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ABOUT FISH BRIEFS

Fish Briefs is a "plain language" summary of the latest scientific papers about fish with a focus on their interactions with habitat. It is distributed every four months by Oceana and is peer reviewed by a volunteer scientific panel to ensure that the scientific results are not lost in the translation.

Fish Briefs is an experiment in translation of technical research papers for those who are trying to apply the information. Our audience includes fishermen, fishery managers, scientists, conservationists, government officials and others.

If you know someone who wants to receive Fish Briefs, please forward their email.

If you have comments, questions or suggestions, please contact Oceana at info@oceana.org or 1-877-7-OCEANA.

Oceana is a non-profit international environmental organization created for the sole purpose of protecting the world's oceans to sustain the circle of life. In May 2002, Oceana merged with the American Oceans Campaign to bring together dedicated people from around the world to build an international movement to save the oceans through public policy advocacy, science, economics, legal action, grassroots mobilization, and public education. Please join us in generating a new and powerful force to save the world's oceans.

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Thanks to Chris Zeman, New England Fisheries Program Counsel

American Oceans Campaign and Oceana have joined together to save the world's oceans.

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Welcome to the eleventh issue of Fish Briefs!

Articles in Issue Eleven:

- Peter J. Auster, Kevin Joy, Page C. Valentine. "Fish species and community distributions as proxies for seafloor habitat distributions: the Stellwagen Bank National Marine Sanctuary example (Northwest Atlantic, Gulf of Maine)." *Environmental Biology of Fishes,* Vol. 60, pgs. 331-346. (2001).
- J.A. Koslow, G.W. Boehlert, J.D.M. Gordon, R.L. Haedrich, P. Lorance, N. Parin. "Continental slope and deep-sea fisheries: implications for a fragile ecosystem." *ICES Journal of Marine Science*, Vol. 57, pgs. 548-557. (2000).
- The scientific paper "Effects of Marine Reserves on Adjacent Fisheries" (summarized in the tenth issue of Fish Briefs) generated several letters by scientists that were published in Science (Volume 295, Feb. 15, 2002), along with a response to the letters by the original authors. The article presented data indicating that marine reserves increased fishery yields in adjacent waters.

Fish species and community distributions as proxies for seafloor habitat distributions: the Stellwagen Bank National Marine Sanctuary example (Northwest Atlantic, Gulf of Maine)

One of the major obstacles to developing conservation strategies for fish habitat on outer continental shelves is the lack of high resolution data on the seafloor itself. Consequently, fishery scientists have begun to investigate an approach which uses patterns in the distribution and abundance of fishes, information that is widely available in many regions from resource surveys and catch statistics, as a substitute for actual habitat distribution data. The underlying concept behind this approach, that areas with the greatest numbers of a specific fish species are located in that species' preferred habitat, is based in ecological theory but has only been confirmed in the field on a small scale.

Using data from the Gulf of Maine in the Northwest Atlantic, the authors demonstrate that fish distribution and abundance from trawl data can be used to identify seafloor habitats over large areas. Important caveats for interpreting such data are also identified. Fish abundance and distribution data were obtained from trawl surveys of the northeast continental shelf of the United States from 1970 to 1994. Habitat types in the Gulf of Maine were classified indirectly based on an acoustic signal from sonar surveys of the area. Values of the signal were shown to correspond to seabed type along a gradient from gravel to mud. The relationship between abundance and distribution of fish and habitat type was assessed using statistical methods for the 20 fish species caught in the greatest abundance in the trawl surveys.

The authors tested to see if the relationship between fish abundance and seabed composition was random and found that in 17 of the 20 species it was not, indicating that these species had affinities for particular habitats. They also tested for linear relationships between abundance and seabed composition, where a change in one is accompanied by a proportional change in the other, and found significant correlations in 12 of the 20 species. For example, the largest numbers of yellowtail flounder were found over sand, and the largest numbers of haddock were found over hard seabed types such as sand-gravel, both patterns that have been confirmed in earlier research.

The data analysis also indicated that distributions of fish communities, that is, groups of fish composed of different species, were correlated with seabed composition. However, as the data showed that not all communities occurred in areas of unique seabed composition, the authors note that a greater number of communities within a given area may indicate a greater range of habitats. These results validate that species distributions based on trawl survey data can be used as a substitute for direct data on the distribution of seafloor habitats over large areas.

(over)

Continental slope and deep-sea fisheries: implications for a fragile ecosystem

The development of deepwater fisheries - those fisheries that target fish species in waters deeper than 500 meters - rapidly expanded during the 1950s and 60s due to the decline of traditional fisheries in shallower waters on the continental shelf. The authors examine the biology and ecology of deepwater fish that have been, or presently are, exploited by deepwater fisheries, and then review the development and direct impact of fishing on deepwater fish populations and associated deep-sea seafloor habitats.

Many exploited deepwater fish species are biologically distinct from those in shallower waters, as indicated by significant differences in body shape, reproductive and foraging strategies, and evolutionary ancestry. The authors grouped the deepwater fish studied by habitat type. The first group consists of those that live on seamounts and banks, such as the orange roughy, the pelagic armorhead, and several species of rockfish (*Sebastes* spp.). Fish in the second group live on the continental slope and open seafloor. Major exploited species in this group include hakes, sablefish, and the Greenland halibut.

Deepwater, bottom-dwelling fish tend to be long lived and slow growing, and are not ready to reproduce for many years, sometimes decades. The orange roughy, a seamount and bank residing species, lives for over 100 years, and does not breed until over 20 years of age. Several species of Macrouridae, a group of fish comprised of rattails and grenadiers that generally dominate over the slope and open seafloor, live for at least 60 years. Many deepwater fish species exhibit low natural death rates and have relatively few, large eggs in comparison to shallow water species. The annual input of young fish, or recruitment, to deepwater fish populations has been studied for a few species, and appears to be unpredictable. Such extreme biological characteristics may have profound implications for conservation and management. For example, common fish management approaches that assume relatively constant annual population recruitment rates may be inappropriate.

Fish Briefs - Issue Eleven - Sept. 2002

Fish Briefs is reviewed by a volunteer scientific advisory committee. The members of the committee include:

Kent Gilkinson, Northwest Atlantic Fisheries Centre • Ron Hill, National Marine Fisheries Service • Les Kaufman, Boston University • Rich Langton, Buccoo Reef Trust • Barbara Jeanne Polo, Oceana • Les Watling, University of Maine • James Lindholm, Stellwagen Bank National Marine Sanctuary • Maia McGuire, University of Florida Marine SeaGrant • Francis Juanes, University of Massachusetts

Since the 1970s, annual world landed catches of deepwater fish species by deepwater fisheries have been between 800,000 and one million tons. This apparent stability, however, hides a boom-bust pattern of individual fisheries, where progressively new fisheries are developed as traditional fish populations are fished down to very low levels, often within just 5-10 years. Most deepwater fish populations that are targeted for fishing are today overfished or even depleted.

There is considerable potential to examine the larger scale impacts of deepwater fisheries on communities or entire ecosystems. As the development of deep sea fisheries is a relatively recent phenomenon, and information for similar unfished areas is available, we have the opportunity to study these habitat types in their pristine state. However, knowledge of ecosystem impacts of deepwater fisheries is currently inconclusive.

Habitat damage by fishing gear is one of the clearest impacts of deepwater fisheries. Seamount-dwelling animal species are typically distinct from those found on the surrounding seafloor, and include coldwater corals. Such corals are directly exploited for jewelry using tangle nets, a method that is both damaging to the environment and inefficient, with only a fraction of the coral being recovered. Deepwater trawling may also severely impact the seabed and the animal species living there. Photographs of the seafloor taken during a study on seamounts around Tasmania indicated that 95 percent of the bottom was bare rock in a heavily fished area, compared to around 10 percent in a comparable unfished area. A study is underway to assess the impacts of trawling on New Zealand seamounts. The authors conclude that adequate conservation will require a network of reserves both in areas of national jurisdiction and in international waters, and that in some fisheries a switch from trawling to long-lining should be considered.

Effects of Marine Reserves on Adjacent Fisheries

Letter 1: Mark H. Tupper, University of Guam Marine Laboratory. Email: mtupper@guam.uog.edu.

Dr. Tupper questioned the applicability of the examples used by the Roberts et al. the use of marine reserves, or no-take zones, **as** fishery management tools. He notes that the St. Lucia example is specific to coral reef fisheries and does not prove the global utility of reserves to fisheries. As to the use of the Merritt Island National Wildlife Refuge, he recognizes that the marine reserve has provided trophy-size fish to a limited area outside their boundary, but notes that fishery management measures imposed on recreational fisheries have doubled the average weight of red drum and black drum in east Florida since the 1980s.

The original authors generally agreed with Dr. Tupper that recreational fisheries have benefited from other management measures implemented over the period of their study, but note that well-enforced reserves have additional benefits beyond conventional management approaches such as size or bag limits.

Letter 2: Karl Wickstrom, Founder and Editor-in-Chief, Florida Sportsman Magazine. Email: karl@floridasportsman.com

The author believes the conclusions in the Roberts et al. paper are overreaching, given the data they present. Specifically, the author believes that the authors failed to recognize the effects of a 1995 state ban on the use of gill nets. Furthermore, he notes that the Roberts et al. paper fails to recognize that the area within the Merritt Island National Wildlife Refuge harbored record specimens of certain species before it was established as the Cape Kennedy security zone and closed to the public.

The original authors disagreed with Mr. Wickstrom that state-wide management measures resulted in the record patterns identified in the study area.

Letter 3: Ray Hilborn, Ph.D., School of Aquatic and Fishery Sciences, University of Washington. Email: rayh@u.washington.edu

The author questions the conclusion in the Roberts et al. paper that the Soufriere Marine Management Area resulted in the almost immediate increase in abundance and catch outside the reserve. He claims that such a rapid increase in the amount of fish could not have been due to the establishment of the marine reserve, but was likely due to an environmental change or the effect of the experiment. As the experiment required daily patrolling of fishing effort in the marine reserve, improved compliance with existing regulations and other factors could have contributed to the increase.

The original authors disagreed with Dr. Hilborn's claim that the observed increases outside the reserve were too quick to be related to the creation of the marine reserve. The St. Lucia fishery depends mainly on small, short-lived species, and 5 years would certainly be sufficient for those fish to grow to catchable size limits outside the reserve. Furthermore, there was no evidence of any environmental regime shift. Lastly, as there are no other management measures for the St. Lucia fishery, Dr. Hilborn's last point is not a possible contribution to the increase in fish outside the area.