

Spiny lobster recruitment and sea level: results of a 1990 forecast

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A relation between recruitment to the fishery and sea level for the spiny lobster *Panulirus marginatus*, in the Northwestern Hawaiian Islands, was supported by data from 1985 through 1990 (Polovina and Mitchum, 1992). A forecast of future recruitment was made based on projected sea levels (Polovina and Mitchum, 1992). This note updates that forecast with two more years of data.

Fishery data from 1985 to 1990 indicated considerable inter-annual variation in recruitment strength of spiny lobster, *Panulirus marginatus*, between the two principal fishing grounds (Necker Island and Maro Reef), although separated by about 700 km (Fig. 1; Polovina and Mitchum, 1992). Recruitment strength variation between the two fishing areas was measured as the ratio of the commercial landings from Maro Reef divided by the combined commercial landings from Necker Island and Maro Reef. A strong correlation was ob-

served between this measure of recruitment strength at Maro Reef and the sea level gradient along the Northwestern Hawaiian Islands, advanced by four years (Polovina and Mitchum, 1992). The sea level gradient was measured as the difference in sea level between tide gauges at French Frigate Shoals, southeast of Maro Reef, and Midway Island, northwest of Maro Reef. A high proportion of the commercial landings came from Maro Reef following a steep gradient, while relatively few spiny lobsters were caught at Maro Reef following a flat gradient. The four-year lag is based on the minimum legal harvest size which, for the spiny lobster is about three years old, after benthic settlement. Prior to benthic settlement, the larvae are planktonic for about one year.

Since sea level gradient appears to lead recruitment to the fishery by four years, the relation can provide up to a four-year forecast. Based on data through 1990, it

was forecast that in 1991 recruitment to the fishery at Maro Reef would be weak but would recover in 1992 relative to recruitment at Necker Island (Fig. 2). The 1991 and 1992 fishery data show this forecast correct (Fig. 2), although the fishery for the entire Northwestern Hawaiian Islands was relatively weak in 1992. Thus, while sea level gradient index does forecast the relative strength of recruitment at Maro Reef, it is not, by itself, an index of absolute recruitment strength.

It has been argued that sea level gradient measures the strength of the Subtropical Counter Current, which appears to intersect the Hawaiian ridge as three narrow eastward flowing bands at 20, 24, and 26 degrees north latitude (Polovina and Mitchum, 1992; White and Walker, 1985). Recent studies of *P. marginatus* larval distribution find a relatively high abundance of late stage larvae consistently present near lat. 26°N, and tracks from Argos drifter buoys drogued at 30 m indicate buoy entrainment along lat. 26°N.¹ These results provide some additional support to our original hypothesis that a positive relationship exists between the strength of the Subtropical Counter Current and local larval survival, retention, and recruitment to the fishery at Maro Reef (Polovina and Mitchum, 1992).

Literature cited

Polovina, J. J., and G. T. Mitchum.

1992. Variability in spiny lobster *Panulirus marginatus* re-

¹ Polovina, J.J., and R.B. Moffitt. In review. The spatial and temporal distribution of the larvae of the spiny lobster (*Panulirus marginatus*) in the Northwestern Hawaiian Islands.

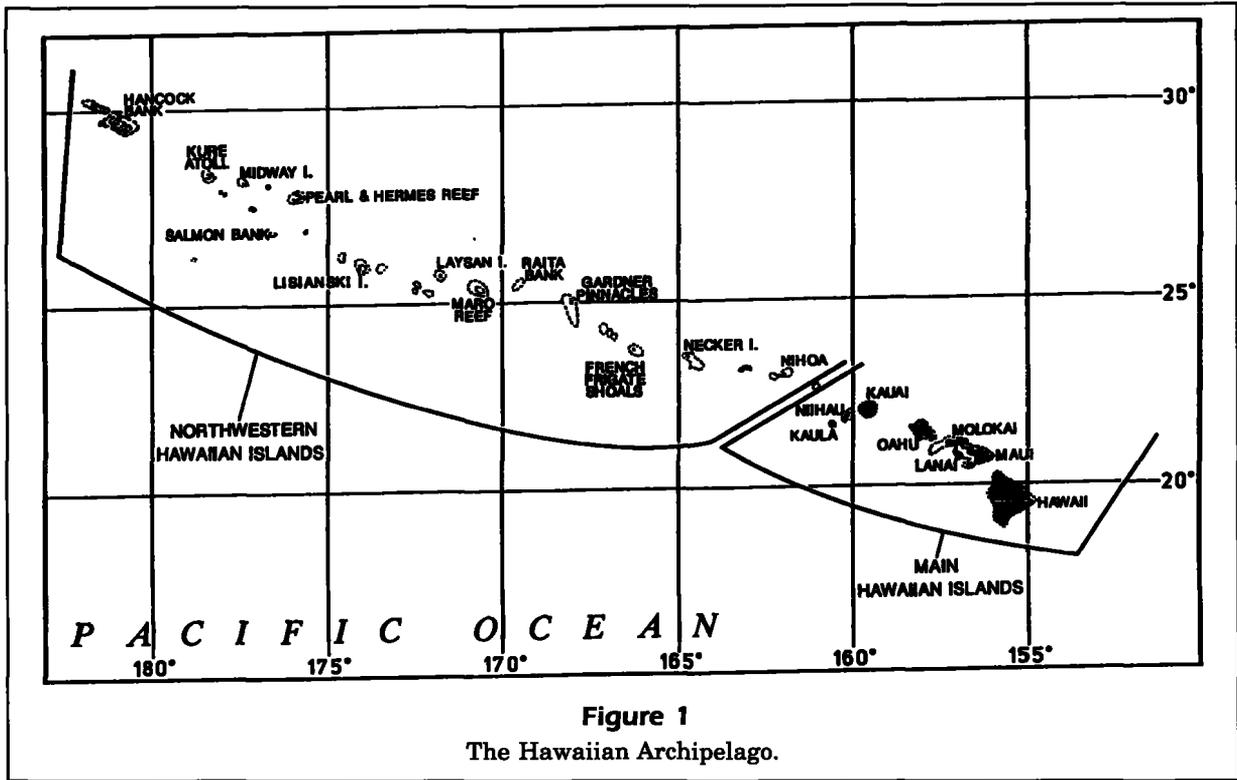


Figure 1
The Hawaiian Archipelago.

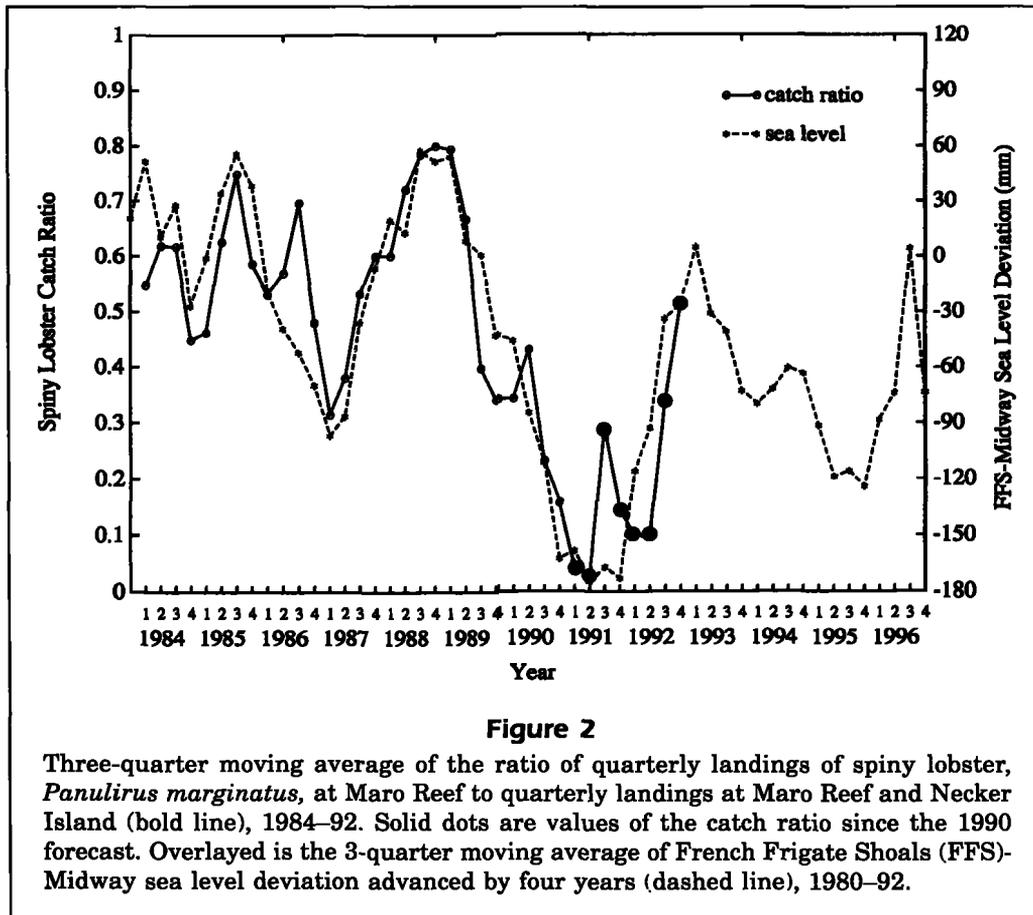


Figure 2

Three-quarter moving average of the ratio of quarterly landings of spiny lobster, *Panulirus marginatus*, at Maro Reef to quarterly landings at Maro Reef and Necker Island (bold line), 1984–92. Solid dots are values of the catch ratio since the 1990 forecast. Overlaid is the 3-quarter moving average of French Frigate Shoals (FFS)-Midway sea level deviation advanced by four years (dashed line), 1980–92.

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White, W. B., and A. E. Walker.

1985. The influence of the Hawaiian Archipelago upon the wind-driven subtropical gyre in the Western North Pacific. *J. Geophys. Res.* 90 C4:7061–7074.