

Report of the Advisory Panel on *Marine Birds and Mammals*

The meeting of the Advisory Panel for Marine Birds and Mammals (AP-MBM; under the auspices of BIO Committee) was held from 09:30–17:00 hours on October 12, 2013 in Nanaimo, Canada. The business meeting focused on the current activities of AP-MBM at the Annual Meeting, on preparations for holding a 1-day session necessary to complete the objectives of the Activity Plan adopted during the 2011 Annual Meeting, and potential for new projects to start in 2015.

AGENDA ITEM 1

Welcome

Dr. Yutaka Watanuki (Japan), Co-Chair of AP-MBM, called the meeting to order and welcomed members and observers (*AP-MBM Endnote 1*). AP-MBM members representing Canada, Japan and USA, and were present. Unfortunately, the U.S. Co-Chair, Dr. Rolf Ream, was not able to attend. AP-MBM has new members appointed from China and Korea, but they, as well as any Russian members, were not able to attend.

AGENDA ITEM 2

Adoption of agenda

The agenda was reviewed and modified (*AP-MBM Endnote 2*) to orient new AP-MBM members and observers with reviews of FUTURE, Terms of References and the AP-MBM Spatial Ecology project. The Terms of Reference and project plan were approved. Members agreed that AP-MBM should be involved in FUTURE and that AP-MBM should have active “responsibilities” in support of FUTURE goals (*AP-MBM Endnote 3*).

AGENDA ITEM 3

Reports from participants

Dr. Robert Suryan (USA) reported on the publication resulting from the BIO/POC Topic Session (S2, co-sponsored by ICES) at PICES-2011 entitled “*Mechanisms of physical-biological coupling forcing biological “hotspots”*”. The Advisory Panel agreed that a pdf of this publication should be shared with the PICES Committee chairs and other interested parties (<http://www.int-res.com/articles/theme/m487p177.pdf>; see also http://www.pices.int/members/advisory_panels/MBM.aspx).

Dr. Suryan reported on the BIO workshop (W3) on “*Marine bird and mammal spatial ecology*” held on October 11. The workshop was well attended (25 attendees) from Canada, Japan, and the U.S. Workshop discussion continued on October 13 (19 attendees; *AP-MBM Endnote 4*; for a summary of the workshop, see http://www.pices.int/publications/annual_reports/Ann_Rpt_13/2013-Session-summaries.pdf).

Dr. William Sydeman (USA) introduced the BIO/FIS/POC Topic Session (S2), entitled “*Are marine ecosystems of the North Pacific becoming more variable?*” to be held October 18, 2013. Two invited and 6 contributed papers will be presented.

Dr. Tsutomu Tamura (Japan) reported on Dr. Hidehiro Kato’s activities as the PICES liaison to the International Whaling Commission (IWC; *AP-MBM Endnote 5*). The Advisory Panel thanked Dr. Kato for his efforts to integrate PICES science in the IWC science-policy arena, and recommends to BIO that Dr. Kato remain as the PICES liaison. The Panel also continues to recommend to BIO that seabird observers be added in the IWC “POWER” cruise.

AP-MBM-2013

Dr. Watanuki (Japan) introduced his paper for MEQ/FUTURE Topic Session (S3) entitled “*Status, trends and effects of pollutants in coastal ecosystems*”. The Panel agreed to note to BIO the value of seabirds and mammals as sentinels of pollution and that AP-MBM can easily contribute to this aspect of the FUTURE program (AICE).

AGENDA ITEM 4

Discussions

Dr. Elliot Hazen (USA) introduced the ½-day workshop entitled, “*Top predators as indicators of climate change*” (Hazen *et al.*) to be held at the FUTURE Open Science Meeting in Kohala Coast, Hawaii (April 15–18, 2013; *AP-MBM Endnote 6*). All AP members have an interest in this session and suggest that an announcement for this workshop should be distributed widely.

Dr. Hazen introduced a 1-day Topic Session proposal for PICES 2014, entitled, “*Strengths and Limitations of Habitat Modeling*” (*AP-MBM Endnote 7*) and agreed to bring the proposal to the BIO Committee. Early career scientists who might become long-term PICES participants were suggested as potential speakers. Needs of better communication to the public, lead time for arranging support from agency managers, and outreach to mammal researchers were also suggested.

Lastly, Dr. Watanuki reviewed AP-MBM activities in 2011–2012 (*AP-MBM Endnote 8*) and noted that the Spatial Ecology and Conservation project ends in 2015. Other potential topics for AP-MBM projects were discussed, and included “Climate Change Impacts, Indicators of Pollutants, and Prey Consumption” (diets, food web dynamics). After deep discussion, it is likely that a project related to prey consumption (led by AP-MBM member, Dr. Andrew Trites, with Martin Renner and Rob Suryan) will be the next focus of AP-MBM science. This will be reviewed and decided at the 2014 business meeting (to be held in Yeosu, Korea).

AP-MBM Endnote 1

AP-MBM participation list

Members

Kaoru Hattori (Japan)
Ken Morgan (Canada)
Patrick O’Hara (Canada)
William Sydeman (USA)
Andrew Trites (Canada)
Tsutomu Tamura, representing Hidehiro Kato (Japan)
Yutaka Watanuki (Japan)

Observers

Elliot Hazen (USA)
George Hunt (USA)
Trevor Joyce (USA)
Oleg Katugin (Russia)
Martin Renner (USA)
Jarrod Santora (USA)
Robert Suryan (USA)
Atsushi Tsuda (Japan)

AP-MBM Endnote 2

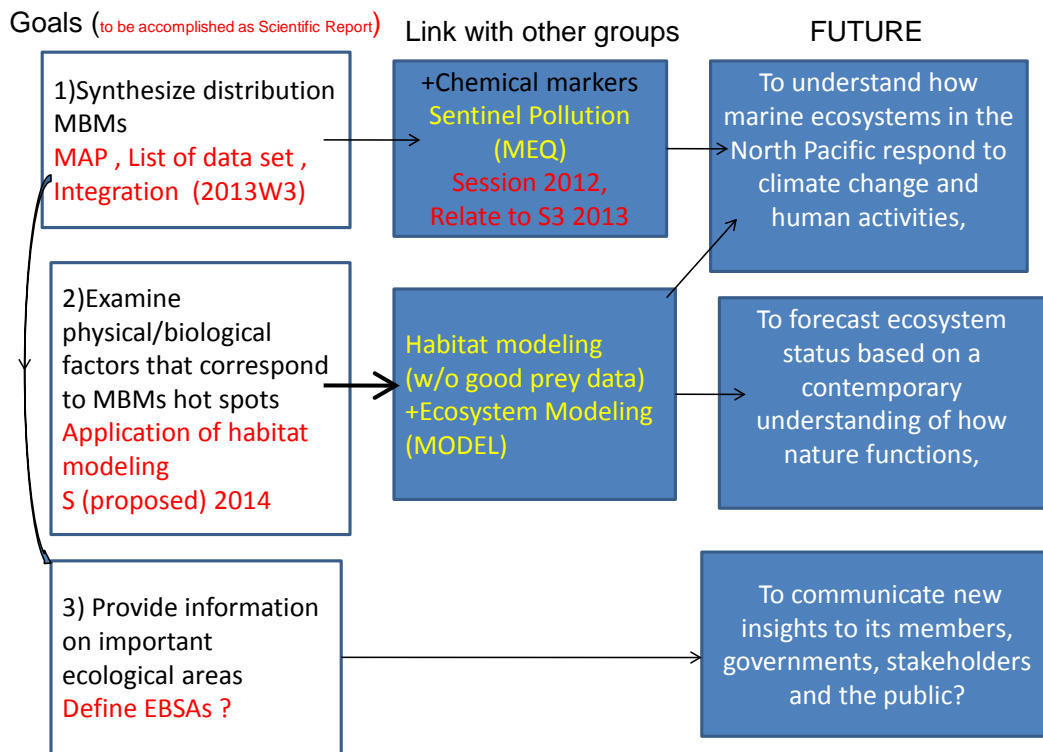
AP-MBM meeting agenda

1. Call to order – Review agenda (modify as needed)
2. Introductions - meeting participants, new members of PICES community
3. Review FUTURE, AP-MBM Terms of reference, AP Spatial Ecology Project plan
4. Reports from participants
 - a. Publication of the Hot Spot symposium 2011 (R. Suryan)
 - b. Report of W3 (R. Suryan)
 - c. Introduction of S2 2013 (W. Sydeman)

- d. IWC (T. Tamura)
- e. Link with other groups (MEQ session, Y. Watanuki, many others?)
- 5. Discussions
 - b. Review 2014 April Inter-sessional Workshop in Hawaii (E. Hazen)
 - c. Review 2014 session proposal and identify possible participants and speakers (Y. Watanuki)
 - d. Long term strategic plan; link with FUTURE, other committees, potential workshop, session
 - e. Ideas of the next 3-year project starting in 2015
 - f. Data integration and strategy to complete PICES report on AP-MBM 3-year project “SPATIAL ECOLOGY” (lead by R. Suryan)

AP-MBM Endnote 3

Spatial Ecology project (2012-2014) of MBMs, HOW USEFUL ?



AP-MBM Endnote 4

PICES Workshop W3
Marine Bird and Mammal Spatial Ecology

“Approaches to Integrate Individual Tracking and Vessel-based Survey Data”*

PICES-2013, Nanaimo, Canada

Co-Convenors

Robert Suryan
Oregon State University, USA

William Sydeman
Farallon Institute for Advance Ecosystem Research, USA

Yutaka Watanuki
Graduate School of Fisheries Sciences, Hokkaido University, Japan,

Rolf Ream
National Marine Fisheries Service, USA

11-12 October 2013

Nanaimo, BC Canada

See [Session Summaries](#) for a full report of the workshop

Marine Bird and Mammal Spatial Ecology

Objectives

1. The primary goal of this workshop was to assess techniques to compile and integrate vessel-based marine bird and mammal surveys with individual tracking data sets.
2. The secondary goal was to catalogue and assess avenues for integrating various data sets. Once primary databases are identified and/or compiled and integrated, the subsequent objectives will include:
 - Synthesize distribution data of marine birds and mammals (MBMs) and assess changes over time
 - Examine physical and biological factors that correspond to high use “hot spots”
 - Map and provide information on important ecological areas in the PICES regions.
3. Outline and coordinate our efforts in producing the final results

Background

Marine birds and mammals (MBMs) are highly mobile, yet relatively easily observed and tracked to determine their spatial distribution throughout the North Pacific Ocean. They are important marine top predators that consume substantial amounts of zooplankton and fish, and are susceptible to changes in marine food web structure, productivity, and to a variety of anthropogenic impacts. Therefore, MBMs are highly visible sentinels of ecosystem health and its change. To incorporate these roles and characteristics of MBMs into ecosystem based management and meet objectives of FUTURE, the PICES MBM Advisory Panel (MBM AP) proposed to focus on MBM spatial ecology and conservation as a priority topic for their 2012-2014 activities.

Over the past several decades, a wide variety of research programs have collected observational and tracking data of MBMs throughout the North Pacific. Portions of these data have been compiled into large databases, such as the North Pacific Pelagic Seabird Database (NPPSD). Other data sets, however, still need to be integrated for more complete coverage of the PICES regions. Holding the proposed workshop is an important first step to compiling and integrating these massive datasets. In February 2012, we held discussions with several of the main data holders/contributors and they expressed broad support for this effort. Workshop invitees were contacted over the past year and included data holders, spatial analysis experts, and end product users.

Appendix 1 Workshop attendees

Sonia Batten	Canada	Corinne Pomerleau	Canada
Douglas Bertram	Canada	Martin Renner	USA
Bryan Black	USA	Tamara Russell	Canada
Carrie Eischens	USA	Ryan Rykaczewski	USA
Jerome Fiechter	USA	Hiroaki Saito	Japan
Marisol Garcia-Reyes	USA	Jarrold Santora	USA
Tracee Geernaert	USA	Hiroko Sasaki	Japan
Kaoru Hattori	Japan	Huamei Shao	Japan
Elliott L. Hazen	USA	Melanie Smith	USA
George Hunt	USA	William Sydeman	USA
Trevor Joyce	USA	Tsutomu Tamura	Japan
Ken Morgan	Canada	Andrew Trites	Canada
Chad Nordstrom	Canada	Atsushi Tsuda	Japan
Patrick O'Hara	Canada	Yutaka Watanuki	Japan
Mayuko Otsuki	Japan		

Appendix 2 Workshop Schedule

Friday, 11 October:	09:00 – 18:00	W3
Saturday, 12 October:	09:30 – 12:30	AP-MBM
	14:00 – 15:00	W3 continued discussion
	15:45 – 17:30	Strategy to complete PICES report

Friday, 11 October

Datasets	
9:00 – 9:15	Suryan: <i>Overview and discussion of goals of workshop</i>
9:15 – 9:30	Piatt et al. (presented by Martin Renner): <i>The North Pacific Pelagic Seabird Database (NPPSD) Version 2: Expanding spatial and temporal ranges and identifying data gaps</i>
9:30 – 9:45	Geernaert et al.: <i>Trends in seabird occurrence on Pacific halibut assessment surveys (2002-2012)</i>
9:45 – 10:00	Ballance, Barlow, and Joyce: <i>At sea marine mammal, seabird, and ecosystem assessment surveys in the eastern Pacific: an overview of Southwest Fisheries Science Center's 23-year time series</i>
10:00 – 10:15	Morgan et al.: <i>Vessel-based marine bird and mammal surveys in BC Canada.</i> Zerbini et al.: <i>An overview of vessel-based cetacean surveys and satellite telemetry studies conducted by the National Marine Mammal Laboratory in the North Pacific Ocean, the Bering Sea and adjacent waters (cancelled)</i>
10:15 – 10:45	Break
10:45 – 11:15	<i>Discussion: Data gaps, accessibility, and needs</i>
Applications	
11:15 – 11:30	Tamura et al.: <i>Geographical and temporal distribution of common minke, sei and Bryde's whales in the western North Pacific in relation to prey availability</i>
11:30 – 11:45	Hazen et al.: <i>Understanding spatial overlap of human impacts and marine predator distributions</i>
11:45 – 12:00	Sasaki et al.: <i>Seasonal shift of Bryde's and sei whale habitat in the western North Pacific</i>
12:00 – 12:15	Bertram et al.: <i>Interannual variation in zooplankton prey distribution determines marine breeding distributions of Cassin's Auklet in the proposed Scott Islands National Marine Wildlife Area in Canada</i>
12:15 – 1:30	Lunch
1:30 – 2:00	<i>Discussion: How would integrated datasets be used and who/what would benefit from these.</i>
Integration	
2:00 – 2:30	Renner (invited): <i>Combining tracking and transect data - issues and possible solutions</i>
2:30 – 2:45	Watanuki et al.: <i>Distribution of short-tailed shearwaters in the northern North Pacific: a comparison between geolocator-based tracking of individuals and boat-based surveys</i>

2:45 – 3:00	Santora et al.: <i>Comparative habitat use and spatial overlap of sooty shearwaters using shipboard surveys and satellite-tracking</i>
3:00 – 3:15	Bailey, Bograd et al. (presented by Elliott Hazen): <i>Integrating blue whale satellite telemetry and oceanographic data to develop habitat models for conservation management</i>
3:15 – 3:45	Break
3:45 – 6:00	<i>Discussion & Simulations: Integrating tracking and survey data. Synthesis and next steps (to be continued Saturday afternoon, if needed)</i>

Saturday, 12 October

9:30 – 12:30	Marine Bird & Mammal Advisory Panel Meeting
2:00 – 3:00	W3 discussion of end product users needs from data, including modelling and FUTURE
3:15 – 3:45	Break
3:45 – 17:30	Strategy to complete PICES report

AP-MBM Endnote 5

PICES Observer Report on the 2013 IWC Scientific Committee Meeting

Hidehiro Kato

Tokyo University of Marine Science and Technology, Tokyo 104-8477, Japan

The 65th scientific committee meeting (SC) of the International Whaling Commission (IWC) was held at Jeju, Republic of Korea from June 3–15, 2013. A total of 96 participants from 27 contracting governments, in addition to 46 invited experts and 4 observers from 4 international organizations (CCAMLR, IUCN, PICES, SPAW), participated this year's annual meeting. PICES was especially welcomed by the IWC/SC. For the management of cetacean stocks, which is the most important task for the committee, the SC explored improvement of management methods for cetacean stocks after enforcement of the commercial whaling moratorium in 1985, and had already agreed with the scientific basis of RMP (Revised Management Procedure) in 1996 through long time endeavors by many scientists. The IWC/SC is now continuing work on checking the performance and implementation trial of the RMP for the stocks after completion of their comprehensive assessments.

Under the IWC/SC, following six sub-committees and nine working groups have been established:

- Sub-committee on Revised Management Procedure (RMP),
- Sub-committee on Bowhead, Right and Gray Whales (BRG),
- Sub-committee on In-Depth Assessments (IA),
- Sub-committee on Other Southern Hemisphere Whale Stocks (SH),
- Standing Sub-committee on Small Cetaceans (SM),
- Sub-committee on Whale Watching (WW);
- Working Group on Western North Pacific common minke whales (NPM)

- Standing Working Group Aboriginal Subsistence Whaling Management Procedure (AWMP),
- Working Group on Stock Definition (SD),
- Working Group on Non-Deliberate Human-Induced Mortality of Large Whales,
- Standing Working Group on Environmental concerns (E),
- Working Group to Address Multi-species and Ecosystem Modelling Approaches (EM),
- Working Group on DNA (DNA),
- Working Group on National Progress Reports
- Working Group on Scientific Permits (SP).

Every substantial issue is discussed once at the sub-committees or the working group and then goes to plenary of the committee. After completion of its business at its annual meeting, the IWC/SC makes scientific advice and recommendations to the IWC commission. However, according to resolution adopted in last year's commission meeting, the commission meeting which is usually held immediately after the scientific committee meeting, was held biennially and no commission meeting was held this year.

This year the following topics were noted in discussions from the 2013 annual meeting:

1. RMP implementation

For the RMP implementation, the IWC/SC has focused on the North Pacific common minke whale, and completed the implementation review and made some recommendations though the implementation review will be still continued. In addition, the implementation trials for the North Atlantic fin whale, North Atlantic common minke whale are ready to start, and for the western North Pacific stock, Bryde's whales will start in 2016.

2. Comprehensive assessment, etc.

Under the comprehensive assessments through IA, SH and BRG sub-committees, this year the IWC/SC continued on review of stock status of blue and humpback whales in the southern hemisphere; also North Pacific sei whales and sperm whales in the southern hemisphere are to be discussed priorities in next year's meeting. For the Antarctic minke whale stocks, there was some progress in VPA type analyses (Statistical catch-at-age models) and further discussion on the comparison of population abundance estimates between the second and the third circumpolar surveys. For conservation of western North Pacific gray whale stock, which is a highly depleted one, the IWC/SC originated the GWAP (Western Gray Whale Advisory Panel) in cooperation with IUCN.

3. Management of aboriginal and subsistence whaling

The IWC/SC has managed ongoing aboriginal and subsistence whaling with using AWMP (Aboriginal and subsistence whaling management scheme): including Bowhead whale stocks in the Arctic region, fin whale, minke whale and humpback whale stocks of west Greenland and humpback whale off St. Vincent and Grenadines and Eastern stock of gray whales of Chukotka. Through examinations of updated scientific information the IWC/SC concluded the present catch levels for respective stocks would not harm the stocks.

4. Scientific permit

Under the SP sub-committee to review the scientific permit program (based on Article VIII of the international convention for regulation of whaling), the report from the Icelandic scientific permit workshop and research results and plans for Japanese scientific permits were reviewed.

5. Environment issues and ecosystem modeling

For environment issues around cetacean stock management, the SC has two working groups (E, Environmental concern; EM, ecosystem modeling) and discussed a number of matters related to environmental factors that affect cetaceans.

This year, the following issues were reviewed in looking at the progress of the respective issues of E Working Group:

- 1) Status of the cetacean Environment Report
- 2) Review progress in planning for POLLUTION 2000+, Phase II
- 3) Review oil spill impact
- 4) Review activities by working group of CERD (cetacean emerging and resurging disease)
- 5) Review anthropogenic sounds related issues
- 6) Review activities related Climate Change issue

For ecosystem modeling, EM Working Group dedicated its time to three general tasks: (1) reviewing ecosystem models and modeling approaches that were developed outside of the IWC/SC, especially CCMLR's ecosystem monitoring and management programme; (2) explore how ecosystem models can contribute to developing scenarios for simulation testing of the RMP; (3) review of issues relevant to ecosystem modeling within the SC, focusing on changes in blubber thickness of the Antarctic minke whales in conjunction with environmental changes used in the analyses based on JARPA II (Japanese scientific permit sampling) and GADGET model in some analyses by the Icelandic special permit.

6. North Pacific Sighting survey cruise (IWC/POWER)

IWC sponsored an international cetacean sighting survey program, started in 2010, in cooperation with Japan, Korea and United States. The project includes line transect sighting for estimating population abundance and biopsy skin-sampling and photo ID for stock structure on major large cetaceans. The programme was renamed POWER (North Pacific Ocean whales and ecosystem research project) in 2011, and this year the SC received the 2012 cruise report conducted in waters surrounding 40°N–60°N and 134°W–150°W, which made 169 fin and 151 sei whale sightings, etc. during 2,126 nm effective searching distance. It was planned to conduct a 2013 POWER cruise in waters surrounding 30°N–40°N and 134°W–160°W. Kato requested that PICES' AP-MBM conduct a piggyback sea-bird census on the research vessel; however, it was not accepted by the SC due to logistical reasons, mainly the limitation in accommodations for researchers.

7. Other issues

The SC also covers relevant issues to small cetaceans, whale watching, by-catch and humane deduced mortality, etc., as in previous years.

Next year's annual meeting of the IWC/SC will be held in the alpine town of Bled, Slovenia, from May 12–24, 2014. The IWC commission meeting is planned to be held in the next year, but details of place and date are not yet known.

AP-MBM Endnote 6

Proposal for a ½-day Workshop on “Top predators as indicators of climate change: statistical techniques, challenges and opportunities” at the 2014 FUTURE Open Science Meeting

Sponsoring Committees: POC/WG 27; BIO will seek co-sponsorship from the IMBER 10-year regional program CLIOTOP

Co-conveners: E. Hazen (lead), M. García-Reyes, M. Litzow, J. Santora, I. Schroeder, S. Bograd (proponent POC/WG27), Y. Watanuki (proponent BIO/ AP-MBM)

Top predators such as fish, turtles, marine mammals, and seabirds can serve to integrate multiple lower trophic level processes and can provide top-down control of marine food webs. Climate variability and changes affect the timing and strength of productivity at the base of pelagic ecosystems, which are integrated by top predator life histories. This could result in changes in breeding patterns, migration strategies and dietary switching, and ultimately in the fitness and reproductive success of the animal. There is a suite of information from top predators around the Pacific, including survey data, tracking data, diet data, and reproductive data, as well as extensive environmental and climate data that can be synthesized to examine differential ecosystem responses spatially as a function of climate variability and change. There are suites of statistical tools used to analyze climate change effects and part of our discussion would be to identify techniques and synthetic approaches for a potential pan-Pacific meta-analysis. Spatial patterns in species response We propose a half-day workshop, and invite topics addressing (1) oceanographic and top predator datasets that can be used to examine responses to climate variability and change, (2) statistical techniques that can be used in differentiating top predator responses to climate variability and climate change, (3) identification of sentinel species that respond directly to climate effects and can be used as leading indicators of ecosystem state, and (4) synthetic approaches to understanding how climate variability and change is incorporated in top predator distribution, abundance, or foraging datasets. From this workshop, we will plan a pan-Pacific meta-analysis and review paper examining this subject.

Potential invited presentations:

- Streaked shearwaters and environmental variability in the Western Pacific (Takashi Yamamoto, Japan)
- Large-scale climate variability, climate change, and predictability in the N. Pacific (M. DiLorenzo / N. Mantua / R. Rykaczewski, USA)
- Seabird responses to climate variability and change in the N. Pacific (W.J. Sydeman, USA)
- Climate change effects in the North Pacific and potential effects on marine predators (J. Polovina, USA)

*AP-MBM Endnote 7***Proposal for a 1-day Topic Session on “Strengths and limitations of habitat modeling: Techniques, data sources, and predictive capabilities” at PICES-2014 [later changed to ½-day]**

Sponsoring Committee: BIO

Co-conveners: Elliot Hazen (NOAA affiliate, Elliott.hazen@noaa.gov), Sei-ich Saito (MONITOR.), William Sydeman (MBM-AP, wsydem@ucsd.edu), Enyuan Fan (MBM-AP.), Rob Suryan (MBM-AP.), Yutaka Watanuki (MBM-AP, lead)*

Habitat modeling has been a powerful tool to find key factors affecting distribution of marine organism and its mechanisms, to predict optimal fishing grounds, to evaluate human impacts on ecosystems, and to project distribution shifts in the face of climate change. Thus evaluation of the strengths and weakness of various modeling approaches is increasingly important. Environmental data are derived from satellite, shipboard surveys, or ocean models and include SST, SST gradient, SSH, Chl-a, and their variation across time, etc and geographic features such as shelf breaks as these are available proxies for prey. While distribution data is based on various sources, ship based line transect survey, animal tracking, fisheries activities (log data, satellite-based fishing light distribution) and hence contains inevitable biases including the selection of the survey line and season, tagging location of tracked animals, the number of sample animals, type of the fishing activities. Biases are also depend on the models; Generalized linear and additive models (GLMs and GAMs), Random Forests, boosted regression approaches, Maximum Entropy modeling (MaxEnt). The session will examine factors causing biases, identify direction of biases, discuss techniques for mitigating or accounting for biases, and create a best-practice guide for using habitat modeling approaches to predict distribution of marine organism in dynamic marine environments.

Support requested for 2 invited speakers

Potential speakers:

M. Renner (Contractor with USFW in Alaska), Ensemble modeling of seabirds at sea.

H. Murase (Fisheries Agency, Japan), Habitat modeling of whales using different techniques.

I. Alabia (Department of Fisheries Sciences, Hokkaido University), Comparison of predictive power of various habitat modeling using fisheries data.

AP-MBM Endnote 8

Time schedule of the Spatial Ecology project

2012

PICES Annual Meeting (Hiroshima, Japan): Start of project

- BIO/MEQ Topic Session (S6): *Environmental contaminants in marine ecosystems: Seabirds and marine mammals as sentinels of ecosystem health* (Y. Watanuki, lead),
- BIO Workshop (W3): *The feasibility of updating prey consumption by marine birds, marine mammals, and large predatory fish in the PICES regions* (G. Hunt, lead).

2013

PICES Annual Meeting (Nanaimo, Canada)

- BIO/FIS/POC Topic Session (S2): *Are marine ecosystems of the North Pacific becoming more variable?* (W. Sydeman, lead),
- BIO Workshop (W3): *Marine bird and mammal spatial ecology* (R. Suryan, lead).

2014

Inter-sessional Meeting (14 April 15–18, 2014, Kohala Coast, Hawaii)

- BIO/POC Workshop (W1): *Top predators as indicators of climate change: Statistical techniques, challenges and opportunities* (E. Hazen, lead).

PICES Annual Meeting (Yeosu, Korea): End of project

- BIO Topic Session (S2): *Strengths and limitations of habitat modeling: Techniques, data sources, and predictive capabilities* (Y. Watanuki, lead),
- Business meeting (request 1 day): Bring draft for Science report.

2015~2017

Next potential 3-year project starting in 2015:

- “Marine climate impacts on MBMs through food web” (Potential leader: William Sydeman, USA),
- “Marine mammals and seabirds as indicators of temporal and spatial variations of pollutants”,
- “MBMs as a predictive indicator of forage fish”,
- “MBMs as consumers” will be probably the focus of the next science project/plan (Potential leader: Andrew Trites, Canada) and will be integrated with spatial data and ecosystem modeling.

At a related Workshop at PICES-2012 (“The feasibility of updating prey consumption by marine birds, marine mammals, and large predatory fish in the PICES regions (Co-Convenors: G.L. Hunt, H. Kato, M. Seki)), participants agreed that it is important to update information on prey consumption by marine birds and mammals, and to include a select group of large predatory fishes.