

ALAN E. LEVITON STUDENT RESEARCH AWARD PRELIMINARY PROJECT REPORT

*Determinants of Territory Quality and Male Reproductive Success
in Southern Sea Otters (*Enhydra lutris nereis*)*

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L. Maxine Tarjan is the recipient of the 2011 AAAS, Pacific Division Alan E. Leviton
Student Research Award. Dr. Tim Tinker is her advisor.



Photo courtesy herself.

The effects of resource availability and distribution on mating systems are well documented. Abundant, patchily distributed resources allow males to monopolize mates, leading to increased polygyny and reproductive skew.(1) Also recognized is the impact of mating location on polygyny among marine mammals. Female aggregation on limited, terrestrial haul-outs leads to extreme mate monopolization and reproductive skew, as seen in elephant seals.(2) Conversely, aquatic mating results in low levels of polygyny, such as in harbor seals.(3) For my Ph.D. project, I am studying the sea otter mating system to determine the environmental drivers of aquatic territoriality in males and the effects of asynchronous breeding on male reproductive success.

The objectives of my project are: (1) to determine the degree of polygyny and reproductive skew in territorial male sea otters, and (2) to identify individual and territory features that confer high male reproductive success. I hypothesize that if reproductive success is skewed, then reproductive success of territorial males will vary predictably with one or more of the following territory features: (a) foraging opportunities, (b) kelp canopy availability, (c) shelter availability, (d) habitat diversity, and (e) territory size. To test this alternative against the null hypothesis—reproductive success is unrelated to these properties—I will determine reproductive success of each territorial male, map territories, and quantify territory features.

Funding from the AAAS Pacific Division Alan E. Leviton Student Research Award was allocated towards micro-satellite analysis of existing tissue samples from radio-tagged territorial males and female pups in Monterey Peninsula, CA.

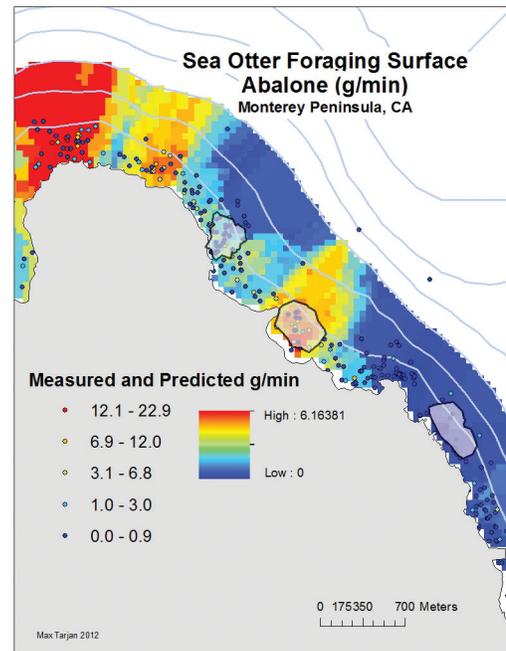
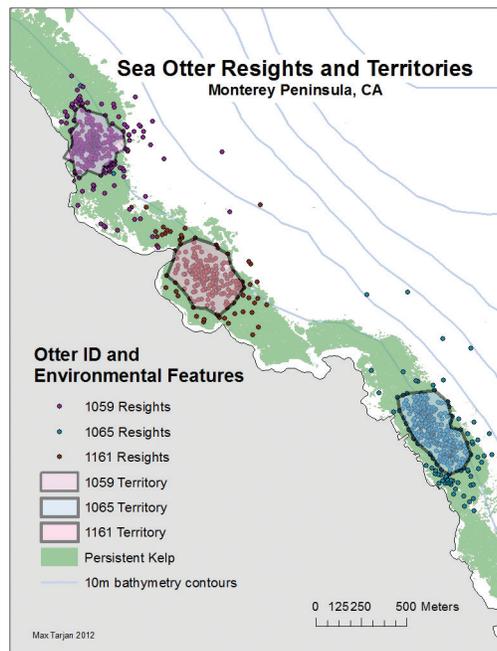


Figure 1 (left). Sample plot of territorial male resights with territories. Territories were generated using adaptive Local Convex Hull analysis. **Figure 2 (right).** Sea otter foraging surface for abalone. Points represent the measured data obtained during observed foraging bouts in the field. The surface was created using ordinary kriging of these points. The surface and points are color coded to indicate high (red) versus low (blue) return of abalone (g/min). Sample territories are shown in gray for scale. Note that abalone return is variable at a large scale relative to the territories.

Twenty-five samples have been analyzed, with an additional 63 samples prepared for processing. Results from the microsatellites will be entered into paternity and sibship analyses to determine the reproductive success of candidate territorial males and the reproductive skew among male sea otters in Monterey, CA.

This award also supported travel to my study site in Monterey, CA, where I collected GPS locations (resights) of radio-tagged sea otters. I spatially defined the territories of fifteen candidate males using adaptive Local Convex Hull Analysis of these resights. Average territory area is 0.11 km², with a minimum of 0.07 km² and a maximum of 0.20 km². To compare feeding opportunities within each territory, I plotted foraging success (grams of prey consumed per minute) as a function of dive location for all recorded feeding data, and smoothed these data using ordinary kriging(4) to create a GIS “surface” of foraging success. Average foraging success was relatively consistent across territories. When individual prey types are considered, however, potential prey return (g/min) differed across territories. These results suggest that the likelihood of encountering a given female within a territory is related to that female’s diet specialization.(5) There exists up to a 17-fold difference in kelp density across territories, suggesting that a male has the opportunity to increase his reproductive success by monopolizing patches of kelp with resting females. These territory features will be included with measures of reproductive success in structural equation models to identify which of these variables contribute to male reproductive success.

Citations: (1) S. T. Emlen, L. W. Oring, *Science* 197, 215-223 (1977). (2) B. J. Le Boeuf, *Behavior of Pinnipeds* (Chapman & Hall, London, 1991), pp. 45-65. (3) G. A. Bartholomew, *Evolution* 24, 546-559 (1970). (4) G. Matheron, *The Theory of Regionalized Variables and Its Applications: Cahiers du Centre de Morphologie Mathématique no. 5* (Fontainebleau, France, 1971), pp. 211. (5) M. T. Tinker et al. *PNAS* 105, 560-565 (2008). 📄