AAS Panel: Long-lived deep-sea fishes imperiled by technology, overfishing

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Many commercially prized fish from the depths of the worldâ€™s oceans are severely threatened by over-fishing and the speciesâ€™ ability to recover is constrained by the fishesâ€™ long lifespans and low reproductive success, a panel of experts said today at the annual meeting of the American Association of the Advancement of Science.

Some of the fish species living at depths greater than 500 meters take decades to reach breeding maturity, so there are no quick-fix remedies available to replenish the population, said Selina Heppell, a fisheries biologist from Oregon State University.

â€œThe harvest of deep-sea fishes is a lot like the harvest of old-growth timber,â€• Heppell said, â€œexcept we donâ€™t â€˜replantâ€™ the fish. We have to depend on the fish to replenish themselves. And the habitat that used to provide them protection â€“ the deep ocean â€“ is now accessible to fishing because of new technologies.â€•

Among the most recognized deep-sea species at-risk are orange roughy and Patagonian toothfish, better known as Chilean sea bass. In the deep ocean off the Pacific Northwest, sablefish â€“ also known as black cod â€“ are another depleted species.

Deep-sea fishes grow slowly because of limited food sources and slow metabolisms; many donâ€™t reach sexual maturity for 30-40 years, Heppell said. The harvest of older fish may have an even greater impact on threatened populations because they are more likely to breed successfully than younger fish.

â€œWhen you buy orange roughy at the store, you are probably purchasing a filet from a fish that is at least 50 years old,â€• Heppell said. â€œMost people donâ€™t think of the implications of that. Perhaps we need a guideline that says we shouldnâ€™t eat fish that are as old as our grandmothers.â€•

Most of the deep-sea fishes are in international waters, where there are no guidelines and protections â€“ unlike within United States territorial waters. Most of these fish are caught by deep trawlers near seamounts, where they congregate because of food.

Technological advances have made targeting these fish easier, the panelists pointed out, because powerful ships can drag huge nets hundreds of feet below the surface. New refrigeration techniques, including â€œflash freezing,â€• allow ships to range far out into the ocean for days at a time. And sophisticated global positioning systems (GPS) and fish finders can target schools of fish or seamounts with ease.

â€œOne reason that many of these fish species were fished sustainably in the past is that we couldnâ€™t fish all of the places all of the time,â€• Heppell said. â€œThat isnâ€™t necessarily true anymore.â€•

Heppell is a faculty member in the Department of Fisheries and Wildlife at Oregon State, where she studies fish dynamics, populations and life cycles. The deep-sea fishes are among the hardest to study for obvious reasons, she said, and additional research is critical to protect these species.

Long-lived fish usually have low reproductive rates, either because of low breeding success or high mortality. In the case of deep-sea fishes, both scenarios often play out.

In some species, such as sharks, the fish may only produce a handful of offspring and the chances of survival by an individual are low. In other species, including orange roughy and oreos, an individual fish produces thousands of eggs â€“ most of which die through predation or starvation.

â€œOne of the things we need to know more about is how the fish larvae get transported,â€• Heppell said. â€œWe donâ€™t know whether fish from different seamounts are genetically distinct or whether larvae from one seamount end up populating another. The odds against these fish are so high that, in a reproductive sense, they have to wait for the stars to align before they successfully produce offspring that will survive until maturity.â€•

Natural and human-influenced climate factors including El NiÃ±o, the Pacific Decadal Oscillation and hypoxia zones all can influence shallow-water fishesâ€™ breeding and mortality rates, but deep-sea environments are usually stable. The deep sea is almost completely dark, very near freezing and has very little food â€“ reasons for the fishesâ€™ slow growth and low productivity.

â€œOld fish donâ€™t necessarily need to breed every year,â€• Heppell pointed out, â€œso when nature throws a bad reproductive year at them, the species can survive. But the point remains that you have to have older fish to replenish the stock when those bad years come.â€•

Conversely, Heppell said, good years often can carry the population in a phenomenon known as â€œepisodic recruitment.â€• In studies of long-lived fish species, it isnâ€™t unusual to find a school with numerous 18-year-old fish, for example, but very few fish that are 17 or 19 years of age. Scientists can determine the age of fish through their otoliths, or ear bones, which regularly accumulate rings much like trees. Variations in the size of the rings can indicate ocean productivity that year.

Harvesting older fish lessens the likelihood of many productive breeding years, Heppell pointed out, and lengthens the time species need to recover.

â€œThere are models that estimate the recovery time for some rockfish species is at least 200 years,â€• Heppell said. â€œAnd we still donâ€™t know all of the factors that influence their survival.â€•

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