



Ecosystem Studies of the Subarctic and Arctic Seas (ESSAS)

Report for IMBeR SSC Virtual Meeting November 2018

1. Ongoing activities, in line with the IMBeR Grand and Innovation Challenges

- a. GC I. Understanding and quantifying the state and variability of marine ecosystems
 - The 3rd Resilience and Adaptive Capacity of Arctic marine ecosystems (RACArctic) workshop was held in Trømsø, Norway, 6-8 March 2018, to develop detailed outlines for three synthesis papers resulting from the RACArctic project. This project aims to synthesize expected effects of climate change on high-latitude marine ecosystems, including their consequences for fisheries and management.
 - ESSAS Annual Meeting in Fairbanks, Alaska, June 11-14, 2018, with sessions on:
 - Novel applications of remote sensing in Subarctic and Arctic marine ecosystems
 - Integrated Ecosystem Assessments (IEA) in the Subarctic and Arctic
 - Paleoecology of Subarctic and Arctic gadids
 - Biology and ecology of Arctic gadidsA special issue in Polar Biology from the latter session is in preparation
- b. GC II. Improving scenarios, predictions and projections of future ocean-human systems at multiple scales
 - 3rd RACArctic workshop (see above): One of the aims of RACArctic is to develop plausible scenarios for anticipated changes in high-latitude marine ecosystems, and in particular its consequences for fish populations and fisheries, based on a review of available literature, including qualitative predictions and available projections. Three manuscripts are in preparation, as well as an informational sheet for stakeholders.
- c. GC III. Improving and achieving sustainable ocean governance
 - 3rd RACArctic workshop (see above): One of the three synthesis papers will assess the ability of current management structures in the Pacific and Atlantic Arctic to address challenges associated with the effects on climate change on marine systems.
- d. IC I. To enhance understanding of the role of metabolic diversity and evolution in marine biogeochemical cycling and ocean ecosystem processes
 - N/A
- e. 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

- One of the ESSAS endorsed projects, the Arctic Marine Biological Observation Network (AMBON), aims to develop a long-term observing program in the Chukchi Sea to monitor EOVs and biodiversity at all trophic levels.
 - Session on 'Integrated Ecosystem Assessments (IEA) in the Subarctic and Arctic' at the ESSAS Annual Meeting.
- f. IC III. To advance understanding of ecological feedbacks in the Earth System
- N/A
- g. IC IV. To advance and improve the use of social science data for ocean management, decision making and policy development
- Our working group on Human Dimensions is now under new leadership (Alan Haynie, NOAA, USA) and is in the process of re-defining its Terms of Reference.

2. Selected highlights

- a. Selected scientific highlights last six months (1-3)
- Ecosystem responses to a cold period in the Northeast Atlantic in the 1970s and 1980s, linked to the Atlantic Multidecadal Oscillation (AMO), were synthesized by Drinkwater and Kristiansen (2018). During this period, below average air and sea temperatures, expanded sea-ice cover and reduced Atlantic inflow into the Northeast Atlantic Ocean led to decreased primary production, a general southward expansion of arctic and boreal zooplankton and fish species, and a southward retreat of temperate species. These changes, along with fishing pressure, led to the collapse of several important fisheries at the northern end of their distribution, including the Atlantic cod fishery off Greenland and Labrador/northern Newfoundland and the Norwegian spring-spawning herring off Iceland and Norway. The authors conclude that a primary mechanism driving these changes was declines in growth rates and recruitment associated with the impacts of temperature on food availability.
 - Models of species distribution in the Pacific Arctic Gateway (eastern Bering Sea and Chukchi Sea) suggest that shifts in the distribution of fish species lags behind changes in climate and the pace of change differs substantially among species (Alabia et al. 2018). Subarctic species were more sensitive to habitat changes than Arctic species but often shifted in unexpected ways and climate velocity (the rate of climate shifts) was poorly correlated with observed shifts in species distribution. This study highlights the importance of understanding species-specific responses when predicting range shifts.
- b. Selected publications last six months (1-5)
- Alabia, I.D., García Molinos, J., Saitoh, S.-I., Hirawake, T., Hirata, T., Mueter, F.J., 2018. Distribution shifts of marine taxa in the Pacific Arctic under contemporary climate changes. *Divers. Distrib.* 24, 1583-1597, doi:10.1111/ddi.12788
 - Drinkwater, K. F. and Kristiansen, T., 2018. A synthesis of the ecosystem responses to the late 20th century cold period in the northern North Atlantic. *ICES J. Mar. Sci.*, doi:10.1093/icesjms/fsy077.

- Laurel, B. J., Copeman, L. A., Spencer, M., and Iseri, P., 2018. Comparative effects of temperature on rates of development and survival of eggs and yolk-sac larvae of Arctic cod (*Boreogadus saida*) and walleye pollock (*Gadus chalcogrammus*). ICES J. Mar. Sci., doi:10.1093/icesjms/fsy042
 - Rastrick, S.S.P., Graham, H., Azetsu-Scott, K., Calosi, P., Chierici, M., Fransson, A., Hop, H., Hall-Spencer, J., Milazzo, M., Thor, P., Kutti, T., 2018. Using natural analogues to investigate the effects of climate change and ocean acidification on Northern ecosystems. ICES J. Mar. Sci., doi: 10.1093/icesjms/fsy128
 - Skern-Mauritzen, M., Olsen, E., and Huse, G., 2018. Opportunities for advancing ecosystem-based management in a rapidly changing, high latitude ecosystem. ICES J. Mar. Sci. fsy150, doi:10.1093/icesjms/fsy150
- c. Number of publications last six months
- 11
- d. International events (Title, date, and place, incl. participation as chairing and/or running titled sessions and workshop)
- ESSAS Annual Science Meeting June 11-14, 2018 (see above). Convened by ESSAS co-chairs Franz Mueter, Ken Drinkwater and Sei-Ichi Saitoh.
 - ICES Annual Science Conference, September 24-27, 2018, Hamburg, Germany (2 ESSAS presentations).
 - PICES Annual Meeting Workshop 2: MONITOR/FIS Workshop: PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment. Co-convened by Sei-Ichi Saitoh.
- e. SSC meeting/workshops
- Annual meeting, June 15, 2018, Fairbanks, Alaska

3. International collaboration and links

- Japan: Arctic Climate Centre, Hokkaido University, Sapporo, Dr. Sei-Ichi Saitoh, Dr. Irene Alabia; Graduate School of Fisheries Sciences at Hokkaido University in Hakodate, Dr. Toru Hirawake; Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokosuka, Dr. Naomi Harada.
- Korea: Korea Polar Research Institute (KOPRI), Incheon, South Korea, Dr. Hyun-Cheol Kim.
- USA: University of Alaska, Fairbanks, Dr. Franz Mueter, Dr. Seth Danielson; University of Washington, Seattle, Washington, Dr. George Hunt and Dr. Ben Fitzhugh; NOAA, Dr. Alan Haynie.
- Canada: Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Dr. Kumiko Azetsu-Scott.
- Greenland: Greenland Institute of Natural Resources (GNIR), Nuuk, Dr. Caroline Bouchard.
- Iceland: Marine Research Institute, Reykjavik, Dr. Olafur Astthorsson.
- Norway: Institute of Marine Research, Bergen, Dr. Ken Drinkwater; Institute of Marine Research, Tromsø, Dr. Benjamin Planque; Arctic University of Norway, Tromsø, Dr. Arne Eide; Norwegian Institute for Water Research (NIVA), Oslo, Dr. Trond Kristiansen.

4. Input to management and policy

- ESSAS members Franz Mueter and George Hunt serve on the Scientific and Statistical Committee of the North Pacific Fishery Management Council, directly providing advice to fishery managers, including the setting of biological catch limits. Other SSC members provide advice to fishery managers in Japan (Sei-ichi Saitoh), Iceland (Olafur Astthorsson) or Norway (Benjamin Planque).
- Two papers in a recent ICES Journal of Marine Science special issue based on the 2017 ESSAS Open Science Meeting in Trømsø, Norway, provide management and policy relevant recommendations on the scientific basis for management in the US (Merrick, <https://doi.org/10.1093/icesjms/fsx228>) and on ecosystem-based management in a rapidly changing Arctic (Skern-Mauritzen et al, <https://doi.org/10.1093/icesjms/fsy150>).
- The RACArctic project is currently preparing a synthesis manuscript on the preparedness and resilience of fishery management systems in Japan, Norway and the US.

5. Education and outreach

- ESSAS did not engage in formal outreach activities in 2018 beyond outreach to the scientific community through sessions and workshops and outreach to stakeholders in Norway in preparation for a RACArctic stakeholder meeting.

6. Planned activities for next six months

- a. Activities within the Programme
 - One-day RACArctic stakeholder meeting in Norway
- b. Actions to link Programme to the Challenges
 - Supporting a new working group (AnalogueART) that examines the use of natural analogues in understanding the sensitivity of marine systems to climate change and ocean acidification and to assess the capacity of different species acclimation and adaptation to elevated CO₂ levels
 - Organizing an Arctic session and two workshops at the IMBER Open Science Conference:
 - Session: Arctic marine ecosystems in a changing climate
 - Workshop: Bioenergetics and survival trajectories of Arctic fish in response to environmental stressors
 - Workshop: Natural analogues of an Arctic in rapid transition (AnalogueART); Using natural analogues to investigate the effects of climate change and ocean acidification on northern ecosystems
- c. Outreach (Convening sessions, meetings, etc)
 - See sessions above
- d. Upcoming papers (Community-Position-Review-etc)
 - Three RACArctic synthesis papers on physical and biological changes affecting Subarctic and Arctic marine ecosystems and the responses of fish populations, fisheries and fishery management to these changes.

- F. Mueter (University of Alaska Fairbanks) and M. Fossheim (IMR, Trømsø) are preparing a comparative paper on the borealization of the Pacific Arctic (Bering Sea) and the Atlantic Arctic (Barents Sea).

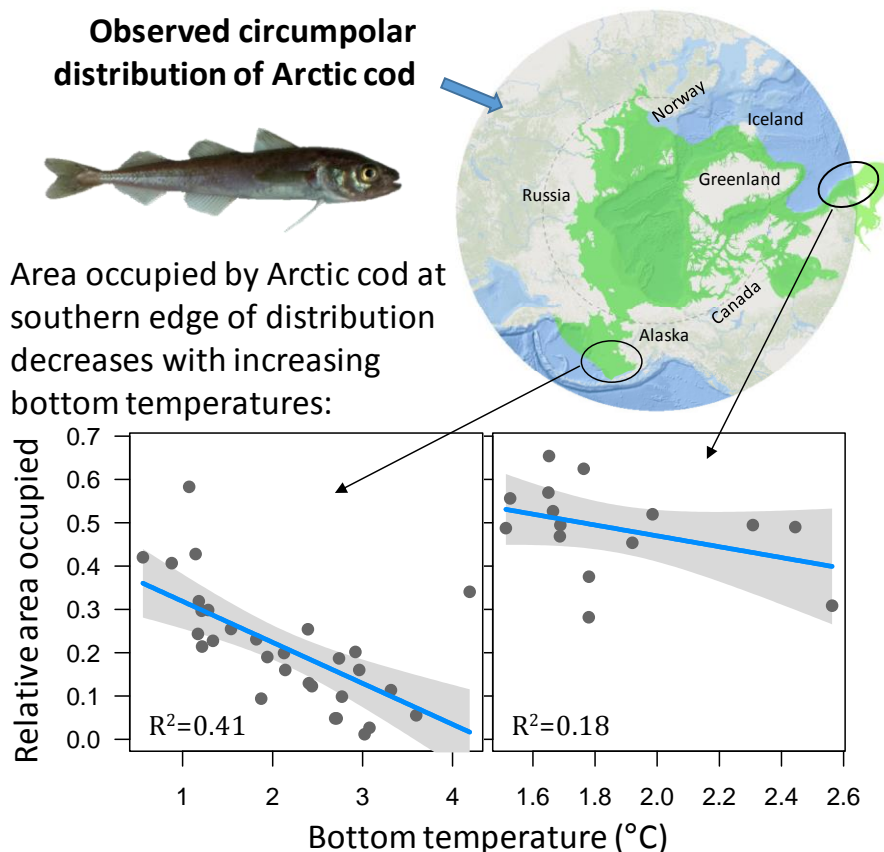
7. Funding

- Funding from external sources
 - Support for the Annual Science Meeting was obtained from the European Space Agency, the National Science Foundation, the Alaska Satellite Facility (University of Alaska Fairbanks) and the College of Fisheries and Ocean Sciences (UAF).
- Funding proposals in progress or planned
 - Proposal to the US National Science Foundation for a program office in Alaska.

8. Changes to Organisational Structure (e.g. SSC) of RP / WG

New leadership and Terms of Reference for the Human Dimensions Working Group (Dr. Alan Haynie) and the Bioenergetics Working Group (Dr. Benjamin Laurel).

9. Image / Figure



10. Update on Action Items from Hobart SSC meeting

Please update the table of Action Items (below) indicating whether an item is completed or ongoing and adding any further details if appropriate.

11. Appendices

For other updates, see <http://essas.arc.hokudai.ac.jp>

**List of Actions resulting from the 15th IMBeR Scientific Steering Committee Meeting
16-19 April 2018, CSIRO, Hobart, Tasmania**

Please indicate if action item is “DONE”, “ONGOING”, and provide any other details if pertinent. For expansive comments, please write under “Item” in a different colour

Number	Item	Progress
Action 1	Cisco and Alistair to make a recommendation on the level of reporting for all the GC's	
Action 2	Cisco and Alistair to consider developing a session proposal for the OSC to review the progress of GCI	
Action 3	Laurent to contact Derek Tittensor (UNEP) to discuss mutual benefit of FISH-MIP being an IMBeR endorsed project	
Action 4	Lisa and Fang to watch for the Lotze et al Nature Climate Change paper, currently in review. (it includes important figures on change in marine animal biomass)	
Action 5	Carol to contact Katya Fennel and Marion Gehlen on linking GODAE back with IMBeR and propose session at OSC.	DONE
Action 6	Alistair to develop an OSC session on adaptation	DONE
Action 7	Eugene and Laurent to develop a 'Best practice guide' to standardize models to enable comparisons of changes in different systems	
Action 8	Marion, Mark and Ingrid to decide on three actions (and who will do them) to progress GC3 to be able to assess by the next SSC meeting how successful progression of GC3 was during 2018-2019	
Action 9	Marion, Ingrid and Mark to rephrase text boxes to remove any ambiguity regarding ocean governance.	
Action 10	Marion, Ingrid and Mark to rephrase Text box 6 so that it explicitly shows that science must be able to be communicated	
Action 11	Marion, Ingrid and Mark to determine where IMBeR might position itself in relation to ocean governance by the October SSC meeting.	
Action 12	Marion to forge links with ESG and the Ocean KAN and determine how IMBeR can contribute.	
Action 13	SSC to convey comments on the CMWG to Richard and SuMei via Fang at the Regional Project Office	
Action 14	Regional programme chairs to contact Ingrid to discuss ways to integrate the human dimension into the regional programmes	
Action 15	Carol to send Ingrid the HD contact in SIOA following their meeting in May to Ingrid	DONE
Action 16	Ruben to inform the IPO who has been invited to join the IMBeR EBUS WG by 30 June 2018 (after the meeting in Washington)	
Action 17	Ruben to update the EBUS ToRs and identify what each of the three groups will do by 30 June	
Action 18	IPO to send Laurent details of the Carbon think-tank meeting in Paris so that he can attend on behalf of IMBeR if he is available	

Action 19	SSC to consider appointing someone with carbon expertise onto the 2019 IMBeR SSC to provide a link to the new carbon group	
Action 20	Carol to discuss carbon group and the potential inclusion of DOC at SOLAS-IOCCP meeting in May	DONE
Action 21	Carol to send the name of the SIOA socio-economist to Ingrid	DONE
Action 22	Carol to suggest that Jim Orr submit a theme proposal for OSC	DONE
Action 23	IPO to highlight the Kwiatkowski & Orr 2018 Nature Climate Change paper on the website	DONE
Action 24	Gerhard to submit special session at ASLO, Puerto Rico 2019 (explicitly mentioning IMBeR in the abstract)	
Action 25	Gerhard to progress review paper / papers from IMBIZO5 and send to the IPO at the end of July 2018	
Action 26	Gerhard to submit a session proposal on evolution/biodiversity for the IMBeR OSC	DONE
Action 27	Patricia was invited to attend the final day of the SSC meeting to discuss GOOS and whether there are any aspects of the EcoBio Panel work that IMBeR can help with	
Action 28	Frank to keep 'watching brief' on international progress on ocean observations	
Action 29	Laurent and Eugene to assess the potential of publishing a position paper on ecological feedbacks	
Action 30	Laurent and Eugene to contact other modellers to propose (and convene) a collaborative session on Ecological Feedbacks at the IMBeR OSC	DONE
Action 31	Frank to send Ingrid the contact information of those involved in the GEO data portal	
Action 32	Ingrid to discuss developing a best practice data acquisition/procurement guide with the HDWG	
Action 33	Ed to send the SCOR Human Capacity Development document to Chris	DONE
Action 34	Eugene to send Chris APECS contact information	
Action 35	Chris to contact the chairs of the other early career groups to find synergies	
Action 36	Chris to report back to SSC following the first meeting of the Early Career Network committee in Croatia in June	
Action 37	Carol, Lisa and John to attend Future Earth meeting in August 2018	
Action 38	Ed to contact Chris re required text and setting up crowd-sourcing on the SCOR platform	DONE
Action 39	Ken to contact Jim Orr to potentially link ESSAS's ocean acidification working group with the SIOA	
Action 40	Carol to contact Cat Downy at ESF re funding and to send a representative who uses ESF tools to the ESSAS ASM	DONE
Action 41	Carol and Fang to contact Prof Lui to renegotiate the MoU with ECU in early 2019	
Action 42	Fang to set up a meeting to review the IMBeR metadata portal for endorsed projects with Carol and John later this year	
Action 43	Carol discuss with Frank re endorsing Metropole	DONE
Action 44	Fang to facilitate the IMBeR endorsement of the Metropole project.	
Action 45	Carol to contact Jim Orr re submitting an Ocean Acidification session	DONE
Action 46	Carol to contact SOCAT/Dorothee Bakker re submitting a session proposal on inorganic carbon cycling	DONE
Action 47	Gerhard to submit a session proposal on DOM Lablity and the microbial carbon pump	DONE

Action 48	Lisa to contact Ratana Chuenpagdee re submitting a session proposal on her OFI module	DONE
Action 49	Lisa to discuss with Alistair re a co-convener (Karen mentioned Madeleine Cahill) for an extreme events session	DONE
Action 50	Mark, Chris and Ingrid to submit a proposal for a governance workshop	DONE
Action 51	Gerhard to submit a proposal on evolution and metabolic diversity	DONE
Action 52	Eugene and Laurent to submit a proposal on feedbacks to the Earth System	DONE
Action 53	Fang to encourage Richard and Su Mei to submit a continental margins proposal	DONE
Action 54	Ruben to submit a session proposal on EBUS	
Action 55	Lisa to contact the regional programmes about submitting sessions for the OCS	DONE
Action 56	Lisa to contact Laurent re holding the 2019 SSC meeting in Paris	DONE
Action 57	IPO to do a cost comparison of holding the meeting in Paris or Concepcion for the SSC meeting	DONE
Action 58	Carol to progress with Eileen for OSC	DONE
Action 59	IPO to watch for the Belmont Forum call pertaining to Marine issues	DONE
Action 60	Ingrid to investigate SNAPP and inform the IPO and HDWG if appropriate	
Action 61	Eugene to inform the IPO when the NERC call is launched	
Action 62	IPO to investigate POGO funding opportunities	
Action 63	All SSC members to pass any call that looks appropriate for IMBeR onto the IPO	
Action 64	Chris to undertake stakeholder mapping analysis across the SSC, include Carol in discussion	
Action 65	Carol to send relevant submitted OSC proposals to Cisco and Alistair to ensure that GCI is covered	DONE
Action 66	Alistair to define success of GCI, decide reporting level, produce paper on speeding up the process	
Action 67	Fang to contact Eric Galbraith re IMBeR endorsement of FISH-MIP	
Action 68	Laurent to attend FISH-MIP workshop later in 2018	
Action 69	Fang to contact Eric Galbraith about endorsing BIGSEA	
Action 70	Carol to ask Katja Fennel and Marion Gehlen (cc Laurent and Eugene) re leading an OSC session on forecasting	DONE and Laurent also sent a reminder
Action 71	?? to suggest that Mick Follows and Stephanie Dutkiewicz convene a session on biodiversity at the OSC	
Action 72	?? to submit an OSC session on extreme events	DONE
Action 73	Cisco to speak to Robin Brown about a joint session at the IMBeR OSC	DONE and proposal submitted
Action 74	Marion to act as a link with Ruben Zondervan, Executive Officer of ESG	DONE
Action 75	Carol to contact Alice about potential OSC sessions	DONE and proposal submitted
Action 76	Fang to send Patricia's presentation to SSC	DONE
Action 77	Carol to introduce Patricia and Gerhard electronically	DONE
Action 78	IPO to contact Future Earth re communications help	DONE but no response
Action 79	Marion and others involved in ocean governance to submit a proposal for a session or workshop at the IMBeR OSC.	DONE

Action 80	Marion to submit a follow-up proposal to the TRANSCOM proposal (Belmont T2S final round) in an appropriate funding line.	
Action 81	Chris to provide links to environmental social science associations and programmes to help identify the groups that IMBeR needs to influence.	
Action 82	Alice Newton and Marion Glaser to link to the different ocean governance groups and inform IMBeR about any potential inputs for GCIII or gaps that IMBeR could address	
Action 83	SSC test-drive web-based guide and give Phil feedback (Philip.Boyd@utas.edu.au)	
Action 84	SSC test-drive the web-based resource and send feedback to Phil	
Action 85	IPO to include a link to GOA-ON on the IMBeR website	DONE
Action 86	Laurent and Eugene to contact Marcello Vichi and Marion Gehlen re organising a modelling development framework workshop at the OSC.	
Action 87	Frank to send IPO contact details for GEO, GEOBON and Blue Planet for Carol to make contact with them to initiate collaboration with IMBeR	DONE
Action 88	Ruben to inform Carol of developments regarding joint meeting with SCOR WG and CLIVAR at the end of June	
Action 89	Lisa to inform IPBES that Frank is the new IMBeR observer	DONE
Action 90	Karen to send Frank the call for review of the regional reports.	
Action 91	Carol to contact Wendy Watson-Wright regarding the possibility of hosting the IPO	DONE
Action 92	Carol to contact BioDISCOVERY co-chairs Lynne Shannon (lynne.shannon@uct.ac.za) and Michael Schaepman (Michael.schaepman@geo.uzh.ch) and Cornelia Krug (Exec Officer)	
Action 93	Marion, Mark, Ingrid and Chris to develop a list to map potential social/political groups IMBeR might engage with before the October SSC meeting	
Action 94	Carol to make initial contact with identified social/political groups IMBeR might engage with	
Action 95	All to encourage acknowledgement of IMBeR in publications	
Action 96	Special issue editors to ensure that all authors acknowledge IMBeR in acknowledgements	
Action 97	IPO to arrange biannual meetings of the regional programme chairs to highlight synergies between the projects	
Action 98	Carol to contact Raleigh with feedback from the SSC and to discuss SSC succession	
Action 99	Chris to check if there is a programme linking society and regional governance after the June meeting	
Action 100	Mark and Eugene to discuss stakeholder involvement processes (ICES experience)	DONE
Action 101	Lisa to ask Nadine Johnson to send 10 years of ICED text for IMBeR website in May	DONE
Action 102	Lisa to ask Nadine Johnson for blurb for website when Johnson et al. - 10 Years of Integrating Climate and Ecosystem Dynamics (ICED) in the Southern Ocean: Developments, highlights and future direction is published	DONE
Action 103	Carol thanked Eugene and the ICED team for their great work. She will send feedback from the SSC to Eugene to pass on to the ICED team.	
Action 104	Marion to send contact details of Joan Nymand Larsen (social science in the Arctic) to Ken	
Action 105	IPO to contact Ken/Alf, Rachel and Henrik regarding an OSC session on regional governance	DONE
Action 106	Carol thanked Ken and ESSAS for their great work. She will provide feedback from the SSC to Ken to pass on to the ESSAS team	
Action 107	Cisco to encourage PICES to come to the CLIOTOP Symposium	

Action 108	Carol to contact Karen and the CLIOTOP team to thank them for the great work CLIOTOP	
Action 109	IPO and Carol to consider more interactive sessions in the 2019 agenda – discuss with Ingrid and Chris (2 hours for regional programmes, but more interactive)	
Action 110	SSC send suggestions expertise (top three) needed to Lisa 1 May for call in May	DONE
Action 111	SSC to provide suggestions to Fang if they know of potential projects that might want to seek IMBeR endorsement	
Action 112	Veslemøy to produce a budget estimate for Concepcion or Paris	DONE
Action 113	Carol to contact Wendy Watson-Wright	DONE
Action 114	Carol to contact Future Earth to see if co-hosting with the one of the hubs would be feasible	DONE