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Editorial: Design change to fishery independent surveys: when to adjust and how to account for it

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Editorial on the Research Topic
Design change to fishery independent surveys: when to adjust and how to account for it

Fishery independent surveys provide crucial information for monitoring and assessing marine fish stocks and ecosystems. For example, such surveys provide data on temporal fluctuations and trends in abundance, as well as age or length composition of studied populations. These data form the backbone of many stock assessments worldwide. In addition, most fishery independent surveys provide data on physical variables and on multiple species, often across a broad range of taxa, such that the information generated can help to understand and monitor communities of organisms and how they relate to their environments.

The term "fishery independent" differentiates these surveys from sampling that targets fishery operations themselves for such data as landings and discards. It implies that the survey is operated by, or in close collaboration with, scientists. A fishery independent survey generally applies standardized sampling procedures that are consistent across space and time. These procedures specify the statistical sampling design, as well as the gear type, such as handline, longline, trawl, trap, video, or acoustics. The sampling consistency across space and time allows for reasonable inference that any observed dynamics reflect those of the population or community being studied, even when the data need to be standardized to account for unequal sampling or factors outside human control (e.g., environmental variables).

Sometimes, however, changes to the sampling design or gear become desirable or necessary. They may be desirable if the benefits of modification outweigh the benefits of consistency. Examples might include improvements or innovations in sampling gear, technology, or efficiency; revised management or survey priorities; and increased funding that allows for additional gears, greater spatial coverage, or temporal resolution. In other cases, changes to the survey design may not be desirable but necessary. Examples might include reductions in funding, ship time, or human resources; modified mandates imposed by survey administrators; and when requisite supplies or equipment become unobtainable. Ironically, the longer a survey is in existence, the more valuable consistency becomes for evaluating long-term trends, and the more likely a change in survey design—whether desirable or necessary—will be forced or require consideration.

This Research Topic compiled case studies that describe and evaluate changes to fishery independent surveys from a wide range of aquatic systems. The case studies document the rationale for making changes and how those changes were accounted for in monitoring and assessment.

Evaluations of survey design change generally fall into one of two categories: those that evaluate potential or inevitable changes prior to their occurrence and those that evaluate their effects *post hoc*. The former is particularly relevant for emerging technologies or infrastructure. White et al. used a modeling approach to evaluate survey designs for using active acoustics to sample fish aggregations, and they found that a parallel line design outperformed a "star" design in most of the scenarios tested. Bolser et al. evaluated the potential for acoustic data, including data collected by uncrewed surface vehicles, to estimate biomass-at-age of Pacific hake, providing a methodology for estimation along with advice and caveats for application. Methratta et al. considered offshore wind energy development that is now underway in the northeast United States (US). These projects are expected to affect current surveys that have been in place for decades, and the authors evaluated whether project-level monitoring by wind energy developers would be sufficient to mitigate the effects on surveys. They concluded that current efforts were insufficient, and offered recommendations for how to mitigate impacts of offshore wind development on existing fishery independent surveys in their and other systems.

Several other papers evaluated effects of potential, but not yet implemented, changes to the surveys in the Bering and Chukchi Seas. Bryan and Thorson analyzed 1) the performance of spatio-temporal statistical models when estimating relative abundance in a new climate-adaptive spatial stratum and 2) whether annual sampling at reduced intensity or biennial sampling would provide the most informative data, if effort reductions were necessary. DeFilippo et al. evaluated effects of reduced sampling intensity in areas of currently high sampling rates, which could provide useful guidance whether sampling effort is reduced or redistributed. Oyafuso et al. used simulation tests to analyze three different statistical designs for the US Chukchi Sea bottom trawl survey: simple random, stratified random, and systematic. They found best performance from the stratified random design.

In not all cases is it possible to evaluate changes prior to their implementation. Several papers demonstrated the value of *post hoc* evaluations through statistical modeling, with focus on data products used in stock assessments. Along these lines, Hendon et al. evaluated a bottom longline survey and Pollack et al., a long-term groundfish trawl survey, both in the US Gulf of America (also called Gulf of Mexico). They highlighted the positive effects that design changes, including spatial expansion in sampling, had on the survey products. Vecchio et al. evaluated effects of spatial expansion in a trap survey conducted in the US Atlantic. Chang et al. considered the fluctuating sampling protocol of an ichthyoplankton survey in the Hudson River Estuary. Schrandt et al. described the evolution of estuarine surveys in the US state of Florida. They focused on the need to balance utility of long-term data with shifts in funding and management priorities, offered advice on how to do so, and highlighted the benefits of reconnaissance sampling prior to survey modifications.

When possible and funding allows, the effects of changing from one sampling procedure to another can be informed by pairing the two procedures in simultaneous data collection. This pairing of methods allows for direct comparison of data collected before and after the change, with the potential benefit of a continuous time series. Bacheler et al. examined fish counts from a video survey in the US Atlantic that upgraded the video cameras used for sampling. A paired-gear study, using both the old and new cameras, allowed for data calibration such that fish counts could be utilized across the full time series of the survey. Latour et al. described a trawl survey conducted in the Chesapeake Bay, the largest estuary in the US. The survey underwent multiple, simultaneous improvements, including a new sampling vessel, and it utilized paired-tow studies to calibrate data from before and after the change. The authors offered cogent advice that, among other topics, highlights the value of making multiple changes simultaneously when forward planning is feasible.

This Research Topic compiled 13 papers addressing design change to fishery independent surveys. The compilation provides lessons learned from real-world examples across a variety of aquatic systems. Collectively, these papers can inform those in the future faced with potential or inevitable changes to survey design.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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