Apr 4th, 1:30 PM - 1:45 PM

Evaluation Salish Sea marine bird Indicators with insights from recent research by professional and citizen scientists

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Evaluation Salish Sea marine bird Indicators with insights from recent research by professional and citizen scientists

Scott F. Pearson &
Martin J. Raphael

Goals for Today

- Linking research and monitoring results in more informed indicators

Bird Vital Sign Indicator

Scott F. Pearson

PSEMP

PUGET SOUND ECOSYSTEM MONITORING PROGRAM

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

U.S. FISH & WILDLIFE SERVICE DEPARTMENT OF THE INTERIOR

BBS

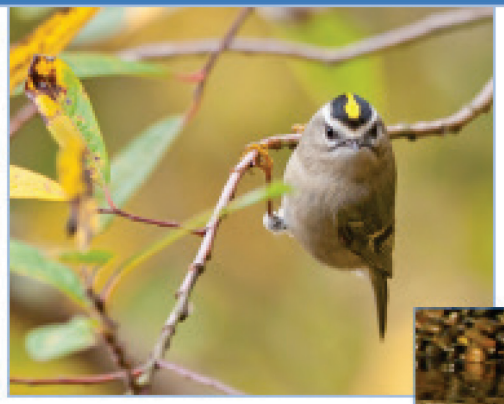
Coarse-grained indicators

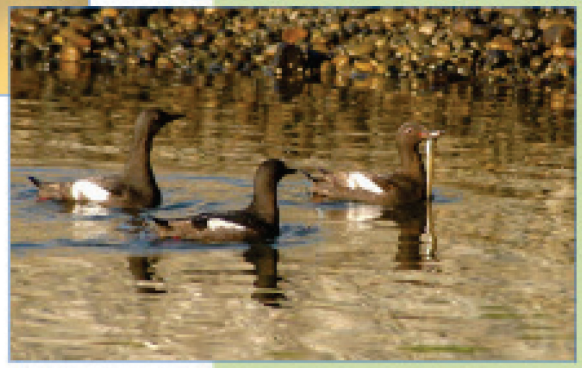
- Vital Signs are aimed at the general public and policy makers with the goal of providing a limited number of indicators of ecosystem conditions
- Vital Signs show the collective impacts of new and ongoing management strategies

What are we trying to “indicate”?

Primarily indicate – along with orca, herring and salmon indicators – whether or not the Puget Sound Partnership is achieving its goal of “healthy and sustaining populations of native species”

Marine and Terrestrial Bird Indicators for Puget Sound





Washington Department of Fish and Wildlife
& Puget Sound Partnership

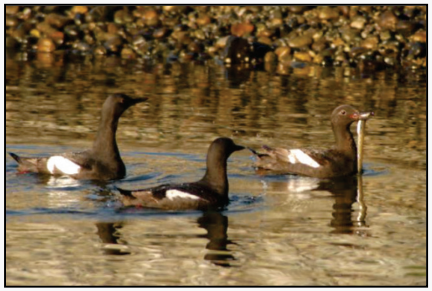
12/31/2013

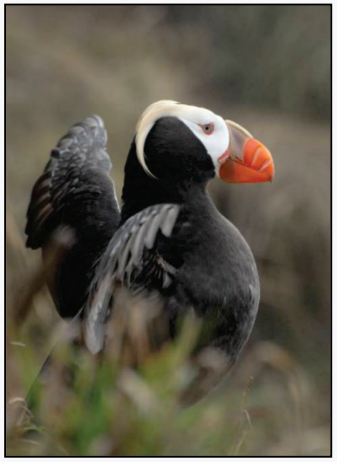
Indicator Status

Marine Birds

Vital Sign indicator

Seabird community in the Salish Sea: *summer*





Marine Bird Indicator #1

Spring/summer density trends for seabirds breeding in Puget Sound and Strait of Juan de Fuca.

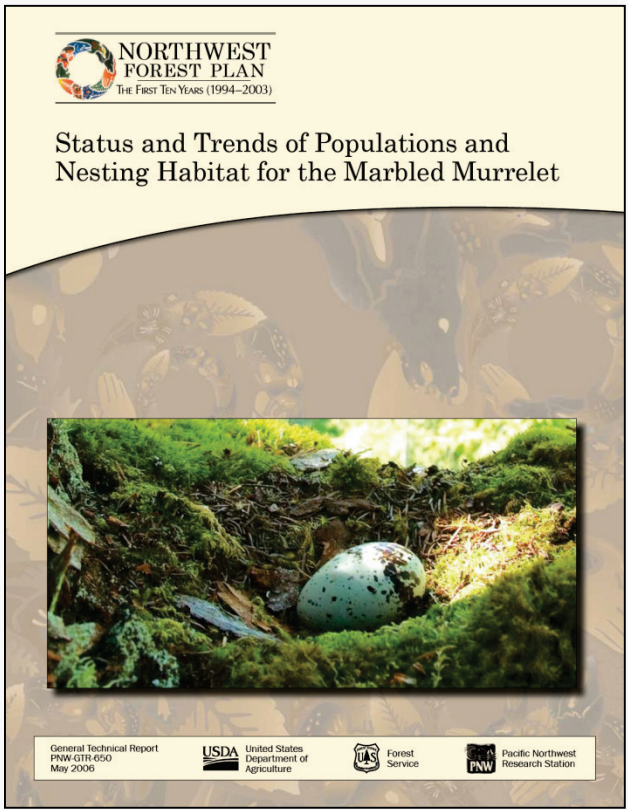
Pigeon guillemot

Rhinoceros auklet

Marbled murrelet

Approach

- Data from the spring summer marbled murrelet survey effort conducted for the Northwest Forest Plan
- Use line-transect survey methods

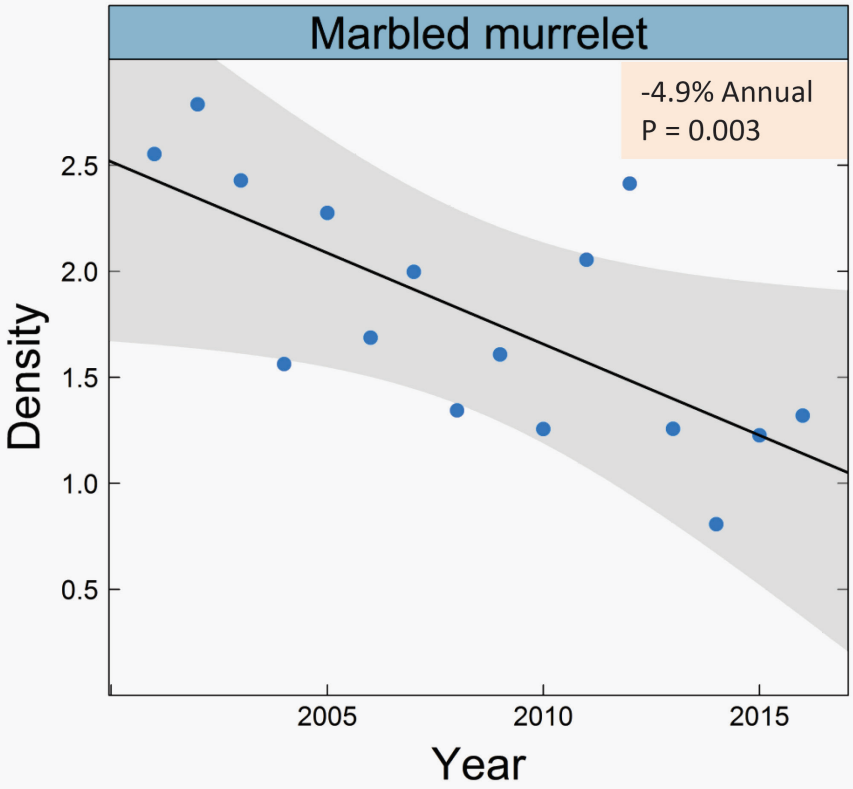



The Salish Sea
from the north end of the Strait of Georgia
to the west end of the Strait of Juan de Fuca
and the south end of Puget Sound
Mt. Waddington
Monmouth Mountain
DESOLATION SOUND
Watershed Boundary
STRAIT of GEORGIA
Vancouver Island
Fraser River
Mt. Baker
Skagit River
STRAIT of JUAN de FUCA
PUGET SOUND
Glacier Peak
Pacific Ocean
Olympic Peninsula
Mt. Rainier
N
0 50 100 km.
0 50 mi.
Data Sources:
SRTM (CGIAR-CSI), NOAA, Wa. DFW,
Wa. DNR, BC Digital Atlas, ESRI
stefan freelan - 2009
http://my.web.facstaff.wwu.edu/~stefan/Salish_Sea.htm

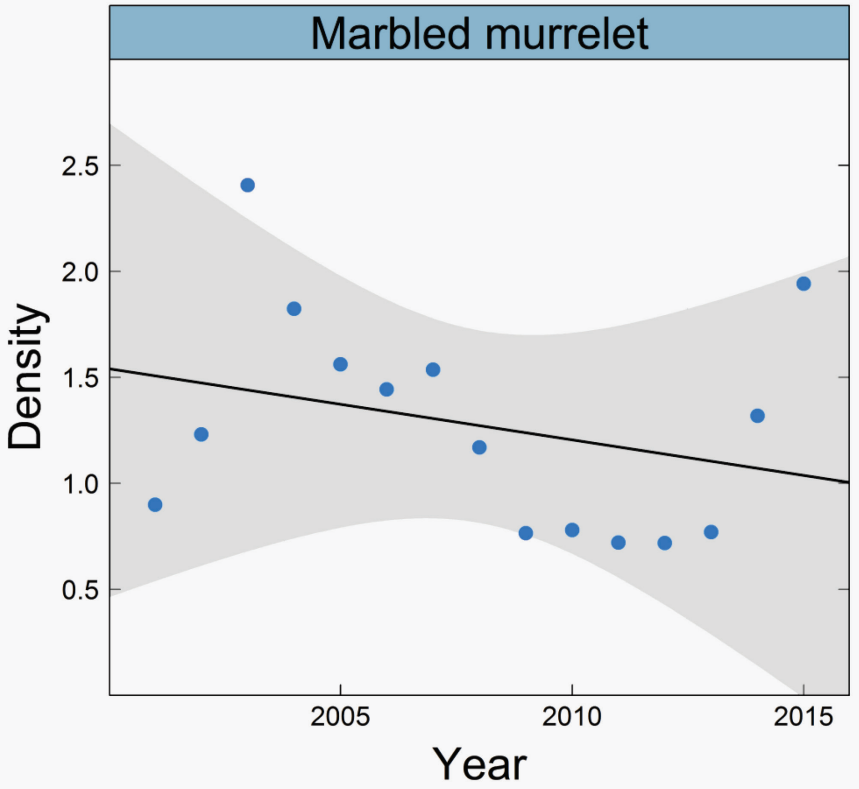

Vancouver
Victoria
CANADA
USA
Seattle
Portland
California
Current LME
San Francisco
Los Angeles
San Diego
MEXICO
Baja California

Marbled Murrelet

Salish Sea
2001-2016



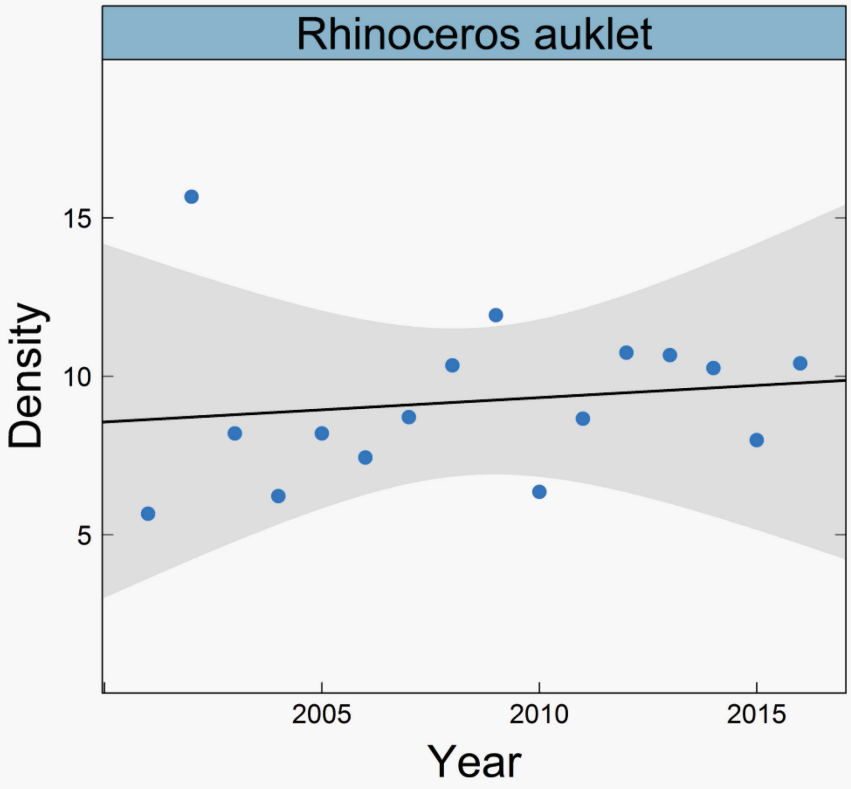
California Current
2001-2015

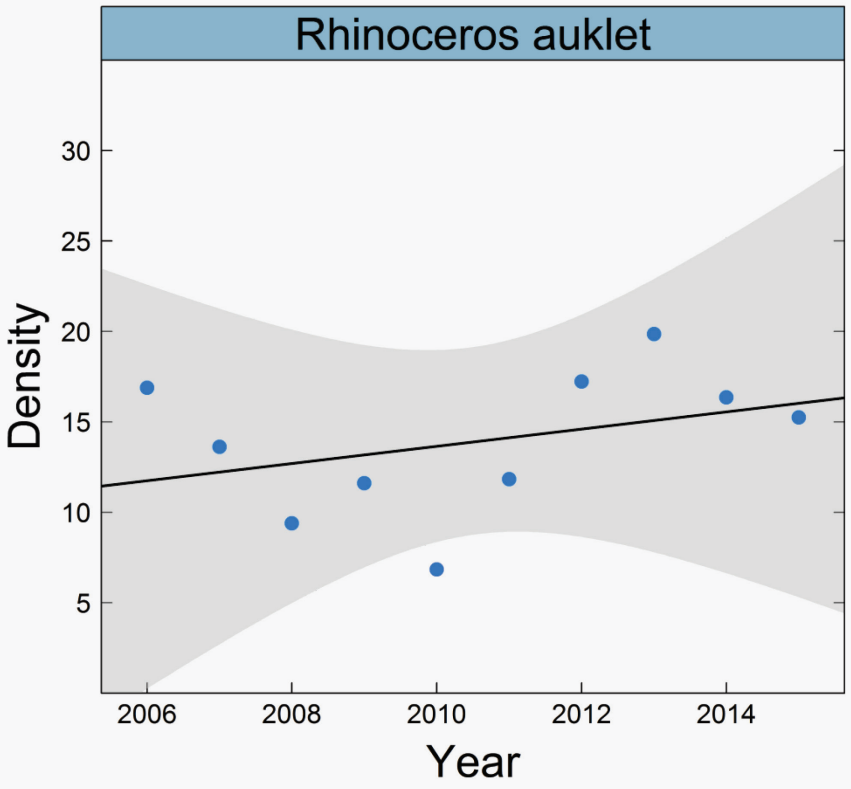


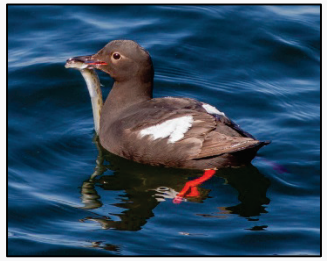
Rhinoceros Auklet

Salish Sea
2001-2016

California Current
2006-2015

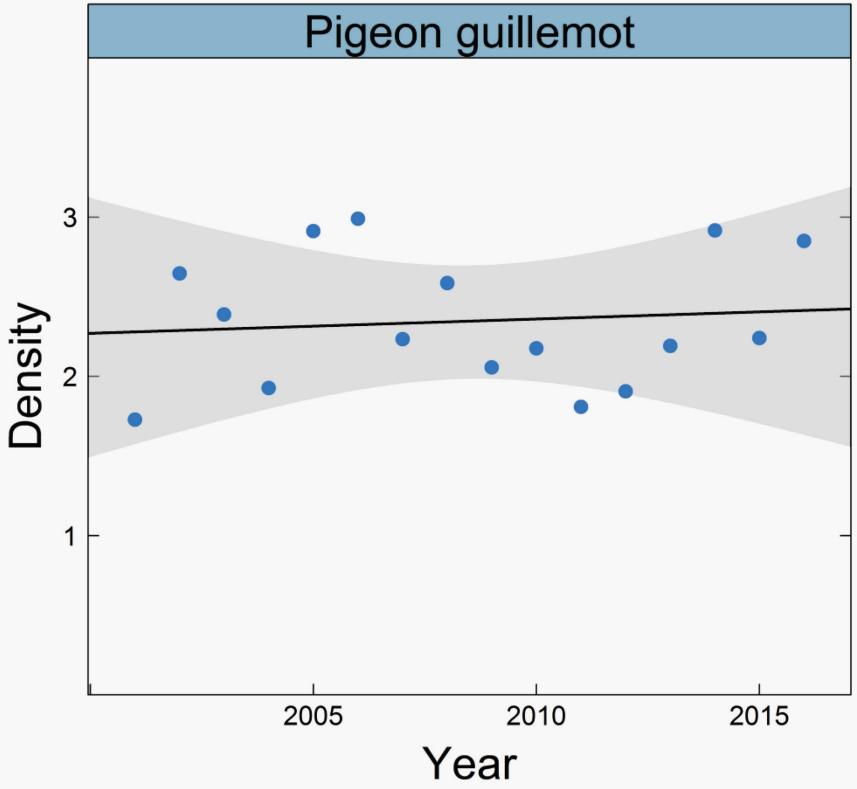




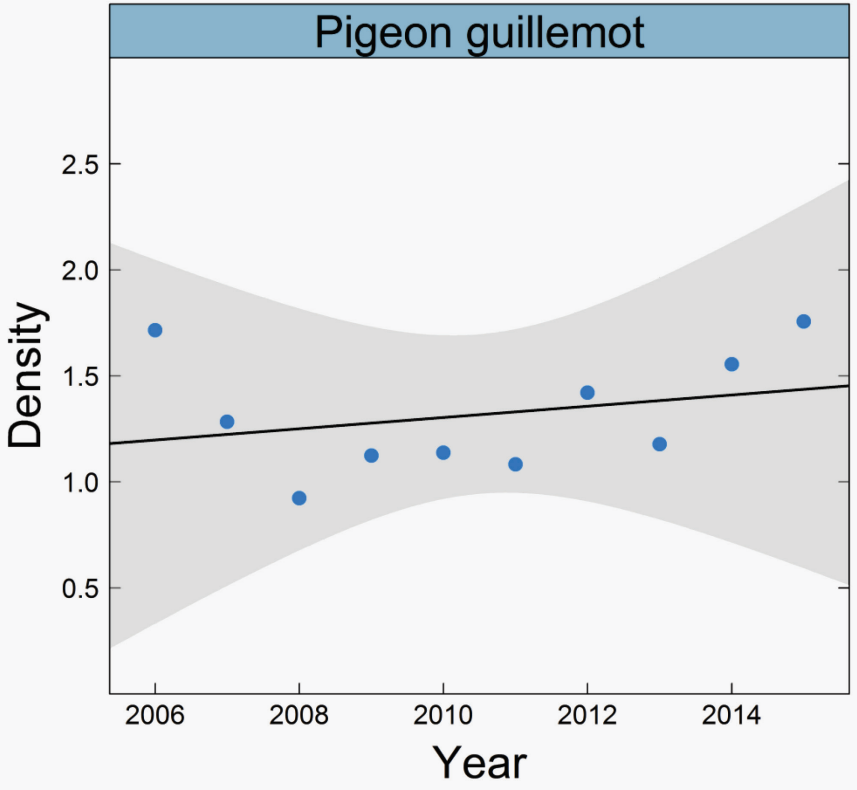


Pigeon Guillemot

Salish Sea
2001-2016



California Current
2006-2015



Integrating Monitoring and Research

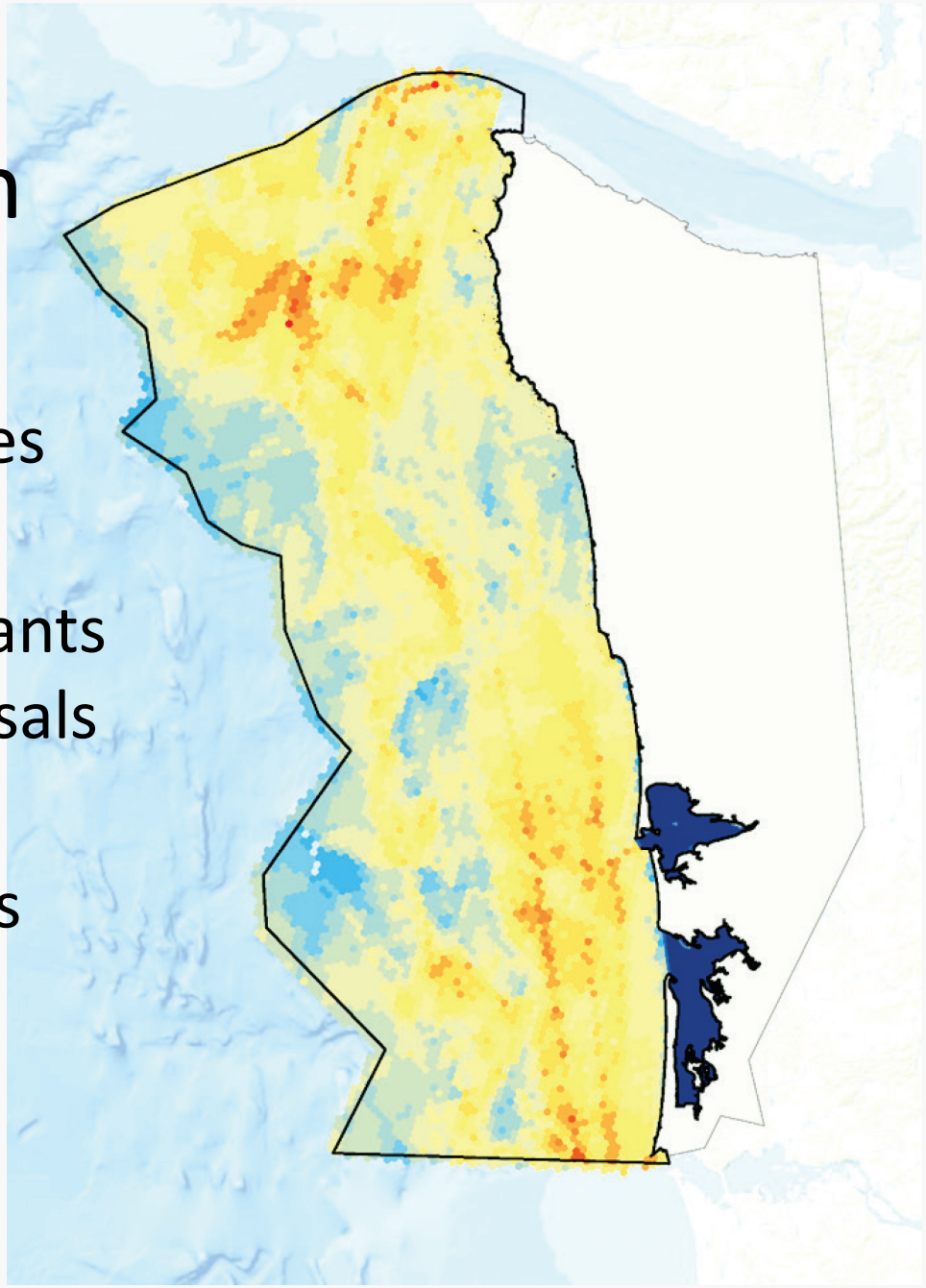
- More likely to result in informed trends
- Additional uses of the information

Washington State Marine Spatial Plan

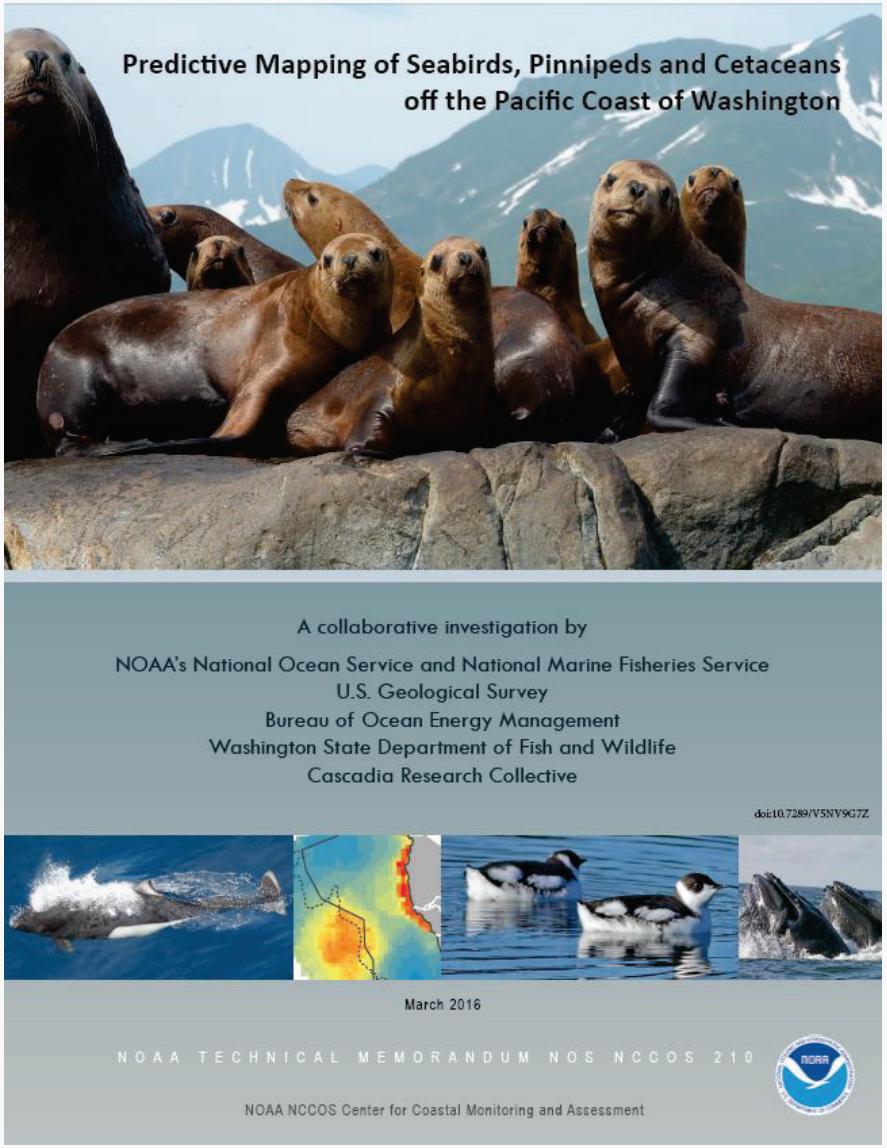
- Need:
  - Potential new ocean uses such as offshore wind energy or offshore aquaculture could Impact important ocean resources and uses
  - Multiple, overlapping jurisdictions and authorities create additional challenges for coordinated decision-making and proactive planning

Washington State Marine Spatial Plan

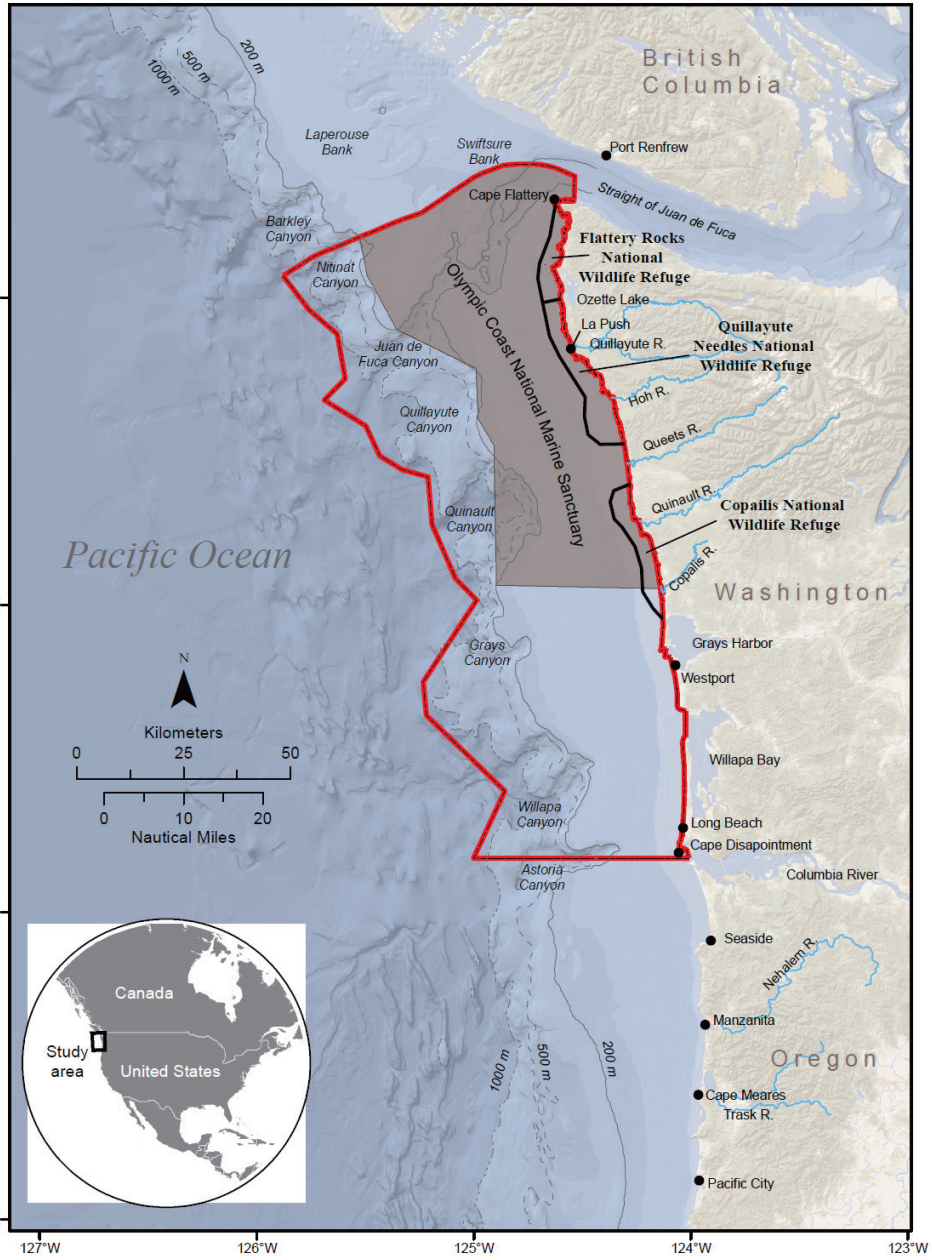
- The plan is a tool to:
  - Protect ocean resources and uses
  - Guide potential applicants as they develop proposals
  - Assist state in the evaluation of proposals



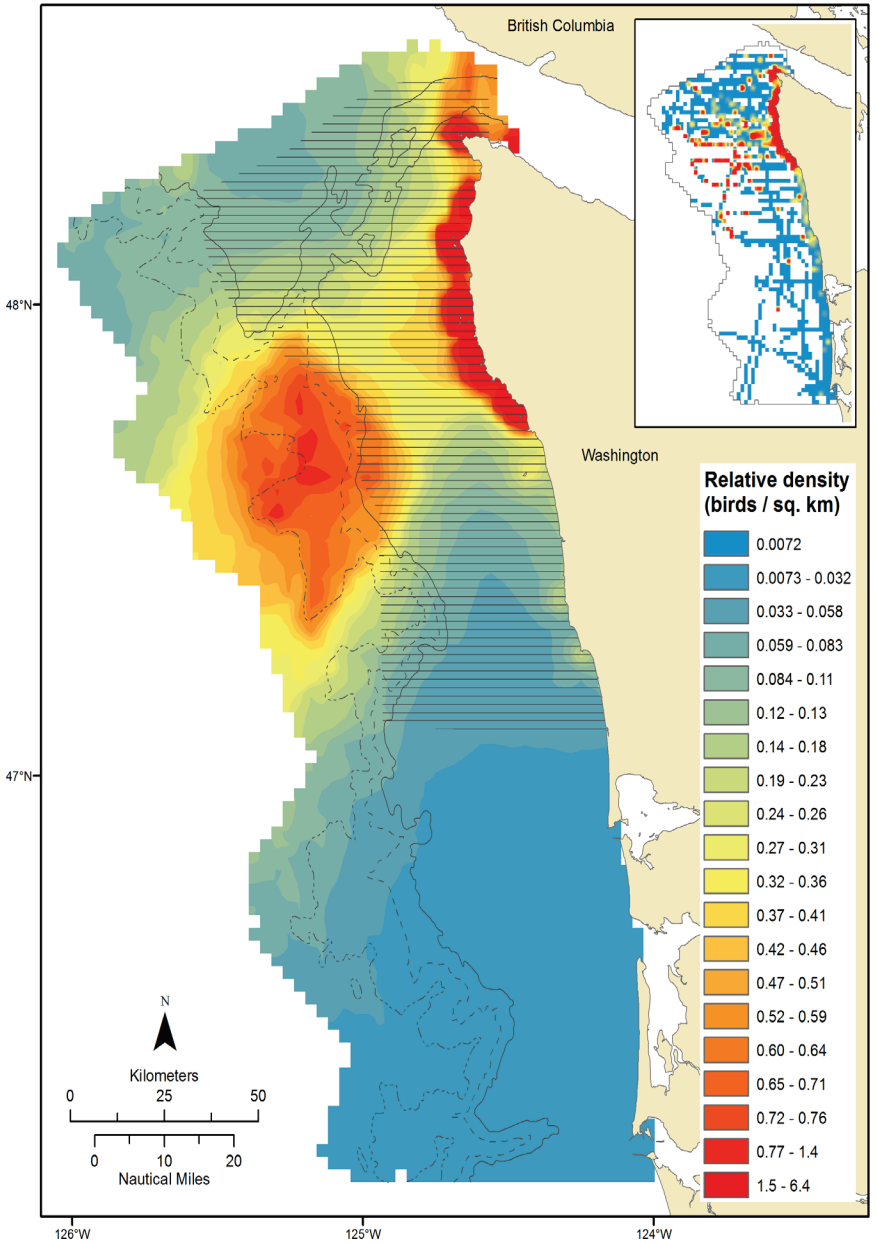
Marine spatial planning



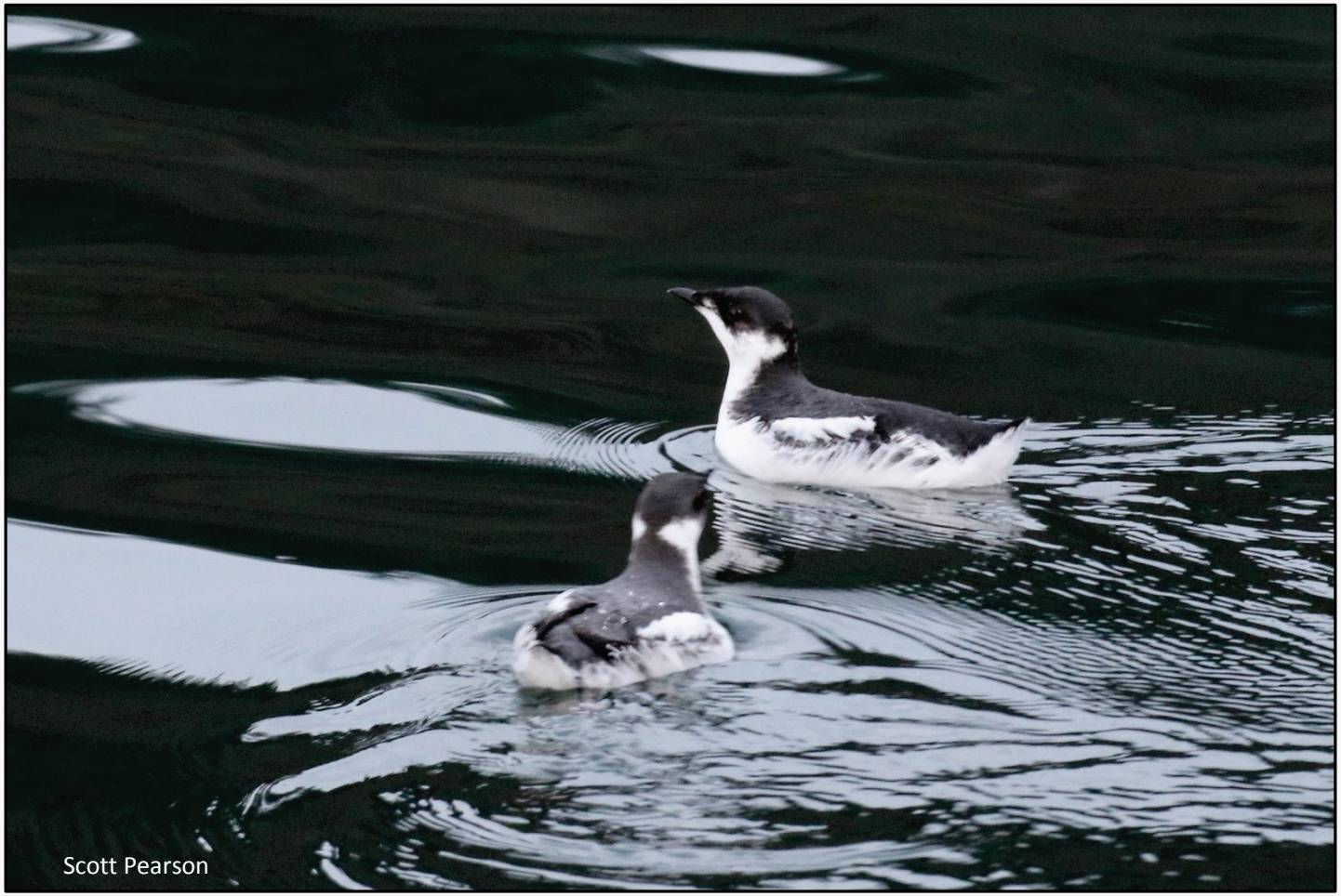
Reference Map



Tufted puffin (*Fratercula cirrhata*): April to October



Marbled Murrelet

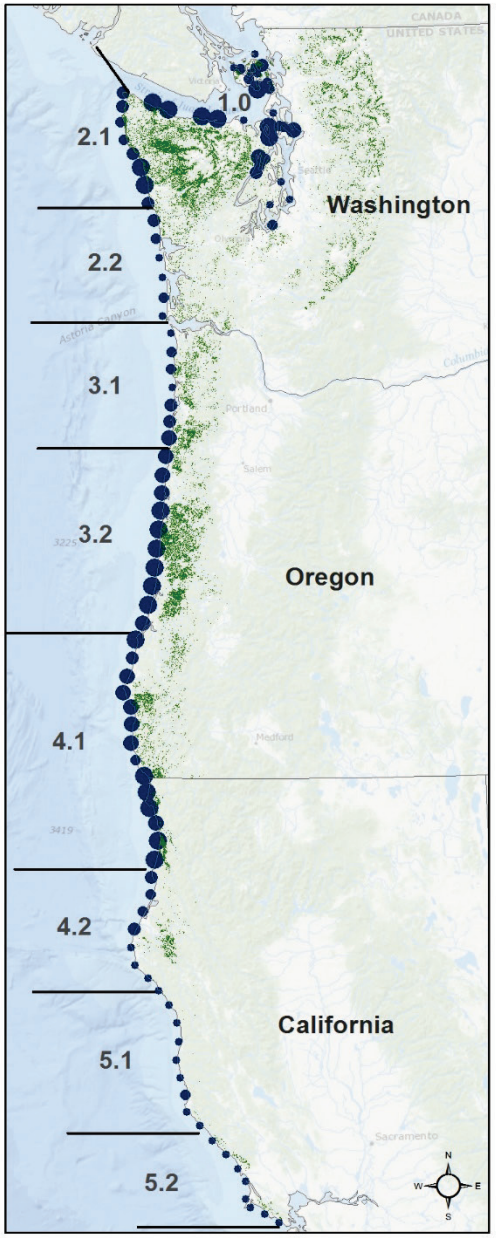


USDA
United States Department of Agriculture

NORTHWEST FOREST PLAN
THE FIRST 20 YEARS (1994–2013)

Status and Trend of Marbled Murrelet Populations and Nesting Habitat

Forest Service
Pacific Northwest Research Station
General Technical Report PNW-GTR-933
May 2016



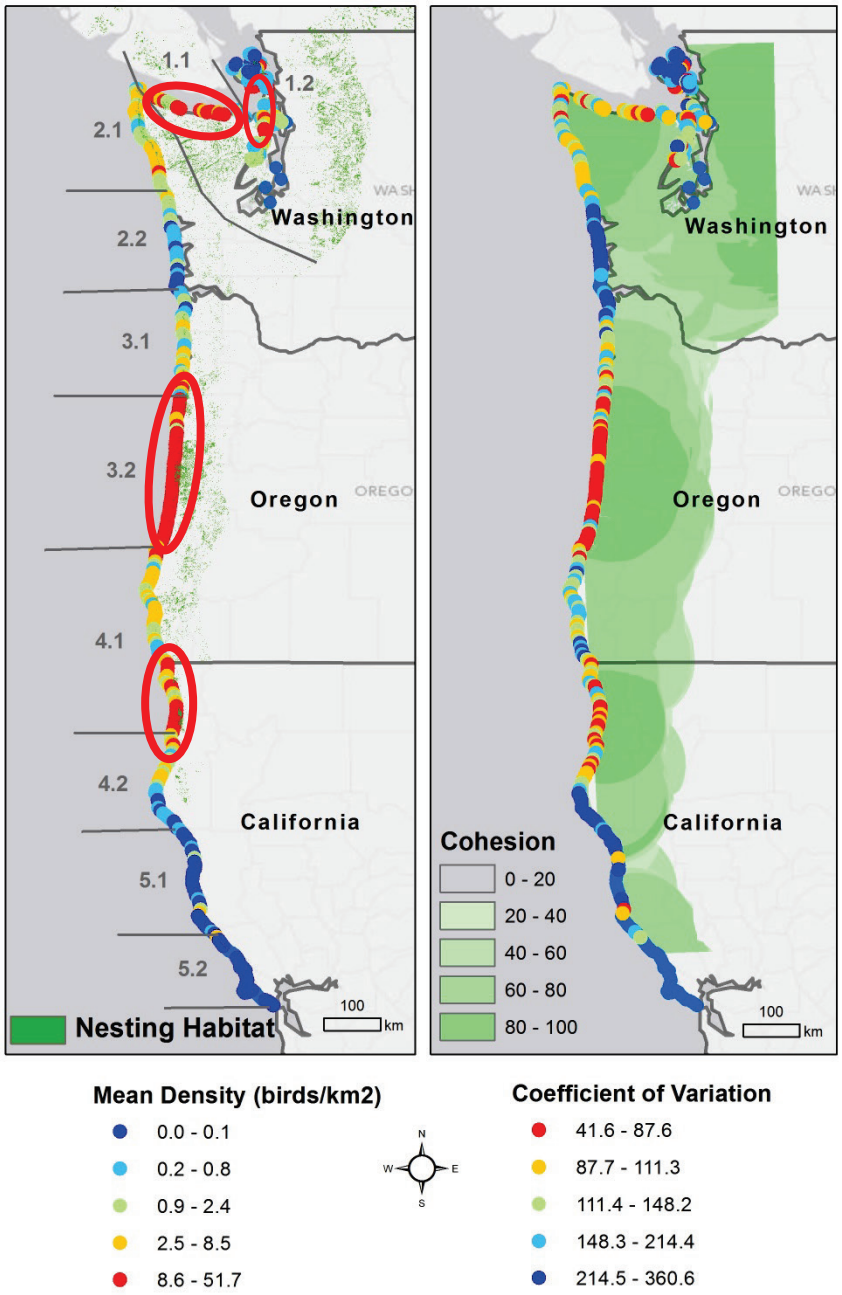
Nesting Habitat

Mean Density (birds/sq. mile)

- < 1
- 1 - 3
- 3 - 5
- 5 - 10
- > 10

Strata Boundaries

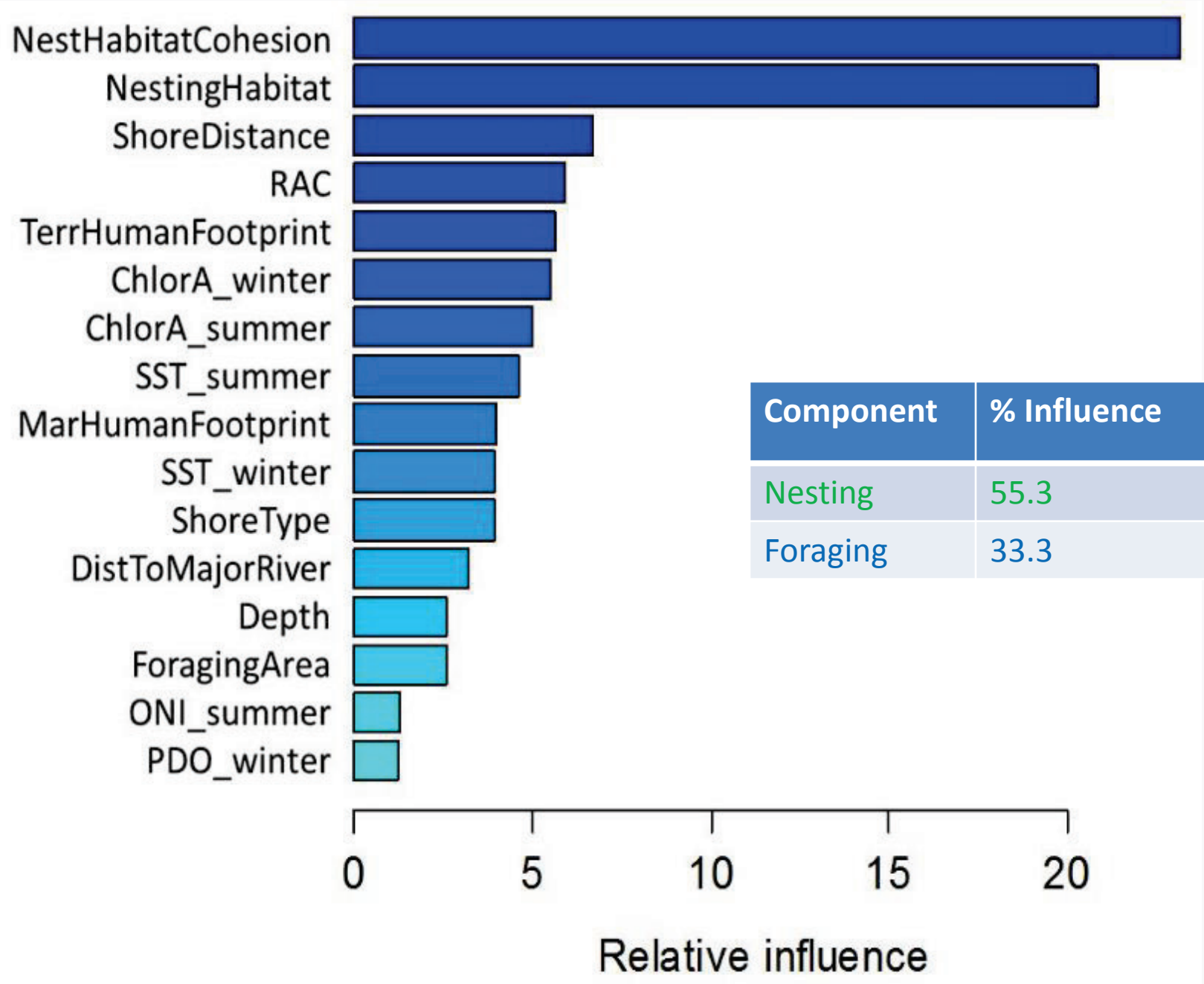
0 30 60 120
Miles



Raphael, M.G., A. Shirk, G.A. Falxa, and S.F. Pearson. 2015. Habitat associations of marbled murrelets during the nesting season in nearshore waters along the Washington to California coast. Journal of Marine Systems 146:17-25.

“Land-Sea” Modeling

- Question: What factors best explain marbled murrelet distribution and trends at sea?
- Used population and habitat monitoring results, plus data on marine conditions



Component	% Influence
Nesting	55.3
Foraging	33.3

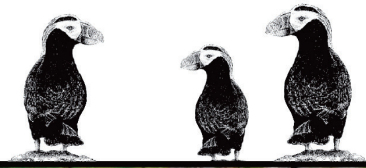
Raphael, M.G., A. Shirk, G.A. Falxa, and S.F. Pearson. 2015. Habitat associations of marbled murrelets during the nesting season in nearshore waters along the Washington to California coast. Journal of Marine Systems 146:17-25.

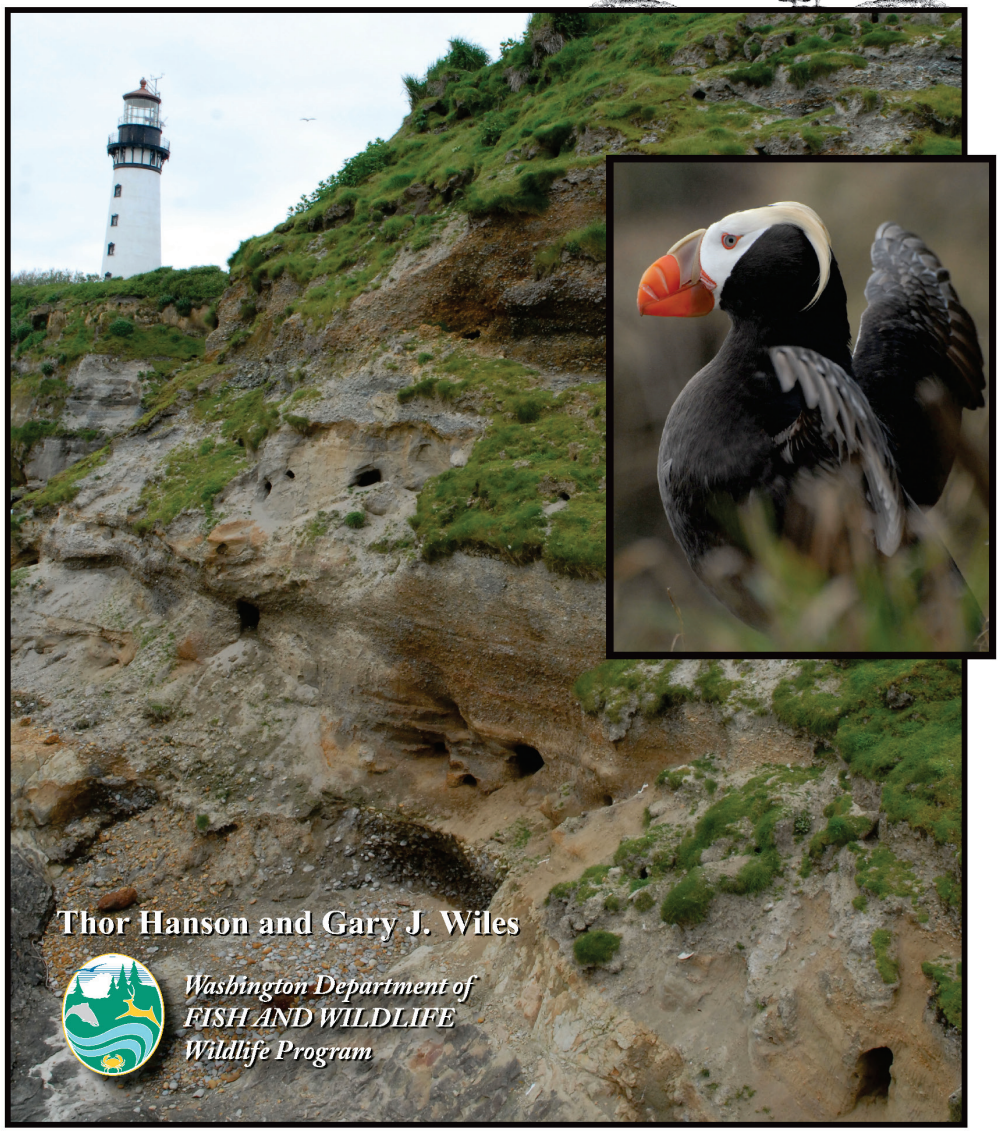
“Land-Sea” Modeling

- **Key Finding:** Terrestrial factors, particularly the amount and pattern of nesting habitat, best predict murrelet distribution and trends at sea
- **In Puget Sound**: Marine factors become better predictors.

STATE OF WASHINGTON January 2015

Status Report for the Tufted Puffin



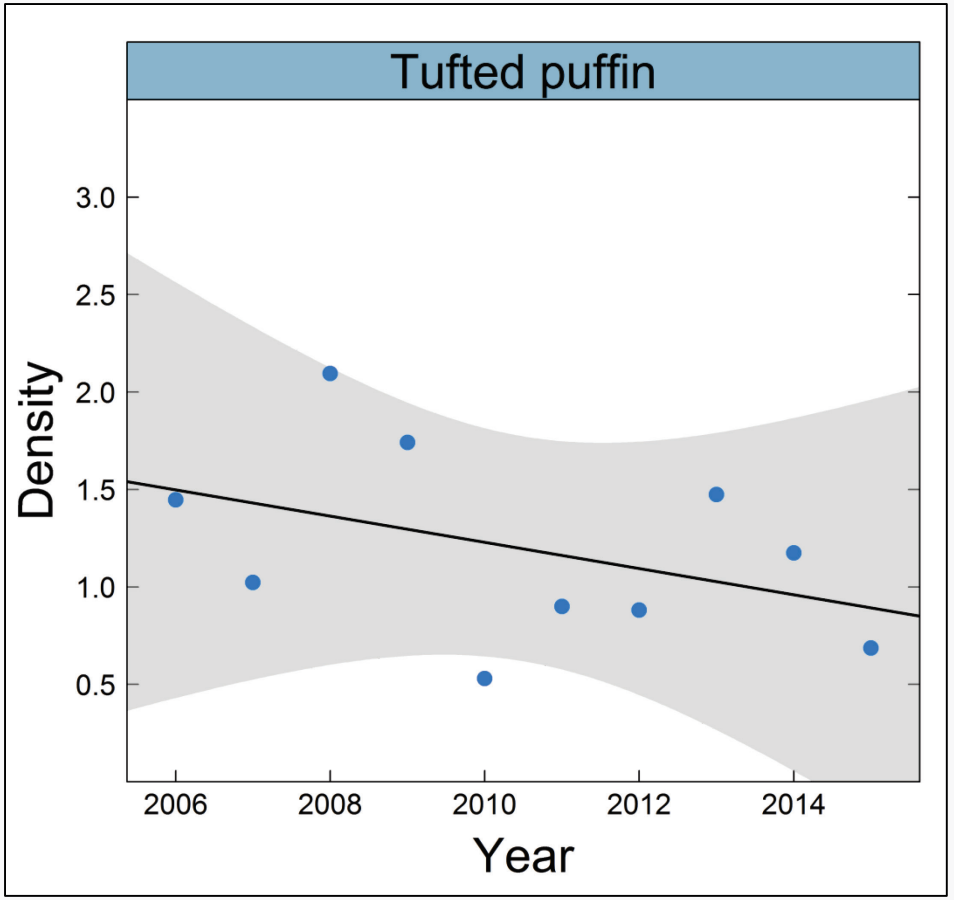


Thor Hanson and Gary J. Wiles

Washington Department of FISH AND WILDLIFE Wildlife Program

The SeaDoc Society
People and science healing the sea

Trends of other species of conservation concern



The SeaDoc Society
People and science healing the sea

University of Puget Sound

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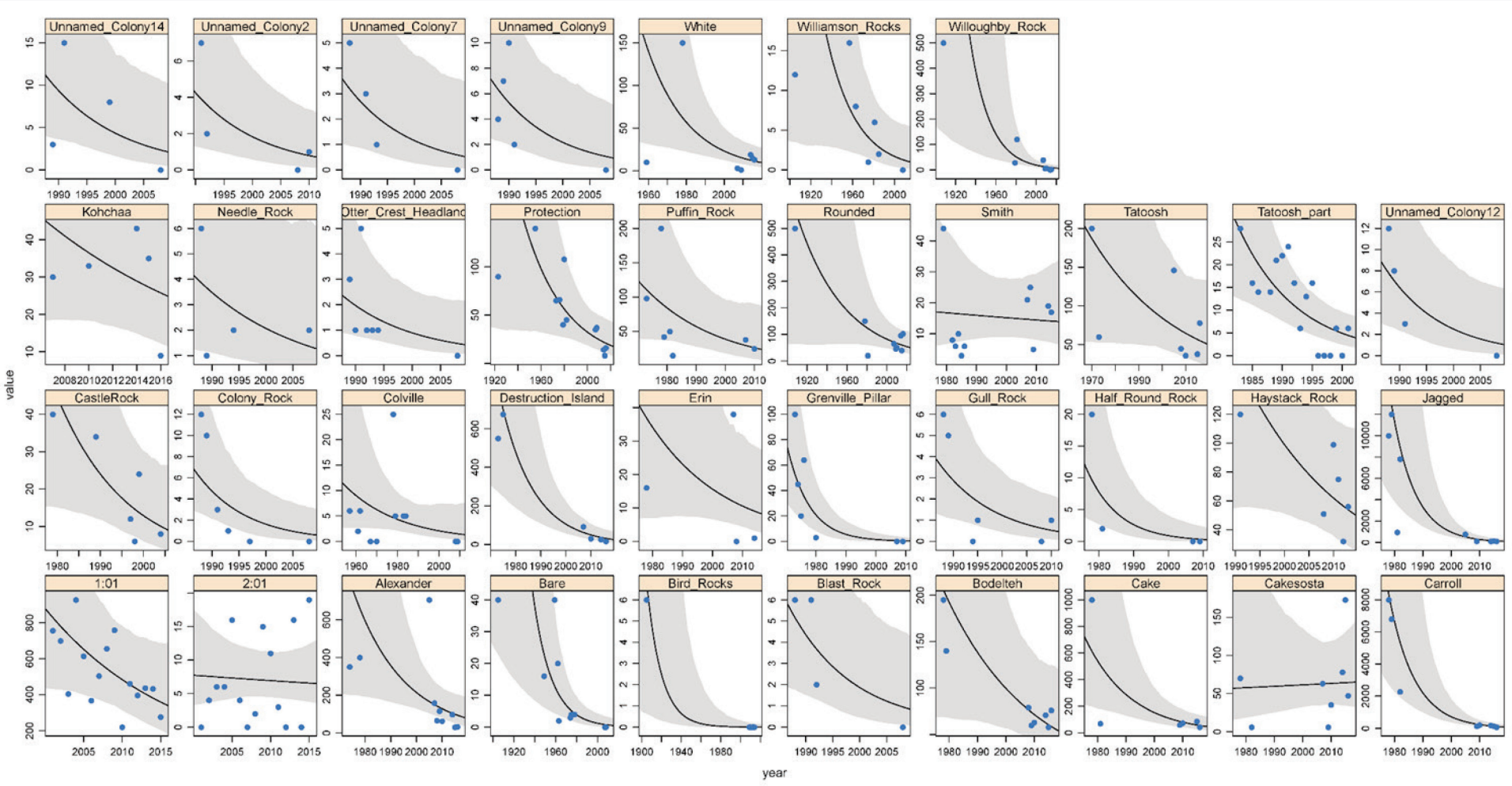
Washington Department of Fish and Wildlife

U.S. Fish & Wildlife Service

Meta-analysis



Climate Change

Will the California Current Lose its Nesting Tufted Puffins?

Chris Hart, Ryan Kelly, and Scott Pearson

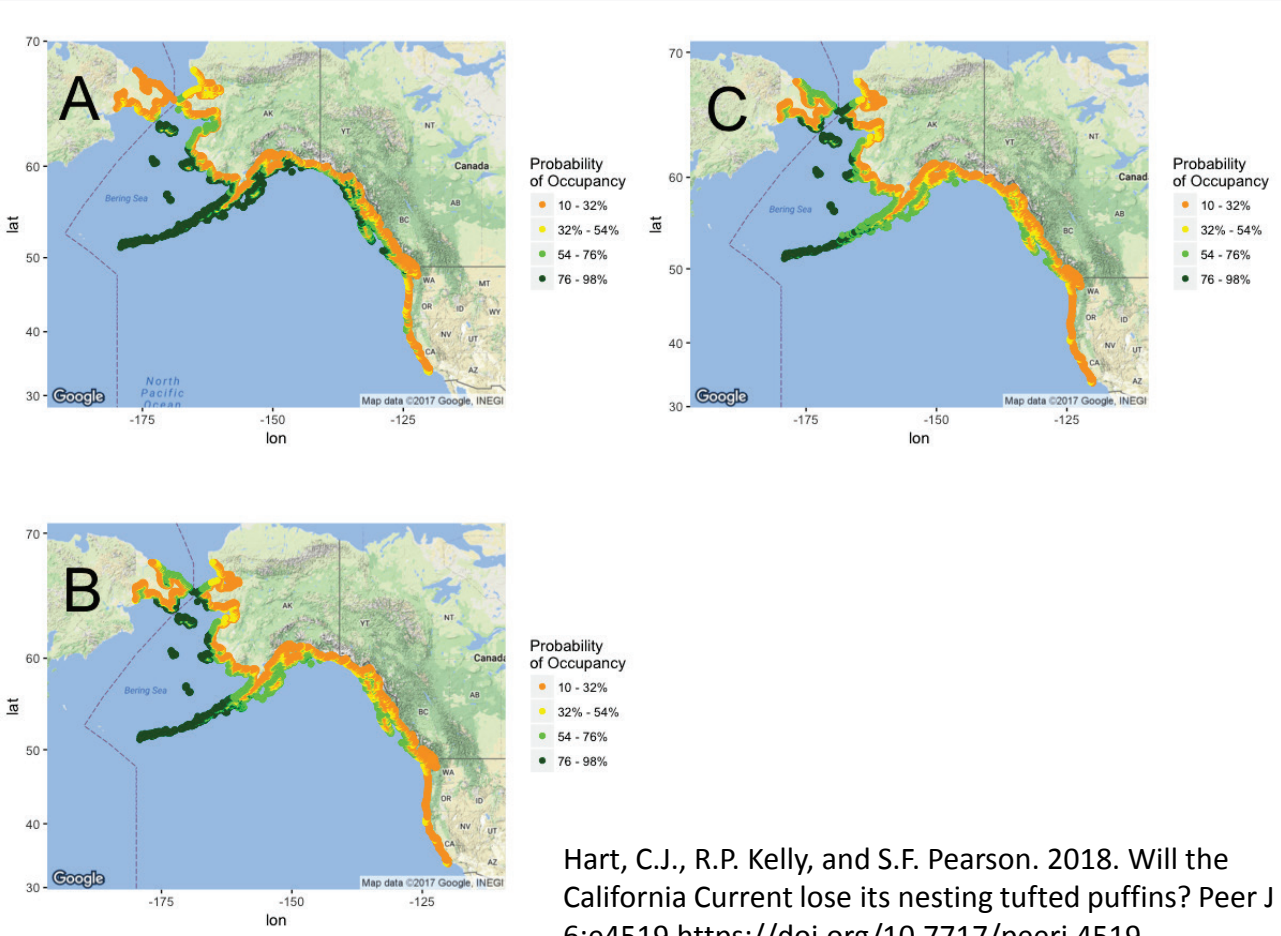
Hart, C.J., R.P. Kelly, and S.F. Pearson. 2018. Will the California Current lose its nesting tufted puffins? Peer J 6:e4519 https://doi.org/10.7717/peerj.4519

Approach

- Three species distribution models to evaluate breeding range shifts under two IPCC emission scenarios

Results

- Under both IPCC emission scenarios, models predict loss of > 93% of the California Current suitable nesting habitat
- Greater than 18% loss of suitable nesting sites throughout the entire North American range



Hart, C.J., R.P. Kelly, and S.F. Pearson. 2018. Will the California Current lose its nesting tufted puffins? Peer J 6:e4519 https://doi.org/10.7717/peerj.4519

Integrating Monitoring and Research

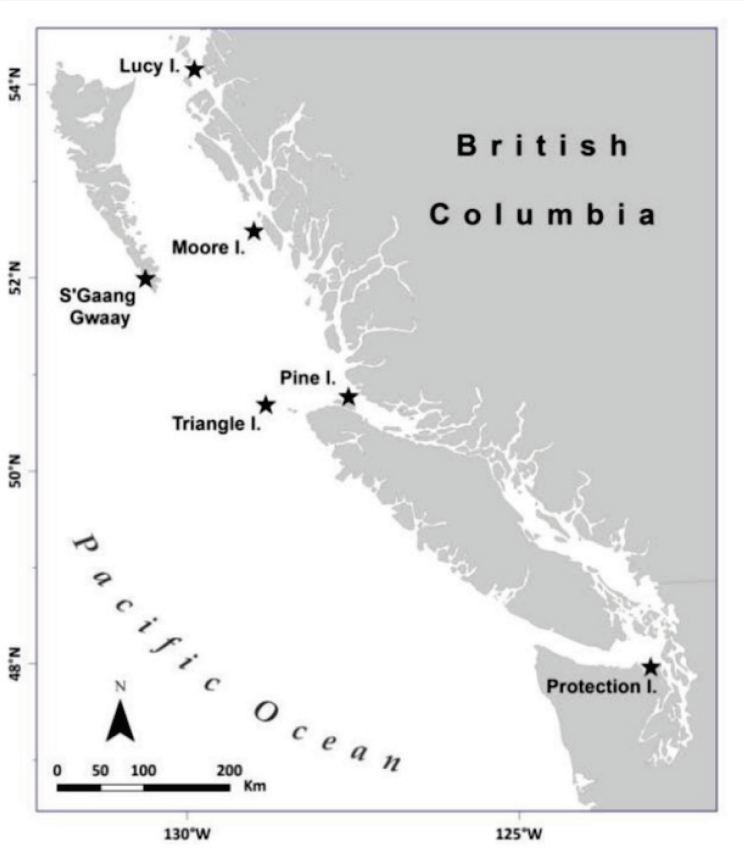
- Additional uses of the information
- More likely to result in informed trends

Contaminants in Prey

- Fish from Puget Sound were 2–4 times more contaminated and had similar contaminant profiles compared to fish from the outer coast (Good et al. 2014)

Good, T.P. Good, S.F. Pearson, P. Hodum, D. Boyd, B.F. Anulacio, and G.M. Ylitalo. 2014. Persistent organic pollutants in the diet of rhinoceros auklets (Cerorhinca monocerata) breeding in Puget Sound and the northern California Current. Marine Pollution Bulletin 86:367–378.

- Do Pacific sand lance and herring act as conduits for the verticle transfer of microfibers in food webs?
  - Quantified microfibres in stomachs of 734 sand lance and 205 herring from rhinoceros auklet bill-loads from 6 nesting colonies.
  - Sampling at Protection Island in 2016 yielded most (sand lance) or all (herring) of the microfibers recovered over the 30 colony-years of sampling involved in this study



Hipfner, J.M., M. Galbraith, S. Tucker, K.R. Studholme, A.D. Domalik, S.F. Pearson, T.P. Good,and P. Hodum. In press. 2018. Two forage fishes as potential conduits for the vertical transfer of microfibers in Northeastern Pacific Ocean food webs. Environmental Pollution.

Questions?