THE ORCA IN GALÁPAGOS: 135 SIGHTINGS

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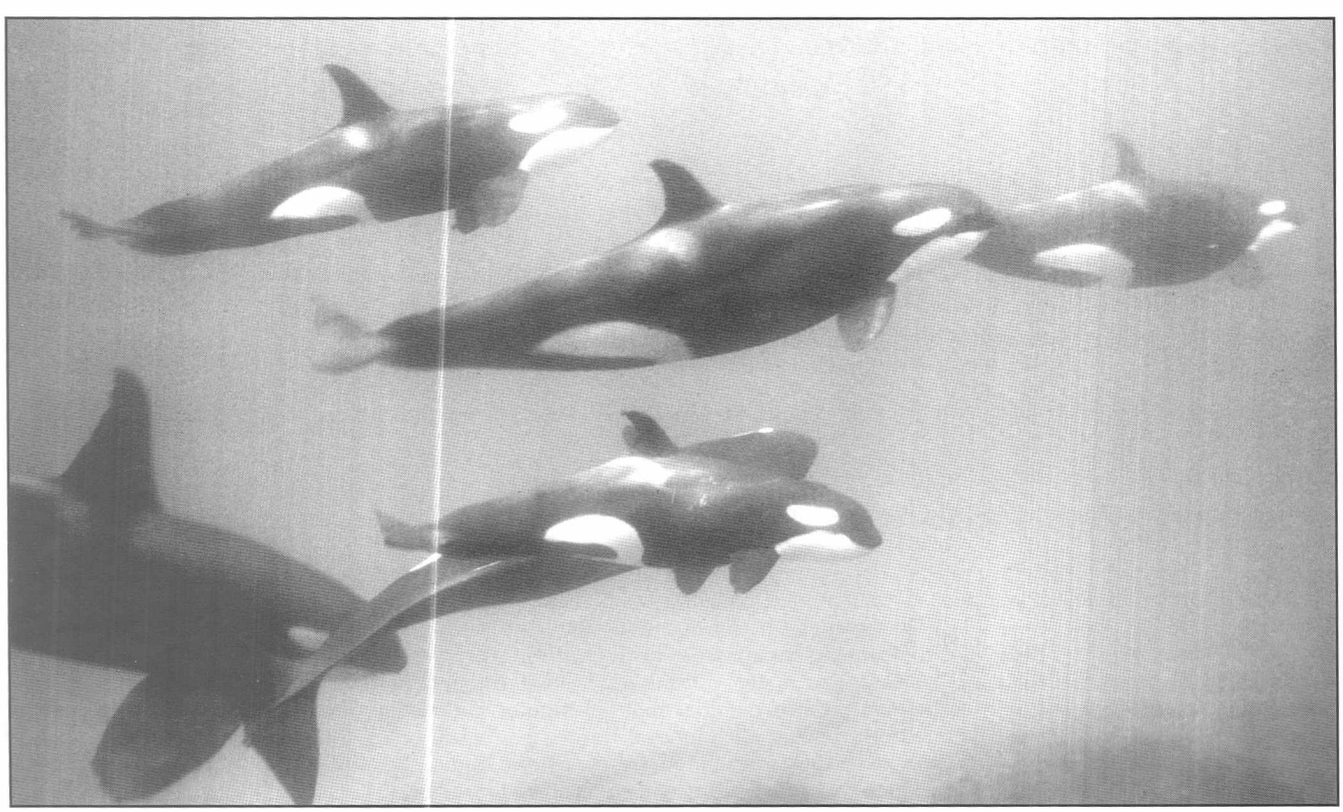
INTRODUCTION

The toothed cetacean, *Orcinus orca,* known commonly as the killer whale or orca, occupies an ecological role as top predator throughout its world-wide range. From verbal reports, it has been known for a long time that they are regular visitors, if unpredictable as to location, to the Galápagos Archipelago, but no concentrated effort has been made to identify their range, prey, or identity.

As a consequence, there is little information concerning the effect orcas may have on the marine ecosystem of Galápagos, on the behavior of their prey species, or even their distribution both temporally and spatially. This was mainly because of the small number of vessels navigating the waters, the lack of record-keeping, and the large size of the Archipelago. Nevertheless, over the last 50 years, some records are available that reveal the presence and, occasionally, the feeding activities of these social marine mammals. During the last 10 years, many more vessels, especially in the tourist trade, have been navigating the waters of the Archipelago. This has been particularly so within the Archipelago, rather than in the seas outside it. The increasing number of observations from these boats have been complemented by several scientific expeditions that provide records outside the Archipelago during part of the same time span. Since 1992, advantage has been taken of the increased number of people traveling through the Archipelago by introducing a more regular marine mammal monitoring program using standardized sighting sheets. I have accumulated 135 sightings, some with observations on behavior and prey, which may allow at least some generalizations to be made about orca life in Galápagos.

Of all cetaceans, the orca is perhaps the best known and the most distinctive. This makes them a suitable subject for a survey, such as the one in this report, since their clear black-and-white markings, their lack of fear of boats, the remarkable development of the adult male dorsal fin, and the fact that their feeding activity attracts large seabirds, such as frigatebirds, *Fregata* spp., all help to locate, identify, and approach orcas. At a distance, females, young males, and calves could be confused with false killer whales, *Pseudorca crassidens*, and perhaps pilot whales, *Globicephala* spp., but a clos-



Social animals, an orca family swims off Punta Espejo, Marchena Island, December 12, 1991. *Photo by Godfrey Merlen.*

er view, which is often easy to obtain, when the black-and-white markings become visible, eliminates any doubt.

METHODS

The sources of the sightings include:

1. Personal sightings within and outside the Archipelago whilst undertaking marine mammal searches.
2. Library search at the Charles Darwin Research Station.
3. Sighting sheets (a slightly modified NOAA marine mammal sighting form). These were filled out by National Park-trained tour guides (who receive some guidance on marine mammal identification in their training course), who work on every vessel licensed to operate in the Galápagos tourist trade. Forms were also returned by other individuals such as boat captains, film makers, scientists, and yachtsmen.
4. Records from scientific expeditions which have been studying cetaceans.
5. Records compiled after personal conversations with witnesses.

BIAS

Although there have been attempts to maintain sighting lists of cetaceans in the past, they have generally been included in general observation programs and as such not specific to cetaceans. Only in the last four years has a more concentrated system been operating. Thus many more sightings appear in recent years, which does not necessarily indicate an increase in the number of orcas or the frequency of their occurrence in Galápagos waters. An additional source of bias is generated, because most tour boats travel by night and visit specific land areas during the day. Thus most of the sightings by tour guides are from limited areas near the shoreline. However, because orcas feed on sea lions and many of the visitor sites are near sea lion colonies, the chances of seeing passing orcas is probably enhanced, since orcas may come close to the shore specifically to feed in these areas. Luckily, boats traveling in deep water, supplying offshore sightings, may tend to balance this near-shore bias and give a better overall view of orca activity in the Archipelago.

RESULTS

For the analysis of the data, the inshore was defined as all waters less than 1000 m deep, while the offshore waters were considered to be those greater than 1000 m deep.

Composition of the pod

Appendix 1 lists the sightings in chronological order. The average size of the pods was 3.11 animals (n = 134), or 3.46 if the exceptional sighting of 48 animals (June 15, 1981) is included. The range of the sightings was between a pod size of one (32.6% of the sightings) and 48 (0.75%) (see Figure 1). However, if the pods were separated into "offshore" and "inshore," then a rather different composition was apparent. The pods offshore contained 5.08 animals (n = 49) whilst those inshore contained 1.98 (n = 86). The small size of the 86 inshore pods was influenced by the fact that 40 sightings (46.5%) were of single animals, of which 13 were identified as mature males.

Amongst the total of 135 pods, 57 pods have some identification as to age or sex, *i.e.*, male, female, calf. Mature males were identified in 49 of them (83%).

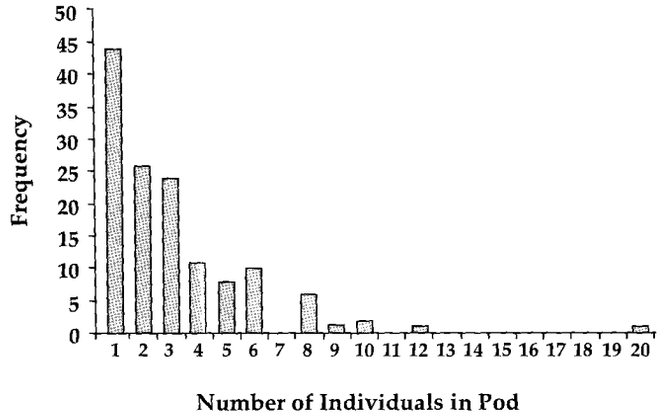


Figure 1. Range of pod sizes and their frequency of occurrence. This chart excludes the exceptional sighting of 48 orcas on June 15, 1981.

Prey items

Orcas in Galápagos appear to be carnivorous generalists (Table 1). Although there is sometimes no direct evidence that an animal has been killed by orcas, for this often appears to occur under water, the proximity of orcas to freshly killed animals, sometimes displaying raking teeth marks or pools of blood, implicates them in an attack.

Although there are few witnesses to sea lions being killed by orcas, it is perhaps significant that 45 of all sightings (40%) are close to large sea lion colonies, *e.g.*, Plazas (Santa Cruz), Gardner Bay (Española), Punta Cormorán (Floreana), Puerto Egas (Santiago), and the Canal de Bolívar between Fernandina and Isabela islands.

Table 1. Species attacked or harassed (no evidence of physical contact made).

Species	Bitten/Killed	Harassed
Shark - Carcharhinidae	1	0
Hammerhead shark, *Sphryna* sp.	1	0
Manta ray, *Manta hamiltoni*	5	0
Sting ray, *Dasyatis* sp.	1	0
Sunfish, *Mola mola*	0	1
Snapper, *Lutjanus* sp.	0	1
Green turtle, *Chelonia mydas*	1	0
Fur seal, *Arctocephalus galapagoensis*	1	0
Sea lion, *Zalophus californianus*	2	1
Sperm whale, *Physeter macrocephalus*	2	1
Cuvier's beaked whale, *Ziphius cavirostris*	2	0
Bottle nosed dolphin, *Tursiops truncatus*	1	0
Common dolphin, *Delphinus delphis*	1	3
Rorqual - Balaenopteridae	1	1
Pilot whale, *Globicephala macrorhynchus*	0	1

DISCUSSION

Orcas have been sighted near virtually every island in the Galápagos Archipelago (Figure 2) and are present in the region in all months of the year. For example, in the east and northeast of Santa Cruz, there are 21 reports spread over every month of the year, with maximums of 3 in March and 3 in August. Not only do they travel close to the shoreline, but they also, at least occasionally, swim into very shallow water (< 4 m) and enclosed bays, apparently in search of food. At the same time, they are not uncommon in the deep waters (2000-3000 m) off the edge of the basaltic Galápagos Platform (400 m average depth), from which many of the islands were volcanically built. The pods appear to travel continuously, as there are no reports of orcas remaining in any location for days, or even more than a few hours at a time.

An unanswered question is whether orca pods are resident within the Archipelago or whether they are oceanic wanderers who visit the islands from time to time on an irregular or regular basis.

Pod size is variable, with an average of 3.11 with larger pods (average 5.08) being found offshore. It is rare, apparently, to find pods of over 10 animals. Lone animals are common, especially near shore, where they compose 50% of the sightings. Since orcas are social animals, I suspect that some of the lone animals belong to larger pods whose other members are perhaps acoustically in touch, but not seen by the observer. From the 26-year study of orcas in British Colombia (Ford, Ellis, and Balcomb, 1994), "resident pods" typically contain between 10 and 20 individuals and are highly structured socially. The off-shore transient pods are smaller in size, less vocal, and may consist of a lone male. Thus, in that respect, the orcas of Galápagos seem to resemble the transients of North America. They also resemble them in being predators on marine mammals rather than fishes. Very few underwater recordings are available from the orcas in Galápagos, but one that was made off the south coast of Fernandina on June 17, 1994, may contain elements that resemble those of the transients of British Colombia (Dr. John Ford, pers. comm.).

Dr. Mike Bigg at the Biological Research Station in British Colombia was the first to recognize that it was possible to identify orcas from the shapes of their fins, which differ through genetic characteristics or through damage, and the shape and intensity of the gray saddle markings behind the dorsal fins. These differences can be recorded photographically (Bigg, Ellis, and Balcomb 1986). From this technique, it has been possible to study family relationships and movements of pods. At present, an attempt is being made to photograph local animals in Galápagos, as this may be the only way to settle the question of whether the orcas of Galápagos are transients or residents and, if transients, whether the same individuals return.

Several sightings reveal insights into orca behavior.

Sighting 41. In 1985, an orca half beached itself on the steep shoreline of rounded boulders on the north shore of South Plaza Island in an attempt to catch sea lion pups (National Park Guide Richard Polatty, pers. comm.). This type of behavior is well known in orcas from Argentina and the Crozet Islands (David Parer, film-maker of "Wolves of the Sea," pers. comm.).

Sightings 52 and 54. On March 7 and April 5, 1991, Dr. Hal Whitehead reported that sperm whales, *Physeter macrocephalus*, chased orcas. In the first case, 12 sperm whales pursued 3 orcas (1m, 2f.). In the second about 20 sperm whales chased 8 orcas (1m., 5f., 2c.) for about 5 minutes.

Breaching has only been recorded twice (sightings 16 and 101). In one pod, followed by the author for four hours on June 17, 1994 (sighting 78), spyhopping occurred 5 times and inverted tail lobbing 6 times. Spyhopping also occurred once in sighting 121.

Common dolphins appear to be an accessible prey of orcas (n = 3. Sightings 48, 93, 105). This might explain the highly-strung and suspicious nature of these small cetaceans in the waters of the Archipelago. Perhaps they are an important prey item of orcas. Orca hunting strategy appears to be to follow fleeing dolphins and to single out a lone animal from the often large dolphin schools (30-1000 individuals), perhaps a straggler which then seems to fall as easy prey.

When orcas approach sperm whales, it seems that the sperm whales cease to make sounds (sightings 47 and 125). We found that pilot whales in close proximity to orcas (sighting 121) behaved totally differently, making an enormous barrage of whistles. We could only suppose that their ultimate defense was to try to confuse the sonar of the orcas, which was occasionally audible through the whistles.

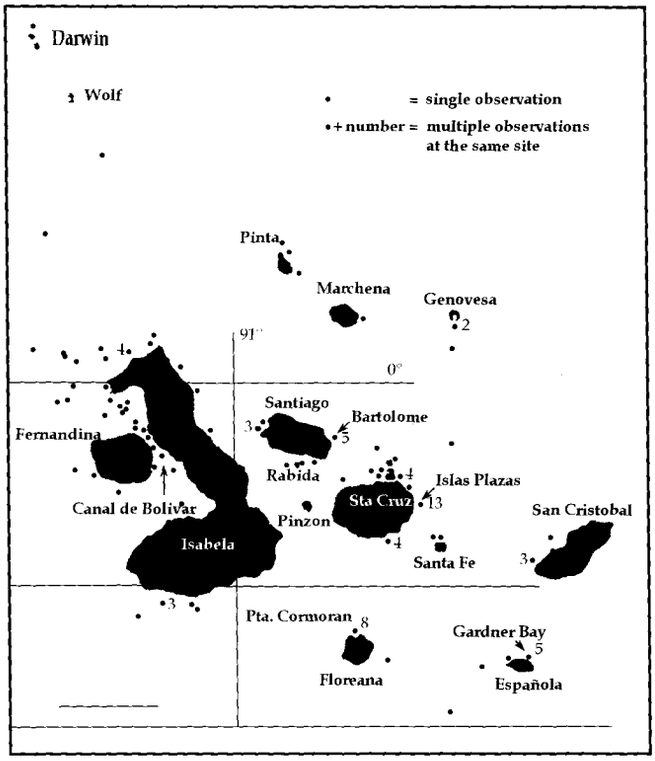


Figure 2. Map of the Galápagos Archipelago, indicating distribution of orca sightings. Sightings 29, 38, 41, and 53 are not included as being outside the scope of the map.

CONCLUSION

The orca in Galápagos remains, to a large extent, an enigmatic animal. Nevertheless, a long-term monitoring program will provide information that allows a small window to be opened into the lives of these powerful predators. Their importance in the general ecosystem remains unclear. The fact that large numbers of resident pinnipeds and small dolphins are found in and near the Archipelago, both of which fall prey to orcas, leads to the unanswered question: what are the controlling factors for the orca population in Galápagos? Does a resident population exist? There is also the unanswered question of whether orcas feed at night, for at that time many species of dolphins and the Galápagos fur seals are highly vocal, suggesting an easy target for sonar-equipped orcas.

Providing the population sizes of their prey species are maintained, it seems that orcas will continue to grace the waters of Galápagos. However, should certain fishing techniques, such as net-fishing for sharks, become common in bays where orcas are known to fish, entanglements may start to occur. Should the orcas be transients, then there is the hope that they will not learn to remove fish from hooks from an increasing longline fleet and become the subject of the fisherman's ire and revenge.

ACKNOWLEDGMENTS

I would like to express my appreciation to all the National Park Guides who have dedicated their time to filling out the sighting forms. Without their help, information on orcas would be little more than hearsay. At the same time, I would like to thank all those who have helped with information on orcas. Mention must be made of Dr. Hal Whitehead for his unwavering help, and I would like to thank Daniel Palacios for sharing his unpublished orca database, which contained information difficult of access. I would also like to express my thanks to Eduardo Diez (Quasar Nautica) for his continuing support of my projects. I thank Dr. Rodrigo Bustamante for his helpful review of an earlier version of this manuscript. The Galápagos National Park Service, under the direction of Biol. Eliecer Cruz, and the Instituto Nacional de Pesca (INP) have maintained their support for ongoing research into marine mammals in Galápagos.

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APPENDIX

The 135 sightings are listed in chronological order, with information on date, location, and pod composition.

The **date** is given as precisely as was known. The **location** is generally given as the location where the orcas were first seen. Sometimes orcas were followed for some time and thus changed their position. For the purpose of this report, it was felt generally preferable to name locations rather than degree and minute positions, as the animals are often very close to shore and

difficult to pinpoint by the latter method.

In the column entitled **Composition**, the first figure is the total number of animals observed. Thereafter follows the sex and age composition, if known. *Mature males*, for example, are shown thus: *2m.* (= two mature males). Because it is generally impossible to differentiate between females and young males, *all smaller animals*, except obvious calves, are marked thus: 3f. (= three females or young males). *Calves*, much smaller animals and often swimming close to an adult, suspected to be its mother, are marked thus: *1c.* (= one calf).

Under the composition title, attacks, or potential attacks, if they occurred, are marked with an *asterisk* (*).

A species name following the orca pod composition indicates the animal being harassed (that is, not seen to be touched), bitten, or eaten. A *single asterisk* * indicates an harassment. *Double asterisks* ** indicate observed bites, blood, or prey being eaten.

Attempts have been made to improve sighting accuracy by a publication (Merlen 1995), through the greater availability of guide books in general, and through the National Park's guide training courses. However, occasional misidentifications cannot be ruled out and some compositions may be imprecise. Nevertheless, the accuracy is considered to be high.

APPENDIX 1. CHRONOLOGICAL LIST OF ORCA SIGHTINGS.

	Date	Location	Composition
1.	1948 +	Near Santa Fe	3.
2.	1950 +	Puerto Ayora, Santa Cruz	1
3.	1950s	Gardner Bay, Española	1.
4.	1959	Wreck Bay, San Cristóbal	2.
5.	1959	Canal de Bolívar, Isabela	2.
6.	1960 September	Punta Espinosa, Fernandina	1.
7.	1961 February	Post Office Bay, Floreana	1.
8.	1961 November	Wreck Bay, San Cristóbal	1.
9.	1961 December	Pta. Albermarle, Isabela	3.
10.	1961 December	Darwin Bay, Genovesa	5.
11.	1976 January 29	00°11.3'N 91°48.5'W	4.
12.	1976 December 1	Bartolomé, Santiago	1. 1m.
13.	1978. April 3	Punta Cormorán, Floreana	3. 1m. 1f. 1c.
14.	1978 June 12	Canal de Itabaca	2. 1m. 1f.
15.	1978 August 13	00°33.6'S 90°06.5'W	4.
16.	1978 August 13	00°44.9'S 90°09.6'W	1.
17.	1979 June 10	Gardner Bay, Española	1. 1m. Sealion **
18.	1979	Darwin Bay, Genovesa	2. Hammerhead shark **
19.	1980 January 28	00°25'S 90°20'W	1.
20.	1980 April 16	Punta Cormorán, Floreana	3. 1m. Manta ray **
21.	1980 April 23	Bartolomé, Santiago	1.
22.	1980 April 24	Espumilla Beach, Santiago	1.
23.	1980 May 1	Plaza Islands	1.
24.	1980 May 5	Caleta Tortuga, Santa Cruz	1.
25.	1980 July 7	00°17'N 89°57'W	3. 1m. 1f. 1c
26.	1981 February 4	00°37'S 90°10'W. (Plaza Islands)	2. 2.m.
27.	1981 June 12	00°19.4'S 90°20.8'W	2.
28.	1981 June 15	02°13.3'S 92°29.9'W	48.
29.	1981 June 15	02°18.1'S 92°03.2'W	2.
30.	1981 August 7	Canal de Itabaca	1+.
31.	1981 August 13	00°17'S 90°34'W, Bartolomé	3.
32.	1981 September	00°17'S 91°21'W, C. de Bolívar	2.
33.	1981 October	00°28'S 90°28'W	1.
34.	1981 November 15	00°34'S 90°10'W, Plaza Islands	1.
35.	1982 January 8	02°05'S 84°34'W	3-4. 8 sperm.
36.	1982 January 12	00°25'S 91°23'W, C. de Bolívar	1. 1m
37.	1982 January 21	Santiago, Espumilla Beach?	1.
38.	1982 January 22	01°05'S 91°12'W	1.
39.	1982 January 24	Santiago, Puerto Egas?	2.
40.	1982 January 26	00°29'S 90°16'W, C. de Itabaca	1.

41.	1983 January 22	Plaza Islands, Santa Cruz	1.
42.	1983 April 16	Canal de Bolívar	1.
43.	1983 October 10	South Plaza Island, Santa Cruz	1. Manta **
44.	1983 November 17	01°43'S 83°56'W	2.
45.	1985 January 17	Punta Cormorán, Floreana	1.
46.	1985April 10	Bartolomé, Santiago	1.
47.	1985 April 18	00°57'S 93°07'W	20+. 3m. Sperm ** 15-20f. 2c.
48.	1985	South Plaza Island, north shore	1. 1m. sealion **
49.	1986 January 28	Inside Tagus Cove, Isabela	2. 1m. 1f.
50.	1986 February 4	Pta. García, Isabela, 1 n.m.to S.	1.
51.	1986 May 15	Baltra Harbor, Baltra	1. 1m
52.	1986 November 16	00°29.1'N 92°11.0'W	1.
53.	1987 May 29	00°10'N 91°48'W	5. 2m. 3f.
54.	1987 June 2	00°49'N 91°52'W	4.
55.	1988 October 11	00°10.0'N 91°28.0'W	1.
56.	1988 December 21	00°09.0'S 91°37.0'W	1.
57.	1988 December 21	00°05.0'S 91°48.0'W	2.
58.	1989 January 3	Puerto Ayora, Santa Cruz	2.
59.	1989 January 17	00°11.0'S 92°34.0'W	10.
60.	1989 January 21	00°06.0'S 91°52.0'W	6.
61.	1989 January 27	01°22'S 89°54'W	1.
62.	1989 March 1	00°45.0'N 90°46.0'W	8.
63.	1989 March 22	Banks Bay, Isabela	8. 1m. Common dolphins *
64.	1991 December 12	Punta Espejo, Marchena	6. 1m. 3f. 2c. Snappers *
65.	1991	Puerto Ayora, Santa Cruz	2. Sting ray **
66.	1991 January 17	Sombrero Chino, Santiago	2. 2f. Manta **
67.	1991 March 7	02°44'S 81°56'W	3. 1m. 2f. 12 sperm
68.	1991 March 23	00°13'N 91°36'W	3. 1m. 2f.
69.	1991 April 5	00°07'S 90°37'W	8. 1m. 5f. 2c. 20+ sperm
70.	1991April 14	00°20'S 89°58'W	6. 2m 2-3f. 1c.
71.	1992	Punta Espinosa, Fernandina	6.
72.	1992. May	Pta. Vicente Roca, 2 n.m. to S.	4. Cuvier's beaked whale **
73.	1992 August (late)	South Plaza Island, east point	2.
74.	1992 September 25	Santa Fe, NW point	1. 1m.
75.	1992 September 30	Santa Cruz, NE coast	3. 1c.
76.	1992 November 5	Gardner Bay, Española	1. 1m.
77.	1993 February 4	Gardner Island, Floreana	1. 1m.
78.	1993 July 19	Gordon Rocks, Santa Cruz	1. 1m.
79.	1993 July 25	Gordon Rocks, Santa Cruz	2.
80.	1993 August 3	Puerto Egas, Santiago	4.
81.	1993 August 3	00°09.0'S 92°29.8'W	5.
82.	1993 August 5	NE Baltra, Santa Cruz	3. 1m.
83.	1993 August 6	Buccaneer Bay, Santiago	1. 1m.
84.	1993 August 15	00°00.9'S 91°44.8'W	4.
85.	1993 August 19	Punta Cormorán, Floreana	1.
86.	1993 August 19	Punta Cormorán, Floreana	1.
87.	1993 October 25	00°09'S 91°33'W, Banks Bay	10. 2m. 5 Rorqual. *B. edeni* **
88.	1993 October 26	00°29'S 91°45.5'W	8. 1m. 3f. 1c. 12 sperm **
89.	1993 November 13	00°35.8'S 91°34.0'W	2.
90.	1993 December 11	Rábida, west side	2. 1f. 1c.
91.	1994 February 4	Cape Marshall, Isabela	1.
92.	1994 February 23	Plaza Islands, Santa Cruz	2.
93.	1994 February 26	Canal de Itabaca, E entrance	2. 1m. 1f.
94.	1994 March 4	00°11'N 92°02'W	10-15. Cuvier's beaked whale**
95.	1994 April 4	Post Office Bay, Floreana	3. 1m. 1f. 1c.
96.	1994 April 10	North Plaza Island, north coast	3.
97.	1994 June 17	Fernandina, south coast	5. 1m. 2f. 2c. Turtle **

98.	1994 July	Darwin Island, 1 n.m. to north	5+. 1m. shark **
99.	1994 November 3	Gardner Bay, Española	6. 1m. 1f. 3c.
100.	1994 November 24	Gardner Bay, Española	1. 1m.
101.	1994 December 15	Plaza Islands, Santa Cruz	2.
102.	1995 February 17	Wolf Volcano, Isabela, east coast	8. Manta ray **
103.	1995 March 20	North Plaza Island, north coast	6. 1+m.
104.	1995 April 4	Punta Cormorán, Floreana	3.
105.	1995 April 9	01°50'S 90°02'W	5. 3m. 1f. 1c.
106.	1995 April 20	01°08'N 91°44'W	5. 5f. 2c.
107.	1995 June 13	00°11'S 91°30'W, Banks Bay	2-4.
108.	1995 July 15	Kicker Rock, San Cristóbal	1. 2 Rorquals *
109.	1995 July 19	Banks Bay, Isabela	2-4. Manta ray. **
110.	1995 August 11	Puerto Egas, Santiago	4. 1m. 3f. Sealions *
111.	1995 August 28	Wreck Bay, San Cristóbal	3. 1m. 1f. 1c.
112.	1995 September 7	00°09'N 91°44'W	6. 6f. Common dolphins **
113.	1995 September 10	Rábida, red beach	3. 1m. 2f.
114.	1996 January 13	Puerto Egas, Santiago	1. 1m.
115.	1996 January 14	Punta Flores, Isabela	3. Sunfish *
116.	1996 January 17	00°10'N 91°37'W	2. 2f. Bottle nosed dolphin **
117.	1996 January 19	Punta Flores, Isabela	6-7. 2m.
118.	1996 January 26	Caleta Derek/Fragata, Isabela	2. 2f.
119.	1996 January 26	Urvina Bay, Isabela	3. 3f.
120.	1996 January 27	South of Cerro Azul, Isabela	2-3. 1m.
121.	1996 February 24	01°12'S 91°30'W	6. 1m. 3f. 2c. 50 + Pilot whales *
122.	1996 March 27	South of Cerro Azul, Isabela	4. 2m. 2f. 1c.
123.	1996 April 17	South of Cerro Azul, Isabela	5. 1m.
124.	1996 April 21	00°15'N 91°24'W	4. Common dolphins *
125.	1996 April 28	Cape Rose, Isabela	3-4. 12 Sperm *
126.	1996 August 18	00°02'S 91°36'W	1. 1m.
127.	1996 August 21	Puerto Ayora, Santa Cruz	2. 1m. 1f.
128.	1996 September 21	Punta Flores, Isabela	9.
129.	1996 November 22	Daphne Islands	3.
130.	1996 December 3	Darwin Island	3.
131.	1996 December 31	Bartolomé, 2 nm to East	6. 2m. 2f. 2c.
132.	1997 January 2	Punta Albemarle	3. 1m. 2f.
133.	1997 January 29	00°41.5'N 90°44.0'W	8. 1m. 6f. 1c.
134.	1997 January 29	00°31.9'N 90°41.2'W. Pinta	4. 1m. 3f. Feeding. Prey?
135.	1976-1983	Cape Hammond, Fernandina	3-5. Fur seal **

TOTAL=135 sightings