



COEXIST



Integration of Fisheries and Aquaculture

Baltic Maritime Spatial Planning Forum

PartiSEApate Conference

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Coastal zones – competing claims

- ✓ Aquaculture – increased pressure
 - ✓ Increasing globally
 - ✓ NOT increasing in the EU
- ✓ Fisheries – stagnant at best
 - ✓ Conflicts with other users
- ✓ Tourism
 - ✓ Conflicts with other users
- ✓ Windfarms, wavefarms
 - ✓ Extreme growth potential
- ✓ Marine Protected Areas (MPA), conservation

Consortium and Case Studies

1. **HARDANGERFJORD – LP:IMR**
2. **ATLANTIC SEA COAST - LP: UCC**
3. **ALGARVE COAST - LP: IPIMAR**
4. **ADRIATIC SEA COAST – LP: CNR-ISMAR**
5. **COASTAL NORTH SEA – LP: vTI-SF**
6. **BALTIC SEA – LP: FGFRI**

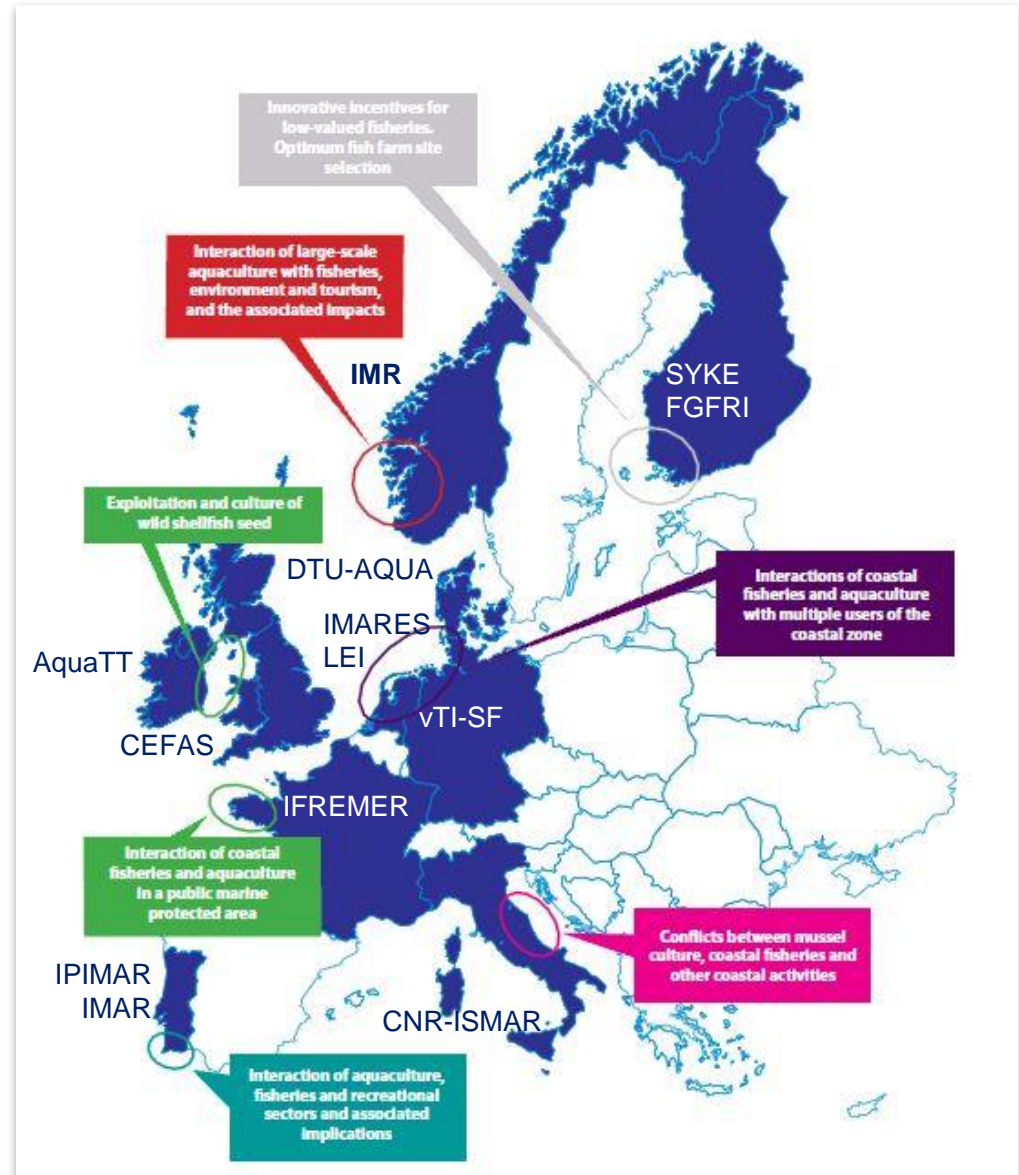






Foto: Epigraph

INTEGRATION - EU POLICY DRIVERS

- EU Integrated Maritime Policy
- Nature protection directives and policies to halt loss of biodiversity and ecosystem services
- Water Framework Directive and Floods Directives
- Marine Strategy Framework Directive
- Integrated Coastal Zone Management (EU ICZM Recommendation)
- Sectoral, cross-cutting policies: energy, transport, regional policies, etc.

From J. Gault et al. Coexist project



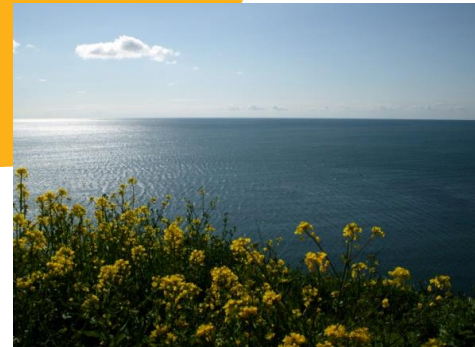
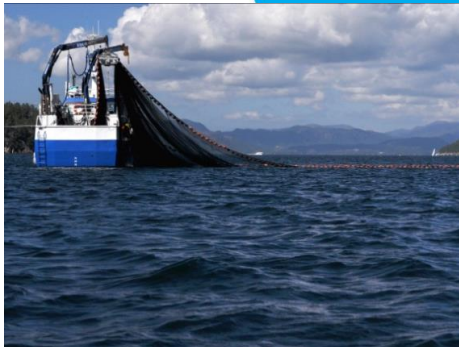


Aquaculture



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Fisheries

Energy, Transport,
Tourism,
Environment, etc.



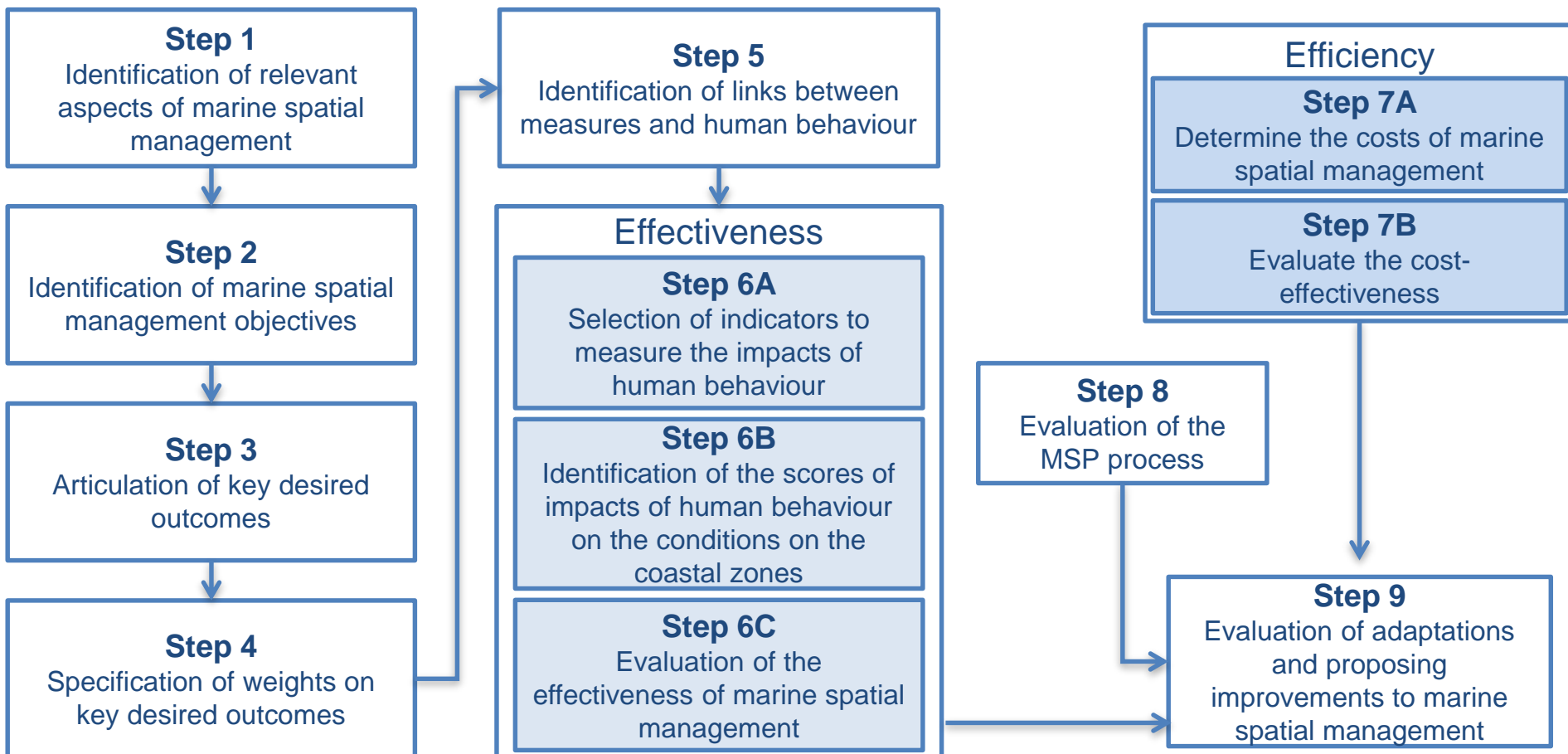
Multi-Criteria Analysis - what is it?

Most MCAs incorporates the following steps:

- ✓ Define and structure the problem
- ✓ Identify relevant alternatives (possible solutions)
- ✓ Identify relevant objectives/ criteria (interests/ values/ aspects)
- ✓ Identify scores for each alternative
- ✓ Identify weights (preferences)
- ✓ Compare results
 - By looking at the MCA matrix, or
 - By aggregating with a suitable MCA techniques

Multi-Objective evaluation

Framework for Multi-objective Quantitative and Qualitative Evaluation of Marine Spatial Management in Coastal Zones



Evaluation of spatial management tools

Objective: To **assess the existing spatial management** tools for each selected case study and propose improvements to those tools

Outcomes: Framework for multi-objective quantitative and qualitative evaluation of marine spatial management of coastal zones

COEXIST
Interaction in coastal waters

COEXIST
Interaction in coastal waters: A roadmap to sustainable integration of aquaculture and fisheries

Project number: 243175
Start date of the project (duration): April 1st, 2010 (36 months)

Deliverable D2.4
Framework for multi-objective quantitative and qualitative evaluation of marine spatial management in coastal zones

Organisation name of lead contractor: LEI, as part of WUR
Due date of deliverable: M12
Actual submission date: M12

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)	
Classification level	
PU: Public	
PP: Restricted to other programme participants (including the Commission Services)	
RS: Restricted to a group identified in the consortium (including the Commission Services)	
CO: Confidential: only members of the consortium (including the Commission Services)	

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The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 243175. The publication of this document is the author's and the European Union's responsibility and does not necessarily reflect the opinions of the European Commission.



Conflicts and synergies

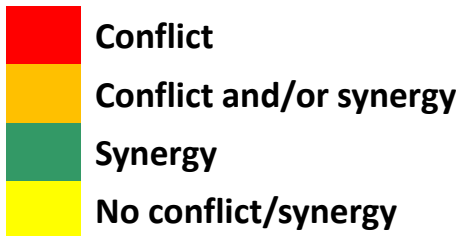
Analysis of conflicts and synergies in each Case Study Area:
Matrix of interactions

Aquaculture vs. Fisheries

		Fisheries					
		Clam fishery	Fixed gears	Mussel fishery	Pelagic trawling	Rapido trawling	Otter trawling
A	Mussel cultivation	Conflict	Conflict and/or synergy	No conflict/synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy

Aquaculture & Fisheries vs. Other activities

		Fisheries & Aquaculture						
		Clam fishery	Fixed gears	Mussel fishery	Otter trawling	Rapido trawling	Pelagic trawling	Mussel cultivation
Other activities	Cables and pipelines	Conflict	Conflict	No conflict/synergy	Conflict	Conflict	Conflict	Conflict
	Coastal constructions	Conflict	Conflict	No conflict/synergy	No conflict/synergy	No conflict/synergy	No conflict/synergy	No conflict/synergy
	Dredging	No conflict/synergy	No conflict/synergy	No conflict/synergy	Conflict	Conflict	Conflict	No conflict/synergy
	Marine Protected Areas	Conflict	Conflict and/or synergy	Conflict and/or synergy	No conflict/synergy	No conflict/synergy	No conflict/synergy	Conflict
	Oil and gas extraction	No conflict/synergy	No conflict/synergy	Synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	No conflict/synergy
	Shipping and transport	Conflict	Conflict	No conflict/synergy	Conflict	Conflict	Conflict	Conflict
	Tourism	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy
	Urban and rural residues	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy	Conflict and/or synergy



Aquaculture – impact on pathogens

Pathogen reservoirs in wild organisms -

Pathogens proliferates in aquaculture

Movement of cultured organisms: vectors for pathogens



Disease

- ✓ Most significant limiting factor in aquaculture
- ✓ Direct impact: mortality
- ✓ Pathogens can be amplified within farm, causing significant infection pressure towards wild stocks
- ✓ Aquaculture and coastal management practices influence the transmission and impact of pathogens



We do know:

Diseases are an integral part of nature

Pathogens are subject to evolution, thus diseases are, too

There is no such thing as a disease-free wild population

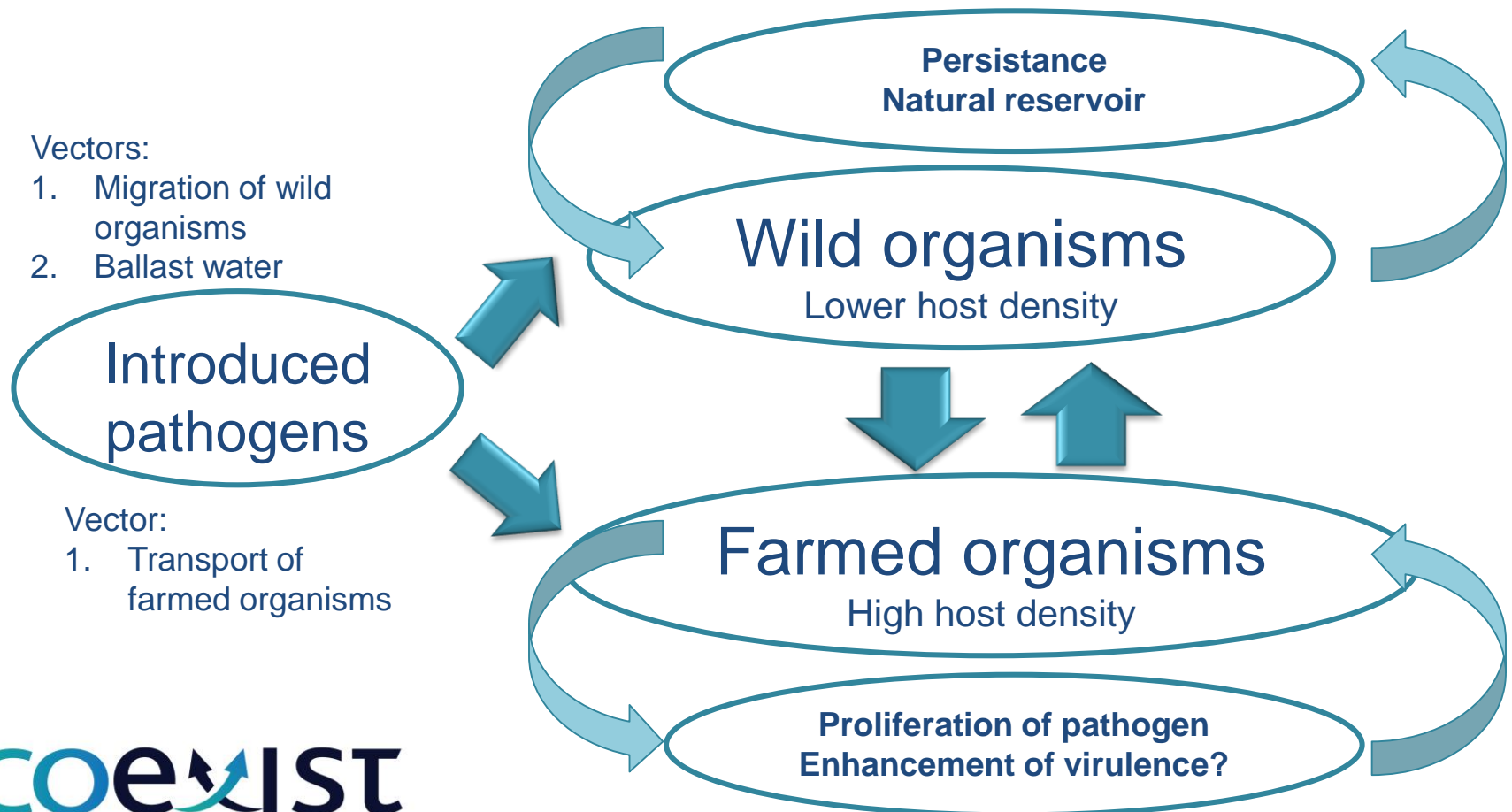
- 1. Absence of pathogens: a situation only existing in an imaginary world of some environmental NGO's.*
- 2. Human behaviour affect proliferation and distribution of pathogens in the wild*

Lessons learned

- Knowledge based on experience
 - Often very expensive "learning"
 - ✓ Introductions of diseases.
 - ✓ Uncontrolled proliferation of diseases
- Models learned from culture of other species
 - Adapt the models
 - ✓ to the marine environment
 - ✓ to bivalves

Exchange of pathogens wild-farmed

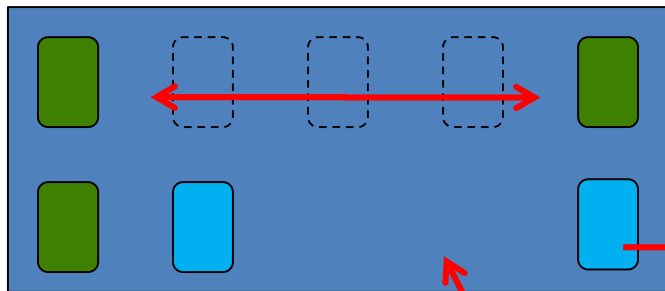
Integration of models and processes



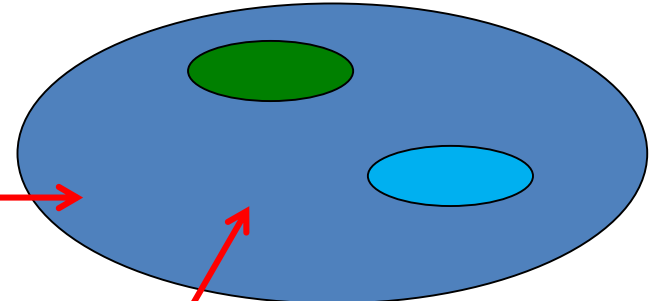
Interconnectivity farmed-wild stocks

Models: Animal welfare

Integrated Multi-Trophic Aquaculture (IMTA)



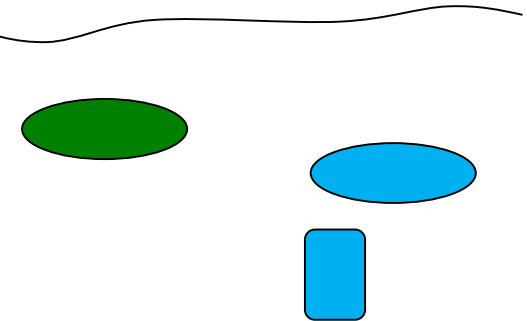
Wild stocks
Wild fish reservoirs



Anthropogenic stock movements
Finfish escapes/migrations
Hydrodynamic connectivity

Offshore
Inshore

Relaying



Compartment-based models:

Individuals transcend through a series of states

- ✓ Susceptible
- ✓ Infected
- ✓ (potentially) back to susceptible

Maximum host carrying capacity – **critical threshold** N_t

- ✓ = maximum number of susceptible individuals
- ✓ - total number of individuals is N

In aquaculture N_t/N can be **manipulated**

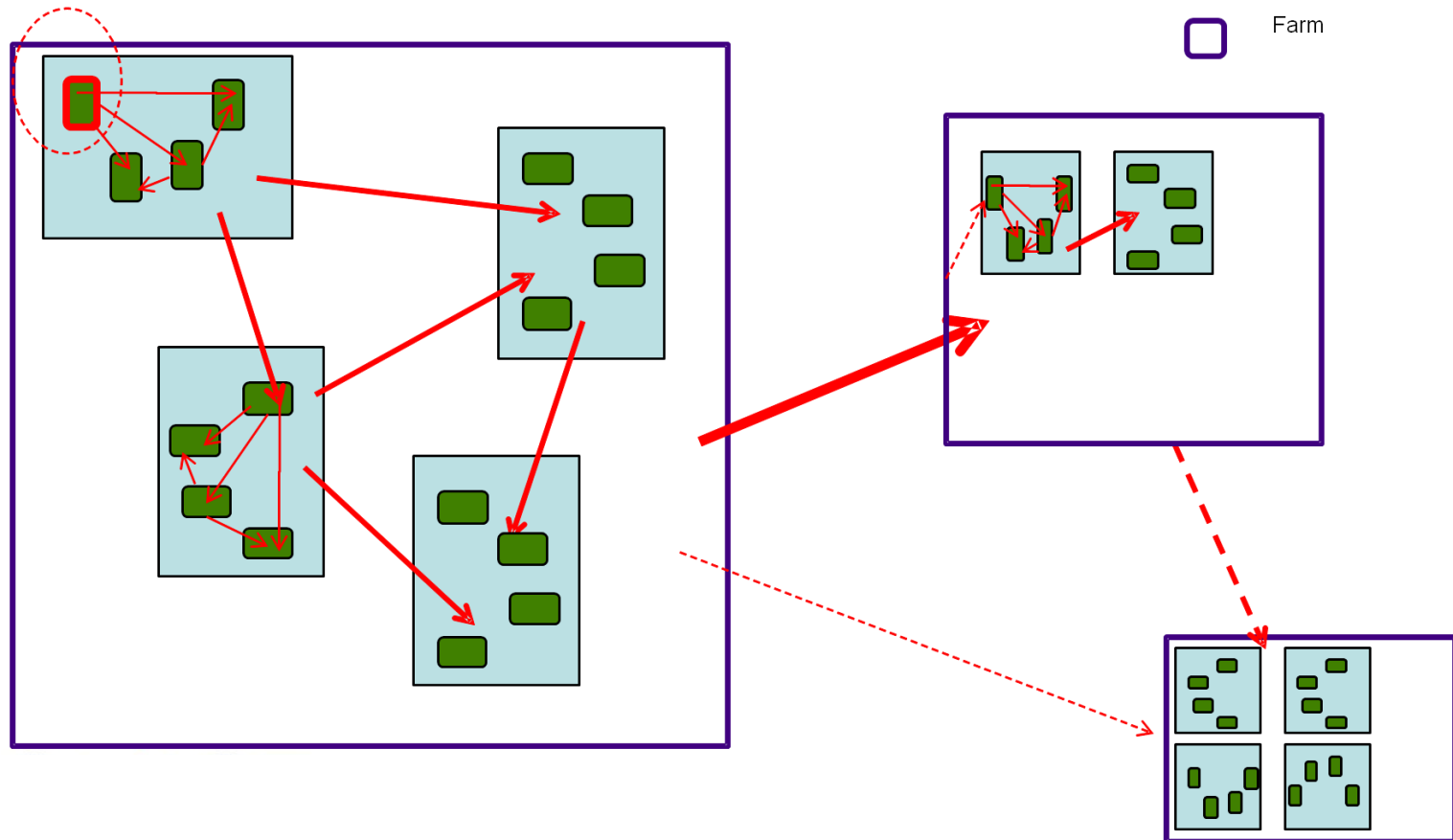
Network-based models

Take into account the **contacts between populations** that actually DO take place:

- ✓ Movement of populatons
- ✓ Movement of people
- ✓ Movement of equipment
- ✓ Movement of water
- ✓ Movement of other vectors

Network models working at different scales in time and space

INDEX CASE



Examples of tools

- Distance between farms
- Maximum amount of animals per farm
- Maximum impact on environment
- Fallowing
- Restriction on movement of animals
- Restrictions on sources of juveniles
 - Specific-pathogen-free quality
 - Screening for pathogens

Impact from aquaculture - Norway

Escapees – **RED LIGHT**

- Wild salmon stocks vulnerable

Salmon Louse – **RED LIGHT**

- Affecting wild trout and salmon

Pharmaceuticals – **Yellow light**

- Antibacterials: **Green**, Antiparasitics: **RED**

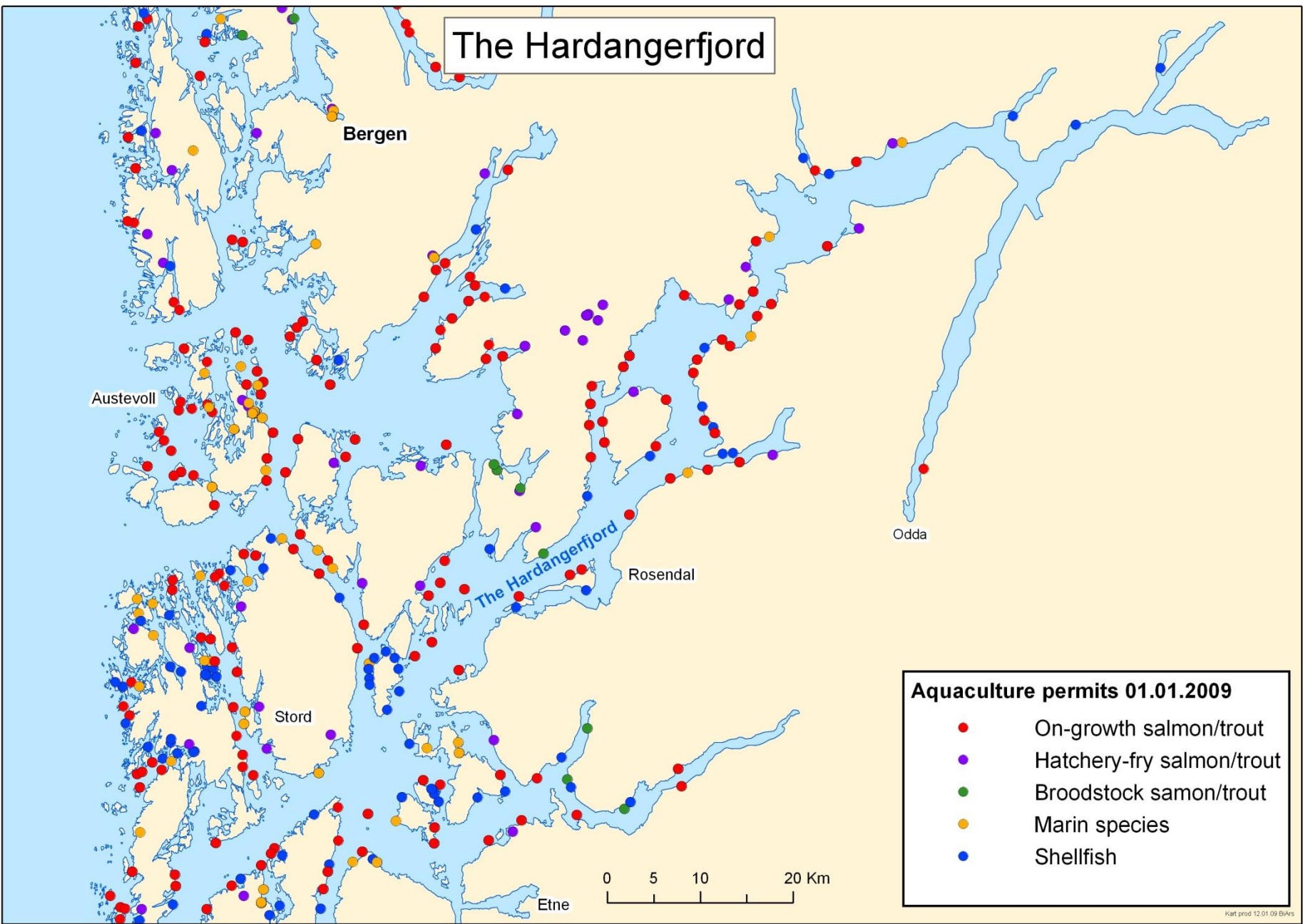
Eutrophication – **green light**

- Coastal current from Baltic dominates area

Other diseases – n.a., Shellfish n.a.



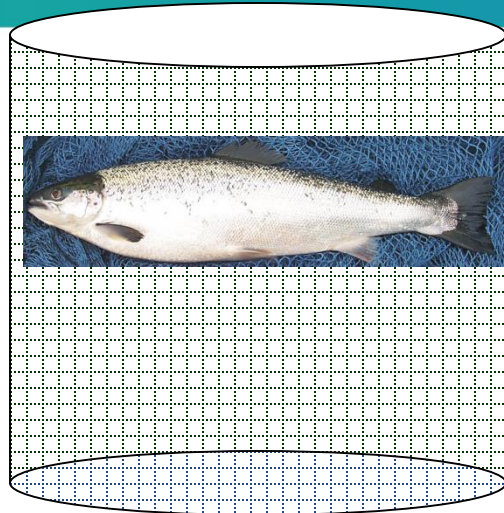
The Hardangerfjord



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Salmon/rainbow trout:
n=300 000 000
Wild salmon/sea trout
n=1,5-2 000 000

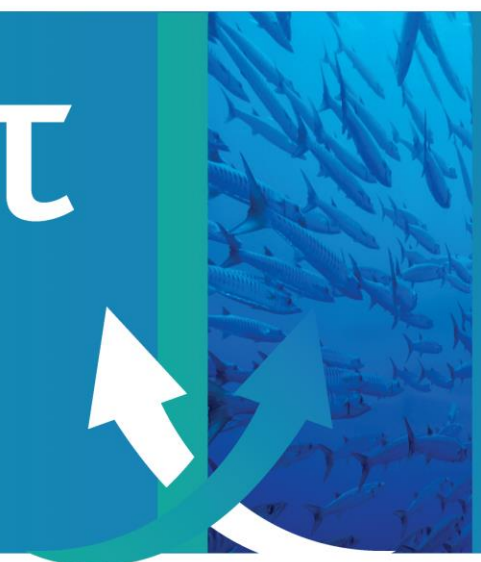


0.5 lice/fish

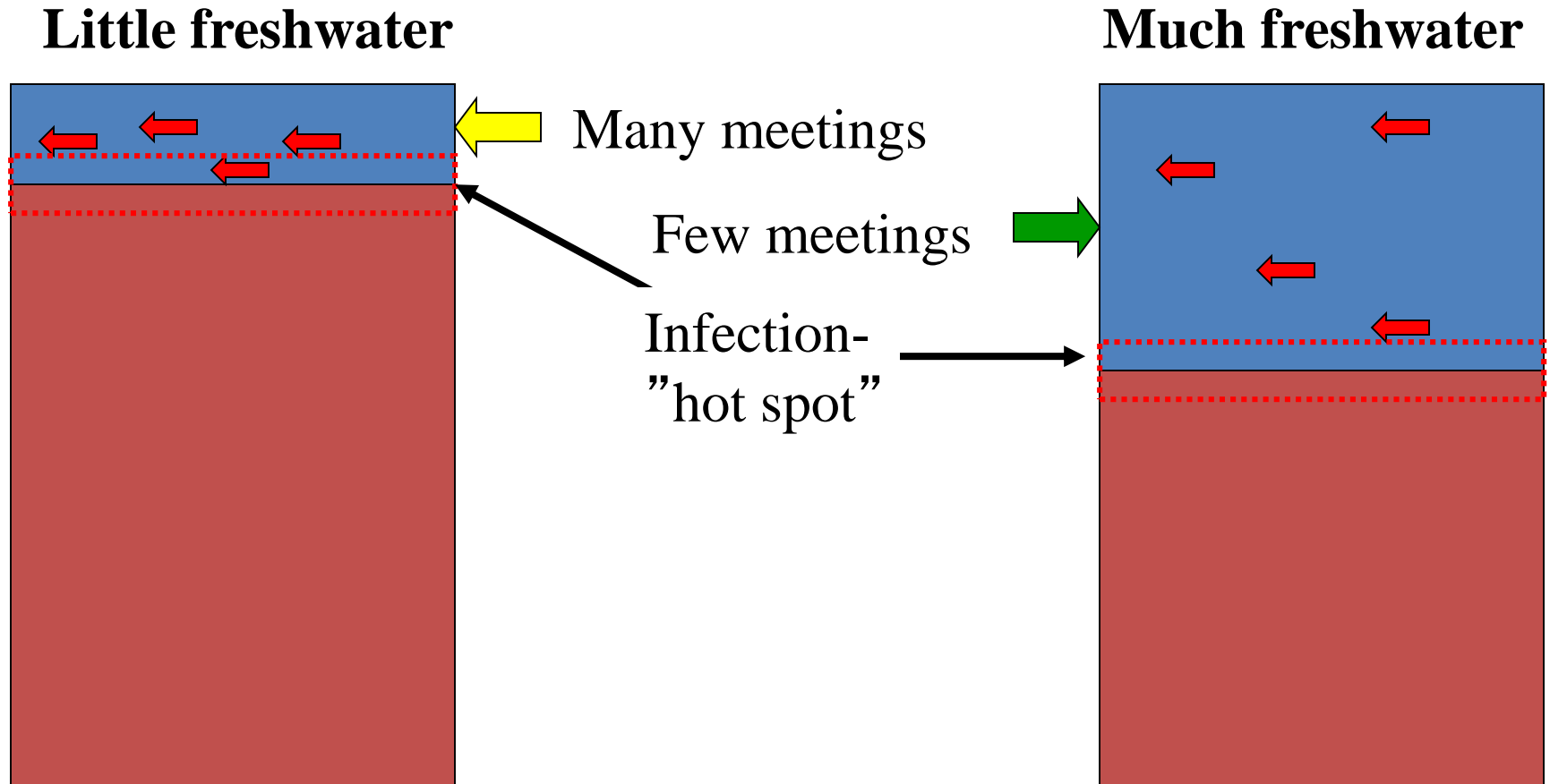
150 000 000 lice



20 000 000 lice

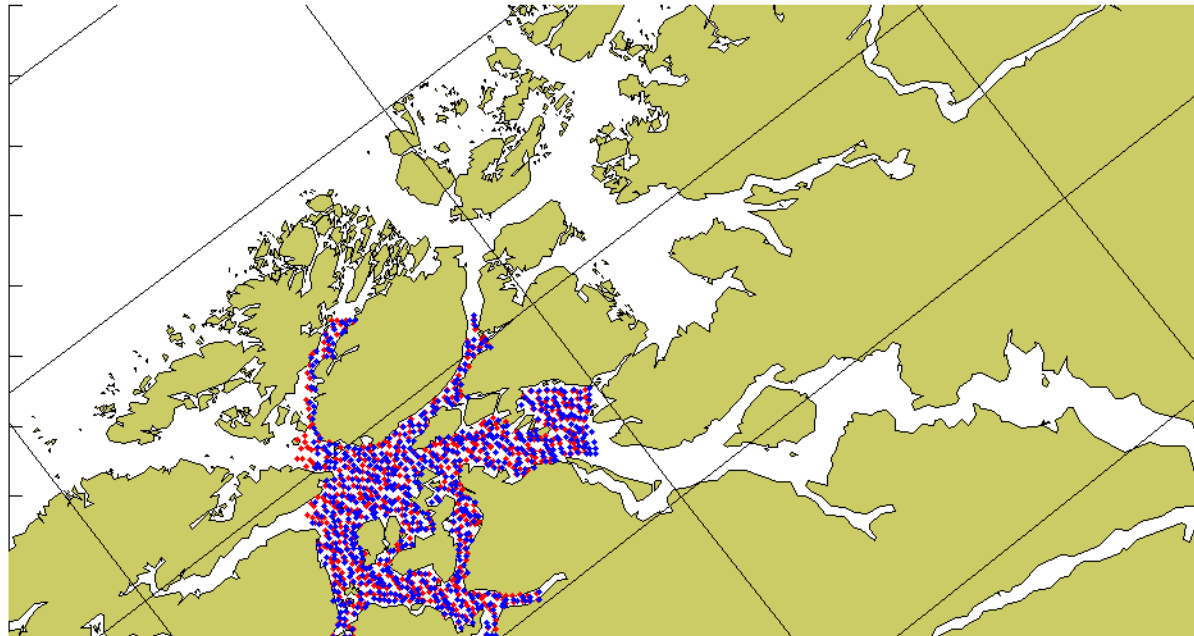


Hydrodynamic models: the amount of freshwater in a fjord has impact on the frequency of salmon-lice contact



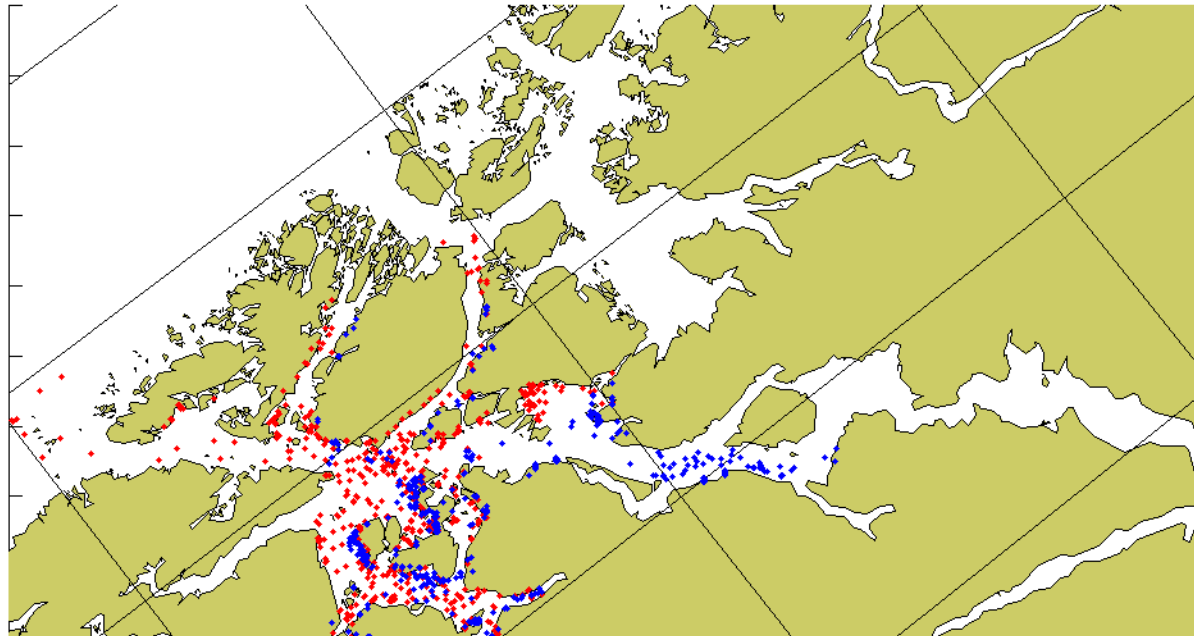
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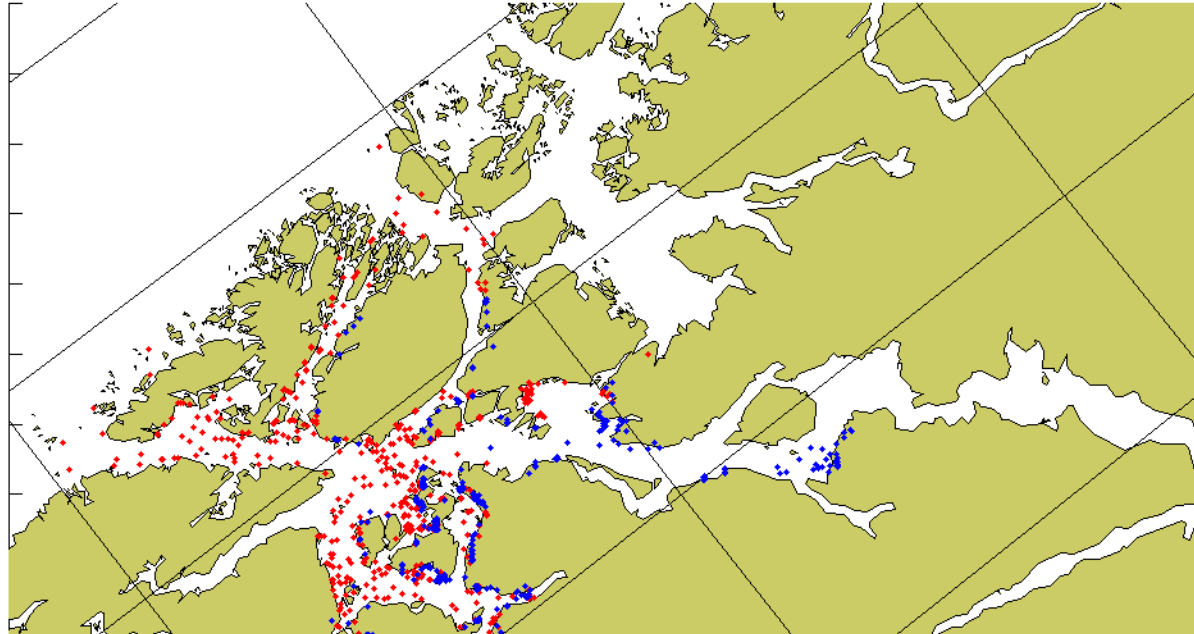
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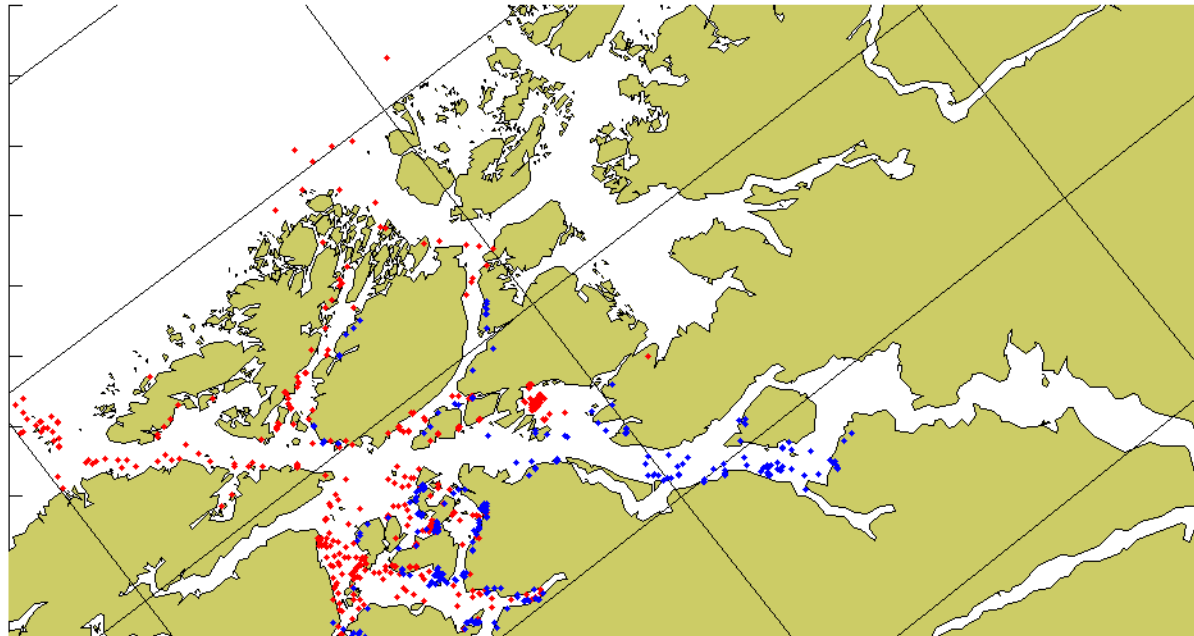
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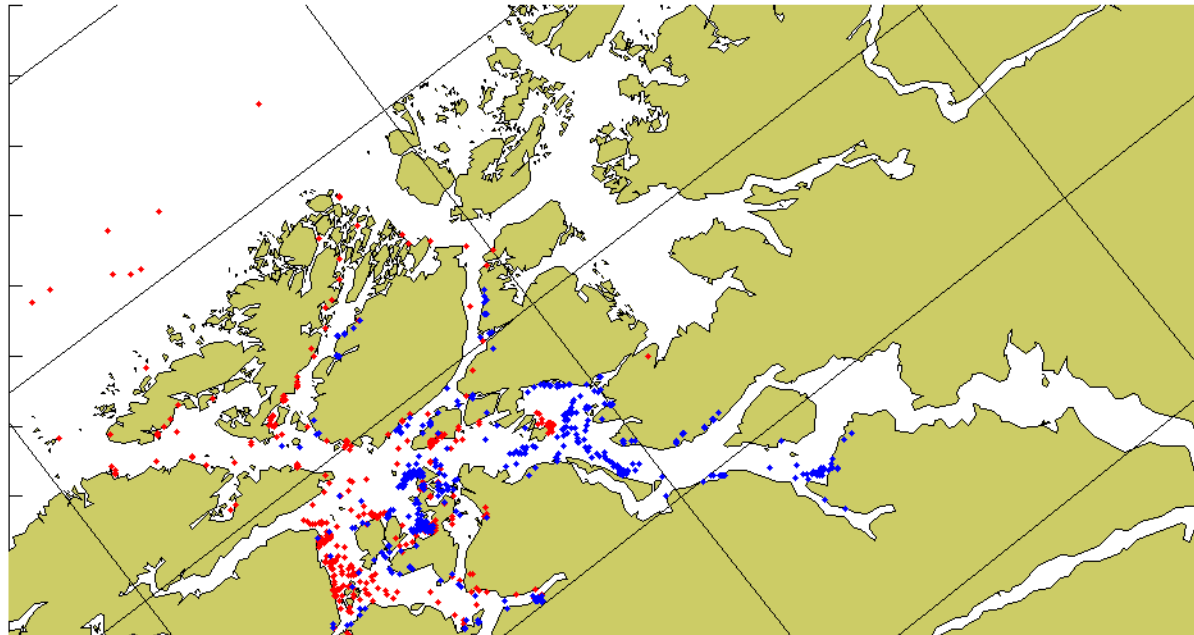
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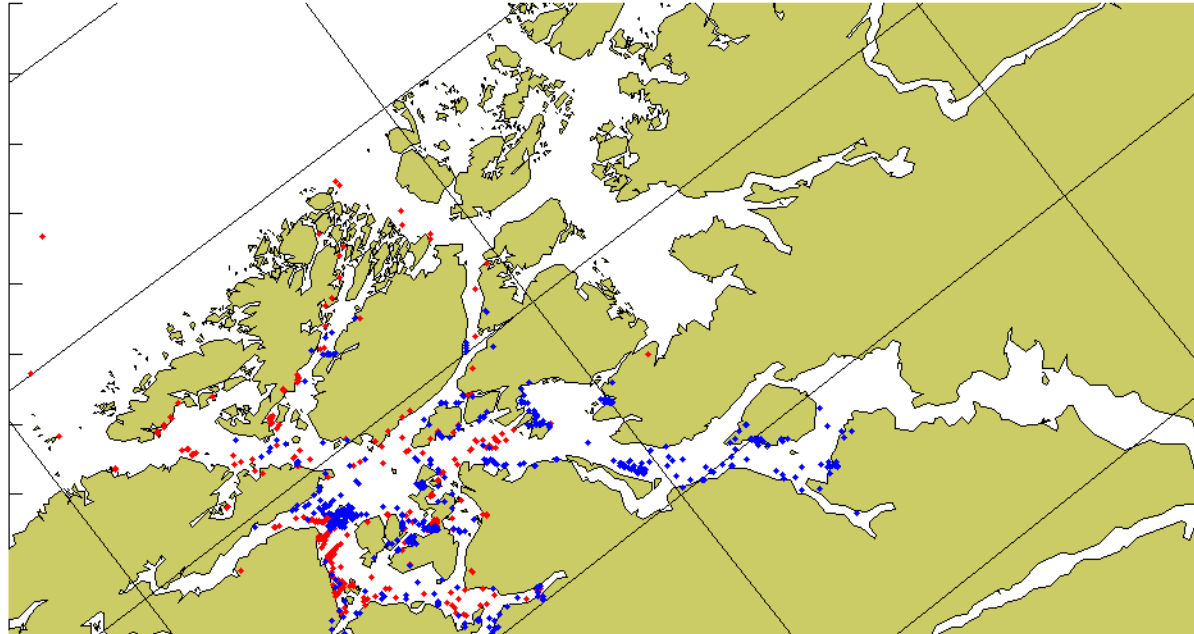
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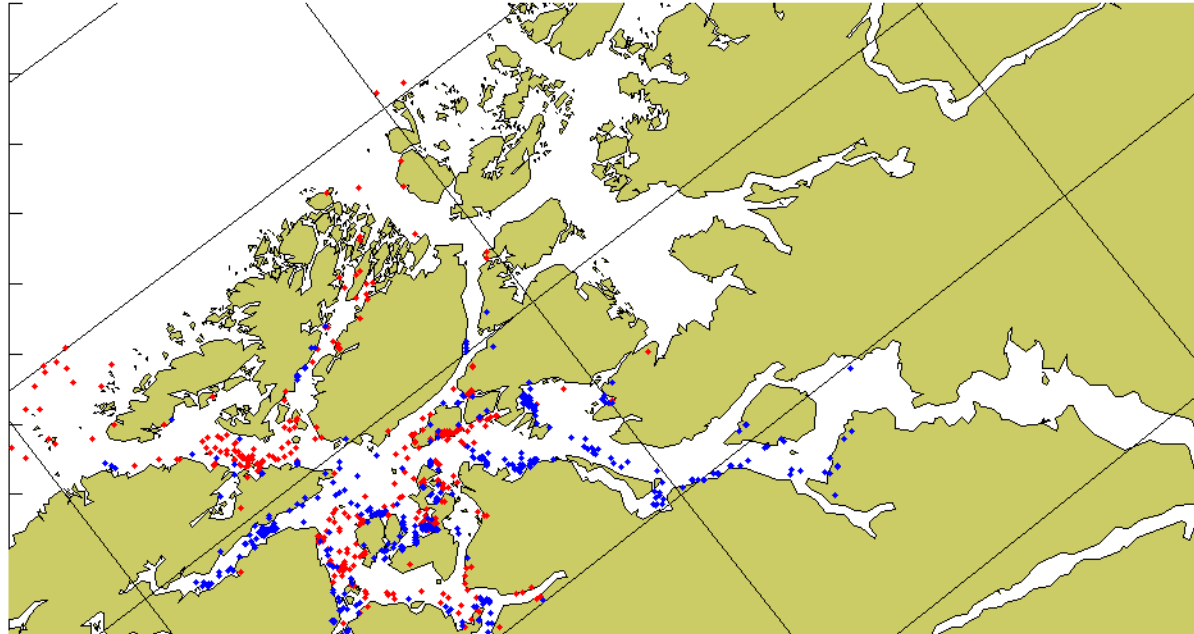
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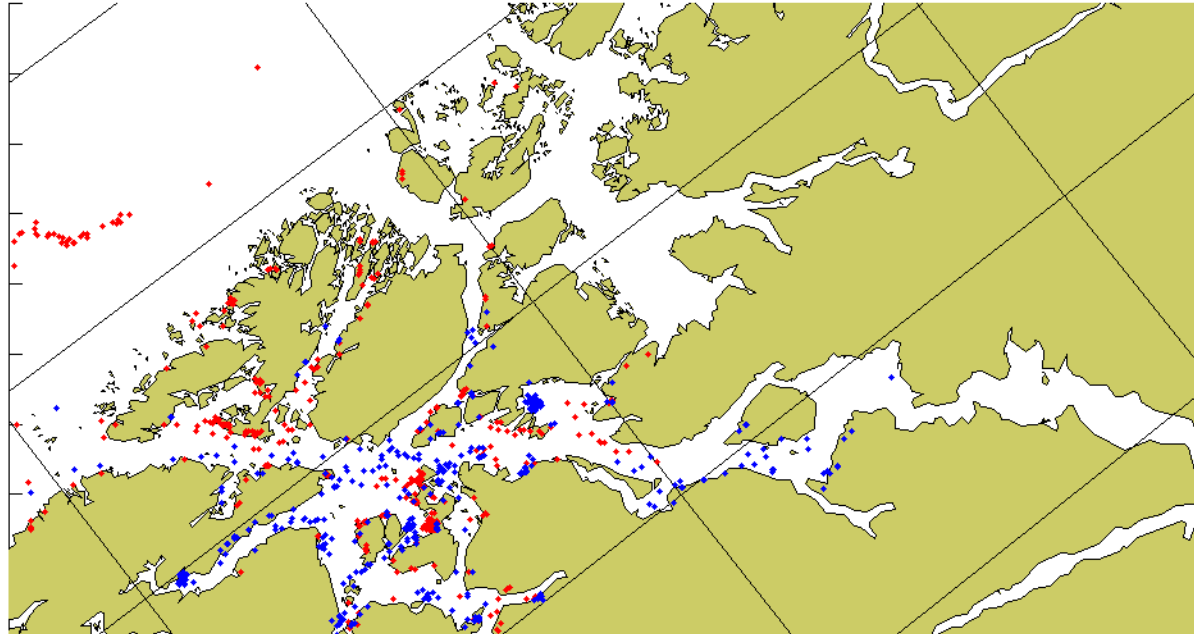
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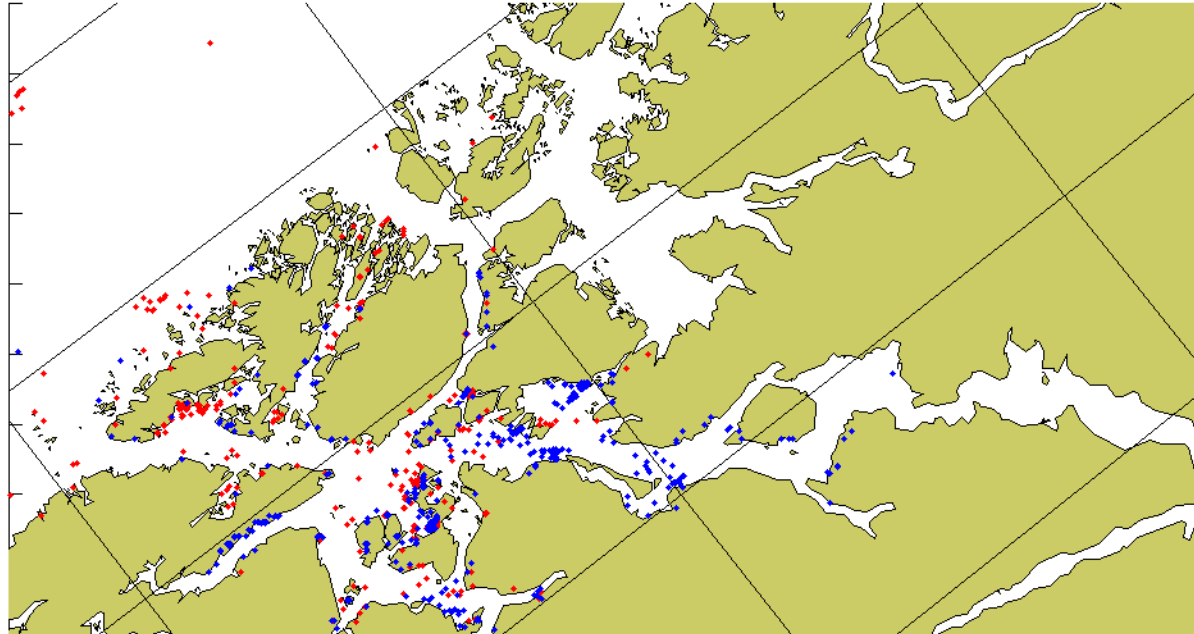
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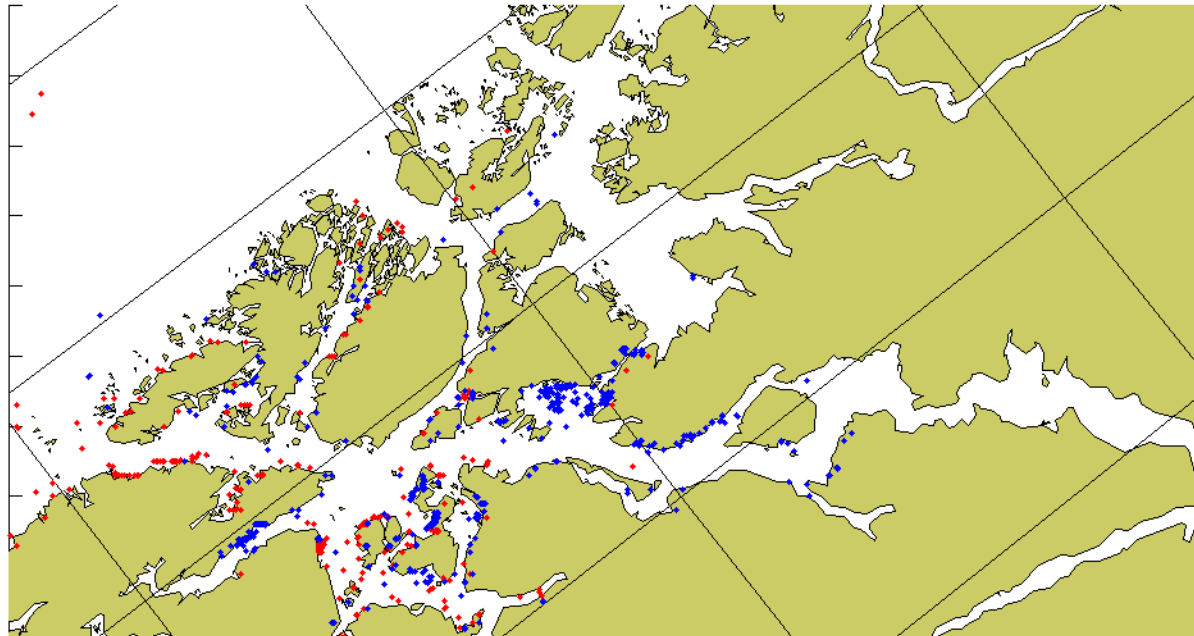
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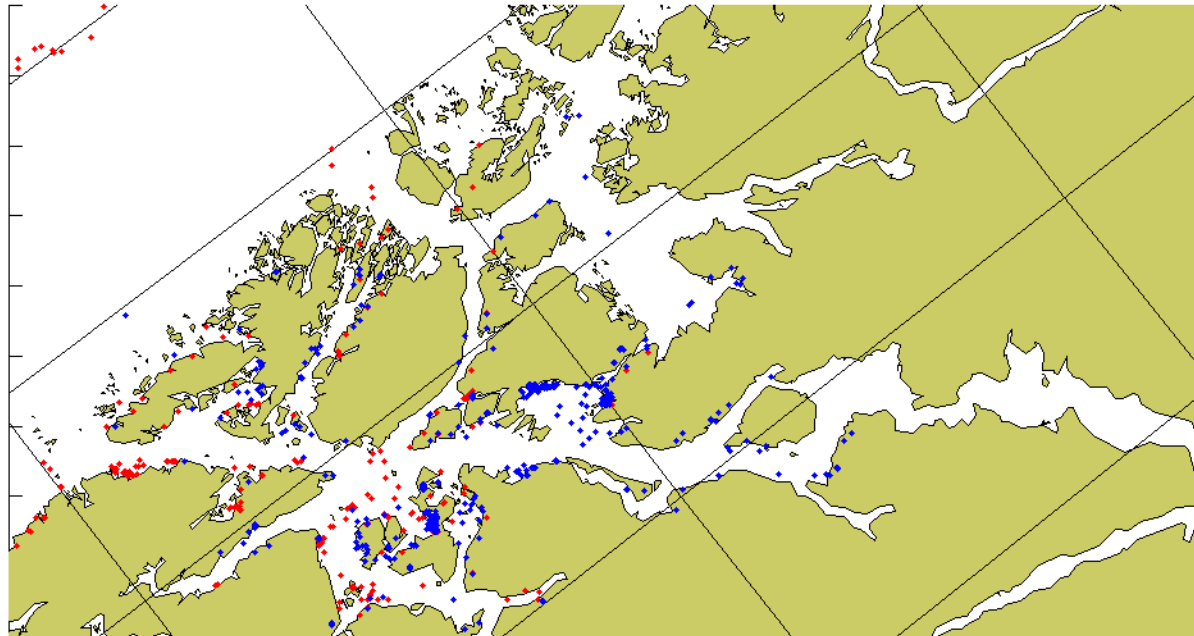
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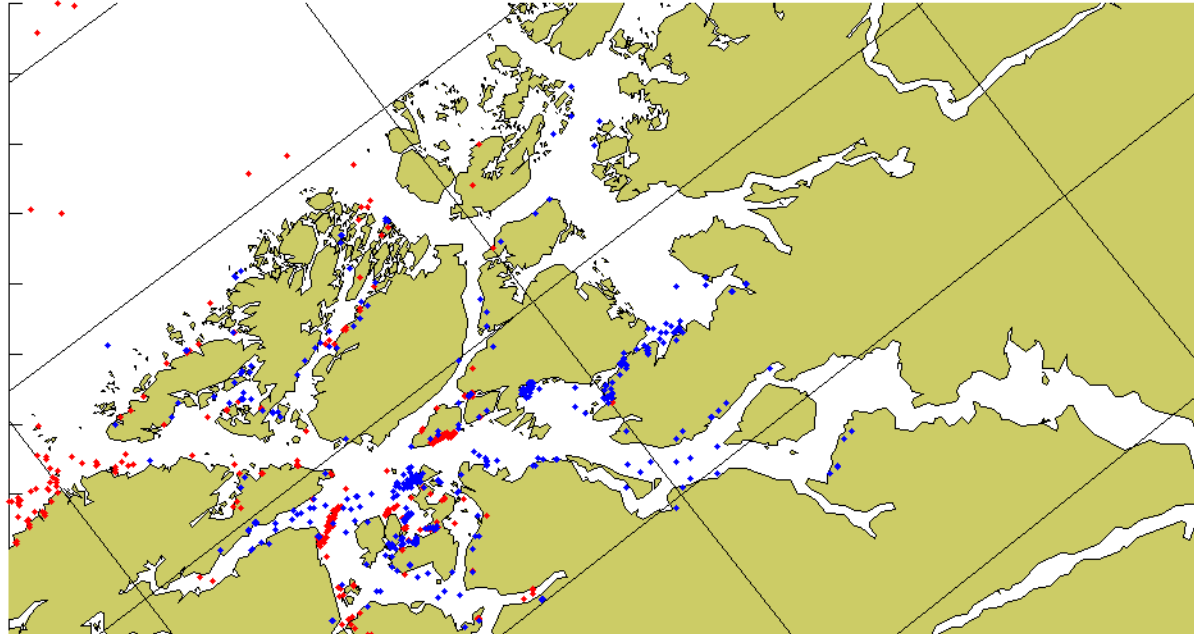
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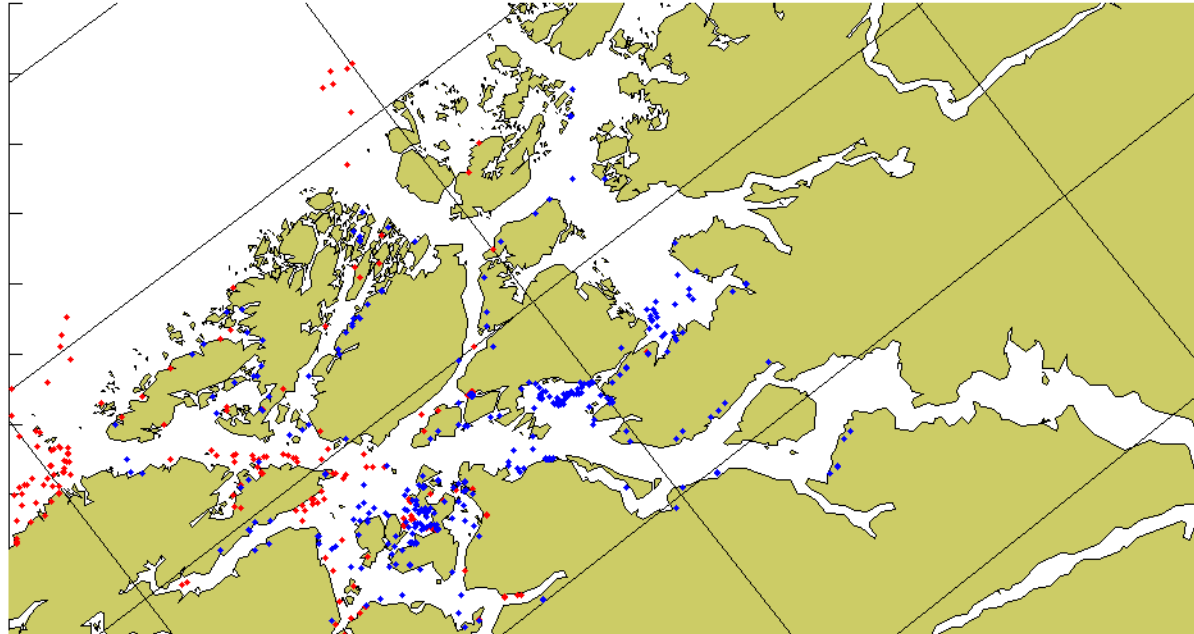
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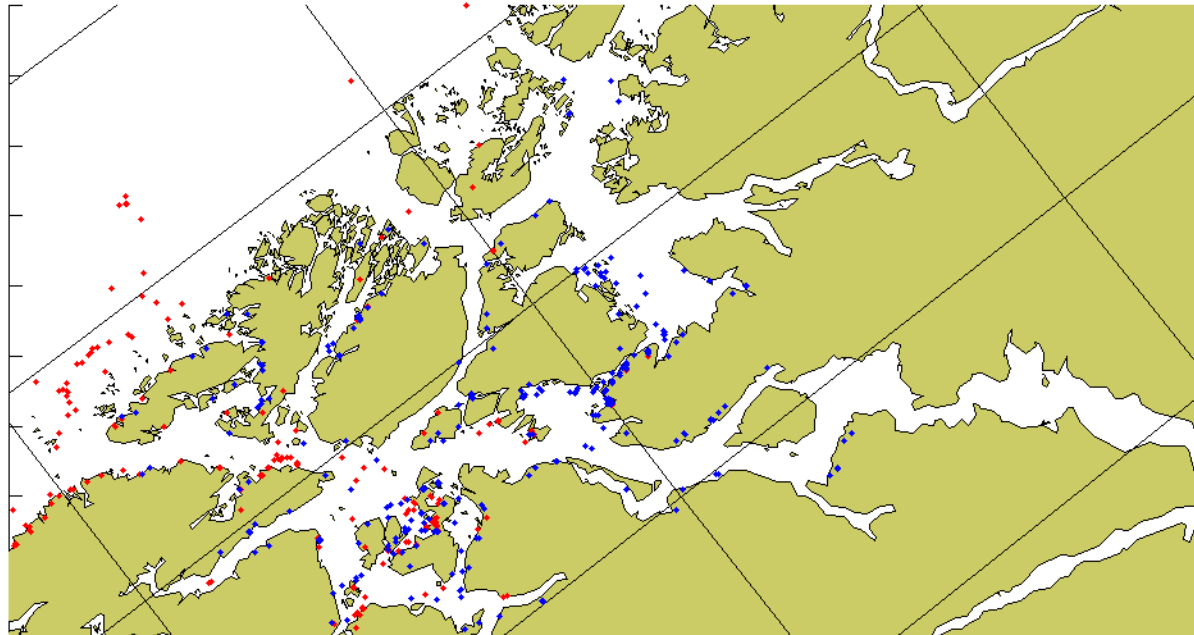
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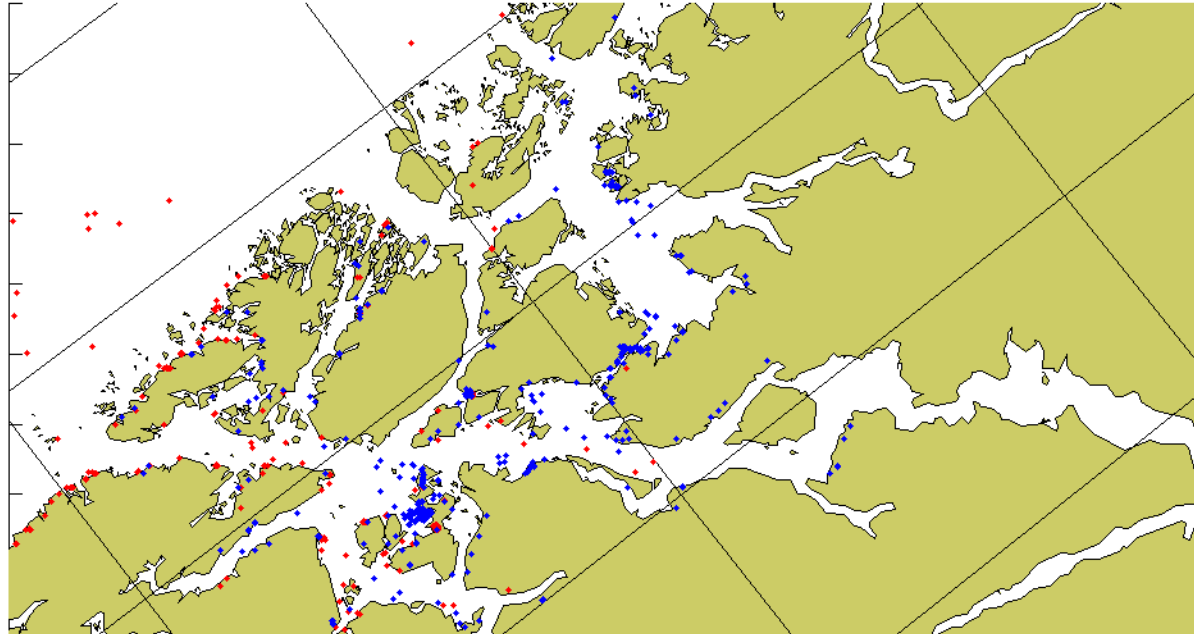
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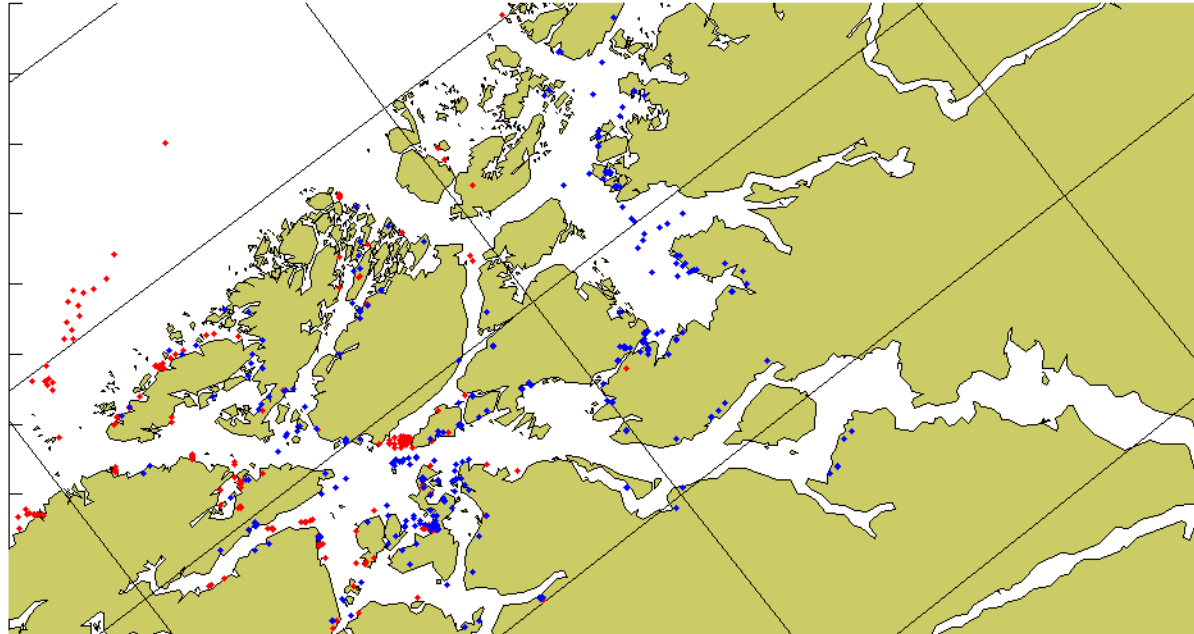
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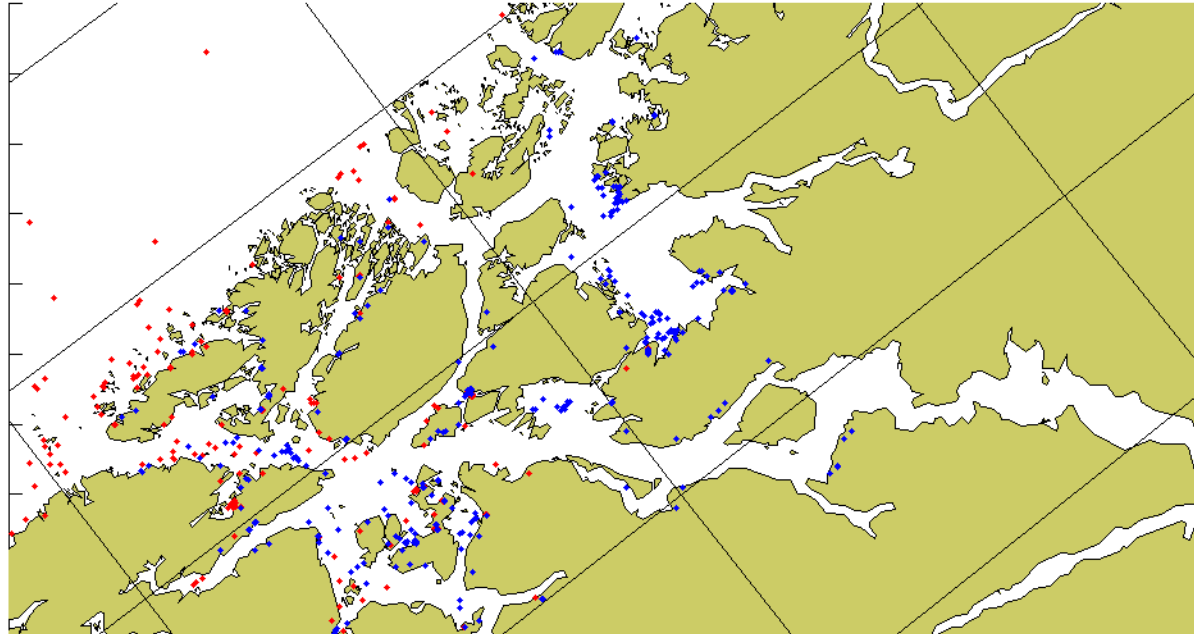
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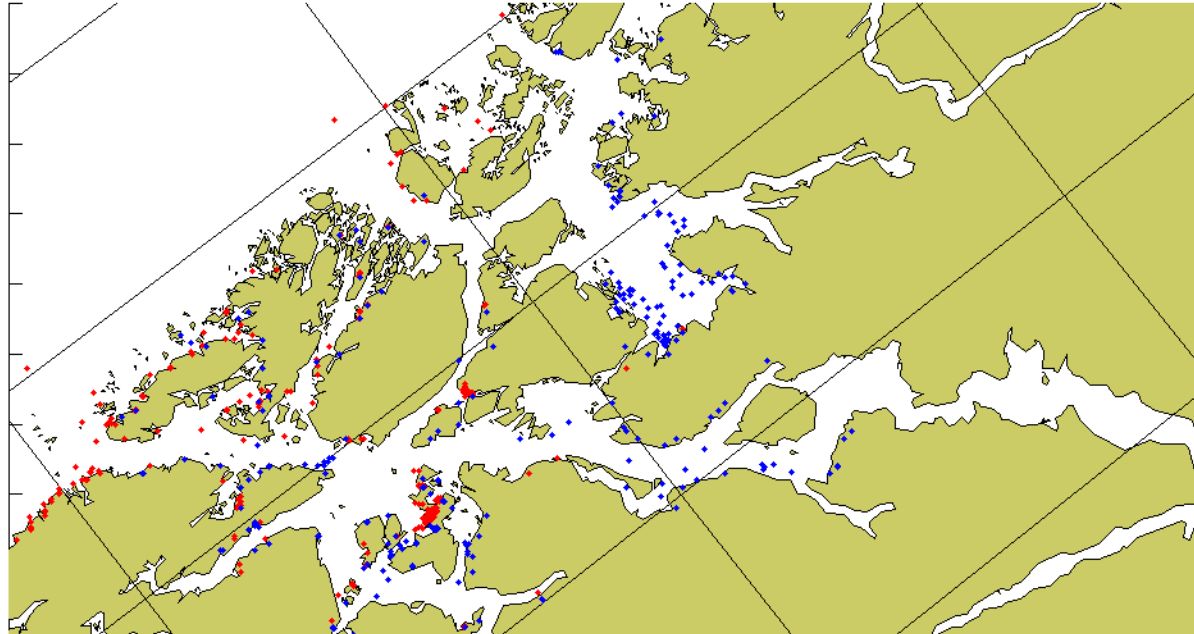
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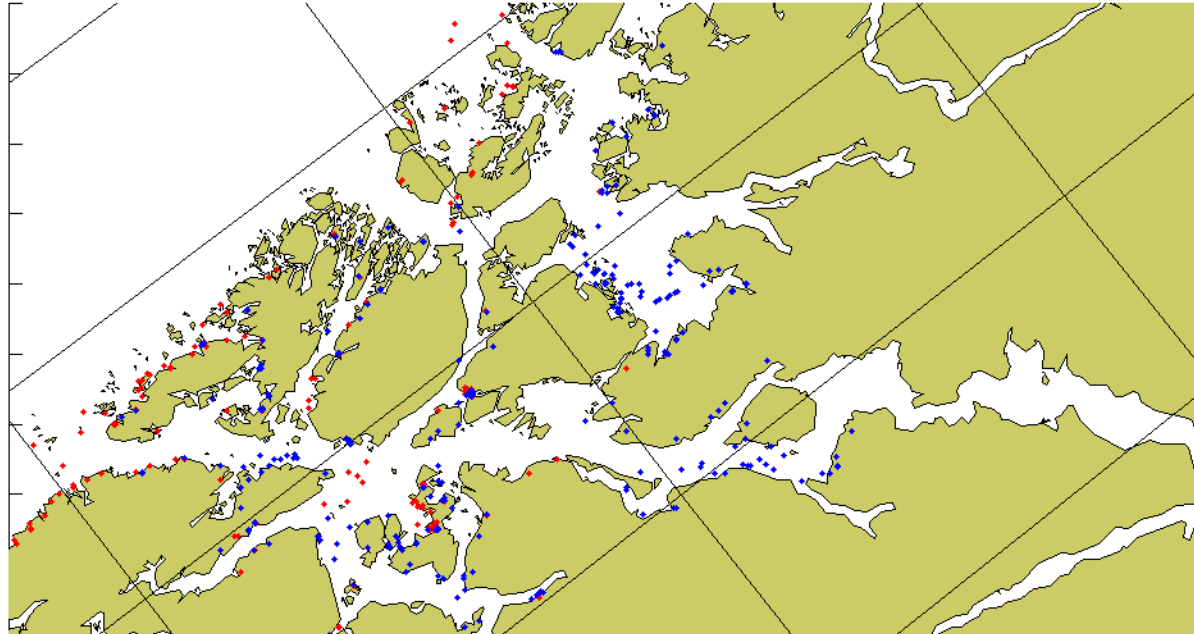
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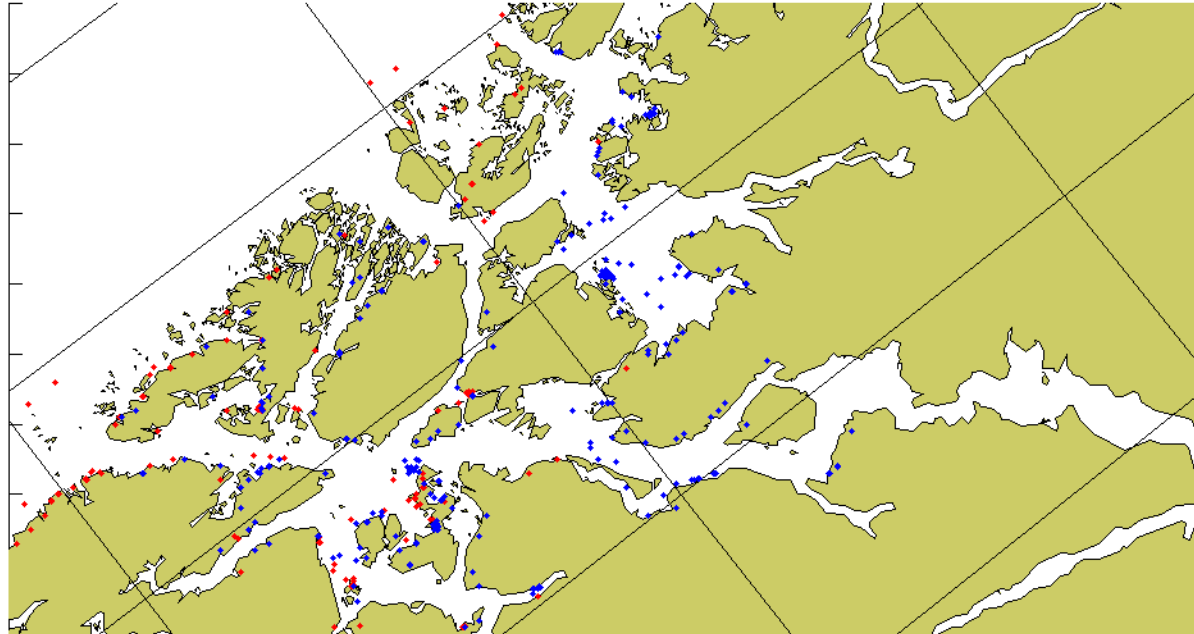
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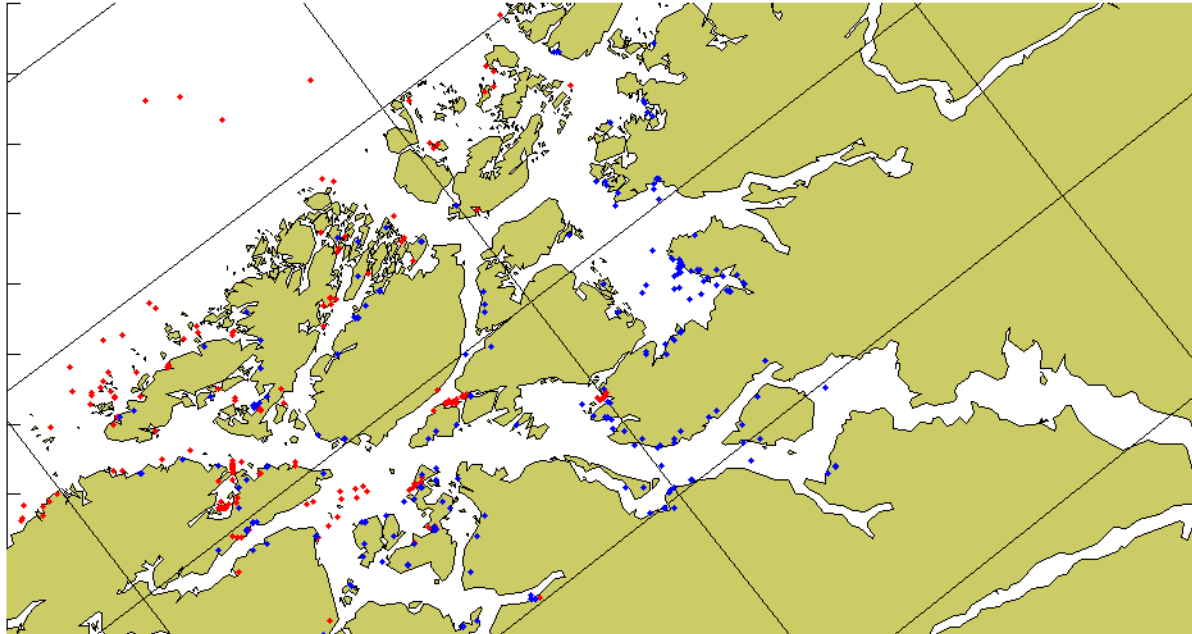
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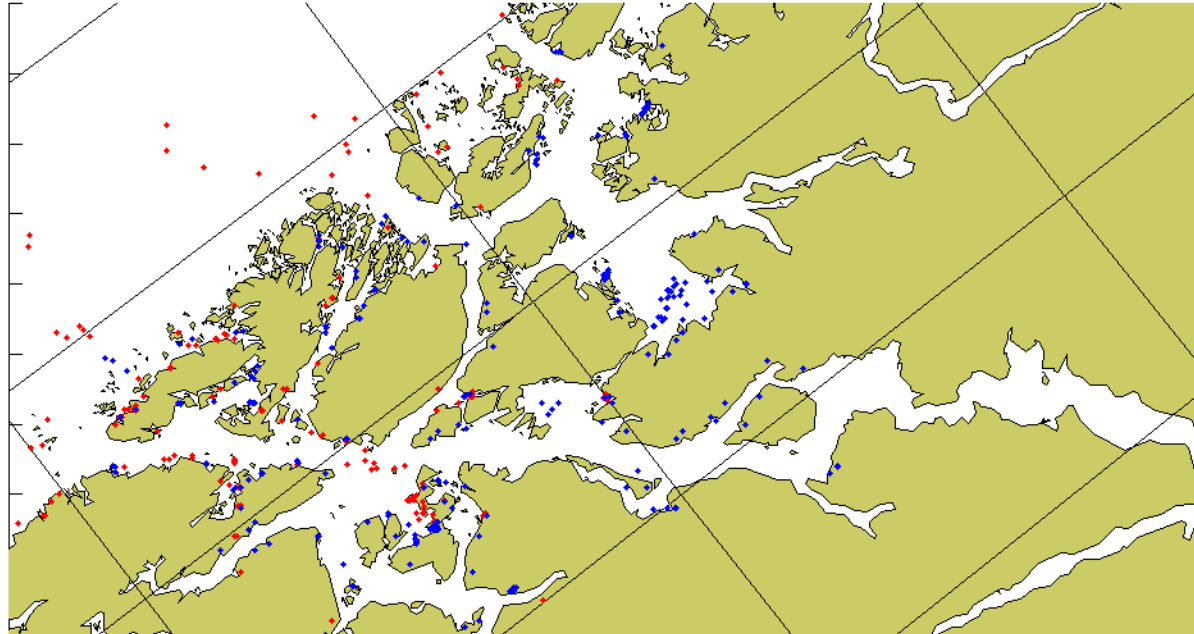
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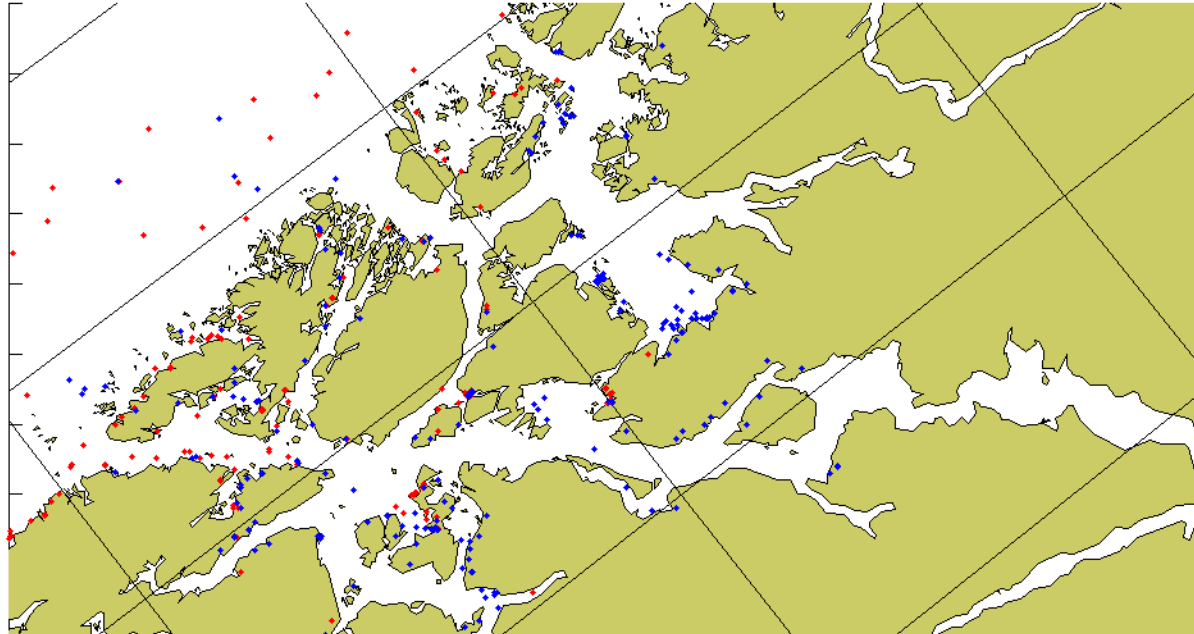
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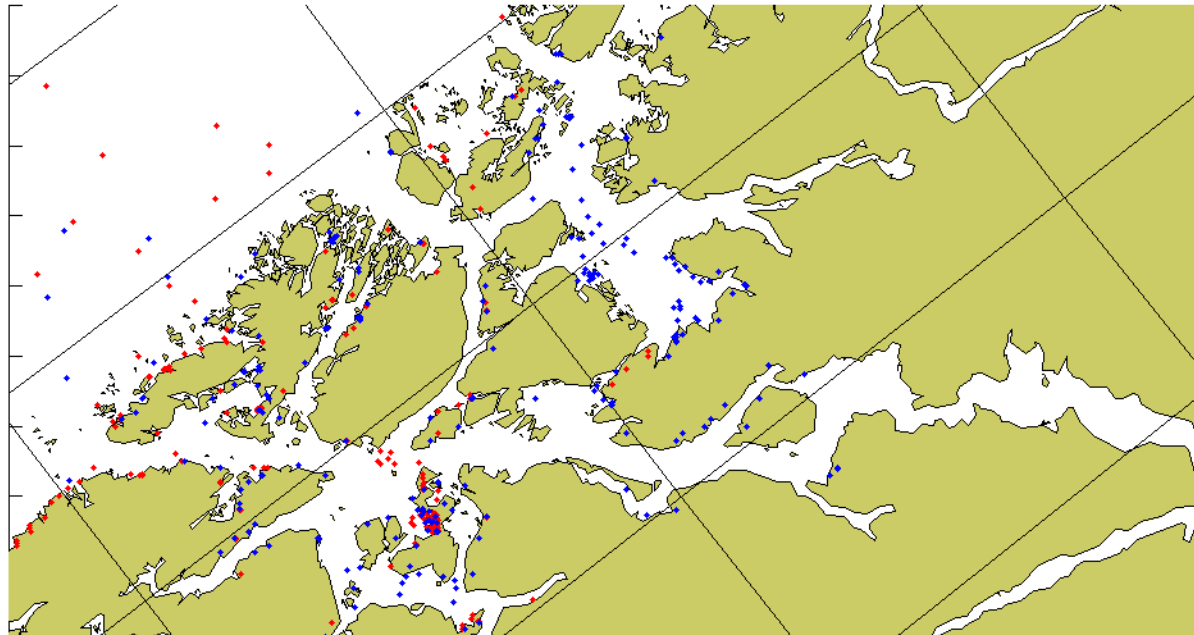
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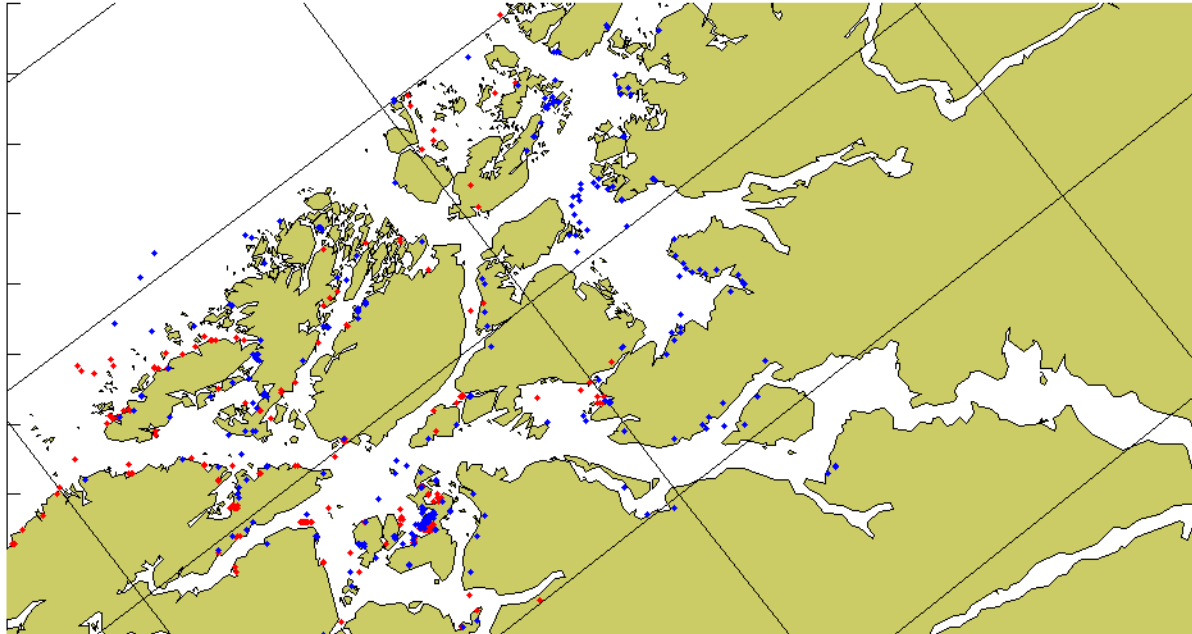
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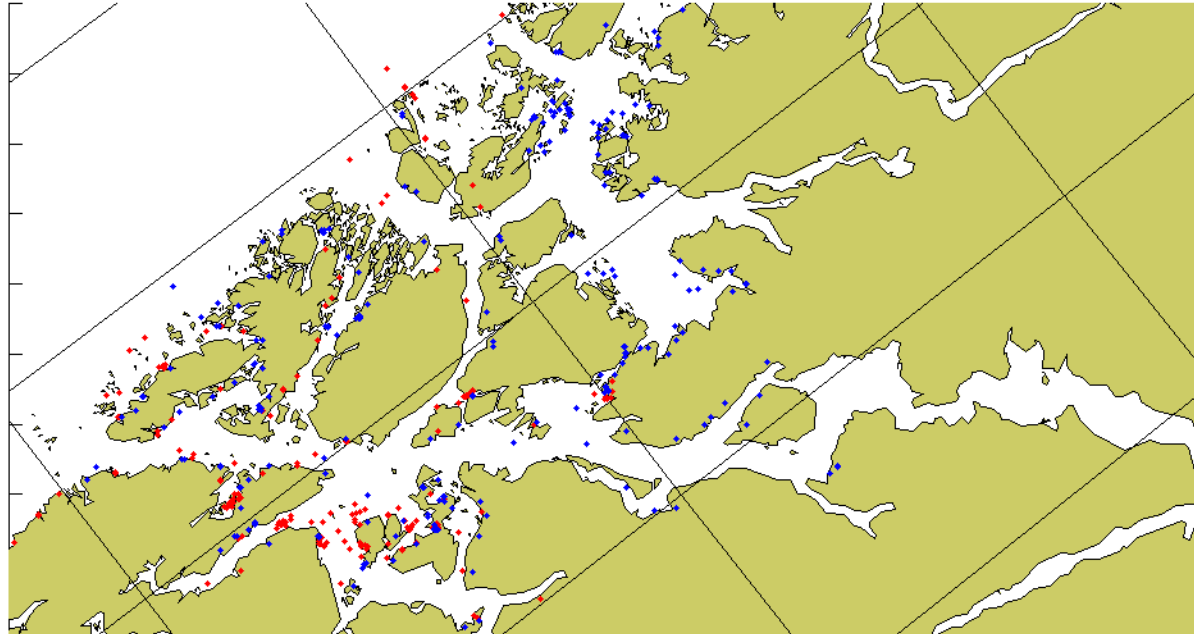
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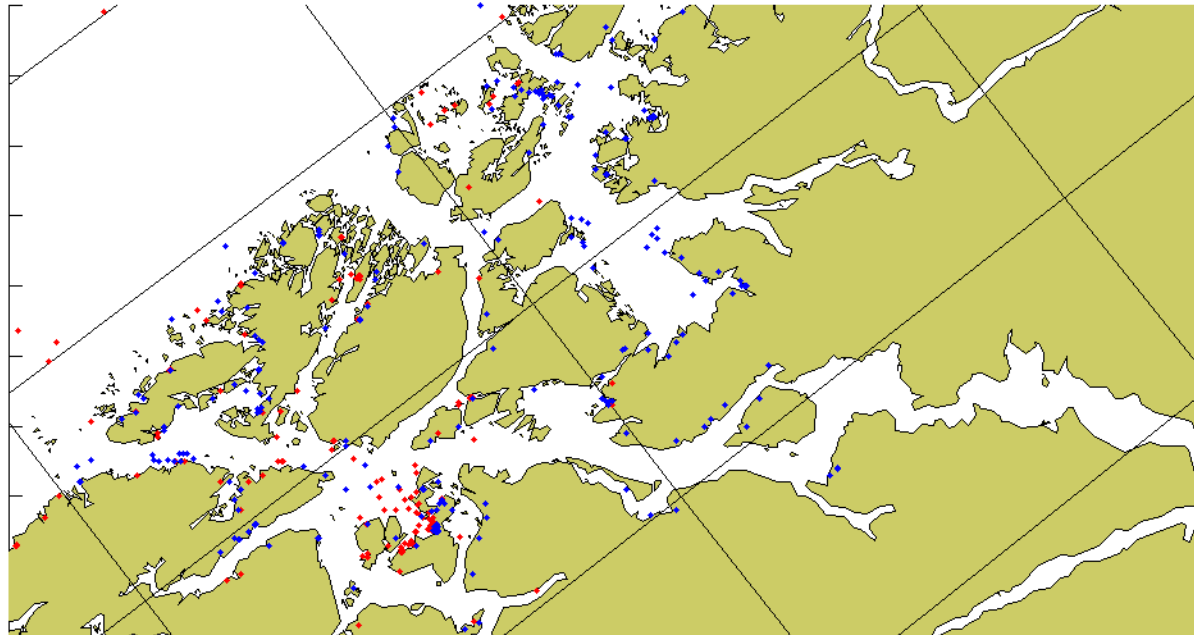


General considerations

- ✓ Appoint biosecurity managers
- ✓ Appoint veterinary health contacts
- ✓ Provide staff training in animal health
- ✓ Identify risks for contact and spreading
 1. Movements
 2. Site procedures
- ✓ Risk limitation measures
- ✓ Monitor the plan
- ✓ Contingency planning

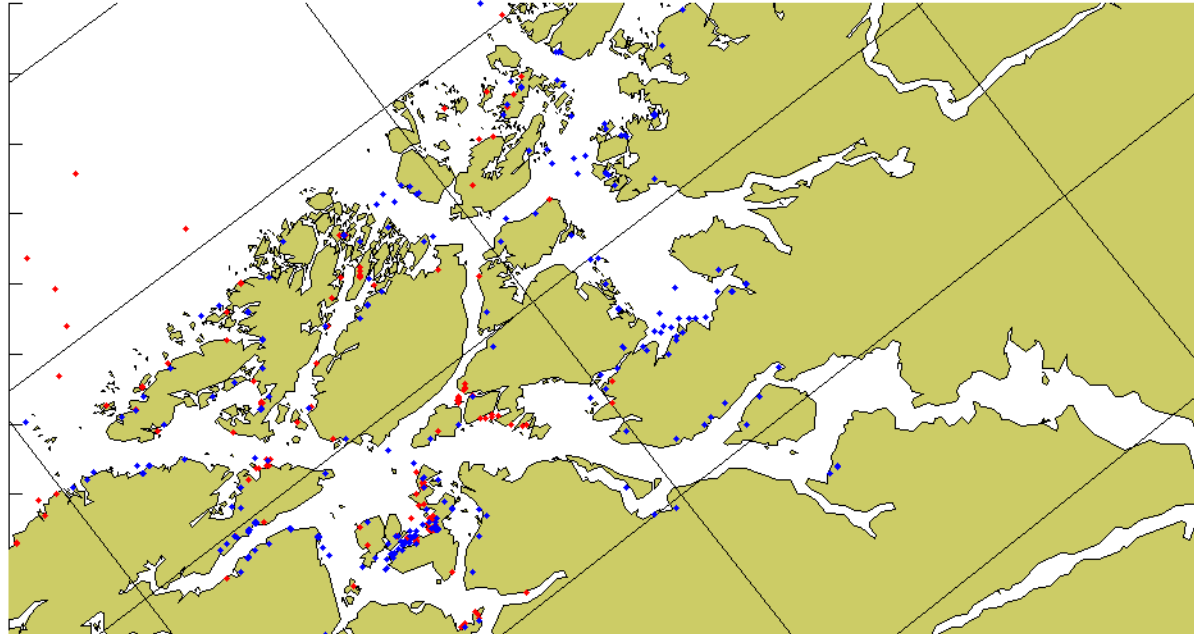
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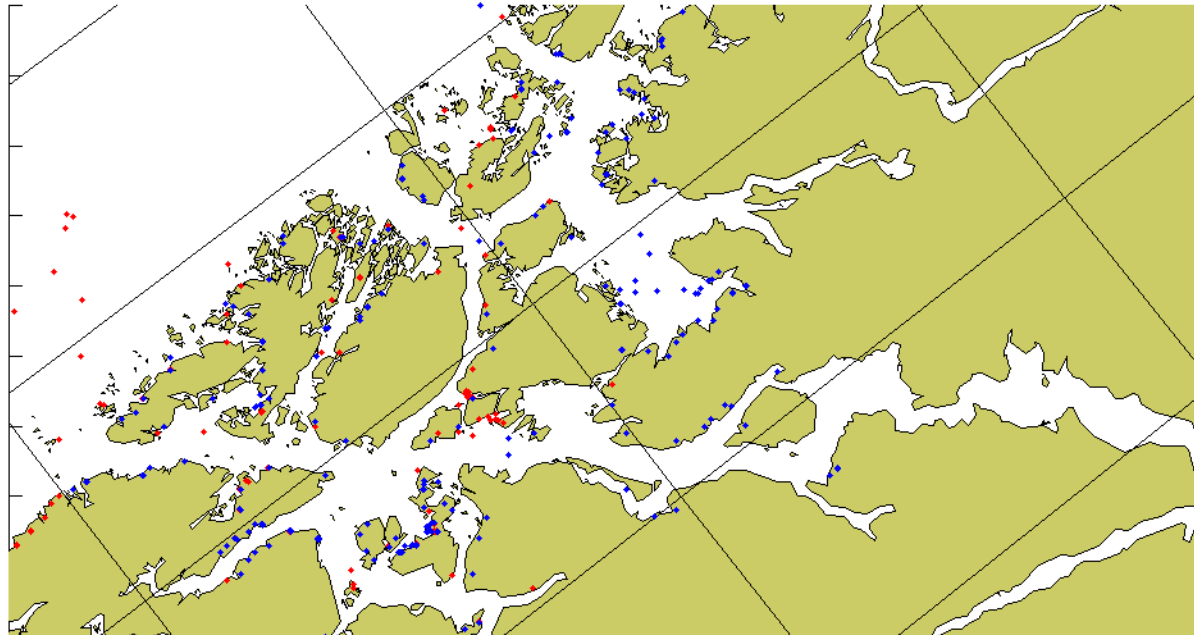
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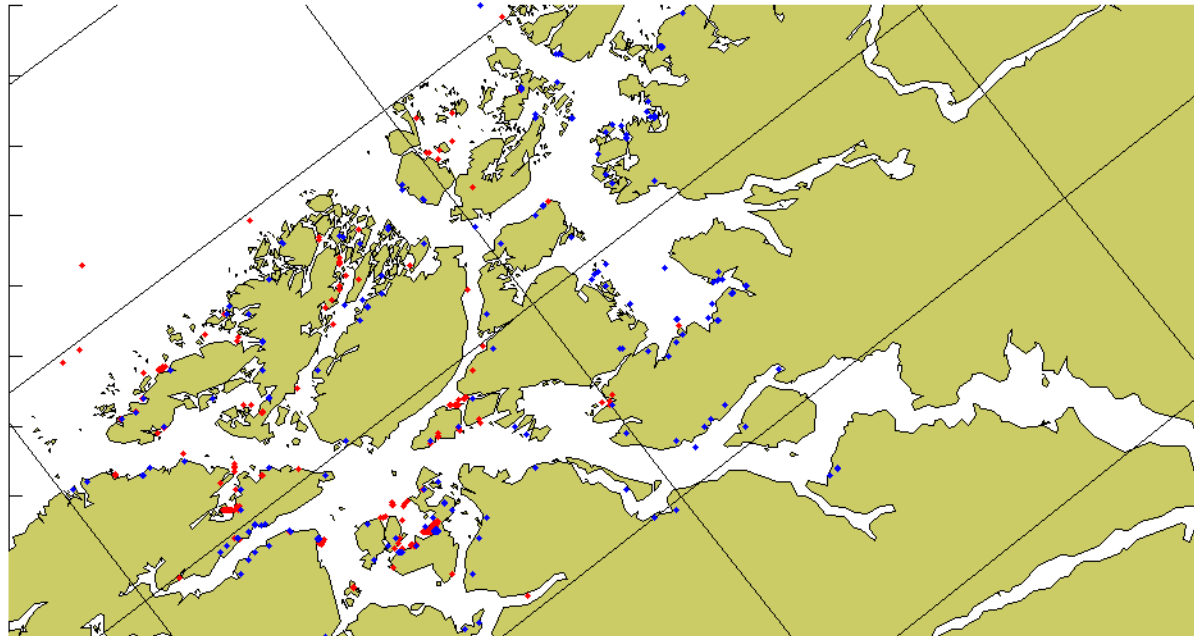
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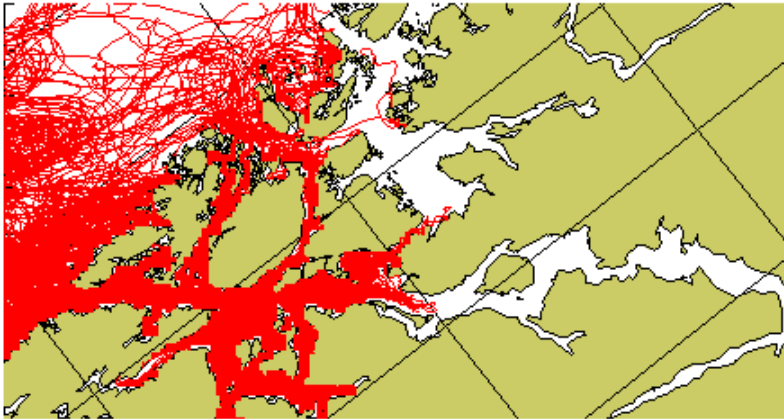


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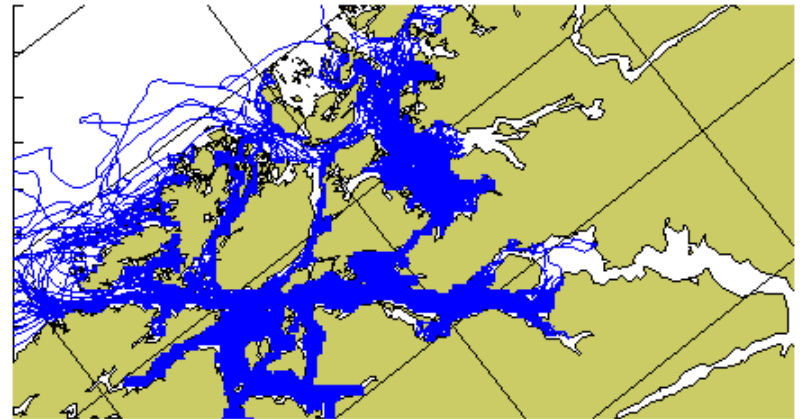
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Trajectories for salmon lice movement from May 10 to June 10, 2001



Trajectories for salmon lice movement from May 10 to June 10, 2003

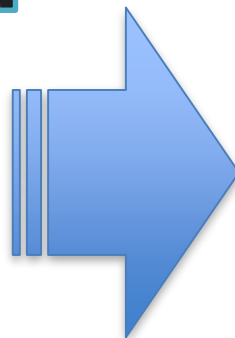




Consequences for management:

- ✓ Spreading of highly specialized pathogens may be very efficient
- ✓ Management plans on farm level are not sufficient
- ✓ Management plans must be extended to the level of municipalities or even counties.
 - synchronized treatments
 - Mandatory, synchronized, prophylaxis
 - Synchronized fallowing
 - *"All in – all out"* principle

COEXIST Guidelines



Guideline for Best Practice in Spatial Planning to integrate Fisheries, Aquaculture and further Demands in European Coastal Zones



Some conclusions

- Any spatially based management system will require input from ALL relevant stakeholders
- Adaptive management can incorporate uncertainty as part of an evolving process but needs buy-in to succeed
- ICZM provides the framework for adaptive management,
 - MSP is a process within the overall ICZM process
- We need to adopt a Human centred Ecosystem approach – we are:
 - customers, market competitors, competitors for space, polluters etc, etc
 - unpredictable, but paradoxically reluctant to accept uncertainty

COEXIST

The logo for COEXIST features the word in a white, sans-serif font. The 'e' and 'x' are stylized with two white arrows pointing upwards and to the right. The background is a teal-to-blue gradient with a vertical strip on the right showing a school of fish swimming in blue water. A white arrow points from the bottom right towards the 'x', and a teal arrow points from the bottom left towards the 'e'.

Thank you for your attention

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Website: www.coexistproject.eu

DISCLAIMER



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