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Tests show that traps are a better means of catching sablefish than trawls.

Results of Comparative Trawl and Trap Fishing off Oregon for Sablefish, *Anoplopoma fimbria*

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ABSTRACT

A comparison of catches taken in trawls and traps fished at the same time and location off northern Oregon indicated that the traps were more selective for sablefish. Moreover, the trap-caught sablefish averaged 5.2 inches longer than, and were twice as heavy as the trawl-caught sablefish (average fork length 21.0 inches, average weight 3.4 lb). The percentage of marketable sablefish (4 lb or heavier) in the trap catches was 93.3 percent, but only 57.2 percent in the trawl catches.

Sablefish, *Anoplopoma fimbria*, also known as black cod, range from Cedros Island, Baja California, to the Bering Sea and Japan (Miller and Lea, 1972). They occur from the intertidal zone to depths of almost 900 fathoms but are most commonly taken in trawl catches off Oregon and Washington at depths between 100 and 500 fathoms (Alverson et al., 1964). Sablefish have long been an important species in the longline and trawl fisheries along the Pacific coast of the United States and British Columbia. These fish are usually smoked or salted, but are not often sold fresh because of their high oil content.

Scientists of the National Marine Fisheries Service (NMFS) in Seattle have been experimenting since 1969 with trap fishing systems to capture sablefish. Initially, the work was aimed at determining the feasibility of using traps to harvest sablefish (Hipkins and Beardsley, 1970; Hughes et al., 1970). More recently, traps have been used to capture sablefish for tagging in growth and migration studies.

The traps have been successful in catching sablefish, and experience indicates they are selective for this species (Hughes et al., 1970). An opportunity to compare the catches of traps and bottom trawls took place in October 1971, when a 17-day cruise was made on the NMFS research vessel *John N. Cobb* to assess the sablefish resource off the northern Oregon coast. During the cruise, traps and trawls were fished simultaneously in the same location.

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FISHING GEAR

Gear included 28 collapsible, rectangular fish traps, 8 feet long by 34 inches wide by 34 inches high. The traps were constructed of 10-gauge steel mesh with 2- by 2-inch openings (Figure 1). All traps had a single fyke-type tunnel entrance constructed of nylon web (High, 1971). Each tunnel was fitted with a closing device consisting of a nylon noose, large rubber bands, and a magnesium-link closing device which closed the tunnel after approximately 24 hours of fishing to standardize fishing times. Traps were fished five per string and attached at 100-fathom intervals to a 5/8-inch polypropylene groundline with a 6-ft gangion ending on a snap-swivel. Each end of the string was rigged with a 35-lb halibut anchor, polypropylene buoy line, inflatable surface buoys, and a lighted flagpole. Cut herring placed in perforated 2-quart plastic jars was used to bait the traps. The jars were loose in the traps.

The trawl was a standard 400-mesh Eastern otter trawl with a 71-ft headrope, and was constructed of 4-inch-mesh nylon with 3½-inch-mesh cod end and rigged with eleven 8-inch-diameter trawl floats. Galvanized steel V-doors, 5 by 7 feet, were used with 30-fathom dandylines.

METHODS

All fishing was conducted in an area between 25 and 34 nautical miles southwest of the mouth of the Columbia River. Originally, two trawl hauls were planned, setting two strings of trap gear at 50-fathom-depth intervals between 100- and 450-fathom depths, but severe weather conditions during most of the cruise restricted sampling to depths of 100, 150, 200, and 250 fathoms and to only one trawl haul at each depth of sampling. The two strings of traps were set approximately 4 nautical miles apart at each depth, except at 250 fathoms where five strings were set. The single trawl haul at each

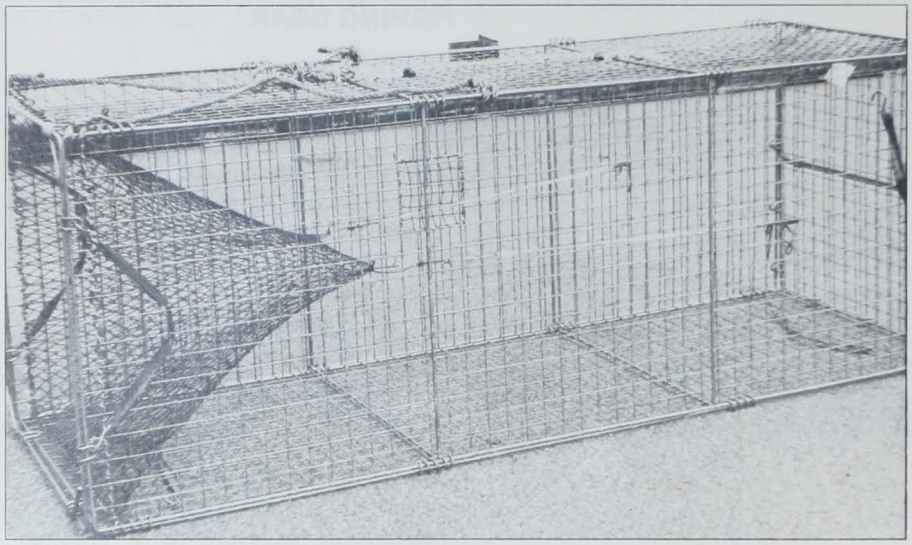

Figure 1.—Collapsible sablefish trap with single fyke and magnesium-link closing device.

depth was made between the two strings of traps. Trawl hauls at 100, 150, and 250 fathoms were of 1-hr duration; the haul at 200 fathoms was abbreviated because the net snagged after 14 minutes of fishing.

RESULTS

The composition of the catches by the two types of gear indicate that the traps were selective for certain species, particularly sablefish (Table 1). At 200 and 250 fathoms, they captured only sablefish. At 100 fathoms the traps also caught Pacific halibut, lingcod, and Dungeness crab; at 150 fathoms they took arrowtooth flounder, Pacific halibut, and lingcod, in addition to sablefish. In contrast to the trap gear, the trawl captured a variety of fish, including rockfish, Pacific hake, arrowtooth flounder, sole, and sablefish.

Catches of sablefish by both types of gear generally increased with depth, but differed distinctly in length and weight at all depths fished (Table 2). The mean round weights of trap- and trawl-caught sablefish taken at all depths were 6.8 and 3.4 lb, respec-

Table 1.—Species taken in traps and trawl hauls off northern Oregon in October 1971.

		Species by gear and depth							
		100 fms		150 fms		200 fms		250 fms	
Common name	Scientific name	Traps	Trawl	Traps	Trawl	Traps	Trawl*	Traps	Trawl
Sablefish	*Anoplopoma fimbria*	X	X	X	X	X	X	X	X
Brown cat shark	*Apristurus brunneus*	—	—	—	—	—	—	—	X
Spiny dogfish	*Squalus acanthias*	—	—	—	X	—	X	—	—
Big skate	*Raja binoculata*	—	X	—	X	—	—	—	X
Starry skate	*Raja stellulata*	—	X	—	X	—	X	—	X
Ratfish	*Hydrolagus colliei*	—	X	—	X	—	X	—	—
Pacific hake	*Merluccius productus*	—	—	—	X	—	X	—	X
Grenadier	Macrouridae	—	—	—	—	—	—	—	X
Pacific sanddab	*Citharichthys sordidus*	—	X	—	—	—	—	—	—
Arrowtooth flounder	*Atheresthes stomias*	—	X	X	X	—	X	—	X
Pacific halibut	*Hippoglossus stenolepis*	X	—	X	—	—	—	—	—
Petrale sole	*Eopsetta jordani*	—	—	—	X	—	—	—	—
Dover sole	*Microstomus pacificus*	—	X	—	X	—	X	—	X
Rex sole	*Glyptocephalus zachirus*	—	X	—	X	—	X	—	X
Lingcod	*Ophiodon elongatus*	X	—	X	—	—	—	—	—
Aurora rockfish	*Sebastes aurora*	—	—	—	—	—	—	—	X
Bocaccio	*S. paucispinis*	—	X	—	—	—	—	—	—
Silvergray rockfish	*S. brevispinis*	—	X	—	—	—	—	—	—
Canary rockfish	*S. pinniger*	—	X	—	—	—	—	—	—
Darkblotched rockfish	*S. crameri*	—	X	—	X	—	X	—	—
Redstripe rockfish	*S. proriger*	—	X	—	—	—	—	—	—
Pacific ocean perch	*S. alutus*	—	X	—	X	—	X	—	—
Stripetail rockfish	*S. saxicola*	—	X	—	—	—	—	—	—
Splitnose rockfish	*S. diploproa*	—	—	—	X	—	X	—	—
Yelloweye rockfish	*S. ruberrimus*	—	—	—	—	—	X	—	—
Redbanded rockfish	*S. babcocki*	—	—	—	X	—	—	—	—
Sharpchin rockfish	*S. zacentrus*	—	X	—	—	—	—	—	—
Greenstriped rockfish	*S. elongatus*	—	X	—	—	—	—	—	—
Rosethorn rockfish	*S. helvomaculatus*	—	X	—	X	—	X	—	—
Shortspine thornyhead	*Sebastolobus alascanus*	—	—	—	X	—	X	—	X
Eelpout	*Lycodes* sp.	—	X	—	—	—	—	—	—
Dungeness crab	*Cancer magister*	X	X	—	—	—	—	—	—
Total species		4	20	4	16	1	14	1	11

*This haul snagged and was pulled up after 14 minutes.

Table 2.—Comparison of lengths and weights of sablefish taken at three depths[1] by traps and trawl.

Depth (fm)	Gear	Number of sablefish	Mean fork length (inches)	Range (inches)	Mean round weight (lb)	Computed t 0.05 values
150	Traps	5	24.2	18.9-28.7	5.33	
	Trawl	45	18.3	14.2-25.6	2.21	
200	Traps	76	25.0	16.9-36.6	5.89	
	Trawl	6	22.4	18.1-35.4	4.13	
250	Traps	113	27.0	18.5-35.4	7.47	
	Trawl	330	21.5	16.1-37.8	3.65	
All depths	Traps	194	26.2	16.9-36.6	6.81	13.98*[2]
	Trawl	381	21.0	14.2-37.8	3.40	12.42*[3]

* Significant at the 0.05 level.
[1] The 100-fm depth was not included in the table since a total of only six sablefish were captured.
[2] Overall mean fork lengths (inches) compared.
[3] Overall mean round weights (lb) compared.

tively, whereas the mean lengths were 26.2 and 21.0 inches respectively. The calculated t values in comparing the mean lengths and weights of trap- vs. trawl-caught sablefish at all depths were significant at the 5 percent level (14.0 and 12.4, respectively). The percentage of marketable sablefish (4 lb or heavier round weight) was 93.3 percent of the trap-caught and 57.2 percent of the trawl-caught sablefish.

Length frequencies (Figure 2) and sex composition of sablefish taken in traps and those taken by trawl at 250 fathoms differed considerably. Large sablefish[1] predominated in the trap catches, whereas undersize sablefish comprised nearly half of the trawl catch. Of the trap-caught sablefish, 78 percent were females; whereas of the trawl-caught sablefish, only 39 percent were females.

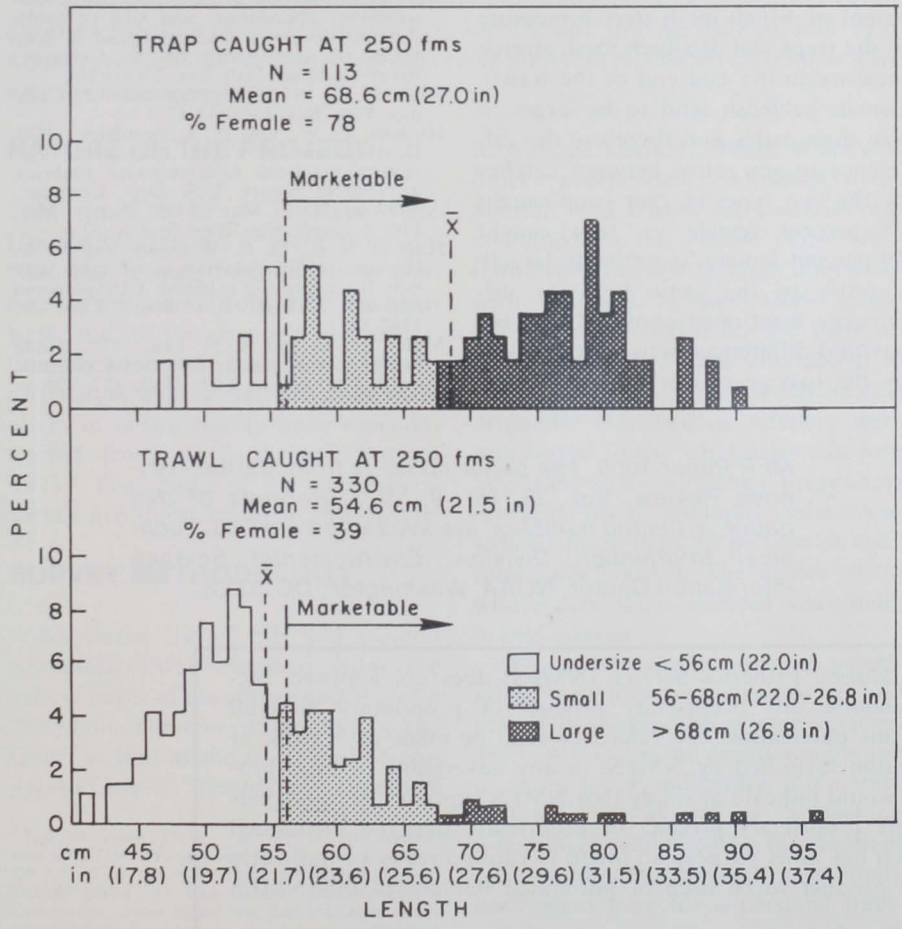

Figure 2.—Comparison of length frequencies of sablefish captured in traps and in trawl at 250 fathoms. Marketable fish are larger than 56 cm (22.0 inches) or greater than 4 lb round weight.

DISCUSSION

Large predatory bottom fishes are apparently most apt to be taken in the fish traps used. In coastal areas off the Pacific Northwest, these would include large specimens of sablefish, Pacifc halibut, arrowtooth flounder, lingcod, and some rockfishes. In previous cruises where traps were used, a few sole and rockfish were also captured in the traps (Hughes et al., 1970). During this cruise, however, none were caught in the traps although they were present in the trawl hauls. No Pacific halibut or lingcod and few large sablefish were captured in the trawl, but they did occur in some of the trap catches (Table 1). These fishes were probably able to avoid the trawl.

Both trap and trawl catches indicate the greater availability of sablefish at 250 fathoms than at lesser depths and represent relative indices of sablefish abundance. Data obtained during past cruises and from commercial vessels indicate sablefish catches in traps are usually greatest at depths between 200 and 400 fathoms. Heyamoto and Alton (1965) found that the catch rates for sablefish taken in trawls were usually highest at stations from 200 to 450 fathoms. At these depths, halibut, lingcod, arrowtooth flounder, and some rockfishes are less common than at lesser depths (Alverson et al., 1964).

Past data on trap catches also indicate that the catch ratio of sablefish to other species varies with depth,

[1] Commercial fish processors usually classify sablefish as being either large (greater than 26.8 inches), small (26.8 to 22.0 inches), or undersize (less than 22.0 inches).

evidently because of changes in species distribution with depth. This relation was indicated by 430 trap hauls (Table 3) made during 1970 by Captain Sig Jaeger[2] on the MV *Seattle* off Oregon, Washington, and British Columbia. In depths of less than 150 fathoms, incidental catches including rockfish, lingcod, and flatfish, ranged from 48 to 60 percent; at depths greater than 250 fathoms, the incidental catches dropped to 2 percent or less. Since most of the trap fishing in past years was conducted between 200 and 450 fathoms, these trap catches seem to indicate that traps are somewhat more selective for sablefish than would have been the case if they had been fished in shallower depths. Hughes et al. (1970), using large modified king crab-type traps at depths between 155 and 203 fathoms off the coast of Oregon, found that a total of 222 individual trap hauls took 29,157 lb of sablefish and an incidental catch of only five yelloweye rockfish, two Dover sole, one arrowtooth flounder, and one octopus. Regardless of relative abundance of different species, however, data collected to date suggest that sablefish are captured by traps more readily than are most other species.

The size differences between the trawl-caught sablefish (average fork length 21.0 inches[3]) and the much larger trap-caught sablefish (average fork length 26.2 inches, Table 2) must be primarily related to behavioral differences (trawl avoidance and more predaceous feeding habits of the larger sablefish) rather than mesh selectivity since the mesh sizes were similar in both types of gear (equivalent of 4-inch mesh stretch measure in the traps and 3½-inch mesh stretch measure in the cod end of the trawl). Female sablefish tend to be larger in size than males and therefore the difference in sex ratios between catches by the two types of gear (trap-caught 78 percent female vs. trawl-caught 39 percent female) is probably largely a result of the same behavior differences mentioned above. These behavioral differences between fish taken by the two gears work to the advantage of the trap fisherman. For example, Figure 2 shows that a greater proportion of large sablefish (>68 cm) was taken by trap gear than was taken by trawl gear in the same general fishing area. Undersize sablefish (<56 cm) are usually unmarketable on the Pacific coast and fishermen often receive considerably less per pound for small sablefish (56-68 cm) than they receive for large sablefish (>68 cm). In the catches shown in Figure 2, the trap-caught sablefish are considerably more valuable per pound than trawl-caught sablefish because of their larger average size.

Table 3.—Variation in incidental trap catches by depth. Data from 430 trap hauls by a commercial fisherman (Jaeger, personal communication).

Depth range (fm)	No. of traps hauled	No. of sablefish	No. of incidental fish	Percentage of incidental fish (by number)
76-100	7	1	1	50
101-125	17	15	14	48
125-150	41	55	83	60
151-175	25	211	24	10
176-200	10	60	41	41
201-225	38	390	23	6
226-250	57	449	15	3
251-275	144	1,641	39	2
276-300	91	1,185	18	1
Total	430	4,007	258	6.05

LITERATURE CITED

Alverson, D. L., A. T. Pruter, and L. L. Ronholt. 1964. A study of demersal fishes and fisheries of the northeastern Pacific Ocean. H. R. MacMillan Lectures in Fisheries, Inst. Fish., Univ. B.C., Vancouver, 190 p.

Heyamoto, H., and M. S. Alton. 1965. Distribution, abundance, and size of sablefish (*Anoplopoma fimbria*) found in deep water off the mouth of the Columbia River. Commer. Fish. Rev. 27(11):1-8.

High, W. L. 1971. Trapping sablefish. Commer. Fish. Rev. 33(6):43-47.

Hipkins, F. W., and A. J. Beardsley. 1970. Development of a pot system for harvesting blackcod (*Anoplopoma fimbria*), a progress report. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Mar. Fish. Conserv. Eng. Base, Seattle, 32 p.

Hughes, S. E., D. D. Worlund, and F. W. Hipkins. 1970. Adaptation of king crab pots for capturing sablefish (*Anoplopoma fimbria*). J. Fish. Res. Board Can. 27: 1747-1755.

Miller, D. J., and R. N. Lea. 1972. Guide to the coastal marine fishes of California. Calif. Fish Game, Fish. Bull. 157, 235 p.

[2] Personal communication. Sig Jaeger, Kodiak Community College, Box 946, Kodiak, Alaska 99615.

[3] Heyamoto and Alton (1965) found that the average fork length for trawl-caught sablefish taken between 150 and 250 fathoms in this same area during 1961 to 1963 was 51.5 cm (20.3 inches).

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