

Report for the Pacific Seabird Group – Craig S. Harrison Conservation Fund  
Grants

**Multi-species tracking of seabirds in a new Marine protected Area in Peru**

Rosana Paredes<sup>1,2</sup>, Susana Cárdenas<sup>2</sup>, Antje Chiu Werner<sup>2</sup>

<sup>1,2</sup> Department Fisheries and Wildlife, Oregon State University, Corvallis, USA.

<sup>2</sup> Proyecto Punta San Juan, Centro para la Sostenibilidad Ambiental, Universidad Peruana Cayetano Heredia, Lima, Peru.

February 2015

## Background

The Humboldt Current sustains more than 15 percent of the global annual fish catch and large breeding populations of seabirds and pinnipeds. On the Peruvian coast, these top predators are concentrated in a network of reserves that were originally created for the extraction and commercialization of seabird guano to use as fertilizer. Guano harvesting historically reduced nesting habitat for burrowing seabirds such as the endangered Humboldt penguin (*Spheniscus humboldti*) and endemic Peruvian diving petrel (*Pelecanoides garnoti*). After a decade of dedicated efforts by local conservationists lead by Dr. Patricia Majluf, Director of the Center for Environmental Sustainability (CSA, Spanish acronym), in 2009, the Peruvian government officially approved the incorporation of guano-bird reserves (22 islands and 11 capes) into the National Protected Area System. However, the protection of marine habitats surrounding these Marine Protected Areas (MPAs) was established to a few kilometers from shore without scientific basis. Seabirds not only compete with commercial fisheries for their main prey, anchovy (*Engraulis ringens*, Bertrand et al. 2012), but also have a high rate of entanglement in gill nets of artisanal fishermen (Majluf et al. 2002). Information on seabird spatial and temporal distribution and identification of critical feeding areas would be useful to fill this gap and help implement an effective protection of marine resources. Recently, there have been several seabird-tracking studies in Peru (Zavalaga et al. 2010; Chiu et al. 2011; Weimerskirch et al. 2012; Bertrand et al. 2012) although they were mostly based in single-species from islands in the central and northern coast of Peru. Punta San Juan (PSJ) has had long-standing ongoing research since 1980's, which supported CSA efforts in MPA network designation. A seabird-tracking study at PSJ would not only provide new information in a southern MPA, which may vary from that in other northern sites due to different proximity to the shelf edge, but also serve as a catalyst for integration of existent data.

## Proposed objectives

1. Determine the foraging ranges and feeding locations of four dominant seabird species with different guilds at Punta San Juan to aid in the implementation of new designated MPA network in Peru.
2. Summarize available information from other localities and guano-bird reserves in Peru.

### Proposed activities/actions

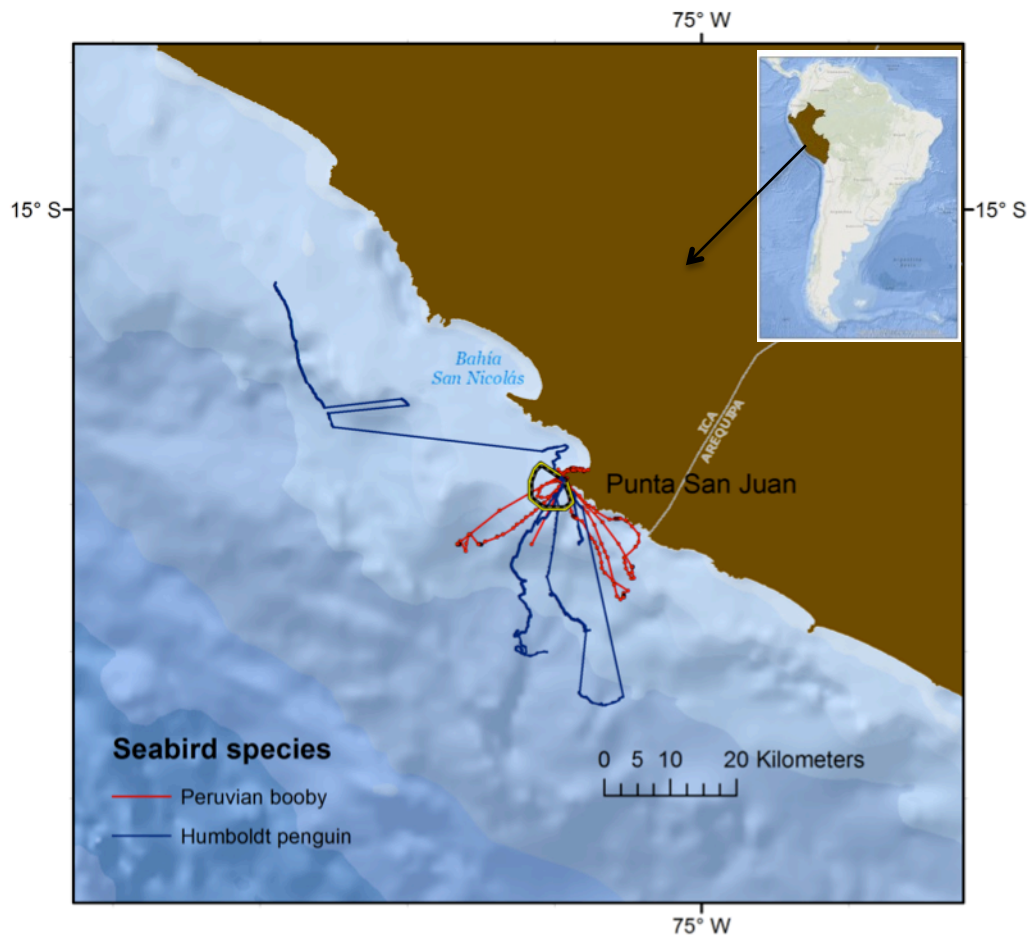
1. Deploy GPS and time-depth recorders (TDRs) simultaneously on the deep-diving Humboldt penguin, pursue-diving Guanay cormorant (*Phalacrocorax bougainvillii*), plunge-diving Peruvian booby (*Sula variegata*), and endemic surface-feeder Inca tern (*Larostreus inca*) at Punta San Juan de Marcona, Ica, Peru (15° 21' 40" S, 75° 10' 51.6" W).
2. Provide information on foraging ranges to the authorities of SERNANP to be used for possible modification of current marine boundaries in the reserve.
3. Capacity building of local biologists in techniques associated with tracking seabirds to promote local research initiatives.

### Actual activities/actions

- 1) We deployed GPSs on three seabird species breeding sympatrically between November and December 2013. We obtained trips from 3 of 7 Humboldt penguins, 2 of 3 boobies, and 0 of 3 Inca terns (Table 1; Figure 1). The GPSs of the Inca terns malfunctioned as well as all the TDRs. There was no attempt for deploying on Guanay cormorants due to inaccessibility of reliable candidates within the nesting colony and unpredictable conditions of 2014-15 El Niño.
- 2) Although limited by sample size, the foraging ranges of the two seabird species tracked during the chick-rearing period clearly showed the need for extension of the current marine boundaries at Punta San Juan, and other reserves based on other studies (Table 2). A report has been prepared in Spanish and will be delivered to SERNANP.
- 3) Five local biologists (Susana Cárdenas, Antje Chiu, Marco Cardeña, Franco Sandoval and Alonso Bussalleu) were trained in capture/recapture techniques, deployment of GPS, blood and feather sampling and visualization of bird tracks in ArcGIS (Figure 2). In addition to the tracked birds, eight birds including cormorants were captured for training purposes (Table 1). We were able to capture Inca terns with noose poles and directly from the nest; and successfully recaptured terns using noose lines. Therefore, we did not use the infrared Peer-o-Roo camera (Zavalaga et al. 2010) that was going to be borrowed by Peter Hodum.

Table 1. Number of birds captured and tracked at Punta San Juan in 2013-14.

Seabirds	P. Booby	H. Penguin	Inca Tern	G. Cormorant
Captured	4	9	10	2
Dummy & Training	1	0	6	2
GPS deployed	3	9	5	0
GPS recovered	2	7	3	0
GPS with data	2	3	0	0



**Figure 1.** GPS tracking of Humboldt penguins ( $n = 3$ ) and Peruvian Boobies ( $n = 2$ ) during the chick-rearing period at Punta San Juan, Peru in 2013. The yellow polygon represents the current marine boundaries of the Marine Protected Area.

**Table 2.** Summary of foraging ranges reported in seabird tracking studies on the Peruvian coast.

Distance (km)	Punta San Juan* (South)	La Vieja Island* (South)	Pescadores Island (Central)	Lobos de Tierra Island * (North)	Lobos de Afuera Island * (North)
Humboldt penguin					
Chick	5-40 <sup>(1,2)</sup>				
Egg	65-72 <sup>(2)</sup>				
Inca tern					
Egg		72 <sup>(3)</sup>			
Peruvian boobie					
Chick	5-20 <sup>(1)</sup>		10-30 <sup>(6)</sup>	14-51 <sup>(5)</sup>	5-68 <sup>(5)</sup>
Guanay cormorant					
Chick			12-25 <sup>(6)</sup>		
Peruvian pelican					
Egg		21-82 <sup>(4)</sup>			

\* Marine Protected Area. (1) This study; (2) Chiu et al. 2011; (3) Zavalaga et al. (2010a); (4) Zavalaga et al. (2011); (5) Zavalaga et al (2010 a); (6) Weimerkirch et al. (2012)



**Figure 2.** Training of local biologists on field techniques for tracking seabirds by Dr. Rosana Paredes in 2013.

## Evaluation of the effectiveness of the actions in conserving seabirds

- 1) Our results are limited by sample size and number of species tracked. However, we were able to obtain data from two of the four species proposed. The foraging ranges of both species were 3-12 times larger than the current marine boundaries (5 km) at Punta San Juan and other MPAs. Preliminary results including a summary of seabird foraging ranges in other localities (Table 2) will be provided to SERNANP.
- 2) We initiated a training program to capacitate local biologists on seabird tracking techniques, which is not currently taught at any university in Peru. Unfortunately, we could not raise more funds to continue working in 2014 as planned. We plan to look for more funding, as we believe this is an important study for the conservation of seabirds. It encourages local research by locals, and has the potential of providing a unique perspective of multi-species usage of marine habitats in the Humboldt Current ecosystem.

## Comparison of proposed and actual expenditures of money/use of donated materials

<b>Proposes Expenses</b>	<b>US\$</b>
Infrared binoculars	500
Shipping costs from USA to Canada for infrared camera from Peter Hodum	275
Bus transportation Lima-Marcona 2 persons (R. Paredes and assistant)	140
Local transportation (R. Paredes)	40
Food costs (\$15/per day - R Paredes and assistant)	420
Tesa tape (2 rolls)	50
Cable ties (200)	40
4 Loctite 401 glue (\$26 each)	105
2 Headlamps (\$40 each)	80
Roll of monofilament (200 lb)	40
2 Rite in the rain notebooks	20
Desk supplies (sharpies, pencils, etc)	30
USB flash drive and external drive	100
Miscellaneous (duct tape, ziplock bags, alcohol, cotton, etc)	60
Recharger and batteries	<u>100</u>
<b>Total</b>	<b>2,000</b>

<b>Actual Expenses</b>	<b>US\$</b>
Infrared binoculars	550
Bus transportation Lima-Marcona 2 persons (R. Paredes and assistant)	140
Local transportation (R. Paredes)	40
Food costs (\$15/per day - R Paredes and assistant)	420
Tesa tape (2 rolls)	96
Cable ties (200)	54
4 Loctite 401 glue (\$26 each)	105
2 Headlamps (\$40 each)	80
Roll of monofilament (200 lb)	40
2 Rite in the rain notebooks	20
Desk supplies (sharpies, pencils, etc)	30
USB flash drive and external drive	150
Miscellaneous (duct tape, ziplock bags, alcohol, cotton, etc)	150
Recharger and batteries	160
<b>Total</b>	<b>2,035</b>

We spent a bit more of what was budgeted for some equipment and shipping to Canada as well as bringing donated material (GPSs and TDRs, noose poles, shrink tubing, etc.) to Peru. We also had unexpected expenses in the field for making additional traps. Some of the equipment and leftover supplies will be used for continuation of the project.

### **Suggestions for further work or improvements to the completed project design.**

- 1) Some of the GPS malfunctioned especially the small tags for Inca terns and all the TDRs did not work. We plan to raise funds to buy new instruments as the ones we had were refurbished tags from other projects.
- 2) This study was ambitious, however, we managed to obtain some data and most importantly initiated local training and standardized methodology on seabird tracking. The experience obtained in 2013 will be an asset for the success of future projects at Punta San Juan or other reserves.

### **References**

- Bertand S, Joo R, Arbulu Smet C, Tremblay Y, Barbraud C, Weimerkirch H. 2012. Local depletion by a fishery can affect seabird foraging. *Journal of Applied Ecology*: 49, 1168-1177
- Majluf, P., Babcock, E.A., Riveros, J.C., Schreiber, M.A., Alderete, W., 2002. Catch and bycatch of sea birds and marine mammals in the small-scale fishery of Punta San Juan, Peru. *Conservation Biology* 16: 1333–1343

- Chiu Werner A, Cárdenas Alayza S, Cardeña Mormontoy M, Bussalleu Cavero A, Guerrero Bustamante P, Sandoval García F, and Tremblay Y. 2011 La ruta del pingüino: Uso de habitat marino y patrón de atención al nido por el Pingüino de Humboldt (*Spheniscus humboldti*) en Punta San Juan, Perú. Boletín Informativo de la Unión de Ornitólogos del Perú (UNOP) 6 (2):21-27
- Weimerkirch H, Bertrand S, Silva J, Bost CA, Peraltilla S. 2012. Foraging in Guanay cormorant and Peruvian booby, the major guano-producing seabirds in the Humboldt Current System. Marine Ecology Progress Series. 458: 231-245
- Zavalaga CB, Halls JN, Mori GP, Taylor SA, Dell'Omo G (2010a) At-sea movement patterns and diving behavior of Peruvian boobies (*Sula variegata*) in northern Peru. Marine Ecology Progress Series 404: 259–274
- Zavalaga CB, Alfaro-Shigueto J, Dell'Omo G (2010b) First GPS-Tracks of Peruvian diving-petrels and Inca terns in the Southern Peru. Report submitted to the Pacific Seabird Group.
- Zavalaga CB, Dell'Omo G, Becciu P, Yoda K (2011) Patterns of GPS Tracks Suggest Nocturnal Foraging by Incubating Peruvian Pelicans (*Pelecanus thagus*). PLoS ONE 6(5): e19966. doi:10.1371/journal.pone.0019966