

AMERICAN SAMOA 2003 FISHERY STATISTICS

Compiled by

American Samoa

Department of Marine and Wildlife Resources

and the

Western Pacific Fishery Information Network

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CONTENTS

	Page
Introduction	A.1
Special Note on Data Revisions	A.2
Data Collecting System	A.2
Data Processing System	A.6
Data Quality and Cross Validation: American Samoa Longline Example	A.8
Data Reporting System	A.9
Interpretation of Statistics	A.14
Tables	A.16
Figures	A.30

LIST OF AMERICAN SAMOA SUMMARY TABLES

Table	Title	Page
A-1	American Samoa Annual 2003 Estimated Commercial Landings	A.16
A-2	American Samoa January 2003 Estimated Commercial Landings	A.18
A-3	American Samoa February 2003 Estimated Commercial Landings	A.19
A-4	American Samoa March 2003 Estimated Commercial Landings	A.20
A-5	American Samoa April 2003 Estimated Commercial Landings	A.21
A-6	American Samoa May 2003 Estimated Commercial Landings	A.22
A-7	American Samoa June 2003 Estimated Commercial Landings	A.23
A-8	American Samoa July 2003 Estimated Commercial Landings	A.24
A-9	American Samoa August 2003 Estimated Commercial Landings	A.25
A-10	American Samoa September 2003 Estimated Commercial Landings	A.26
A-11	American Samoa October 2003 Estimated Commercial Landings	A.27
A-12	American Samoa November 2003 Estimated Commercial Landings	A.28
A-13	American Samoa December 2003 Estimated Commercial Landings	A.29

LIST OF AMERICAN SAMOA FIGURES

Figure	Title	Page
A-1-1	2003 Monthly Estimated Commercial Landings for Pelagic, Bottom, Reef, and Other Fish	A.30
A-1-2	2003 Monthly Estimated Commercial Landings of Tunas, PMUS, and BMUS	A.30
A-1-3	2003 Monthly Estimated Commercial Landings of Wahoo, Mahimahi, and Billfish	A.31
A-1-4	2003 Monthly Estimated Commercial Landings of Albacore and Yellowfin Tunas	A.31
A-1-5	2003 Monthly Estimated Commercial Landings of Skipjack, Bigeye, and Other Tunas	A.32
A-2-1	1982-2003 Average Monthly Estimated Commercial Landings of Tunas, PMUS, and BMUS	A.32
A-2-2	1982-2003 Average Monthly Estimated Commercial Landings of Wahoo, Mahimahi, and Billfish	A.33
A-2-3	1982-2003 Average Monthly Estimated Commercial Landings of Surgeonfish (Tangs), Bluelined Snapper, and Spiny Lobster	A.33
A-2-4	1982-2003 Average Monthly Estimated Commercial Landings of Albacore and Yellowfin Tunas	A.34
A-2-5	1982-2003 Average Monthly Estimated Commercial Landings of Skipjack, Bigeye, and Other Tunas	A.34
A-3-1	1982-2003 Annual Estimated Commercial Landings for Pelagic, Bottom, Reef, and Other Fish	A.35
A-3-2	1982-2003 Annual Estimated Commercial Landings (Pounds and Dollars)	A.35
A-3-3	1982-2003 Annual Estimated Commercial Landings for Tunas, PMUS, and BMUS Landings	A.36
A-3-4	1982-2003 Annual Estimated Commercial Landings for Wahoo, Mahimahi, and Billfish	A.36
A-3-5	1982-2003 Annual Estimated Commercial Landings for Albacore and Yellowfin Tunas	A.37
A-3-6	1982-2003 Annual Estimated Commercial Landings for Skipjack, Bigeye, and Other Tunas	A.37

LIST OF AMERICAN SAMOA FIGURES (cont)

Figure	Title	Page
A-4-1	1982-2003 Monthly Estimated Commercial Landings of Wahoo	A.38
A-4-2	1982-2003 Monthly Estimated Commercial Landings of Mahimahi	A.38
A-4-3	1982-2003 Monthly Estimated Commercial Landings of Blue Marlin	A.39
A-4-4	1982-2003 Monthly Estimated Commercial Landings of Albacore	A.39
A-4-5	1982-2003 Monthly Estimated Commercial Landings of Skipjack Tuna	A.40
A-4-6	1982-2003 Monthly Estimated Commercial Landings of Yellowfin Tuna	A.40
A-4-7	1982-2003 Monthly Estimated Commercial Landings of Bigeye Tuna	A.41
A-4-8	1982-2003 Monthly Estimated Commercial Landings of Blue-lined Snapper	A.41
A-4-9	1982-2003 Monthly Estimated Commercial Landings of Spiny Lobster	A.42
A-4-10	1982-2003 Monthly Estimated Commercial Landings of Surgeonfish (Tangs)	A.42

AMERICAN SAMOA 2003 FISHERY STATISTICS

INTRODUCTION

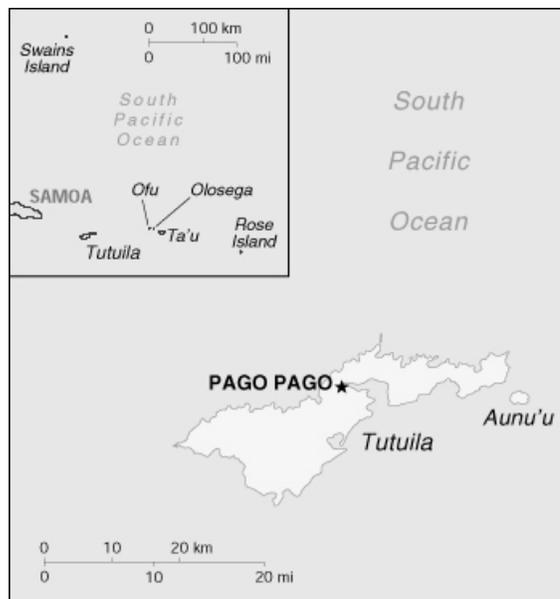
Location: 14°S latitude, 170°W longitude

Islands: Tutuila, Aunu'u, the Manu'a Islands (Ofu, Olesaga, Ta'u), Rose Atoll (uninhabited), and Swain's Island (sparsely populated)

Population: 57,900, 80 % on Tutuila; (*The World Factbook*, 2004)

Economy: tuna industry

The American Samoa Department of Marine and Wildlife Resources (DMWR; formerly the Office of Marine Resources) is located near Pago Pago on Tutuila and has been collecting commercial fisheries data from the Tutuila fleet since the early 1970s. In 1983 it extended its coverage to the Manu'a Islands, and in 1985 DMWR modified its data collection programs to include recreational and subsistence fisheries data.



American Samoa Source:
<<http://www.cia.gov/cia/publications/factbook/geos/aq.html>>;
The World Factbook

American Samoa's domestic fisheries have typically been small-boat, one-day fisheries using primarily 28-to 32-foot long, outboard-engine-powered catamarans called *alias* (pronounced *ah-lee-ahs*). Traditionally, trolling and bottomfishing were the major methods of fishing, and a little spearfishing, netting, and vertical longlining were done occasionally. Beginning in about mid-1995 some of the traditional *alias* began converting to horizontal longlining. During 1996 horizontal longlining became the largest fishery in American Samoa based on total landed weight of the catch, even though only about one-third of the fleet had converted to this method. Over the next few years the fleet grew rapidly with the addition of new *alias* up to about 38 feet in length and, more significantly, with the addition of other larger mono-hull vessels that fished much longer trips. The primary target species is albacore tuna, but the fishery has also resulted in significant increases in landings of yellowfin tuna, wahoo, blue marlin, mahimahi, and some other incidentally caught species.

During 2003, the various fishery monitoring programs in American Samoa identified 82 active vessels — 77 home ported on Tutuila and 5 in the Manu'a Islands. Many of these vessels participated in more than one fishery, and 64 of the Tutuila boats (including 32 vessels which were over 50 feet in length) did at least some longlining. Of the 82 total boats, 19 participated in the troll and bottomfish fisheries and 3 were used in other forms of fishing activities. On average, the *alia* fleet on Tutuila consisted of 3-man crews, fished 7 hours, and caught about 261 pounds of fish; the Manu'a-based fleet typically had 3-man crews, fished about 5 hours and landed 113 pounds of fish. Essentially all of the longlining was based out of Tutuila, where the majority of the catch was off-loaded to the canneries.

SPECIAL NOTE ON DATA REVISIONS

Significant changes in the fisheries occurred in the mid-1990s with the development of the longline fishery and a nighttime, boat-based scuba spearfishing fishery. Because of the nature of these fisheries, biases began creeping into the effort-counting and interviewing processes of the DMWR surveys. By 1997 WPacFIN staff discovered the problems, and modifications to survey techniques were implemented by DMWR staff. It became clear by early 1998 that the algorithms used to expand the survey data and estimate for the total fishery also needed to be changed. The new data processing system that better handles the more complex nature of today's fisheries in American Samoa as detailed below has been completed and was used to reprocess the historical time series. This volume includes the results of this new improved algorithm, but additional data quality control procedures and algorithm enhancements are still being made that may cause small changes in subsequent reports.

DATA COLLECTING SYSTEM

The data collecting systems used by DMWR to monitor the changing fisheries of American Samoa have evolved considerably over the past 20 years. One common factor of all systems has been that they have relied heavily on personal contacts with the fishermen and on a significant amount of dockside monitoring and interviewing.

The major systems in place today include: 1) boat-based access-point creel surveys on Tutuila and the Manu`a Islands (Offshore Creel Survey System), which are the mainstay of the monitoring program; 2) a mandatory purchase receipt "trip ticket" system for fish businesses on Tutuila (Commercial Purchase System); 3) a vessel history and tracking system for all American Samoa vessels (Vessel Classification System); 4) a Daily Effort Census System for detailed tracking of the developing longline fishery; 5) a mandatory federal Longline Logbook System; 6) a Cannery Landings System to document all landings at the two canneries made by domestic and foreign vessels; and 7) a size frequency sampling program at the canneries. Data from all these major systems are used to develop the best available data for the complex and ever changing fisheries of American Samoa. More details of the first five data collection systems follow.

Commercial Catch Monitoring System. From 1982 to 1985, DMWR obtained catch statistics by interviewing commercial fishermen at the end of their trips and kept records of as much commercial fishing activity as possible. This data collection method was accurate for trips where interviews were conducted. However, it was very labor intensive, did not cover all trips, and did not include the small but growing recreational and subsistence fisheries.

Vessel Classification System. Beginning in the early 1980s, a vessel classification system was established to collect information on all vessels participating in any domestic fisheries. This system provides the following information on American Samoa vessels:

A.3

- Boat Name
- Registration Number
- Propulsion
- Length
- Beam
- Number of Engines
- Type of Use
- Trailered
- Number of Crew
- Depth
- Engine Type
- Fuel Type
- Material
- Horsepower
- Port
- Methods of fishing
- Federal Permit

Offshore Creel Survey System. In October 1985 a new creel survey sampling system was implemented on Tutuila to provide better coverage and statistics on all boat-based fisheries. This replaced the Commercial Catch Monitoring System. Soon afterwards similar monitoring programs were established in the Manu`a Islands, where the fishing fleets are centrally located and small enough for statistics to be collected for nearly every trip. The surveyors in the Manu`a Islands send their monitoring forms to DMWR in Tutuila for processing. The Manu`a statistics are entered and compiled on a monthly basis and are adjusted by an estimated percent coverage factor that is usually 100%.

The details of the Tutuila boat-based fishery sampling program have changed over the years to accommodate changes in the fisheries; but it is still a systematic, random sampling program that stratifies sampling by type of day (either weekday or weekend/holiday) and by fishing method. For logistical and cultural reasons, Sundays are no longer sampled as effort is extremely low and not similar to other weekend/holiday-type days.

DMWR staff normally sample 2 weekdays and 1 weekend/holiday per week. During survey days, counts of total participation are collected, and as many returning vessels as possible are interviewed for catch, effort, and biological samples. Tutuila is divided into six sample areas, five of which are sampled. It is assumed that the non-sampled area is similar to the sampled areas in fishing activity and success rate. Furthermore, it is assumed that the fishermen interviewed are representative of the entire fishing population and that they give accurate information.

Unless contrary information is available from dockside questioning of knowledgeable persons, a boat is assumed to be “out fishing” if its trailer is at a boat ramp or the boat is missing from its normal berthing area during the 18 hour survey day. The following participation information is recorded for all boats determined to be “out fishing.” The participation data is expanded to estimate the total number of fishing trips in Tutuila.

- Sample Date
- Boat Name
- 3 Observation Times
- Type of Day
- Fishing Method
- Sample Area

A.4

The remaining data items listed below are collected on each boat for which an interview is successfully completed.

- Interview Time *
- Area fished
- Home island
- Total hours fished (trip length) *
- Number of fishermen
- Number of gear used
- Total trip weight in pounds *
- Species caught *
- Number of pieces for each species
- Disposition of species*
- Weight in pounds for each species *
- Condition of species if not whole
- Length of fish (converted to weight)
- Price per pound for each species

It is not always possible to obtain information on all the items listed. However, the ones marked with an asterisk (*) are considered essential for data expansion purposes. Also, identification and weight of each species are often not obtainable; in this case a code for species groupings (e.g., miscellaneous bottom fish) is used. The interview data is later expanded to estimate the total catch per fishing trips and other CPUE measures in Tutuila. The catch per trip estimate is multiplied by the number of trips estimate for each strata to get an estimate of the total catch for Tutuila.

Commercial Purchase System. For several decades the two canneries provided monthly summary statistics about their purchases of fish from all vessels, foreign and domestic. Then in September 1990, a Commercial Purchase (receipt book) System was instituted in which all businesses in Samoa that buy fish directly from fishermen were required by local law to submit a copy of their purchase receipts to DMWR. Receipt books are issued by DMWR to all fish markets, stores, hotels, and restaurants that resell fish, either whole or prepared. The following information is collected via these receipts.

- Invoice Date
- Invoice Number
- Buyer's Name
- Boat Name, Owner
- Area Fished
- Fishing Method
- Species bought
- Number of pieces for each species
- Weight in pounds for each species *
- Price per pound for each species

Federal Longline Logbook System and Daily Effort Census. In January 1996, in response to the developing longline fishery, a federal longline logbook system was implemented by NMFS. All longline fishermen are required to obtain a federal permit that requires them to submit logs containing detailed data on each of their sets and the resulting catch. From 1996 to 1999, the logbooks submitted by the local longliners were edited by the NMFS fisheries monitoring agent in Samoa for any missing data and were then sent to the NMFS Honolulu Lab (now the PIFSC) for further editing and data processing.

A.5

To improve monitoring of the fast-growing longline fishery, in July 1999 DMWR implemented a Daily Effort Census (DEC) for all federally permitted longline vessels. Six days a week, DMWR staff make two visits a day to ports where longline vessels move. The staff document whether each vessel on the list is “in port” or “out fishing.” The DEC data are used to track the activity of each vessel and to help ensure all fishing log sheets are submitted by the fishermen. To further improve the quality and timeliness of the data, beginning in January 2000 logbook data collecting, editing, and processing has been done by DMWR in Samoa and is downloaded to NMFS periodically. The following information is recorded for each set these longline fishermen make:

- Set Date
- Vessel
- Date of Departure
- Port of Departure
- Date of Arrival
- Port of Arrival
- Observer on Board
- Target Species
- Bait Used
- Mainline Length
- No. of Hooks
- No. of Hooks/Float
- No. of Lightsticks Used
- Bird Catch Mitigation Measures
- Wind Detection
- Wave Height
- Sea Surface Temperature
- Wind Speed
- Begin Set Time
- Begin Set Latitude and Longitude
- End Set Time
- End Set Latitude and Longitude
- Haul Date
- Begin Haul Date
- Begin Haul Latitude and Longitude
- End Haul Time
- End Haul Latitude and Longitude
- No. of Pelagic Species kept
- No. of Pelagic Species released
- No. of Sharks finned
- No. of Sharks kept
- No. of Sharks released
- No. of Protected Species released alive
- No. of Protected Species released injured
- No. of Protected Species released dead

Logbook data are also compared with cannery unloading data for Samoa-based boats on a monthly basis to identify boats that unload at the canneries but did not turn in any longline logs or turn in just a part of the logs that they are required to.

The longline logbooks provide no information on the pounds caught or the disposition of fish caught by large longliners, which are not covered by the Offshore Creel Survey. Beginning in April 2001, length data from South Pacific Regional Longline Port Sampling Forms were collected for Samoa-based longliners and converted to pounds to provide better estimates of the pounds per fish of fish caught by the large longliners. Disposition data were also entered in the comments section of these forms to provide sampled disposition data on the fish caught.

DATA PROCESSING SYSTEM

As the data collecting systems used by DMWR to monitor the fisheries in American Samoa have changed over the years, so have the data processing systems. Numerous versions of database and utility software and microcomputer systems have been used over the years to meet the growing demand for processing the collected data. Generally speaking, these changes, with their significant emphasis on improving data quality and their cross validation among systems, have made the data processing systems more robust, complex, and complete.

Several important principles have remained constant over time: 1) keep data processing close to the source of data collecting; 2) provide all of the needed software tools to ensure the quality of data; 3) make the systems user friendly and functional for the local staff; and 4) maintain as many standards as possible throughout the time series of data collected.

Typically, when upgrades (such as changes in expansion and reporting algorithms for the creel survey data and commercial landings data) have been made to data processing systems, the entire time series of data would be reprocessed using the same algorithms so that trends in the fisheries would remain as intact as possible. The annual and monthly estimated commercial landings data and the corresponding time series figures included in this report were produced with the versions of data processing systems in use in May 2001. To help the reader understand the origin of the data included in this report, a general description of these processes follows. It does not include the details on many minor changes that have occurred throughout the evolutionary history of these systems.

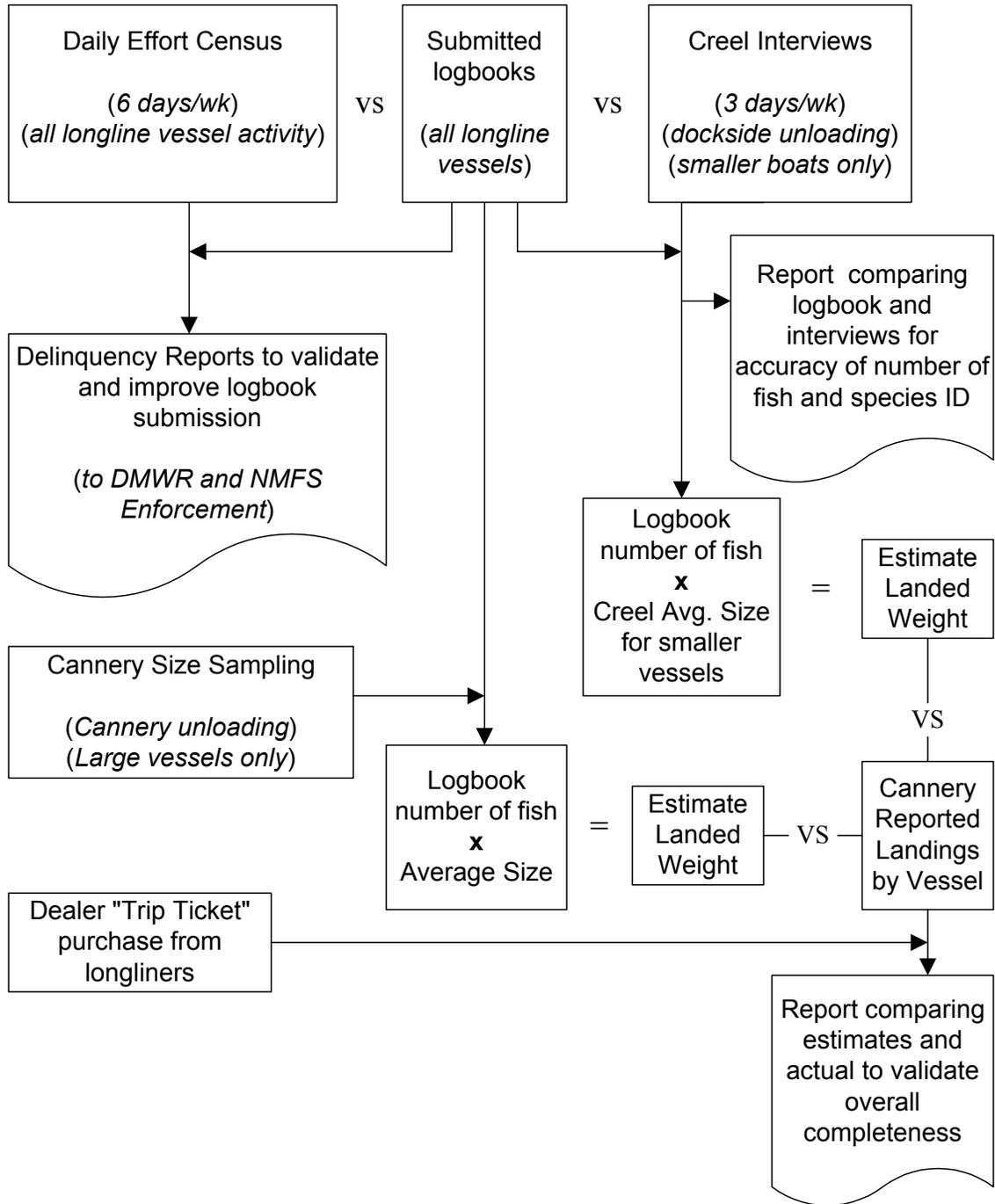
The data from 1982-85 have been imported directly from the original Commercial Catch Monitoring System used before the implementation of the offshore creel survey. Since 1986, the boat-based creel survey data expansion system has been the central system for estimating total commercial landings in American Samoa. In short, the survey data expansion process involves multiplying the average daily participation by the average catch per trip for each stratum. For the years 1986-90, commercial sales portions of the expanded creel survey data from Tutuila and the Manu'a Islands were combined to produce estimated total commercial landings. Since 1990, with the implementation of the mandatory fish dealer receipt book system on Tutuila, further adjustments have been made to these combined creel data by using receipt book data. These adjustments made significant improvements in overall totals as they helped adjust for sales not monitored through the boat-based survey (e.g., shoreline and strictly nighttime commercial fishing). Species totals modified with these types of adjustments are flagged in reports with an asterisk. Finally, in the late 1990's when larger longline vessels began landing their catches directly at the canneries and thus out of the monitoring capabilities of the standard creel surveys, the longline logbook system and cannery size frequency sampling data entered the algorithm to fill the gap for this portion of the fishery. This data added the landings of these vessels to create a more complete picture of the estimated total commercial landings for the Territory.

One of the most significant recent improvements made in the data processing systems for DMWR has been in the area of cross-system data validation and quality control. By collecting similar data from several sources using different monitoring and reporting tools, the

A.7

quality of reported data can be cross-referenced between systems to provide insight into the validity and completeness of each data set. The following schematic shows some cross-system data validation relationships and features that are utilized in the most current version of the integrated DMWR fisheries monitoring programs (see next page):

Data Quality and Cross Validation American Samoa Longline Example



DATA REPORTING SYSTEM

After all editing, quality control, and data interpretation activities are completed, monthly and annual commercial landings data tables by species are generated. Each of the commercial landings data tables contains the common name, weight in pounds, value in dollars, the average price per pound of each species or species group, and whether the data was modified by Commercial Purchase System data (denoted by asterisks). The monthly data tables are based on monthly expansions of the Tutuila Offshore Creel Survey Data with enhancements by monthly Longline Logbook, Commercial Purchase System, and Manu`a data as explained previously. Annual data tables are based on combined annual expansions of the creel data for the entire calendar year with similar annual enhancements from Longline Logbook, Commercial Purchase System, and Manu`a data. Since the monthly and annual data tables are based on separate monthly and annual expansion of the creel data, the annual data tables are not the exact sum of the 12 monthly data tables, but they fall within the standard error. These data tables are listed as Tables A-1 to A-13 in this report.

The charts that make up the rest of the report are for groups of species as well as for some of the dominant individual species. Some of the charts in this volume are new or modified from earlier volumes. The top ten commercial species for the year are emphasized, and they will change from year to year. The species in the species groups used in the charts of this report are defined below.

To access the most up-to-date data and charts, please visit the WPacFIN Website at <<http://www.pifsc.noaa.gov/wpacfin>>.

Note: Many of the species included in this report have been recategorized over the years. For example, the Magnuson Fishery Conservation and Management Act of 1976 was amended in 1992 to include tunas in the Pelagic Management Unit Species (PMUS) category. However, this FSWP volume will maintain the original species categorizations from previous volumes for comparative purposes. As such, tunas are kept in a separate category.

I. Pelagic Management Unit Species (PMUS)

Although the Magnuson Fishery Conservation and Management Act of 1976 was amended in 1992 to include tunas in the PMUS (PPMUS), this report series will continue to tunas as a separate category from the PPMUS. The PMUS category includes:

Other Sharks	Black marlin
Blacktip reef shark	Striped Marlin
Blue shark	Sailfish
Mako Shark	Spearfish
Nurse shark	Swordfish
Thresher Shark	Wahoo
White-Tip Shark	Pomfret
Mahimahi	Moonfish
Blue marlin	

II. Bottomfish Management Unit Species (BMUS)

Black Jack	Hawaiian opakapaka
Amberjack	Gindai (flower snap)
Giant trevally	Yellowtail snapper
Yelloweye Snapper.	Lehi (silverjaw)
Blacktip grouper	Onaga (longtail snapper)
Lunartail grouper	Ehu (squirrelfish snap.)
Blue lined snapper	Ambon emperor
Gray jobfish	Redgill emperor

III. Billfish

Swordfish	Striped Marlin
Blue marlin	Sailfish
Black marlin	Spearfish

IV. Tunas

Tunas	Bluefin Tuna
Skipjack Tuna	Yellowfin Tuna
Dogtooth tuna	BigeyeTuna
Albacore	Kawakawa

V. Other Tuna

Tunas	Bluefin Tuna
Dogtooth tuna	Kawakawa

VI. Fisheries Categories

A. Pelagics

Albacore	Other Sharks
Barracudas	Other birds
Bigeye Tuna	Pomfret
Black marlin	Rainbow runner
Blacktip reef shark	Sailfish
Blue marlin	Sharks
Blue shark	Silky Shark
Bluefin Tuna	Skipjack Tuna
Dogtooth tuna	Small barracuda
Hammerhead Shark	Snake mackerel
Kawakawa	Spearfish
Large barracuda	Striped Marlin
Mackerel	Swordfish
Mahimahi	Thresher Shark
Mako Shark	Tiger Shark
Moonfish	Tunas
Nurse shark	Wahoo
Oilfish	White-Tip Shark
Other Pelagic Fish	Yellowfin Tuna

B. Bottom Fish

Amberjack	Humpback snapper
Ambon emperor	Jacks (misc)
Bigeye emperor	Kusakar's snapper
Bigeye trevally	Lehi (silverjaw)
Black Jack	Longnose emperor
Black snapper	Lunartail grouper
Blacktail snapper	Multidens snapper
Blacktip grouper	Onaga (longtail snapper)
Blood snapper	Onespot snapper
Blue lined gindai	Orangespot emperor
Blue lined snapper	Peacock grouper
Bluefin trevally	Pristipomoides/Etelis
Blueline bream	Redgill emperor
Bottom Handline Snappers	Rufous snapper
Bottomfish (Assorted)	Smalltooth grouper
Brown jobfish	Spotted grouper
Ehu (squirrelfish snap.)	Stone's snapper
Emperors (misc)	Striped grouper
Flagtail grouper	Tomato grouper
Giant grouper	Trevally (C.caeruleop.)
Giant trevally	Twinspot/red snapper
Gindai (flower snap)	Whitemouth trevally
Goldenline bream	Yellow opakapaka
Goldspot trevally	Yelloweye Snapper.
Gray jobfish	Yellowspot grouper
Groupers (misc)	Yellowtail snapper
Hawaiian opakapaka	

C. Reef Fish

Bigeye scad	Moray eels
Catfish	Needlefish
Conger eels	Octopus
Crabs	Rays
Eagle ray	Salmon
Eels	Sea shells
Flyingfish	Sea urchins
Giant clam	Sharks
Halfbeaks	Shrimp
Invertebrates	Slipper lobster
Kona crab	Spiny lobster
Leatherback	Spotted eels
Limu, algae	Squid
Mackerel scad: opelu	Sunfish
Mangrove crab	Threadfin
Milkfish	Tilapia
Miscellaneous	Turban snail

D. Other

Bigeye squirrelfish	Porcupinefish
Bigeyes	Rabbitfish
Bigscale soldierfish	Red snapper, mu
Brown surgeonfish	Reef fish (Assorted)
Brwn wrasse:pataotao	Rudderfish
Butterflyfish	Saber squirrelfish
Cardinalfish	Sargent major
Convict tang	Squirrelfish
Flounders	Striped bristletooth
Goatfish	Surgeonfishes/tangs
Hawkfish	Sweepers
Inshore groupers	Sweetlips
Inshore snappers	Terapon perch
Lined surgeon	Tilefish
Mountain bass	Triggerfish
Mulletts	Unicornfishes (misc)
Naso tang	Whitespotted surgeonfish
Orangespine unicornfish	Wrasse
Parrotfishes	Yellowfin surgeonfish
Pink goatfish	

INTERPRETATION OF STATISTICS

The user is reminded to pay heed to the precautions and assumptions identified earlier in this document when making interpretations of or inferences from data reported in the tables and graphs. Remember also that the commercial landings summaries are not based on a census of all the fishing activities, but on samples of those activities and on integration of data from four separate data systems. One of the major factors in expanding the creel survey data into monthly and annual estimates is the use of proportionality constants to adjust for percent coverage of the surveys. The flexibility of the survey design allows for refinement of these constants as additional information is gained on the fishing activities. If the constants are improved upon, the basic survey data can be expanded again to create better overall estimates. However, the variability and species composition would not be expected to change since these statistics are based on the actual survey information collected from the fishermen. The estimates of total landings are considered to be conservative because the catch from the subsistence inshore fisheries are currently not included in this document.

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Table A-1
American Samoa Annual 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Jacks (misc)	637	\$1,326	\$2.08
Black Jack	174	\$395	\$2.28
Barracudas	1,646	\$3,875	\$2.35
Other Sharks	129	\$65	\$0.50
Spotted eels	123	\$247	\$2.00
Groupers (misc)	83	\$104	\$1.25
Flagtail grouper	24	\$59	\$2.50
Tomato grouper	133	\$307	\$2.31
Blacktip grouper	39	\$98	\$2.50
Striped grouper	19	\$46	\$2.50
Smalltooth grouper	31	\$79	\$2.50
Lunartail grouper	491	\$1,003	\$2.04
Blue lined snapper	1,902	\$3,612	\$1.90
Rufous snapper	28	\$70	\$2.50
Onespot snapper	20	\$50	\$2.50
Humpback snapper	2,564	\$4,392	\$1.71
Blood snapper	7	\$14	\$2.10
Gray jobfish	438	\$927	\$2.12
Pristipomoides/Etelis	435	\$1,303	\$3.00
Yellow opakapaka	220	\$826	\$3.75
Hawaiian opakapaka	743	\$1,304	\$1.76 *
Gindai (flower snap)	55	\$102	\$1.85 *
Yellowtail snapper	60	\$149	\$2.50
Lehi (silverjaw)	291	\$728	\$2.50
Onaga (longtail snapper)	415	\$1,066	\$2.57 *
Ehu (squirrelfish snap.)	385	\$921	\$2.39
Emperors (misc)	2,383	\$4,181	\$1.75
Longnose emperor	808	\$1,537	\$1.90
Ambon emperor	164	\$246	\$1.50
Orangespot emperor	75	\$151	\$2.00
Redgill emperor	70	\$155	\$2.21
Oilfish	183	\$183	\$1.00
Rudderfish	6	\$10	\$1.75
Surgeonfishes/tangs	7,620	\$14,969	\$1.96 *
Unicornfishes (misc)	2,430	\$4,804	\$1.98 *
Squirrelfish	1,210	\$2,379	\$1.97 *
Saber squirrelfish	64	\$127	\$2.00
Bigscale soldierfish	22	\$55	\$2.50
Bigeye squirrelfish	19	\$46	\$2.39
Parrotfishes	5,015	\$9,811	\$1.96 *
Terapon perch	19	\$37	\$2.00
Goatfish	50	\$146	\$2.95
Inshore groupers	635	\$1,087	\$1.71
Porcupinefish	112	\$224	\$2.00
Red snapper, mu	20	\$40	\$2.00 *
Mahimahi	17,399	\$30,225	\$1.74
Swordfish	8,086	\$18,230	\$2.25 *
Blue marlin	4,703	\$4,926	\$1.05
Black marlin	4,192	\$4,192	\$1.00
Sailfish	2,108	\$1,973	\$0.94
Rainbow runner	32	\$64	\$2.00
Wahoo	368,453	\$353,896	\$0.96
Skipjack Tuna	252,711	\$151,473	\$0.60

Table A-1 (Cont.)
American Samoa Annual 2003 Estimated Commercial Landings

Species	Pounds	Value	\$/Lb
Dogtooth tuna	1,055	\$1,551	\$1.47
Albacore	8,664,396	\$8,186,667	\$0.94
Yellowfin Tuna	1,074,659	\$943,411	\$0.88
BigeyeTuna	519,383	\$575,105	\$1.11
Moonfish	4,090	\$4,090	\$1.00
Crabs	121	\$234	\$1.95
Spiny lobster	779	\$3,018	\$3.87 *
Octopus	512	\$1,024	\$2.00 *
Salmon	14	\$28	\$2.00
TOTAL	10,954,686	\$10,343,362	\$0.94

* Data replaced or modified by Actual Commercial Landings Data

Table A-2

American Samoa January 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Other Sharks	1,499	\$750	\$0.50
Tomato grouper	29	\$70	\$2.43
Lunartail grouper	25	\$63	\$2.50
Blue lined snapper	75	\$188	\$2.50
Gray jobfish	60	\$150	\$2.50
Ehu (squirrelfish snap.)	64	\$192	\$3.00 *
Emperors (misc)	40	\$100	\$2.50
Rudderfish	8	\$13	\$1.75
Surgeonfishes/tangs	801	\$1,602	\$2.00 *
Unicornfishes (misc)	323	\$639	\$1.98 *
Squirrelfish	159	\$312	\$1.97 *
Parrotfishes	617	\$1,199	\$1.95 *
Terapon perch	2	\$4	\$2.00
Goatfish	13	\$39	\$2.95
Inshore groupers	26	\$46	\$1.75 *
Porcupinefish	11	\$21	\$2.00
Mahimahi	3,248	\$5,934	\$1.83
Swordfish	374	\$733	\$1.96 *
Blue marlin	5,193	\$5,193	\$1.00
Black marlin	2,094	\$2,094	\$1.00
Sailfish	71	\$95	\$1.33
Wahoo	40,407	\$42,459	\$1.05
Skipjack Tuna	26,196	\$22,622	\$0.86
Dogtooth tuna	40	\$60	\$1.50
Albacore	422,641	\$385,056	\$0.91
Yellowfin Tuna	55,213	\$53,727	\$0.97
Bigeye Tuna	19,733	\$21,775	\$1.10
Moonfish	3	\$3	\$1.00
Crabs	27	\$45	\$1.69
Spiny lobster	87	\$271	\$3.13
Salmon	1	\$3	\$2.01
TOTAL	579,078	\$545,457	\$0.94

* Data replaced or modified by Actual Commercial Landings Data

Table A-3
American Samoa February 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Jacks (misc)	10	\$25	\$2.50
Barracudas	116	\$286	\$2.47
Tomato grouper	5	\$10	\$2.00
Lunartail grouper	20	\$50	\$2.50
Blue lined snapper	8	\$13	\$1.65 *
Gray jobfish	10	\$25	\$2.50
Hawaiian opakapaka	30	\$50	\$1.65 *
Lehi (silverjaw)	30	\$75	\$2.50
Onaga (longtail snapper)	76	\$190	\$2.50 *
Ehu (squirrelfish snap.)	100	\$250	\$2.50 *
Rudderfish	10	\$17	\$1.75
Surgeonfishes/tangs	536	\$1,071	\$2.00
Unicornfishes (misc)	254	\$499	\$1.97
Squirrelfish	67	\$134	\$2.00 *
Parrotfishes	244	\$488	\$2.00 *
Terapon perch	4	\$7	\$2.00
Goatfish	17	\$51	\$2.95
Inshore groupers	31	\$57	\$1.85
Porcupinefish	21	\$43	\$2.00
Mahimahi	607	\$610	\$1.00
Swordfish	196	\$433	\$2.21 *
Blue marlin	2,949	\$2,545	\$0.86
Sailfish	200	\$150	\$0.75 *
Wahoo	23,658	\$22,742	\$0.96
Skipjack Tuna	28,424	\$16,723	\$0.59
Albacore	269,462	\$255,663	\$0.95
Yellowfin Tuna	33,175	\$29,396	\$0.89
Bigeye Tuna	5,197	\$5,711	\$1.10
Moonfish	2	\$2	\$1.00
Crabs	43	\$74	\$1.74
Spiny lobster	138	\$429	\$3.11
Salmon	3	\$5	\$2.00
TOTAL	365,641	\$337,824	\$0.92

* Data replaced or modified by Actual Commercial Landings Data

Table A-4

American Samoa March 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Barracudas	30	\$38	\$1.25
Groupers (misc)	69	\$86	\$1.25
Tomato grouper	28	\$69	\$2.44
Blacktip grouper	20	\$50	\$2.50
Lunartail grouper	36	\$75	\$2.10
Blue lined snapper	103	\$222	\$2.16
Humpback snapper	30	\$38	\$1.25 *
Blood snapper	16	\$33	\$2.10
Gray jobfish	20	\$50	\$2.50
Pristipomoides/Etelis	361	\$1,083	\$3.00
Yellow opakapaka	183	\$686	\$3.75
Onaga (longtail snapper)	57	\$143	\$2.50 *
Ehu (squirrelfish snap.)	126	\$246	\$1.95 *
Emperors (misc)	399	\$523	\$1.31
Rudderfish	6	\$11	\$1.75
Surgeonfishes/tangs	504	\$1,008	\$2.00 *
Unicornfishes (misc)	201	\$389	\$1.94 *
Squirrelfish	93	\$180	\$1.94 *
Parrotfishes	531	\$1,001	\$1.89 *
Terapon perch	3	\$6	\$2.00
Goatfish	11	\$33	\$2.95
Inshore groupers	143	\$259	\$1.82
Porcupinefish	19	\$38	\$2.00
Mahimahi	870	\$1,599	\$1.84 *
Swordfish	208	\$468	\$2.25 *
Blue marlin	247	\$371	\$1.50 *
Sailfish	271	\$247	\$0.91
Wahoo	23,664	\$24,922	\$1.05
Skipjack Tuna	15,206	\$9,160	\$0.60
Albacore	266,419	\$255,811	\$0.96
Yellowfin Tuna	91,576	\$81,073	\$0.89
Bigeye Tuna	37,323	\$41,102	\$1.10
Moonfish	8	\$8	\$1.00
Crabs	32	\$57	\$1.78
Spiny lobster	118	\$364	\$3.08
Octopus	103	\$206	\$2.00 *
Salmon	2	\$5	\$2.00
TOTAL	439,034	\$421,658	\$0.96

* Data replaced or modified by Actual Commercial Landings Data

**Table A-5
American Samoa April 2003 Estimated Commercial Landings**

Species	Pounds	Value	Price/Lb	
Jacks (misc)	35	\$88	\$2.50	
Tomato grouper	4	\$8	\$2.00	
Lunartail grouper	25	\$63	\$2.50	
Gray jobfish	25	\$63	\$2.50	
Lehi (silverjaw)	40	\$100	\$2.50	
Onaga (longtail snapper)	77	\$193	\$2.50	*
Ehu (squirrelfish snap.)	70	\$210	\$3.00	
Emperors (misc)	25	\$63	\$2.50	
Surgeonfishes/tangs	775	\$1,550	\$2.00	*
Unicornfishes (misc)	378	\$737	\$1.95	*
Squirrelfish	152	\$298	\$1.97	*
Parrotfishes	715	\$1,365	\$1.91	*
Terapon perch	4	\$8	\$2.00	
Goatfish	9	\$28	\$2.95	
Inshore groupers	34	\$60	\$1.75	*
Porcupinefish	23	\$45	\$2.00	
Mahimahi	1,075	\$2,026	\$1.88	*
Swordfish	788	\$1,845	\$2.34	*
Blue marlin	133	\$141	\$1.06	
Black marlin	2,063	\$2,063	\$1.00	
Wahoo	18,380	\$16,817	\$0.91	
Skipjack Tuna	23,953	\$14,359	\$0.60	
Dogtooth tuna	20	\$50	\$2.50	
Albacore	457,285	\$432,334	\$0.95	
Yellowfin Tuna	166,193	\$146,368	\$0.88	
BigeyeTuna	60,459	\$66,745	\$1.10	
Moonfish	15	\$15	\$1.00	
Crabs	22	\$43	\$2.00	
Spiny lobster	141	\$433	\$3.08	
Salmon	3	\$6	\$2.00	
TOTAL	732,917	\$688,118	\$0.94	

* Data replaced or modified by Actual Commercial Landings Data

Table A-6
American Samoa May 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Barracudas	5	\$13	\$2.47
Other Sharks	437	\$219	\$0.50
Surgeonfishes/tangs	977	\$1,896	\$1.94 *
Unicornfishes (misc)	214	\$426	\$1.99 *
Squirrelfish	146	\$288	\$1.98 *
Parrotfishes	423	\$836	\$1.98 *
Inshore groupers	16	\$24	\$1.50 *
Mahimahi	1,232	\$2,290	\$1.86
Swordfish	559	\$1,259	\$2.25 *
Wahoo	14,839	\$13,777	\$0.93
Skipjack Tuna	28,567	\$16,940	\$0.59
Albacore	1,081,203	\$1,022,578	\$0.95
Yellowfin Tuna	189,466	\$165,166	\$0.87
Bigeye Tuna	116,761	\$128,408	\$1.10
Moonfish	4	\$4	\$1.00
TOTAL	1,434,848	\$1,354,123	\$0.94

* Data replaced or modified by Actual Commercial Landings Data

Table A-7
American Samoa June 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Barracudas	70	\$130	\$1.85
Blue lined snapper	92	\$161	\$1.75 *
Humpback snapper	140	\$245	\$1.75 *
Gray jobfish	120	\$210	\$1.75 *
Hawaiian opakapaka	140	\$252	\$1.80 *
Gindai (flower snap)	22	\$44	\$2.00 *
Ehu (squirrelfish snap.)	27	\$54	\$2.00 *
Surgeonfishes/tangs	467	\$934	\$2.00 *
Unicornfishes (misc)	118	\$236	\$2.00 *
Squirrelfish	82	\$164	\$2.00 *
Parrotfishes	288	\$576	\$2.00 *
Mahimahi	767	\$1,455	\$1.90 *
Swordfish	636	\$1,515	\$2.38 *
Rainbow runner	1	\$2	\$2.00
Wahoo	24,684	\$23,406	\$0.95
Skipjack Tuna	27,867	\$16,364	\$0.59
Albacore	914,741	\$864,971	\$0.95
Yellowfin Tuna	144,511	\$131,916	\$0.91
Bigeye Tuna	80,795	\$89,685	\$1.11
Moonfish	4	\$4	\$1.00
Spiny lobster	45	\$158	\$3.50 *
TOTAL	1,195,617	\$1,132,481	\$0.95

* Data replaced or modified by Actual Commercial Landings Data

Table A-8

American Samoa July 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb	
Jacks (misc)	40	\$100	\$2.50	
Black Jack	51	\$126	\$2.50	
Barracudas	357	\$892	\$2.50	
Flagtail grouper	13	\$31	\$2.50	
Tomato grouper	1	\$2	\$2.00	
Striped grouper	10	\$24	\$2.50	
Smalltooth grouper	11	\$28	\$2.50	
Blue lined snapper	87	\$194	\$2.22	
Rufous snapper	15	\$37	\$2.50	
Humpback snapper	95	\$166	\$1.75	*
Gray jobfish	84	\$147	\$1.75	*
Hawaiian opakapaka	44	\$77	\$1.75	*
Gindai (flower snap)	4	\$7	\$1.75	
Yellowtail snapper	19	\$48	\$2.50	
Lehi (silverjaw)	108	\$271	\$2.50	
Onaga (longtail snapper)	25	\$65	\$2.58	
Ehu (squirrelfish snap.)	160	\$361	\$2.26	
Emperors (misc)	28	\$49	\$1.75	
Redgill emperor	16	\$39	\$2.50	
Oilfish	5	\$5	\$1.00	
Surgeonfishes/tangs	526	\$1,052	\$2.00	*
Unicornfishes (misc)	194	\$384	\$1.98	*
Squirrelfish	100	\$196	\$1.97	*
Parrotfishes	432	\$827	\$1.91	*
Terapon perch	1	\$2	\$2.00	
Goatfish	3	\$9	\$2.95	
Inshore groupers	34	\$60	\$1.75	*
Porcupinefish	7	\$14	\$2.00	
Mahimahi	1,179	\$1,727	\$1.46	
Swordfish	1,104	\$2,678	\$2.43	*
Blue marlin	288	\$353	\$1.23	
Black marlin	118	\$118	\$1.00	
Sailfish	374	\$374	\$1.00	*
Wahoo	36,438	\$36,577	\$1.00	
Skipjack Tuna	32,497	\$19,044	\$0.59	
Dogtooth tuna	70	\$175	\$2.50	
Albacore	653,395	\$620,212	\$0.95	
Yellowfin Tuna	63,800	\$58,845	\$0.92	
Bigeye Tuna	37,466	\$41,935	\$1.12	
Moonfish	408	\$408	\$1.00	
Crabs	7	\$14	\$2.00	
Spiny lobster	138	\$581	\$4.22	*
Salmon	1	\$2	\$2.00	
TOTAL	829,752	\$788,256	\$0.95	

* Data replaced or modified by Actual Commercial Landings Data

Table A-9
American Samoa August 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Jacks (misc)	47	\$98	\$2.11
Barracudas	59	\$104	\$1.75
Tomato grouper	27	\$67	\$2.48
Blacktip grouper	7	\$18	\$2.50
Smalltooth grouper	10	\$25	\$2.50
Lunartail grouper	36	\$80	\$2.22
Blue lined snapper	201	\$352	\$1.75 *
Humpback snapper	1,057	\$1,850	\$1.75
Gray jobfish	45	\$113	\$2.50
Hawaiian opakapaka	120	\$210	\$1.75 *
Emperors (misc)	52	\$107	\$2.08
Redgill emperor	32	\$63	\$2.00
Surgeonfishes/tangs	359	\$718	\$2.00 *
Unicornfishes (misc)	114	\$228	\$2.00 *
Squirrelfish	59	\$118	\$2.00 *
Parrotfishes	243	\$494	\$2.03 *
Terapon perch	1	\$2	\$1.99
Goatfish	3	\$9	\$2.95
Inshore groupers	7	\$11	\$1.73
Porcupinefish	7	\$15	\$2.00
Mahimahi	2,378	\$4,401	\$1.85
Swordfish	541	\$1,191	\$2.20
Blue marlin	97	\$170	\$1.75 *
Rainbow runner	19	\$38	\$2.00
Wahoo	21,701	\$20,834	\$0.96
Skipjack Tuna	19,200	\$11,637	\$0.61
Dogtooth tuna	73	\$73	\$1.00 *
Albacore	787,442	\$745,824	\$0.95
Yellowfin Tuna	41,597	\$36,758	\$0.88
Bigeye Tuna	20,107	\$22,359	\$1.11
Moonfish	469	\$469	\$1.00
Crabs	7	\$14	\$2.00
Spiny lobster	177	\$739	\$4.18 *
Octopus	175	\$350	\$2.00 *
Salmon	1	\$2	\$1.99
TOTAL	896,470	\$849,542	\$0.95

* Data replaced or modified by Actual Commercial Landings Data

Table A-10
American Samoa September 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Jacks (misc)	42	\$98	\$2.32
Barracudas	49	\$119	\$2.42
Tomato grouper	9	\$21	\$2.41
Blacktip grouper	12	\$30	\$2.50
Lunartail grouper	7	\$12	\$1.86
Blue lined snapper	108	\$189	\$1.75 *
Onespot snapper	20	\$50	\$2.50
Humpback snapper	433	\$758	\$1.75
Gray jobfish	25	\$63	\$2.50
Hawaiian opakapaka	16	\$28	\$1.75 *
Gindai (flower snap)	25	\$44	\$1.75 *
Ehu (squirrelfish snap.)	50	\$88	\$1.75 *
Emperors (misc)	24	\$50	\$2.13
Redgill emperor	13	\$26	\$2.00
Oilfish	13	\$13	\$1.00
Surgeonfishes/tangs	555	\$1,110	\$2.00 *
Unicornfishes (misc)	205	\$410	\$2.00 *
Squirrelfish	84	\$165	\$1.96 *
Parrotfishes	394	\$791	\$2.01 *
Terapon perch	2	\$3	\$2.00
Goatfish	4	\$11	\$2.95
Inshore groupers	28	\$64	\$2.28
Porcupinefish	9	\$18	\$2.00
Red snapper, mu	20	\$40	\$2.00 *
Mahimahi	2,541	\$4,187	\$1.65
Swordfish	669	\$1,356	\$2.03 *
Blue marlin	591	\$591	\$1.00 *
Sailfish	9	\$8	\$0.91
Rainbow runner	8	\$16	\$2.00
Wahoo	34,948	\$33,520	\$0.96
Skipjack Tuna	16,985	\$10,330	\$0.61
Albacore	1,068,726	\$1,012,263	\$0.95
Yellowfin Tuna	119,547	\$104,521	\$0.87
BigeyeTuna	57,551	\$63,678	\$1.11
Moonfish	219	\$219	\$1.00
Crabs	9	\$17	\$2.00
Spiny lobster	311	\$1,191	\$3.83 *
Salmon	1	\$2	\$2.00
TOTAL	1,304,258	\$1,236,097	\$0.95

* Data replaced or modified by Actual Commercial Landings Data

Table A-11
American Samoa October 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb	
Jacks (misc)	196	\$392	\$2.00	
Black Jack	45	\$89	\$2.00	
Barracudas	328	\$788	\$2.40	
Spotted eels	71	\$141	\$2.00	
Tomato grouper	18	\$36	\$2.00	
Lunartail grouper	158	\$316	\$2.00	
Blue lined snapper	430	\$752	\$1.75	
Humpback snapper	455	\$744	\$1.63	
Gray jobfish	80	\$140	\$1.75	
Hawaiian opakapaka	38	\$67	\$1.75	*
Gindai (flower snap)	8	\$14	\$1.75	*
Yellowtail snapper	13	\$33	\$2.50	
Lehi (silverjaw)	9	\$23	\$2.50	
Onaga (longtail snapper)	52	\$134	\$2.58	
Ehu (squirrelfish snap.)	7	\$16	\$2.26	
Emperors (misc)	1,040	\$1,820	\$1.75	
Longnose emperor	48	\$96	\$2.00	
Orangespot emperor	43	\$86	\$2.00	
Oilfish	81	\$81	\$1.00	
Surgeonfishes/tangs	806	\$1,516	\$1.88	*
Unicornfishes (misc)	158	\$316	\$2.00	*
Squirrelfish	86	\$172	\$2.00	*
Parrotfishes	307	\$614	\$2.00	*
Inshore groupers	131	\$218	\$1.66	*
Mahimahi	2,144	\$3,861	\$1.80	
Swordfish	1,100	\$2,550	\$2.32	*
Blue marlin	170	\$153	\$0.90	*
Black marlin	1,772	\$1,771	\$1.00	
Sailfish	496	\$447	\$0.90	
Rainbow runner	5	\$11	\$2.00	
Wahoo	51,145	\$47,682	\$0.93	
Skipjack Tuna	16,284	\$9,934	\$0.61	
Dogtooth tuna	510	\$687	\$1.35	
Albacore	984,081	\$934,311	\$0.95	
Yellowfin Tuna	69,498	\$62,182	\$0.89	
Bigeye Tuna	41,622	\$46,038	\$1.11	
Moonfish	911	\$911	\$1.00	
Spiny lobster	23	\$92	\$4.00	*
Octopus	79	\$158	\$2.00	*
TOTAL	1,174,448	\$1,119,388	\$0.95	

* Data replaced or modified by Actual Commercial Landings Data

Table A-12
American Samoa November 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb
Jacks (misc)	55	\$109	\$1.98
Black Jack	11	\$23	\$2.00
Barracudas	31	\$68	\$2.19
Spotted eels	18	\$36	\$2.00
Tomato grouper	5	\$10	\$2.00
Lunartail grouper	46	\$90	\$1.97
Blue lined snapper	144	\$251	\$1.75
Humpback snapper	144	\$239	\$1.66
Gray jobfish	24	\$41	\$1.75
Hawaiian opakapaka	15	\$26	\$1.75 *
Yellowtail snapper	3	\$8	\$2.50
Lehi (silverjaw)	2	\$6	\$2.50
Onaga (longtail snapper)	100	\$278	\$2.78 *
Ehu (squirrelfish snap.)	14	\$25	\$1.75 *
Emperors (misc)	292	\$511	\$1.75
Longnose emperor	58	\$105	\$1.80
Orangespot emperor	11	\$22	\$2.00
Surgeonfishes/tangs	918	\$1,742	\$1.90 *
Unicornfishes (misc)	183	\$363	\$1.98 *
Squirrelfish	112	\$209	\$1.87 *
Parrotfishes	485	\$970	\$2.00 *
Terapon perch	1	\$1	\$1.98
Goatfish	2	\$4	\$2.95
Inshore groupers	196	\$311	\$1.58 *
Porcupinefish	4	\$7	\$2.00
Mahimahi	792	\$1,577	\$1.99
Swordfish	828	\$1,826	\$2.21 *
Blue marlin	738	\$781	\$1.06
Sailfish	262	\$239	\$0.91
Wahoo	38,987	\$36,935	\$0.95
Skipjack Tuna	11,748	\$7,036	\$0.60
Dogtooth tuna	130	\$174	\$1.35
Albacore	962,310	\$910,789	\$0.95
Yellowfin Tuna	58,828	\$50,011	\$0.85
BigeyeTuna	23,163	\$25,640	\$1.11
Moonfish	274	\$274	\$1.00
Crabs	4	\$7	\$2.00
Spiny lobster	23	\$70	\$3.08
Octopus	155	\$310	\$2.00 *
Salmon	1	\$1	\$1.98
TOTAL	1,101,116	\$1,041,127	\$0.95

* Data replaced or modified by Actual Commercial Landings Data

Table A-13
American Samoa December 2003 Estimated Commercial Landings

Species	Pounds	Value	Price/Lb	
Jacks (misc)	37	\$72	\$1.92	
Barracudas	40	\$71	\$1.80	
Tomato grouper	1	\$1	\$2.00	
Lunartail grouper	27	\$46	\$1.74	
Blue lined snapper	203	\$355	\$1.75	
Humpback snapper	100	\$174	\$1.75	
Gray jobfish	7	\$12	\$1.75	
Hawaiian opakapaka	340	\$595	\$1.75	*
Onaga (longtail snapper)	105	\$263	\$2.50	*
Emperors (misc)	58	\$101	\$1.75	
Longnose emperor	217	\$410	\$1.89	
Ambon emperor	49	\$74	\$1.50	
Surgeonfishes/tangs	544	\$1,066	\$1.96	*
Unicornfishes (misc)	169	\$330	\$1.95	*
Squirrelfish	72	\$144	\$2.00	*
Parrotfishes	337	\$652	\$1.93	*
Terapon perch	1	\$1	\$2.00	
Goatfish	2	\$4	\$2.94	
Inshore groupers	59	\$95	\$1.61	
Porcupinefish	4	\$7	\$2.00	
Mahimahi	1,439	\$2,214	\$1.54	*
Swordfish	1,105	\$2,426	\$2.20	*
Sailfish	2	\$2	\$0.91	
Wahoo	44,085	\$42,255	\$0.96	
Skipjack Tuna	16,152	\$9,758	\$0.60	
Dogtooth tuna	63	\$110	\$1.75	*
Albacore	778,184	\$735,993	\$0.95	
Yellowfin Tuna	65,122	\$56,427	\$0.87	
BigeyeTuna	17,997	\$19,889	\$1.11	
Moonfish	6	\$6	\$1.00	
Crabs	3	\$7	\$2.00	
Spiny lobster	22	\$67	\$3.08	
Salmon	0	\$1	\$2.02	
TOTAL	926,548	\$873,628	\$0.94	

* Data replaced or modified by Actual Commercial Landings Data

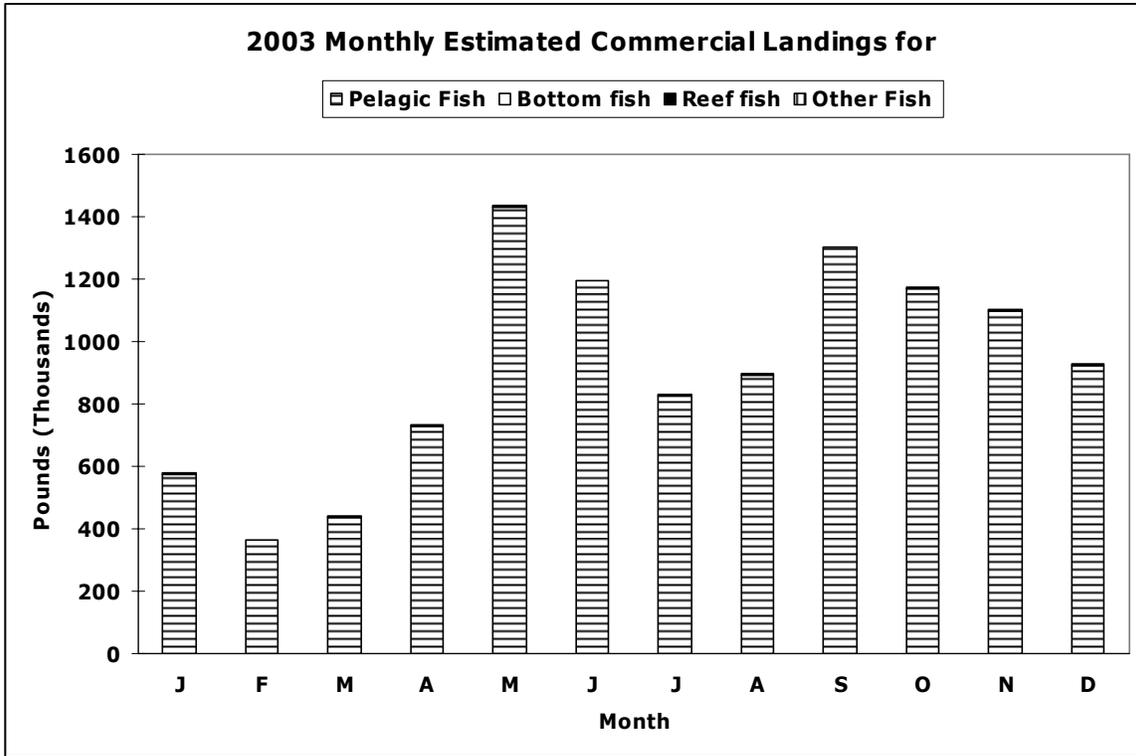


Figure A-1-1

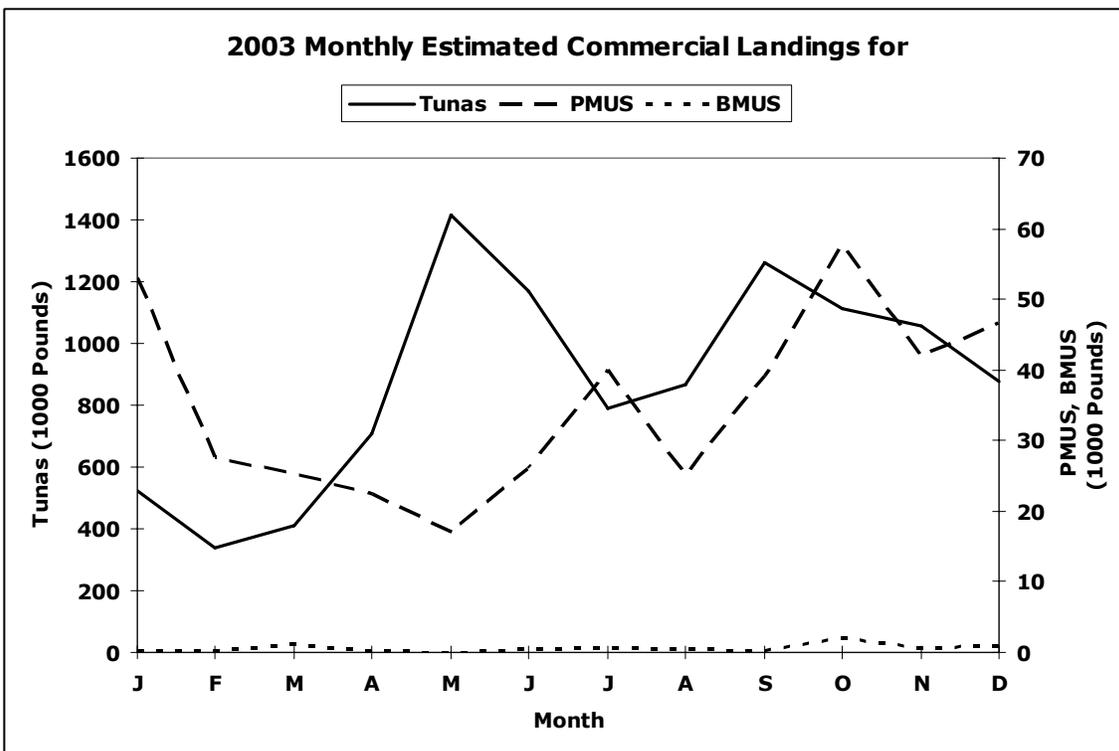


Figure A-1-2

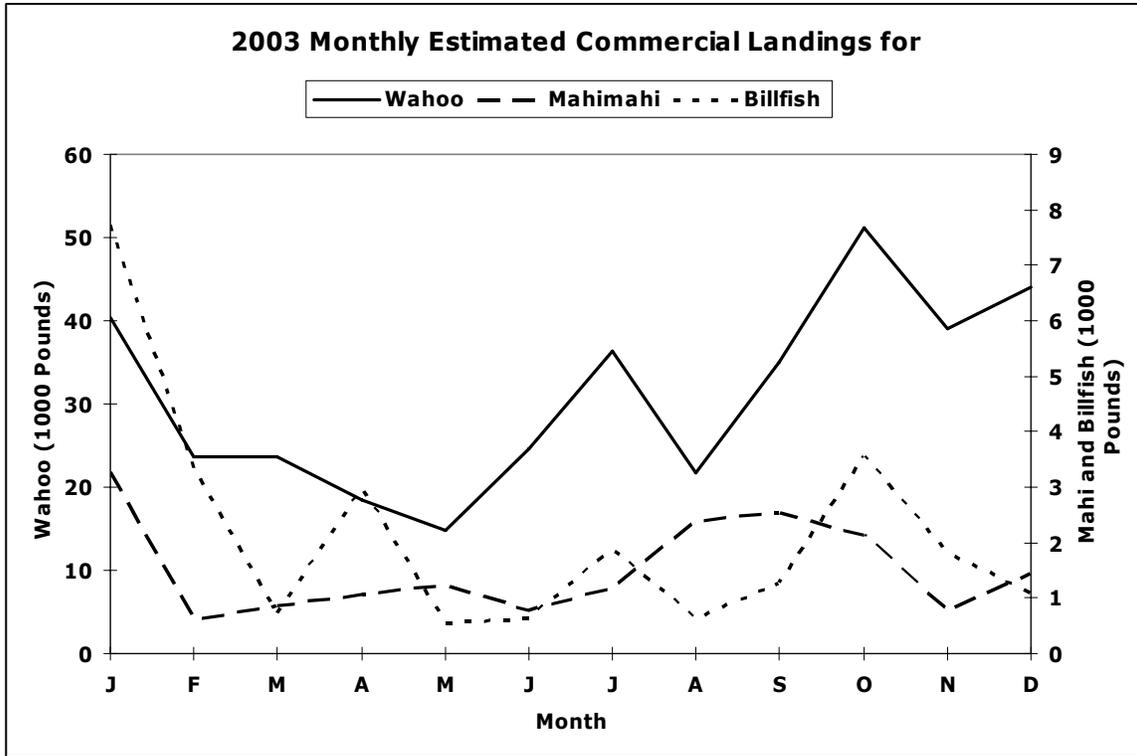


Figure A-1-3

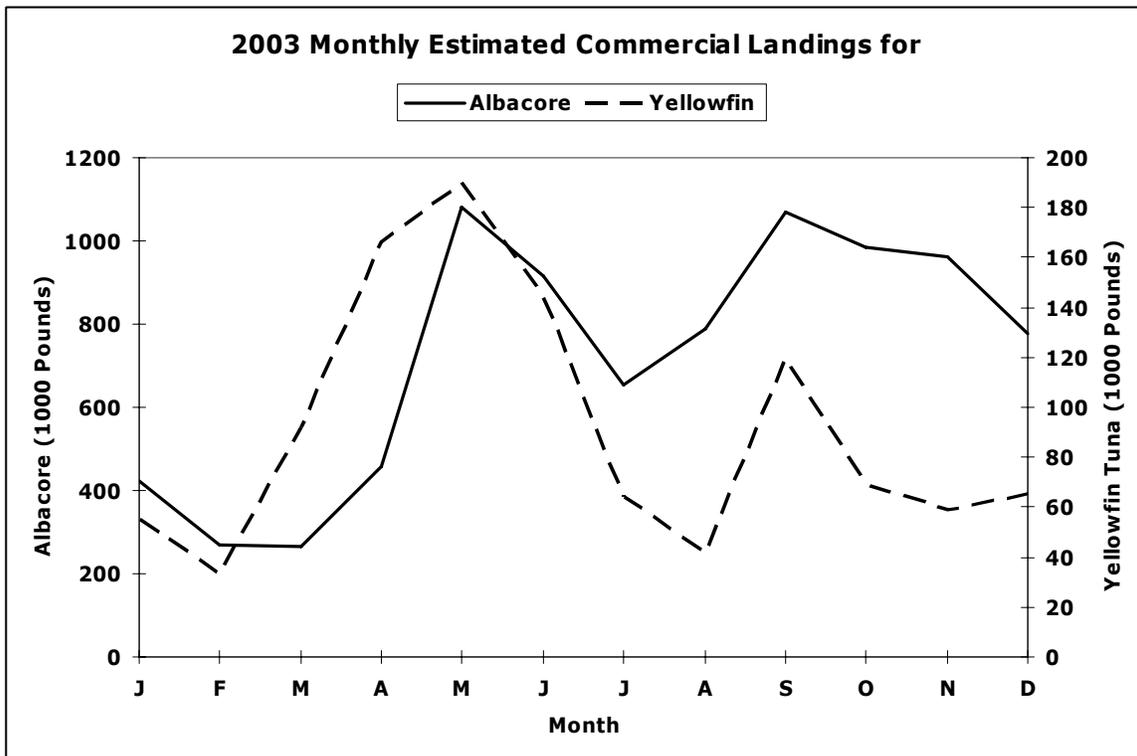


Figure A-1-4

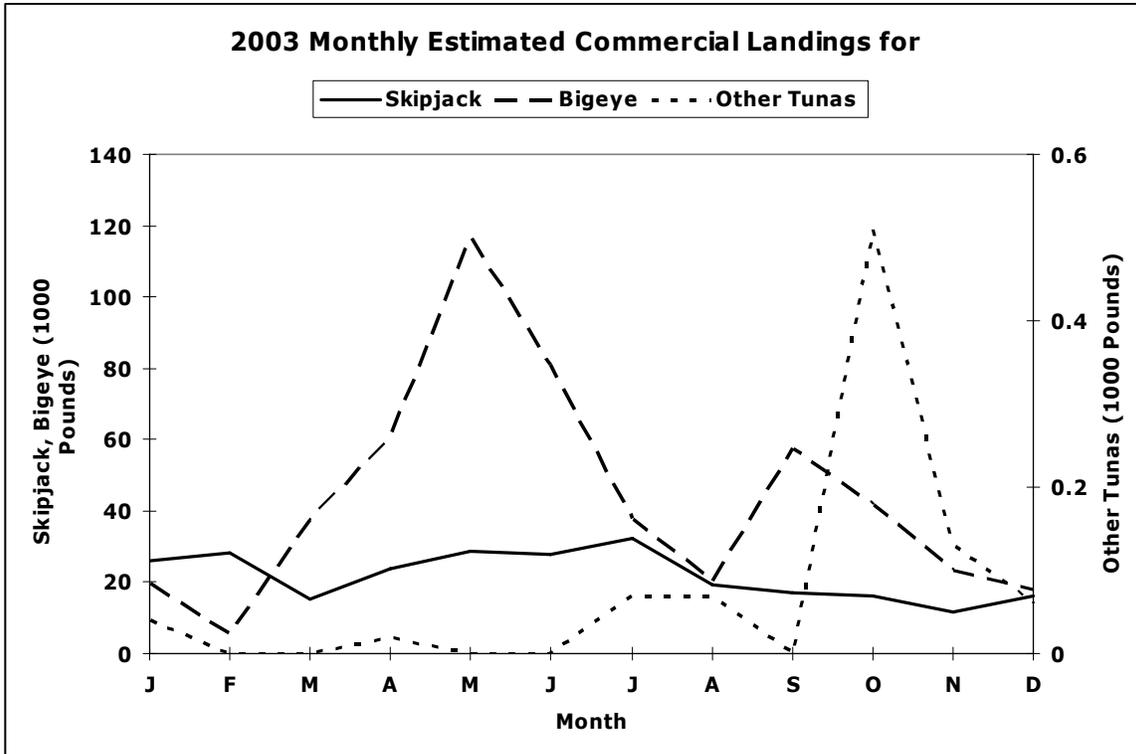


Figure A-1-5

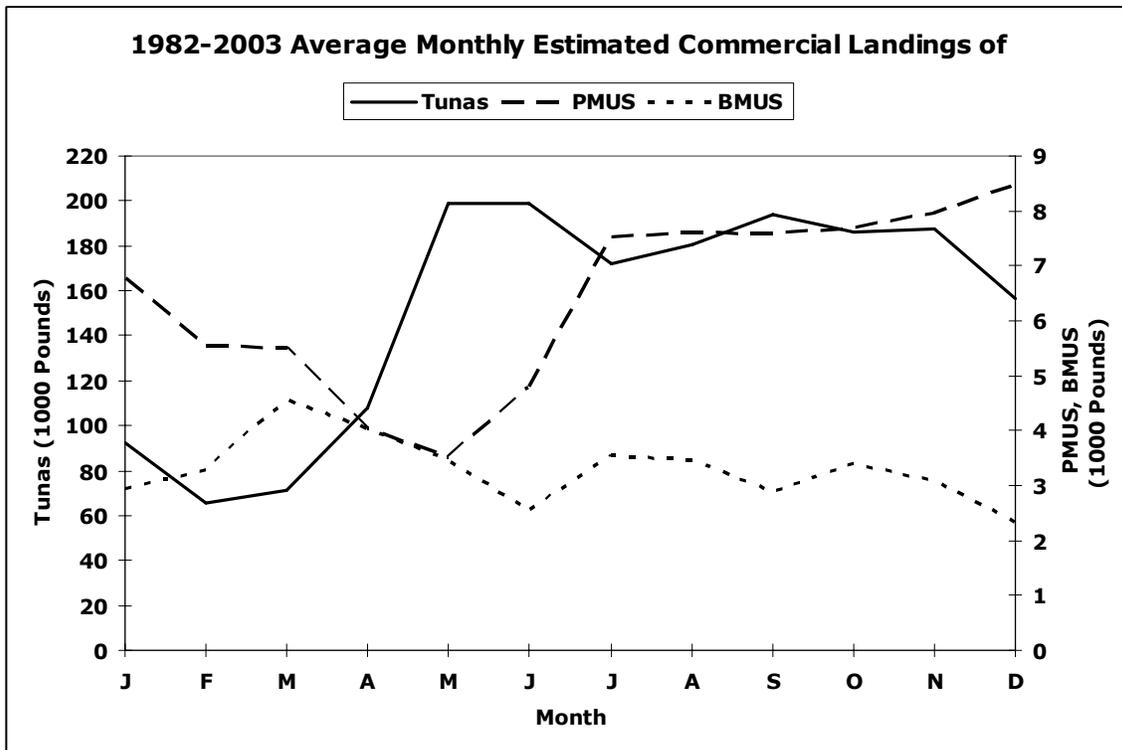


Figure A-2-1

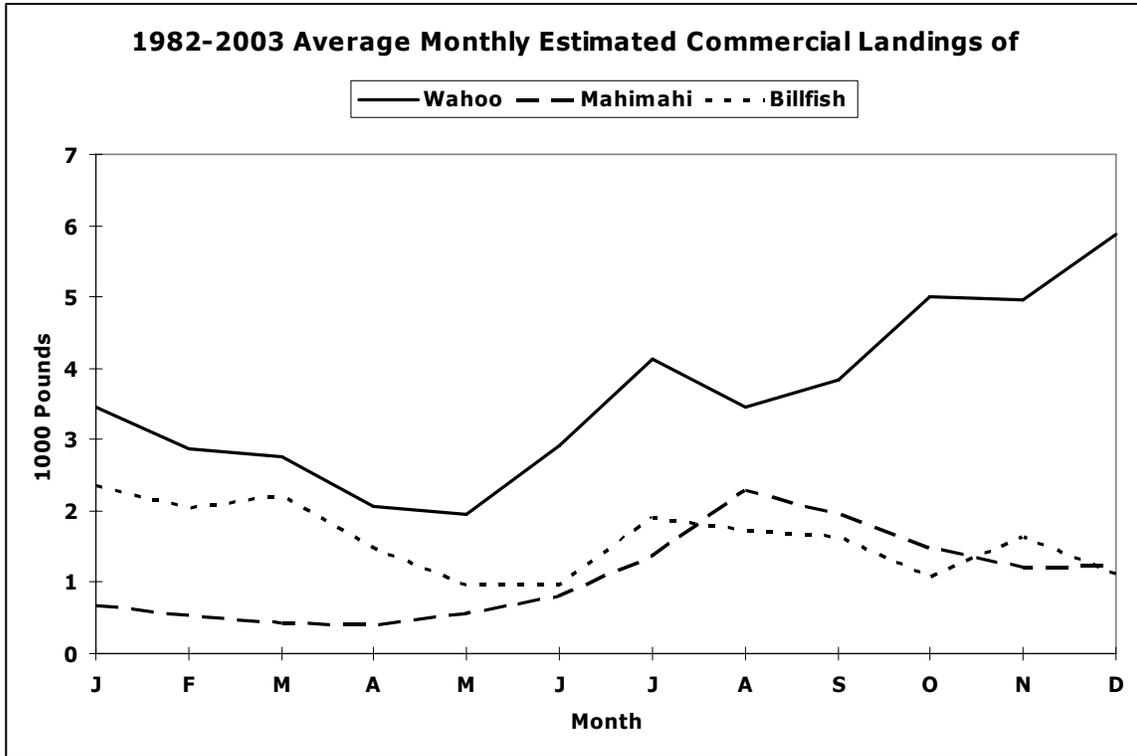


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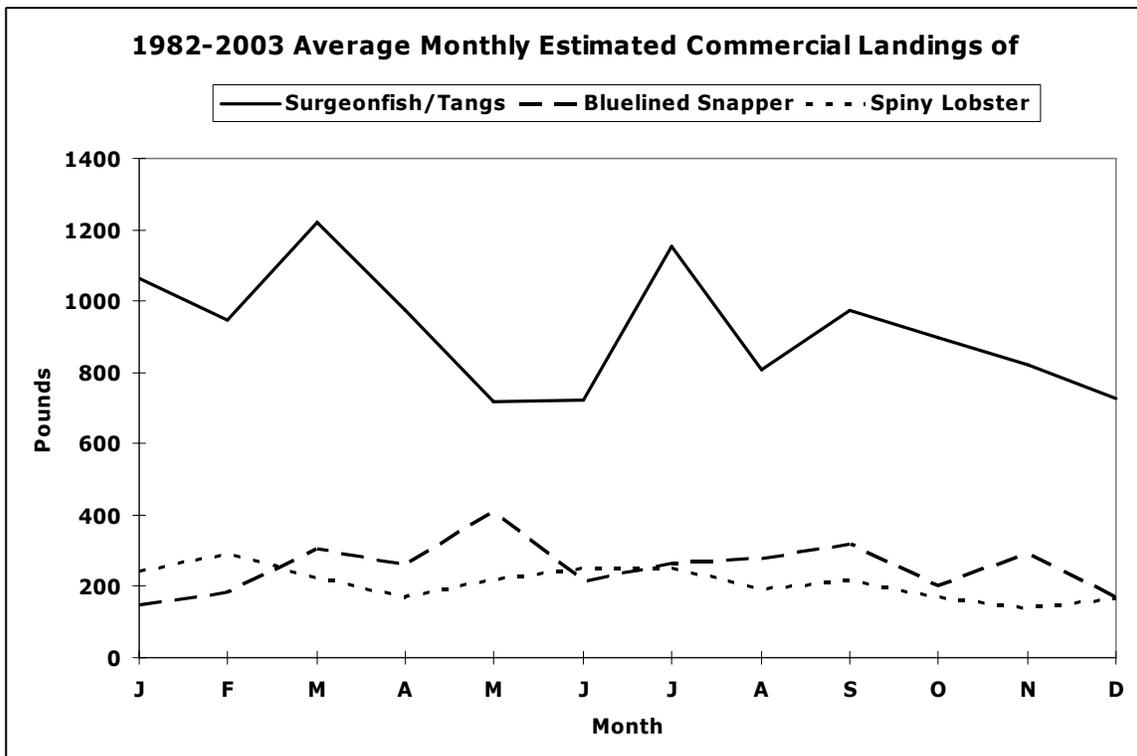


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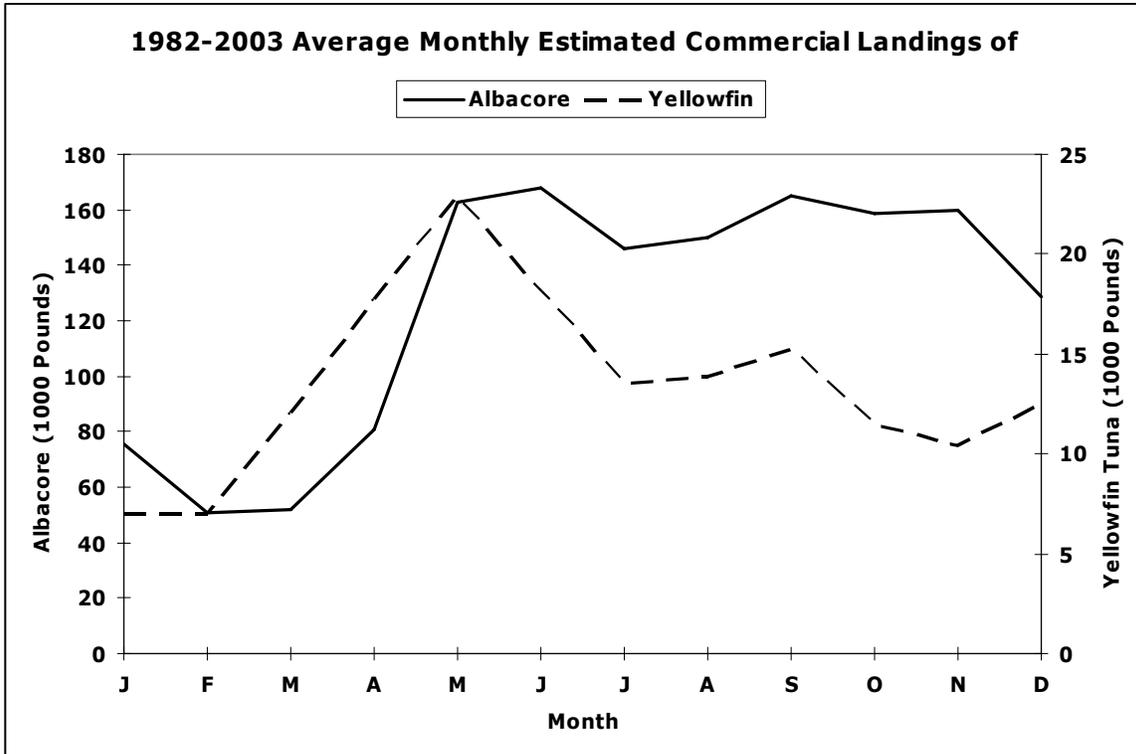


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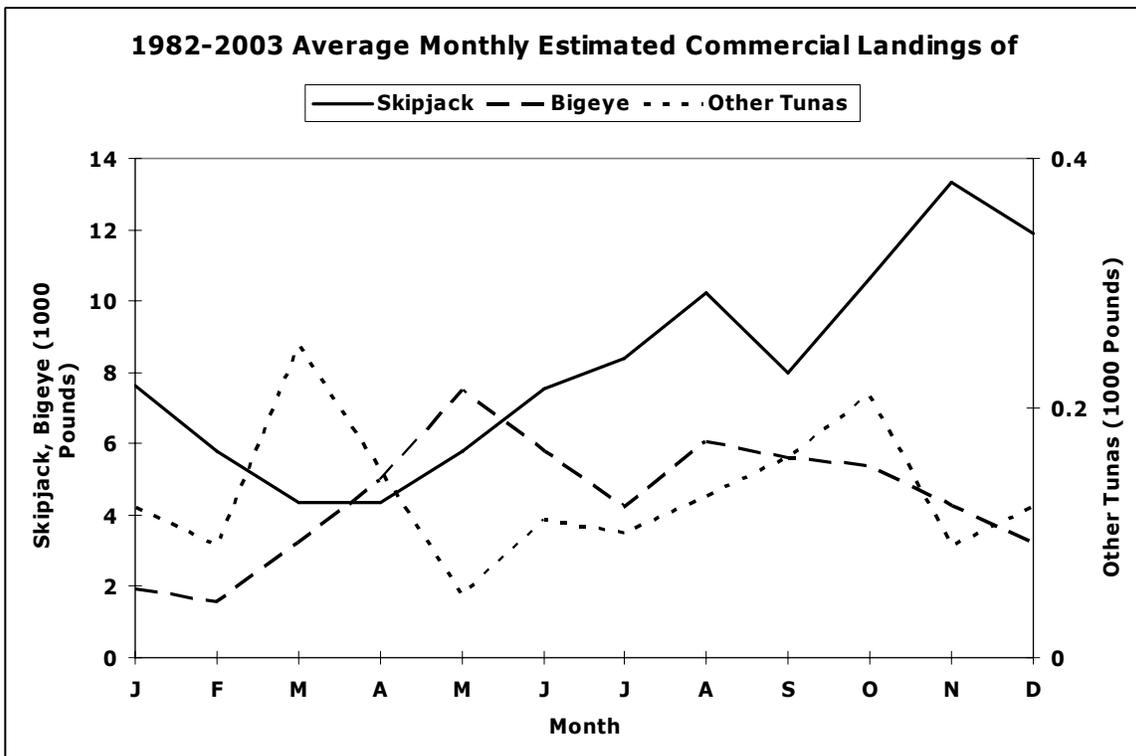


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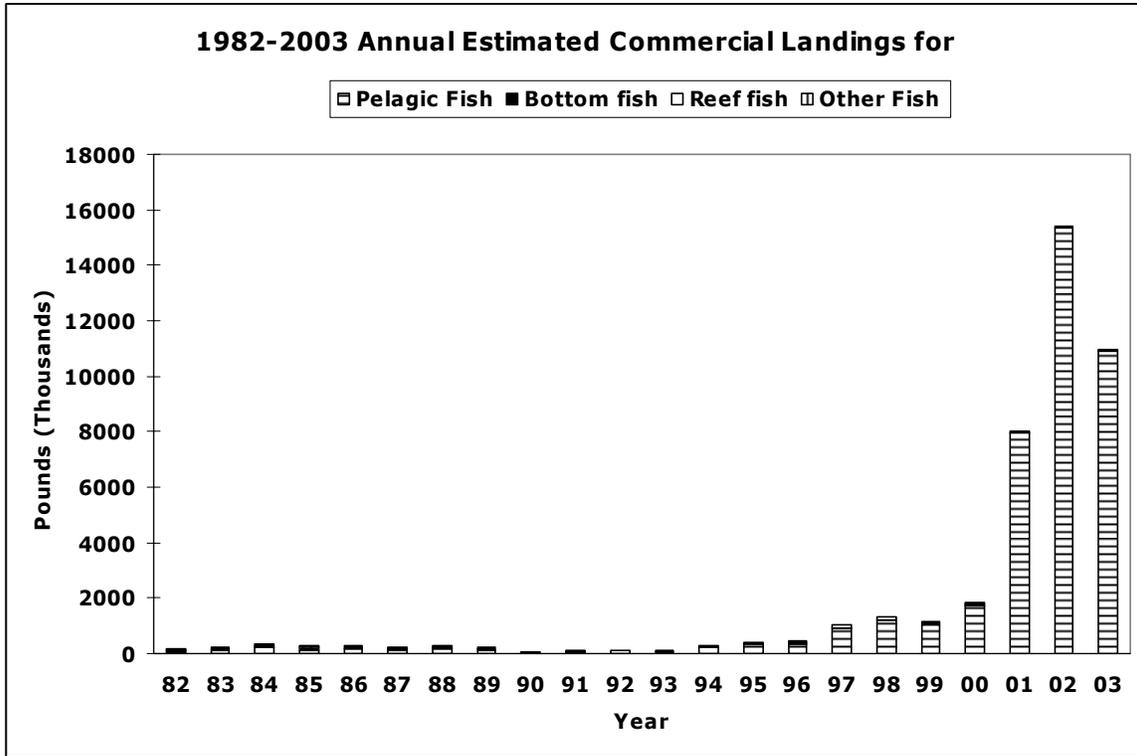


Figure A-3-1

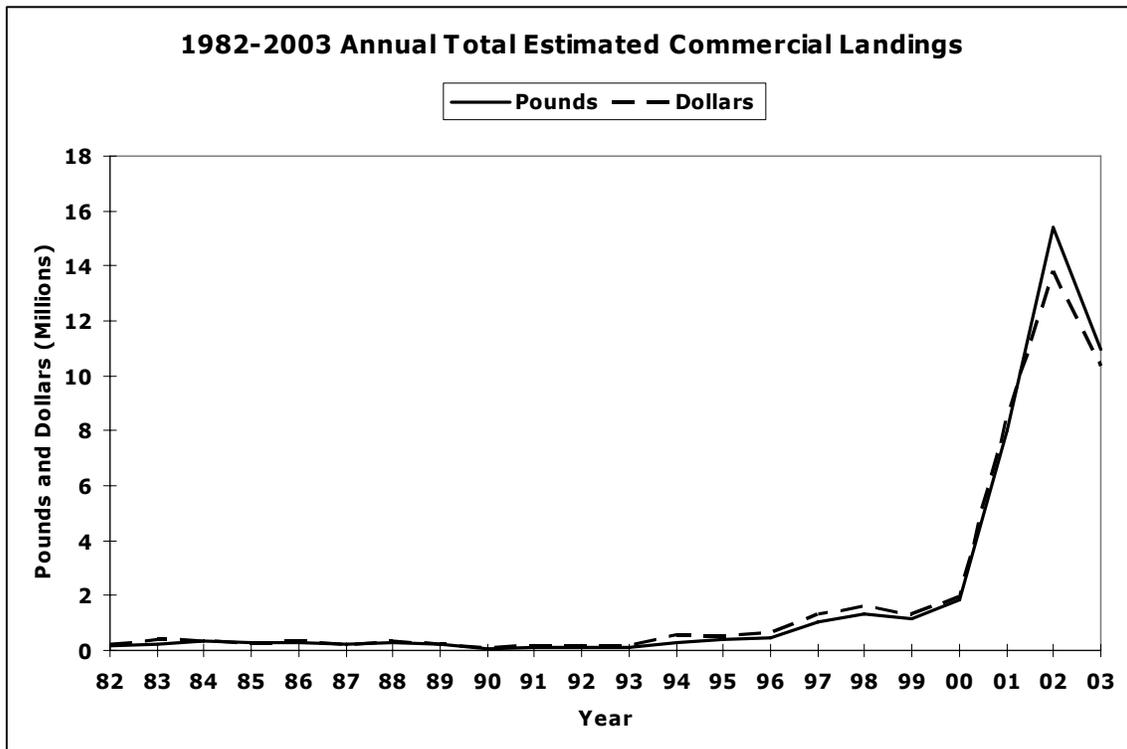


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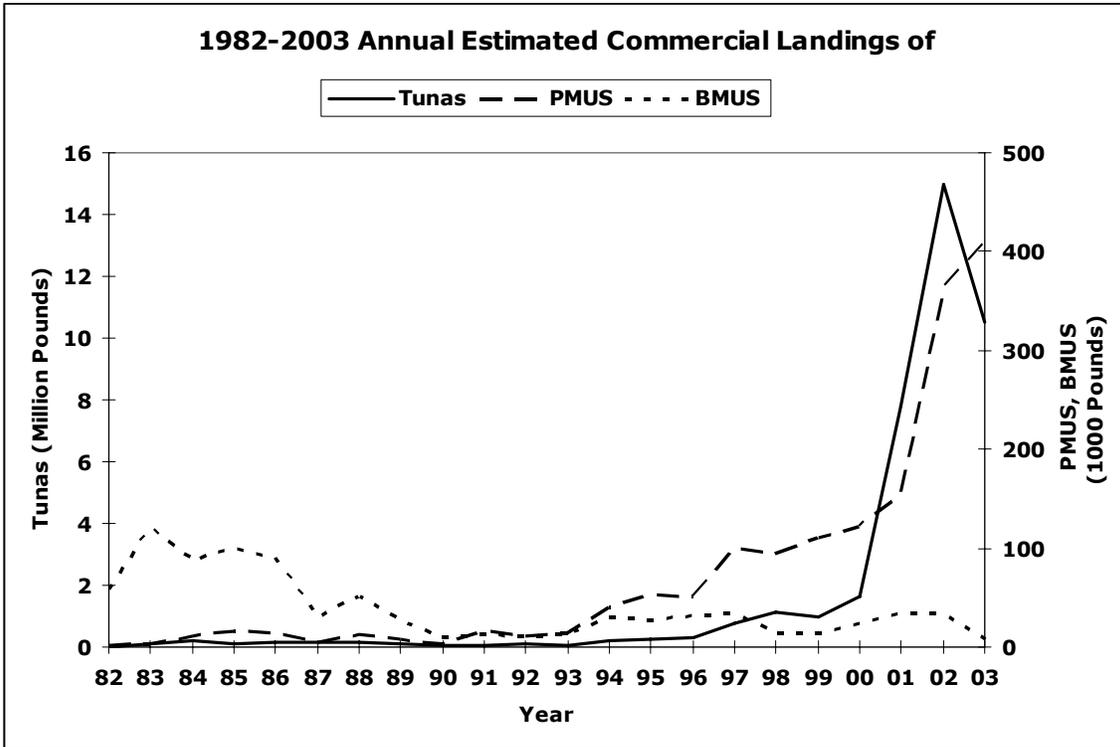


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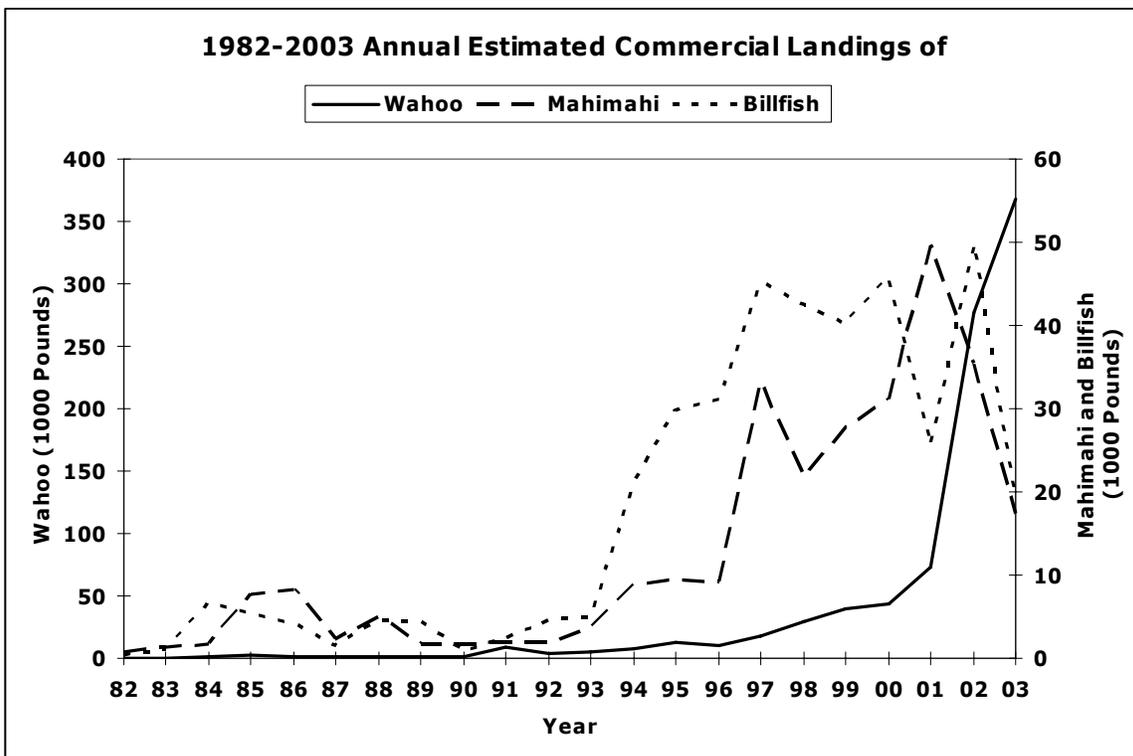


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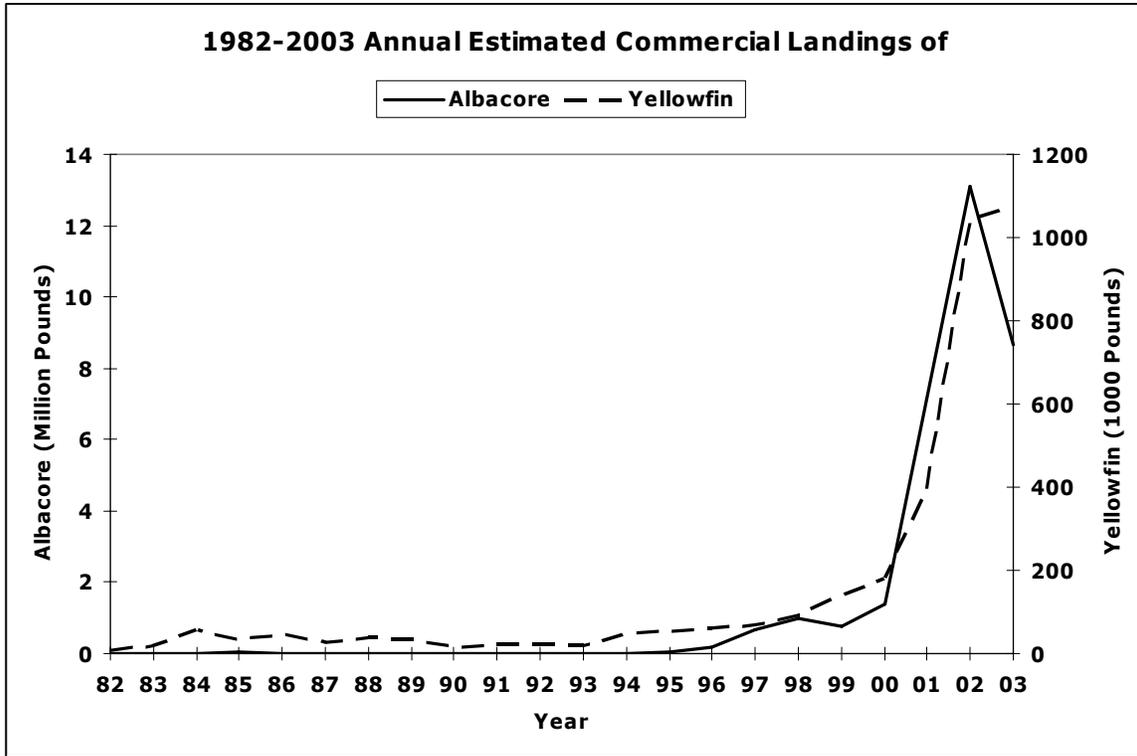


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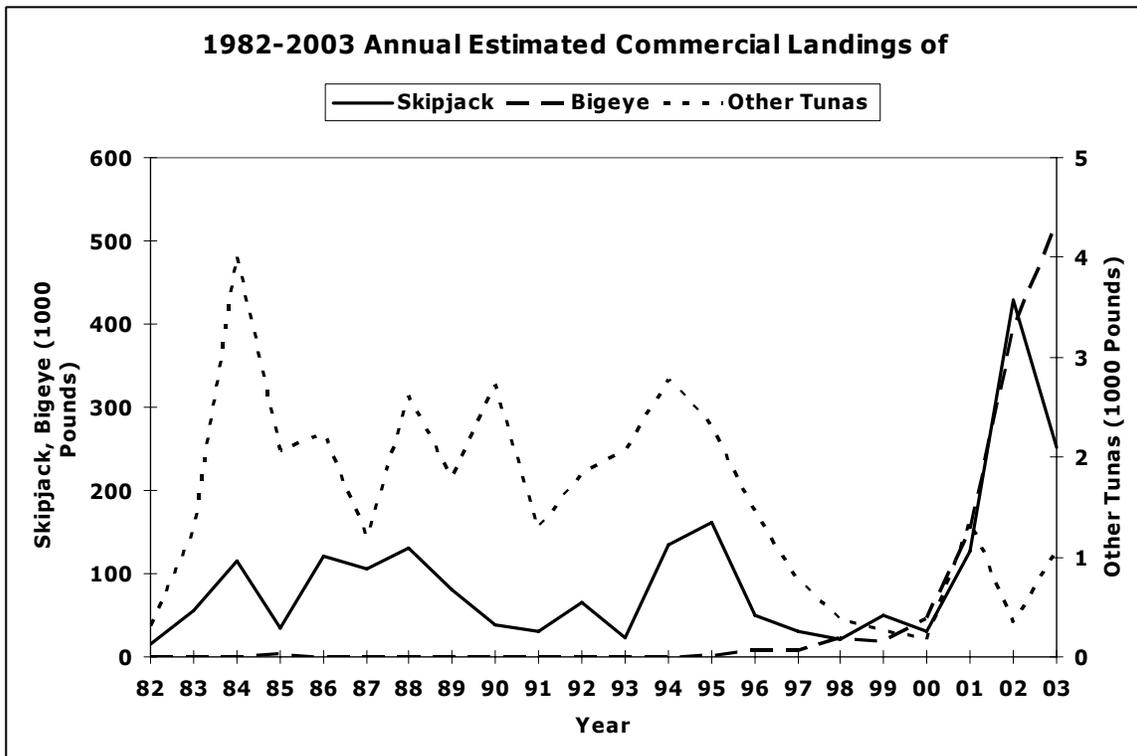


Figure A-3-6

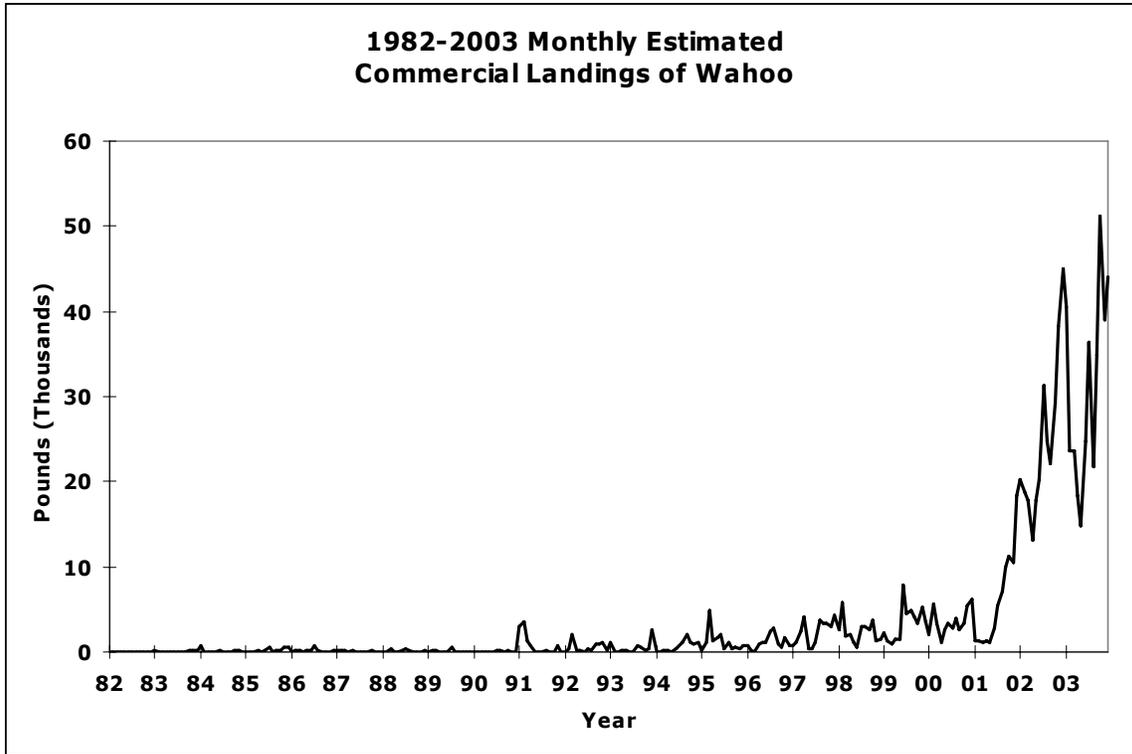


Figure A-4-1

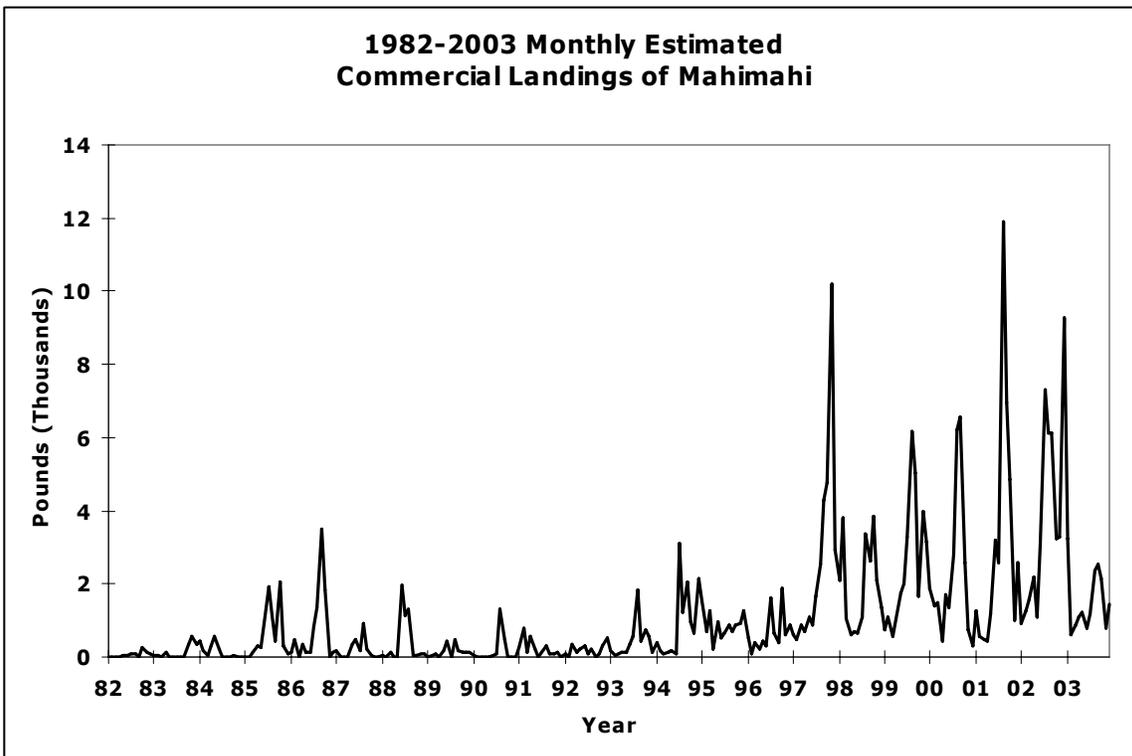


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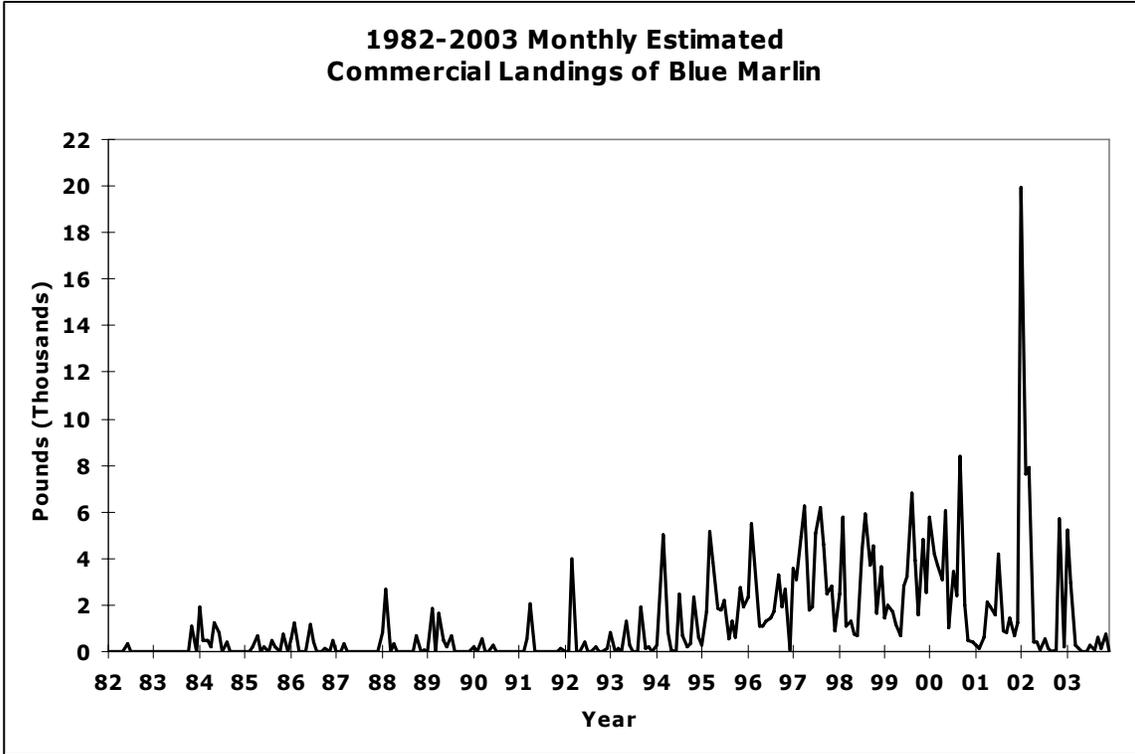


Figure A.4.3

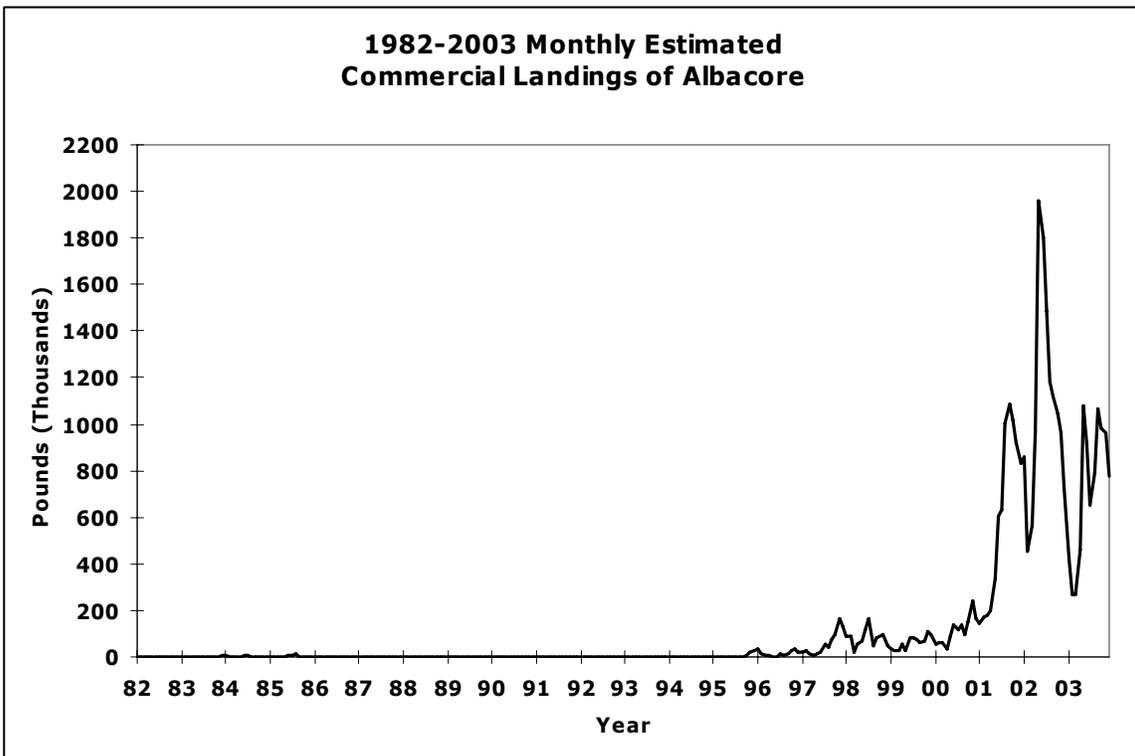


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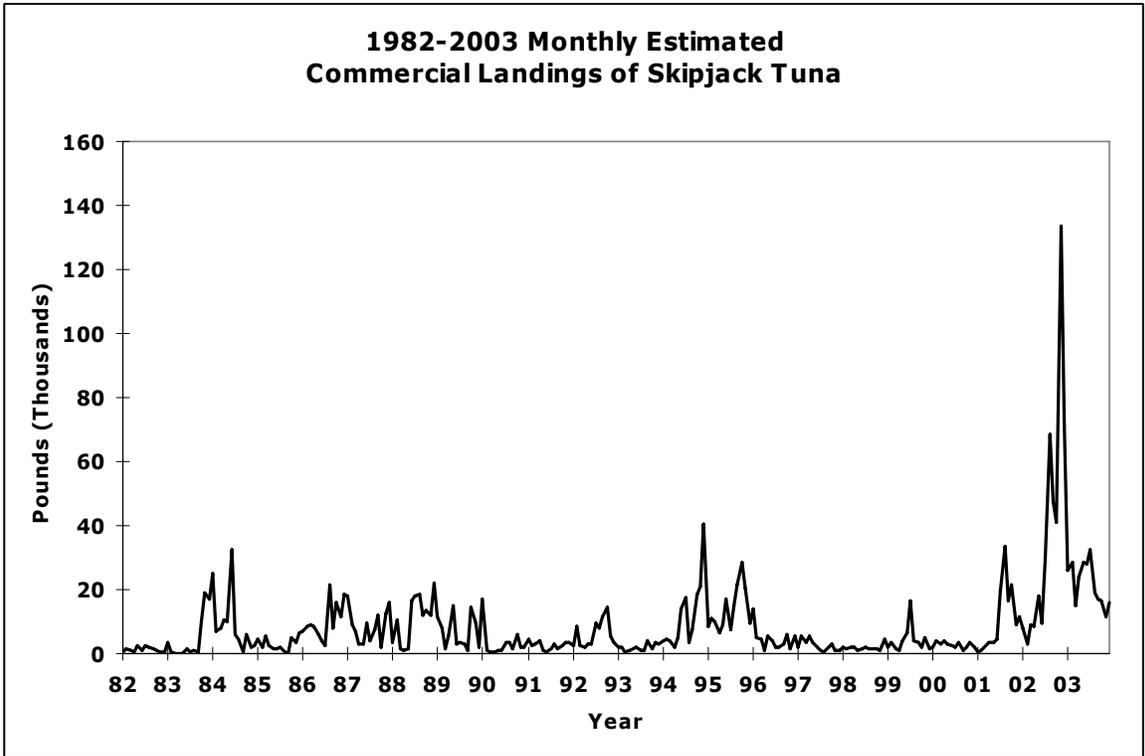


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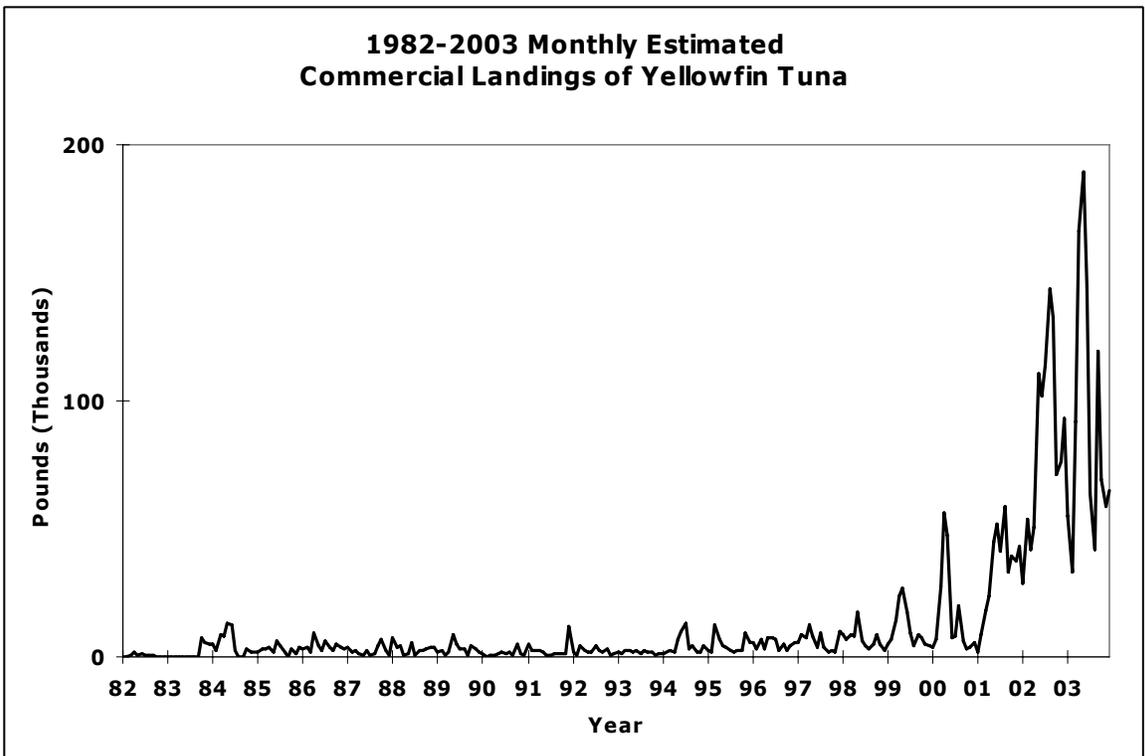


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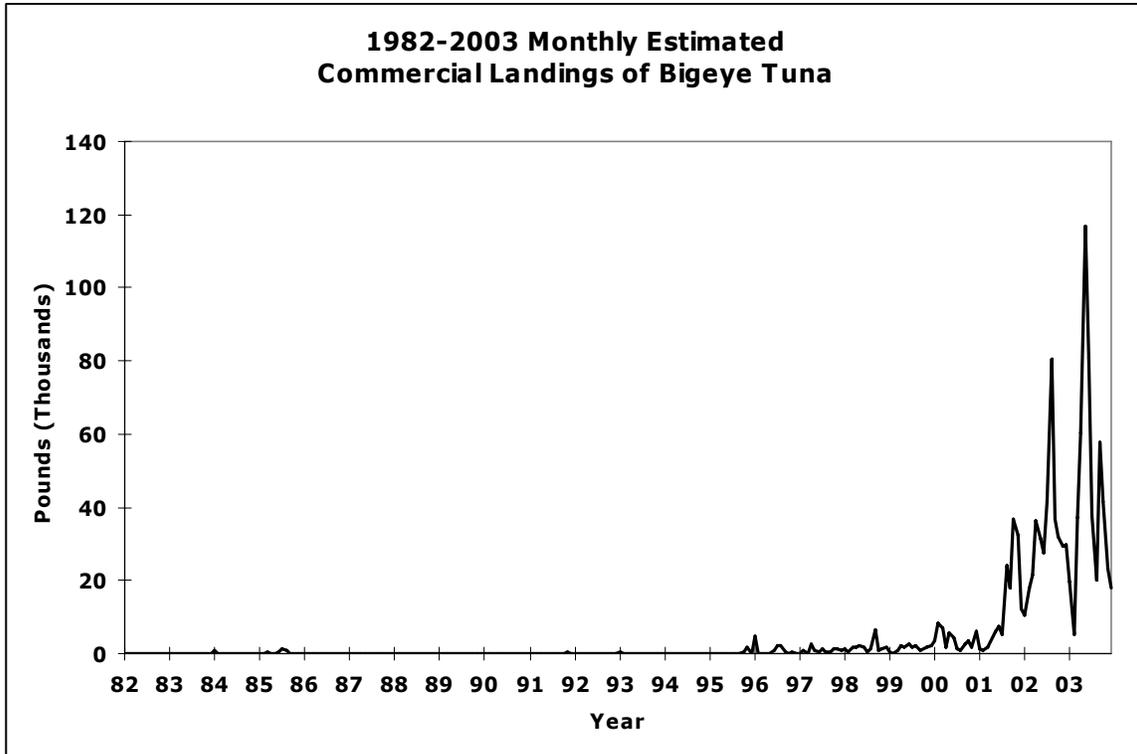


Figure A-4-7

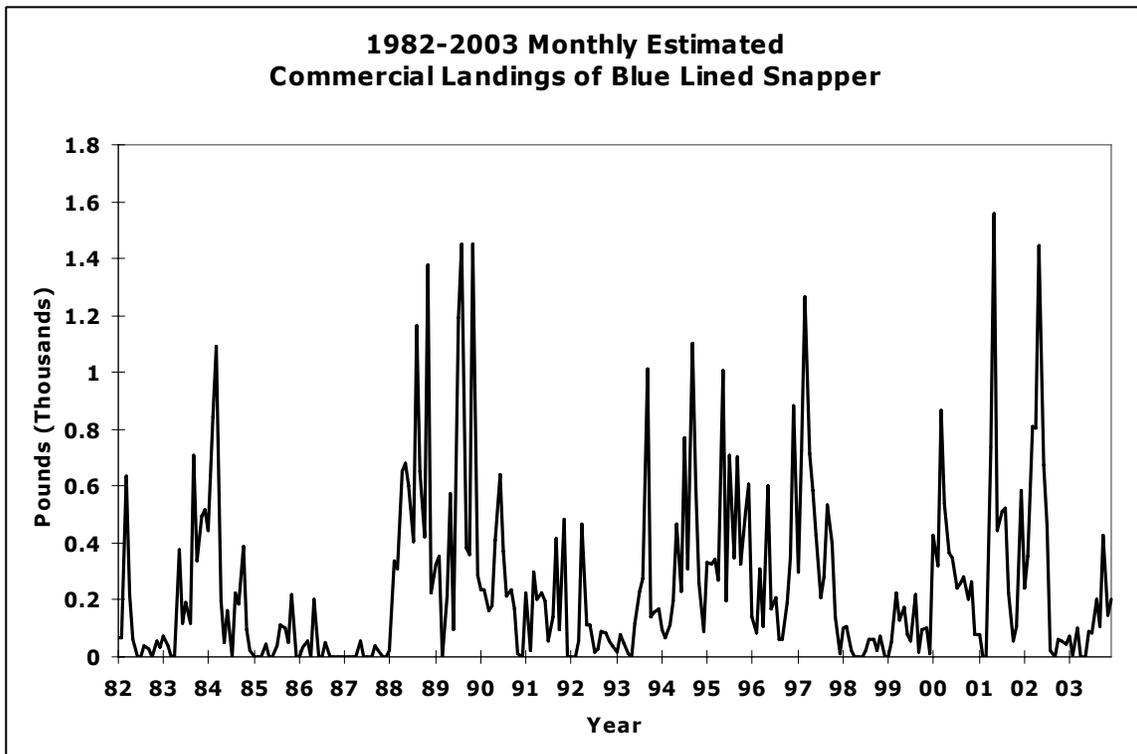


Figure A-4-8

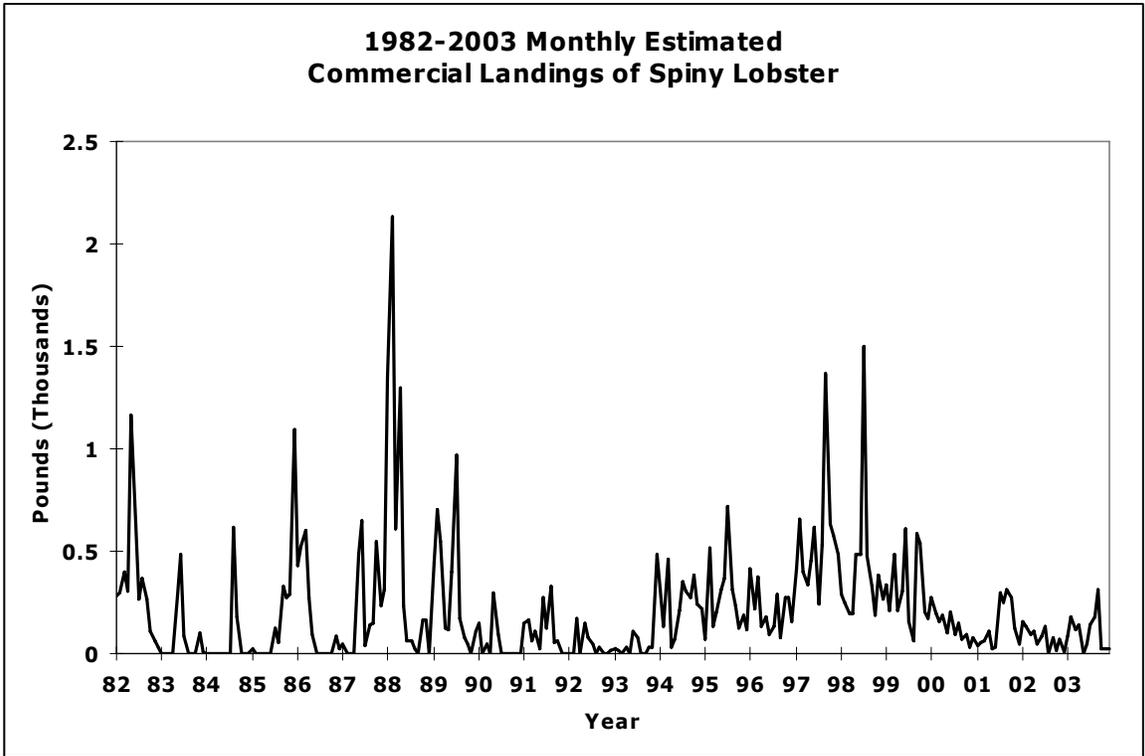


Figure A-4-9

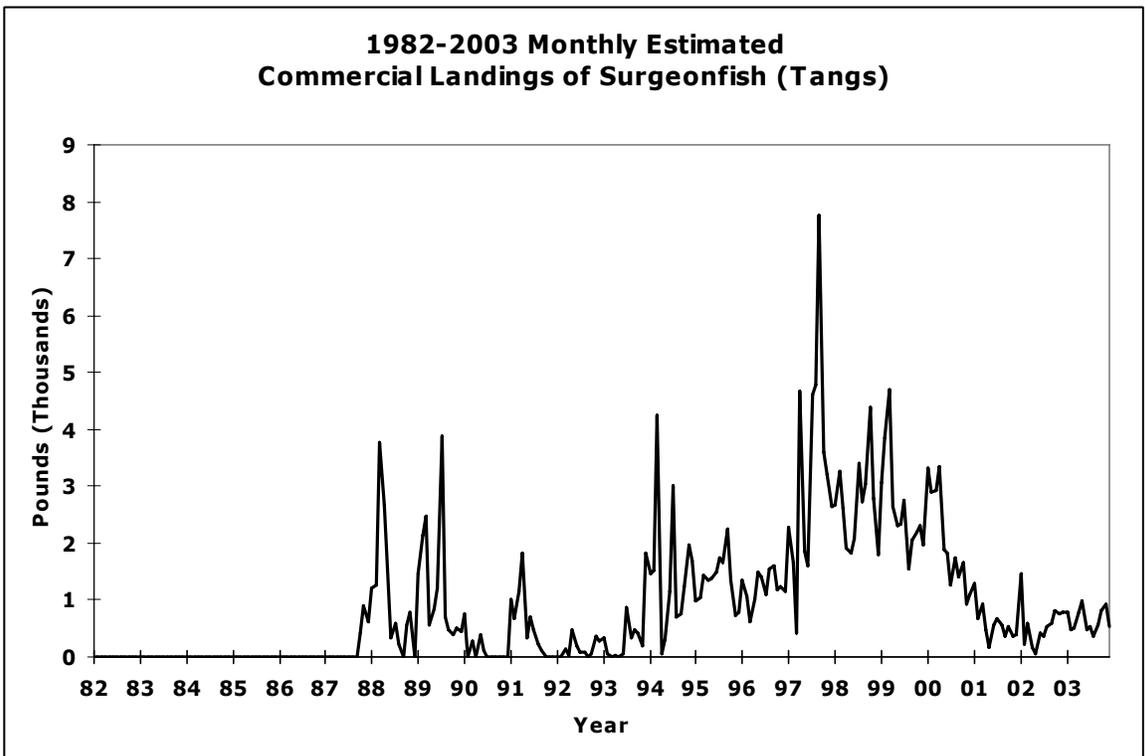


Figure A-4-10