



Trip Report-Dec. 2002

Inventory and Monitoring of Seabirds in
National Park, American Samoa.

By Mark Rauzon

For Pacific Cooperative Studies Unit
University of Hawaii at Manoa

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Seabird Survey of the Ta'u and Tutuila Units of American Samoa National Park.

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Itinerary:

Nov. 30: Lv. San Fran - Arr. Hnl.
Dec. 6: Lv. Hnl- Arr. Pago Pago, Amer. Samoa
Dec. 10: Lv. Pago - Arr. Ta'u, Amer. Samoa
Dec. 10-18: On Ta'u-
Dec. 18-22: Lv. Ta'u - Arr. Pago Pago
Dec. 21: Lv. Pago Pago - Arr. Hnl
Dec. 22: Lv. Hnl - Arr. San Fran.

Summary:

The primary purpose of this five-night trip was to make audio recordings and listen at night to determine extent of the Tahiti petrel (*Pseudobulweria rostrata*) population and ascertain if other species of seabirds were present. Tape recordings of nesting Tahiti petrels were made for further analysis using spectrographs (sonagrams). Although wet weather conditions were not very suitable for using tape recordings, we sampled two evenings and heard many Tahiti petrels and several Audubon shearwaters (*Puffinus lherminieri*). We also heard spotless crakes (*Porzana tabuensis*) twice. An additional six sets of feathers from live Tahiti petrels were collected for DNA analysis along with bird weight, culmen and tarsus lengths and archived at the Smithsonian Institute. Traps were used to secure voucher Norway rat (*Rattus norvegicus*) specimens from Mt. Lata for the USFWS collection. A preliminary boat survey of Tutuila was made to survey seabird populations and sites. Bridled Terns (*Sterna anaethetus*) were found to be present in small numbers, and may be a new breeding species for the Park.

Personnel:

Mino Fialua -USPS
Junior West-USPS
Thre?ee Volunteers in the Parks
Mark J. Rauzon-RCUH

Introduction:

This was the third visit to Mt. Lata during this seabird assessment of American Samoa National Park. This December 2002 trip was chosen in part due to the contract period expiring, however, a closer examination of the schedule revealed that the contract expires in September 2003. Since we thought the contract was nearing the end, we chose Dec. in order to be assured that Tahiti petrels would be present and on the ground for further DNA sampling, measurements and additional tape recording.

U.S. Park personnel went to Ta'u in late November 2002 to clear the existing trail to the top and along the summit crest of Mt. Lata. The workers included Volunteers in the Park (VIPs) hired on Tutuila and flown over to Ta'u to assist. Local workers and schoolboys were not available for hire on Ta'u at this time. The VIP workers carried drinking water and USPS gear to the top and later carried up Rauzon's camping and technical gear and food. Fialua and Rauzon spent five nights camping at the summit. A re-supply trip was scheduled to bring more water and the GPS unit.

This trip occurred in the rainy season and for the first three days, wind and fog hampered our recording efforts but made for cool working conditions. Every evening we hiked along the one mile summit trail and listened for seabirds. We also caught by hand four Tahiti petrels in the trail and took measurements. Heavy rain occurred in latter half of the week but cleared out the fog and wind, allowing our best recording sessions to occur. An edited tape/CD will be provided later. The trail became very muddy and rubber boots and rain gear were necessary. The last evening we captured another two petrels. Torrential rains and a lightening storm occurred on the last night.

Methods:

We walked the summit track after 6 PM playing a taped series of calls made by New Zealand researchers at a Tahiti petrel colony, presumably in New Caledonia. Birds responded to the taped calls by replying with a series of their own. Equipment used includes Marantz PMD-222 recorder using Sony Hi-Bias 60 minute tapes with a Stith parabolic dish and a Tesinga microphone. To analyze the tapes, the Kay Elemetrics DSP Sonagraph Model 5500 was used.

When birds responded to taped calls, it often seemed that males were challenged by the taped call and came out of hiding. At this time we grabbed them and put them into a holding bag made of old pantyhose and weighed them with a 500 gram Pesola scale. Using calipers, we measured their beaks and legs, and also took a feather for DNA sampling. The birds were examined for brood patches and rat bite marks before usually being photographed and released into burrows. GPS recordings of calling birds on the ground, feather sampling sites and trail landmarks were made. See Figure 1.

Feathers were collected from six birds that either responded to the played tape and walked into the trail, or were located by their answering the tape and we pulled them from the vegetation. Feathers were plucked from the breast of the birds handled. Feathers were put into individual separate envelopes for future analysis. Measurements of culmen, tarsus and weight were also taken. A 500 g. Pescola scale was used and since two birds exceeded the maximum value, accurate weights are not available for them.

Results:

Petrels were nesting in the area along the summit trail and at the small lava peaks near the trail's end (See Figure 2). It sounded like fewer birds were calling in 2002 than in 2001. Approximately 30 known potential nests were located and marked in 2001 and about 20 were noted in 2003. This trip was a week later than last year so timing might have affected the comparison. Other reasons for lower numbers include the birds along the trail may have habituated to the tape recording, the weather may have been more inclement

Lata Mountain

Legend

- ✦ nest site mapped in 2001
- ✦ new nest site mapped in 2002
- ⊙ USGS benchmark
- 2002 specimen testing
- ▲ camp site (Mark)
- ▲ camp site (Mino)
- ↑ Mt Lata Peak
- ⊙ photo point/ observation site
- ⊙ rat trap
- ★ site of Paul O'Conner's original specimen

0 50 100 150 200 Meters

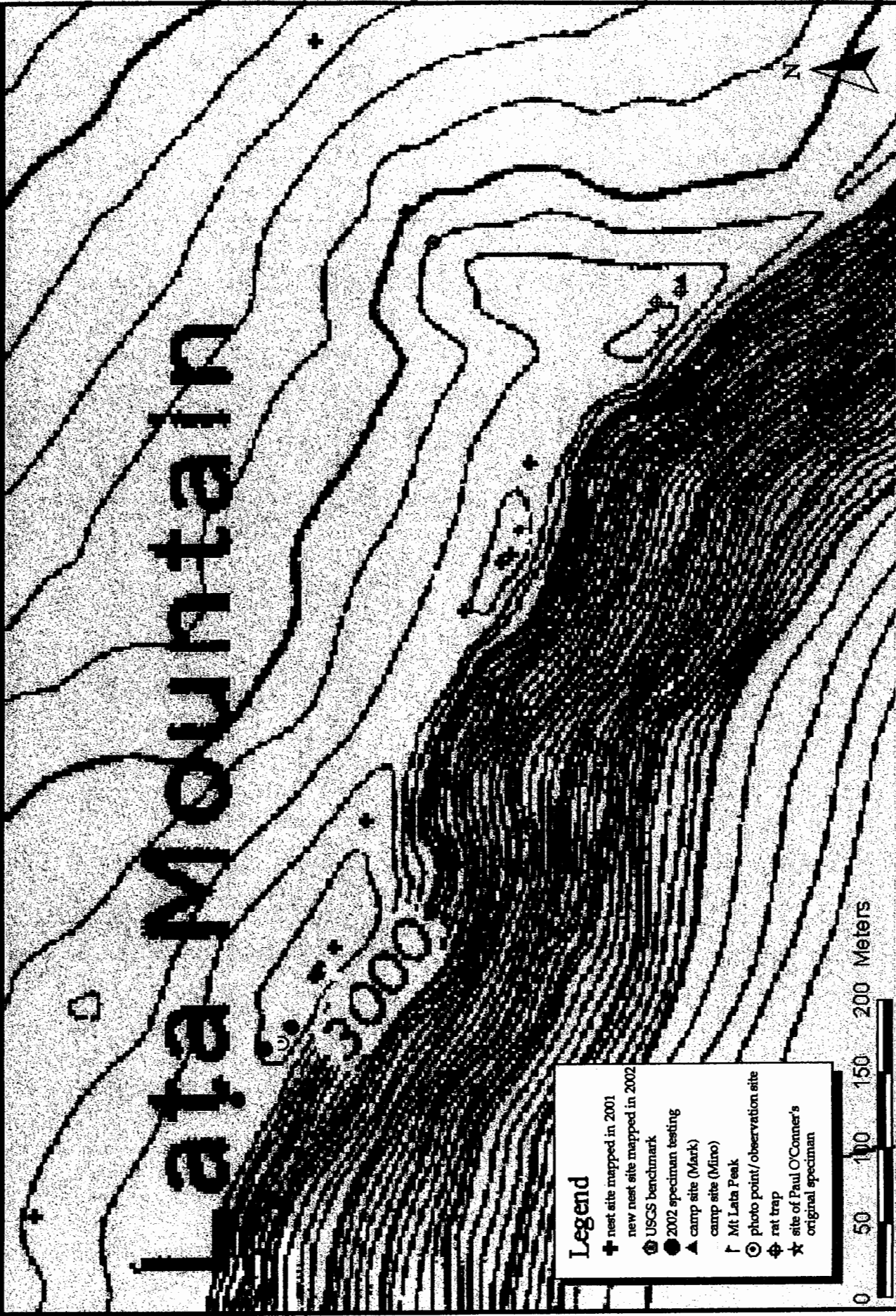


Fig. 2: Summit trail descends into Crake Valley: and extends about one mile to cinder cone in top right of photo.



and rats/humans have caused some decline or abandonment. Calling petrels are not found in suitable habitat near the camping area, although in the early morning hours, one was heard calling from the vicinity of the burrow from which the male specimen was collected by Paul O'Connor in 2000. Densities of calling petrels on the ground were highest near the summit of Mt. Lata and along the newly cleared trail.

Petrels began calling about one half-hour after sunset and called actively until around 10 PM but some flight calls could be heard all night. With a sound collecting parabola, we recorded two 60 minute tapes in order to gauge the densities of seabirds in the area. The parabola recordings give another perspective of bird activity in the area below the summit. It is not possible to determine how far down the cliff birds could be heard, although it may be only 150 ft (Stith website). A cone of air space several hundred feet long and tens of feet wide was sampled for two evenings. We recorded the flight calls of Tahiti petrels and noted that the long drawn out calls of birds on the ground are condensed into a swift ascending pitched whistle. This piercing call may be used by birds approaching the nesting area in the dense fog and darkness and may have echo-location qualities. The whistle of the petrel may travel far and the amphitheater of the cliffs may enhance or echo calls.

The summit trail is an arbitrary path through some petrel habitat (Fig. 2) and while perhaps representative, it is extremely limited in scope and cannot be used for any reasonable colony estimate of the entire Ta'u petrel population. Owing to the dense vegetation and large scale of the region, it is very difficult to render a full population estimate. From the vicinity of the summit perhaps as many 200 birds were heard calling from lower down during the listening periods. About five miles of summit rim exists and petrels are likely distributed along its course as well on Olotania Crater and on the southern side of the mountaintop. Roughly, based on the estimated space, known density of calling birds and extensiveness of the potential habitat, one to two thousand pairs may be present over the island summit areas.

We spent five nights on the summit listening and recording petrel calls. The estimate of "thousands" was less than what we thought in 2001 but now with the new perspective, is an appropriate estimate. Previous investigators (Crossin in Amerson 1982) reported Tahiti petrel as an uncommon resident, heard from Olotania crater to the summit and beyond, ranging deep into the forest in May. He notes it was the most common procellariid and the number of calling birds indicates that thousands are present. He collected several specimens.

Along the summit track, the Tahiti Petrel nesting habitat is characterized by hollows dug under a tree root system. It is possible this warren system is created by the activities of petrel diggings over millennia. Many, if not all, of the tree tops were damaged in the 1991 hurricane, and may contribute to a dense undergrowth of vines, more than before when an intact shade canopy existed. Other petrel areas are under very dense tangles of vines and ferns. Koster's curse (*Clidemia hirta*) is also prevalent along the trail as well as off-trail.

Aside from calling birds caught on the ground, two or three petrels were seen flying at dusk over the summit. Notably, one petrel was seen at sea level about 10 AM flying out to sea at about 30 feet elevation from Fitiuata village. A few

Audubon shearwaters were heard calling below the summit of Mt. Lata. They are less common than Tahiti petrels at this season and do not nest on the summit track, but in the cliffs below. The 2000' cliff also supports different habitat. The face appears covered with large tree ferns and has caves and overhangs that allow shearwaters, petrels, tropicbirds and possibly storm-petrels to shelter their nests.

Discussion:

Vocalization analysis and auditory surveys are possible with the recorded sounds. The parabola allowed us to record with greater range than before. The Stith website [www.stithrecording.com] reports:

"A parabolic reflector will allow you to pick up sounds much further away than a shotgun microphone. A parabolic microphone is equivalent to having a telephoto lens. It zooms in on the bird enabling you to pick up the bird at a further distance away, with much less surrounding noise. To get a sense of this difference, a parabola may pick up sounds 150' or more whereas a shotgun microphone may be able to only pick up sounds 30' to 75' away. This is all very dependent, though, on how loud the source is that you're trying to record, how much surrounding noise is present, and what microphone and recorder you are using. A parabola is also much more directional than a shotgun microphone... A disadvantage of using a parabola is its somewhat cumbersome size. If you'll be walking through thick brush, a shotgun microphone may be much easier to carry around and it's also easier to operate. A parabola may also not be the best choice if you're recording in high wind or rain."

Auditory Census:

Tapes require further technical analysis to determine if counting the calls is a way to obtain a meaningful index of bird density per time of night and season. Sound analysis is a rapidly developing field. New programs like Canary 1.2.4 or Raven are available from Cornell University for about \$250.00. Personnel from the Cornell Library of Natural Sounds report "If you were recording with a single microphone, it is probably impossible to determine how many birds were recorded, unless there are very few calls and you have additional information available. For example, if you have some evidence that calls of individual birds are distinctively and reliably recognizable from each other based on their acoustic structure, you could perhaps infer numbers of birds from recording if there aren't too many. But this would be an unusual circumstance."

Since only one microphone was used, and many whistles sound familiar, it may not be possible to determine how many birds were calling. Further investigation is required. Copies of tapes of various calling birds will be archived at the Macaulay Library (formerly the Cornell Library of Natural Sounds). Greg Budney (gfb3@cornell.edu) is curator of the sound collection. Computer counting with consultant Bill Evans ([Old Bird.com](http://OldBird.com)) is possible. He wants copy of tape for full time periods. He hope to create an index of calls.

Bill Evans
Old Bird Inc.
605 W. State St.
Ithaca, NY 14850
(607) 272-1786
wrevans@clarityconnect.com

Figure 3: Phoenix Petrel vocalizations ("Ti-Ti") for comparison with Tahiti Petrel vocalizations.

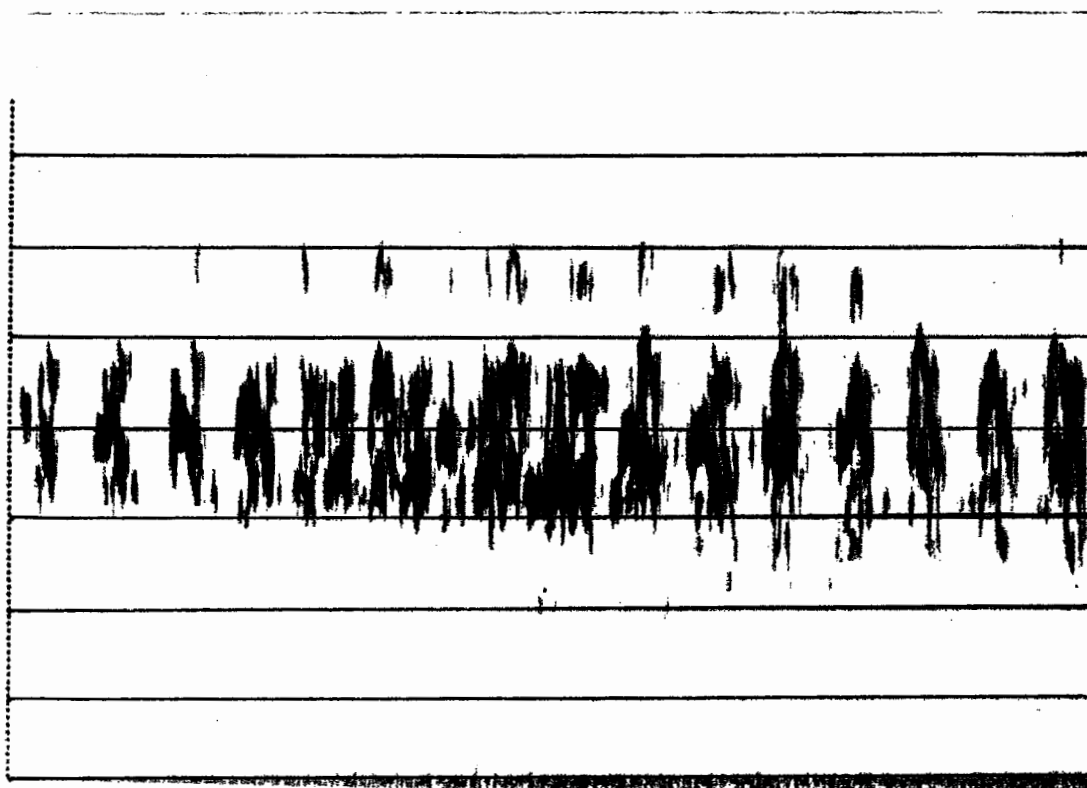


Figure 4: Tahiti Petrel vocalizations showing two birds dueting. One bird nearing the end of its call is picked up by another during the 'hiccup' portion.

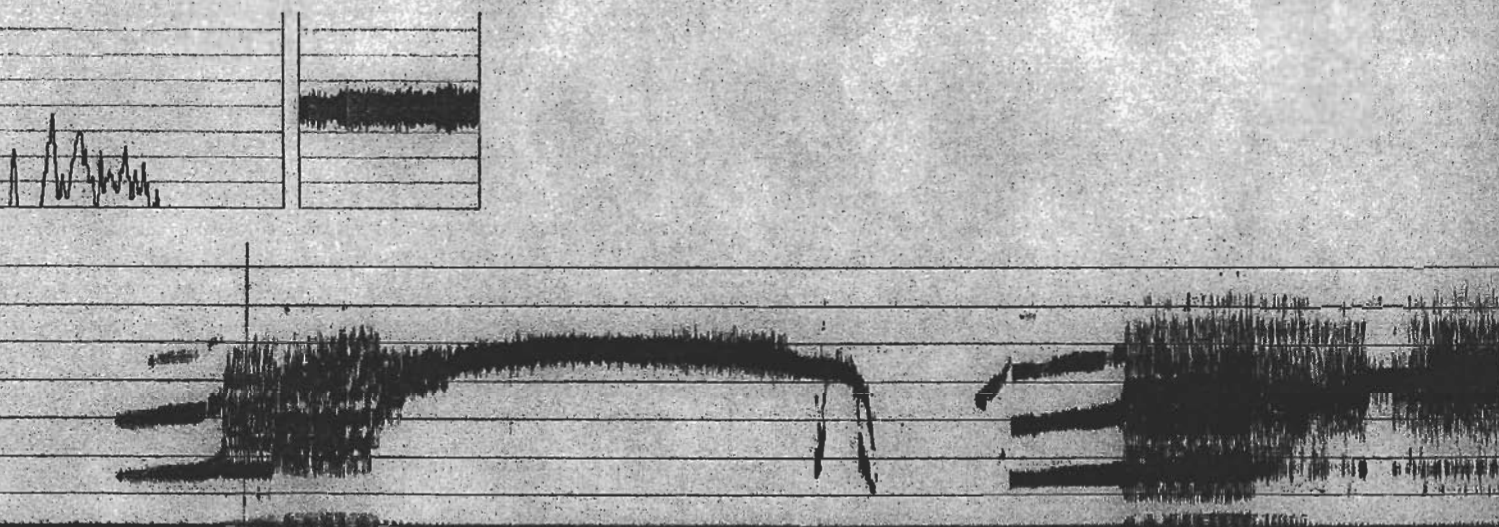


Figure 5: Tahiti Petrel vocalization. Each call starts with the hiccup note separated by a gap (inhalation?) then the variable center portion rich in harmonics, ending in a descending whistle.

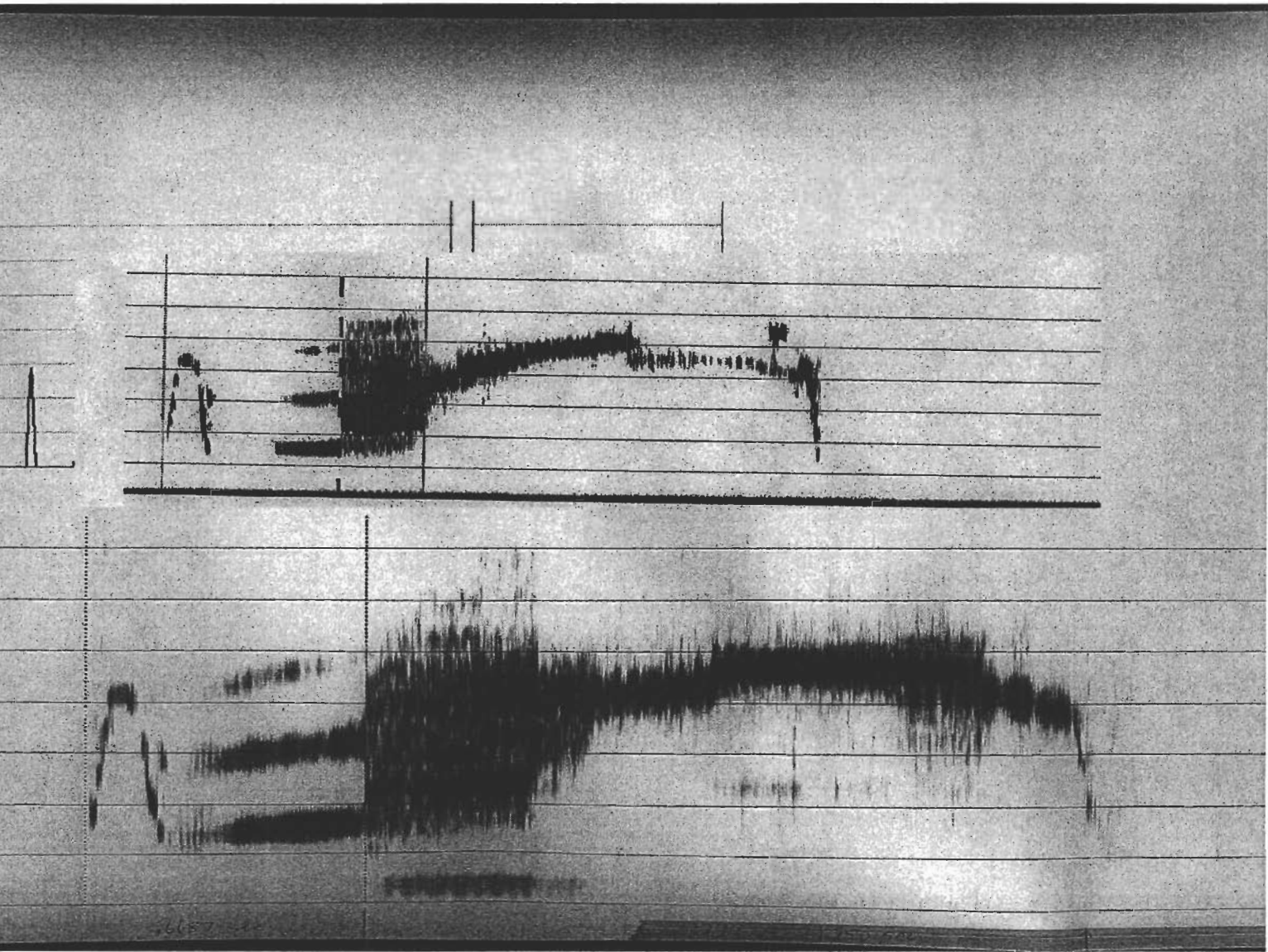




Figure 6: Tahiti Petrel specimen #1 showing wing lining and head.

Specimens:

Feather collection was possible with a letter of permission and a permit for export signed by the U.S. Park Service and the American Samoa Department of Marine and Wildlife Resources (DMWR). The feathers were hand-carried to Hawai'i. US Customs and USFWS Enforcement took no interest in the paperwork declaring said items. The feathers and rodent voucher specimens entered Hawai'i without inspection of the material and were passed to the USFWS in Honolulu and the Smithsonian Institution. Dr. Storrs Olson warned collectors not to send any DNA material via the mails after the Anthrax letters episode in 2001 since all correspondence is now irradiated, thus destroying DNA. So the feathers were sent to Dr. Olson's home address. The feathers were received by Dr. Olson and some were processed. See Appendix 2 for more about Tahiti Petrel genetics.

>>> Storrs Olson - 12/30/02 10:19 AM writes>>>

"I think that all your previous samples have been run but that we are still waiting for the comparative samples from elsewhere in the Pacific. Haven't heard anything about this in a while but perhaps Rob can fill us in. "

Carl E. McIntosh writes:

"I amplified a portion of Cyt-B that I hope will be sequenced in the new year. The first set of sequences from the feathers were contaminated."

Carl McIntosh
National Zoo - Genetics Program
3001 Connecticut Ave., NW
Washington, DC 20008
ph: 202-673-4781
fax: 202-673-4648

Figure 7: Norway rat (female) caught at Mt. Lata. Voucher specimen #1.



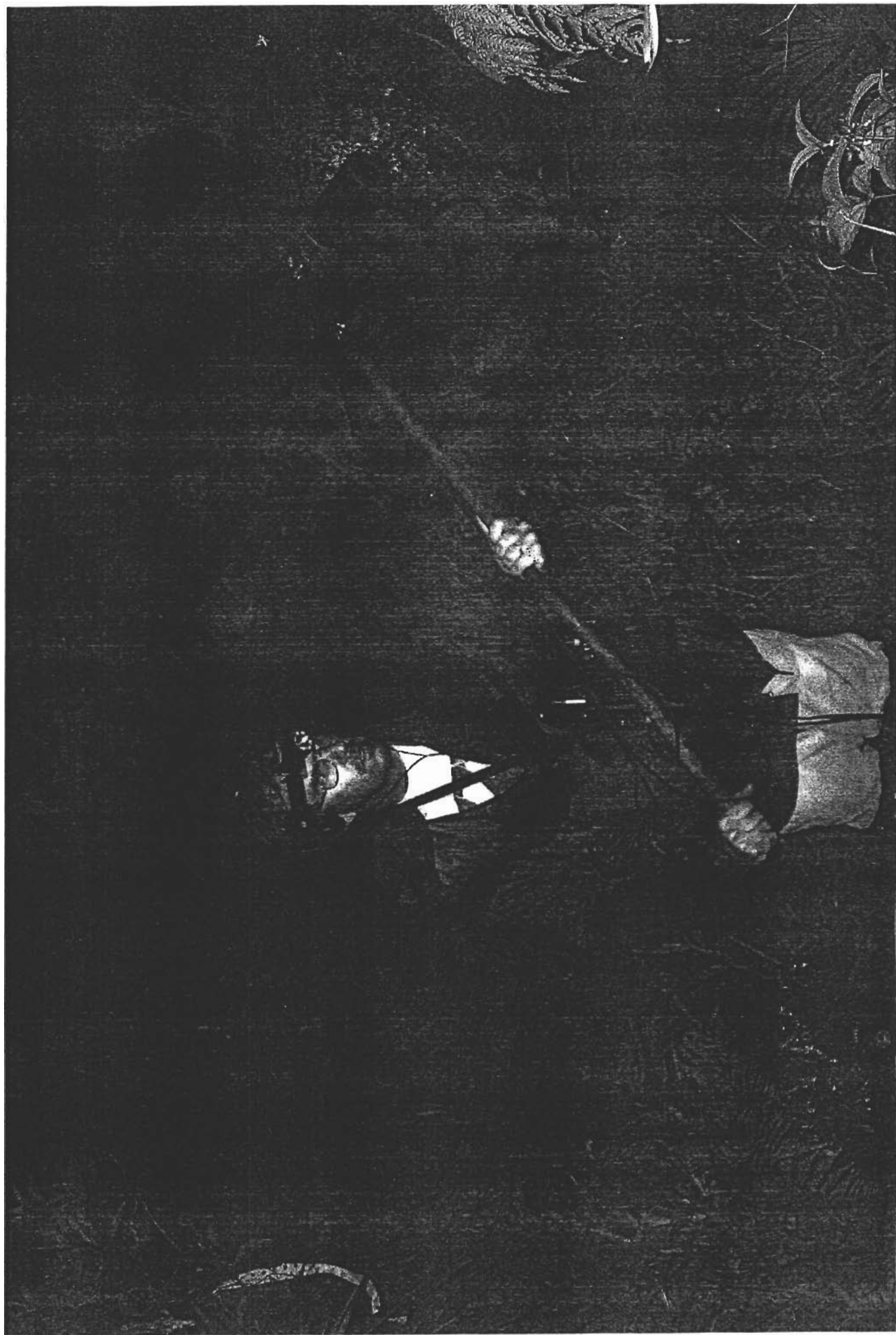


Figure 8: Rauzon with audio recording gear and parabolic microphone on long handle.

Other Specimens:

Rodents:

In 2002, we were prepared to repeat the rat trapline survey conducted in 2001 with 20 new rat traps which had been purchased and shipped to American Samoa. The existing traps had rusted and deteriorated significantly in the year and a half on Mt. Lata. Rat voucher specimens were also requested by USFWS to confirm rodent identification. Because we required export permits from the Dept. of Marine and Wildlife, and due to the remote possibility of accidentally catching a spotless crake in a snap trap, DMWR provided the permits with the stipulation that only live traps be used and the rats hand-suffocated. DMWR provided us with 10 folding live Havahart™ traps.

This resulted in us not using the new snap traps to replicate the old trapline data. Instead we opted to obtain voucher specimens. These live traps were much heavier and bulkier so we carried only five to the summit. At camp we found rats to be diurnal. The food provisions we left at camp had been well chewed up so in concern for our food supplies, we set some of the rusted traps. We set three snap traps for three nights, and 4 live traps for two nights. (20 trap nights approximately) and caught 4 rats or 0.2%, the highest yield thus far.

In 2001 a total of 20 Victor rat traps were placed along the track. The trail from the camp site to the summit of Mt. Lata was trapped. Single traps were not set in any particular distance from each other but placed in areas likely to catch rats. Each trap was baited with a small piece of coconut smeared with peanut butter. The traps remained in place for five nights (100 trap nights) and caught 8 rats for a trapping success 0.08%. On the first night, a female Norway rat was caught. Its abdomen was swollen and appeared pregnant. See Fig. 7. Another trap killed two subadult males at the same time. One adult male was taken in addition to another adult female. The other three rats taken were subadult males.

In contrast, six male rats were caught in July 2001 when traps ran for 4 nights (176 trap nights) over a linear area of approximately 440 m (1324 ft.) long. The December trapping effort caught more rats than in July (0.08% verse 0.03%), and a greater gender/age diversity. Based on trapping success, rat densities were highest in areas nearest the camp, areas without petrels. Rat trap success in petrel nesting areas was zero, however, in consideration of potential non-target trapping injuries, trapping was limited. Some traps were sprung by unknown animals. However, trap operation was impacted by rust and compromised springs, so were not as sensitive as originally. Nevertheless, trapping success was higher in 2002, 4 for 20 trap nights verses 8 for 100 trap nights in 12/01, and 6 for 100 nights in 7/01).

Morphometric Data:

- 1). *R. norvegicus*-female lactating, rump balding, 165 g. caught 12/10/02 by camp at night using tuna oil and cracker. Voucher specimen to USFWS. See Fig. 7.
- 2). *R. norvegicus*-male 200 g. caught 12/11/02 by camp during daylight using tuna oil and cracker.
- 3). *R. norvegicus*-immature male 45 g. caught 12/11/02 by camp during daylight using tuna oil and cracker.
- 4). *R. norvegicus*-male 140 g. caught 12/12/02 in petrel colony using tuna oil and cracker Voucher specimen to USFWS.

In July 2001, Norway rats were slightly less common, and perhaps more food limited since large males were primarily caught. In December, 2001, and 2002, austral summer rainy season may produce more food and allow less dominant rats to gain access to bait. It could also be that rats are increasing. In 2001, no rats were caught in the petrel colony. In 2002, at the summit of Mt. Lata, rat scat was spotted on a ti leaf on the trail and in a backpack that had left there for several hours. A live rat was caught here later.

The presence of Norway rats atop Ta'u is a significant ecological problem and could likely mean the eventual extirpation of breeding petrels along the ridge line and extirpation of local crane populations. While it seems unlikely that trail cutting is facilitating rat movement, it could be possible. And while it seems that petrels are less evident this year than year and appear to nest further from camp than they have in the past, it is more likely a seasonal variation, than attributable to rat predation since no birds handled show bite marks. *R. norvegicus*, which weigh over 200 g. could wreck havoc on the small petrel chicks and cranes. It is possible that in 20 years, there will not be a colony of Tahiti petrels on the summit track of Ta'u. On the positive side, it is likely seabirds nesting in relatively inaccessible cliff faces will persist since *R. norvegicus* are less agile climbers than black rats (*R. rattus*).

Initiating rat control is problematic. Legal constraints prevent the use of brodifacoum in wilderness areas on Territory lands (E. Campbell-USFWS, pers. comm.). Inaccessibility of the site for bait station maintenance is also prohibitive. Bait stations that are rat-proof would also be needed.

Seabird Survey of Tutuila:

On 12/18/02, a survey was made of the seabird colonies around the island of Tutuila. The USPS 25 ft. zodiac left the dock at 8:00 AM returning by 11:30 AM. We began by moving south and west from Pago Pago harbor on a clear calm day. An attempt was made to estimate the number of birds seen along the way. The majority of seabird and seabird habitat is protected in the Park unit. Forested cliffs and rocky cliff provide a variety of habitat types.

American Samoa National Park: The Pola Unit:

Red-footed boobies (*Sula sula*) -nests along the crest of the ridges in trees. The dark-backed phase is most prevalent, but one all white phase was noted. At least 300 RFBO were estimated to nest in park.

Great Frigatebird (*Fregata minor*)-10 in flight, reported to nest on Pola by Park personnel.

White terns (*Gygis alba*)- A clicker counter was used to record all the sightings of white terns (WHITE), usually singles and pairs, along the upper ridges and at sea. 142 were recorded, although a few may represent tropicbirds seen from afar.

Brown Noddies (*Anous stolidus*)- the most common seabird, using both trees and cliffs for nesting substrate. At least 500 were estimated to occur in the park.

Black noddies (*A. minutus*)- none were identified.

Blue Noddies, formerly blue-gray noddies (*Procelsterna cerula*)- Approximately 10 seen. A few reported to nest on each major cliff around the island.

Gray-backed tern/Bridled Terns (*S. lunata/anaethetus*)- About 50 were seen during the survey. See Seabird Notes.

Other Areas Surveyed:

Fagetele Bay National Marine Sanctuary is a sheltered bay with fruit bat roosts.

BRNO-5

BRBO-10

GRTE-1

WHITE-1

WTTB-1

spinner dolphins-7

Cape Taputapu National Natural Landmark has rocky promontories with seabird roosting and nesting.

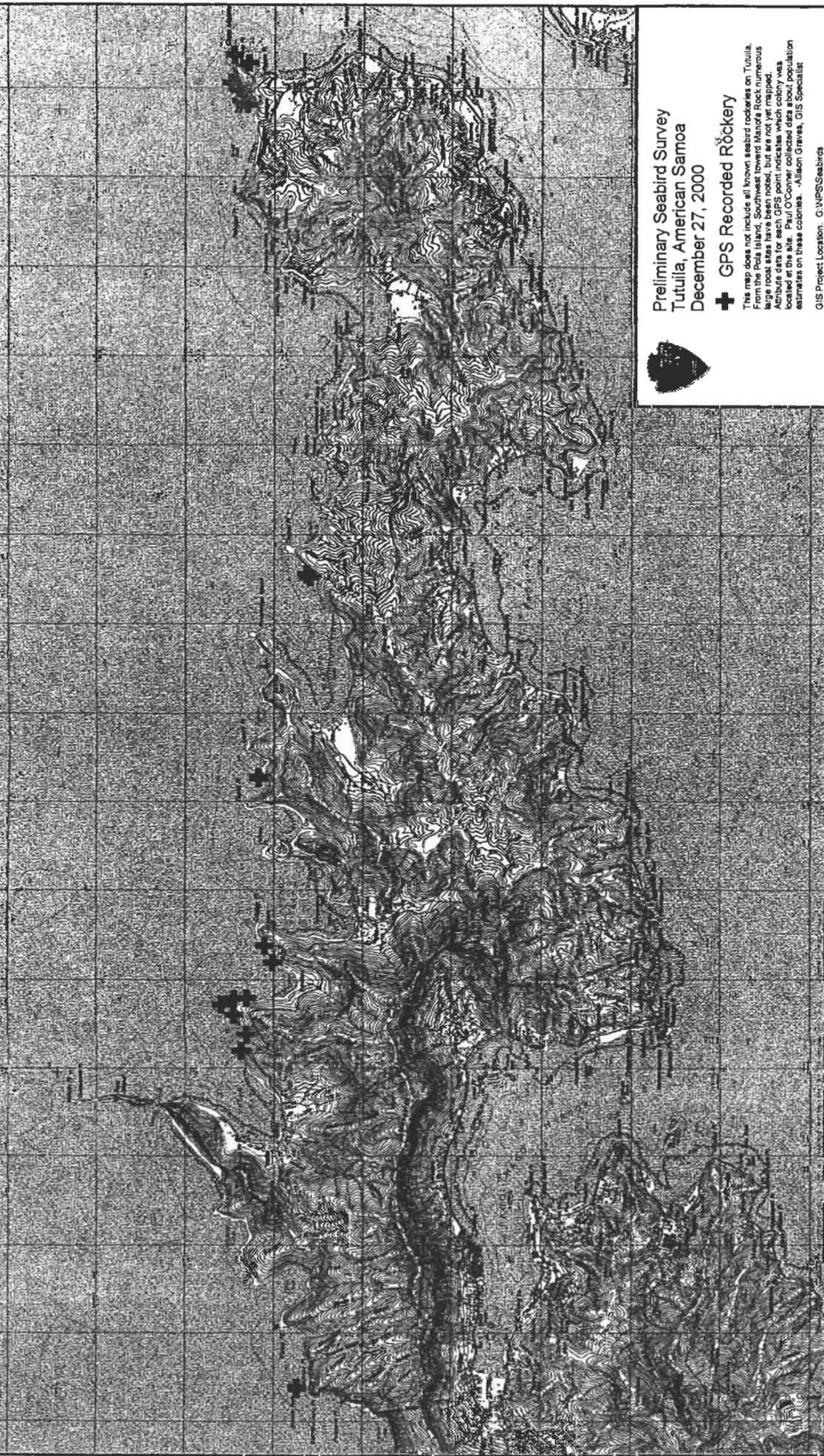
BRNO-50

BRBO-10

WHITE +

Blue-gray Noddy-1

Fruit Bats +



**Preliminary Seabird Survey
Tutuila, American Samoa
December 27, 2000**



+ GPS Recorded Rookery

This map does not include all known seabird rookeries on Tutuila. From the Pola Island, Southwest toward Manafu Rock numerous large rookery sites have been noted, but are not yet mapped. Aribou data for each GPS point indicates which colony was located at the site. Paul O'Connor collected data about population estimates on these colonies. - Alison Greene, GIS Specialist

GIS Project Location: G:\NPS\Seabirds

Seabirds Notes:

Gray-backed Tern/Bridled Tern Identification:

Gray-backed terns replace bridled terns in Central and N.E. tropical Pacific (Mostello et al. 2000). It may be that bridled terns are expanding their range into the south-central Pacific region. Bridled terns are recently reported to breed in Upolu, Samoa (Watling 2001). See Appendix 3. Amerson (1982) reports that gray-backed terns (*S. lunata*) were resident breeders on Tutuila and bridled terns (*S. anaethetus*) were recorded at sea prior to 1975 (p. 91). Bridled terns are considered as a vagrant in 1967. King (1967) noted one record and several sightings with no details (Amerson 1982). R.S. Crossin reported collecting a specimen off Tutuila but no details were available. Amerson and Sesepasara report 8-10 gray-backed terns in Fagatele Bay on 17 Feb. 1976. About 100 birds in Larsen Bay were flying around an inaccessible cliff. Their behavior suggested they were nesting there. During 12-16 July 1976, about 125 adult birds and an immature bird were seen, suggesting breeding occurs. Gray-backed terns have also been reported as breeders from Rose Atoll and visitors to Annu'u Island.

Past confusion of gray-backed terns with similar bridled terns renders some older records questionable (e.g. Amerson et al. 1982) (Mostello et al. 2000). "Plumage similarities of *S. lunata* and *S. anaethetus* may have led to confusion in early records of both species in Samoa. Voucher specimens would be useful." (Amerson 1982). We also experienced some confusion as did DMWR personnel (J. Seamon pers. comm.) trying to identify terns from the moving boat because it seemed the actual status was the reverse of the published status. Initially I identified the terns as *S. lunata*, suggesting that gray-backs are also present but outnumbered by *S. anaethetus*. The only vocalizations I clearly heard sound like the 'churr' call of a gray-back tern given as a warning call at intruders (Mostello et al. 2000). Note that gray/brown color on the upper back, even on brown noddies, is difficult to distinguish in strong sunlight. Harsh lighting can easily complicate judgement of brown and gray shades (Western Birds 1996, 2001, 2002). We present figures of terns that show how gray-backed terns appeared darker than they actually are. Heavily worn gray-backs at the beginning of pre-basis molt have darker brownish cast on outer secondary covert but inner coverts and back remain medium gray readily distinguishable from dark brown of bridled terns. (Western Birds 2002). Also there may be color variations in upperparts in the western Pacific forms of *S. anaethetus* (P. Pyle, PRBO, pers. comm.) but all subspecies have white outer tail feathers (rectrices).

Since determination of true back and wing color is problematic, we focus on underwing patterns of light and dark. In *S. anaethetus*, the extensive dark underwing primaries contrast that of the *S. lunata*'s light primary underwings and may be the most diagnostic field marks. We provide here some photographic evidence that suggest Bridled terns are breeding residents in the Park. Also included are photographs of *S. lunata* for comparison. Figures 9 and 10. I also viewed terns from land at the Pola from land where the late afternoon light was less harsh. Flying between the arch were a pair of bridled terns; later, a single bridled tern chased away a brown noddy then landed on a cleft on the seawall wall. This site had a clump of grass growing on it. The tern slowly moved around it and I saw the darker brown head and back and wings and noted the upright posture was like a sooty tern (*S. fuscata*), not angled and low like gray-backed terns, a lesser used field mark (Pratt et al. 1987).

Figure 9: Bridled Terns at Tutuila, Pola Unit NPS. Note dark under primaries, white forehead and dark mantle. Contrast this with Gray-back terns in Figure 10.





Bridled Terns in Flight- 12/18/02, Tutuila, American Samoa



Figure 10: Gray-backed terns- Christmas I. (Kiritimati). Note reduced black primaries under the wing in spite of darker upper primaries (especially on the top bird).



Miscellaneous Seabird Sightings:

Lesser Frigatebird (*F. ariel*) male, was seen off Fituati village area, Ta'u, 12/15/02.

Black Noddies were seen at sea off Fituati village area, Ta'u, on 12/15/02. They were in feeding flocks with white terns and brown noddies. I did not view any forest nesting BLNO because no transport was available to Saua due to road conditions.

Black Noddies reported from Saua area by Peter Craig
July 28, 1998 -19 nests
December 15, 1998 -12 nests
April 7, 1999 -1 nest

Crested Tern (*Thalasseus bergii*) seen from Ofu Beach in 1995 and reported to Dick Watling so it could be included in his 2001 book.

Bridled Tern was seen flying along the shoreline of Ta'u on 12/16/02.

Collared Petrel (*Pterodroma brevicipes gouldi*) reported by Josh Seamon from 2002 on Tutuila, adult turned into DMWR, photographed and released alive. The collared petrel is a significant find since it fuels the assumption that they breed somewhere in Samoa. Some researchers had come to the conclusion that there were probably never any collared petrels in Samoa and those on Ta'u were herald petrels. I asked for details and saw digital photos of the bird but no recorded data of time and location of stranding was immediately available. Other specimens have been picked up before. It is possible that collared petrels are passing through the region and get disoriented. However sightings of them made in Oct. 1976 by Amerson on Mt. Lata suggest they are resident breeders that thus far deny confirmation. See Appendix 3.

That seabirds come ashore who are not breeders has been well documented. Grant and Clapp (1994) describe new records of two live sooty shearwaters, one Newell's shearwater and a wing from a dead white-faced storm-petrel.

Archeological research also suggests disoriented seabirds were eaten and were later interpreted to be part of the endemic fauna. Steadman (1993) conjectures that there may have been a resident seabird very similar to sooty shearwater, extirpated by Polynesians but Grant and Clapp (1994) report two live specimens found. A common migrant passing through the region today, some may have been blown ashore in the prehistoric past when the birds were even more numerous. Other results are interesting in creating a picture of pre-Polynesian species no longer extant:

<u>Species Uncovered</u>	<u># of bones</u>
wedge-tailed shearwater-WESH	11 bones
sooty shearwater-SOSH	15
Audubon shearwater-AUSH	2
Tahiti petrel-TAPE	6
Herald petrel-like spp.	2
<u>Megapodius Spp.</u>	<u>2</u>

He found 2 bones of a *Megapodius* spp. Prichardii type from Tonga. That are now extirpated in Samoa suggesting people ate the last of these flightless ground-nesting land birds.

WESH - may nest on Pola and Ta'u but not confirmed, nor considered to by recent workers (Watling 2001). WESH may have been extirpated by early colonists.

AUSH- 500 breed in cloud forest on Ta'u (Amerson 1982).

TAPE- 500 in colony in 1976 in montane cloud forest. One on Tutuila in 1986 (Amerson 1982).

Non-seabird sightings:

The sooty rail or spotless crake (*Porzana tabuensis*) was heard calling again from the area where it was first discovered. This habitat is waist high shrub forest composed of vines and ferns in the valley about a 1/4 mile from camp, now referred to as Crake Valley (Fig. 11). The call "bup-bup-bup-bup-bup" was briefly heard in "Crake Valley" on 12/9/03, and another call was heard in the same vicinity on 12/13/03. The calls were not as distinct or repeated as before but conditions to hear them was compromised by wind. However, repeated calls suggesting crakes are on territory here year-round.

About three pairs of wattled honeyeaters have territories along the summit track. A Polynesian Starling (dark Manu'a type) was seen as well as a Pacific Pigeon flying over. White-rumped swiftlets were abundant. White terns and white-tailed tropicbirds were seen below the rim of the crater once when the fog cleared for about 45 minutes.

Fruit bats were also seen transiting the summit and foraging on 'ie'ie vine fruits. On the evening before the thunderstorm, there were very many bats foraging and milling about the cloud forest. At least 35 were in the air at the same time. One was flushed from next to the trail. Up until darkness, many were seen flying, an impressive display of a healthy Samoan forest.

One terrestrial amphipod was collected. Dr. Rosie Gillespie UC Berkeley was notified. She has recently returned from Rapa in the Austral Is., French Polynesia and reports that a French researcher was studying Tahiti petrels and collecting blood for DNA work.

Future project Recommendations:

- Comprehensive boat surveys of Ta'u and Tutuila. With advance planning, charter of McConnell-Dowell boat on Ta'u is a possibility.
- Population estimates needs confirmation and could be based on ornithological radar, and/or at-sea censuses.
- Create remote audio recording station for a year.
- Survey other islands for seabirds.
- Obtain seabird stranding data from DMWR on Tahiti and collared petrels.
- Survey in July for possible occurrence of Herald's and collared petrels.
- Obtain voucher specimens of bridled terns.
- Develop water catchment system on summit- see <http://www.wildlifewaterguzzler.com/> 200 gallon light fiberglass tank (4'X2'X4')

References:

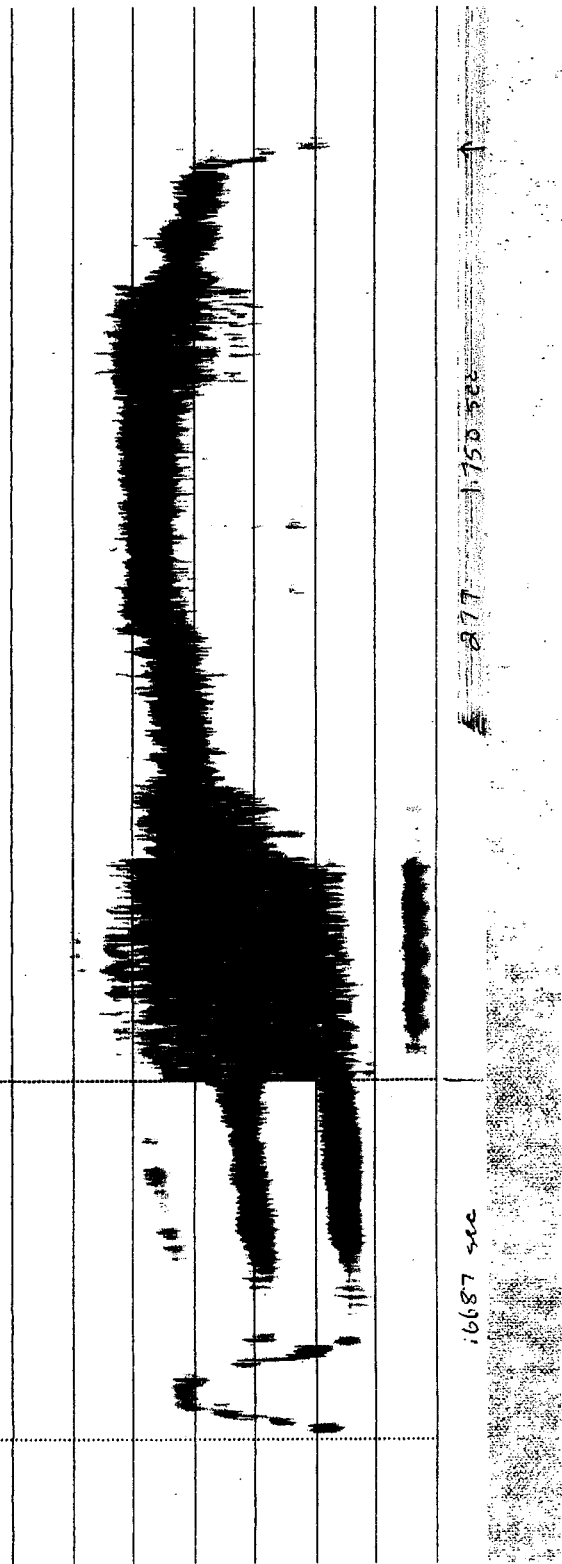
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Appendix 1: Tahiti Petrel Sonagrams

Tahiti Petrel Vocalization Key:

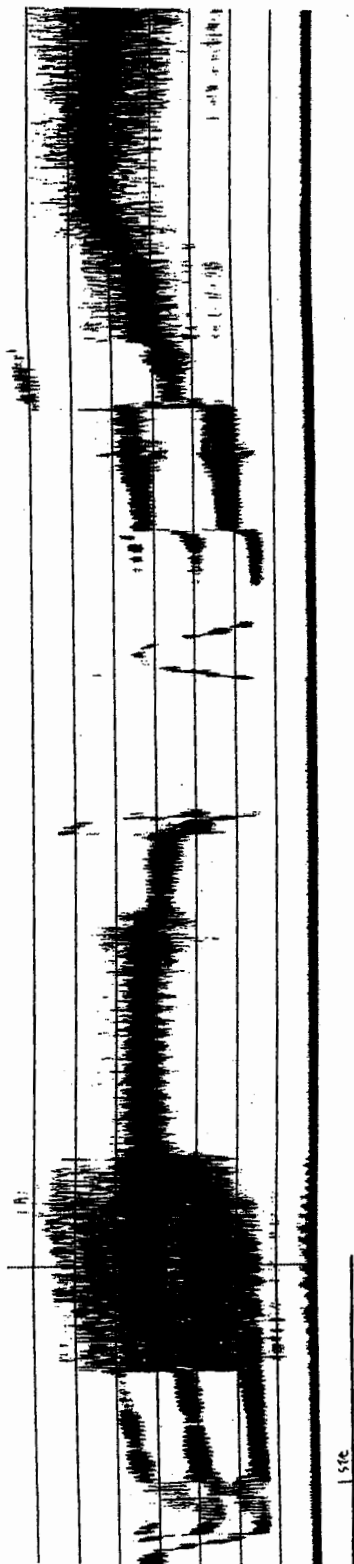
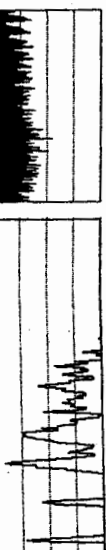
- a. "Typical" call in 12/01- in five parts. Inverted 'U' (hiccup), pause, harmonics, fuzzy body of call with low register purr, elongated whistle decending at end. Grounded bird
- b. Variet of call (male?) 12/01 Grounded bird
- c. Birds calling to each other. Note 1 second duration scale. 12/01 Grounded bird
- d. Note elongation of call in comparison to c. 12/01 Grounded bird
- e. Note trucation of call and harmonics trending up. This appears to be part of the aerail whistle. 12/01 Grounded bird
- f. "Typical call"
- g. "Idiosyncratic" call.
- h. Flight call.
- i. "Typical" call approximately three seconds in duration showing gap between calls, approximately three seconds.
- j. Calls overlapping.
- k. Duetting calls. Characteristic bold calls (male?) overlapping hiccup portion of typical (female) call. 12/01
- l. Duetting calls. Characteristic bold call (female?) overlapping hiccup portion of typical (male?) call. 12/01.
- m. "Idiosyncratic" call note four part harmonics and long purr.
- n. Aerial chorus, some calls are bolder and closer than others, but creates a wall of sound. 12/02
- o. Audubon Shearwater call. 12/02
- p. "Idiosyncratic" call of grounded bird in 12/02, lacks hiccup portion, has confused harmonics and whistle and purr overlap.
- q. Same as above without whistle portion of call.
- r. "Idiosyncratic" call of grounded bird in 12/02, note steady shreik potion and moan at end. Bird was calling from rootmass 12/11/02 nearest to camp and a bird was later captured here as #6.
- s. Bird #3 captured 12/10/02, had low body weight, initially thought to be female but now in doubt diue to larger morphometrtics.
- t. Flight call whistle followed by a purr and a second bird joining in a full call.
- u. Three flight calls -ascending whistles.

a.

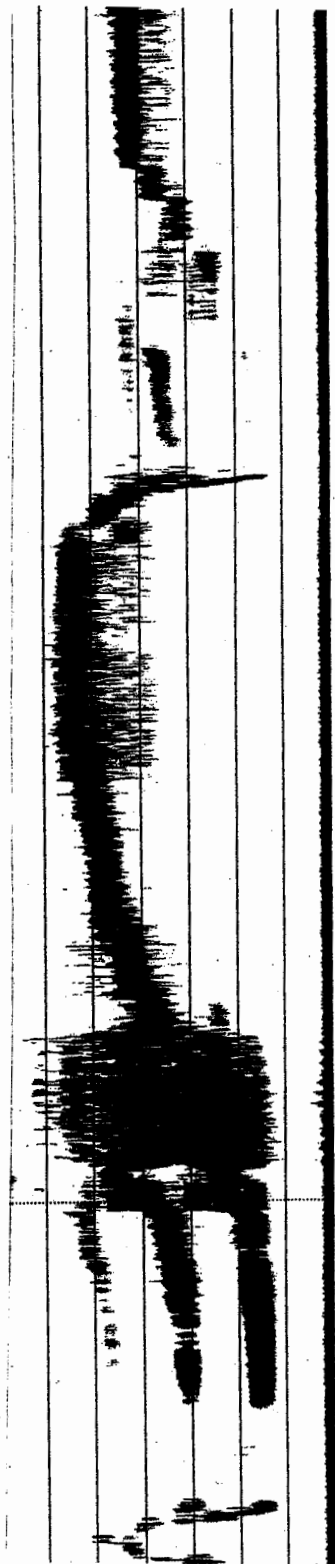


b.



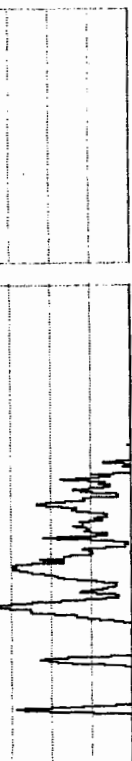


C.

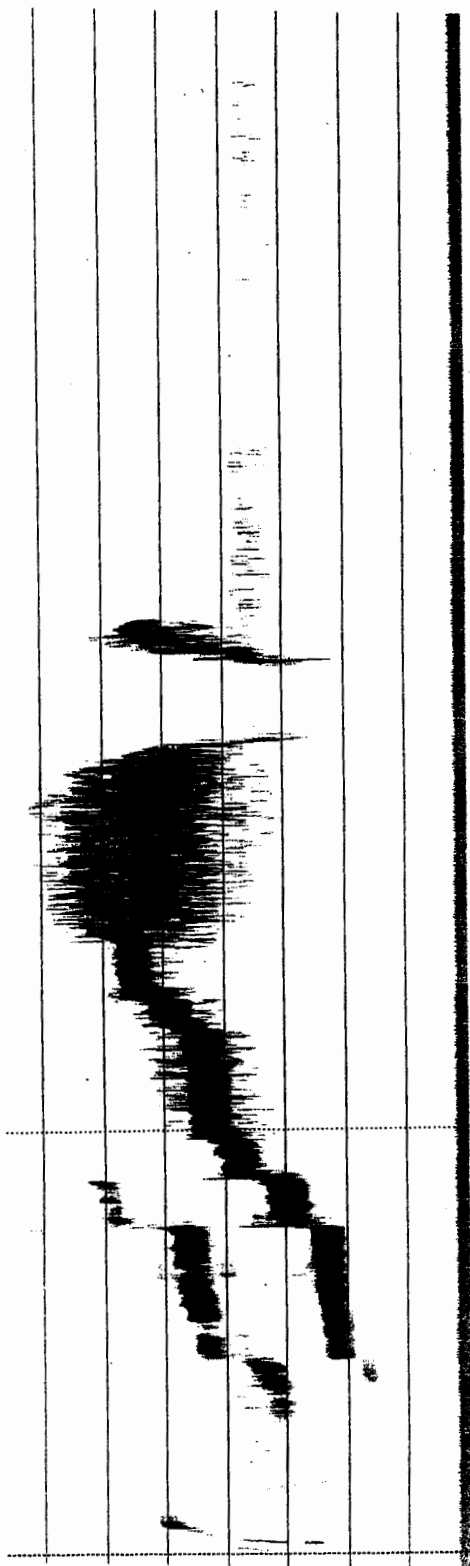


D.

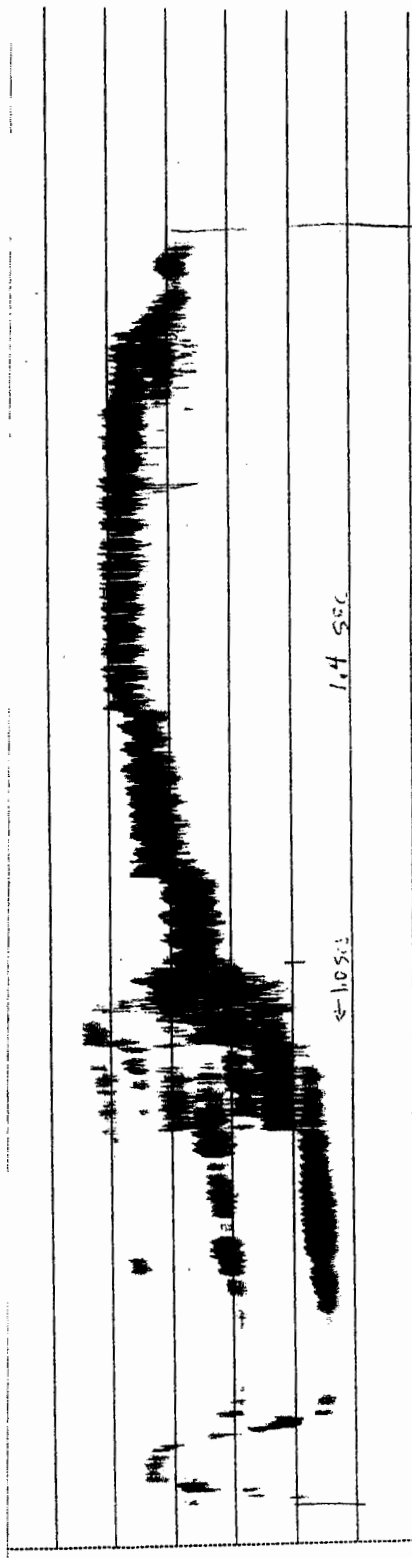
1 SECOND



e.



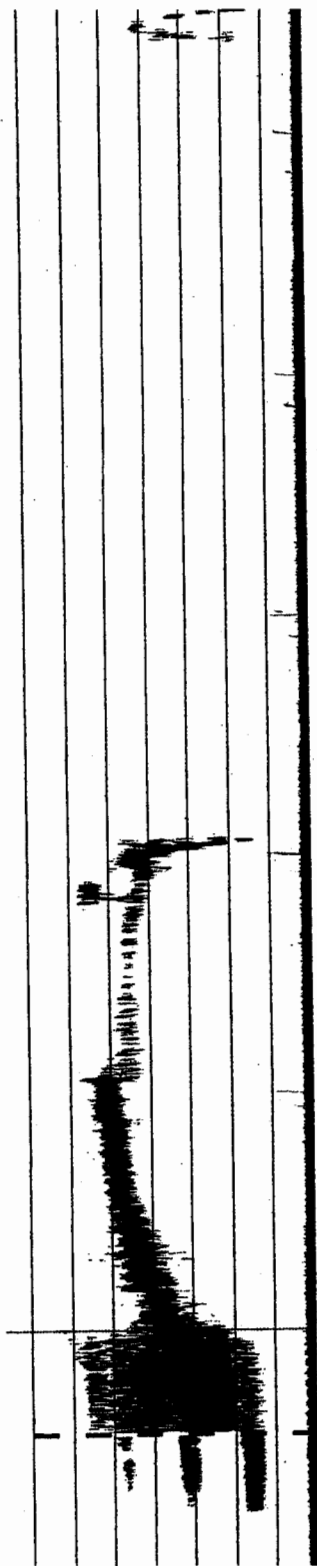
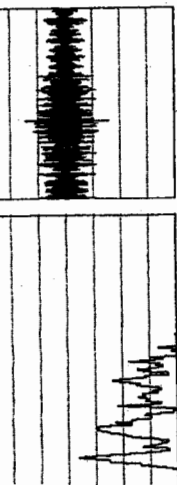
f.



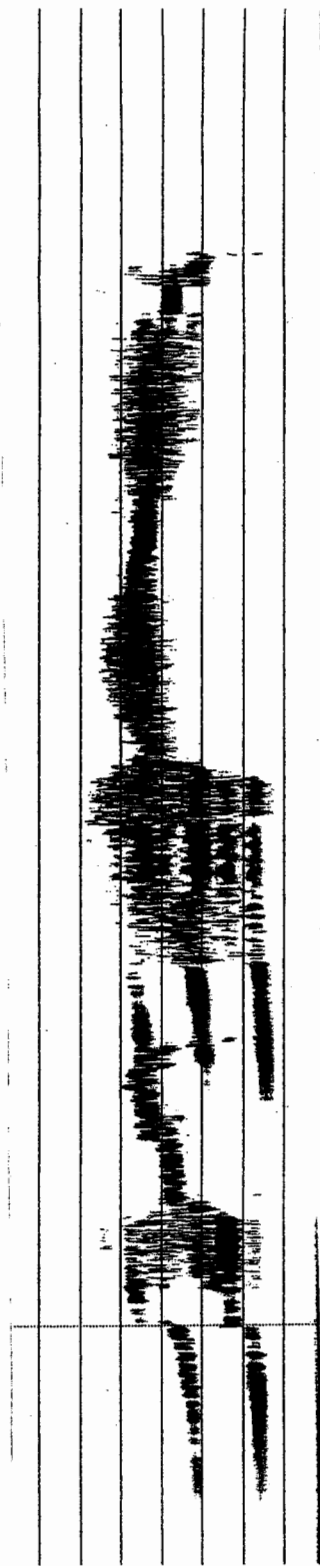
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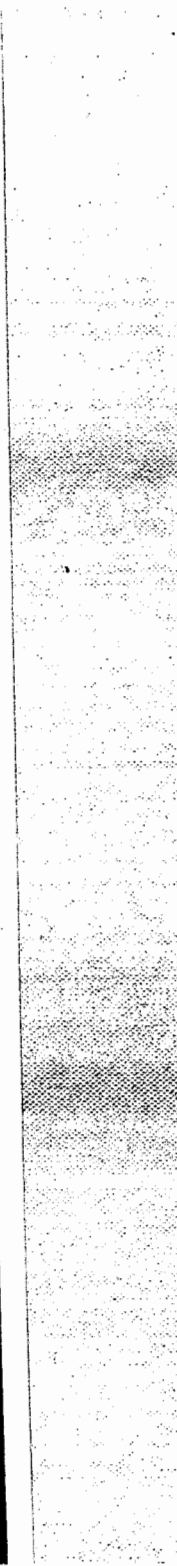
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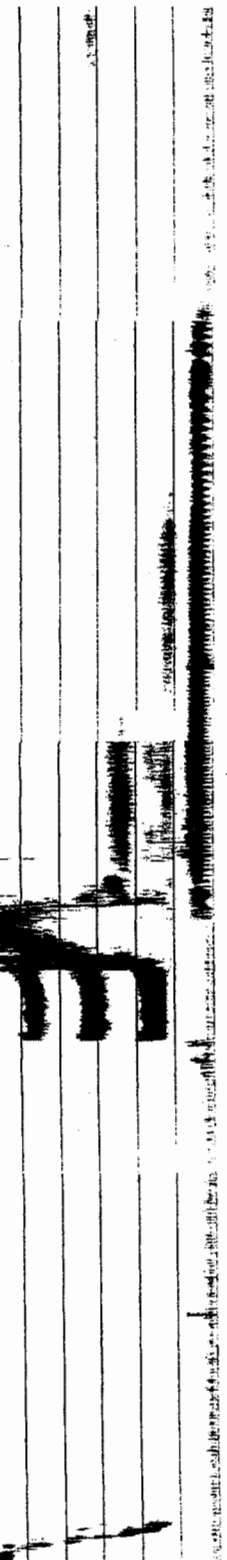
I.



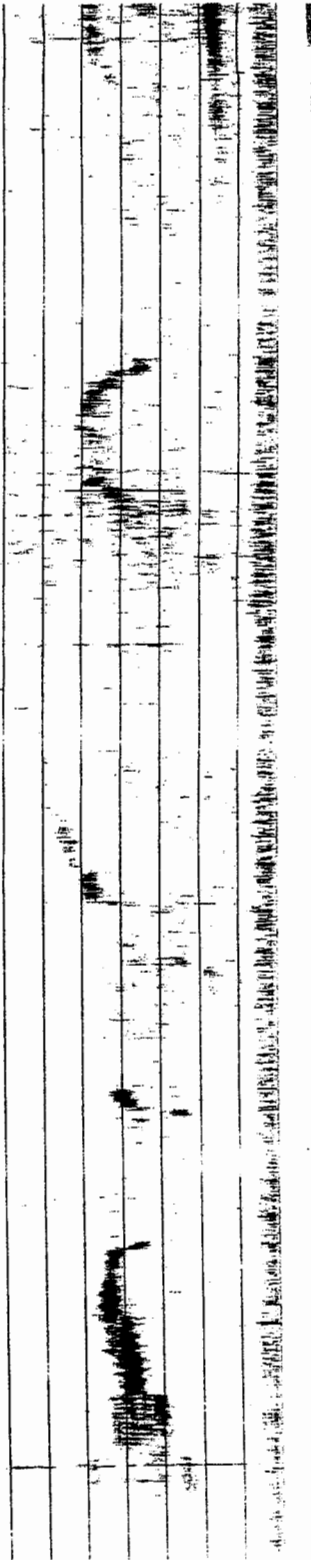
J.



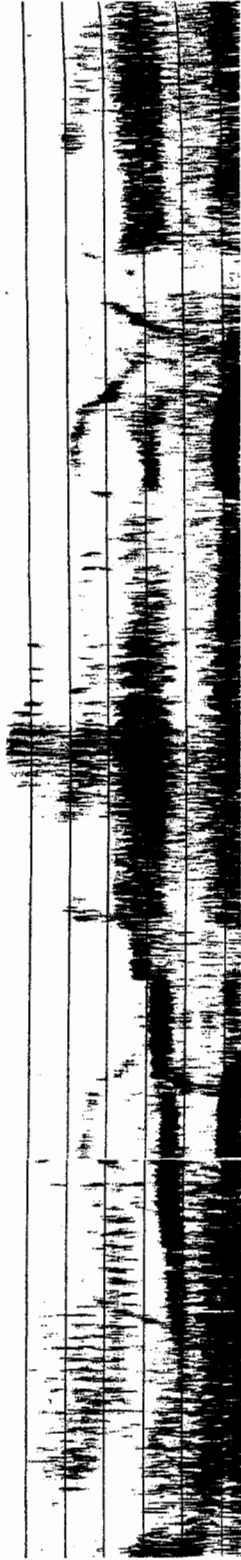
M.



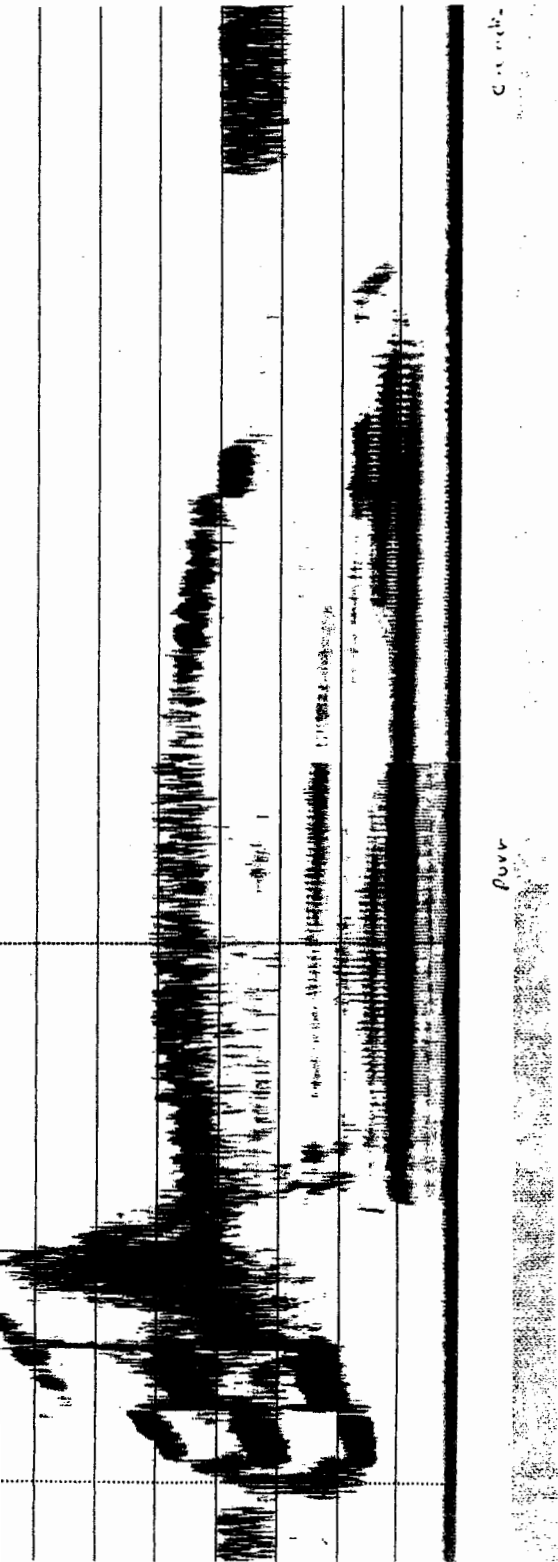
N.



O.



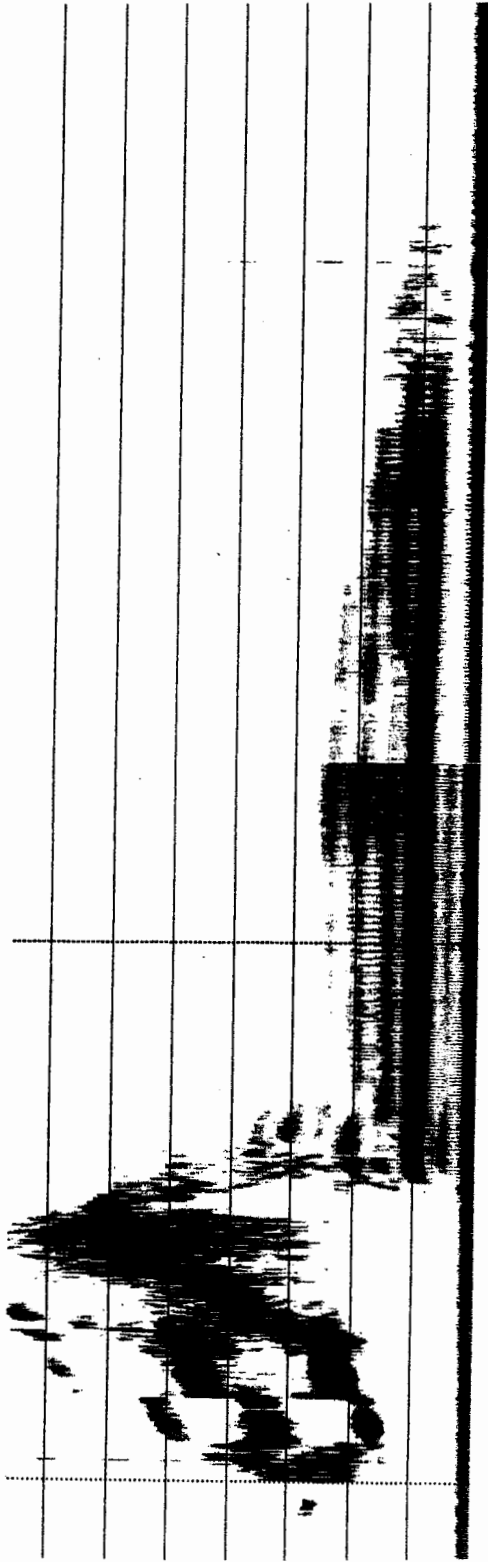
P.



Q. 1000

1000

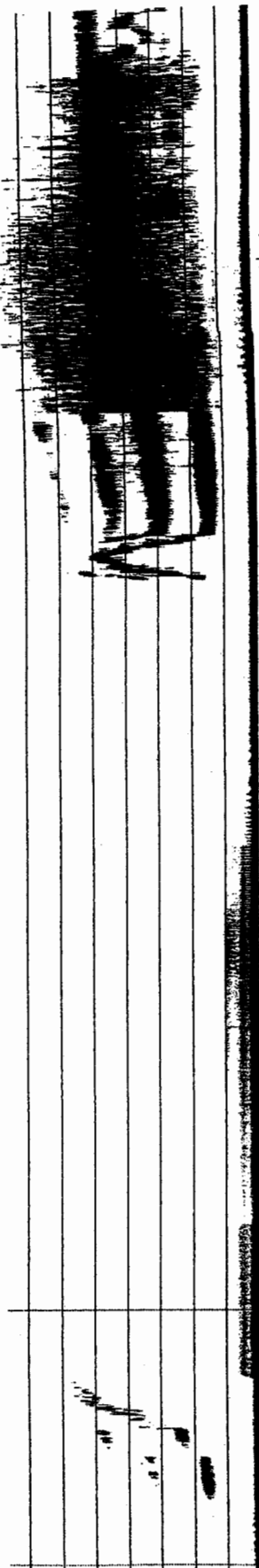
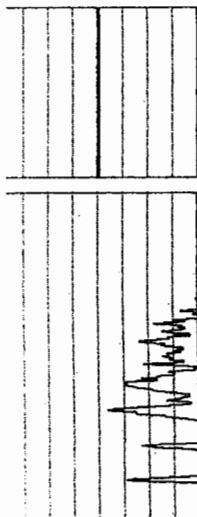
Q.



R.



T.

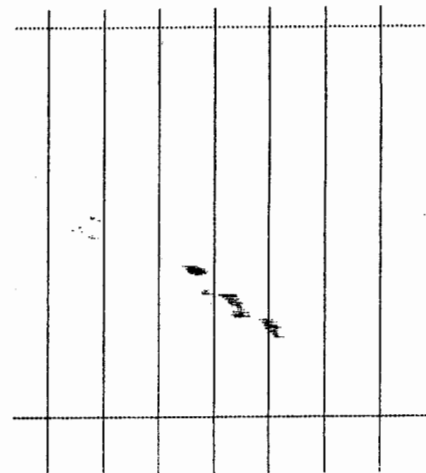
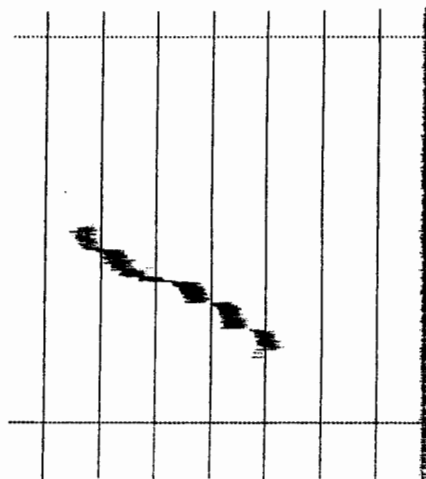
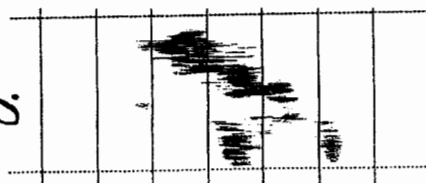


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Appendix 2: Tahiti Petrel Genetics

Correspondance with other researchers of Tahiti Petrels. Of immediate concern are the observations that feral cats are in the Fijian and New Caledonian colonies as are rats in all known colonies.

Fiji:

"This year we are starting a project on Gau, home of the Fiji Petrel, firstly it will be mainly villager awareness but we hope to move up the mountain when finance is sorted out. On one of our last visits up the mountain there we confirmed Tahiti Petrels on the island and so it would be good to know what they sound like. I will remember to keep anything that could help your DNA work should we find it - last time we got a cat kill ! I will copy this to Dave Olson of the Wildlife Conservation Society here, he has a contact at a hotel on Taveuni where Tahiti Petrels are regular visitors - attracted in by a bright security light. Please let us know what could be taken off a live bird by a hotelier (don't ask for blood) and how it should be preserved. My impression from looking at historical records and current sightings in Fiji is that the Tahiti Petrel has undergone considerable expansion in Fiji."

Dick Watling Ph.D.

Environment Consultants Fiji

Tel: +679 338 3189; Fax: +679 338 1818.

Box 2041, Government Buildings, Suva, Fiji

259 Prince's Rd., Tamavua, Suva, Fiji

Websites : www.environmentfiji.com; www.pacificbirds.com

New Caledonia:

"We've actually heard Tahiti petrels in most reserves we've been to, some of which are rather far from the sea. They seem to roost at the top of mountains but we haven't found exactly where. We think it's a fair guess that rats are in their colonies as we have found "good" densities *R. rattus* and *R. exulans* over the whole range of altitudes. Fortunately, *R. norvegicus* doesn't seem to have made it to rainforest areas and we've only found it in towns. We've also seen a few dead petrels, one of which may have been killed by a feral cat. We saw a fresh petrel carcass at about 1100 m, it had been consumed by a cat but we cannot confirm the causes of death (although signs indicated that the bird had been killed on site). Feral cats have colonized even the top of mountains in NC."

We think that the interactions between Tahiti petrels and introduced mammals are really worth looking into, unfortunately we have no time for that as we are working with endemic birds that are the top priority at the moment. We'd nonetheless like to know more about the ecology of petrels in other islands, have you got any publications about it?

We've tried stomach analyses of rats but find the identification of "the mush" pretty tough going, do you know if there are any secrets as we'd obviously like to do more analyses of the type. We're actually looking at testing alternative methods to poison as we're quite concerned about dumping large quantities of poison in native habitat. Have you thought of trying contraceptive baits?"

Sophie Rouys & Jörn Theuerkauf
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98846 Nouméa Cedex
New Caledonia
Tel/Fax: +687-254473

Austral Islands:

"The French have already published sequences from the Austral population---the problem is that there are no voucher specimens, so no one knows whether those birds are like those of the Marquesas and Tahiti, or like the bigger birds of New Caledonia (and presumably Samoa)."

The problem is that this DNA from "P. rostrata from Polynesia" was from a new population in the Austral Islands for which they kept no voucher specimens, so they don't know what they were actually sampling. Olson has lots of comparative material from at-sea birds all with voucher specimens. Although he can't say what island they bred on, he can definitely say that they are not from the New Caledonia or Samoa birds as they are all markedly smaller.

Samoa:

Dr. Olson writes: On Jan. 25, 2002, I finally got around to preparing the *Pterodroma rostrata* from Samoa. It was an adult male, very much emaciated and without any fat whatever, so it apparently had suffered from something that caused it to starve to death. I have compared the uncleaned skull with those of typical *Pt. rostrata* and it is markedly larger and more robust, so it would either have to be *trouessarti* or something else altogether. I hope the DNA will tell. When the French did their analysis of the DNA they compared material from New Caledonia (*trouessarti*) with that from a newly discovered population in the Austral Islands and found very little difference. However, they did not have any voucher specimens so there is no telling which form is the one that is in the Australs. We have lots of DNA from at-sea birds with voucher specimens that are surely the nominate form of *rostrata* and presumably from Tahiti or the Marquesas. So again, I hope the DNA will give us the true picture. I am not sure that we got the actual collection data for the Samoa specimen (date, collector, exact locality). Jim Dean may have it but is not at his desk at the moment. It was not with the specimen. Next time someone handles some of these birds in the field they should take a Pesola and get some live weights. The weight of one emaciated specimen is not much of a statistic.

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all hard copy to my home address:
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Cytochrome-B evidence for validity and phylogenetic relationships
of *Pseudobulweria* and *Bulweria* (Procellariidae)

Bretagnolle, Vincent {a}; Attie, Carole; Pasquet, Eric

AF: Author Affiliation

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AUK 115(1), January, 1998: 188-195

Abstract

Although the genus *Pseudobulweria* was described in 1936 for the Fiji Petrel (*Ps. macgillivrayi*) its validity, phylogenetic relationships, and the number of constituent taxa it contains remain controversial. We tried to clarify these issues with 496 bp sequences from the mitochondrial cytochrome-b gene of 12 taxa representing three putative subspecies of *Pseudobulweria*, seven species in six other genera of the Procellariidae (fulmars, petrels, and shearwaters), and one species each from the Hydrobatidae (storm-petrels) and Pelecanoididae (diving-petrels). We also include published sequences for two other petrels (*Procellaria cinerea* and *Macronectes giganteus*) and use *Diomedea exulans* and *Pelecanus erythrorhynchos* as outgroups. Based on the pronounced sequence divergence (5 to 5.5%) and separate phylogenetic history from other genera that have been thought to be closely related to or have been synonymized with *Pseudobulweria*, we conclude that the genus is valid, and that the Mascarene Petrel (*Pseudobulweria aterrima*) and the Tahiti Petrel (*Ps. rostrata*) are distinct species. In trees constructed with maximum parsimony and maximum likelihood, *Pseudobulweria* is the sister taxon to *Puffinus* and *Calonectris*, and these genera in turn are most closely related to *Bulweria* (and *Procellaria* in the maximum-parsimony tree). *Pseudobulweria* is not closely related to *Pterodroma* in either tree. Because *Ps. r. trouessarti* from New Caledonia, and *Ps. r. rostrata* from Polynesia differ by only 0.6%, these taxa do not deserve species status and should be regarded as valid subspecies.

Appendix 3: Possible Breeding Species at Ta'u

Bridled Tern
Sterna anaethetus
(BRTE) Brown-winged tern.

STATUS

Federal: ? State: ? IUCN: Not globally threatened.

RANGE AND POPULATION TRENDS

Pantropical. Breeds in colonies on coral beaches, rocky and sandy slopes on tropical and subtropical islands in all three oceans. Total population probably exceeds 200,000 pairs with stronghold in Persian Gulf where 130,000 pairs may breed (1).

Occurs in Africa, Australia, India, Japan, Philippines, and west coast of Mexico and Central America, northern South America, and West Indies (1). In US locally off the Florida Keys, regular in summer in Gulf of Mexico and the Gulf Stream to N. Carolina, rarely to New Jersey and after tropical storms to New England (2). Semi-pelagic tern (H). Prone to displacement by hurricanes. Has also occurred in Europe.

Usually absent in the central and eastern tropical Pacific. Common to abundant resident of Palau. Accidental Bikar, Marshal Is. Published records for other places (Hawaii, Samoa, Tonga, Fiji) possibly based on confusion with spectacled tern (gray-backed) tern (3).

Bridled terns are recently reported to breed in Upolu, Samoa. Mike Tarburton who taught in Apia for several years and left in 2000, confirmed the Bridled terns nesting. He is a very competent birder with a lot of hands on field work and research (6). It may be that bridled terns are expanding their range into the south-central Pacific region. About 50 bridled terns were seen along seacliffs of the American Samoa National Park on Tutuila and off Ta'u in Dec. 2002. The birds acted like they were resident breeders, occurring in ones and twos, chasing other terns and landing on cliff face nooks.

Amerson (1982) reports that bridled terns were listed as a vagrant species in 1967 in Samoa, noting one record and several sightings with no details (4). R. S. Crossin reported collecting a specimen off Tutuila but no details were available. At that time, gray-backed terns (*S. lunata*) were considered resident breeders on Tutuila and may have led to some confusion in identification. "Plumage similarities of *S. lunata* and *S. anaethetus* may have led to confusion in early records of both species in Samoa. Voucher specimens would be useful."(4).

Bridled tern plumage is described as upperparts and tail brownish-black, outermost tail feathers white. Upperwing blackish brown, darker on primaries and secondaries (5) Leading edge conspicuously pale (1). Underwing white with brownish flight feathers, (shorter winged than Sooty tern and 10% smaller). Non-breeding adult somewhat paler, Races differ mainly in darkness of plumage, amount of white in outer tail, and size (1). Grey-backed tern has a mainly white underwing, with browner flight feathers (1).

<u>Egg</u>	<u>relay young</u>	<u>inc</u>	<u>fledge</u>	<u>breed</u>	<u>nest</u>	<u>feeding beh.</u>	<u>marine</u>
1	?	1	30d	50-65d	?	scrape dipping	semi-pelagic,

ECOLOGY

Less pelagic than *S. furcata* (1). Perches on vegetation, trees at night. Mainly surface schooling fish and squid. Flocks feed over shoals of small fish, occasionally with *Anous*, over schools of predatory fish.

Plunge diving, with submerging, or contact dipping. Surface-dipping over current contact zones and drifting seaweed. Breeding-usually associates with *S. lunata*, and Crested tern. Colonies 3-20 pairs, up to 400 pairs or 2000 pr in W. Australia (1). Nests distributed among vegetation rock or rubble rather than clustered, spacing not dictated by nest site availability. Nest contents normally concealed under rocks or vegetation, First breeding four years, has lived 18 years. (1).

Threats:

No immediate threats in this protected area.

Actions:

- Confirm status of breeding/nonbreeding.

References:

1. Del Hoyo et al. (1992); 2. National Geographic (1999). 3. Pratt et al. (1987). 4. Amerson (1982). 5. Enticott and Tipling (1997). 6. Watling (2001).

Researchers:

Rauzon, M. -Identification, monitoring.

Collared Petrel
Pterodroma leucoptera
Gould's Petrel

STATUS

Federal: ? State: ? IUCN: Not globally threatened?

Range and Population:

The Collared Petrel has three subspecies. The species has gray plumage above and a white face. The bill base, throat and chin are white. They have a defined black hood, which extends to nape and hind neck in sooty-black; a black patch reaching to sides of neck and sides of upperbreast finishes the cap. This cap is the darkest of all *Pterodroma* and is very clearly marked. A dark M stripes across the upperwings and dark underwing borders extend diagonally across secondary coverts. Gould's Petrel has a short, rounded grayish-brown tail with darker tips; outer tail feathers are lighter in color. The iris is dark brown, bill black, feet off-white.

Gould's Petrel breeds only at Cabbage Tree Island in Australia from October to April. During the breeding season they are thought to feed in the Tasman Sea. Migration occurs from May to October and the birds again disperse to the Tasman Sea and also toward the central Pacific; they are solitary at sea. The Gould's Petrel population is small, although not threatened (1).

ECOLOGY

Gould's Petrel is marine and generally pelagic. Breeding occurs on oceanic islands or steep forested slopes and in palm forest gullies. Nests are formed on the ground in rocky crevices or spots sheltered by thick foliage. Little is known about Gould's Petrels' dietary habits; it is assumed that squid is taken for food. One egg is laid, incubation lasts approximately 6-7 weeks. Chicks have dark gray down and fledge at 11-12 weeks. The oldest known bird lived over 20 years in the wild (2).

Threats:

No cats or rats exist on the island. Many birds are incapacitated after becoming enmeshed with seeds from the bird-lime tree (*Pisonia umbellifera*). There is some predation by ravens and raptors and the introduced rabbit has stripped away much of the vegetation needed for Gould's Petrel habitat.

Action:

- Conservation priorities include further data on numbers, breeding grounds, productivity and population trends.

References:

1. Del Hoyo et al. (1992); 2. Enticott and Tipling (1997).