

# FORAGING MOVEMENTS OF PERUVIAN DIVING-PETRELS ON ISLA LA VIEJA, PERU



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## Background

Peruvian Diving-petrels (*Pelecanoides garnotii*, PDP) are endemic seabirds to the Humboldt Current breeding on islands off Peru and northern Chile (Murphy 1936). Habitat loss, human disturbance and poaching have been well-documented causes of population decline over the last 100 years (Coker 1919, Murphy 1936, Hays 1989, Jahncke and Goya 1998). In the last decades, it has been speculated that interactions between PDP and the fisheries are the main factor of PDP's population decline through incidental by-catch (Garcia-Godos and Goya 2006, Birdlife International 2008). This species is essentially confined to the inshore islands of La Vieja and San Gallan, on the central coast of Peru, with approximately 13,000 breeding pairs in 1995-96 (Jahncke and Goya 1998). Recent estimates have revealed that the breeding population size in these two islands has increased to approximately 36,500 breeding pairs (Zavalaga and Alfaro 2009). Because of the small population size, restricted distribution and increasing threats, PDP is categorized as globally Endangered (Birdlife International 2008).

From 2009 onwards, we have been investigating the at sea movements of PDP on Isla La Vieja-Peru using miniaturized GPS dataloggers with an initial support from the Pacific Seabird Group (PSG Grant 2009). The results have been preliminary, based on the foraging activities of three birds; but despite this small sample size the results have revealed basic information of the PDP foraging range. For instance, most of the birds exploited waters located north and south of the island, with foraging ranges ranging between 15 and 47 km from the mainland (Zavalaga et al. 2010). Unexpectedly, the foraging activities of all birds were enclosed in an area running parallel to the mainland rather than offshore (Zavalaga et al. 2010). They are strictly diurnal foragers, and some birds ventured beyond the boundaries of the Marine Protected Area. These data were considered preliminary as the majority of the tracks were truncated as PDP spent a large proportion of the feeding trips under water. The objective of the proposal was to provide a more accurate estimation on how local artisanal fisheries may potentially affect the PDP around their colonies. The plan was to deploy GPS dataloggers in a number of net-fishing boats from the nearest port to track their trips and at-sea activities (net setting, net retrieval recorded by onboard Pro delphinus observers). However, fishermen were reluctant in using GPS in their boats when asked to collaborate with this study. Therefore, we report the foraging range of PDP around Isla La Vieja. The new GPS tracks added foraging movement data to the former tracks obtained in 2009 and 2010 (Zavalaga et al. 2010).

## Objective

To corroborate preliminary foraging movement data (2009-2010) of Peruvian diving-petrels on Isla La Vieja with the use of improved and smaller GPS loggers.

## Methods

The study was undertaken on Isla La Vieja (14°17'S), Independencia Bay between the first and second week of June 2012. The study was intended to start in June 2011, but bad sea conditions prevented to enter on the island for weeks and the field season needed to be suspended. The Island is located ca. 350-400 km south of the city of Lima. Ten chick-rearing adults were captured in their burrows after sunset (1-2 birds per day). The GPS-logger was attached to the contour feathers of the lower bird's back with 2-3 strips of waterproof tape (TESA tape). This procedure takes < 10 min from capture to release. The bird was released inside the burrow and the nests was checked the next day to recapture the bird and retrieve the logger (i.e. the logger will be attached for 1 foraging trip only to minimize any handicapping effect of the logger). To enhance the chances of recapture, one small infrared wireless surveillance camera was placed 30 cm from the entrance of each of the study nests. The images was received in a small monitor within a tent located

50 m away from the colony periphery. Once a bird entered the nest, a person approached the nest to capture the bird. The use of cameras substantially improved the recapture rates in comparison to 2009 because PDP spend a variable amount of time outside the nest after feeding their chicks. Most of these birds lie in the nest entrance and fly away when a researcher approaches at night with a bright light. The recaptured bird was brought to the tent, measured and the logger was retrieved. The logger information was downloaded in a laptop computer in the field and the GPS-loggers were used in another set of birds until complete a minimum of 10 birds (The GPS-loggers have rechargeable batteries).

#### GPS-loggers

The GPS (GyPSi-2, [www.technosmart.eu](http://www.technosmart.eu)) weighed 1.8 g and was powered by a small battery of 50mA with a weight of 1.8 g. The GPS were heat-sealed in shrinking tubes (< 2 g). Overall, the logger, battery, shrinking tube and tape added approximately 7-8 g sealed to an average weight of 200-g diving-petrel (3.5 - 4% of the adult's body weight). To maximize the short lifespan of a small battery, the GPS were programmed to record one position fix every 3 minute. Likewise, the GPS was set to switch ON only between 0500 h and 1900 h (local time, daylight period). This procedure considerably decreased the number of fixes recorded by the GPS, assuming that diving-petrels spend a considerable amount of time underwater or sitting on the sea surface.

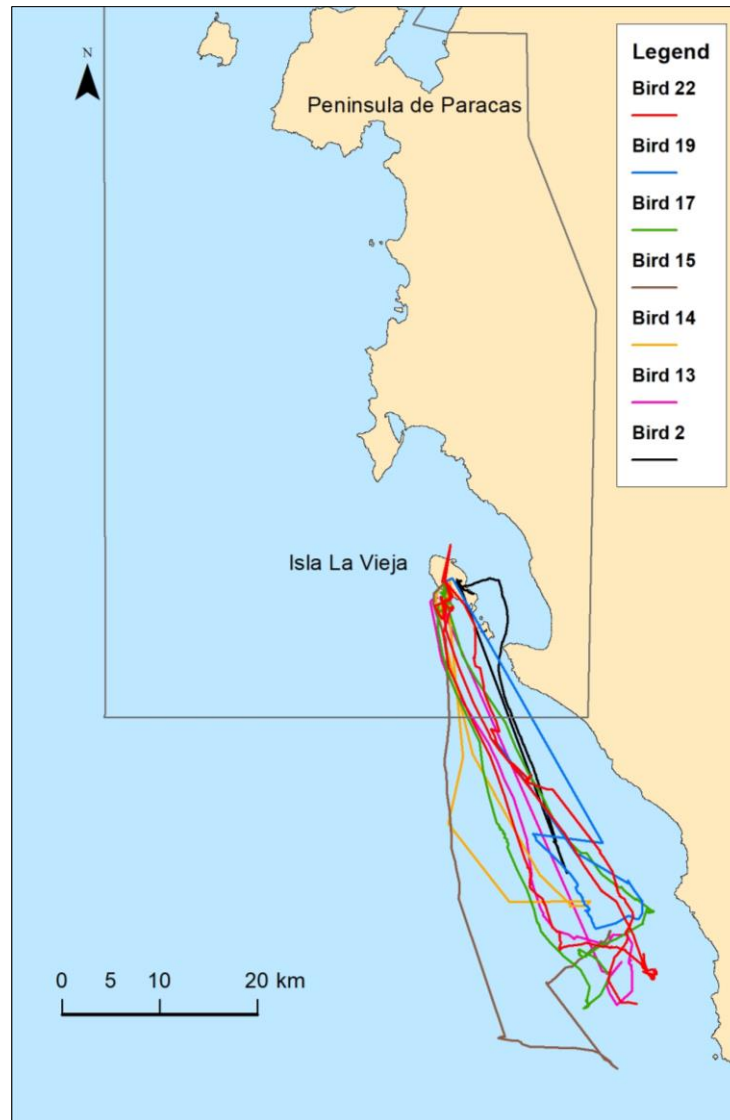
#### Results

A total of 8 out of 10 instrumented PDP were recaptured. From those recovered birds, only seven provided reliable GPS data. Overall, 8 trips were recorded, five of them were complete (fixes at departures and returns) and three were truncated when the birds returned to their colonies (it was possible to determine the maximum foraging distance). All birds foraged to the south of the island, beyond the boundaries of the Marine Protected Area (Fig 1). The pattern of movement is just parallel to coast instead of flying offshore. The results of maximum foraging distance are shown in Table 1. Overall, the maximum foraging range of PDP was  $46 \pm 8.7$  km ( $n = 8$  trips). Birds left the colony right before dawn about 1 h after sunset.

Table 1. Maximum foraging distance (km) of chick-rearing Peruvian diving petrels from Isla La Vieja, Peru.

Bird ID	Maximum Foraging Distance (km)	Data collection Interval (min)	Completed/Truncated track
Bird 22	46	3	Completed
	47.5	3	Truncated
Bird 19	59.5	3	Completed
Bird 17	46	3	Completed
Bird 15	53	1	Truncated
Bird 14	36	1	Completed
Bird 13	48	3	Completed
Bird 2	32	3	Truncated

Figure 1. GPS tracks of six chick-rearing Peruvian diving-petrels from Isla La Vieja in June 2012.

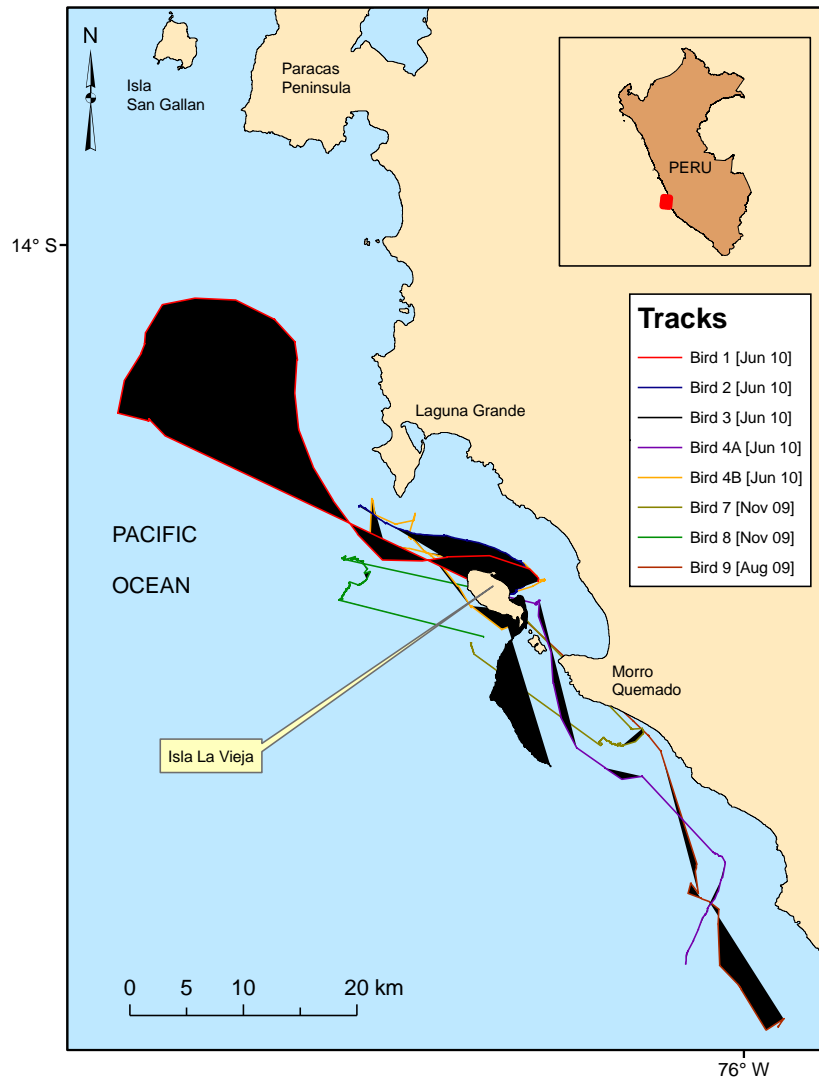


In comparison to 2009-2010 (Zavalaga et al. 2010), PDP did not fly to the north or west. However, the maximum foraging distance reached in 2009-2010 (47 km, Fig. 2) was shorter than that found in 2012 (59.5 km, Table 1). Likewise, the improvement of the recapture technique, a reduction in GPS weight and an improvement of GPS data collection made possible to have complete looping trips.

Another important finding was the occurrence of mice in the PDP colony. Mice were not found during the 2009-2010 season so it is likely that mice colonization of new areas are recent. In three nights of tracking we captured 3 adult mice (*Mus musculus*) that entered our tents during bird handling. In another bird recovery night we found a group of mice eating a PDP chick inside a burrow. The occurrence of rodent seriously jeopardizes the P. DP colony and study must

be taken to examine the extent of mice invasion and their effects on the PDP population on isla La Vieja. This must offer a baseline and strategy for an eradication campaign.

Figure 2. GPS tracks of six chick-rearing Peruvian diving-petrels from Isla La Vieja in November 2009 and June 2010.



## Conclusions

The results on this study provide additional information of the foraging movements of PDP and confirm with best quality data the results obtained in 2009-2010 that birds are inshore feeders and that can feed 40 -50 km from the colony. They travel beyond the boundaries of the Marine Protected Area. Fishing areas could not be obtained from local fishermen as they were afraid to be tracked fishing in forbidden areas. Mice presence in the PDP colonies (200-250 m high) was discovered for first time during the 2012 season. Mice must feed on eggs and PDP chicks as it occurs in other seabird species worldwide.

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## Budget (Main investigator and two field assistants)

Items	US \$
Bus transportation from Lima to Pisco (3 persons/round trips)	100
Hostal in Pisco (4 nights/3 persons)	250
Local transportation from Pisco-Laguna Grande round trip	200
Boat transportation (two trips)	400
Food for two weeks in the field	650
Car batteries to recharge GPS	70
Stationary	200
Surveillance camaras	200
TOTAL	2070

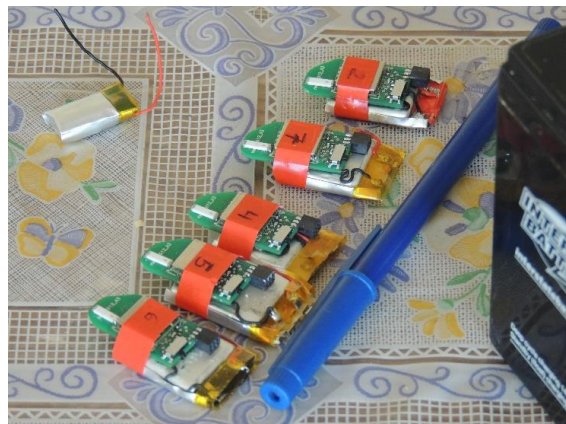
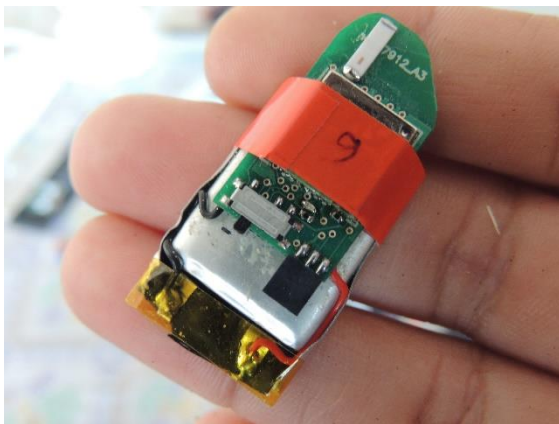
## PHOTO GALLERY



Preparing for the trip. We rented a van in Pisco city to load it with food and field equipment. We cross 60 km of the Paracas desert to arrive into a small fishing village called Laguna Grande.



At Laguna Grande we rent a fisherman boat to travel to the island. From Laguna Grande to La Vieja island we spent about 3 h traveling.



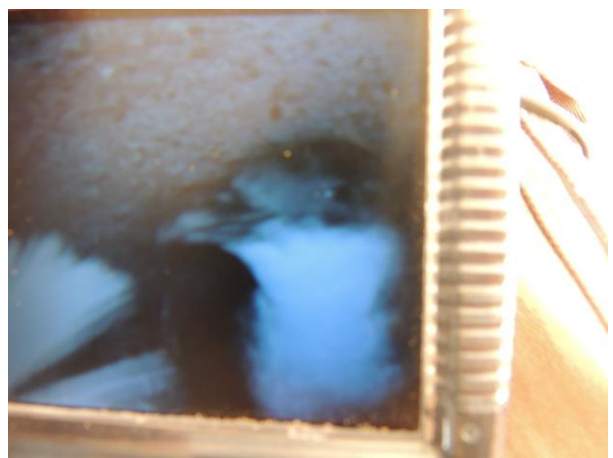
We used Gipsy 2 GPS to track Peruvian Diving-petrels.



GPS are attached to the dorsal PDP dorsal feathers with TESA tape.



We camp high on the island to capture and recapture the petrels at night.



We use infrared surveillance cameras to observe when the tagged birds enter the nest so we can recapture it at time.