

2017

Regional Programme Report

CLIOTOP



The CLimate Impacts on Oceanic TOp Predators (CLIOTOP) is an IMBER regional programme. It was established in 2005 and is now in its third phase (2016-2020).

CLIOTOP is an international research network open to researchers, managers, and policy makers involved in marine research related to large marine species. Network participants organise large-scale comparative efforts to elucidate key processes involved in the interaction between climate variability and change and human uses of the ocean on the structure of pelagic ecosystems and large marine species. CLIOTOP seeks to develop predictive capability for these socio-ecological systems and evaluate adaptation options to ensure future sustainability. The successful implementation of CLIOTOP will provide information, products and tools for better resource and conservation management.

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1. Ongoing activities, in line with the IMBeR Challenges

GC I Understanding and quantifying the state and variability of marine ecosystems

Task Team 2016-01 which developed out of working group three of the first and second phases of CLIOTOP has been working on improving understanding of the trophic pathways that underlie the production of tunas and other pelagic predators in the open ocean, the movements of these predators, and the natural variability forced by the environment. Two workshops co-funded by IMBeR and CSIRO were held at CSIRO, Hobart, in November: (1) on the 7-11th attended by Heidi Pethybridge, Anne Lorrain (IRD) and Brittany Graham (NIWA); and (2) on the 14-21st attended by Heidi Pethybridge and Anela Choy (MBARI). Several other CLIOTOP members, including SSC members also attended parts of each workshop. Both workshops were successful with visions and structures for two papers established and around 30-40% of the papers content written and subsequent workshop summary published on the IMBeR-CLIOTOP website. Improved understanding resulting from the outputs of this task team will directly assist IMBeR-CLIOTOP in addressing a cadre of overarching scientific questions in relation to advanced understanding of marine ecology, food web dynamics, movements of top predators in a changing climate, and ocean biogeochemistry. Furthermore, knowledge of top predator diets and movements in the open ocean is crucial to the management of these commercially and ecological important species and to determine shifts in distribution and foraging patterns in a changing climate. The work being done by this task teams also provides important input into **ICII**.

Task team 2016-05, which developed out of working group two of the first and second phases of CLIOTOP has been working on developing a manuscript from initial work presented at the third CLIOTOP Symposium. This initial work was focused on developing a standard set of metrics for describing the movements of marine animals that could be used across multiple platforms and multiple species (current metrics are often platform or position estimation method specific), thereby allowing for multi-species, multi-platform comparisons in investigating the environmental and physiological drivers of movement in marine animals. Australian based members of the task team have met twice during early 2017 and progressed the manuscript which sets out a roadmap for quality control essentials leading to the calculation of three movement metrics able to be applied across geolocation based, satellite based and GPS based position estimates.

GC II Improving scenarios, predictions and projections of future ocean-human systems at multiple scales

Task team 2016-02 has been working on the activities originally informally developed from a workshop in late 2013 at UNESCO/IOC (funded through EUR-OCEANS) involving scientists and various stakeholders in oceanic fisheries management including representatives from the industry focused on developing global fisheries scenarios. A first workshop of the task

team was held 7-9 February 2016 in Sète, France where five OSPs (Oceanic System Pathways) dealing with oceanic fisheries were developed. These OSPs have recently been chosen to form the official scenario basis of the FishMIP (Fisheries Model Inter-Comparison initiative, the marine component of the Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP)). Output from the workshop is a publication that has been submitted to Global Environmental Review (see publications).

Task team 2016-03 has been working on a number of activities aimed at developing dynamic seasonal forecasting models relevant to fisheries and conservation management. This has included:

- Submission of the book chapter Predicting the distribution of bluefin tunas in a changing ocean,” as part of a book from the Bluefin Futures symposium
- presenting 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.”
- attending an ICES conference on topic Seasonal to decadal prediction of marine ecosystems: opportunities, approaches and applications in Sept. 2016
- publication of two task-team led articles in the CLIVAR newsletter *Variations* 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”
- holding a workshop in Hobart, Australia February 6-8, 2017. The workshop, in reviewing the objectives set out under the task team, firstly mapped out the ‘landscape’ of work on seasonal forecasting in a broad sense, enabling the team to then plan future research outputs and relate them to the existing published literature on dynamic ocean management and seasonal forecasting.
- Submitting a number of funding proposals that would ensure continued work of the study group in the US, Australia, and beyond (see proposals listed below).

Task team 2016-04 has been working on a number of activities aimed at: i) identifying key species, ii) identifying oceanographic processes driving species ecology and iii) connecting oceanographers and biologist to improve assessment and management. These have included:

- AZTI-TECNALIA, SOCIB and IEO started collaborating in the study of oceanic habitats of Silky shark (*Carcharhinus falciformis*), a bycatch specie in tropical tuna purse seine fisheries.
- University of Miami, NOAA, SOCIB and IEO, started a collaboration to develop a spawning habitat model of Bluefin tuna (*Thunnus thynnus*) in the Atlantic waters based on knowledge derived from larval ecology studies from both the Mediterranean and the Gulf of Mexico.
- IEO, SOCIB and the INSTM started a collaboration to compare environmental drivers of Atlantic Bluefin tuna spawning and larval habitats in the Westerns and Central Mediterranean.

- NOAA, SOCIB, IEO attended ICCAT SCRS data preparatory meeting to present advances on including habitat information in the larval indices to assess spawning stock biomass.
- Participants of the task group attended the first GBYP workshop of larval ecology. One of the main objective of this workshop was to discuss how operational oceanography and habitat modeling improves assessment of Atlantic tunas. The activities of the Operational Oceanography for supporting Sustainability of Top Predators (OOSTOP) task team were also presented in the meeting for dissemination and networking.
- SOCIB and AZTI-TECNALIA developed and shared software for reading and processing operational oceanography data from the Copernicus Marine environment monitoring service in the framework of the modeling of Silky shark ocean habitats.
- SOCIB and Miami University developed and shared software for reading and processing operational oceanography data from HYCOM hydrodynamic models in the framework of modeling and forecasting spawning habitats.
- SOCIB and NOAA explored statistical approaches to include non linear effects on habitat models for larval indices.
- SOCIB , IEO and IMEDEA started a study directed to evaluate the applicability of Lyapunov characteristic exponents, derived from satellite altimetry, in larval habitat modeling used to standardize larval abundance indices. Larval abundance indices are applied now in the framework of ICCAT to assess bluefin tuna spawning stock biomass.

Task team 2016-06 has been working on developing process-based animal movement models that are biologically reasonable and capable of i) modelling behavioural response in relation to environmental covariates, and therefore ii) predicting animal movements in response to climatic changes. The task team met three times during 2016-17: (1) May 23-27th 2016 in Hobart, Australia co-hosted at the Institute for Marine and Antarctic Studies, University of Tasmania and CSIRO Oceans and Atmosphere; (2) September 12-15th 2016 in Copenhagen, Denmark hosted at the Danish Technical University. Work continued the subsequent week in Bielefeld, Germany and (3) February 28th – March 3rd 2017 in Hobart, Australia co-hosted at the Institute for Marine and Antarctic Studies, University of Tasmania and CSIRO Oceans and Atmosphere. Workshop activities included further testing of movement model parameterisations, advancing candidate models using continuous-space parameterizations and drafting a manuscript detailing the encoding of trip-based animal movement behaviours and demonstrating the capacity for simulation from such a model fitted to observational data.

GC III Improving and achieving sustainable ocean governance

Co-chair Karen Evans attended two workshops organized by Future Earth in 2016. The first was aimed at developing an Australian hub of the Future Earth program (Future Earth-Australia) and held in Canberra, Australia 28-29 April 2016. The second was a Future Earth Oceans Knowledge Action Network held in Kiel, Germany 4-5 December 2016 which several

other IMBeR members also attended. Both initiatives have subsequently been established and further input into the development of a steering committee for the Oceans KAN has been provided. Reports from both workshops are attached to this report as **Appendix 1**.

IC I To enhance understanding of the role of metabolic diversity and evolution in marine biogeochemical cycling and ocean ecosystem processes

N/A

IC II To contribute to the development of a global ecosystem observational and modelling network that provides essential ocean variables (EOVs) and to improve marine data and information management

See details of task team 2016-01 above.

Co-chair Kevin Weng attended a IOC-UNESCO (GOOS)/OceanObs Research Coordination Network co-ordinated workshop on the Implementation of a Multi-Disciplinary Sustained Ocean Observations (IMS00) held in Miami, USA 8-10 February 2017. The workshop was focused around three pre-selected demonstration themes:

- Plankton community changes (including ocean color),
- Oxygen minimum zones,
- Open ocean/shelf interactions (including boundary currents)

Co-chair Karen Evans attended a meeting of the Commission for the South Pacific Regional Fisheries Management Organisation in Adelaide Australia, 21-22 January, as part of activities of the JCOMM/CAgM Task Team on Weather Climate and Fisheries. The aim was to distribute a proposal put together by the WMO exploring the potential for collaboration between WMO and Regional Fisheries Management Organisations (RFMOs) in provision of relevant climate related products to fisheries and collection and provision of ocean and climate observations by fisheries to the WMO and discuss pathways for facilitation of the proposal.

Several CLIOTOP members provided feedback to a draft paper on essential ocean variables for fish abundance and distribution circulated by the GOOS Panel on Biology and Ecosystems (a copy of the draft can be supplied on request).

IC III To advance understanding of ecological feedbacks in the Earth System

N/A

IC IV To advance and improve the use of social science data for ocean management, decision making and policy development

N/A

2. Selected highlights

a. Selected scientific highlights last year (1-3)

- (i) CLIOTOP and Task team 2016-01/2017-01 member Anela Choy was awarded a 2016 L'Oreal-UNESCO for Women in Science International Award. This will allow Anela to extend her current position at the Monterey Bay Aquarium Research Institute and further her work exploring the chemical fingerprints of plastic in marine food webs of the Pacific Ocean.
- (ii) The five Oceanic Scenario Pathways developed by Task Team 2016-02 were chosen to form the official scenario basis of the FishMIP (Fisheries Model Inter-Comparison initiative), the marine component of the Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP).
- (iii) The CLIOTOP SSC welcomed five new members: Associate Professor Takashi Kitigawa (University of Tokyo, Japan), Dr. Masashi Kiyota (Fisheries Research and Education Agency, Japan), Dr Chistine Meynard (Virginia Institute for Marine Science, USA), Dr Lilis Sadiyah (Research Center for Fisheries Management and Conservation, Indonesia), Dr Sebastian Villasante (University Santiago de Compostela, Spain). The SSC also farewelled Professor Dan Costa who came to the end of his second term.

b. Selected publications last year (1-5)

Hobday, A.J., Arrizabalaga, H., Evans, K., Scales, K.L., Senin, I., Weng, K.C. (2017). International collaboration and comparative research on ocean top predators under CLIOTOP. *Deep Sea Research Part II: Topical Studies in Oceanography*. In press. doi:[10.1016/j.dsr2.2017.03.008](https://doi.org/10.1016/j.dsr2.2017.03.008)

c. Number of publications last year

Across the period March 2016-March2017 a total of 36 peer-review publications were produced.

d. International events (Title, date, and place, incl. participation as chairing and/or running titled sessions and workshop)

Future Earth Workshop on the Development of an Integrated Ocean Research Network (Future Earth Oceans KAN), Kiel, Germany 4-5 December 2016. Karen Evans attended as an invited participant.

Commission for the South Pacific Regional Fisheries Management Organisation, Adelaide Australia, 21-22 January 2017. Karen Evans attended as an invited participant.

IOC-UNESCO (GOOS)/OceanObs Research Coordination Network co-ordinated workshop on the Implementation of a Multi-Disciplinary Sustained Ocean Observations (IMS00), Miami, USA 8-10 February 2017. Kevin Weng attended as an invited participant.

United Nations Group of Experts for the second cycle of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects, New York, USA 14-17 March 2017. Karen Evans attended as a member of the Group of Experts.

e. SSC meeting/workshops etc

The CLIOTOP SSC held a virtual meeting in September 2016. The minutes and actions from the meeting are attached in **Appendix 2**.

3. International collaboration and links

Most task teams have been developing international collaborations and networks as part of their activities. CLIOTOP's network of researchers numbers on the order of 350 people. The CLIOTOP co-chairs have put concerted effort into linking with international organisations such as GOOS, the UN and WMO.

4. Input to management and policy

This is the first year of operation of the third phase of CLIOTOP. While many activities occurring under CLIOTOP's task teams are aligned with management needs, most are yet to produce direct inputs into management and policy.

5. Education and outreach

Several opportunities for outreach have been identified in the reported activities of the task teams and in the planned activities for the next 12 months (see both above and below). CLIOTOP presented a poster at the Future Earth Workshop on the Development of an Integrated Ocean Research Network (Future Earth Oceans KAN), Kiel, Germany 4-5 December 2016 (attached in **Appendix 3**).

6. Planned activities for next 12 months

a. Activities within the Programme

The major activity of the CLIOTOP SSC over the next twelve months will be the development and organization of the Fourth CLIOTOP Symposium, which we aim to hold in late 2018.

Task team 2016-01

This task team submitted a proposal for continuation of the task team across 2017-2019 in the 2017 call for proposals, which was subsequently approved by the CLIOTOP SSC (2017-01). Activities over the next twelve months include:

- Continued data compilation of isotope values for top predator species other than yellowfin, albacore and bigeye including: swordfish, skipjack, dolphinfish, and lancetfish.
- Further global comparative analyses of the isotopes of individual or grouped top predators including using predictive models to undertake an inter-oceanic comparison of nitrogen and carbon isotopes and comparisons of isotope trophic niche metrics
- Connect with other international 'isotope' groups undertaking meta-analyses on the isotopes of other marine consumers with the aim of obtaining a global view of the trophic niche/relationships/role of entire community of pelagic predators.
- Multi-biogeochemical tracer studies, including incorporating data from the analysis of compound specific stable isotopes, trace metals and/or fatty acid analysis. This would assist in giving greater specificity in regards to disentangling baseline versus trophic influences and to understand trophic fractionation through the food web.
- Link available tagging and isotope data to better understand movement and migration patterns of tunas, particularly through task teams 2016-05 and 2016-06.

Task team 2016-02

Activities over the next twelve months include:

- A dedicated workshop aimed at extending the current Oceanic System Pathways from ocean fisheries to global fisheries, including coastal and reef fisheries. This will place the task team at the core of the international process that is expected to provide model-based ecosystem and fisheries scenarios for the next IPCC and IPBES reports.

Task team 2016-03

Activities over the next twelve months include:

- 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.
- A follow-up meeting with task-team members to discuss potential publications and workshop.
- 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.

Task team 2016-04

Activities over the next twelve months include:

- Finalise development of the OOSTOP web site (<https://oostop.wixsite.com/oostop/participants>) including getting all participants of OOSTOP involved in the development of the contents of the web site and to set various meetings to promote it and to get more researchers involved.

Task team 2016-05

Activities over the next twelve months include:

- Finalization of a manuscript setting out a roadmap for quality control essentials leading to the calculation of three movement metrics able to be applied across geolocation based, satellite based and GPS based position estimates.
- Progressing of multi-species analysis of metrics in relation to a number of processes including:
 - Type of movement: Central place vs 'free movement'
 - Guild: fish, mammal, seabird
 - Reproductive state: Reproductive vs non reproductive
 - Latitude: Polar vs tropical vs sub-tropical vs temperate
 - Body size

Task team 2016-06

Activities over the next twelve months include:

- Finalise extension of the trip-based hidden Markov models to include external covariates, with exploration for both ice and pelagic foraging animals
- Pursue the habitat electivity approach, and through this
- Work to establish connectivity to the climate model projections via the virtual machine infrastructure already built for the team
- Draft manuscript detailing the TMB approaches
- Initiate coordination with CLIOTOP TT2016-05
- Deliver presentations highlighting task team activities to international audiences

b. Actions to link Programme to the Challenges

The goals of CLIOTOP under its phase three are intimately linked to IMBeR's identified Grand Challenges. As such the activities of the programme are implicitly linked to the Challenges.

c. Outreach (Convening sessions, meetings, etc)

Several opportunities for outreach have been identified in the planned activities for the next 12 months (see above). Task teams have identified the following upcoming conferences as those that presentations will be made:

Australian Marine Sciences Association Conference, July 2017, Darwin, Australia
XIIth SCAR Biology Symposium, July 2017, Leuven, Belgium
6th Biologging Symposium, September 2017, Lake Constance, Germany
4th international *Effects of Climate Change on the World's Oceans* symposium, June 2018, New York, USA

d. Upcoming papers (Community-Position-Review-etc)

A special issue of the journal Deep Sea Research II contained selected papers from the third CLIOTOP Symposium is due to be published in April. This will include the following publications (note that papers in this special issue have already been published online):

- Albo-Puigserver, M., Muñoz, A., Navarro, J., Coll, M., Pethybridge, H., Sánchez, S., Palomera, I. Ecological energetics of forage fish from the Mediterranean Sea: seasonal dynamics and interspecific differences. doi:[10.1016/j.dsr2.2017.03.002](https://doi.org/10.1016/j.dsr2.2017.03.002)
- Alderman, R., Hobday, A.J. Developing a climate adaptation strategy for vulnerable seabirds based on prioritisation of intervention options. doi:[10.1016/j.dsr2.2016.07.003](https://doi.org/10.1016/j.dsr2.2016.07.003).
- Aoki, Y., Kitagawa, T., Kiyofuji, H., Okamoto, S., Kawamura, T. Changes in energy intake and cost of transport by skipjack tuna (*Katsuwonus pelamis*) during northward migration in the northwestern Pacific Ocean. doi:[10.1016/j.dsr2.2016.05.012](https://doi.org/10.1016/j.dsr2.2016.05.012)
- Arthur, B., Hindell, M., Bester, M., Bruyn, P.J.N.D., Trathan, P., Goebel, M. Lea, M.-A. Winter habitat predictions of a key Southern Ocean predator, the Antarctic fur seal (*Arctocephalus gazella*). doi:[10.1016/j.dsr2.2016.10.009](https://doi.org/10.1016/j.dsr2.2016.10.009).
- Briscoe, D.K., Hobday, A.J., Carlisle, A., Scales, K., Eveson, J.P., Arrizabalaga, H., Druon, J.N., Fromentin, J.-M. Ecological bridges and barriers in pelagic ecosystems. doi:[10.1016/j.dsr2.2016.11.004](https://doi.org/10.1016/j.dsr2.2016.11.004).
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- García, A., Laiz-Carrión, R., Uriarte, A., Quintanilla, J. M., Morote, E., Rodríguez, J. M. Alemany, F. Differentiated stable isotopes signatures between pre- and post-flexion larvae of Atlantic bluefin tuna (*Thunnus thynnus*) and of its associated

- tuna species of the Balearic Sea (NW Mediterranean).
doi:[10.1016/j.dsr2.2017.02.006](https://doi.org/10.1016/j.dsr2.2017.02.006)
- Goetz, K. T., Burns, J.M., Hücksttdt, L.A., Shero, M.R., Costa, D.P. Temporal variation in isotopic composition and diet of Weddell seals in the western Ross Sea.
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International collaboration and comparative research on ocean top predators under CLIOTOP. doi:[10.1016/j.dsr2.2017.03.008](https://doi.org/10.1016/j.dsr2.2017.03.008)
- Ingram, G.W., Alvarez-Berastegu, D., Reglero, P., Balbín, R., García, A., Alemany, F.
Incorporation of habitat information in the development of indices of larval bluefin tuna (*Thunnus thynnus*) in the western Mediterranean Sea (2001-2005 and 2012-2013). doi:[10.1016/j.dsr2.2017.03.012](https://doi.org/10.1016/j.dsr2.2017.03.012)
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- Louzao, M., Navarro, J., Delgado-Huertas, A., de Sola, L.G., Forero, M.G. Surface oceanographic fronts influencing deep-sea biological activity: Using fish stable isotopes as ecological tracers. doi:[10.1016/j.dsr2.2016.10.012](https://doi.org/10.1016/j.dsr2.2016.10.012).
- Lucena-Frédou, F., Kell, L., Frédou, T., Gaertner, D., Potier, M., Bach, P., Travassos, P., Hazin, F., Ménard, F. Vulnerability of teleosts caught by the pelagic tuna longline fleets in South Atlantic and Western Indian Oceans.
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- Pérez-Jorge, S., Louzao, M., Oro, D., Pereira, T., Corne, C., Wijtten, Z., Gomes, I., Wambua, J., Christiansen, F. Estimating the cumulative effects of the nature-based tourism in a coastal dolphin population from southern Kenya. doi:[10.1016/j.dsr2.2016.08.010](https://doi.org/10.1016/j.dsr2.2016.08.010)
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- Saijo, D., Mitani, Y., Abe, T., Sasaki, H., Goetsch, C., Costa, D.P., Miyashita, K. Linking mesopelagic prey abundance and distribution to the foraging behavior of a deep-diving predator, the northern elephant seal. doi:[10.1016/j.dsr2.2016.11.007](https://doi.org/10.1016/j.dsr2.2016.11.007)
- Schirripa, M. J., Abascal, F., Andrushchenko, I., Diaz, G., Mejuto, J., Ortiz, M., Santos, M.N., Walter, J. A hypothesis of a redistribution of North Atlantic swordfish based on changing ocean conditions. doi:[10.1016/j.dsr2.2016.11.007](https://doi.org/10.1016/j.dsr2.2016.11.007)
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7. Funding

a. Funding from external sources

N/A

b. Funding proposals in progress or planned

Members of task team 2016-03 developed the following proposals in relation to furthering the work of the task team:

- NOAA's Climate Program Office - Downscaled seasonal forecasts for living marine resource management off the US west coast.
- Fisheries Research and Development Corporation (FRDC) - Investigate oceanographic and environmental factors impacting on the Eastern Tuna and Billfish Fishery
- SCOR - Developing seasonal forecasts for large pelagics in developing countries

Members of task team 2016-04 in collaboration with researchers working on early life fish ecology responded to a specific research call from GBYP focused on the science improvements for assessment and management of Atlantic Bluefin tuna.

Members of task team 2016-06 have submitted the following proposals in relation to the work of the task team:

- Australian Research Council – Discovery project.

8. Publication list

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Appendix 1: Reports of workshops and meetings attended by the CLIOTOP SSC

A. Future Earth Australia

The report from this workshop can be referred to at:

<https://www.science.org.au/news-and-events/future-earth-australia-workshop>

B. Future Earth Oceans KAN

The report from this workshop can be referred to at:

http://www.futureearth.org/sites/default/files/workshop_report_ocean_kan_full.pdf

Appendix 2: Minutes of the CLIOTOP SSC meeting, September 2016

11th CLIOTOP Steering Committee Meeting (virtual)

21 September 2016 (Wednesday)

Varying times

Invitees: Haritz Arrizabalaga, Dan Costa, Karen Evans, Mary Gasalla, Alistair Hobday, Takashi Kitagawa, Masashi Kiyota, Lisa Maddison, Christine Meynard, Lilis Sadiyah, Sebastian Villasante, Kevin Weng

Attending: Haritz Arrizabalaga, Karen Evans, Mary Gasalla, Masashi Kiyota, Lisa Maddison, Christine Meynard, Kevin Weng

Apologies: Takashi Kitagawa, Lilis Sadiyah, Sebastian Villasante

Agenda and Meeting notes

1. Welcome
2. Adoption of agenda
 - a. Review SSC action items from 9th meeting (see Table at end of the notes)
3. New SSC members (Kiyota, Meynard)
4. CLIOTOP highlights and activities
 - a. ~~Volume in DSR II (Hobday).~~
 - b. Task team reports
5. Last IMBER SSC meeting (Weng, ~~Costa~~)
6. IMBER activities and upcoming SSC meeting (Maddison)
7. Any other CLIOTOP/IMBER/Future Earth related activities SSC members have been involved in (all)
8. Future activities (all)
 - a. Conferences and workshops
 - b. Funding opportunities
 - c. Next meeting
9. Other Business

Summary Minutes

Opening remarks (Items 1, 2, 3)

Karen and Kevin welcomed everyone to the 11th CLIOTOP SSC meeting, noting apologies.

The agenda was adopted with the addition of a short update from IMBER and removal of the update on the special issue (to be deferred to next meeting). Progress on action items was noted, in particular the establishment of the framework for Phase 3 of CLIOTOP, the establishment of the task teams, the revision of the webpages for CLIOTOP and the addition of five new SSC members. Those SSC members that have not provided updates for the revised webpages are reminded to please do so.

Kevin provided an update on action item 9, which is ongoing. This led to further discussion focused on potential funding sources including NSF (there may be the potential to channel funding through SCOR to overcome restrictions on supporting travel for non-US collaborators), the Centre for the Synthesis and Analysis of Biodiversity (<http://cesab.org/index.php/en/infos/actualites/158>), the EU Horizon 20:20 program (<https://ec.europa.eu/programmes/horizon2020/>). Both the CESAB and Horizon 20:20 require French and European leads respectively but both allow for international collaborators. KE to follow up with CSIRO colleagues in regards to further details on the Horizon 20:20 funding process. KW also mentioned that he and AH had two proposals in with NOAA for CLIOTOP related work.

Masashi Kiyota and Christine Meynard were welcomed and provided a short summary of their research and interest in CLIOTOP to the SSC.

ACTION: SSC members that have not already done so to provide a recent high quality photograph and short biography to the chairs for inclusion in the revised website

ACTION: KW to continue to follow up on the potential for NSF funding

ACTION: KE to follow up with CSIRO colleagues in regards to further details on the Horizon 20:20 funding process

CLIOTOP highlights and activities (Item 4)

a. Task team reports

Six task teams were established in March 2016 and are underway with most providing updates on their first six months of activities. Most task teams have progressed against their goals with research networks established (task teams 2016/04, 2016/05), several papers produced (task teams 2016/01, 2016/03) or workshops held (task team 2016/06) with further workshops planned for late 2016/early 2017. Further detail on the task teams is available on the CLIOTOP website and updates on progress including publications and reports are detailed in reports available in the CLIOTOP dropbox folder (CLIOTOP SSC/11_SSC_virtual meeting).

ACTION: KE to follow up with task team leaders that have not provided an update

IMBER SSC meeting (Item 5)

The IMBER SSC held a face-to-face meeting in February, attended by KW. The major item of discussion was focused on Future Earth (FE; the parent program for IMBER: <http://www.futureearth.org>), its role, objectives and funding framework. Funding under Future Earth is limited (it provides 15K to IMBER) with its Knowledge Action Networks (KANs) competing for funding with its core project programs, with most funding derived from traditional funding avenues. How the competition between FEs KANs and core projects and how effective FE will be as an international co-ordinating body under such a funding scheme is still not clear. However, IMBER have been working with FE to provide some direction to the proposals being put up through FE.

Also raised was that there was some concern over the reorientation of environmental research from pure or discovery science to applied science. This has particularly been a focus of FE which has identified that it would like to develop stronger ties with stakeholders and many of its activities are aimed at providing input into the internationally agreed sustainable development goals. The concern is that this creates some tension between the overall objectives of FE and the funding sources it is applying for fund from such as NSF and SCOR, whose primary aims are to support pure/discovery science. It was noted that the Belmont Forum (<https://www.belmontforum.org/>) had been disappointed with the FE proposal submitted to it to date and was wanting FE to develop future research proposals of a higher standard that will produce strong outcomes.

In the following discussion was identified that it was important for members of the SSC to seek opportunities to be included in discussions around FE to gain a better understanding of FE overall, to identify opportunities for CLIOTOP involvement and potential funding sources, particularly as FE is likely to have input into designing Belmont's FRPs. It was noted that KE has applied to attend a workshop being held by FE focused on the development of an Oceans KAN in December 2016, although it was uncertain when feedback on applications would be provided. Eugene Murphy (ICED), Carol Robinson (IMBERSSC Chair) and Gro van der Meeran (IMBER EO) have also applied to attend.

ACTION: KE to keep the SSC updated on attendance at the FE workshop

IMBER activities and next SSC meeting (Item 6)

LM detailed recent activities by IMBER which included:

- Welcoming of new executive officer, Gro van der Mereen
- Launch of the new IMBER website
- 5th IMBER summer school, with the next one to be held in 2018 in Ghana

- Announcement of next IMBIZO to be held at Woods Hole in October 2017 (http://www.imber.info/events/imber-relevant-meetings/marine-biosphere-research-for-a-sustainable-ocean-linking-ecosystems_-future-states-and-resource-management). The meeting will consist of three parallel workshops focused on three of the grand challenges in the IMBER science plan: (i) prediction and projections, (ii) metabolic biodiversity (iii) management strategy evaluation; transparency in the natural sciences. There will also be an early career science workshop to be held directly before the meeting. Abstract submission will be announced soon.
- IMBER is supporting one of the themes at the PICES meeting in 2017 in Victoria, Canada (focus is on small pelagics).
- The next SSC meeting is to be held in early October with the main objective to progress the implementation of the IMBER science plan. KW will be attending on behalf of CLIOTOP.

ACTION: SSC to consider participating in IMBIZO

ACTION: KW to attend next IMBER SSC meeting and provide overview back to the SSC

CLIOTOP/IMBER/Future Earth related activities (Item 7)

KE provided an overview of a workshop held in Canberra by the Australian Academy of Sciences which was aimed at bringing together scientists, policy makers, artists, business leaders, architects and social scientists to discuss the potential for an Australian FE Hub. KE's overall impression was that it wasn't clear how the types of projects discussed would fit into FE's overall objectives, could constitute a cohesive approach to addressing particular challenges and therefore what the support would be for establishing such a Hub. It was also not clear how the Hub would operate and therefore it would add more overhead to the already large overhead of FE.

Future activities (Item8)

- a. Conference

It was noted that the next symposium is to be held in 2018, with the SSC asked to consider potential locations for the symposium, noting that previous symposia had been held in Mexico, New Caledonia and Spain, so it would be good to hold the conference on a continent or in a region that the symposium has not been held in as yet..

ACTION: SSC members to consider appropriate locations for a 4th CLIOTOP symposium in 2018.

b. Funding opportunities

See earlier discussion and action items. Note carry-over of action item: Dan to follow up on ONR-Global funds, NSF dollars for workshops.

c. Next meeting

It was agreed that the SSC would make contact via email after the IMBER SSC meeting to discuss any opportunities or actions arising from the meeting. Following this the aim would be to held quarterly virtual meetings.

ACTION: KW to organise next SSC meeting

Summary of meeting actions

Action number	Item	Responsible	Completed
CARRY OVER ACTIONS FROM LAST MEETING			
1	Action: consider ways in which we can better collaborate with IMBERs regional programs, particularly where there may be overlap in focus.	All	Continuing
2	Action: provide co-chairs with list of past chairs for updating webpage	Olivier	Yet to be done
3	Action: ask Nils how to link CLIOTOP to FAST webpages	Olivier	Yet to be done
4	Action: compile a list of upcoming funding opportunities for CLIOTOP activities	Kevin	Yet to be done
5	Action: oversee co-ordination of the publication of CLIOTOP 3 rd Symposium proceedings	Alistair	In progress
6	Action: decide on location of 4 th Symposium	All	In progress
7	Action: identify meetings that a number of SSC members likely to go to for a face-to-face meeting	All	In progress
8	Action: follow up with Eileen Hoffman (SCOR) on developing a relationship with NSF	Kevin	Yet to be done
9	Action: follow up on potential funding sources via NSF and ONR	Dan	Yet to be done
10	Action: explore the potential for the MACROES-MDST project to reconnect with CLIOTOP through a task team	Olivier	Yet to be done
NEW ACTION ITEMS FROM MEETING			
11	Action: SSC members that have not already done so to provide a recent high quality photograph and short biography to the chairs for inclusion in the revised website	All	In progress
12	Action: follow up on further details on the Horizon 20:20 funding process	Karen	Yet to be done
13	Action: follow up with task team leaders that have not provided an update	Karen	Yet to be done
14	Action: keep the SSC informed of the FE Oceans KAN workshop	Karen	Yet to be done
15	Action: SSC to consider participating in IMBIZO	All	Yet to be done
16	Action: attend next IMBER SSC meeting and provide overview back to the SSC	Kevin	Yet to be done
17	Action: decide on date for next meeting (virtual meeting) and develop schedule for following meetings	Kevin	Yet to be done

Appendix 3: Poster presentation to the Future Earth Oceans KAN workshop

See attached poster.