

en otro lugar. Durante la noche del 8 de diciembre, el galápagos No. 13.264 se movilizó 45 m a otro lugar. Estas observaciones nos indican que a veces las tortugas se mueven para conseguir mejor dormitorio.

Talvez la observación más estraña ocurrió en la zona de anidación (D), los Guayabillos. Durante la noche del 15 de noviembre de 1982, C. Márquez acompañado por H. Serrano observó un galápagos juvenil No. 13.800 que anochió refugiado a unos 8 m de la carpa. A las 2050 se observó el animal inquieto y empezando a moverse. Al mirar el animal alumbrado con una linterna, se vio al galápagos pasar a 2 m frente de la carpa, escoltado por una lechuza, *Asio flammeus*.

El galápagos amaneció en otro refugio unos 60 m de distancia del primero.

En el caso de los animales que se desplazaron en la garúa, concluimos que andaban buscando agua. El motivo de los desplazamientos en diciembre cuando no había lluvia no es tan claro. No sabemos si el movimiento por el animal acompañado por la lechuza fue por efecto del ave o si ésta lo montó para aprovechar la oportunidad de cazar de una plataforma móvil. **Cruz Márquez y Solanda Rea, Estación Científica Charles Darwin, Isla Santa Cruz, Galápagos, Ecuador.**

## IN SEARCH OF THE DARK-RUMPED PETREL

By: Rosi Dagit

"It's raining in the highlands!" This remark has come to have special significance for several students who, over the past 3 years, have spent many very wet days searching the area around Media Luna on Santa Cruz for nest burrows of the Dark-rumped Petrel (*Pterodroma phaeopygia*). The students came to Galápagos because they were intensely interested in the fate of the Dark-rumped Petrel, and were willing to put up with the cold, wet, dirty clothes and soggy sleeping bags in order to contribute to the study of these incredible birds. The Dark-rumped Petrel breeding areas are limited to the highlands of four Islands in the Archipelago, with declining populations on Santa Cruz (Baker 1980), Santiago, and Isabela (Harris 1970). Only on Floreana, where Felipe and Justina Cruz have instigated an intensive protection program, has the breeding success increased (from 32% in 1982 to 75% in 1986 [Cruz and Cruz 1986]).

Although most visitors remember the Islands as sunny, dry, blistering piles of lava rocks, the highlands of Santa Cruz can be just the opposite. Often draped in garúa, they call forth images of a prehistoric time, and life, amid a tangle of dense, wet vegetation. Into these thickets, the Dark-rumped Petrels come at night to dig their nests, mate, and raise their young. As darkness descends and the stars fade away in the encroaching clouds, the haunting calls of these birds echo through the night. How they find their burrows year after year remains a mystery. Why they choose

such an unlikely area is also unclear. Other members of the Procellariiformes are also ground nesters, but they tend to select isolated Islands and areas along cliffs for their breeding grounds.

The birds select nest sites in moist soils along the banks of sinkholes, gullies, and streambeds, and they are especially vulnerable to predation by rats and dogs. On Santa Cruz, the close proximity of farms to the breeding areas has led to drastic losses of eggs and chicks to introduced animals. Since 1978, the number of active burrows has declined at a rate of 33% per year, leading to predictions of total extinction within 10 to 15 years (Coulter et al. 1982). A protection program for the Media Luna area on Santa Cruz, similar to the one on Floreana, has been planned and begun under the guidance of Felipe and Justina Cruz.

This program seeks to approach the problem of population decline from several directions. First, monitoring of known nesting areas is continued. Second, Mirador crater was set aside as an area to be enclosed by fencing. This would serve to keep out dogs and pigs and to complement the heavy poisoning to control rats in a limited area. Artificial burrows were dug in choice locations to encourage more birds to nest there.

Third, a team, under the direction of Dr. Stephen Kress and Dr. Richard Podolsky, began a project designed to determine the influence of social

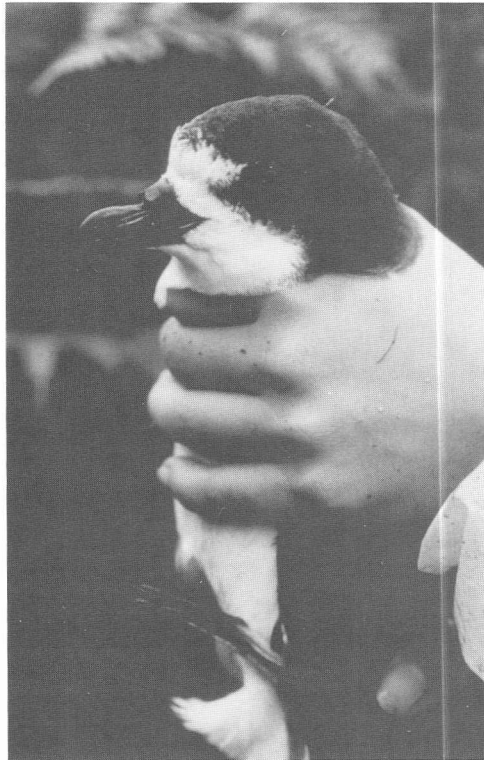
stimulation on nest site selection (Kress and Podolsky 1987). By broadcasting tapes of recorded sounds of petrel colonies, pre-breeding birds might be attracted to sites within the protected area. During the summer of 1988, the researchers began the first stage of this experiment by broadcasting the sounds and setting up mist nets to capture any birds attracted by the broadcasts. In addition to the study area near the caseta at Media Luna, tapes were also broadcast within Mirador crater each night.

June 1988 was dry in Galápagos, and for the first time in 3 years our study team had hope that we might not get wet in the highlands. But, on 4 July when we arrived at the caseta, the garúa set in to stay. Dry paths quickly became quagmires and clothes took on a permanently wet and mildewed odor. The 10 students and two instructors from International Student Research (ISR) had offered to help the Cruz team with the large task of removing invading *Cinchona succiruba*, an introduced pest species, from Mirador crater so that the endemic *Miconia robinsoniana* would become reestablished. In addition, we planned to repeat our 1986-87 transects of several nest areas near Media Luna and to help monitor the mist nets during the all-night petrel vocalization project.

Life in the small caseta was pretty crowded, with 5 Park wardens, 5 members of the Petrel Project, and 12 people from ISR. All meals had to be cooked in shifts and, because the heavy mist never ceased, eaten inside. Bold "kitchen finches" competed with hungry researchers for crumbs. "Hey, you in the feathers, that's my breakfast!" became a constant chorus. Our tents quickly became ponds in the continuing rain. One particularly wet morning, a

soggy student came to breakfast somewhat disgruntled, complaining poetically that "Every morning I wake up in despair, with mildew growing in my hair!" Despite the fact that nearly every morning meant putting on wet, dirty clothes, our team kept up their spirits by singing and by attacking the *Cinchona* with a vengeance. After waiting our turn to cook and eat breakfast, we would hike through the Fern/Sedge zone to Mirador crater. Along the way we often encountered curious Short-eared Owls, which would sit and with puzzled gazes watch us pass.

The *Cinchona* eradication in the area was started years ago, and it seemed for awhile that the Park wardens were able to keep it under control. However, funding cuts and a changing focus meant that large areas were still vulnerable to being invaded by dense stands. *Cinchona* was introduced to Galápagos in the 1940s with the hope of selling quinine, which was made from its bark. The tree quickly became naturalized, and spreading vegetatively as well as by seeds, it out-



A bird in the hand...in this case a Dark-rumped Petrel...is worth a lot of work (photograph by R. Dagit). Un pájaro en la mano...en este caso un petrel o pata pegada...vale mucho trabajo.

competed much of the endemic *Miconia*. It is not clear whether the Dark-rumped Petrel populations are directly affected by the vegetation shift, but everyone felt the protection of Mirador in its natural condition was important. Hence, the removal project.

In 4 backbreaking, blister-producing days, the team pulled up well over 4,000 trees. Earlier eradication efforts had left stumps with roots intact, and only years later did biologists realize that these had sprouted into large multiple shoots, capable of covering areas of 5 m<sup>2</sup>. With only one axe but with lots of teamwork, we were able to successfully remove

all *Cinchona* trees, large and small, from the crater, with the exception of those in the area with the recently dug artificial burrows. The Park wardens cheerfully assisted the students with the largest trees. Soon the area was dotted with large piles of trees on platforms prepared for us by the wardens. All roots and shoots had to be placed above the ground because new roots would appear quickly from excavated plants touching soil. Several days later, with a great sense of satisfaction, we stood at the rim looking down on the destroyed plants. We hoped that the *Miconia* would be able to regain its foothold. However, when we turned to hike back to the caseta and saw the extensive stands of *Cinchona* colonizing the outside flank of the crater, we realized how much work remains to be done. It will take constant vigilance to keep the *Cinchona* from reinvading.

Our plant work had other benefits for the project. In the course of crawling under the remaining *Miconia* in search of small shoots, several previously undiscovered burrows, two with birds inside, were discovered. Each afternoon we would take a break from pulling the *Cinchona* and hike transects with either Felipe or Justina Cruz to monitor nests. The nest burrows can be as deep as 2 m, so even when a bird is heard inside, it can be difficult to remove it for inspection. The preferred technique is to lie flat on your back, stick your hand in slowly, and let the bird bite your finger so that you can then drag it out. Despite the fears of some students who worried about disturbing the birds, previous experiments had shown little effect of investigator interference on breeding success (Bass 1980).

Even with bloody and bruised fingers, the students carefully held the birds so that measurements of wings, tarsus, and beaks could be taken. Each bird was also weighed and banded, if necessary. Any eggs found were also weighed and measured. The students enthusiastically crawled along the banks in search of burrows. Jane Gray became immortalized when she located a new nest with birds in it and Felipe named the nest after her! As each student assisted with the project by finding burrows or holding the birds, their determination to do whatever was in their power to save those birds increased visibly. Most interesting was an adult petrel found that had originally been banded as an adult by Michael Harris

in 1968-69 (ED22101). Because these birds don't begin nesting until they reach 8-9 years of age, this bird now was probably well over 20 years old! What stories it could have told, of nests destroyed, chicks fledged or killed by rats, and flights throughout the Archipelago in search of food.

Equally exciting were the results of the vocalization experiments. Using a variety of tapes of petrel colony sounds, a random selection was played for half-hour intervals all through the night. Large mist nets were unfurled to monitor the entrance of birds, and eager researchers waited, hidden under a tarp, for something to hit the nets. Data on birds heard calling or flying by were also noted. Any birds caught in the nets were weighed, measured, and banded if needed before being released.

On the last night of our visit, one female petrel flew into the net on her way out to sea after laying her egg. Her band number documented that we had just weighed her earlier that afternoon prior to her depositing an egg at her nest. It was great to have such specific information on pre- and post-egg weight, accurate date of laying, and nest location. Further monitoring of the nest promised to add information about incubation time by each adult, duration of incubation, and fledging.

On our way back the next day to the Darwin Station, showers, and dry clothes, one volunteer echoed the feelings of all when he remarked that he had never been so dirty, tired, wet, and happy in his whole life! Having the chance to work for the preservation of this species was definitely the highlight of all our projects in Galápagos.

The fate of the Dark-rumped Petrel as a species is by no means assured despite all the efforts currently being made. Further research and intensive monitoring are needed to continue their protection. There is also some concern about the wisdom of concentrating nests in only one protected area. This potentially exposes a large part of the remnant population to disease, predation, or some other catastrophe. The project will have to continue for several years. Despite the overwhelming odds, those involved with the Petrel Project continue to work with the hope of preventing the extinction of these wonderful birds.

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## FERNANDINA VOLCANO ERUPTS

**Editor's Note.**—The following report is adapted from two issues of the SEAN Bulletin, the monthly publication of the Smithsonian Institution's Scientific Event Alert Network (SEAN). This small group has been reporting on volcanic activity around the world since 1975. Readers interested in this aspect of natural history, in Galápagos and elsewhere, should know that the first 10 years of SEAN reports have been recompiled, on a regional basis and with a comprehensive index, as a 657 page book, to be published in February by Prentice Hall and the American Geophysical Union. Its title is *Global Volcanism 1975-1985*, and publication information can be obtained from the Scientific Event Alert Network, NHB stop 129, Smithsonian Institution, Washington, D.C. 20560, USA. The following report was written largely by Tom Simkin, Secretary for the Americas (Science) of the Darwin Foundation, and a volcanologist with the Smithsonian since 1967.

**Fernandina Volcano, Galápagos Islands, Ecuador (0.37°S, 91.55°W).**—All times are local (= GMT -6 hours). On 14 September an eruption of

Fernandina ended the longest period of volcanic quiet in the Galápagos Islands in the last 20 years. Fernandina's last eruption was in March/April 1984 (see SEAN Bulletin vol. 9, no. 33), and no eruptions have been reported from the Galápagos since then.

An unusual earthquake swarm was recorded by the U.S. Geological Survey's (USGS) Worldwide Seismic Station Network on 24 February 1988, and the most recent epicenter locations place six events within 25 km of Fernandina's caldera. These took place within a 10-hour period and were in the magnitude range 5.0 to 5.5.

Two more recent earthquakes have also been located within 25 km of Fernandina's caldera, a magnitude 4.8 event on 15 April and a 5.3 event on 20 May. Inquiries following the 24 February swarm revealed no observations of volcanism by scientists, residents, or tour vessel personnel in Galápagos, but Fernandina is uninhabited and cannot be seen from inhabited parts of the Archipelago. Inspection of low-resolution satellite imagery found no Galápagos plumes on 24 February.

On 14 September, residents of southern Isabela