

Integrating USVs into Small Pelagic Fish Monitoring

A Case Study from Norwegian Fjords

Florian Berg, Cecilie Kvamme, Arne Johannes Holmin, Sindre
Vatnehol, Nils Olav Handegard, and Espen Johnsen



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Norwegian fjords

- Important ecosystems with unique environments
- Covering 5 fjords
 - Oslofjorden
 - Hardangerfjorden
 - Sognefjorden
 - Nordfjorden
 - Trondheimsfjorden



Importance of the survey

Joined by the Crown Prince
and the Princess



Uncrewed surface vehicles (USVs)

CRIMAC – Workshop on Fisheries acoustics and Uncrewed Surface Vehicles 2023



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Quo Vadimus



Uncrewed surface vehicles (USVs) as platforms for fisheries and plankton acoustics

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Kay Jørgensen



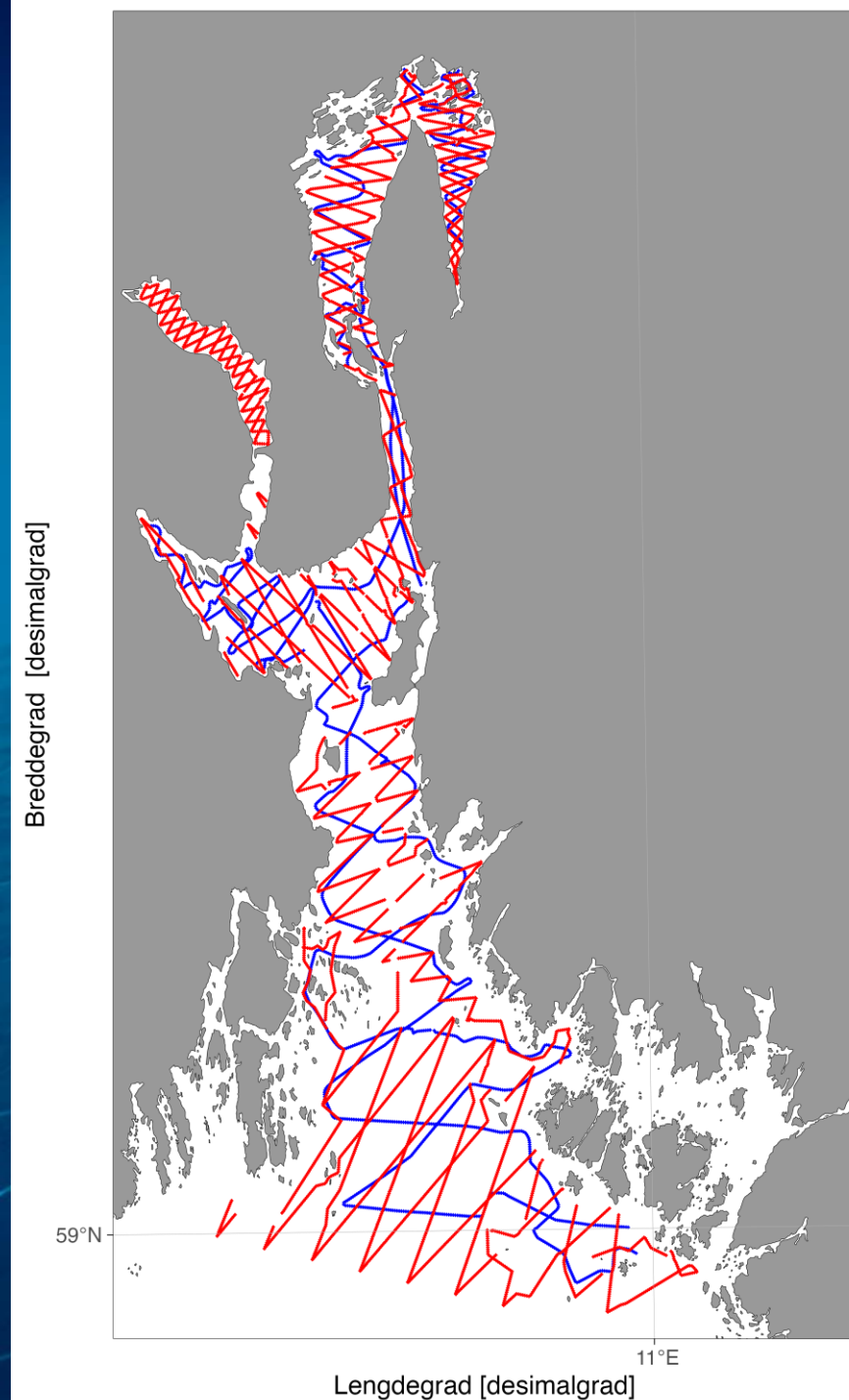
ROC = Remote Operation Center
Placed in Bergen, Norway



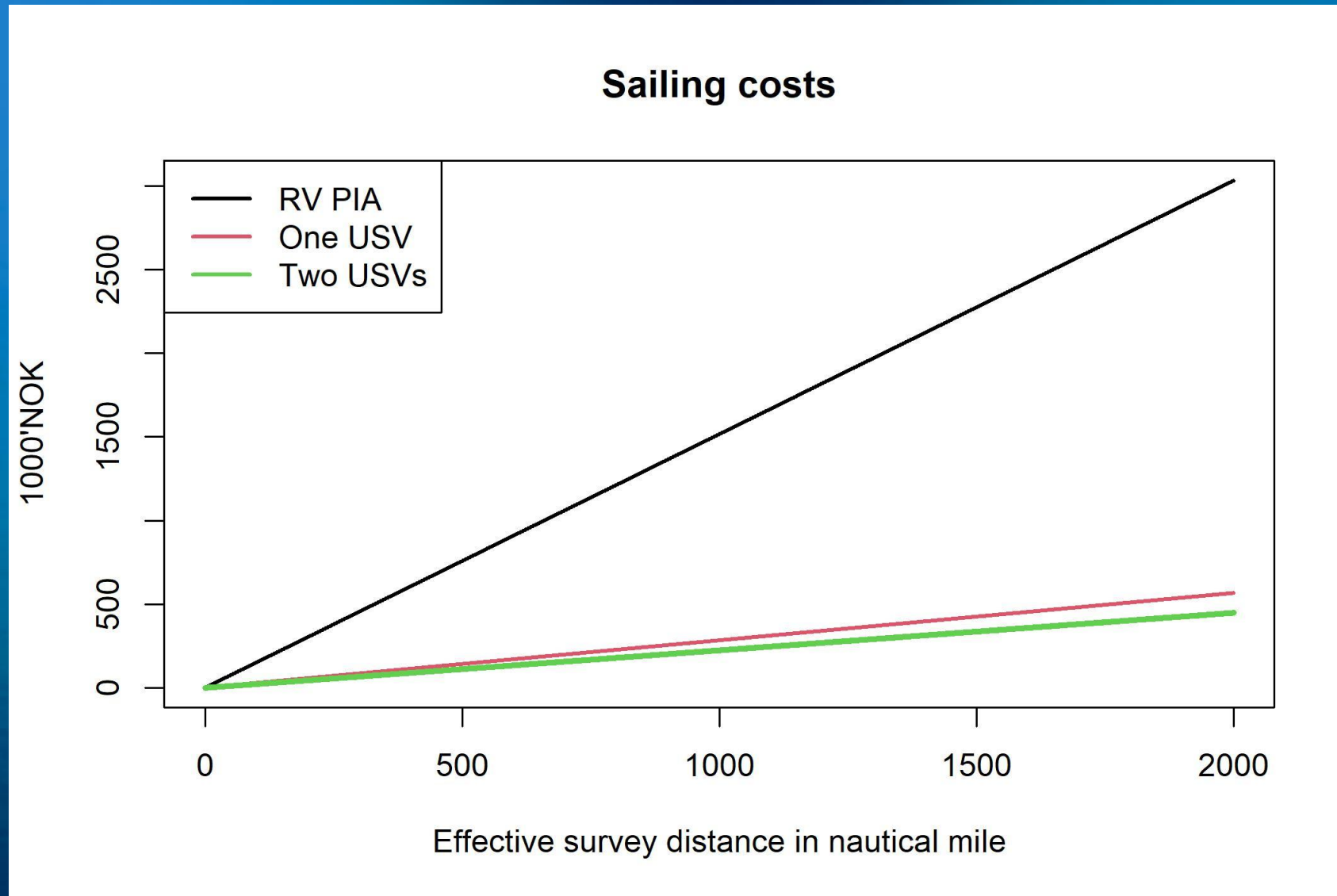
Overview of survey

- Acoustic trawl survey
 - 2024 – Research vessel (RV) only
 - 2025 – USV (acoustics) + RV (trawling)
 - USV - 3 days ahead of RV → acoustics used for targeting trawl hauls in high density areas
 - Hours a day
 - RV – 12
 - USV – 24

Year	RV	USV	Trawl stations	Acoustic transects	Survey coverage	CV No Age 1 sprat
2024	5 days	-	12	272 nmi	7	0.33
2025	7 days	7 days	18	682 nmi	15	0.18

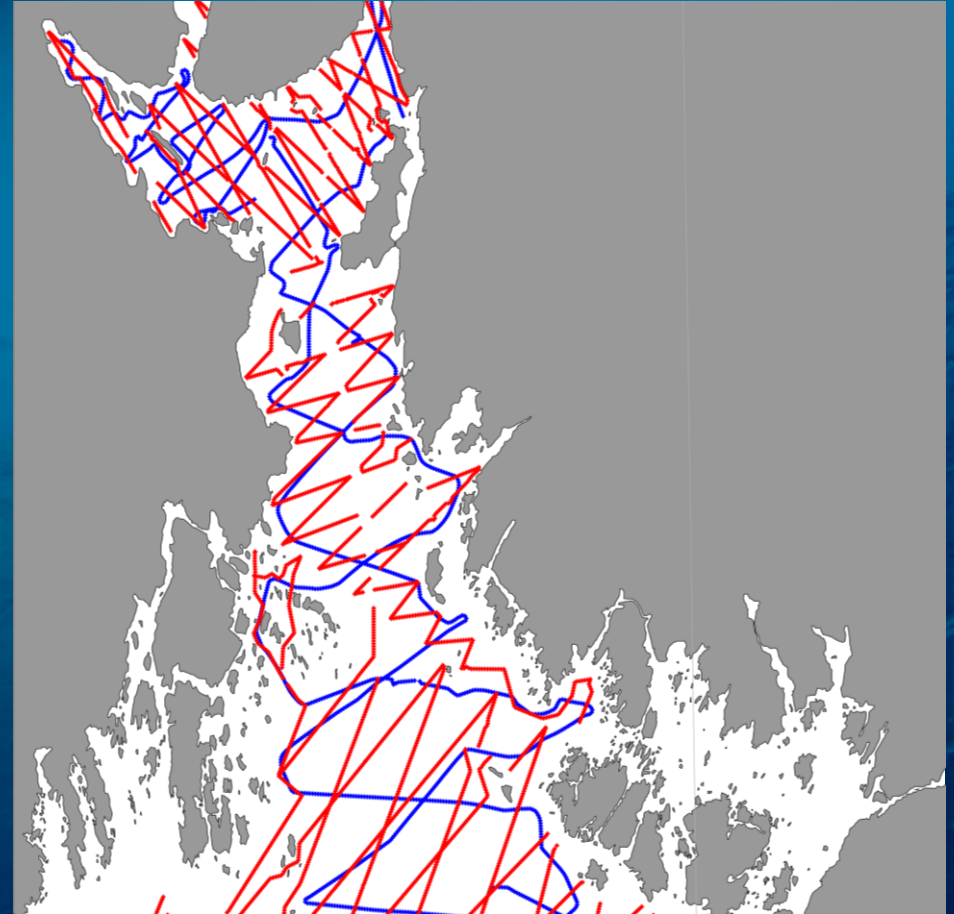


Economy




Data quality of USV

- High echo sounder data quality when
 - speed < 6 knots
 - wave height < 1 m
 - rolling is a problem
- High navigation performance
 - follow planned cruise track and get into shallow waters

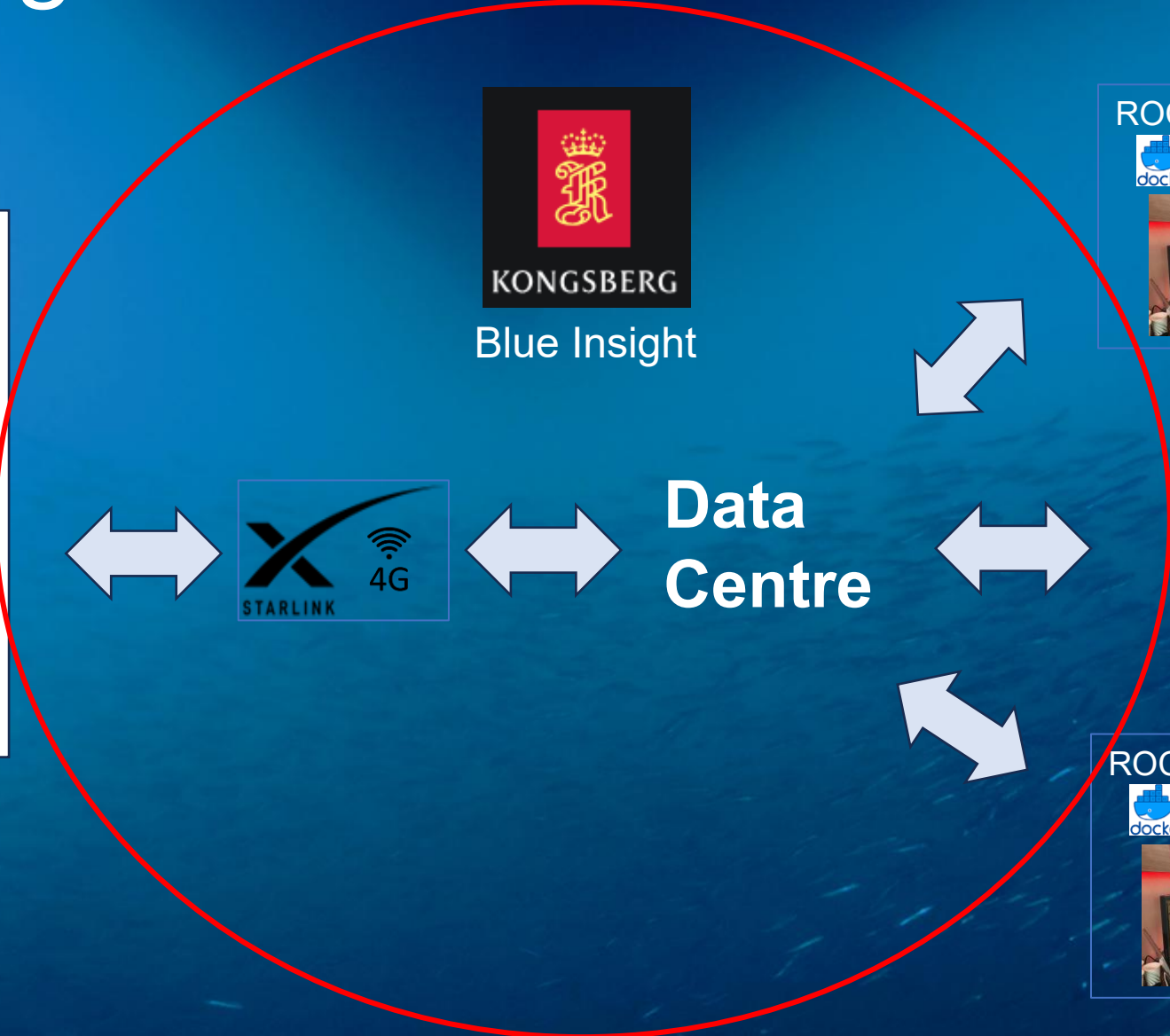


BUT how to get the data?



Key Jørgensen

- docker Data QC algorithm
- docker Acoustic Target Classifiers
- docker Data compression
- docker Echo integration




ROC Data scrutiny

docker Unpack data



ROC Data QC



ROC Data scrutiny

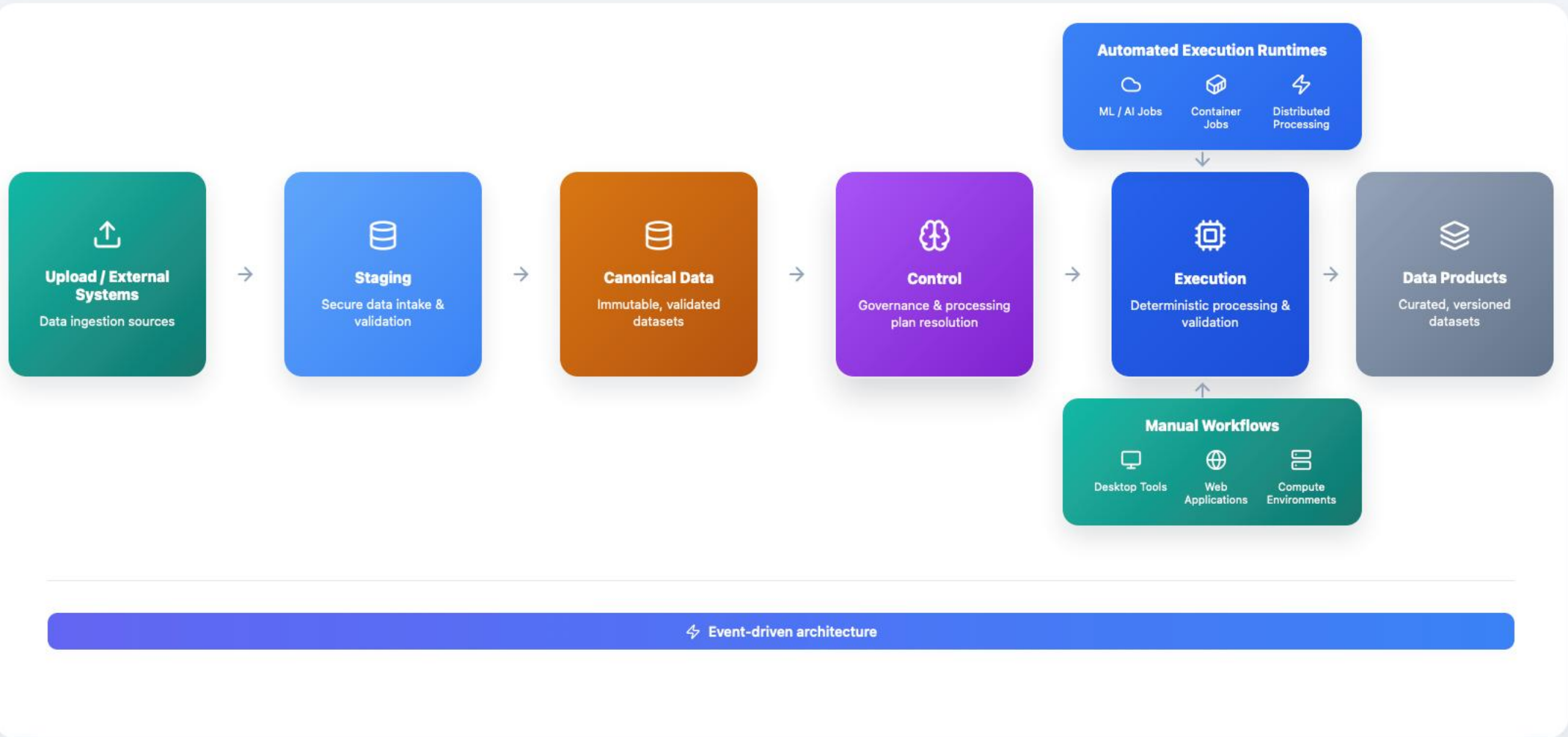
docker Unpack data



End-to-End Data Platform Lifecycle

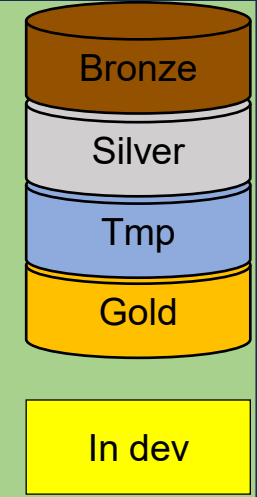
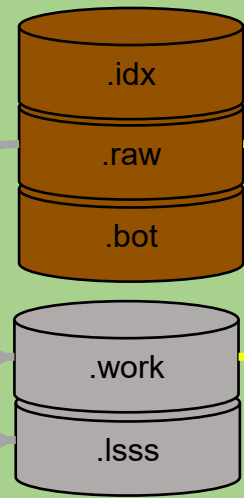
Governed, event-driven, and reproducible data processing platform

Governance • Access control • Metadata • Lineage • Sharing

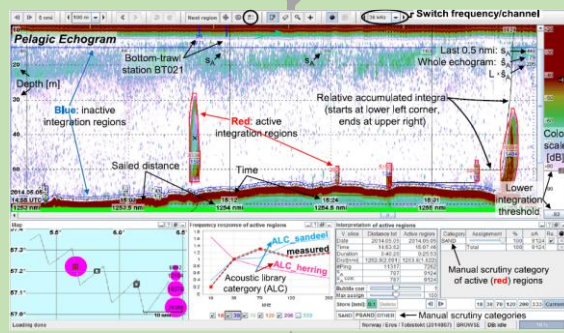


Manual interpretation in cloud

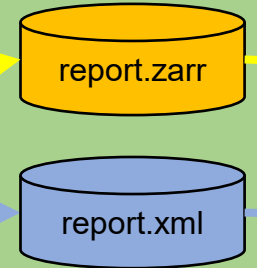
Data Platform



IMR Cloud



sv echo integrator



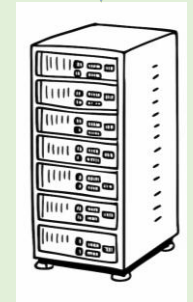
On Land



User specific write access



User specific view access



AI scrutinizing

Training CRIMAC ML models - testing

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Original Article



ICES
CIEM

International Council for
the Exploration of the Sea
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l'Exploration de la Mer

Integrating and assessing machine learning acoustic target classification models for fish survey estimations

Nils Olav Handegard ^{1,*}, Arne Johannes Holmin ², Ahmet Pala ³, Ingrid Utseth ⁴,
Espen Johnsen ²

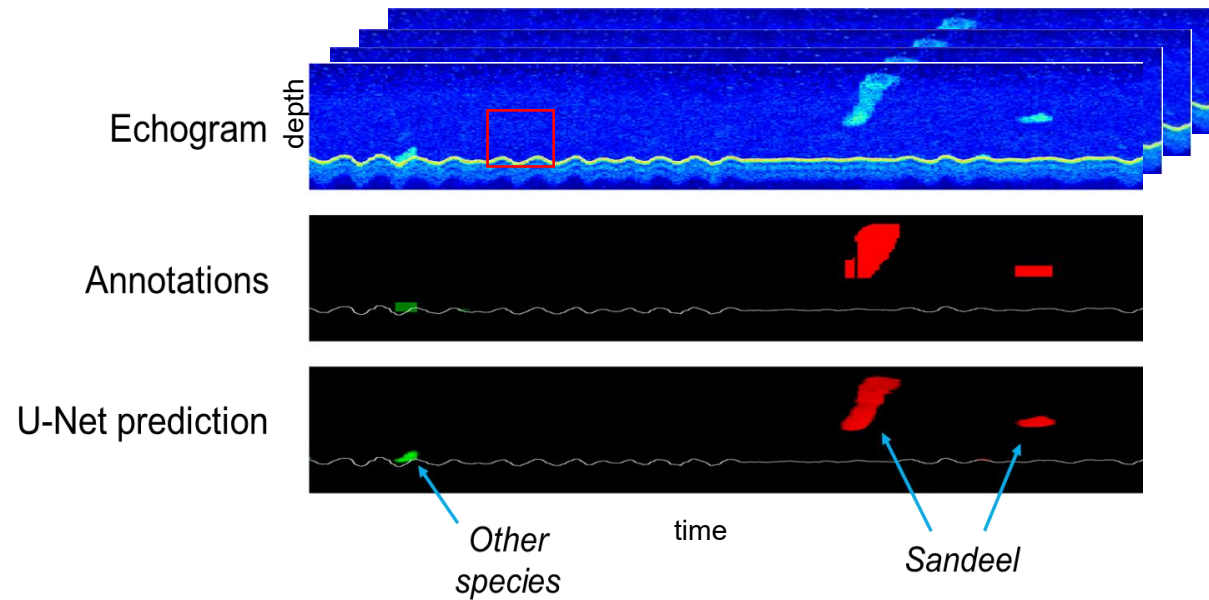
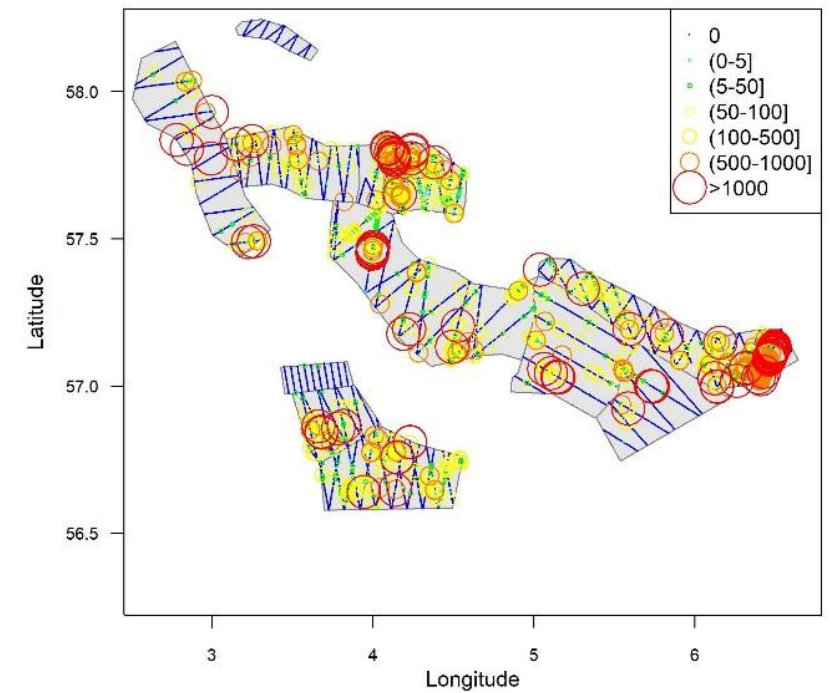
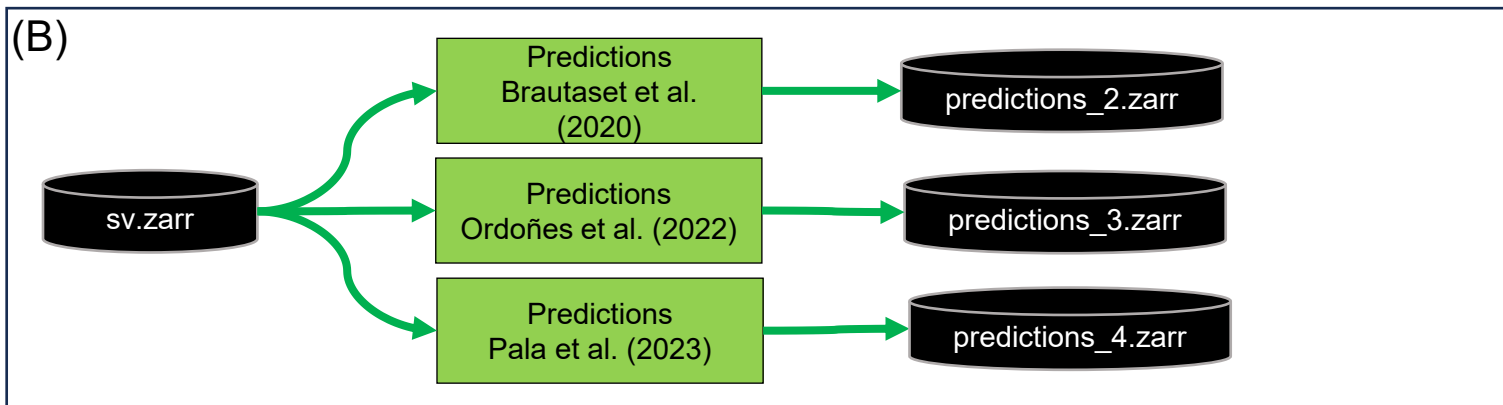
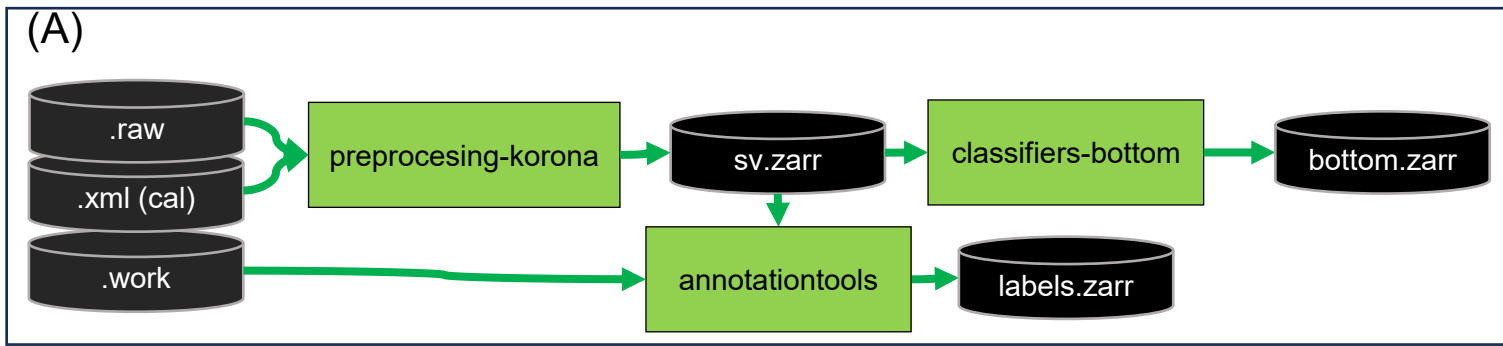
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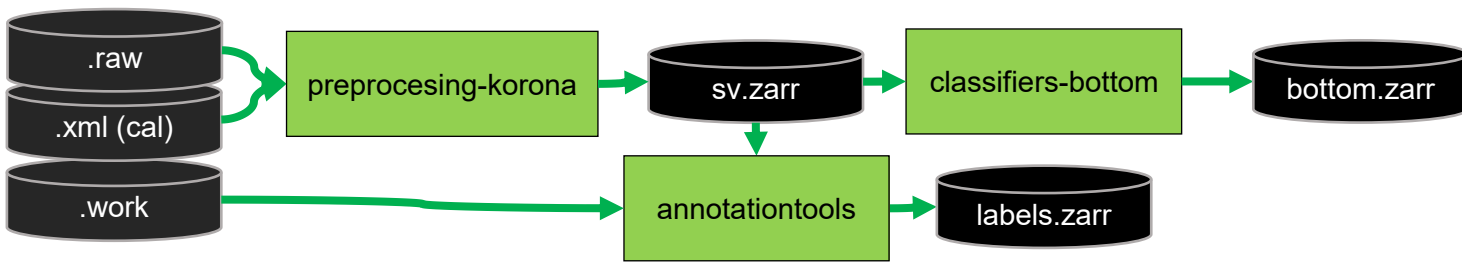
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⁴Department of Image Analysis, Machine Learning and Earth Observation, Norwegian Computing Center, Gaustadalleen 23A, 0373 Oslo, Norway

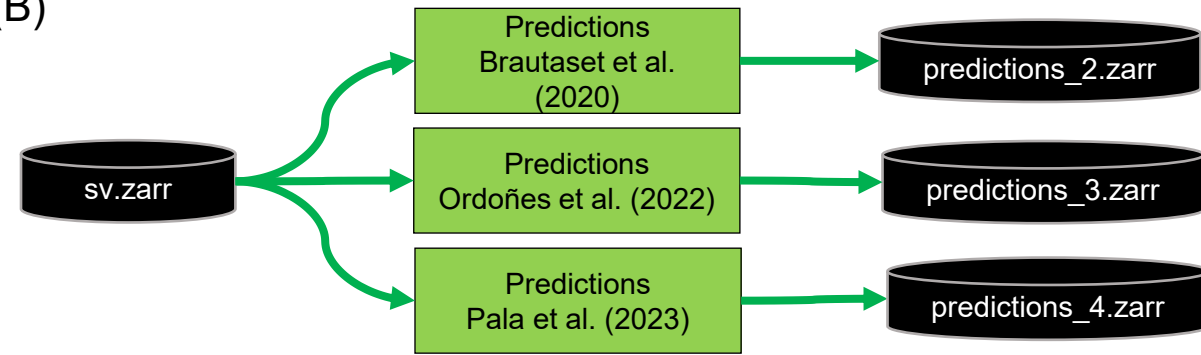




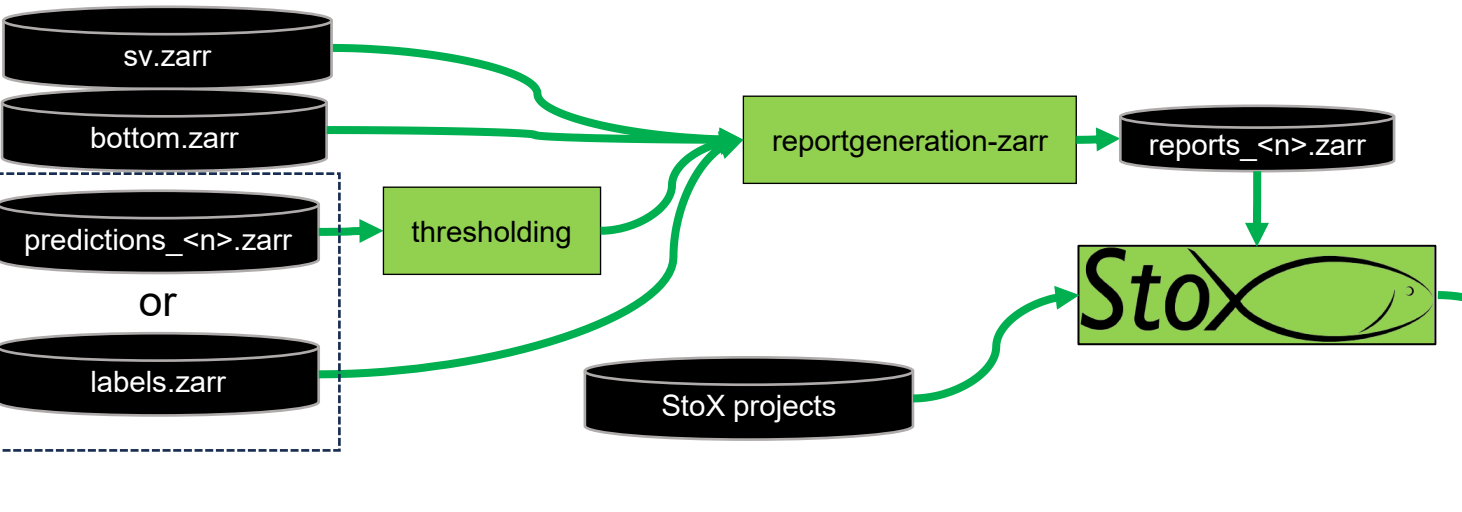
(A)



(B)



(C)



Integrating and assessing machine learning acoustic target classification models for fish survey estimations

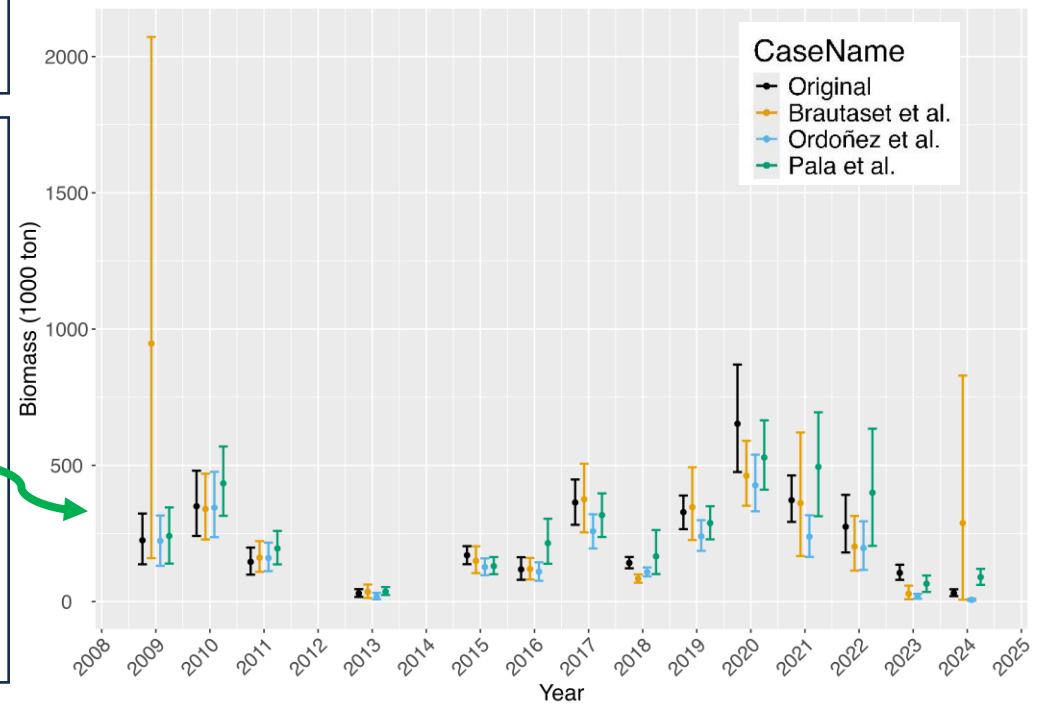
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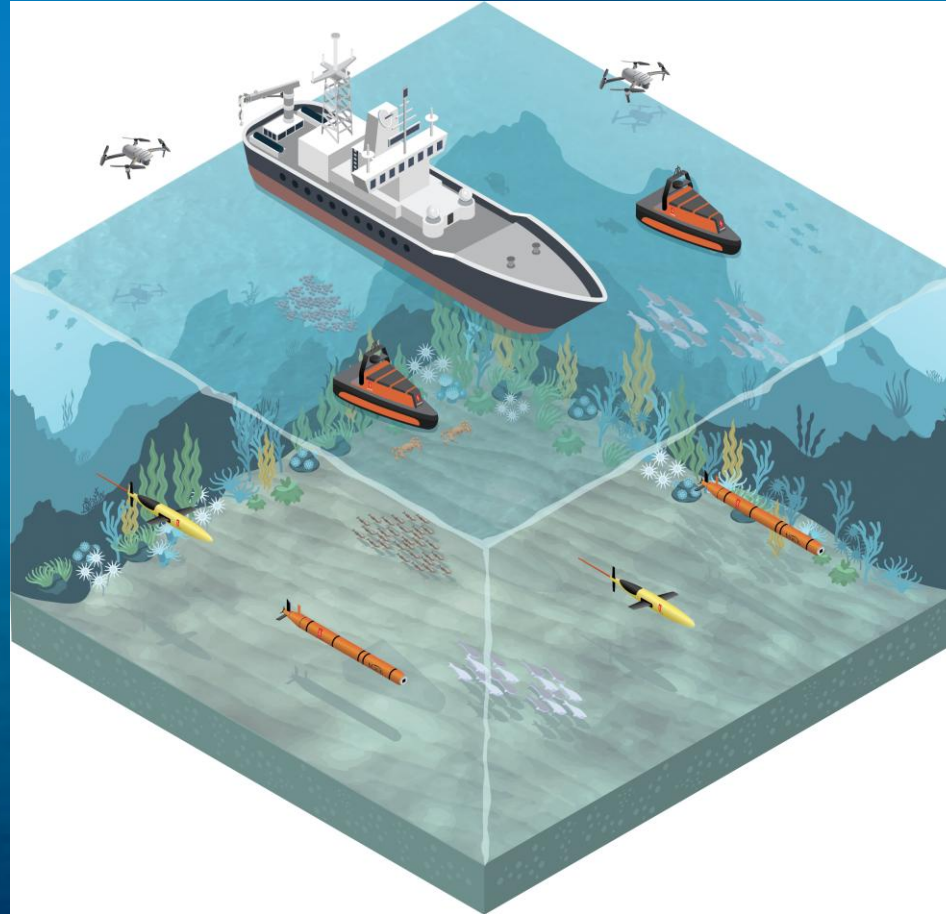
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IMRs future plans → Armadastrategy





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Questions

