

Southwest Fisheries Science Center
Administrative Report H-00-02

**ANNUAL REPORT OF THE 1998
WESTERN PACIFIC LOBSTER FISHERY
(WITH PRELIMINARY 1999 DATA)**

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April 2000

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PREFACE

This report provides an accessible summary of basic information on the performance of the Northwestern Hawaiian Islands (NWHI) lobster fishery. Preliminary information on the 1999 season has been added to selected tables and figures to speed dissemination of the information. More detailed information on the status of the NWHI lobster populations is contained in separate reports prepared by the National Marine Fisheries Service (NMFS) Honolulu Laboratory's Stock Assessment Investigation (Haight et al., 1995; DiNardo et al., 1998). Economic research on the NWHI lobster fishery has been limited in recent years to ad hoc analyses required for fishery management plan amendments. The last comprehensive analysis was conducted by Clarke and Pooley (1988) and Clarke, Yoshimoto, and Pooley (1992).

The Fishery Management Plan (FMP) for the western Pacific crustacean fisheries was prepared by the Western Pacific Regional Fishery Management Council (Council) and was implemented by NMFS in midyear 1983. Lobster permits are issued by the Regional Director, Southwest Region (SWR) through the Pacific Islands Area Office (PIAO) in Honolulu. These permits allow lobster fishing operations in the U.S. Exclusive Economic Zone (EEZ) from 3 to 200 nmi offshore American Samoa, Guam, and Hawaii (including the NWHI and the EEZ areas of the main Hawaiian Islands). The NWHI lobster fishery is a limited entry fishery with all permits currently issued.

The Fishery Management and Economics Program (FMEP) of the Honolulu Laboratory collects catch, effort, landings, and economic information from Federally permitted vessels. All information presented in this report pertains only to the NWHI.

No Federally permitted lobster vessels have operated in the EEZs of American Samoa or Guam since the passage of the FMP in 1983. One Federally permitted vessel began to operate in the EEZ of the main Hawaiian Islands in 1997 but has since discontinued operations. That vessel was required to file Federal logbooks for its operations in the EEZ and to comply with all State and Federal fishery regulations. However, because of confidentiality restrictions, no information on the operations of that vessel is included in this report.¹ Information on the nearshore lobster fisheries of these areas can be found in the NMFS WPacFIN's Fishery Statistics of the Western Pacific annual volumes (Hamm, 1998).

Alvin Z. Katekaru of PIAO provided information on permit transfers and current regulations for this report.

¹Federal confidentiality restrictions require activity by at least three vessels before aggregate or summary statistics are made public.

INTRODUCTION

The 1998 NWHI lobster fishery has distinguished itself in two areas: 1) it has temporarily reduced fishing pressure on the Necker Island fishing grounds due to direct industry and management actions; and 2) all of the participants voluntarily took scientific data collectors to help monitor the status of the stocks. During the two previous seasons the single archipelago-wide harvest guideline forced the fishery into a "derby-like" contest which primarily targeted the stocks around Necker Island, the closest productive fishing area. All those involved had been concerned about the detrimental effects of taking the archipelago-wide harvest guideline from a single bank area and its possible negative effects on the sustainability of the NWHI stocks.

The 1998 harvest guideline was divided into four management areas and reduced to a total of 286,000 lobsters. Only 78.5% of the overall harvest guideline was taken. There were two areas that minimally exceeded the individual area specific guidelines, one area that was slightly under, and one area that took only 41%.

The overall ex-vessel value of the fishery decreased from \$1.88 million in 1997 to \$1.03 million in 1998 (Table 1). For the first time in the history of the fishery the slipper lobster catch as well as the catch-per-unit-effort (CPUE) has surpassed that of the spiny lobster. The spiny lobster catch had been the mainstay of the fishery since 1983 (Table 2², 3). The overall CPUE was 1.31 lobsters (combined) per trap-haul in 1998 compared to 1.75 in 1997. The combined effect of a lower CPUE, the lower price for the increased volume of slipper lobster landings, and the much decreased volume of spiny lobster landings was to reduce the revenue per trap-haul to \$6.07 (compared to \$10.59 per trap-haul in 1997).

This report details commercial lobster fishing activity in the NWHI for the 1998 fishing season. Current catch, effort, and revenue statistics are based on federal logbook data and landings reports. Statistics are presented for the main target species in tabular format, and brief summaries illustrate key points. This report concludes with information on protected species interactions and administrative activities in the fishery. Because this report was completed after closure of the 1999 fishery, preliminary information on the 1999 fishery is appended to several tables.

BACKGROUND

The Northwestern Hawaiian Islands are an isolated range of islands, atolls, islets, reefs, and banks which extend 1,500 nmi west northwest of the main Hawaiian

²Tables 1 and 2 contain revisions and updates from Clarke, Pooley, et al., 1988; Clarke, 1989; Landgraf et al., 1990; Dollar and Landgraf, 1992; and Dollar, 1995.

Islands from Nihoa Island to Kure Atoll (Fig. 1). The commercial lobster fishery has operated in the NWHI for 20 years, targeting primarily two species: the red spiny lobster, *Panulirus marginatus*, and the common slipper lobster, *Scyllarides squammosus*. Two other species—the green spiny lobster, *P. penicillatus*, and the ridgeback slipper lobster, *S. haanii*, are also taken. The green spiny lobsters are caught incidentally in low numbers whereas the ridgeback slipper lobsters are targeted from time to time and can be caught in fairly large numbers. The fishery currently operates under a seasonal harvest guideline system and opens on July 1. The closure date depends on how quickly the harvest guideline is taken. It ultimately closes by regulation on December 31. The fishery became an optional “retain-all” fishery without size limits or prohibitions on the retention of berried female lobsters in 1996 (Amendment 9). The retain-all fishery may release lobsters voluntarily, but those releases must be counted toward the harvest guideline. Limited access has been in place since 1991 (Amendment 7). Escape vents have been required on all traps since 1987 (Amendment 5).

During the past 6 years, the NWHI lobster fishery has faced many adverse developments. A complete closure which occurred in 1993 was prompted by the National Marine Fisheries Service's (NMFS) preseason estimate that catch rates would lie below a threshold level, resulting in a zero quota. The fishery and environmental causes which might have led to the 1993 closure are discussed in Polovina and Mitchum (1992, 1994). They believe that the spawning stock biomass at Maro Reef (a major bank in the NWHI lobster fishery) declined dramatically due to extremely poor post-larval recruitment and subsequent fishing down of the remaining population in the years following 1986. The recruitment problem appears associated with 1) a shift in oceanographic regime (a weakening of the subtropical counter current) which changed patterns of larval lobster transport, and 2) the cumulative commercial fishing pressure during that period.

The 1994 mid-season emergency closure occurred when in-season reports of commercial catch rates were substantially less than anticipated, which led to an emergency action by the NMFS Southwest Region (SWR) to close the fishery 8 weeks into the season. The fishery remained closed for the remainder of 1994. Taking a cautious approach in 1995, the fishery opened to only one vessel under an experimental fishing permit (EFP) to assess conditions of the lobster stocks. Subsequently, the Stock Assessment Investigation of the NMFS Honolulu Laboratory, in conjunction with the Western Pacific Regional Fishery Management Council (Council), undertook a comprehensive review of the quota-setting procedure. The result was the development of a risk assessment model in 1996 which opened the lobster (lobster refers to spiny and slipper lobsters combined) fishery with a small “harvest guideline” (“harvest guideline” replaces “quota” in Amendment 9) but with the removal of the previous restrictions against taking small-size and berried lobster (DiNardo, 1995). In 1996, relatively normal operations returned with a larger harvest guideline.

Other important developments also influenced the fishery, its operations, and management. In 1996, the NMFS SWR experimented with the use of a Vessel

Monitoring System (VMS) for communicating daily catch reports from vessels on the lobster grounds directly to the Pacific Island Area Office (PIAO), SWR, NMFS. More importantly the use of the VMS's communication features allowed the accurate forecasting of the close of the fishery and the timely notification of the vessels. It was by the end of the 1996 season that the voluntary VMS system had proved its usefulness and was accepted by the fishermen and fishery managers alike.

Although the confidential nature of fishing locations continues to worry the fishermen, VMS's worthwhile uses became apparent such that its use was requested in 1997 to allow a change in the "starting point" for the fishery. This proposal was accepted by the Council and NMFS, and during the 1997 season the vessels using VMS were allowed to be outside 50 miles (corresponding to the NWHI Protected Species Zone) of any lobster fishing location in the NWHI when the season opened on July 1. In previous seasons, all vessels were required to be east of longitude 161°W or outside the 200-mile Exclusive Economic Zone (EEZ) around the NWHI at the opening of the season.

The lobster fishery has also recently been evolving from a primarily frozen spiny lobster tail fishery into a multispecies, multiproduct-form fishery. In the period from 1994 to 1996 the fishery primarily targeted spiny lobsters for the premium frozen tail market. In 1996, two vessels landed a fair number of live lobsters, and there was substantial discussion within the industry about focusing on becoming more of a live spiny lobster fishery. However, due to operational and infrastructural problems, only four vessels landed live lobsters in 1997. Concerns with the percentage of dead loss associated with the onboard and shoreside holding facilities and the current shipping practices for spiny lobsters also added to the uncertainties. Despite all of the uncertainties, further expansion of the live lobster fishery was avidly pursued, and it was predicted to be larger in 1998 than in 1997.

RECENT DEVELOPMENTS

The 1998 lobster fishery had a few interesting "wrinkles" to add to the annals of lobster trapping in the NWHI. For the first time ever the fishery was separated into four discrete fishery locations with corresponding individual harvest guidelines; there was an informal operating agreement among four of the five participating vessels to spread out the fishing effort; one vessel ran aground while transiting, and there was an unforeseen weakness of the Asian economy which affected the live market.

Information for the 1998 season was limited to data summaries of the four management areas. Under normal circumstances the limited fishing that occurred in 1998 would have allowed only the information from Necker Island to be reported under Federal confidentiality procedures (NOAA Administrative Order 216-100). The Council chairman asked for and was granted permission by all of the active participants to make public the summary reports for the four management areas. The operators sent their signed release statements to the NMFS.

During the 1996 and 1997 seasons the single harvest guideline unintentionally forced the fishermen to concentrate their efforts on the closest productive bank--Necker Island. The limited harvest guideline and the derby-type fishing did not allow the fishermen to take the time to explore the possibilities of fishing other banks. All those involved--fishermen, scientists, and fisheries managers--realized that the effects of an archipelago-wide guideline being taken from a single bank was not conducive to the sustainability of the NWHI lobster stocks. Thus, each did their part to reduce the uneven distribution of effort.

The results were that in 1998 all of the vessels voluntarily used VMS, and the fishing season did not resemble a derby with the fishermen competing among themselves for the lion's share of the lobsters. The five participating vessels made a total of nine trips and fished on 13 separate banks. The effort was spatially diffused but in reality four of the five vessels still fished at Necker Island at some time or other. Necker Island still attracted the majority of the effort and produced the majority of the spiny lobster catch. The trips, with the exception of the single trip terminated by grounding, tended to be longer and more geographically spread out (Table 4). The informal industry operating agreement, the individual bank harvest guidelines, and the targeting of the live market combined to allow the vessels to make multiple trips (Table 5). The overall CPUE for the fishery did drop (Table 2) as would be expected when fishermen fish new or unfamiliar fishing locations. Many, if not most, of the areas that are explored will not yield large concentrations of the targeted species without a great deal of luck or a concerted effort to locate the most economically productive fishing grounds.

The 1998 season was predicted to be a heavier season for the fishery for live lobsters as there was more preparation time for the further researching of markets, contacting interested dealers and companies, preparing the holding facilities, and planning for the live shipments. Live lobsters were targeted by all five vessels and on seven of the nine fishing trips (Table 6). The unforeseen slump in the Asian economy had a huge negative effect on the value of the live catch, which altered expectations dramatically before and during the season.

CATCH, LANDINGS, AND REVENUE

The total combined NWHI landings of lobsters in number retained (kept), pounds (round weight), ex-vessel revenue, and vessel participation are shown in Table 1 and Figure 2. The 222,000 lobsters and the 220,000 pounds landed were below that of the 1997 season. The results indicate that approximately 85,000 fewer lobsters were landed, 110,000 fewer pounds were landed (whole weight), \$0.8 million fewer dollars were made, and four fewer vessels fished during the 1998 season.

Overall catch composition (Fig. 3) showed large changes this season with spiny lobster landings dropping 53% while its CPUE also dropped to 0.48 per trap-haul from 0.99 last season. Approximately 66% of the spiny catch was from the Necker Island

area. Catch and catch rate of lobsters by species from 1983 to 1998 are presented in Table 2. Landed pounds, price per pound, and price per lobster all decreased (Table 3).

The slipper lobster landings (which increased fivefold in 1997) increased only 4% (Table 2) while CPUE increased to 0.82 from 0.76 in 1997. Despite the increase in number of pieces landed the associated pounds sold (Table 3) decreased by 3,000 pounds indicating a smaller per-piece size. There was a minimal increase in the price per pound but a loss in the price per lobster (Table 3).

These fluctuations in the catch during the last few years were affected to some degree by the regulatory regime. The 1998 area distribution of catch and associated species percentages were driven by the Council's establishing bank-specific harvest guidelines based upon recommendations from its advisory bodies. The area-specific guidelines were management's preferred alternative to prevent local bank depletion at Necker Island, Gardner Pinnacles, and Maro Reef. It would also serve to promote broader distribution of fishing effort among the remaining NWHI banks and to provide data on the lobster stocks from other areas. Concurrently, the industry also realized that it was not in their best interest to continue to take the archipelago-wide harvest guideline from a single bank area. In an effort to proactively manage themselves and the fishery, the majority of the participants voluntarily made an informal operating agreement to spread out the fishing effort. The area distribution of the catch is summarized in Table 4 (although some information is not reported here due to confidentiality restrictions).

Previous to the 1998 area-specific harvest guidelines, the fishery operated in a much more reactionary manner that was driven by the regulations. In 1996, the year that the "take all" regulatory regime was initiated, regulations on the starting point for the July 1 opening and the total area harvest guideline forced the fishermen into a derby-type scenario. The competition for catch forced the fishery to concentrate its efforts at Necker Island's bank which had a large supply of spiny lobsters and good catch rates (CPUE). Intense competition between the five vessels, each fishing the maximum number of traps in the relatively confined area of Necker Bank, led to gear conflicts. In 1997, with nine vessels committing to fishing, some of the vessels decided to fish other banks which had historically exhibited good catch rates. These fishermen were counting on the high catch rates and the lack of competition and gear conflicts to land their share (or more) of the harvest guideline.

In 1998, the industry was seemingly headed into a transition from a frozen-tail fishery to a higher valued live-lobster fishery. It was hoped that the Hawaii lobsters would be able to compete with the highly priced Australian cold water lobsters. In 1996, there were 14,700 lb (Table 6) of spiny lobsters that were landed for the live market. The 1997 season was predicted to be a better year for the live market with more lead time to plan for holding facilities and to set up sales connections. As a result of the preseason planning efforts, the landings of live lobsters rose in 1997 (Figs. 4 and 5) with slipper lobsters also being landed live.

The unforeseen downturn in the Asian economy in 1998 dramatically altered the expected prices and even the preferred species. The Asian economic crisis resulted in the depression of the lobster prices such that it became more cost effective to purchase spiny lobsters from other economically depressed Asian countries rather than from higher priced U.S. sources with the increased shipping costs and mortality. Hawaii had priced itself out of the running for international live spiny sales. Sales of live spiny lobsters to high-priced local outlets were extremely limited.

Live slipper lobsters became 1998's most highly valued export species. They exhibited many desirable characteristics such as being easier to handle (no long antennas or spines) and being much hardier during holding and air shipment. Figure 6 shows the trends in the percentages of the live to frozen catch from 1983-98. The long-term trend in annual landings and revenue (and adjusted for inflation) is shown in Figure 2. The composition of landings (spiny and slipper lobster) is shown in Figure 3.

The CPUE in 1998 was 1.31 lobsters per trap-haul, compared to 1.74 in 1997 (Kept CPUE in Table 2). The total CPUE has decreased this year as has the spiny lobster CPUE. The drop in the spiny lobster CPUE from 0.99 in 1997 to 0.48 in 1998 accounts for the overall drop in the total CPUE. There has also been a steady increase in the slipper lobster landings these last 3 years; the CPUE has risen from 0.76 in 1997 to 0.82 in 1998. This is the first year in the history of the NWHI lobster fishery that the slipper lobster catch has exceeded the spiny lobster catch.

The optional retain-all fishery which started in 1996 has necessarily raised the kept CPUE nearly even with the total CPUE (Fig. 7). Most fishing effort has been at Necker Island, although some fishing has occurred at Maro Reef and other locations in the NWHI. Catch rates (total and kept) are shown in Figure 7. Total CPUE (total number caught per trap-haul) had been stable through the 1994-96 period. Total CPUE rose in 1997 but fell below the 1994-96 level during the 1998 season (Table 2).

FISHING EFFORT

Five fishing vessels participated in the 1998 fishery and made a total of nine trips. The number of trips varied among participants with two of the vessels making one trip each, while two other vessels made two trips each, and the remaining vessel made three trips. The informal agreement between the majority of the participants resulted in 13 different areas being fished. The average vessel made 2.1 moves (movement between banks per trip). Only three moves were made due to bank closures after the area specific harvest guideline was met. Two vessels terminated trips after management areas were closed.

The average trip consisted of 22.9 days of fishing with an additional 0.4 day involved in moving between banks. There was also 1.0 trip day that was not fished

(rest, breakdowns, maintenance, unaccounted movement, etc.).³ Travel time to and from Honolulu was estimated at 6.6 days. There were 30.9 total trip days (excluding transit days to and from Honolulu).

Range of trip lengths indicate that they took shorter or longer trips depending on if live lobster or frozen tails were being targeted. In general, trips that primarily targeted live lobsters were of shorter duration.

Fishing effort, as measured by trap-hauls, was the second highest (171,000 traps hauled) since 1992 (Table 5 and Figs. 8 and 9) with 1997 being the highest (177,000 traps hauled). However, the vessels fished for twice as many days in 1998 (41 days) as in the 1997 season (20 days) which was the shortest in the history of the fishery. The trap-hauls per vessel nearly matched the 1994 season where the fishing days per vessel were nearly identical also.

Because the lobster fishery has had seasons as short as 1 month in the 1990s, all NWHI lobster vessels currently participate in other fisheries during the year. These include the Hawaii-based domestic longline fishery as well as fisheries on the mainland U.S. and in other countries.

ECONOMIC INFORMATION

During 1995-98, as in most of the previous years, frozen lobster tails represented the predominate product (Table 10) of the NWHI lobster fishery and accounted for the largest source of income (approximately two-thirds of total sales by weight and value). Live lobster is more important in the current fishery than it has been in the past. Live lobsters, both spiny and slipper, have been exported to Japan, Taiwan, Hong Kong, and the continental U.S. Some live lobster are also sold locally to various retail and restaurant outlets. Larger quantities are sold to upscale restaurants in Hawaii, particularly in tourist resort areas. The high prices and inconsistent supply do not lend themselves to mass marketing to the general public.

Competition with other lobster producers in the world market is very keen, both for live and frozen products. The Hawaii live product production has primarily focused on exports to Asian markets, primarily to Taiwan. Taiwan and Japan make up 40% and 38% of Australia's export sales. In 1997, the USDA reported that the Taiwanese market imported US\$178 million in which the United States was in fourth position (12%) behind Thailand (28%), Australia (22%), and Ecuador (13%). It was also reported that nearly 99% of all lobsters consumed in Taiwan are imported.

³One trip was terminated after less than a week's fishing due to accidental grounding. Removing this trip from the overall average increases average fishing days to 24.9 days per trip and 27.1 total days (excluding transit to and from Honolulu).

Changing market conditions greatly influence the price and salability of seafood products. During 1993-95 there was a significant shortage of frozen Hawaii lobster tails due to the fishery closures. Brokers said that the 1993-95 closures hurt the Hawaii lobster product both locally and in mainland U.S. markets since the lobsters were no longer available on a timely and consistent basis in the quantities and sizes preferred by restaurants and other retailers. Because of this, several brokers have stopped handling Hawaii lobster products. In general, almost everyone in the industry was unhappy with the impact of the seasonal and full-year closures on the market for Hawaii lobsters. Therefore, the return of substantial quantities in 1996 and 1997 was well received. Market conditions and prices in 1996 and 1997 were quite good (and there was relatively little discounting by size or species). Ex-vessel price trends are shown in Figure 10. Economic information on landings by product type are summarized in Table 6. Some information is not reported in these tables due to confidentiality restrictions (the number of sellers or buyers was fewer than three).

Average spiny lobster frozen tail prices in 1998 fell within the average range of \$15-\$18 per pound received in 1995-97. Slipper lobster tail prices slipped into the \$9 per pound range from the previous year's highs of \$10-\$11 per pound. Live spiny and slipper lobsters were valued in the \$7-per-pound range (Table 6).

The 1998 ex-vessel revenue per trap-haul fell to \$6.07 from the 1996-97 average of \$10.79, the highest in the history of the fishery in both nominal and inflation-adjusted terms (Fig. 11). Total revenue for the fleet decreased to \$1.04 million in 1998 from \$1.88 million in 1997. Overall revenue per vessel decreased minimally while the average revenue per trip decreased by the substantial amount of \$93,000 per trip. On average, vessels received \$115,000 per trip in ex-vessel revenue.

A simple analysis of the vessel operating patterns for 1996 through 1998 shows the following range of basic operating characteristics (Table 7). The 1998 season has shown an increased diversity of operating patterns due to the non-derby type of effort. The spread of areas fished which resulted in some vessels being able to fish noncompetitively on some banks is witnessed by the increase in the coefficient of variation. This is the opposite of the 1997 season where there was more competition for the quota which resulted in more trap-hauls per set and a consequent decrease in variation, as all of the vessels tried to fish the maximum number of traps on a daily basis.

Representative cost of operations figures was not available, but economic conditions have changed dramatically since the 1980s, and largely not for the better. The 1998 season saw some vessels making multiple fishing trips and a higher number of fishing days per vessel. Some of the vessels that targeted live lobsters made multiple fishing trips to ensure product quality. Additional expenses were incurred through increased transit and multiple unloading days which prolonged the time between trips.

Participation in alternative fisheries must also weigh heavily in the decision about participation in the NWHI lobster fishery. Although crew availability may improve because of the short season, limited returns to the crew may also restrict the labor pool from which crew can be attracted. Collectively, these economic factors, as well as the uncertainty of the forthcoming year's harvest guideline, make the rebound in the Hawaii lobster fishery not entirely the bonanza it appears.

HARVEST GUIDELINE

The Honolulu Laboratory's Stock Assessment Investigation estimates the annual exploitable lobster population which is used by the NMFS SWR Director to issue a harvest guideline for the year. The guideline is to be announced annually in the *Federal Register* by March 31.

The NWHI harvest guidelines for 1995-99 were:

Annual Harvest Guideline	
Year	Number of spiny and slipper lobsters combined
1995	38,300
1996	185,000
1997	310,000
1998	286,000
1999	243,100

1998 Northwestern Hawaiian Islands Harvest Guideline

Area	Catch	Guideline	Percentage caught
1. Necker Island	67,800	70,000	96.9%
2. Gardner Pinnacles	20,200	20,000	101.0%
3. Maro Reef	88,400	80,000	110.5%
4. All Other Areas	48,100	116,000	41.5%
TOTAL	224,500	286,000	78.5%

1999 Northwestern Hawaiian Islands Harvest Guideline

Area	Catch	Guideline	Percentage caught
1. Necker Island	55,749	54,600	102.1%
2. Gardner Pinnacles	28,994	27,690	104.7%
3. Maro Reef	91,893	89,570	102.6%
4. All Other Areas	59,479	71,240	83.5%
TOTAL	236,115	243,100	97.1%

*Preliminary from logbooks

In 1998, three management areas closed in mid-season: Necker Island 53 days into the season (August 22); Gardner Pinnacles after 68 days (September 6); and Maro Reef after 80 days (September 18). The harvest from the "all other areas" category approached 40% of the harvest guideline but did not reach the allowed level and remained open to the last day of the season, December 31. Altogether, 78% of the total harvest guideline was taken.

ENDANGERED AND THREATENED SPECIES INTERACTIONS

There were no direct interactions reported for the 1998 season. Summaries of interactions with endangered and threatened species in the NWHI lobster fishery are based on information received from the daily lobster catch log reports. They are outlined in Table 8.

These data are as reported by the lobster fishermen in the logbook's protected species section. Fishermen may see greater numbers of protected species than are indicated in the catch reports. Observer data should be used as the primary source of protected species interactions.

INCIDENTAL CATCH

The incidental catch for the 1997-98 fishery is presented in Table 9. These numbers are compiled from the logbooks. In general, the incidental catch does not make up a large percentage of the landings. It is mainly confined to Kona crabs (*Ranina ranina*) and octopus (*Octopus* sp.). There are other species that are landed occasionally; e.g., generally, eels, shells, and small fishes (pers. commun.). Various vessel captains theorized that there is very little incidental and bycatch because of the escape vents.

FISHERY MANAGEMENT ACTIVITIES

The Council is the primary policy-making organization for the management of fisheries in the U.S. EEZ around American Samoa, Guam, Hawaii, the Northern Mariana Islands, and other U.S. island possessions in the Pacific. The FMP for crustaceans was prepared by the Council and implemented in 1983. It has since been amended nine times as conditions in the fishery have changed (Table 10).

The 1998 lobster season saw a major change in the harvest guideline regulation such that the Crustaceans Permit Area 1 (NWHI) was subdivided into four geographic areas, each of which had its own harvest guideline. The bank-specific harvest guidelines were established to prevent the potential risk of overexploiting the lobster population at Necker Island. The fishery had been heavily targeting Necker Island for the past two seasons due to the regulatory constraints and the high catch rates of the highly valued spiny lobsters there.

The 1998 season continued to see lobster catch and effort data reported by vessel operators through a daily call-in or VMS report. These data were used to effectively forecast the close of the fishery. The close of the fishery is declared 5 days in advance and is transmitted via VMS technology and other ship-to-shore contacts. Unlike the 1996 and 1997 seasons which closed on July 26 and on July 22, respectively, the 1998 season was incrementally closed by the predetermined management areas on different dates depending on the reported catches that occurred within each area.

Fisheries research has been ongoing with scientific data collectors being voluntarily accepted onboard the vessels since 1995. In the 1995 experimental permit fishery, a NMFS observer was onboard the one vessel that was permitted to operate. In 1996 all five of the vessels voluntarily accommodated scientific data collectors while six of the nine vessels which operated in 1997 were covered. In 1998, all five of the vessels were again covered. Over the years, the industry has been more than willing to take the data collectors, and the limiting factor has been the availability of trained data collectors.

Other fisheries research, both preseason and postseason, have been conducted on an annual and as-needed basis. The NOAA ship *Townsend Cromwell* has its annual stock assessment cruise scheduled in June of every year. Handling mortality studies were also undertaken during the 1996 assessment cruise (DiNardo and Haight, 1996). During the 1996 and 1997 season, NMFS scientists extensively sampled the landed product (DiNardo, 1997). Tagging research was initiated in 1997 and continued through 1998 (September) and 1999 (March/April) with two tagging cruises which tagged approximately 3,000 lobsters each. In 1998 and 1999 the *Townsend Cromwell* also made its annual June assessment lobster research cruise to acquire more life history, index of abundance, and population parameter information.

PERMITS

In 1991, a limited-entry program for the NWHI lobster fishery was established under FMP Amendment 7 which imposed a limit of 15 permit holders at any time. Permits can be transferred or sold; however, no one individual, partnership, or corporation is allowed to hold a whole or partial interest in more than one permit, except for any person who qualified initially for two or more permits.⁴ A permit must be registered to a vessel in order for the vessel to fish in the NWHI lobster fishery (Crustaceans Permit Area 1).

Between 1991 and 1997, there were 20 permit transfer actions (Table 11). By 1997, fewer than half of the permits that were issued in 1991 were still held by fishermen who initially had qualified for and were issued limited-entry permits.

Although the value of the permits transferred is not recorded by NMFS, dockside reports indicate values ranging from \$40,000 to more than \$100,000 over the past 2 years. Permit prices roughly represent the economic rent available from the fishery and, hence, represent an estimate of the future net value of landings based on the condition of the lobster population and lobster market conditions.

ACKNOWLEDGMENTS

We would like to thank all of the participants in the fishery for their continued support and cooperation. It is with their open willingness to voluntarily accept scientific data collectors, to provide accurate information as well as many suggestions, and to conduct personal observations that advances in the management of the lobster fishery have been made.

Thanks also to Alvin Z. Katekaru of PIAO who provided information on regulatory and administrative details and the Honolulu Laboratory editorial staff for their assistance in completing this report.

⁴Final rule implementing FMP Amendment 7 (*Federal Register* Vol. 57, No. 59, March 26, 1992, 10437-10442)

TABLES

Table 1.--Annual NWHI lobster landings and ex-vessel revenue (spiny and slipper lobsters combined) and vessel participation, 1977-99. [Data compiled by Year of landing]^a

Data from 1977-82 are estimates from NMFS Honolulu Laboratory's Fishery Monitoring and Economics Program (FMEP) shoreside monitoring; data from 1983-97 are from Federal logbooks and revenue reports compiled by FMEP. Detailed description of data sources is on the following page.

Year	Landings (Spiny and slipper lobsters combined) [Year of landing]			Fishery participation [Year of landing]	
	Number landed	Pounds (Whole weight) ^b	Revenue	Vessels	Trips
1977	57,000	72,000	\$209,000	5	14
1978	36,000	45,000	\$135,000	2	12
1979	79,000	100,000	\$320,000	2	6
1980	260,000	328,000	\$1,114,000	3	12
1981	618,000	780,000	\$2,730,000	10	25
1982	148,000	187,000	\$673,000	7	19
1983 ^c	175,300	220,000	\$621,000	4	19
1984	935,200	1,189,000	\$2,943,000	11	38
1985	1,940,200	2,369,000	\$5,888,000	16	62
1986	1,950,300	2,213,000	\$6,006,000	16	60
1987	805,000	965,000	\$3,972,000	11	38
1988	1,063,900	1,404,000	\$5,034,000	9	28
1989	1,166,000	1,470,000	\$6,295,000	11	33
1990	777,400	950,000	\$4,889,000	14	45
1991	146,100	183,000	\$1,028,000	9	19
1992 ^d	434,200	473,000	\$2,116,000	12	27
1993	Fishery closed				
1994	131,000	159,000	\$835,000	5	5
1995 ^e	38,300	56,000	\$300,000	1	1
1996	185,200	211,000	\$1,268,000	5	5
1997	309,800	330,000	\$1,881,000	9	9
1998	222,350	220,000	\$1,039,000	5	9
1999 ^f	235,749	261,000	\$1,198,000	6	6

^aData are compiled either by Year of landing (the year in which the vessel actually returned to port), or Year of haul (the year in which the lobsters were actually harvested from the sea).

^bIncludes frozen lobster tails expanded to estimate whole weight (see accompanying notes).

^cNumber caught for 1983 is from logbook records only; landings are extrapolated to estimate the entire year.

^dIncludes some lobsters "landed" from fishing in 1993 when the fishery was officially closed.

^eIn 1995 the fishery was officially closed. One vessel was allowed to operate under an experimental permit to assess the conditions of the stocks.

^fData for 1999 are preliminary.

Source: NWHI lobster catch, effort, landings, and revenue data.

For 1977-82, data are estimates from NMFS Honolulu Laboratory shoreside monitoring of the growing NWHI spiny lobster fishery.

In 1983, the fishery management plan (FMP) for spiny lobsters prepared by the Western Pacific Regional Fishery Management Council (Council) was implemented by NMFS. The FMP required logbooks and revenue reports be filed by participating fishermen. Because the regulations went into effect during the fishing year, NMFS Honolulu Laboratory staff made estimates of complete year catch, effort, landings, and revenue for 1983.

From 1983-95 logbooks specified legal, sublegal, and berried (egg-bearing) categories for catch.

From 1984-87, size and condition regulations were limited to spiny lobsters, although reporting of slipper lobster catch was required. During this period, NMFS fishery monitoring staff convinced most participating fishermen to record the amount of slipper lobster retained and discarded on a voluntary basis. However, the figures for released slipper lobsters may be particularly suspect during this period.

In 1988, size and condition regulations were applied to slipper lobsters.

Beginning in 1996, size and condition regulations were replaced with a retain-all management regime: lobsters were recorded as kept or released following the format of the Federal logbooks for the U.S. domestic longline fishery in the western Pacific region. For NWHI lobster logbook reports prior to 1996, legal lobsters were recoded as kept, and sublegal and berried lobsters were recoded as released.

Data are compiled and reported in both Year of landing and Year of haul summaries. In some years lobsters which were caught (hauled) in one year were landed shoreside in the following year (e.g., caught on the banks in November for a vessel returning to port in January). Year of landing information is primarily of interest from a fisheries statistics and aggregate economics point of view (e.g., for inclusion in *Fisheries of the United States*) while Year of haul information is primarily of interest from a stock assessment perspective.

Catch is reported in number of lobsters, either for individual species or combined. Landings are reported in both number and pounds.

Pounds are round weight (whole lobster) estimates from product categories listed in the revenue reports. Spiny lobster tails are estimated to be 35.6% of round weight; slipper lobster tails are estimated to be 33.3% of round weight.

Trap-hauls are the basic level of fishing effort, representing the setting, soaking, and hauling of the lobster traps. Multiple and partial day sets are unusual in this fishery. Data reported here are not corrected for duration of set.

CPUE (catch-per-unit-effort) is the number of total lobsters caught per trap-haul or the number of lobster kept per trap-hauls. Previous reports used the number of legal lobster caught (equivalent to the number of lobsters kept). In years before the retain-all regulation, the number of lobsters discarded may have been estimated by lobster vessel captains.

Revenue is reported on a per trip basis. Some trips overlap years; some sales are delayed from one year to another. Revenue for those years is prorated to each year. Revenue frequently is obtained by fishermen over a period of time (frequently several months) as frozen product is sold from storage. As a result, revenue from one year's fishing may be reported from a subsequent year.

Table 2.--NWHI lobster fishing effort (trap-hauls) and catch and catch rates by species, 1983-99.

Data are from Federal logbooks and revenue reports compiled by the NMFS Fishery Monitoring and Economics Program. [Year of haul].^a

Year	Trap-hauls	Total catch Spiny and slipper lobsters combined		Retained (kept) Spiny and slipper lobsters combined		Spiny lobsters		Slipper lobsters	
		Total number caught	Total CPUE ^b	Number kept	Kept CPUE	Total number caught	Total CPUE	Total number caught	Total CPUE
1983 ^c	64,700	243,700	3.77	175,300	2.71	218,100	3.37	25,600	0.40
1984	371,400	1,279,000	3.44	948,200	2.55	991,000	2.67	288,000	0.78
1985	1,040,500	2,739,100	2.63	2,034,200	1.96	1,490,100	1.43	1,249,000	1.20
1986	1,293,100	2,475,500	1.91	1,848,800	1.43	1,293,700	1.00	1,181,800	0.91
1987	806,200	1,216,200	1.51	802,200	1.00	727,300	0.90	488,900	0.61
1988	841,800	1,566,400	1.86	1,061,800	1.26	1,281,700	1.52	284,700	0.34
1989	1,068,100	1,821,100	1.71	1,165,500	1.09	1,481,000	1.39	340,100	0.32
1990	1,182,500	1,546,300	1.31	777,400	0.66	1,236,400	1.05	309,900	0.26
1991	297,300	402,500	1.35	166,800	0.56	352,600	1.19	49,900	0.17
1992	683,700	850,400	1.24	413,600	0.60	607,700	0.89	242,700	0.36
1993	Fishery closed								
1994	168,500	270,100	1.60	131,000	0.78	185,300	1.10	84,800	0.50
1995	64,200	101,200	1.58	38,300	0.60	89,700	1.40	11,500	0.18
1996 ^d	115,300	187,600	1.63	185,200	1.61	165,200	1.43	22,400	0.19
1997	177,700	310,200	1.75	309,800	1.74	175,800	0.99	134,400	0.76
1998	171,000	224,500	1.31	224,400	1.31	82,350	0.48	140,000	0.82
1999	236,491	236,115	1.00	235,749	1.00	85,858	0.36	150,257	0.64

^aSee detailed notes following Table 1.

^bCatch-Per-Unit-Effort (number of lobsters per trap-haul). Kept CPUE is number of lobsters retained per trap-haul; Total CPUE includes lobsters kept (previously termed legal and lobsters discarded (including sublegal or berried during the period of size and condition restrictions). Lobsters discarded may be estimated, rather than counted.

^c1983: Data for 1983 reflect only the 9 months in which logbooks were required.

^d1996: A retain-all regulatory regime begins in 1996. Size limits and prohibition on landing berried female lobsters removed in 1996 and for subsequent years.

Table 3.--Annual NWHI lobster landings and prices by species and total revenue, 1983-98.

Data are from Federal revenue reports compiled by the NMFS Fishery Monitoring and Economics Program. [Compiled by Year of landing]

Year	Spiny lobster			Slipper lobster		
	Pounds	Price per pound ^a	Price per lobster	Pounds	Price per pound	Price per lobster
1983 ^b	203,000	\$2.91	\$3.75	17,000	\$1.78	\$1.69
1984	935,000	\$2.66	\$3.73	254,000	\$1.78	\$1.69
1985	1,437,000	\$2.94	\$4.42	932,000	\$1.78	\$1.69
1986	1,149,000	\$3.23	\$4.14	1,064,000	\$2.16	\$2.18
1987	528,000	\$4.68	\$6.26	437,000	\$3.44	\$3.66
1988	1,218,000	\$3.66	\$5.01	186,000	\$3.12	\$3.32
1989	1,267,000	\$4.44	\$5.96	203,000	\$3.29	\$3.00
1990	784,000	\$5.51	\$7.31	166,000	\$3.44	\$3.06
1991	150,000	\$6.06	\$7.97	33,000	\$3.55	\$3.68
1992	319,000	\$5.20	\$6.27	154,000	\$2.97	\$2.71
1993	Fishery closed					
1994	113,000	\$5.92	\$7.86	46,000	\$3.62	\$3.63
1995 ^c	52,000	\$5.92	\$7.86	4,000	\$3.62	\$3.63
1996	191,000	\$6.24	\$7.31	20,400	\$3.77	\$3.44
1997	211,000	\$6.76	\$8.14	119,000	\$3.82	\$3.38
1998	104,000	\$5.55	\$7.05	116,000	\$3.94	\$3.29

^aPrice per pound is estimated whole (round) weight from both live, frozen whole, and frozen tail product forms.

^b1983-85: Slipper lobster revenue and prices are estimated for these years.

^c1995: Landings (pounds), price per pound, and revenue figures for 1995 are estimated using 1994 average weights per piece and average prices (due to confidentiality nondisclosure).

Table 4.--Annual fishing effort (fleet days fished and trap-hauls) and total catch-per-unit-effort (CPUE) for spiny and slipper lobsters by area in the NWHI, 1995-99. [Data compiled by Year of haul]

1995 ^a			Total catch-per-unit-effort	
			Spiny lobster	Slipper lobster
Area	Fleet days fished	Trap-hauls	Total	Total
Necker	35	36,213	1.95	0.11
All other	28	28,008	0.69	0.27
Total	63	64,221	1.40	0.18

1996			Total catch-per-unit-effort	
			Spiny lobster	Slipper lobster
Area	Fleet days fished	Trap-hauls	Total	Total
Total ^b	118	115,340	1.43	0.19

1997			Total catch-per-unit-effort	
			Spiny lobster	Slipper lobster
Area	Fleet days fished	Trap-hauls	Total	Total
Necker	117	113,861	1.33	0.18
All other	62	63,851	0.36	1.77
Total	179	177,712	0.99	0.76

Table continued on next page.

^aThe fishery was closed by regulation in 1995: one vessel fished under an experimental permit.

^bOnly one vessel fished outside of Necker Island.

Table 4.—Continued.

1998			Total catch-per-unit-effort	
			Spiny lobster	Slipper lobster
Area	Fleet days fished	Trap-hauls	Total	Total
Necker	77	65,600	0.83	0.20
Gardner	20	20,100	0.49	0.51
Maro	35	37,100	0.22	2.17
All other	74	48,200	0.22	0.73
Total	206	171,000	0.48	0.82

1999			Total catch-per-unit-effort	
			Spiny Lobster	Slipper Lobster
Area	Fleet Days Fished	Trap-hauls	Total	Total
Necker	42	45,227	1.01	0.22
Gardner	31	26,991	0.65	0.43
Maro	63	63,949	0.10	1.34
All Other	117	100,324	0.16	0.43
Total	253	236,491	0.36	0.64

Table 5.--Annual fishing effort (vessels, trips, fishing days, fishing days per vessel, and trap-hauls) for the NWHI lobster fishery, 1983-99. [Compiled by Year of haul]

Year	Vessels	Fleet trips	Fleet fishing days	Fishing days/ vessel	Total trap-hauls	Trap-hauls/vessel
1983	4	19	273	68	64,700	16,175
1984	13	41	845	65	371,400	28,569
1985	17	66	1,738	102	1,040,500	61,206
1986	16	62	2,016	126	1,293,100	80,819
1987	11	40	1,211	110	806,200	73,291
1988	9	29	1,139	127	841,800	93,533
1989	11	33	1,309	119	1,068,100	97,100
1990	14	45	1,466	105	1,182,500	84,464
1991	9	21	433	48	297,300	33,033
1992	12	28	850	71	683,700	56,975
1993	Fishery closed					
1994	5	5	199	40	168,500	33,700
1995 ^a	1	1	63	63	64,200	64,200
1996	5	5	118	24	115,300	23,060
1997	9	9	179	20	177,700	19,744
1998	5	9	206	41	171,000	34,200
1999	6	6	253	42	236,500	39,400

^aThe fishery was closed by regulation in 1995. One vessel operated under an experimental permit.

Table 6. --NWHI lobster landings, revenue, and price by product type and species, 1990-98. [Data compiled by Year of landing]^a

Year	Product form	Vessels	Trips	Spiny lobsters			Slipper lobsters		
				Pounds	Revenue	Price per pound (product weight)	Pounds	Revenue	Price per pound (product weight)
1990	Live	6	16	57,900	\$421,300	\$7.28	6,000	\$41,000	\$6.83
	Frozen Tailed	14	43	258,300	\$3,894,000	\$15.08	53,200	\$526,800	\$9.90
1991	Live	4	11	5,900	\$47,400	\$8.03	2,500	\$19,200	\$7.68
	Frozen Tailed	9	14	51,300	\$859,900	\$16.76	10,000	\$97,900	\$9.79
1992	Live	4	10	10,100	\$98,700	\$9.77	2,100	\$20,500	\$9.76
	Frozen Tailed	11	23	110,000	\$1,554,200	\$14.13	50,500	\$437,500	\$8.66
1993	Fishery closed								
1994	Frozen Tailed	5	5	40,100	\$668,900	\$16.68	15,200	\$166,400	\$10.95
1995 ^b	Product form data confidential in 1995 due to small number of vessels and buyers. ^c								
1996	Live	2	2	14,700	\$137,000	\$9.32			
	Frozen Tailed	5	5	62,900	\$1,054,000	\$16.76	6,800	\$77,000	\$11.32
1997	Product form data confidential in 1997 due to small number of buyers.								
1998	Live	5	7	9,700	\$69,000	\$7.11	25,600	\$181,700	\$7.10
	Frozen Tailed	5	8	33,700	\$510,000	\$15.13	30,300	\$277,600	\$9.16

^aTrips may not sum to total across product forms since single trips can result in multiple product forms (e.g., live and frozen tails).

^bThe fishery was closed by regulation in 1995. One vessel fished under an experimental permit.

^cNOAA confidentiality restrictions require 3 or more business entities to be involved in an activity before any aggregate information on that activity can be released.

Table 7.--Average NWHI lobster fishing vessel operating patterns, 1996, 1997, and 1998. [Data compiled by Year of haul]

NWHI lobster vessel operating patterns				
		1996	1997	1998
Trap hauls per trip	Average	23,068	19,407	18,486
	Standard deviation	5,965	3,342	10,251
	Coefficient of variation	25.9%	17.2%	55.5%
Sets per trip	Average	23.6	19.8	22.9
	Standard deviation	1.1	1.3	9.2
	Coefficient of variation	4.8%	6.5%	40.1%
Trap hauls per set	Average	971	980	830
	Standard deviation	222	135	307
	Coefficient of variation	22.9%	13.7%	37.0%

Table 8.--Protected species interactions, 1995-99. [Data compiled by Year of haul]

Type of interaction	1995	1996	1997	1998	1999
Observed in area					
Monk seals	0	4	3	3	2
Turtles	0	2	0	2	0
Observed in vicinity of fishing gear					
Monk seals	0	0	1	3	2
Turtles	0	0	0	0	0

Protected species interactions as reported by commercial fishermen on Federal logbooks. No direct interaction with protected species were recorded by fishermen or by NMFS observers.

Table 9.--Other catch (number of pieces) reported from the 1997 to 1999 seasons.

Species	1997	1998	1999
Kona crab	7	452	275
Octopus	48	230	69
Other species	117	1	146
TOTAL	172	683	490

Table 10.--NWHI lobster fishery regulations (FMP, amendments, and major administrative actions), 1983-98.

Year	FMP or Amendment	Primary regulatory effect ^a
1983	FMP takes effect (3/8/83)	Permits, logbooks, legal sizes, and trap dimensions
	Amendment 1	Adopt State of Hawaii measures in EEZ around main Hawaiian Islands
	Amendment 2	Limit the size of trap entrances
1985	Amendment 3	Redefine minimum size by tail width and set smaller minimum size
1986	Amendment 4	Prohibits capture of slipper lobster in refugia
1987	Amendment 5	Minimum size for slipper lobster; require escape vents in traps
1990	Amendment 6	Defines overfishing as Spawning Stock Biomass per Recruit
1991	Amendment 7	Limited access system; adjustable annual harvest quota; closed season
1993	Emergency closure	Fishery closed for entire year
1994	Emergency closure	Fishery closed following in-season revision (decrease) in harvest quota
	Amendment 8	Revision to limited access system (removal of 2-year use-lose requirement)
1995	Fishery closed	One vessel operates under experimental (exploratory) permit (with observer)
	Amendment 9	Revised annual harvest guideline; elimination of in-season adjustment to quota; removal of minimum size and condition restrictions. A regulatory "framework" procedure was implemented to ease annual regulatory changes.
1996		Risk-based management system (Amendment 9) replaces original quota system; optional retention of all sizes; small quota.
1997		Normal operations; "normal" harvest guideline (quota); observers on most vessels; VMS used by all vessels.
1998		Council established bank-specific harvest guidelines for the 1998 lobster season to prevent the potential risk of overexploiting the lobster population at Necker Island.

^aThis table should not be viewed as a substitute for the detailed Federal regulations implementing these and additional measures in the fishery.

Initial Permit Holder (F/V Name)	1992	1993	1994	1995	1996	1998
Pacific Seafoods Inc F/V Bouny						Pacific Seafoods Inc F/V Pacific Dream
Pacific Seafoods Inc F/V Cornucopia						Pacific Seafoods Inc F/V Pacific Pride
Pacific Seafoods Inc F/V Miss Jessico						Pacific Seafoods Inc F/V Miss Jessico
J. Ray F/V Archer				J. Ray No Vessel		J. Ray No Vessel
Parker Seafoods Inc F/V Sea Spray				Parker Seafoods Inc F/V Sea Spray		Sea Spray LLC F/V Sea Spray →
Marie M Corp F/V Marie M						Viking V. Inc F/V Marie M
K. Knutsen & D. Gunn F/V Aleutian Spray						K. Knutsen F/V Aleutian Spray
Shaman Inc F/V Shaman		Pacific Winds Inc F/V Haida	J. Johnson No Vessel			BEL Leasing Inc. No Vessel
Ka'upu Ltd F/V Laysan		CKM Inc F/V Petite One	Ka'upu Ltd F/V Petite One			Ka'upu Ltd F/V Petite One
Blue Hawaii Enterprise Inc F/V Haida		G. Johnson F/V Ocean Challenger	Blue Hawaii Enterprise Inc F/V Fortuna	J. Burr No Vessel		J. Burr No Vessel
DGA Inc F/V Dominis				Hawaii Protective Assoc No Vessel		Na Mea Kai Ltd. F/V Manaakalani
Yochum Trust F/V Liberty				J.H. Prescott No Vessel		D.M. Prescott No Vessel
Lusty Voyages Inc F/V Lusty				J. Hebert No Vessel		D. Gunn/D. Williscroft F/V Sea Venture
Dragon Fishing Co F/V Magic Dragon				K. Bowyer No Vessel		K. Boyer No Vessel
G. Nabeshima F/V Betty N						Vessel Mgmt Inc F/V Katy Mary
				R. Enslow -- No Vessel P. Sakuda -- No Vessel		

** = No permits were transferred in 1994

Source: NMFS SWR/PIAO

FIGURES

Figure 1.--Map of the Northwestern Hawaiian Islands (NWHI).

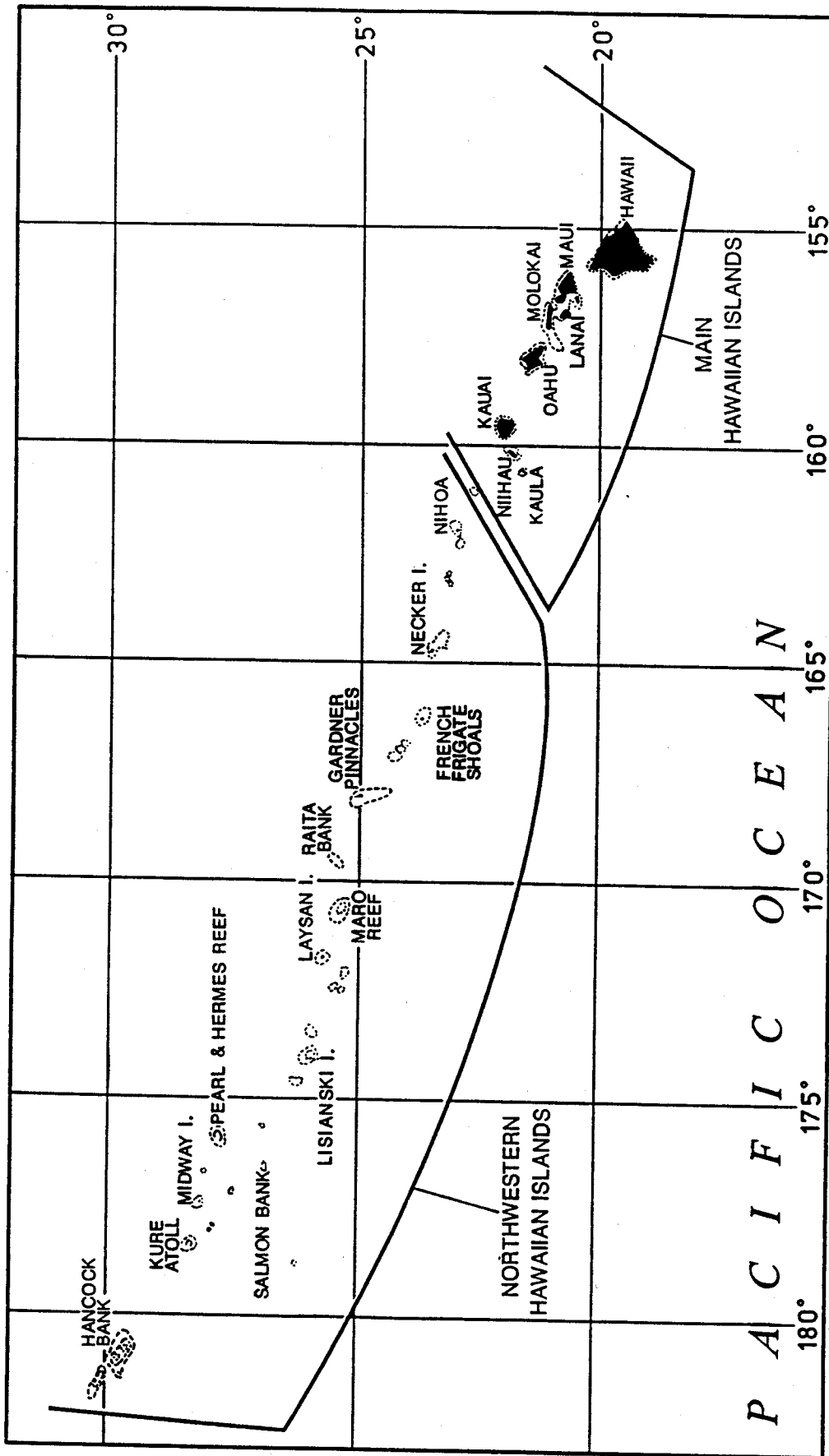


Figure 2.--NWHI lobster landings (whole pounds) and ex-vessel revenue (nominal and inflation-adjusted base year 1998 [*]), 1977-98. [Compiled by Year of landing]

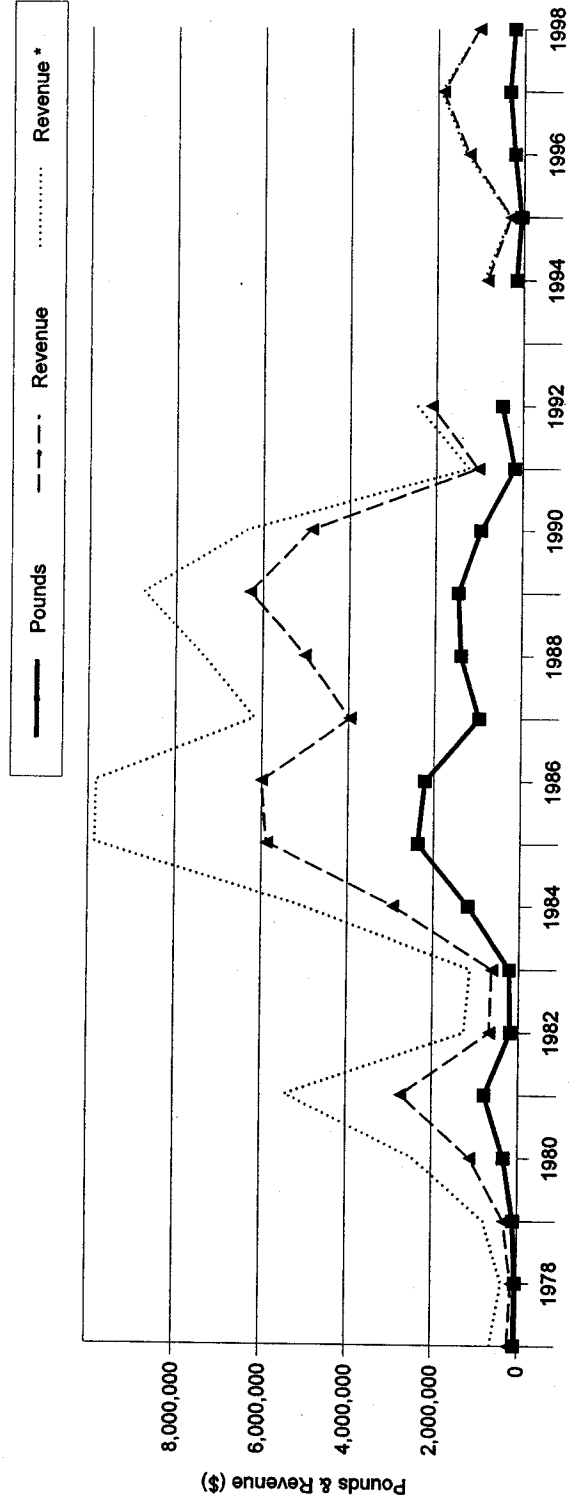


Figure 3.--NWHI landings (pounds, whole weight) of spiny and slipper lobsters, 1983-98. [Compiled by Year of landing]

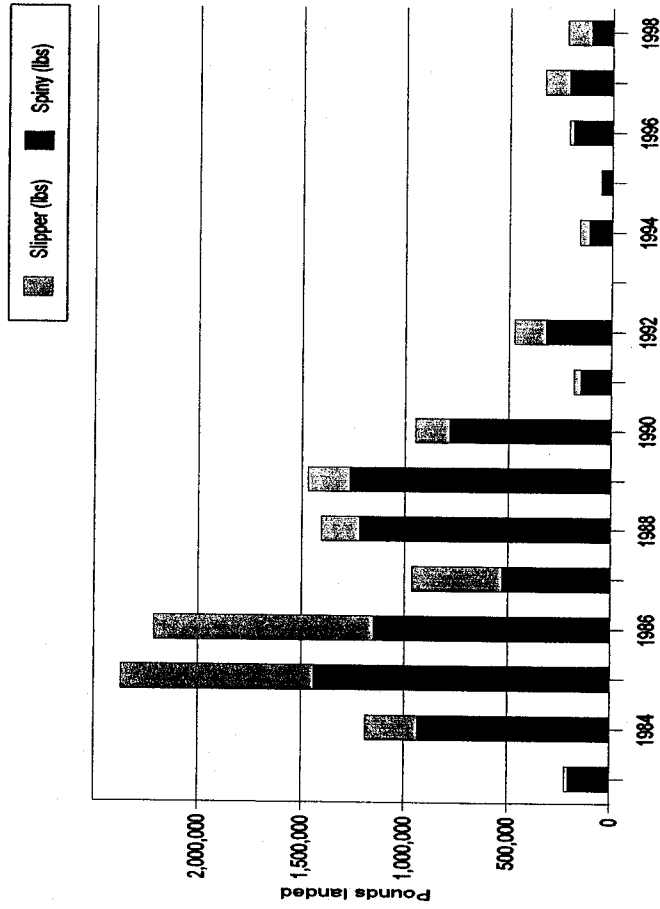


Figure 4.--NWHI lobster fishery catch rates (total and kept), 1983-98. [Compiled by Year of haul]

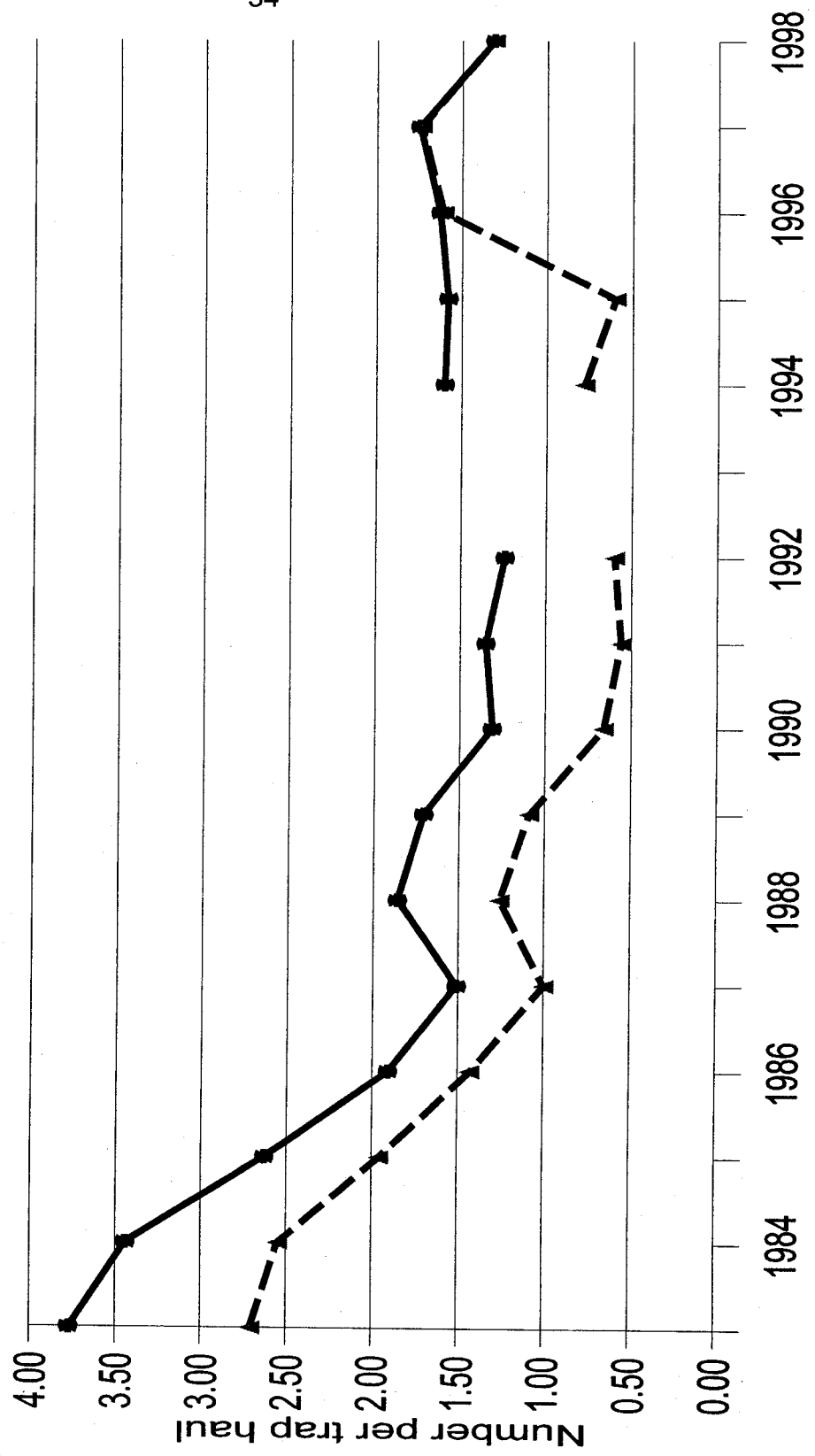
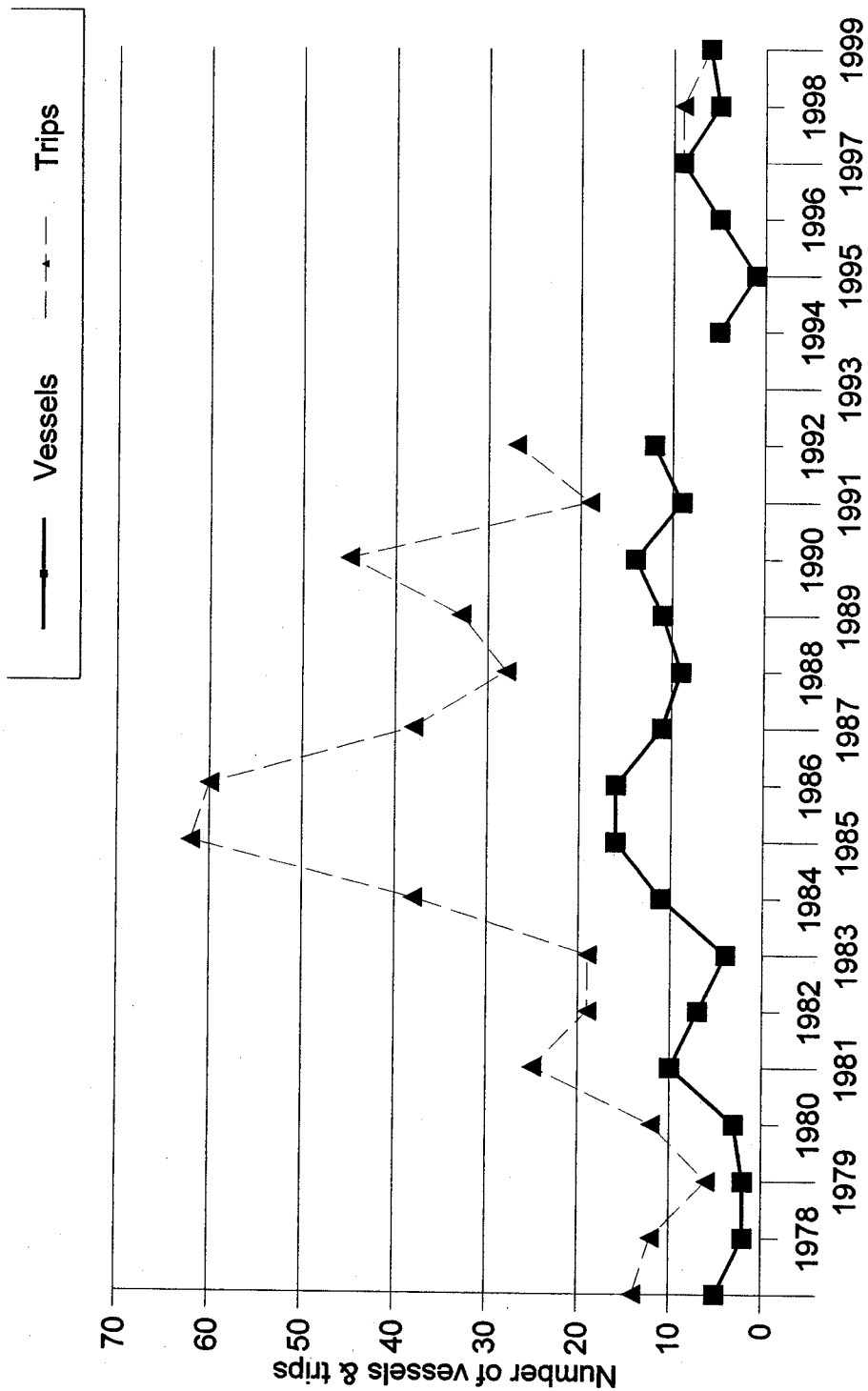


Figure 5a.--NWHI lobster fishery participation (vessels and trips), 1977-99.^a [Compiled by Year of landing]



^aNumber of vessels and trips coincide for 1994-97.

Figure 5b.--NWHI lobster fishing effort (trap-hauls) and catch (number of spiny and slipper lobsters, combined), 1983-99.
 [Compiled by Year of haul]

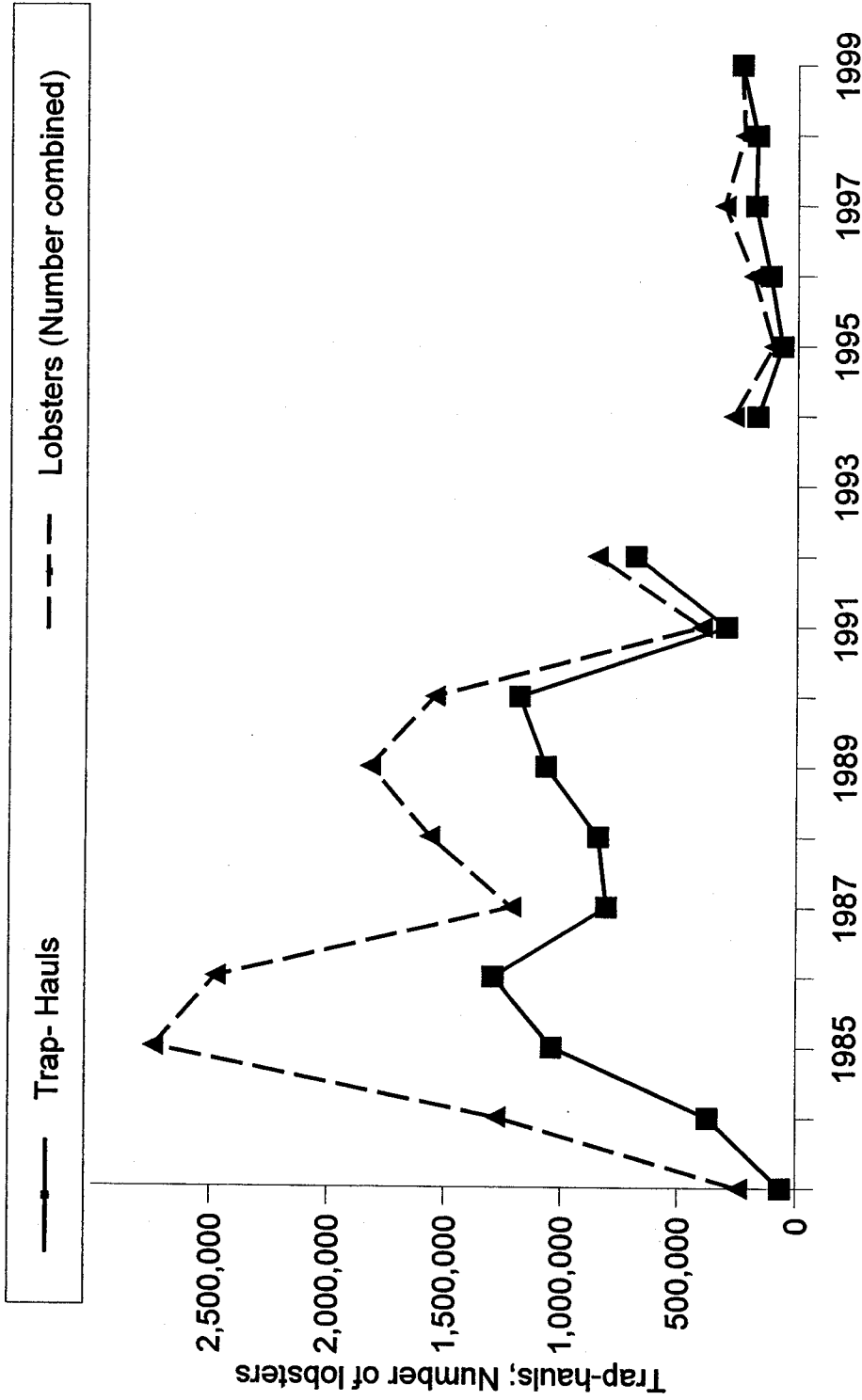


Figure 6.--NWHI lobster fishery average ex-vessel prices (per lobster [nominal and inflation-adjusted {*}], and per pound [nominal]), 1977-98. [Compiled by Year of landing]

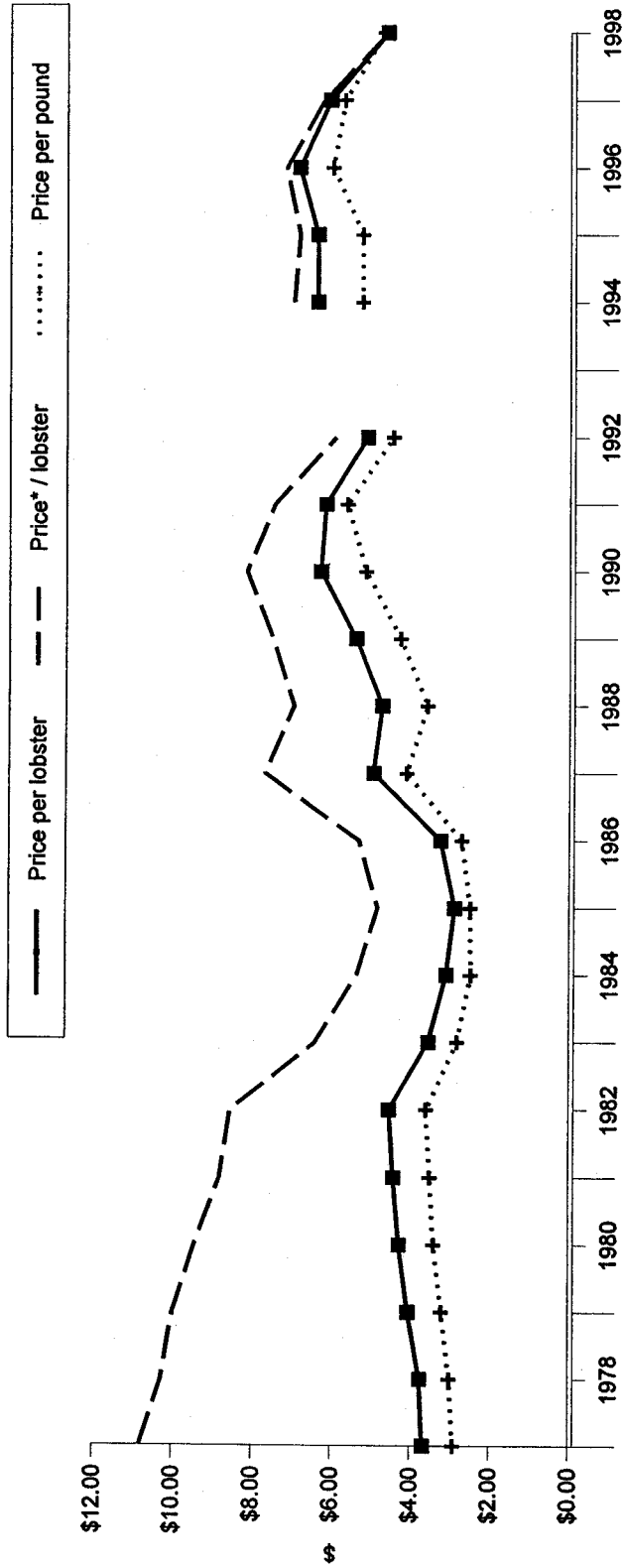


Figure 7.--NWHI lobster fishery, revenue per trap-haul (nominal [RPUE] and inflation-adjusted [RPUE*]), 1983-98.
 [Compiled by Year of haul]

