



QUANTIFYING SEA TURTLE NESTING HABITAT:

Using Beach Profiles and Nesting Distribution as a Conservation Tool

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INTRODUCTION

Climate change and coastal development potentially provoke changes in beach morphology. Marine turtle nesting activity can be used as an indicator for predicting these changes and thus used as a conservation tool in regulatory land use decisions.

We evaluated the nesting activity of *Lepidochelys olivacea* species on a temporal and spatial analysis at two nest monitoring sites in the southern Pacific coast of Baja California Sur, México.

We found temporal changes in the density of nests between two field sites. We also found significant spatial differences nesting distance from the highest recorded mean high tide to each nest and significant differences in spatial density throughout the study area using 2013 nesting data.

Our data is applicable to all nesting beaches in the region, and be used as a conservation and planning tool for future coastal development, such as identification of priority conservation areas, setback construction distances, and regional education programs.

OBJECTIVES

The ultimate goal of this project is to quantitatively monitor nesting activity of *Lepidochelys olivacea* in correlation with abiotic factors in order to use nest site preference as an indicator of climate change and coastal development impacts to protect northern nesting beaches in the southern portion of the Baja California peninsula.

We aim to:

1. Identify and rank priority conservation areas from nesting hotspots, as beach-dune morphology fluctuates due to natural and anthropogenic activity
2. Evaluate the response of female nest site preference due to a variety of spatial and temporal factors.
3. Create a Model for Conservation Tourism for the region which highlights conservation strategies and memorandums of agreements (MOA) with tourism companies and developers.

STUDY AREA

1. San Cristobal – 5km
2. El Suspiro – 16km



ASUPMATOMA, The Mexican Association for the Protection of Marine Turtles and the Environment monitors 21 kilometers of nesting beach. Since 1995, biologists conduct nightly patrols and relocate approximately 90% of nests to a protective corral to avoid loss from the threats listed above.

HABITAT CHARACTERISTICS

The study area is located within the southern Pacific cape region of Baja California Sur which provides the northern most primary nesting range for *Lepidochelys olivacea*. The nesting beaches in this region are characterized by sandy beaches backed by coastal dunes ranging in height from 10 - 300 meters and width to over 600 meters. As climate change provokes species ranges northern due to temperature regimes, this northern nesting area is vital for conservation for future generations. Habitat loss from natural and anthropogenic causes throughout the species range is a major concern, further placing vital importance on these northern nesting grounds.



Beginning of nesting season, the beach width ranges from 60 - 200 meters and the vegetation is dry with loose sand.

March - July



Throughout the season, tropical storms and hurricanes provoke over 60 meters erosion and create sand barriers.

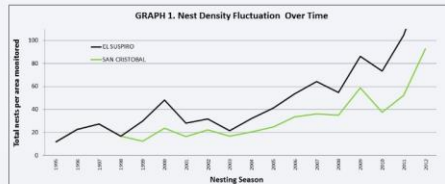
August - November.



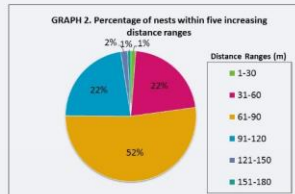
End of the nesting season, the beach begins to recuperate from offshore winds replenishing the beach sand from a reservoir of coastal dunes.

December - March

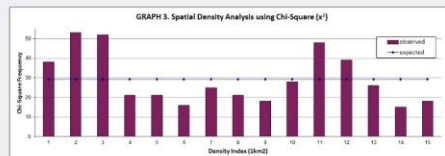
RESULTS



Comparison of *Lepidochelys olivacea* nest density between two field stations over the past 15 years in the southern Pacific coast of Baja California Sur, México. Overall density has increased over time as monitored efforts increased.



The distance of nests from the shore on average was 76.6 meters. The differences were significant ($P \leq 0.05$) when analyzed in ANOVA comparing five different ranges of increasing distance. (*Federal protected zone= $\geq 20m$; developable area= $\leq 20m$)



The Chi-square χ^2 test resulted in a null hypothesis that the density is not uniform throughout the entire study area. Data shows a significant difference ($P \leq 0.001$) in five polygons, where the density is higher than the expected average.

METHODS and MATERIALS

Nest distribution

Field equipment used - Garmin GPS E-trex 30; GPS coordinates were recorded for 80% of nests accounting for both field stations totaling 21km of monitoring area. Nest coordinates were collection prior to before relocation on a nightly basis from July through December 2013.

Data Analysis

Software used - ArcGIS and Excel.

Density Temporal= Avg number of nests per year divided by the distance patrolled per season. Change over time. Comparing San Cristobal and El Suspiro field stations.

Density spatial= Study area (21.5 km) was indexed into 15 different sections (polygons) Polygons measure 1000m (length) x 500m (width) removing areas of rocky shoreline. 2013 coordinate data input into ArcGIS. Chi-Square analysis. Significance= $P \geq 0.05$. Observed value: Total number of nests per polygon, calculated using ArcGIS. Expected value: Average nest distance from shore. (Graph 2).

Distance (meters) was calculated on a perpendicular line from the recorded mean high tide to each nest (San Cristobal; N=486) using ArcGIS (Graph 1). A pre-determined shoreline shapefile was used from INEGI (Instituto Nacional de Ecología y geografía). ANOVA analysis of distance ranges. Significance= $P \geq 0.05$.

Beach Profiles

Field equipment used - Abney level; Degree and minutes taken every 5 meters at 10 points along the beach every 2 months. We based our methodology on the UNESCO Sandwatch Program for use with an Abney level. Beach profiles were analyzed using a software program used was an input model created by SeaGrant Puerto Rico (2010) in accordance with UNESCO Sandwatch Program methodology.

CONCLUSIONS

The laws in México are conflicting between coastal development, tourism activities, and wildlife protection. For example, The Federal Maritime protection zone only protects 20 meters from the highest tide, yet our research shows that over half of the nests in San Cristobal were found between 60 - 90 meters from shore and density decreases in developed areas compared to undeveloped areas.

We hope this research will promote the expansion of the federal protection zone to at least 60 meters with a vegetated coastal dune buffer of 100 meters to prevent light pollution and erosion effects from future coastal development. The significant distances and density polygons combined are considered priority conservation areas.

We also want to expand our research efforts to include more than 80 km of nesting beach by training local coastal residents such as those in Migrino Haciendas in a community monitoring program and coordinating with other volunteer monitoring groups to report GPS nest coordinates before relocation, such as those located in Todos Santos, Los Cabos, Los Barriles, and Mogote.

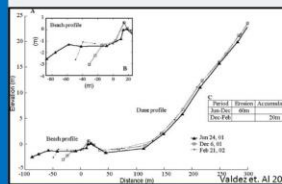
We also hope to offer training workshops in beach profile methodology and hope that these communities will form Sandwatch programs to help monitor beach morphology and coordinate nesting activity in response to climate change and coastal development.

Final outcome:

Through data and community participation, we aim to create a Model for Conservation Tourism for the Southern Coastal Region of Baja California Sur to help safeguard marine turtle nesting beaches from encroaching development and high impact tourism activities and protect coastal dune biodiversity.

The Model for Conservation Tourism:

- >Memorandums of Agreement with tourism companies and developers
- >Community Monitoring Programs for marine turtle nesting and beach profiles
- >Examples of well designed developments using a conservation approach
- >Best Management Practices for tourism activities within coastal ecosystems
- >Conservation Areas for biodiversity protection and conservation tourism activities



Example of a beach profile collected in Cabo Falso, the southern portion of El Suspiro before, during, and after Hurricane Juliette in 2001.

This profile shows the volume of sand eroded and accumulated and a comparison of beach profiles over a typical nesting season in the study area

REFERENCES

1. Choi, G-Y and Eckert, K.L. 2009. Manual de Mejores Prácticas para la Protección de Playas de Anidación de Tortugas Marinas. Informe Técnico de WIDECAST No. 9.
2. Honey, M. and D. Krantz. 2012. Alternative Models and Best Management Practices for Sustainable Coastal Tourism: Framework for Decision Makers in Mexico. Center for Responsible Travel, Washington D.C. March.
3. Humke, M., Hilbrunner, R. and Hawkins, D.E. 2011. Tourism and Conservation: Sustainable Models and Strategies. USAID.
4. UNESCO 2010. Sandwatch: adapting to climate change and educating for sustainable development. Paris, UNESCO.
5. Valdez, V.C., Jimenez, J.M.M., Sanchez, E.H.N., and Thompson, C.T. 2008. Dune and Beach Morphodynamics at Cabo Falso, B.C.S., Mexico. J. of Coastal Research, No. 24:154-160.

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