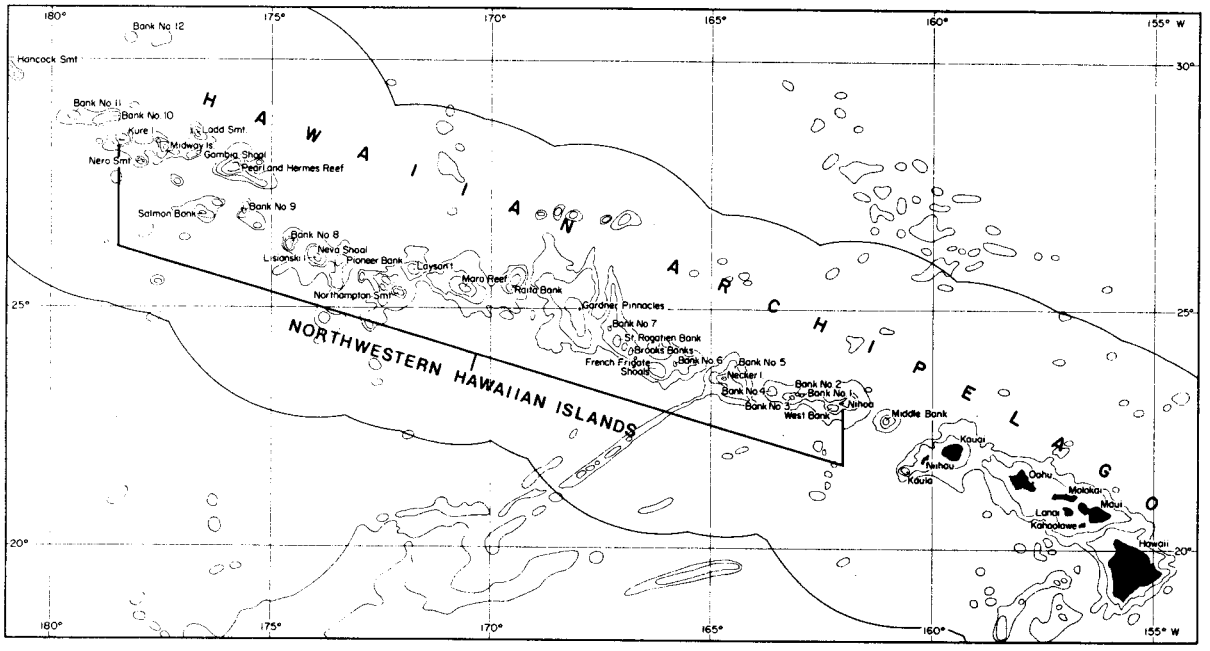


Figure 2.—The Hawaiian Archipelago, including the Northwestern Hawaiian Islands.

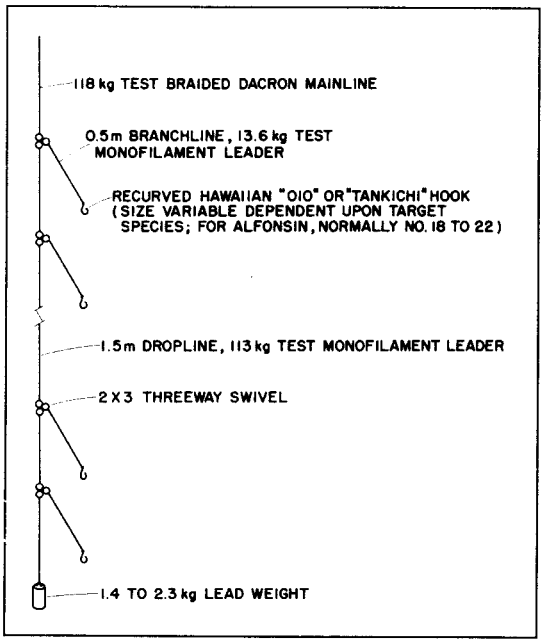


Figure 3.—Terminal rig of Hawaiian deep-sea handline gear when fishing for alfonsin, *Beryx splendens*.

Table 1.—Total number and catch per unit effort (CPUE × $10^{-1}$) (by hook-h) of groundfish taken by handline at three seamounts along the northern Hawaiian Ridge.

| | SE Hancock | | NW Hancock | | Seamount 11 | |
|---|---|---|---|---|---|---|
| | No. | CPUE | No. | CPUE | No. | CPUE |
| *Etmopterus* sp. | 2 | 0.02 | 1 | 0.01 | 1 | 0.02 |
| *Squalus* sp. | 51 | 0.48 | 11 | 0.09 | 55 | 1.26 |
| *Polymixia berndti* | 9 | 0.08 | 4 | 0.03 | | |
| Moridae | 1 | 0.01 | 1 | 0.01 | | |
| Macrouridae | | | | | 1 | 0.02 |
| *Beryx splendens* | 24 | 0.23 | 55 | 0.43 | 24 | 0.55 |
| *Hozukius guyotensis* | 11 | 0.10 | 10 | 0.08 | | |
| *Helicolenus avius* | 2 | 0.02 | | | | |
| Scorpaenidae | | | | | 1 | 0.02 |
| *Epinephelus quernus* | | | | | 4 | 0.09 |
| *Plectranthias kelloggi* | 2 | 0.02 | 2 | 0.02 | | |
| *Cookeola boops* | | | | | 6 | 0.14 |
| *Decapterus tabl* | 12 | 0.11 | 5 | 0.04 | | |
| *Pseudopentaceros wheeleri* | 247 | 2.33 | 341 | 2.67 | 14 | 0.32 |
| *Parapercis* sp. | 1 | 0.01 | | | | |
| *Scomber japonicus* | 44 | 0.42 | 2 | 0.02 | | |
| *Promethichthys prometheus* | 1 | 0.01 | | | 8 | 0.18 |
| *Ruvettus pretiosus* | 1 | 0.01 | | | | |
| *Hyperoglyphe japonica* | 9 | 0.08 | 20 | 0.16 | | |
| Total fishes | 417 | 3.94 | 452 | 3.53 | 114 | 2.61 |

the NWHI banks south of Kure Atoll. Humphreys et al. (1984) attributed the sharp demarcation of the ichthyofauna around the 180th meridian to differences in summit depth and temperature.

Little effort was expended at other seamounts in the SE-NHR. At Koko Seamount, 73.2 hook-h of fishing produced 11 *H. avius*, and at Kammu Seamount, 6 pelagic armorhead and 4 dogfish were taken in 140.0 hook-h. Twenty pelagic armorhead, 1 dogfish, 1 medai, and 1 broad alfonsin were caught at Colahan Seamount in 80.4 hook-h of fishing and at Yuryaku Seamount, there was no catch in 36.0 hook-h.

The SWFC surveys have shown that alfonsin caught on the slopes with handlines were significantly larger than those taken on the summit by trawling ($F = 4,644.6$; $df = 1,562$; $P < 0.0001$). Handline-caught alfonsin from the slope ranged from 24.3 to 41.3 cm standard length (SL) and averaged 33.0 cm SL but trawl-caught alfonsin from the summit ranged from 12.5 to 31.5 cm SL and averaged only 16.5 cm SL (Fig. 4). Since most of the trawl-caught alfonsin from the summit were juveniles and those caught on the slope were adults, this difference in size classes between the two habitats may be attributed to depth preference of the age classes. Our results corroborate the findings by Iguchi (1973) who reported that alfonsin taken from seamounts in the SE-NHR at depths >400 m averaged 37.7-38.4 cm, whereas those taken in depths <300 m were composed of two modal size classes at 16.8 and 21.9 cm. He postulated that alfonsin initially occupy relatively shallow waters as juveniles and progressively move into deeper water as they grow larger.

The size of handline- and trawl-caught pelagic armorhead was similar, although large specimens of *P. wheeleri* (49.5-54.7 cm total length, 2.0-3.4 kg) have been hooked in deep waters at French Frigate Shoals, Ladd Seamount, and Kure Atoll in the NWHI (Randall 1980; Tagami and Humphreys in prep). The occurrence of this species as far south as French Frigate Shoals has spurred speculation that the distributional range of pelagic armorhead through the Hawaiian Archipelago is much wider than previously believed.

To test consumer reaction, approximately 240 kg of four species of frozen groundfishes from the seamounts were placed on sale in July 1983 through the Honolulu fish auction. The akodai-like *H. guyotensis* received the highest prices ranging from $0.25 to $0.57/kg. Alfonsin also received $0.25/kg, whereas pelagic armorhead received $0.23/kg and medai received $0.11/kg. The pelagic armorhead were taken by trawl and handline, whereas the other three species were captured exclusively with hook and line. The limited market test suggested that product promotion would be necessary to develop a commercially feasible domestic fishery for seamount species. Similarly when pelagic armorhead was initially marketed in Japan, it met stiff consumer resistance. Extensive advertising and sales promotion there, however, boosted market demands ([U.S.] NMFS 1975).

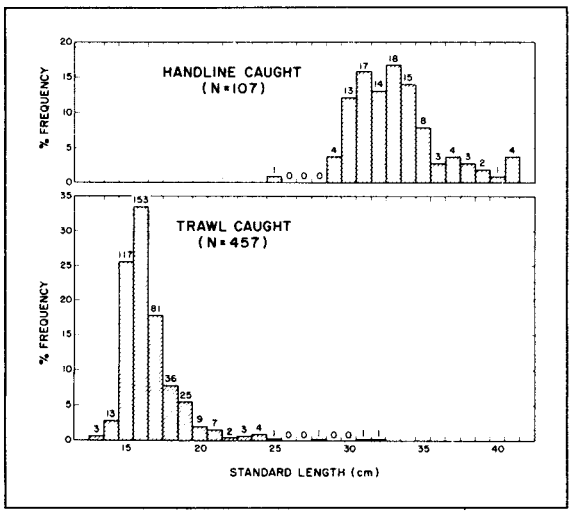


**Figure 4.—Length-frequency comparison of handline versus trawl-caught alfonsin, *Beryx splendens*.**

## OTHER RESEARCH

Exploratory surveys for deep groundfish were initiated by the Pacific Tuna Development Foundation (PTDF) through the Government of Guam in 1980 and the State of Hawaii in 1981. In both surveys, the chartered fishing vessels used primarily vertical handlines, similar to the gear described earlier.

The PTDF-Guam surveys, conducted on the deep banks and seamounts of the South Honshu Ridge and around the Northern Mariana Islands, targeted depths from 40 to 640 m (22-350 fathoms); most of the effort was focused at depths <274 m (150 fathoms). As a result, the catch was composed primarily of fishes in the tropical snapper-grouper complex. Limited effort in waters deeper than 366 m (200 fathoms) yielded occasional catches of polymixiids, gempylids, and squalids (Hosmer and Kami 1981). Although the alfonsin was targeted during the surveys, none was taken. In 1977, however, two chartered Korean vessels with bottom longline gear caught 15 broad alfonsin in the Northern Marianas. Another Japanese vessel under charter to the Commonwealth of the Northern Mariana Islands caught about 227 kg (500 lb) of broad alfonsin near Saipan with a bottom gill net (Uchida 1983).

The broad alfonsin, the pomfret, *Eumegistus illustrus*, and other groundfishes that inhabit depths greater than those usual for commercially valuable snappers and groupers were sought during exploratory surveys conducted around the main Hawaiian Islands by the PTDF and the Hawaii State Department of Land and Natural Resources. Only a single broad alfonsin off Lanai and two off Oahu in depths of about 320 m (175 fathoms) were taken; however, the pomfret was moderately abundant (75 caught, 72.2% of the catch by weight) and appeared to hold the most potential as a new deep groundfish resource. In a consumer acceptance test at the Honolulu fish auction, fresh pomfret received prices ranging from $0.39 to $0.82/kg while fresh broad alfonsin received $0.45/kg (Okamoto 1982).

## FUTURE RESEARCH AND CONCLUSIONS

A major problem of deep-sea multihook gear has been the tangling of hooks. A proposed solution involves the use of terminal rigs with dropper lines constructed of polyvinyl chloride pipes, which can be utilized on vertical handlines as well as on bottom longlines. This experimental gear, originally devised in the eastern Caribbean Sea for use over extremely rocky bottom and to alleviate the hauling effort, was found to be extremely successful and effectively caught all the species of snapper inhabiting waters down to 549 m (300 fathoms) (Crowley 1982). In depths of 183-366 m (100-200 fathoms), 3,000 or more hooks could be set and hauled by a three-man crew in one day compared with no more than 1,500 hooks set and hauled in a day with conventional nylon gear.

In conclusion, preliminary findings reveal the existence of a potentially exploitable groundfish resource in the SE-NHR seamounts; however, we need to determine the feasibility of a domestic hook-and-line fishery on these slopes and to decide how such a resource should be managed. The feasiblity of such a domestic fishery will ultimately depend on whether market prices will cover the inevitably high operational costs.

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