Real-time fishery management significantly reduces bycatch

January 12 2016

A school of sardines in Italy. Credit: Wikimedia / Alessandro Duci

Using real-time management policies to regulate fisheries can reduce the accidental bycatch of juvenile fish and endangered species with substantially less economic impact on fishermen, a new Duke University-led study finds.

The study compared results from six different types of fishery closures commonly used to reduce bycatch.

It found that "dynamic closures"—which typically involve setting smaller portions of the ocean off-limits for shorter periods, based on fine-scale, real-time assessments of changing conditions—are up to three times more efficient at reducing bycatch with lower costs to fishermen than static measures that close large areas and remain in force longer.

"The ecological patterns that create bycatch don't occur on monthly or 100-square-kilometer-size scales or larger. They occur at much smaller time-space scales," said Daniel C. Dunn, lead author of the study and a research scientist in the Marine Geospatial Ecology Lab at Duke's Nicholas School of the Environment. "Our study provides empirical evidence that if we're not managing the ocean at these smaller scales there is an inherent inefficiency in the system that costs both fishermen and species alike."

The study appeared the week of January 6 in the *Proceedings of the National Academy of Sciences*.

The success of dynamic fisheries management hinges on recent advances "that extend the real-time technology at our fingertips and take it into the ocean," said Sara M. Maxwell, assistant professor of biological sciences at Old Dominion University, who co-authored the study.

"The speed at which we can now collect and share data means we can communicate in real time, or very near real time, when bycatch species are sighted or conditions are right for their presence," she said. This alerts fishermen to move on to other areas and helps them avoid costs associated with exceeding bycatch quotas or having to lease additional quotas.

Being able to manage catch data and bycatch risks on shorter time frames and at scales as small as 1 to 10 square kilometers allows managers to zero in on transitory hotspots and can reduce the need for large-scale, long-term closures that put more of the fishery's targeted catch off-limits. The new study finds that employing dynamic closures, such as daily "move-on" rules, placed less than 9 percent of the targeted catch off-limits, compared to more than 40 percent that were placed off-limits through static month-long total closures.

"For a while, the speed of communications between fishermen and managers was outpaced by the speed at which fishermen could catch fish and impact the ecosystem," Dunn said. "But now, fishermen and managers can communicate catch data with each other using mobile apps such as eCatch, Digital Deck and Deckhand, or even just emails or texts. It is a real game changer."

The researchers compared results from six types of closures used to reduce bycatch in the 16-species U.S. Northeast Multispecies Fishery. For each option, the researchers calculated the percent of bycatch reduction achieved, the percent of target catch affected, the overall rate of bycatch reduction efficiency, and the duration and size of closures needed to achieve the desired results. Closure types were then ranked from most effective to least effective based on a summary metric that reflected how well they met and balanced human and ecological needs.

The study finds that dynamic ocean management can reduce bycatch in highly mobile long-line fisheries such as bluefin tuna as well as bottom-dwelling fisheries such as scallops. And the costs associated with implementing and enforcing it are not necessarily higher than those for coarser-scale, static ocean management.

"If the incentives are well-placed, you don't need added enforcement," Maxwell said. "With the right information, fishermen are able to better

refine where and how they fish."

"Dynamic management is not meant to supplant traditional adaptive management of fisheries or permanent Marine Protected Areas but rather is meant to add another tool to our toolbox to address specific problems such as bycatch," Dunn emphasized.

"Managing at larger time-space scales is, and will likely continue to be, the dominant method for strategic fisheries management," he said. "However, our study reinforces that managers must also develop finer-scale management measures to ensure that the tactical implementation of those strategies is done as efficiently as possible."

More information: Daniel C. Dunn et al. Dynamic ocean management increases the efficiency and efficacy of fisheries management, *Proceedings of the National Academy of Sciences* (2016). DOI: 10.1073/pnas.1513626113

Provided by Duke University

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