

Movement, Habitat Use, and Population Assessment of Wood Turtles (*Glyptemys insculpta*)

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Study Sites

Maine

Oxford County, ME
4 km of river
Turtles notched: 67

Vermont

Essex County, VT
5 km of river
Turtles notched: 8



Above: Quality nest beach, characteristic of both study sites.
Left: River habitat in Vermont.

Goal:

To inform management decisions by assessing habitat use, movement, and limiting factors for long-term survival.

Spatial Data Collection: Radio telemetry and GPS

VHF tags (n=20) and GPS tags (n=13) were attached to the carapace in the spring. Effort was made to locate turtles weekly via radio telemetry. GPS tags attempted four locations every day between 10:00-16:00. GPS tags were removed in the fall for data download. Home range was estimated using a 95% minimum convex polygon (MCP; Table 1 and Figure 2) and patterns were examined in the spatial data (Figure 1).



Habitat Use:

Conducted habitat sampling in 3-m radius plots with a focus on third order selection.

Sampled:

1. Turtle locations
2. Paired random locations

A general linear mixed-effects model (GLMM) was used to analyze habitat selection. Initial results are presented.



Variables examined:

% Graminoid
% Forb/herb
% Shrub
% Vine
% Tree
% Woody debris
% Nonvascular
Food presence
Trees ≥ 5 cm DBH
Overstory density
Cover type

Degree-Days:

HOBO Temperature Loggers

HOBO temperature loggers were deployed in potential nest beaches from June-October at both study sites. The HOBO was buried 10 cm deep into the sand at the crest of the beach. The data was fitted to a degree-days model, which predicts that 788 accumulated degree-days above 12.5 °C are needed to hatch wood turtle eggs (Compton 1999; Figure 3). Temperature was recorded hourly and the median daily temperature was used in the model.

What is the mean home range size?

Table 1: The 95% MCP estimates from the recapture and GPS tag data. Estimates include 2019 data only. The MCP estimate is reported, followed by the range and the number of turtles included in that estimate.

* Indicates that one or more turtles only had partial GPS tag data to analyze.

	Recapture points (ha)	GPS tag points (ha)
Total mean	2.19 (0.40-6.27) n=9	11.33* (1.83-37.08) n=11
Mean females	2.09 (0.40-5.78) n=4	8.68 (4.42-21.91) n=5
Mean males	2.27 (0.51-6.27) n=5	13.54* (1.83-37.08) n=6

Where do these turtles go? Are there patterns in their spatial movements?

Figure 1: Turtle GPS locations in Maine. Males primarily stayed close to the river and moved parallel with the river. The majority of females made movements perpendicular to the river.

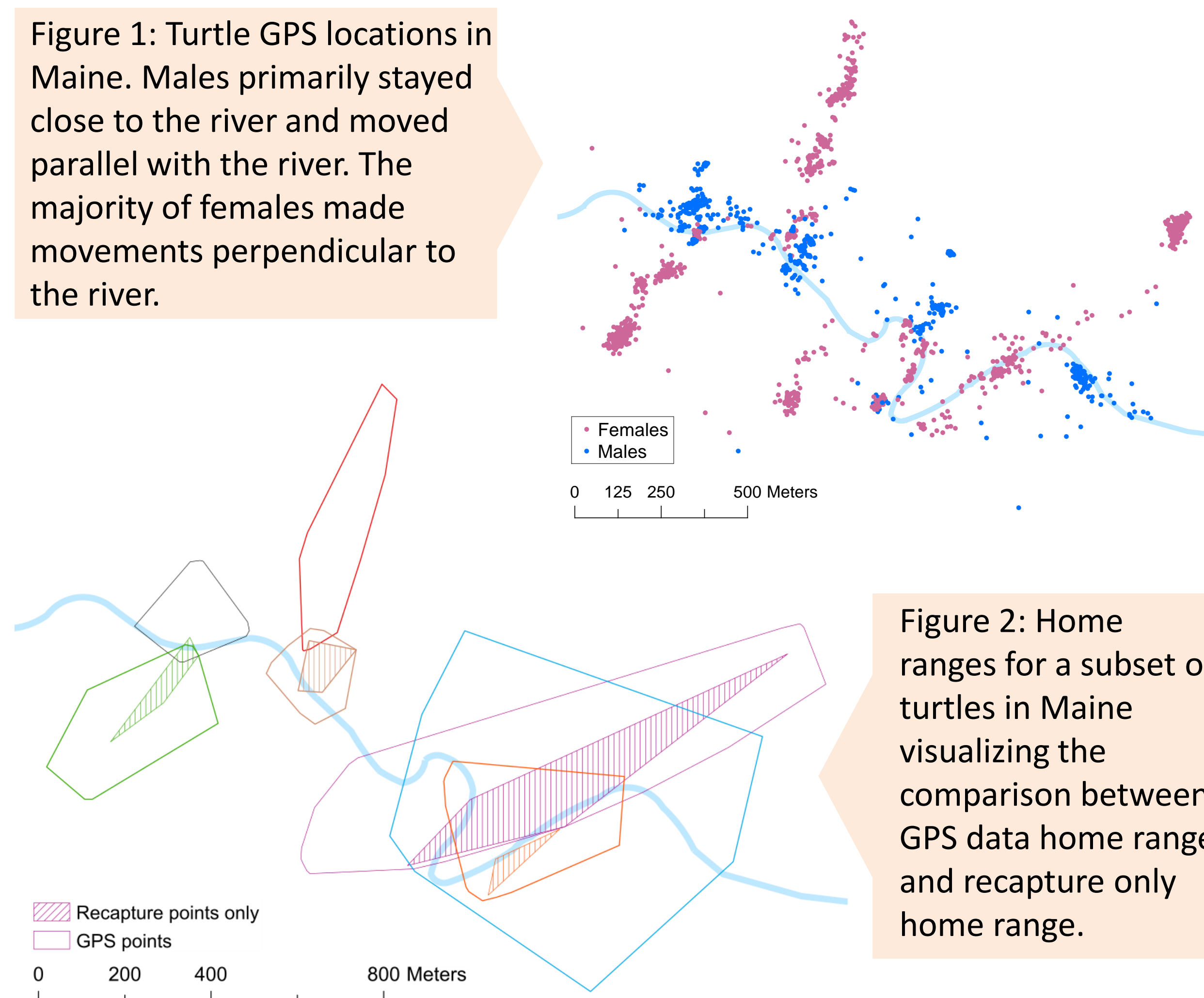


Figure 2: Home ranges for a subset of turtles in Maine visualizing the comparison between GPS data home range and recapture only home range.

What variables are influencing habitat selection?

Habitat data was collected at 65 turtle and paired locations between May-September. Turtle ID was used as a random effect. The best models selected by Akaike's Information Criterion ($\Delta AIC < 2$) suggest that turtles select for:

- lower forb and herbaceous vegetation
- lower mean DBH of trees
- lower overstory density
- higher graminoid cover
- higher woody debris component
- higher shrub cover

Percentage of turtle locations by cover type:

- 31% water
- 28% mixedwood overstory
- 25% shrub
- 6% hardwood overstory
- 3% softwood overstory
- 1% graminoid marsh



What is the estimated abundance at each site?

Surveys were conducted during 2018-2019 at both sites using the Northeast Wood Turtle Working Group protocol. A total of 8 turtles in Vermont and 67 in Maine have been notched with a unique code (Ernst et al. 1974). Juvenile turtles too small to notch have been encountered in Maine 44 times during the two years.

Preliminary abundance estimates were derived using regional estimates of capture probabilities ($p = 0.10$ to 0.13) and ranged from 118 to 138 and 47 to 55 turtles at the Maine and Vermont study areas, respectively.

Do nest beaches reach the adequate number of degree-days to incubate eggs?

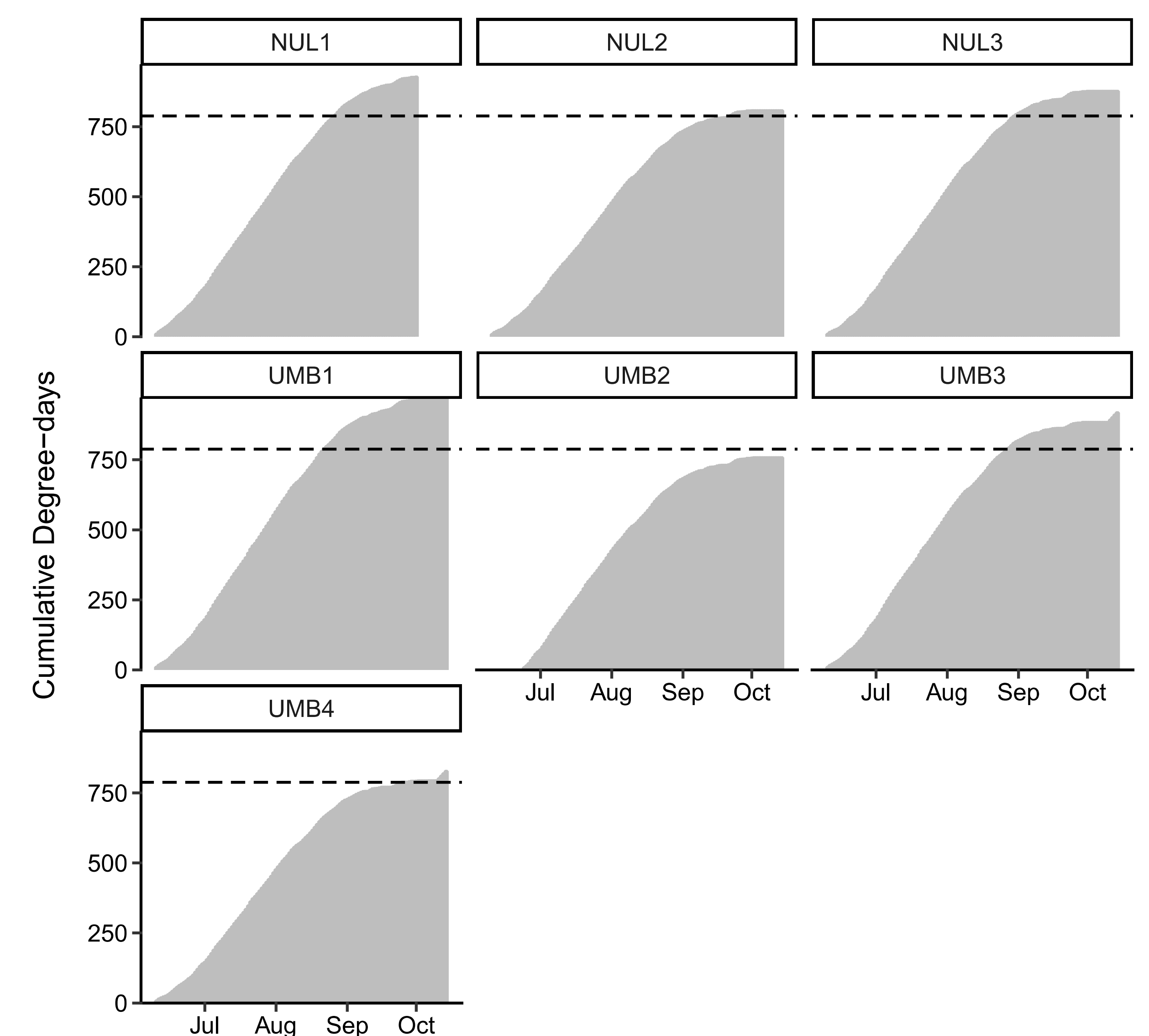


Figure 3: The cumulative sum of degree-days from the HOBO data. The dashed line marks the 788 degree-days threshold that Compton (1999) predicted in his model. UMB1 and UMB2 had confirmed nests laid in 2019. Accumulation of degree-days began on 10 June 2019 for all beaches except UMB2, which began 24 June 2019, likely multiple days after the nest was laid in that beach. Accumulations ended on 14 October 2019 for all beaches except NUL1, which ended on 2 October 2019.

Future directions:

- Continue radio telemetry, surveys, and GPS monitoring.
- Measure nest beach characteristics in conjunction with monitoring temperatures.
- Cover confirmed nests with protective cages and monitor nest success.
- Investigate threats contributing to adult mortality, such as road mortality or predation.

Literature cited:

Compton, B.W. 1999. Ecology and conservation of the wood turtle (*Glyptemys insculpta*) in Maine. Master's Thesis. University of Maine. Orono, Maine, USA.
Ernst, C.H., M.F. Hershey, and R.W. Barbour. 1974. A new coding system for hard-shelled turtles. Kentucky Acad. Of Science (35): 27-28.