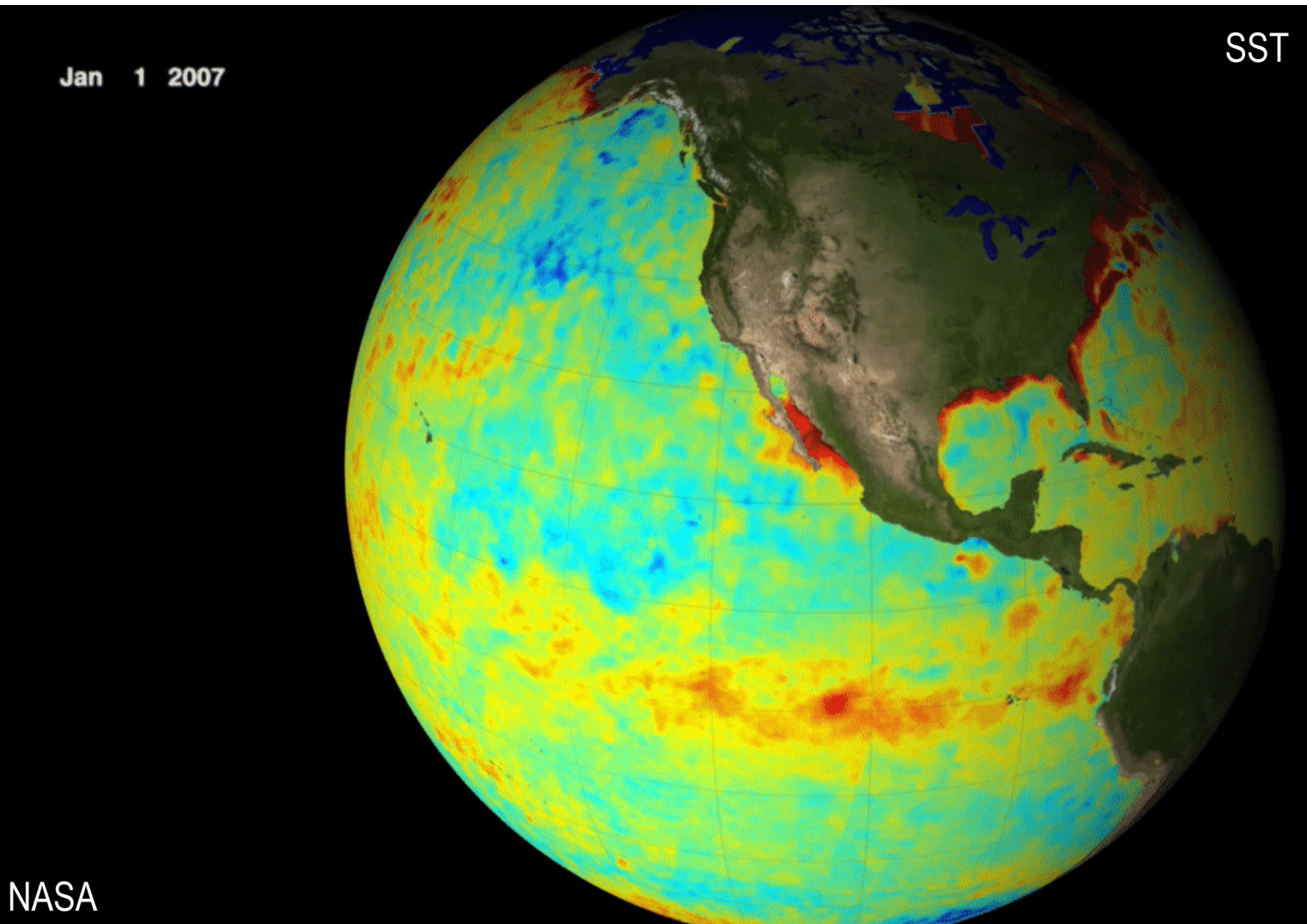
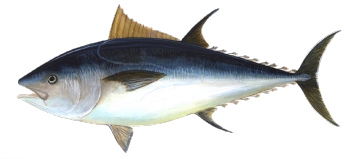
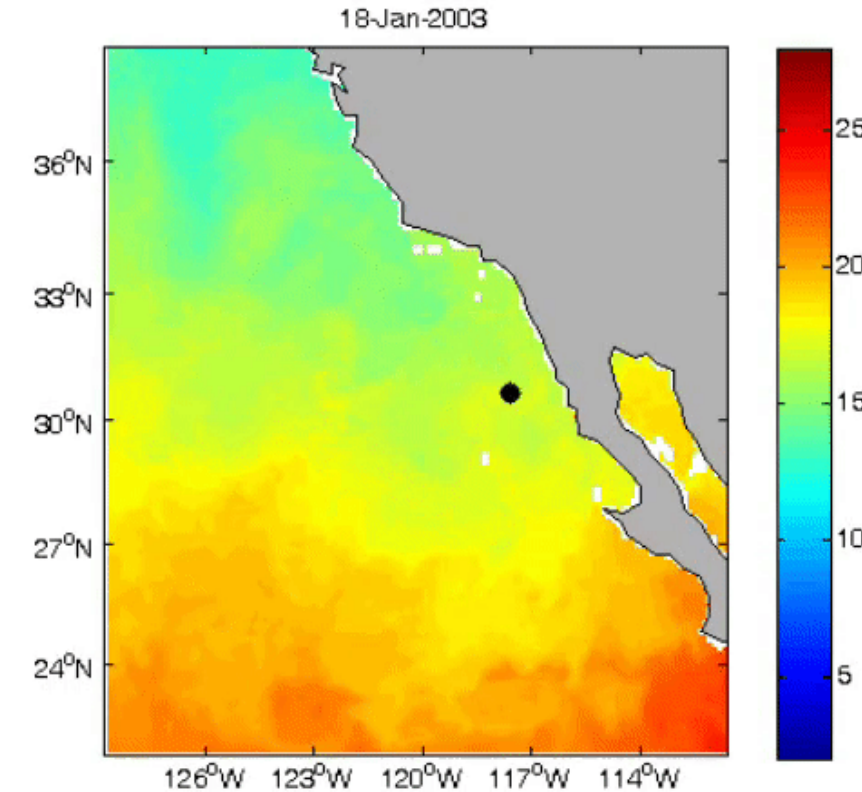


Dynamic Oceans and Dynamic Ecosystems

Agenda Item H.1.a
Supplemental NMFS Presentation 2
November 2017



NASA



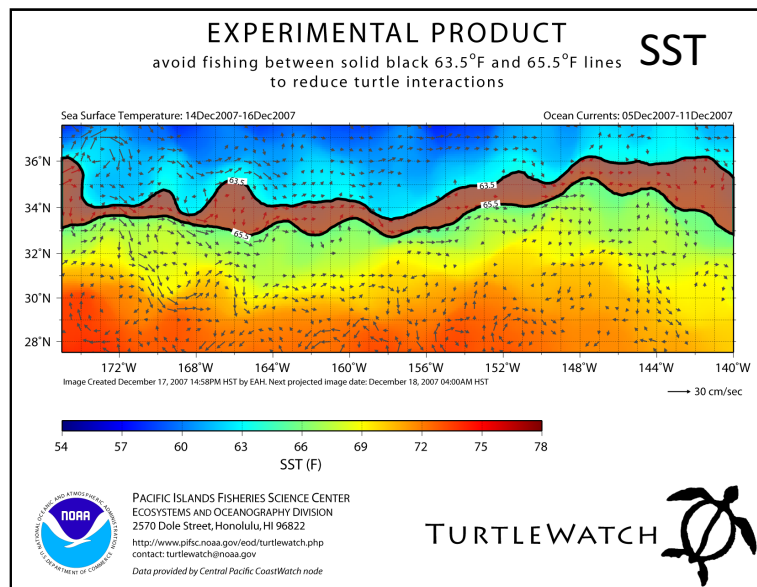
Southwest Fisheries Science Center,
Environmental Research Division
UCSC – Cooperative Institute for Marine
Ecosystems and Climate

elliott.hazen@noaa.gov

TurtleWatch



Voluntary,
yet effective



Vol. 5: 267–278, 2008
doi: 10.3354/esr00096

ENDANGERED SPECIES RESEARCH
Endang Species Res

Printed December 2008
Published online July 1, 2008

Contribution to the Theme Section 'Fisheries bycatch: problems and solutions'



TurtleWatch: a tool to aid in the bycatch reduction of loggerhead turtles *Caretta caretta* in the Hawaii-based pelagic longline fishery

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FISHERIES OCEANOGRAPHY

FISHERIES OCEANOGRAPHY

Fish. Oceanogr. 24:1, 57–68, 2015

Enhancing the TurtleWatch product for leatherback sea turtles, a dynamic habitat model for ecosystem-based management

EVAN A. HOWELL^{1,*}, AIMEE HOOVER^{2,4}, SCOTT R. BENSON³, HELEN BAILEY⁴, JEFFREY J. POLOVINA¹, JEFFREY A. SEMINOFF⁵ AND PETER H. DUTTON⁵

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³NOAA Southwest Fisheries Science Center, 7544 Sandholdt Road, Moss Landing, CA, 95039, U.S.A.

⁴Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science, 146 Williams Street, Solomons, MD, 20688, U.S.A.

⁵NOAA Southwest Fisheries Science Center, 8901 La Jolla Shores Dr., La Jolla, CA, 92037, U.S.A.

centered at 17.2° and 22.9°C, occupied by leatherbacks on fishing grounds of the Hawaii-based swordfish fishery. This new information was used to expand the TurtleWatch product to provide managers and industry near real-time habitat information for both loggerheads and leatherbacks. The updated TurtleWatch product provides a tool for dynamic management of the Hawaii-based shallow-set fishery to aid in the bycatch reduction of both species. Updating the management strategy to dynamically adapt to shifts in multi-species habitat use through time is a step towards an ecosystem-based approach to fisheries management in pelagic ecosystems.

Key words: Central North Pacific, dynamic management, fisheries, leatherback sea turtles, sea surface temperature, swordfish

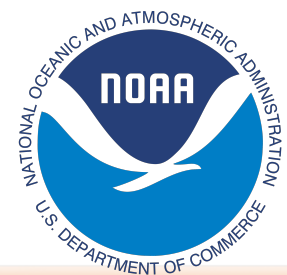
ABSTRACT

EcoCast

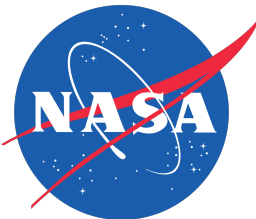
Fishing zones predicted based on ocean features, catch potential, and weighted by bycatch risk

Good fishing zones served via web and mobile devices

Models to include: hard cap species, risk weightings, seasonal forecasting

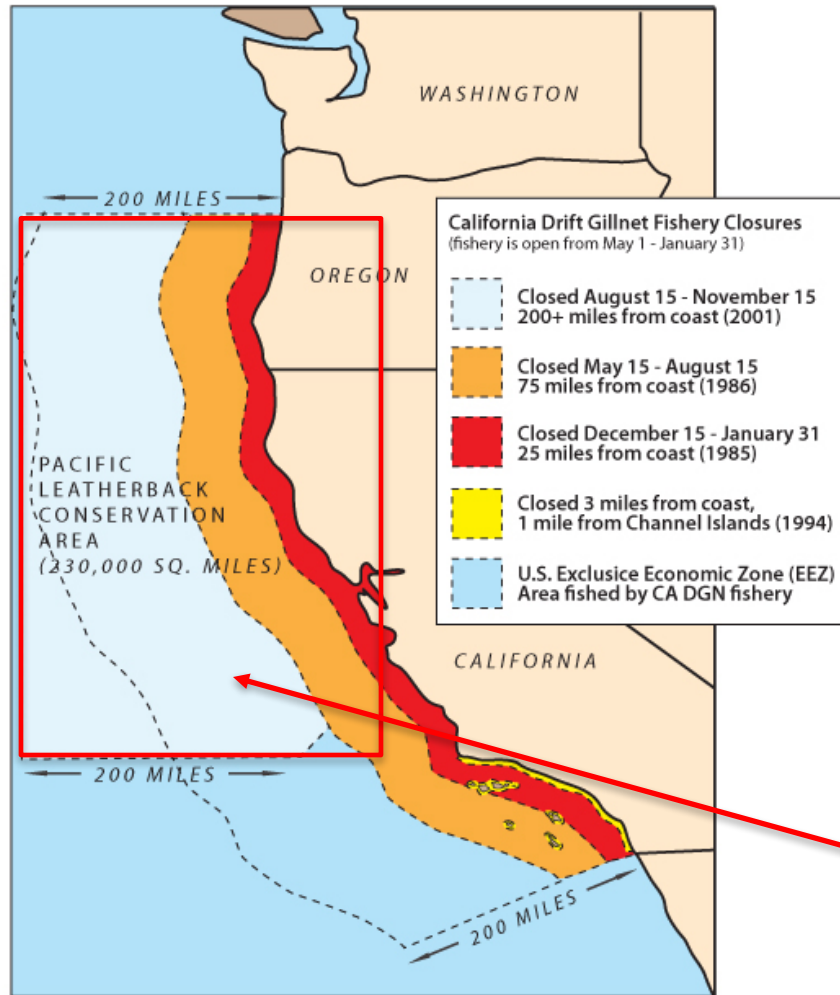


SAN DIEGO STATE
UNIVERSITY

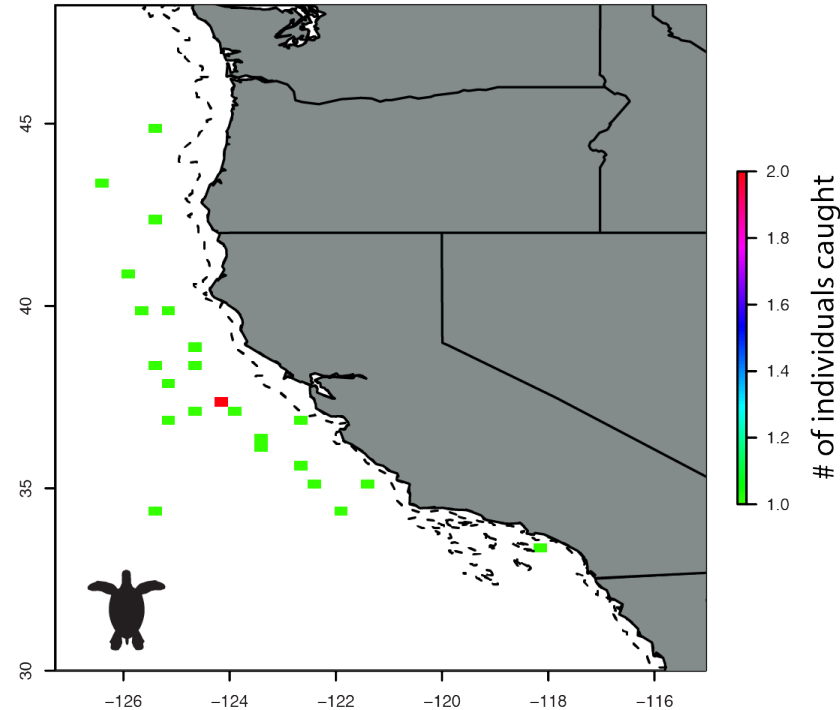


Sea Grant
California

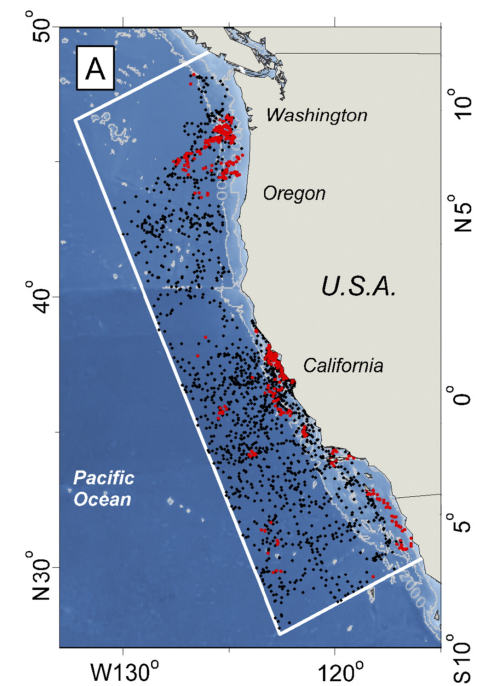
California Drift Gillnet fishery



Bycatch: Leatherback sea turtles



Large seasonal closure put into place in 2001 to protect critically endangered leatherbacks
....leatherback bycatch dropped significantly since closure, but large **economic cost**



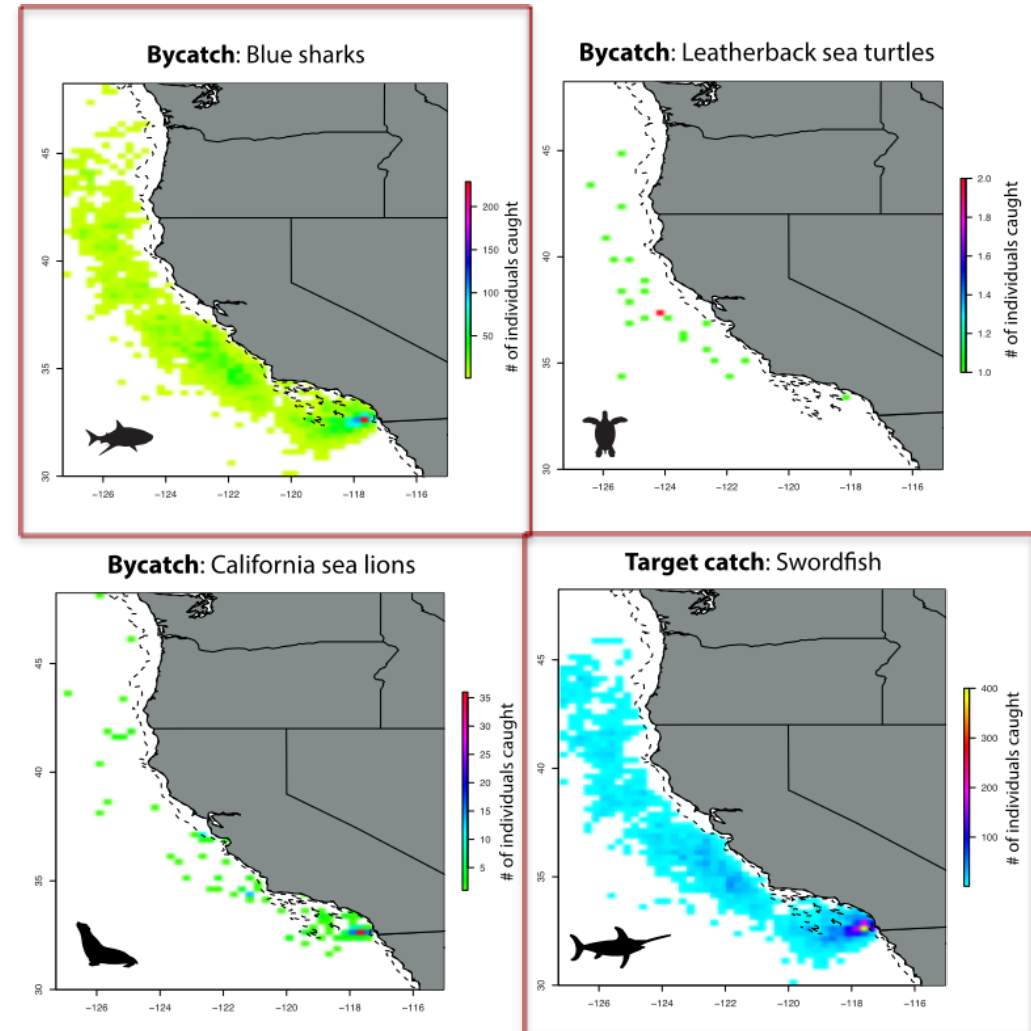
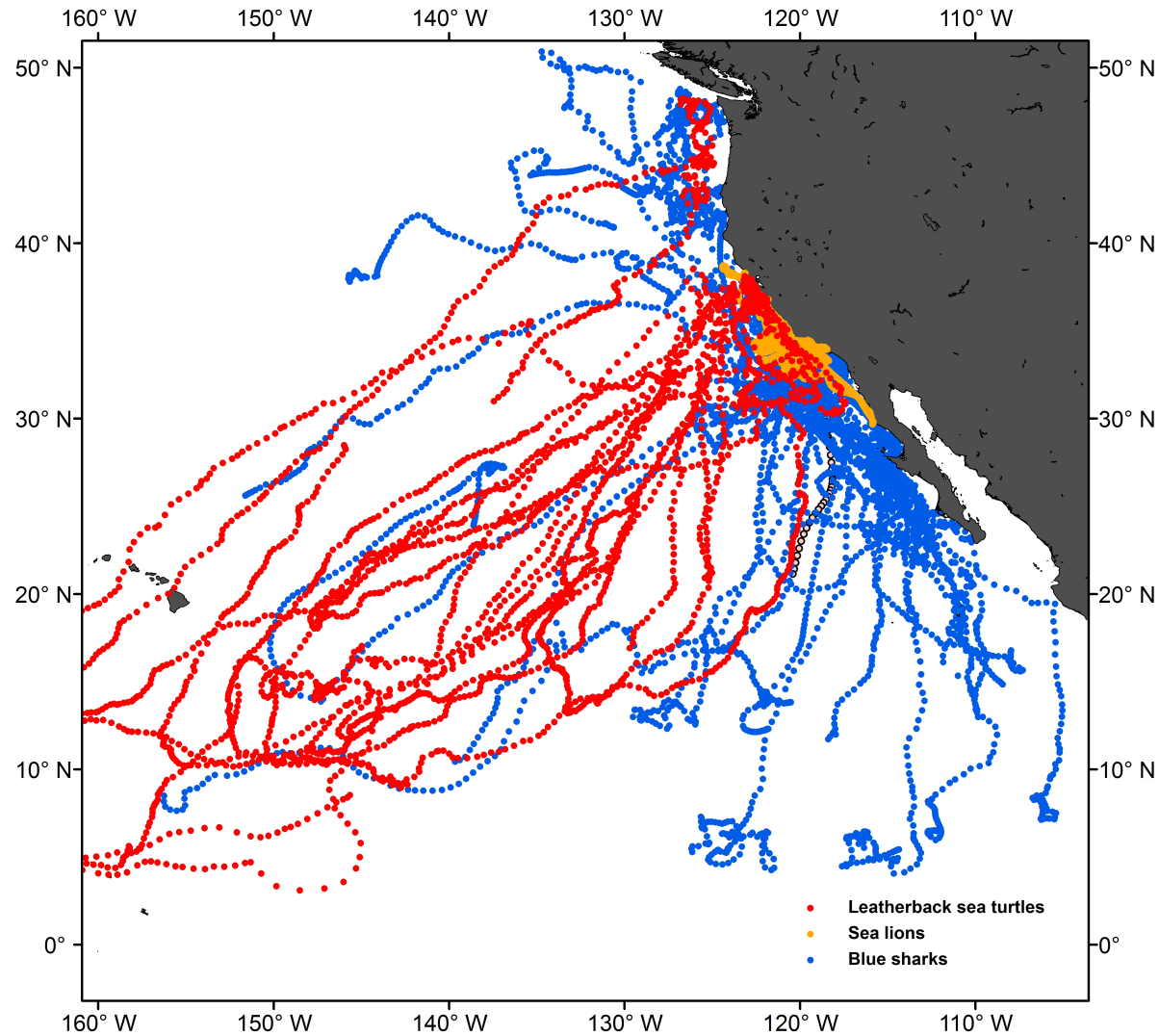
Benson et al 2011 *Ecosphere*
Eguchi et al 2016 *Fish Oceanogr*

EcoCast: Datasets

Data Types:

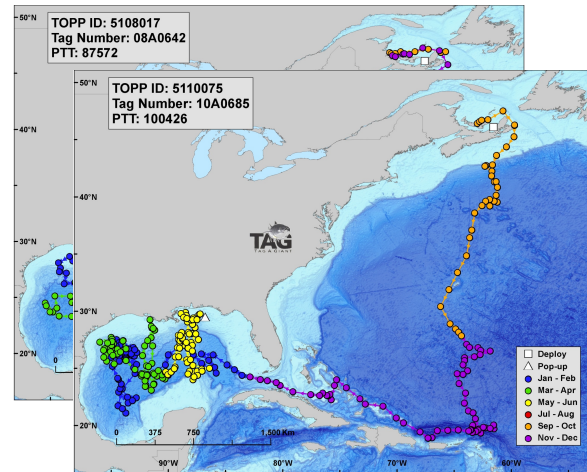
Satellite tracking data

Fishery observer data

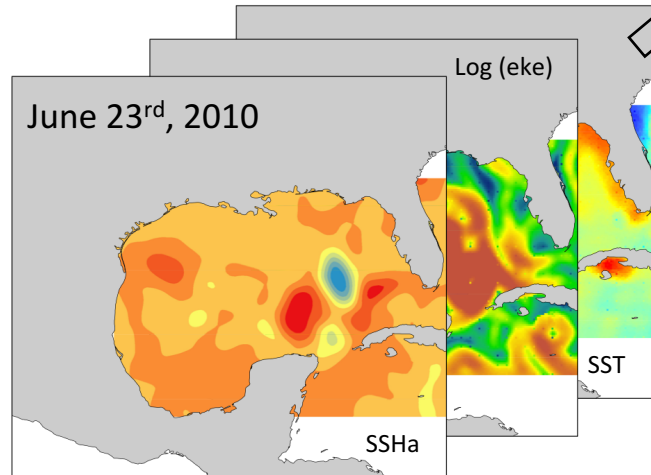


Species Distribution Models

Distribution / behavioral data
e.g. sightings data, tag data, foraging events



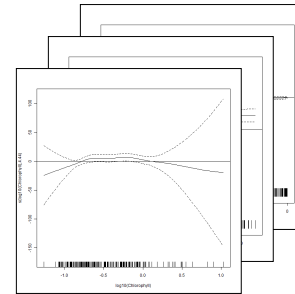
Sampled environmental data



Fit

Statistical
models

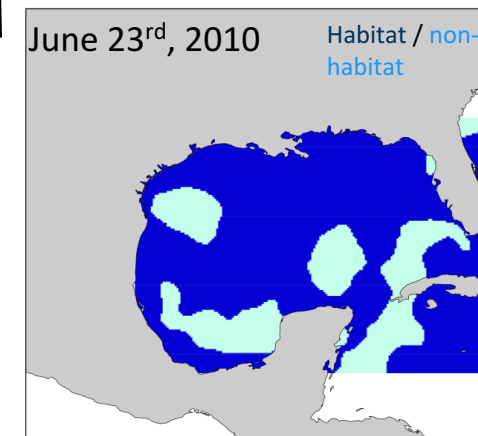
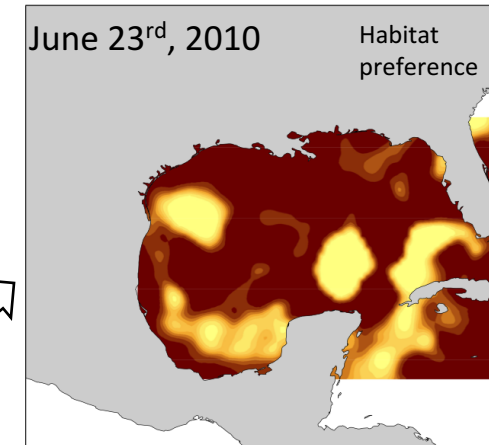
$$g(\mu) = \beta_0 + \beta_1 x_1 + \dots + \beta_m x_m$$



e.g. Generalized Additive
Mixed Models,
Boosted Regression Trees

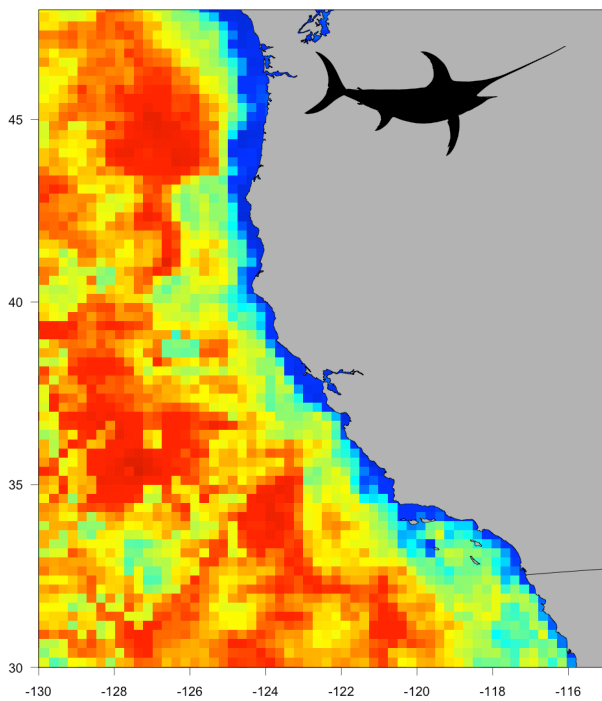
Probability of occurrence predicted
from environmental covariates

Predict

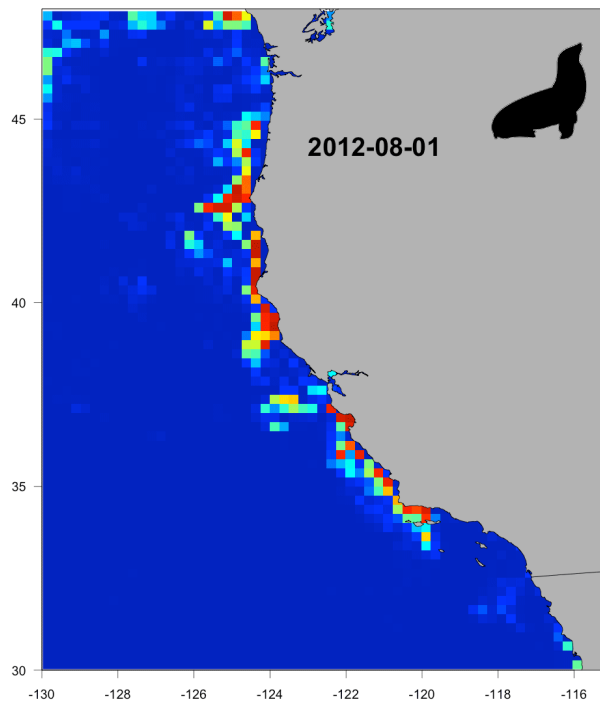


Single Species Predictions

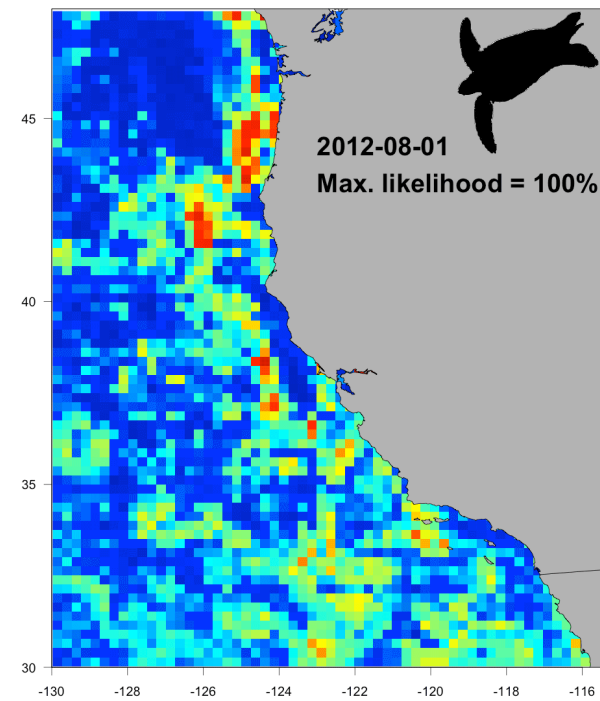
Swordfish Observer



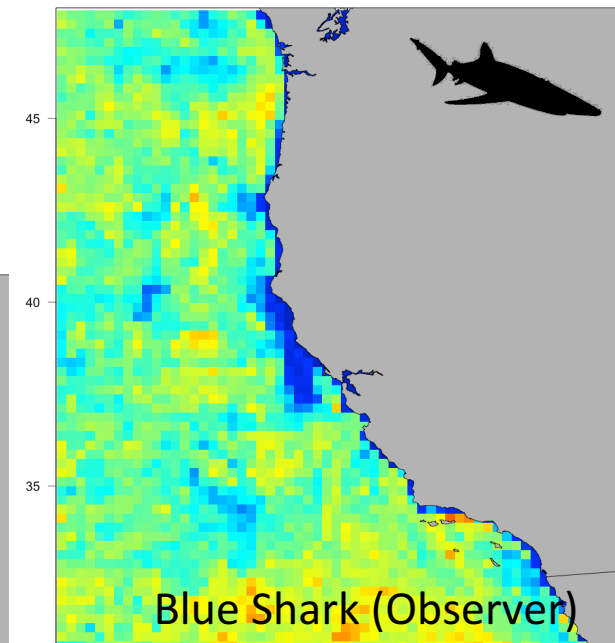
California Sea Lion



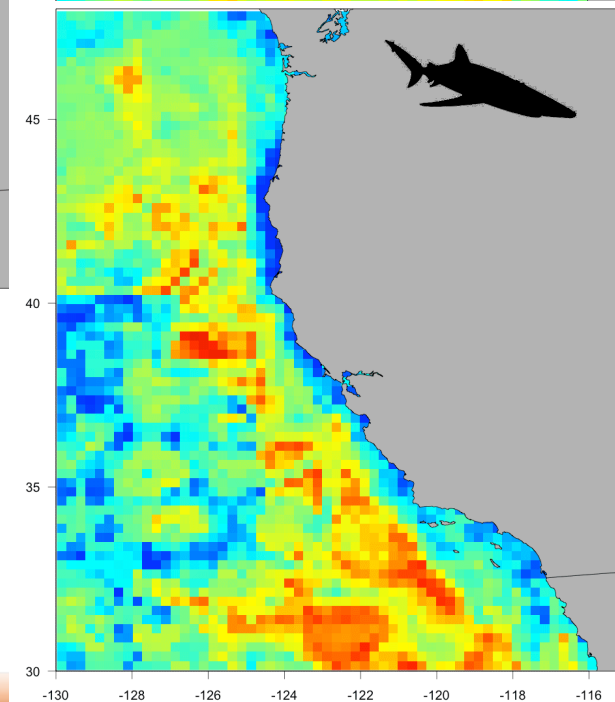
Leatherback Turtle



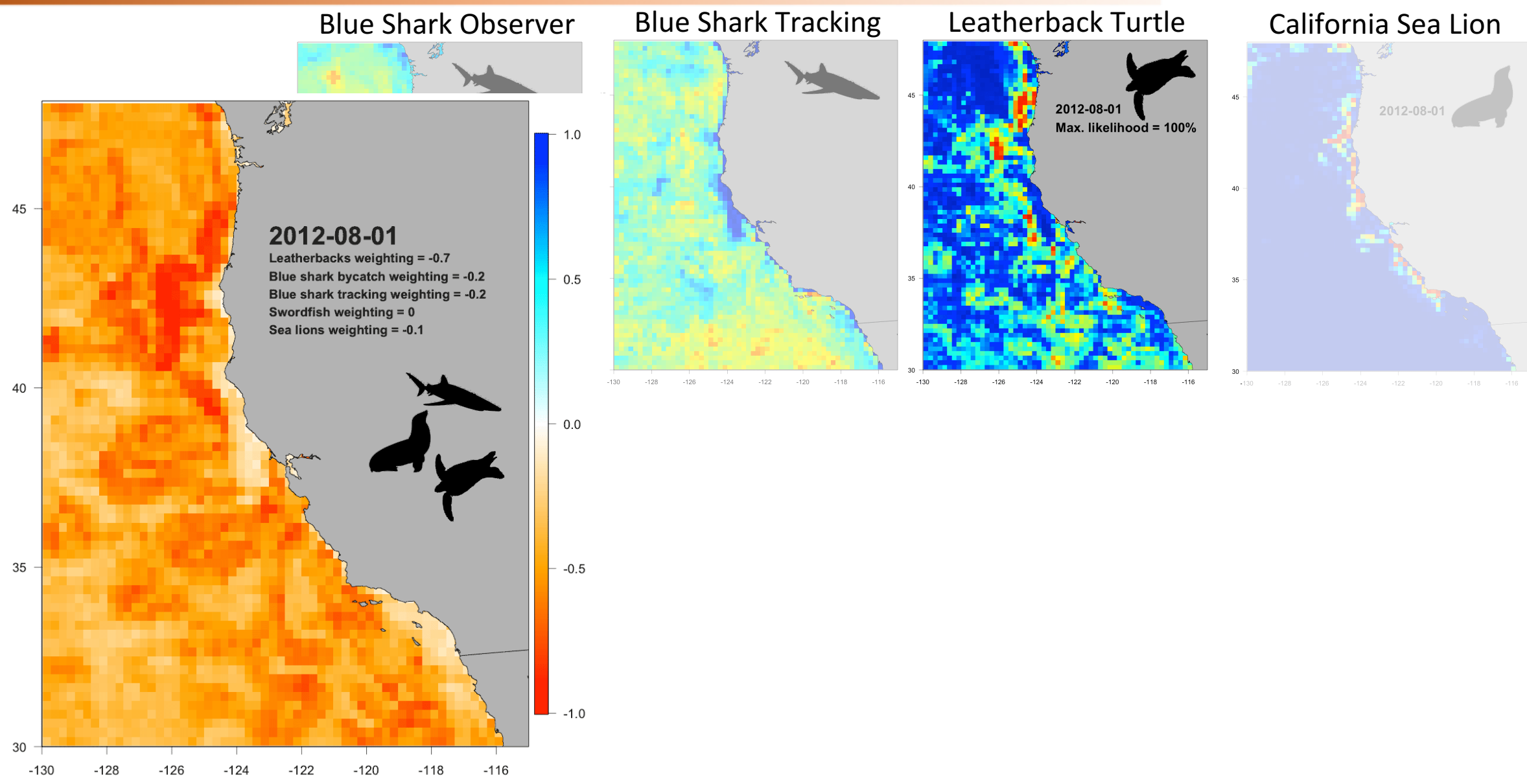
Blue Shark (Tracking)



Blue Shark (Observer)



EcoCast predictions - California Drift Gillnet Fishery

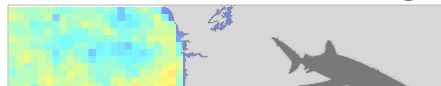


EcoCast predictions - California Drift Gillnet Fishery

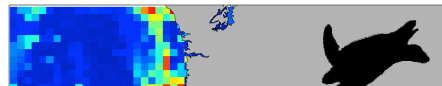
Blue Shark Observer



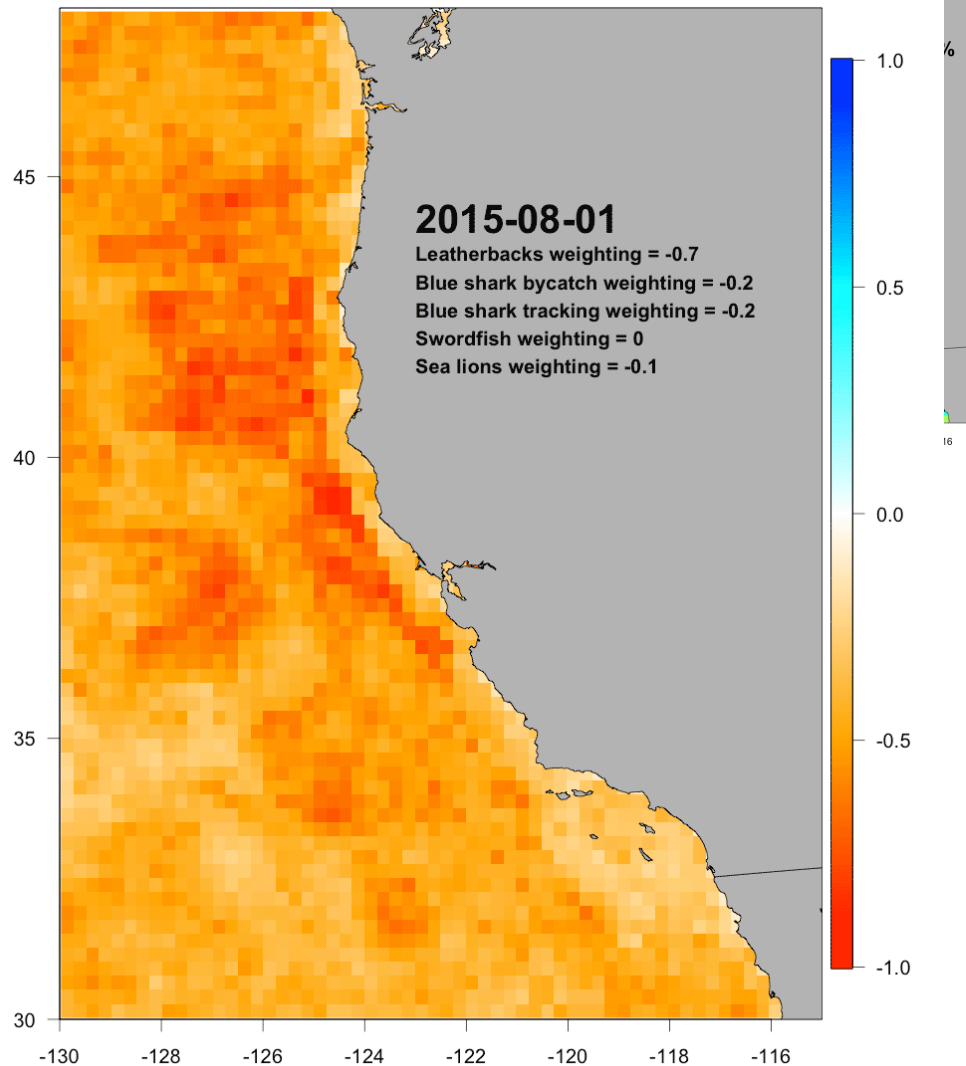
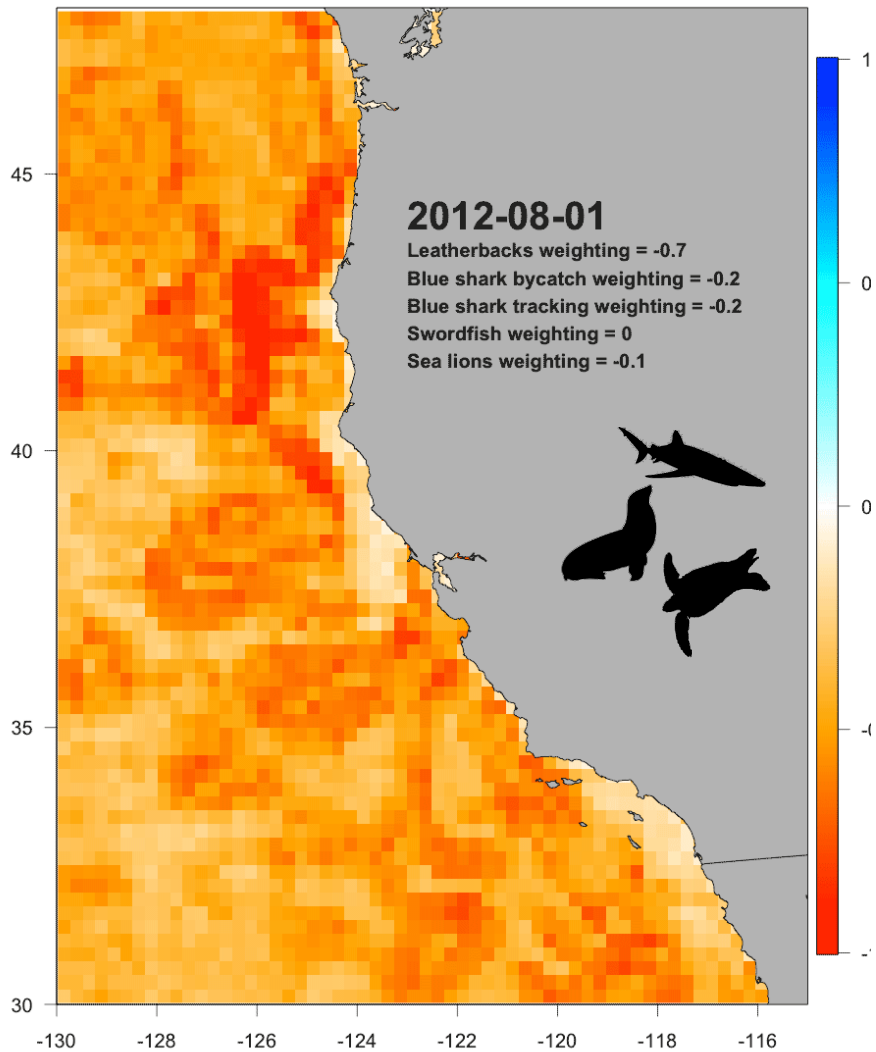
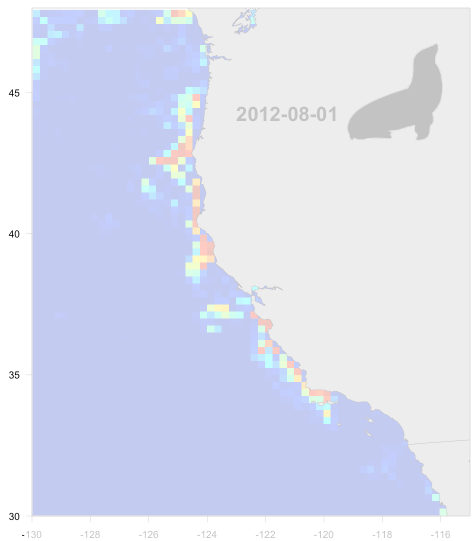
Blue Shark Tracking



Leatherback Turtle

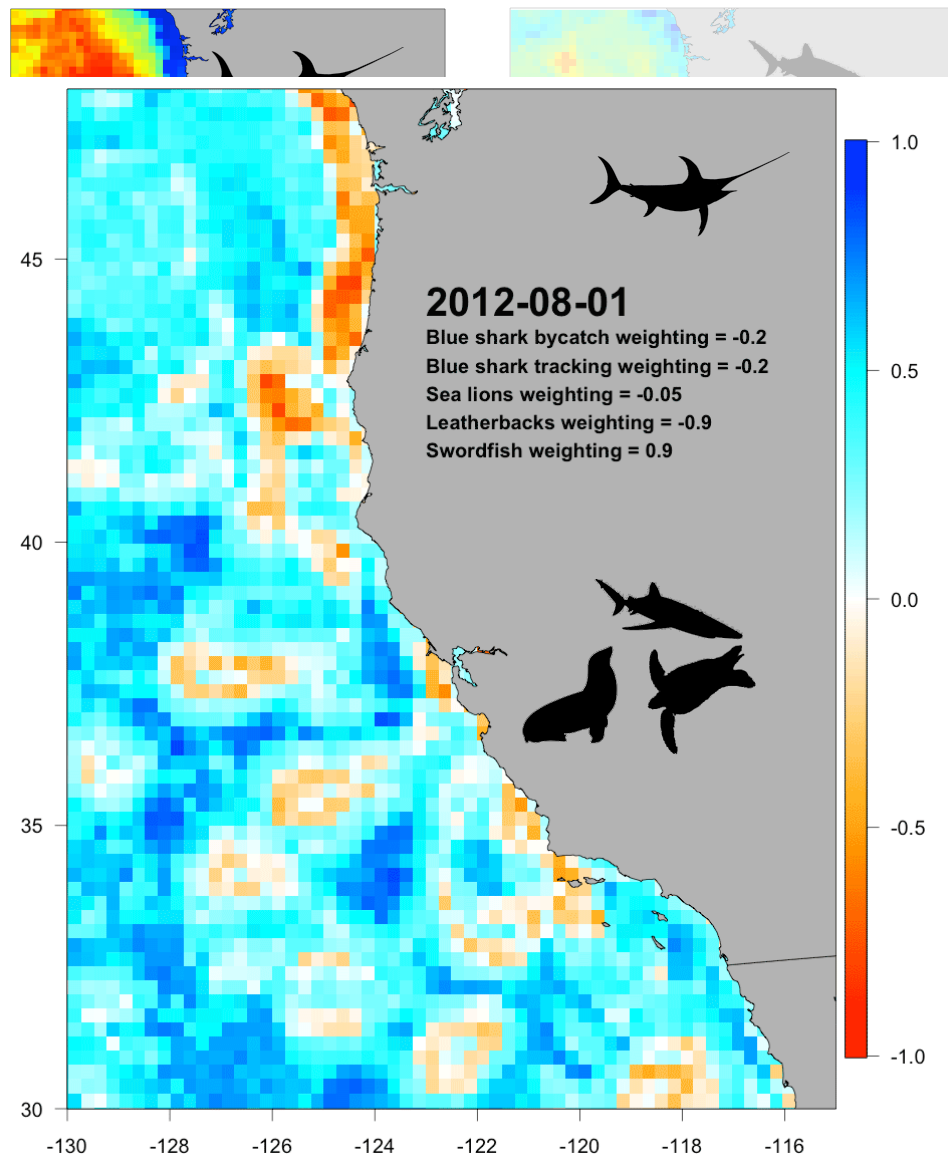


California Sea Lion



EcoCast predictions - California Drift Gillnet Fishery

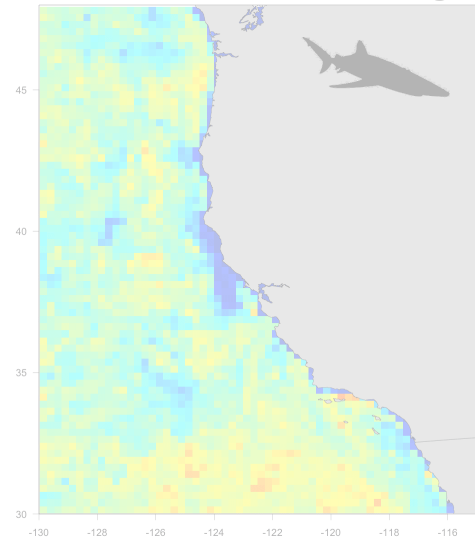
Swordfish Observer



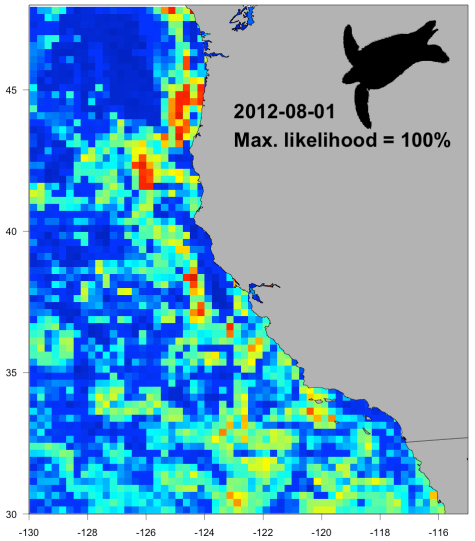
Blue Shark Observer



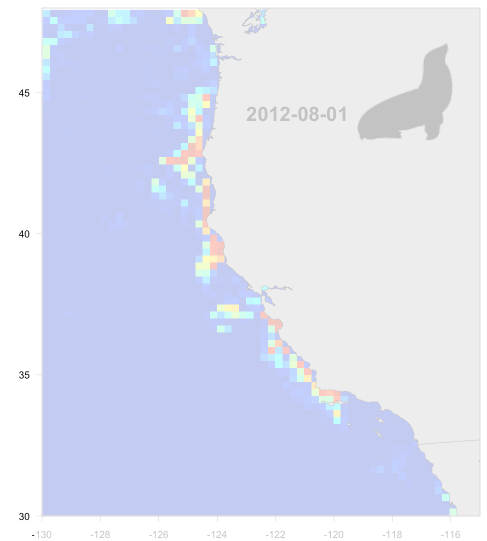
Blue Shark Tracking



Leatherback Turtle



California Sea Lion



EcoCast predictions - California Drift Gillnet Fishery

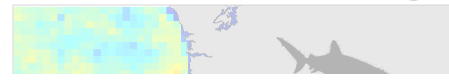
Swordfish Observer



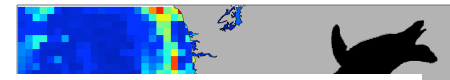
Blue Shark Observer



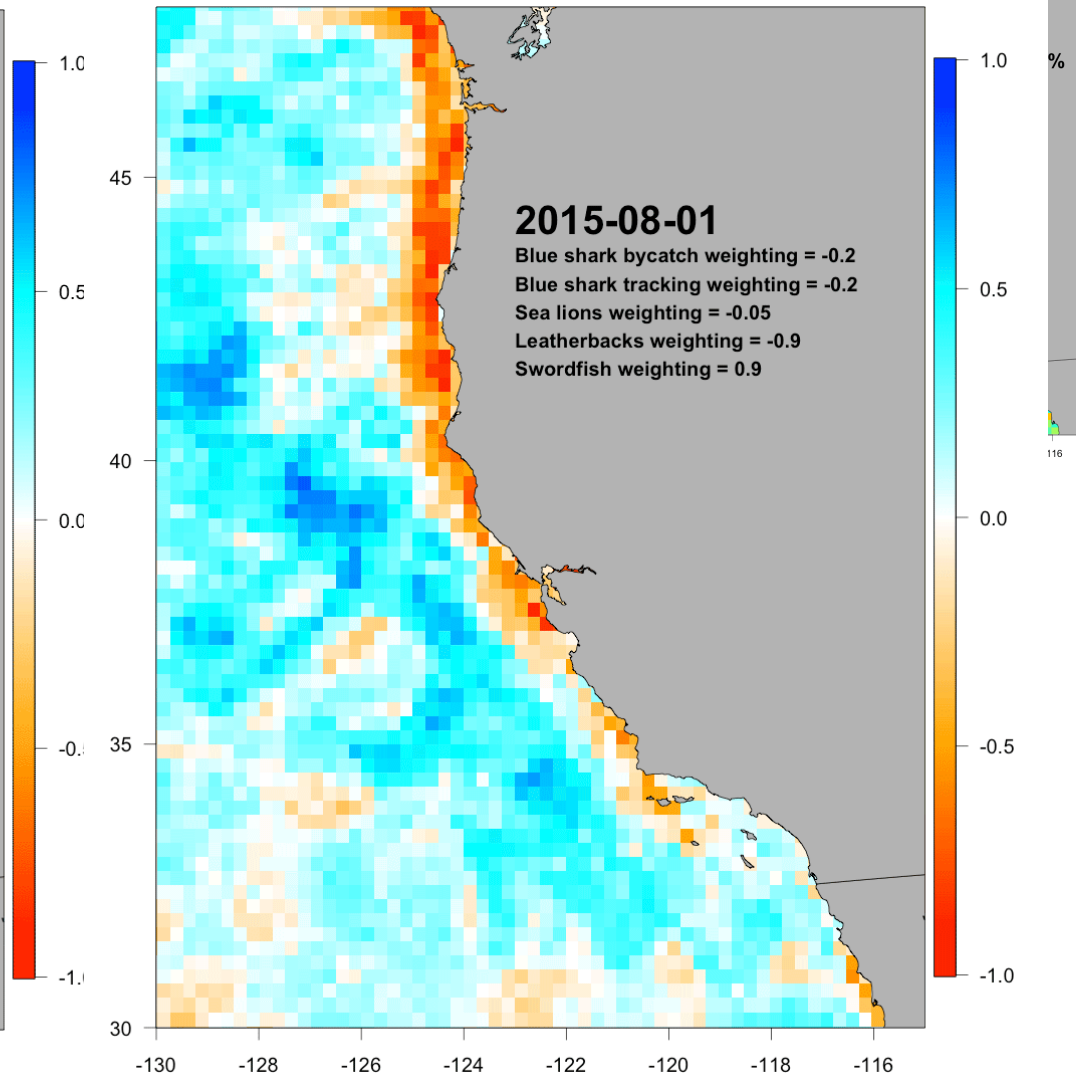
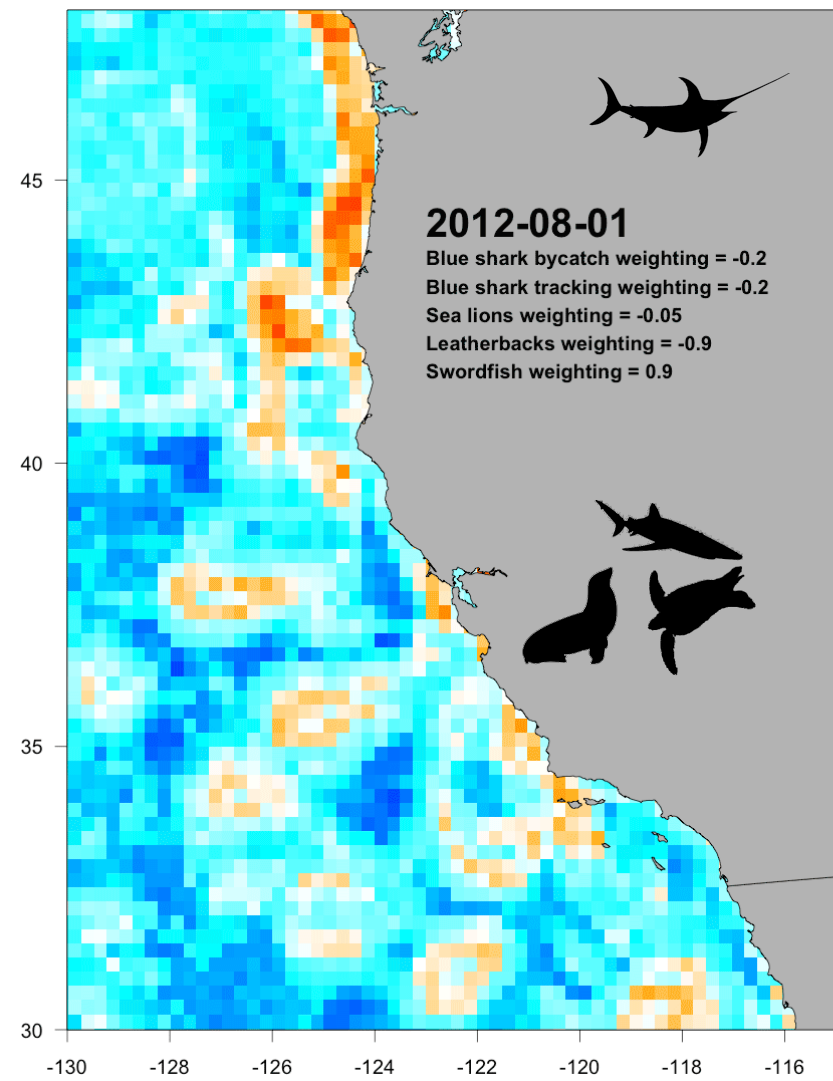
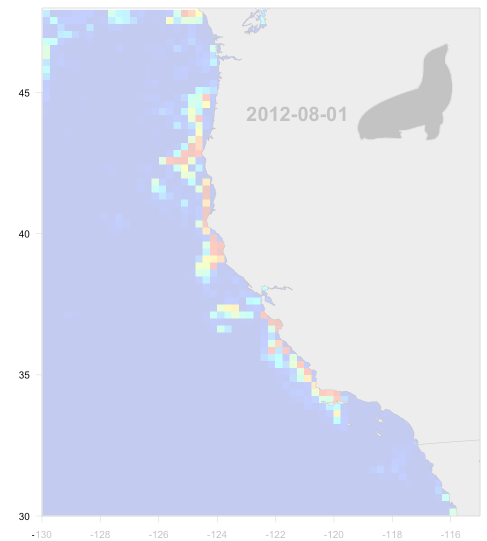
Blue Shark Tracking



Leatherback Turtle

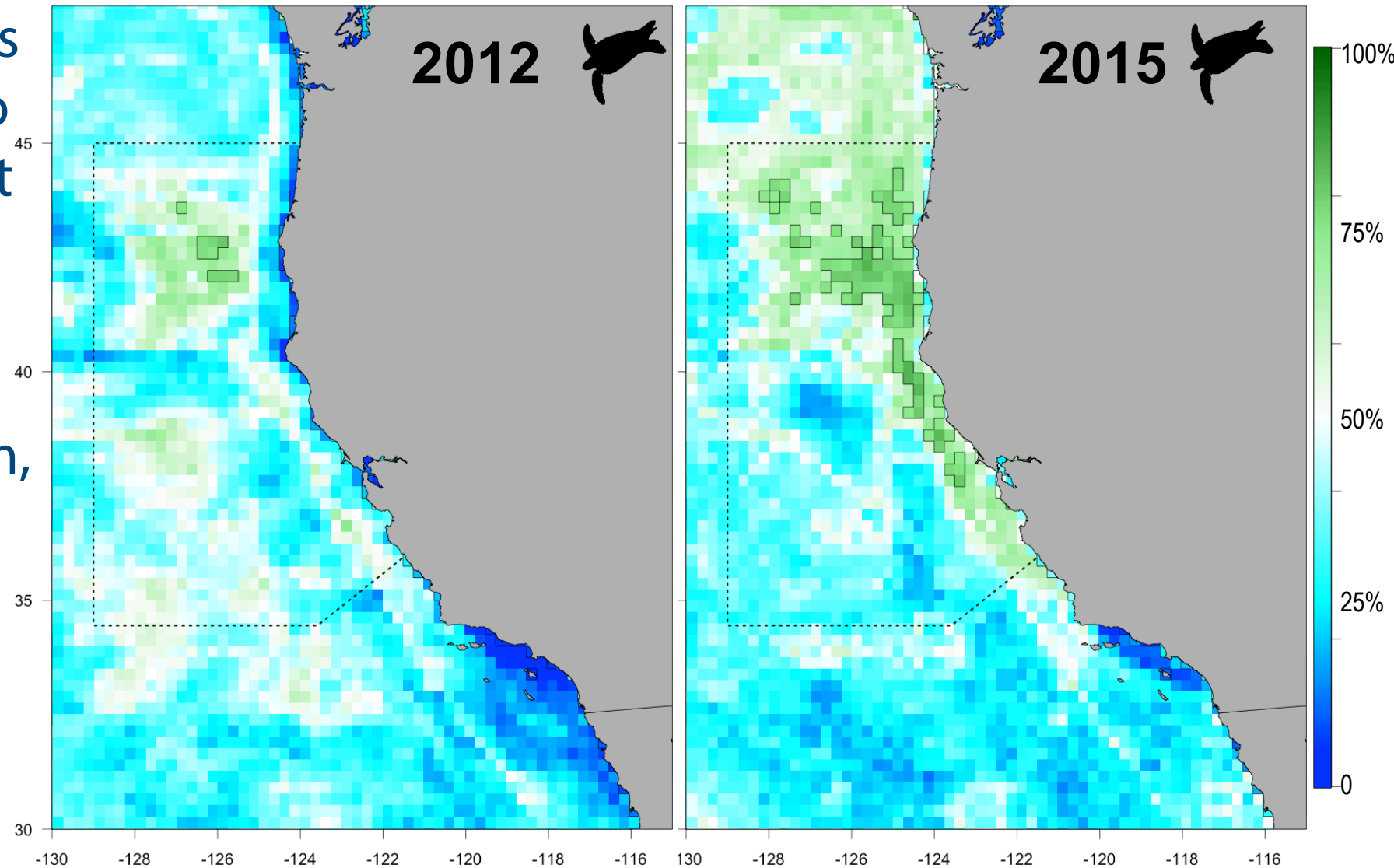


California Sea Lion

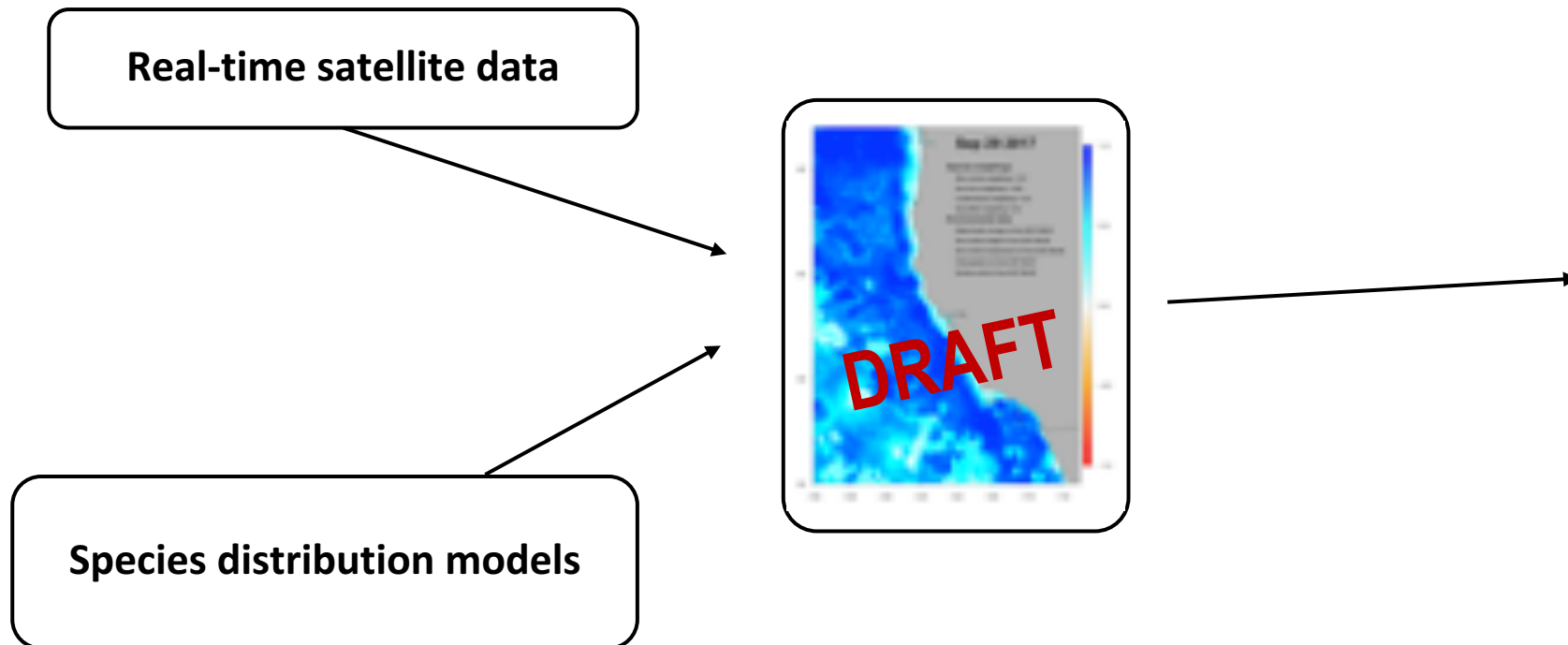


EcoCast predictions - California Drift Gillnet Fishery

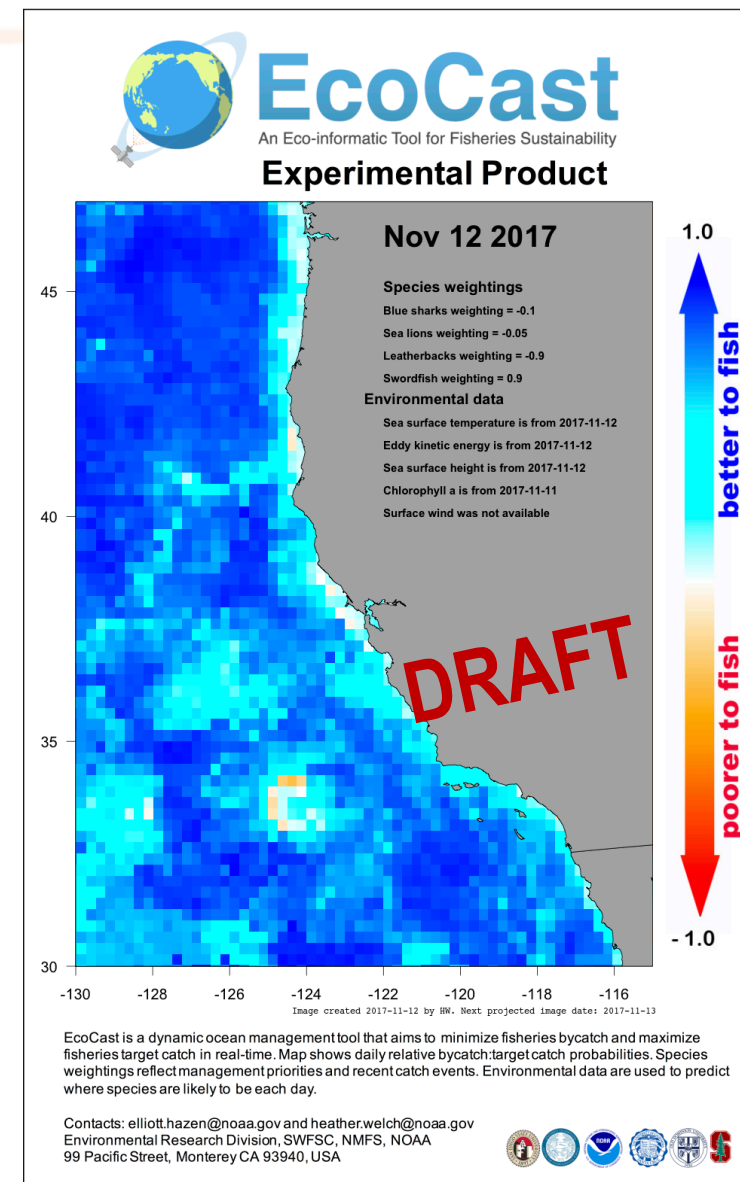
- Z = Percentage of days that were predicted to be leatherback habitat
- PLCA captures $> 80\%$ of habitat in “normal” year but less in a warm, El Niño year.
- A tool to evaluate efficacy (and timing) of seasonal closures



Operationalizing EcoCast: real-time risk



http://oceanview.pfeg.noaa.gov/ecocast/output/mean/EcoCast_ecocastrisk_latest_mean.png

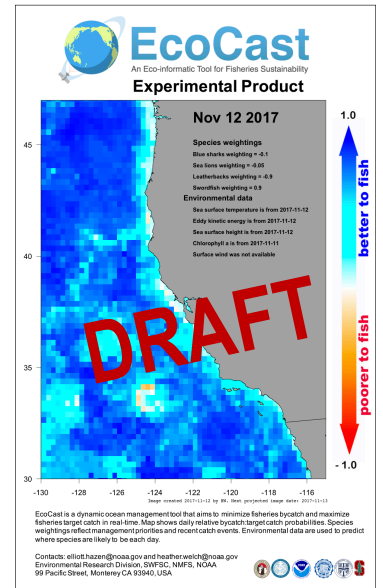
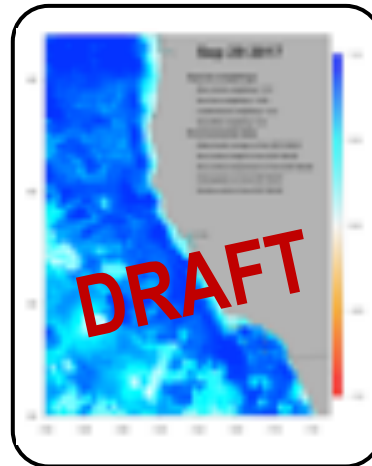


Serve product daily via persistent web address

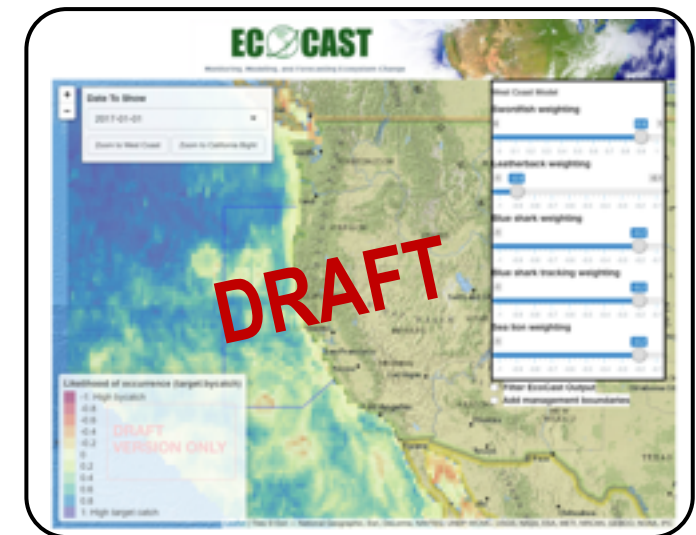
Operationalizing EcoCast: historical risk

Real-time satellite data

Species distribution models



Serve product daily via persistent web address



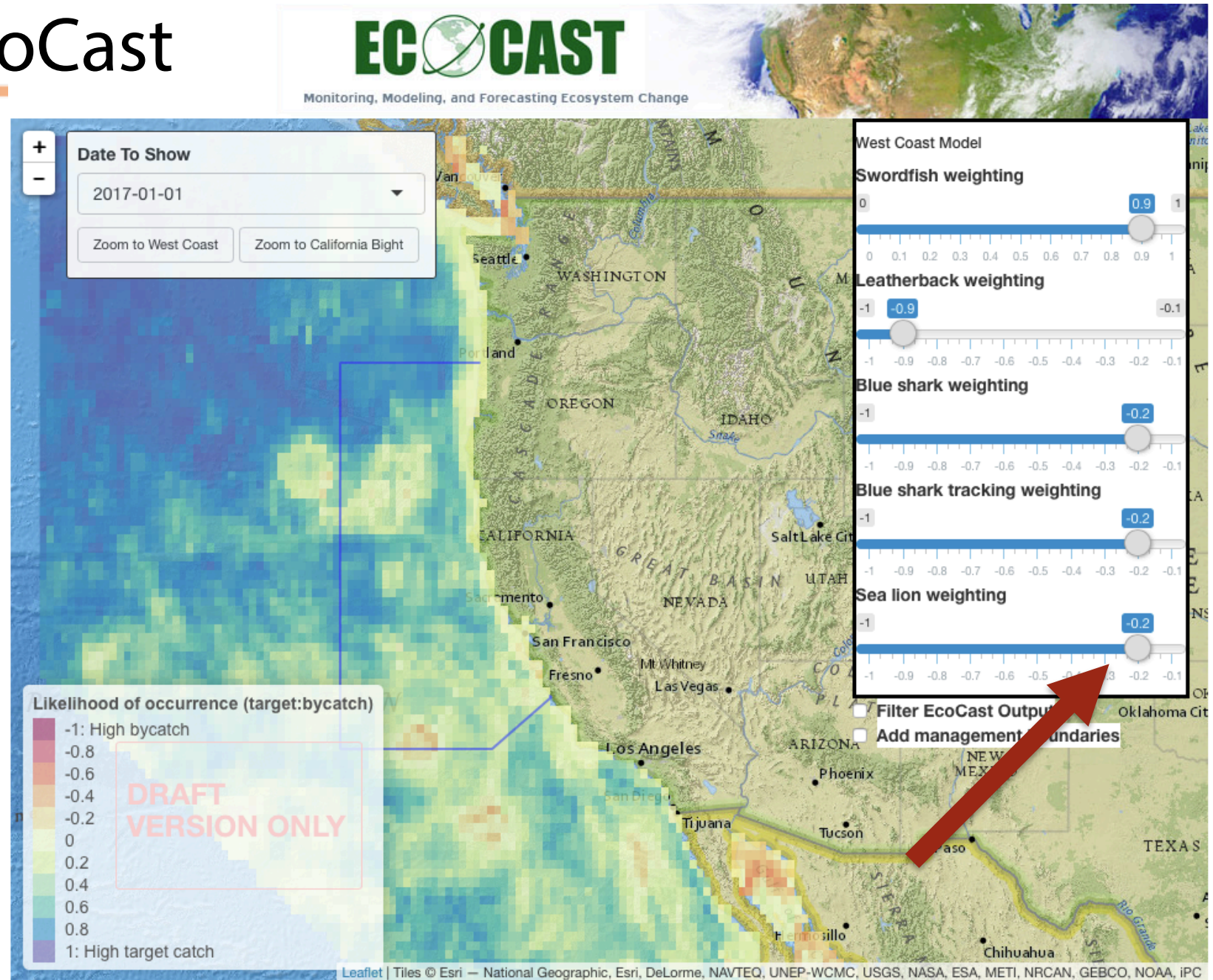
https://heatherwelch.shinyapps.io/rshinyapp_historical/

Serve historical products via an online Shiny application

Operationalizing EcoCast

Adjustable
bycatch risk
weightings

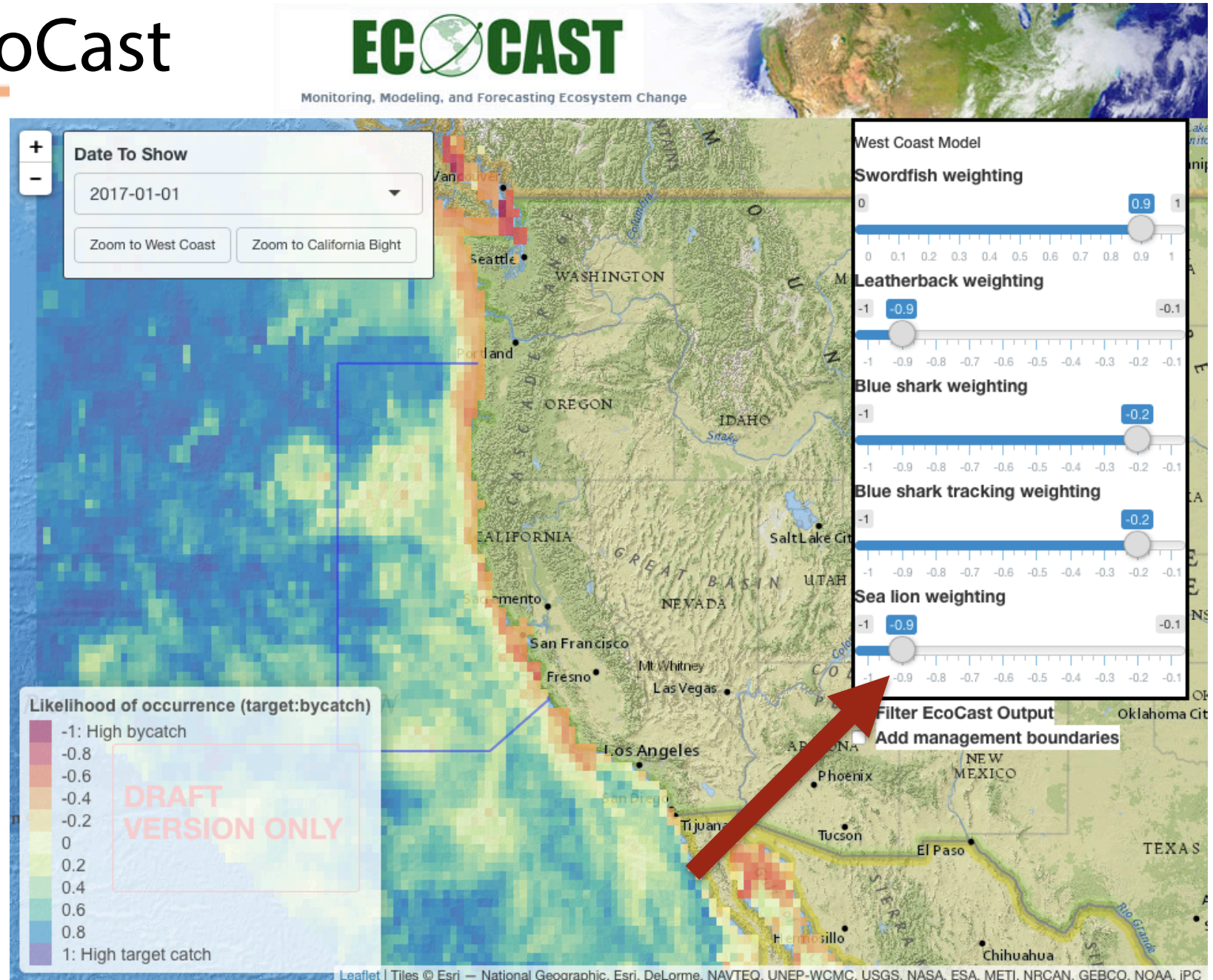
R Shiny app.



Operationalizing EcoCast

Adjustable
bycatch risk
weightings

R Shiny app.



Operationalizing EcoCast:

Adjustable
bycatch risk
weightings

Choose a date

R Shiny app.

