

**Craig S. Harrison Conservation Grant 2008
Pacific Seabird Group**

**“Identifying new interactions between seabirds
and the artisanal fishing on Chonos archipelago,
Chilean Patagonia”**



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Final Report, January 2009

I. Introduction

This report considers the review and analysis of human activities that interact daily with wildlife in the region of southern fjords and channels, represented in the unknown Chonos archipelago (Chilean Patagonia), regions which have always been have unknown effects from the interactions that occur between human and their immediate environment.

However, there are major gaps in real information and representative of this biologically unexplored region. It is emphasizing the urgent need to understand the structure and dynamics of the biotic component of this region for recently started to understand the health status of these ecosystems and the potential routes to follow to achieve its proper management and/or conservation.

The acquisition of new knowledge of the relationship between man and his natural environment in the archipelago of Los Chonos is needed urgently. For this, the present project presents for first time some issues about the impact and our level of knowledge in such remote areas of the world and which follows through its seabirds.

II. Objectives y Methodology

The present proposal has these preliminary objectives:

- (1) Identify and quantify the species associated with artisanal fishing in the north zone of the inner sea of Aysén, integrating interactions of the reproductive and migratory resident species of sub Antarctic and Antarctic origin (e.g. Black-browed Albatross (Endangered) and Giant Petrel (Vulnerable) (IUCN redlist);
- (2) Identify the effects of bycatch during the setting and haul of the lines, interactions with birds during offal discharge and intentional capture;
- (3) Identify the effects of the artisanal fishing on the unstudied reproductive colonies of marine birds associated to the historical zones of fishing;
- (4) Characterize the perceptions of artesanal fishermen towards the marine birds (preliminarily, we have found that the fishermen believe they attract marine mammals that damage to take and equipment);
- (5) Evaluate the effects induced by the birds towards the artisan fishing, as the alarm and attraction of harmful marine mammals for the fishing (e.g., Sea lion *Otaria flavescens*)
- (6) Evaluate mitigation measures for incidental capture of birds, which measures might also reduce flocks and the attraction of marine mammals, which is an aim of the fishermen.

In order to reach these objectives, we had two field seasons during 2008, one from January to March 2008 and another between July and September 2008 in the inner sea and islands from Chonos Archipelago (between 44°30' and 46°00' S) in Chilean Patagonia (Fig. 1) considering de artisanal fishermen's town in Huichas Islands (45°21'S; 73°40'W, Fig. 1). These field seasons windows are large to accommodate the unpredictable climatic conditions of the region. During each day of fishing, three scientific observers in boats of the artisanal fleet were recorded observations of 50 to 150 m radius of the boat during 10 minute periods throughout the setting, haul and offal discharge. During these sampling times, observers recorded the identity and proportion of birds captured during the three activities, composition and structure of the marine assemblages of birds and their relation to other species like marine mammals.

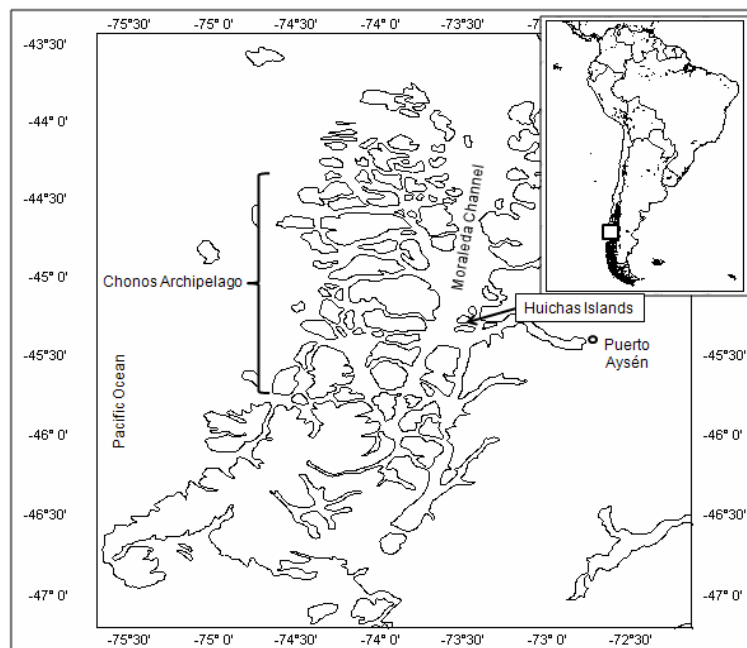


Figure 1. Chonos Archipelago in Chilean Patagonia.

The expeditions to identify reproductive colonies of marine birds were made with the aid of artisanal fishermen as guides. In points and small barren islands, perimeter censuses were implemented from the coast. In these areas were also recorded anthropogenic effects like pollution, destruction of habitat, extraction of birds, and introduced animals (e.g., dogs left in islands; Suazo, personal observations).

On the other hand, 50 artisanal fishermen were formally (questionnaires) and 30 informal interviewed from Huichas Islands who fish in the north area of the inner sea and direct observations of fishing operations between summer and winter 2008.

The questions covered topics related to fishing, such as target species, fishing methods and areas of extraction. As for seabirds, we identified the season with greater frequency of observations, feeding activity of birds

(distinguishing types of prey as far as possible), identification and location of breeding colonies, temporal variation in abundance, incidental mortality and /or collection of eggs, effects of fishing on seabirds and finally a free opinion about his perception on seabirds.

Almost the interviews considered the effects of birds on fishing especially damage to catch, which is perceived to be a serious problem.

Finally, the evaluation of mitigation measures for birds, and the diminution of their attracting mammals was rejected for operational limitations and modified by courses and environmental education modules directed for local community. The justification of this objective's modification is presented in section number 5 – Introduced species and dispersed by human in Chonos Archipelago.

To assessing the objectives outlined by presenting results and discussing them, it will cover the following sections:

1. Identity, activity and abundance of seabird species associated with fishing in Chonos Archipelago
2. Knowledge and perception of seabirds from fishing in Chonos Archipelago
3. Introduced species and dispersed by human in Chonos Archipelago
4. Outreach and Education (Materials and methods used)
 - 4.1. Community workshops, courses and conferences
 - 4.2. Participation in Joint Research
5. Remarks

1. Identity, activity and abundance of seabird species associated with fishing in Chonos Archipelago

In the Chonos Archipelago was possible to detect two associations of species associated to artisanal fishing. The first group of species is represented preferably by marine-coastal birds (e.g. Kelp gull *Larus dominicanus*) and with pelagic habits such as Black-browed Albatross *Thalassarche melanophrys*, which interact directly with the fishing activities through the use of bait and offal (e.g. viscera) (Fig. 2). The second group is composed of species that are directly affected in their nesting sites, such as the Magellanic penguin *Spheniscus magellanicus*, species caught for food and bait from fishermen (Fig. 3). This activity reaching deposits with up to 18 skeletons of penguins distributed in a single islet.



Figure 2. Black-browed albatrosses feeding on offal from artisanal fishing activities.



Figure 3. Magellanic penguin (*Spheniscus magellanicus*) Skeleton hunted for food and bait.

As for the fluctuations in species composition, it was possible to register on navigation in the area during travel to and from points in the fishing sites visited during this study. The mapping of cumulative distribution and abundance of seabirds in the archipelago was possible during the summer, because the component species during the austral winter moved towards

greater dispersion in the case of local species (*Larus dominicanus*, Blue eyed Cormorant *Phalacrocorax atriceps*), the return of nearctic migratory species (e.g. Franklin's gull *Larus pipixcan*) and procellariiformes heading towards their wintering sites in the northern hemisphere (Sooty shearwater *Puffinus griseus*).

However, *L. dominicanus* was the most abundant species throughout the study period, reaching abundances of *ca.* 15 individuals around a boat, with peaks of up to 30 individuals within 100 m of observation. The second species in abundance around the boat (fleet of 15 boats during winter campaign and 28 during summer) was *T. melanophrys* reaching abundances of 12 individuals around a boat. During the winter period, a relative increase in Procellariiformes from Antarctic and sub-Antarctic origin, as the Southern giant petrel *Macronectes giganteus* (groups up to six individuals around a boat) and *T. melanophrys* (reaching peaks of up to 10 individuals around a boat) is the second most abundant species associated with fishing boats, after *L. dominicanus*.

During the summer Procellariiformes increased the number of individuals with reproductive activity in the area (e.g. *P. griseus*), but preferably in active feeding on schools of small pelagic fish along the Canal Moraleda (Fig. 4). The dominant species during this period, was *L. dominicanus* followed by *T. melanophrys*.

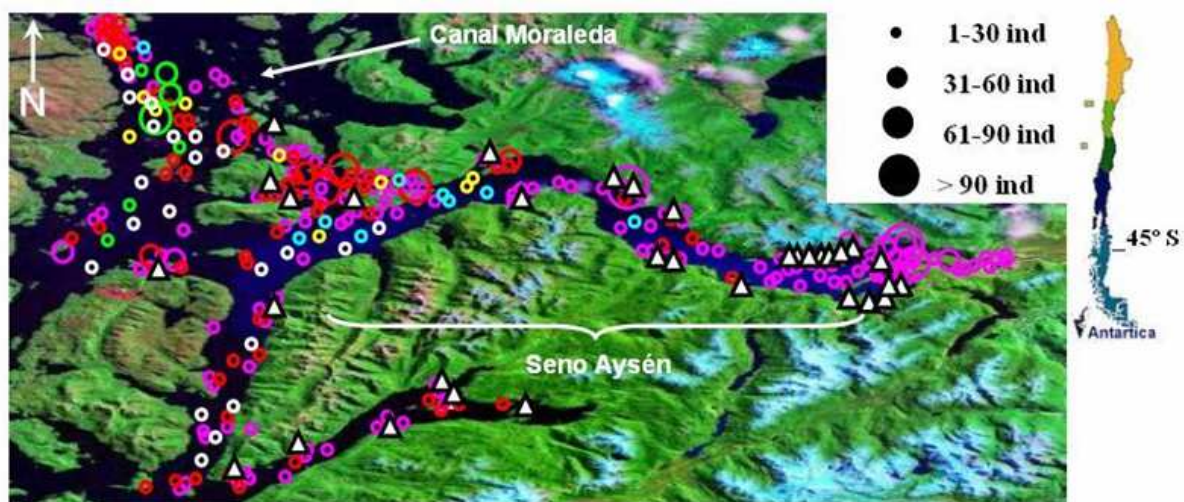


Figure 4. Seabird distribution in the inner sea of Chonos Archipelago (expressed in number of individuals observed in transects at sea). ● *P. atriceps*; ● *T. melanophrys*; ● *L. dominicanus*; ● *P. griseus*; ● *M. giganteus* y ○ *S. magellanicus*. ▲ Salmon farming.

For the species in colonies, it was recorded 10 colonies of *L. dominicanus* with abundances of up to 220 breeding pairs, *P. atriceps* three colonies with a maximum of 60 pairs and *S. magellanicus* with six colonies and a maximum of 150 pairs in one of them, all associated with the Moraleda Channel. Importantly, an island near to Huichas islands had a colony of *S. magellanicus*, but it was extirpated, probably to the current presence of abandoned dogs.

The activity of species associated with fishing operations was largely associated with the discharge of offal, with active participation of *L. dominicanus* and *T. melanophrys* during the summer over other species. During the winter the

sum to these two species of the Southern fulmar *Fulmarus glacialoides* (with up to 15 individuals in a boat), showing an aggressive and competitive behavior on the collection of offal.

About the attack to fishes taken by fishermen, it was possible to observe the damage to fish caught by *T. melanophrys*, but only on three occasions during the winter activities.

For records of incidental mortality in fishing gear, it was possible to register the death of an adult *T. melanophrys* caught in hook of a fishing line the winter (Fig. 5).



Figure 5. Adult Black-browed albatross, killed by immersion in fishing line.

Because this low mortality observed in the sea, the application of experimental methods to evaluate the mitigation of incidental killing of birds and approach were discarded. The reasons for not choosing those evaluations are detailed rooted in the short of a haul of fishing line, which have a faster sink rate *ca.* 0.33 m/s (Moreno *et al.*, 2006), resulting in short periods in set of line and faster shifts to other fishing sites. Moreover, the main agent of destruction and disturbing lines, bait and fish caught was the South American lion *Otaria flavescens*, where groups of up to 12 individuals were observed a few minutes after arrival and activity of fishermen in search of offal from seabird flocks associated with fishing boats.

Moreover, it is obtained through informal interviews that despite the absence of a significant incidental death, the killing of *T. melanophrys* and *F. glacialoides* carried out to use as food and bait, which is still a point for future assessments and identification (e.g. remains in islands with fishermen camps).

2. Knowledge and perception of seabirds from fishing in Chonos Archipelago

Formal interviews to fishermen considered people between 20 and 65 years old (mean 33.8 ± 12.3 years).

In the responses, the main resources extracted were Southern hake *Merluccius australis* and Pink cusk-eel *Genypterus blacodes* with vertical and horizontal fishing lines, respectively. The usual fishing areas were the inner sea islands in Moraleda channel between 44°S and $45^\circ 30' \text{S}$ (Fig. 6).

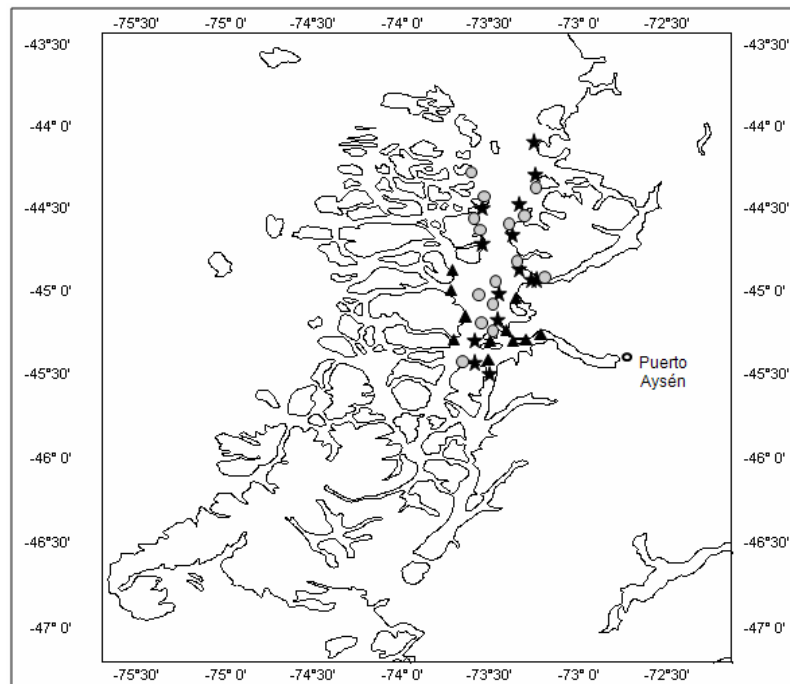


Figure 6. Usual fishing areas in Chonos Archipelago inner sea. Stars are line fishing, triangles are net fishing and circles are seabird breeding colonies (mainly *S. magellanicus*, *P. atriceps*, *L. dominicanus*).

The most recognized seabird species by fishermen were *S. magellanicus*, *M. giganteus* and *F. glacialoides* watched throughout the year. The lesser-known species, were smaller and less conspicuous seabird such as Wilson's storm petrel *Oceanites oceanicus* during summer and Magellanic diving-petrel *Pelecanoides magellani* only seen during winter (Table 1). The rare records in small and dark species, is due to the difficulty in detecting it, instead of larger and pale species (Bibby *et al.*, 2000). In addition, this last species avoid added with mixed flocks, thereby reducing the risk of predation (Veit & Silverman, 2001) a documented situation between albatrosses and storm petrels (Seco Pon & Gandini, 2008).

Among the abundance of seabirds 10 years ago and today, the fishermen recognize that there are more birds (67% of the answers), the same number (23%) and fewer birds (10%) than in the past decade. The highest number of seabirds was attributed to factors such as the abundance of food, nobody kill them, no predators and the effect salmon culture by the greater availability of

food. Who assumed a decline in the abundance of seabirds, considered that in fishing areas there are fewer birds because they are migrating to other sites with greater availability of food. Almost they attribute this abundance reduction to pollution and oil spills.

In the interviews the main threats to seabirds in relation to artisanal fisheries in the Patagonian channels, were incidental mortality during fishing operations and hunting seabirds with the collection of eggs in their nesting sites over the most threatened species (Table 1). Another captured species was *S. magellanicus* in gillnets (56% of cases).

The species subject to hunting and egg collection were *S. magellanicus* (61 observed cases), being used as bait (45%), eggs and meat for direct consumption with 39% and 16% respectively. In some cases, the hunt was carried out with hooks and dogs. Another affected species was *L. dominicanus* (56 observed cases), by collecting eggs for consumption (98%) and meat (2%). In one interview, intentional capture of an Southern fulmar individual by harpoon (while consuming bait the line) it was highlighted.

Tasker *et al.* (2000) noted the limited impact of the systematic work on birds by fishing equipment lost at sea. This is an unexplored issue for artisanal fisheries in southern Chile, where they use drifting lines (called atorrantes). Moreover, it is necessary to identify and assess the impact of the presence of fishing camps associated with seabird colonies. The temporary use of seabird islands by fishermen during their activities, has resulted in the loss of colonies by direct disturbance of habitat and introduced predators like rats and cats (Tasker *et al.*, 2000). Thus, the combined effect of human activities can facilitate and accelerate the extirpation of seabird breeding colonies in Chonos Archipelago.

Fishermen negatively perceived seabirds to be disturbing during their fishing operations, stealing bait, catch damaging and attracting *O. flavescens*, a species recognized as harmful to fishing activities.

Positively, fishermen recognized that seabirds contributed to fishing to take the waste of it. Almost they, they recognized their utility as good indicator of fish presence and their contribution to the landscape beauty of the region.

Table 1. Seabirds recognized by artisanal fishermen in Chonos Archipelago, together with the food observed and the main threats identified in the area. NI (No Information). The information presented in this study is contrasted with the information published by Schlatter & Simeone (1998) for the seabird endemism area in the Sub-Antarctic region of Chile.

Species	% recognized by fishermen	% Main food (component)	Main threats, this study	Threats (Area) in Chile, Schlatter & Simeone (1998)	Category IUCN ¹
Magellanic penguin <i>Spheniscus magellanicus</i>	100	100 (small fish)	Gill net, inshore fishery lines, eggs, food and fishing bait collection	Eggs & fishing bait collection (center and South of Chile)	NT
Antarctic giant petrel <i>Macronectes giganteus</i>	82.5	44 (fishing bait from lines) 47 (viscera)	Inshore fishery lines	NI (subantarctic islands)	NT
Southern fulmar <i>Fulmarus glacialisoides</i>	80	49 (small fish)	Inshore fishery lines, fishing bait	NI (NI)	LC
Black-browed albatross <i>Thalassarche melanophrys</i>	67.5	44 (fishing bait from lines) 42 (viscera)	Inshore fishery lines	Future shrimp fishery (far South)	EN
Sooty shearwater <i>Puffinus griseus</i>	55	50 (small fish)	Inshore fishery lines	NI (far southern islands)	NT
Wilson's storm petrel <i>Oceanites oceanicus</i>	10	NI	NI	NI (far southern islands)	LC
Magellanic diving petrel <i>Pelecanoides magellani</i>	2.5	NI	NI	NI (interior waters and far southern islands)	LC
Kelp gull <i>Larus dominicanus</i>	100	(mainly viscera)	Egg collection, fishing bait	Egg collection (all along Chile)	LC

¹ IUCN Categories, NT: Near Threatened, VU: Vulnerable, LC: Least Concern, EN: Endangered.

3. Introduced species and dispersed by human in Chonos Archipelago

In human settlements as Huichas islands was possible to observe the presence of introduced species such as rodents (Black rat *Rattus rattus*, House mouse *Mus musculus*), birds (Rock Dove *Columba livia*, House Sparrow *Passer domesticus*), almost pets as dogs and cats.

In the case of rodents as *M. musculus*, these have been considered low risk for seabirds on islands, but recently has shown that the mortality of chicks from some Procellariiformes by these rodents have significant effects on reproductive success (Wanless *et al.*, 2007).

As for sites away from human settlements, it was possible to record the presence of the invasive American mink *Mustela vison* escaped from fur industries in 1960s decade from Argentinian Patagonia (Anderson *et al.*, 2006) and which has spread north along the Patagonian channels and the continent to the south central Chile (40 ° Lat. S) (J.L. Bartheld, personal communication). The fishermen have attributed to this introduced species the drastic decline in populations of Magellanic flighthless steamer duck *Tachyeres pteneres* in the area of fjords and marine channels of the Chonos Archipelago.

Solitary individuals of *M. vison* was observed on six occasions in the islands and islets associated to Moraleda Channel. The presence of this species has been widely recognized for Chonos Archipelago islands (Valenzuela & Grau, 2005), which overlaps their distribution with the Southern river otter *Lontra provocax*, which is also found in marine environments in this region (Bartheld & Leiva, 2004).

On the other hand, there is a significant presence of abandoned dogs on islands of the archipelago. In this system could account 10 islands with the presence of isolated dogs and in some cases it was possible to observe the remarkable presence of up to five individuals in which the reproductive activity is confirmed by the presence of pups (Fig. 7).



Figure 7. Pups of abandoned dogs in an islet of Moraleda Channel, Chonos Archipelago. This pups belong to a familiar group with three adults.

The presence of dogs throughout the archipelago is attributed to the transport of these animals for fishermen (Fig. 8) and landing in their camps during fishing operations.

These animals, like cats, have been used by fishermen to avoid rodents and *M. vison* in their camps. However, in most cases, these animals have been abandoned and which has not existed antecedent of such a phenomenon that

until this work. This discovery, along with the predatory activity and the faster invasive expansion of *M. vison* provide an important line for future research, in addressing the potential impact of these predators on seabird colonies such as *S. magellanicus*, is now internationally regarded as close to the threat, so the effects of extirpation of colonies by this predators by analysis and characterization of its trophic spectrum (e.g. feces), requires urgent attention.



Figure 8. Ships used by artisanal fishermen in Chonos Archipelago and the tradicional dog transport.

The presente project in Chonos Archipelago highlights unknown interactions between seabirds and human activity in the area. We still have to establish the effects of dogs and mink made by man on the rest of the wildlife in this archipelago. We need more information about bird hunting for live food, as also in the collection of eggs.

These background reformulated our vision to a strong interaction between man and seabirds on land during the breeding season in summer and on sea during winter with some catch of seabirds such as food by fishermen.

As an alternative estrategy, the project re-converted items destined preliminarily to experiments of mitigation and seabird estrangement, for the implementation of environmental workshops and courses with emphasis on seabirds of Chonos Archipelago for high school students, children of fishermen (Fig. 6 A, B, section 4 - Outreach and Education), obtaining good results in terms of interaction with the students and the role of these when creating a new

awareness and perception towards seabirds conveying this vision to their families involved with fishing, sea and biota.

4. Outreach and Education (Materials and methods used)

4.1. Community workshops, courses and conferences



Figure 9. Seabird's conservation in Chonos Archipelago. Workshop presentation for fishermen's children in local schools (June 2008).



Figure 10. Course of biology, ecology and conservation of Procellariiformes to secondary students (fishermen's children, June 2008).



Figure 11. Course presentation of biodiversity and conservación of seabirds for Marine Biology undergraduate students and local community (September 2008).

IDENTIFICANDO NUEVAS INTERACCIONES Y PERCEPCIONES ENTRE LAS AVES MARINAS Y LA PESCA ARTESANAL EN EL ARCHIPIÉLAGO DE LOS CHONOS, PATAGONIA CHILENA

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INTRODUCCIÓN

Entre las aves marinas y la pesca artesanal en Chile, se han identificado mortalidades de aves buceadoras como el pingüino de Humboldt *Spheniscus humboldti*, el pingüino de Magallanes *S. magellanicus* y comoranes (e.g., ile *Phalacrocorax gaimardi* y guanay *P. bougainvillii*) ahogados en redes agalleras en la costa de Chile central (c. 33°S) (Simeone *et al.* 1999).

En el sistema de fiordos y canales del archipiélago de Los Chonos (entre 44° y 48°S) (Fig. 1), existe una significativa flota artesanal dedicada a la extracción de peces demersales. La merluza austral *Merluccius australis* es capturada mediante líneas verticales individuales con un flotador a la deriva, llamada "atorrante". Estas líneas presentan hasta 200 m de longitud, conteniendo de 30 a 35 anzuelos (Moreno *et al.* 2006) (Fig. 2).

El presente trabajo tiene como objetivo identificar el conocimiento y percepción de los pescadores artesanales del archipiélago de los Chonos hacia las aves marinas asociadas a su actividad y caracterizar el tipo de interacciones que ocurren con éstas.

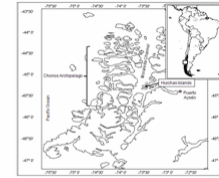


Fig. 1. Archipiélago de Los Chonos, Patagonia Chilena. En el mar interior del océano Pacífico.

Figure 12. Poster's detail presented at the "Congreso de Ciencias del Mar de Chile" (Chilean Marine Sciences Congress) (May 2008). This presentation considered the analysis of perception and interaction between seabirds and artisanal fishermen in Chonos Archipelago.

4.2. Participation in Joint Research



Figure 13. Presentation's detail presented at the "Congreso Chileno de Ornitología" Chilean Congreso of Ornithology (Octubre 2008). This work was developed in conjunction with Universidad de Magallanes, broadening the range of action of the present project to Cape Horn region in analyzing the relationship of seabirds and offal discharges from artisanal fishing.

5. Remarks

In terms of obtained information (review and analysis of the observations in the archipelago of Los Chonos), it is possible to emphasize that the negative interactions (in terms seabird deaths) is stronger between fishermen and seabirds during summer.

These seabird mortalities are associated with egg's harvesting from breeding colonies (e.g. Kelp gull) and directly hunting for food and bait in colonies (e.g. Magellanic penguin).

These backgrounds do not preclude the existence of negative effects of human activity to seabirds during winter. In surveys and informal interviews, it is possible detect the deaths of Procellariiformes for bait and food (e.g. Southern fulmar and Black-browed Albatross in Magallanes region – section 4.2. Participation in Joint Research).

A new point of deleterious effects were detected by this project and also an unknown situation for Chile is the impact of domestic predators (e.g. dogs and cats) on seabirds at Chonos Archipelago.

In addition, the dispersive role of these predators is facilitated mainly by man through the complex network of fjords and southern channels.

We are facing a serious problem, considering that these predators have a broad dietary range and its distribution is in broad altitudinal ranges and also in dense austral rain forests (Anderson *et al.*, 2006).

Therefore, an initiative that addresses the quantification of these effects and appropriate environmental education campaigns are vital to mitigate and minimize the effects of one of the most important agents of extinction of native species (Rau, 2005).

Thus to this new and unfamiliar setting detected by the support of the Pacific Seabird Group, this new initiative is vital to implement studies to understand the unknown diet of these predators (e.g. American mink, dogs). Also, the actual size of its presence in Chonos Archipelago and the implementation of effective measures to eradicate the role of humans as a dispersion agent for these predators.

Acknowledgments

The author is grateful for the confidence and support of the Pacific Seabird Group to realize this study. Thanks also to professor Dr. Roberto P. Schlatter and Dr. Jaime R. Rau for believing and supporting my efforts from the

beginning.

To my colleagues Luis A. Cabezas and Aldo M. Arriagada for all the field and intellectual support, sincerely thank you very much.

To the Comisión Nacional del Medio Ambiente (CONAMA, Gobierno de Chile) (National Environmental Commission, Chilean government) for all the support to environmental and conservation initiatives developed at Chonos Archipelago.

Finally and especially to all the artisanal fishermen from Huichas islands who helped with the interviews and to Patricio Cárcamo and his family for their support in the field.

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