Swedish Agency for Marine and Water Management

PAME II-2019: Agenda 4.2

Modelling Arctic oceanographic connectivity to further develop PAME's MPA toolbox

This project is a continuation to PAME's

Framework for a Pan-Arctic Network of Marine Protected Areas

Lead country: Sweden

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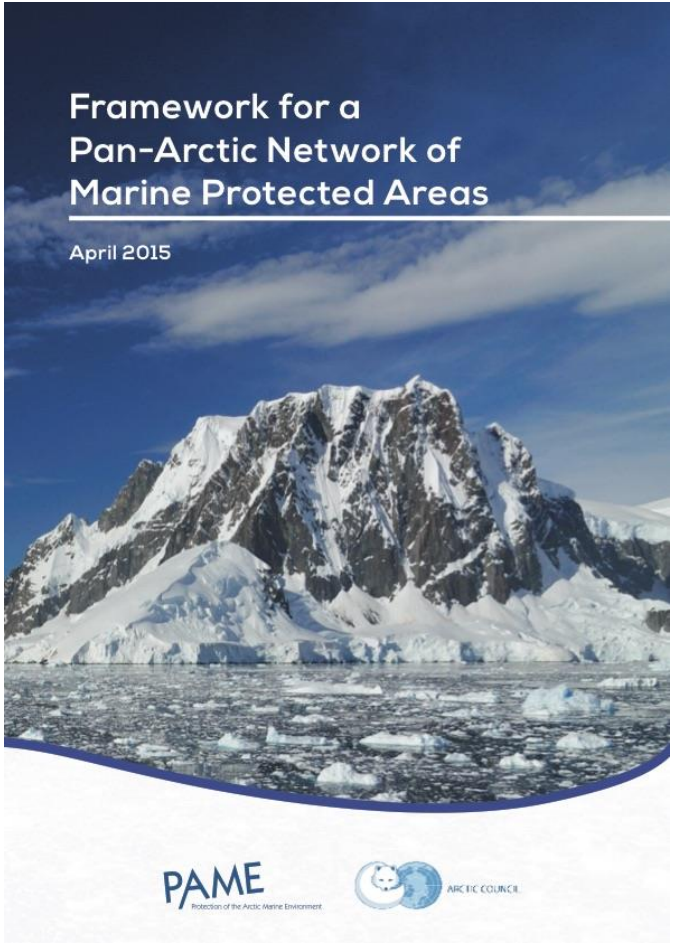

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Vision: Ecologically connected, representative and effectively managed network of protected and specially managed areas

PAME recognizes that each Arctic State pursues MPA development based on its own authorities, priorities and timelines.

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Aim & objectives

- To further develop the PAME MPA toolbox;
- To map oceanographic connectivity in the Arctic region using biophysical modelling; and
- To identify major barriers to gene flow based on modelled marine connectivity.

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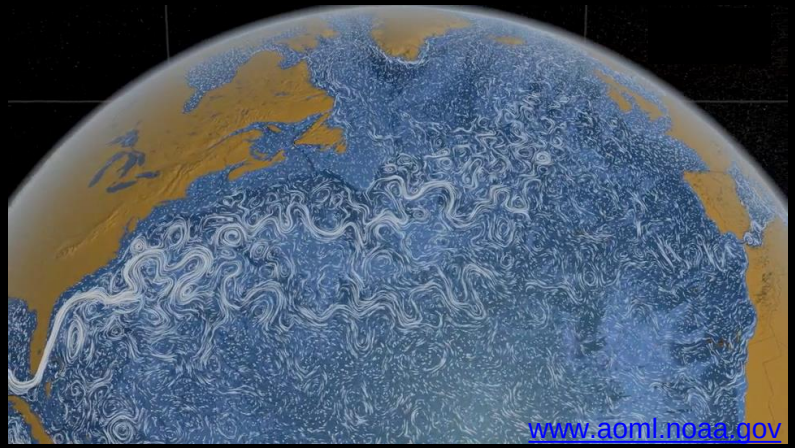
Model connectivity for key species or dispersal strategies in order to e.g.:

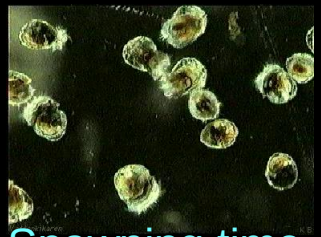
- Identify minimum size of MPAs/ specially managed areas for sufficient self-recruitment of key species
- Identify optimal MPA networks based on modelled connectivity
- Identify major barriers to gene flow based on modelled connectivity

Modelling dispersal & connectivity

Oceanography + Biology



www.aoml.noaa.gov



- Spawning time
- Pelagic larval duration
- Vertical behavior

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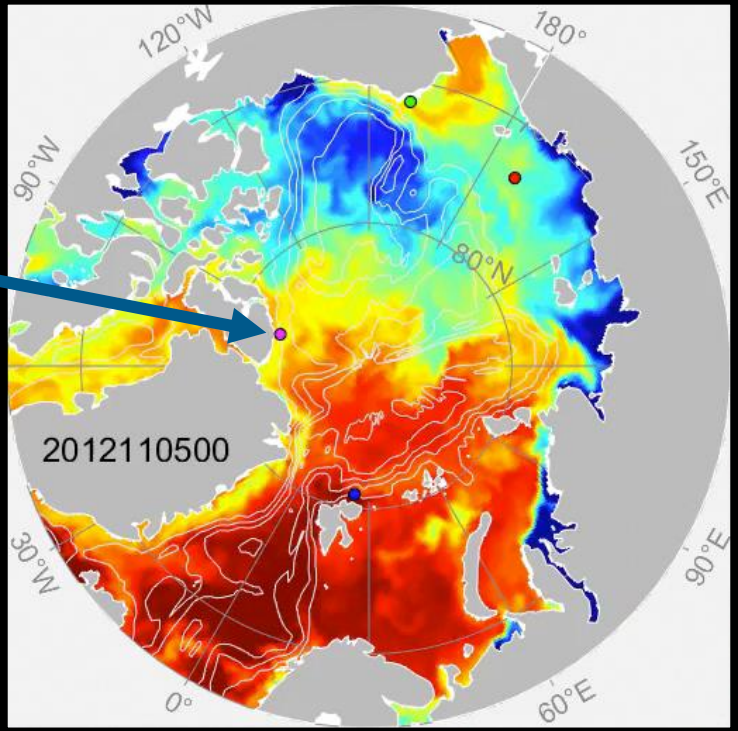
Planned work

- Biophysical modelling of connectivity at the scale of the Arctic Ocean
- Analysis of dispersal distance
- Analysis of connectivity, sources and sinks
- Ranking of areas according to network importance
- Mapping of dispersal barriers

Development of trajectory model

Example of release point



Based on the Norwegian Meteorological Institute former Arctic forecast and prognosis model with 20 km resolution

Meta-analysis of larval dispersal traits

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1				Larval type	Depth of occurrence (m)	Depth distribution (m)					Spawning	Spawning	Larval	Larval	Larval
2						%					season from	season to	season from	season to	peak
3	Phylum/Class	Order/Family	Species/Stage	Pelagic/Benthic		0-20	20-50	50-100	100-200	>200	(month)		(month)	(month)	(month)
4	Pisces	Gadiformes	*Boreogadus saida*	P	surface	100					1	2	2	4	
5	Pisces	Gadiformes	*Eleginus gracilis*	P	surface	100					1	2	2	4	
6	Bivalvia	Adepodonta	*Hiatella arctica*	P	0-65								5	10	
7	Bivalvia	Myida	*Mya truncata*	P	0-65								5	10	
8	Bivalvia	Cardiida	*Serripes groenlandicus*	P	0-65								6	7	
9	Annelida	Polychaeta	*Ampharete arctica*	B	0-65										
10	Annelida	Polychaeta	*Artacama proboscidea*	P	6-200								4	6	
11	Annelida	Polychaeta	*Chone duneri*	P	6-200								6	10	
12	Annelida	Polychaeta	*Eteone barbata*	P	6-200								3	5	
13	Annelida	Polychaeta	*Gattyana cf. cirrosa*	P	6-200								5	8	
14	Annelida	Polychaeta	*Nereis zonata*	B	6-200										
15	Annelida	Polychaeta	*Nicomache lumbricalis*	B	6-200										
16	Annelida	Polychaeta	*Pholoe minuta*	P	6-200								6	8	
17	Annelida	Polychaeta	*Phyllodoce groenlandica*	P	6-200								6	8	
18	Annelida	Polychaeta	*Polydora quadrilobata*	P	6-200								3	5	
19	Annelida	Polychaeta	*Prionospio cirrifera*	P	6-200								7	8	
20	Annelida	Polychaeta	*Scoloplos armiger*	P	6-200								2	5	
21	Annelida	Polychaeta	*Sphaerodorum flavum*	B	6-200										
22	Annelida	Polychaeta	*Terebellides stroemi*	B	6-200										
23	Mollusca		*Macoma calcarea*	P	6-200								5	8	
24	Echinodermata	Holothuroidea	*Eupyrgus scaber*	P	6-200								5	8	
25	Echinodermata	Holothuroidea	*Myriotrochus eurycyclus*	P	6-200								5	8	
26	Echinodermata	Holothuroidea	*Myriotrochus rinki*	P	6-200								5	8	
27	Echinodermata	Ophiuroidea	*Ophiocten sericeum*	P	6-200								1	12	
28	Polychaeta		*Harmothoe sarsi*	P	6-200								6	8	
29	Polychaeta		*Nereis diversicolor*	P	6-200								3	8	
30	Polychaeta		*Nereis pelagica*	P	6-200								4	8	
31	Polychaeta		*Polydora coeca*	P	6-200								5	6	
32	Polychaeta		*Prionospio malmgreni*	P	6-200								6	8	
33	Crustacea		*Balanus sp.*	P	6-200								2	8	
34	Bryozoa		*Group*	P	6	100							6	7	
35	Cru	Cirripedia	*Group*	P	6	100							6	8	
		Bivalvia	*Group*	P	6								5		

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Time plan

- Selection of oceanographic model - TOPAZ, Feb 2019
- Download and preparation of data, May 2019
- Meta-analysis of larval traits, June 2019
- Development of trajectory model, August 2019
- Finalise literature study on key species / larval dispersal traits, September 2019
- Production phase of dispersal trajectories, autumn 2019
- Analysis of connectivity matrices and dispersal barriers, spring 2020
- Delivery of report, June 2020

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Collaboration

- Collaboration with CAFF / CBMP
- Skype meetings with experts from NOAA and WWF
- Experts / reference group

Scientific input

Management questions / user needs

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Thanks to

- Per Jonsson, University of Gothenburg
- Göran Broström, University of Gothenburg