Assessment of the Status, Distribution and Levels of Abundance of the Mexican North Pacific Humpback Whale Populations

A report of activities carried out in support of SPLASH under the North American Conservation Action Plan (NACAP) for the Humpback Whale

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Introduction

The humpback whale (*Megaptera novaeangliae*) inhabits the waters of Canada, the United States, and Mexico. The species is considered key to securing trinational participation in conservation efforts (CEC 2005).

This report presents the activities carried out in the context of the North American Conservation Action Plan for the Humpback Whale during four winters seasons from 2004 to 2007.

The humpback whale

Characteristics. Adult humpback whales measure 14–16 m in length and weigh between 34,000 and 45,000 kg. These cetaceans are easy to recognize by their long flippers (as much as one-third the length of the body). The flippers are generally white or partially white with rough edges. Like all species in the family *Balaenopteridae* (rorquals), the whale exhibits numerous skin folds (grooves) on the throat and abdomen. It has a small dorsal fin on the middle third of the body and tubercles or sensory nodules on the face. The flukes (tail) normally have a serrated edge, and the variable white spotting pattern on their ventral side is used by researchers as a "fingerprint" for identifying individual whales (Figure 1).

Figure 1. Humpback whale, *Megaptera novaeangliae*

Distribution. In winter, these whales generally live in tropical or subtropical areas, where they mate and calve. They migrate to polar and temperate latitudes to feed in the spring, summer, and fall. While the humpback's range is larger, this NACAP focuses on the Pacific region from Baja California to the Bering Sea, one of the CEC's Priority Conservation Areas. Therefore, for the purposes of this plan, conservation activities for the species focus on this specific geographical area (US Department of Commerce 2002, 2003).

Status. The humpback whale is listed as an endangered species under the *United States Endangered Species Act* (ESA), and its population is considered depleted and strategic under the *United States*

Marine Mammal Protection Act (MMPA). In the Northern Pacific it is listed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003) and it is subject to special protection in Mexico (*Diario Oficial* 2002). The species is classified as vulnerable in the Red List of the World Conservation Union (IUCN) (Cetacean Specialist Group 1996) and in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The exact size of the world population is unknown, but it is estimated at 15,000–20,000 animals (approximately 10–20 percent of the population prior to exploitation). The Northern Pacific humpback whale population is currently believed to exceed 6,000 individuals and is growing (US Department of Commerce 2003).

Conservation. While commercial hunting, the main threat to large whales, has long been restricted, other factors are currently affecting the recovery of this species. In general, entanglement in fishing gear and collisions with boats appear to be the main causes of death; noise impacts, food availability, loss of prey habitat, and unknown factors affecting prey species may also be significant in some subpopulations (Cetacean Specialist Group 1996). Humpbacks are the objects of increasing commercial whale watching activity, and many parts of their habitat have experienced rapid changes due to human use (IUCN 1996). The main threats to humpback whales in the Northern Pacific (Canada, the United States, and Mexico) are entanglement, collisions with boats, disturbance by whale watching boats, noise and acoustic injury or disturbance, impacts on habitat and prey, and pollutants and pollution. Many of these factors are described in detail below (Perry et al. 1999).

The humpback whale's vulnerability demands cooperation among North American governments and interest groups. The CEC's conservation recommendations identify those activities for which a coherent trinational focus presents a special opportunity that would not be possible or as efficient if undertaken individually by the three NAFTA countries (CEC 2005).

In this context, and given the need for better understanding of the status and patterns of Northern Pacific humpback whale populations and the way in which they are structured, as well as knowledge of the extent to which human and environmental impacts are occurring, the CEC considers support for the SPLASH project (Structure of Populations, Levels of Abundance and Status of Humpbacks) to be essential. SPLASH identifies specific priority areas that may benefit from coordination through the CEC (for example, building support for the project, sharing information among the three Parties, assessing humpback whale populations, and provision of environmental impact-related information by experts and organizations). Sharing the costs of this initiative among Canadian, US, and Mexican funding sources will help to ensure that these efforts continue.

The following sections present the results of activities carried out and coordinated by participants in the Marine Mammal Research Program at the Universidad Autónoma de Baja California Sur (UABCS) during the 2004–2007 winter seasons.

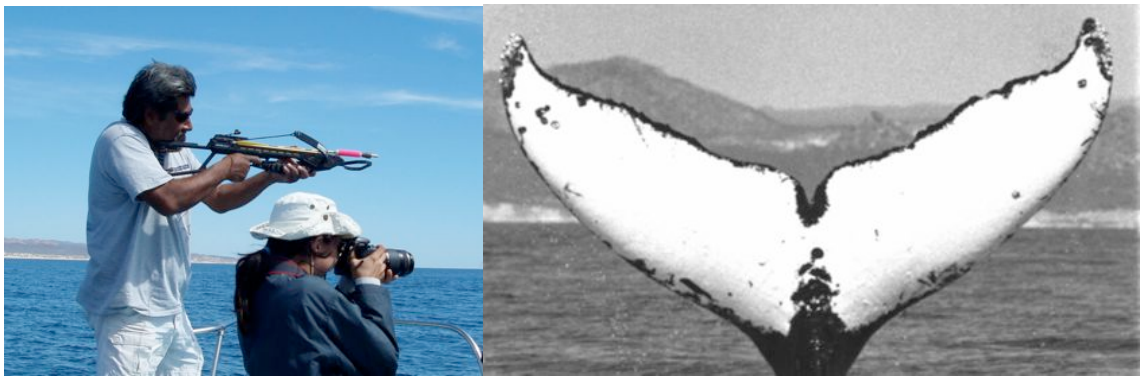
1 Humpback whale abundance and population structure

The following techniques were used:

Photo-identification*. Identification photos of ventral fluke patterns for each individual (Figure 2). Digital reflex cameras were used. The photos were edited with ACDSee. The printed photos were stored in catalogs. Finally, information on each whale and each photo was stored digitally in an Access database.*

The photos will mainly be used to study their migratory fates and local movements and for population estimates.

Skin biopsies*. Collection of a small piece of skin using a crossbow with a specially modified arrow. Genetic analysis will be used to determine the sex and haplotype with a view to differentiating population units.*



A B

C

Figure 2. A) Collection of biopsies with crossbow and photos for individual identification. B) Sample photo of identified whale in catalog. C) Crossbow arrow shot into side of whale to collect skin biopsy.

Both the photos and the skin biopsies were obtained using different types of craft (Figure 3).

A

B

C

D

E

Figure 3. A) Mar VIII 21'; B) Yubarta 22'; C) Koupai Yu Xa 29'; D) Pez Sapo 48'; E) El Amigo 44'

The collection of photos and skin samples in the 2004, 2005, and 2006 seasons focused on the three main aggregations of humpback whales in the Mexican Pacific, located respectively in the "Continental" region, particularly Banderas Bay (Nayarit/Jalisco); the south coast of the Baja California Peninsula, and the Revillagigedo Archipelago (see Figure 4). Support for this work was provided by the SPLASH project. In 2007, the work focused exclusively on the Baja California aggregation.

Figure 4. Main humpback whale aggregation regions in Mexico

Results (2004–06)

A total of 1336 days were devoted to searching for humpback whales. During this time, 4883 will groups were sighted, 1191 skin biopsies were collected, and 5772 fluke photos were taken, leading to identification of 2485 different individuals.

Table 1 presents detailed results broken down by season and region. The second column from the right refers to individuals observed in two different regions during the same season.

Table 1. Results of 2004–2006 fieldwork

	Effort	Sightings	Flukes photographed	Photo-identified whales	Sightings with other aggregations during the same season	Biopsies
2004						
Baja Calif.	60	194	215	219	24	134
Continental	226	669	529	97	18	77
Revillagigedo	169	836	1383	332	12	149
Subtotal	*455*	*1699*	*2127*	*648*	*54*	*360*
2005						
Baja Calif.	102	353	339	244	18	97
Continental	261	666	745	401	18	130
Revillagigedo	132	530	782	247	4	123
Subtotal	*495*	*1549*	*1866*	*892*	*40*	*350*
2006						
Baja Calif.	52	157	197	138	16	120
Continental	194	613	696	488	12	145
Revillagigedo	140	815	816	319	6	216
Subtotal	386	1585	1709	945	34	481
Total	***1336***	***4883***	***5772***	***2485***	***256***	***1191***

As Table 1 indicates, the greatest effort was expended in 2005, while the largest number of sightings took place in 2004, and the largest number of biopsies and photo-identifications took place in 2006. These results may be interpreted as indicating the increasing experience and efficiency of the researchers.

Comparison of the photo-identified whales in the three regions of the Mexican Pacific is taking place at the UABCS Marine Mammal Lab. Preliminary results indicate highest transit between the Continental and Baja California regions, moderate transit between Baja California and Revillagigedo, and very limited transit between the Revillagigedo and Continental regions (Figure 5).

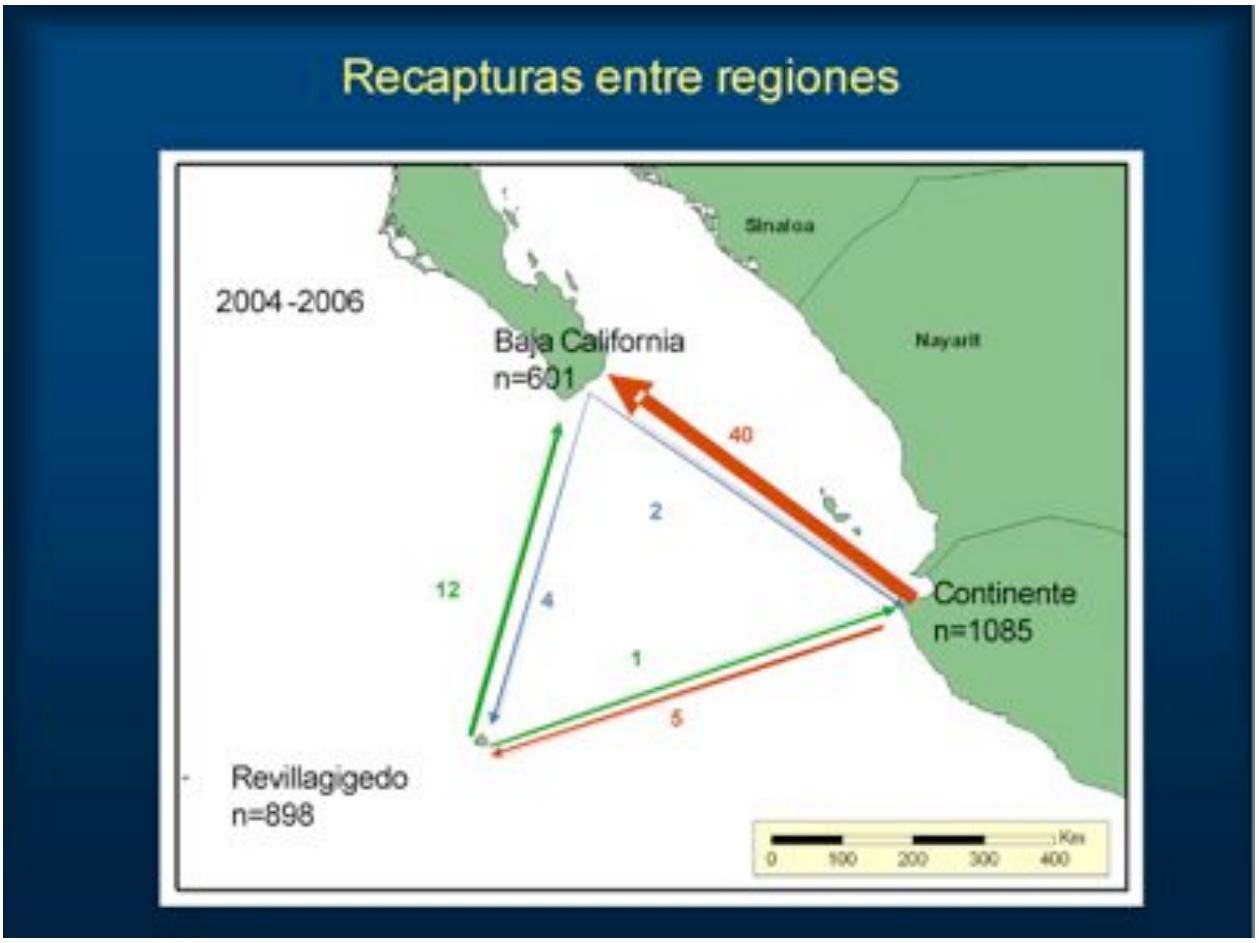


Figure 5. Results comparing humpback whale populations identified in three general areas from 2004 to 2006.

The figures beside each arrow correspond to the numbers of whales sighted in two aggregations during the same season. Each arrow shows where a given aggregation was first and later photographed and its direction of movement.

These results confirm the hypothesis of Medrano et al. (1995), Urbán et al. (2000), and Calambokidis et al. (2001) that whales congregating in the Revillagigedo Archipelago constitute a different population from the ones congregating along the continental coast and that the Baja California coast serves as a breeding area for some whales and as a migratory stopover for others coming from the continent and from the Revillagigedo on their return trip to the feeding grounds.

Comparison of photo-identified whales of the Mexican Pacific with those identified in the Northern Pacific feeding grounds is being carried out by the Cascadia Research Collective in Olympia, Washington under the coordination of John Calambokidis (Calambokidis and Falcone 2007). Preliminary results indicate a different migratory fate for humpback whales congregating along the continent as compared with those congregating in Baja California and, to a greater extent, with those congregating in Revillagigedo (Figure 6).

Humpback whale migrations in 2004 and 2005

		Rus	Ber	W Al	E Al	WGOA	NGOA	SEAK	NBC	NWA	CA-OR
	IDs	40	228	12	51	224	726	795	421	75	253
Winter 2004 to Summer 2004											
Ogas.	114	2	1								
Okin.	43			1							
Phil.	27	2									
Hawaii	697		8	1		10	35	66	20	3	
MXRev	317		1			7	22	3	2	1	
Mx-Mnld	223		2			1	4	1		2	29
Mx-Baja	182		1			2	4	2	1	1	3
Cent Am.	18										3
Winter 2005 to Summer 2004											
Ogas.	123	1	1			2					
Okin.	55	1									
Phil.	35	2									
Hawaii	846	1	4	1	1	4	31	77	38	4	
MXRev	193		2			1	11	4	3		
Mx-Mnld	266		2				2	2	2	5	28
Mx-Baja	157		1		1	4	6	2	1	2	7
Cent Am.	48									1	7

Figure 6. Preliminary results of photo comparison of photo-identified whales between Northern Pacific breeding and feeding grounds

2 Spatiotemporal distribution analysis of humpback whales off the Baja California Peninsula

Effort. Humpback whale search expeditions were conducted to different areas ranging from the Canal de San Lorenzo to Cabo San Lucas. Generally, these monitoring expeditions were conducted in various boats each month during the 2004–07 winter/spring seasons. Each expedition lasted between 5 and 15 days.

Methods. Recording of the geographical position of each sighting enabled us to determine the distribution of the humpback whale and to ascertain the depths at which it occurs (Figure 7). The routes of the expeditions were displayed on a map in order to determine the areas in which the greatest effort was expended. This mapping was done with digitalized GC coastline and bathymetric maps (Ulloa et al. 2006). These maps were made with geographical information systems (Ilwis 3.0 and ArcView GIS 3.2). Kruskall-Wallis one-way analysis of variance was used to determine whether humpback whale distribution was influenced by depth and surface water temperature.

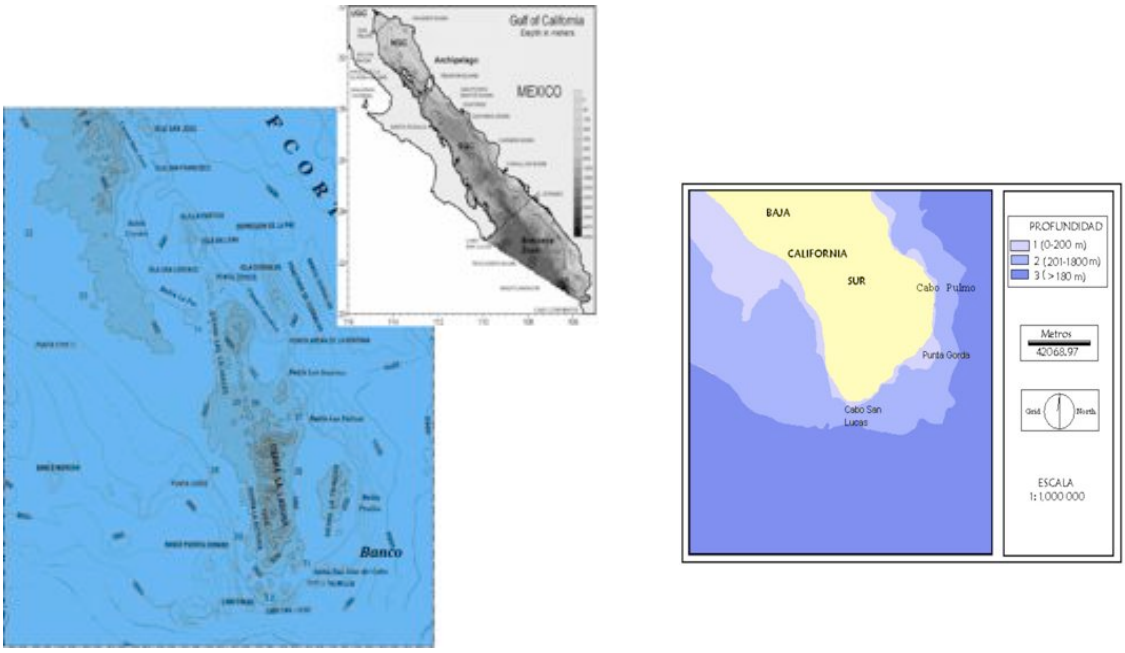


Figure 7. Study area, indicating the depths near the coast, with the exception of the northern part of San José del Cabo Bay (due to its irregular topography with two shallow areas: Banco Gorda de Afuera and Banco Gorda de Adentro (hereinafter referred to as the "Bancos")).

Results

Effort and number of humpback whale sightings. Effort expended during the study period (2004–2007), and the results obtained, varied. Table 2 shows that 2004 and 2005 were the years in which the largest numbers of humpback whales were recorded. In 2006 and 2007, despite the greater effort expended, humpback whale sightings were much fewer.

Table 2. Annual effort and number of humpback whale sightings off the Baja California Sur coast

Year	Time	Distance	MC	MCE	MCA	LA	PA	GA	Total
2004	102.73 hrs	902.22 km	24	11	5	110	52	46	**248**
2005	413.46 hrs	4283.00 km	13	2	1	124	91	35	**266**
2006	221.16 hrs	1902.29 km	19	13	4	61	43	21	**161**
2007	180.38 hrs	965.78 km	18	8	2	64	43	27	**162**
Total	**917.73 hrs**	**8053.29 km**	**74**	**34**	**12**	**359**	**229**	**129**	**837**

Key: MC=mother+calf; MCE=mother+calf+adult male escort; MCA=mother+calf+two or more adults; LA=lone adult; PA=pair of adults; GA=group of adults (more than two)

In addition, the categories including a calf (MC, MCE, and MCA) only represented 14.33 percent (120) of the total sightings (837). During the study period, the number of sightings of these types did not change much from one year to the next (exception: MCE in 2005). Among adult sightings, lone adults represented nearly half the total (42.9 percent). These were more commonly found in 2004 and 2005 (over 100 records), while their numbers declined markedly in 2006–07 (less than 70). The same pattern was observed for groups of more than two adults and adult pairs.

Humpback whale distribution in relation to sea surface temperature. Table 3 shows that during the study period, humpback whales were found in areas with sea surface temperatures ranging from 19 to 26°C, with a mean of 22°C. The high temperatures (25 and 26°C) were due to fortuitous sightings in the month of May. In addition, temperature data for 2004, 2006, and 2007 were similar. The hottest minimum, maximum, and mean temperatures of the study period were recorded in 2005.

Table 3. Temperature data (°C) at sites of humpback whale sightings

Year	Minimum	Maximum	Mean	σ†
2004	19	25.5	21.5	0.86
2005	20.5	26	22.1	0.84
2006	20	24	21.5	0.98
2007	19	24	21.8	1.03

† σ = Standard deviation

As mentioned previously, the year with the largest number of sightings was 2005, and the Kruskall-Wallis statistical analysis of variance by ranks suggested that temperature was probably one of the causes. Temperature in 2005 was significantly different from the other years (p-value < 0.001). However, 2007 temperatures also showed significant differences ($p < 0.001$) from the other years, yet there were very few sightings. Temperature in 2006 was not significantly different from 2004 ($p < 0.001$), yet the number of sightings varied greatly between these two years. In summary, it is suggested that either humpback whale presence was probably not influenced by sea surface

temperature or no direct relationship between sighting numbers and effort was observed due to the heterogeneity of the expeditions to the study area.

Humpback whale distribution in relation to depth. Humpback whales (across all ages and categories) were found in areas with a mean depth of 400.8 m. The shallowest minimums, deepest maximums, and highest means were found for adults-only sighting categories, and sightings including calves occurred, on the whole, at shallower depths (Table 4).

Table 4. Depth (m) at humpback whale sightings across all categories and study years

Category	Minimum	Maximum	Mean	σ†
*Calves**	19	2033	271.7	316.6
MC	20	875	235.5	218.4
MCE	21	2033	368.8	558.3
MCA	19	1300	219.7	348.9
Adults+*	7	2974	422.4	446.7
LA	7	2974	423.9	434.2
PA	10	2967	411.2	449.2
GA	15	1967	438.3	478.7

* Includes all categories that include a calf.
+ Includes all categories that include at least one adult.
† σ = Standard deviation

The Kruskall-Wallis statistical analysis of variance showed that the categories including a calf and the categories including at least one adult in addition to the cow were significantly different (p-value < 0.001). These results suggest that in the study area, categories with calves preferred shallower water than categories including at least one adult.

Humpback whale distribution. As may be seen in the following figures in this section, the expeditions (effort) mainly targeted waters near the coast between Cabo Pulmo and San José del Cabo.

In general, humpback whales preferred shallow water. The main areas where they were recorded are between the banks and waters of Los Frailes-Cabo Pulmo. The categories including calves predominated in waters nearer to the coast and in protected waters such as those of Los Frailes Bay, Cabo Pulmo, and Punta Palmilla. Only a few sightings in these categories occurred in the northern portion of the study area. The adult categories were generally distributed similarly. However, a few adult whales were typically found in areas peripheral to the areas of largest humpback concentration.

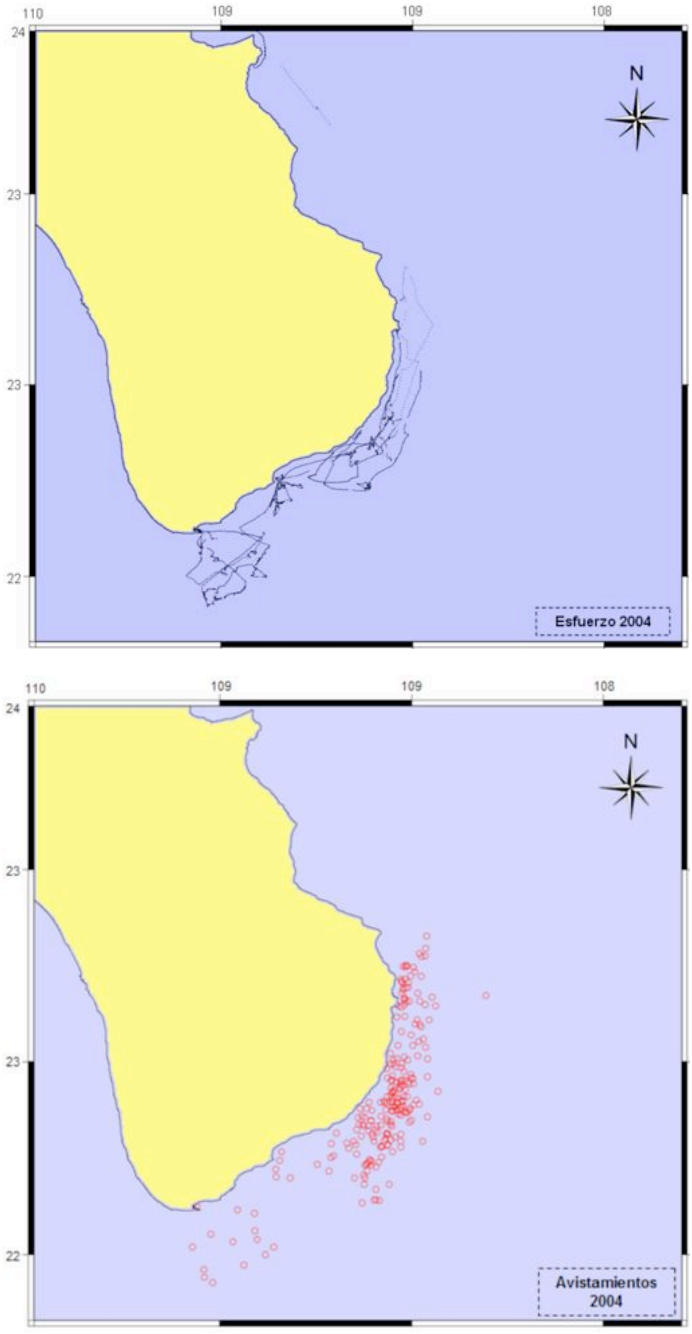


Figure 8. Expeditions and whale sightings in 2004.

As may be seen in Figure 8, the expedition routes were concentrated along the coast from Los Frailes to Cabo San Lucas. Most of the sightings (across all categories) occurred in the shallow waters of Banco Gorda de Afuera and Banco Gorda de Adentro and in the vicinity of Los Frailes. This figure also shows that despite considerable effort expended in the southern portion of the study area, few sightings were recorded. No humpback whales were found in the northern portion of the area, but effort expended there was minimal.

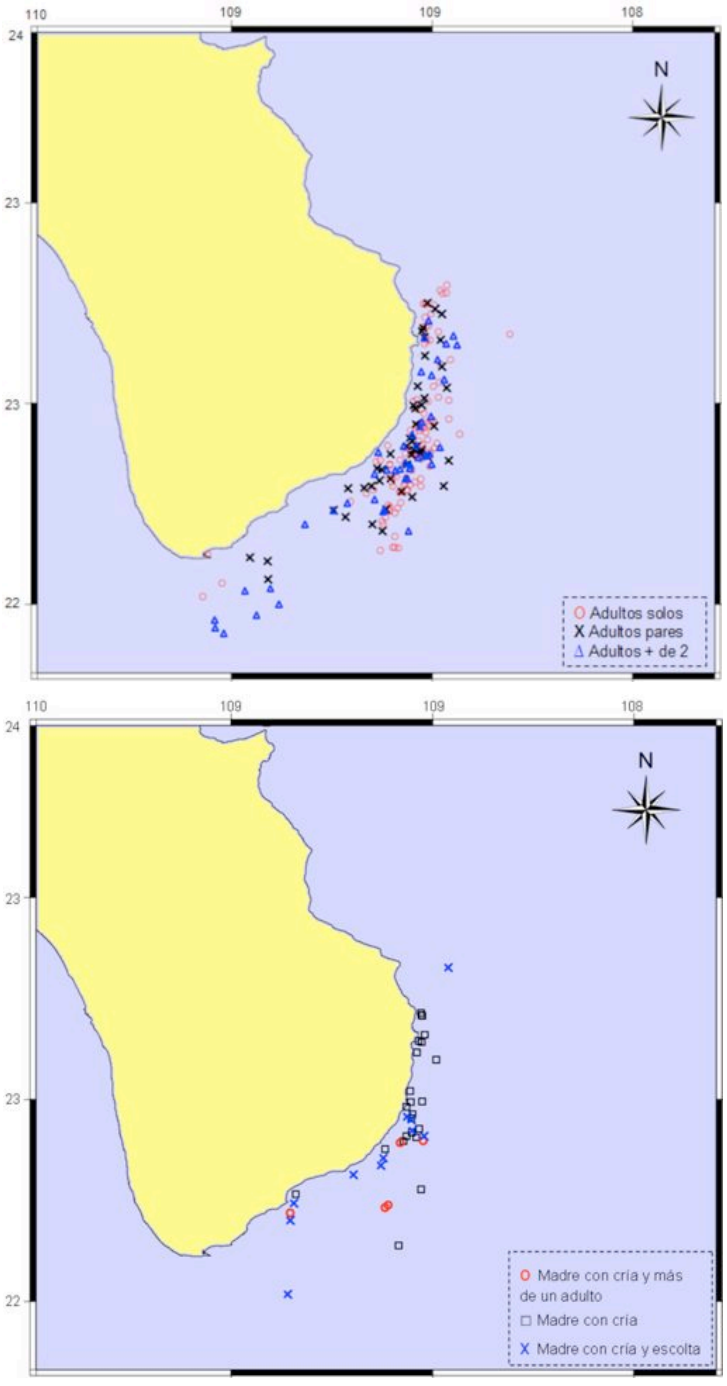


Figure 9. Humpback whale sightings in 2004 by adult categories and categories including a calf

From Figure 9 it is evident that lone adults were the most common sighting. Such sightings were distributed between the Bancos Gorda and the Los Frailes area. In contrast, the categories including calves occurred in shallower water nearer to the coast, primarily in protected waters such as Punta Palmilla and Los Frailes Bay.

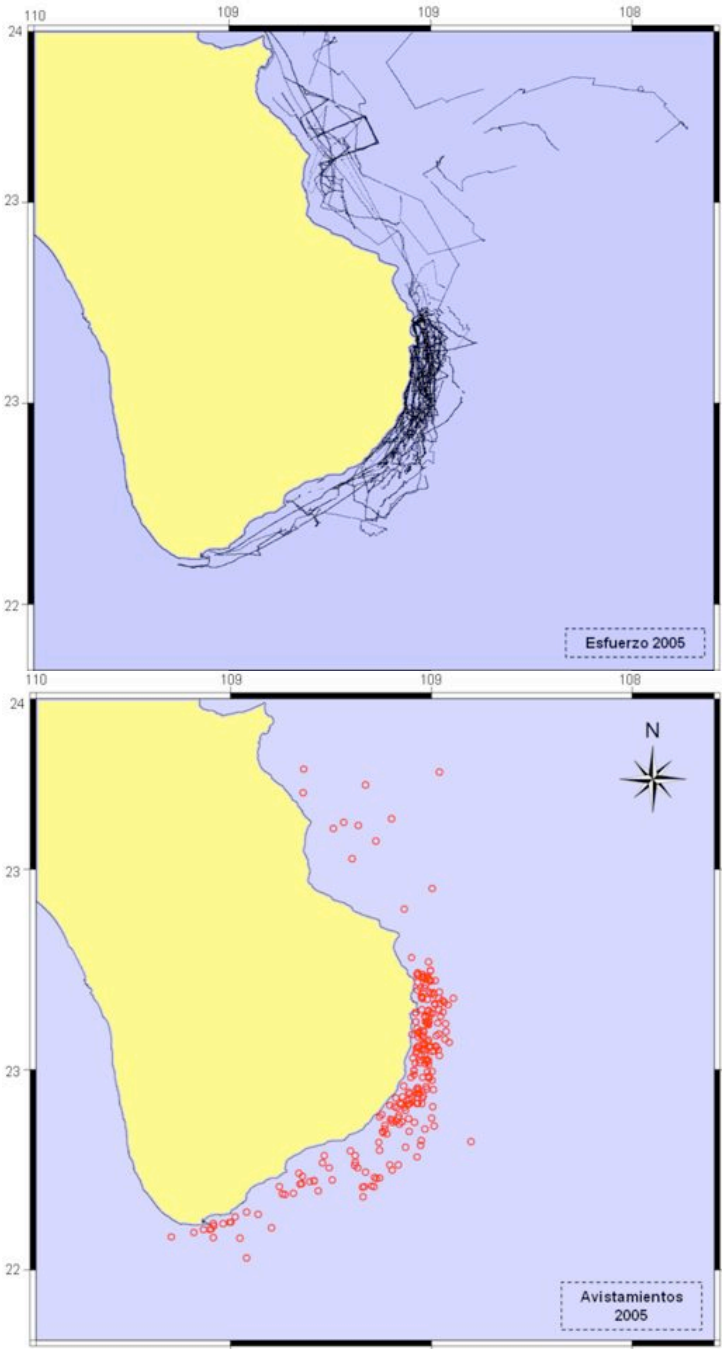


Figure 10. Expeditions and sightings in 2005

From Figure 10 it may be observed that the humpback whale distribution in 2005 was different from that of 2004. In 2005, the whole area of the Bancos was not an area of humpback concentration; the majority was found to the north of that area up to the Los Frailes and Cabo Pulmo areas, and mainly in these latter areas. In addition, whales were found in the northern portion of the study area. However, many sightings were recorded in the southern portion (from San José del Cabo to Cabo San Lucas). In short, whales were sighted this year throughout the study area, but the largest number of sightings occurred somewhat further north than in 2004.

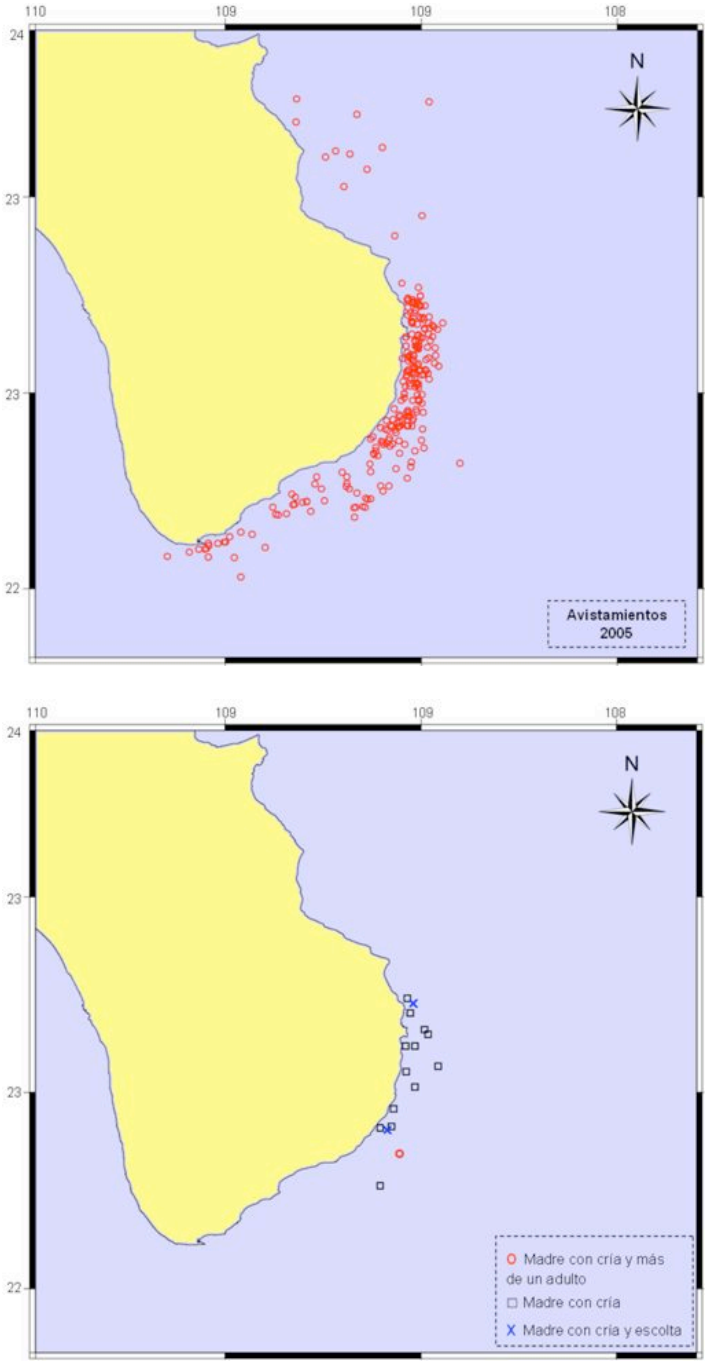


Figure 11. Humpback whale sightings in 2005 by adult categories and categories including a calf

Figure 11 illustrates the distribution of humpback whale sighting categories. Sighting with calves were rare and distributed from the northern portion of the Bancos to the Los Frailes and Cabo Pulmo areas. Sightings recorded at the far ends of the study area did not include calves. No particular pattern of distribution was observed for the adult categories. It is worth noting that adults occurred in deeper, further offshore waters in the northern portion.

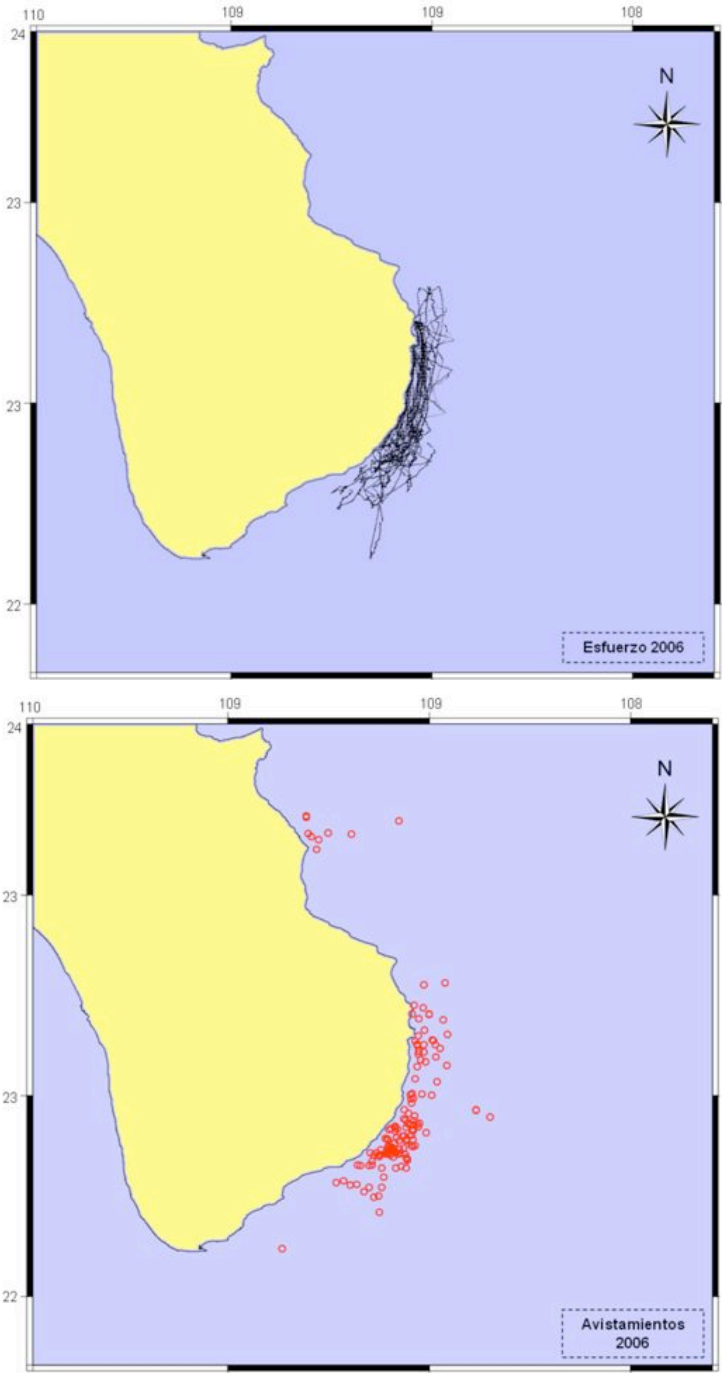


Figure 12. Expeditions and sightings in 2006

In Figure 12, the effort was concentrated in the area of the Bancos and Los Frailes-Cabo Pulmo. This was a reflection of the sightings recorded throughout the study area. This figure shows that the majority of humpback whale sightings were recorded from the northern portion of the banks to the southern part of Los Frailes. The sighting in the south and the sightings from the northern portion of the study area were fortuitous, but they are important because they indicate the presence of whales in these areas. The figure also confirms the comparatively few sightings in this year with respect to 2004 and 2005.

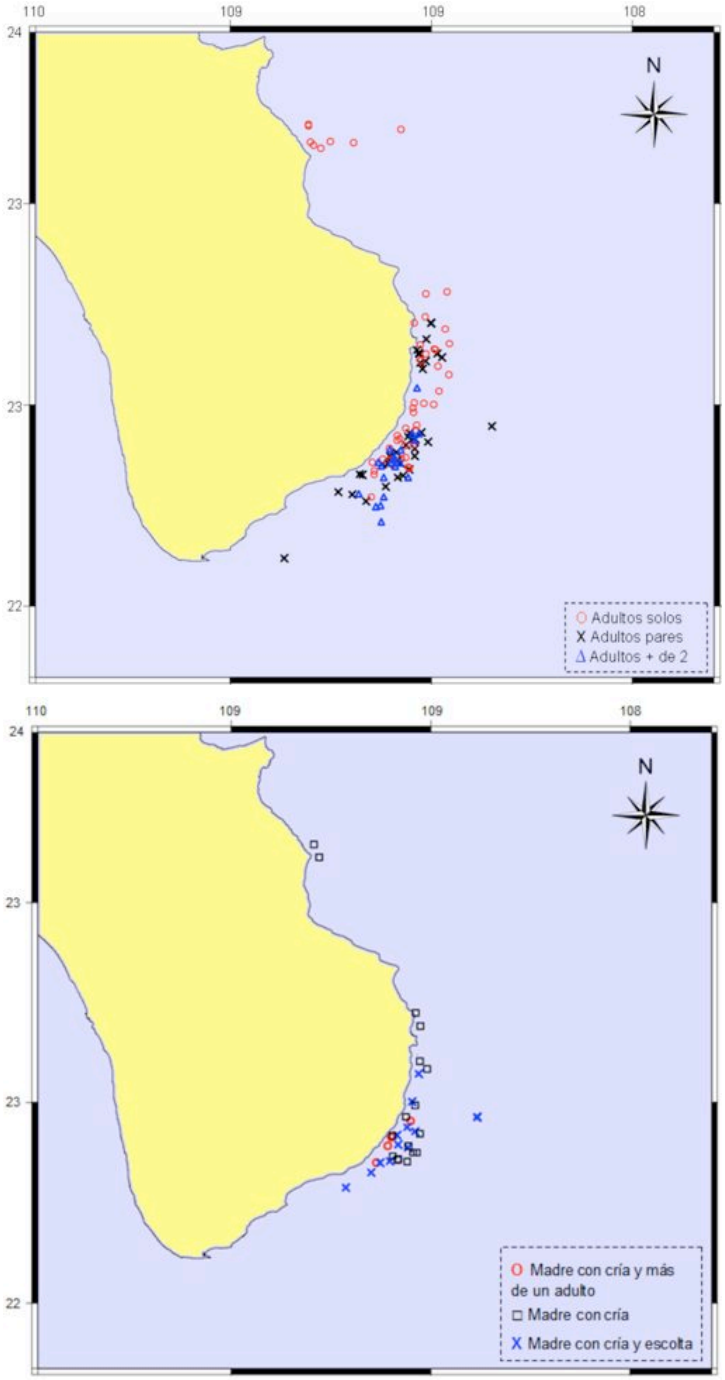


Figure 13. Humpback whale sightings in 2006 by adult categories and categories including a calf

Figure 13 shows that the category of sightings with more than two adults largely took place in the northern part of the Bancos, and that lone adult whales were distributed further north. Cows with calves, in addition to being distributed to the north of the Bancos, were also found in the Los Frailes and Cabo Pulmo areas. For the first time during the study period, cows with calves were recorded in the northern portion (Punta Pescadero).

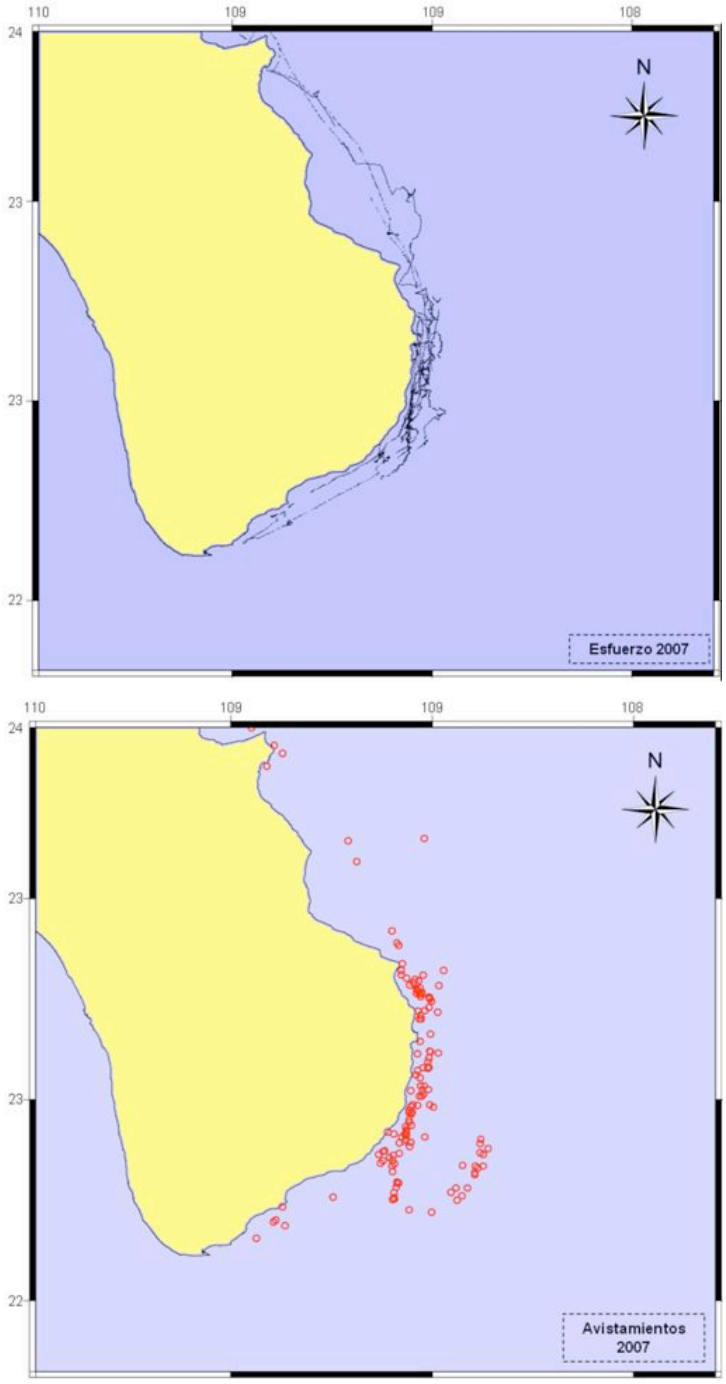


Figure 14. Expeditions and sightings in 2007

The expedition routes in the final year of the study were more homogeneous (Figure 14). Nevertheless, the most often visited areas were the Bancos and the northern part of Cabo Pulmo. As in 2006, this figure shows that few humpback whales were recorded. As in other years, whales were distributed to the north of the Bancos, but they were also frequently found from the Cabo Pulmo area to Punta Arena. Other (fortuitous) sightings occurred far from the coast. This year too, several whales were found in the northern portion. Sightings recorded in the Punta Palmilla area were scarce as well.

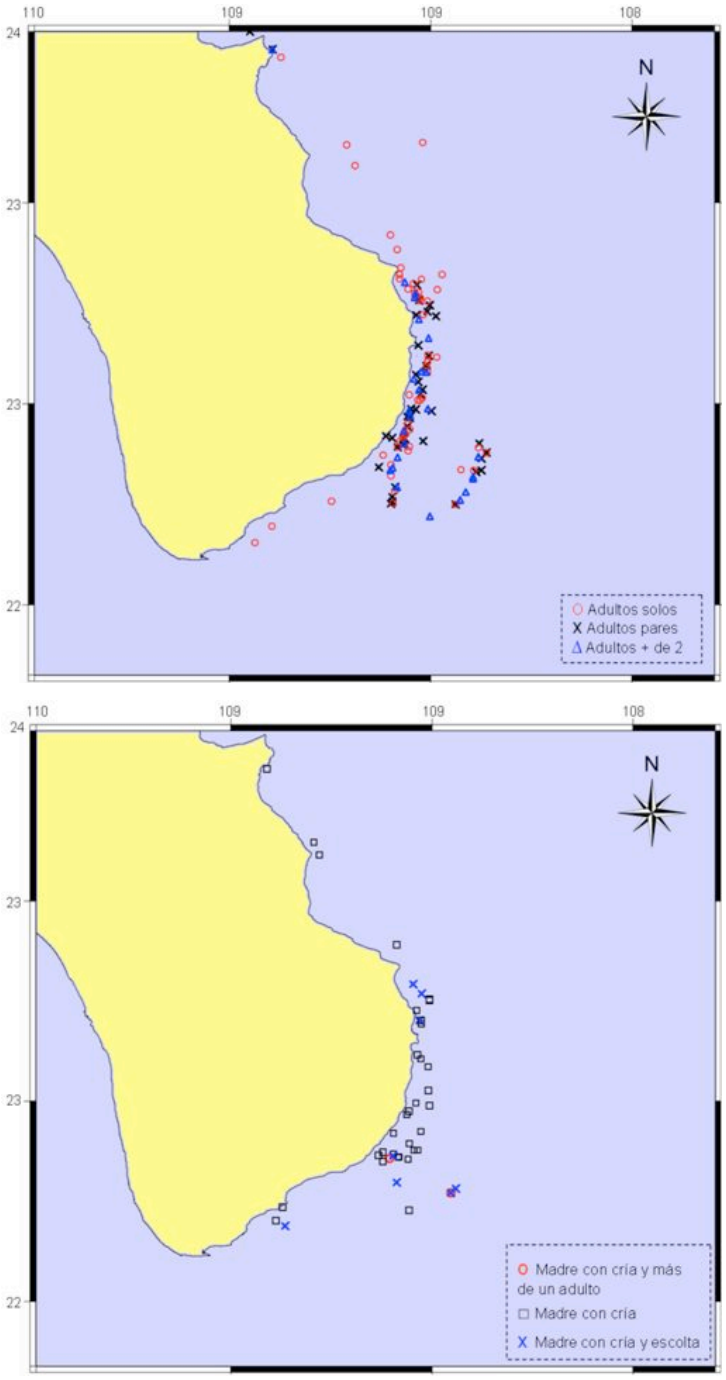


Figure 15. Humpback whale sightings in 2007 by adult categories and categories including a calf

As in 2006, several cows with calves were observed in the northern portion of the study area. In contrast to 2006, cows with calves were recorded at Punta Palmilla in addition to the areas from Cabo Pulmo-Los Frailes to the Bancos. The adult categories did not exhibit a particular distribution pattern; they were mainly found between the Bancos and the northern part of Cabo Pulmo. A few lone adults were recorded in the southern and northern portions (Figure 15).

3 Entanglement

In order to assess the impact of fishing gear on humpback whales, an analysis was performed on caudal peduncle photos taken in 2004 and 2005 in the three Mexican Pacific regions where they congregate: 124 off the continental coast, 134 off the Baja California Peninsula, and 110 in the Revillagigedo Archipelago (Foubert 2006).

The photos were analyzed by looking for scars or marks caused by fishing gear in the area of the caudal peduncle, as shown in Figure 16. Each photo was assigned a code (Table 5 and Figure 17).

Figure 16. Caudal peduncle showing sites of scars inflicted by fishing gear

Table 5. Likelihood of entanglement

LIKELIHOOD OF ENTANGLEMENT	DESCRIPTION
NONE (E0)	No evidence of entanglement observed.
LOW (E1)	Marks visible but these do not suggest previous entanglement. This category corresponds to scars no larger than type C2 in any region.
UNCERTAIN (E2)	Scars visible that may be due to entanglement but do not exhibit a consistent pattern. At least one region may be characterized with scars of type C3 or higher.
HIGH (E3 and E4)	Scars caused by gear in addition to the presence of damaged tissue. At least two regions show marks of type C3 or higher.
HIGH (E4 and E5)	Scars caused by gear in addition to the presence of damaged tissue. At least two regions show marks of type C3 or higher. At least one region shows marks of type C5.

No likelihood of entanglement E0

Low likelihood of entanglement E1

Likelihood of entanglement uncertain E2

High likelihood of entanglement E3

High likelihood of entanglement E4

Figure 17. Likelihood of entanglement code

The results of these analyses are given in Table 6, where it may be observed that over 42 percent of the whales analyzed showed marks indicating a high likelihood of entanglement at least once in their lives.

Table 6. Entanglement codes assigned in each zone of aggregation

	E0	E1	E2	**E3**	**E4**
Banderas Bay n=103	5	12	38	**32**	**16**
Baja California Sur n=93	4	16	32	**27**	**14**
Revillagigedo Archipelago n=77	5	16	29	**27**	**0**
Percentage	5.12	16.11	32.26	**42.49**	

Similar studies using the same technique were conducted in the Gulf of Maine on the east coast of the United States and in southeastern Alaska. The percentage of individuals exhibiting a high likelihood of entanglement was lower than that found in Maine but higher than that found in the Gulf of Alaska (Neilson, 2006; Robbins and Mattila 2003, 2004).

In recent years, several entanglements have occurred in Banderas Bay. In 2006, five cases were recorded. Three of these, two calves and an adult, were observed entangled with gear detritus and later without it. The other two were entangled adults, one of which was released and the other of which was not sighted again (María Eugenia Rodríguez Vázquez, COVISI, pers. com.). During the 2006 CEC-SPLASH cruise we had an opportunity to identify other areas where this type of event is likely to occur with some frequency due to the high density of trawl nets in areas where whales were frequently observed. These areas were the Nayarit coast from Punta Mita to San Blas and the west coast of Isabel Island where the scale-fish fishery is active in winter and spring using gill nets. A large number of whales of different age categories, including cows with calves, were observed in the vicinity of this island. Figure 18 presents photographs of a whale displaying detritus from these nets entangled with the caudal peduncle.

Figure 18. Humpback whale entangled in fishing gear at Isabel Island.

In the 2007 season, two cases were recorded on the Baja California Sur coast. The first case, that of an adult entangled in a gill net, was recorded on 7 March 2007, in the area of Banco Gorda de Adentro. The individual was sighted by tourists, who photographed it and sent the information to David Mattila, the US researcher who provided us with the data and photograph (Figure 19).

Figure 19. Humpback whale entangled on 7 March 2007, at Punta Gorda, BCS

The second sighting took place on March 17 of the same year at Canal de San Lorenzo, in La Paz Bay. This was another adult entangled in a gill net. The animal had been severely weakened, was moving slowly, and had obvious difficulty breathing. Since we did not have the appropriate equipment on hand, we decided not to attempt to release it, but observed it for more than 90 minutes before leaving (Figure 20).

Figure 20. Humpback whale entangled on 17 March 2007, at Canal de San Lorenzo, BCS.

Table 7 presents records of humpback whales entangled in Banderas Bay from 2003 to 2006. As is evident, the number of entangled whales has increased each year, and calves are the most affected age category (Foubert 2006).

Table 7. Humpback whales entangled in Banderas Bay, 2003–2006.

	DATE	SPECIES	SEX	AGE	PLACE	RELEASED	DEAD	WITH NET
								X
2003	January 29	Humpback	Female		Banderas B.			
2004								
	January 31	Humpback	Female	Adult	Banderas B.	X		
	January	Humpback			Banderas B.			X
	December 12	Humpback		Adult	Banderas B.			X
2005	February 1	Humpback		Calf	Banderas B.			X
	February 7	Humpback		Calf	Banderas B.	X		
	March	Humpback		Calf	Banderas B.	X		
	December	Humpback		Adult	Banderas B.			X
2006	January 26	Humpback			Banderas B.		X	
	February 2	Humpback			Banderas B.	X		
	February 2	Humpback			Banderas B.			X
	February 5	Humpback			Banderas B.			X
	February	Humpback		Calf	Banderas B.			X
	March 9	Humpback		Calf	Banderas B.	X		
	April 15	Humpback			Banderas B.		X	

Information derived from Banderas Bay Entangled Whale Response Network (*Red de Atención de Ballenas Enmalladas de Bahía de Banderas*—RABEBB).

Table 8 shows humpback whale records for the rest of the Gulf of California for 2002–2005 (Foubert 2006).

Table 8. Humpback whales entangled in the Gulf of California, 2002–2005

	DATE	SEX	AGE	PLACE	RELEASED	DEAD	WITH NET
2002	April		Adult	La Paz Bay		X	
	April 15				X		
	April 4		Young		X		
	April 4	Male				X	
	March					X	
					X		
	21 November 2003			Cabo Pulmo		X	X
2004	January 10	Female		Cabo San Lucas	X		
	February		Adult	Las Ventanas Bay	X		
	February 27			Cabo San Lucas	X		
2005	February	Female		Cabo San Lucas			X
	March		Young	La Paz Bay			X
	November 14		Young	Zihuatanejo			X

This information was provided by the National Institute of Ecology (*Instituto Nacional de Ecología*) and the mass media, including Televisa and local newspapers.

4 Collisions with boats

There is no available information for the Mexican Pacific on humpback whale collisions with boats. However, during the 2006 CEC-SPLASH cruise, a humpback whale competition group was observed in the path of a tanker (Figure 21) at 21.46°N 106.02°W, about 40 km east of María Magdalena Island. When the boat approached, the whales changed their behavior and stayed under water for a longer time. Several minutes later they resumed their previous behavior.

Figure 21. Humpback whale after passage of a tanker

On the Nayarit coast it was common to see groups of humpback whales very close to working shrimp boats (Figure 22).

Figure 22. Humpback whale competition group near a shrimp boat

Finally, on three occasions we had the opportunity to observe humpback whales with injuries very probably caused by the keels or propellers of large ships. These encounters may have occurred months or years before and not necessarily in Mexican waters (Figure 23).

Figure 23. Humpback whales with injuries probably caused by large ships

5 Opportunities and impact of ecotourism

Ecotourism—in this case whale watching—is rapidly growing in Mexico. Much of the whale watching activity focuses on the humpback whale. Various problems with this activity in the area of Banderas Bay have been identified. Since the area has no protected status, most tourism companies observe the existing whale watching regulations but private boats have no obligation to do so. This problem was observed during the 2006 CEC-SPLASH cruise. Numerous craft of different types, including barges and sailboats, came very close to the whales and/or crossed their path. This issue has been made known to the state and federal authorities, such as Semarnat, which are analyzing the problem with a view to proposing solutions.

On the Baja California Sur coast, particularly in the Los Cabos area, this activity is in its initial phase but growing exponentially. The knowledge that we are acquiring about the whales' spatiotemporal distribution, in particular that of cows with calves and singing males, will enable us to make recommendations of places and times where this activity demands special care.

In parallel, we know that several tourism companies want to begin operating at this site. Thus, this is an opportune time to use the knowledge acquired in order to develop a program of whale watching activities that includes monitoring, regulations, restrictions, and the opportunities that this region offers. To date, there is no official list of boats and/or companies totally or partially dedicated to whale watching in the Los Cabos area.

Therefore, a workshop on best practices for humpback whale watching in Mexico was held in La Paz, BCS on 22–23 November 2007. The workshop is funded by the CEC, the Mexican Fund for Nature Conservation (*Fondo Mexicano para la Conservación de la Naturaleza*), and WWF-Mexico.

6 Recommendations

- Continue to monitor the three aggregations of humpback whales in the Mexican Pacific in terms of their spatiotemporal distribution. In particular, it is recommended to pursue the photo-identification of whales and begin acoustic monitoring using fixed hydrophones.
- Recognize the existence of two different humpback whale populations in the Mexican Pacific, one continental and the other at Revillagigedo, with Baja California being a transit and destination zone. Management and conservation measures must be suited to the characteristics of each aggregation.
- Improve the monitoring of entangled whales through coordination with the different orders of government and the media.
- Train a group of people in rescue techniques for entangled whales.
- Based on whale distribution and behavior, and in coordination with the authorities and tourism service providers, develop appropriate guidelines for humpback whale watching in Baja California Sur.
- Maintain ongoing monitoring of the effect of tourism activity on humpback whales, particularly in the Banderas Bay area.

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