

Observations of prion (*Pachyptila*) wrecks on the west coast of South America

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Abstract A massive northward movement and wreck of prions (*Pachyptila*) along the coast of Antofagasta, Chile is described, and I review the occurrence of prions along the west coast of South America. Prions breed in southern Chile and the sub-Antarctic and move northwards to the coasts of northern Chile and Peru in the Southern Hemisphere winter. Chilean and Peruvian wrecks are primarily *P. belcheri*, with smaller numbers of *P. desolata*. *P. vittata* has only been recorded once. The occurrence of *P. salvini* is unproven. There are no records of *P. turtur*; a purported specimen from Chile is actually *P. belcheri*. The only report of *P. crassirostris* is that of a bone fragment from an archaeological site on Easter Island, Chile.

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INTRODUCTION

The prions *Pachyptila* are a genus of petrels breeding in the Antarctic and/or sub-Antarctic that disperse widely in the Southern Hemisphere winter after breeding. Here I report a massive northward movement and wreck of prions in Antofagasta province, northern Chile, and summarize what is known of the status of prions along the west coast of South America. Prion taxonomy has a long controversial history. In this paper I recognize 6 species in the genus following Turbott *et al.* (1990).

Published reports of prions along the west coast of South America are rare. Johnson (1965) summarized what was known up until that time. Except for the briefly mentioned occurrence of "considerable numbers" of *desolata* and "several" *belcheri* found dead and exhausted on the beach at Maullín, southern Chile after a "severe" storm in July 1942, his account consists of a few scattered reports of the dead or mummified remains of *P. belcheri* and *P. desolata* found elsewhere on the beaches of Chile. In Mollendo, southwest Peru, Hughes (1970) reported that corpses found on the beaches were also *P. belcheri* and *P. desolata*. Plenge (1974) considered these species were regular migrants, with Hughes (1970) stating they occurred "most years in July and August, occasionally in some numbers" as in the years 1966 and 1968. Plenge (1974) later reported the finding of 4 beach-washed *P. desolata* and 10 *P.*

belcheri on Peruvian beaches north to just south of Lima.

P. becheri was only known to breed on Crozet, Kerguelen and the Falkland Islands until a breeding colony was discovered on Isla Noir (54°29'S, 73°02'W), Chile in 1984 (Clark *et al.* 1984). *P. desolata* is circumpolar, breeding on Antarctic and Subantarctic islands in the South Indian, Southern and South Atlantic Oceans (Marchant & Higgins 1990). Both species disperse widely after breeding but the full extent of their post-breeding dispersal along the west coast of South America is unknown.

Observations of prions at sea

Birds found dead or dying on the beaches are usually only a small reflection of what is occurring at sea. Most of what is known of the distribution of prions in Chilean waters comes from oceanographic research vessels. During the Austral summer, prions have only been encountered in the vicinity of breeding areas where vast numbers of *belcheri* were seen at the Isla Noir breeding colony in Feb (Clarke *et al.* 1984). Michael Force (*unpubl. data*) sailing from Punta Arenas, Chile, encountered about 985 *belcheri* and another 800 prions that were probably *belcheri*, about 10 to 20 km west northwest of Isla Santa Inés (53°45'S, 72°45'W) on 11 Feb 2002. He writes that *belcheri* tends to be the common prion north of the Polar Front whereas *desolata* replaces *belcheri* south of the Polar Front. Thus, in 12 years of crossings of the Drake Passage (1994-2006) between Jan and Mar (roughly 4 per year) he always encountered a

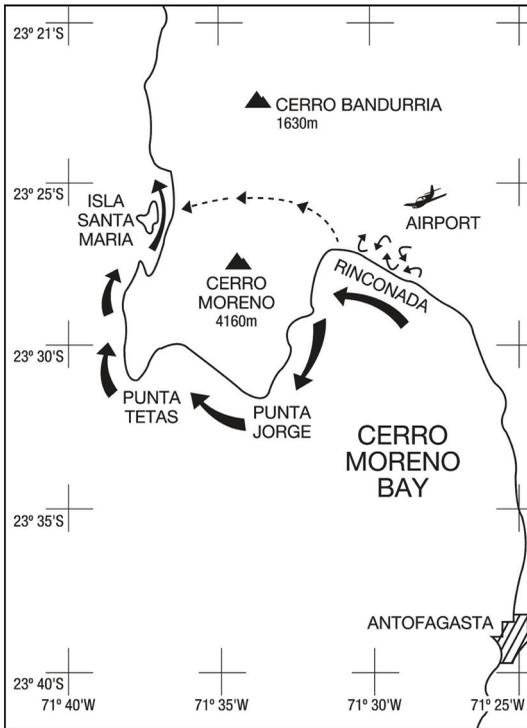


Fig 1. Area of Antofagasta province, northern Chile, showing the location and flight direction of prions observed during the wreck of 4 May 1968. Large arrows show the main flight direction. Arrows connected with a dotted line show the flight direction of the smaller number of individuals that flew overland between Cerro Bandurria and Cerro Moreno. Small arrows show flight direction of birds over the beach at Rinconada.

few prions, mostly *desolata*, but occasionally a few *belcheri*. On some crossings he saw almost none and on others massive numbers. He writes that the same can be said for the east side of Tierra del Fuego.

Brown *et al.* (1975) saw only 1 bird that may have been a prion during oceanographic explorations of the Drake Passage, the Patagonia Shelf (Argentina) and the Chilean fjords from Dec 1969 to Apr 1970 and in Mar and Apr 1972. Numerous research cruises between California and the south-central Peruvian coast between Oct and Mar failed to yield any prions (M. Force, *unpubl. data*). In Apr, except for one flock of over 1,000 birds on 16 Apr at 47°11'S, 77°30'W, Watson & Angle (1965) found only a few scattered prions between 60°S and 47°08'S. The 1 bird collected proved to be *belcheri*. Jehl (1973) found several hundred prions in the Golfo de Arauco (37°15'S) on 30 May and thousands (both *belcheri* and *desolata*) at Bahía Quebrada Honda (29°S) on 12 Jun, as well as others within the next few days at sea off the coast of Valpariso and Coquimbo. Four

desolata and 2 *belcheri* were collected. These limited observations confirm that during the breeding season prions are scarce or absent away from the breeding colonies and that post-breeding dispersal starts in Apr and May.

Observations made during a prion wreck in northern Chile

On 4 May 1968 Adrian J. Brown and Stephen Chapman found the remains of 2 prions at Rinconada (25°27'S, 71°30'W), Antofagasta, Chile, a 3 km stretch of white sand which lies at the head of Cerro Moreno Bay and which is open to the prevailing southerly winds. A return visit on 12 May led to the discovery of an additional 31 prions above the high tide mark along one small section of the beach. All were in an advanced state of decay but the species was not identified during either visit.

On 7 Jul 1968, the author visited the shore opposite Isla Santa Maria with Brown and Jaime Amenabar. This site is about 25 km from Rinconada. At about 1130 h, the author spotted a prion moving north a few hundred meters off the beach. Others were soon noted and it became evident that large streams of prions were moving north just offshore. In a nearby cove that opens to the south, several prions were flying and sitting on the water. We tried to capture and identify 1 sick bird that had drifted to shore but were unsuccessful. We then traveled to Rinconada, hoping to find wrecked specimens for specific identification.

The road from Isla Santa Maria to Rinconada reaches an altitude of about 500 meters and passes between two mountains (Cerro Moreno at 4,160 m, and Cerro Bandurria at 1,600 m). We encountered several prions along this road and some passed within a few meters at eye-level. All were heading in the direction of the ocean, which was not visible from this vantage point. At Rinconada, hundreds of prions were moving north along the beach, following the contour of the coast. A few crossed overland to the north and west of Cerro Moreno following the route of the birds we had encountered along the road. Many birds were on the water and dozens were found dead or dying on the beach. Others were flying a meter or less above the sand. One of several southern caracaras (*Caracara planus*) was seen attacking a prion flying over the beach. Several prions were found with the skullcap and brain missing, apparently the result of similar attacks. When we left Rinconada at 1600 h the flight was still in progress. During 4 hours of observation we estimated that we saw > 50,000 prions. During the following month, the author found dead prions on all the beaches (Chacaya, Hornitos, Tocopilla) of Antofagasta visited. On 11 Aug, 12 prions were seen flying north along the beach at Tocopilla during a half-hour period of observation, confirming that

the movements of birds continued well through the winter.

Dead prions were collected on a number of visits and used to confirm identification. Five prions collected on 7 Jul as well as those found previously at Rinconada were skinned and deposited in the American Museum of Natural History (AMNH 792883-87). Brown and Post returned to Rinconada on 28 Jul, and collected 4 examples of a second, thicker-billed species. They were badly decomposed, so only the heads were saved (AMNH skeletal coll. 6974-77). An additional 6 prion heads belonging to the thinner-billed species were also collected (AMNH skeletal coll. 6968-73). Later, a prion head was collected on 10 Aug at Tocopilla (AMNH 792888). Additional fresh specimens were collected at Rinconada by Brown on 15 Aug and deposited in the British Museum of Natural History (BMNH 1969.2.1 and BMNH A/1969.5.1), a head was collected on 15 Aug by Amenabar (BMNH S/1969.2.1), and 2 specimens were collected 25 Aug by Chapman (BMNH 1969.2.2 and BMNH S/1969.2.2). While on a brief trip to Antofagasta in Jun 1969, the late William R. Millie and his son, visited Rinconada and collected 10 individuals each on 22 and 26 Jun, respectively. Only 2 (found on 26 Jun) of the 20 were fresh enough to keep as specimens (BMNH 1972.14.1. and 1972.14.2.).

Identity of the specimens from the Chilean wreck

Unfortunately, most prion material from Chile and Peru consists of beached birds that were in such poor condition that only selected body parts were saved, and these were made into skeletons in which the bill sheath was removed. Most Chilean and Peruvian specimens appear to be immature individuals, which have less developed bills than adults. This together with shrinkage in bill width between fresh and dried specimens further complicates identification (Kinsky and Harper 1968).

Salvin's prion (P. salvini)

BMNH S/1969.2.1 (consisting of a head, neck, and tail), BMNH 1972.14.2 (skin) from Rinconada, a head collected in 1970 by R.A. Hughes in Mollendo, Peru, and the specimen I collected at Tocopilla (AMNH skeletal collection 792888) were identified by W.R.P. Bourne as all belonging to *P. salvini*. I was able to examine these 4 specimens (BMNH S/1069.2.1), the Mollendo specimen, and a head collected 30 Jul 1972 at Playa Villa, Peru (AMNH skeletal collection 10626). All 4 birds appeared to be the same taxa but I am not sure they are *P. salvini*. *P. salvini* and *P. desolata* are often inseparable on the plumage characters alone (Harper 1980) and measurements overlap. In profile, with the bill closed, *P. salvini* clearly shows lamellae, a key identifying feature, and the upper mandible exhibits a slight curve.

Close up photographs of the latter 2 specimens were sent to Peter Harper who has had extensive experience with identification of this genus (Harper 1972, 1980). He believes that they are not *P. salvini*, but typical adult *P. desolata*, based on the well-formed strong nail and the appearance of the plates, and that they look like the Kerguelen form, although he noted the skull would be needed for final confirmation. Alvaro Jaramillo (*pers. comm.*) also believes that these 2 specimens are *P. desolata* based on his examination at the AMNH. I have not seen the other British Museum prion specimens discussed in this paper.

The identification of a specimen as *P. salvini* in the Zoological Museum of the University of Concepción (Oyarzo & Cekalovic 1981), collected in the Wollaston archipelago, Cape Horn in Jan 1974, was apparently identified without the aid of comparative material. Under these circumstances, and the difficulty of separating *salvini* from *desolata*, it seems best at present to relegate *salvini* to hypothetical status along the west coast of South America pending further material.

Antarctic prion (P. desolata)

The 4 heads (AMNH skeletal collection Nos. 6974-6977) collected at Rinconada were identified as *P. desolata*. This species apparently occurs annually along the coast of Chile and Peru but in much smaller numbers than *P. belcheri*. Although the "*desolata*" specimen reported by Johnson (1965) in the Chilean National Museum could not be located, there are a number of well-substantiated *P. desolata* specimens from both Chile and Peru. These are similar in appearance to the immature specimens of *P. salvini*, but with the bill closed they do not show any lamellae. There is also a tendency for the upper mandible to be less curved, a trait, however, which is not a consistent feature.

Thin-billed prion (P. belcheri)

All the individuals examined from the Rinconada wreck, except for those mentioned above, proved to be *P. belcheri*.

Observations from Arica, Chile

As detailed above prions have been found dead on the beaches of Antofagasta as early as 4 May with thousands seen from shore at Rinconada on 7 Jul 1968. The observations of Robert W. McFarlane (*unpubl. data*) from Arica, Chile (located just south of the Peruvian border), between Apr 1972 and Jul 1973 allow us to follow the northward progression of prion post-breeding dispersal. McFarlane writes that "steady lines of" up to 6 prions in sight at the same time were seen flying north over the beach and surf from late Jun to late Jul in both years. In both years "several hundred [prions] could be seen during a mile hike along the beach...with birds[s]

occasionally being seen as far as 2 km inland." The earliest (10, 12 & 14 June) and latest records (12 Aug & 14 Sep) were of fresh birds found dead on the beach. Many birds were found dead in both years. A few birds seen sitting on the water or on the beach appeared to be in poor health. Except for 1 *desolata* all the other specimens encountered were identified as *belcheri*.

Distribution in Peru

There are a total of 39 *belcheri* and 8 *desolata* specimens from Peru in the Louisiana State University Museum of Zoology, the Museum of Comparative Zoology (Harvard University), and the Peabody Museum (Yale University), collected between the first week of Jun and the last week in Sep. Apparently all are beached birds. The *desolata* specimens range north along the coast to the Department of Lima and the *belcheri* specimens north almost to Pimentel (6°50' S), Department of Lambayeque. Clements & Shany (2001) citing a personal communication from Larry Spear state that *belcheri* occurs north to Piura (5°00' S). No other information is available.

Thus the number of museum specimens and the numerous prions found dead or dying on Chilean and Peruvian beaches and reported in this paper indicate that *belcheri* is by far the commonest *Pachyptila* species found along the west coast of South America.

Other prion species reported from the west coast of South America

Broad-billed prion (*P. vittata*)

A broad-billed prion carcass of the nominate subspecies (*P. vittata vittata*) was found by Hughes (1982) on a beach near Mollendo, Department of Arequipa, Peru, on 3 Oct 1980. The skull is in the Louisiana State University Museum of Zoology (LSUMZ 97456). It is apparently the only record for the west coast of South America.

Fairy prion (*P. turtur*)

Philippi (1967) reported a specimen of fairy prion (*P. turtur*) in the collection of Francisco Behn that was found dead on the beach at Arica on 10 Aug 1966. I was able to examine this specimen. It had a narrow bill and distinctly narrow tail band; a combination of characters that is found only in *P. belcheri* (Fullagar 1972), and it matched specimens of *P. belchei* in the AMNH collection. The specimen from Chile or Peru originally described by Mathews (1912) as the type of ?*Pseudoprion* (= *Pachyptila*) *turtur solandei* (BMNH 1888.5.18.158) is also an immature example of *P. belcheri* (Jouanin & Mougin 1979, W. R. P. Bourne, *pers. comm.*). A specimen of *P. turtur* in the British Museum (BMNH 1911.1.14.1) also obtained from Mathews is labeled "Cape Horn, Jun 1864" (W.R.P. Bourne, *pers. comm.*). Lacking further

data it seems best not to place too much confidence in the accuracy of the locale.

Fulmar prion (*P. crassirostris*)

A specimen of the fulmar prion (*P. crassirostris*), of doubtful provenance, labeled *P. eatoni* (= *crassirostris eatoni*), Cape Horn, Jun 1894 in the British Museum was received in exchange from Mathews in 1911 (W.R.P. Bourne, *pers. comm.*). Carr (1980) reported the proximal end of a carpometacarpus that was excavated from an Easter Island archaeological site dated from 600-200 BP.

DISCUSSION

My observations and review of the literature suggests that the northward movement of large numbers of *P. belcheri*, with lesser numbers of *P. desolata*, along the coasts of Chile and Peru during the Southern Hemisphere winter appears to be an annual event. A specimen of *P. vittata* from Peru is the only known occurrence of this species from the west coast of South America. The occurrence of *P. salvini* along the coasts of Chile and Peru remains unproven.

The cause of prion wrecks along the coasts of Chile and Peru is unknown. Food shortages, pollutants, unfavorable weather, or disease have been suggested as possible causes of sea-bird wrecks (Bourne 1982). Strong winds and rough seas leading to starvation (as indicated by low weight, lack of body fat, or empty or near empty stomachs) are the factors most commonly cited as the probable cause of prion wrecks that occurred in New Zealand (Veitch 1976; Powlesland 1989), South Africa (Batchelor 1981; Ryan *et al.* 1989), and Brazil (Martuscelli *et al.* 1997).

The 5 birds (AMNH 792883-87) that I skinned and the 3 birds deposited in the BMNH (Chapman *pers. comm.*) (A/1969.5.1; 1969.2.1; 1969.2.2), also showed evidence of starvation. They were devoid of fat and their stomachs were empty or largely empty. Two wrecks of 13,000 prions that came ashore in New Zealand during Jun and Jul 1964 "showed obvious signs of starvation" (Veitch 1976), as did a wreck of prions that occurred in 1981 in South Africa (Batchelor 1981).

The day of the Rinconada wreck was calm with only a gentle onshore breeze. There had been no storms or unusual weather conditions in the preceding weeks that might have forced the birds to congregate along the shore. As was the case in Chile, only light to moderate winds occurred off the New Zealand coast before the wrecks that occurred there. Veitch (1976), however, believes that the occurrence of bad weather earlier in the season or further from shore reduced the body condition of these birds to "a level from which they were not able to recover in the better sea conditions later in

the month or closer to New Zealand." Other prions wrecks in New Zealand, South Africa and Brazil occurred after strong southerly winds.

The El Niño/Southern Oscillation, a warm water Equatorial current that irregularly flows south along the Chilean and Peruvian coasts is well known to disrupt marine (and terrestrial) ecosystems and to raise havoc among some seabird populations. However, it appears that prion wrecks off the west coast of South America are not correlated with this phenomenon. McFarlane's (1972) observations at Arica occurred during a strong El Niño episode whereas his observations the following year, also at Arica, occurred during a period of colder than normal water temperatures known as La Niña. The large numbers of prions seen by Hughes (1970) at Mollendo in 1966 and the 1968 Rinconada wreck occurred during periods of neutral water temperatures, the former following an El Niño and the latter following a La Niña (Climatic Prediction Center 2007). Previous attempts to correlate similar wrecks to El Niño events have yielded similar results (Ryan *et al.* 1989).

No obvious evidence of pollutants or parasitic infection was evident among the wrecked birds that I examined that are reported in this paper. However, these may be undetectable without detailed pathological examination. Autopsies performed after the Brazilian wreck (Martuscelli 1997) showed evidence of pathology, but these cannot be tied to any specific cause (Andrew Major, *pers. comm.*) and the cause of prion wrecks in this part of the world also remains unclear.

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