Assessing the efficacy and applicability of dynamic ocean management for the US West Coast

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A.46 Earth Science Applications:
Ecological Conservation Impact Assessment


PC: OSU

About The Project

DYNAMIC OCEAN MANAGEMENT is;

- management that uses near real-time data to guide the spatial distribution of human activities
  - used to balance multiple objectives
    - an adaptive approach under a changing climate.

Maxwell et al., 2015. Dynamic ocean management: Defining and conceptualizing real-time management of the ocean. Marine Policy, 58, pp 42-50.

We investigate the efficacy of two tools built to inform Dynamic Ocean Management

1. EcoCast

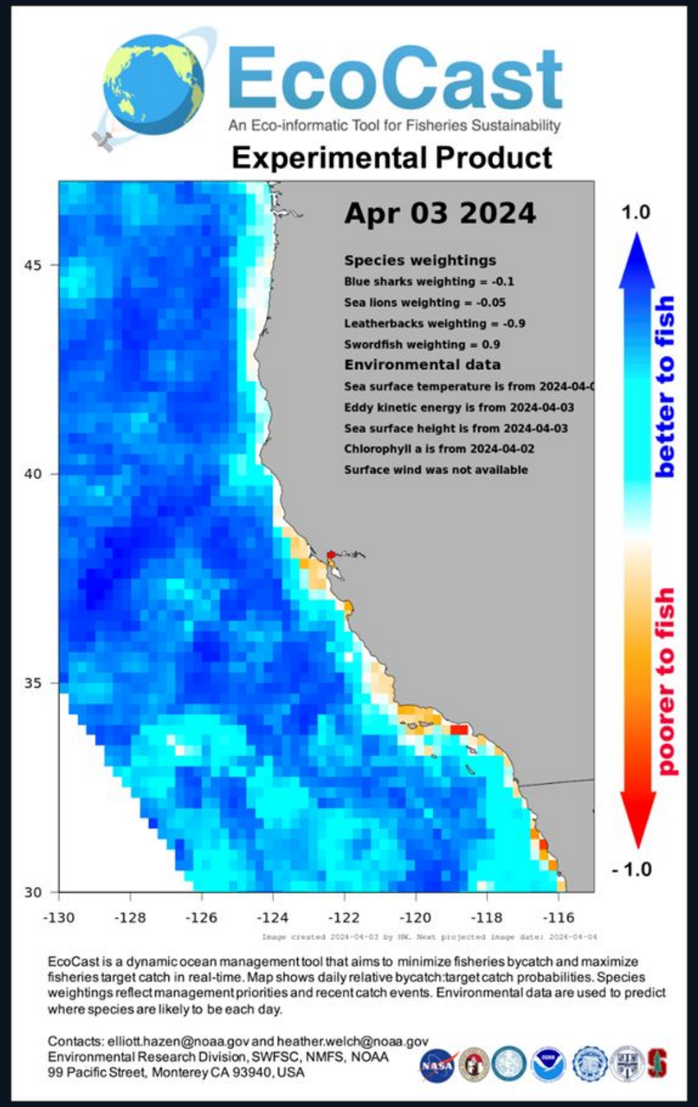
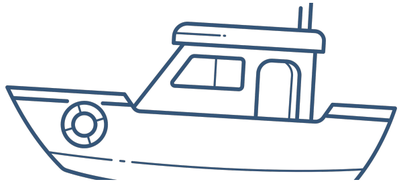


Fig 1. An example of the EcoCast daily map product https://coastwatch.pfeg.noaa.gov/ecocast/

Finding a good place to fish….

- Purpose built for the drift-gillnet fishery in California
- Decision-support tool for fishermen to find a good place to fish
- Built by Hazen et al., 2018
- Remotely-sensed earth observations and biological observations (fishery observer and satellite tracking data)
- Daily suggestions of where to fish to avoid bycatch and target species
  - Consider economic and ecological criteria

Hazen, L., K.L. Scales, S.M. Maxwell, D.K. Briscoe, H. Welch, S. J. Bograd, H. Bailey, S.R. Benson, T. Eguchi, H. Dewar, S. Kohin, D.P. Costa, L.B. Crowder and R.L. Lewison. 2018. A dynamic ocean management tool to reduce bycatch and support sustainable fisheries. Science Advances 4: eaar3001.

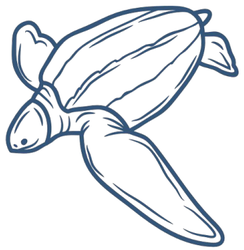


Questio n

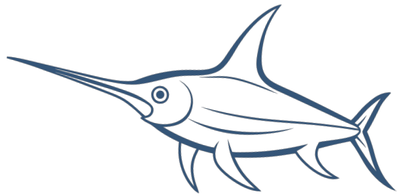
Is EcoCast useful as a decision-support tool for fishermen to achieve these objectives?

Objective

To evaluate the efficacy of EcoCast for meeting its goals to;



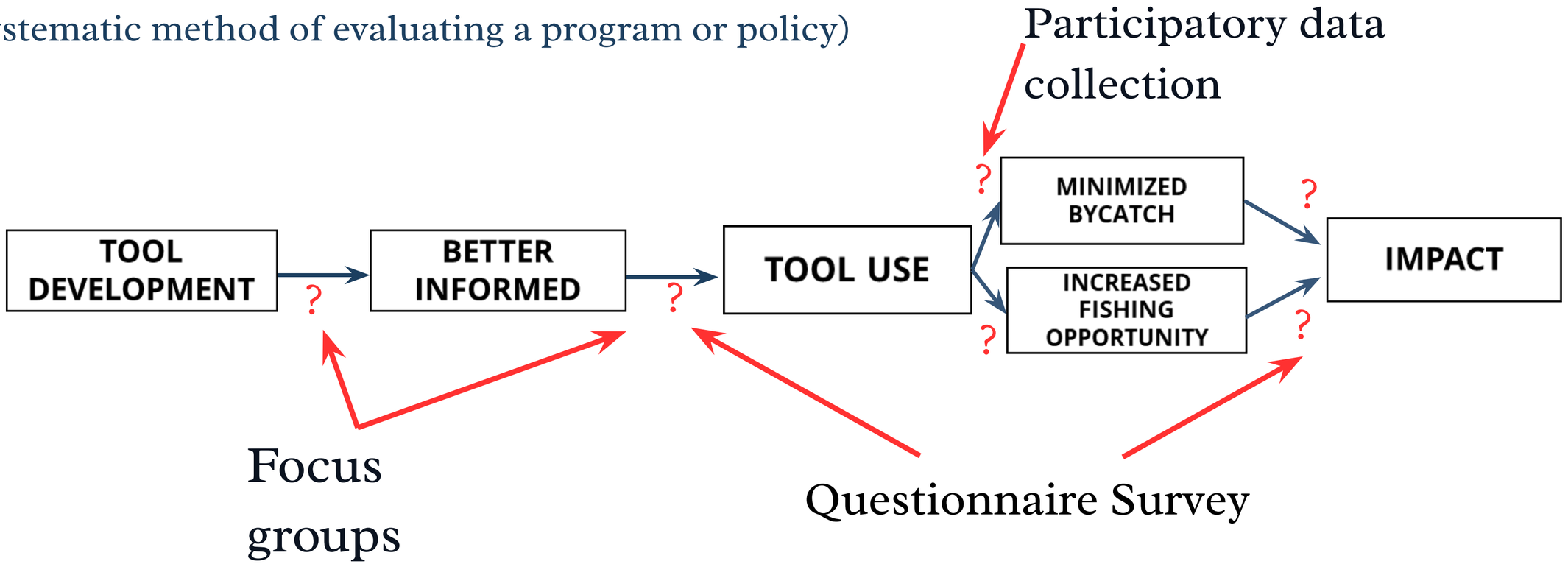
- minimize bycatch
- increase fishing opportunity.



APPROACH

Program performance evaluation

(systematic method of evaluating a program or policy)



- Mixed methods to develop an evidence base at each of these change points
- Determine how EcoCast development **leads to a** positive impact

RESULTS

FOCUS GROUPS

- Operationalized
- Spatially and temporally dynamic
- Multiple species
- Protected and target species

- 2019 Exempted Fishing Permit Holders
- 2024 Exempted Fishing Permit Holders

- Evidence of efforts to reduce interactions
- Potential fishing ground access

- Other DOM tools inspired by EcoCast

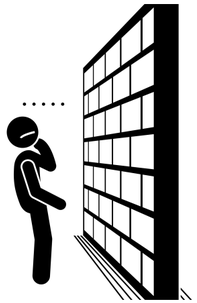
TOOL DEVELOPMENT → ? → **BETTER INFORMED** → ? → **TOOL USE**

TOOL USE → ? → **MINIMIZED BYCATCH**

TOOL USE → ? → **INCREASED FISHING OPPORTUNITY**

MINIMIZED BYCATCH → ? → **IMPACT**

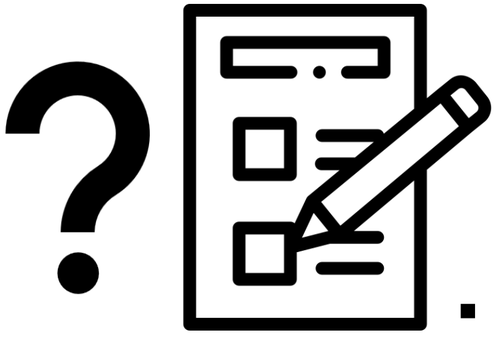
INCREASED FISHING OPPORTUNITY → ? → **IMPACT**



- Spatial resolution
- Consistent funding

- Delivery system
- Political barriers (fishery sunsetted)
- Model uncertainty
- Opposition by conservation groups
- Fear of losing opportunity

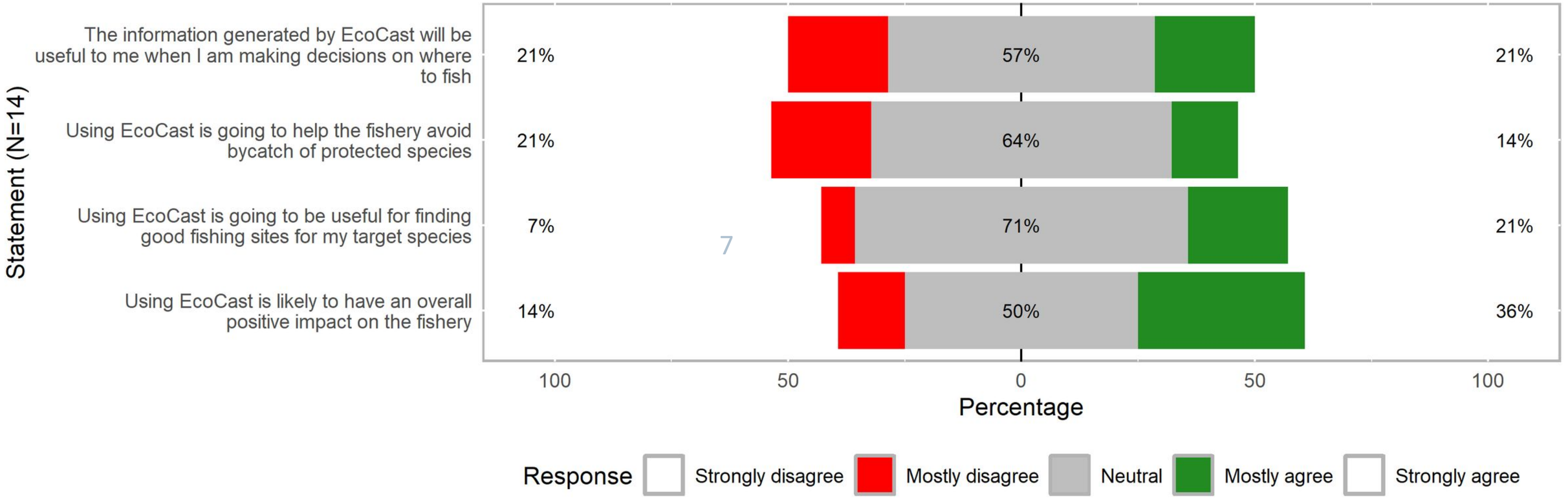
- Not there yet on bycatch



RESULTS

Skipper Questionnaire Survey

To be tested pre and post EcoCast use



Upcoming

PARTICIPATORY DATA COLLECTION

Voluntary (compensated) data collection by HMS EFP holders to test the reliability of EcoCast

SURVEY CARD

Participants fill out a short survey card during normal fishing trips

PROJECTION VS REALITY

Note EcoCast projection, and then make an assessment of pre-set and post-haul real fishing conditions

MEASURE THE DIFFERENCE

We compile data and measure the difference between EcoCast projections and skipper evaluations of conditions to assess how well the tool works

Captain name:

EcoCast Survey Card

Assessment Key:	Color	Description
	Dark blue	Best to fish (highest chance of catch, lowest bycatch)
	Light blue	Good to fish
	White	Neutral
	Orange	Poor to fish
	Red	Worst to fish (lowest chance of catch, highest bycatch)

**Please note that the scale is relative to the conditions of the day.

												Factors that influenced fishing location (check "y" on all that apply):								
Trip date	Vessel identification number	Gear type	Lat	Lon	EcoCast map date	EcoCast Prediction	Pre-set Assessment	Fishing gear deployed?	Observer Trip Number	Set	Target species	Water conditions	SST map	Chlorphyll map	EcoCast predictions	Sighting of non-target species	Sighting of target species	Other	Post-haul Assessment	Comments
Example:																				
12.9.23	CF1234AB	MWSG	36.6039	-121.8946	12/09/2023	light blue	light blue	y	DN-SD-0001	1	swordfish, opah	y	y	n	y	n	n	e.g. cloud cover	light blue	Lots of blue sharks in catch, not many swordfish
12.9.23	""	""	36.7539	-121.8946	12/09/2023	red	light blue	n		2	swordfish, opah	n	y	n	y	n	n		NA	water looks good but decided not to fish due to EcoCast prediction
12.9.23	""	""	36.6539	-121.8946	09/09/2023	dark blue	red	n		3	swordfish, opah	n	y	y	n	y	n		NA	was going to fish but saw 10 leatherbacks on surface of wate
14.9.23	665885	XLBG	36.7539	-121.8946	13/09/2023	red	orange	y	DN-SD-0002	1	swordfish	n	y	n	n	n	n	e.g. previous catch reports	red	decided to fish because other fishermen said it was good, but we got only unwanted catch

2.

WhaleWatch

MOTIVATION:

- To reduce ship-strikes on Whales off the California Coast and therefore reduce pressure on recovering blue whale populations

END-USERS:

- NOAA west coast regional office - protected resources division & NOAA Sanctuaries

PRODUCT:

- Satellite-telemetry-based habitat model
- Operationalized to produce a daily map (originally monthly) which shows probability of Blue whale presence

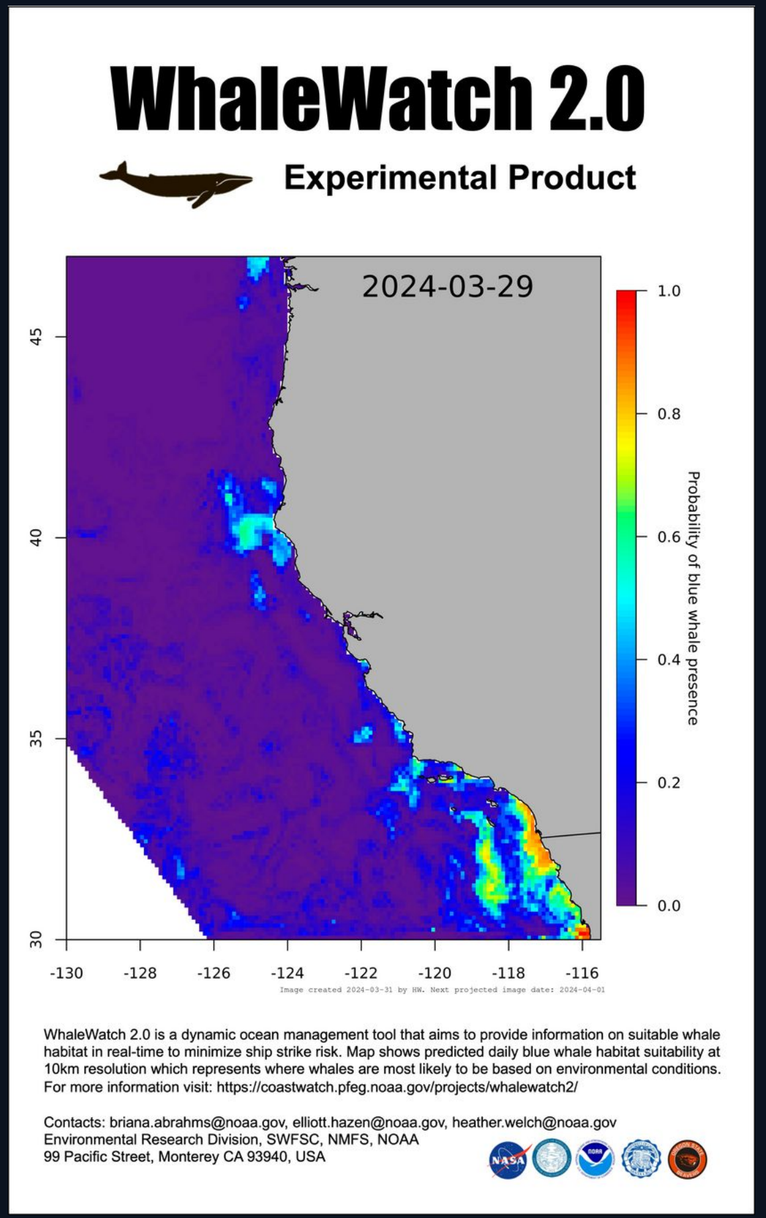


Fig 1. An example of the WhaleWatch map product

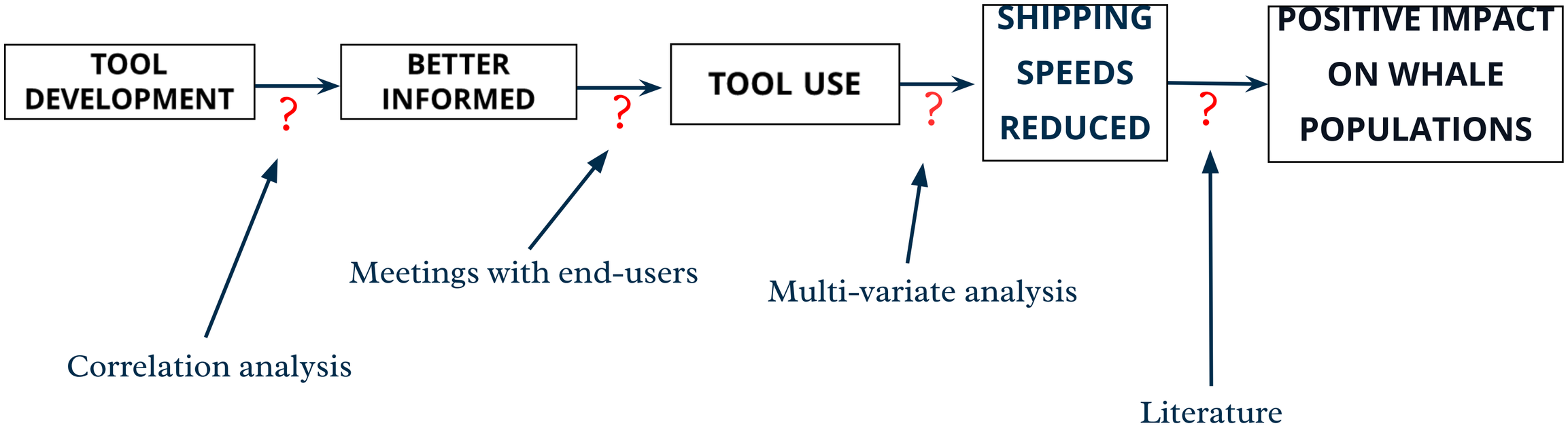
Objective

To evaluate the efficacy of WhaleWatch for meeting its goal to;

- reduce ship-strikes on whales (by getting ships to slow down when whales are present)

APPROACH

Program performance evaluation



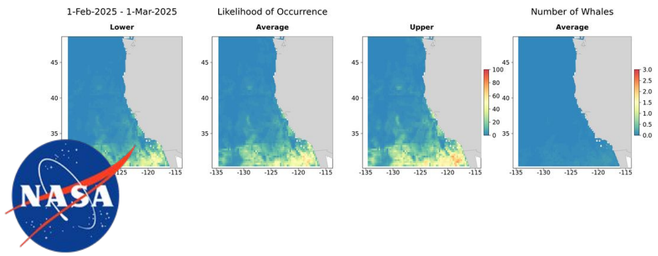
BETTER INFORMED → ? TOOL USE

Meetings with end-users

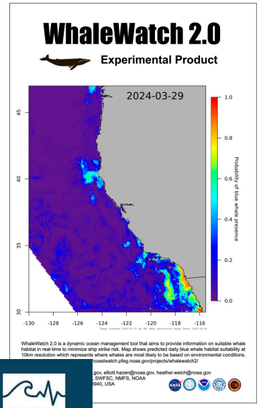
NOAA Protected Resources Division

NOAA Sanctuaries

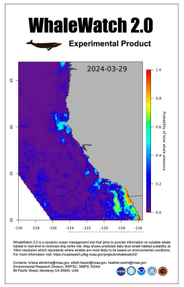
WhaleWatch 1.0 (2015)



WhaleWatch 2.0 (2018)



Hazen/Abrahms et al.



Whale Safe (2020)

Whale Presence Rating

Whale Alert/ Spotter Pro

Baumgartner et al., 2019

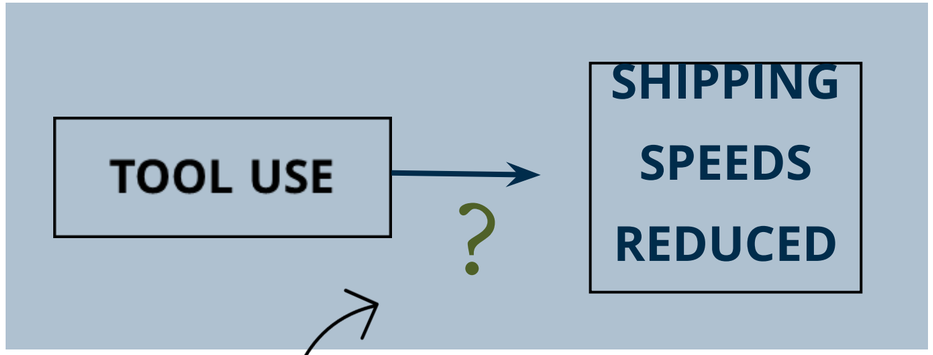
Blue Whales Blue Skies (2014)

Protecting Blue Whales and Blue Skies

Voluntary Speed Reduction Zones

San Francisco Bay Area

Santa Barbara Channel



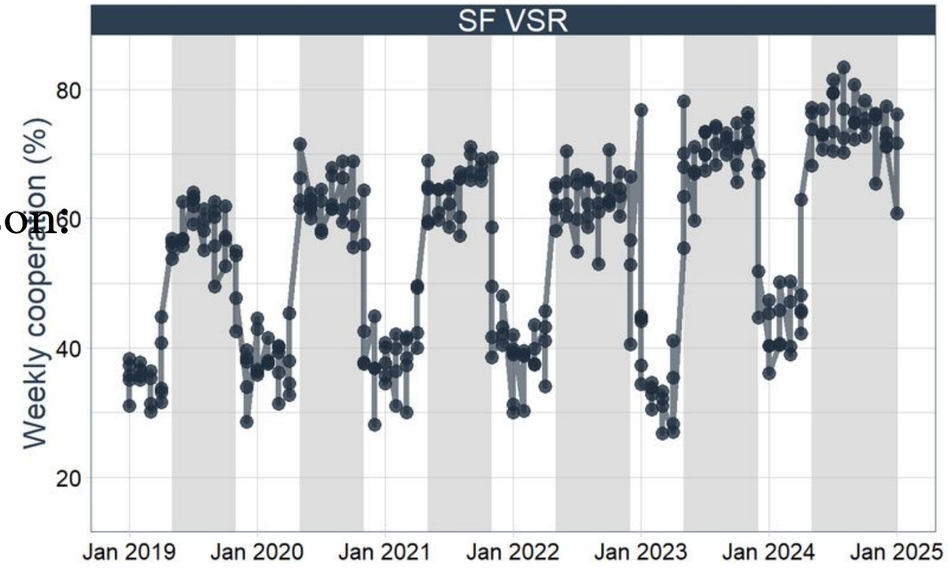
Shipping speeds have decreased!

Cooperation = Speed of < 10 knots within the Voluntary Speed Reduction Zone

Cooperation in the active VSR season:

Median = 84.0 %

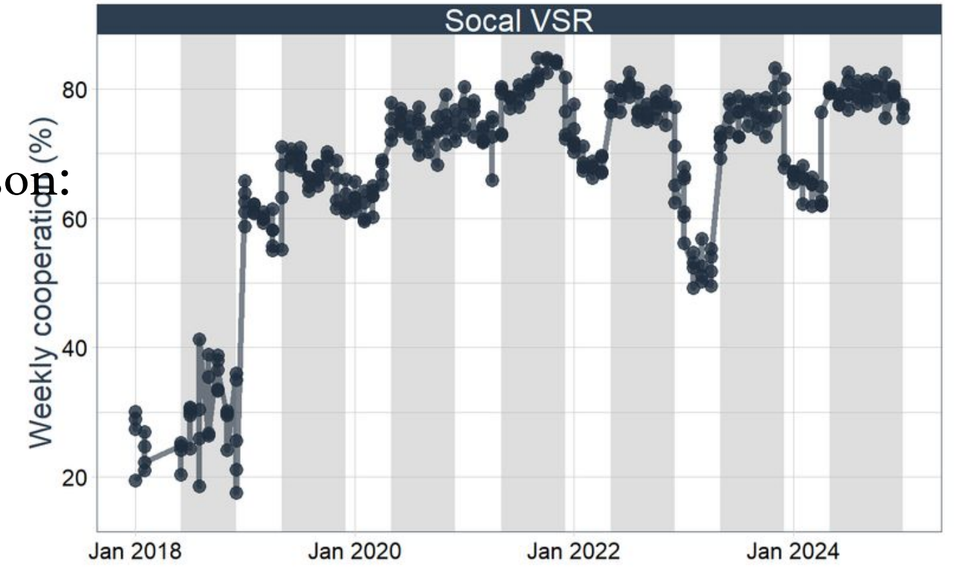
Mean = 66.3 %



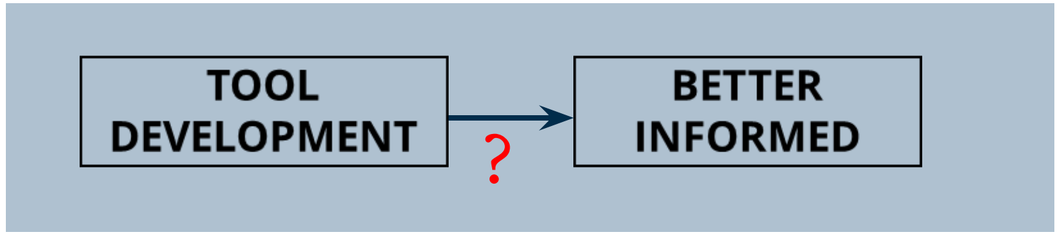
Cooperation in the active VSR season:

Median = 99.6 %

Mean = 75.5 %



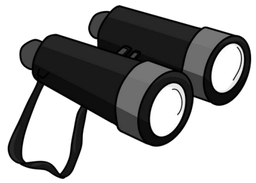
Data: WhaleSafe (Rachel Rhodes)

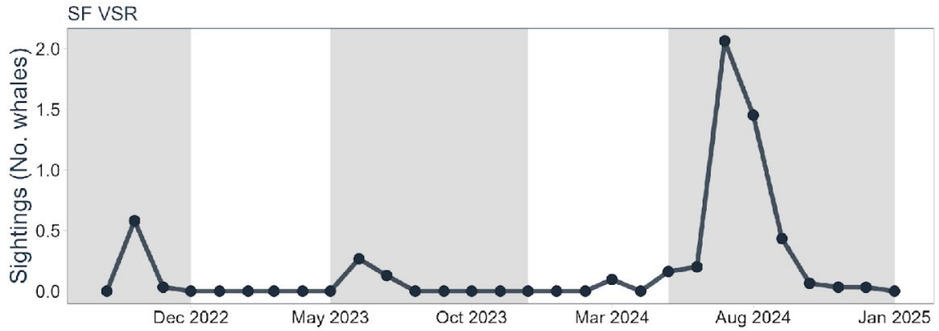


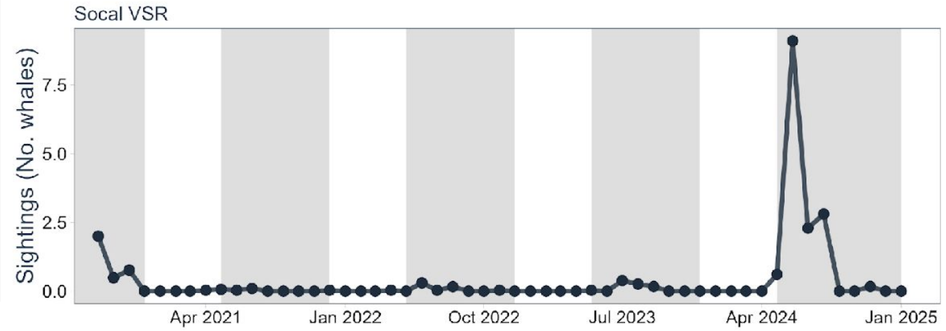
Question:

How important is the contribution of the WhaleWatch model towards reducing vessel speeds?

Three data streams provide the information we need on whale presence, each has their own drawbacks:



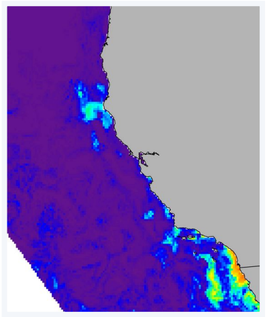




Correlation analysis

- Identify correlation strength and significance between:

1



WhaleWatch

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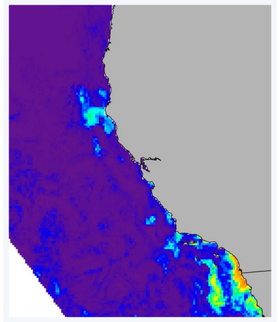
Acoustic detections

2



WhaleWatch

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Sightings data

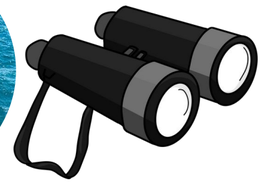
- Done in San Francsico and Southern California vessel speed reduction zones
- Assessed correlation using Pearson's, Spearman's, and Kendall's rank correlation coefficients

PC: Robots4Whales, NOAA, Whale Watching Catalina Island

Correlation Results

WhaleWatch ~ Acoustics

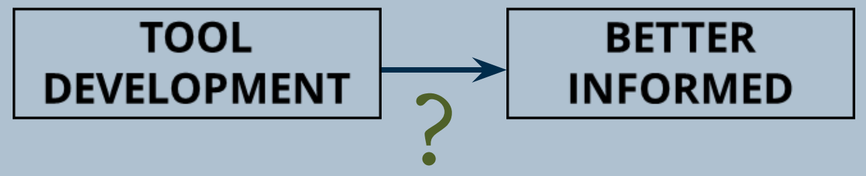
Region	Method	Correlation metric	*P* value
San Francisco	Spearman	0.68	***P*** **< 0.01**
Southern California	Spearman	0.19	***P*** **< 0.01**



WhaleWatch ~ Sightings

Region	Method	Correlation metric	*P* value
San Francisco	Spearman	0.25	***P*** **< 0.01**
Southern California	Spearman	0.13	***P*** **< 0.01**

PC: Robots4Whales, NOAA, Whale Watching Catalina Island



Outcomes

- We can rely on WhaleWatch model alone when other data streams are not available

- Promise for using SDM's for Dynamic Ocean Management alone elsewhere

TOOL USE → ? SHIPPING SPEEDS REDUCED

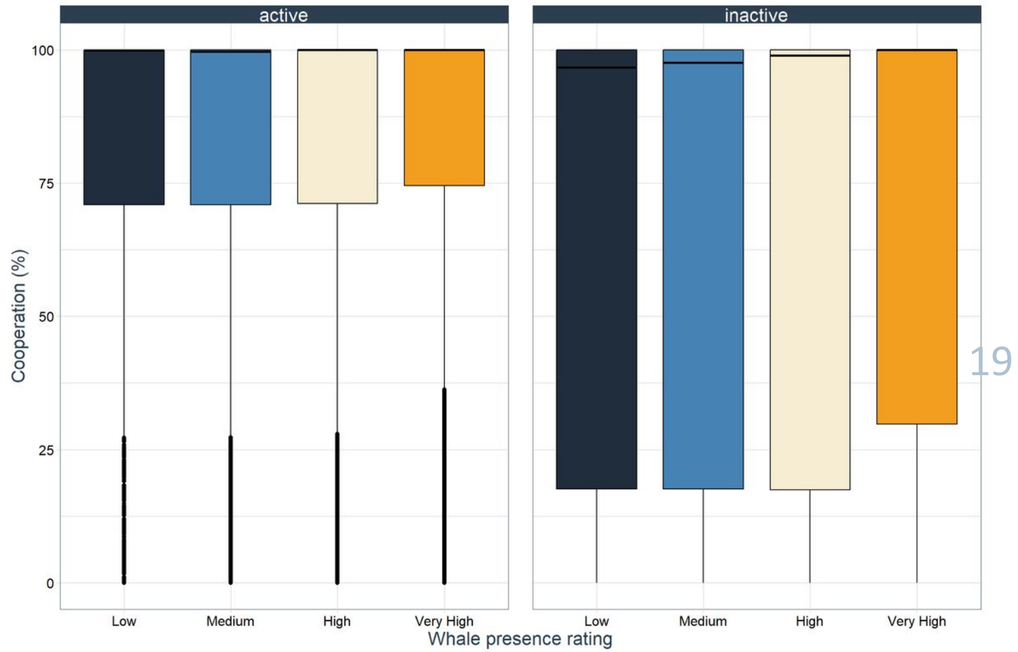
Next question (ongoing):

What is the influence of whale presence on shipping speeds?

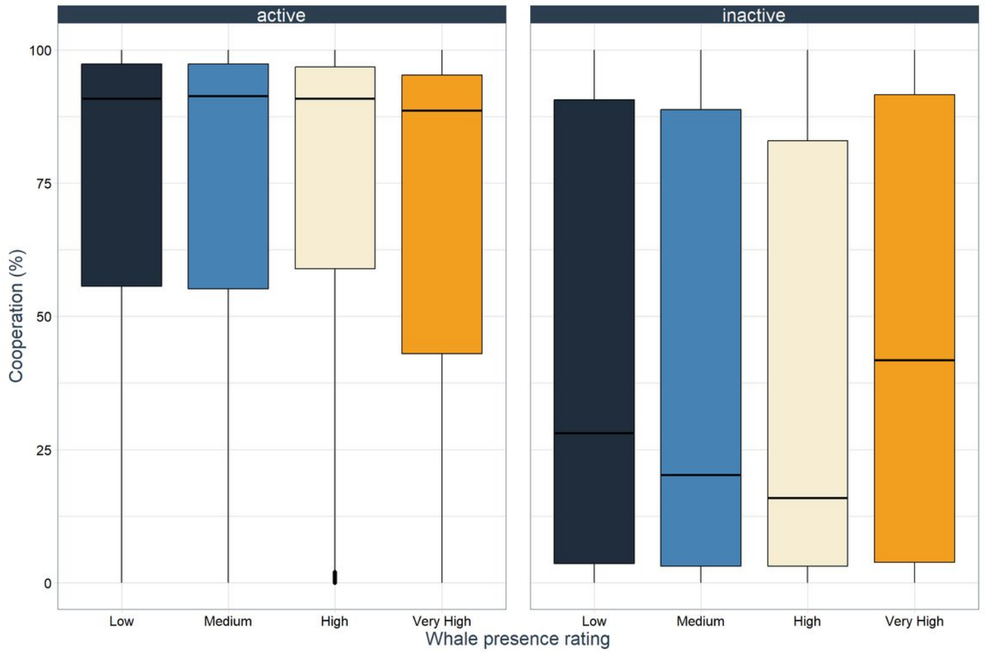
(A deeper dive into Vessel speed ~ The Whale Presence Rating)

Ship speeds are influenced by whale presence even outside of the active Voluntary Speed Reduction period?

Southern California



San Francisco



Methods: Generalised linear mixed model

Cooperation ~ Whale Presence Rating + VSR Season + Ship Category + Program Membership + (1|year) + (1|month)

Conclusions

We find applications of these two tools for Dynamic Ocean Management almost a decade after they were first built (although not quite as imagined)

1) **EcoCast:**
   - Useful from the perspective of resource managers
   - Potential for use by fishermen if some changes are made to the tool

2) **WhaleWatch**
   - Actively being used within a 3-pronged approach to provide information on whale presence that is being used sucessfully to reduce shipping speeds in high risk areas
   - Information combined with clear end-user instructions and accountability has led to impact