SCIENCE SUMMARY

Current Approach Performs Well in Rebuilding U.S. Fisheries

The current approach to restoring U.S. fisheries performs well compared to recently proposed alternatives, according to a January 2016 study by Benson *et al*.[1] In simulations, the strategy used now by federal fisheries managers generally achieved the best rebuilding outcomes: shorter rebuilding times and higher average catch over 40 years, despite lower catch in the short term.

Background

In 1996, Congress mandated that fish populations at unsustainably low levels be rebuilt within 10 years, unless a longer time was required because of the biology of the fish, environmental conditions, or an international agreement. Under rebuilding plans, fishing is reduced until the fish stock can produce maximum sustainable yield (MSY). For stocks that cannot be rebuilt in 10 years, the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA Fisheries) currently sets the rebuilding timeline by calculating the time it would take the stock to rebuild in the absence of fishing (T_{min}), then adding one generation (commonly interpreted as the average age of spawning fish).

A report by the National Research Council found that rebuilding has been effective under this legal framework.[2] It also suggested that focusing more on controlling fishing rates and less on achieving a target population size could reduce uncertainty in management. NOAA Fisheries subsequently proposed the following alternative strategies for calculating the length of time to rebuild,[3] both of which focus on controlling fishing rates:

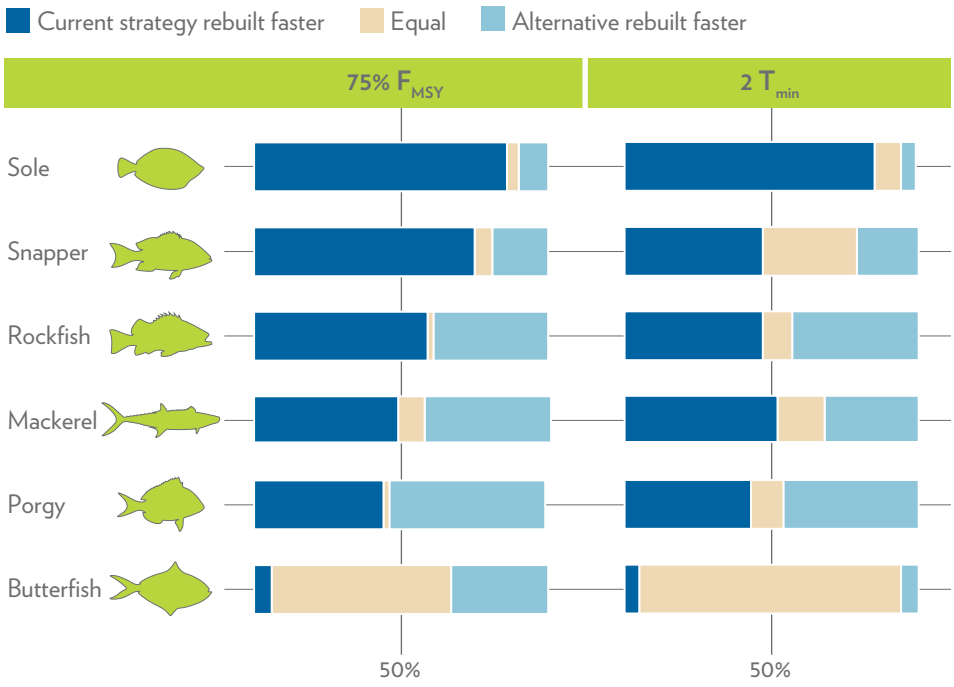
2 T_{min}: This approach would set a constant fishing mortality (F, the rate of removal by fishing) that would rebuild in twice T_{min}.

75% F_{MSY}: This approach would set F at 75 percent of F_{MSY}, which is the fishing mortality that maintains a stock at MSY. According to a NOAA Fisheries modeling study,[4] this rate would result in rebuilding of simulated average stocks in 10 years.

The Benson *et al*. study used a simulation model to evaluate these two approaches against NOAA Fisheries' current strategy. The following describes the methods and selected results of the study; additional details are available in the full article, published in the open-access journal PLOS ONE.

Figure 1. Rebuilding time

Proportions of simulations in which the current strategy rebuilt faster than the alternatives. Species listed are generic representations of life-history types.



Methods

The researchers used simulations to evaluate the three strategies. They applied the strategies to six generic representations of species, chosen to reflect the variation in rates of reproduction and survival. They repeated the simulations hundreds of times for five possible real-world scenarios which represent a range of initial stock levels, assessment quality, fishing fleets, and uncertainty.

Selected results

Rebuilding time

The current management strategy resulted in equal or faster rebuilding times for most species. The *2 T_{min}* strategy did not outperform the current strategy for any of the six species, and the *75% F_{MSY}* strategy did so for two species (figure 1).

In simulations when rebuilding took 10 years or less under the current strategy, the alternative management strategies generally resulted in longer rebuilding times.

KEY POINTS:

In simulations comparing strategies for rebuilding U.S. fisheries, the current strategy:

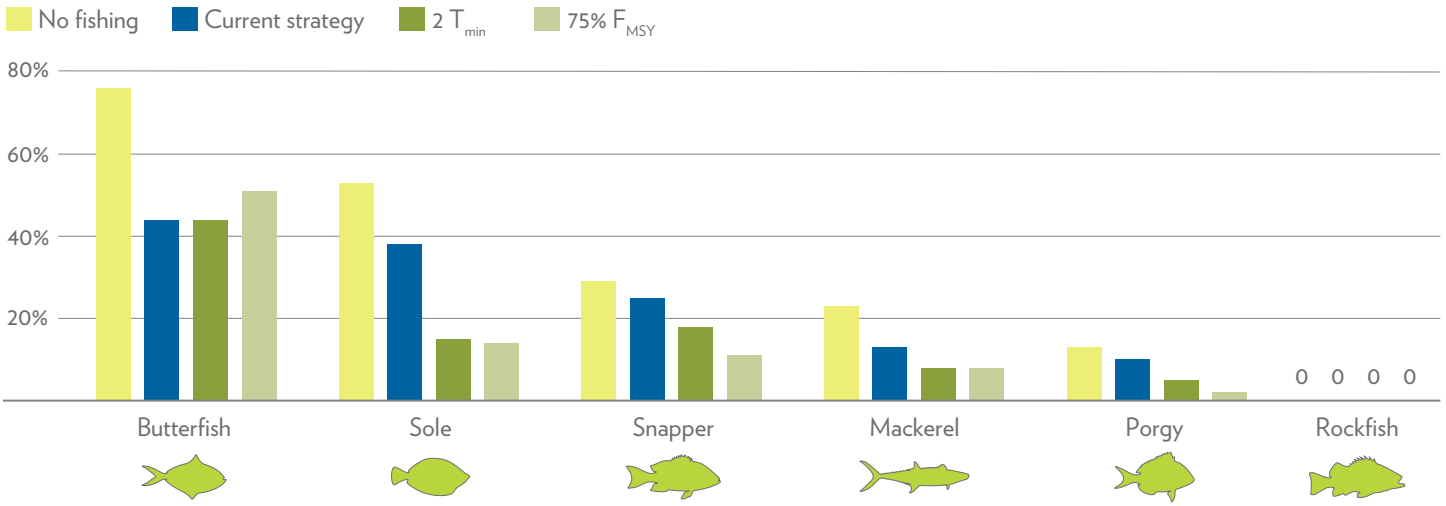
- resulted in equal or faster rebuilding times for nearly all species modeled.
- was more likely to rebuild stocks within 10 years.
- yielded the highest catch over a 40-year period, despite lower catch in the short term.

Probability of rebuilding

The current strategy was more likely than the alternatives to result in rebuilding in 10 years for nearly all species. Over a 40-year period, there was little difference in the probability of rebuilding (figure 2).

Figure 2. Probability of rebuilding

Probability of rebuilding to B_{MSY} in the first 10 years of the simulation projection period.

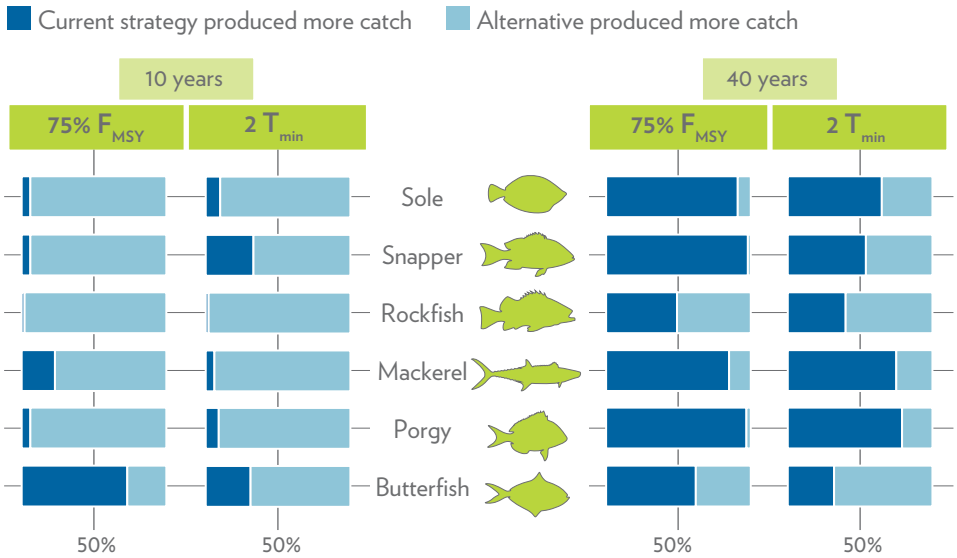


Catch

The current strategy generally resulted in less catch over the first 10 years. Over 40 years, the average annual catch was usually greater for the current strategy than for the alternatives (figure 3).

Figure 3. Average annual catch over time

Proportions of simulations in which the current strategy produced more catch as an annual average over 10 and 40 years.



Conclusions

The Benson *et al*. study found that the current rebuilding strategy rebuilt fish stocks faster than the proposed alternatives and yielded higher long-term average catch after initial reductions. The authors concluded, "Given the [legal] requirement that overfished stocks be rebuilt in a period of time that is 'as short as possible,' it would be difficult to justify switching to either the *75% F_{MSY}* or *2 T_{min}* MPs [management procedures] as modeled here."

REFERENCES

1. Benson, A.J., A.B. Cooper, and T.R. Carruthers. 2016. "An Evaluation of Rebuilding Policies for U.S. Fisheries." PLOS ONE.
2. National Research Council. 2013. "Evaluating the Effectiveness of Fish Stock Rebuilding Plans in the United States." National Academies Press.
3. Patrick, W.S. and J. Cope. 2014. "Examining the 10-Year Rebuilding Dilemma for US Fish Stocks." PLOS ONE 9(11): e112232. doi:10.1371/journal.pone.0112232
4. NOAA Fisheries. Magnuson-Stevens Act Provisions; National Standard Guidelines. Proposed Rule, Request for Comments. 80 Fed. Reg. 2786. Jan 20, 2015.

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