
Western Pacific Invertebrate Fisheries

INTRODUCTION

The Northwestern Hawaiian Islands (NWHI) lobster fishery is the major commercial marine invertebrate fishery in the western Pacific. A very small-scale, primarily recreational, fishery for lobster also exists in the Main Hawaiian Islands (MHI), American Samoa, Guam, and the Northern Mariana Islands. A deepwater shrimp resource is found throughout the Pacific islands but is relatively unexploited. A resource of deepwater precious coral (gold, bamboo, and pink corals) exists in Hawaii and possibly other western Pacific areas. A short-lived (1974–79) domestic fishery operated off Makapu'u Point in Hawaii, but there has been no significant precious coral harvest for 20 years. However, interest in the fishery has recently resurfaced, and one Federal permit was issued in 1997.

Management Situation

The NWHI lobster fishery, which began in 1977, harvests spiny and slipper lobsters and is governed by the Western Pacific Regional Fishery Management Council under a fishery management plan. The MHI lobster fishery is managed by the state of Hawaii, although a few offshore banks are included in the Fishery Management Plan for the Crustacean Fishery of the Western Pacific Region.

This plan was implemented in 1983 and has since been amended nine times. Many of the earlier amendments were in response to requirements to eliminate lobster trap interactions with the endangered Hawaiian monk seal (Amendments 2 and 4), protect spiny and slipper lobster repro-

ductive potentials (Amendments 3 and 5), and specify overfishing definitions (Amendment 6). The most significant change in the plan occurred in 1992. In response to continuing declines in commercial lobster catch per unit of effort, the plan was amended (Amendment 7) to include an annual 6-month closed season (January–June), limit entry into the fishery, and establish an annual catch quota. The plan was amended again in 1996 (Amendment 9) to implement a quota system based on a constant harvest rate that allows only a 10% risk of overfishing in any given year and allows the retention of all lobsters caught.

Precious corals occurring in the U.S. Exclusive Economic Zone also are managed under a fishery management plan implemented in 1983 by the Western Pacific Regional Fishery Management Council. Very limited quotas are allowed under regular permits, and experimental permits are required for unassessed coral beds.

Fishery Landings

The combined landings of spiny and slipper lobster in 1997 were 330,000 pounds whole weight (150 metric tons (t) valued at \$1,900,000) and consisted of 175,000 spiny lobster and 135,000 slipper lobster. The fishery initially targeted spiny lobster, but by 1984 gear modifications and improved markets led to an increase in slipper lobster landings. Landings peaked in 1985 at 1,300 t (worth \$6,000,000), and generally declined from 1986 to 1995. (The fishery was closed in 1993 and had shortened seasons in 1994 and 1995.) Catches of slipper lobster were significant for a brief period, 1985 to 1987, and fell into a

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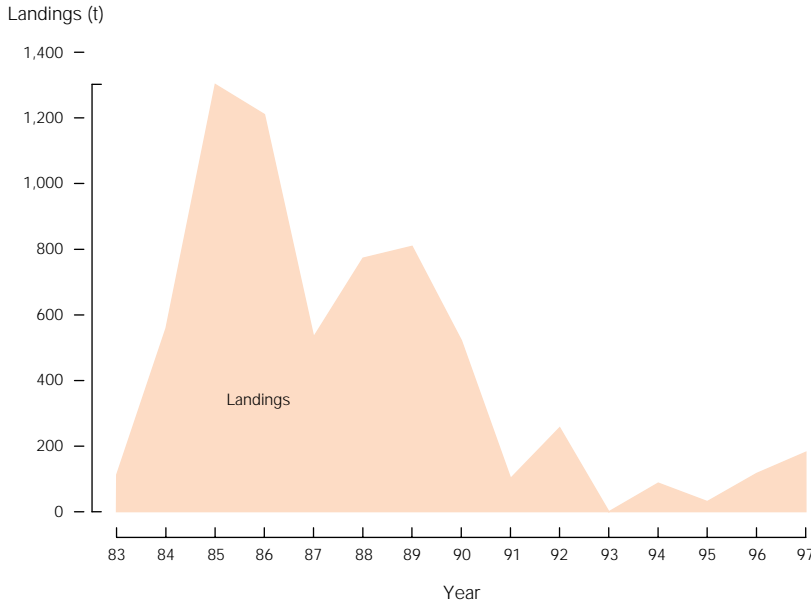


Figure 16-1
Hawaiian lobster landings (spiny and slipper lobsters) for 1983–97, in metric tons (t). The fishery was closed in 1993 and the seasons shortened in 1994 and 1995.

general decline from 1989 to 1996. Overall landings increased in 1996 and 1997 due to recovery of the population following several years of closures and shortened seasons and changes in the fishery management plan, which allowed the retention of juvenile and egg-bearing lobsters (Figure 16-1).

Most of the lobster catch is processed at sea and landed as frozen tails. In recent years, the opening of several foreign markets has led to an increase in live landings. Nonetheless, most lobsters are still landed as processed frozen tails.

Since 1983 the commercial fishery has fished plastic traps. Approximately 10 strings of 100 traps each are fished overnight at depths generally ranging from 15 to 35 fathoms (27–64 m). Historically, traps set at the deeper depths caught slipper lobster while the shallower sets caught spiny lobster. In recent years, slipper lobsters have been caught at shallow depths presumably due in part

to the “fishing down” of spiny lobsters and availability of suitable lobster habitat. Current, recent, and long-term potential yields for these species are given in Table 16-1.

SPECIES AND STATUS

Lobster

The populations of spiny and slipper lobster declined dramatically from the mid 1980’s through the mid 1990’s. Much of this decline has been attributed to the combined effect of a shift in oceanographic conditions affecting recruitment and fishing mortality in the mid 1980’s. The spawning potential ratio (SPR), which is used to measure the status of the stocks, has ranged between 74% and 88% over the past three seasons (1995–97).

Overfishing is defined in the fishery management plan in terms of recruitment¹ overfishing. The criterion used to assess overfishing is the SPR: the ratio of the spawning potential of a cohort² in a fished condition relative to that in an unfished condition. The fishery management plan defines the 20% level as a minimum SPR threshold, below which the stock is considered overfished, and establishes a warning SPR threshold at 50%, indicating the need for additional conservation measures. The NWHI lobster fishery is managed with a constant harvest rate such that there is only a 10% chance in any given year that the fishing mortality will exceed the mortality associated with the minimum SPR threshold. Since 1994, SPR values have been substantially above the minimum threshold level, indicating that the levels of fish-

¹Recruitment is the process of new generations of young fish or animals entering the stock.

²Recruits from the same year are called cohorts.

Table 16-1
Productivity in metric tons and status of Western Pacific Region lobster fishery resources.

Species	Recent average yield (RAY)	Current potential yield (CPY)	Long-term potential yield (LTPY)	Fishery utilization level	Stock level relative to LTPY
Spiny and slipper lobster	109	160	222	Full ¹	Above

¹Approaching full utilization level.

ing effort exerted during the 1994–97 commercial fishing seasons, and resulting fishing mortality and exploitation rate, would not cause long-term recruitment overfishing under equilibrium conditions (Table 16-2).

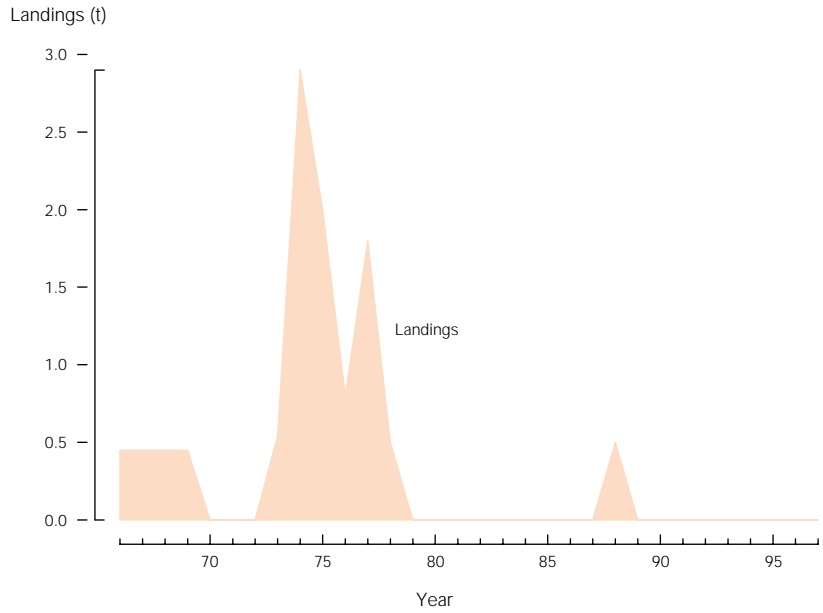
Coral

Because there has been no fishery on precious corals over the past 20 years, little solid evidence is available on recovery of the population from the low levels which existed when the Magnuson-Stevens Act was first passed in 1976. However, recent video analysis suggests that the unfished beds have recovered much of their potential and that new beds have been identified. Nonetheless, it also appears that illegal foreign fishing in some remote areas during the 1980’s had a very significant impact on some beds. In 1997, one company obtained a permit to fish precious coral at Makapu’u, Oahu, under a 2-year quota for 2,000 kilograms (kg) of pink coral and 600 kg each for bamboo and gold coral. Harvesting began in early 1998. Historical landings of precious corals are shown in Figure 16-2.

ISSUES

Bank-specific Status of Lobster Stocks

The proportion of fishing effort and reported catch at each bank within the NWHI region has varied both spatially and temporally throughout the 20-year history of this fishery. While as many as 16 banks have been fished on an annual basis, the majority of fishing effort has been directed at four banks: Maro Reef, Gardner Pinnacles, St. Rogatien, and Necker Island (Figure 16-3). The observed spatial-temporal shifts in fishing effort between banks is attributed to declines in the spiny lobster catch per unit of effort; as spiny lobsters were fished down and catch rates at one bank fell



below a minimum economic threshold, fishing effort shifted to a more productive bank. In recent years, fishing has generally been limited to Necker Island, where there has been a relatively higher concentration of spiny lobsters.

Figure 16-2
Landings of precious coral in metric tons (t), 1966–97.

Lobster Discards

In the 1980’s, problems were identified related to high catch rates of then sublegal-sized lobsters and associated discard mortality caused by top-level predators (sharks and jacks) and on-deck handling. Escape vents were mandated in 1987 to release small lobsters on the bottom or during trap hauling. Nonetheless, from 1983 through 1995 the lobster (spiny lobster and slipper lobster combined) discard rate (the reported ratio of lobsters discarded to total lobsters caught) generally increased, rising from 0.28 in 1983 to 0.62 in 1995 (Figure 16-4). Although the escape vents reduce the number of small lobsters in each trap (based on research results), the average size of lobsters in the population declined during this period.

After 1995, the discard rate decreased significantly due to a relaxation of the minimum legal size requirement in favor of an optional retain-all policy. Implementation of the retain-all policy was based on research conducted by the National Marine Fisheries Service’s Honolulu Laboratory

Year	SPR (%)
1994	74
1995	88
1996	80
1997	74

Table 16-2
Annual estimates of spawning potential ratio (SPR) for NWHI lobsters.

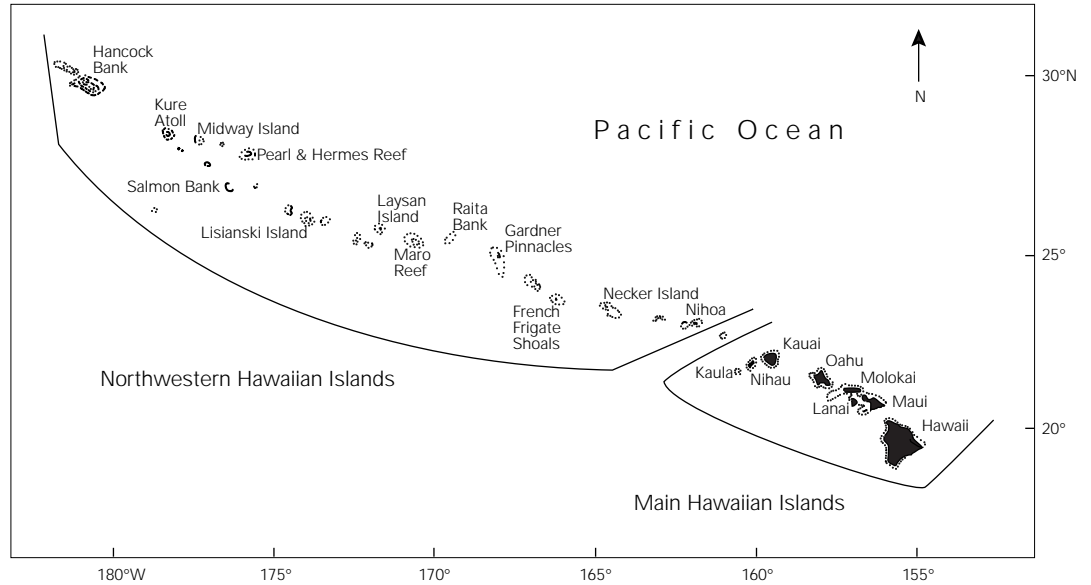


Figure 16-3
The Main Hawaiian Islands (MHI) and Northwestern Hawaiian Islands (NWHI).

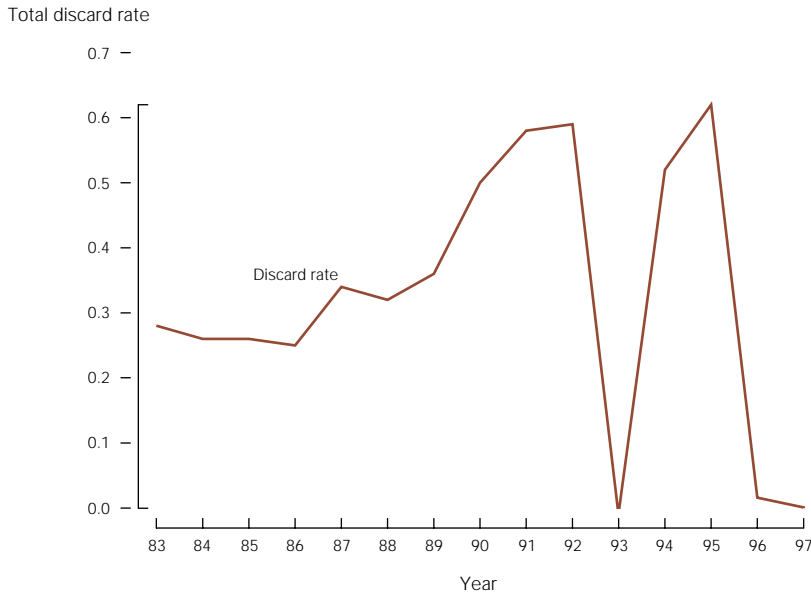


Figure 16-4
Lobster discard rate (ratio of lobsters discarded to total lobsters caught), 1983–97. The season was closed in 1993. The effect of new regulations took place in 1996.

to determine the effects of on-deck exposure on the mortality of sublegal and egg-bearing lobster. Handling mortalities for two on-deck handling methods (dry and wet) and a variety of exposure times were estimated to be as high as 77% for spiny lobsters and 44% for slipper lobsters, depending on the duration of exposure after being brought on deck.

Scientific Information and Adequacy of Assessments

Despite the multispecies nature of the NWHI lobster fishery and regulatory measures, most of the biological research has been directed at spiny lobster. Future research is needed to address knowledge shortfalls of slipper lobster biology. Estimates of the exploitable population of lobsters in the NWHI have been based solely on commercial catch and effort data from the NWHI lobster fishery as a whole. This approach neglects the fact that fishermen target areas with higher concentrations of lobsters, and may lead to estimates of exploitable biomass that are biased. More accurate assessments will require the integration of fishery-independent data into assessments in an effort to fine-tune the parameter estimates and assessment of exploitable biomass on a bank-specific basis.

Factors Affecting Abundance

In predicting the response of the NWHI lobster population to fishing harvest, it must be noted that research to date has identified a dynamic change in the spatial and temporal structure of the NWHI lobster population. One major fishing area, Maro Reef, continues to be characterized by low spiny lobster abundance. Based on

oceanographic research, size class and genetic structure analysis, and trends in catch per unit of effort, it appears that recruitment in the NWHI spiny lobster population differs between the south-eastern and northwestern segments of the archipelago and remains depressed in the northwestern segment relative to the 1975–85 level. Numerous hypotheses have been advanced to explain population fluctuations of lobsters in the NWHI, including environmental, biotic (e.g. habitat and competition), and anthropogenic (e.g. fishing). Each hypothesis by itself offers a plausible, however simple, explanation to a rather complex phenomenon operating in a system of very high dimensionality. It is likely that population fluctuations of lobsters in the NWHI will be more accurately described by a mix of the hypotheses presented, each describing a different set of mechanisms.

Multispecies Interactions

The long-term effects of fishing on ecosystems are not well understood, and cautious management controls are required. The removal of one species, or complex of species, could result in species composition shifts. Although both spiny and slipper lobsters are harvested in the NWHI lobster fishery, spiny lobster is the primary target at most banks. As large numbers of spiny lobster were being removed from banks in the NWHI, the abundance and spatial distribution of slipper lobster on these banks apparently increased; areas traditionally defined as spiny lobster habitat appear now to be occupied by slipper lobster.

Progress

Much progress in assessing the status of exploited lobster stocks of the Western Pacific Region has been made in the past several years. Shoreside sampling of the commercial landings was started in 1996 and has provided valuable information for characterizing the size-structure composition of the commercial landings. Likewise, sampling of the commercial catch by at-sea observers was conducted in 1995 and 1997, providing information to characterize the commercial catch, as well as spatial heterogeneity of lobster

abundance and size composition. These data were used to enhance the annual NWHI lobster fishery-independent survey and provide a more representative basis for future stock assessments.

FOR FURTHER READING

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