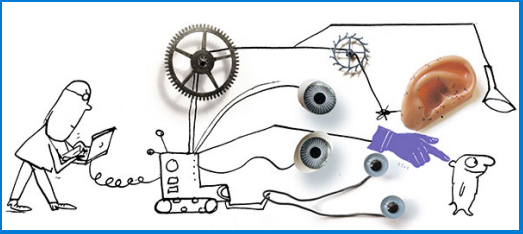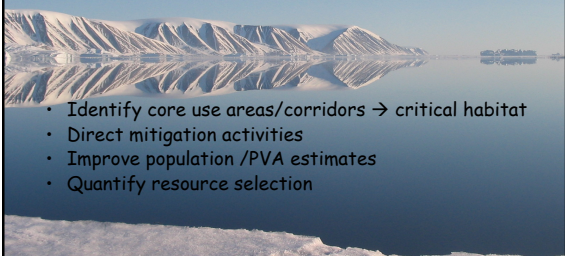Animal Movement Modeling Session

Introduction

Kristin Laidre
University of Washington, Seattle

Understanding how animals make use of their environment and the consequences on fitness (i.e., survival and reproduction) is a central theme of ecology

- Identify core use areas/corridors → critical habitat
- Direct mitigation activities
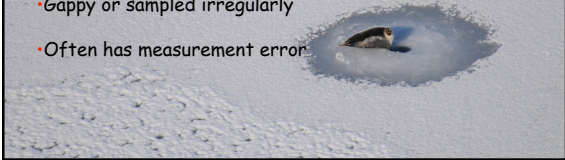- Improve population /PVA estimates
- Quantify resource selection

What technologies we using to study movement?

- VHF transmitters
- Satellite-liked radio transmitters (ARGOS) – including temperature sensing tags (external and internal)
- 'FastLoc' GPS (Global Positioning System) transmitters
- Light level geolocation
- Archival Time-Depth-Recorders - with numerous capabilities like fluorescence, acoustic recording, velocity, body motion
- Video cameras/'Crittercams'
- Cellular phone/SMS

Movement data in a nutshell:

- Longitudinal
- Spatially and temporally autocorrelated
- Collected from a sample of individuals and expected to represent population-level behavior
- Gappy or sampled irregularly
- Often has measurement error

Added bonus with *marine mammal* data:

- Very low sample sizes (# of individuals)
- Few locations per day (per individual)
- Large variation in tag attachment durations (usually short)
- Poor location qualities

Our speakers

Dr. Rob Schick – Duke University, USA

Dr. Eliezer Gurarie – University of Helsinki, Finland

Two great talks!

1. Dr. Rob Schick – "Understanding movement data and movement processes: what's the state of the art?"

2. Dr. Eli Gurarie – "Seasonal sea otters, foraging fur seals, and whimsical wolves: Analysis of individual animal movement data on various scales"

Dr. Rob Schick

2002 M.S. and 2009 Ph.D. in Ecology from the Nicholas School of the Environment at Duke University on movement modeling of right whales and bluefin tuna.

Also spent 2 years at New England Aquarium working on bluefin tuna and right whales, and at NOAA in Santa Cruz leading a GIS team on salmonid research.

Lives in Chicago, researching movements of leatherback turtles in the Pacific - and 4-year olds in the swimming pool.

Dr. Rob Schick

Review of a wide range of techniques including diffusion modeling, descriptive statistics (Levy walks and fractal dimensions), random walk and CRW models, multiple behavior modes, long distance dispersal processes, first passage time (FPT) methods, resource selection functions (RSF), and mechanistic home range modeling.

Schick R, S. R. Loarie, F. Colchero, B. D. Best, A. Boustany, D. A. Conde, P. N. Halpin, L. N. Joppa, C. M. McClellan and J.S. Clark. 2008. Understanding movement data and movement processes: current and emerging directions. Ecology Letters 11: 1338-1350.

Dr. Rob Schick

Application of the model developed in the 2008 Ecology Letters paper to compare how migrating right whales view habitat with respect to ship traffic restrictions around eastern seaboard ports.

Schick R, S. R. Loarie, F. Colchero, B. D. Best, A. Boustany, D. A. Conde, P. N. Halpin, L. N. Joppa, C. M. McClellan and J.S. Clark. 2008. Understanding movement data and movement processes: current and emerging directions. Ecology Letters 11: 1338-1350.

Schick, R., P. N. Halpin, A. J. Read, C. K. Slay, S. D. Kraus, B. R. Mate, M. F. Baumgartner, J. J. Roberts, B. D. Best, C. P. Good, S.R. Loarie, and J. S. Clark. 2009. Striking the right balance in right whale conservation. Can. J. Fish. Aquat. Sci. 66(9): 1399-1403

Dr. Eli Gurarie

MS in 2000 from University of Marseille, France

Ph.D. in 2008 in Quantitative Ecology and Resource Management, University of Washington, on animal movement modeling.

Currently a post-doctoral researcher in the Metapopulation Research Group in Helsinki, Finland where he has betrayed his aquatic roots and works on wolf movements.

Dr. Eli Gurarie

The behavioral change point analysis- or BCPA– detects behavioral changes in a movement dataset with minimal a priori assumptions, and in a way that accounts robustly for measurement error and irregular sampling. Manuscript uses fur seal tracking data as an example.

Gurarie, E., R. Andrews, and K. L. Laidre. 2009. A novel method for identifying behavioral changes in animal movement data. Ecology Letters 12: 395-408.

Dr. Eli Gurarie

Manuscript shows how dispersal processes are controlled by heterogeneity in a population.

Gurarie, E., R. Andrews, and K. L. Laidre. 2009. A novel method for identifying behavioral changes in animal movement data. Ecology Letters 12: 395-408.

Gurarie, E., J. Anderson, and R. Zabel. 2009. Continuous models of population-level heterogeneity inform analyses of animal dispersal and migration. Ecology 90(8):2233-2242

Enjoy!