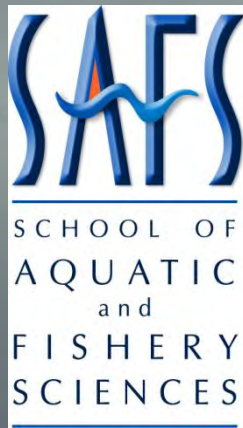


Marine birds, mammals, and PICES: Brief history and roadmap for the future

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Hidehiro Kato⁶, and Ken Morgan³

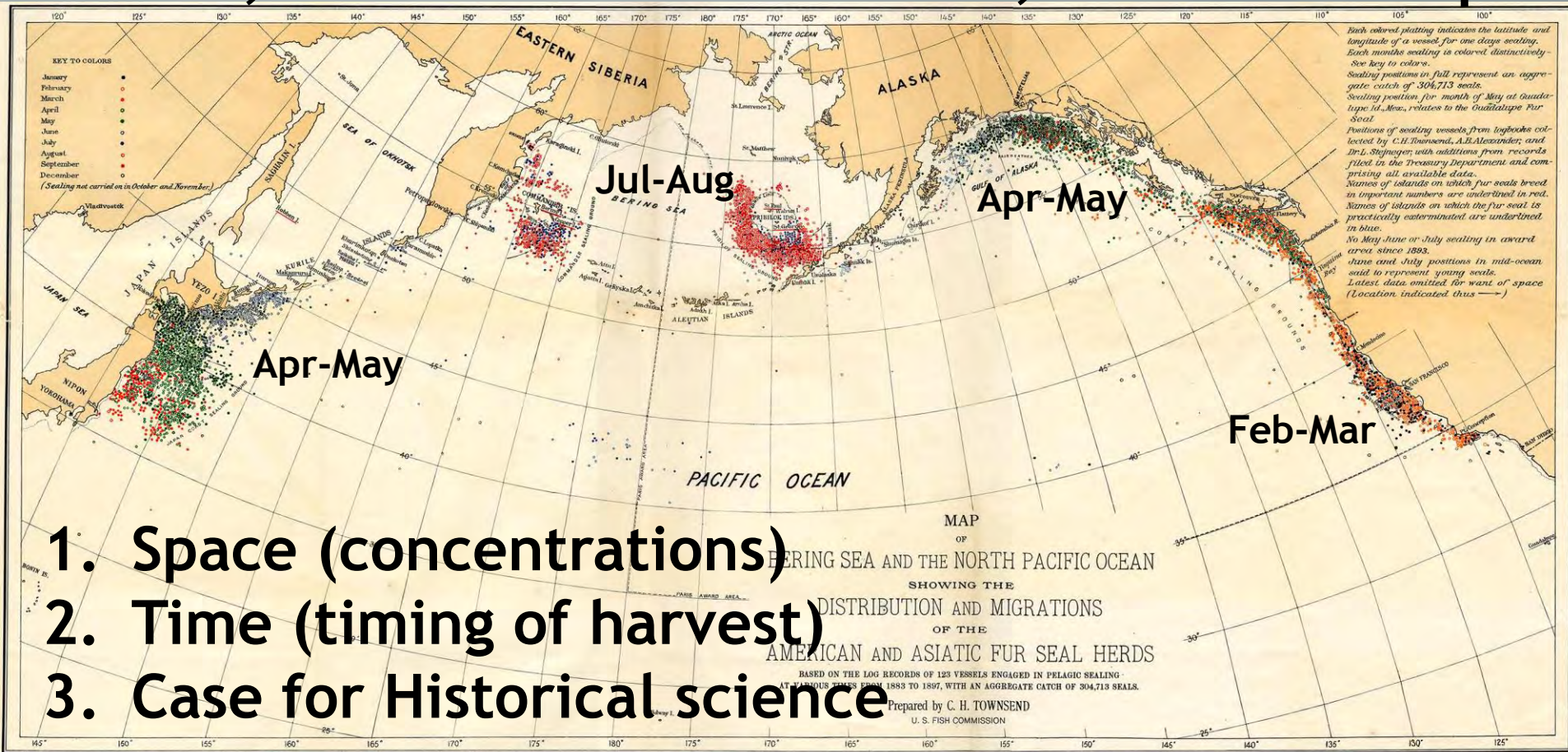


Environment and
Climate Change Canada

Environnement et
Changement climatique Canada



n=304,713 seals from 1883-1897; Townsend map



1. Space (concentrations)
2. Time (timing of harvest)
3. Case for Historical science

PICES Section - Marine Birds and Mammals (S-MBM)

Began in 1995 as PICES Working Group II

- Charged with assembling information on the prey consumption by marine mammals and seabirds in the PICES area
- Led to the Advisory Panel - Marine Birds and Mammals (AP-MBM)
 - Very active in the PICES community since 1995 (20+ years)
 - In short (ToR): bring marine birds and mammals to the scientific and outreach table...

interrelated themes

1. Diets and populations; prey consumption and top-down control of pelagic food webs



interrelated themes

2. Climate variability and change, bottom-up control of species, populations, distributions



interrelated themes

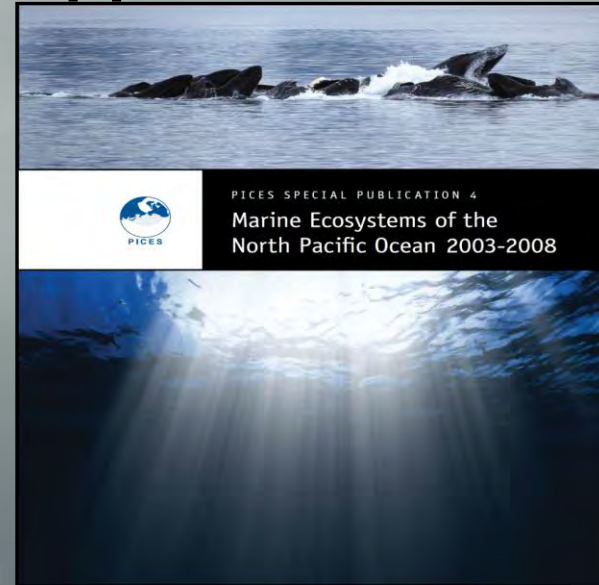
3. Spatial ecology of seabirds and marine mammals, “hotspots” of trophic activities, *places of significance in the ocean*



Humpback whale, CA sea lion

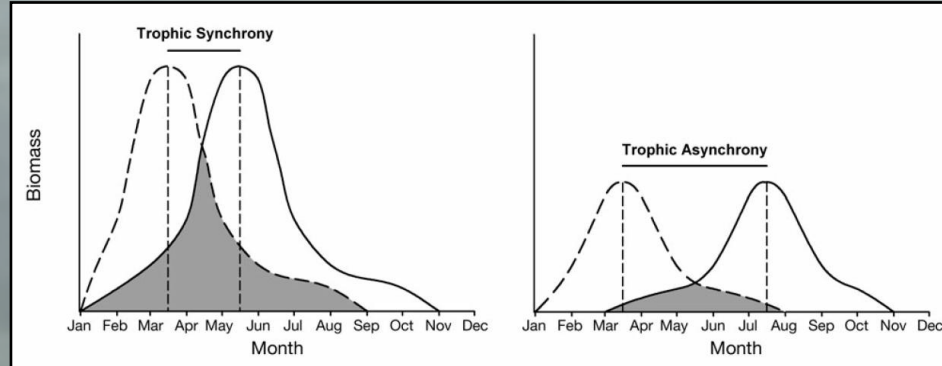
interrelated themes

4. Ecological indicators, sentinels of ocean health, pollution/contamination; applications to ecosystem management and ecosystem-approach to fisheries



Climate change and marine ecosystems

- 2005: Factors affecting distribution, foraging ecology, and life histories of top predators in the northwestern Pacific Ocean and its marginal seas
- 2007: Phenology and climate change in the North Pacific: Implications of variability in zooplankton production to fish, seabirds, marine mammals, and fisheries (humans)



- 2009: Integrating marine mammal populations and rates of consumption in models and forecasts of climate change-ecosystem change in the North Pacific and North Atlantic oceans
- 2014: Top predators as indicators of climate change: Statistical techniques, challenges, and opportunities

Directly observable

**...conspicuous at sea
(seabirds, whales) and
at island/coastal sites
(seabird, seal, and sea
lion breeding and
resting sites)**



Perceive environment at multiple scales

**...local, regional, basin-wide,
and even trans-hemispheric**

Mammals > Birds

Amenable

**...withstand some
manipulation, support
tracking devices, can be
used to sample marine
conditions, to depth**

Responsive

...signal-to-noise ratio is high; amplify natural and anthropogenic influences on ecosystems (food webs, contamination, etc.)

Natural integrators

**...“*bird’s-eye view*”
down into food webs
and physical drivers**

Big Stories

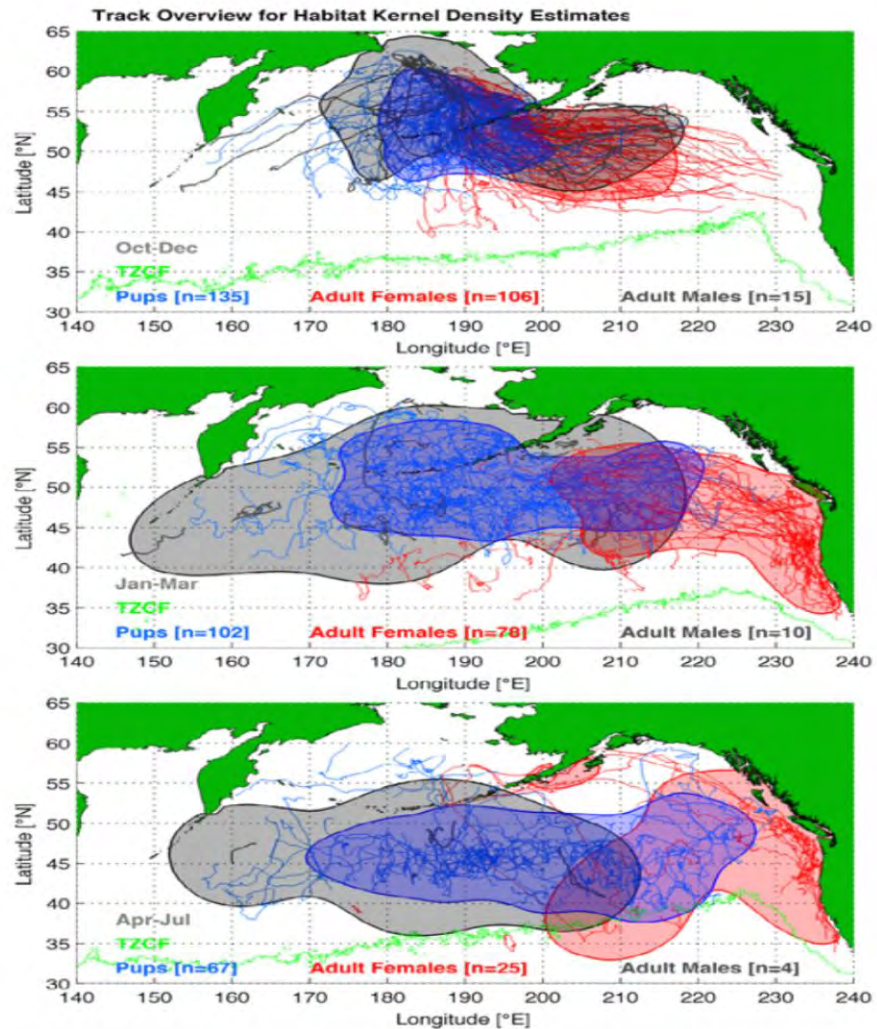
Where to next?



1. Technological advances

Novel information on wintering ecology (range, distribution, movements, survivorship)

Hourly information on animal lives...



Importance of winter to North Pacific ecosystem dynamics

(Hollowed et al. 1992 and many others
thereafter)

2. Recovery

~3-8% increase / year

-- impact on food webs and trophic controls?



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Fin Whale

Major consumers of zooplankton and small pelagic fish



Blue Whale

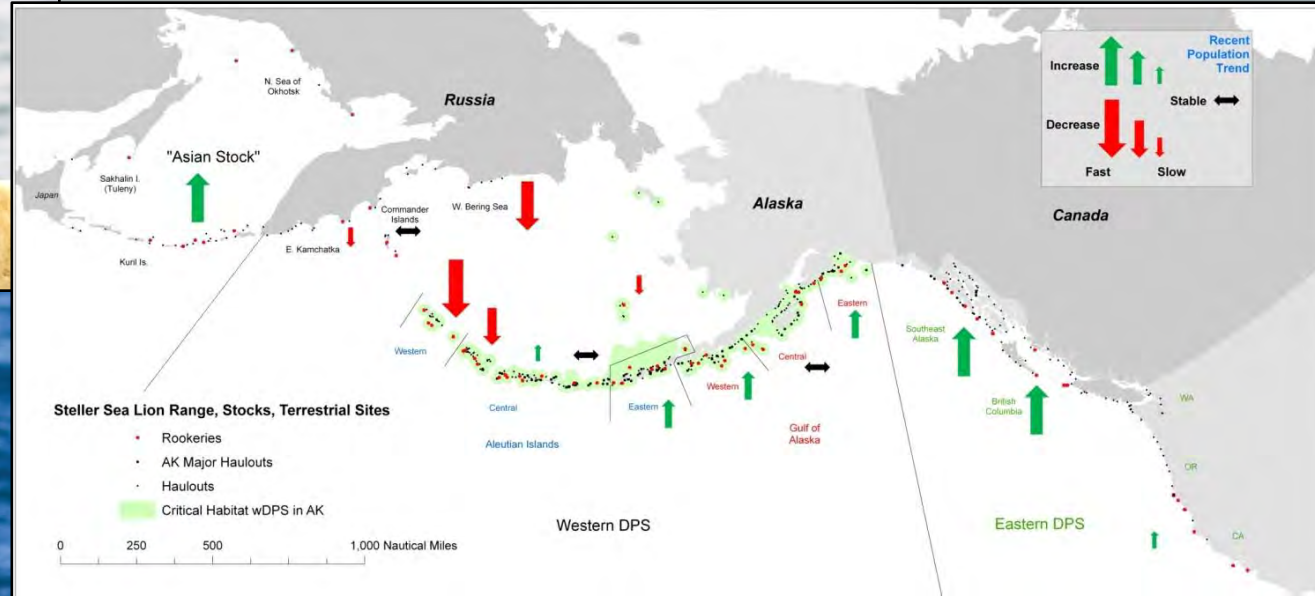
© Ron LeValley



Northern Sea Lion



3. Basin-scale spatial variation (decadal scale)



Northern Fur Seal

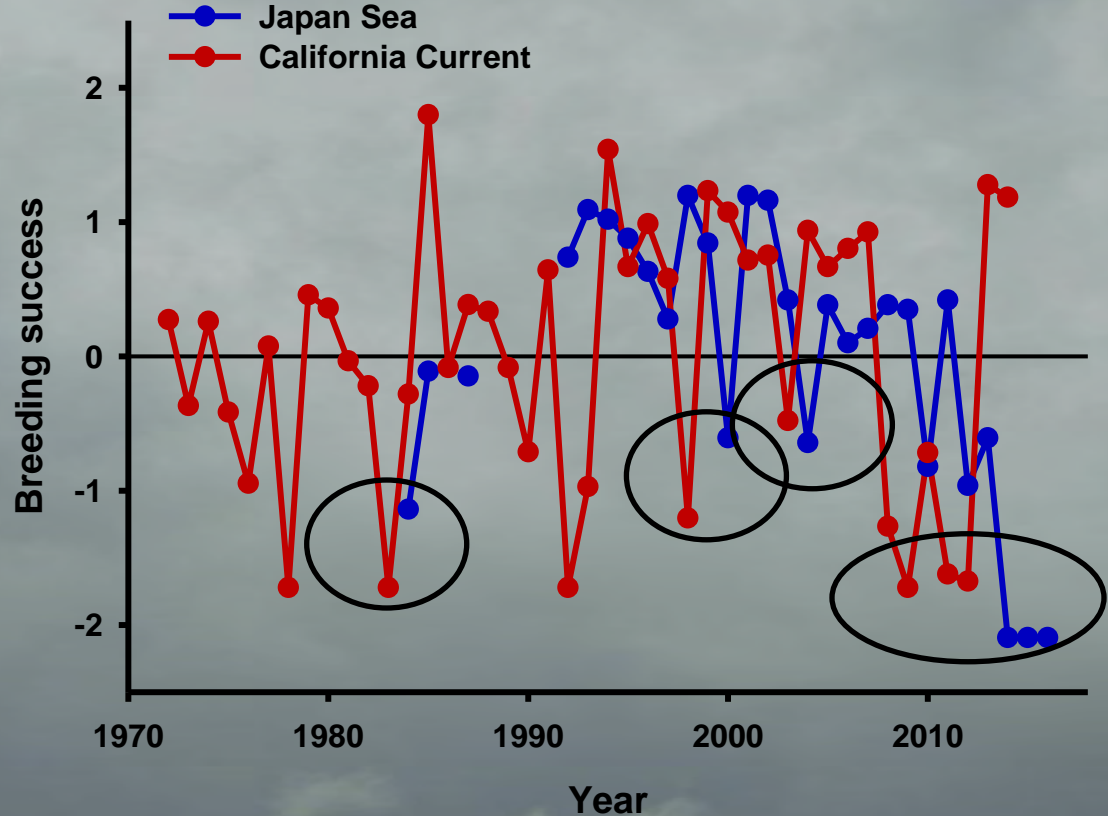


Image Courtesy NOAA/NMML

4. Basin-scale synchrony (interannual, lagged)

Data Courtesy Y. Watanuki & Point Blue Conservation Science

Brandt's Cormorant



5. Indicators of change

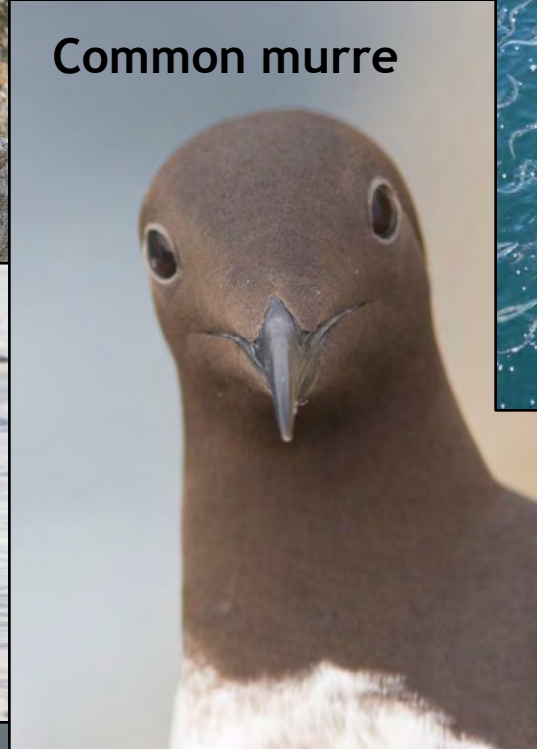
Cassin's auklet



Sand lance



Common murre

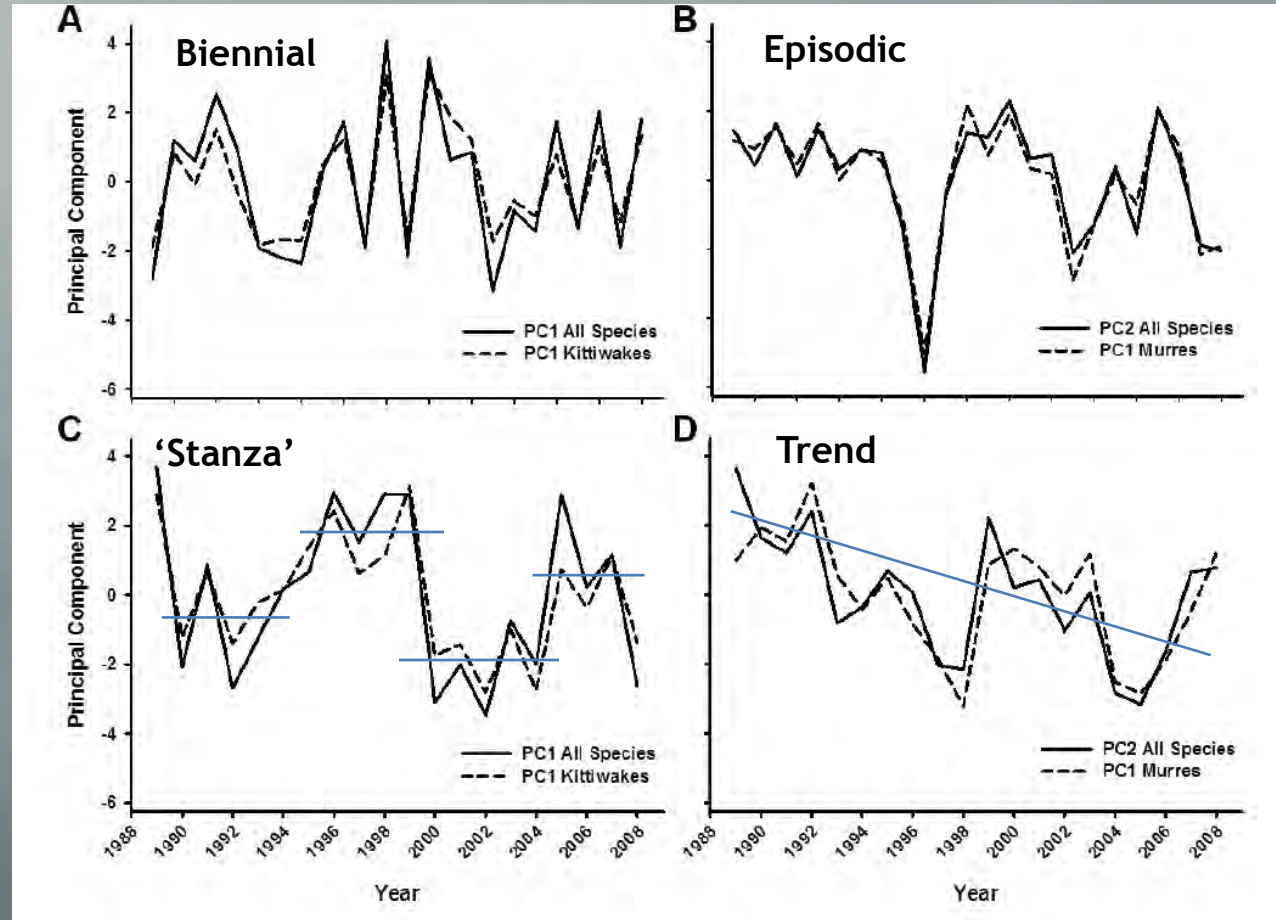


Brown pelican

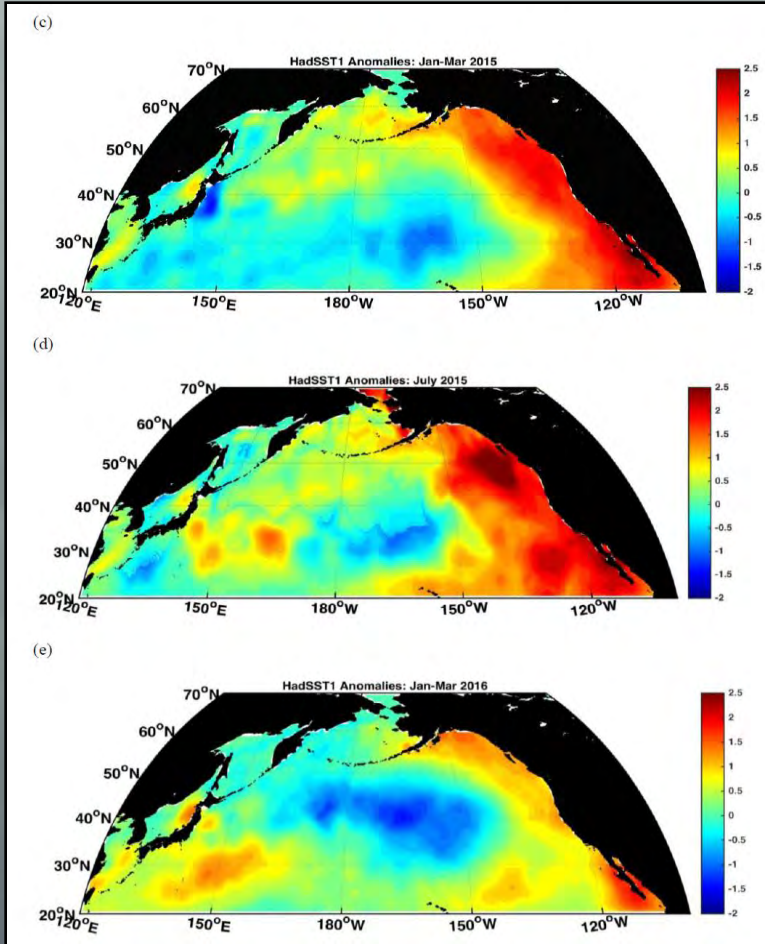


a. Long-term (4 modes of variability)

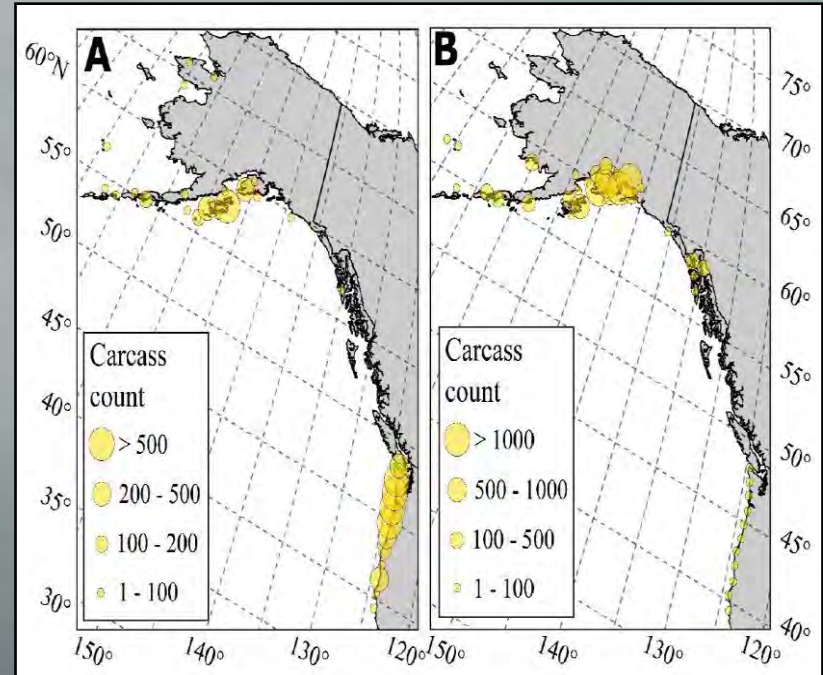
Eastern Bering Sea Seabirds



b. Short-term extremes (2014-2016 heat wave)

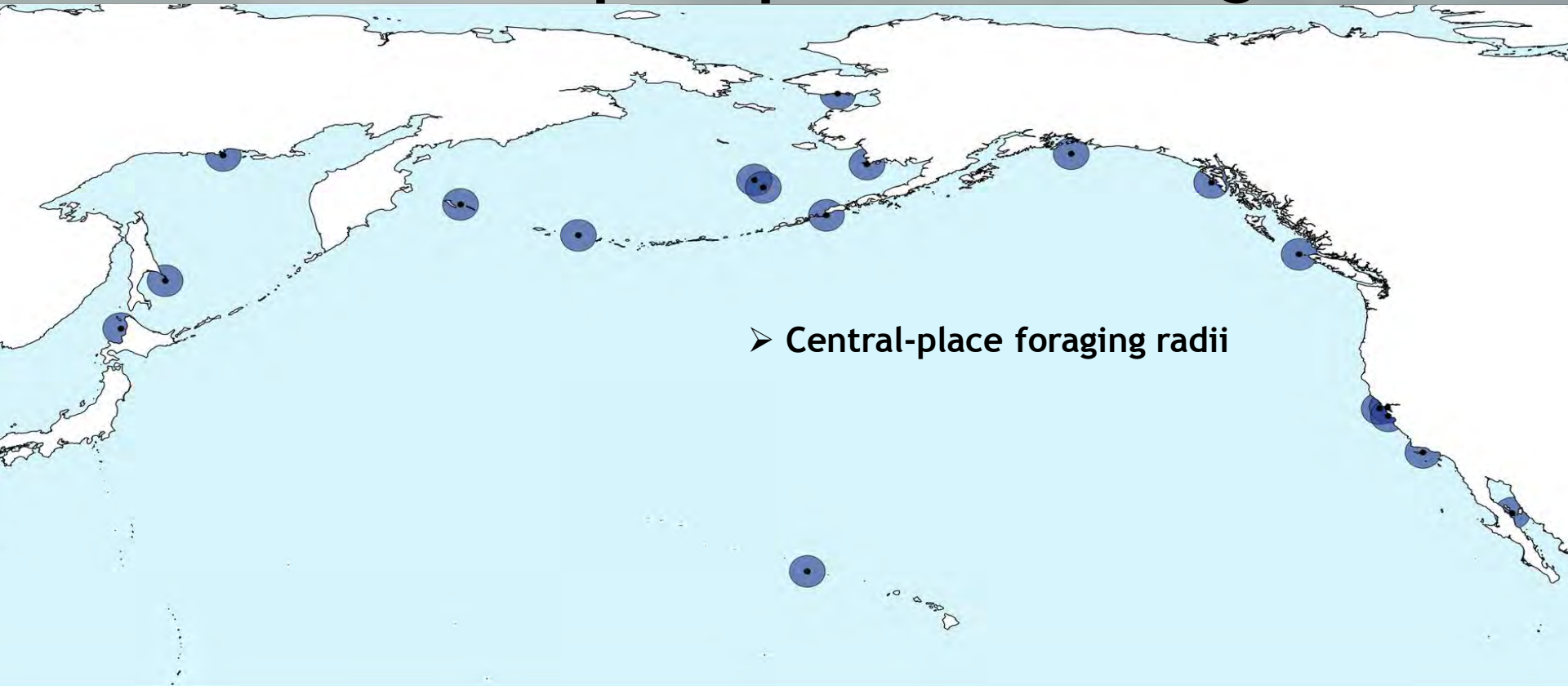


- Unprecedented auklet mortality event (2014)
- Unprecedented murre mortality event (2015)

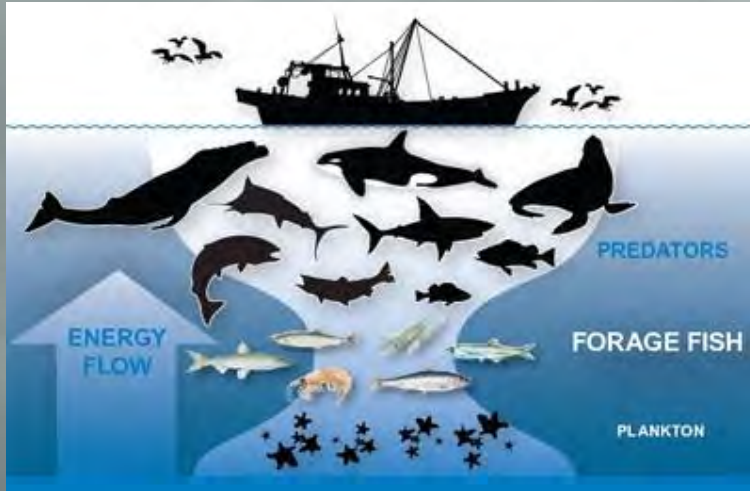


Parrish et al. in prep, Piatt et al. in prep

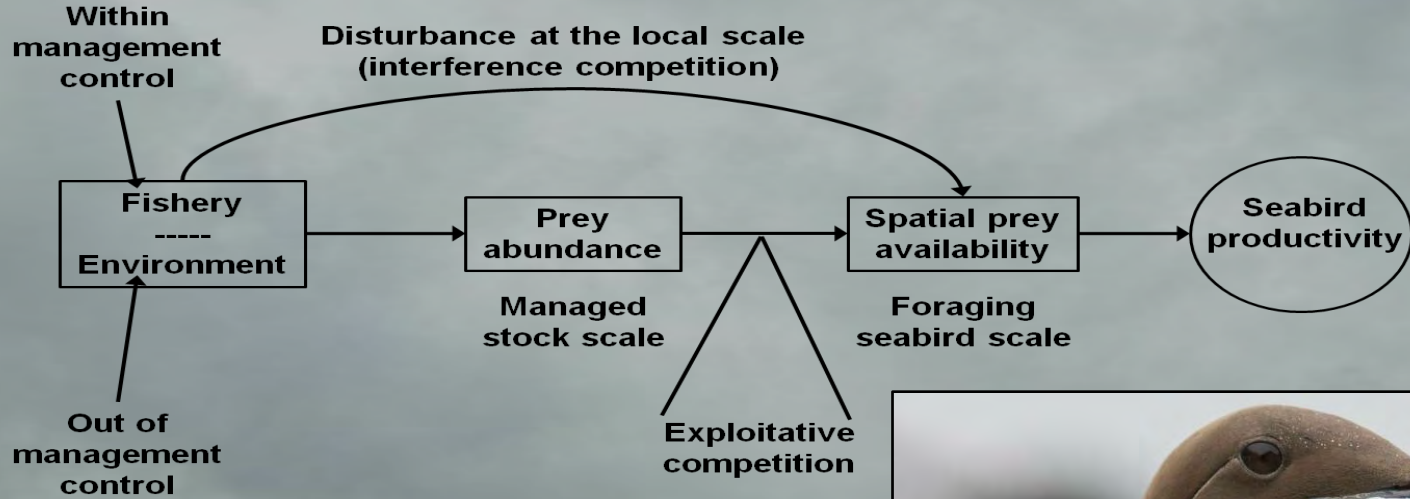
Sites of long-term (25+ years) marine bird and pinniped monitoring



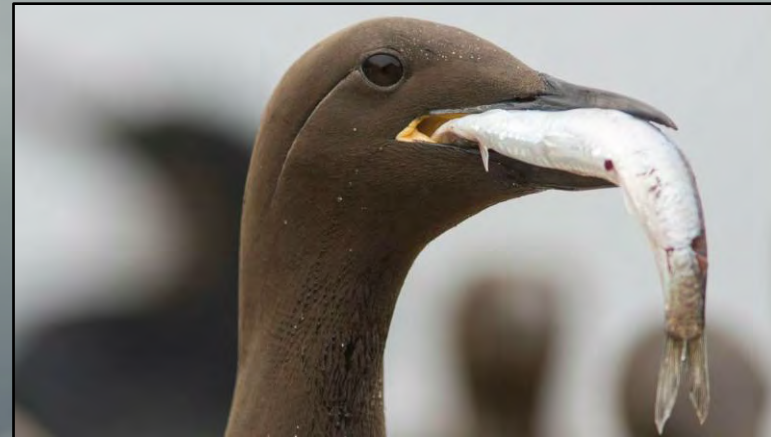
6. Fisheries interactions (human dimension) (upper trophic level predators)



Marine birds/mammals may compete with fisheries (and *vice versa*)



Difficult to study, highly controversial,
but very important to FUTURE



Thank you for listening

(time for reception!)

Photos: Ron LeValley

Making this PPT pretty: Sarah Ann Thompson
S-MBM, colleagues far and wide: various ideas

