its

own from 1986-2011. Total pounds caught, total licenses, total trips, trips per license, pounds per license, and CPUE in terms of pounds per trip was plotted through time for both of these gear groupings. From October 2002 through 2011, a detailed subset of effort was available, so CPUE was analyzed as pounds per trip, pounds per hours fished, and pounds per number of traps for this time series.

Analyses of Species Composition

Analyses of species composition was also broken up into the two gear groupings, where gear code 11 (general code for traps used prior to 1986), gear code 24 (bullpen traps), and gear code 52 (fish trap gear code added in 1986) were considered together from 1948 to 2011, and then gear code 52 was considered separately from 1986 to 2011. For both gear groupings, total landings by species in descending order for the respective time frame was generated. The top four species in each gear grouping were ranked for each fiscal year in terms of total landings for that year. Also, the top five species landed in fish traps per year from 1986-2011 were recorded in a table. The top two or three species or species groups of Carangidae, Acanthuridae, Mullidae, and two other top species were analyzed for their change in percent of total landings in fish traps from each fiscal year from 1986-2011.

Species were also grouped under the categories snappers, goatfish, jacks, parrotfish, surgeonfish, and filefish, and analyzed by the percent of total pounds each group contributed per fiscal year. Both gear groupings were used for these analyses across time. These figures were used in order to identify changes in species composition through time without the influence of species code changes at the species level, which could be driven by the discontinuance of a code or the addition of codes for species previously considered under one code. For instance, a species code change occurred for the goatfish with the addition of species codes 127, *Mulloidichthys*

vanicolensis and 128, *Mulloidichthys flavolineatu*s added in 2002, and the corresponding disappearance of species code 103, Mullidae.

Analyses by Area

Analyses by area were also considered in the two different gear groupings. The top statistical fishing areas in terms of total pounds landed were identified from 1948-2011 for all three gear types, and from 1986-2011 for only fish traps. Also, the top three areas and their percent of total landings per year were generated in a table for both gear groupings.

Analyses by island area were considered for both gear groupings. Aggregation was necessary resulting in four island areas: Big Island (Areas 100-127); Maui Nui, which included Moloka'i, Lana'i, and Penguin Banks (Areas 300-332); O'ahu (Areas 400-429); and Kaua'i, which included Ni'ihau and Ka'ula (Areas 500-528). Analyses included total landings per island area, CPUE in pounds per trip, and the percent of total landings and total trips that each island area accounted for from 1948-2011 in all traps, and from 1986-2011in just fish traps.

III. Results

Analyses through time

When all three trap types were considered from 1948-2011, the greatest catch, participation (in terms of number of licenses), and effort in number of trips occurred at the beginning of the time series (Figures 1.1 and 1.2). In the early 1960s and late 1990s there was a spike in trips per license and pounds per license. Catch, effort, and CPUE have not followed the same trend through time, but have been fluctuating throughout this time series, with the highest peaks in the late 1970s and early 2000s.

When only fish traps were considered from 1986-2011, the greatest catch, trips per license, pounds per license, number of trips, and CPUE in pounds per trip occurred in the late 1990s

(Figures 2.1 and 2.2). In Figure 2.2, the trend does not dissociate for effort in trips and CPUE in pounds per trip, showing that catch in this gear type alone can be considered somewhat consistent from 1986-2011. In the analysis of detailed effort from 2003-2011, CPUE in pounds per trip, pounds per hours fished, and pounds per number of traps showed that the highest CPUE occurred in 2008 (Figure 2.4). The trends in CPUE are comparable between the different considerations of effort after 2005, but before 2005, the trends for each form of CPUE do not correspond. Correlations in the form of a simple linear regression between the CPUE's with different measures of effort, showed that the most comparable pair was CPUE in pounds per trap and CPUE in pounds per trip, with 67% (R^2=0.6737) of the model explaining the linear relationship (Figure 2.5 A,B,C). The relationships between pounds per hour and pounds per trap (R^2=0.523), and between pounds per hour and pounds per trip (R^2=0.2332) were less comparable, therefore, pounds per hour is a less reliable form of measuring CPUE than pounds per trip and pounds per trap.

Analyses of Species Composition

Landings by species were not consistent across time; the top species fluctuated from year to year. Analysis of species composition, showed that the top five species or species groups in terms of total landings when all traps (gear codes 11, 24, and 52) are considered were Mullidae, *Parupeneus multifasciatus*, *Acanthurus dussumieri*, *Parupeneus porphyreus*, and Carangidae, accounting for 48% of all landings from 1948-2011 (Figure 3.1). The top five species in terms of total landings in fish traps (gear code 52) were *Acanthurus dussumieri*, *Lutjanus kasmira*, *Scarus* spp. (misc.), *Acanthurus olivaceus*, and *Mulloidichthys pflugeri*, accounting for 55% of all landings from 1986-2011 (Figure 3.3). Analysis of the percent of total pounds contributed by species groups showed the same inconsistency across time (Figures 3.7 and 3.8). Therefore,

these fluctuations in species composition are not due to changes in species coding and their changing definitions through time.

Species composition by the top areas, 403, 404, and 409, was also considered. Analyses of the top five species per year in each of these areas showed that species composition has been changing within these areas. Also, areas are not distinguishable from other areas simply by species composition; therefore, change in top areas does not mean a corresponding change in top species. However, these areas do not have three licenses contributing to catch per year, so no quantitative data or figures can be shown due to the confidentiality agreement.

Analyses by Area

Landings by fishing area were also not consistent; the top areas fluctuated from year to year. The top areas in terms of total landings when all three trap gear types were considered were all areas on Oahu: 403, 409, and 402, which accounted for 58% of the total landings from 1948-2011. The top areas in terms of total landings when only fish traps were considered were also all areas on Oahu: 404, 409, and 403, which accounted for 59% of the total landings from 1986-2011.

Analysis by island area showed that O'ahu contributed the highest total catch and the highest total effort, but the Kaua'i island area had the highest CPUE compared to the other islands/island groups, in both gear groupings. Considering only catch, effort, and CPUE off of O'ahu did not change the overall trends across time that were seen in the figures considering catch on all islands. Therefore, the trap fishery on O'ahu is driving these trends through time.

IV. Discussion

From the analyses, the trap fishery, when considering all trap types (gear codes 11, 24, and 52) has not been as consistent in terms of fisher effort through time (Figure 1.1 and 1.2).

Therefore, the data considering all trap types could not be used as an ecosystem indicator. When considering only fish traps (gear code 52), there is no directional trend in catch, effort, or pounds per trip (Figure 2.1 and 2.2). However, the trend of catch (total pounds) and effort (pounds per trip) have not dissociated across time. Therefore, fish trap data for gear code 52 has been relatively consistent compared to the data considering all trap types, and would be better to use for assessing the ecosystem from 1986 to 2011. However, analysis of fishing areas has shown that the top areas fished have been changing through time, whether or not fish traps are considered alone (Table 4.3 and 4.4). The main assumption about the trap fishery was that fishing was territorial and generational, meaning that the catch data for traps would be like sampling the ecosystem in the same area across time. If the areas are changing, then trap data for these ecosystems is not consistent.

When the top fishers were investigated in terms of where they were fishing, these high liners were fishing a total of 1-4 areas, with 1-2 areas always dominating the majority of the catch. Among these top fishers, taking years off throughout their fishing career was a common occurrence. A closer look at their catch, effort, and CPUE was only possible starting from 1993, when permanent license numbers were assigned. A 15-year span (not continuous, however) was common among the more effective fishers. A common trend amongst these fishers was not seen in terms of catch in total pounds, effort in number of trips and traps (only from 2003-2011), and CPUE pounds per trips. Species composition per year was also highly variable, and was similar to the overall change across time. Also, fishing areas for these top fishers has changed across time, contradicting the assumption that locations for each fisher are consistent across time. The data for individual fishers cannot be reported in figures or quantified due to the confidentiality agreement.

CPUE changes across time might not be explicitly a factor of a change in stock abundance. The loss of an experienced fisher may lower overall CPUE, simply because a highly efficient and knowledgeable participant is removed. Less experienced fishers may not know when and where the best place to leave their traps is, leading to inflation of effort with less catch, when compared to a more experienced fisher. From 1993, when permanent license numbers began to be assigned, years where there was a loss of efficient fishers could be easily identified. Top fishers were identified, and their catch was followed through time, showing that they did not always fish consistently, often taking one or two years off throughout their span in the fishery. However, due to confidentiality, these years cannot be identified in this report.

Among all the island areas, O'ahu was identified as the top island area in terms of landings and fisher participation, and analyses by island area has shown that the top fishing areas are mostly on O'ahu. In Table 4.3, areas on the other islands appear in the top three areas (determined by percent of landings per year in all trap types) 13 times out of the total 189 rankings (three per year) from 1948-2011, and only appear in 10 individual years. In Table 4.4, islands other than O'ahu appear in the rankings 8 times out of the total 75 ranks (three per year) from 1986-2011. Removing the other island areas from the analyses across time did not change the overall trends in catch, effort, or CPUE, meaning the trap fishery on O'ahu is driving the trends seen (Figures 1.3 and 2.6). Kaua'i had a much lower catch in terms of pounds when compared to O'ahu, however CPUE in pounds per trip was nearly three times that of O'ahu (Figures 4.4-4.9).

In the analysis of top species across time, species in terms of pounds landed has been changing across time. Top species analyzed in three of the top fishing areas showed the same fluctuation. Whether these species changes across time were a factor of the environment is

unknown. Fish traps used by highly skilled trap fisherman, may be more selective than previously thought. Placement of these traps is known to be important for effective fishing, but trap position, habitat of choice, methods of concealment, and bait could be used to target some species over others. Therefore, species composition seen in traps may be market driven rather than the nature of the ecosystem. In fish traps, *Scarus* spp. (misc.) was one of the top species from 1986-2011 (Figure 3.2). *Scarus* spp. (misc.) rose in total landings starting in 2003, and has been top in landings until 2011 (Figures 3.5D and 3.6D). Further investigation of *Scarus* spp. (misc.) records in detail, showed that the entrance of a few fishers into the fishery in the late 1900s to early 2000s, contributed to the increased landings for this species from 2003-2011. These fishers may be experienced at targeting parrotfish, which are in demand on the market. Communication with trap fishers may help in understanding these strategies.

The regulation changes noted through the history of the fishery may also have an effect on catch and effort. This includes the regulation change on trap dimensions established in 1989 and enforced (for previous license holders) in 1994, where the trap dimensions of 6’ x 6’ x 10’ were established along with a trap minimum mesh size of 2” x 1” for hard material. This change did not seem to cause any change in catch-per-unit effort, in pounds per trip. A slight decline in CPUE can be seen between 1990 and 1994, however it is unknown if this regulation change was the cause of this decline (Figure 2.2).

Also, the fishing logbook was changed in October 2002, which led to the addition of data fields that recorded fisher effort in more detail. When the logbook was changed, an effort was made to explain the correct way to record fishing activity, therefore reporting accuracy is assumed to be higher since the fiscal year of 2003. Prior to 2003, underreporting is believed to have occurred. In the analysis of all trap gear types from 1948-2011, the top species, Mullidae,

no longer appeared in the reports after 2003. A possible explanation for this disappearance is the logbook change in 2003 and an attempt to elucidate reporting methods to fishers, resulting in reporting to the species level of goatfish previously lumped under Mullidae. However, analyses grouping all goatfish landings through time to account for species code changes showed that goatfish landings as a whole have been in decline (Figures 3.7 and 3.8). A sharp decrease occurred in the early 1970s, and landings have been in a gradual decline since the late 1970s.

In conclusion, the data available for the trap fishery could not be used as an ecosystem indicator. The trap fishery has not been static, as was previously assumed. Fisher effort has changed through time, and fishing locations have been changing as well. Also, skilled fishers may be targeting market driven species, therefore making the trap fishery more selective than was assumed. However, if the right to confidentiality were waived, using the data to follow the trends of individual fishers could be a way to use the trap fishery as an ecosystem indicator.

V. Tables

Table 1.1: Total fish landings and effort using traps (gear code 11, 24, and 52) from 1948-2011

Fiscal year	Licenses	Total lbs	Trips	Lbs/trip	Lbs/license	Trips/license
1948	62	94,390	767	123	1,522	12
1949	55	149,731	1,834	82	2,722	33
1950	58	156,888	1,487	106	2,705	26
1951	55	134,904	1,248	108	2,453	23
1952	43	136,342	1,291	106	3,171	30
1953	56	154,327	1,313	118	2,756	23
1954	32	135,095	1,354	100	4,222	42
1955	39	155,230	1,615	96	3,980	41
1956	44	138,132	1,431	97	3,139	33
1957	37	134,654	1,456	92	3,639	39
1958	30	127,977	1,156	111	4,266	39
1959	21	126,326	1,067	118	6,016	51
1960	17	109,673	991	111	6,451	58
1961	15	124,361	982	127	8,291	65
1962	16	111,427	859	130	6,964	54
1963	22	94,325	795	119	4,288	36
1964	26	140,296	1,002	140	5,396	39
1965	18	90,110	835	108	5,006	46
1966	16	82,279	644	128	5,142	40
1967	18	59,907	584	103	3,328	32
1968	17	51,644	488	106	3,038	29
1969	27	71,080	604	118	2,633	22
1970	23	65,452	519	126	2,846	23
1971	22	60,587	575	105	2,754	26
1972	20	61,624	530	116	3,081	27
1973	19	46,580	526	89	2,452	28
1974	26	45,388	587	77	1,746	23
1975	23	45,781	659	69	1,990	29
1976	28	50,031	561	89	1,787	20
1977	33	83,594	830	101	2,533	25
1978	32	81,441	532	153	2,545	17
1979	33	71,411	334	214	2,164	10
1980	35	67,960	506	134	1,942	14
1981	31	98,594	885	111	3,180	29
1982	23	70,634	705	100	3,071	31
1983	20	47,283	487	97	2,364	24
1984	25	52,191	564	93	2,088	23
1985	22	45,819	453	101	2,083	21
1986	12	36,637	242	151	3,053	20
1987	19	38,139	303	126	2,007	16

Fiscal year	Licenses	Total lbs	Trips	Lbs/trip	Lbs/license	Trips/license
1988	17	17,082	188	91	1,005	11
1989	18	28,087	265	106	1,560	15
1990	18	43,485	250	174	2,416	14
1991	21	38,776	252	154	1,846	12
1992	16	21,265	194	110	1,329	12
1993	13	23,226	185	126	1,787	14
1994	15	22,283	160	139	1,486	11
1995	16	27,789	169	164	1,737	11
1996	14	42,128	220	191	3,009	16
1997	15	58,125	279	208	3,875	19
1998	15	76,425	327	234	5,095	22
1999	14	77,671	327	238	5,548	23
2000	11	72,215	295	245	6,565	27
2001	13	43,263	220	197	3,328	17
2002	13	68,751	257	268	5,289	20
2003	17	41,519	194	214	2,442	11
2004	12	35,130	242	145	2,928	20
2005	8	22,057	152	145	2,757	19
2006	7	13,615	106	128	1,945	15
2007	9	27,867	186	150	3,096	21
2008	10	31,628	201	157	3,163	20
2009	14	20,354	142	143	1,454	10
2010	11	21,911	186	118	1,992	17
2011	12	22,326	176	127	1,861	15

Table 2.1: Total fish landings and effort using fish traps (gear code 52) from 1986-2011

Fiscal year	Licenses	Total lbs	Trips	Lbs/trip	Lbs/license	Trips/license
1986	9	20,724	145	143	2,303	16
1987	15	29,479	214	138	1,965	14
1988	14	14,360	160	90	1,026	11
1989	12	20,864	200	104	1,739	17
1990	13	34,268	208	165	2,636	16
1991	12	21,114	157	134	1,760	13
1992	13	17,949	157	114	1,381	12
1993	8	18,860	167	113	2,358	21
1994	10	12,439	123	101	1,244	12
1995	10	20,301	140	145	2,030	14
1996	11	37,069	182	204	3,370	17
1997	11	53,414	257	208	4,856	23
1998	12	69,629	281	248	5,802	23
1999	12	58,844	274	215	4,904	23
2000	8	52,104	237	220	6,513	30
2001	8	34,868	191	183	4,359	24
2002	8	35,924	198	181	4,491	25
2003	11	22,203	163	136	2,018	15
2004	10	34,423	238	145	3,442	24
2005	6	18,635	133	140	3,106	22
2006	5	12,694	102	124	2,539	20
2007	8	27,402	183	150	3,425	23
2008	8	31,025	197	157	3,878	25
2009	10	19,725	136	145	1,973	14
2010	11	21,911	186	118	1,992	17
2011	10	21,062	173	122	2,106	17

Table 2.2: Catch, Effort, and CPUE for fish traps (gear code 52) from 2003-2011

Fiscal Year	Total Lbs.	Total Licenses	Total Trips	Total Hours	Total Traps	Lbs./trip	Lbs./trap	Lbs./hours	Hours/Trip	Traps/trip
2003	15,390	10	112	15,253	827	137	19	1.0	136	7
2004	34,395	10	237	21,505	2,411	145	14	1.6	91	10
2005	18,508	6	132	11,352	1,498	140	12	1.6	86	11
2006	12,694	5	102	8,799	1,046	124	12	1.4	86	10
2007	27,402	8	183	14,437	1,314	150	21	1.9	79	7
2008	31,025	8	199	16,048	1,286	156	24	1.9	81	6
2009	19,725	10	137	14,727	985	144	20	1.3	107	7
2010	21,911	11	188	20,733	2,072	117	11	1.1	110	11
2011	21,030	10	172	15,714	1,582	122	13	1.3	91	9

Table 3.1: Landings by Species in traps (code 11, 24, and 52) from 1948-2011

Species Code	Species Name	Total lbs.	% of total	Cumulative %	Licenses
103	*Mullidae*	733,003	16%	16%	>3
68	*Parupeneus multifasciatus*	424,331	9%	25%	>3
86	*Acanthurus dussumieri*	361,246	8%	33%	>3
52	*Parupeneus porphyreus*	347,355	8%	41%	>3
23	*Carangidae*	342,246	8%	48%	>3
24	*Mulloidichthys pflugeri*	304,107	7%	55%	>3
114	*Lutjanus kasmira*	202,051	4%	60%	>3
93	*Muraenidae*	173,068	4%	63%	>3
92	*Acanthurus blochii, xanthopterus*	157,690	3%	67%	>3
47	*Naso annulatus, brevirostris, unicornis*	150,837	3%	70%	>3
64	*Acanthurus triostegus*	136,651	3%	73%	>3
96	*Scarus* spp. (misc.)	136,204	3%	76%	>3
100	*Myripristis spp.*	109,512	2%	78%	>3
72	*Acanthurus olivaceus*	106,389	2%	81%	>3
95	*Congridae spp.*	89,797	2%	83%	>3
77	*Aluterus scriptus*	76,317	2%	84%	>3
18	*Caranx melampygus*	70,727	2%	86%	>3
110	*Parupeneus pleurostigma*	66,181	1%	87%	>3
16	*Seriola dumerili*	51,961	1%	89%	>3
63	*Abudefduf abdominalis*	49,088	1%	90%	>3
30	*Mugil cephalus*	44,446	1%	91%	>3
124	*Naso hexacanthus*	42,778	1%	92%	>3
20	*Aprion virescens*	33,802	1%	92%	>3
205	*Caranx ignoblis*	33,239	1%	93%	>3
74	*Kyphosus bigibbus, cinerescens*	21,509	0%	94%	>3
78	*Albula glossodonta*	20,259	0%	94%	>3
71	*Monotaxis grandoculis*	19,646	0%	94%	>3
87	*Scarus spp. (sleeping uhu)*	18,622	0%	95%	>3
19	*Prisitipomoides filamentosus*	17,991	0%	95%	>3
88	*Scarus spp. (Uhu)*	17,078	0%	96%	>3
28	*Selar crumenopthalmus*	16,593	0%	96%	>3
43	*Balistidae*	16,566	0%	96%	>3
81	*Decapterus macarellus*	15,830	0%	97%	>3
34	*Heteropriacanthus cruentatus*	14,265	0%	97%	>3
46	*Sphyraena barracuda*	12,231	0%	97%	>3
3	*Thunnus albacares*	10,860	0%	97%	>3
25	*Bodianus albotaeniatus*	10,453	0%	98%	>3
206	*Parupeneus cyclostomus*	8,658	0%	98%	>3
60	*Acanthurus nigroris*	6,734	0%	98%	>3
75	*Scorpaenopsis spp.*	6,098	0%	98%	>3
67	*Etrumeus micropus*	5,564	0%	98%	>3
57	*Chaetodon auriga*	5,123	0%	98%	>3
	Other	73,084	2%	100%	>3

Table 3.2: Landings by Species in traps (code 52) from 1986-2011

Species Code	Species	total lbs	% of total	Cumulative %	Licenses
86	*Acanthurus dussumieri*	113,266	15%	15%	>3
114	*Lutjanus kasmira*	108,295	14%	29%	>3
96	*Scarus* spp. (misc.)	75,319	10%	39%	>3
72	*Acanthurus olivaceus*	64,480	8%	47%	>3
24	*Mulloidichthys pflugeri*	56,491	7%	55%	>3
77	*Aluterus scriptus*	50,728	7%	62%	>3
23	*Carangidae*	41,912	6%	67%	>3
124	*Naso hexacanthus*	41,455	5%	72%	>3
92	*Acanthurus blochii, xanthopterus*	34,661	5%	77%	>3
47	*Naso annulatus, brevirostris, unicornis*	27,331	4%	81%	>3
52	*Parupeneus porphyreus*	21,546	3%	83%	>3
205	*Caranx ignoblis*	16,693	2%	86%	>3
103	*Mullidae*	12,870	2%	87%	>3
68	*Parupeneus multifasciatus*	11,851	2%	89%	>3
64	*Acanthurus triostegus*	8,845	1%	90%	>3
100	*Myripristis spp.*	8,410	1%	91%	>3
206	*Parupeneus cyclostomus*	7,181	1%	92%	>3
87	*Scarus spp. (sleeping uhu)*	5,626	1%	93%	>3
25	*Bodianus albotaeniatus*	5,549	1%	94%	>3
20	*Aprion virescens*	5,325	1%	94%	>3
18	*Caranx melampygus*	5,289	1%	95%	>3
93	*Muraenidae*	5,267	1%	96%	>3
110	*Parupeneus pleurostigma*	3,908	1%	96%	>3
71	*Monotaxis grandoculis*	3,756	0%	97%	>3
115	*Lutjanus fulvus*	3,217	0%	97%	>3
127	*Mulloidichthys vanicolensis*	2,462	0%	97%	>3
63	*Abudefduf abdominalis*	1,887	0%	98%	>3
60	*Acanthurus nigroris*	1,592	0%	98%	>3
95	*Congridae spp.*	1,383	0%	98%	>3
128	*Mulloidichthys flavolineatus*	1,241	0%	98%	>3
34	*Heteropriacanthus cruentatus*	1,224	0%	98%	>3
	Other	12,246	2%	100%	>3

Table 3.3: Top 5 species landed in fish traps (gear code 52) per fiscal year

1986			1987			1988		
Species	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**
Acanthurus dussumieri	6,494	31%	*Lutjanus kasmira*	5,689	19%	*Acanthurus dussumieri*	3,114	22%
Acanthurus olivaceus	2,333	11%	*Acanthurus dussumieri*	4,909	17%	*Scarus* spp. (misc.)	1,479	10%
Mullidae	1,957	9%	*Naso annulatus, brevirostris, unicornis*	2,418	8%	*Parupeneus multifasciatus*	1,450	10%
Scarus spp. (misc.)	n/a	n/a	*Acanthurus blochii, xanthopterus*	2,030	7%	*Lutjanus kasmira*	1,221	9%
Parupeneus pleurostigma	1,454	7%	*Carangidae*	1,943	7%	*Acanthurus olivaceus*	1,090	8%
1989			**1990**			**1991**		
Species	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**
Acanthurus dussumieri	3,879	19%	*Lutjanus kasmira*	8,754	26%	*Acanthurus dussumieri*	4,876	23%
Lutjanus kasmira	2,258	11%	*Acanthurus dussumieri*	5,407	16%	*Naso hexacanthus*	1,781	8%
Acanthurus olivaceus	1,908	9%	*Carangidae*	2,806	8%	*Carangidae*	1,614	8%
Parupeneus multifasciatus	1,801	9%	*Scarus* spp. (misc.)	2,252	7%	*Acanthurus olivaceus*	1,437	7%
Scarus spp. (misc.)	1,643	8%	*Parupeneus porphyreus*	1,709	5%	*Scarus* spp. (misc.)	1,249	6%
1992			**1993**			**1994**		
Species	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**
Acanthurus dussumieri	4,622	26%	*Acanthurus dussumieri*	3,886	21%	*Acanthurus dussumieri*	2,698	22%
Lutjanus kasmira	2,468	14%	*Acanthurus olivaceus*	2,454	13%	*Mulloidichthys pflugeri*	1,545	12%
Acanthurus olivaceus	2,324	13%	*Mulloidichthys pflugeri*	1,717	9%	*Acanthurus olivaceus*	1,043	8%
Naso hexacanthus	1,296	7%	*Scarus* spp. (misc.)	1,428	8%	*Scarus* spp. (misc.)	957	8%
Acanthurus blochii, xanthopterus	1,234	7%	*Lutjanus kasmira*	1,219	6%	*Naso hexacanthus*	845	7%

1995			1996			1997		
Species	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**
Carangidae	3,629	18%	*Carangidae*	15,793	43%	*Lutjanus kasmira*	15,215	28%
Acanthurus dussumieri	2,914	14%	*Mulloidichthys pflugeri*	2,947	8%	*Mulloidichthys pflugeri*	7,327	14%
Mulloidichthys pflugeri	2,362	12%	*Acanthurus dussumieri*	2,446	7%	*Carangidae*	5,152	10%
Acanthurus olivaceus	1,488	7%	*Lutjanus kasmira*	2,111	6%	*Acanthurus dussumieri*	5,119	10%
Naso annulatus, brevirostris, unicornis	1,358	7%	*Naso annulatus, brevirostris, unicornis*	2,088	6%	*Acanthurus olivaceus*	3,045	6%

1998			1999			2000		
Species	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**
Lutjanus kasmira	25,589	37%	*Mulloidichthys pflugeri*	12,821	22%	*Aluterus scriptus*	20,280	39%
Acanthurus dussumieri	9,115	13%	*Aluterus scriptus*	7,304	12%	*Mulloidichthys pflugeri*	5,719	11%
Mulloidichthys pflugeri	6,690	10%	*Acanthurus dussumieri*	6,967	12%	*Lutjanus kasmira*	5,595	11%
Naso hexacanthus	4,330	6%	*Naso hexacanthus*	5,617	10%	*Acanthurus dussumieri*	4,383	8%
Carangidae	3,159	5%	*Lutjanus kasmira*	5,364	9%	*Naso hexacanthus*	3,847	7%

2001			2002			2003		
Species	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**	**Species**	**Lbs**	**% of total**
Aluterus scriptus	7,862	23%	*Acanthurus dussumieri*	6,313	18%	*Acanthurus dussumieri*	4,270	19%
Mulloidichthys pflugeri	3,644	10%	*Lutjanus kasmira*	4,401	12%	*Acanthurus olivaceus*	3,490	16%
Naso hexacanthus	3,601	10%	*Mulloidichthys pflugeri*	4,145	12%	*Scarus* spp. (misc.)	2,852	13%
Naso annulatus, brevirostris, unicornis	3,549	10%	*Naso hexacanthus*	3,606	10%	*Acanthurus blochii, xanthopterus*	1,758	8%
Lutjanus kasmira	3,257	9%	*Acanthurus olivaceus*	3,436	10%	*Caranx ignoblis*	1,524	7%

2004		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	5,870	17%
Acanthurus olivaceus	5,240	15%
Acanthurus dussumieri	4,867	14%
Aluterus scriptus	3,569	10%
Caranx ignoblis	2,502	7%

2005		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	4,253	23%
Acanthurus dussumieri	4,061	22%
Acanthurus olivaceus	3,313	18%
Acanthurus blochii, xanthopterus	1,329	7%
Lutjanus kasmira	1,211	6%

2006		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	3,683	29%
Acanthurus olivaceus	2,551	20%
Acanthurus dussumieri	2,505	20%
Lutjanus kasmira	1,426	11%
Caranx melampygus	n/a	n/a

2007		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	7,055	26%
Lutjanus kasmira	5,460	20%
Acanthurus dussumieri	4,932	18%
Acanthurus olivaceus	3,261	12%
Mulloidichthys pflugeri	1,054	4%

2008		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	9,670	31%
Acanthurus dussumieri	*5,215*	*17%*
Lutjanus kasmira	*3,513*	*11%*
Acanthurus olivaceus	*3,278*	*11%*
Myripristis spp.	*1,452*	*5%*

2009		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	8,178	41%
Acanthurus dussumieri	2,740	14%
Acanthurus blochii, xanthopterus	1,864	9%
Acanthurus olivaceus	1,769	9%
Naso hexacanthus	1,147	6%

2010		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	5,125	23%
Lutjanus kasmira	2,905	13%
Acanthurus olivaceus	2,487	11%
Acanthurus dussumieri	1,989	9%
Naso hexacanthus	1,588	7%

2011		
Species	**Lbs**	**% of total**
Scarus spp. (misc.)	4,339	21%
Acanthurus olivaceus	2,846	14%
Naso hexacanthus	2,668	13%
Acanthurus dussumieri	2,346	11%
Lutjanus kasmira	2,151	10%

Table 3.4: Percent of total landings in fish traps (gear code 52) per fiscal year of the species ranked as the top 5 in any year from 1986-2011. The confidentiality agreement requires there to be three licenses per data point, therefore 'n/a' appears in those cells.

Species	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Acanthurus blochii, xanthopterus	n/a	7%	6%	3%	3%	5%	7%	5%	5%	5%	6%	3%	4%	6%	2%	5%
Acanthurus dussumieri	31%	17%	22%	19%	16%	23%	26%	21%	22%	14%	7%	10%	13%	12%	8%	9%
Acanthurus olivaceus	11%	6%	8%	9%	4%	7%	13%	13%	8%	7%	3%	6%	4%	7%	4%	6%
Aluterus scriptus	1%	1%	0%	0%	1%	1%	1%	n/a	n/a	n/a	n/a	4%	3%	12%	39%	23%
Carangidae	4%	7%	5%	7%	8%	8%	0%	0%	2%	18%	43%	10%	5%	3%	1%	1%
Caranx ignoblis	n/a	n/a	n/a	1%	0%	3%	n/a	1%	n/a	2%	1%	2%	1%	2%	3%	3%
Caranx melampygus		1%	2%	0%	0%	1%	0%	0%	n/a	1%	0%	n/a	0%	0%	0%	n/a
Lutjanus kasmira	5%	19%	9%	11%	26%	5%	14%	6%	5%	6%	6%	28%	37%	9%	11%	9%
Mullidae	9%	6%	4%	5%	5%	3%	3%	4%	2%	n/a	1%	2%	1%	1%	0%	1%
Mulloidichthys pflugeri	n/a	2%	n/a	2%	4%	2%	4%	9%	12%	12%	8%	14%	10%	22%	11%	10%
Myripristis spp.	n/a	0%	2%	3%	1%	3%	3%	2%	2%	0%	1%	0%	1%	0%	1%	0%
Naso annulatus, brevirostris, unicornis	n/a	8%	0%	2%	2%	5%	2%	n/a	3%	7%	6%	3%	4%	6%	4%	10%
Naso hexacanthus		n/a	n/a	1%	1%	8%	7%	6%	7%	5%	4%	3%	6%	10%	7%	10%
Parupeneus multifasciatus	6%	6%	10%	9%	4%	3%	1%	3%	1%	1%	1%	1%	0%	0%	0%	0%
Parupeneus pleurostigma	7%	1%	0%	1%	1%	1%	0%	n/a	n/a	n/a	n/a	0%	0%	0%	0%	0%
Parupeneus porphyreus	5%	4%	8%	8%	5%	3%	3%	4%	2%	3%	1%	3%	1%	1%	2%	2%
Scarus spp. (misc.)	n/a	5%	10%	8%	7%	6%	4%	8%	8%	5%	3%	3%	3%	3%	2%	4%

Table 3.4 (continued)

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Acanthurus blochii, xanthopterus	5%	8%	4%	7%	n/a	n/a	n/a	9%	4%	5%
Acanthurus dussumieri	18%	19%	14%	22%	20%	18%	17%	14%	9%	11%
Acanthurus olivaceus	10%	16%	15%	18%	20%	12%	11%	9%	11%	14%
Aluterus scriptus	7%	3%	10%	5%	2%	2%	1%	1%	1%	1%
Carangidae	4%	3%	n/a	n/a		1%	0%	n/a		
Caranx ignoblis	2%	7%	7%	2%	n/a	1%	5%	2%	5%	3%
Caranx melampygus	n/a	1%	1%	1%	n/a	1%	1%	1%	3%	1%
Lutjanus kasmira	12%	6%	7%	6%	11%	20%	11%	4%	13%	10%
Mullidae	1%		n/a				n/a			
Mulloidichthys pflugeri	12%	1%	2%	1%	0%	4%	1%	n/a	3%	2%
Myripristis spp.	0%	1%	1%	0%	2%	1%	5%	1%	1%	1%
Naso annulatus, brevirostris, unicornis	6%	2%	1%	n/a	n/a	0%	1%	1%	1%	1%
Naso hexacanthus	10%	4%	4%	2%		2%	2%	6%	7%	13%
Parupeneus multifasciatus	0%	1%	1%	1%	1%	0%	0%	0%	1%	1%
Parupeneus pleurostigma	0%	0%	n/a			0%	n/a	n/a	0%	0%
Parupeneus porphyreus	3%	3%	2%	4%	n/a	2%	1%	1%	3%	5%
Scarus spp. (misc.)	5%	13%	17%	23%	29%	26%	31%	41%	23%	21%

Table 3.5: Percent of total landings in traps (gear code 11, 24, and 52) per fiscal year of the species ranked as the top 5 in any year from 1948-2011. The confidentiality agreement requires there to be three licenses per data point, therefore 'n/a' appears in those cells.

Species	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Carangidae	8%	14%	12%	10%	10%	9%	7%	5%	7%	8%	9%	9%	9%	9%	6%	6%
Mulloidichthys pflugeri	3%	4%	2%	2%	5%	4%	5%	6%	4%	3%	4%	3%	7%	8%	2%	4%
Mugil cephalus	8%	0%	0%	1%	2%	1%	2%	5%	3%	5%	2%	3%	n/a	n/a	n/a	
Naso annulatus, brevirostris, unicornis	1%	1%	2%	1%	0%	n/a	0%	0%	0%	0%	1%	1%	1%	2%	6%	9%
Parupeneus porphyreus	6%	7%	7%	9%	10%	10%	11%	9%	12%	13%	14%	11%	11%	11%	12%	9%
Acanthurus triostegus	4%	8%	6%	5%	4%	4%	5%	4%	4%	3%	3%	4%	2%	3%	2%	3%
Parupeneus multifasciatus	5%	9%	14%	17%	13%	15%	17%	11%	15%	15%	11%	12%	15%	10%	9%	9%
Acanthurus olivaceus	n/a	n/a			n/a	n/a	0%	1%	2%	0%	n/a	n/a	n/a	n/a	1%	1%
Kyphosus bigibbus, cinerescens	0%	0%	0%	0%	0%	0%	n/a	0%	0%	n/a	0%	n/a	n/a	n/a	n/a	0%
Aluterus scriptus	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%
Albula glossodonta	5%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	0%	n/a	n/a	n/a
Acanthurus dussumieri	1%	4%	3%	2%	1%	1%	4%	7%	5%	4%	5%	5%	5%	6%	3%	3%
Acanthurus blochii, xanthopterus	5%	4%	3%	3%	4%	3%	2%	2%	1%	2%	3%	4%	4%	6%	5%	5%
Muraenidae	9%	9%	6%	7%	5%	6%	4%	4%	1%	1%	1%	0%	1%	1%	2%	2%
Scarus spp. (misc.)	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	1%	1%	1%	2%	1%	1%
Myripristis spp.	6%	6%	5%	5%	4%	5%	6%	3%	3%	5%	4%	3%	3%	1%	2%	3%
Mullidae	19%	15%	20%	17%	24%	25%	19%	25%	22%	21%	26%	25%	26%	25%	30%	28%
Lutjanus kasmira																
Naso hexacanthus																
Mulloidichthys vanicolensis																
Caranx ignoblis																

Table 3.5 (continued)

Species	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Carangidae	4%	7%	4%	6%	11%	8%	6%	7%	4%	3%	7%	6%	6%	8%	7%	10%
Mulloidichthys pflugeri	3%	7%	9%	13%	10%	9%	4%	9%	15%	19%	15%	14%	6%	8%	15%	10%
Mugil cephalus	n/a	n/a	n/a	n/a		n/a	n/a	n/a			n/a		n/a	n/a		
Naso annulatus, brevirostris, unicornis	15%	10%	13%	5%	7%	3%	5%	6%	5%	3%	1%	3%	2%	4%	2%	2%
Parupeneus porphyreus	6%	10%	7%	10%	11%	8%	9%	7%	6%	10%	12%	10%	9%	7%	7%	7%
Acanthurus triostegus	3%	3%	3%	3%	3%	3%	3%	4%	3%	3%	3%	4%	5%	2%	1%	1%
Parupeneus multifasciatus	11%	16%	12%	17%	20%	16%	16%	15%	13%	11%	9%	9%	9%	5%	5%	4%
Acanthurus olivaceus	0%	0%	0%	0%	n/a	1%	n/a	2%	2%	n/a	1%	1%	1%	3%	1%	1%
Kyphosus bigibbus, cinerescens	0%	n/a	n/a	n/a		n/a	n/a	n/a	n/a			n/a	0%	1%	0%	n/a
Aluterus scriptus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	2%	4%
Albula glossodonta	n/a	0%	n/a	n/a	n/a	n/a		n/a	n/a	n/a	0%	2%	0%	n/a	0%	n/a
Acanthurus dussumieri	3%	3%	6%	9%	5%	9%	12%	14%	10%	13%	14%	18%	15%	17%	14%	12%
Acanthurus blochii, xanthopterus	2%	2%	2%	1%	2%	n/a	0%	2%	1%	2%	3%	5%	8%	6%	5%	5%
Muraenidae	2%	n/a	1%	3%	5%	5%	11%	10%	12%	10%	10%	8%	8%	7%	6%	6%
Scarus spp. (misc.)	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	2%
Myripristis spp.	2%	2%	1%	1%	1%	1%	2%	1%	0%	1%	0%	1%	0%	1%	1%	3%
Mullidae	32%	22%	30%	17%	10%	16%	17%	12%	12%	9%	10%	6%	7%	5%	10%	5%
Lutjanus kasmira								0%	2%	3%	3%	3%	4%	8%	9%	11%
Naso hexacanthus																
Mulloidichthys vanicolensis																
Caranx ignoblis															1%	2%

Table 3.5 (continued)

Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Carangidae	12%	8%	6%	7%	10%	4%	3%	5%	6%	6%	8%	6%	2%	8%	7%	17%
Mulloidichthys pflugeri	15%	18%	18%	12%	9%	7%	n/a	2%	0%	3%	4%	1%	4%	7%	7%	10%
Mugil cephalus	n/a		n/a													
Naso annulatus, brevirostris, unicornis	2%	5%	4%	7%	6%	2%	1%	7%	1%	3%	2%	5%	2%	2%	4%	6%
Parupeneus porphyreus	5%	5%	4%	6%	6%	5%	3%	3%	7%	7%	4%	3%	3%	3%	1%	3%
Acanthurus triostegus	1%	1%	1%	1%	1%	1%	2%	1%	2%	3%	2%	2%	2%	2%	2%	1%
Parupeneus multifasciatus	5%	5%	4%	8%	7%	4%	4%	5%	9%	7%	3%	2%	1%	2%	1%	1%
Acanthurus olivaceus	2%	4%	3%	5%	5%	10%	7%	5%	7%	9%	3%	5%	12%	11%	5%	6%
Kyphosus bigibbus, cinerescens	0%	0%	n/a	0%	0%	n/a	n/a	n/a	n/a	n/a	2%	6%	2%	1%	1%	3%
Aluterus scriptus	2%	3%	5%	1%	1%	1%	0%	1%	0%	0%	1%	1%	1%	n/a	n/a	n/a
Albula glossodonta	n/a	n/a	0%	n/a	n/a	n/a	n/a	2%	n/a		n/a	n/a	n/a	n/a	6%	n/a
Acanthurus dussumieri	11%	10%	12%	10%	12%	14%	20%	14%	19%	18%	15%	18%	23%	18%	20%	13%
Acanthurus blochii, xanthopterus	5%	6%	7%	5%	4%	3%	4%	6%	6%	4%	3%	4%	6%	5%	4%	4%
Muraenidae	7%	5%	5%	5%	7%	4%	n/a	0%	1%	2%	n/a	n/a	1%	n/a	n/a	n/a
Scarus spp. (misc.)	2%	1%	1%	3%	4%	4%	5%	4%	9%	8%	6%	4%	4%	6%	5%	5%
Myripristis spp.	1%	1%	0%	1%	1%	1%	1%	0%	2%	2%	1%	3%	3%	1%	2%	0%
Mullidae	9%	4%	3%	6%	8%	15%	20%	9%	4%	6%	7%	12%	5%	9%	17%	3%
Lutjanus kasmira	9%	8%	13%	11%	4%	11%	3%	15%	8%	9%	24%	7%	13%	6%	3%	6%
Naso hexacanthus				n/a	n/a	1%	1%	5%	6%	5%	4%	4%	4%	3%	6%	8%
Mulloidichthys vanicolensis																
Caranx ignoblis	1%	2%	9%	8%	n/a	5%	1%	3%	3%	1%	n/a	3%	1%	2%	1%	2%

Table 3.5 (continued

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Carangidae	41%	10%	6%	3%	2%	4%	4%	4%	n/a	n/a		1%	0%	n/a		
Mulloidichthys pflugeri	7%	13%	11%	17%	8%	8%	6%	1%	1%	1%	n/a	4%	1%	n/a	3%	2%
Mugil cephalus																
Naso annulatus, brevirostris, unicornis	5%	3%	4%	6%	4%	9%	6%	3%	1%	0%	n/a	0%	1%	1%	1%	2%
Parupeneus porphyreus	1%	3%	1%	1%	2%	2%	2%	2%	2%	3%	3%	2%	1%	1%	3%	5%
Acanthurus triostegus	1%	1%	1%	2%	1%	2%	1%	2%	2%	1%	1%	1%	1%	2%	2%	1%
Parupeneus multifasciatus	1%	1%	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%	1%	1%
Acanthurus olivaceus	3%	6%	4%	7%	4%	5%	5%	12%	15%	15%	19%	12%	10%	9%	11%	13%
Kyphosus bigibbus, cinerescens	0%	n/a		n/a	3%	n/a	0%	1%			n/a	1%	n/a	0%	n/a	n/a
Aluterus scriptus	n/a	4%	3%	9%	29%	18%	3%	2%	10%	4%	2%	1%	1%	1%	1%	1%
Albula glossodonta	n/a		n/a		n/a	n/a	n/a			n/a					n/a	n/a
Acanthurus dussumieri	6%	9%	12%	12%	9%	10%	15%	17%	14%	19%	18%	18%	17%	13%	9%	11%
Acanthurus blochii, xanthopterus	5%	3%	4%	5%	3%	5%	3%	5%	4%	6%	n/a	n/a	n/a	9%	4%	4%
Muraenidae	n/a	n/a	1%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a		3%	n/a
Scarus spp. (misc.)	3%	3%	2%	4%	3%	3%	5%	9%	17%	19%	27%	25%	31%	40%	23%	19%
Myripristis spp.	1%	0%	1%	0%	1%	0%	0%	1%	1%	0%	3%	1%	5%	1%	1%	1%
Mullidae	6%	5%	3%	4%	6%	5%	18%	6%	n/a				n/a			
Lutjanus kasmira	6%	28%	35%	13%	11%	10%	15%	17%	7%	7%	14%	20%	11%	4%	13%	13%
Naso hexacanthus	6%	8%					5%	2%	4%	2%		2%	2%	6%	7%	12%
Mulloidichthys vanicolensis								3%	2%	8%	n/a	1%	1%	1%	1%	1%
Caranx ignoblis	2%	2%					1%	5%	8%	3%	3%	3%	6%	4%	5%	3%

Table 3.6: Landings by species in bullpen traps (gear code 24) from 1948-2011. Species are arranged in descending order by total lbs. The species shown account for 98% of the total catch from 1948-2011. There were 43 more species, together accounting for 2% of the catch.

Species Code	Species	Total lbs	3 licenses?
103	*Mullidae*	102,396	Yes
30	*Mugil cephalus*	31,026	Yes
114	*Lutjanus kasmira*	27,676	Yes
23	*Carangidae*	21,709	Yes
86	*Acanthurus dussumieri*	20,181	Yes
78	*Albula glossodonta*	15,382	Yes
205	*Caranx ignoblis*	13,561	Yes
47	*Naso annulatus, brevirostris, unicornis*	10,681	Yes
3	*Thunnus albacares*	n/a	no
74	*Kyphosus bigibbus, cinerescens*	8,202	Yes
96	*Scarus* spp. (misc.)	7,472	Yes
64	*Acanthurus triostegus*	6,584	Yes
92	*Acanthurus blochii, xanthopterus*	6,150	Yes
52	*Parupeneus porphyreus*	4,962	Yes
63	*Abudefduf abdominalis*	4,773	Yes
18	*Caranx melampygus*	4,700	Yes
60	*Acanthurus nigroris*	4,606	Yes
72	*Acanthurus olivaceus*	3,867	Yes
71	*Monotaxis grandoculis*	2,884	Yes
69	*Polydactylus sexfilis*	2,334	Yes
127	*Mulloidichthys vanicolensis*	n/a	no
100	*Myripristis* spp.	1,843	Yes
27	*Kuhlia sandvicensis*	1,842	Yes
24	*Mulloidichthys pflugeri*	n/a	no
33	*Elops hawaiensis*	1,669	Yes
49	*Sphyraena helleri*	n/a	no
31	*Chanos chanos*	1,471	Yes
28	*Selar crumenopthalmus*	n/a	no
115	Lutjanus fulvus	1,073	Yes
128	Mulloidichthys flavolineatus	n/a	no
67	Etrumeus micropus	n/a	no
46	Sphyraena barracuda	845	Yes
204	Carangoides orthogrammus	n/a	no
122	Upeneus arge	n/a	no
104	Alectis ciliaris	n/a	no

Table 3.7: Landings by species in traps (gear code 11) from 1948-1999. Gear code 11 was used prior to 1986, to report landings in traps, and these included crab, shrimp, and lobster traps. Species are arranged in descending order by total lbs. The species shown account for 98% of the total catch from 1948-1999. There were 83 more species, together accounting for 2% of the catch. Also, the total of all goatfish catch is shown, because of possible misreporting of certain species to species code 103 (Mullidae).

Species Code	Species	total lbs	% of total	Cumulative %	3 Licenses?
103	*Mullidae*	617,737	18%	18%	Yes
68	*Parupeneus multifasciatus*	411,946	12%	30%	Yes
52	*Parupeneus porphyreus*	320,847	9%	39%	Yes
23	*Carangidae*	278,625	8%	47%	Yes
24	*Mulloidichthys pflugeri*	245,939	7%	55%	Yes
86	*Acanthurus dussumieri*	227,800	7%	61%	Yes
93	*Muraenidae*	167,737	5%	66%	Yes
64	*Acanthurus triostegus*	121,223	4%	70%	Yes
92	*Acanthurus blochii, xanthopterus*	116,879	3%	73%	Yes
47	*Naso annulatus, brevirostris, unicornis*	112,825	3%	76%	Yes
100	*Myripristis* spp.	99,259	3%	79%	Yes
95	*Congridae* spp.	88,395	3%	82%	Yes
114	*Lutjanus kasmira*	64,264	2%	84%	Yes
110	*Parupeneus pleurostigma*	62,245	2%	85%	Yes
18	*Caranx melampygus*	60,738	2%	87%	Yes
96	*Scarus* spp. (misc.)	53,413	2%	89%	Yes
16	*Seriola dumerili*	50,717	1%	90%	Yes
63	*Abudefduf abdominalis*	42,428	1%	91%	Yes
72	*Acanthurus olivaceus*	38,042	1%	93%	Yes
20	*Aprion virescens*	28,406	1%	93%	Yes
77	*Aluterus scriptus*	25,586	1%	94%	Yes
19	*Prisitipomoides filamentosus*	17,117	0%	95%	Yes
88	*Scarus* spp. (Uhu)	16,541	0%	95%	Yes
43	*Balistidae*	16,445	0%	96%	Yes
81	*Decapterus macarellus*	15,092	0%	96%	Yes
30	*Mugil cephalus*	13,420	0%	96%	Yes
71	*Monotaxis grandoculis*	13,006	0%	97%	Yes
87	*Scarus* spp. (sleeping uhu)	12,977	0%	97%	Yes
34	*Heteropriacanthus cruentatus*	12,452	0%	97%	Yes
46	*Sphyraena barracuda*	11,309	0%	98%	Yes
57	*Chaetodon auriga*	5,047	0%	98%	Yes
75	*Scorpaenopsis* spp.	5,037	0%	98%	Yes
67	*Etrumeus micropus*	4,698	0%	98%	Yes
25	*Bodianus albotaeniatus*	4,554	0%	98%	Yes
	Other (83 species)	55,484	2%	100%	Yes
	All Goatfish	1,658,714	48%		Yes

Table 3.8: Reference table for the species included under the species groups in Figures 3.7 and 3.8. Note: For filefish only one code (77) for *Aluteris scriptus* was used

Snappers		Goatfish		Jacks		Parrotfish		Surgeonfish	
code	**Species**	**code**	**Species**	**code**	**Species**	**code**	**Species**	**code**	**Species**
17	*Pristipomoides sieboldii*	24	*Mulloidichthys pflugeri*	16	*Seriola dumerili*	87	*Scarus* spp. (sleeping uhu)	47	*Naso annulatus, brevirostris, unicornis*
19	*Prisitipomoides filamentosus*	52	*Parupeneus porphyreus*	18	*Caranx melampygus*	88	*Scarus* spp. (Uhu)	59	*Acanthurus nigrofuscus*
20	*Aprion virescens*	68	*Parupeneus multifasciatus*	23	*Carangidae*	96	*Scarus* spp. (misc.)	60	*Acanthurus nigroris*
21	*Etelis carbunculus*	103	*Mullidae*	28	*Selar crumenopthalmus*			61	*Acanthurus leucopareius*
22	*Etelis coruscans*	110	*Parupeneus pleurostigma*	37	*Selar crumenopthalmus (J)*			64	*Acanthurus triostegus*
58	*Aphareus rutilans*	121	*Parupeneus insularis*	48	*Elagatis bipinnulata*			72	*Acanthurus olivaceus*
97	*Pristipomoides zonatus*	122	*Upeneus arge*	56	*Scomberoides lysan*			81	*Decapterus macarellus*
114	*Lutjanus kasmira*	127	*Mulloidichthys vanicolensis*	79	*Caranx mate*			83	*Zebrasoma flavescens*
		128	*Mulloidichthys flavolineatus*	81	*Decapterus macarellus*			85	*Acanthurus achilles*
		206	*Parupeneus cyclostomus*	89	*Gnathanodon speciosus*			86	*Acanthurus dussumieri*
				104	*Alectis ciliaris*			92	*Acanthurus blochii, xanthopterus*
				200	*Pseudocaranx dentex*			124	*Naso hexacanthus*
				201	*Caranx helvolus*			125	*Naso lituratus*
				202	*Caranx lugubris*				
				203	*Caranx sexfasciatus*				
				204	*Carangoides orthogrammus*				
				205	*Caranx ignoblis*				

Table 4.1: Top Areas in Traps (11,24,52) from 1948-2011

Area	Total Lbs.	% of total	Cumulative %
403	1,037,693	23%	23%
409	866,319	19%	42%
402	736,192	16%	58%
Other	416,314	9%	67%
400	345,007	8%	75%
401	315,129	7%	82%
404	308,405	7%	89%
407	140,960	3%	92%
405	125,083	3%	94%
310	97,838	2%	97%
408	52,385	1%	98%
423	50,924	1%	99%
406	40,327	1%	100%
other = 69 areas			

Table 4.2:Top Areas in Fish Traps (52) from 1986-2011

Area	Total Lbs	% of total	Cumulative %
404	190,796	25%	25%
Other	161,693	21%	46%
409	157,487	21%	67%
403	99,632	13%	80%
405	66,679	9%	89%
401	56,568	7%	96%
500	27,128	4%	100%
other=39 areas			

Table 4.3: Top 3 Areas for traps (code 11, 24, and 52) per year and percent of total landings by area per year (1948-2011). The confidentiality agreement requires there to be three licenses per data point, therefore 'n/a' appears in those cells.

Area	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
101																
301																
310																
314																
321																
400																10%
401																
402	8%	18%	20%	16%	13%	12%	n/a	22%	0%	0%	26%	27%	n/a	n/a	n/a	n/a
403	47%	42%	34%	24%	17%	15%	19%	30%	37%	35%	36%	39%	40%	42%	47%	38%
404																
405																
406																
407																
408																
409	15%	18%	19%	19%	20%	26%	34%	30%	32%	22%	17%	19%	19%	n/a	n/a	
420																
429																
500																
501																
504																
506																

Area	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
101																
301																
310																
314																
321																
400			8%	15%	20%	25%	24%	29%	24%		19%		16%	11%		22%
401						19%	18%		17%	n/a		20%			21%	20%
402	35%	34%	n/a	n/a	n/a									11%	n/a	
403	31%	32%	33%	40%	30%			n/a		21%	n/a	n/a				
404																
405																
406																
407													12%			
408																
409	10%	16%				22%	27%	n/a	28%	n/a	n/a	20%	n/a		16%	15%
420														14%		
429																
500																
501																
504																
506																

Area	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
101			n/a													
301									n/a							
310							n/a	n/a								
314												n/a				
321																n/a
400	16%	15%	12%		12%								13%	n/a	10%	
401	12%	21%	n/a				n/a					11%				
402																
403				n/a						n/a					9%	n/a
404																
405																
406									n/a							
407					13%	13%							13%	n/a		
408						17%										
409	28%	15%		26%	36%	30%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	35%	n/a
420																
429				n/a												
500										n/a						
501								n/a			n/a					
504																
506											n/a					

Area	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
101																
301																
310																
314																
321	n/a															
400																
401							n/a					n/a	n/a			n/a
402																
403	15%			17%	n/a	n/a			19%	n/a			n/a		n/a	n/a
404		23%	23%	42%	55%	41%	31%	25%	n/a	45%	n/a	30%	21%	51%	43%	34%
405		n/a		n/a	n/a	n/a	19%	13%				17%				
406																
407																
408											n/a			n/a	n/a	
409	n/a	16%						21%	47%	n/a	n/a			n/a		
420																
429																
500			n/a													
501																
504			n/a													
506																

Table 4.4: Top 3 Areas for fish traps (code 52) per year and percent of total landings by area per year (1986-2011). The confidentiality agreement requires there to be three licenses per data point, therefore 'n/a' appears in those cells.

Area	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
321										n/a	n/a		
400							16%	n/a	n/a				
401	n/a					n/a							
403									n/a	26%	17%	n/a	
404				n/a								n/a	22%
405													
406		n/a	n/a										
407							16%	n/a					
408	11%												
409	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	17%	
500			n/a	n/a									n/a
501		n/a			n/a								
504													n/a
506					n/a	n/a							

Area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
321													
400													
401									n/a	n/a			n/a
403	22%	n/a	n/a		21%	20%	n/a			n/a		n/a	n/a
404	45%	n/a	44%	41%	19%	n/a	n/a	n/a	30%	22%	52%	43%	36%
405	n/a	n/a	n/a	n/a					17%				
406													
407													
408								n/a			n/a	n/a	
409				n/a	39%	48%	n/a	n/a			n/a		
500													
501													
504													
506													

VII. Figures

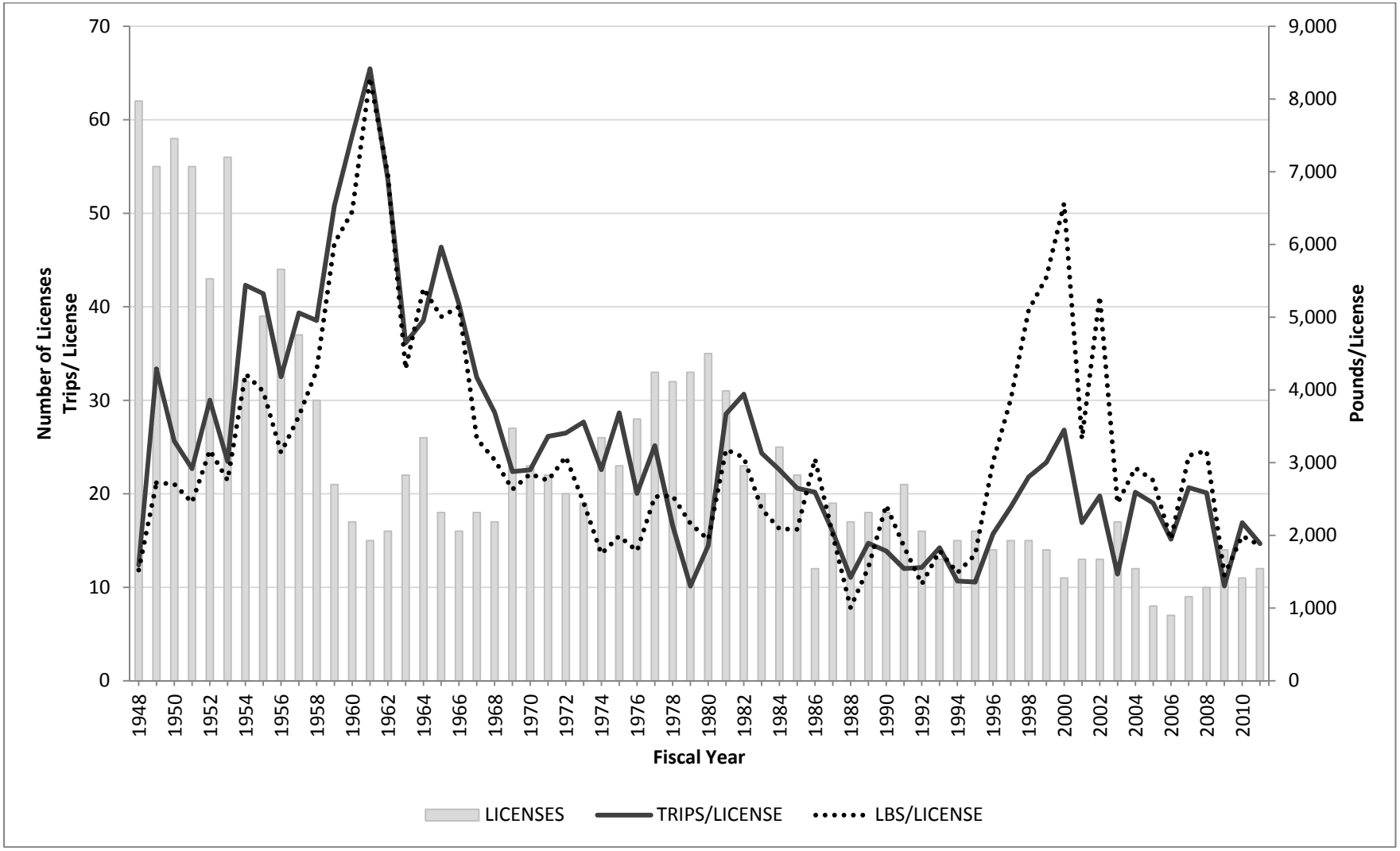


Figure 1.1: Pounds per license, trips per license, and total licenses per year for traps (gear 11, 24, and 52) from 1948-2011. Catch and effort for fish species caught in several types of traps were considered in this figure, including code 11 (general trap code used prior to 1986), code 24 (bullpen trap), and code 52 (fish trap established 1986).

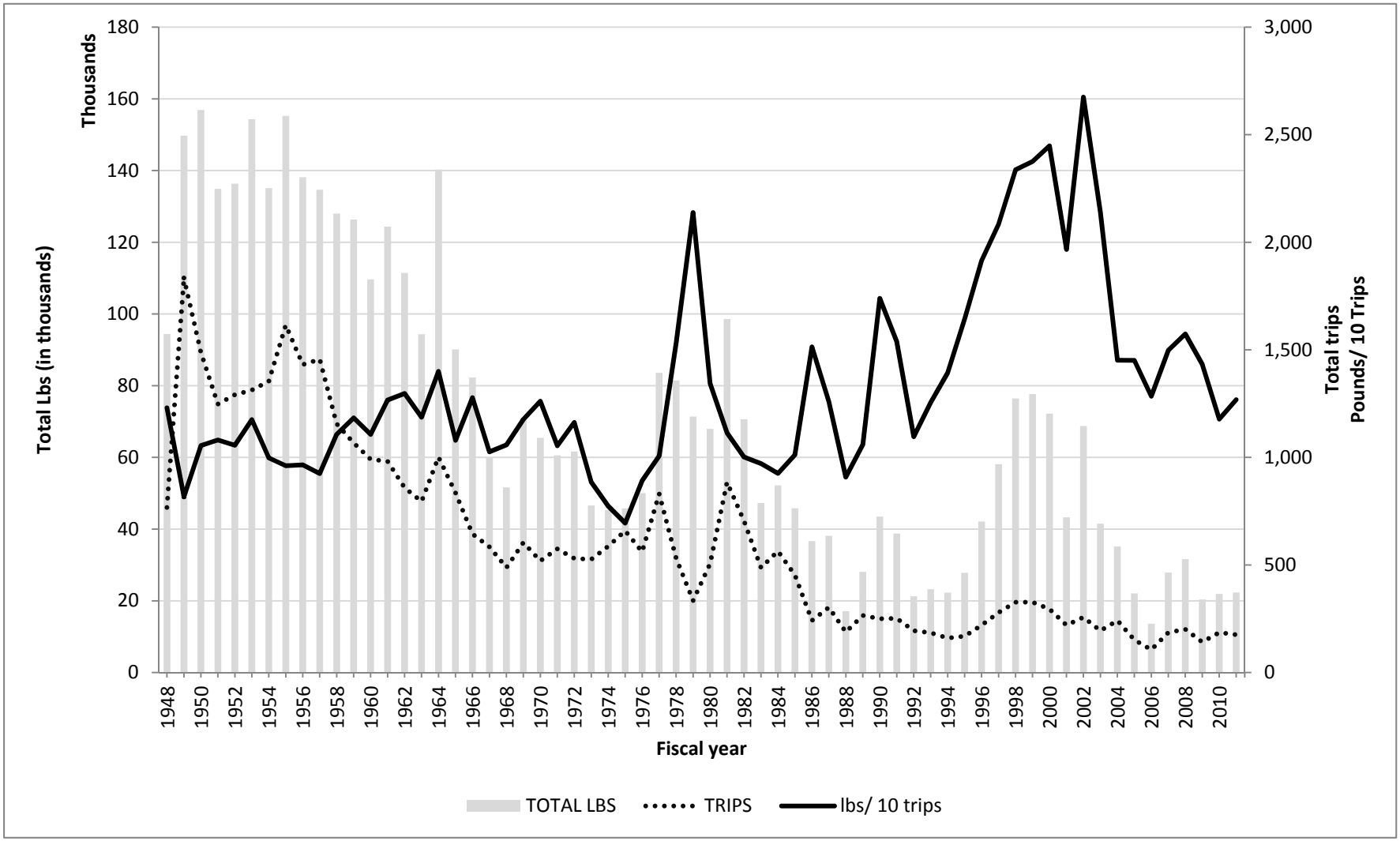


Figure 1.2: Pounds of fish caught per trip, total trips, and total landings with traps (gear code 11, 24, and 52) from 1948-2011. This figure shows effort in pounds of fish species landed per trip using several types of traps were considered in this figure, including code 11 (general trap code used prior to 1986), code 24 (bullpen trap), and code 52 (fish trap established 1986), along with total landings per year

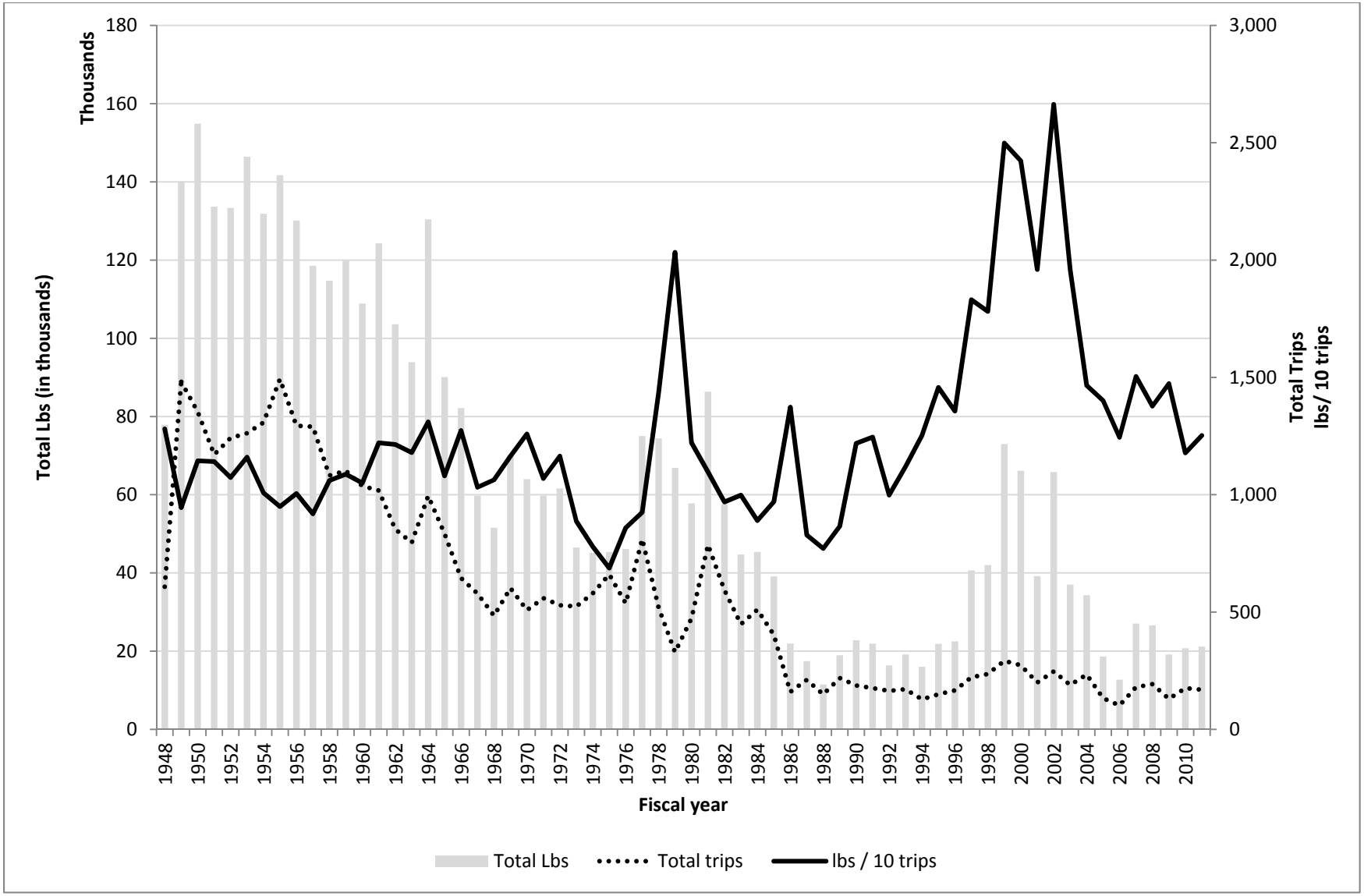


Figure 1.3: Catch, effort (in trips), and CPUE (in lbs/ 10 trips) for traps (gear code 11, 24, and 52) on the island of O'ahu only from 1948-2011.

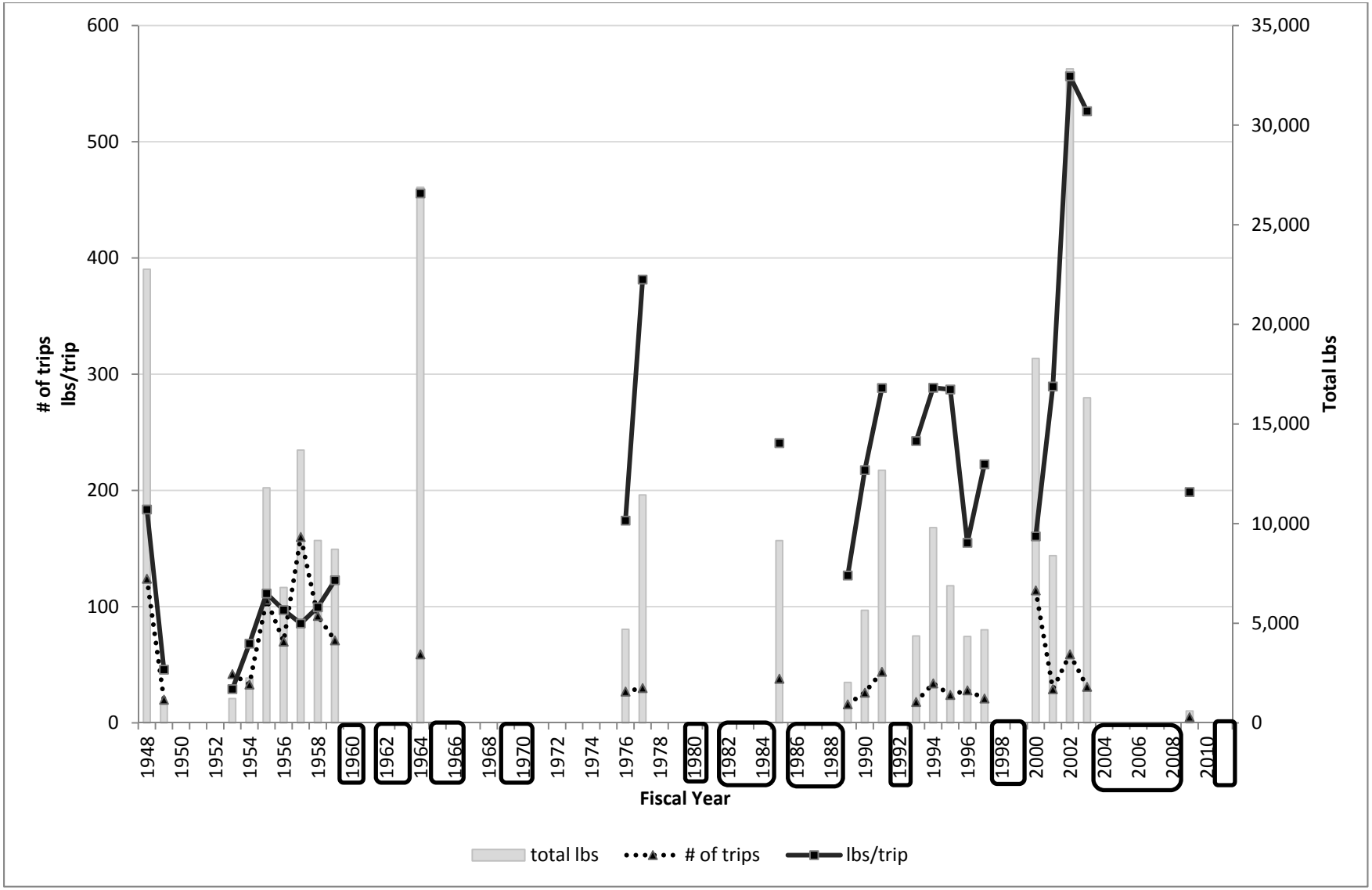


Figure 1.4: Pounds of fish caught per trip, total trips and total pounds with Bullpen traps (gear code 24) from 1948-2011. The years circled are years where there was catch, but less than 3 licenses for that data point, therefore, the data could not be shown. A total of 333,783 lbs. were landed in this gear type from 1948-2011, in a total of 1670 trips. There was an average of 4 licenses per year from 1948-2011.

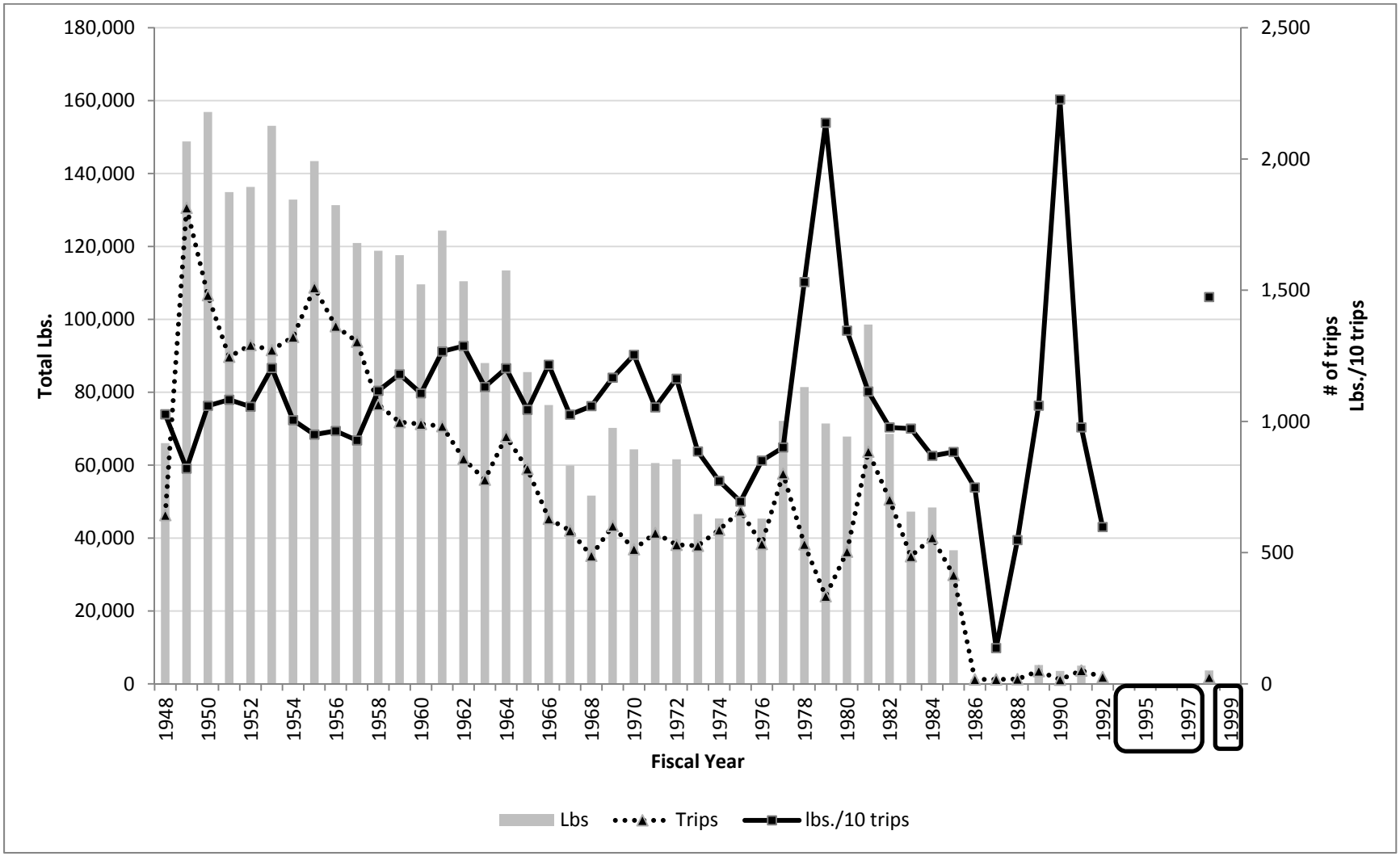


Figure 1.5: Pounds of fish caught per trip, total trips and total pounds in general traps code 11 from 1948-1999. Gear code was replaced with more specific trap codes, 51-54 in 1986; however it continued to appear in records until 1999. This is an reporting error, during the adjustment to the new codes. The years circled are years where there was catch with this gear, but less than 3 licenses for that data point, therefore, the data could not be shown. A total of 3,438,223 lbs. were landed in this gear type from 1948-1999, in a total of 32,373 trips.

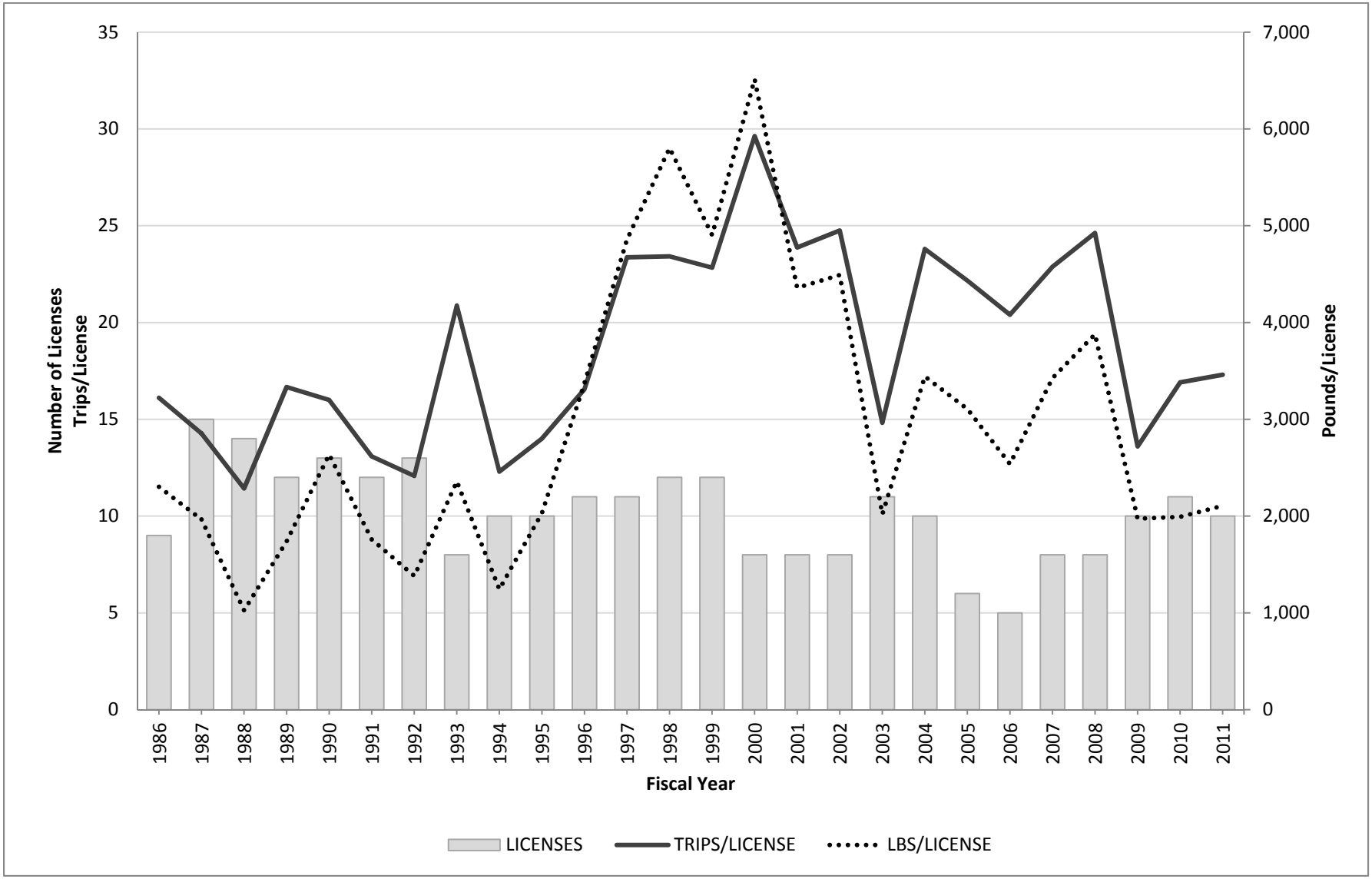


Figure 2.1: Pounds per license, trips per license, and total licenses per year for fish traps (gear 52) from 1986-2011. Only catch and effort for fish species caught in fish traps were considered in this figure.

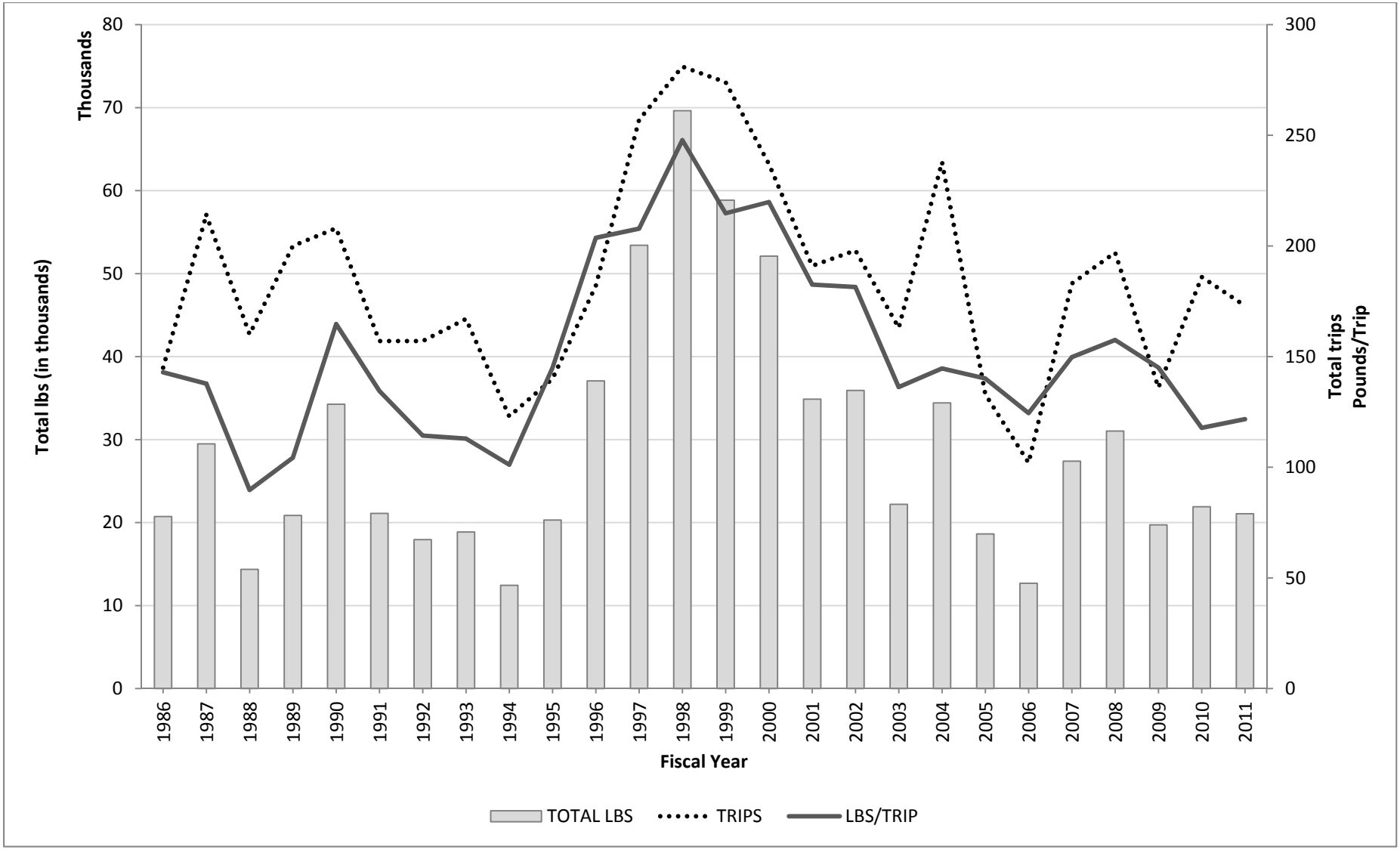


Figure 2.2: Pounds of fish caught per trip, total trips, and totals pounds with fish traps (gear code 52) from 1986-2011. This figure shows effort in pounds of fish species landed per trip using only fish traps, along with total landings per year.

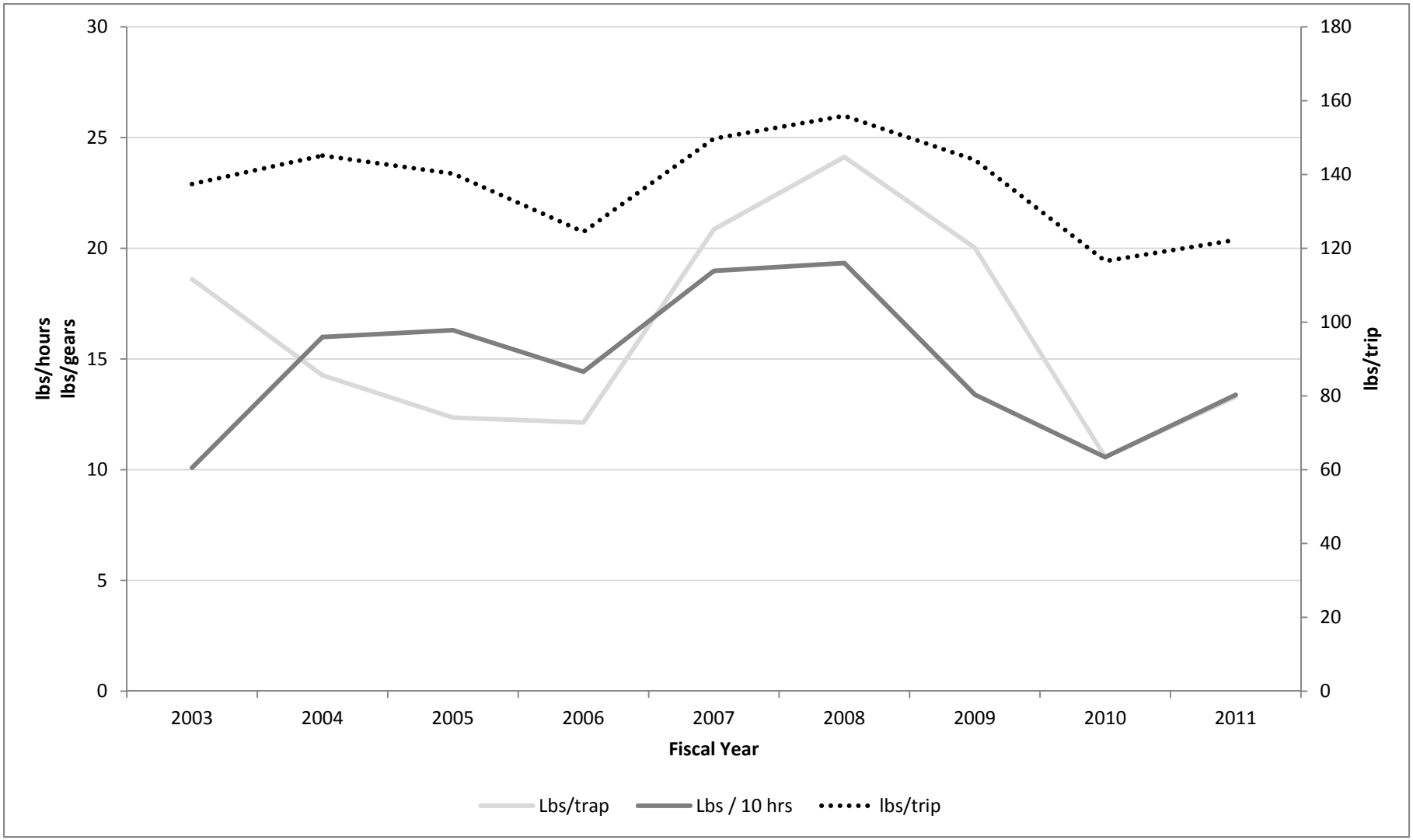


Figure 2.3: Catch-per-unit effort in pounds per trip, pounds per gear, and pounds per hours fished in fish traps (gear code 52) for 2003-2011. The logbook change in fiscal year 2003, added the fields of 'hours' and 'no_gears' (number of gears) to the fishing reports.

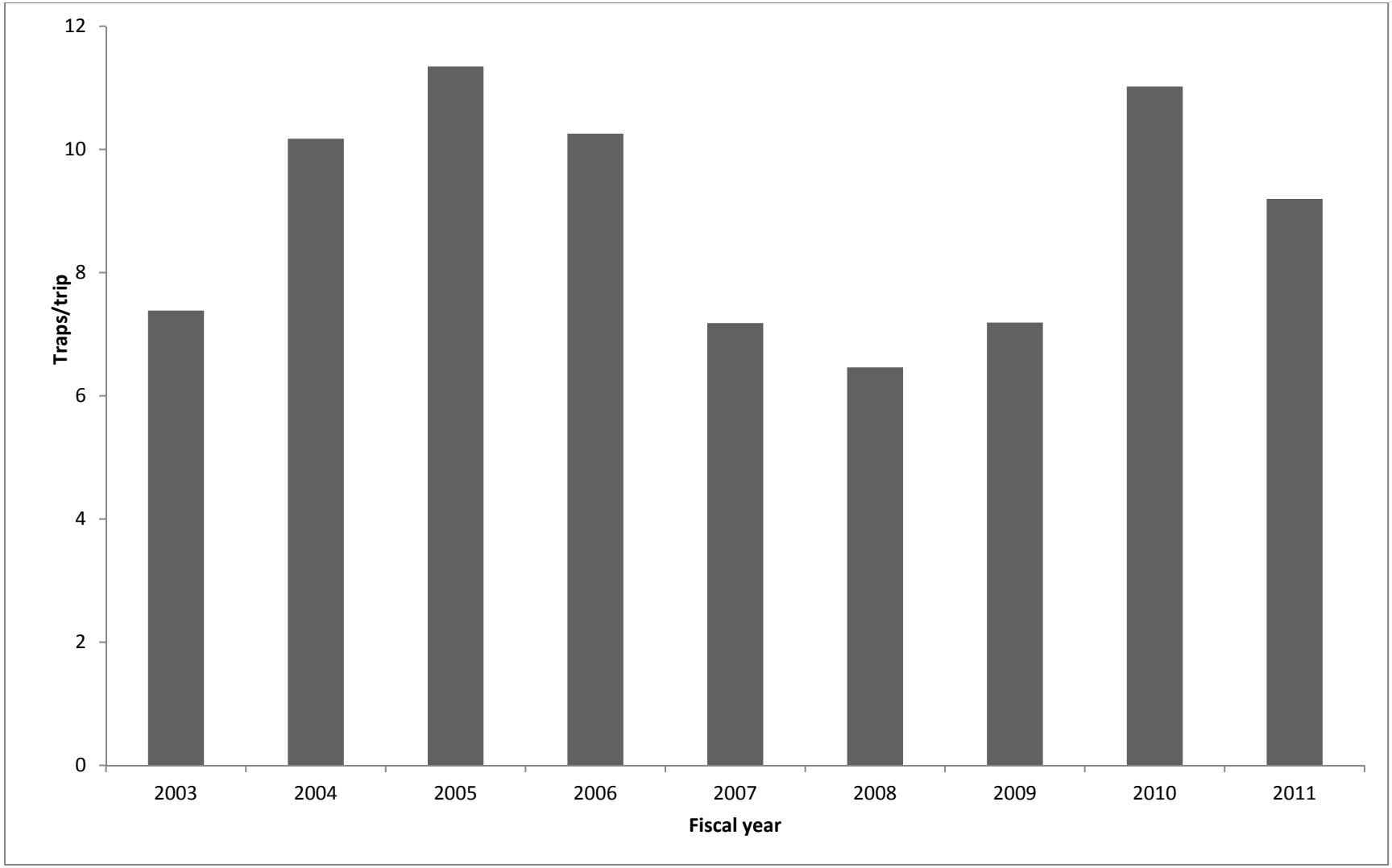


Figure 2.4: Traps per trip for fish traps (gear code 52) from 2003-2011.

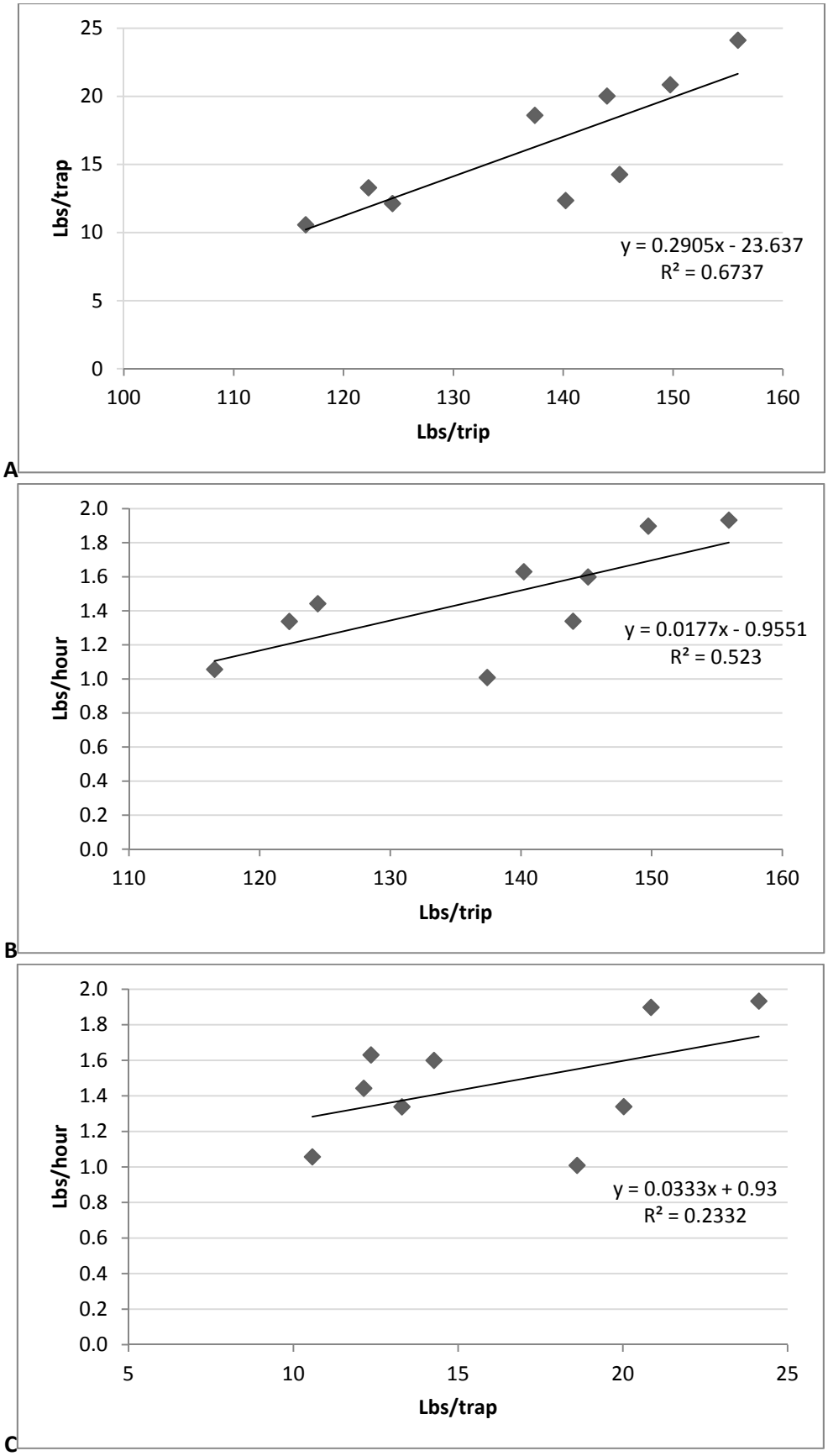


Figure 2.5 A,B,C: Correlations between CPUE with the three different measures of effort (A. Pounds per trap vs. Pounds per trip; B. Pounds per hour vs. Pounds per trip; C. Pounds per hour vs. Pounds per trap)

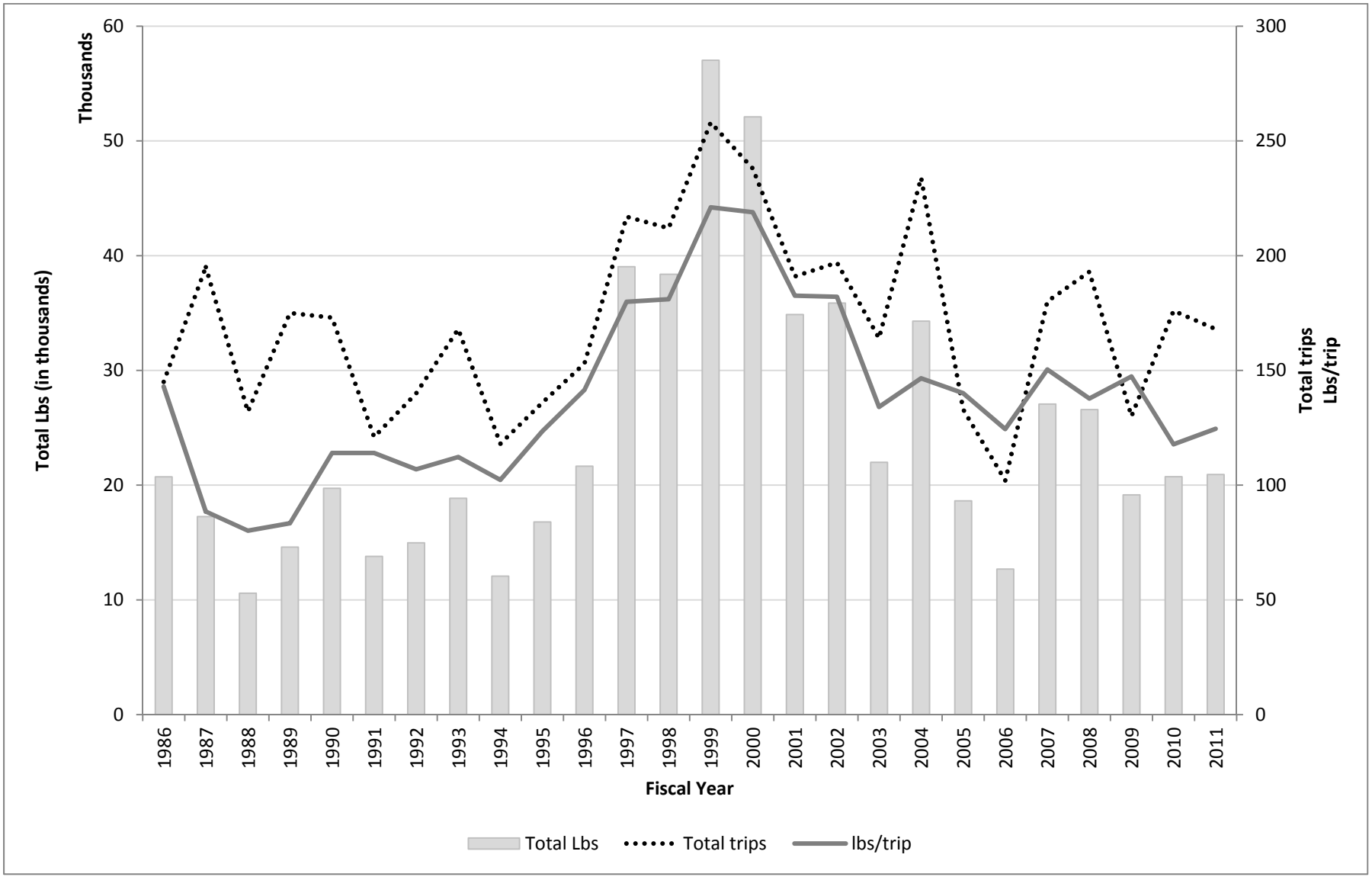


Figure 2.6: Catch, effort (in trips), and CPUE (in lbs/trip) for fish traps (gear code 52) on the island of O'ahu only from 1986-2011.

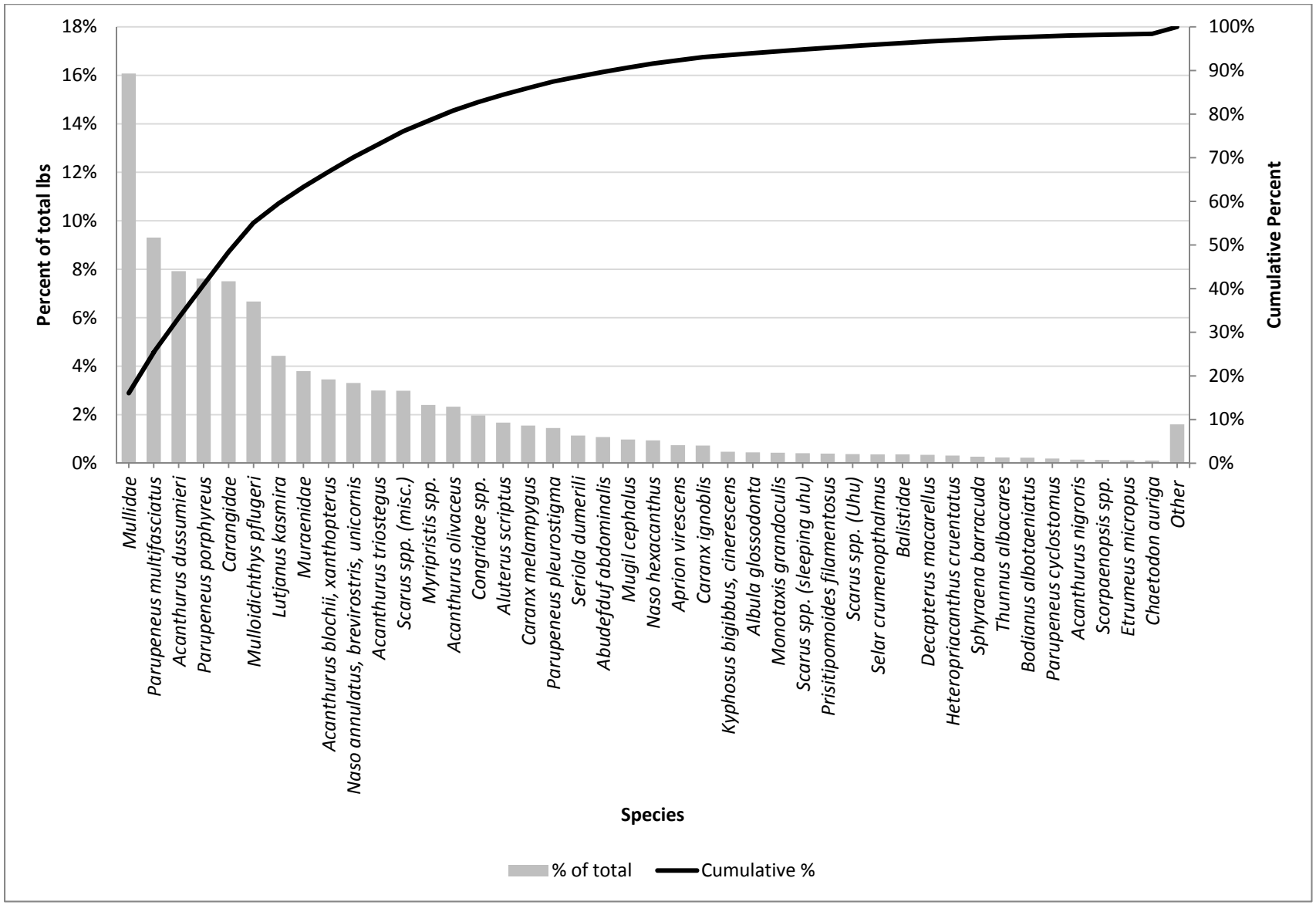


Figure 3.1: Percent of total landings by species in traps (gear code 11, 24, and 52) from 1948-2011

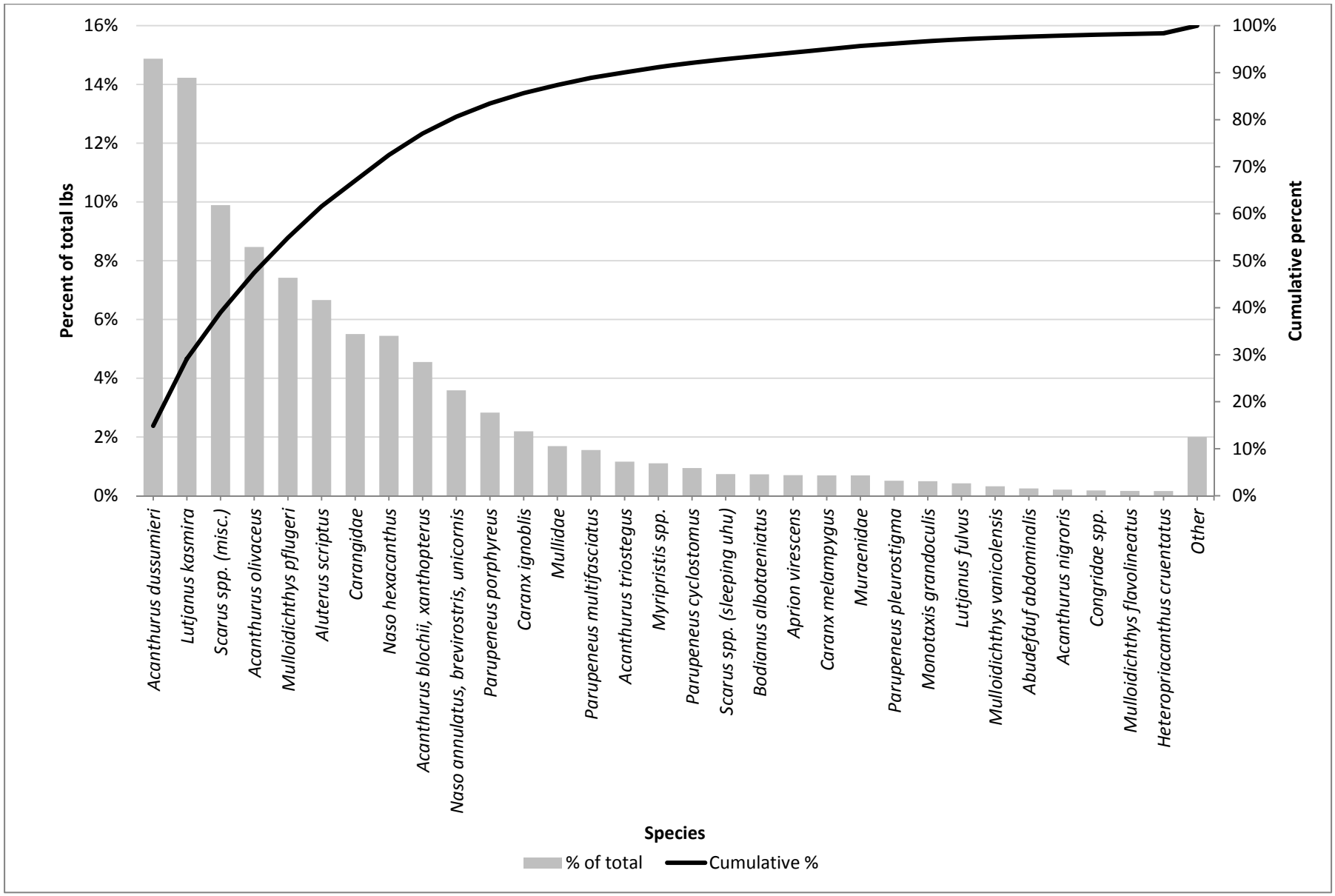


Figure 3.2: Percent of total landings by species in fish traps (gear code 52) from 1986-2011

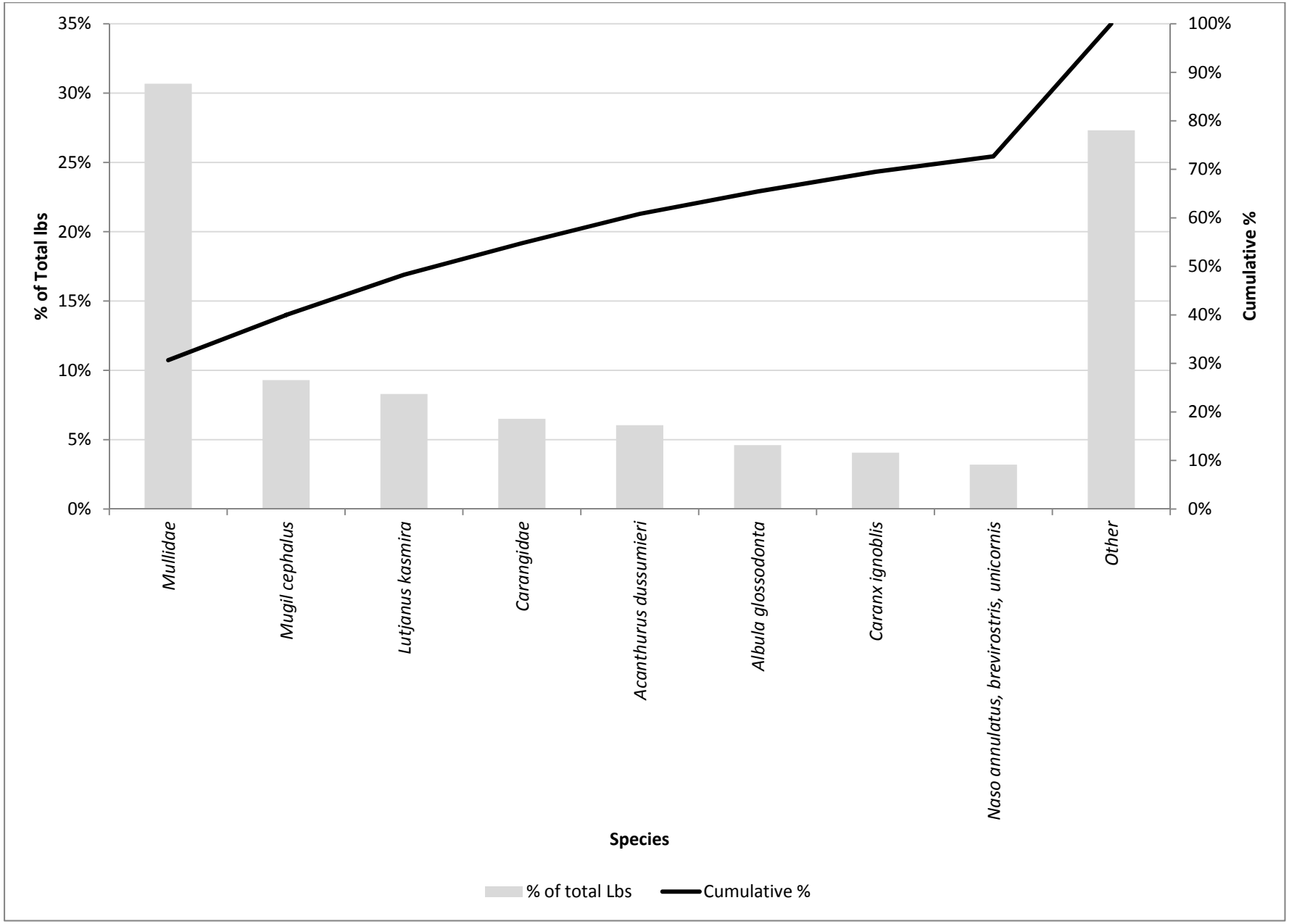


Figure 3.3: Percent of total landings by species in bullpen traps (gear code 24) from 1948-2011

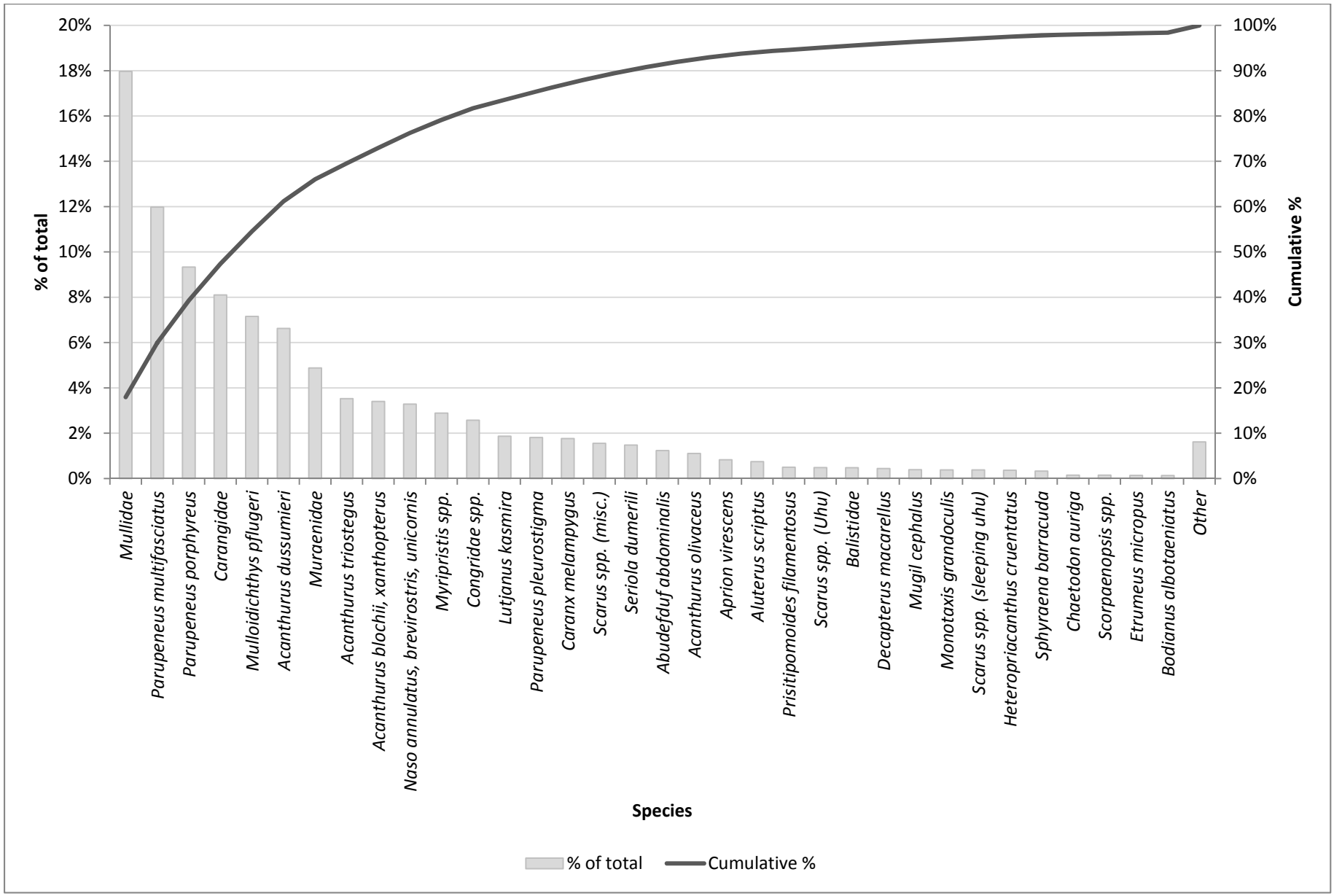
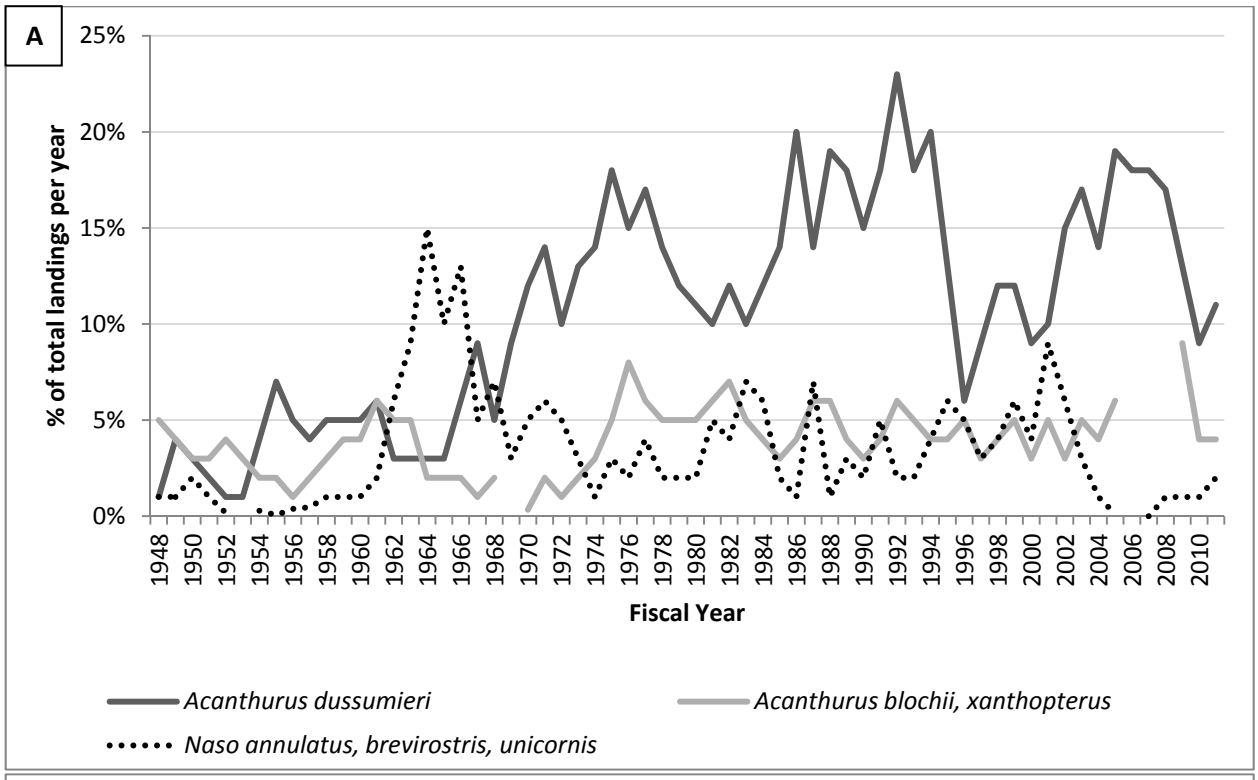
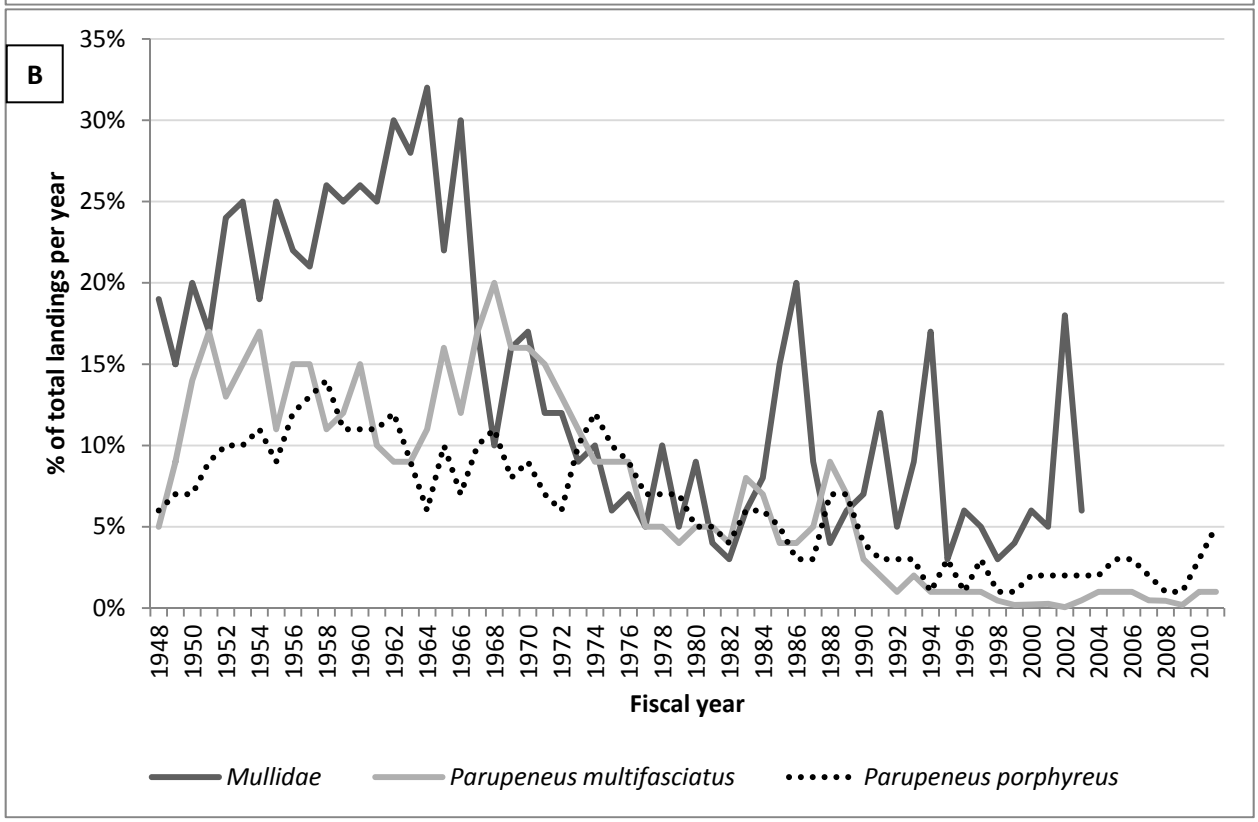
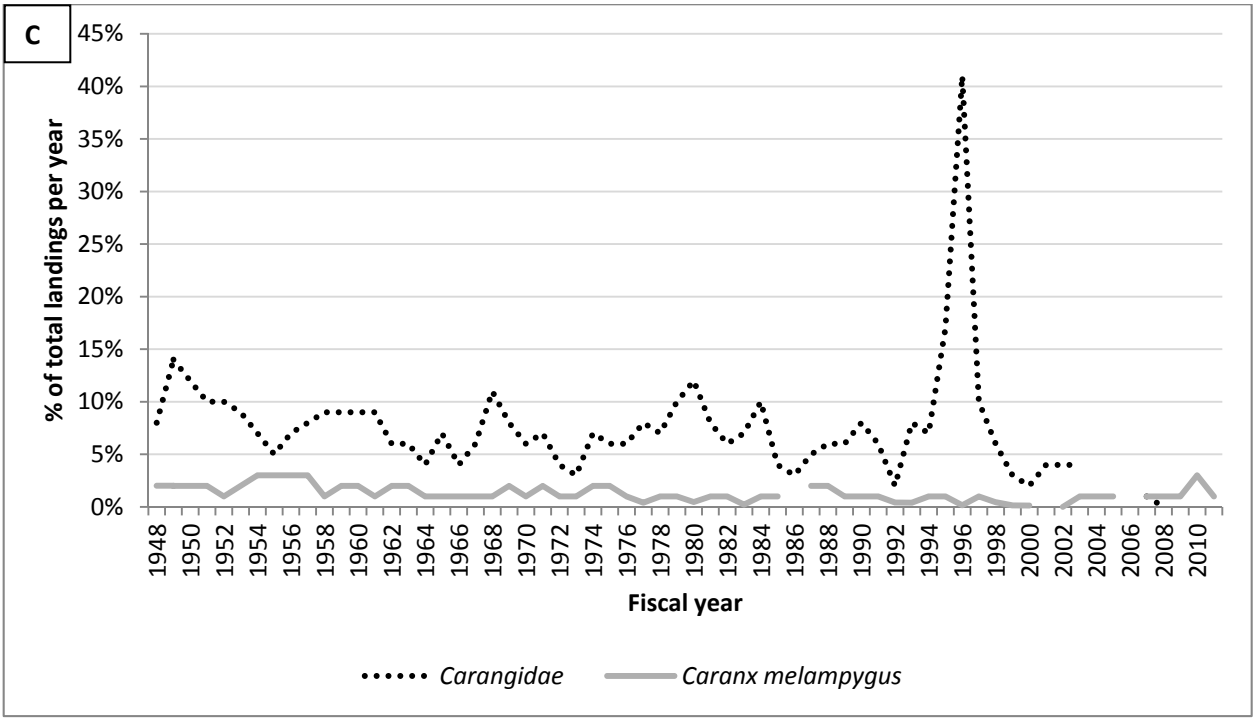


Figure 3.4: Percent of total landings by species in traps (gear code 11) from 1948-1999. This gear type was replaced by gear codes 51, 52, 53, and 54 in 1986, but it does not completely disappear until 1999.


A
25%
20%
15%
10%
5%
0%
% of total landings per year
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Fiscal Year
Acanthurus dussumieri
Acanthurus blochii, xanthopterus
Naso annulatus, brevirostris, unicornis


B
35%
30%
25%
20%
15%
10%
5%
0%
% of total landings per year
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Fiscal year
Mullidae
Parupeneus multifasciatus
Parupeneus porphyreus



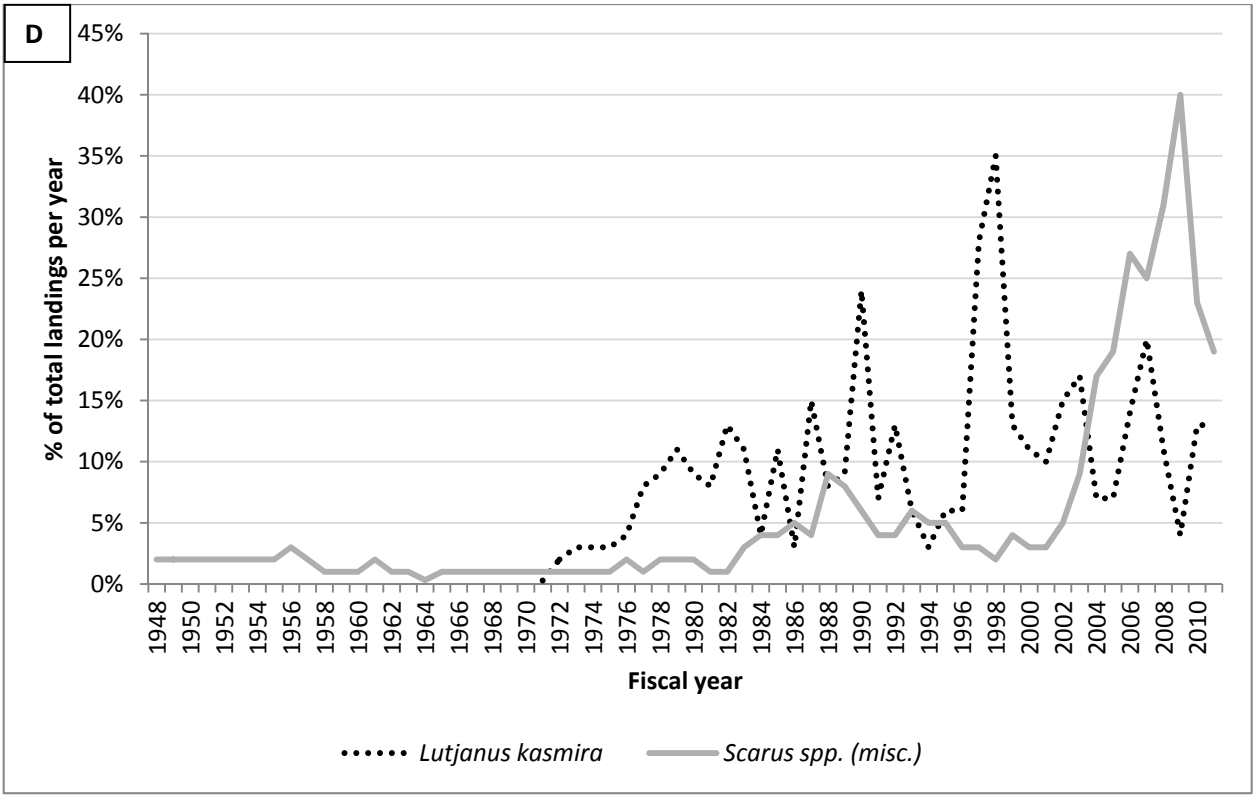
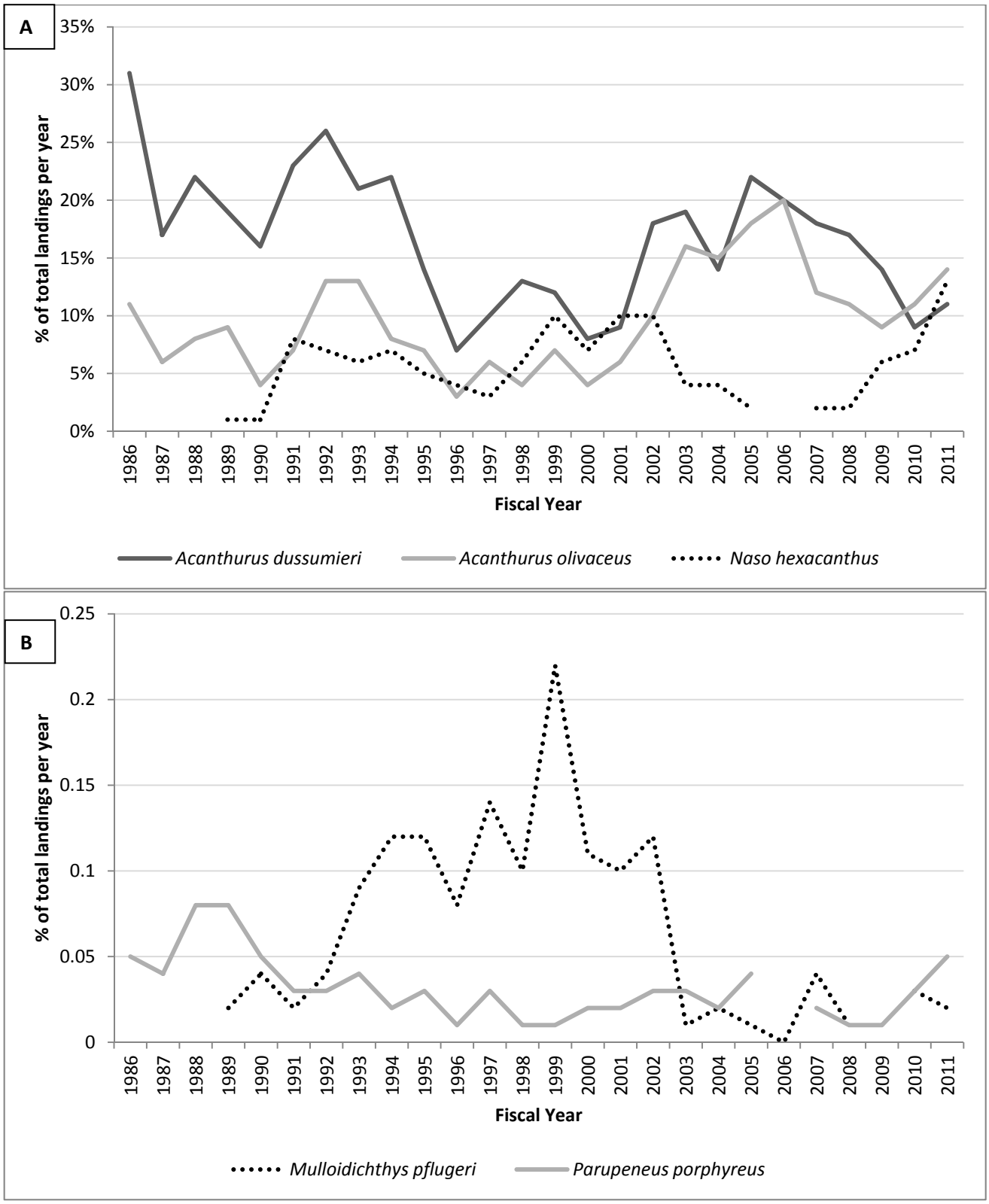


Figure 3.5 A,B,C, and D: The top 2 or 3 Acanthuridae species (A), Mullidae (B), Carangidae species (C), and other species (D), in percent of landings for each fiscal year in traps (gear codes 11,24, and 52) from 1948-2011.


A
35%
30%
25%
20%
15%
10%
5%
0%
% of total landings per year
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Fiscal Year
Acanthurus dussumieri
Acanthurus olivaceus
Naso hexacanthus
B
0.25
0.2
0.15
0.1
0.05
0
% of total landings per year
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Fiscal Year
Mulloidichthys pflugeri
Parupeneus porphyreus

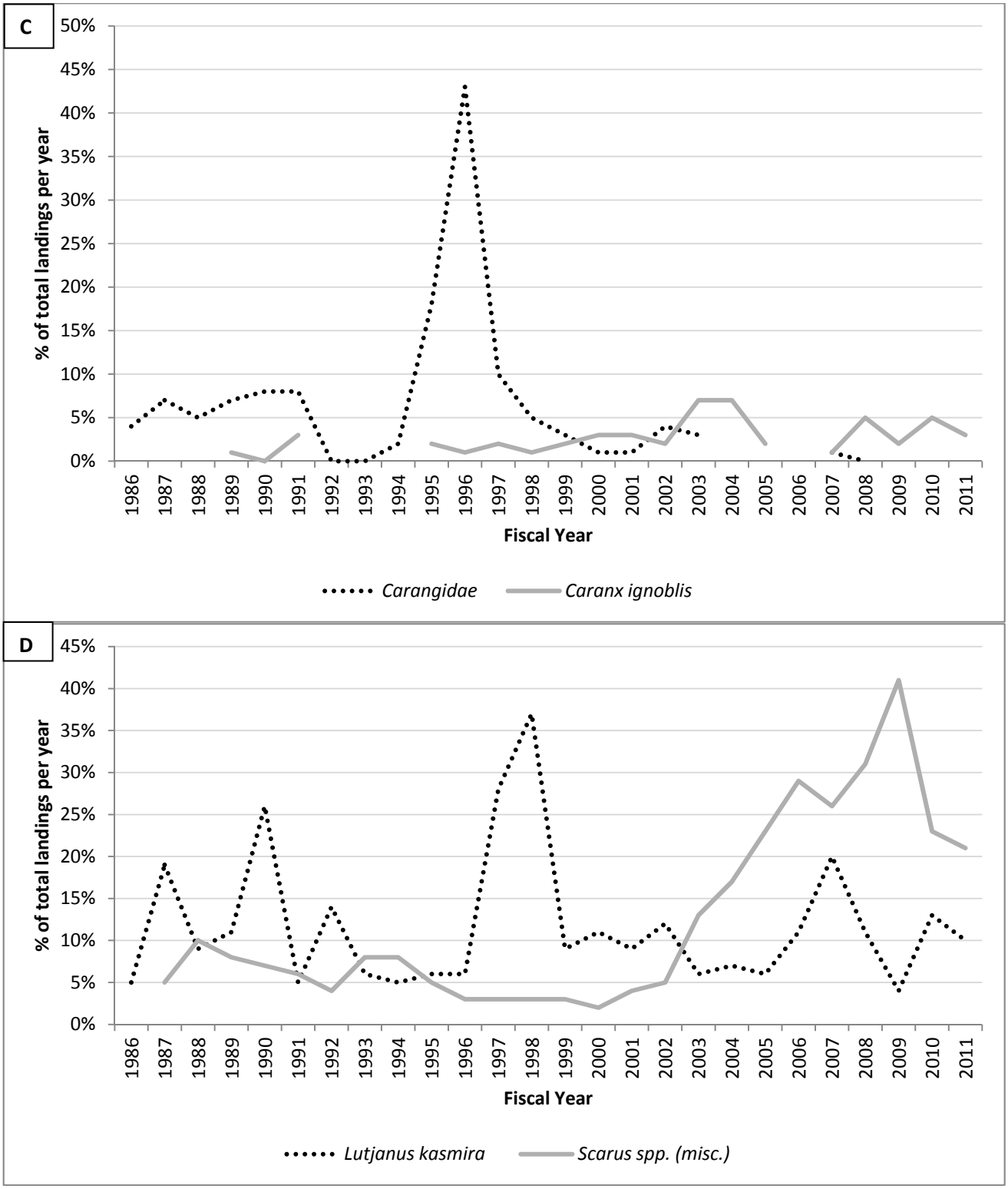


Figure 3.6 A,B,C, and D: The top 2 or 3 Acanthuridae species (A), Mullidae (B), Carangidae species (C), and other species (D) in percent of landings for each fiscal year in fish traps (gear code 52) from 1986-2011.

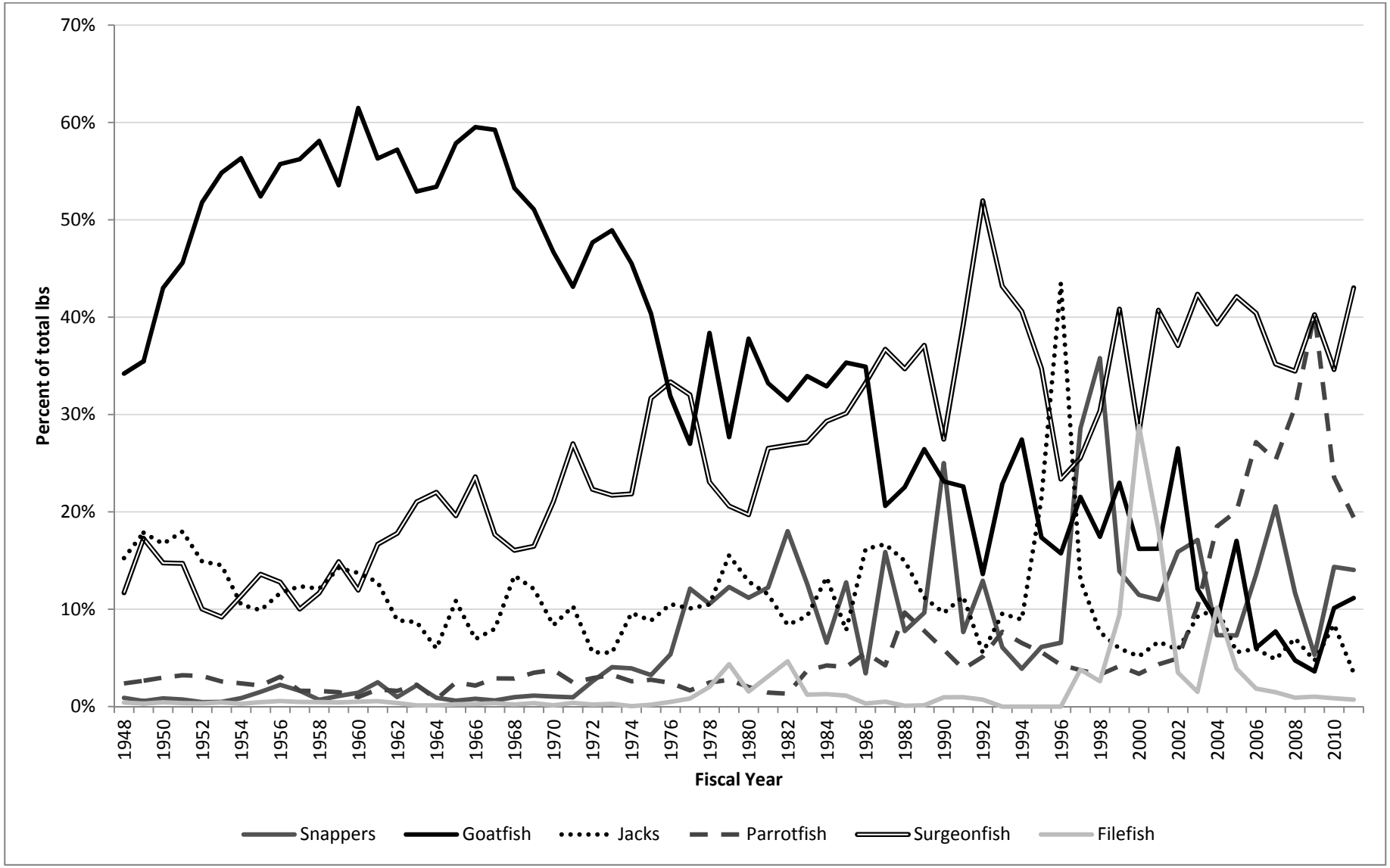


Figure 3.7: Percent of total pounds landed in traps (gear code 11, 24, and 52) by species group for each fiscal year (1948-2011). Reference Table 3.8 to see species included under the categories snappers, goatfish, jacks, parrotfish, surgeonfish, and filefish.

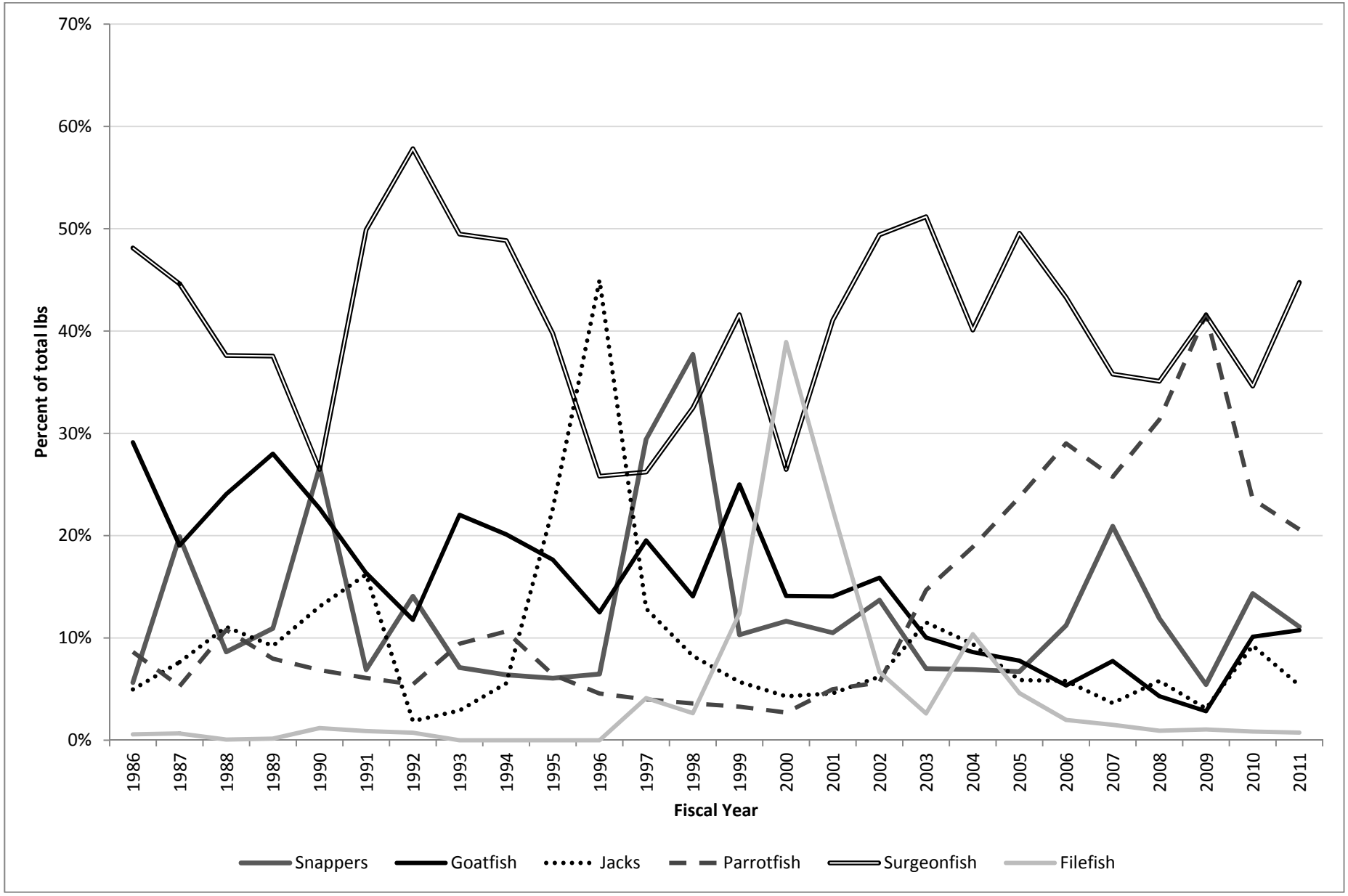


Figure 3.8: Percent of total pounds landed in fish traps (gear code 52) by species group for each fiscal year (1986-2011). Reference Table 3.8 to see species included under the categories snappers, goatfish, jacks, parrotfish, surgeonfish, and filefish.

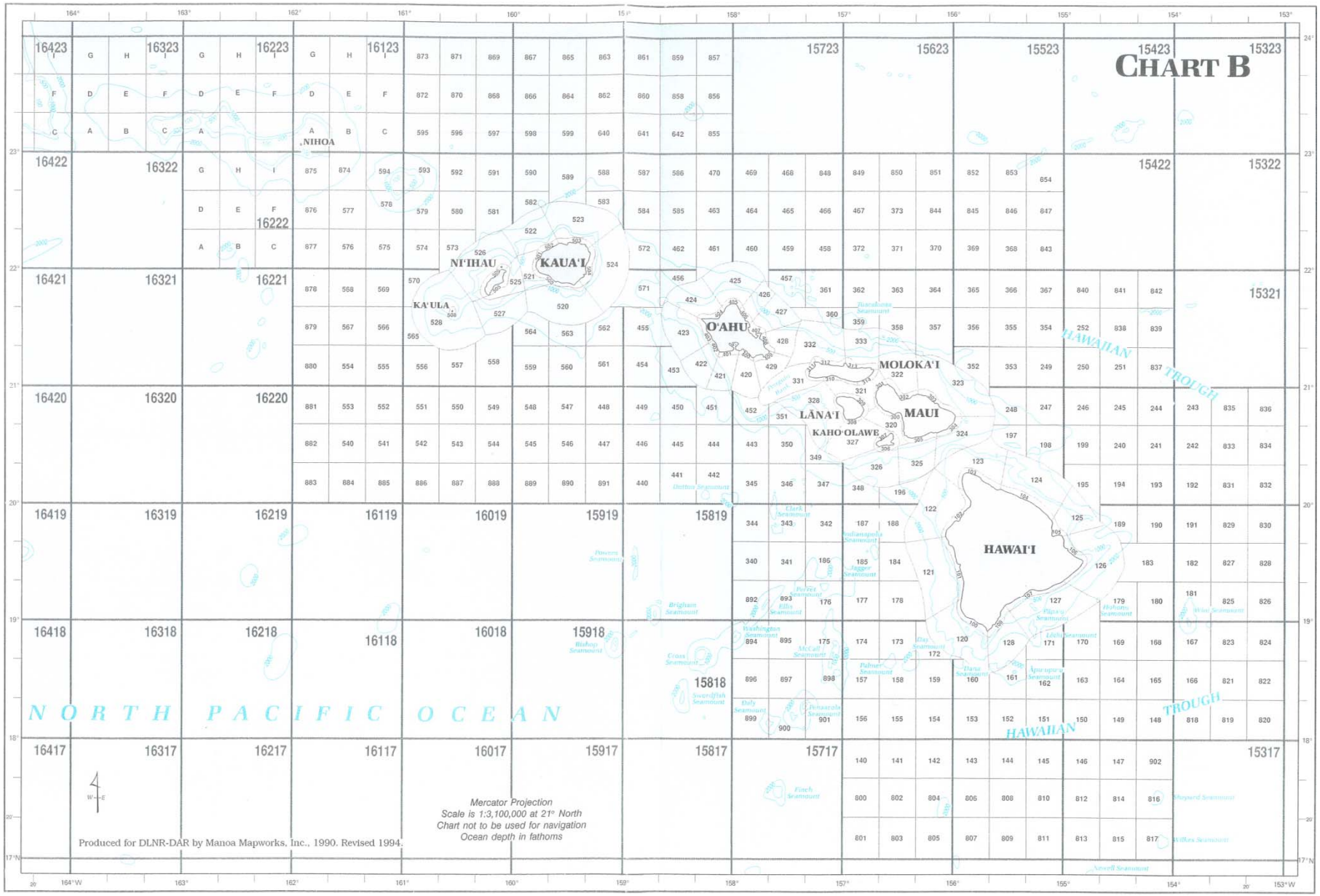


Figure 4.1: Map of the statistical fishing areas surrounding the Main Hawaiian Island chain, for reference. Courtesy of the Hawaii Division of Aquatic Resources

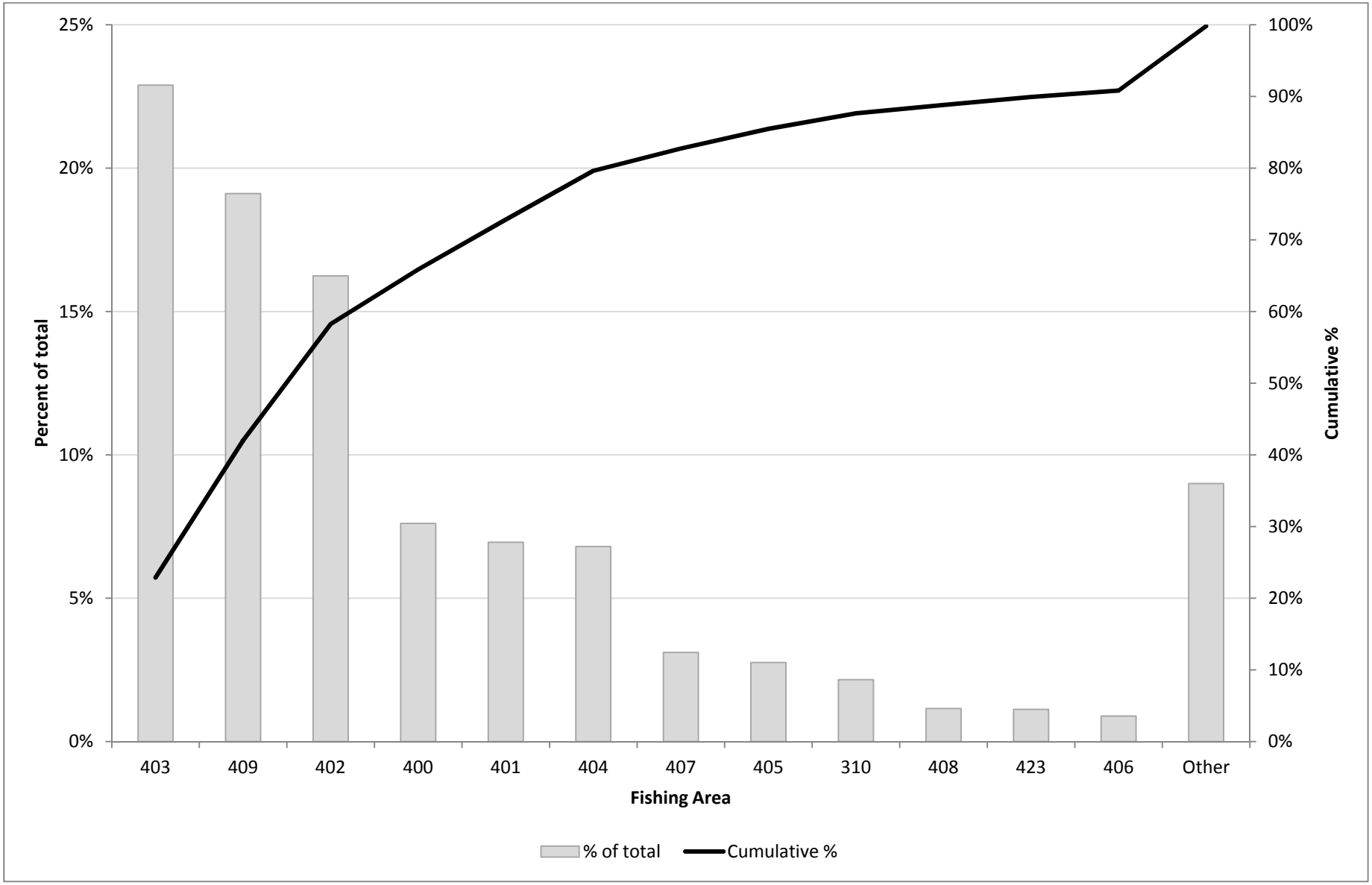


Figure 4.2: The top fishing areas by percent of total landing in traps (code 11, 24, and 52) from 1948-2011.

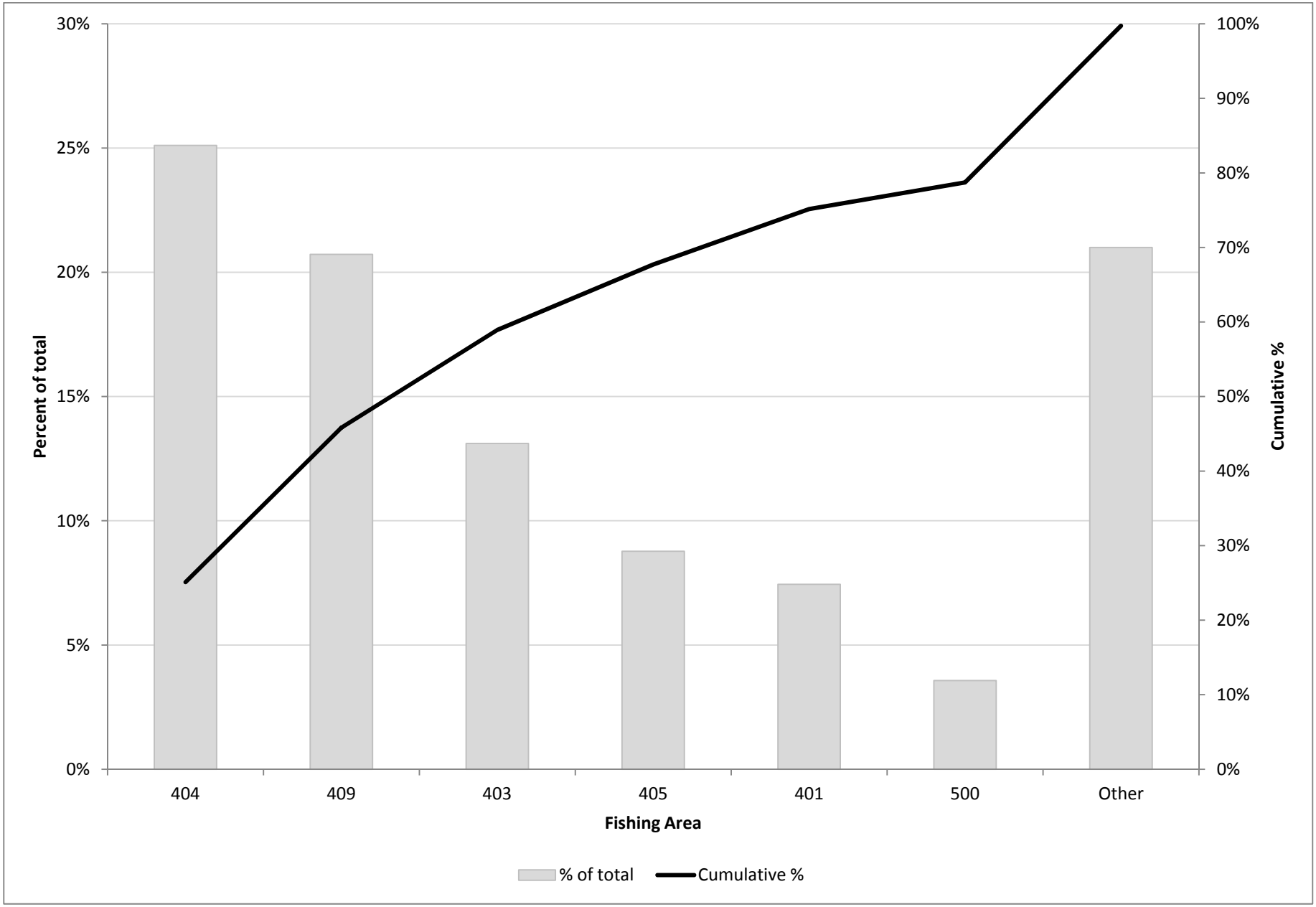


Figure 4.3: The top fishing areas by percent of total landing in fish traps (code 52) from 1986-2011

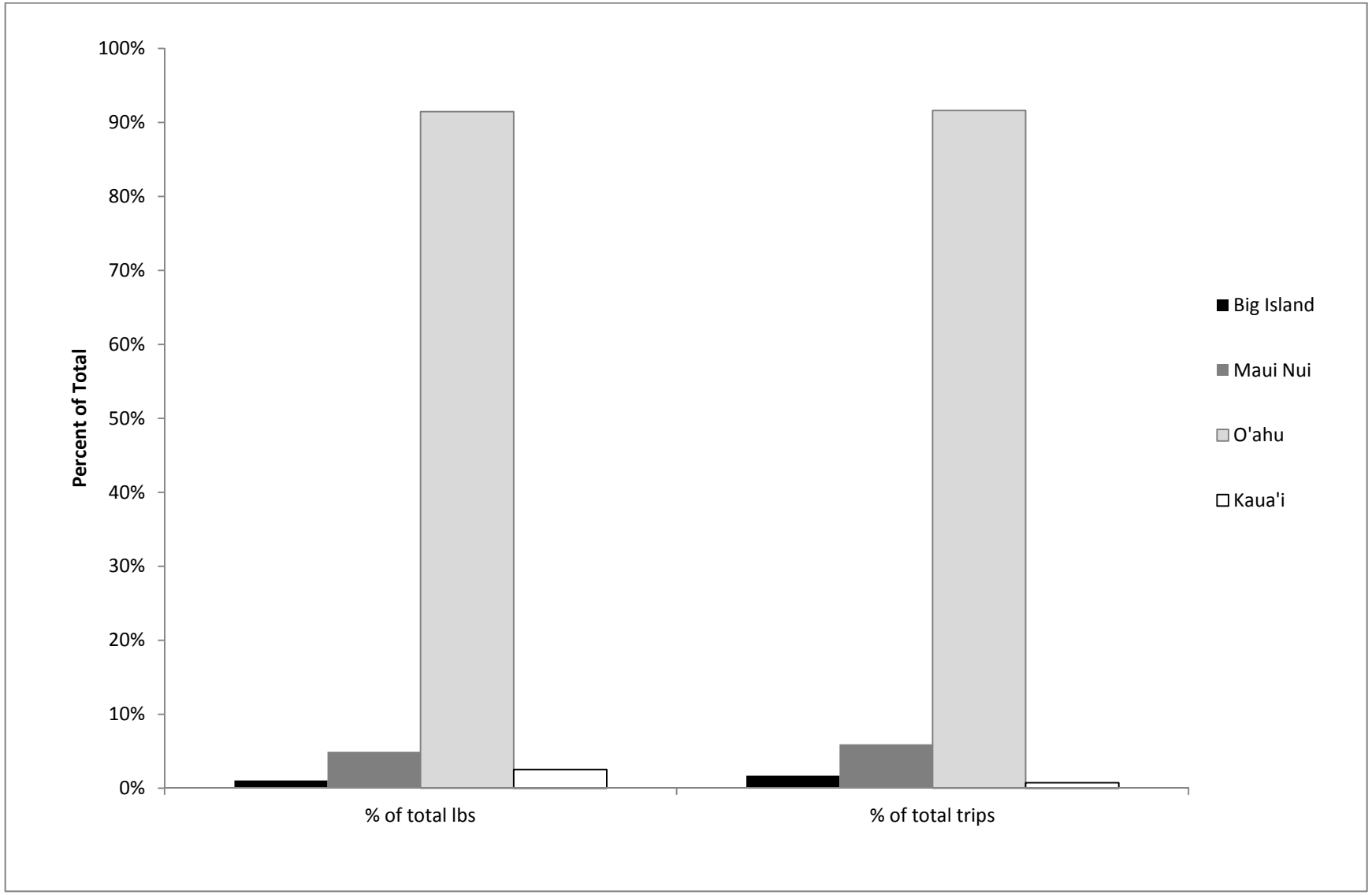


Figure 4.4: Percent of total landings and total trips in fish traps by island area from 1948-2011. Only fish species caught in traps (gear 11. 24, and 52) were considered for this figure. Note: Maui Nui includes: Moloka'i, Lana'i, and Penguin banks; Kaua'i includes: Ni'ihau and Ka'ula.

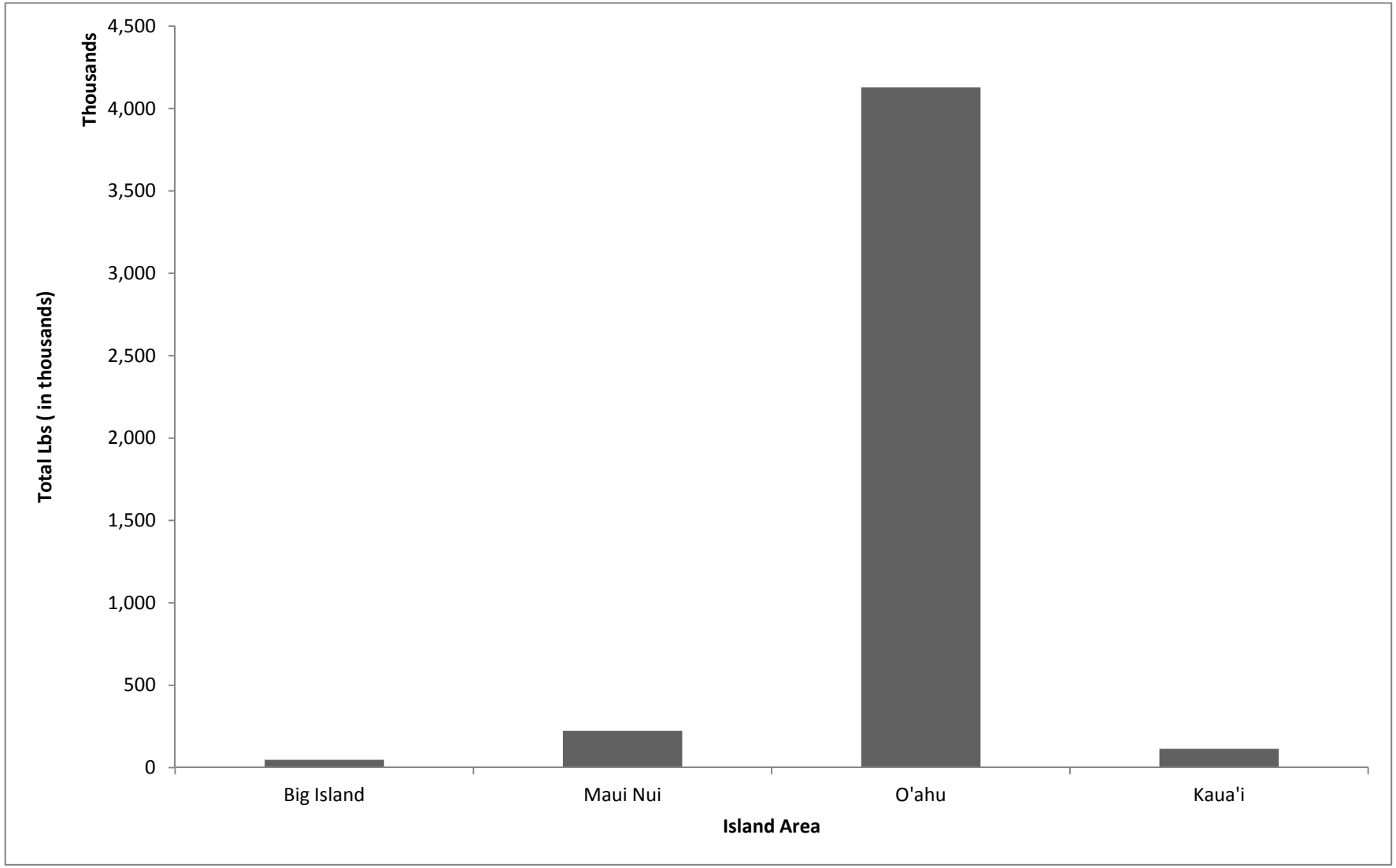


Figure 4.5: Total landings in traps (gear code 11, 24, and 52) by island from 1948-2011. Only fish species caught in traps were considered for this figure. Note: Maui Nui includes: Moloka'i, Lana'i, and Penguin banks; Kaua'i includes: Ni'ihau and Ka'ula

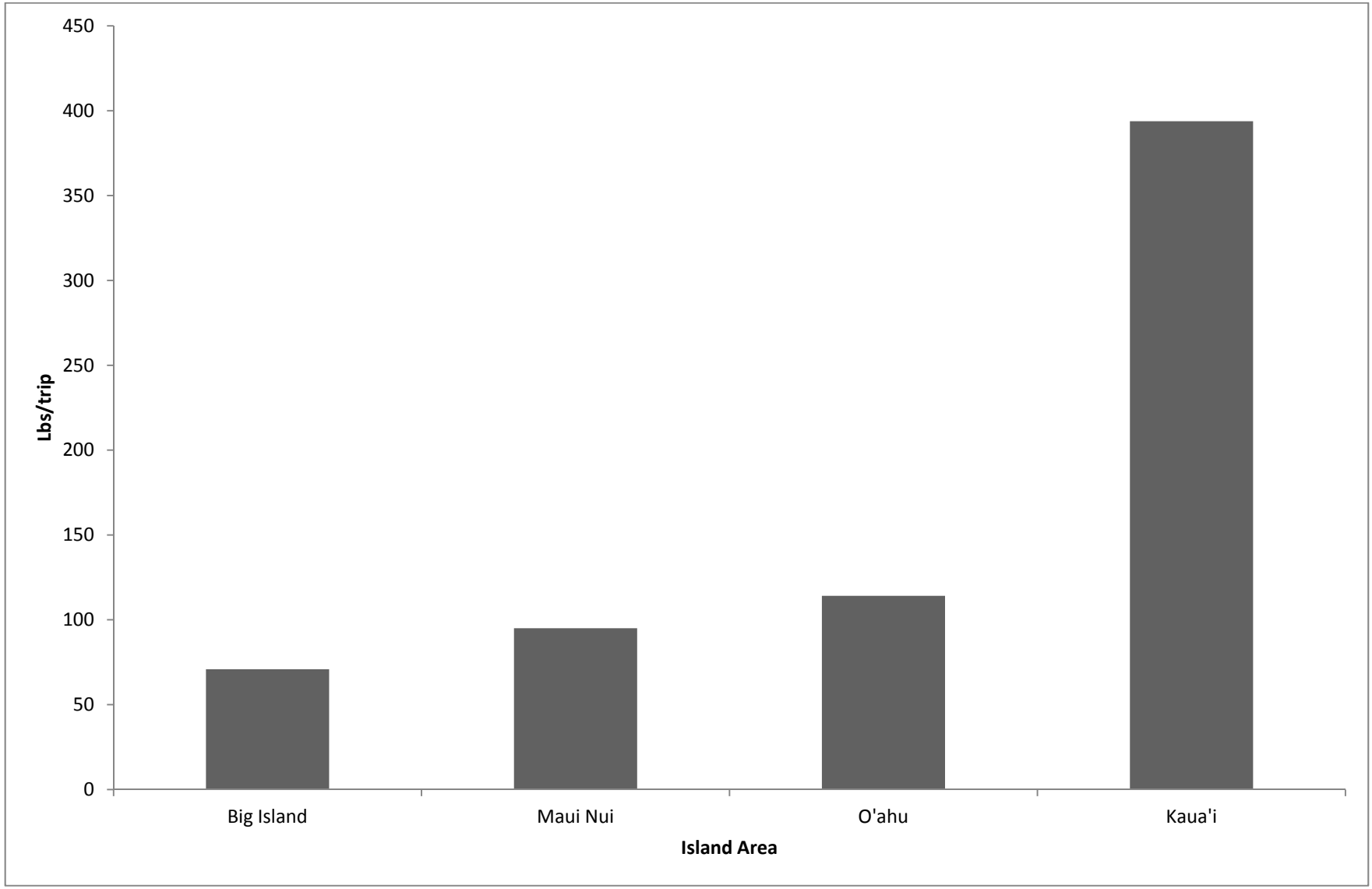


Figure 4.6: Pounds per trip in fish traps (gear code 11, 24, and 52) by island area from 1948-2011. Catch-per-unit effort is shown in terms of pounds per trip for fish species caught in traps in 4 island areas. Note: Maui Nui includes: Moloka'i, Lana'i, and Penguin banks; Kaua'i includes: Ni'ihau and Ka'ula.

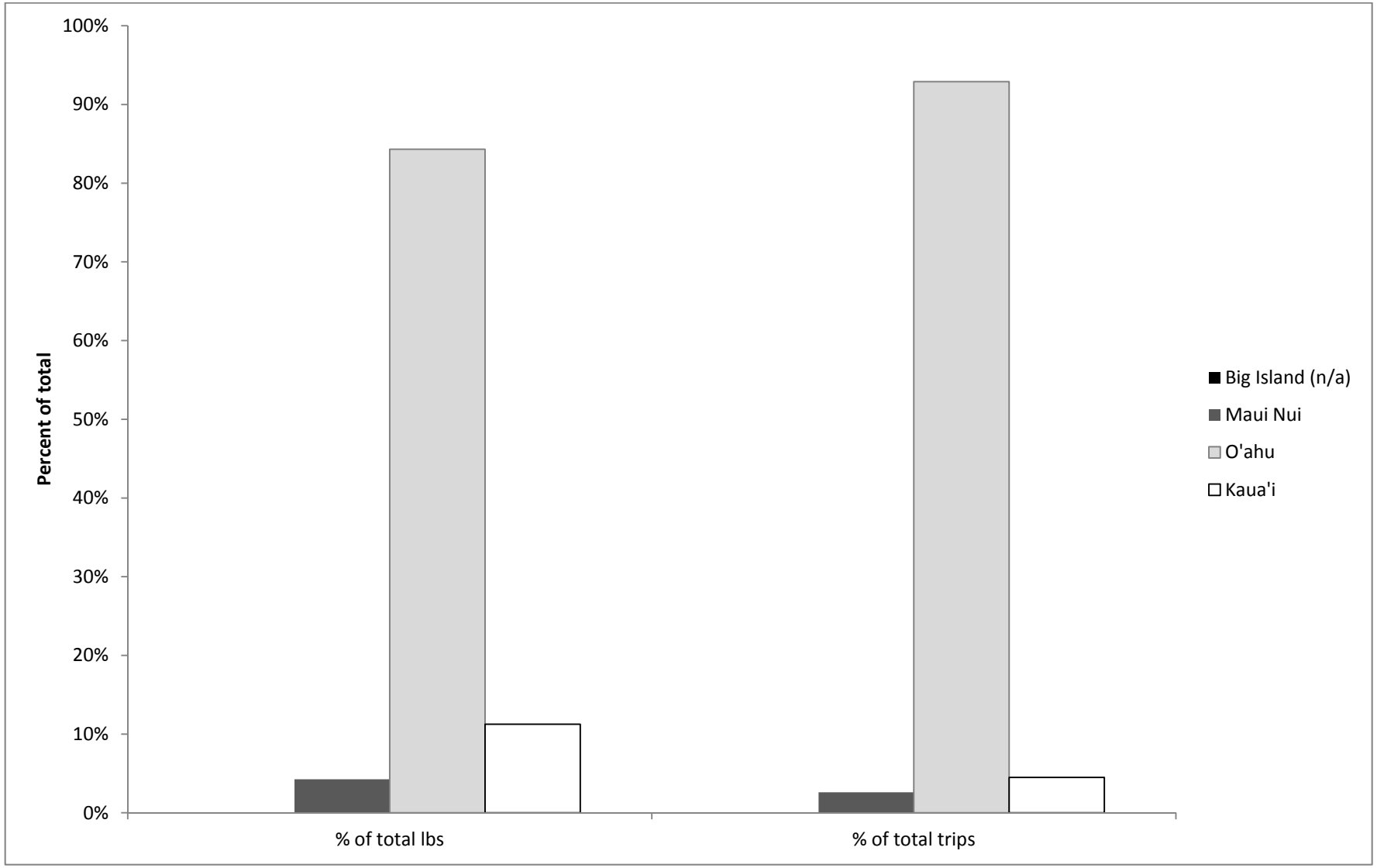


Figure 4.7: Percent of total landings and total trips in fish traps by island area from 1986-2011. Only fish species caught in fish traps were considered for this figure. The Big Island data are not available because of the confidentiality agreement. Note: Maui Nui includes: Moloka'i, Lana'i, and Penguin banks; Kaua'i includes: Ni'ihau and Ka'ula.

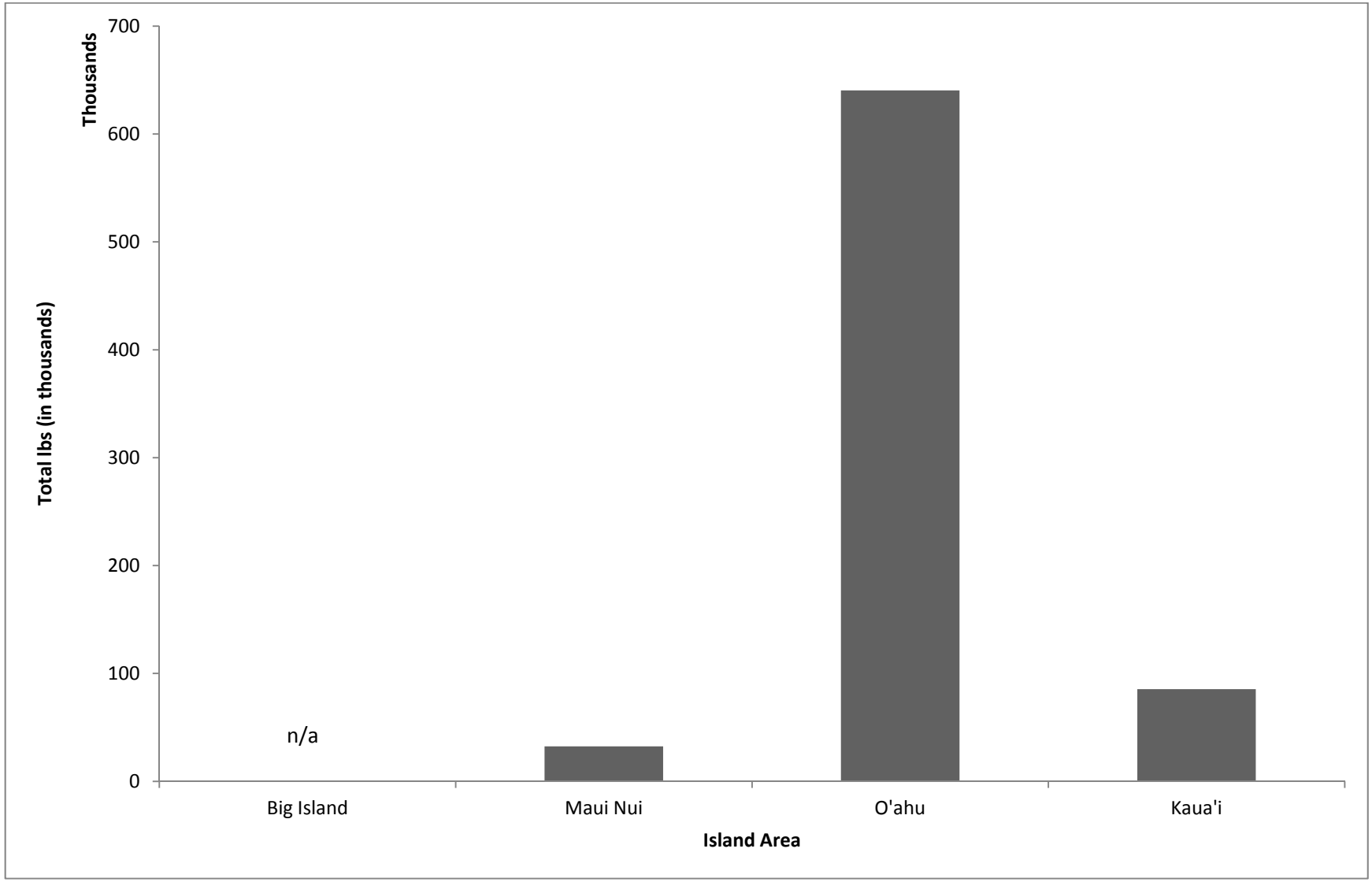


Figure 4.8: Total landings in fish traps (gear code 52) by island from 1986-2011. Only fish species caught in fish traps were considered for this figure. The Big Island data are not available because of the confidentiality agreement. Note: Maui Nui includes: Moloka'i, Lana'i, and Penguin banks; Kaua'i includes: Ni'ihau and Ka'ula.

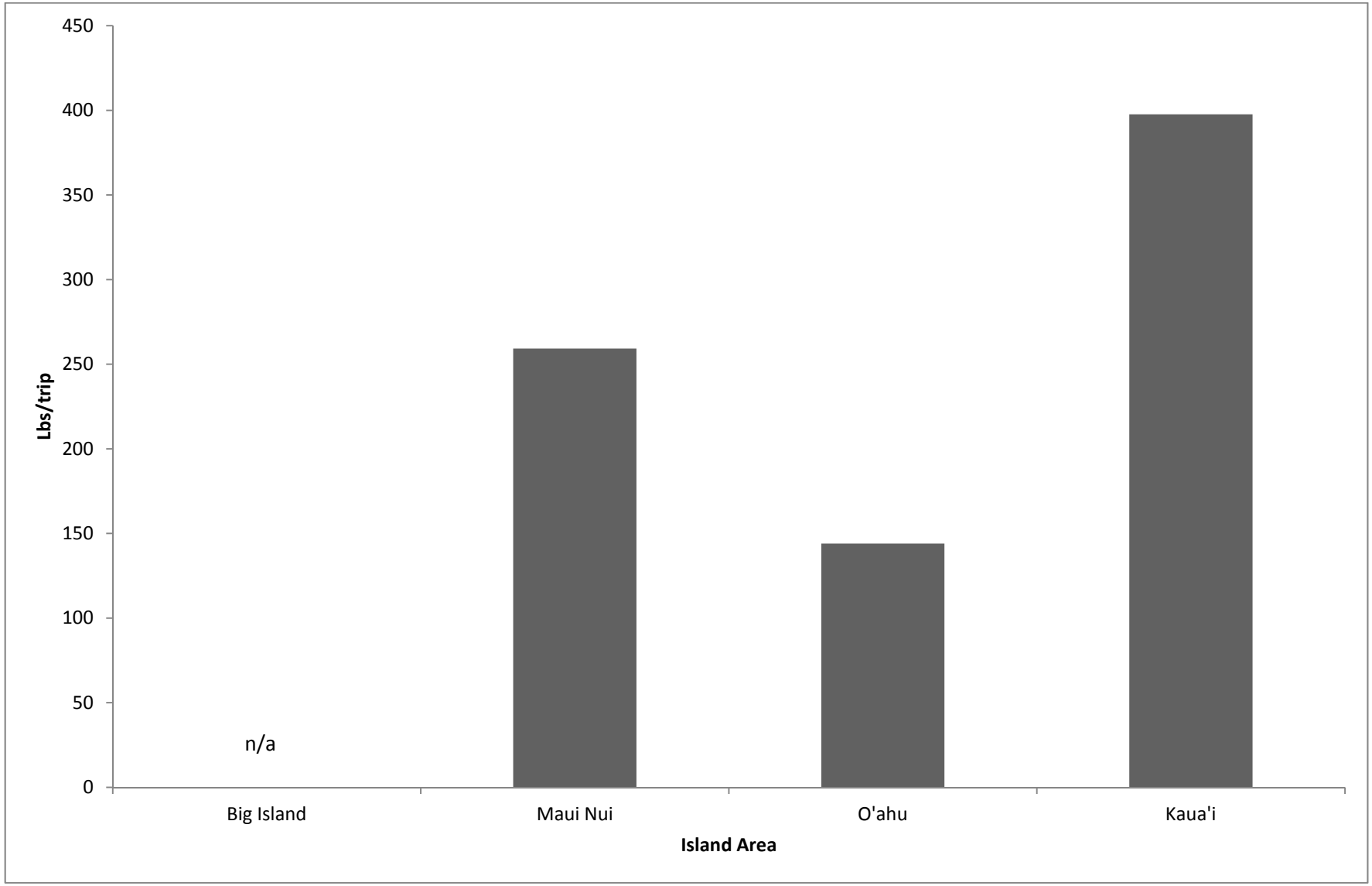


Figure 4.9: Pounds per trip in fish traps (gear code 52) by island area from 1986-2011. Catch-per-unit effort is shown in terms of pounds per trip for fish species caught in fish traps in 4 island areas. The Big Island data are not available because of the confidentiality agreement. Note: Maui Nui includes: Moloka'i, Lana'i, and Penguin banks; Kaua'i includes: Ni'ihau and Ka'ula