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Sightings of marine mammals and birds in the Comau Fjord, Northern Patagonia, between 2003 and mid 2012

(Mammalia; Aves)

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We present a list of the marine mammals and birds sighted during 2003 and mid 2012 in the Comau Fjord, as well as information from the neighbouring Reñihué Fjord. The sighted cetaceans include blue whales, killer whales, Peale's, Chilean and bottlenose dolphins. Other marine mammals observed are the South American sea lion, elephant seal, leopard seal, Chilean sea otter and the introduced North American mink. Birds include the Magellan penguin, Chilean flamingo, flightless steamer duck, brown pelican, Peruvian booby, three species of cormorant, several species of petrel, and the black-browed albatross. Our records of bottlenose dolphins and regular sightings of elephant seals contribute to the very few records for these species in Chilean Patagonia, and our leopard seal sightings represent only the second and third records of this species in the Northern or Central Patagonian Zone. This data might indicate an underestimation of species distribution ranges, and show the need for systematic surveys on the migration patterns and habitat preferences of species that reach into regions where human activities could intensively impact them.

Presentamos una lista de los avistamientos de mamíferos y aves marinos durante los años 2003 hasta medianos del 2012 en el fiordo Comau, e información del fiordo vecino Reñihué. Los cetáceos avistados incluyen ballenas azules, orcas y delfines austral, chileno y nariz de botella. Otros mamíferos marinos observados son el lobo marino sudamericano, elefante marino de sur, leopardo marino, chun-gungo y visón norteamericano, una especie introducida. Las aves incluyen el pingüino de Magallanes, flamenco chileno, pato no volador, pelicano y piquero, tres especies de cormoranes, varias especies de petreles y el albatros de ceja negra. Nuestros registros de delfines nariz de botella y elefantes marinos contribuyen a los registros escasos de estas especies en la Patagonia chilena; las observaciones de leopardos marinos representan el segundo y tercer registros de esta especie en la Patagonia Norte o Central. Estos datos podrían indicar una subestimación de rangos de distribución, y muestran la necesidad de un monitoreo sistemático de los patrones de migración y de preferencia de hábitat para especies que llegan a regiones donde podrían ser impactados fuertemente por las actividades humanas.

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Introduction

The southern Chilean fjord region with its coastline of more than 80 000 km is the most extensive fjord region in the world and encompasses extremely heterogeneous marine ecosystems. It is known as a highly productive and complex oceanographic area (Hucke-Gaete et al. 2004, Delgado & Marin 2006, Iriarte et al. 2007, Sobarzo 2009, González et al. 2010, Aracena et al. 2011) and a hotspot of marine biodiversity including an outstanding number of benthic invertebrates (Häussermann & Försterra 2009) and cetaceans (Hucke-Gaete et al. 2004, Viddi et al. 2010, Galletti Vernazzani et al. 2012).

The Comau Fjord (42°10' – 42°30' S; Fig. 1) extends over 45 km from its mouth at Lilihuapi Island to its head at Leptepu (Fig. 1). It ranges between two and 8.5 km broad and presents a typical U-shaped cross section profile with near vertical walls, both above and below the water. At its deepest point, close to the mouth it reaches nearly 500 m depth, more than 200 m deeper than the adjacent Ancud Gulf. The basin of the fjord is U-shaped with very steep walls and a comparably flat-sediment-filled bottom. The coastal mountains rise up to 2000 m, their lower slopes are densely covered with temperate deciduous rainforests. The Comau Fjord system possesses two latitudinal fjords, Cahuelmo and Quintupeu, which extend from east to west. Fresh water influx is distributed comparably evenly over the coast. Landslides are a common and natural phenomenon, often extending into the marine ecosystem. Rainfall between 4500 and 7000 mm per year (based on registers since 2002) creates a superficial low salinity layer, which varies in thickness along the fjord and between seasons. At Huinay Scientific Field Station (HSFS), half way into the fjord at the mouth of the Loncochaigua river, the low salinity layer is between 0.5 m in summer and 8 m in winter. Pronounced density differences to the underlying higher saline water body strongly reduce vertical mixing. Tidal amplitudes vary between 0.35 m and 7.42 m. Water temperatures below the pycnocline vary seasonally between 8 °C and 12 °C, and surface temperatures between 6 °C and 23 °C.

First studies carried out from HSFS revealed a highly complex oceanography (Djurfeldt pers. comm., Sobarzo 2009) and a high marine biodiversity in Comau Fjord (Försterra & Häussermann 2003, Försterra et al. 2008, Häussermann & Försterra 2009) including many previously undescribed benthic species (Cairns et al. 2005, van Ofwegen et al. 2006, Galea et al. 2007, Sinniger & Häussermann 2009) and even new communities, such as shallow water scleractinian cold-water coral banks, brachiopod banks and chemotrophic bacteria associated with

volcanic cold-seeps (Försterra & Häussermann 2003, Gallardo et al. 2005, Försterra et al. 2008). Herein we summarize records of marine mammals (for blue whales see also Försterra & Häussermann 2012) and birds.

Material and methods

Since 2003, sightings of marine mammals and birds have been recorded by the team of HSFS (Tables 1, 2). The observations were opportunistically carried out from HSFS and from small vessels during transport trips between Hornopirén and the station, and during boat trips for field work (concentrated on the months January through April) in the Comau Fjord, generally on marine benthos. Since 2002 boat hours and number of trips have constantly been rising with increasing scientific activity at the station (approx. one weekly trip in winter and two to three in summer). During the same time the number of scientific staff at the station has been growing, increasing the possibility of incidental sightings. Sea lion counts are minimum estimations based on conservative estimations in the field and from photos taken by the staff and scientific visitors over the years. Since 2011, photos of sea lion colonies were specifically taken with the aim to monitor population size. Since late 2011, the Pumalin Park also has a register of sightings.

Results and discussion

The Comau Fjord

(Fig. 1)

Marine mammals

(Figs 2,3)

Blue whales (Fig. 2A)

A blue whale (*Balaenoptera musculus* (Linnaeus, 1758)) feeding ground was described in the Corcavado Golf in 2004, the west coast of Chiloé Island and the Los Lagos coast in southern Chile (Hucke-Gaete et al. 2004, Cabrera et al. 2005, Galletti Vernazzani et al. 2012). Most whale sightings occurred during the southern hemisphere spring and summer; the blue whales were hypothesized to migrate northward during winter (Hucke-Gaete 2004, Hucke-Gaete & Mate 2005). Up to 14+ blue whales were observed in the narrow Comau Fjord in Chilean late autumn/early winter 2009, autumn and early winter 2010 and 2012, see Försterra & Häussermann (2012). For a detailed discussion see Försterra & Häussermann (2012).

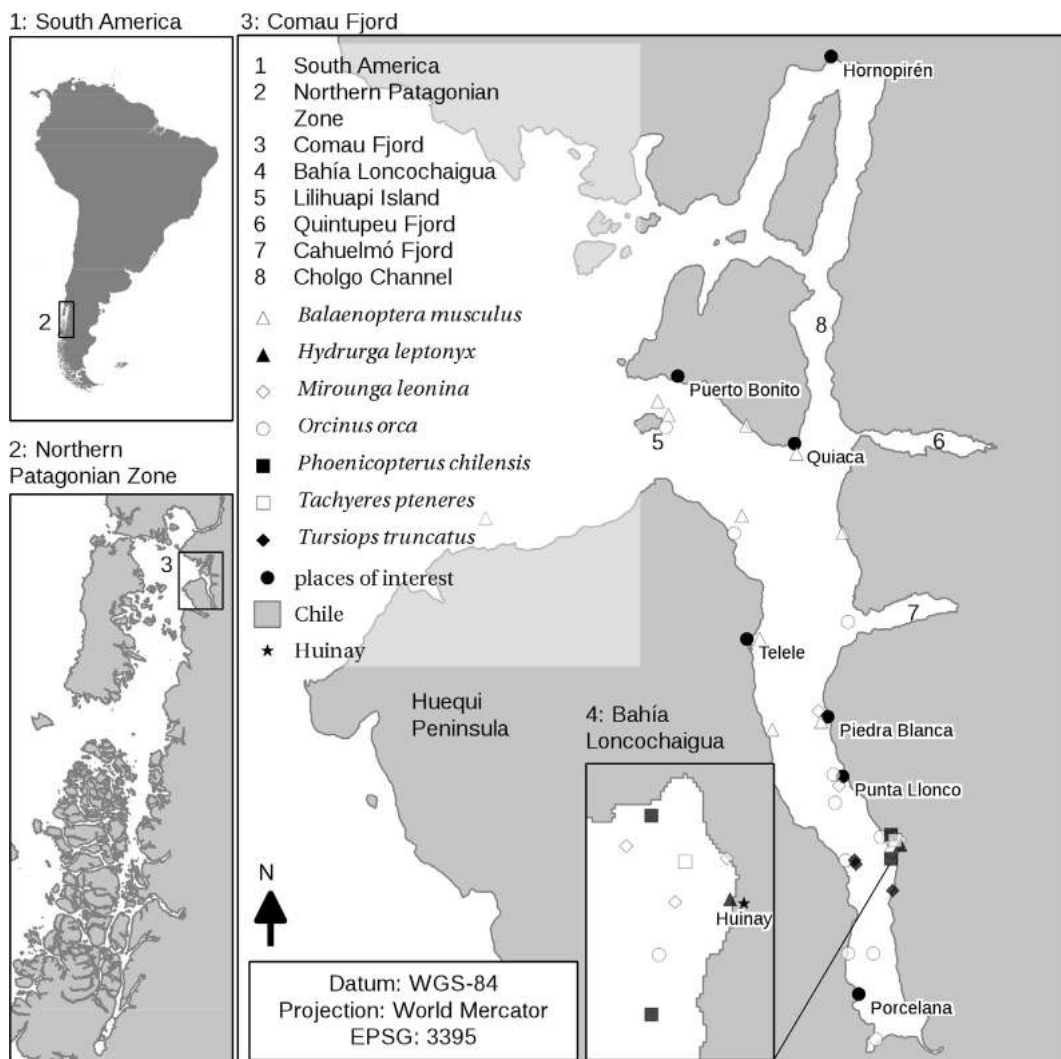


Fig. 1. The Comau Fjord.

Killer whales (Fig. 2C)

Due to few recorded sightings, *Orcinus orca* (Linnaeus, 1758) was thought not to be common in Chile; only 30 sightings were registered from the fjord region (Capella et al. 1999). Despite observer effort remaining low, 115 recent new sightings suggest that killer whales might be much more common in Chilean waters than previously thought (Häussermann et al. in review). A total of 27 killer whale sightings from the Comau Fjord are listed (see Tab. 1). Twelve individuals could be photo-identified, four large males and eight females or young males. For a detailed discussion, see Häussermann et al. (in review).

Other small cetaceans (Fig. 2B,D)

Chilean Patagonia, the poorly known Peale's dolphin *Lagenorhynchus australis* (Peale, 1848) (Fig. 2B) and the Chilean dolphin *Cephalorhynchus eutropia* Gray, 1846 (Fig. 2D) occur sympatrically (Viddi et al. 2011). In Comau Fjord, *L. australis* has been regularly seen in groups between three and ten to 15 specimens; however, groups larger than 10 individuals were less common. *Lagenorhynchus australis* has mainly been seen swimming along and close to the shore between the delta of the Lloncochaigua river, where it was often hunting, and the Tambor river. If a group remained for an extended period of time, they gener-

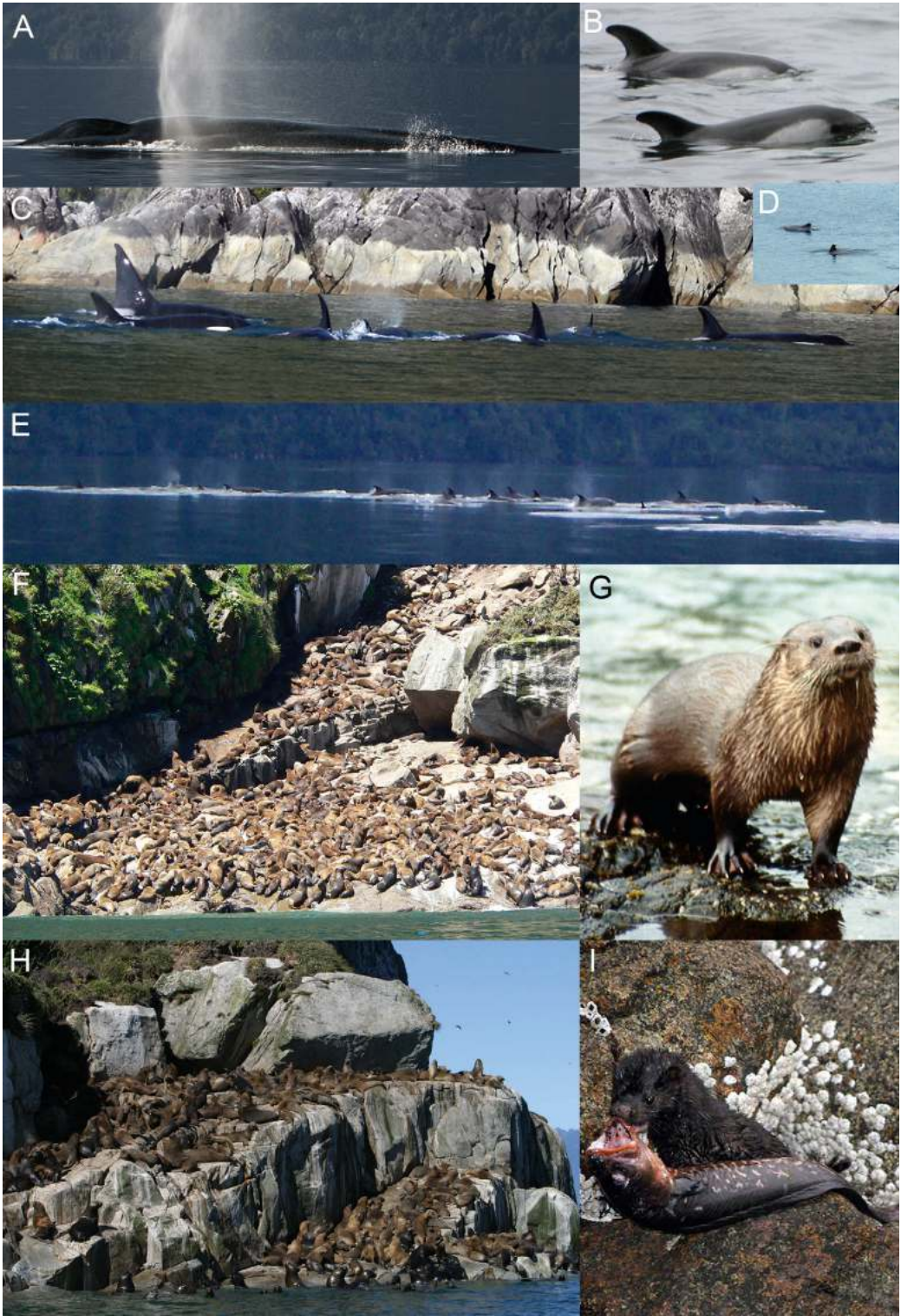




Fig. 3. Pinnipeds sighted in the Comau Fjord. **A.** The sea lion colony at Cahuelmo. **B, C.** Elephant seals (*Mirounga leonina*) were sometimes seen resting along the shores. **D, E.** Leopard seals (*Hydrurga leptonyx*) belonged to the rarest visitors. Photos: David Thompson (B), Reinhard Fitzek (C), Aruna Singh (D,E).

ally stayed close to a river mouth, and more rarely off HSFS. Often several distinct and small groups could be observed in the area. In 2007, a mating

couple was observed directly off HSFS (J. Biro, pers. comm.). The Chilean dolphin has rarely been seen in Comau Fjord, low numbers of individuals were spotted a couple of times in the last 10 years.

The common bottlenose dolphin *Tursiops truncatus* (Montagu, 1821) (Fig. 2E) is known from Peru and central-northern Chile (Aguayo-Lobo et al. 1998). Two ecotypes are known, the inshore and the off-shore type (Sanino et al. 2005). There is genetic evidence for a single, wide-ranging Peru-Chile off-shore stock, whereas a separate cluster is formed by the Peruvian inshore ecotype and a single resident inshore community (pod-R) in central-north Chile differing from both (Sanino et al. 2005). In 2002 it was reported from the Chonos Archipelago in spring and summer (Torres et al. 2002), and in 2006 also during winter (Aguayo-Lobo et al. 2006). In 2010, Olavarria et al. (2010) summarized the records from

◁ **Fig. 2.** Cetaceans and further mammals sighted in the Comau Fjord. **A.** Blue whales (*Balaenoptera musculus*) visited April through early July. **B.** Small groups of Peale's dolphins (*Lagenorhynchus australis*) could be seen year round. **C.** Killer whales (*Orcinus orca*) showed up irregularly to hunt sea lions. **D.** The Chilean dolphin (*Cephalorhynchus eutropia*) was rarely seen. **E.** Bottlenose dolphins (*Tursiops truncatus*) were observed in large groups for a few days once or twice a year. **F.** Left side of the sea lion (*Otaria flavescens*) colony on Lilihuapi Island. **G.** The sea otter (*Lontra felina*) was only rarely spotted. **H.** Right side of the sea lion colony on Lilihuapi Island. **I.** The mink (*Neovison vison*) with its prey, a congrio (*Genypterus chilensis*). Photos: Reinhard Fitzek (C,E), Carlos Spano (D), Jörg Sareyka (F), Juan Carlos Torres (I).

Table 1. Sightings of marine mammals in the Comau Fjord between 2003 and mid 2012.

Sighting date	No. of individuals	Time	Gender	Site if known	X
Marine Mammals					
Elephant seal¹ (<i>Mirounga leonina</i> (Linnaeus, 1758))					
1-Sep-05	1	All day	♂	Huinay	-42.3777
3-Sep-05	1	Over night	♂	Lloncochaigua river mouth	-42.3746
4-Sep-05	1	a.m.	♂	Lloncochaigua river mouth	-42.3746
15-Dec-05	1	All day	♀	Huinay	-42.3797
4-Nov-06	1	All day	♀	Huinay	-42.3797
17-Jul-07	1		♂	Piedra Blanca	-42.3104
8-May-08	1	3-4 weeks during April/May (report from local policemen)	♀	Vodudahue river mouth	-42.4769
12-Nov-11	1		♀	Huinay	-42.3797
Orca² (<i>Orcinus orca</i> (Linnaeus, 1758))					
20-Jul-06	7	a.m.	2♂, 4♀, 1J	Pta. Llonco	-42.3438
13-Aug-06	5	p.m.	3♂, 2♀	Huinay – Mid fjord	-42.3578
21-May-07	3 or 4	p.m.	2♂, 2♀/J	Huinay – Mid fjord	-42.3797
16-Jul-07	3	p.m.	1♂, 1♀, 1J	Huinay – Mid fjord	-42.388
Oct-07	6		2♂, 4♀/J	Calhuelmo	-42.2629
11-Nov-07	7	a.m.	1♂, 4♀, 2J	near Lilihuapi island	-42.2052
1-Aug-08	2 groups (3,?)		1♂, 2♀	Punta Huinay	-42.3749
Sept,Oct,Nov-08 ³				Comau fjord	-42
19-Nov-08	13		2♂, 11♀/J	Marilmo	-42.2164
15-Jul-09	5 or 6	a.m.	2♂, 4♀	Huinay – Mid fjord	-42.388
Aug,Sept,Oct,Nov-09 ³				Comau fjord	-42
28-Mar-10	3	p.m.	2♀, 1J	South of Huinay	-42.4367
3-Apr-10	4		3♂, 1♀	Lilihuapi island	-42.1583
Nov-11	3-6			Comau fjord	-42.4367
2-Dec-11	6	p.m.	2♂, 4♀/J	Huinay – Mid fjord	-42.4367
3-Dec-11	6	a.m.	2♂, 4♀/J	Huinay – Mid fjord	-42.4367
17-Dec-11	1	p.m.		Lilihuapi Island	-42.1583
24-Dec-11	1		♂	Huinay – Mid fjord	-42.4367
Dec-11	~6			South of Calhuelmo	-42.2803
6-Jan-12	6			Leptepu	-42.4816
20-Feb-12	3 or 4			Huinay – Mid fjord	-42.3882
12-May-12	5		1♂, 4♀/J	Huinay – Mid fjord	-42.3797
13-June-12	5-7		2♂	Huinay – opposite side	-42.4050
28-June-12	5			Huinay-opposite side	-42.4050
Bottlenose dolphins¹ (<i>Tursiops truncatus</i> (Montagu, 1821))					
16-May-05	>30			Huinay – Mid fjord	-42.3828
Feb-06	25-30			South of Huinay	-42.4367
Jan-07	>30			Huinay – Mid fjord	-42.3828
10-Sep-07	25-30	a.m.		Rio Tambor	-42.4037
11-Sep-07	25-30	a.m.		Huinay – Mid fjord	-42.3851
10-Sept-08	50			Leptepu	-42.4831
Sept,Oct,Nov-08				Huinay – Mid fjord	-42.3851
Sept,Oct,Nov-10				Huinay – Mid fjord	-42.3851
26-Nov-11	>30	p.m.		Huinay – Mid fjord	-42.3851
13-Apr-12	>50			Huinay – Mid fjord	-42.3851
Aug-12	>> 100			between Huinay – Mid fjord and Telele	-42.3832
	(approx. 200)				-42.2761

Y	Source	Activity
-72.4185	R. Fitzek	resting
-72.4241	R. Fitzek	resting
-72.4241	R. Fitzek	resting
-72.4154	D. Thompson etc.	resting
-72.4154	R. Fitzek	resting
-72.4702	M. Melipillan	swimming
-72.4079	M. Marcotte etc.	swimming, resting
-72.4154	E. Plotnek etc.	swimming
-72.4583	V. Häussermann etc.	hunting
-72.4627	R. Fitzek	swimming
-72.4154	M. Melipillan	swimming
-72.4552	M. Marcotte etc.	hunting
-72.4536	M. Melipilla etc.	
-72.5034	R. Fitzek	hunting
-72.428	M. Marcotte etc.	hunting
-72	R. Fitzek	
-72.534	R. Fitzek	hunting
-72.4552	L. Hernández	swimming
-72	R. Fitzek	
-72.4356	Peruvian ambassador	
-72.5953	C. Mayr etc.	swimming
-72.4356	Local reports	
-72.4552	L. Hernández etc.	hunting
-72.4552	L. Hernández etc.	swimming
-72.5953	E. Plotnek etc.	swimming
-72.4552	L. Hernández	
-72.4674	L. Hernández	
-72.4337	C. Zambrano	
-72.4463	L. Hernández	
-72.4154	L. Hernández	hunting
-72.4501	L. Hernández	
-72.4501	L. Hernández	swimming
-72.4386	R. Fitzek	swimming
-72.4356	C. Zambrano	swimming
-72.4386	V. Chrapkowski	swimming
-72.4219	R. Fitzek	swimming
-72.42368	R. Fitzek	swimming
-72.4361	C. Zambrano	
-72.42368	R. Fitzek	socialising
-72.42368	R. Fitzek	socialising
-72.42368	R. Fitzek	socialising
-72.42368	L. Hernández	swimming
-72.4386	L. Hernández	swimming
-72.5212		

Chilean Patagonia. Olavarria et al. (2010) also added some new sightings with which they extended the distribution to the Straights of Magellan (53°S). Large pods of up to 100+ bottlenose dolphins have been seen in the Comau Fjord off HSFS practically every year. They stayed in the fjord for one to four days. They were usually traveling fast and jumping frequently and high out of the water. Many of their visits probably stayed unnoticed since they cannot be seen from larger distances and they are not as eye-catching as e.g. killer whales so that locals would not talk about them even if they saw a group.

Some coastal dolphins in higher latitudes show a clear tendency towards seasonal migrations, travelling towards warmer waters in winter. However, the sightings year round suggest that at least part of the bottlenose dolphins stay in Chilean Patagonia all year. So far nothing is known on migration patterns and behaviour of southern Chilean bottlenose dolphins.

South American sea lions (Fig. 2F,H; Fig. 3A)

Two non-breeding colonies of the South American sea lion *Otaria flavescens* (Shaw, 1800) can be found in Comau Fjord, one at Lilihuapi Island (Fig. 1, 2F,H) and on at the entrance of Cahuelmo Fjord (Fig. 1, 3A). Sielfeld (1983) listed both as non-reproductive colonies. However Oporto et al. (1999) described Lilihuapi as reproductive colony. Based on our photo record, the Lilihuapi Island colony has been strongly fluctuating between 300 and 800 animals counted from photos taken between 2003 and 2009. However, due to the complexity of the shore morphology, the photographic record did not capture the entire colony. Estimations in the field reached 1500 to 2000 animals, depending on time of the day and year. De la Torriente et al. (2010) counted between six and 2114 animals on Lilihuapi Island in 2005 and 2006, other reports list 449 animals on January 8, 1998, 366 on March 24, 1998 (including 45 large males) (Oporto et al. 1999), 219 in summer 1996, 15 in winter 1996 (Oporto et al. 1996), 34 in summer 2006 and 312 in winter 2006 (Oliva 2008) and counted 42 in winter 2011 during the FAP 2011/2012 project (M. Sepulveda, pers. comm.). Based on our photos, the colony in Cahuelmo varied between approx. 80 and 200 sea lions between 2003 and 2009; in the field estimations reached up to 300 animals. De la Torriente et al. (2010) counted between 55 and 480 animals in Cahuelmo in 2005 and 2006, other reports list 96 on January, 1998, 132 on March 24, 1998 (Oporto et al. 1999), 94 in summer 1996, 82 in winter 1996 (Oporto et al. 1996), 237 in summer 2006 and 303 in winter 2006 (Oliva 2008). Since 2009, the colony in Lilihuapi has decreased significantly and disappeared completely

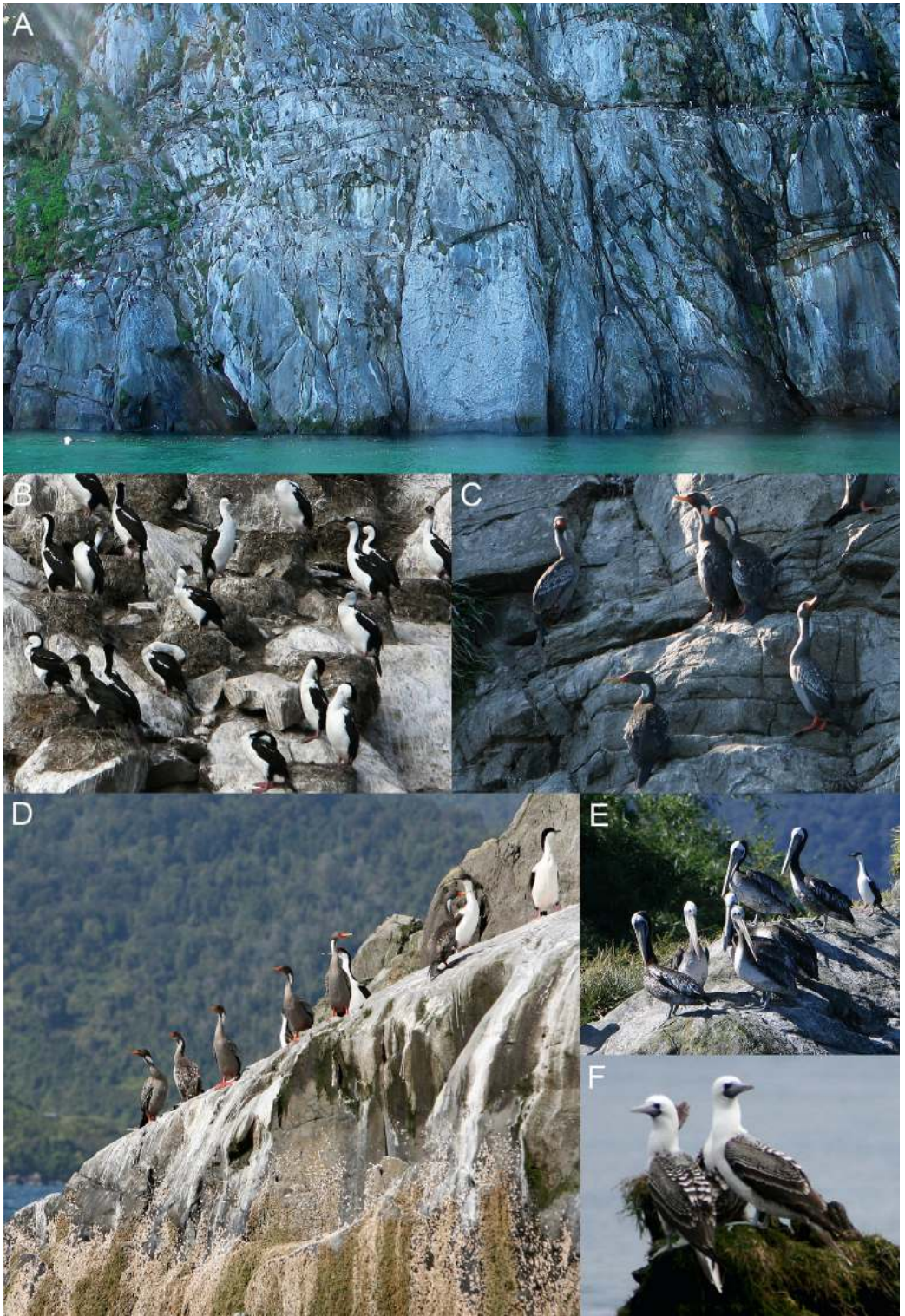




Fig. 5. Further marine birds sighted in the Comau Fjord. **A,B.** Magellanic penguins (*Spheniscus magellanicus*) were breeding on Lilihuapi Island. **C.** Flightless steamer ducks (*Tachyeres pteneres*). **D.** Chilean flamingoes (*Phoenicopterus chilensis*) were resting on the tidal flats during winter. Photos: Reinhard Fitzek (A), Robert Catalán (B).

in 2011 mainly due to abandoned dogs on the island while at the same time the colony in Cahuelmo was growing to more than 700 individuals (a detailed paper is being prepared).

Elephant seals (Fig. 3B,C)

The southern elephant seal *Mirounga leonina* (Linnaeus, 1758) is a large predator, and one of the

principal consumers of squid and small fish in the southern oceans (Bradshaw et al. 2003, Hindell et al. 2003). Its annual cycle is characterized by two terrestrial phases; one for breeding (September to November) and one for molting (December to March) and two pelagic foraging phases in between (Campagna et al. 1993, Campagna et al. 1999). It is distributed throughout the Southern Ocean. Lewis et al. (2006) summarized haul-out sites north of the Polar Front: 13 sightings have been documented before 2006 from the continental Chilean coast, 11 of them in the Southern Patagonian Zone and none in the Central and Northern Patagonian Zone. There are no breeding records for Chile, but occasional haul-out records come from the central-northern coast of Chile, Reserva Nacional Pingüino de Humboldt (RNPH)/Central Chile, Pangal river/Aysen, Isla Diego Ramírez and Seno Almirantazgo/Magel-

◁ **Fig. 4.** Marine birds sighted in the Comau Fjord. **A.** The steep wall of Lilihuapi Island is used as nesting area by many birds. **B.** Imperial shag (*Phalacrocorax atriceps*) and **C.** Red-legged cormorant (*Phalacrocorax gaimardii*) on their nesting places. **D.** Both resting on the lower rocks. **E.** Brown pelicans (*Pelecanus occidentalis*) and **F.** Peruvian boobies (*Sula variegata*) only showed up in combination with large schools of fish. Photos: Martin Thiel (A), Reinhard Fitzek (F).

Table 1. (continued).

Sighting date	No. of individuals	Time	Gender	Site if known	X
Bottlenose dolphins ¹ (<i>Tursiops truncatus</i> (Montagu, 1821)) (continued)					
20-Sept-12	> 80–100	11 a.m.		Huinay – Mid fjord	–42.38915
21-Sept-12	6	6 a.m.		Next to the jetty	–42.37581
21-Sept-12	> 80–100	2 p.m.		Huinay – Mid fjord	–42.37581
22-Sept-12	> 80–100	5 p.m.		Huinay – Mid fjord to opposite side	–42.38915
22-Sept-12	80–90	1.30 p.m.			–42.4831
23-Sept-12	> 80–100	6 p.m.		Huinay – mid fjord	–42.38915
01-Nov-12	20	11.30 a.m.		close to Caleta Marilmo	–42.2164
07-Nov-12	approx. 20	11 a.m.		Huinay Mid fjord	–42.38915
Leopard seal ¹ (<i>Hydrurga leptonyx</i> (de Blainville, 1820))					
14-May-09	1	Midday		Huinay	–42.3797
28-Sep-11	1	p.m.		Huinay	–42.3797
Blue whales ⁴ (<i>Balaenoptera musculus</i> (Linnaeus, 1758))					
13-Feb-09	2	11 a.m.		Huequi Peninsula	–42.2084
5-Jun-09	2			Telele – Puerto Bonito	–42.2071
15-Jun-09	3	11–12 a.m.		Piedra Blanca	–42.3104
15-Jun-09	3	1–2 p.m.		Lilihuapi island	–42.1583
18-Jun-09	3			Lilihuapi – Puerto Bonito	–42.1469
25-Jun-09	3 or 4	9–11 a.m.		west of Lilihuapi	–42.1596
19-Apr-10	14			Telele	–42.2761
22-Apr-10	3–4			Telele	–42.2761
23-Apr-10	5	p.m.		Telele	–42.3194
24-Apr-10	2	a.m.		Calmaco	–42.2159
24-Apr-10	3 groups (9–14)	a.m.		near Cahuelmo	–42.1731
7-May-10	5			Lilihuapi	–42.1583
12-May-10	6	a.m.		Lilihuapi	–42.1583
14-May-10	2	p.m.		Lilihuapi	–42.1583
25-May-10	at least 7 (four groups: 2,2,2,1)			Telele	–42.2761
1-Jun-10	several			Comau fjord	–42
8-May-12	2 (mother with calf)		♀, ?	Poyo	–42.2047
2 July-12	7–9 (rorqual whales, most probably blue whales)			Lilihuapi	–42.1583
Marine birds					
Chilean flamingo ⁵ (<i>Phoenicopterus chilensis</i> Molina, 1782)					
9-Sep-03	23			Lloncochaigua river mouth	–42.3746
Aug-03	20			Lloncochaigua river mouth	–42.3746
14-Jul-07	20			Huinay	–42.3797
7-Aug-08				Lloncochaigua river mouth	–42.3746
3-Sep-08	6			Lloncochaigua river mouth	–42.3746
6-Aug-09	1–2			Comau fjord	–42
Aug-09	29			Lloncochaigua river mouth	–42.3746
27-Aug-11	15			Lloncochaigua river mouth	–42.3746
every August				Lloncochaigua river mouth	–42.4769
Flightless steamer duck ¹ (<i>Tachyeres pteneres</i> (Forster, 1844))					
27-Jun-05	4		2 breeding pairs	off HSFS	–42.3797
12-May-06	2		♂, ♀	off HSFS	–42.3797

¹, Status: Least concern; ², Status: Data insufficient; ³, 3 sightings, dates not properly recorded; ⁴, Status: Endangered; ⁵, Status: Near threatened.

Y	Source	Activity
-72.44690	G. Försterra	swimming into the fjord
-72.43900	U. Pörschmann	swimming
-72.43900	V. Häussermann	swimming out of fjord
-72.44690	V. Häussermann	swimming out of the fjord
-72.4361	C. Zambrano	swimming
-72.44690	C. Zimmermann	swimming out of the fjord
-72.534	D. Bellhoff	swimming
-72.44690		
-72.4154	A. Singh etc.	resting
-72.4154	D. Bellhoff etc.	swimming
-72.7098	The Arrecife	
-72.5286	Carlos Zambrano	swimming
-72.4702	V. Häussermann etc.	feeding
-72.5953	R. Fitzek	feeding
-72.5881	V. Häussermann etc.	
-72.5254	R. Fitzek etc.	
-72.5212	L. Hernández	
-72.5212	R. Fitzek	
-72.5071	G. Försterra etc.	feeding
-72.4573	M. Melipillán etc.	
-72.4888	V. Häussermann etc.	
-72.5953	J. Laudien etc.	
-72.5953	G. Försterra etc.	
-72.5953	G. Wenborne	
-72.5212	Fishermen	
-72	Fishermen	
-72.7229	Carlos Zambrano	
-72.5953	D. Bellhoff	
-72.4241	V. Häussermann etc.	resting
-72.4241	R. Fitzek	resting
-72.4154	M. Melipillán	flying
-72.4241		resting
-72.4241		
-72	M. Melipillán etc.	flying
-72.4241	L. Hernández	resting
-72.4241	C. Spano etc.	
-72.4079	C. Zambrano	resting
-72.4154	R. Fitzek	
-72.4154	V. Häussermann	swimming

lanic Region, and Easter Island (Sielfeld et al. 1978, Aguayo-Lobo et al. 1995, Torres et al. 2000, Gibbons & Miranda 2001, Aguayo-Lobo et al. 2006, Lewis et al. 2006, Sepúlveda et al. 2007). In addition, historical information indicates the presence of *M. leonina* on Juan Fernandez Island (Sielfeld 1983). The only place north of Tierra del Fuego with repeated (four) sightings was RNPH (Sepúlveda et al. 2007). In an ongoing study, elephant seals from Seno Almirantazgo, Tierra del Fuego, are tracked via satellite (Claudio Campagna, pers. comm.).

In Comau Fjord, eight sightings at six distinct events were recorded since 2005 (see Tab. 1). The individuals stayed between one day and approx. one month in the fjord. Sightings were recorded in late spring (early December 2005, November 2006, November 2011), autumn (April/May 2008), and winter (early September 2005, July 2007). None was recorded during their molting time in summer, as were all sightings from Sepúlveda et al. (2007). The longest periods of permanence in the fjord were in September (four days) and April/May (approx. four weeks). The latter could have been a molting event, especially since the animal stayed four weeks, the other sightings however seem to represent shorter rests which are common throughout the year (Lewis et al. 2006). The reason why elephant seals come to the Inner Sea of Chile (they have also been sighted on the beaches of the neighbouring Reñihué Fjord) might be due to the high productivity in this area (Hucke-Gaete et al. 2004, Delgado & Marin 2006, Iriarte et al. 2007, González et al. 2010, Aracena et al. 2011).

Leopard seals (Fig. 3D,E)

The leopard seal *Hydrurga leptonyx* (de Blainville, 1820) with its circumpolar distribution inhabits pack-ice in waters south of the Polar Front. However, some specimens also leave their preferred habitat and can be spotted in Chilean waters. Sixty-seven sightings with a total of 115 leopard seals have been recorded along the Chilean coasts between 1927 and 2010; most animals (96) have been sighted after 2000 (Aguayo-Lobo et al. 2011). At least 19 vagrant individuals have been documented between 30°10'S and 56°S since that time (Aguayo-Lobo et al. 2011). The seals that occurred in central and northern Chile were mostly immature and were observed predominantly in winter, while immature and adult individuals of both sexes and in good physical condition were commonly sighted year-round in glacial areas of southern Chile, especially Tierra del Fuego (south of 53°43'S) (Markham 1971, Sielfeld 1979, Aguayo-Lobo et al. 2011). Sightings in the Northern and Central Patagonian Zone are very rare. Between 41°S (northern limit of Chilean Patagonia) and 53°S

(Straights of Magellan) only one sighting of several leopard seals was recorded, in February 1979 at the San Rafael Lagoon, 46°S (Torres et al. 1979).

Twice a leopard seal was sighted in Comau Fjord. Once an adult individual in apparently good physical conditions was observed resting on the dock of HSFS for a couple of hours on May 14, 2009 (see Fig. 3D,E). Another large individual was observed swimming close to the dock on September 28, 2001.

Traditionally, the movement of leopard seals from the Southern Ocean northward of the Antarctic Polar Front has been attributed to the northward extension of the pack ice during winter (Aguayo-Lobo et al. 2011). However, it would normally only move to the Southern Patagonian Zone where they are currently commonly sighted. It is unclear why leopard seals sporadically visit the Northern Patagonian fjords. They might benefit from the high density of marine mammals and birds in the productive Inner Sea of Chiloé (Hucke-Gaete et al. 2004, Delgado & Marin 2006, Iriarte et al. 2007, González et al. 2010, Aracena et al. 2011).

Sea otters (Fig. 2G)

In Chile, two species of sea otters are known, *Lontra felina* (Molina, 1782) and *L. provocax* (Tomas, 1902) (Vianna et al. 2011). Sightings of the marine otter *Lontra felina* in the Comau Fjord have been very rare. High boat traffic and density of aquaculture farms are threatening its habitat; the population in general is declining (Alvarez & Medina-Vogel 2008). Specimens have been spotted only a few times over the years and seem to be more common in Reñihué than in Comau Fjord. This could be also due to the more exposed character of the Reñihué Fjord; sea otters prefer habitats exposed to waves (Sielfeld & Castilla 1999).

Introduced marine mammals (Fig. 2I)

The North American mink *Neovison vison* Schreber, 1777 (Fig. 2I) was introduced to Chile and Argentina in the 1930s for its fur and is expanding its range in southern South America (Jaksic et al. 2002). It escaped and can be found in many areas of Chile

Table 2. Status and abundance of additional marine mammals and birds observed in the Comau Fjord.

Name	Status	Records
Marine mammals		
Sea lion (<i>Otaria flavescens</i> (Shaw, 1800))	least concern	common
Chungungo (<i>Lontra felina</i> (Molina, 1782))	endangered	very rare sightings (3–5 individuals in the last 10 years)
Peale's dolphin (<i>Lagenorhynchus australis</i> (Peale, 1848))	status unknown	common in groups between 3 and 10, rarely up to 20 animals
Chilean dolphin (<i>Cephalorhynchus eutropia</i> Gray, 1846)	near threatened	rare individual sightings in the last 10 years, several since early 2012
Birds		
Magellanic penguin (<i>Spheniscus magellanicus</i> (Forster, 1781))	near threatened	during breeding season on Lilihuapi Island
Imperial shag (<i>Phalacrocorax atriceps</i> King, 1828)	least concern	during breeding season common on Lilihuapi Island
Red-legged cormorant (<i>Phalacrocorax gaimardii</i> (Lesson & Garnot, 1828))	near threatened	rare on Lilihuapi Island
Neotropic cormorant (<i>Phalacrocorax brasilianus</i> (Gmelin, 1789))	least concern	rare on Lilihuapi Island
Brown pelican (<i>Pelecanus occidentalis</i> Linnaeus, 1766)	least concern	during breeding season on Lilihuapi Island, with big schools of anchovies entering the fjord with big schools of anchovies
Peruvian booby (<i>Sula variegata</i> (Tschudi, 1843))	least concern	regularly flying in the fjord
Giant Petrel (<i>Macronectes</i> sp.)	least concern	regularly flying in the fjord
Black-browed albatross (<i>Thalassarche melanophrys</i> (Temminck, 1828))	endangered	rarely flying in the fjord
Diving petrel (<i>Pelecanoides</i> sp. Lacépède, 1799)	least concern	formerly nesting on the shore (not seen any more)

leading to severe threats to the natural environment (Schüttler et al. 2010). However, information of distribution and impacts of this invader is lacking (Schüttler et al. 2010). From Europe it is known to affect ground-nesting birds, fish, crustaceans and amphibians (Schüttler et al. 2010). In Comau, we had observed it sporadically at the shore around HSFS; however, it seems to be more frequent recently. Here it was observed to prey on individuals of congrio (*Genypterus chilensis* (Guichenot, 1848)) (Fig. 2I) and chancharro (*Sebastes oculatus* Cuvier, 1833) larger than itself which live below 15 m depth.

Marine birds (Figs 4, 5)

Lilihuapi Island is located at the entrance of Comau Fjord. It is a small, steep uninhabited island with a vertical rock wall at its west side which is densely populated with marine birds (Fig. 4A). Here the red-legged cormorant *Strictocorbo gaimardi* (Lesson and Garnot, 1828) (Fig. 4C,D), the imperial shag *Phalacrocorax atriceps* King, 1828 (Fig. 4B,D) and in small numbers also the neotropic cormorant *Phalacrocorax brasilianus* (Gmelin, 1789) have been observed breeding; on the lower rocks the brown pelican *Pelecanus occidentalis* Linnaeus, 1766 (Fig. 4E), and the Peruvian booby *Sula variegata* (Tschudi, 1843) (Fig. 4F) have been spotted in summer. In the dense forest along the northern shore up to 100 pairs of the Magellanic penguin *Spheniscus magellanicus* (Forster, 1781) (Fig. 5A,B) have been breeding on the island until 2008 (Häussermann et al. in preparation). Around Lilihuapi island the giant petrel *Macronectes* sp. and black-browed albatross *Thalassarche melanophrys* (Temminck, 1828) could be spotted regularly.

Groups of 25 to 30 flamingoes *Phoenicopterus chilensis* Molina, 1782 (Fig. 5D) have been regularly observed resting on the river banks of the Lloncochaigua and Vodudahue rivers for a few days in late winter. Breeding pairs of the flightless steamer duck *Tachyeres pteneres* (Forster, 1844) (Fig. 5C) have been observed close to the mouth of the Lloncochaigua river in 2005 and 2006.

The neighbouring Reñihué Fjord

It resembles the Comau Fjord, e.g. it belongs to the only three fjords in Chilean Patagonia in which cold-water coral banks can be found (Häussermann & Försterra 2009). However, it also differs in benthic life, e.g. many sponge species that can be found in Comau are not represented in Reñihué and vice versa (Häussermann & Försterra 2009, Willenz et al.

2012). The reason probably is due to the exposure – the Reñihué Fjord is east-west oriented and thus exposed, the Comau Fjord is north-south-oriented and thus protected – and to the higher sediment load coming from the Reñihué river.

In Reñihué Fjord, the following sightings were recorded by the administrative staff of the Pumalin Foundation: Practically every year, between July and September, small groups of killer whales have been seen. In 2010, 12 individuals were reported; none in 2011. Large elephant seals were observed in the years 2004, 2006, 2008 and 2010. Blue whales were seen practically every year except 2011 and the first semester of 2012; in 2010, ten blue whales were recorded. Penguins have been seen swimming, but never on land. Sea otters could be seen irregularly. Peale's dolphins have been the most common dolphins in the Reñihué Fjord, but Chilean dolphins have also been observed on a regular basis. Flamingoes were spotted every August to the river mouth of the Reñihué river. Flightless steamer ducks have been seen regularly (e.g. three sightings between mid December 2011 and end of January 2012). Coloured cormorants have been seen every year in May. A detailed table of sighting of marine life was started end of 2011.

Conclusions

Probably due to its high productivity and also due to the still pristine forests flanking the waters, the Comau and Reñihué Fjords not only host a great diversity of benthic invertebrates, such as unique cold-water coral banks, but also of marine mammals and birds. Most of the presented sightings significantly increase the existing distributional information on the described species.

Conservation and threats

A total of seven out of the 20 recorded species are endangered or near threatened (Tabs 1, 2; IUCN 2012). The 13 km coast along the territory of the Huinay Scientific Field Station includes a 70 m broad zone dedicated to scientific research and is officially protected from extractive activities, although this regulation is violated on a regular basis (most the mytilid banks have been harvested so that only clean rock is left behind) due to the lack of enforcement. In addition, six aquaculture concessions (five of them for salmonids) were already present in the protected area before establishment, 10 more are applied for; one or two salmon farms have been operating at most times. In 2006, a proposal for a marine park

for the fjords Comau and Reñihué was submitted to the Subsecretaría de Pesca, the Subsecretaría Marina and the CONAMA (today Ministry of Environment). Since aquaculture and extractive activities have increased dramatically since then (own observations; Vester & Timme 2010), abundance and diversity of marine life in these two fjords is highly threatened (a detailed paper on threats and occurred changes is being prepared) and spatial planning is needed more urgent than ever.

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