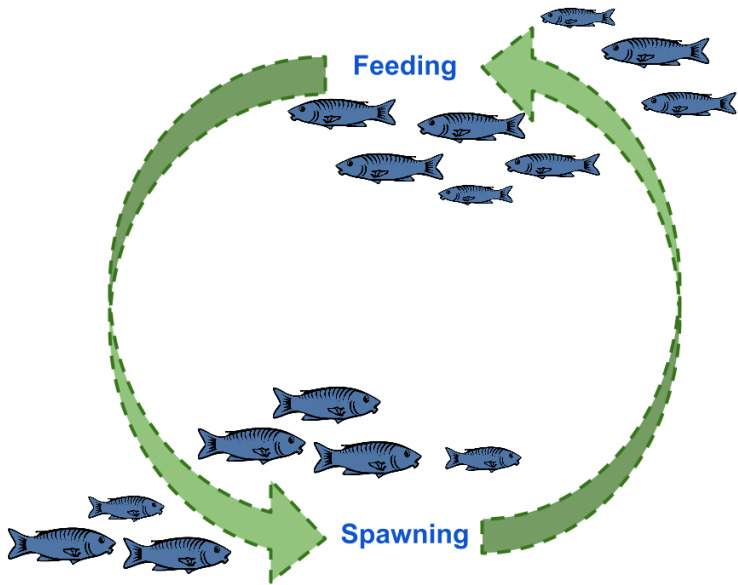


A movement model to assess management performance for transboundary stocks

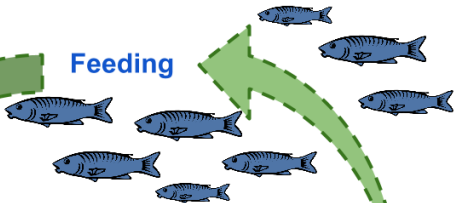
Catarina Wor • UBC • catarinawor@gmail.com

Co-authors: Carl Walters, Steve Martell and Murdoch McAllister

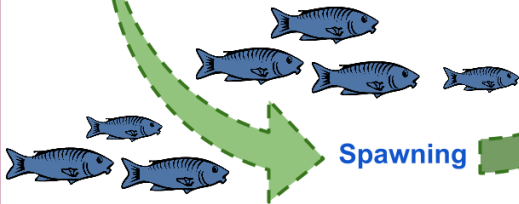


Country A

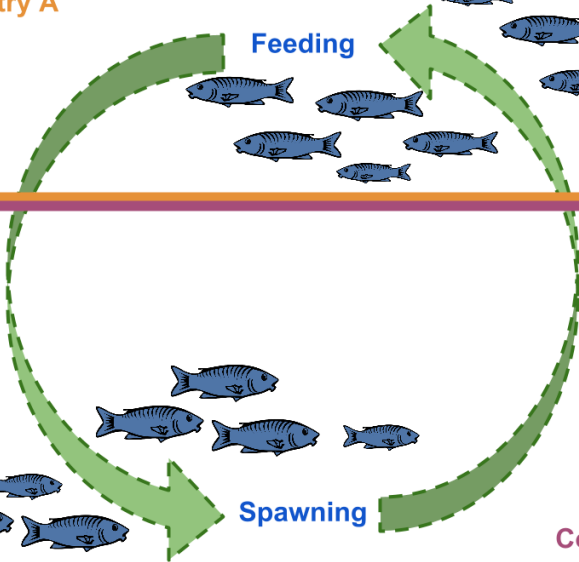
Feeding



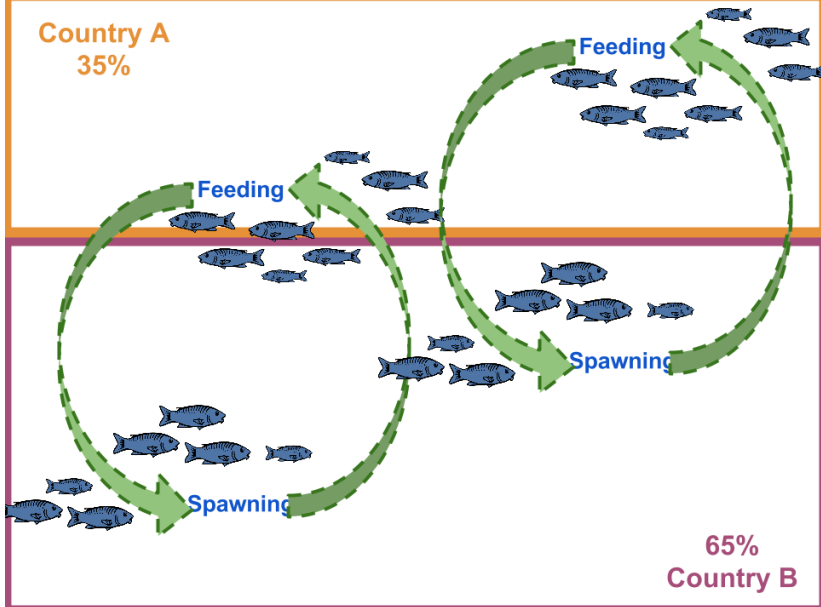
Spawning



Country B

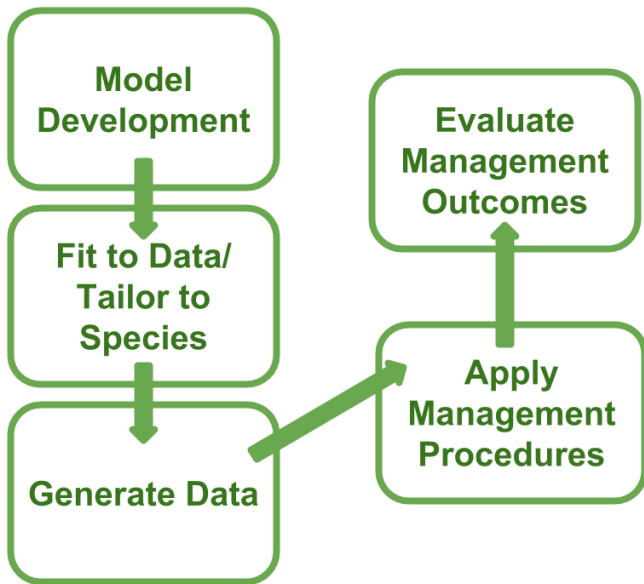


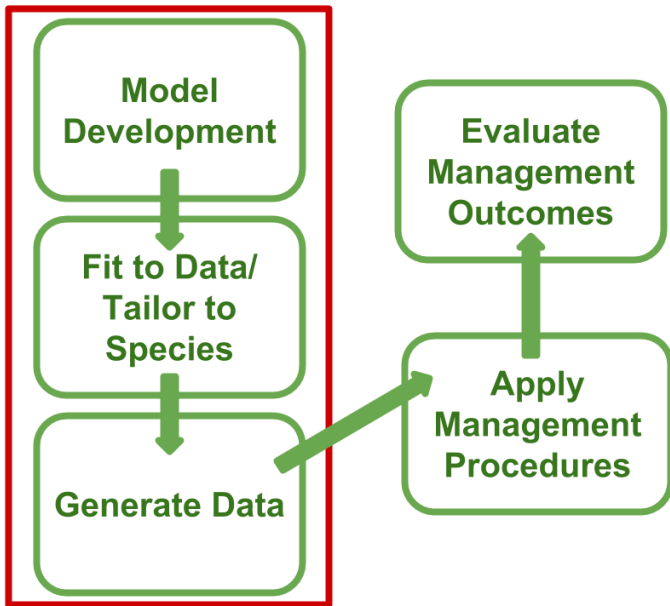
Country A
35%

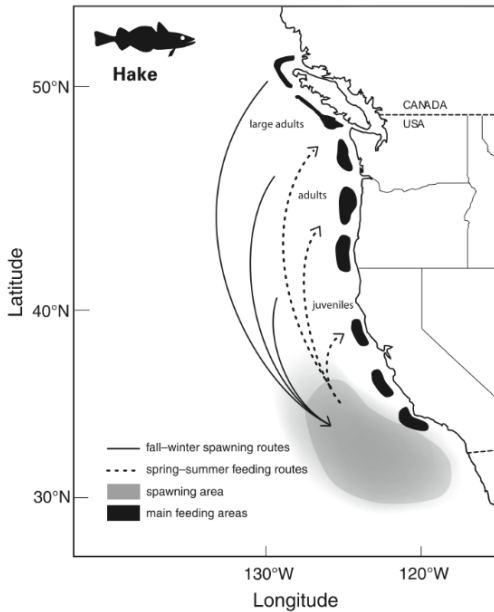


65%
Country B

Can we identify
management procedures
that are robust to migration
variability?







From: Agostini et al. 2006

Modeling migration

- Lagrangian movement model:
 - continuous in time and space
 - age/size structured movement
 - allow for movement variability:
abundance and environmentally driven
- Can be fit to data: spatial age composition

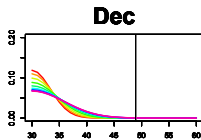
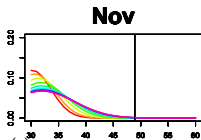
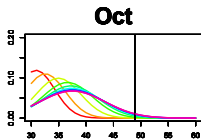
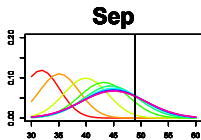
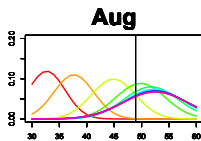
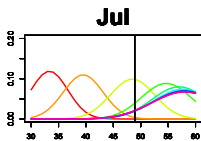
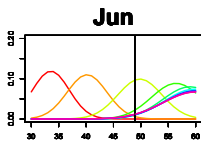
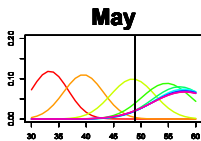
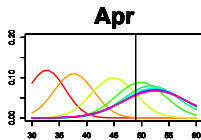
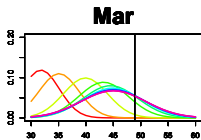
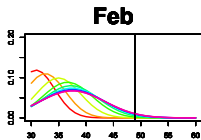
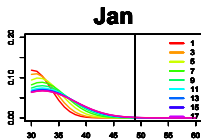
Lagrangian movement model - fish movement

$$\bar{X} = X_{min} + (X_{max} - X_{min}) \cdot \left(0.5 + 0.5 * \sin \left(t \cdot \frac{2\pi}{T} - t_0 \cdot \frac{2\pi}{T} \right) \right)$$

$$pos_{a,X,t} \sim \mathcal{N}(\bar{X}, \sigma)$$

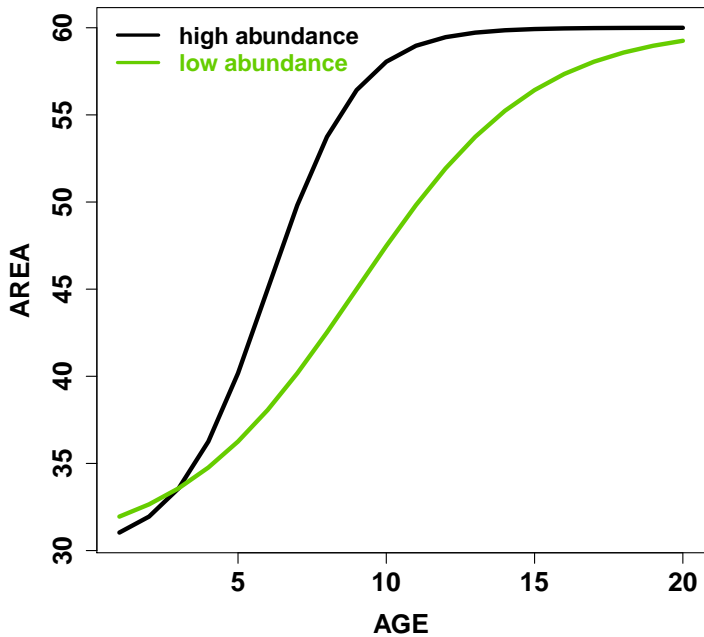
Lagrangian movement model - Fishing effort

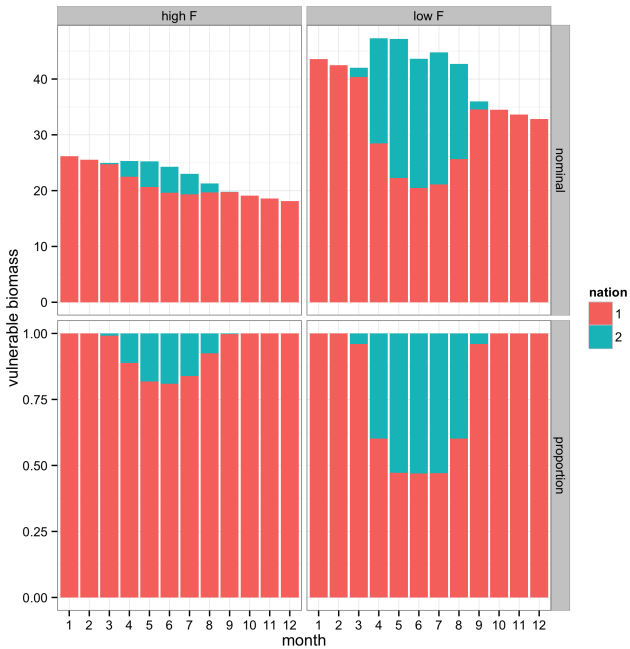
- Gravity model for effort distribution
- Higher fishing effort in areas with observed high abundance
- Areas with low likelihood of fishing (distance, bycatch)



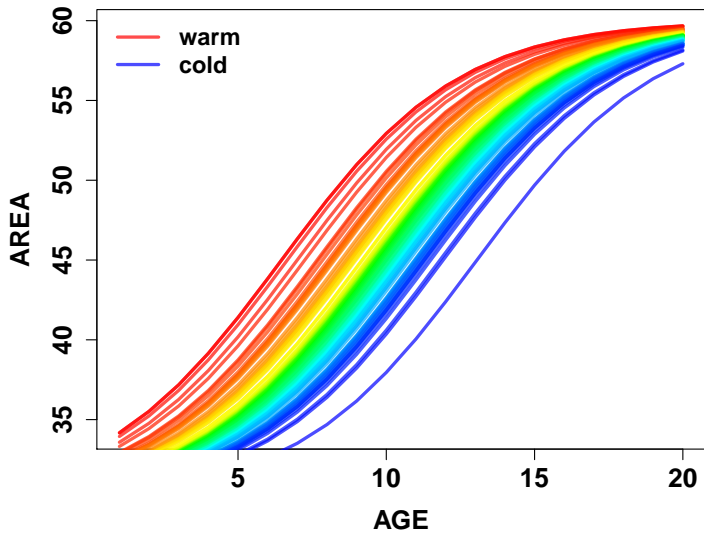
Latitude ($^{\circ}$)

Migration changes with
abundance





Migration changes with environmental changes





Next steps:

- Evaluate how different movement scenarios impact management outcomes
- Identify management procedures that mitigate unexpected impacts of movement variability



Canadian Fisheries
Research Network

Thank you!