Supporting Information S3 - Additional Results

Overview

Here we present additional results of the individual and population-level study of northern fur seals (NFS). Section 1 contains plots of $\beta_{i,t}$ for the two animals in our focused individual study for all models listed in Table 1. Section 2 contains results for $\beta_{i,t}$ in the full model for all animals and trips not shown in the manuscript. The temporally-varying nature of the $\beta_{i,t}$, and the variation in path length, observation window, and spatial locations between the northern fur seals in the study make it difficult to tabulate results. The plots in Section 2 show the time varying $\beta_{i,t}$, and the population-level movement clusters that each time-point on each path corresponds to. Finally, in Section 3 we have included example trace plots for the $\beta_{i,t}$ that illustrate convergence of the MCMC algorithm used in our individual-level approach.

1 Results for Animal 1 and Animal 2 - Model Comparison
Animal 1 - Model 2

Animal 1 - Model 3
Animal 1 - Model 4

Distance to Rookery

Chlorophyll A

Primary Production

Animal 1 - Model 5

Distance to Rookery

Chlorophyll A

Sea Surface Temperature
Animal 1 - Model 6

![Graph 1](#)

Animal 1 - Model 7

![Graph 2](#)
Velocity-Based Movement Modeling

Animal 1 - Model 8

Animal 1 - Model 9
Animal 1 - Model 10

Animal 1 - Model 11
Animal 1 - Model 12

Primary Production

Animal 1 - Model 13

Sea Surface Temperature
Animal 1 - Model 14

![Chlorophyll A graph](image)

Animal 1 - Model 15

![Distance to Rookery graph](image)
Animal 2 - Model 2

Animal 2 - Model 3
Animal 2 - Model 4

Animal 2 - Model 5

Sea Surface Temperature
Animal 2 - Model 6

Animal 2 - Model 7
Animal 2 - Model 8

Distance to Rookery

Primary Production

Animal 2 - Model 9

Chlorophyll A

Sea Surface Temperature
Animal 2 - Model 10

Animal 2 - Model 11
Animal 2 - Model 12

![Primary Production Graph]

Animal 2 - Model 13

![Sea Surface Temperature Graph]
Animal 2 - Model 14

![Chlorophyll A](image)

Animal 2 - Model 15

![Distance to Rookery](image)
2 Full-Model Individual Results for All Animals Not Shown In Paper
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Velocity-Based Movement Modeling

Animal 4 Trip 1, male

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

Animal 13 Trip 1, male

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling
Velocity-Based Movement Modeling

Animal 14 Trip 2, female

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production

Hours

Hours

Hours
Velocity-Based Movement Modeling

Animal 15 Trip 2, female

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling
Velocity-Based Movement Modeling

Animal 16 Trip 1, female

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling
Velocity-Based Movement Modeling

Animal 16 Trip 2, female

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

Animal 21 Trip 1, male

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

Animal 22 Trip 1, male

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

Animal 24 Trip 1, male

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling
Velocity-Based Movement Modeling
Velocity-Based Movement Modeling
Velocity-Based Movement Modeling

Animal 31 Trip 1, male

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

![Animal Trip Chart](image)

- **Distance to Rookery**
  - **Chlorophyll A**
- **Sea Surface Temperature**
- **Primary Production**

Hours: 36765, 36770, 36775, 36780

- -0.10 to 0.10
- -1.5 to 1.5

Cluster 1, 2, 3, 4, 5, 6, 7
Velocity-Based Movement Modeling

Animal Trip 2, female

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

Animal Trip 1, female

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

**Animal 39 Trip 2, female**

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
Velocity-Based Movement Modeling

Animal 39 Trip 3, female

Distance to Rookery

Chlorophyll A

Sea Surface Temperature

Primary Production
3 Trace Plots

To assess convergence of our MCMC algorithm, we examined trace plots. We show trace plots from Animal 1 that exhibit convergence. Trace plots for 4 out of the 50 at-sea paths in our study exhibited slow mixing, and were removed from the analysis for lack of convergence (see Section 3.1 of the manuscript).

Figure 1. Animal 1 - Trace Plot for $\sigma^2$. 
Figure 2. Animal 1 - Trace Plot for $\beta_t$ at $t = 50$ hours.
Figure 3. Animal 1 - Trace Plot for $\beta_t$ at $t = 100$ hours.
Figure 4. Animal 1 - Trace Plot for $\beta_t$ at $t = 200$ hours.