# Agreement on the Conservation of Albatrosses and Petrels

## Joint Fourth Meeting of Breeding Sites Working Group (BSWG4) and Sixth Meeting of Status and Trends WG (STWG6)

Guayaquil, Ecuador, 25-26 August 2011

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# A review of parasites, pathogens and diseases of ACAP species

**Argentina**

# A review of parasites, pathogens and diseases of ACAP species

A short paper for the BSWG at AC6 that briefly summarizes published studies plus includes a brief description of ongoing work.

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**Introduction**

According to article 5.1 of the ACAP Agreement, the reports of the Advisory Committee should, as appropriate, include 5.1 h) "reviews of the status at breeding sites of introduced animals, plants and disease-causing organisms known or believed to be detrimental to albatrosses and petrels". In order to address this, I prepared this short review on parasites, pathogens and diseases in albatrosses and petrels listed as ACAP species. The BSWG recognized that there is a risk of the introduction and dissemination of pathogens and diseases into albatross and petrel colonies, and that should it occur the consequences may be serious.

Although they often breed on remote islands, far from continents, albatrosses and large petrels are not beyond the effects of parasites or pathogens. Moreover, an infection that is widespread in any population can have major ecological consequences and has the potential to cause rapid declines (Weimerskirch 2004, Rolland *et al*. 2009). Furthermore, as highly mobile vectors, these seabirds can move parasites and disease over vast distances, potentially introducing pathogens to populations lacking immunity. To date, no major outbreaks of infectious diseases have been reported for albatross and large petrel species (but see Weimerskirch 2004) and one of the reasons could be the isolation, cold climate and reduced numbers of vectors at colonies. However recent studies suggest that pathogens causing infectious diseases are present, and that ongoing environmental changes could facilitate their increased prevalence and risk of establishment elsewhere.

The health status of albatrosses and large petrels is poorly known (Weismerskirch 2004) and there are few reports on the pathogens and health status of these pelagic species. Because they spend most of their life at sea and return to land only to breed, the impact of diseases on these seabird group is perhaps more difficult to detect. The information on host species, parasites and pathogens by geographic region is incomplete, and data on ecological impacts, including how birds respond to pathogens and parasites, are almost nonexistent. Here, I do not review the literature *in extenso*, but highlight some information and references about pathogens and parasites of this group of seabirds. I provide a baseline for the evaluation of the health of the group and illustrate potentially significant conservation issues.

Hence, the aim of this paper is to compile published information on the presence and the effects of disease, pathogens and parasites in albatross and petrel species listed under ACAP.

## Materials and methods

I made a search of published studies on parasites, pathogens and diseases in albatrosses and petrels in the Google Scholar database and summarized unpublished data, kindly offered by colleagues. I also used a review of parasites, pathogens and diseases of Antarctic birds prepared by Barbosa and Palacios (2009).

## Results

### Published data

I found 33 published papers dealing with issues related to parasites, pathogens or diseases in the ACAP species. These papers referred to 12 (41%) of the 29 species listed under ACAP (Table 1).

With respect to disease agents (or antibodies) reportedly in ACAP species, bacteria were detected in 5 species (17%), viruses in 3 (10%), protozoa in 4 (14%), gastrointestinal parasites in 3 (10%), ectoparasites in 9 (31%) and fungus in 1 species (3%) (Table 1). The Southern Giant Petrel was the species with the highest number of parasites or pathogens described (33), followed by two species of albatrosses, the Wandering Albatross and the Black-browed Albatross with 12 described parasites and pathogens. Conclusions regarding differences between species in the prevalence of these disease agents (or antibodies), should be taken with caution because they are probably a reflection of the differences in research effort rather than based on biological reasons.

The review showed that 21 bacteria species were detected (at least 18 were isolated) in the study species (Table 1). Most of them (16), reported in a single species: the Southern Giant Petrel (Munday, 1972, Jorge *et al*. 2002, Leotta *et al*. 2001, 2003, in press, Bonnedahl *et al*. 2005). Interestingly, Salmonella was not only found in scavenging species, such as the Southern Giant Petrel. Three different species of Salmonella (*S. havana, S. typhimurium and S. enteriditis*) were isolated in Black-Browed and Grey-headed albatrosses. These bacteria are common inhabitants of the intestinal tract of birds, and are usually the cause of disease only under conditions of stress. Birds contract the bacteria either through direct contact with infected birds or through ingestion of contaminated food or water (Tizard 2004).

Two species, the Southern Giant Petrel and the Yellow-nosed Albatross were infected by the bacterium *Pasteurella multicida*, which is responsible for avian cholera (Leotta *et al.* 2003, Weimerskirch 2004). Weimerskirch (2004) suggested that the outbreak of avian cholera in the population of Yellow-nosed Albatross is the major cause of the decrease on Amsterdam Island (Rolland *et al*. 2009). Another pathogenic bacterium, *Erysipelas*, was also recorded in this species. Avian cholera is now affecting Sooty Albatrosses breeding in the same colony as yellow-nosed albatrosses. Avian cholera represents a potential threat for the very rare Amsterdam Albatross that is breeding in a distinct colony two kilometers from the infested colonies (Weimerskirch 2004), and measures are taken to avoid a potential transport of the disease from infested colonies to sites free of disease.

Only a small number of viral diseases have been reported in seabirds (Wood *et al.* 2009). For albatrosses and large petrels, only four types of viruses were detected. Prevalence of avian pox virus (*Poxvirus avium*) was reported in the Laysan albatross and the Southern Giant Petrel (Shean-Boscher *et al*. 2008, Young and Vander Werf 2008). Antibodies to avian adenovirus and avian influenza viruses were also found in the Southern Giant Petrel (Uhart *et al*. 2003, Baumeister *et al*. 2004) and evidence of exposure to the adenovirus and the avian encephalomyelitis virus were observed in the Waved albatross (Padilla *et al*. 2003). Of the four viruses reported, the one responsible for avian pox was the only that was isolated (Shean-Boscher *et al*. 2008). The other three reports are based on serological evidence only and their significance is unknown. Thus, if the presence of viruses is implied and solely determined by serological techniques, caution needs to be applied when interpreting the results. Further studies applying direct detection or isolation should be carried out to confirm or reject the presence of a certain organism.

Pierce and Prince (1980) recorded a new species of hematozoan (*Hepatozoon albatrossi*, Eucoccida: Hepatozoidae) in the blood of three species of albatross (Grey-headed, Wandering and Black-browed albatross) at Islas Georgias del Sur (Table 1). They suggested that the vector of *H. albatrossi* was probably shared by penguins and albatrosses and was likely to be the tick *I. uriae* or a laelapid mite (Wood *et al*. 2009). Gastrointestinal parasites as well as ectoparasite and the only case of fungus reported by ACAP species are summarized in Table 1.

**Unpublished data**

Marcela Uhart from the Global Health Program of Wildlife Conservation Society is overseeing a health surveillance program at the Black-Browed Albatross colony at Isla Salvaje del Oeste in Islas Malvinas. Blood samples for analysis of disease exposure were collected in 2003 and 2008 (2003 n= 26, 2008 n= 15) from non-breeding adults. In addition, 46 cloacal and 46 tracheal swabs were collected for avian influenza surveillance in 2008. All albatrosses were serologically negative to evidence of exposure to infectious laryngotracheitis, avian encephalomyelitis, avian influenza, avian reovirus, infectious bursal disease, infectious bronchitis virus, paramyxovirus types 1, 2, and 3, Salmonella, Marek, West Nile Virus, and Aspergillosis. Antibodies to avian adenovirus were found in 92% of the study birds during the first sampling season, and all individuals were positive in 2008. Additionally, 27% of birds had antibodies for Chlamydiosis in 2003, but none showed titers the following time. Swabs were negative for avian influenza viruses. Black-Browed albatrosses from Isla Salvaje del Oeste seem to be remarkably free of exposure to infectious diseases, as are Southern Giant Petrels breeding on the South American mainland (Uhart *et al*. 2003).

Dr. Marcela Uhart also started health studies on the same species at Islote Albatros, Admiralty Sound, Tierra del Fuego, Chile. Blood samples for disease exposure analysis were collected in December 2010 (n=17) from non-breeding adults. In addition, 22 cloacal and 22 tracheal swabs were collected for avian influenza surveillance. Results are not yet available.

## Concluding remarks

Clearly more research is required into infectious diseases of albatrosses and petrels, and baseline data should be acquired against which future changes can be measured. One of the recommendations of the Breeding Sites WG (BSWG) could be to greatly encourage the establishment of a structured research program in order to provide information about the occurrence of diseases and parasites in albatrosses and petrels. This would require collection of a broader, standardised suite of samples by fieldworkers when handling birds, under the supervision of specialists (e.g., parasitologists, wildlife veterinarians). Collectively, such efforts will greatly improve our ability to establish baseline physiological indices for the ACAP species, against which we can detect future changes in marine ecosystems. In colonies that are already affected by diseases, studies should be carried out to better understand the effects and transmission of disease, and eventually examine the possibility to reduce effects when necessary.

Finally, we conclude that more research is needed to establish general patterns of spatial and temporal variation in pathogens and parasites, and to determine how such patterns could influence hosts. This information is crucial to limit the spread of outbreaks and may aid in the decision-making process should they occur.

## Acknowledgments

I am grateful Richard Phillips and Henri Weimerskirch for their valuable comments on the early versions of the manuscript. Language and editing remarks were also made by RP and HW. I thank Marcela Uhart for providing update data on her ongoing project of the health surveillance in the Black-browed Albatross.

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**Table 1.** Microorganisms, parasites and diseases recorded in ACAP species (adapted from Barbosa and Palacios 2009).

| Species | Bacteria | Virus | Protozoa | Gastro-intestinal Parasites | Ectoparasites |
|---|---|---|---|---|---|
| ***Diomedea exulans*** | | | *Hepatozoon albatrossi* (1) | | *Ixodes uriae* (2) |
| | | | | | *Docophoroides brevis* (3, 4, 5) |
| | | | | | *Naubates fuliginosus* (4, 5) |
| | | | | | *Pseudonirmus gurlti* (4) |
| | | | | | *Trabeculus hexacon* (4) |
| | | | | | *Harrisoniella hopkinsi* (3,5) |
| | | | | | *Paraclisis hyaline* (3, 5) |
| | | | | | *Naubates pterodromi* (3) |
| | | | | | *Austromenopon affine* (5) |
| | | | | | *Perineus concinnoides* (5) |
| | | | | | *Episbates pederiformis* (5) |
| **Total** | **0** | **0** | **1** | **0** | **11** |
| ***Diomedea nigripes*** | | | | | *Carios (Ornithodoros) capensis* (6) |
| **Total** | **0** | **0** | **0** | **0** | **1** |
| ***Thalassarche melanophrys*** | *Salmonella havana* I (7) | | *Hepatozoon albatrossi* (1) | *Stomachus sp* (8) | *Ixodes uriae* I (9, 10, 11) |
| | *Salmonella typhimurium* I (7) | | | | *Paraclisis diomedeae* (3, 5) |
| | *Salmonella enteriditis* I (7) | | | | *Perineus circumfasciatus* (3, 5) |
| | *Borrelia burgdorferi* (11) | | | | *Austromenopon affine* (5) |
| | | | | | *Harrisoniella ferox* (5) |
| | | | | | *Docophoroides brevis* (5) |
| **Total** | **4** | **0** | **1** | **1** | **6** |
| ***Thalassarche chrysostoma*** | *Salmonella havana* I (7) | | *Hepatozoon albatrossi* (1) | | *Ixodes uriae* (9) |
| | *Salmonella typhimurium* I (7) | | | | *Docophoroides simplex* (3) |
| | *Salmonella enteriditis* I (7) | | | | *Paraclisis diomedeae* (3, 5) |
| | | | | | *Austromenopon affine* (5) |
| | | | | | *Perineus circumfasciatus* (5) |
| **Total** | **3** | **0** | **1** | **0** | **5** |
| ***Thalassarche chlororhynchos*** | *Pasteurella multocida* I (12) | | | | |
| | *Erysipelothrix rhusiopathiae* I (12) | | | | |
| **Total** | **2** | **0** | **0** | **0** | **0** |

| Species | Bacteria | Virus | Protozoa | Gastro-intestinal Parasites | Ectoparasites |
|---|---|---|---|---|---|
| ***Phoebetria palpebrata*** | | | | *Seurati shipleyi* (8) | *Ixodes uriae* I (2) |
| | | | | *Paranisakiopsis sp* (8) | *Ixodes kerguelensis* I (13) |
| | | | | | *Paraclisis diomedeae* (3, 5) |
| | | | | | *Perineus circumfasciatus* (3, 5) |
| **Total** | **0** | **0** | **0** | **2** | **4** |
| ***Phoebastria immutabilis*** | Enteritis as cause of mortality (14) | *Poxivirus avium* (15) | | | |
| **Total** | **1** | **1** | **0** | **0** | **0** |
| ***Phoebastria irrorata*** | | *Adenovirus* A (16) | | | |
| | | *Avian encephalomyelitis* A (16) | | | |
| **Total** | **0** | **2** | **0** | **0** | **0** |
| ***Macronectes giganteus*** | *Pasteurella multocida* I (17) | *Influenza* A (18) | *Sarcocystis sp* (19) | *Capillaria convoluta* (8) | *Ixodes uriae* (2) |
| | *Escherichia coli* I (17) | *Poxivirus avium* I (21) | | *Stegophorus macronectes* (23) | *Parapsyllus cardinis* (2) |
| | *Enterococcus faecalis* I (20) | *Adenovirus* A (22) | | *Stegophorus arctowski* (23) | *Glaciopsyllus antarcticus* (24) |
| | *Bacillus subtilis* I (20) | | | | *Docophoroides murphyi* (3, 5) |
| | *Brevibacterium brunneum* I (20) | | | | *Paraclisis obscura* (3, 5) |
| | *Alcaligenes faecalis* I (20) | | | | *Perineus macronecti* (3) |
| | *Plesiomonas sp* I (20) | | | | *Austromenopom assifragae* (5) |
| | *Mycoplasma gallisepticum* A (25) | | | | *Perineus circumfasciatus* (5) |
| | *Mycoplasma synoviae* A (25) | | | | |
| | *Edwardsiella tarda* I (26) | | | | |
| | *Psittacosis-Lymphogranuloma group* A (27) | | | | |
| | *Salmonella gallinarum* A (25) | | | | |
| | *Salmonella pollorum* A (22, 25) | | | | |
| | *Campylobacter lari* I (28) | | | | |
| | *Campylobacter jejuni* I (28) | | | | |
| | *Salmonella sp* I (28) | | | | |
| | *Yersinia sp* I (28) | | | | |
| **Total** | **18** | **3** | **1** | **3** | **8** |

| Species | Bacteria | Virus | Protozoa | Gastro-intestinal Parasites | Ectoparasites |
|---|---|---|---|---|---|
| ***Macronectes halii*** | | | | | *Docophoroides murphyi* (3) |
| | | | | | *Paraclisis obscura* (3) |
| | | | | | *Perineus macronecti* (3) |
| **Total** | **0** | **0** | **0** | **0** | **3** |
| ***Procellaria aequinoctalis*** | | | | | *Ixodes kerguelensis* I (13) |
| | | | | | *Zachvarkinia robusta* (29) |
| | | | | | *Docophoroides brevis* (4) |
| | | | | | *Naubates fuliginosus* (4, 5) |
| | | | | | *Pseudonirmus gurlti* (4) |
| | | | | | *Trabeculus hexacon* (4, 5) |
| **Total** | **0** | **0** | **0** | **0** | **6** |
| ***Procellaria cinerea*** | | | | | *Naubates fuliginosus* (3) |
| | | | | | *Trabeculus hexacon* (3) |
| | | | | | *Halipeurus procellariae* (3) |
| | | | | | *Halipeurus diversus* (3) |
| **Total** | **0** | **0** | **0** | **0** | **4** |

(A) Antibodies, (I) Isolated. Numbers in brackets refers to references in table footnote:

References: (1) Peirce and Prince (1980), (2) Murray and Vestjens (1967), (3) Palma and Horning (2002), (4) Zlotorzycka and Modrzejewska (1992), (5) Clay and Moreby (1970), (6) Tsurumi and Sato (2002), (7) Palmgrem et al. (2000), (8) Mawson (1953), (9) Bergstrom et al. (1999b), (10) Bergstrom et al. (1999a), (11) Olsen et al. (1996), (12) Weimerskirch (2004), (13) Wilson (1970), (14) Work et al. (1998), (15) Young and Vanden Werf (2008), (16) Padilla et al. (2003), (17) Leotta et al. (2003), (18) Baumeister et al. (2004), (19) Ippen and Henne (1989), (20) Jorge et al. (2002), (21) Shearn-Boschler et al. (2008), (22) Uhart et al. (2003), (23) Zdzitowiecki and Drozdz (1980), (24) Whitehead et al. (1991), (25) Leotta et al. (2001), (26) Leotta et al. (2009), (27) Munday (1972), (28) Bonnedahl et al. (2005), (29) Mironov (1991).