Theme session N

Advances in data-limited assessment methodologies for marine and diadromous stocks

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The majority of the world's marine and diadromous fish stocks lack adequate data for conventional stock assessment methods. Such stocks, known as “data-limited", can also occur in regions with long-term surveys (e.g. northeast Atlantic). Until recently, fisheries science has been unable to inform decision-makers on their status and potential, as the assessments of data-limited species and stocks still need sufficient data and to be based on robust calibration, statistical design, and data-handling. The number of stocks in need, and the timetables of policy-makers around the world, make it vital to improve methodologies. The global fisheries science community is innovating methodologies to take advantage of the available data to assess data-limited stocks. This session provided an international forum where the latest advances in data-limited method development and application were presented and discussed. While there is an impressive selection of data-limited assessment strategies, it is imperative to develop innovative and practical approaches for identifying and assessing data-limited fisheries and species complexes to provide effective scientific advice to fisheries managers. Theme session N highlighted approaches that have the potential to be practical in their implementation and effective in their application.

The session included keynote presentations by Carl O’Brien and Adrian Hordyk, 14 additional oral presentations, and nine posters. A variety of topics related to data-limited methods for marine and diadromous species were presented, which can be coarsely grouped into three categories (development of new methods, models, and toolkits; method application to data-limited stocks; management and management strategy evaluation (MSE)).

The opening keynote by Carl O’Brien provided a brief history of the development of data-limited methods and their relation to ICES advice. This talk described the necessity of these methods within the current ICES framework, and how to move forward by integrating data-limited methods into more data-rich mixed and multispecies approaches. The talk stimulated healthy discussion, including on the challenges of dealing with uncertainty, a theme that persisted throughout the session.

Development of new methods, models, and toolkits

Presenters discussed new tool platforms that are available online, including an interactive size spectrum calculator that uses growth and life history traits to quantify fishing reference points. Data-limited methods are constantly evolving and require unique and innovative ways to use available data. For some data-limited species, catch trends are unavailable and assessments rely on models based on life history from a single year’s data or borrowing information from other similar species. Methods

presented in this session, illustrated by “data non-existent” examples, demonstrated that these approaches are useful as either a starting point or to produce effective management advice.

As an example, the MIZER tool provides a single stock size spectrum calculator, considering that energy budgets within growth profiles can provide a proxy for a stock recruitment relationship. Crucially, the approach demands only classical growth metrics that are available for most exploited stocks, and a few or even a single year’s data, but can be developed as more data become available. The application was illustrated by “data non-existent” examples to demonstrate to fishery managers there is always a way to start. These also considered the effects of climate change.

Although method development is often based on simulations, presentations illustrated the key step of taking these simulations or ideal examples into the ‘real world’, linking neatly into the next sub-session.

Method application to data-limited stocks

Moving out from the electronic and biological computers [brains], the session learned of several further examples where data-limited methods are being applied, with diverse examples ranging from a trawl fishery for shrimp off French Guiana, a razor clam fishery in Irish waters, Arctic charr in northern Canadian waters to electrofishing surveys of juvenile salmonids in rivers and streams flowing into the Baltic Sea, and taking metrics developed for marine commercial fisheries and applying them to freshwater recreational fisheries. Research presented in this session also addressed challenges related to the management of anadromous species and the necessity for improved and increased monitoring and surveys, particularly to determine if restocking these native species is a feasible management strategy.

Management and management strategy evaluation (MSE)

The last sub-section focused on the role of management strategy evaluation (MSE) for data-limited stocks and how this approach can be used to produce advice and make informed management decisions.

This topic was introduced by our second keynote speaker, Adrian Hordyk, who presented the concept of MSEs as a closed loop simulation of reality to determine practical and effective management actions. MSEs are particularly useful in conducting quantitative risk assessments for species with minimal information. Operating models try to represent aspects of the true dynamics for a data-limited stock, and the lack of information for a given stock or fishery simply means the operating model will look more like a block of marble rather than the sculpture of reality within. This metaphor extended throughout the keynote and set the scene nicely for the remaining talks that presented on specific uses of MSEs in data-limited scenarios.

The presentations in this sub-session addressed the versatility and practicality of MSEs. Throughout the session we learned the importance of testing a variety of data-limited methods to determine which models perform best for a given type of information

available or for specific species type. Performing sensitivity runs and simulation testing provides scientists and managers a better perspective on the cost of uncertainties in the data and management regimes. Additionally, a common theme throughout the session was adaptive management. Data-limited fisheries are continuously evolving and new information becoming available; the ability to incorporate new information and change when necessary is imperative to successful fisheries management.

In possibly the most temporally and thematically diverse talk, we heard how economics theory from the 19th century could be applied to 21st century fisheries management, using multi-stock challenges to consider risks to the fish communities. The use of a Nash equilibrium to determine catch allocations in a multispecies context was highly intriguing, and deserves further exploration within the ICES advice framework.

The session was rounded off with an entertaining delve into the challenges of taking the tools outside the science community and using them to work directly with stakeholders who have diverse perspectives and points of view, highlighting that feedback through the tool development process is key to maximising buy-in. The involvement of stakeholders (e.g. fishers) in the state of the fishery and transparency throughout the assessment process is key to effective management.

Throughout the session, there were some recurring questions that raised interesting points for ICES to consider in future. The general limitations of simulations versus direct application were discussed; the role of simulations and the specific assumptions involved in each simulated reality should be carefully explored before accepting a tested methodology. For example, we can deceive ourselves in our simulations if uncertainty is incorporated in some key aspects but not the truly uncertain parameters. Another discussion point of interest related to ICES' role in the interplay between science and policy with data-limited stocks. The current framework utilizes precautionary buffers and uncertainty caps when calculating catch advice to reflect the inherent uncertainty in the use of these methods; however, the point was raised that this practice toes the line between science and policy. In moving forward, it would be useful to stakeholders if ICES was able to provide more background into the evidence-based science behind applying buffers and/or caps.

The session was a great success, not only for its diverse content and interactive approach but also for its global reach evidenced by talks and posters covering research in 12 countries across three continents. Lastly, the session used Twitter for social media outreach. Session conveners published tweets for each of the talks. In total, these generated 72 likes and 26 retweets. The #dlmfish hashtag received 9 tweets, which generated 76 likes and 35 retweets.

This is a rapidly growing field of science within the ICES community with new methods being developed, applied, and tested. We look forward to learning about the next steps at a future ICES ASC.