Evaluating habitat suitability predictions: Using contemporary sightings and prey data to assess model assumptions

Rowenna Gryba
Stantec Consulting Ltd.

Edward Gregr
SciTech Consulting Ltd.

Photo: John Ford

Outline

Evaluation of right whale habitat suitability using independent data

- Model assumptions
- Evaluation methods and data
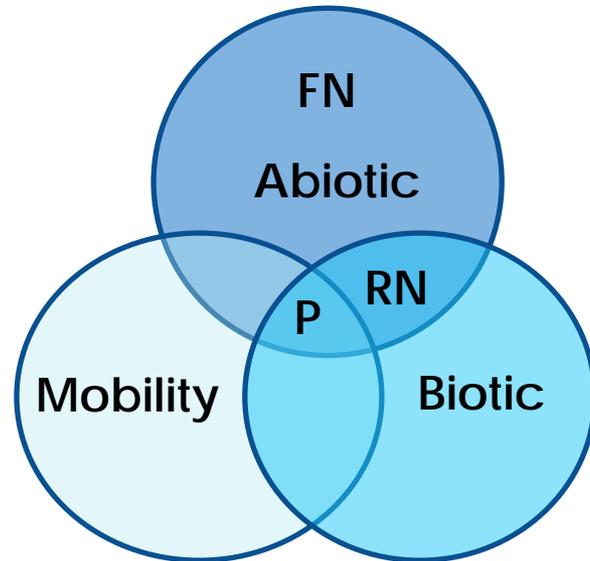- Results

Model Assumptions

What are we predicting?

- Does habitat suitability = species occurrence?

- Does habitat suitability = foraging areas?

Model Assumptions

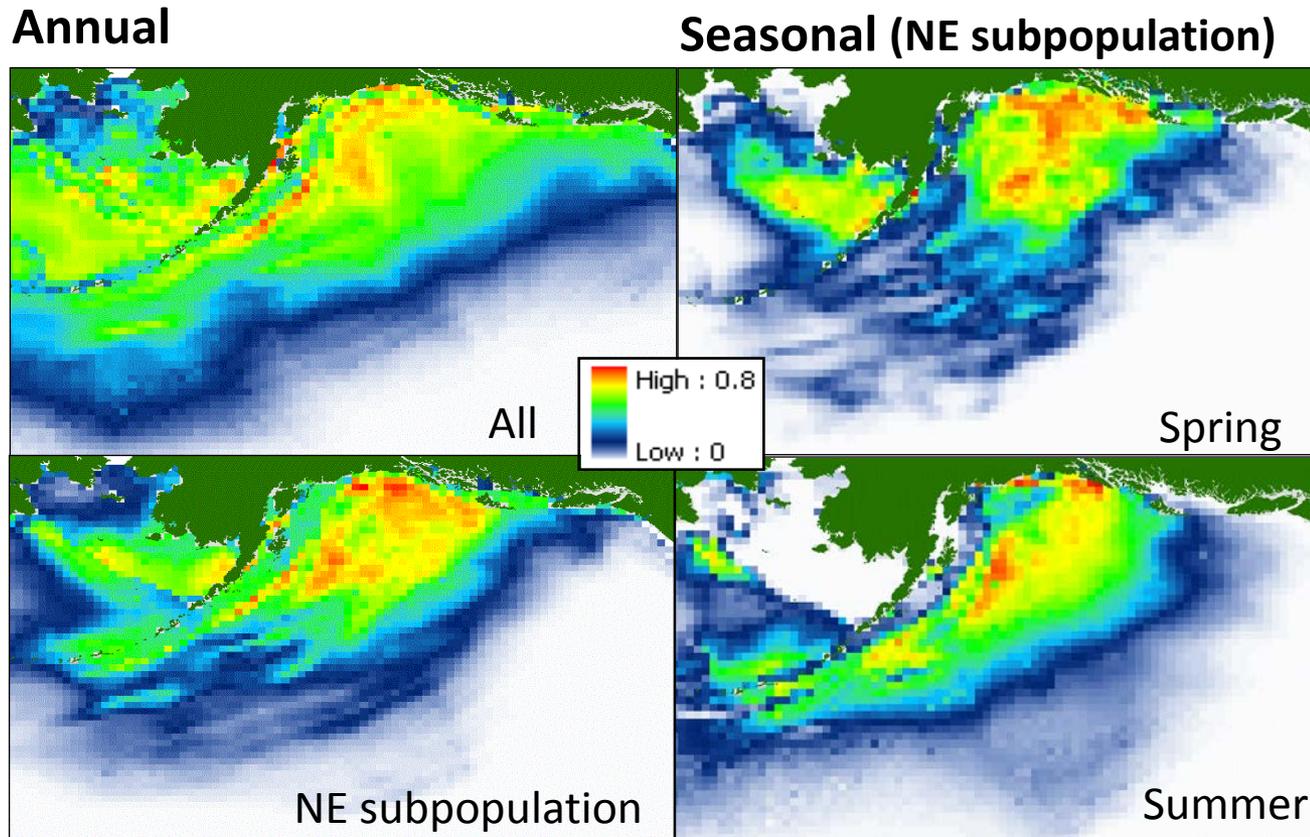- Niche concepts (Soberon & Peterson 2005)

Fundamental Niche (FN) = Abitioc
Realized Niche (RN) = Abiotic ∩ Biotic
Distribution(P) = Abiotic ∩ Biotic ∩ Mobility

Right Whale habitat suitability

Annual   **Seasonal (NE subpopulation)**

Habitat predictions for North Pacific right whales in the North Pacific based on historic accounts and physical oceanography. (Gregr 2011, Endangered Species Research).
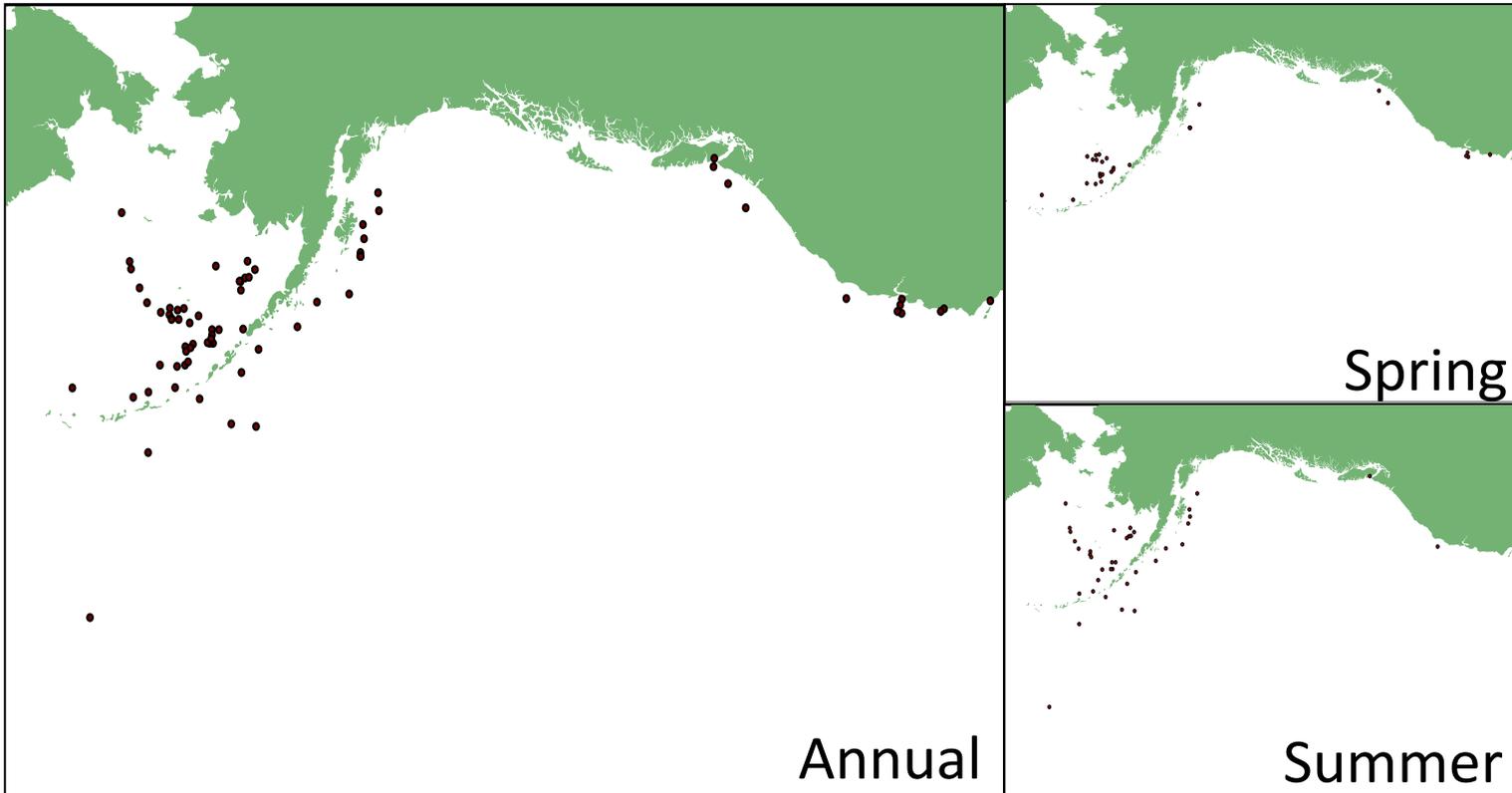
Evaluation

1. Operational validation

- Does the model mimic the system?

Does habitat suitability = occurrence?
Fundamental Niche?

Evaluation

Contemporary Sightings

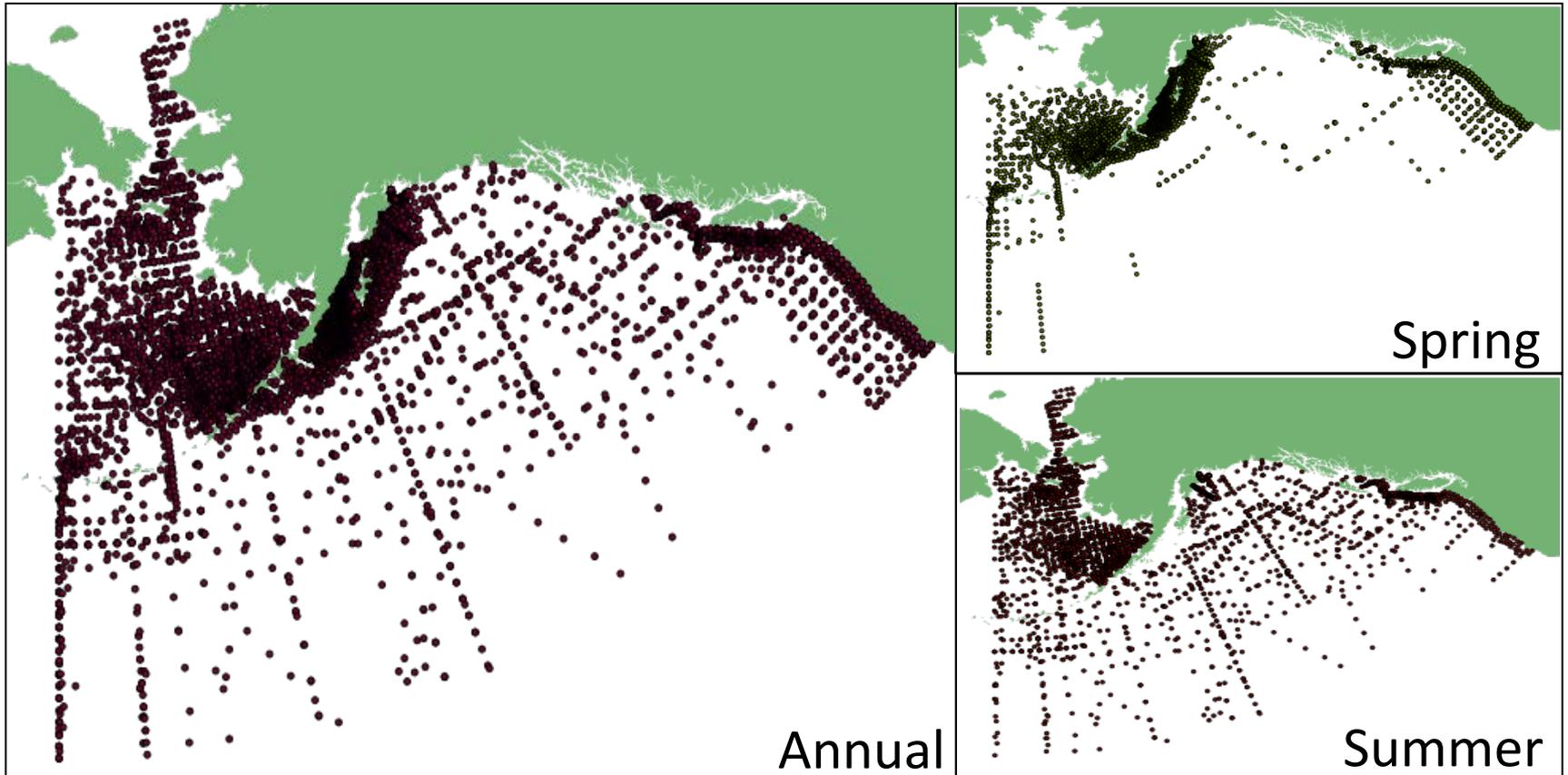Brownell et al. (2001)

Evaluation

2. Conceptual validation

- Are the model hypotheses correct?

Does habitat suitability = foraging areas?
Realized Niche?

Evaluation
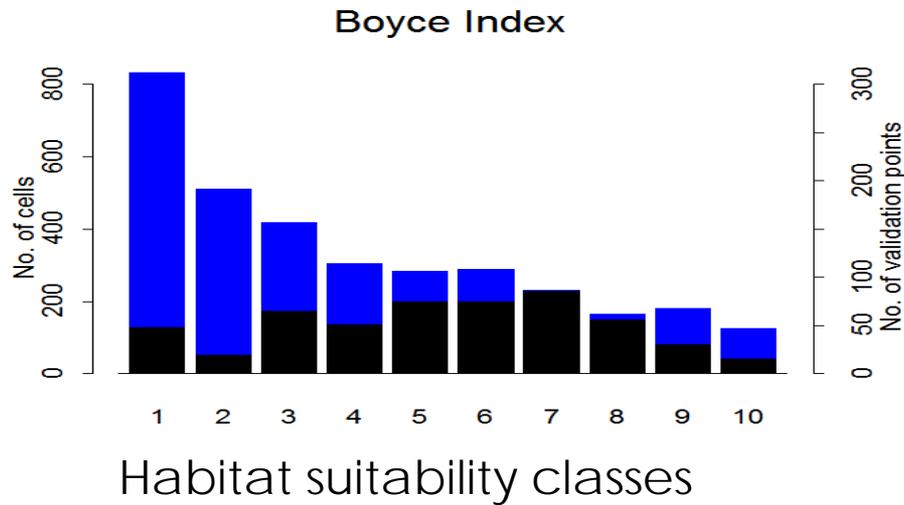
Prey data

Annual · Spring · Summer

DFO & NMFS (1951-2000)

Evaluation Methods

1. Boyce Index (Hirzel et al. 2006)
2. Adjusted Skewness (Gregr & Trites 2008)

- Both methods:
  - Presence only
  - Incorporate range of habitat suitability
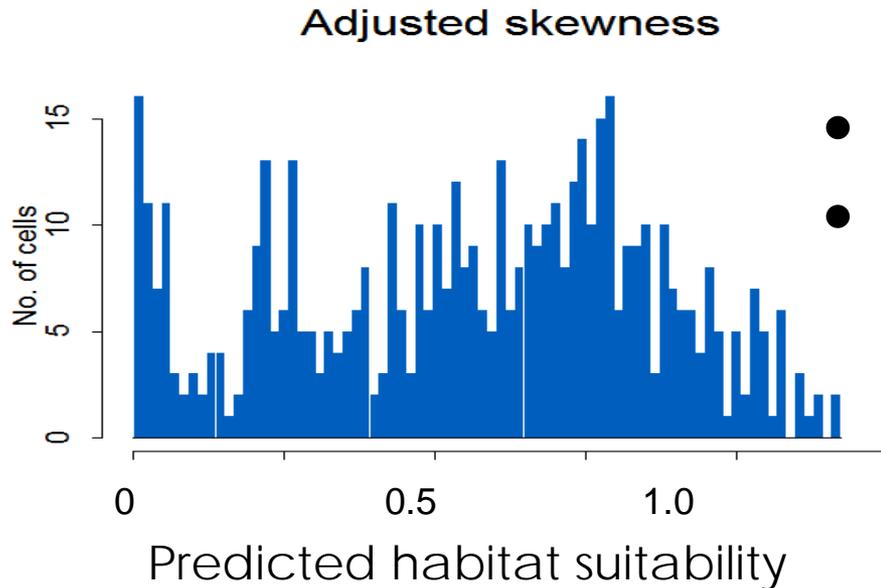 - Associate presence data habitat suitability classes

Evaluation

Boyce Index

Boyce Index

- Spearman's Rank
- 10 classes

Evaluation

Adjusted Skewness

- Measure of asymmetry
- 100 classes

Results: North Pacific Scale

Spatial Extents	Boyce Index North Pacific		Adjusted Skewness North Pacific	
Evaluation Data Set	Sightings	Prey	Sightings	Prey
Model:				
All Annual	0.816 (n=51)	0.915 (n=517)	-0.630	-0.527

Habitat suitability

High : 0.8

Low : 0
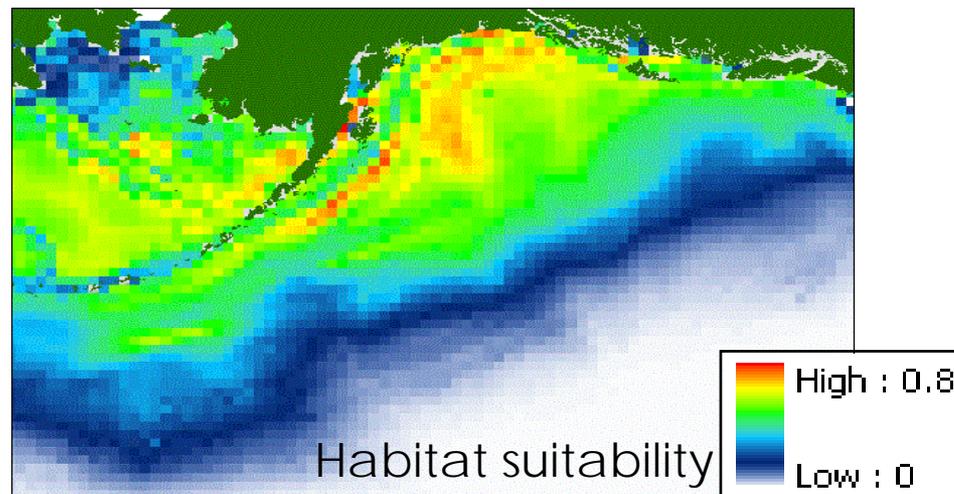
Results: North Pacific Scale

Realized niche ≈ Fundamental niche

Habitat suitability predictions are likely estimating potential distribution

Results: Sub-population scale

NE Sub-population

Spatial Extents	Boyce Index North Pacific		Adjusted Skewness North Pacific	
Evaluation Data Set	Sightings	Prey	Sightings	Prey
Model: NE Subpopulation				
Annual	0.239 (n=51)	0.442 (n=517)	-0.066	-0.128
Spring	-0.356 (n=19)	-0.721 (n=310)	0.397	0.477
Summer	0.103 (n=34)	0.709 (n=400)	0.123	-0.094

Habitat suitability   Annual

High : 0.8
Low : 0

Spring

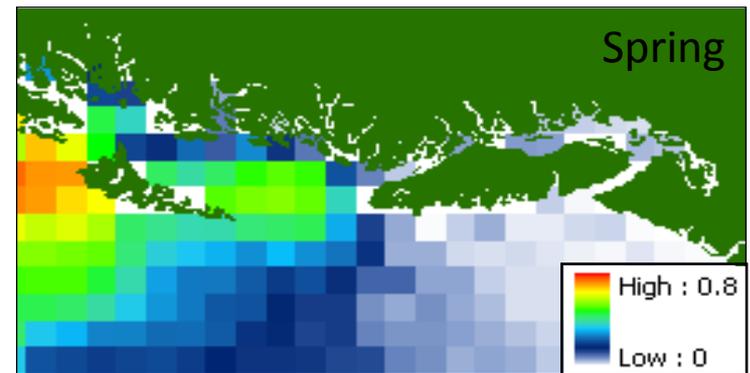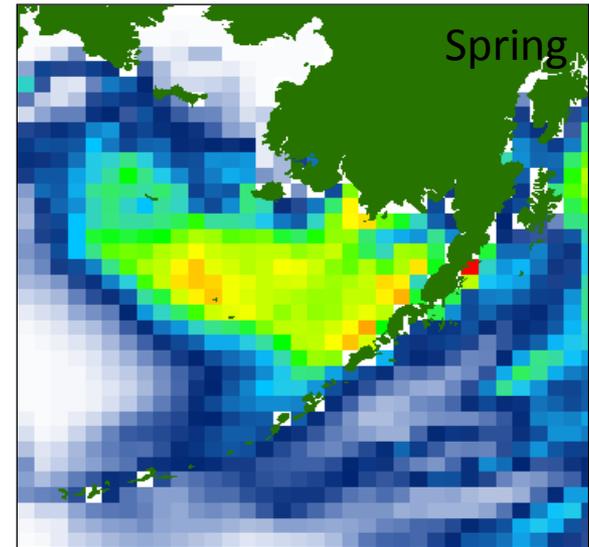Summer
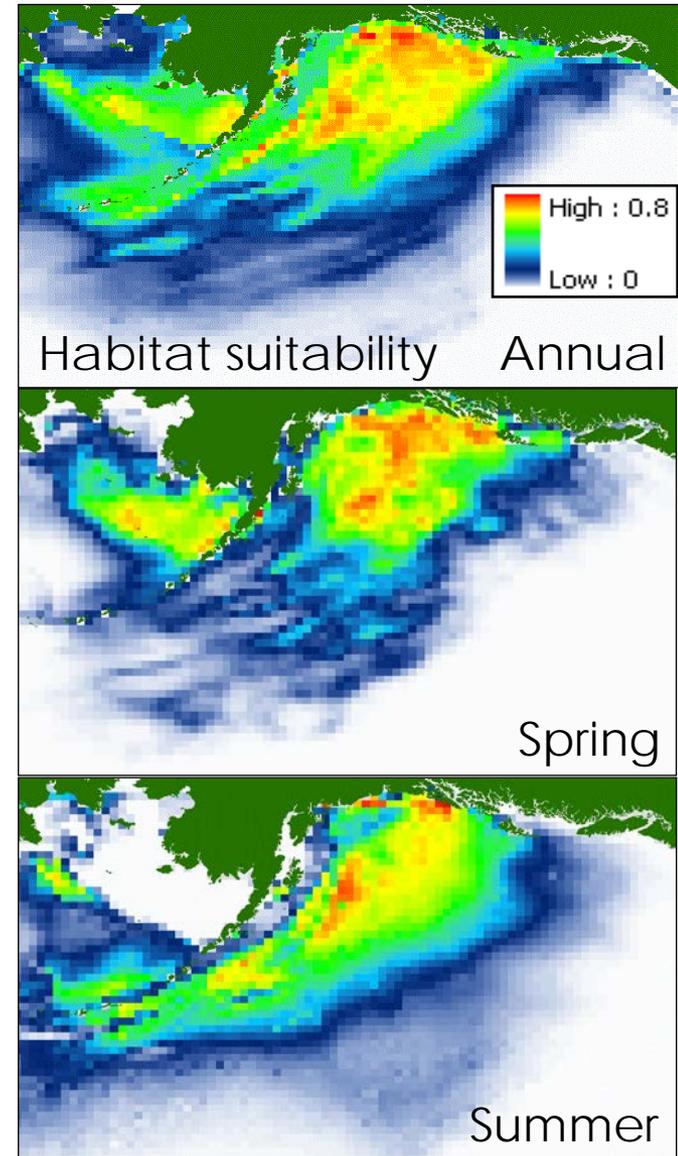
Results at Sub-population scale

Annual model validation

- Basin wide – dispersion largest influence
- Sub-population – inter-specific interactions
- Prey data is a better evaluator at this scale $\longrightarrow$ Conceptual Validation

Seasonal model validation

- Spatial bias in validation data

Results: Regional Scale

Spring

Spring

Spatial Extents	Boyce Index Regional		Adjusted Skewness Regional	
	Berring	BC	Berring	BC
Evaluation Data Set	Prey	Prey	Prey	Prey
Model:				
All Annual	0.377	0.568	-0.267	-0.550
NE Subpopulation Annual	-0.304	0.411	-0.03	-0.256
Spring	-0.620	0.128	0.448	0.976
Summer	0.624	0.204	-0.231	-0.446

High : 0.8
Low : 0

Results at regional scales

Bering Sea annual model is missing something at the conceptual level?

Seasonal prey data allows for further investigation into model performance.

- Apparent when looking between spring and summer predictions

Conclusions

- Different types of validation data can expand on our knowledge on operational and conceptual levels.

- Validation at different scales can give more informative results

- Seasonal prey data provides further insight

Thank you!

Photo: John Ford