SEA-FLOOR ECOSYSTEMS

Trawling's a Drag for Marine Life, Say Studies

Scientists at a recent Florida meeting debated how best to manage fishing practices that affect life on the ocean bottom

TAMPA, FLORIDA—Trawlers are catching more than fish these days. The boats are also capturing the attention of marine scientists, conservationists, and fisheries managers, more than 300 of whom gathered here last month* to discuss, among other topics, new studies on trawling's impact on sea-floor ecosystems and ways to limit the damage. A decade ago, "you couldn't have found enough people interested in trawling impacts to fill a phone booth," jokes Les Watling, a marine biologist at the University of Maine's Darling Marine Center in Walpole.

The growing interest stems in part from new laws that require governments to protect vulnerable marine habitats. Critics say boats dragging heavy nets across the sea floor kill nontarget species such as corals and harm even commercially valuable populations by flattening habitat (*Science*, 18 December 1998, p. 2168). But many fishers have argued that the impacts are short lived and that "tilling" the sea floor can augment food supplies for certain prized table fish. That idea took a battering here.

Three years ago, marine ecologist Simon Jennings, biostatistician Mike Nicholson, and their colleagues at the Centre for Environment, Fisheries, and Aquaculture Science in Suffolk, U.K., decided to test claims that trawling helps spur the growth of sole and plaice, two popular flatfish that live in Europe's North Sea. The theory was that frequent trawling had removed larger, slower-reproducing organisms from the sea floor and made room for marine worms and other smaller, faster-breeding competitors favored by flatfish. "Everyone agrees that trawling decimates big animals; the question is what happens further down the food chain," says Jennings.

The team members analyzed data from ship-mounted monitoring tags to identify 27 sites in the Silver Pit, a popular North Sea fishing ground, that had been trawled heavily, moderately, and lightly between 1994 and 2000. They then counted and weighed every organism in 10 sediment samples from each site. Their conclusion, published in the 13 November *Marine Ecology Progress Series*: Water depth and sediment type are the major influences on polychaete worm populations. The presence of trawlers had little effect. The study appears to "lay the farming analogy to rest," says marine ecologist John Steele of the Woods Hole Oceanographic Institution in Massachusetts, who chaired a National Academy of Sciences panel that issued a report last January on trawling impacts.

Jennings and others also raised questions about another popular but largely untested idea: periodically closing certain areas to trawling to allow sea-floor communities to recover. Drawing on several European examples, the researchers showed that current trawling patterns are generally uneven and patchy, allowing organisms from untrawled areas to recolonize nearby trawled zones. But temporary closures can concentrate fleets in smaller areas, increasing pressure on undisturbed sea floors. Over time, a system of rotated closures could also prompt trawlers to venture into previously unfished areas, increasing the total area disturbed unless the number of boats were reduced. "The first impacts of fishing are always more profound than subsequent impacts," Jennings notes, so "you have to think carefully before you start moving fleets." That message might complicate pending policy decisions in several regions of the world, including the fish-rich waters off Alaska, where the U.S. government is considering rotating closures to protect potentially sensitive areas.

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Making tracks. Marine scientists want to know more about how trawling activities, such as these gouges off Greece, reshuffle sea-floor communities.

Conservationists, meanwhile, are pushing for permanent trawling bans in what they say are especially sensitive habitats, such as coral reefs and sponge gardens in deep and shallow waters. Studies presented at the meeting confirmed earlier views that these craggy, high-relief habitats are typically more vulnerable to trawling damage—and slower to bounce back—than are flatter, softer bottoms sifted by strong currents or other natural disturbances. With corals, for instance, the nets can break and crush organisms that are hundreds of years old. "It's become clear that we should be talking about a global ban on trawling in corals," argued Mike Hirshfield, the science chief of Oceana, a marine conservation group based in Washington, D.C.

Fishing industry representatives didn't disagree, but they expressed frustration at the dearth of information about where such habitats are located. "There is a lot of mapping" and research to be done before large areas are fenced off, said John Gauvin, head of the Groundfish Forum, an industry-backed group in Anchorage, Alaska. The existing trawling literature is "unbalanced," echoed Jeremy Collie of the University of Rhode Island, Kingston, noting that most studies have focused on the least vulnerable sea-floor types.

The time for information gathering is growing short, however, at least in the United States. Next month, under a 1999 federal court ruling won by Oceana, fisheries managers in Alaska and elsewhere must start releasing draft plans for protecting "essential fish habitat"—including sensitive sea-floor areas—from trawling nets and other fishing gear. Other countries, including Canada and Norway, are also moving to identify and protect sensitive zones.

Well-designed conservation efforts, however, will require more-sophisticated studies, argued several researchers. Scientists have so far focused on changes in the populations of large, relatively easy-to-study organisms, noted Watling. Now, they need to tackle the harder questions of how trawling might change microorganism communities and fundamental sediment and nutrient cycles. As Collie puts it, "we need to go beyond the kill-'em-and-count-'em studies."

Those finer-scale studies will require additional funding, however, for which the prospects are uncertain. But even making such a request is a sea change in trawling science. "The debate has shifted," says Hirshfield, "from whether trawling has an impact to how big it is."

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* "Effects of Fishing Activities on Benthic Habitats," 12 to 14 November, Tampa, Florida.