Rediscovery of a humpback whale (*Megaptera novaeangliae*) feeding ground in the Straits of Magellan, Chile

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ABSTRACT

New information is presented on the summer distribution of southeastern Pacific humpback whales along the Southern Chilean fjords. Sightings of 128 humpback whales observed between December and June from 1997-2001 were analysed. Sightings occurred between 48°50′S to 54°18′S and were concentrated in the waters surrounding Isla Carlos III in the Straits of Magellen (53°37′S, 72°21′W) and in the Canal Wide (49°36′S–5°S). To date, 23 individual whales have been identified from photographs of the ventral surface of the flukes. Throughout the austral summer, seven individuals were resighted near Isla Carlos III over periods between 2-5 months. Two individuals were observed in 1999 and 2000, and two individuals were previously recorded in 1997 in Canal Wide, about 365km north of Isla Carlos III. Historical records show the occurrence of whales in the area from the 16th to the 20th Century. From historic records, scattered whaling data, the small amount of scientific literature available, and the results of this study, it is suggested that the southwestern part of the Straits of Magellan, especially the waters surrounding Isla Carlos III, is the first known feeding ground for humpback whales along the Pacific coast of South America.

KEYWORDS: HUMPBACK WHALE; SOUTH AMERICA; PACIFIC OCEAN; SIGHTINGS SURVEY; PHOTO-IDENTIFICATION; FEEDING GROUNDS

INTRODUCTION

Humpback whales (*Megaptera novaeangliae*) are widely distributed throughout the oceans of the Southern Hemisphere. The question of stock identity has recently been reviewed by the IWC Scientific Committee (e.g. IWC, 1998b; 2001). Seven distinct Southern Hemisphere breeding stocks have been identified, including Group G – the West South America stock (see Fig. 1, IWC, 1998a, p.27). The general distribution and migratory destinations of humpback whales in the West South America stock (Group G) are known from studies based on whaling data (Townsend, 1935; Clarke, 1962; Aguayo, 1974; Ramírez, 1988), occasional sightings (Oporto, 1986; Guerra *et al.*, 1987; Aguayo *et al.*, 1998; Gibbons *et al.*, 1998; Capella *et al.*, 1999) and from the identification of individual animals (Stone *et al.*, 1990; Flórez, 1991; Flórez *et al.*, 1998; Scheidat *et al.*, 2000; Félix and Haase, 2001).

The known summer feeding grounds of the southeastern Pacific humpback whale stock extend along the western coast of the Antarctic Peninsula (Omura, 1953; Mackintosh, 1965; Olavarría *et al.*, 2000), south to the Antarctic Convergence. The cold inshore waters of the southern Chilean fjords, including the Straits of Magellan, have not been considered part of the summer range of humpback whales in the Eastern South Pacific.

In recent years, however, there has been an apparent increase in the frequency of sightings of humpback whales off the coast of Chile (Aguayo, *et al.*, 1998; Capella *et al.*, 1999), especially during summer and autumn in the Patagonian fjords between 49°S to 53°S (Gibbons *et al.*, 1998). This paper considers sightings and photo-identification data that have been collected since 1997 in the Southern Chilean fjords, as well as a compilation of historic records and opportunistic observations. These data are used to examine local distribution, seasonality and the possible existence of feeding grounds in the Straits of Magellan.

METHODS

Study area (Fig. 1)

The study was carried out along inner waters in the Southern Chilean fjords, from south of the Golfo de Penas (47°40′S) and the Beagle channel (55°S). The region exhibits a varied physiography, with more than 37,000km of coastline, great environmental heterogeneity and extreme oceanographic conditions.

Due to its large geographical extent, the area has been divided into the three regions described below.

Region (1). Patagonian fjords, from the south of Golfo de Penas (47°22°S, 74°50W) to the western area of the Straits of Magellan (52°40′S).

The area under study included the main channels that connect this area with the Pacific Ocean (Canal Messier, Canal Wide and Canal Concepción), interior channels and fjords that are adjacent to the Southern Ice fields (a 300km × 40km wide field of ice). This area is characterised by cold waters with low salinity due to the high rainfall, fresh water influx from rivers and glacial melting.

Region (2). The Straits of Magellan.

This is a 570km long V-shaped channel that connects the Pacific and the Atlantic Oceans and separates the southern part of the continent from Tierra del Fuego. Linked with the Straits are the sounds, Seno Almirantazgo, Seno Otway and Seno Skyring; due to their characteristics these last two sounds are considered true inner seas (Magazzú *et al.*, 1996). This region has rich habitat diversity as a result of the different influences of the water masses coming from the Pacific and the Atlantic Oceans, the east-west gradient in precipitation, the freshwater contribution of rivers and glaciers, and major differences in coastal morphology, tides and water depths (Panella *et al.*, 1991).

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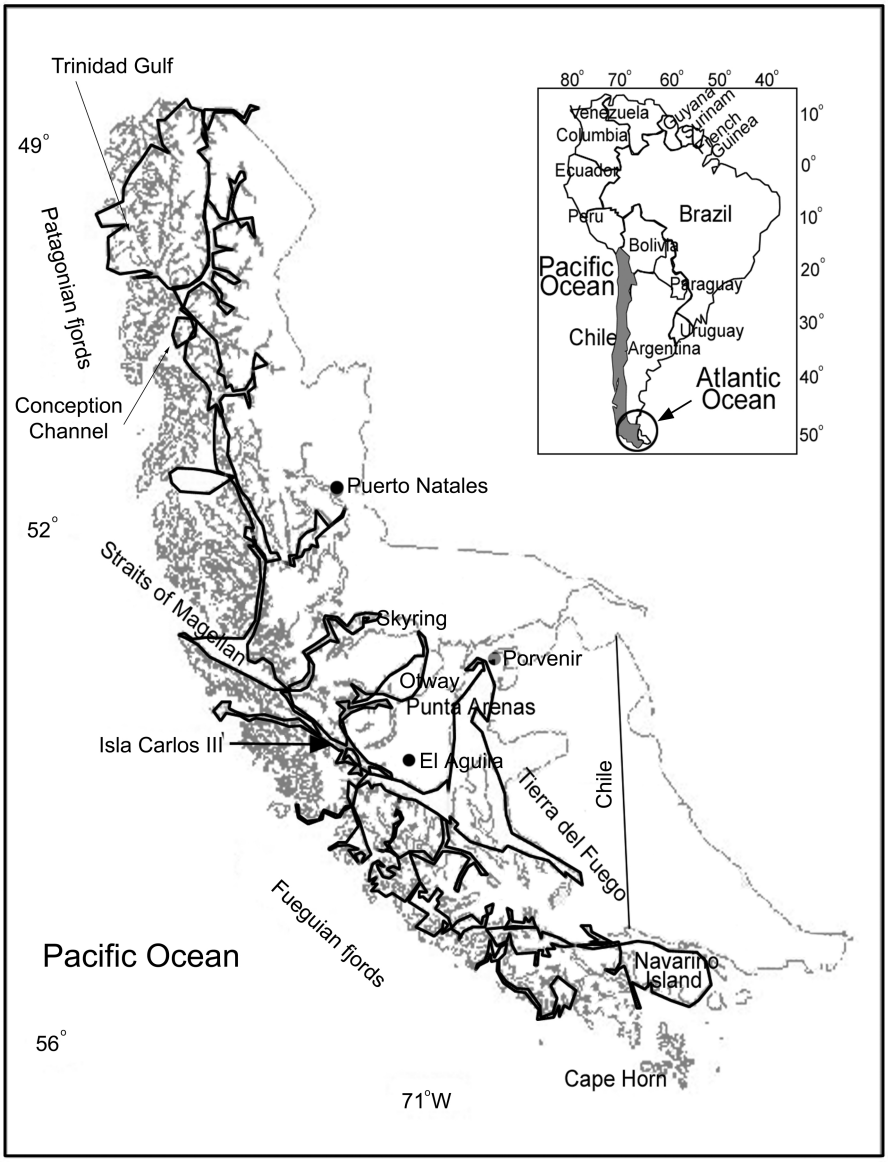

Fig. 1. Humpback whale survey track in the Patagonian and Fuegian fjords and the Straits of Magellan.

Region (3). Fuegian fjords located to the south of the Straits of Magellan.
These are similar to the Patagonian fjords in extent, environmental heterogeneity and varied physical geography, although glacial influence from the Darwin mountains is less important than from the Southern Ice fields. They are influenced in the east by Atlantic waters.

Survey methods and effort
Region 1
A total of 16 trips were made in different boats (14-16m in length, similar in height and speed) for a total of 126 days of work: 52 days in 1997, 47 in 1998, 25 in 2000 and 2 in 2001 (Table 1). The surveys followed a predetermined track of approximately 1,172km (Fig. 1), with minor variations in five excursions. Iceberg Fjord, Peel Fjord, Golfo de Trinidad and Seno Ladrones were occasionally visited in addition to the predetermined track.

Region 2
Both systematic and non-systematic sampling occurred. In the Primera Angostura of the Straits of Magellan, 227 crossings were made on commercial ferries between Punta Delgada (52°29′S, 69°30′W) and Bahía Azul (52°029′, 69°31′W) for a total of 22 days between May 2000 and June 2001, on a twice-monthly basis (Fig. 1).

Table 1
Survey effort and sightings by month in the whole study area (three sectors) for the period 1997-2001.

	Region 1		Region 2		Region 3	
Month	Days	Groups	Days	Groups	Days	Groups
Jan.	0	0	7	11	4	0
Feb.	28	7	15	20	5	1
Mar.	30	15	11	32	0	-
Apr.	9	3	13	17	21	1
May	11	3	11	12	0	-
Jun.	14	3	7	0	0	-
Jul.	0	-	7	0	0	-
Aug.	8	0	4	0	7	0
Sept.	0	-	10	0	0	-
Oct.	20	0	6	0	8	0
Nov.	0	-	10	0	7	0
Dec.	6	1	7	1	11	0
Total	126	32	108	93	63	2

In the central area (Paso Ancho) of the Straits of Magellan, 48 trips were made between Punta Arenas (53°07′S, 70°55′W) and Bahía Chilota, Tierra del Fuego (53°18′S, 70°26′W) onboard commercial ferries (Fig. 1), for a total of 24 days between June 2000 and June 2001, on a twice-monthly basis.

Between Seno Otway and the southern portion of the Straits of Magellan (Fig. 1), surveys were conducted along a 259km predetermined (entire or partial) track. A total of 57 days over 21 months from 1999 to 2001 were dedicated to surveys (Table 1). Two main vessels were used: a 10m rigid inflatable boat with an inboard diesel engine and a *Zodiac* MK5 equipped with a 40Hp outboard engine. Shore based surveys around Isla Carlos III and vessel surveys along the Straits of Magellan from Punta Arenas to the western mouth of the Straits were occasionally conducted.

Seno Skyring was surveyed opportunistically on 3 and 21 February 2000 and 30 March 2001, as was Seno Almirantazgo on 1 September 2000 and 8 February 2001.

Region 3

A total of seven trips was made in December 1999, April, August, October and November 2000 and February 2001, for a total of 63 days (Table 1). These trips were made using different boats (14-16m in length, similar in height and speed), along a predetermined 497km track between Paso Shag (Bárbara Channel) and the east of Isla Navarino (Fig. 1). Other surveyed sections, where the effort was more irregular, have not been considered in this analysis.

Data collection

For each sighting of a whale or a group of whales, the following information was recorded: date, time, GPS position, group size and feeding behaviour. Whenever possible, pictures of flukes or dorsal fins were taken. Humpback whales were usually individually identified by their unique patterns of ventral fluke pigmentation (Katona and Whitehead, 1981). Whales were photographed with a 35mm camera using a 70-210mm zoom lens, black and white or colour print film (ISO 100 and 200) and colour slide film (ISO 100 and 400). Photo-identification effort was low for Region 1 section and minimal for Region 3. Search effort does not include fieldwork carried out in rain or seastate > 4 Beaufort.

For the literature survey to determine the historic presence of whales in the study area, shipping reports, historic chronicles written since the European discovery of the Straits of Magellan in the 16th century, other non-referenced sources of information on whales, as well as available scientific literature were reviewed. Opportunistic records of humpback whales in recent years, obtained from photographs or detailed observations provided by qualified observers that included date and location, were also collected.

Data management and analysis

Sightings data were analysed by month in order to examine the temporal and geographic distribution of humpback whales.

Relative abundance (defined as the number of whales surveyed per hour during systematic sampling) was estimated by region and month. Analysis units of a constant length of 86.5km were established in the Fuegian and Patagonian fjords and in Seno Otway – Straits of Magellan. Relative abundance was compared among all the units with whale records in order to identify concentration areas of humpback whales.

High-quality fluke photographs (60% or more of the fluke surface and a vertical angle sufficient to distinguish the shape of the trailing edge of the fluke) were used to identify individual animals and create a catalogue. Poor-quality photographs were not considered in the dataset. Photographs were used to assess annual returns and within-season 'residency'. The term 'residency' means here the interval from the first to the last sighting of an individual whale in a season. Photo-identification data collected along the Patagonian fjords (two whales) north to 51°S between 1997 and 1998 (Gibbons *et al.*, 1998) were also included for regional comparison between Regions and verification of local movements.

RESULTS

Distribution, abundance and seasonality of whales

An overall summary of effort and whales observed in the three regions is given in Table 1. A total of 128 groups were observed. These groups were distributed from Canal Messier (48°50′S) in the north to the Fuegian fjords (54°18′S) in the south. Whales were not evenly distributed, with a number of concentrations being observed. The highest relative abundance in the period December to May, was observed in the units that included the Straits of Magellan between Canal Jerónimo and Isla Charles, with 1 animal/hour, increasing to 1.51 animals/hour in the specific area of Isla Carlos III but decreasing to 0.21 animals/hour in Canal Wide in the Patagonian fjords region (Fig. 2). Humpback whales were not seen in Seno del Almirantazgo, Seno Skyring or in the western Primera Angostura and the central areas (Punta Arenas – Porvenir) of the Straits of Magellan. They were only occasionally seen in the northernmost part of Fuegian fjords (2 sightings) with just one sighting on a systematic track in good conditions (Figs 1 and 2).

Humpback whales were observed from late spring to late autumn. The first sighting was made on 1 December (1998) and the last on 8 June (1997). No whales were directly observed between July and November although there is evidence from other observers of the presence of humpback whales in the months of August, October and November (see below). The greatest frequency of sightings (98%) occurred between January and May (Fig. 3).

Group size

Humpback whales formed small groups, with a maximum of five, a mean of 1.9 (SD = 0.73) and a mode of two. Group size distribution is given in Fig. 4.

Resighting, local movements and residency of individuals

Twenty-seven individual whales have been identified from fluke photographs. A total of six different animals have been resighted between years, indicating that at least some individuals return to the area. The observed 'residence' time of individuals throughout the summer season ranged from 1 to 5 months, with three different whales being seen more than once in a year. The individual with the longest 'residence' was identified in January, February and May 1999. Short-range movements were recorded in different years for two individuals photographed in Canal Wide (50°03'S, 74°33'W) in February and June 1997 respectively, and again in the proximity of Isla Carlos III in February and April 1999, respectively. These sites are separated by approximately 365km.

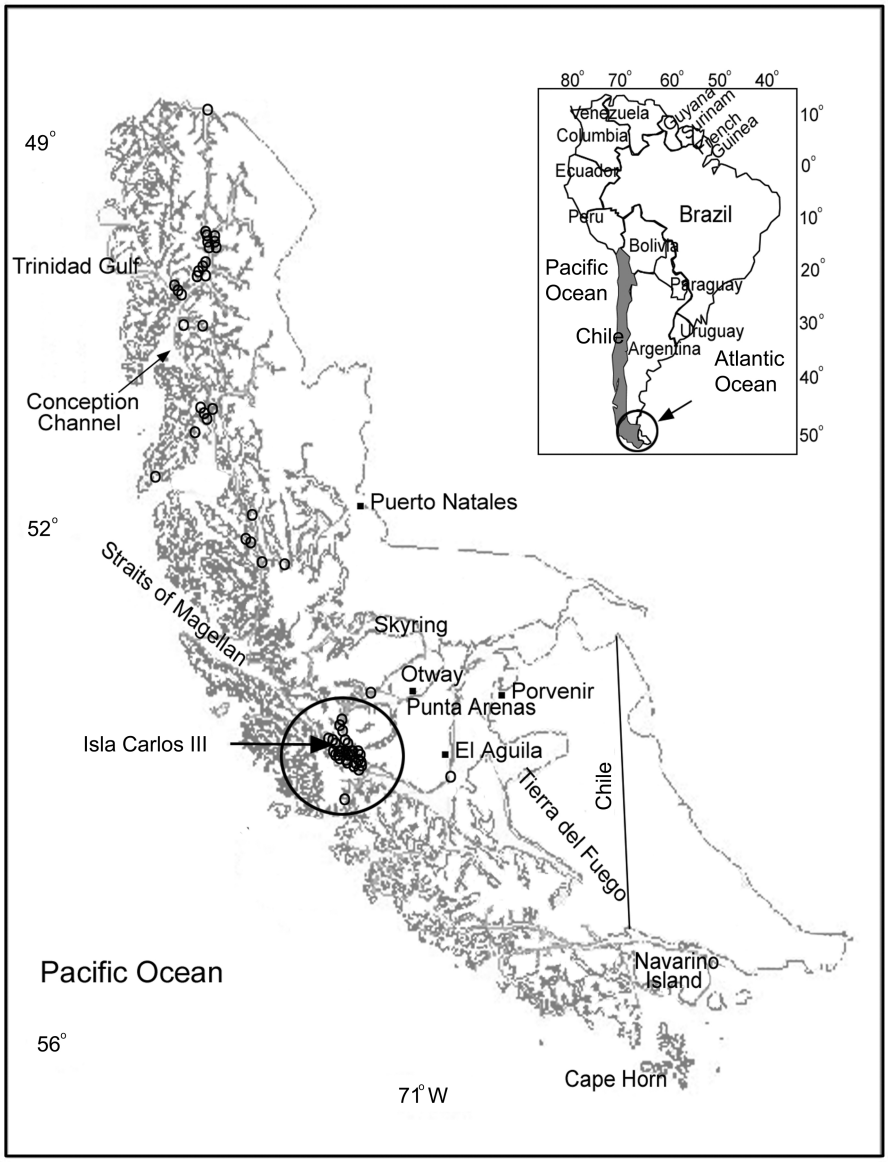

Fig. 2. Humpback whales sighting distribution on the Patagonian and Fuegian Fjords and the Straits of Magellan.

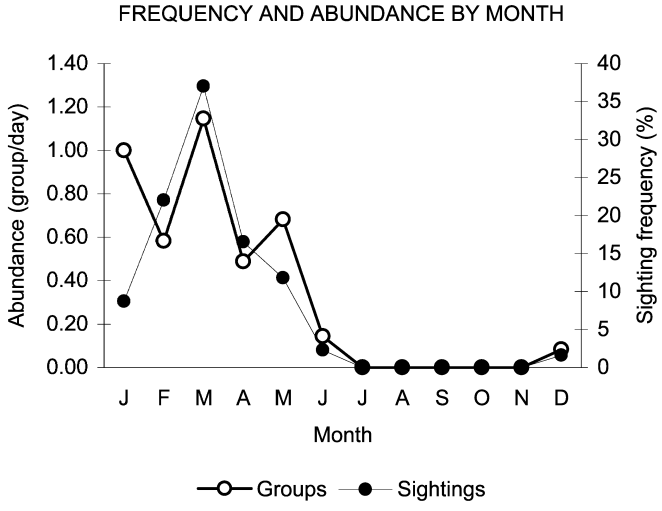

Fig. 3. Seasonal changes in abundance of humpback whales throughout the study period (1997-2001) in the Southern Chilean fjords region.

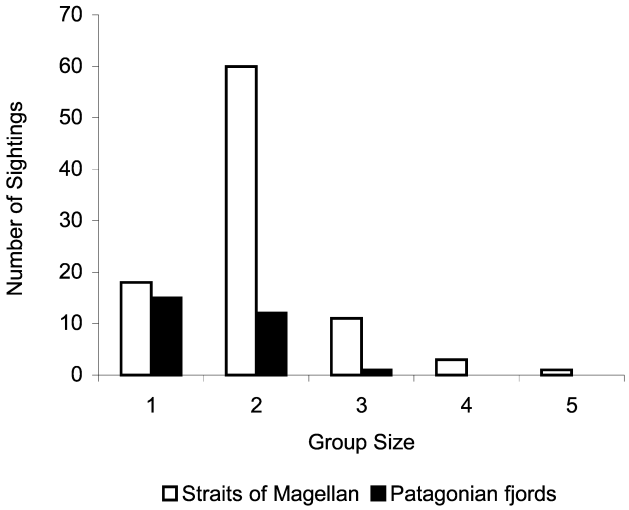

Fig. 4. Frequency histogram of group size in the Patagonian fjords and the Straits of Magellan during the study period.

Foraging activities

Common humpback whale feeding behaviour was observed throughout the summer and autumn, including surface feeding (both vertical and horizontal lunge feeding; Jurasz and Jurasz, 1979) and 'flick' feeding. However, other typical feeding behaviour described for the species in the Northern Hemisphere, bubble net and bubble cloud feeding (Jurasz and Jurasz, 1979; Hain *et al.*, 1982), was not recorded. Defecation was not observed during the study.

Other behaviour, presumed to be subsurface feeding, was also observed. This included observations of regular diving in the same location for 7-15 minutes whilst simultaneous surface feeding by South American fur seals (*Arctocephalus australis*) and sea birds (skuas, *Catharacta chilensis*; South American stern, *Sterna hirundinacea*; black-browed albatross, *Diomedea melanophris*; and Southern fulmar, *Fulmarus glacialoides*) occurred. These events were observed for several hours on 12 different days in 1999 and 2000. The prey species recorded, based on surface observations during these events, were Galatheid crab (*Munida subrugosa*) and schooling fish such as herring (*Sprattus fueguensis*).

Historic and present time records

There is evidence of the presence of whales in the Straits of Magellan, mainly near Isla Carlos III, for six consecutive centuries. Up to the middle of the 19th century, these reports referred in a general way to 'whales'. Pedro Sarmiento de Gamboa, a 16th century explorer, charted numerous sightings around Isla Carlos III (53°37′S, 72°21′W) and the western branch of the Straits of Magellan during the summer (February) in 1583 (Sarmiento de Gamboa, 1954). Less than one hundred years later, John Narborough observed whales in the same area in November 1670 (Mantellero, 2000) and L.A. Bougainville one century later, on 27 December 1767 (Bougainville, 1946)[1]. In the 19th century, Phillip Parker King (Adventure and Beagle Expedition) sighted large numbers of whales near Caleta Bradley, 20km south of Isla Carlos III in April 1828 (King and Fitz Roy, 1839). The first explicit mention of humpback whales was made by C. Skogman in 1841. He stated that the frigate *Eugenia* encountered 'many humpbacks and finbacks' around Isla Carlos III (south of the English Narrows) in February, 1841 (Skogman, 1942)[2]. B. Phillipi mentioned humpback whales in the Straits of Magellan in 1843 (Martinic, 2001). A shore whaling station was established to the southeast of Punta Arenas (see Fig. 2) in Bahía El Aguila (70°58′S, 53°48′W), on the northern coast of the Straits of Magellan in 1905. Hunting operations from this shore station were concentrated on the coastal waters of the southern tip of western South America (Martinic, 1977), although the species hunted were not clearly documented. The first confirmed report of humpback whales in the Patagonian fjords during the 20th century concerns whales taken in 1914 and 1915 by Chilean whalers (Martinic, 1977).

Since the 1970s, several confirmed records of humpback whales have been collected. In 1972 and 1973, photographs of the same individual were taken in the Patagonian channels and the Straits of Magellan (Orlando Dollenz, pers. comm.); two whales were sighted in the Canal Wide in the Patagonian fjords in January, 1984 (Oporto, 1986); a picture of two humpback whales from Mussel Bay, Isla Carlos III in April, 1984 (Alfonso Martinez, pers. comm.); two sightings from the Canal Abra Channel, 40km north of Isla Carlos III in March, 1997 (Francisco Garrido, pers. comm.); two individuals near Isla Carlos III in January, 1998 (Rodrigo Hucke, pers. comm.); one individual in Mussel Bay, Isla Carlos III in October, 1999 (Porter, pers. comm.); pictures of one individual from Primera Angostura, in the eastern portion of the Straits of Magellan in August 1999 and near Punta Arenas in June, 2000 respectively (Carlos Leal, pers. comm.); pictures of one individual from the Fuegian fjords in March, 2000 (Alejo Contreras, pers. comm.); and a videotape of two individuals from Seno Unión (52°10′S) in the Patagonian fjords in November 2000 (Gonzalez, pers. comm.). Gibbons *et al.* (1998) detailed 32 sightings obtained in surveys along the Patagonian fjords (48°S-52°40′S); these are included in this paper.

[1] Bougainville De, L.A. Viaje alrededor del mundo por la fragata del rey la 'Boudeuse' y la fusta la Estrella en 1767, 1768 y 1769. Segunda Edición. Espasa – Calpe Argentina, S.A. Buenos Aires 1946. Colección Austral.

[2] Skogman, C. Viaje de la fragata Eugenia. 1851-1853. Brasil, Uruguay, Argentina, Chile, Peru. Ediciones Argentinas Solar, Buenos Aires.

DISCUSSION

Distribution and seasonality

The information shows that Isla Carlos III, in the southwestern section of the Straits of Magellan, appears to be a suitable feeding habitat for humpback whales. However, the sample size and effort is still too small to determine the limits of this feeding ground or to eliminate the possibility of others in the southern Chilean fjords.

The occasional sightings of humpback whales in the Straits of Magellan (Leal, pers. comm.) and the Patagonian channels during winter suggest that not all animals undertake the migration to low latitudes each year, (c.f. Brown *et al.*, 1995). Some whales may remain in this feeding ground through the austral winter.

Residence

The sightings of the same animal over a 5-month period in the study area, is similar to the upper range reported for some summer areas from the Northern Hemisphere (e.g. Baker *et al.*, 1985; Clapham and Mayo, 1987; Katona and Beard, 1990; Clapham *et al.*, 1993). The annual return reported here (two whales) provides some evidence for the existence of foraging area philopatry. Studies conducted elsewhere have suggested that this is the case for humpbacks on other high-latitude feeding grounds in the North Atlantic and North Pacific (Baker *et al.*, 1985; Katona and Beard, 1990; Clapham *et al.*, 1993; IWC, 2002). It is probable that the data presented here under-represent the true rates of residence and annual returns given the low level of observations and effort.

Despite the inevitable uncertainty surrounding the species identity of early historical records, the probable residence of humpback whales in the area is reinforced by historical information that constitutes a complementary line of evidence. The existence of reports of 'whales' from each century after the 16th century, confirmed in conjunction with the presence of humpback whales from early 20th century, has led us to suggest that humpback whales have traditionally occupied this region as a summer habitat. A possible recolonisation by whales to their historic feeding area might reflect a recovery of the Group G stock from relatively recent commercial exploitation. However, there are no reliable estimates of the population size in their summer grounds and the extent to which humpback whales return to a specific location has not been fully documented.

CONCLUSION

Although the data collected during the three years remains limited, it does show that feeding behaviour is observed. Together with the inference information about residence, it suggests that the area of Isla Carlos III is a feeding ground, the first identified for humpback whales in South America. It is located about 2,000km closer to the tropical areas than the principal feeding area near the Western Antarctic Peninsula (Stone *et al.*, 1990).

The relationship between the humpback whales of the Straits of Magellan with animals from Colombia and the Western Antarctic Peninsula is being investigated through analysis of genetic and photo-id evidence.

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