Bait Loss From Halibut Longline Gear Observed From a Submersible

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Introduction

Demersal longline gear is fished along the west coast of the United States for Pacific halibut, *Hippoglossus stenolepis*; sablefish, *Anoplopoma fimbria*; and spiny dogfish *Squalus acanthias*. Little information is available on the behavior of fish around the gear and bait, bait durability on hooks, predators other than the target species, and other factors. Usually the gear is fished in deep water, quite inaccessible to direct view or remote data collecting systems. Consequently most conclusions drawn as to catch per unit effort, bait or hook effectiveness, predation on bait and catch, and competition by various species are derived after the gear is retrieved.

Skud and Hamley (1978) reported upon experiments conducted by the International Pacific Halibut Commission (IPHC) to measure catch with relation to soak (time left on the bottom) and bait loss. They reported that bait loss occurred while the gear was being set and from feeding by target species and by other predators.

ABSTRACT—During July 1978 the submersible Nekton Gamma *was used by National Oceanic and Atmospheric Administration (NOAA) investigators to observe halibut longline gear in Alaskan waters. Rate of Pacific herring,* Clupea harengus pallasi, *bait loss to predators was higher than of octopus,* Octopus dofleini, *baited hooks. Species of fish caught included Pacific halibut,* Hippoglossus stenolepis; *arrowtooth flounder,* Atheresthes stomias; *sculpins, family Cottidae; rockfishes, family Scorpaenidae; and others.*

During July 1978 National Oceanic and Atmospheric Administration (NOAA) scientists conducted a series of dives using the chartered submersible *Nekton Gamma* to study longline gear and predation on bait. The study was conducted in Frederick Sound, Alaska, adjacent to the northwest shore of Kupreanof Island. Our objective was to view from the *Nekton Gamma* demersal halibut longline gear on commercial fishing grounds. When we were near the bottom, we observed 1) the behavior of fish before, during, and after they attacked the bait on the hooks, 2) other predators of the bait, and 3) length of time the bait, either Pacific herring, *Clupea harengus pallasi*, or octopus, *Octopus dofleini*, remained on the hooks.

Methods

Two typical halibut longline skates, composed of 250-fathom (fm) (458-m) groundline with 13-foot (4.0-m) hook spacing (IPHC, 1978) were fished from the NOAA RV *John N. Cobb* at depths from 165 feet (50.3 m) to 540 feet (164.6 m). The gear was set slowly without a chute to reduce the possible loss of bait from hooks during the set. The skates were baited with large herring pieces (from frozen blocks) except for one skate having herring and fresh octopus pieces on alternate hooks.

Following the set, the *John N. Cobb* stood by to assist the *Nekton Gamma* if it became entangled with the halibut longline gear. A self-contained battery-powered acoustic transmitter was attached near the gear anchor for the submersible pilot to locate the groundline. While the pilot maintained a course parallel to the groundline and, when possible, 2-3 feet (0.6-0.9 m) off bottom, we attempted to view each hook. Observations, voice recorded on magnetic tape, included presence or absence of bait on hooks, predators present or eating the bait, fish species hooked or near the bait, and whether the hook was fishing or snagged. We photographed the gear, predators, and fish with an externally mounted 35-mm underwater camera.

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Results

Four dives were made to view the sea floor and longline gear. The sea floor composition varied from gravel to boulders rising 5-6 feet (1.5-1.8 m) off bottom and equally long. The large boulders presented some hazard to the submersible, especially when it was necessary to travel down current. Unfortunately, the current on the bottom could not be predicted from the direction or magnitude of the surface current.

We were able to view the longline gear and fish readily from the submersible. Fish did not appear frightened during these or other survey dives. On the contrary, halibut followed us several times until we could count as many as 15 (Fig. 1). Halibut dispersed slowly after the submersible settled to the sea floor, whereas sculpins occasionally gathered in moderate numbers (well over 50 individuals) while we were motionless.

Figure 1.—Both halibut and sculpin were attracted to the submersible. Note swimming halibut in the upper left with two others nearly obscured behind it.

Bait Loss

Strong tidal current on the bottom precluded our prompt arrival at the gear site to observe whether the setting process contributed to bait loss. Consequently our first view of the hooks was 30 minutes or more after the set. Even after this short period, crab and shrimp were actively feeding on the baited hooks. Because the International Pacific Halibut Commission studies showed that few baits were lost to the normal setting process and our gear sets were carefully done to avoid bait loss, we concluded that all observed bait loss was from predators (Fig. 2). The observed gross bait loss rate exceeded a 50 percent loss within 5 hours reported by Skud and Hamley (1978). Hooks with fish were excluded from the tabulation.

Figure 2.—Loss of herring and octopus bait from longline hooks in relation to length of time after the gear had been set.

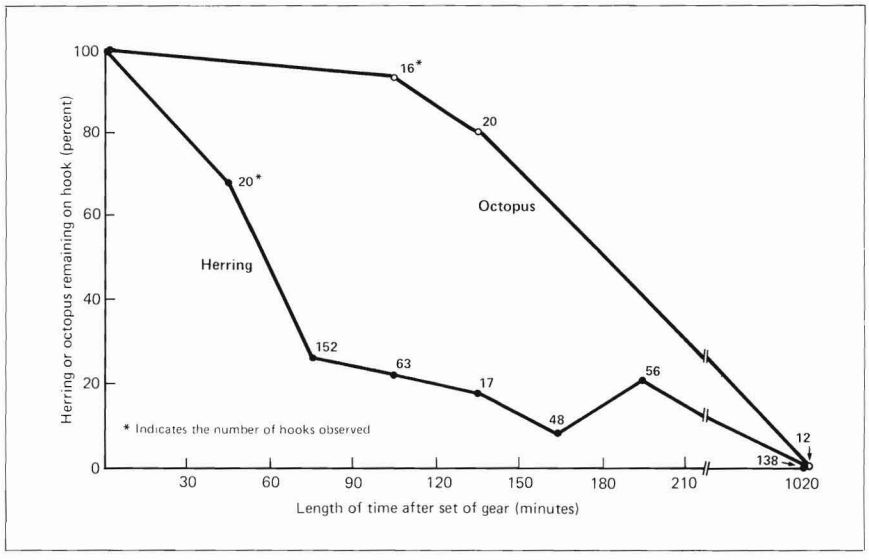

Figure 3.—A portion of demersal longline with a gangion and hook is shown on the sea floor. Two shrimp of the type seen covering many baits were apparently attracted to the bait.

While one could reasonably assume that bait was available when the fish became hooked, our observations showed that eight fish were hooked at locations where previously the hook was without bait. We offer no explanation for this anomaly.

Shrimp, hermit crab, and brachyuran (true) crab were the most abundant observed predators on herring-baited hooks in Frederick Sound (Fig. 3). Often we could not see the herring bait beneath a mound of feeding animals.

Octopus baits, on the other hand, only once appeared to have an animal feeding on them. Our observations suggested that herring, though fragile, was more attractive to predators.

Fish Catches

Some fish passed near the baits without apparent interest while other fish were seen to strike at the bait or become hooked. Of 56 fish we observed hooked during the several dives, 14 (25 percent) were missing from the gear on the subsequent survey. Six of 10 (60 percent) arrowtooth flounder, *Atheresthes stomias*, were missing, whereas only 5 of 26 (19 percent) Pacific halibut were missing. We thought these fish escaped or were removed by larger predators. A large skate, *Raja binoculata*, became hooked where we previously observed an arrowtooth flounder. Other species observed hooked included sculpin, family Cottidae; yelloweye rockfish, *Sebastes ruberrimus*; Pacific cod, *Gadus macrocephalus*; salmon shark, *Lamna ditropis*; and shortspine thornyhead rockfish, *Sebastolobus alascanus*.

The catch of fish on herring-baited hooks increased in a decreasing rate with soak during the first 3 hours until most herring bait was gone from the hooks (Fig. 4). Octopus, on the other hand, produced few fish caught during the early soak. While we recognize that the data are meager, it does suggest that the catch rate of hooks with octopus bait is low. Octopus bait was apparently less attractive to small feeding invertebrates, and because the flesh is tough, the bait remained on the hooks over a long period resulting in a catch similar to that with herring bait. Therefore, when halibut longline gear must have a long soak, octopus bait will remain available for a longer time than herring. When the gear soak is short, octopus offers no advantage.

Some hooked fish were detected at a distance greater than 65 feet (19.8 m) because their escape efforts caused considerable movement of the groundline. On one occasion, a hooked halibut swam more than 8 feet (2.4 m) off bottom carrying the groundline onto our submersible. Deft maneuvering

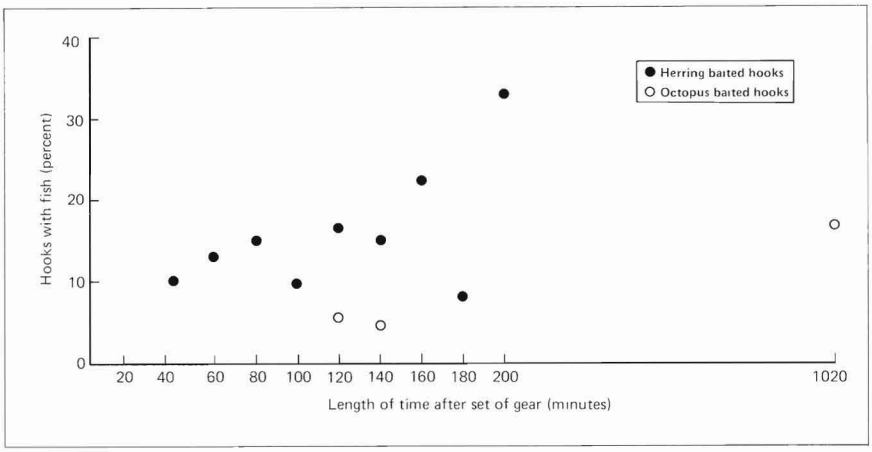

Figure 4.—Catch of fish on herring- or octopus-baited hooks at time intervals following gear set.

cleared the line but the incident pointed up a potential hazard to a submersible operating near gear considered to be lying quietly on the ground.

Summary

Our observations of longline halibut hooks in Frederick Sound, Alaska, baited with Pacific herring or octopus, show that predators such as fish, shrimp, hermit crab, and brachyuran crab contribute to a rapid loss of herring bait. Herring bait attracted far greater numbers of invertebrates than did fresh octopus and, as a result, after a 2-hour soak, more than 80 percent of the herring was consumed whereas only about 15 percent of the octopus was missing from the hooks. Catch of fish on herring-baited hooks in the first 2 hours of soak was much higher than for octopus-baited hooks. A decreasing catch rate for herring with soak is associated with the rapid bait loss. Although the data are meager, they suggest that because of the longer retention of octopus bait on the hook, the catch in long soaks is similar to that of herring. Therefore, on grounds with many actively feeding invertebrates, fishermen are faced with the selection of a best balance of bait type and length of soak.

Strong near-bottom currents and unpredictable movements of the groundline caused by hooked fish presented some potential hazards to the submersible.

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