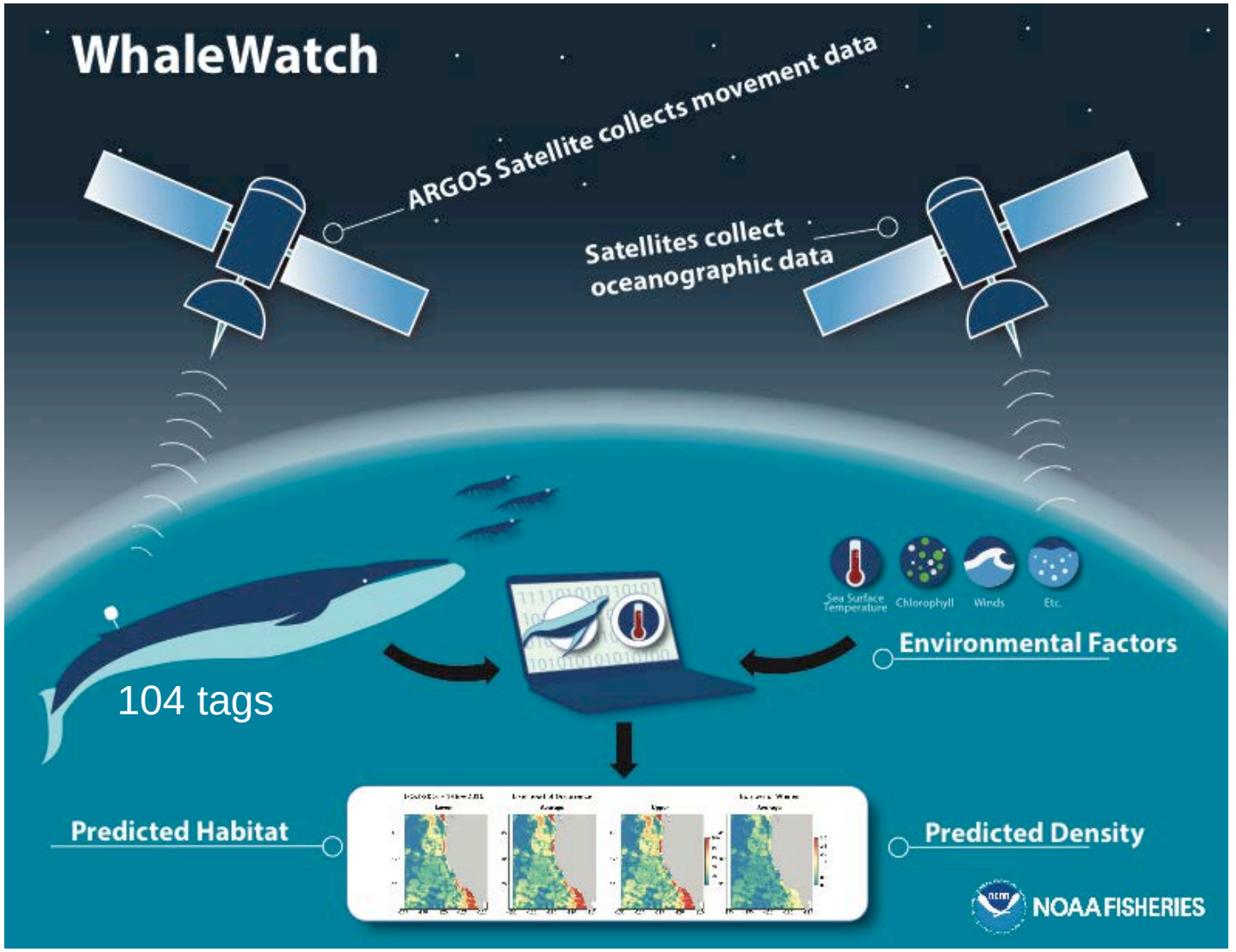
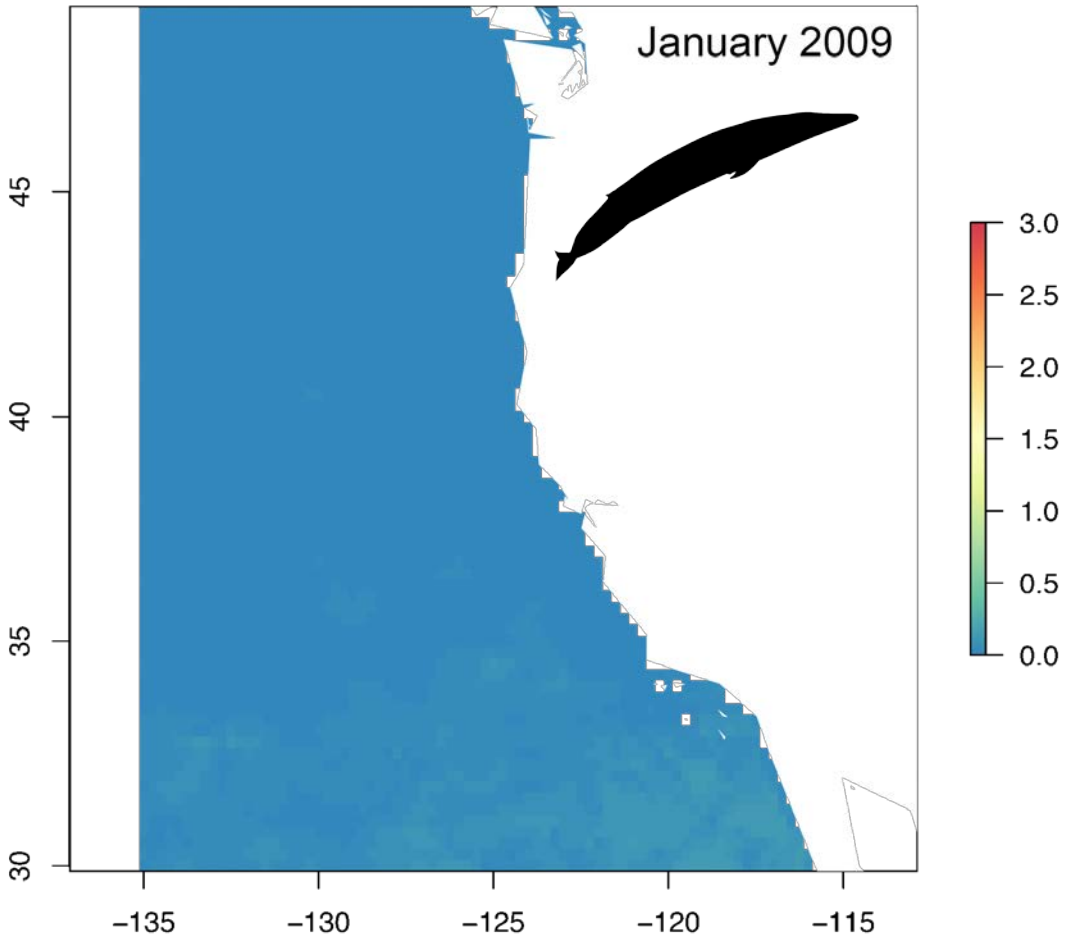
WhaleWatch 2.0: Downscaled Blue Whale Habitat Models along the West Coast

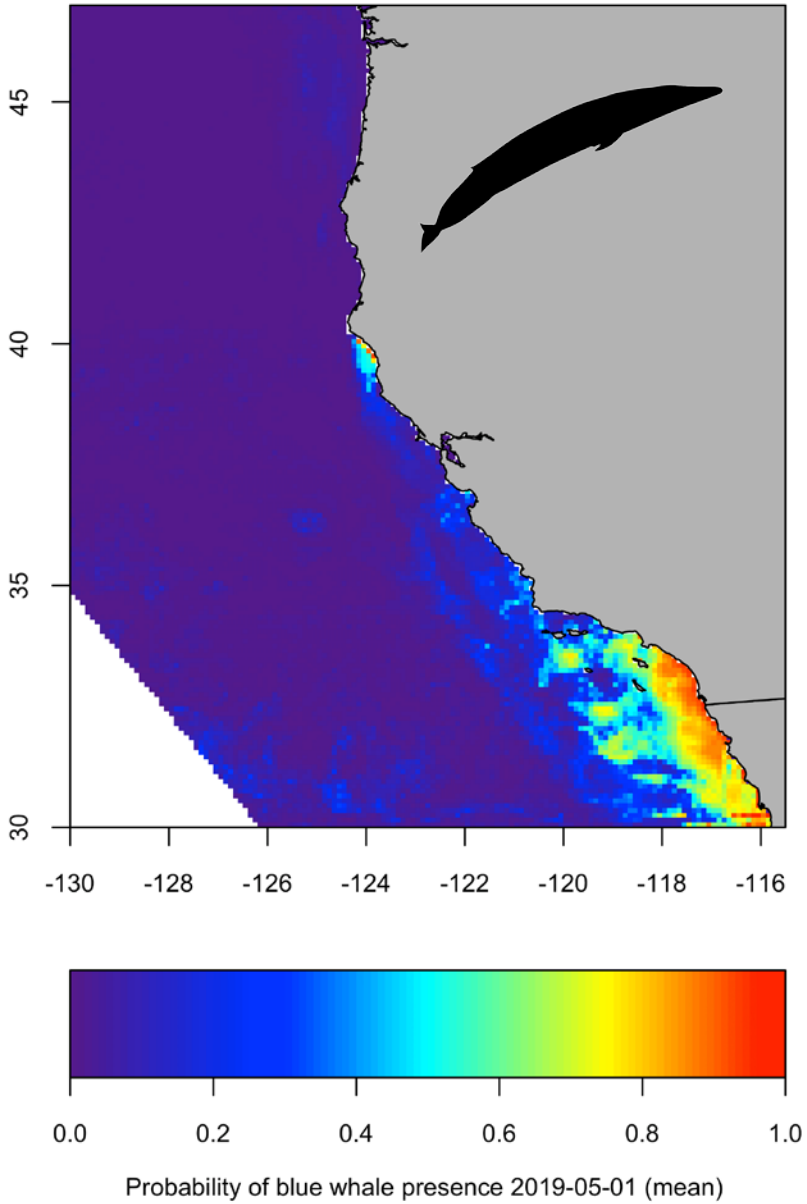
Briana Abrahms, Heather Welch, Stephanie Brodie, Michael Jacox, Elizabeth Becker, Steven J. Bograd, Ladd Irvine, Daniel Palacios, Bruce Mate, Elliott L. Hazen



WhaleWatch 1.0 to 2.0

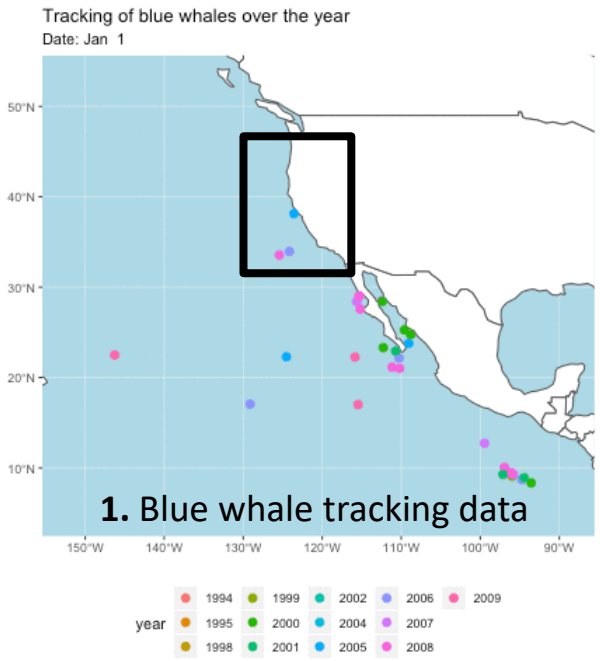


Hazen et al. 2017 J. Appl. Ecol.

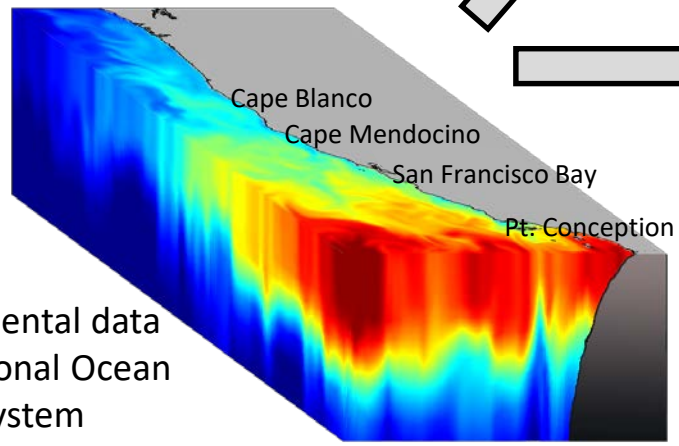


Abrahms et al. 2019 Div. Dist.

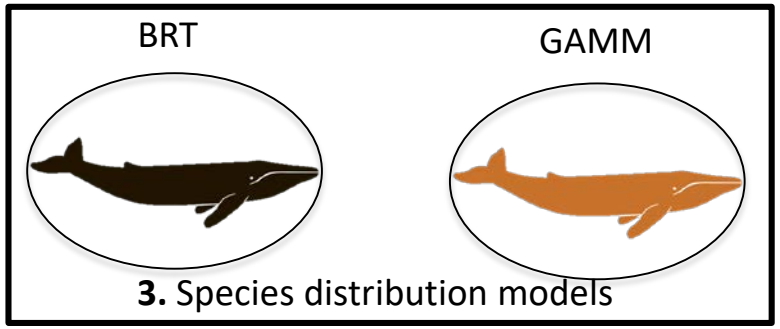
Daily blue whale predictions



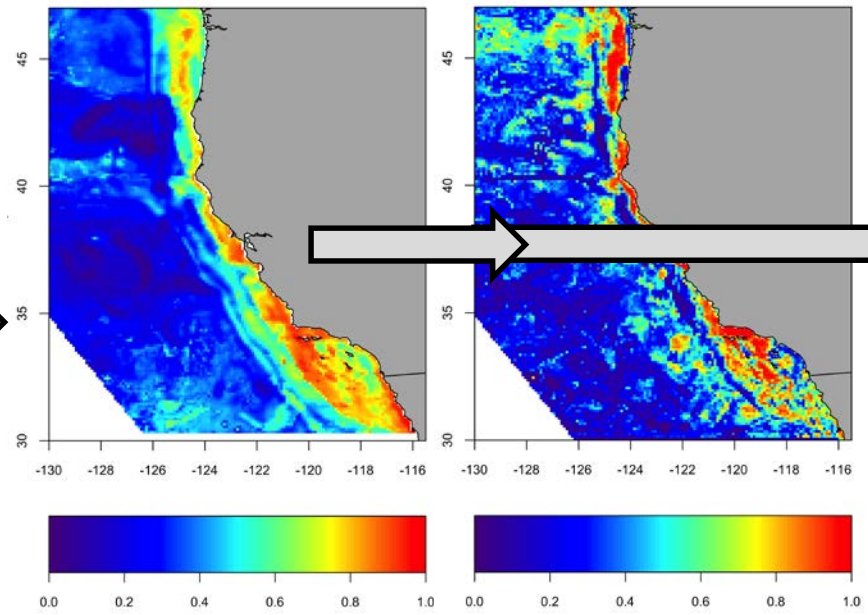
1. Blue whale tracking data



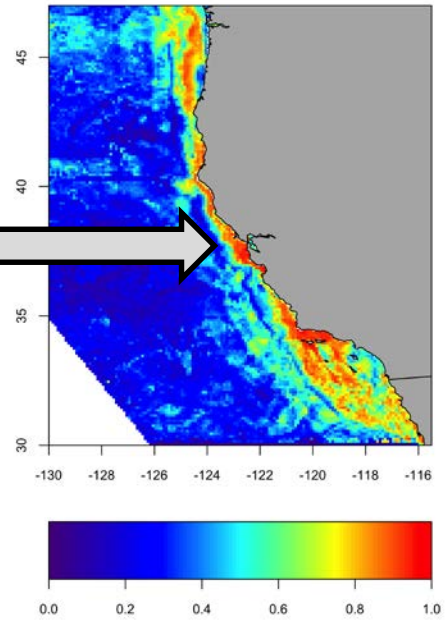
2. Environmental data from a Regional Ocean Modeling System



3. Species distribution models



4. Daily predicted habitat suitability



5. Model ensembles

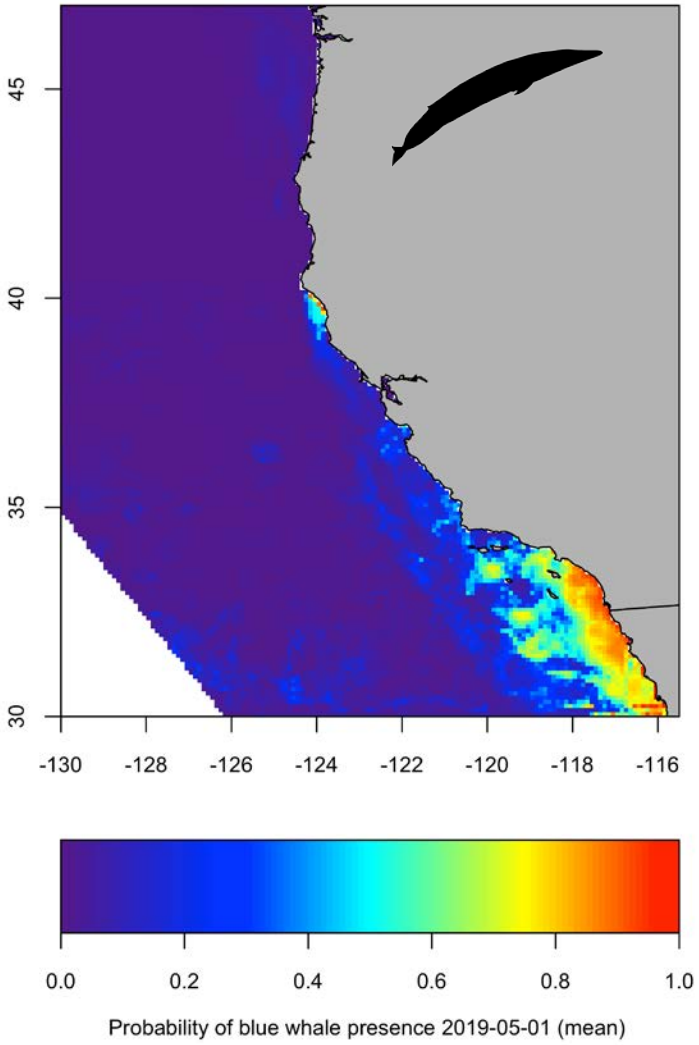
An ensemble of models often yields more robust predictions and minimizes individual model biases.

Wintle et al. 2003, Johnson and Omland 2004, Araújo and New 2007, Thuiller et al. 2008, Gritti et al. 2013, Scales et al. 2015

Model output

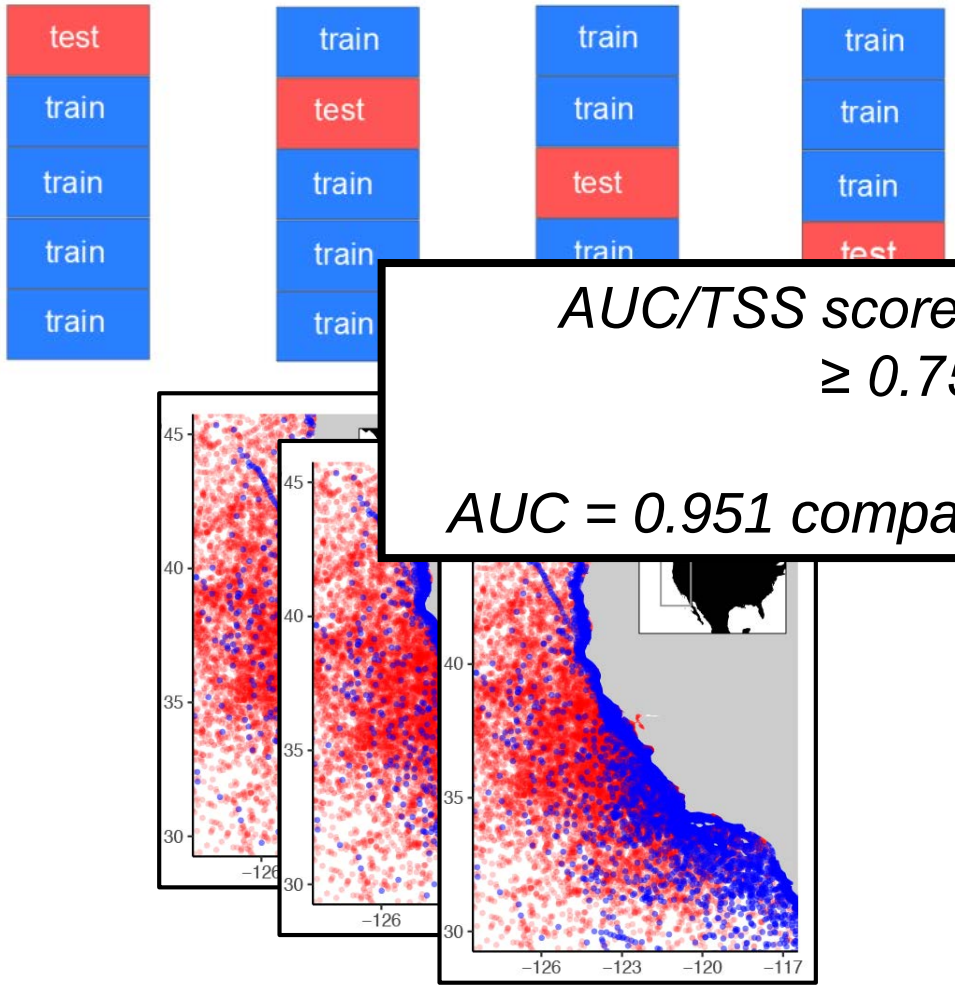
Daily, year-round ”Habitat suitability” or “Probability of occurrence” on a 0-1 scale

Red = more likely, blue = less likely



Model Evaluation

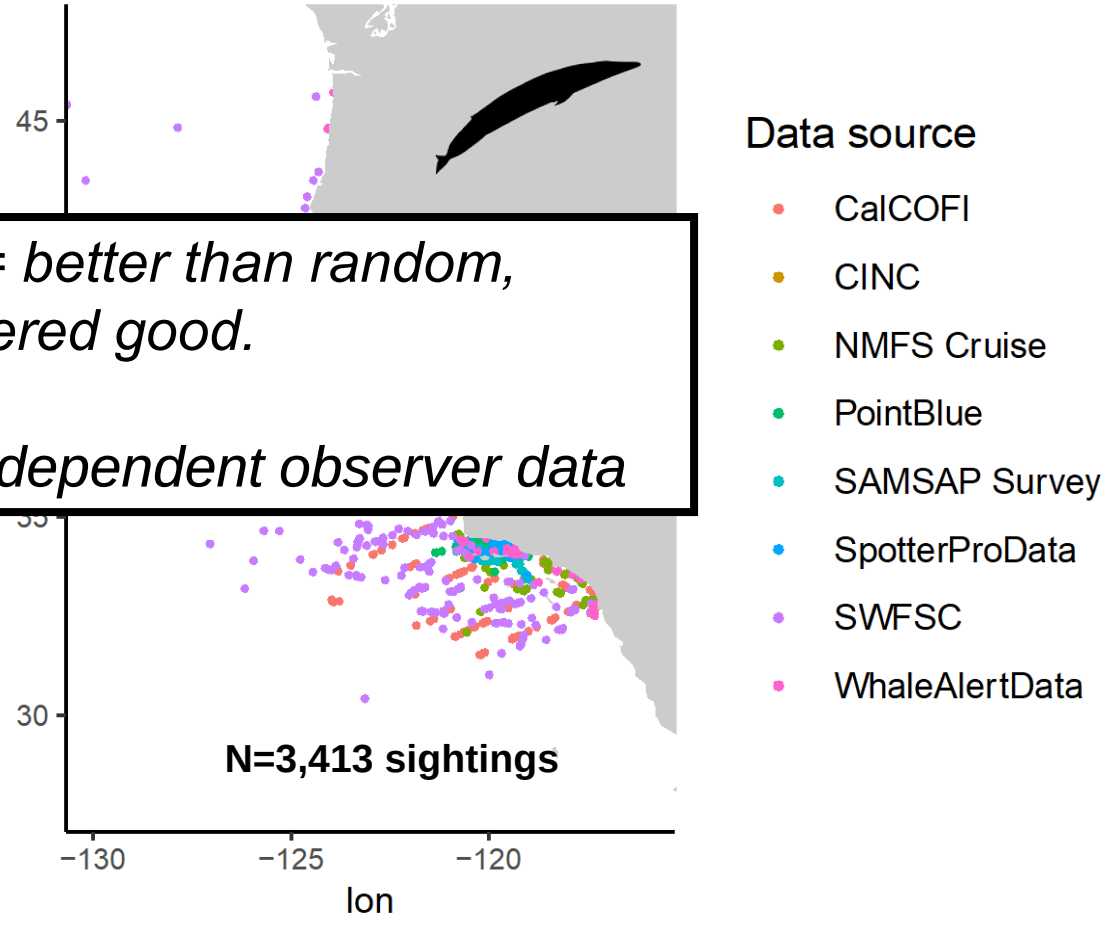
1. Temporal and spatial cross-validation



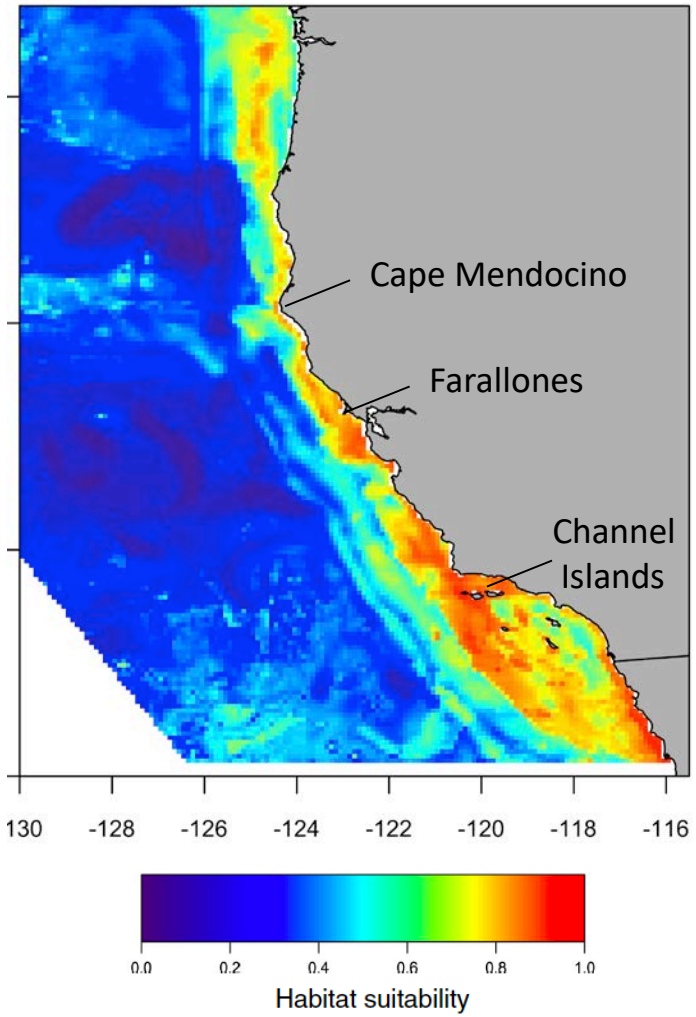
AUC/TSS scores ≥ 0.5 = better than random,
≥ 0.75 considered good.

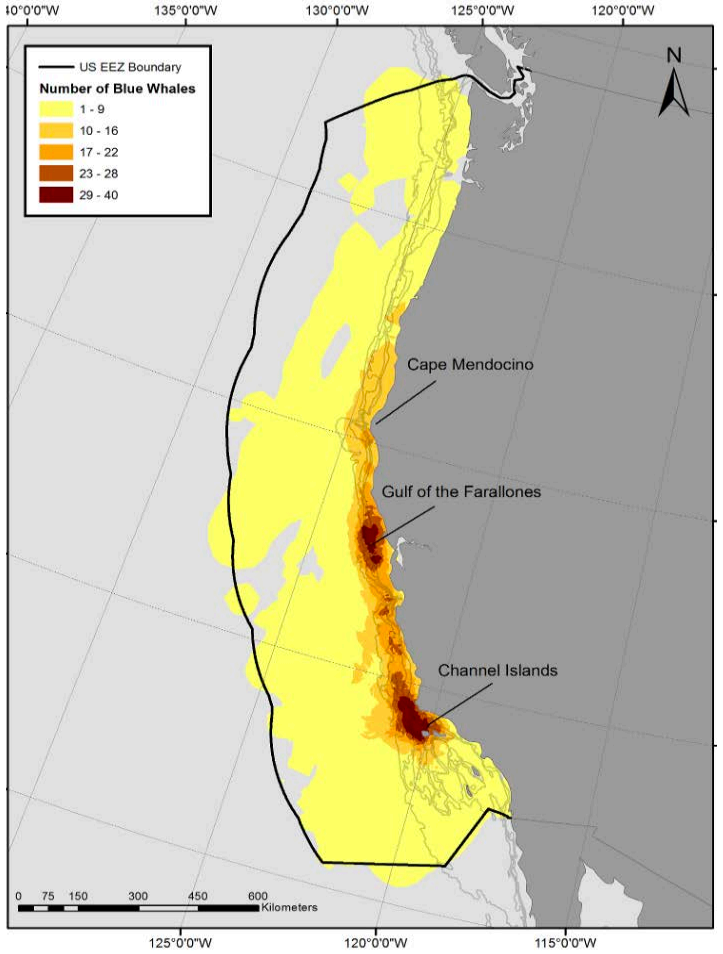
AUC = 0.951 compared to independent observer data

2. Testing on independent observer dataset

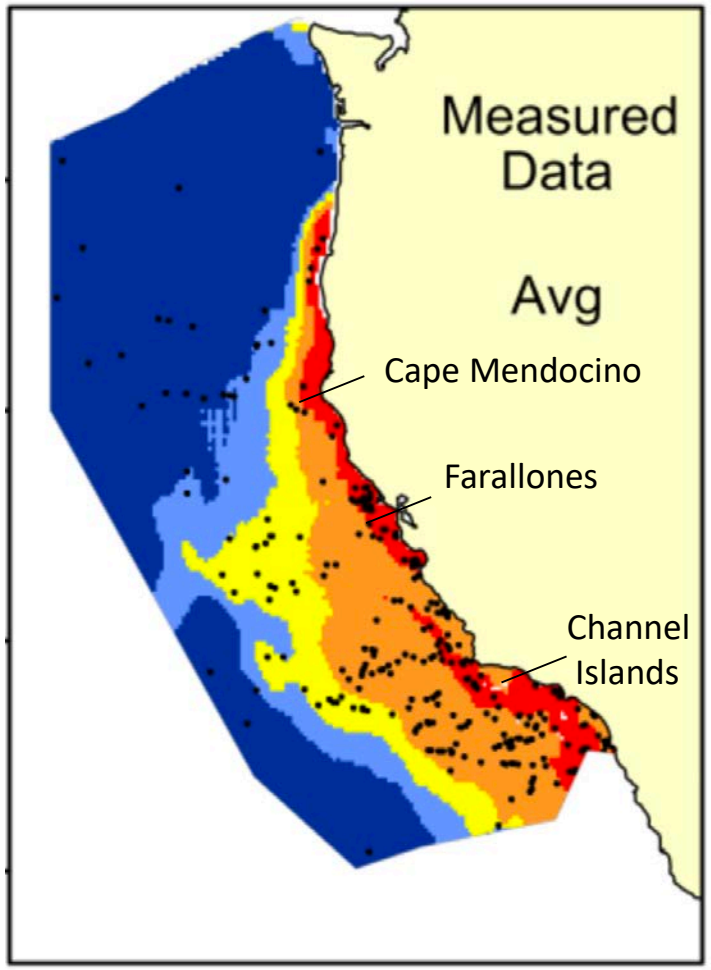


Model Evaluation – Spatial Predictions





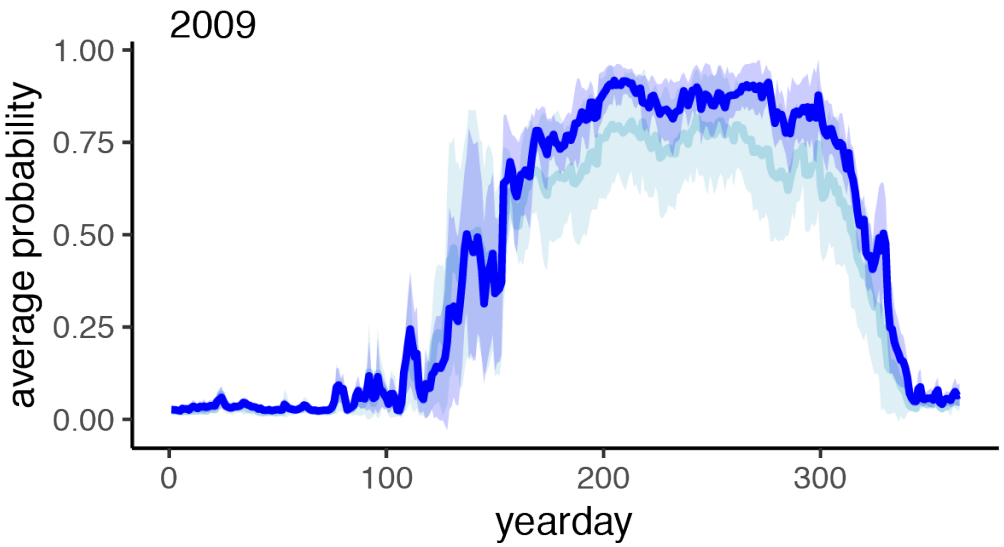
Irvine et al. 2017
90% home range from tagging data

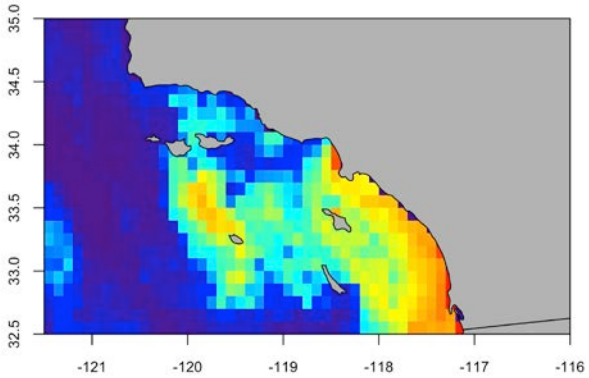


Becker et al. 2016
Long-term survey data

Model Evaluation – Timing

2009
”normal”
conditions





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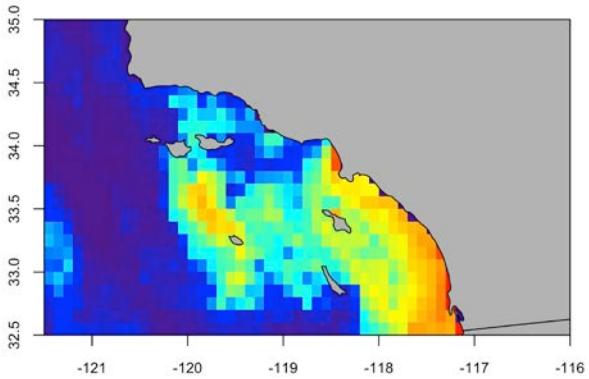
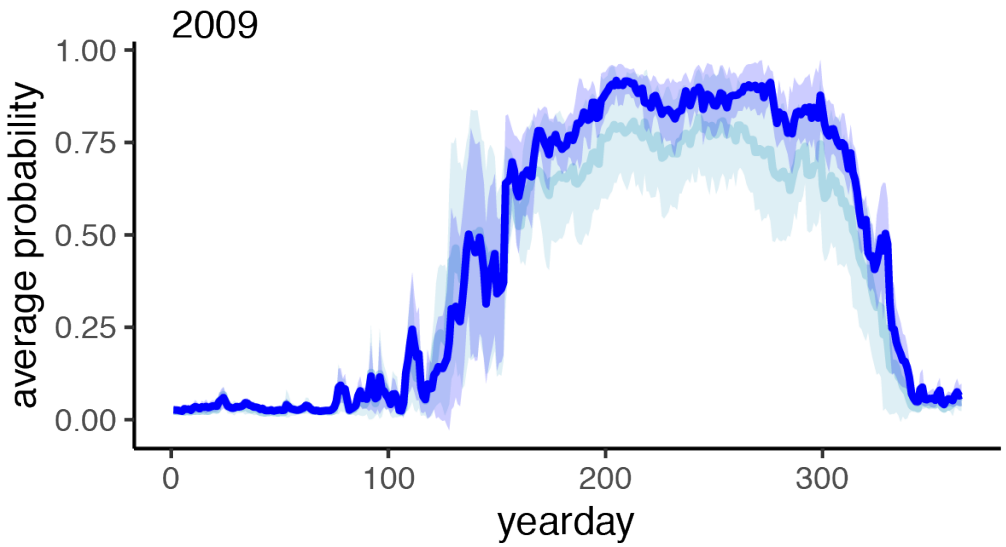
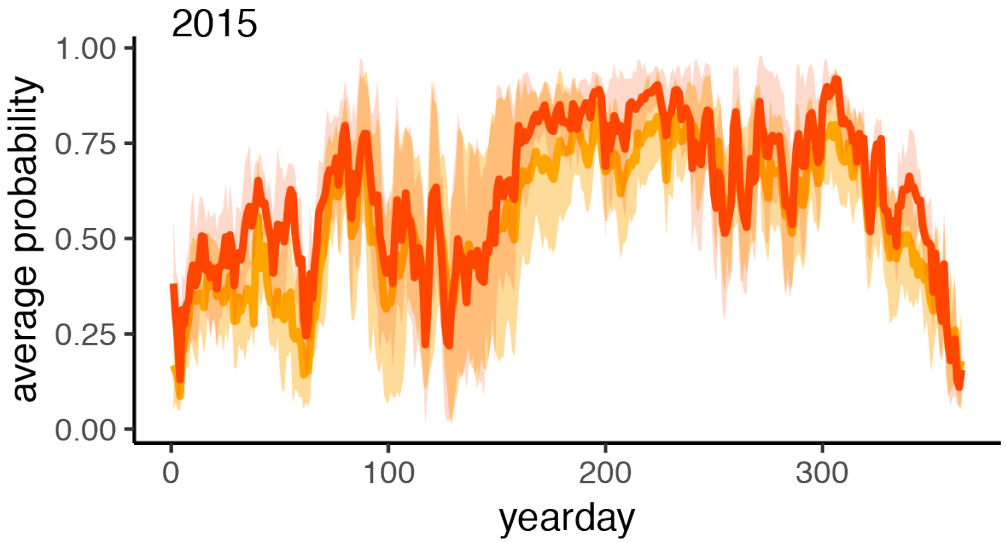


2009 ”normal” conditions



2015 warm water anomaly



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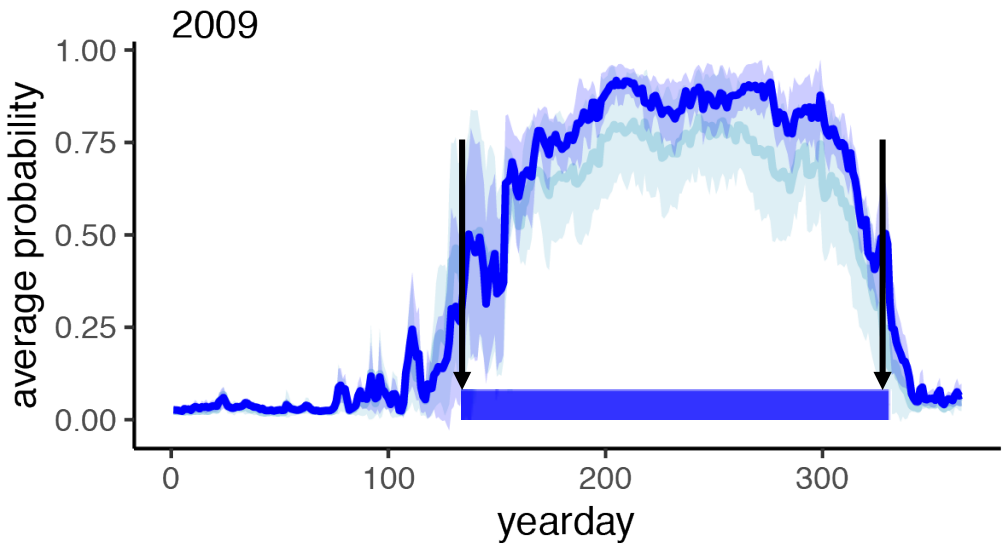

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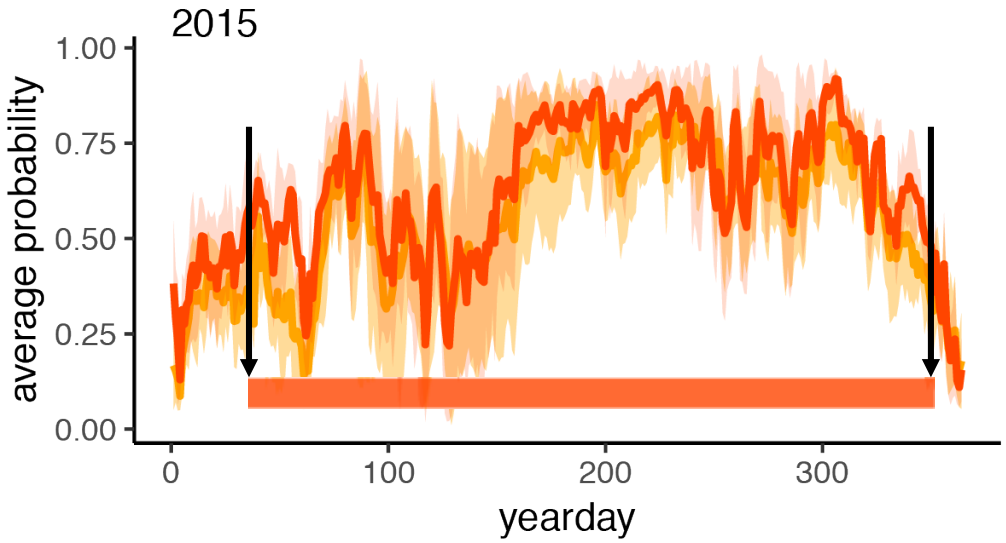
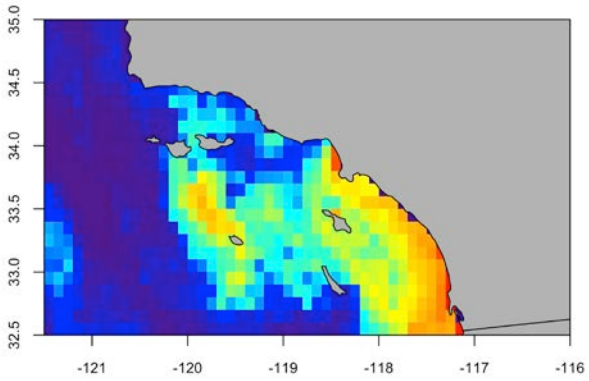
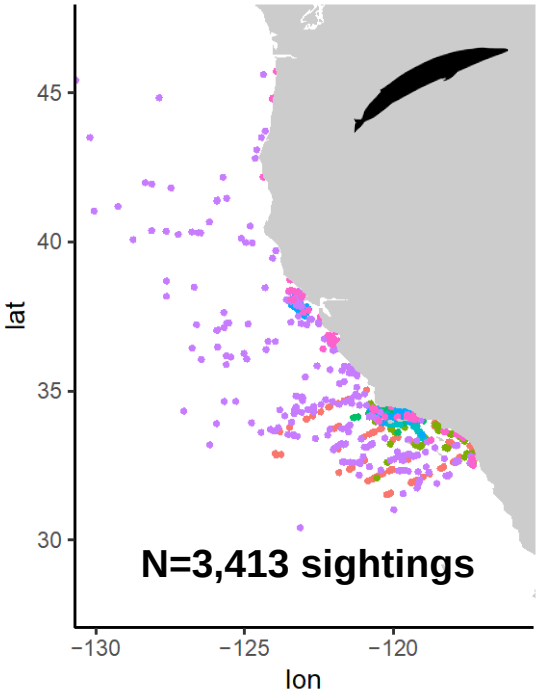
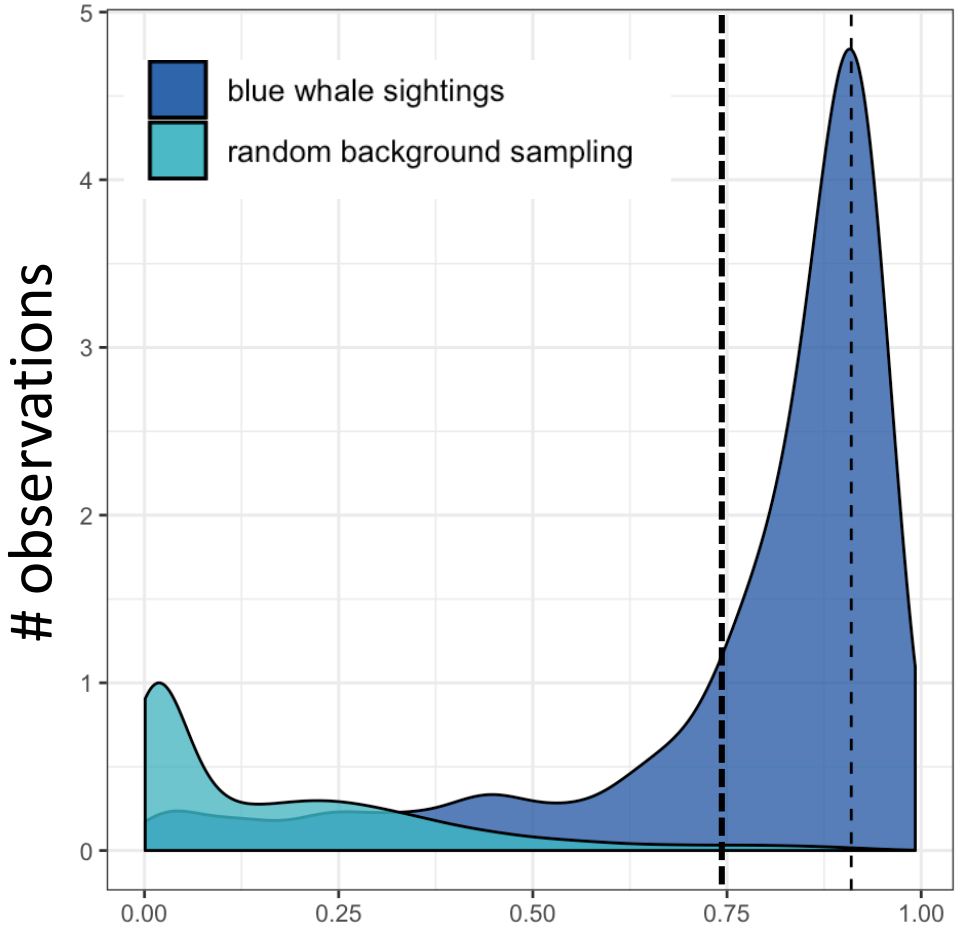




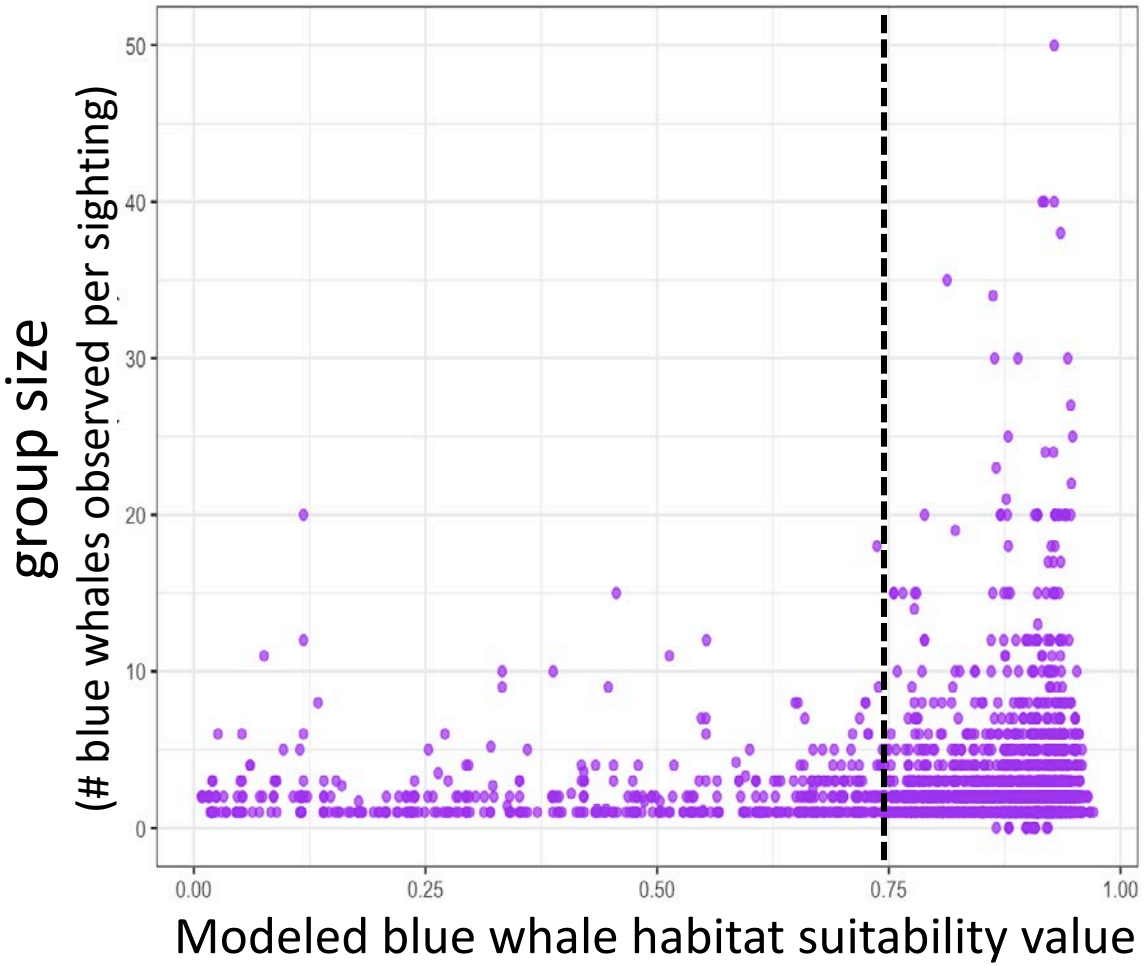


Model Evaluation – Whale Sightings

Higher habitat suitability → more sightings events

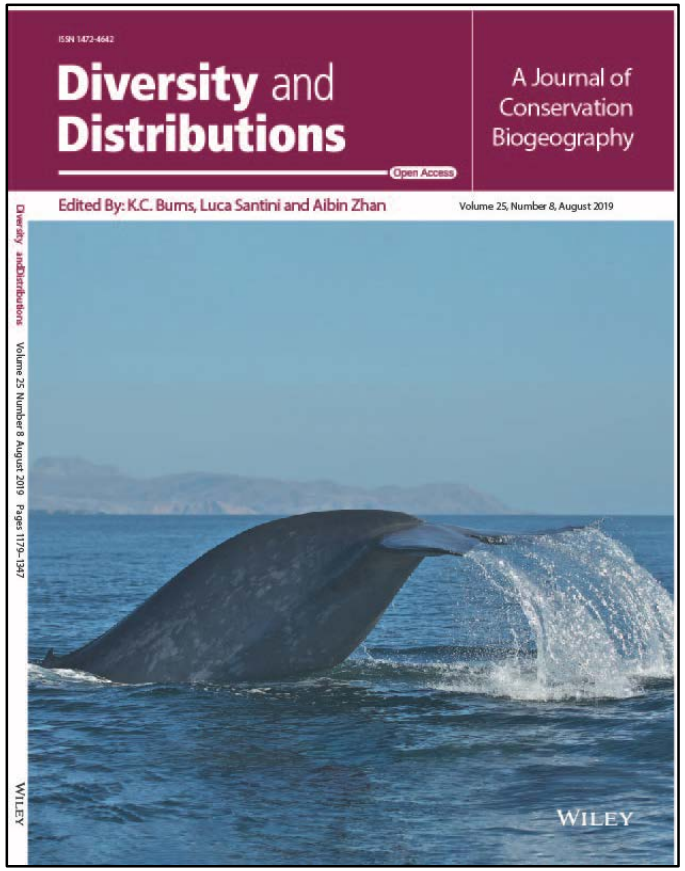


Higher habitat suitability → larger group sizes



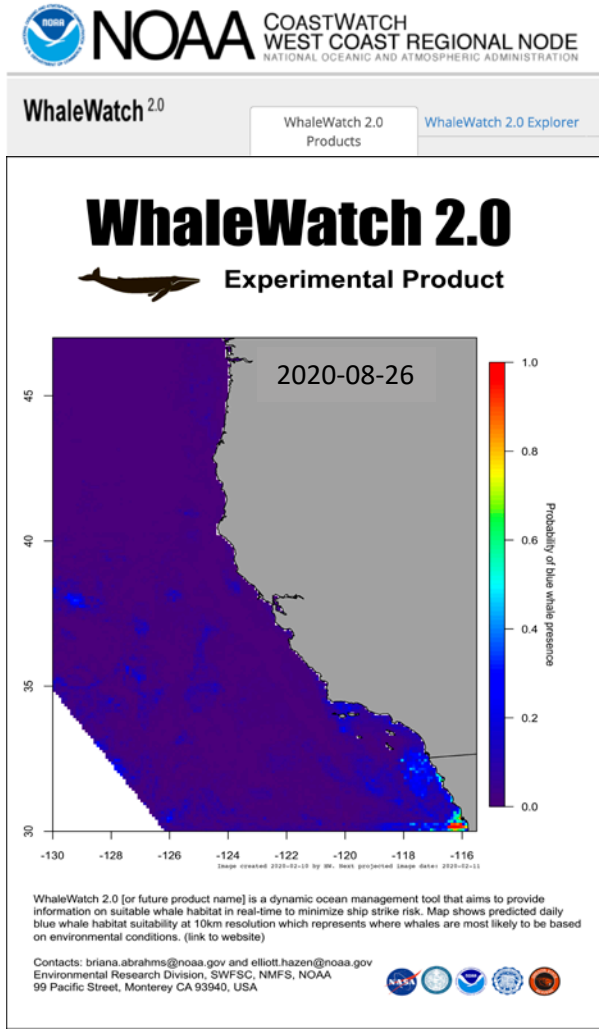
Products

Publication



Abrahms et al. 2019**.** Dynamic ensemble models to predict distributions and anthropogenic risk exposure for highly mobile species. Divers. Distr., 25(8) 1182-1193.

Website



https://coastwatch.pfeg.noaa.gov/projects/whalewatch2/whalewatch2_map.html

John Calambokidis, Cascadia Research

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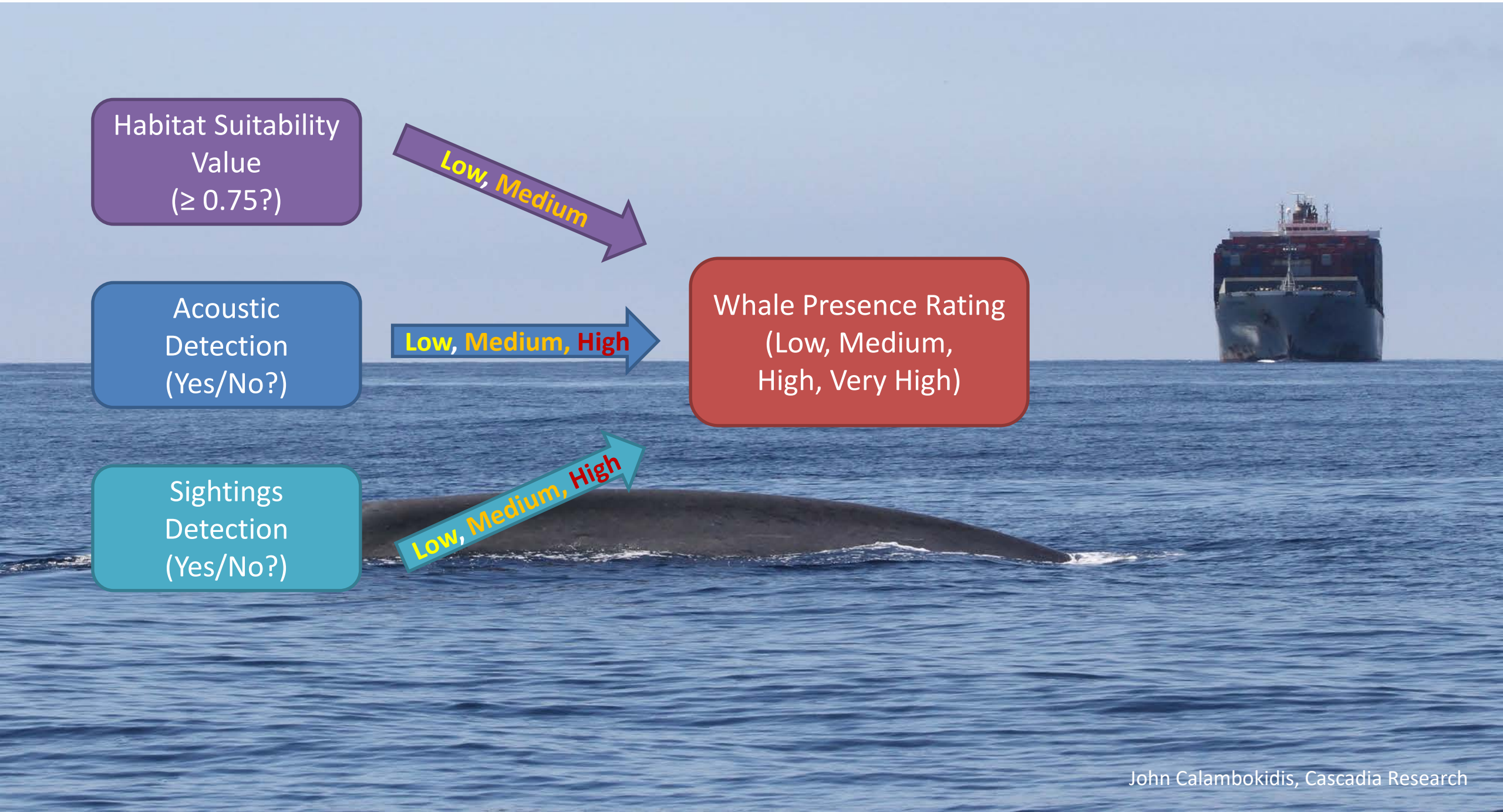

John Calambokidis, Cascadia Research

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MAP

Voluntary Vessel Speed Reduction Zone In Effect | NOAA recommends that vessels > 300 gross registered tons transiting the zone do so at speeds of 10 knots or less

WHALE SAFE

2018 and 2019 Were the Worst Years on Record for Whale-Ship Collisions off the West Coast of the United States.

Despite this trend, there are solutions to combat the problem. Research demonstrates ships that slow to 10 knots in areas with high whale presence significantly reduce the danger to whales.

Whale Safe is a technology-based mapping and analysis tool displaying whale and ship data for the Santa Barbara Channel, with the goal of helping to prevent fatal ship collisions with whales.

Today's Whale Presence: High | August 24, 2020

How was this calculated?

Certainty: High ?

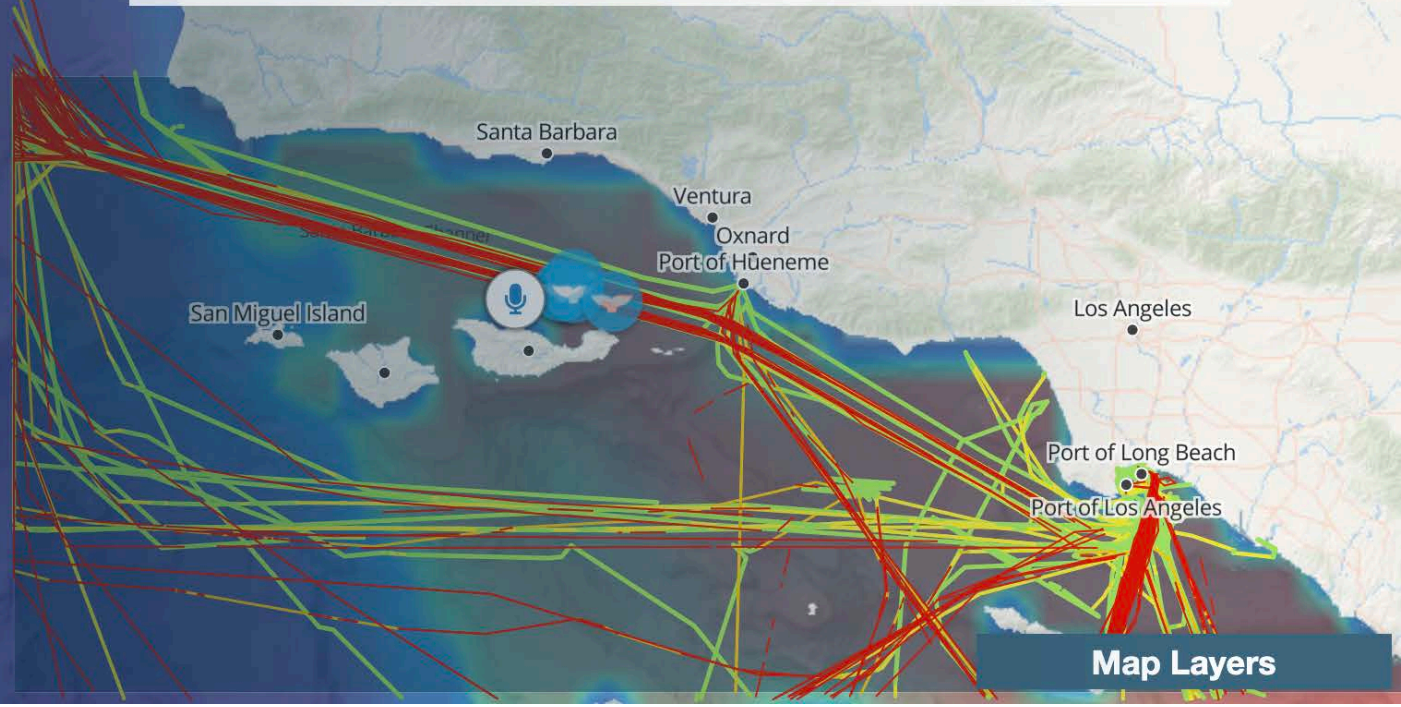
Sightings* 0 Humpback 5 Blue 0 Fin

Blue Whale Acoustic Detection

Humpback Whale Acoustic Detection

* Whale sightings data may be limited due to COVID-19.

Whales may be present even if whale presence rating is low. Please remember you can protect these sensitive species by slowing down. Presence Tracker last updated just now using data from the last five days.



Map Layers

BENIOFF OCEAN INITIATIVE

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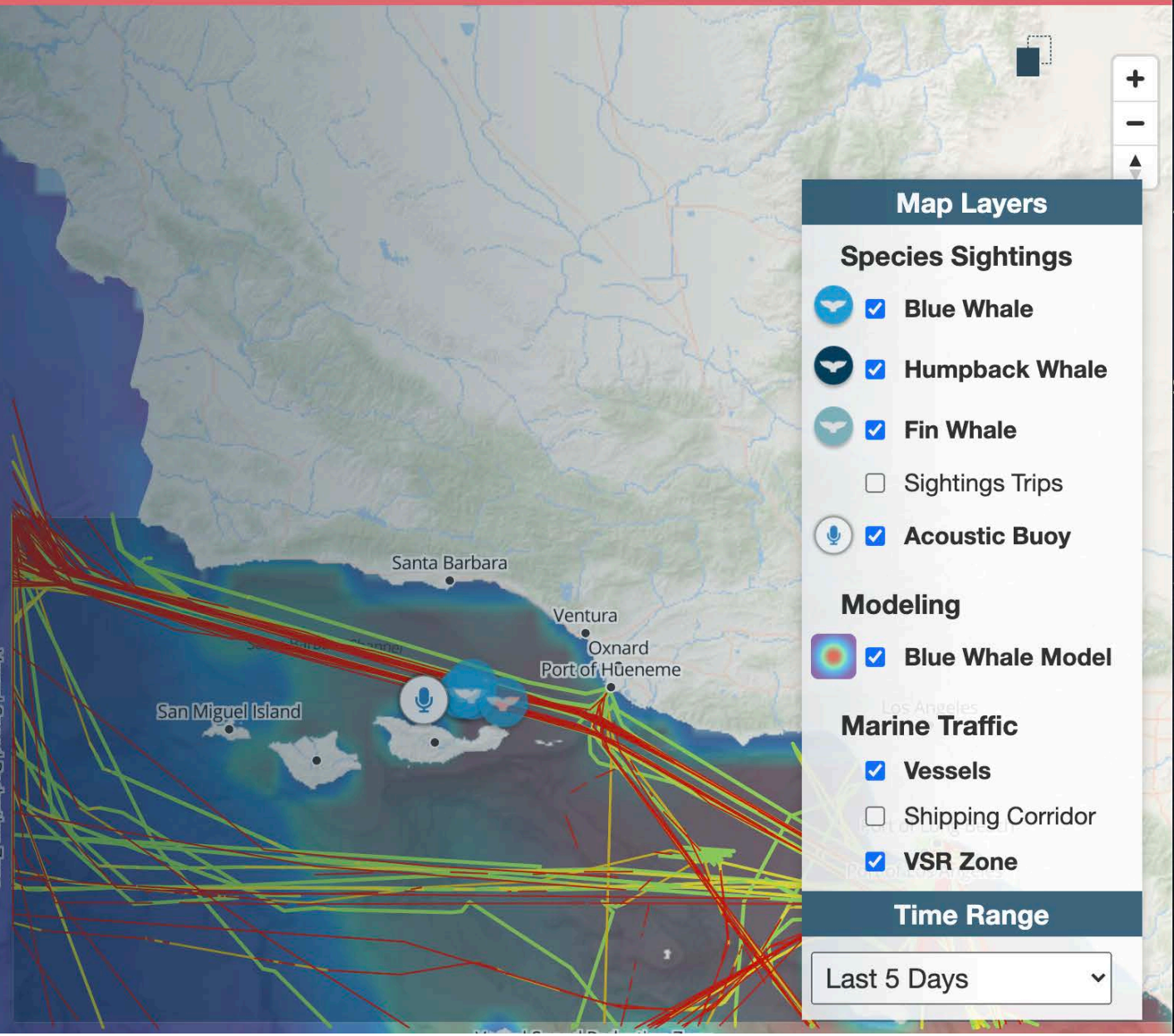

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Whale Presence Rating: Blue Whale Habitat Model

The blue whale habitat model produces predictions of habitat suitability at a 10km resolution. For integration into the Whale Presence Rating, we calculate the average habitat suitability across the vessel speed reduction zone. We then compare this against a threshold value that was determined through additional analyses conducted by authors of Abrahms et al. 2019. In this analysis the distribution of observed blue whale sightings was compared to the average predicted habitat suitability values, and it was determined that peak densities of blue whale sightings occurred at average habitat suitability values above 0.75. Thus, a threshold of 0.75 is used in the Whale Presence Rating.

Species	Average Habitat Suitability Across Vessel Speed Reduction Zone	Whale Presence Rating
Blue	<0.75	Low
Blue	≥0.75	Medium

High suitability predictions are very similar to a “tornado watch” where all the factors point to a high likelihood of blue whale occurrence. However because the model is not able to definitively confirm if blue whales are present, the model cannot trigger a high Whale Presence Rating on its own.

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WhaleSafe Webinar
Sept. 17th
https://bit.ly/34FW7Jx

When are model predictions useful in this context?

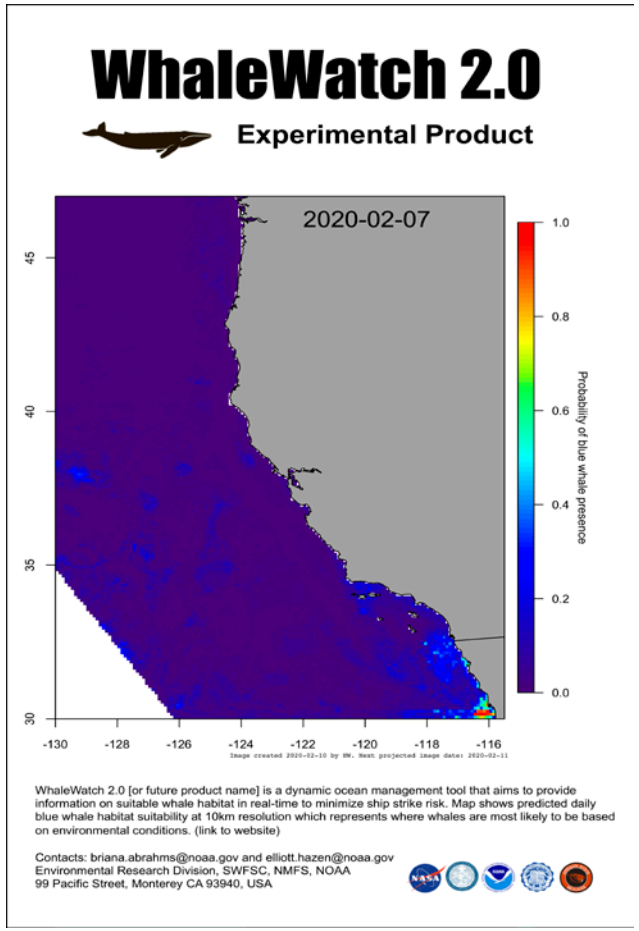
- When data are not available year-round
- When survey data gets interrupted (like during a pandemic!)
- When used as one of several sources of information in decision-making
- When forecasting is needed

Thank you!

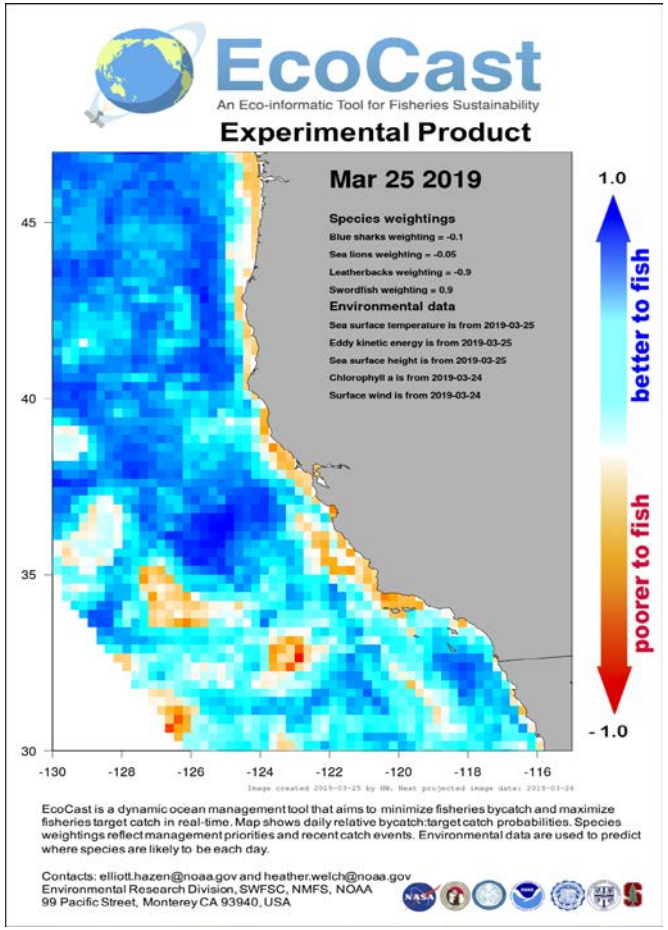
Special thanks to: Co-authors, CINMS staff, Benioff Ocean Initiative

Resources & Related Products

www.coastwatch.pfeg.noaa.gov/projects/whalewatch2/ Abrahms et al. 2019, *Divers. & Distr.*



www.coastwatch.pfeg.noaa.gov/ecocast/ Hazen et al. 2018, *Science Advances*



Contact: Briana Abrahms, abrahms@uw.edu

WhaleSafe Webinar Registration Sept. 17th: https://bit.ly/34FW7Jx