Report on the status and conservation of the

Humboldt Penguin

Spheniscus humboldti

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1. Names

1.1. Scientific name

Spheniscus humboldti, Meyen, 1834

The genus *Spheniscus* (Family: Spheniscidae) comprises four closely related species. *Spheniscus humboldti* is monotypic.

1.2. Common names

English: Humboldt Penguin
French: Machot de Humboldt
Spanish: Pingüino de Humboldt

2. Biological data

This is the only member of the genus that has large fleshy margins at the base of its bill; the juvenile has a grey head and lacks a breast band (Martinez*,* 1992). It forages diurnally, most birds leaving the colony shortly after sunrise, and mostly foraging close to the colony although some may travel longer distances (Williams, 1995). Foraging is by pursuit-diving. The Humboldt penguin is monogamous, tends to exhibit site-fidelity, nests in loose colonies, and may nest year round, with a clutch size of one or two (Williams, 1995).

2.1. Distribution (current and historical)

Spheniscus humboldti occurs in coastal **Peru** and **Chile** with vagrants recorded in Colombia (Morales Sanchez, 1988) and Ecuador (Ridgely and Greenfield, 2001). In Ecuador, it is only known from a few reports involving dead or dying birds; some or all of these birds may have been transported to Ecuador with the assistance of ships (Ridgely and Greenfield, 2001). It is endemic to the Humboldt Current Region where it is restricted to cool, nutrient-rich waters (Williams, 1995).

2.1.1 Current breeding distribution

Currently, this species mainly breeds from Isla Foca ($5^{o}12'$S) in Peru (Paredes *et al*., 2003) to Algarrobo (33^{o}S) in Chile (Williams, 1995; Ellis *et al.,* 1998). It nests on islands and rocky coastal stretches, burrowing holes in guano and, occasionally using scrape nests or caves (Birdlife International, 2003). It is colonial, and colonies are usually small (Martinez*,* 1992).

Chile

Ellis *et al.* (1998) reported that there are 12 breeding colonies in Chile between Grande Island and Punihuil, and at least 14 breeding sites in total although recently it has bred at only 10. This species occupies a small breeding range and there have been extreme population fluctuations, close to one order of magnitude at major colonies in Chile (Birdlife International, 2003).

Peru

Small numbers breed along most cliff sections of Peru, with larger numbers occurring at Pachachamac and Punta San Juan (Martinez, 1992). Ellis *et al.* (1998) reported that there were more than 12 breeding sites in Peru, but only two important breeding colonies, Punta San Juan and Pachacamac. Indeed, Punta San Juan supports the largest Humboldt penguin colony in Peru (Anon., 1987; Majluf *et al.*, 2001). Reports of large numbers at Lobos de Tierra and Punta Pampa Redonda were probably optimistic (Duffy *et al*., 1984). Most recently, 22 Humboldt penguin colonies (see Table 1) in Peru have been identified, 14 of which showed signs of breeding (i.e. nests or nests with chicks) (Paredes *et al*., 2003).

The size and the distribution of the penguin colonies in Peru has changed over the last 15 years, with more penguins now on the southern coast and fewer on the central coastal area, although the breeding range has remained the same (Paredes *et al*., 2003).

Table 1. The location of Humboldt penguin colonies in Peru, according to their location and breeding activity (after Paredes *et al.*, 2003)

Colony	Location	Breeding activity	Colony	Location	Breeding activity
Punta Coles	H	Y	El Submarino	L+E	-
Plantanales	L	N?	Sombrerillo	L	N?
Cocotea	L	-	Punta Mendieta	L+E	-
Hornillos Island	L+I	Y	Punta Gallinazo	L	-
Caleta Quilca	L	-	Tres Puertas	L	N
Punta la Chira	H	N	Culebras	L+E	-
Punta La Norte	H	-	San Gallan Island	I	N?
Punta Caleta	H	Y	Ballestas Island	E	-
Punta San Juan	H	Y	Chincha Island	I+E	N?
Punta San Fernando	H+I	Y	Pachacamac	I	Y
San Juanito Islet	E	Y	La Foca Island	I	N

Location: Headland (H), Coastline (L), Island (I), Islet (E).
Breeding activity: Nests (N), Nests with Chicks (Y), none (-).

2.2. Habitat

The penguin feeds mainly in near-shore waters (BirdLife International, 2003) on pelagic school fish and squid (Martinez, 1992). The penguin breeds year round (BirdLife International, 2003) although peak breeding seasons at certain times of the year (*e.g.* September through November and April through June at Algarrobo in Chile) have been observed (Wallace *et al*., 1999; Simeone *et al*., 2002). It breeds in small colonies, nesting on islands or rocky stretches of mainland coast (See Table 1), not easily accessible to humans. Penguins nest in burrows, crevices and surface nests and favour sites where guano deposits are available for burrow excavation (Paredes and Zavalaga, 2001).

2.3. Population estimates and trends

The total population was estimated to be c.20,000 birds at the beginning of the 1980s, with 10-12,000 in Chile (Martinez, 1992). The population was estimated to be approximately 7,500 in 1995-6 in Chile and 5,500 in 1996 in Peru, giving an overall total of 13,000 birds (Ellis *et al.,* 1998). More recent estimates, such as that of c. 7,000 pairs in one large colony at Chanaral Island in Chile (Simeone *et al*., 2003) point towards an overall total of Humboldt penguins that for Chile is higher than previous recent figures. However, the actual size of the Humboldt penguin population is as yet, still unknown (Luna-Jorquera *et al.,* 2000).

Table 2. Estimated totals of Humboldt penguin populations in Chile and Peru (after Ellis *et al*., 1998, two other counts also noted)

	1980-1982	1983	1984	1985	1986	1987	1988	1988-1989	1990	1995-1996	1996	2000
Chile	10-12,000	300	3,080	10,000	5-6,000	200	400	3,000	4,500	7,500	1,600	
Peru	9,000 (1981)		[1]2,100 -3,000								5,500	4,425[2]

[1] Hays (1986), [2] Paredes *et al.,* (2003)

In the mid 19th century the population of the Humboldt penguin may have been over a million birds (Ellis *et al.,* 1998) since which time it has been declining (Martinez, 1992; Hays, 1986). Murphy (1936) emphasised a decline in numbers by the 1930s.

Particular declines have been observed subsequent to El Niño Southern Oscillation (ENSO) events. The 1982-1983 ENSO event reduced the population from 19,000-21,000 birds to 5,180-6,080 (BirdLife International, 2003). The 1992/1993 El Niño was relatively weak and a marked decline in penguin numbers was not observed (Paredes *et al*., 2003). Instead the population was rising and by 1995-1996, it had increased to 10,000-12,000 birds, mainly at Punta San Juan (3,400 birds) and Isla Pachacamac (800) in Peru, and Isla Pan de Az (1,750), Isla de Chañaral (2,500), Isla Pájaros (1,000), Islote Cachagua (2,000) and ex-Islote Pájaros Niño (1,600) in Chile (Cheney, 1998). However, the 1997-1998 ENSO reduced the population again to 3,300 birds (BirdLife International, 2003). The number of breeding pairs was 55-85% lower than the mean at a colony of Humboldt penguins in central Chile during the 1997/1998 ENSO event, and the attendance of adults and juveniles at the colony during El Nino was 25 and 73% lower, respectively, than the mean (Simeone *et al*., 2002). Paredes and Zavalago (1998) noted a failure in the largest colony in Punta San Juan in Peru after the ENSO event in 1998. In 1998, a population and habitat viability analysis using computer modelling suggested that extinction was likely within 100 years, with the possibility of a remnant population at Punta San Juan remaining in certain situations (Cheney, 1998).

The overall reduction in the number of breeding colonies indicates that there is probably an ongoing underlying decline in both range and population (BirdLife International, 2003). However, Paredes *et al*. (2003) found that the breeding colony range of the penguin has not decreased in Peru in the last 15 years although the distribution of colonies within the range has changed. Indeed, the occurrence of the Humbolt penguin was noted for the first time on La Isla Metalqui near Chiloe in Chile in 1996 (Simeone and Hucke-Gaete, 1997).

It is not clear if data indicating fluctuations in penguin numbers reflect a migration of penguins from one colony to another or if they represent a recovery/decline of the population. In addition, the survey methods used to census penguin populations should be taken into account when making comparisons. Luna-Jorquera *et al.* (2000) concluded that counts on both land and sea needed to be undertaken to provide a reliable population estimate. Higher numbers of penguins have been found on the Chañaral Islands and the Choros Islands when surveying during the moult period compared to during the winter months (H. Diaz, pers comm.), indicating the importance of the timing of the counts.

Peru

Recent estimates from 1999 and 2000 indicated that there were less than 5,000 Humboldt penguins left in Peru (Paredes *et al*., 2003). Counts in 1996 showed 5,500 birds in Peru (Ellis *et al.,* 1998), the total population estimate was 2,100-3,000 in 1984 (Hays 1986), and the maximum number of breeding individuals was estimated to be 10,000 by Duffy *et al.* (1984). Other estimates indicated that there were around 1,800 breeding pairs on the southern coast of Peru (Zavalaga and Paredes, 1997) and 250 breeding pairs on Isla Pachacamac on the central coast (Paz-Soldán and Jahncke, 1998).

The number of colonies in Peru declined from 17 in 1981 to two in 1996 (BirdLife International, 2003). More recently 22 colonies were found in Peru (Table 1), 14 of which showed signs of breeding (Paredes *et al.*, 2003). In addition the size and distribution of colonies in Peru has changed from the

mid 1980s until the present, with some colonies increasing in size (e.g. Punta San Juan) and others reducing in size or being abandoned (e.g. Punta Corio, La Chira) (Paredes *et al*., 2003). In Peru, colonies were found in at least 17 guano-producing areas but only five colonies were larger than 100 breeding pairs (Paz-Soldan and Jahncke, 1998).

Chile

Schlatter (1984) estimated the breeding abundance of Humboldt penguins in Chile at ± 6,000 pairs prior to the 1982/1983 El niño event. Counts in 1995-1996 showed a conservative total of 7,500 birds in Chile (Ellis *et al.,* 1998) with a 1995-1996 estimate of 1,050 breeding birds in the Coquimbo region (Luna-Jorquera *et al.,* 2000). However, about 10,300 birds were counted in the Coquimbo Region of Northern Chile alone (7,619 on land and 2,700 at sea) during the moulting season of February, 1999 (Luna-Jorquera *et al.,* 2000). H. Diaz (pers. comm.) counted 16,262 penguins in a survey of Chañaral Island in 2002. In a survey of nine islands of the central and north coasts of Chile, Simeone *et al*. (2003) found c. 9,000 pairs of Humboldt penguins, the majority of which (c. 7,000 pairs) were found on the Chanaral Islands.

Considerable reductions in the populations of the Humboldt Penguin have been seen on some islands within the Pinguino de Humboldt Penguin Reserve, as well as in Pan de Azucar Island, where the local Park Guards have found evidence of illegal hunting of this bird (J. Gonzalez, pers. comm.). The mixed colony of Humboldt and Magellanic (*S. magellanicus*) penguins on the Puñihuil islands off the coast of Chiloe in Southern Chile contained 210 adult Humboldt penguins, 10% of which were moulting, and six nests with chicks, but no active nests with eggs were observed (Simeone and Schlatter, 1998). A decline in the number of penguins here may have occurred between 1991 and 1997 (Simeone and Schlatter, 1998). However, elsewhere there was an increase in the number of nesting sites at Pájaro Niño Island in central Chile from c. 500 in 1977 to 689 in 1996 despite significant habitat disturbance and alterations (Simeone and Bernal, 2000).

The population estimates given in the Chilean national country report to CMS are shown in Table 3. However, no references or sources for these figures are provided.

Table 3. Population estimates of the Humboldt penguin in Chile (Chile National Report to CMS, 2002).

Year	1996	1997	1998	1999	2000	2001
Population estimate	8,658	5,490	7,500	25,564	29,074	25, 930

2.4. Migratory patterns

For a long time the Humboldt Penguin was regarded as sedentary (Williams, 1995; Croxall and Davis, 1999). Indeed during the breeding season, Humboldt penguins do appear to remain in relative proximity to their nests. Culik and Luna-Jorquera (1997a) found that during the breeding season 90% of Humboldt penguins from Pan de Azúcar Island tended to stay within a 35 km radius of their nests to catch food for themselves and their chicks, and the total area of foraging covered 12,255 km^2. According to studies by Teare *et al.* (1998) Humboldt penguins show a high fidelity to their breeding sites. Of nineteen birds tagged at the breeding colony of Algarrobo in Chile, Wallace *et al.*(1999) found that the majority of birds recovered were within 50 km of the colony. However, they also found that four, and possibly a fifth individual travelled more than 140 km from the colony and one travelled almost 600 km from the colony, although it was not known whether any of these individuals were breeding or raising chicks at the time.

There is evidence that Humboldt penguins do cover large distances, particularly in response to food shortages or changes in environmental conditions as are seen during winter and ENSO events. Recovery patterns after the 1982/83 and 1997/1998 ENSO events suggest that migration might be important for the recovery of penguin colonies. Hays (1986) found dispersal of Humboldt penguins

from their Peruvian colonies during the 1982-1983 El Niño event, probably southwards. Humboldt penguins migrate large distances to avoid food shortages (Araya and Todd 1987; Culik, 2001b). Indeed, penguins from the breeding island of Pan de Azucar in northern Chile travelled between two and 116 km per day, and up to 895 km as marine productivity decreased (Culik *et al*., 2000). Hennicke (2001) postulated a potential southward shift of penguins avoiding food shortage in an ENSO event. He described little or no impact on the most southern colonies in Chile, but losses in more northern colonies.

Culik and Luna-Jorquera (1997b) noted that it was unclear where Humboldt Penguins overwintered, and tracked one bird as far as 640 km from its breeding site. There is also evidence that immediately after moulting, some penguins are capable of moving as far as 600 km from the island (Luna-Jorquera, cited in Luna-Jorquera *et al*., 2000). There may be an extended migration route of c.700 km from Peru to north Chile, and adult birds disperse up to 170 km in Peru (Culik and Luna-Jorquera, 1997a). Other studies in Chile, listed by Ellis *et al.* (1998), show movement of juveniles of 750 km, and dispersal of adults from 50-170 km. Culik (2001a) also observed seasonal migration patterns by tagged birds, due to food shortages in winter on the North Chilean coast (Pan de Azúcar Island), with one bird migrating 640 km north. During their northward migration the birds made several landfalls, which unfortunately could not be confirmed as regular staging places, in need of special protection. Population counts of the Humboldt penguin can sometimes vary considerably at different times of the year, which may indicate the inter colonial migration. For example, counts on the Choros Islands show lower numbers during winter months, with only 400 recorded in September, 2002 compared to 1,500 in February 2000 (H. Diaz, pers. comm.). Studies such as these indicate that the species could be considered a true migrant; in this case migrating between Peru and Chile.

3. Conservation status

The Humboldt Penguin was classified by IUCN (2002) as Vulnerable on the basis that the extent of occurrence was estimated to be less than 20,000 km² or area of occupancy estimated to be less than 2,000 km², and estimates indicated a continuing decline (inferred, observed or projected) in the extent of occurrence, the area of occupancy, the area, extent and/or quality of habitat, and the number of locations or subpopulations and number of mature individuals; and extreme fluctuations in the extent of occurrence and the area of occupancy; and the population was estimated to number less than 10,000 mature individuals with an estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer.

Chile

The Humboldt Penguin breeds in Chile, where it is considered Vulnerable (Simeone, 1996). It is protected within the Pinguino de Humboldt Penguin Reserve and Isla Cachagua Natural Monument. Colonies such as the Isla Chañaral and the Choros Islands, Pan de Azucar and Punihuil are also protected.

Peru

The Humboldt Penguin breeds in Peru. It was listed as Vulnerable in Peru in 1977 but in 1991 it was upgraded to Endangered in the Peruvian red list (Simeone, 1996). Most breeding sites are protected by designated areas, such as Punta San Juan and Paracas.

4. Actual and potential threats

IUCN (2002) listed a number of ongoing threats to the Humboldt Penguin, namely habitat loss/degradation due to extraction, human disturbance, invasive alien species directly affecting the species, harvesting (hunting/gathering), accidental mortality, pollution affecting habitat and/or species, atmospheric pollution, and natural disasters. Fluctuations are caused by (apparently increasing) ENSO events and more recent underlying declines probably relate to over-fishing anchoveta, *Engraulis* spp., stocks and entanglement in nets (BirdLife International, 2003).

4.1. Exploitation: direct and incidental

Penguins have been heavily hunted for their meat, oil, and skins. Adult penguins and chicks were captured for zoos and private collectors. Penguin eggs were also collected (Ellis *et al*., 1998). Hunting of adult birds in their breeding grounds was also a main cause of mortality in some localities (Hays 1986). For example, until 1978 on Isla Mazorca and its satellite islands, between 70 and 200 were killed annually, out of a maximum population of 400 birds (Duffy *et al*., 1984). In addition, adults were usually killed on their nests, thus also causing the deaths of eggs or dependent young (Duffy *et al*., 1984). Approximately 20-150 penguins were reported as killed or removed by humans annually in the Punta San Juan area (Majluf in Cheney, 1998). The main threat to the Chilean population is from egg collecting (Williams, 1995). In addition, both eggs and penguins are collected by many of the workers that are brought in to conduct the guano harvest in penguin habitat (Anon., 1987; Paredes *et al*., 2003). Capture for food is not always for subsistence, one fisherman was observed taking 150 penguins in preparation for a party (Cheney, 1998). However, the consumption of penguin meat is mostly limited to Peru and northern Chile, and little predation has been reported from the rest of Chile (Cheney, 1998).

Recently, the potential scale and impact of penguins drowning from entanglement in fishing nets and on long line fishing gear has been highlighted. The number of incidents and casualties through entanglement in fishing nets has frequently been reported (Paz-Soldan and Jahncke, 1998) and the entanglement in fishing nets can cause substantial losses (Simeone *et al.*, 1999; Wallace *et al.*, 1999; Cheney, 1998). A study by Wallace *et al.* (1999) indicated the scale of the problem, with 8 of nineteen (42%) tagged birds found dead, entangled in fishing nets. In the fishing port of San Juan, near Peru's largest Humboldt penguin colony at Punta San Juan, between late 1991 and mid 1998, 922 bycaught Humboldt penguins were observed by Majluf *et al.* (2001) as fishermen landed their catch. Along a 14 km stretch of coastline in the Valparaiso region of central Chile between 1991 and 1996, at least 650 or an annual average of 120 adult penguins died in nets, with mortalities mostly occurring during the winter months when the penguins are not breeding (Simeone *et al.*, 1999). Although the retention of Humboldt penguins when accidentally caught is not permitted in Peru, fishers often retain such bycatch for local consumption (Majluf *et al.*, 2001).

Majluf *et al*. (2001) found that the number of Humboldt Penguins landed as bycatch varied significantly with the type of nets used and according to the target species fished, with drift gillnets producing higher mortalities than fixed gill nets (Majluf *et al.*, 2001). Taylor *et al.* (2002b) concluded, on the basis of studies on foraging behaviour, that both males and females would be protected from incidental catches if commercial fisheries did not set surface nets at night, and avoided setting nets between 0 and 30 m depth during the day in areas where penguins forage and travel.

Commercial fishing has also reduced prey availability (Ellis *et al*., 1998) although the impact on Humboldt penguin populations is unclear (Cheney, 1998). In addition, penguins are threatened by oil spills from ships and tankers.

4.2. Habitat disturbance

The removal/mining of guano in penguin habitat removes the substrate that penguins use to make their burrows. Population declines between the mid 1800s and early 1900s were due to over-exploitation of guano, for fertilizer, causing damage to breeding sites; the situation was locally improved by fencing off some areas (Williams, 1995). Guano removal has now ceased in Chile (Cheney, 1998). However, guano is still harvested in Peru. The guano harvest at Punta San Juan, Peru's largest Humboldt penguin colony which occurred directly after the 1982/1983 ENSO event caused the majority of penguins, that were about to breed for the first time since the ENSO event, to abandon the area (Anon., 1987). Additionally, alteration of the burrow substrate means that the penguins may nest in less than optimal sites and in the open where heat stress and predation may be increased (Paredes *et al*., 2003; Cheney, 1998).

Human presence or activity in itself can cause stress to the penguins, as well as trampling and destruction of habitat (Cheney, 1998). On the Punihuil islands off the coast of Chiloe in southern Chile, human disturbance as a result of unregulated tourist activity and the introduction of feral goats has had a detrimental impact on the populations of both the Humboldt and Magellanic penguins that reside there (Simeone and Schlatter, 1998). Where tourism is heavier and goats are present, 28% of dirt burrows have collapsed, compared to only 10% collapsed in areas with less tourism and no goats. The goats also browse the vegetation that the penguins use to build their nests (Simeone and Schlatter, 1998). However, in contrast to this, at Pájaro Niño Island in central Chile, there has been an increase in the number of nesting sites from c. 500 in 1977 to 689 in 1996 despite the significant disturbances and changes that have occurred to the island (Simeone and Bernal, 2000). These disturbances included the connection of the island to the mainland by a causeway, thus facilitating the movement of mammals such as cats and dogs onto the island, as well as increasing tourism potential, and the removal of a large stand of pine trees. In Peru, three important breeding colonies are often disturbed by fishermen (Paredes *et al*., 2003). However, the largest colony, Punta San Juan, is protected as part of the guano bird reserve system.

Loss of nesting habitat may also have contributed to the decline of the Humboldt penguin (Paredes and Zavalaga, 2001).

4.3. Environmental variability

Penguins are vulnerable to variations in climate (Ellis *et al*., 1998). The warming of sea temperatures during ENSO events results in prey species moving far offshore, forcing penguins to follow, often resulting in the disruption of the breeding season and the death of some adults. The impact of the ENSO can be devastating and has led to abandonment of broods and chicks (Culik *et al.*, 2000). Although ENSO events have been occurring for some thousands of years, more recently they have become more frequent, with two major events occurring in 1982/1983 and 1997/1998 (Cheney, 1998). The occurrence of El Niño from 1982 to 1983 is thought to have caused the loss of some 65% of the Peruvian (Hays, 1986) and 72% of Chilean (Araya and Todd, 1987) populations of Humboldt Penguins. The 1997/1998 El Niño event was the strongest recorded in history and resulted in a marked decline in Humboldt penguins (Paredes *et al*., 2003; BirdLife International, 2003). However, it would appear that Humboldt penguins have the ability to survive such marked reductions following ENSO events, if additional human related threats and pressures are minimised (Paredes *et al*., 2003) and the penguin may have a greater capacity for displacement than originally supposed (Simeone and Hucke-Gaete, 1997).

4.4. Introduced species

Introduced predators such as rats, foxes, cats and dogs can have a detrimental impact on penguin populations. At Isla Pájaro Niño rats are numerous and are a threat to chicks and eggs; cats are seen regularly at Algarrobo and dogs have caused considerable mortality on a couple of occasions (Cheney, 1998). In addition, goats and sheep can trample and graze the burrowing grounds of the Humboldt penguin (Simeone and Schlatter, 1998).

5. Legislation

5.1. International

The Humboldt Penguin is listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and on CMS Appendix I. It was designated for Concerted Action by the 6th Conference of the Parties of CMS.

United Nations General Assembly resolution 46/215 of 20 December 1991 establishes a moratorium on large-scale fishing with pelagic drift nets in all the world's oceans. In Peru, there is no management

of artisanal use of these nets, and although the retaining of bycaught penguins is prohibited, enforcement seems to be inadequate (Majluf *et al*., 2001).

5.2. National

A number of laws are in force which protect the Humboldt penguin. However, the implementation of hunting restrictions is limited due to limited resources and the remote location of many of the important islands. Neither Chile nor Peru has implemented particular restrictions to limit fishing activities in response to food shortages to safeguard the penguin population.

Chile

In Chile, there is a 30-year moratorium (from 1995) (Actualmente el Decreto Supremo No. 225 de 11 noviembre de 1995 de Ministerio de Economía, Fomento y Reconstrucción) on hunting and capture of Humboldt penguins, and the four major colonies (not including intertidal and marine areas) are protected (Birdlife International, 2003). Most sites where the species occurs belong to the Sistema Nacional de Areas Silvestres Protegidas del Estado (SNASPE) [National Protected Areas System], National Reserves Pingüino de Humboldt, and Natural Monuments Isla Cachagua and Islotes de Puñihuil (Chile National Report to CMS, 2002). Colonies such as the Isla Chañaral and the Choros Islands, Pan de Azucar and Punihuil are protected.

Chile has implemented CITES by means of the National law-decree No. 873. Law 19.300 from 1994 sets the basis for environmental law in Chile. Although particular species are not specifically referred to by this law, it sets the legal basis for Chilean wildlife conservation and sustainable use of the country's natural resources. For more information see http://www.conama.cl/portal/1255/propertyvalue-10593.html

Peru

Most breeding sites are protected by designated areas, such as Punta San Juan and Paracas (Paracas was created with supreme Decree N° 1281-75-AG de 25 September 1975. Ubicado en Ica. Extensión: 335.000,00, of which one of the objectives was to conserve the fauna of the marine ecosystems of this region). In Peru, the principal colonies are legally protected by the government institute managing guano extraction; there are walls and guards at some sites, and extraction is designed to have a minimal impact at Punta San Juan (BirdLife International, 2003).

The Statutory Instrument of 1990 'Resolución Ministerial - Categorización de especies de fauna silvestre' No.1082/1990 lists *Spheniscus humboldti* as Endangered and prohibits for an indefinite period of time the taking, capturing, transport, trade and export of all listed species except for scientific or cultural purposes (ECOLEX, 2003).

This species is classified as a vulnerable species in the Peruvian National Biodiversity Strategy and by the Peruvian regulation (Supreme decree Nº 158-77AG and D.S. Nº 013-99-AG del 19/5/99), which refers to endangered species, all others that are in similar categories and those that are in immediate danger of extinction and whose survival is impossible if the effects causing such extinction continue. http://www.conam.gob.pe/endb/

6. Conservation measures

The species is listed in the Red Data Book in Chile (Vulnerable) and Peru (Endangered) (Simeone, 1996) and is protected year round. Most of the island colonies are protected as national parks or reserves in Peru and Chile. Little has been done to establish particular fishing free zones. There appears to be little progress on preventing penguins from becoming caught in fishing nets. Local protection for individual species and their habitats varies.

Collecting Humboldt Penguins and their eggs are now illegal in both Chile and Peru. Nonetheless, birds are still killed and used for fishing bait or eaten.

Chile

Chile has undertaken a number of conservation measures to safeguard the Humboldt penguin. Many colonies are protected, such as the Chañaral Island in the Reserva Nacional Pingüino de Humboldt (IV Region), and the Pan de Azucar National Park. In addition to the 30 year moratorium on the hunting and capture of marine animals, permits are also required for export to zoos, and for research (Cheney, 1998). However, enforcement of these laws has been problematic, and it would appear that no fines or penalties had ever been levied against anyone for deliberately taking penguin meat (Cheney, 1998).

Peru

In Peru, the five main colonies are at Punta San Juan, Pachacamac Island, Hornillos Island, Tres Puertas and San Juanito Island (Paredes *et al*., 2003). Of these, Punta San Juan and Pachacamac Island are in a guano bird reserve, and so are under the management and protection of the guano extraction agency, which has built walls to keep out both people and predators. Hornillos Island and San Juanito are in non-protected areas, and Tres Puertas is in Paracas National Reserve (Paredes *et al*., 2003). Paracas National Reserve comprises 335,000 ha. 217,594 ha marine area and 117,406 ha on land. Indeed, seven of Peru's 22 colonies are found in this reserve (Paredes *et al*., 2003).

In Peru, the only colonies that have increased in number are those with legal protection, where wardens or scientists are permanently present, such as San Juanito Islet and Punta San Juan (Paredes *et al*., 2003). Many of the islands have been protected by the state-owned guano company since 1909 in Peru (Duffy *et al*., 1984). However, the guano harvest can still have detrimental impacts to the penguin populations. A 1998 agreement between the Wildlife Conservation Society and PROABONOS, the body in charge of guano exploitation, involved penguin rookeries being fenced off during the harvest and observers remained on site throughout the harvest, thus preventing the workers from taking penguins or eggs to supplement their income (Paredes *et al*., 2003).

The National Institute of Natural Resources (INRENA) of the Peruvian Ministry of Agriculture have initiated a project which aims to evaluate the populations of *Spheniscus humboldti* (for further details see section 7).

7. Research activities

Chile

The Sea Birds Lab of the Universidad Católica del Norte supported by scientists at Planeta Vivo is carrying out a research programme on Chañaral Island, the main island of the National reserve "Pingüino de Humboldt" (Planeta Vivo, 2002). The reproductive success of the Humboldt Penguins in the Choros and Damas island of this reserve has been studied during the past two years (Planeta Vivo, 2002).

Other studies are listed by Ellis *et al*. (1998) and include yearly censuses by Braulio Araya and Mariano Bernal on the main colonies along the Chilean coast.

Peru

The Peruvian Association for Conservation of Nature (APECO) in collaboration with the National Institute of Natural Resources (INRENA) of the Peruvian Ministry of Agriculture have initiated a project which aims to evaluate the populations of *Spheniscus humboldti*, including an assessment of the risks to the populations from human activities (Anon., 2003). This will involve surveying penguin populations along the southern coast of Peru, from both land and sea. In addition, a workshop will be

organised involving both Peruvian and Chilean experts, with a view to setting the basis for a bilateral agreement under CMS.

Other studies are listed by Ellis *et al*. (1998) and include work by Carlos Zavalaga and Rosana Paredes on the breeding biology and foraging ecology in Punta Juan, and the long term survey of J. C. Riveros Salcedo on different colonies along the Peruvian coast, evaluating the status of seabirds, including the Humboldt penguin.

8. Needs and recommended actions

a) Policy and legislation

A number of policy and legislation aspects should be considered that would benefit the Humboldt penguin.

- The establishment of fishing restriction zones

  The establishment of fishing restriction zones around the breeding colonies in normal breeding seasons when foraging activites are concentrated within 35 km would greatly benefit the species (Culik, 2001a). In ENSO summers the foraging area extends by several kilometres.
- The establishment of fishing free zones in a flexible manner to address the particular threats to the species under ENSO stress conditions may be important for the long-term survival of the Humboldt Penguin.
- The protection of specific penguin landing zones

  Ideally, specific landing areas at sea should be protected. However, knowledge about the location of these areas is still limited. However, the establishment of marine protection zones outside the 12 mile zone is an unresolved issue relating to many species of CMS concern and would require international legislation.
- Adequate enforcement of existing legislation is essential.

  For example, no penalties or fines have ever been issued in Chile for deliberately taking penguin meat (Cheney, 1998).

b) Species and habitat protection

- All major colonies should be protected and guarded thoughout the main breeding season.
- Disturbances and illegal taking by humans should be prevented and tourism should be adequately regulated.
- The use of certain types of fishing nets should be restricted in penguin foraging areas.

  Majluf *et al.* (2001) found that the number of penguins bycaught varied according to the type of nets and target species. Higher mortalities were sustained when drift gill nets were used than when fixed gill nets were used.
- Penguin rookeries should be fenced off the during the guano harvest

  Fencing off the penguin rookeries during the guano harvest has proved successful in preventing offtake of penguins and their eggs in some colonies in Peru (Paredes *et al*., 2003). This should become standard practice during the guano harvest.
  Conservation efforts must not only be directed at the colonies and adjacent waters *of Spheniscus humboldti*, but also at their foraging and travelling ranges (Wallace *et al*., 1999).

c) Monitoring and research

Ongoing and new monitoring and surveying initiatives that should be promoted and financed include:

- Development of an accurate and standardised census methodology for Humboldt penguins.
- Assessment of the size and status of populations in both Chile and Peru.
- Further satellite transmitter research, to find out whether particular landing areas are preferred by the species for fishing, to confirm regular staging landfall sites, and to determine if these areas should be designated as marine protected areas or have special protection needs. However, care must be taken as data recording devices may alter foraging behaviour and thus have potentially negative impacts (Taylor *et al*., 2002a)
- Continued satellite tracking efforts to verify the southward distribution shift and migration pattern during ENSO events.
- Standardisation of population assessment methods.
- Research into the number of penguins poached or bycaught should be undertaken.
- Research into the impacts of regulated and non regulated tourism should be initiated. Research into the impacts and feasibility of ecotourism should also be conducted.

d) Public awareness and training

- Education and awareness programmes to reduce hunting and bycatch of *Spheniscus humboldti* should be established.

9. Additional remarks

Recent population estimates using new technologies imply a different population size from previous estimates. Without continuous monitoring, the population development and the potential reasons of a decline or a potential recovery cannot be assessed.

10. References

Anon. (1987). Peru's penguins threatened despite agreement. *World Birdwatch*, 9 (2): 3.

Anon. (2003). Survey of the marine otter and the Humboldt penguin populations in Peru. *CMS Bulletin*, no. 17, May 2003.

Araya, B. and Todd, F.S. (1987). *Status of the Humboldt Penguin in Chile following the 1982-83 El Niño*. Proceedings of the Jean Delacour/IFCB Symposium. Los Angeles, California. Pp. 148-157.

BirdLife International (2003). BirdLife 's online World Bird Database: the site for bird conservation. Version 2.0. Cambridge, UK: BirdLife International. Available: http://www.birdlife.org (downloaded 30/5/2003).

Cheney, C. (1998). The current situation of the Humboldt Penguin in Chile and Peru: a report from the Population and Habitat Viability Analysis meeting, Part I. *Penguin Conservation*, 11 (3): 4-9.

Chile National Report to CMS (2002) http://www.unep-wcmc.org/cms/cop7/proceedings/pdf/national_reports/national_report_chile.pdf Downloaded 30 May, 2003.

Croxall, J. P. and Davis, L. S. (1999). *Penguins: paradoxes and patterns*. In: Cooper, J. (ed.): 3rd International Penguin Conference, Cape Town, Proceedings.

Culik, B. (2001a). Satellite-telemetry of Humboldt Penguin (*Spheniscus humboldti*) migratory behaviour: A review. In: Riede, K. (ed.) *New perspectives for Monitoring migratory animals- Improving knowledge for Conservation*. Proceedings of an International Workshop on behalf of the 20th Anniversary of the Bonn Convention. 166p. Fed. Agency for Nature Conservation (BfN), Bonn.

Culik, B. (2001b). Finding food in the open ocean: Foraging strategies in Humboldt penguins. *Zoology*, 104 (3-4): 327-338.

Culik, B. M. and Luna-Jorquera, G. (1997a). Satellite tracking of Humboldt Penguins (*Spheniscus humboldti*) in Northern Chile. *Marine Biology* 128:547-556.

Culik B. M. and Luna-Jorquera, G. (1997b). The Humboldt Penguin *Spheniscus humboldti*: a migratory bird? *Journal of Ornithology* 138: 325-330.

Culik, B. M., Hennicke, J. and Martin, T. (2000). Humboldt Penguins out-manoevering El Niño. *Journal of Experimental Biology* 203: 2311-2322.

Duffy, D. C., Hays, C. and Plenge, M. A. (1984). The conservation status of Peruvian seabirds. In: Croxall *et al*. (eds.) *Status and Conservation of the World's Seabirds*. International Council for Bird Preservation Technical Publication No. 2. Paston Press, Norwich, England.

ECOLEX (2003). ECOLEX – A gateway to environmental law. http://www.ecolex.org/SPECIES/search/FA_search.htm Downloaded 28/07/2003.

Ellis, S., Croxall, J.P. and Cooper, J. (Eds.), (1998). *Penguin Conservation Assessment and Management Plan*. IUCN/SSC Conservation Breeding Specialist Group: Apple Calley, MN, USA.

Hays, C. (1986). Effects of the 1982-83 El Niño on Humboldt Penguin colonies in Peru. *Biol. Conserv*. 36:169-180.

Hennicke, J. (2001). Variabilität im Jagdverhalten des Humboldtpinguins (*Spheniscus humboldti*) unter verschiedenen ozeanographischen Bedingungen. Dissertation University of Kiel. 103p.

IUCN (2002). 2002 IUCN Red List of Threatened Species. http://www.redlist.org/search/details.php?species=20609 Downloaded on 30 May 2003.

Luna-Jorquera, G., Garthe, S., Sepúlveda, F. G., Weichler, T. and Vásquez, J. A. (2000): Population size of Humboldt Penguins assessed by combined terrestrial and at-sea counts. *Waterbirds* 23: 506-510.

Majluf, P., Babcock, E. A., Riveros, J. C., Schreiber, M. A. and Alderete, W. (2001). Catch and bycatch of sea birds and marine mammals in the small-scale fishery of Punta San Juan, Peru. *Conservation Biology*, 16 (5): 1333-1343.

Martínez, I. (1992) Family Spheniscidae (penguins). Pp. 140-160. In del Hoyo, J., Elliott, A. and Sargatal, J. eds. *Handbook of the Birds of the world*. Vol. 1. Lynx Edicions, Barcelona.

Morales Sanchez, J. E. (1988). Confirmacion de la presencia de *Spheniscus humboldti* meyen (Aves: Spheniscidae) para Columbia. *TRIANA (Act. Cient. Técn. INDERENA),* 1:141-143.

Murphy, R. C. (1936). *Oceanic birds of South America*, Vol. 1. New York, Macmillan, 640p.

Paredes, R. and Zavalaga, C. B. (1998). Overview of the effects of El Niño 1997-98 on Humboldt penguins and other seabirds at Punta San Juan, Peru. *Penguin Conservation* 11:5-7.

Paredes, R. and Zavalaga, C. B. (2001). Nesting sites and nest types as important factors for the conservation of Humboldt Penguins *(Spheniscus humboldti*). *Biological Conservation* 100:199-205.

Paredes, R., Zavalaga, C. B., Battistini, G., Majluf, P. and McGill, P. (2003). Status of the Humboldt penguin in Peru, 1999-2000. *Waterbirds*, 26 (2): 129-256.

Paz-Soldán, L. and Jahncke, J. (1998). El evento El Niño 1997 y la población de pingüino de Humboldt *Spheniscus humboldti* en Isla Pachacamac. In: Ecología de alimentación y reproducción de las poblaciones de aves marinas del litoral peruano y sus relaciones con el recurso anchoveta. Inf. anual 1997. Inst. Mar. Peru (Callao). Pp. 105-111. Unpublished.

Planeta Vivo (2002). Current News at Planeta Vivo. http://www.planetavivo.org/english/news/Dic2002/UrsulayThomas.html Downloaded 23/07/2003.

Ridgely, R. S. and Greenfield, P. J. (2001). *The bids of Ecuador, status, distribution and taxonomy*. Christophe Helm, London.

Schlatter, R. P. (1984). The status and conservation of seabirds in Chile. In: Croxall *et al*. (eds.) *Status and Conservation of the World's Seabirds*. International Council for Bird Preservation Technical Publication No. 2. Paston Press, Norwich, England.

Simeone, A. (1996). Conservación del pingüino de Humboldt *Spheniscus humboldti* Meyen 1834 en Chile y situación de algunas colecciones existentes en zoológicos extranjeros. *Boletín Chileno de Onrnitología*, 3: 25-30.

Simeone, A., Araya, B., Bernal, M., Biebold, E., Grzybowski, K., Michaels, M., Teare, A. J., Wallace, R. S. and Willis, M. J. (2002). Oceanographic and climatic factors influencing breeding and colony attendance patterns of Humboldt penguins *Speniscus humboldti* in central Chile. *Marine Ecology Progress Series*, 227: 43-50.

Simeone, A. and Bernal, M. (2000). Effects of habitat modification on breeding seabirds: A case study in central Chile. *Waterbirds* 23 (3): 449-456.

Simeone, A., Bernal, M. and Meza, J., (1999). Incidental mortality of Humboldt Penguins *Spheniscus humboldti* in gill nets, central Chile. *Marine Ornithology* 27:157-161.

Simeone, A. and Hucke-Gaete, R. (1997). Presencia de pingüino (*Spheniscus humboldti*) en Ilas Metalqui, Parque Nacional Chiloé, sur de Chile. *Boletín Chileno de Ornitología* 4: 34-35.

Simeone, A., Luna-Jorquera, G., Bernal, M., Garthe, S., Sepulveda, F., Villablanca, R., Ellenberg, U., Contreras, M., Munoz, J. and Ponce, T. (2003). Breeding distribution and abundance of seabirds on islands off north-central Chile. *Revista Chilena de historia Natural* 76 (2): 323-333.

Simeone, A. and Schlatter, R. P. (1998). Threats to a mixed-species colony of *Spheniscus* penguins in southern Chile. *Colonial Waterbirds* 21 (3): 418-421.

Taylor, S. S., Boness, D. J. and Majluf, P. (2002a). Foraging trip duration increases for Humboldt penguins tagged with recording devices. *Journal of Avian Biology* 32 (4): 369-372.

Taylor, S. S., Leonard, M. L., Boness, D. J. and Majluf, P. (2002b). Foraging by Humboldt penguins (*Spheniscus humboldti*) during the chick-rearing period: General patterns, sex differences, and recommendations to reduce incidental catches in fishing nets. *Canadian Journal of Zoology* 80 (4): 700-707.

Teare, J. A., Diebold, E. N., Grybowski, K., Michaels, M. G., Wallace, R. S. and Wilis, M. J., (1998). Nest site fidelity in Humboldt penguins at Algarrobo, Chile. *Penguin Conservation* 11: 22-23.

Wallace, R. S., Grzybowski, K., Diebold, E. N, Michaels, M, Teare, J. A., and Willis, M. J. (1999). Movements of Humboldt penguins *(Spheniscus humboldti*) from a breeding colony in Chile. *Waterbirds* 22: 441-444.

Williams, T. D., (1995). *The penguins. Spheniscidae. Bird families of the world*. Oxford University Press.

Zavalaga, C. B. and Paredes, R., (1997). Humboldt Penguins at Punta San Juan, Peru. *Penguin Conservation* 10 (1): 6-8.