Free-ranging Marine Mammals: The Next Ships of Opportunity?

Laurie L. Baker[1], Ian D. Jonsen[2], Joanna Mills Flemming[1], Sara J. Iverson[1]
[1]Dalhousie University, [2]Macquarie University

Introduction

- Paired with GPS telemetry, animal-borne instruments provide a unique opportunity to collect spatially-linked, fine-scale information at a scale relevant to the animal's behaviour.
- However, sampling locations are non-random and cannot be predetermined. Therefore, we need to account for biases in sampling effort.
- We explore the individual and collective sampling effort of grey seal *(Halichoerus grypus)* **bioprobes** deployed with two-way (transmitting and receiving) acoustic transceivers in 2011.
- We relate sampling effort to detections of other instrumented grey seals, acoustically tagged fish by bioprobes, and partial acoustic transmissions.

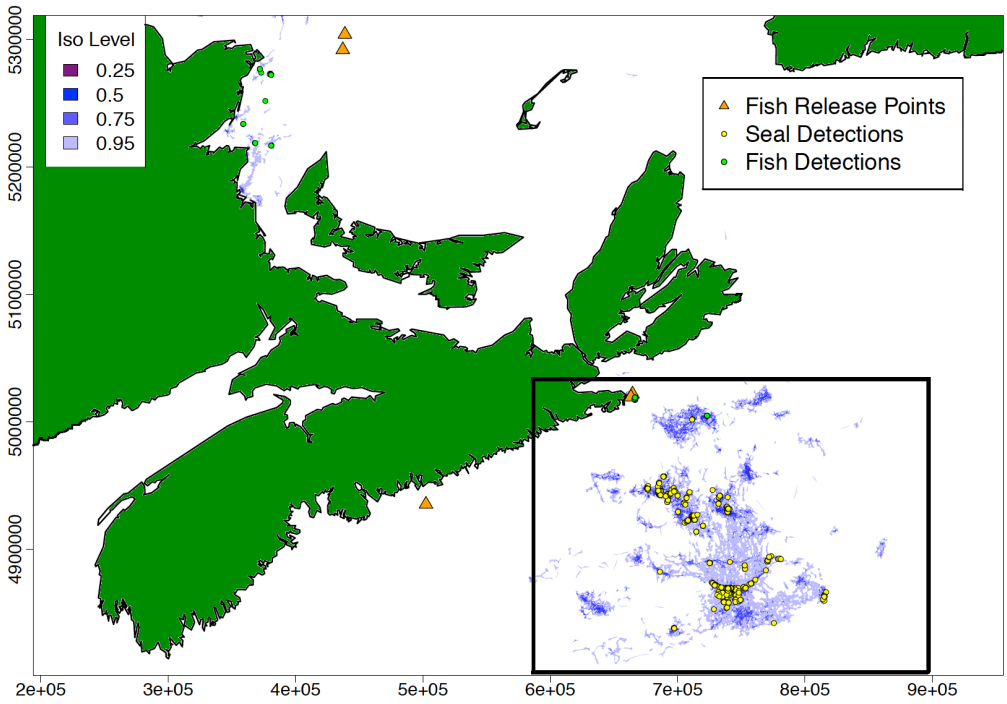

Figure 1. Survey effort of all 16 seals in 2011 in relation to seal (yellow), fish (green) detections (points), and fish release points (orange triangles). Survey effort is represented by isopleths (Iso Level) showing densely surveyed (purple, 25% of locations) and sparsely surveyed (light blue, 95% of locations) areas.

Methods

- **T-LoCoH** is a non-parametric Lagrangian method for constructing utilization distributions by aggregating local minimum convex polygons (MCPs) constructed around each location point.
- MCPs are aggregated using nearest neighbours.
- **Isopleths (contours)** are used to represent sampling effort in each area, from the most heavily used 25% of points to the least heavily used areas that include 95% of points).
- We linked detections of other instrumented grey seals, acoustic tagged fish, and partial acoustic transmissions to locations interpolated from the seal tracks.
- We distinguished acoustic pings originating from VEMCO transmitters from background noise by the signature intervals between each ping in their acoustic codes (Baker et al. 2014).

Objectives

1. **Estimate the area collectively sampled by multiple bioprobes using the *R* package, T-LoCoH (Lyons et al. 2013).**
2. **Identify the areas most heavily surveyed using isopleths.**
3. **Relate detections and partial acoustic transmissions recorded by bioprobes to survey effort.**

Results

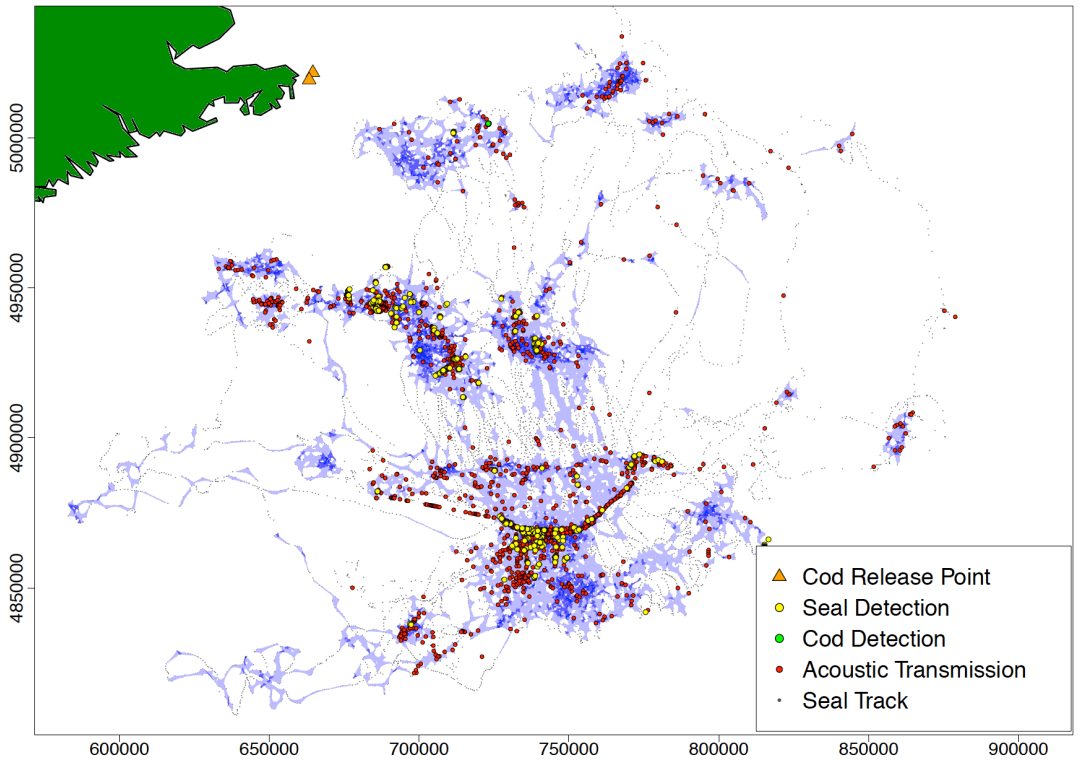

Figure 2. Survey effort of a subset of 9 seals for which we had summarized raw tag data. Survey effort is shown in relation to cod release points (orange triangle) and seal (yellow), fish (green), and acoustic transmission (red) detections (points). Seal tracks are represented by gray points.

Findings

1. **In 2011, seals surveyed 11,308.28 km^2 (95% of locations) and heavily surveyed 31.07 km^2 (25% of locations).**
2. **Seals are detecting more transmissions than detections alone reveal.**
3. **Further research is needed to determine transmission origin (e.g. seal or fish).**

Network Integration and Collaboration

- Accounting for biases in survey effort allows scientists to draw accurate biological inferences from data and policy makers to make informed decisions.
- This work is relevant to OTN partners working with tracking data that wish to: (1) Estimate area use, sampling effort, and sampling coverage. (2) Expand their analyses to include summarized raw acoustic data.

Acknowledgements and Collaboration:

- We thank Damian Lidgard, Don Bowen, Sean Smith and others for collecting the data; Dale Webber and Tim Stone of VEMCO for their assistance providing and in the interpretation of the summarized raw data; Katja Fennel, Laura Bianucci, and Mathieu Dever for guidance in oceanographic aspects of the work.
- This work was funded by the Ocean Tracking Network and the Natural Sciences and Engineering Research Council of Canada.

References

- Baker LL, Jonsen ID, Mills Flemming JE, Lidgard DC, Bowen WD, Iverson SJ, and Webber DM. 2014. Probability of detecting marine predator-prey and species interactions using novel hybrid acoustic transmitter-receiver tags. *P*LOS ONE.
- Lyons AJ, Turner WC, and Getz WM. (2013). Home range plus: A space-time characterization of movement over real landscapes. *M*ovement Ecology, 1(1), 1-14.