

The Task team has made a number of significant steps forward in the goals of the task team. Activities and plans are listed below.

- 1) Response to reviews and re-submission of the Bluefin Futures book chapter titled “**Predicting the distribution of bluefin tunas in a changing ocean,**” led by Alistair Hobday.
- 2) Elliott Hazen presented an invited presentation to the US Clivar workshop on “Forecasting ENSO Impacts on Marine Ecosystems of the US West Coast in August 2016 on “Dynamical and statistical modeling for ecosystem forecasts.”
- 3) Alistair Hobday attended an ICES conference on topic Seasonal to decadal prediction of marine ecosystems: opportunities, approaches and applications in Sept. 2016.
- 4) Publication of two task-team led articles in the CLIVAR newsletter *Variations* led by Elliott Hazen and Michael Jacox titled “Modeling to aid management of marine top predators in a changing climate” and “Seasonal forecasts of ocean conditions in the California Current Large Marine Ecosystem” respectively included as Appendix A.
- 5) Workshop in Hobart, Tasmania on Dynamic ocean management and seasonal forecasting for pelagic ecosystems held in Hobart, February 2017. The workshop report is attached below.
- 6) Submission of a number of funding proposals that would ensure continued work of the study group in the US, Australia, and beyond. The US-led proposal was for NOAA’s Climate Program Office entitled “Downscaled seasonal forecasts for living marine resource management off the US west coast.” The Australia led proposal was for Fisheries Research and Development Corporation (FRDC) in response to their research call to “Investigate oceanographic and environmental factors impacting on the ETBF”
- 7) In addition, following the workshop members of the task team have begun work on a SCOR working group proposal to look at “globalization of seasonal forecast for fisheries management” that would involve an international team of interdisciplinary oceanographers and ecological modelers.

Plans for the upcoming year include:

- 1) Following the workshop, members of the task team have begun outlining and drafting a SCOR working group proposal to look at “globalization of seasonal forecast for fisheries management” that would involve an international team of interdisciplinary oceanographers and ecological modelers.
- 2) A follow-up meeting with task-team members to discuss potential publications and workshop.
- 3) Co-convening a session in June 2018, for ICES S2D (seasonal to decadal), CLIOTOP TT, and PICES forecasting group to hold a joint session at the 4th international *Effects of Climate Change on the World’s Oceans* symposium

2016/03: Dynamic ocean management and seasonal forecasting for pelagic ecosystems

Hobart, Feb 6-8, 2017.

Task Team members (and others) present:

Kylie Scales, Alistair Hobday, Jason Hartog, Paige Eveson

Toby Patterson, Karen Evans

Remote Attendees:

Steven Bograd, Elliott Hazen, Michael Jacox, Heather Welch, Stephanie Brodie

Input via overnight comment:

Harritz Arrizabalaga

Apologies

Claire Spillman

Background:

The world's oceans are under an unprecedented level of pressure from resource use and commercial activities— for example, fisheries, shipping, aquaculture, and mineral, natural gas, and oil extraction. Balancing sustainable ecological and economic objectives is a continuing challenge for resource managers. Management approaches that can address these growing pressures have been the focus of considerable research and agency action, yet marine resource management has generally lagged behind those in terrestrial systems. However, for systems built upon dynamic oceanography and with species that transit ocean basins regularly, more targeted approaches are needed. Dynamic approaches could solve these problems, particularly in the face of a changing climate as traditional management boundaries such as marine protected areas, international borders, and even ecologically and biologically significant areas (EBSAs) are frequently crossed.

When the Task Team was formed at the 2015 CLIOTOP conference, the following items were identified for consideration before the next CLIOTOP meeting:

- 1) Identify existing habitat models that could be used in a forecasting framework, e.g. starting with Temperature both surface (SST) and at depth where available.
- 2) Create a summary table / document of key biological variables, eEOVs (ecological Essential Ocean Variables) that are available for the building on Hayes et al 2015
- 3) A historical approach for those species that need more than SST – use past events as a simple forward looking approach
- 4) Concept of scale and persistence of habitat may be a technique for estimating condition.
- 5) Relevance to management – What management problems can be addressed? What incentivizing is necessary / available to fisherman to make decisions in

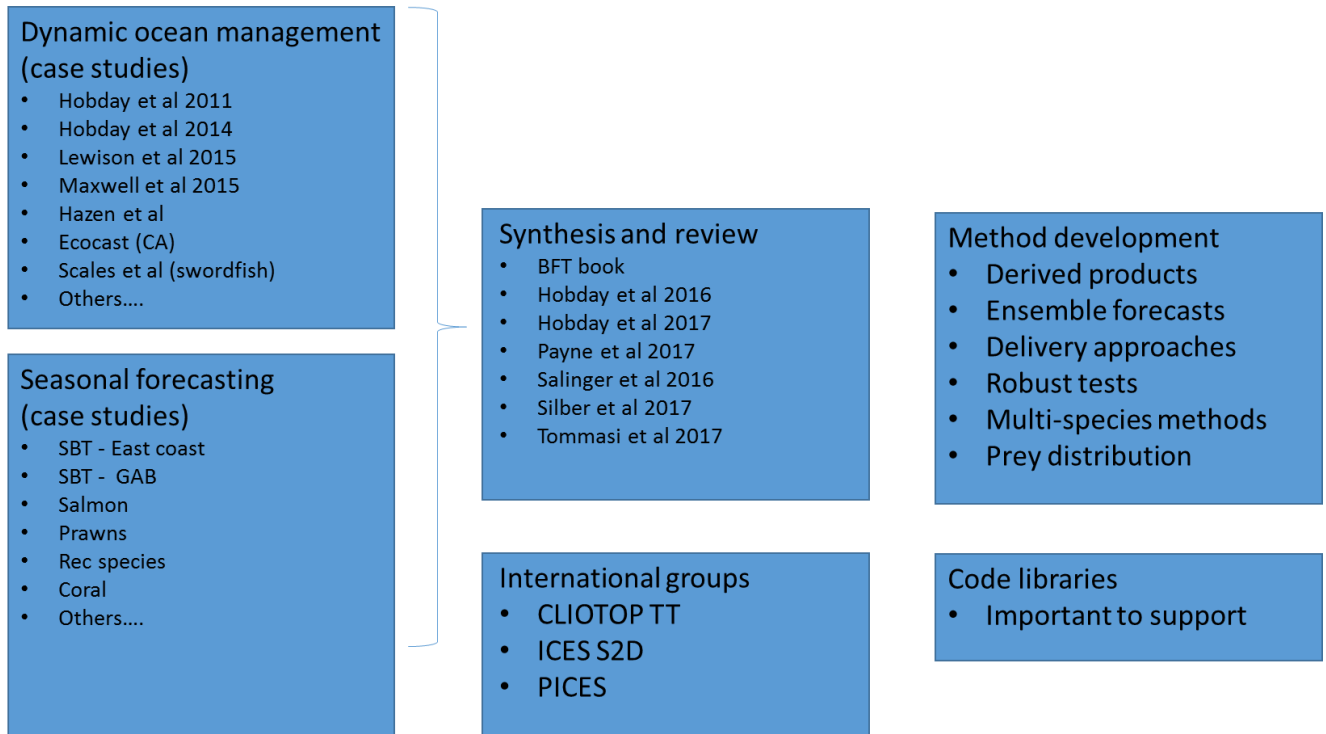
a dynamic framework? What scales are most important for management need (global to local)? How do dynamic forecast approaches differ among regions/species/marine uses (fishery, traffic...)?

- 6) Discussion of the role of dynamic forecasting / dynamic management in monitoring health and condition as an early warning of population / fishery response. Dynamic forecasting is inherently climate ready.
- 7) Reach out to forage fish modeling efforts (e.g. forage fish task force) as they serve as keystone species for forecasting efforts.
- 8) Identify case study areas / species for where dynamic forecasting is used, but also where past examples could be used to identify new approaches.
- 9) Outline and Write a Review paper – meta-analysis on scales of dynamic management needed to capture movement e.g. life history based, or is there commonality among physical processes such as age of an eddy, or is it the prey.
 - a. Potentially could include a global analysis of predictable oceanography (e.g. temperature) for fish forecasting as an example of where it could work best.

The workshop agenda was planned around assessing these broad areas and making recommendations where possible. We prioritised areas of work and made plans to include the research priorities we identified in existing and proposed project work.

In order to assess the merits of point 9 in the task team list above – outline and write a review paper - the workshop agreed it would be a useful process to map out the 'landscape' of this area of work in a broad sense. This enabled us to plan future research outputs and relate them to the existing published literature on dynamic ocean management and seasonal forecasting.

DOM and seasonal forecasting “research landscape”



Kylie Scales, a task team member visiting Hobart for this workshop, presented to the wider marine science community in Hobart the work she (and other US based task team members) has developed that allows for near real-time prediction of fisheries bycatch risk for the California drift gillnet fishery (EcoCast). This work forms part of a large NASA-funded data science project focused on implementation of Dynamic Ocean Management in the California Current System.

As a group, we contributed to a GOOS document ‘Essential Ocean Variables (EOV) for Biology and Ecosystems: Fish abundance and distribution’, point two in the task team broad area of work.

The morning of the second day of the workshop was spent with our non-Hobart based colleagues dialing in where possible. The work on assessing the ‘landscape’ of the literature in the area of the task team was presented and some further contributions made by all. What was apparent from this exercise was that the need for another review paper with a case study approach was not needed as there were already several research outputs in this space. Discussion around the general areas identified for the task team led to an alternative paper being proposed that directly addressed a number of the task team research areas and a brief outline was developed while all members were present.

While developing the paper outline, the team used the broad areas listed earlier to focus the goals of the paper. The working title for the paper we have proposed is 'Variable selection and performance in habitat models for forecasting distribution of large pelagic fishes'. The task team have agreed to include in existing or proposed projects the necessary work to produce results for this paper as outlined.

During the course of this task team workshop, we also heard mini reports from two of the other task teams. Heidi Pethybridge reported on the work of the 'Global comparative analysis of marine trophodynamics inferred by stable isotopes in top order predators' task team, including an outline of research results, planned and published outputs. Sophie Bestley and Toby Patterson reported to the group on recent work of the Modelling animal behaviour in a changing climate working group. Both of these presentations were followed by extended discussion and consideration of linkages among the respective research focus of each of the Task Teams.

The final day of the workshop was spent working together on a joint project proposal which, if funded, will enable the Australian based representatives of the task team to contribute to the combined paper as outlined.

The task team also noted that in the remaining time between CLIOTOP meetings that a joint submission to an international funding source should be initiated. This project would directly investigate in the area of dynamic ocean management and seasonal forecasting for pelagic ecosystems, rather than as is now the case where we have multiple, smaller initiatives. Task team members agreed to work collaboratively to source future funding for collaborative work, particularly support for international collaborative efforts bringing together the complementary expertise of respective members of the dynamic ocean management and seasonal forecasting task team to further the task team agenda.