

## ESRI OCEAN'S SUMMIT POSITION PAPER

### Contact Information:

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### Summary of GIS Activities:

I am a marine biologist with a focus on the physiological ecology of marine mammals. My research questions focus on how human activity impacts the distribution and behavior of marine mammal species inhabiting the local waters of southern California.

As a professor at the UofR I utilize GIS in both my teaching and my research. I started as a typical casual user of GIS, and would rely on colleagues with greater expertise to help me produce simple maps of study areas and animal distributions. I soon realized that I needed to develop more expertise and thus applied for a grant and was funded by the Keck Foundation as a LENS fellow (2011) to expand my use of GIS and to improve my ability to help enhance our students' spatial literacy. My LENS project focused on two main goals:

1. Design and teach a new course: "Mapping Animal Behavior"
2. Develop "Whale mAPP" a citizen science project to collect, map, and share marine mammal sightings.

I taught "Mapping Animal Behavior" in the fall of 2011 and am currently teaching it again this semester (renamed "Mapping Animals"). The goal of this course is to encourage students to think about questions related to animal movements and behavior from a spatial perspective and help design better conservation strategies by using mapping as a tool. The students do weekly lab activities that develop their skills in visualizing behavioral data, analyzing spatial and temporal trends, detecting relationships, and applying the approach to ecological questions. The class is composed of a mix of students from biology and environmental studies majors, and approximately half of the students have taken an Introduction to GIS course while the rest are new to the field, thus I face the challenge of making the material accessible and relevant to all students.

My research has incorporated citizen science since its inception as my primary funding is from Earthwatch, which matches paying volunteers eager to assist with data collection in the field. I wanted to expand the opportunity so that others could become involved while simultaneously contributing much needed data, which led to the idea for "Whale mAPP". I've worked with a MS GIS student at the UofR to develop a mobile app that can be used by the public (e.g. tourists and operators on whale watch boats) to collect and contribute sightings information to an online database. These citizen researchers can use their own personal GPS enabled mobile platforms (e.g. smart phone) to record sightings of marine mammals and collect data on the species, number of animals, behaviors, and even photographs. This data is uploaded to an online geodatabase; the contributor can access an instantaneous map of their sightings and compare to other users. Major benefits of this approach include a large dataset

that can be freely downloaded by researchers (who can query and then select relevant data as a shapefile) along with current maps of sightings that can be monitored by ship captains so they can alter course if needed to avoid concentrations of animals and reduce the risk of collisions.

#### GIS Issues:

My research relies largely on opportunistic sightings of marine mammals to identify what variables (e.g. SST, chlorophyll a, human activity, etc.) are the best predictors of distribution patterns and dominant activities. Thus the issues that I'm most interested in are:

- 1) How are zeroes represented (e.g. no animals seen) versus no data collected? Note: tracks are collected so we know where we were.
- 2) What statistical analyses are most appropriate for this data and what can be done within ArcGIS?
- 3) How can we best visualize and analyze temporal trends?
- 4) Scale issues: how to determine what scale is appropriate for analysis as the organisms of study/interest range in size from small plankton to the largest whales?
- 5) How to model/map the uncertainty of data? Reliability will vary with contributor experience; can that be integrated into analyses?

I'm eager to learn more about the new tools and features available in Arc, especially those designed for marine analyses, along with discussing approaches with other users and benefitting from an interdisciplinary perspective.