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BOTTOMFISH FISHERY IN THE NORTHWESTERN HAWAIIAN ISLANDS, 1989

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RECENT DEVELOPMENTS

The major development in the bottomfish fishery in the Northwestern Hawaiian Islands (NWHI) during 1989 was the implementation of the limited entry plan promulgated by the Western Pacific Regional Fishery Management Council (WPRFMC). The plan divided the NWHI into two permit zones, the Mau and Ho'omalulu Zones. The Mau Zone extends from Nihoa northwestward to, but not including, French Frigate Shoals (long. 161°20'-165°W). The Ho'omalulu Zone (or limited access zone) extends from French Frigate Shoals (west of long. 165°W) to Kure Atoll. The limited entry plan provides a mechanism to effectively restrict the entry of bottomfish fishing vessels into the limited access portion of the island chain (the Ho'omalulu Zone) while allowing other bottomfish vessels an opportunity to gain access into this area by accumulating experience points for fishing in the Mau Zone and the main Hawaiian Islands.

In 1989, a total of 20 permits were issued for the two permit zones, and the number of vessels that fished the NWHI declined 23% from 1988. Eight of the permits were issued for the Ho'omalulu Zone, and vessel participation decreased (54%) from 11 active vessels in 1988 to only 5 active vessels in 1989. The reduction in fishing effort in the Ho'omalulu Zone was due not only to the limited entry plan but also to a number of other factors not associated with the plan. These factors include vessels switching from the bottomfish fishery to tuna longlining and shrimp trapping, increased difficulty in finding concentrations of bottomfish, increased vessel operating costs associated with the increased distance and time, the inclement weather conditions, and owners selling or not fishing vessels as veteran skippers terminated their employment. Twelve of the permits were issued for the Mau Zone, and vessel participation was up (25%) from four active vessels in 1988 to five active vessels in 1989.

Most of the skippers commented that the catch rates of the target species have declined throughout the years. Data indicate that, on a per-trip or per-fishing-day basis, the 1989 catch [all species and bottomfish management unit species (BMUS)] did not decline substantially from previous years (Table 1). "Bank hopping" during an individual fishing trip was the established operating procedure (fishing pattern). During 1989, a few banks provided one-bank fishing trips on numerous occasions. The highly targeted opakapaka, *Pristipomoides filamentosus*, regained its dominance in the landings after sharing the top landings honor with hapuupuu, *Epinephelus quernus*, last year. The "mixed bag" type of landings in 1988 was still seen this year as the prices for hapuupuu and butaguchi, *Pseudocaranx dentex*, increased over last year.

Most of the skippers interviewed commented on the abundance and aggressiveness of the kahala, *Seriola dumerili*, and various species of sharks. These two noncommercial fishes plagued

fishermen to the extent that they were forced in many instances to move from areas of target species abundance. Although closely associated with the opakapaka and its habitat, the kahala would take the hooks before the less aggressive opakapaka. When a desirable fish was hooked, the sharks would often steal or mutilate it before it could be landed. The sharks were also responsible for the majority of the gear loss. Interactions with Hawaiian monk seals, *Monachus schauinslandi*, and sea turtles were not reported.

NWHI FLEET OPERATIONS

The NWHI fleet operations are monitored in Honolulu by personnel of the Fishery Management Research Program of the Southwest Fisheries Science Center Honolulu Laboratory, National Marine Fisheries Service (NMFS), NOAA. The NWHI vessel activity figures given in Table 1 may underestimate total fleet activity and landings because of unmonitored sales of landings on the Islands of Kauai, Maui, Hawaii, and Oahu.

Fifty bottomfish fishing trips were made by 10 different vessels (Table 1; Fig. 1), representing a 46% decrease in the number of bottomfish trips and a 23% decrease in the number of participants from 1988. Of the 10 active vessels in the bottomfish fleet in 1989, only 5 made trips with any regularity: 2 vessels in the Mau Zone and 3 vessels in the Ho'omalulu Zone. In addition, several of the highliners dropped out of the fishery during the last 2 years. This may have some effect on the landings by trip averages.

The average NWHI trip lasted 14.8 days--6.8 days of fishing and 8.0 days of travel. The data on trip operations were very similar to those from the previous 3 years (Table 1). The number of trips made by an individual vessel ranged from 1 to 14. The average number of trips per vessel was five, a decrease from seven in 1988 [Table 1 values for the number of trips per vessel were updated from those in Kawamoto and Pooley (1990)]. This decrease in the average number of trips is a reflection of the highly variable number of trips by individual vessels.

Comparisons of trip operations and landings in the management areas for 1988 and 1989 are covered in Table 2. During 1988, the fishery was unregulated; therefore, the number of vessels fishing within each area reflects the fact that some vessels fished in both areas. It is interesting to note that the catch per fishing day increased for the Mau Zone but decreased for the Ho'omalulu Zone.

The entire NWHI archipelago was fished during the 1989 season. Twenty-eight trips (56%) were made to the Ho'omalulu Zone by five vessels. Only two vessels made two trips into the upper regions of the NWHI, above Pearl and Hermes. The majority of the

trips were in the middle regions, Gardner Pinnacles to Laysan Island. The open access Mau Zone accounted for 22 trips (44%) by 5 vessels.

The average NWHI landings for all species per trip (NMFS-monitored trips) in 1989 was 6,054 lb, down slightly from 1988 (Table 1). The BMUS landings per trip averaged 5,036 lb in 1989. The BMUS accounted for 83% of the landings in 1989, 80% in 1988, 84% in 1987, and 83% in 1986. In the Ho'omalau Zone, the average landings per trip equaled 6,318 lb, with 5,483 lb (87%) of BMUS (Table 2). Bottomfishing was the primary source of income for all of the active NWHI vessels except one.

BOTTOMFISH LANDINGS DATA

There are presently two systems for monitoring the bottomfish landings in Hawaii: the Hawaii Division of Aquatic Resources (HDAR) compiles reports of the commercial fisheries landings, and the NMFS Fishery Management Research Program monitors the seafood sales at a number of wholesale locations. Neither system monitors the quantity of fish landed by recreational or subsistence fishermen. An additional problem is Hawaii's large "recreational/part-time commercial" fleet, which sells its catch directly to wholesalers and retailers outside of any structured reporting or monitoring system and remains a potentially major source of deficiency in the data reporting systems. Both systems have significant limitations.

We believe that the HDAR data set represents a high degree of underreporting. Each segment of the fisheries is biased to a different degree because of the levels of compliance in reporting. The HDAR data on bottomfish landings from 1970 through 1988 are presented in Table 3.

The NMFS monitoring program is limited by the extent of the percentage of the total landings monitored. The sample changes from year to year in terms of number of days monitored and the species and locations monitored. The NMFS data are presented as an expanded estimate to approximate the total market volume represented by the NMFS monitoring sites. The market expansion factors are based on a 1979 survey of wholesale markets in Hawaii and on the landing patterns of specific fleets. The expansion factors range from 1 (which indicates that the NMFS sample represents the entire market for a particular gear and species combination) to 2 (which indicates that the NMFS sample is 50% of the total market). The basis for the expansion should change as the market changes over time, but we do not at this time have a reliable means for making such adjustments. The expansion factors have therefore remained static for the 6 years the NMFS has monitored the fishery. A survey of wholesale dealers is expected to be fielded by the NMFS in 1990. Data from this

survey will be used to update the current expansion factors where applicable.

The NMFS monitoring program also collects information on ex-vessel prices. Average prices are adjusted during the market volume expansion procedure to account for differences in prices between sales locations.

It is our belief that the NMFS coverage of the NWHI landings is nearly complete. The percentage of coverage of the landings from the main Hawaiian Islands (MHI) is lower, possibly as little as 50% of the total and perhaps less for Maui and Kauai. Comparisons of estimates from year to year must be used with care.

The WPRFMC's voluntary NWHI bottomfish logbook program was initiated in 1988. The information provided by the logbook during the first trial was found to be highly variable. The information collected was analyzed, and the logbooks were amended to include information on the disposition of the catch. However, a means for distributing and collecting the logbooks was not achieved. Additional refinements to the logbook may be necessary to ensure reliable results in the future. The logbook program adds an additional paperwork burden on the fishermen, because they are already required to complete the State's fish catch report, which asks for much the same information.

Based on NMFS estimates, the bottomfish landings have declined significantly for the NWHI and, to a lesser extent, for the MHI (Table 4; Fig. 2). This is not surprising because of the decrease in the number of NWHI fishing trips (Tables 1 and 2). The 1989 overall prices for bottomfish rose (Fig. 3A). The NWHI prices for the major species did not show an across-the-board increase, but opakapaka, hapuupuu, and butaguchi prices rose while onaga and ehu prices declined (Fig. 3B). The MHI prices remained relatively stable, declining slightly for onaga, opakapaka, and ehu but increasing for hapuupuu and butaguchi (Table 5; Fig. 3C). The rise in the prices of hapuupuu and butaguchi is not surprising. The NWHI fishery is the main source for these species. The NWHI hapuupuu and butaguchi were landed in quantity, and the existing markets for these two species were further developed. The quantities for these two species experienced a drastic decline in 1989, but demand remained high, leading to the increase in prices.

The top five BMUS accounted for 85.4% of the landings (Table 6; Fig. 5). Opakapaka regained dominance with 30.9%. Hapuupuu, last year's dominant species, and butaguchi followed with 18.2% and 15.8%, respectively. Onaga constituted 3.6% while ehu supplied only 2.6%. The category of "other BMUS" constituted 12.1% of the landings. In terms of revenue, figures are quite different because of the price differential given to the preferred species, onaga, and opakapaka. The species composition

for the MHI is not given because of the potential biases in our samples.

BOTTOMFISH IMPORTS TO HAWAII

Import data for Hawaii were obtained from the U.S. Food and Drug Administration (FDA) and compiled by the NMFS Southwest Region. The bottomfish imports into Hawaii, mainly from the Pacific island nations, increased 69% in 1989 (Fig. 6). Almost all of the imports are snappers. The FDA data system does have some limitations due to the sensitivity of the threshold level of tracking quantities of individual lots.

RECOMMENDATIONS

The WPRFMC's NWHI bottomfish logbook program would be the best source of detailed data on catch and effort needed for stock assessment purposes. More effort will have to be put into fishermen contacts to ensure accurate data if the logbook program is to be successful. If the program is implemented fully, the elimination of also completing the HDAR catch reports should be examined.

Data collection should be expanded to provide a broader base for improved expansion factors. Data are needed primarily from the Islands of Maui and Kauai because these areas have large numbers of bottomfish fishing vessels.

A study is needed to estimate the amount of fish not being reported to the HDAR or monitored by the NMFS. An integration of all of the NMFS data sources should be completed to form a more accurate picture of the landings and value of Hawaii's fisheries.

The decline in bottomfish landings from Hawaii and the availability and improved quality of Pacific island and other foreign snappers have increased the quantity of fish imported into Hawaii. These imports should be monitored more closely as they have a direct effect on the price structure of the local bottomfish.

The export of fish in general seems to have increased over the last few years. National marketing efforts by the Hawaii Seafood Promotion Committee and the State of Hawaii's Department of Business and Economic Development have resulted in increased interest in Hawaii's fish. These exports are not being monitored at present. A study on the exports is needed to complete the picture of Hawaii's market. Some pieces of this puzzle may be answered by the wholesaler survey to be conducted in 1990 by NMFS personnel. This would give a snapshot of the current activities, but an ongoing data monitoring system should be designed to determine long-term trends in the market.

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Table 1.--Activity of the bottomfish fleet in the Northwestern Hawaiian Islands, 1984-89 (BMUS = bottomfish management unit species). Data are based on a consistent sample of the fleet in each year.

Variable	1984	1985	1986	1987	1988	1989
Vessels (No.)	19	23	24	28	13	10
Trips (No.)	135	160	163	134	93	50
Trips (No.)/vessel	7	7	7	5	7	5
Days at sea			2,445	2,211	1,441	740
Days fished			978	938	660	335
Days/trip			15	16	15.5	15
BMUS (lb)/trip	4,318	4,659	4,803	6,145	5,502	5,036
Total catch (lb)/ trip	--	--	5,805	7,303	6,842	6,054
BMUS (lb)/ fishing day	--	--	800	877	786	763
Total catch (lb)/ fishing day	--	--	967	1,043	977	917
Revenue (\$US)/trip	--	--	13,125	17,462	16,400	14,994
Revenue (\$US)/vessel	--	--	87,500	83,571	117,324	74,971

Table 2.--Activity of the bottomfish fleet in the Northwestern Hawaiian Islands, by Mau and Ho'omalu Zones, 1988-89 (BMUS = bottomfish management unit species). Data may not match those in Table 1 because of rounding and extrapolation.

Variable	1988		1989	
	Mau	Ho'omalu ^a	Mau	Ho'omalu
Vessels (No.)	4	12	5	5
Trips (No.)	21	72	22	28
Trips (No.)/vessel	5	6	4	5
Days at sea	199.5	1,242	275	465
Days fished	99.7	561	145	190
Days/trip	9.5	17.25	12.5	16.6
BMUS (lb)/trip	1,530	6,754	4,467	5,483
Total catch (lb)/trip	2,596	8,194	5,719	6,318
BMUS (lb)/fishing day	322	866	677	808
Total catch (lb)/fishing day	546	1,050	867	931
Revenue (\$US)/trip	7,169	17,705	15,204	14,829
Revenue (\$US)/vessel	37,641	104,758	66,898	83,045

^aData not available for 1 trip; all calculations based on 71 monitored trips.

Table 3.--Hawaii's commercial bottomfish landings, 1970-88, based on data from the Hawaii Division of Aquatic Resources.

Year	Landings (lb)	Revenue (\$US)	Price(\$US) per pound ^a
1970	339,502	239,564	2.01
1971	406,006	310,021	2.09
1972	402,173	363,238	2.39
1973	446,139	413,523	2.34
1974	405,864	417,066	2.36
1975	555,255	591,645	2.24
1976	557,835	692,434	2.48
1977	560,447	762,327	2.58
1978	738,070	1,098,093	2.63
1979	692,430	1,120,363	2.57
1980	710,063	1,077,861	2.16
1981	637,841	1,253,469	2.53
1982	746,060	1,587,992	2.58
1983	880,169	1,956,060	2.62
1984	1,028,867	2,376,500	2.64
1985	1,079,619	2,646,412	2.65
1986	1,121,067	2,791,173	2.62
1987	1,087,912	3,103,576	2.95
1988	1,299,773	3,600,448	2.90

^aPrices were calculated from pounds sold, rather than from pounds caught; prices were adjusted for inflation to 1988 price levels.

Table 4.--Hawaii's market for bottomfish caught in the Northwestern Hawaiian Islands (NWHI) and the main Hawaiian Islands (MHI), based on market expansion estimates by the National Marine Fisheries Service, 1984-89.

Source	1984	1985	1986	1987	1988	1989
Landings (x 1,000 lb)						
Hawaii	1,358	1,649	1,693	1,884	2,276	1,543
NWHI	661	922	869	1,015	625	303
MHI	697	727	824	869	1,651	1,234
Imports	152	264	319	472	334	564
Total bottomfish	1,510	1,913	2,012	2,356	2,610	2,107
Revenue (x US\$1,000)						
Hawaii	--	--	4,500	5,300	6,000	4,622
NWHI	1,400	1,800	1,900	2,300	1,500	756
MHI	--	--	2,600	3,000	4,500	3,861
Imports	--	--	760	1,140	790	1,644
Total bottomfish	--	--	5,260	6,440	6,790	6,266

Table 5.--Hawaii's bottomfish prices by capture location, and Hawaii's bottomfish market prices by species and source, 1986-87 (NWHI = Northwestern Hawaiian Islands, MHI = main Hawaiian Islands).

Species	Price (\$US)/lb			Price (\$US)/lb		
	Market	NWHI	MHI	Market	NWHI	MHI
		1986			1987	
Opakapaka	3.41	3.20	3.78	3.56	3.27	3.97
Onaga	3.93	3.13	4.39	4.70	3.24	5.12
Ehu	2.56	2.14	3.32	3.17	2.36	3.75
Hapuupuu	1.61	1.56	2.23	1.93	1.87	2.74
Butaguchi	1.32	1.07	2.00	1.19	1.16	2.51
Other BMUS	--	--	--	--	--	--
Other bottomfish	2.43	2.39	2.26	2.42	2.11	2.55
Imports	2.38	--	--	2.67	--	--
Total bottomfish	2.78	--	--	3.02	--	--
		1988			1989	
Opakapaka	3.51	3.54	3.55	3.58	3.78	3.51
Onaga	4.19	3.30	5.06	4.81	3.23	4.92
Ehu	2.82	2.01	3.80	3.36	1.85	3.71
Hapuupuu	1.96	1.84	2.99	2.86	2.61	3.64
Butaguchi	1.21	1.05	2.54	1.85	1.31	3.16
Other BMUS	--	--	--	2.42	1.20	2.52
Other bottomfish	1.96	2.23	1.19	2.08	1.52	2.16
Imports	2.37	--	--	2.97	--	--
Total bottomfish	2.71	2.37	2.90	3.12	2.61	3.26

Table 6.--Species composition of bottomfish landings in the North-western Hawaiian Islands, 1986-89 (BMUS = bottomfish management unit species).

Species	Catch (x 1,000 lb)			
	1986	1987	1988	1989
Opakapaka	297	370	154	112
Onaga	106	77	80	13
Ehu	30	40	45	9
Hapuupuu	210	223	156	66
Butaguchi	160	217	111	57
Other BMUS	32	74	75	44
Total BMUS	835	1001	621	302
Other bottomfish	35	14	5	1
Total bottomfish	870	1015	626	303

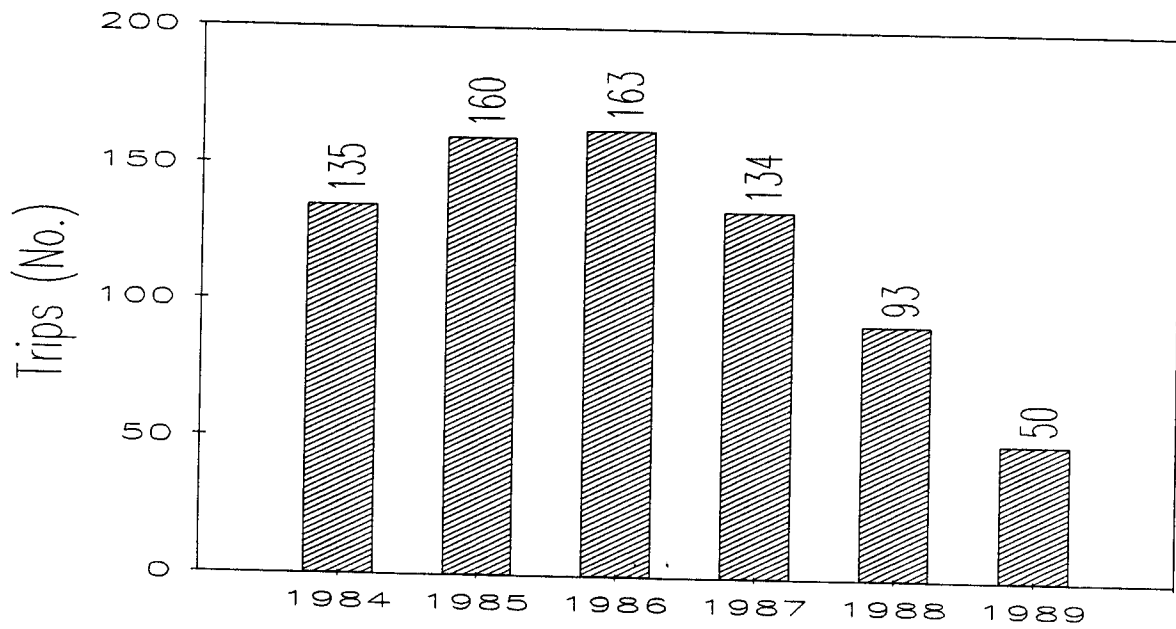
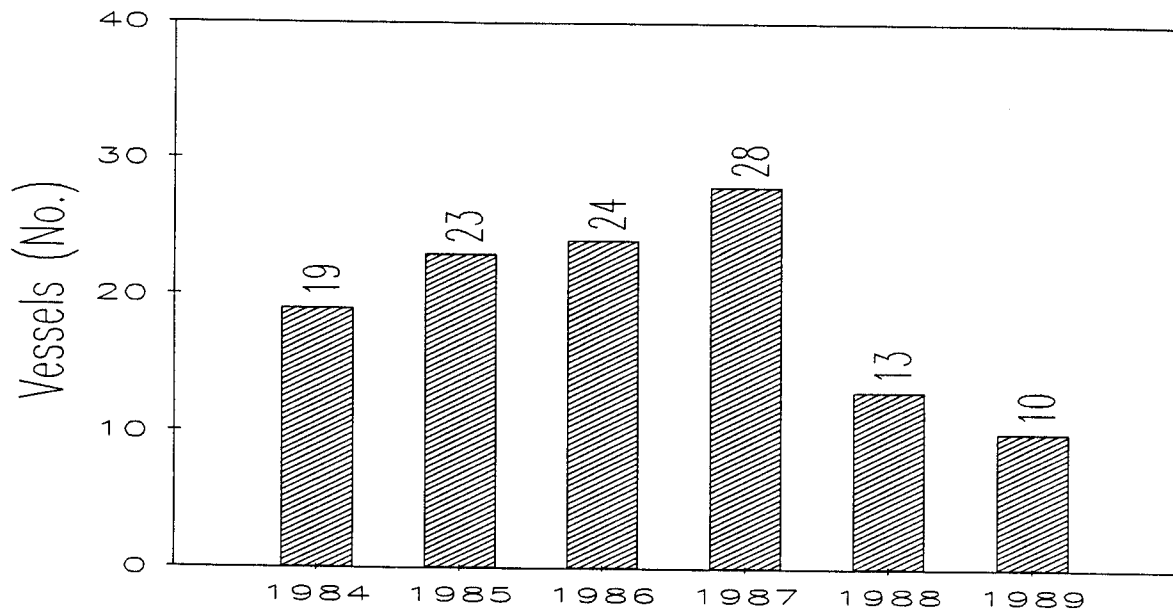


Figure 1.--Number of vessels participating in, and trips taken by, the bottomfish fleet in the Northwestern Hawaiian Islands, 1984-89. Data are from the monitoring program of the National Marine Fisheries Service.

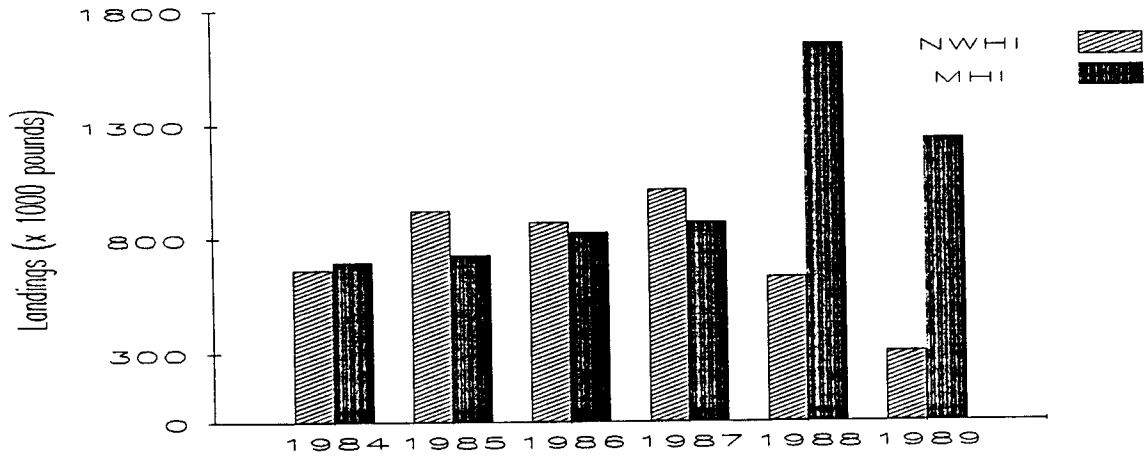


Figure 2.--Hawaii's bottomfish landings, 1984-89, based on estimates made by the National Marine Fisheries Service (NWHI = Northwestern Hawaiian Islands; MHI = main Hawaiian Islands).

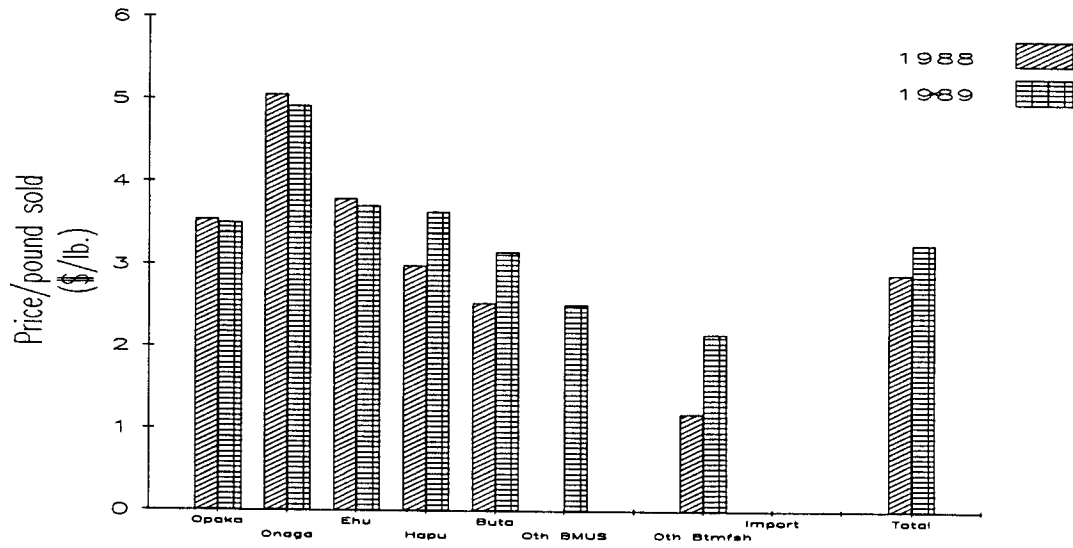


Figure 3.--Continued. (C) Hawaii's 1988-89 market prices for the bottomfish from the main Hawaiian Islands.

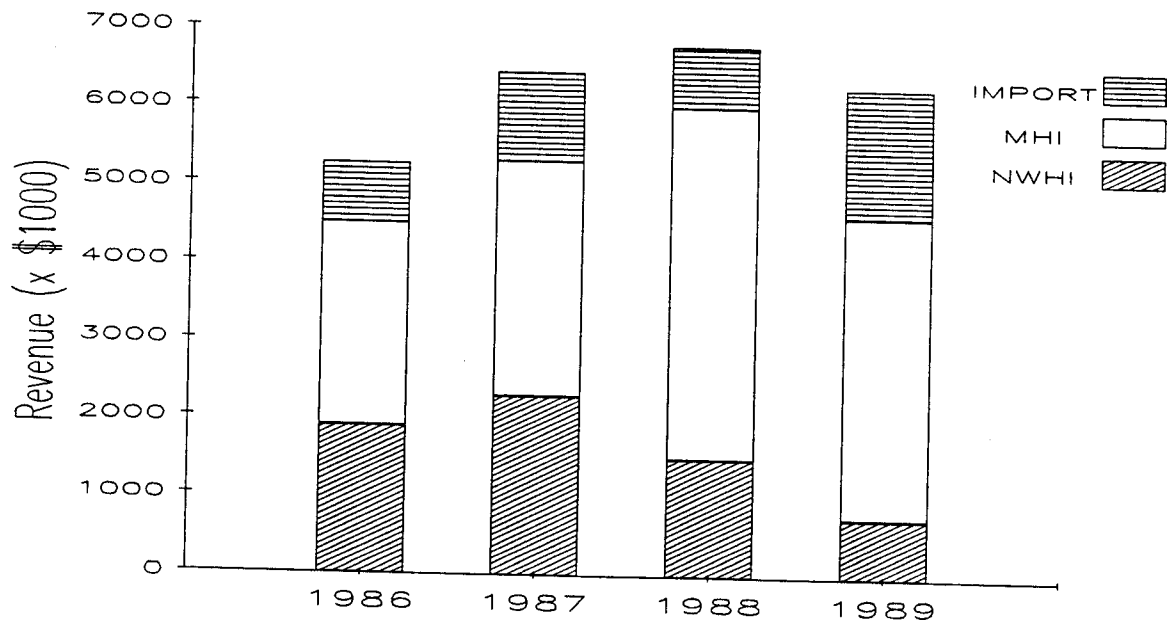
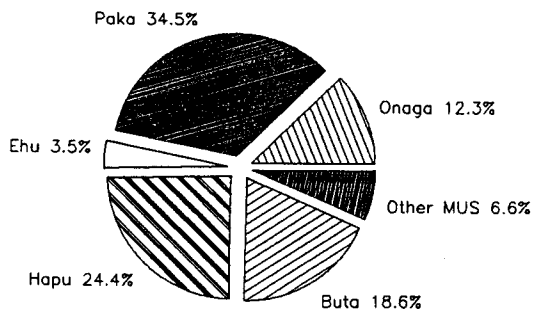
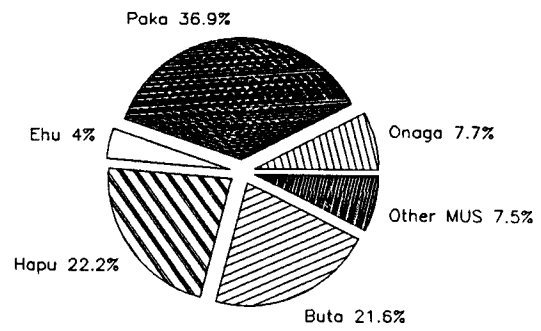


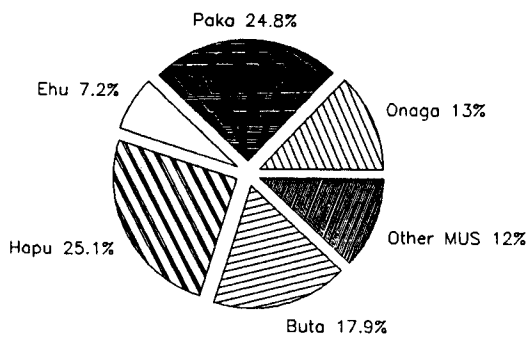
Figure 4.--Hawaii's bottomfish market revenue, 1986-89 (NWHI = Northwestern Hawaiian Islands; MHI = main Hawaiian Islands).



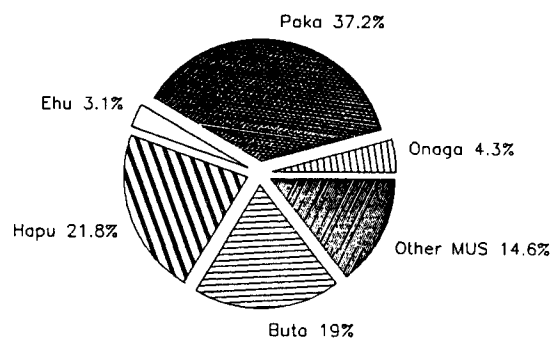
1986



1987



1988



1989

Figure 5.--Composition of bottomfish management unit species landings (by weight) by the bottomfish fleet in the Northwestern Hawaiian Islands, 1986-89.

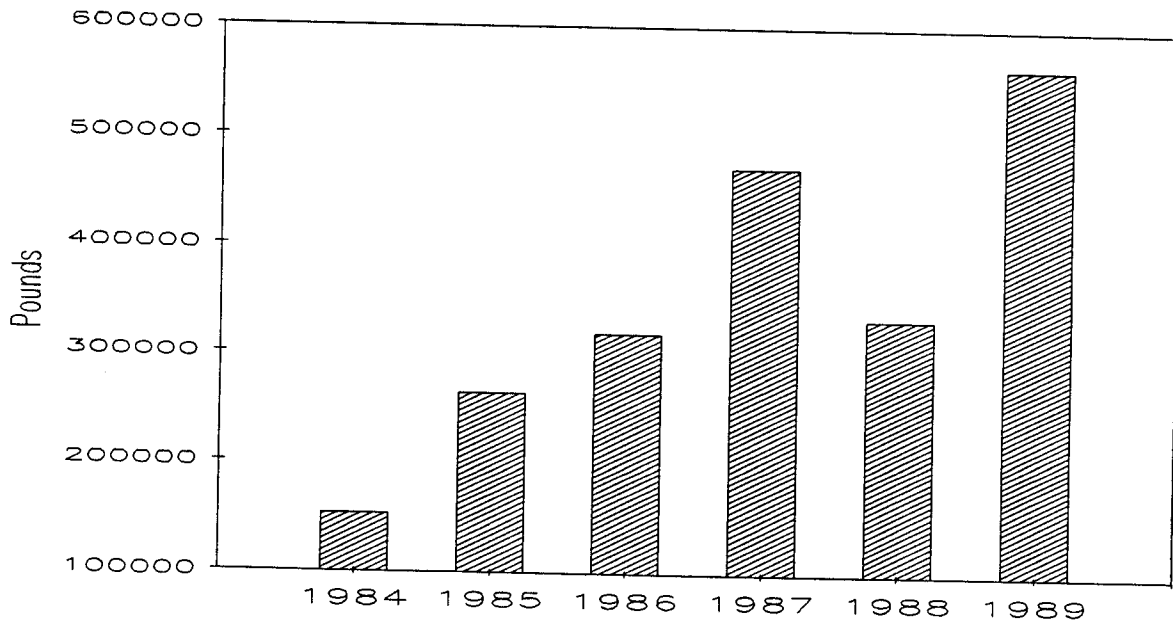


Figure 6.--Bottomfish imports to Hawaii, 1984-89.