Resource Assessment & Conservation Engineering (RACE) Division

Newport Laboratory: Fisheries Behavioral Ecology Program

Reducing Elasmobranch Bycatch on Longline Gear: Laboratory and Field Studies With Rare-Earth Metal De

Figure 12. Spiny dogfish snarled in a demersal longline. Adult dogfish may be up to 1.2 m long and weigh up to 10 pounds.

Unwanted bycatch of elasmobranchs is a worldwide problem in both and recreational fisheries. Sharks, skates, and rays compete with tar baits and can occupy a large proportion of hooks set on longlines, re efficiency and increasing costs of operation. Also, it is now recognize populations of elasmobranchs might result in unintentional changes i structure in both coastal and offshore waters. Thus, new methods are reduce elasmobranch bycatch.

Spiny dogfish are found in temperate and subarctic shelf waters worl small shark (<120 cm) has some economic and cultural significance i areas, but its abundance, toxic spines, and low market value make it nuisance species in both recreational and commercial fishing in both and Pacific Oceans (Fig. 12). Spiny dogfish often occur in large scho great damage to fishing gear. They can make up more than 90% of t surveys for Pacific halibut conducted by the International Pacific Hali Commission (IPHC) at some locations off Alaska and British Columbi dogfish populations appear to be increasing.

During 2006, spiny dogfish was the single most common species ca Columbia and the northwest United States, occupying 15% and 5% c fished in those areas, respectively. The area off Kodiak Island in Alas high dogfish catch (16% of hooks), barely exceeding halibut catch. O ago, the IPHC recognized the negative effects of dogfish on setline c halibut, observing more than a four-fold effect on catchability ratios between areas with low and high dogfish abund

In 2006, the World Wildlife Fund grand prize for "Smart Gear" was awarded for the discovery that rare-earth magne to repulse certain sharks. It has long been known that elasmobranchs respond to magnetic and electrical fields usin of Lorenzini (special sensing organs), but this was the first fishing-related application aimed at reducing shark bycat know that nonmagnetic rare-earth alloys can produce a shark repulsing effect. For example, alloys in the lanthanoid electropositive, giving up electrons in seawater to the more electronegative skin of a shark. While the exact mechan deterrence are not understood, the potential for reducing dogfish bycatch is promising. However, to date, there has reviewed experimentation to assess the efficacy of rare-earth materials in deterring sharks.

During summer 2007, experiments were conducted at the AFSC's Newport Laboratory facility to test the hypothesis magnets and metals placed in close proximity to baits would reduce attacks on and consumption of baits by spiny d were also conducted with Pacific halibut. Attacks on baits were tested in the presence of two different rare-earth ma (neodymium-iron-boride magnets and cerium mischmetal) both believed to affect the behavior of elasmobranchs.

Pairwise tests of the rare-earth materials with inert metal decoys showed that dogfish detected both rare-earth mate magnets provided no protection for baits in feeding trials. However, baits tested with mischmetal were attacked and lower frequency than mimic treatments (to 70% reduction), and times to attack baits were significantly higher, as we approaches before first attack. The time differential between mischmetal and mimic treatments and the number of b converged with increasing food deprivation (to 4 days), but differences were significant for all deprivation levels.Ceri mischmetal appeared to be irritating to dogfish and may disrupt their bait detection and orientation abilities. In contr halibut showed no reaction whatsoever to the rare-earth magnets or cerium mischmetal, and we concluded that the useful in reducing spiny dogfish bycatch in the halibut fishery.

Following the encouraging results of laboratory trials, a fishing trial was conducted during September 2007, to test the efficacy of cerium mischmetal in deterring spiny dogfish in the field. The fishing trial was carried out off Homer, Alaska, in a joint effort between AFSC's Fisheries Behavioral Ecology Program and the IPHC (Steve Kaimmer), with support from NOAA's Bycatch Reduction Program. Thirty-six longline sets were made in locations known for both the presence of halibut and abundant dogfish. Each set contained three skates of gear, one with standard hook gear, one with hooks protected with cerium mischmetal (Fig. 13), and one with inert metal mimics.

Figure 13. Cerium mischmeta attached near the eye of circle Pacific halibut.

Preliminary results indicate modest reduction in dogfish catch on the mischmetal-protected hooks, only about 17%. Catch of longnose skates was reduced 48%. Catch of legal-sized halibut was increased by 5%. While these differences are not large, it is clear that cerium mischmetal can affect catch rates of elasmobranchs. In our field trial, dogfish were caught on 35% of the hooks in short, 2-hour sets. Effectiveness in individual sets appears to be density-dependent, and we speculate that the deterrents will be more effective where dogfish are less abundant.

Some other limitations may affect the use of cerium mischmetal in commercial operations. The material is relatively has some hazardous properties (e.g., it is a flammable solid!), and hydrolyzes in seawater. While experiments are c conducted in Hawaii, New England, and Florida, our study represents the first rigorous experimentation with rare-ea a fishery application.

By Allan Stoner

<<< previous

Webmaster | Privacy | Disclaimer | Accessibility