

## **Improving herring fisheries trade-off assessments**

In 1994, a British author and entrepreneur named John Elkington coined the phrase “triple bottom line.” Elkington was arguing that, rather than just consider the conventional financial metric of profit—the bottom line of revenue, costs, and expenses—companies should also keep two other metrics in mind: people, or a measure of a company’s social responsibility; and the planet, or a measure of the company’s environmental impact and sustainability. These bottom lines are sometimes referred to as the Three P’s: Profit, People, and Planet. Put another way, they are measures of economic, social, and ecological performance.

Although increasing effort is made to include all three measures, most fisheries management approaches focus on only two: the economic and the ecological. But as Daniel Okamoto and his Ocean Modeling Forum (OMF) co-authors argue in new work, effective modern resource management requires taking the sociocultural bottom line into account as well. Doing so will likely result in trade-offs among the three measures. Also, they write, “[q]uantifying the trade-offs of different policies can be difficult because ecological and sociocultural dynamics are often poorly understood and spatially diverse.”

With Pacific herring in a Haida Gwaii, British Columbia-like situation as a case study, Okamoto et al. set out to see how different management strategies can affect the triple bottom line. They did so using a biological model that described the spatial organization of herring into individual sub-stocks, linked to a model of a commercial herring roe fishery operating under different management scenarios. They examined the trade-offs among triple bottom line metrics under four target harvest rates (ranging from 10% to 37.5%), three limit thresholds for fisheries closures (25%, 30%, and 40%), and two spatial closure scenarios, where a traditional roe harvest area is closed to commercial fishing.

After running these scenarios and conditions through the MSE framework, Okamoto et al. found that spatial closures allow commercial harvest while also protecting cultural benefits and reducing the risk of collapse at open locations. “A spatial closure can improve traditional practice and traditional community benefits,” Okamoto and his co-authors write. Depending on the relative productivity of the closed site, however, there are some risks of either collapse at open herring sites or reduction of economic yield to the commercial roe fishery.

Where harvest rates were concerned, the choice of harvest rate generally led to a trade-off between commercial economic yield and the other metrics: the more commercial fishers were allowed to catch, the greater the ecological and social costs. Fishery closure thresholds, on the other hand, resulted in poor performance for the commercial sector without generating any significant sociocultural benefits. “Using a high limit threshold at the stock scale to prevent stock collapses may be enticing because it seemingly requires no spatial management,” the authors write. “However, such policies that rely on the logic of ‘a rising tide lifts all boats’ can cost the commercial fleet substantially without any guaranteed sociocultural benefits to place-based harvesters.”

In sum, Okamoto et al.’s study shows managers the importance of making the trade-offs between economic, ecological, and sociocultural metrics both more explicit and transparent. This is especially true with regard to the sociocultural metrics, which are often ignored. “As Pacific herring illustrate,” the authors write, “management policies inherently involve trade-offs, but their nature and extent is not obvious without accounting for sociocultural benefits and spatial dynamics.” After all, they note, just because sociocultural benefits are often absent in decision science tools does not mean they are not being traded off.