NOAA Technical Memorandum NMFS

JUNE 2004

MARINE MAMMAL DATA COLLECTED DURING THE HAWAIIAN ISLANDS CETACEAN AND ECOSYSTEM ASSESSMENT SURVEY (HICEAS) CONDUCTED ABOARD THE NOAA SHIPS *McARTHUR* AND *DAVID STARR JORDAN*, JULY-DECEMBER 2002

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NOAA-TM-NMFS-SWFSC-362

U.S. DEPARTMENT OF COMMERCE
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NOAA Technical Memorandum NMFS
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NAIONAL MARINE FISHERIES SERVICE
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INTRODUCTION

This is documentation of the first comprehensive survey of marine mammals covering all the waters within the U.S. Exclusive Economic Zone (EEZ) surrounding Hawaii, complementing similar marine mammal assessment surveys in EEZ waters of the West Coast of the contiguous United States (VonSaunder and Barlow 1999; Appler *et al.*, 2004).

SURVEY OBJECTIVES

The primary goal of this expedition was to estimate the abundance and distribution of cetaceans within the Hawaiian EEZ by visual and acoustic methods. Concurrent with the abundance estimation, the expedition participants collected oceanographic data, as well as other forms of biological data, to contribute to a more thorough understanding of the environment in which these species are found.

ITINERARY

The survey began on 27 July and ended on 9 December 2002. It was composed of six legs on the NOAA Ship *David Starr Jordan* and three legs on the NOAA Ship *McArthur*. Scheduled survey legs varied between 16 and 25 days in length, separated by three to eight days in port. The itineraries for the ships are listed below.

NOAA Ship *David Star Jordan*:

LEG 1: 27 July – Depart San Diego, CA	15 August – Arrive Honolulu, HI
LEG 2: 23 August – Depart Honolulu, HI	07 September – Arrive Midway, HI
LEG 3: 10 September – Depart Midway, HI	29 September – Arrive Honolulu, HI
LEG 4: 05 October – Depart Honolulu, HI	24 October – Arrive Honolulu, HI
LEG 5: 27 October – Depart Honolulu, HI	15 November – Arrive Honolulu, HI
LEG 6: 19 November – Depart Honolulu, HI	08 December – Arrive San Diego, CA

NOAA Ship *McArthur*:

LEG 1: 10 October – Depart Coos Bay, OR	04 November – Arrive Hilo, HI
LEG 2: 08 November – Depart Hilo, HI	26 November – Arrive Honolulu, HI
LEG 3: 30 November – Depart Honolulu, HI	09 December – Arrive San Diego, CA

SCIENTIFIC PERSONNEL

The scientific complement per leg included 12 to 14 scientists aboard the *Jordan*, and 9 to 10 aboard the *McArthur*. Appendix A lists the scientists and survey legs on which they participated.

EQUIPMENT AND PROCEDURES

Visual Line-Transect Survey

The survey component of this expedition was conducted according to line-transect methods (Buckland *et al*., 1993) that have been used consistently by the Southwest Fisheries Science

Center for estimating abundance of cetaceans (Kinzey *et al*., 2001). These methods required the survey vessels, the NOAA Ships *McArthur* and *David Starr Jordan*, to follow predetermined tracklines at a cruising speed of approximately 10 kts speed over ground (SOG). As the ship traveled along the trackline, a team of marine mammal observers maintained a watch for signs of marine mammals during all times when visibility and weather conditions allowed. This watch was stationed on the flying bridge of the ship: 10.4 meters above water on the *McArthur* and 10.7 meters above water on the *David Starr Jordan*. Observers used Fujinon[1] 25x150 power pedestal mounted binoculars to scan the area forward of the ship's beam.

The survey tracklines for the expedition were designed to uniformly cover the waters within the 200 nmi EEZ around the entire Hawaiian Island chain from the Island of Hawaii in the southeast to Kure Atol in the Northwest Hawaiian Islands. To avoid surveying at right angles to the dominant swells (generated by the NE to Easterly trade winds), the survey was designed with a series of parallel transect lines oriented in a WNW to ESE direction. The location of a baseline was selected by choosing a random latitude along a chosen longitude, and the other transect lines were parallel to this baseline and were spaced 85 km apart. Because refueling required frequent returns to the Main Hawaiian Islands, a separate stratum was added within approximately 140 km (75 nmi) of these islands; a higher density of coverage was achieved within the Main Island Stratum by placing additional tracklines mid-way between the planned tracklines. Tracklines covered are shown in Figure 1.

There were three marine mammal observer stations: a data recording station in the center of the flying bridge with a view from beam to beam, and port and starboard binocular stations, where the 25x150 binoculars were mounted such that there were clear fields of view from 90˚ directly abeam the ship to 10º across the opposite bow. Observers obtained sighting angles from an azimuth incorporated into the binocular's mount. This azimuth was calibrated to zero along the ship's midline at each port call. The observers entered a watch rotation at the port binocular station and, during a 120-minute watch, moved to the center recorder station, then finally to the starboard binocular station, such that 40 minutes were spent at each location.

While in the center station, the observers scanned the full 180˚ forward of the beam using 7x50 binoculars and unaided eye. This allowed them to concentrate on the area from the ship to approximately 400 m out, which was difficult to see with the large binoculars used at the other two stations.

This rotation was continued through all daylight hours when weather (sea state of Beaufort six or calmer), mechanical performance, and light conditions were such that the ship could maintain ~10 kts SOG, and observers had sufficient visibility to consistently discern signs of marine mammals in the field of view. At the discretion of the cruise leader, there was occasionally a fourth observer on watch, called the independent observer, who scanned from any forward location on the flying bridge using 7x50 binoculars and unaided eye. The

[1] Mention of brand names does not imply endorsement by the National Marine Fisheries Service.

independent observer did not announce the presence of marine mammals until after they had passed abeam and had been clearly missed by the primary observation team.

The act of scanning for marine mammals while moving along the trackline is termed "effort", and observers on watch were considered "on-effort" when the observer team determined that conditions were adequate for sightings. Cues or other information about possible sightings noted by off-effort individuals were not shared with on-effort observers.

The watch team typically went off-effort following a sighting of cetaceans that were within three nautical miles of the trackline, and guided the ship at various courses and speeds to approach the animals for species identification and group size estimation. After the independent estimates of group size had been made by each on-duty observer, and when conditions were appropriate, small boats were used to gather biopsy samples for genetic analysis and photographs for photo-ID. Sightings of new animals made while closing on an existing sighting were recorded as "off-effort sightings."

After completing the estimates and small boat operations, and provided that closing on a sighting had not taken the ship more than five nmi from the trackline, the ship would resume effort on a parallel course to the trackline. If the ship had strayed more than five nautical miles from the trackline, effort would resume on a course angled at 20º towards the trackline until within five nmi of it. If a school that had been previously recorded as an off-effort sighting during closing mode was re-sighted during searching, it was recorded as an on-effort sighting (and the previous off-effort sighting was deleted from the computer record).

The survey was occasionally conducted in passing mode. During such times, the ship did not alter course from the survey trackline to close on sightings.

At all times during survey operations, a record of effort and sightings was kept by the center observer on a laptop computer. This computer ran a program called WinCruz, written by Robert Holland of the SWFSC, which kept track of progress along the trackline (via GPS input), as well as weather and sighting data. These data were backed up to floppy disk, printed, and reviewed by the cruise leader at the close of effort each day.

Cetacean Acoustic Monitoring

There were three main goals of the acoustic program for the HICEAS 2002 survey: to determine whether acoustics can add significantly to the estimation of dolphin abundance, to gather additional information on the range of acoustic detection of sperm whales (*Physeter macrocephalus*), and to examine vocal characteristics of large baleen whales for which genetic information was obtained. To this end, there were two distinct acoustic procedures: continuous monitoring and recording of dolphin and sperm whale vocalizations obtained from a towed hydrophone array and opportunistic deployment of Navy surplus sonobuoys for recording baleen whales. All acoustic effort was on the *Jordan*.

Two different hydrophone arrays were used, each towed at a distance of 200 m behind the *Jordan* at an approximate depth of six meters and a speed of 10 kts. Both of these arrays consisted of three hydrophone elements with an effective frequency response from 500 Hz to 25 kHz (± 10 dB). In addition, the bow of the Jordan was equipped with a bow hydrophone

which consisted of three closely spaced hydrophones with an effective range of less than one km in front of the ship.

Signals received from the array were monitored by an acoustic technician. Two acoustic technicians rotated on three-hour shifts during daylight hours. Signals from the bow hydrophones were periodically monitored when animals were in close vicinity to the bow of the ship. Clear cetacean sounds were recorded on a Tascam DA-38 multi-channel recorder and, occasionally, high-frequency vocalizations were recorded directly to the computer hard disk. A record was kept of acoustic effort, comments, and five-minute acoustic updates using the program WHALTRAK. Real-time visual displays of sounds were monitored using ISHMAEL software, which also was used to estimate bearing angles to a sound source via beamforming and phone-pair (cross-correlation) algorithms. These angles were plotted on the WHALTRAK display and saved to file.

Information regarding sperm whale detections was not shared between visual and acoustic teams until the animals had clearly passed abeam of the vessel; therefore, the visual and acoustic detections of this species can be considered independent. Visual observers frequently relayed information about delphinid sightings to the acoustic team to aid them in documenting delphinid whistle recordings.

Sonobuoys were deployed from the *Jordan* to record low-frequency cetacean sounds that could not be successfully recorded from the hydrophone array. The focus of these efforts was to obtain recordings of blue, Bryde's, and sei whales (*Balaenoptera musculus, Balaenoptera edeni, and Balaenoptera borealis*), especially for animals from which genetic samples were obtained. Sonobuoys (type 53A) were typically deployed within ½ nmi of a baleen whale that had been sighted by the visual team. Sonobuoy signals were recorded on a DAT recorder and monitored using a scrolling spectrographic display.

Photo-Documentation

Photographs of cetacean schools and individuals were taken with 35 mm single lens reflex (SLR) cameras using 300 and 400 mm lenses to assist with stock delineations and studies utilizing identifiable individuals to determine stock movement or, for some whale species, as an alternative means of estimating population sizes.

Biopsy Studies

Two different types of biopsy tips were propelled by either a Barnett Wildcat crossbow or a Barnett Quad 300 compound crossbow. A 25 mm long tip was used to sample smaller odontocete species, while larger odontocete species and all mysticete species were sampled with a 40 mm tip. For sampling some species, a small piece of rubber vacuum hose was added to the tips as a bumper to reduce the depth of tip penetration and to increase the probability that the tip would rebound. The sampling tips were mounted on modified crossbow arrow shafts with threaded adapters to allow tips to be easily fitted and removed.

Behavioral Studies

When time permitted, data on behavioral responses of cetaceans to the survey ships were collected. The observer priority was to record behavior of all odontocete species. Data included both a written narrative as well as seventeen categorical questions regarding individual and school behavior (NOAA Form 88-208).

RESULTS AND DISCUSSION

Sightings and Search Effort

At least 25 species of cetaceans were seen during the HICEAS 2002 survey (Table 1, including off-effort sightings). Most species were found in single-species groups, but bottlenose dolphins (*Tursiops truncatus*) were more often seen in association with other species, and short-finned pilot whales (*Globicephala macrorhynchus*) and rough-toothed dolphins (*Steno bredanensis*) were also commonly seen in mixed-species groups (Tables 1 & 2). On the *David Starr Jordan*, on-effort search effort included 16,982 km during 109 actual survey days (Table 3), for an average of 156 km per day. On the *McArthur*, the on-effort total was 7,756 km during 48 actual survey days (Table 3), for an average of 162 km per day. In total, 307 on-effort sightings were made during 24,738 km of search effort (Table 4). The overall distribution of search effort was nearly uniformly distributed across the study area except for the higher density of coverage achieved in the Main Island Stratum (Figure 1). Very little search effort (less than four percent) was achieved in calm weather conditions (Beaufort sea state zero or one). Approximately 9% of search effort was in Beaufort two conditions, 12% in Beaufort three, 45% in Beaufort four, and 30% in Beaufort five and six (Table 4). Sighting rates (per 1000 km) declined, as is normal, with increasing sea state between Beaufort one and Beaufort five (Table 4). Detailed information on each sighting is presented in Table 5. The locations of sightings for each species (or higher taxonomic category) are illustrated in Figures 2-47.

Line-Transect Studies

Twenty-four different cetacean species were seen within the Hawaii study area. Data from this survey were used to estimate density and abundance for 21 of these species (Barlow 2003). Results showed that the densities of delphinid species were very low compared to previous SWFSC studies in the eastern North Pacific. The densities of sperm whales, beaked whales, Bryde's whales, and dwarf and pygmy sperm whales were generally within the range of estimates found in the eastern tropical Pacific study area (Barlow 2003).

Acoustics

The hydrophone array was towed and monitored for approximately 17,353 km (9,370 nmi). The acoustics team detected 239 of the 271 dolphin schools that were detected while both the visual and acoustic teams were on effort (Figure 48). Of these, 190 were detected by the acoustics team only, and were identified as “unidentified dolphins” (Figure 49). Many of the non-sighted acoustics detections of dolphins were outside of the effective search range of the visual observers.

There was a total of 129 sperm whale detections while both the visual and acoustic teams were on effort (Figure 50). All but six of these detections were heard by the acoustics team, and the visual team independently detected 33 of these sperm whale groups on effort. Many of the non-sighted acoustic detections of sperm whales were outside of the effort range for the visual observers.

The acoustics team on this survey confirmed, for the first time, that a commonly heard sound in the North Pacific (called a "boing") is made by minke whales. There was a total of 41 acoustic detections of minke whale "boings", none of which was independently detected by the visual observers (Figure 51). The location of a single individual minke whale was determined acoustically, and visual confirmation of the sound source was made. This was the only visual detection of a minke whale for the entire survey. Many of the non-sighted acoustic detections of minke whales were outside the effective search range for the visual observers.

Recordings from the towed hydrophone array included vocalizations from sperm whales, minke whales (*Balaenoptera acutorostrata*), humpback whales (*Megaptera novaeangliae*), short-beaked common dolphins (*Delphinus delphis*), striped dolphins (*Stenella coeruleoalba*), spotted dolphins (*S. attenuata*), spinner dolphins (*S. longirostris*), rough-toothed dolphins (*Steno bredanensis*), bottlenose dolphins, Risso's dolphin (*Grampus griseus*), short-finned pilot whales, and pygmy killer whales (*Feresa attenuata*) (Table 6). From mixed species schools, sounds were heard from bottlenose dolphins, false killer whale (*Pseudorca crassidens*), short-finned pilot whales, rough-toothed dolphins, Risso's dolphins, Fraser's dolphins (*Lagenodelphis hosei*), melon-headed whale (*Peponocephala electra*), short-beaked common dolphins, and striped dolphins. Recordings from bow-riding dolphins included many of the species listed above, in addition to vocalizations from Blainsville's beaked whales (*Mesoplodon densirostris*).

A total of 24 sonobuoys (type 53A) was deployed from the Jordan, of which 12 buoys were functional (Table 7). Recordings were made in the presence of Bryde's whales, fin whale (*B. physalus*), and sei whales. These included unique recordings of Bryde's whales and the first recordings of sei whales in the North Pacific Ocean.

Photo-Documentation

Twenty-one cetacean species were photographed in the 84 sightings (Table 8). The most commonly photographed species were sperm whales, short-finned pilot whales, and fin whales. Spinner dolphins were photographed during a port call at Midway Islands, but no sighting number is associated with those photographs.

Biopsy Studies

The biopsy team collected 143 biopsy samples (Table 9) from six mysticete and nine odontocete species during the cruise. The greatest number of samples came from short-finned pilot whales and sperm whales.

Behavioral Studies

Notes on marine mammal behavior were recorded on the behavior section of the marine mammal sighting form used by the observers. These data are being analyzed in conjunction with behavioral data from several other SWFSC cruises.

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We are indebted to the officers and crews of the NOAA Ships *David Starr Jordan* and *McArthur*, whose dedication, experience, and professional support made this survey possible. We also thank Barb Decker, Karen Handschuh, Gaye Holder, Ginny Hostler, Bobbie Watkins, and Ron Whyte of the administrative support staff at the Southwest Fisheries Science Center. Robert Holland created the data collection software. Alan Jackson checked and edited the line-transect data after the cruise. Susan Chivers provided biopsy protocols and the final tables for the biopsy sampling program. Sarah Mesnick and Anne Allen designed the behavioral study. We are grateful to Michael Tillman, Richard Neal, Robert Brownell, and Steve Reilly for their support of the research. Support for acoustic and oceanographic sampling was provided by the U.S. Navy through the Office of Naval Research. Finally, we thank the cruise leaders, marine mammal observers and acousticians who collected the data summarized in this report.

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Table 1. Sightings summary. A summary of all species sighted and number of times each species was sighted during the expedition. Included are on-effort and off-effort sightings.

Species Code	Name	No. Schools Sighted Pure	Mixed	Total	Average School size
071	*Balaenoptera acutorostrata*	1	0	1	1.0
073	*Balaenoptera borealis*	8	0	8	1.1
099	*Balaenoptera borealis/edeni*	3	1	4	1.2
072	*Balaenoptera edeni*	14	0	14	1.1
075	*Balaenoptera musculus*	12	0	12	1.1
074	*Balaenoptera physalus*	7	1	8	1.2
070	*Balaenoptera* species	6	0	6	1.0
017	*Delphinus delphis*	21	1	22	32.8
005	*Delphinus* species	10	0	10	10.4
032	*Feresa attenuata*	3	0	3	5.2
036	*Globicephala macrorhynchus*	19	11	30	9.3
021	*Grampus griseus*	6	5	11	10.3
065	*Indopacetus pacificus*	1	0	1	4.4
047	*Kogia breviceps*	2	0	2	1.0
048	*Kogia sima*	5	0	5	1.7
080	*Kogia* species	1	0	1	1.0
026	*Lagenodelphis hosei*	1	1	2	88.6
076	*Megaptera novaeangliae*	2	0	2	1.0
059	*Mesoplodon densirostris*	3	0	3	1.6
051	*Mesoplodon* species	4	0	4	1.8
037	*Orcinus orca*	2	0	2	2.1
031	*Peponocephala electra*	0	1	1	40.5
046	*Physeter macrocephalus*	51	0	51	2.2
033	*Pseudorca crassidens*	1	1	2	4.0
002	*Stenella attenuata* (offshore)	14	0	14	32.7
013	*Stenella coeruleoalba*	18	1	19	14.4
102	*Stenella longirostris* (Gray's)	8	0	8	14.5
015	*Steno bredanensis*	11	8	19	7.3
018	*Tursiops truncatus*	7	11	18	7.5
096	unid. cetacean	6	0	6	1.5
077	unid. dolphin	19	1	20	6.1
377	unid. large delphinid	1	0	1	4.0
079	unid. large whale	7	0	7	1.0
277	unid. medium delphinid	6	0	6	3.0
177	unid. small delphinid	29	1	30	9.5
078	unid. small whale	8	0	8	1.3
098	unid. whale	4	0	4	1.0
049	ziphiid whale	11	0	11	2.2
061	*Ziphius cavirostris*	7	0	7	1.7
AT	*Arctocephalus townsendi*	1	0	1	1.0
CU	*Callorhinus ursinus*	12	0	12	2.0
MA	*Mirounga angustirostris*	3	0	3	1.0
UA	unid. fur seal	3	0	3	1.3
PU	unid. pinniped	4	0	4	1.3
UO	unid. sea lion	3	0	3	1.0
ZC	*Zalophus californianus*	1	0	1	2.5

Table 2. Schools of mixed species composition – A tally of sightings that included more than one species.

Species 1	Species 2	Total
017 short-beaked common dolphin	013 striped dolpin	1
018 bottlenose dolphin	015 rough-toothed dolphin	5
018 bottlenose dolphin	033 false killer whale	1
021 Risso's dolpin	018 bottlenose dolphin	1
021 Risso's dolpin	177 unid. small dolphin	1
026 Fraser's dolpin	031 melon-headed whale	1
036 short-finned pilot whale	015 rough-toothed dolphin	3
036 short-finned pilot whale	018 bottlenose dolphin	4
036 short-finned pilot whale	021 Risso's dolphin	2
036 short-finned pilot whale	074 fin whale	1
036 short-finned pilot whale	077 unidentified dolphin	1
099 sei or Bryde's whale	021 Risso's dolphin	1

Table 3. Kilometers of effort per ship per day. Totals include 109 days of on-effort observation conducted by *David Starr Jordan* and 48 days of on-effort observation conducted by *McArthur*.

Date	*Jordan*	*McArthur*	Date	*Jordan*	*McArthur*
27 Jul	35	0	7 Sep	161	0
28 Jul	205	0	8 Sep	54	0
29 Jul	201	0	10 Sep	123	0
30 Jul	202	0	11 Sep	203	0
31 Jul	249	0	12 Sep	190	0
1 Aug	235	0	13 Sep	65	0
2 Aug	225	0	14 Sep	194	0
3 Aug	239	0	15 Sep	146	0
4 Aug	238	0	16 Sep	218	0
5 Aug	218	0	17 Sep	165	0
6 Aug	228	0	18 Sep	145	0
7 Aug	157	0	20 Sep	203	0
8 Aug	164	0	21 Sep	192	0
9 Aug	208	0	22 Sep	212	0
10 Aug	188	0	23 Sep	192	0
11 Aug	182	0	24 Sep	154	0
12 Aug	168	0	25 Sep	199	0
13 Aug	162	0	26 Sep	180	0
14 Aug	183	0	27 Sep	197	0
15 Aug	35	0	28 Sep	189	0
23 Aug	121	0	5 Oct	24	0
24 Aug	200	0	6 Oct	173	0
25 Aug	104	0	7 Oct	157	0
26 Aug	216	0	8 Oct	196	0
27 Aug	86	0	9 Oct	148	0
28 Aug	227	0	10 Oct	91	66
29 Aug	171	0	11 Oct	193	0
30 Aug	139	0	12 Oct	151	214
31 Aug	105	0	13 Oct	182	197
1 Sep	83	0	14 Oct	156	184
2 Sep	149	0	15 Oct	122	87
3 Sep	115	0	16 Oct	119	218
4 Sep	222	0	17 Oct	82	216
5 Sep	163	0	18 Oct	113	222
6 Sep	108	0	19 Oct	92	217

Table 3. Kilometers of effort per ship per day (continued)

Date	*Jordan*	*McArthur*
20 Oct	118	133
21 Oct	153	230
22 Oct	130	219
23 Oct	99	0
24 Oct	0	95
25 Oct	0	157
26 Oct	0	173
27 Oct	0	152
28 Oct	138	182
29 Oct	174	36
30 Oct	132	218
31 Oct	176	198
1 Nov	185	115
2 Nov	215	156
3 Nov	170	45
4 Nov	95	0
5 Nov	159	0
6 Nov	122	0
7 Nov	105	0
8 Nov	138	0
9 Nov	110	111
10 Nov	0	85
11 Nov	0	193
12 Nov	171	112
13 Nov	170	166
14 Nov	58	0
15 Nov	0	205
16 Nov	0	178
17 Nov	0	58
18 Nov	0	195
19 Nov	77	82
20 Nov	96	138
21 Nov	141	169
22 Nov	125	184
23 Nov	141	202
24 Nov	212	127
25 Nov	167	168
26 Nov	157	0
27 Nov	173	0
28 Nov	162	0
29 Nov	145	0
30 Nov	138	139
1 Dec	181	186
2 Dec	168	189
3 Dec	190	199
4 Dec	130	208
5 Dec	152	208
6 Dec	172	217
7 Dec	119	212
8 Dec	0	95
Total	**16982**	**7756**

Table 4. HICEAS survey effort (kilometers), number of sightings, and sighting rates stratified by sea state and observer number.

	Kilometers of effort	No. of sightings	Sightings per 1000 km
Total	**24738.4**	**307**	**12.41**
By sea state (Beaufort)			
0	152.8	14	91.61
1	786.6	61	77.55
2	2241.8	74	33.01
3	2921.5	51	17.46
4	11076.5	78	7.04
5	6855.1	23	3.36
6	704.0	6	8.52
By observer number			
4	59.1	0	.00
7	3852.3	11	2.86
15	887.7	3	3.38
73	8722.8	55	6.31
84	18.6	0	.00
85	356.2	0	.00
86	268.5	0	.00
94	6480.8	23	3.55
99	16.3	0	.00
120	11.5	0	.00
126	8332.5	59	7.08
159	239.4	0	.00
168	5772.6	31	5.37
176	567.3	0	.00
196	3915.0	7	1.79
197	3835.4	12	3.13
200	8593.4	30	3.49
208	8370.9	42	5.02
214	1628.4	7	4.30
215	3826.6	13	3.40
216	3950.4	3	.76
223	1216.6	1	.82
224	5398.5	10	1.85
226	324.8	0	.00

Table 5. Marine mammal sightings during HICEAS 2002. "Other Codes" indicate the other sighting-catagories in a mixed-species school. Times are local. School size is the uncalibrated mean of the observers' best estimates of school size. "Bft" is Beaufort sea state.

Total No. of Sightings (on+off) = 388

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
Stenella attenuata (offshore)										
002		5	25 Oct 02	619	N19:17.76	W155:57.15	6	197	7	Off
002		10	25 Oct 02	637	N19:18.90	W155:57.99	1	168	19	Off
002		11	25 Oct 02	706	N19:17.99	W155:58.45	1	197	40	On
002		12	25 Oct 02	939	N19:23.39	W156:18.38	2	197	28	On
002		18	27 Oct 02	1503	N19:00.53	W156:21.33	2	168	34	On
002		26	9 Nov 02	657	N20:27.77	W156:46.73	2	197	42	On
002		47	25 Nov 02	1527	N21:48.10	W157:54.54	5	7	21	On
002		52	1 Dec 02	1542	N22:48.25	W152:04.50	2	7	24	On
002		129	23 Aug 02	1324	N21:27.69	W158:17.01	4	73	80	On
002		138	27 Aug 02	645	N25:37.72	W168:05.42	2	73	74	On
002		195	9 Oct 02	1206	N23:51.34	W157:35.10	4	200	19	Off
002		202	13 Oct 02	701	N26:03.44	W166:40.96	2	208	18	On
002		280	19 Nov 02	1420	N21:42.20	W157:38.28	4	73	25	On
002		296	26 Nov 02	1215	N21:16.87	W158:40.51	2	73	27	On
Delphinus sp.										
005		4	27 Jul 02	1759	N32:37.70	W117:22.59	3	214	25	On
005		12	27 Jul 02	1842	N32:37.94	W117:30.94	3	126	12	On
005		15	27 Jul 02	1907	N32:37.72	W117:35.74	3	168	60	On
005		25	28 Jul 02	744	N32:36.06	W120:01.69	1	168	1	On
005		48	28 Jul 02	1305	N32:35.80	W120:53.93	2	73	1	On
005		50	28 Jul 02	1344	N32:35.70	W121:01.31	2	200	1	On
005		59	28 Jul 02	1500	N32:35.70	W121:12.77	0	208	1	On
005		64	28 Jul 02	1625	N32:35.54	W121:29.05	2	200	1	On
005		71	28 Jul 02	1722	N32:35.54	W121:40.72	2	126	1	On
005		75	28 Jul 02	1829	N32:35.36	W121:53.93	2	168	1	On
Stenella coeruleoalba										
013		2	13 Oct 02	1332	N32:34.43	W134:31.87	2	197	23	On
013		20	28 Oct 02	1610	N18:47.15	W156:54.38	4	215	37	On
013		114	2 Aug 02	907	N28:20.46	W139:47.12	3	73	10	On
013		115	2 Aug 02	1247	N27:55.87	W140:15.89	4	168	15	On
013		122	13 Aug 02	901	N21:51.80	W152:39.02	4	208	8	Off
013		124	14 Aug 02	936	N22:27.30	W155:43.85	4	73	6	Off
013		160	2 Sep 02	1230	N30:49.74	W176:34.81	4	200	5	On
013		162	2 Sep 02	1737	N30:39.17	W175:53.71	4	126	5	On
013		172	14 Sep 02	1433	N26:03.32	W175:41.15	4	208	11	On
013		182	21 Sep 02	1819	N28:29.50	W173:39.79	3	94	11	On
013		189	26 Sep 02	1435	N26:06.65	W163:27.09	3	126	18	On
013		190	28 Sep 02	1524	N23:02.70	W158:48.70	5	200	6	On
013		200	10 Oct 02	1709	N24:55.65	W158:33.40	4	126	2	On
013		205	13 Oct 02	1626	N26:27.33	W168:18.15	3	208	60	On
013		211	15 Oct 02	1716	N25:58.59	W172:49.80	3	208	5	On
013		226	18 Oct 02	837	N24:17.95	W169:05.38	3	126	6	On
013		244	29 Oct 02	1055	N19:49.72	W158:09.55	5	126	15	Off
013		248	1 Nov 02	1301	N22:04.40	W166:42.88	6	126	17	On
013	17	325	7 Dec 02	821	N30:11.66	W120:14.91	4	208	46	On

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
Steno bredanensis										
015	18	3	13 Oct 02	1548	N32:20.63	W134:47.77	2	215	15	On
015	18	6	25 Oct 02	628	N19:17.74	W155:57.53	1	197	12	On
015	18	15	27 Oct 02	1135	N19:05.37	W156:40.06	2	196	4	On
015	18	22	1 Nov 02	1217	N18:58.29	W160:51.70	5	216	7	On
015	18	34	10 Nov 02	706	N22:22.09	W159:24.23	2	7	25	On
015		39	13 Nov 02	1221	N24:56.21	W168:42.23	4	216	4	On
015	36	44	24 Nov 02	1038	N21:47.60	W160:42.09	3	215	14	On
015		45	24 Nov 02	1314	N21:42.60	W160:29.44	2	7	2	On
015		125	14 Aug 02	1150	N22:32.49	W156:01.26	4	126	11	On
015		167	11 Sep 02	1640	N26:50.60	E179:58.32	4	99	7	Off
015		194	9 Oct 02	749	N23:41.37	W157:06.90	4	208	10	Off
015	36	199	10 Oct 02	1402	N24:47.68	W158:16.45	4	208	21	On
015		216	16 Oct 02	1504	N25:28.17	W173:58.35	1	200	12	On
015		234	20 Oct 02	1130	N22:55.94	W163:42.90	4	200	16	On
015	36	241	22 Oct 02	1516	N21:40.40	W158:40.28	6	73	24	On
015		245	30 Oct 02	853	N20:22.57	W160:02.24	5	200	11	On
015		251	4 Nov 02	1228	N24:12.85	W175:29.45	4	126	8	Off
015		292	23 Nov 02	1542	N18:51.22	W155:31.83	4	4	2	Off
015		297	26 Nov 02	1345	N21:13.30	W158:48.60	2	224	2	On
Delphinus delphis										
017		1	27 Jul 02	1738	N32:37.75	W117:18.58	3	73	120	On
017		2	27 Jul 02	1741	N32:37.76	W117:19.10	3	73	125	On
017		18	27 Jul 02	1931	N32:37.64	W117:40.42	2	208	10	On
017		19	28 Jul 02	611	N32:36.25	W119:44.35	1	168	26	On
017		22	28 Jul 02	657	N32:36.18	W119:52.98	1	126	6	On
017		23	28 Jul 02	704	N32:36.19	W119:54.17	1	208	15	On
017		33	28 Jul 02	917	N32:36.12	W120:19.46	1	214	68	On
017		39	28 Jul 02	1114	N32:36.51	W120:32.75	1	126	3	On
017		42	28 Jul 02	1214	N32:35.88	W120:44.16	2	200	8	On
017		45	28 Jul 02	1240	N32:35.84	W120:49.12	2	200	30	On
017		47	28 Jul 02	1303	N32:35.80	W120:53.67	2	200	35	On
017		57	28 Jul 02	1435	N32:36.45	W121:09.89	1	126	20	Off
017		59	8 Dec 02	847	N32:01.69	W119:46.05	3	168	18	On
017		69	28 Jul 02	1654	N32:35.47	W121:35.06	2	73	43	On
017		76	28 Jul 02	1842	N32:35.32	W121:56.46	2	208	18	On
017		79	28 Jul 02	1937	N32:35.41	W122:03.17	2	168	28	On
017		85	29 Jul 02	1243	N32:34.08	W124:57.04	1	73	25	On
017		94	29 Jul 02	1512	N32:33.96	W125:14.86	1	15	30	On
017		100	29 Jul 02	1548	N32:33.91	W125:21.87	1	126	45	On
017		102	29 Jul 02	1721	N32:33.79	W125:39.77	0	126	10	On
017		105	29 Jul 02	1935	N32:33.90	W126:05.87	1	126	6	On
017	13	325	7 Dec 02	821	N30:11.66	W120:14.91	4	208	46	On
Tursiops truncatus										
018	15	3	13 Oct 02	1548	N32:20.63	W134:47.77	2	215	15	On
018	15	6	25 Oct 02	628	N19:17.74	W155:57.53	1	197	12	On
018	15	15	27 Oct 02	1135	N19:05.37	W156:40.06	2	196	4	On
018	21	17	27 Oct 02	1413	N19:03.25	W156:27.50	2	215	7	On
018	15	22	1 Nov 02	1217	N18:58.29	W160:51.70	5	216	7	On
018	15	34	10 Nov 02	706	N22:22.09	W159:24.23	2	7	25	On
018	36	123	13 Aug 02	1522	N21:59.99	W153:40.50	4	15	6	On
018		126	15 Aug 02	648	N21:19.07	W157:36.04	5	126	5	On
018		127	23 Aug 02	1037	N21:14.23	W157:56.58	4	126	20	Off
018		130	23 Aug 02	1417	N21:35.01	W158:18.16	5	126	5	On

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
018		165	8 Sep 02	845	N28:19.06	W177:28.40	4	73	5	Off
018	36	183	23 Sep 02	811	N28:26.28	W170:04.56	2	73	28	On
018	33	184	24 Sep 02	902	N27:17.29	W168:38.90	6	73	19	On
018	36	192	5 Oct 02	1304	N21:21.92	W157:24.80	5	73	12	Off
018		279	19 Nov 02	1007	N21:13.53	W157:49.53	5	99	5	Off
018	36	293	23 Nov 02	1636	N18:53.08	W155:40.11	4	94	8	On
018		321	6 Dec 02	816	N28:12.24	W124:01.84	3	224	12	On
018		324	7 Dec 02	655	N30:04.68	W120:28.96	3	126	13	On
Grampus griseus										
021		10	27 Jul 02	1830	N32:38.02	W117:28.63	3	126	8	On
021	36	16	27 Oct 02	1218	N19:03.98	W156:35.23	2	99	4	Off
021	18	17	27 Oct 02	1413	N19:03.25	W156:27.50	2	215	7	On
021		21	28 Oct 02	1648	N18:46.97	W156:56.57	4	197	8	On
021	36	54	2 Dec 02	838	N23:40.84	W149:05.39	2	168	16	On
021	99	90	29 Jul 02	1449	N32:33.19	W125:10.34	2	73	37	On
021		215	16 Oct 02	1341	N25:31.59	W174:07.34	0	126	8	On
021	77	247	31 Oct 02	1306	N21:18.04	W163:39.61	6	94	5	On
021		266	7 Nov 02	857	N23:15.02	W174:43.52	4	224	19	On
021		290	22 Nov 02	1417	N19:15.47	W153:51.03	4	208	9	Off
021		315	3 Dec 02	834	N25:00.26	W134:43.13	3	224	10	On
Lagenodelphis hosei										
026		42	19 Nov 02	918	N23:47.10	W170:24.73	5	7	47	On
026	31	249	4 Nov 02	804	N24:12.78	W175:19.39	4	73	171	On
Peponocephala electra										
031	26	249	4 Nov 02	804	N24:12.78	W175:19.39	4	73	171	On
Feresa attenuata										
032		29	9 Nov 02	1136	N20:42.45	W157:02.93	2	7	3	On
032		214	16 Oct 02	1230	N25:30.22	W174:10.98	0	126	5	Off
032		240	22 Oct 02	1129	N21:45.85	W159:09.30	5	126	7	On
Pseudorca crassidens										
033		153	31 Aug 02	1152	N29:26.94	E179:11.38	4	225	2	Off
033	18	184	24 Sep 02	902	N27:17.29	W168:38.90	6	73	19	On
Globicephala macrorhynchus										
036		4	25 Oct 02	611	N19:17.72	W155:57.13	6	7	10	Off
036		8	25 Oct 02	633	N19:18.31	W155:57.94	1	168	10	Off
036		9	25 Oct 02	634	N19:18.59	W155:57.95	1	197	4	Off
036	21	16	27 Oct 02	1218	N19:03.98	W156:35.23	2	99	4	Off
036		28	9 Nov 02	819	N20:35.17	W156:56.33	2	168	18	On
036		35	10 Nov 02	941	N22:27.66	W159:46.49	2	196	19	On
036		37	12 Nov 02	1545	N24:28.75	W166:44.38	3	196	6	On
036		38	12 Nov 02	1807	N24:31.79	W166:59.13	3	7	2	On
036		43	24 Nov 02	835	N21:47.51	W160:43.55	2	168	8	On
036	15	44	24 Nov 02	1038	N21:47.60	W160:42.09	3	215	14	On
036	21	54	2 Dec 02	838	N23:40.84	W149:05.39	2	168	16	On
036		57	4 Dec 02	843	N26:25.85	W139:34.16	4	197	15	On
036		118	8 Aug 02	1034	N19:47.80	W154:20.22	5	214	8	On
036	77	121	12 Aug 02	1615	N21:11.04	W153:30.11	4	126	6	Off
036	18	123	13 Aug 02	1522	N21:59.99	W153:40.50	4	15	6	On
036		152	31 Aug 02	1137	N29:26.83	E179:11.54	4	94	2	Off
036	18	183	23 Sep 02	811	N28:26.28	W170:04.56	2	73	28	On

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
036	18	192	5 Oct 02	1304	N21:21.92	W157:24.80	5	73	12	Off
036	15	199	10 Oct 02	1402	N24:47.68	W158:16.45	4	208	21	On
036		209	15 Oct 02	958	N25:46.72	W172:03.51	3	94	7	On
036		219	17 Oct 02	1038	N24:58.92	W171:50.74	0	208	9	On
036		228	18 Oct 02	1358	N24:07.38	W168:31.95	4	208	12	On
036	15	241	22 Oct 02	1516	N21:40.40	W158:40.28	6	73	24	On
036		242	28 Oct 02	759	N20:24.06	W156:38.08	6	94	8	On
036		253	5 Nov 02	818	N25:42.61	W177:37.96	2	225	11	Off
036	74	261	5 Nov 02	1824	N25:20.96	W176:08.12	2	225	15	Off
036	18	293	23 Nov 02	1636	N18:53.08	W155:40.11	4	94	8	On
036		305	30 Nov 02	1324	N25:01.47	W146:02.30	4	200	8	On
036		317	4 Dec 02	1423	N25:06.36	W129:48.50	4	94	12	On
036		318	4 Dec 02	1557	N25:12.59	W129:34.45	4	98	14	Off
Orcinus orca										
037		36	12 Nov 02	1002	N24:20.41	W166:14.01	4	197	2	On
037		168	11 Sep 02	1810	N26:56.00	E179:43.82	5	73	2	On
Physeter macrocephalus										
046		19	27 Oct 02	1615	N18:57.12	W156:10.01	1	197	6	On
046		23	1 Nov 02	1303	N18:59.40	W160:54.56	4	197	2	On
046		24	2 Nov 02	916	N19:32.38	W160:04.94	4	7	1	On
046		49	30 Nov 02	1703	N21:28.41	W156:37.76	4	215	2	On
046		133	25 Aug 02	522	N23:59.10	W161:15.37	3	208	2	Off
046		134	25 Aug 02	1431	N24:12.14	W162:10.85	4	73	3	On
046		141	27 Aug 02	840	N25:41.48	W168:21.52	3	94	3	Off
046		142	27 Aug 02	1406	N25:47.30	W168:45.29	4	208	4	On
046		149	30 Aug 02	918	N28:34.93	W177:04.94	4	200	4	On
046		151	31 Aug 02	1113	N29:25.11	E179:12.58	4	225	2	Off
046		154	1 Sep 02	933	N31:30.58	W179:45.39	2	94	1	Off
046		157	1 Sep 02	1351	N31:30.89	W179:28.41	4	94	2	On
046		159	2 Sep 02	959	N30:51.17	W176:49.78	4	208	3	On
046		163	3 Sep 02	651	N30:19.53	W174:27.79	4	126	1	On
046		170	13 Sep 02	724	N26:24.25	W177:38.41	4	94	1	On
046		171	13 Sep 02	1425	N26:13.70	W177:03.58	4	126	5	Off
046		175	15 Sep 02	1731	N26:55.25	W176:41.35	4	208	2	On
046		191	28 Sep 02	1815	N22:39.71	W158:41.28	5	73	2	On
046		198	10 Oct 02	940	N24:47.80	W158:01.43	4	73	1	On
046		201	12 Oct 02	1530	N25:43.81	W165:20.74	4	126	6	On
046		204	13 Oct 02	1620	N26:26.92	W168:17.35	2	208	4	Off
046		206	14 Oct 02	1150	N27:01.61	W170:42.39	5	208	2	On
046		210	15 Oct 02	1304	N25:52.60	W172:25.47	2	224	1	On
046		217	17 Oct 02	726	N24:57.77	W171:57.48	0	126	4	On
046		220	17 Oct 02	1147	N24:55.25	W171:48.62	0	73	3	On
046		221	17 Oct 02	1555	N24:48.20	W171:18.23	1	126	1	On
046		223	17 Oct 02	1742	N24:44.26	W171:02.22	0	94	1	On
046		233	19 Oct 02	1810	N23:20.38	W165:20.55	2	224	1	Off
046		235	20 Oct 02	1403	N22:51.34	W163:22.91	4	126	1	On
046		236	21 Oct 02	854	N22:28.54	W161:51.94	4	224	1	On
046		246	30 Oct 02	1419	N20:36.50	W160:55.34	5	4	3	Off
046		250	4 Nov 02	1034	N24:14.44	W175:27.69	4	200	3	Off
046		252	4 Nov 02	1430	N24:15.28	W175:29.23	3	200	3	On
046		260	5 Nov 02	1807	N25:20.69	W176:05.72	2	4	1	Off
046		263	6 Nov 02	907	N23:42.38	W176:33.78	4	73	2	On
046		276	8 Nov 02	1807	N22:25.50	W171:33.46	3	200	1	Off
046		281	19 Nov 02	1550	N21:49.34	W157:35.45	4	94	1	On

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
046		282	20 Nov 02	1207	N21:31.56	W156:17.71	4	126	1	Off
046		289	22 Nov 02	1416	N19:15.54	W153:51.28	4	208	1	On
046		291	23 Nov 02	746	N18:34.78	W154:30.31	5	126	2	On
046		294	25 Nov 02	812	N20:12.76	W158:03.99	4	208	1	On
046		295	25 Nov 02	1621	N20:39.25	W159:22.33	4	208	4	On
046		298	28 Nov 02	713	N23:04.83	W155:17.46	4	73	3	On
046		299	28 Nov 02	1344	N23:23.22	W154:05.83	4	94	1	On
046		301	28 Nov 02	1425	N23:25.18	W153:58.22	4	208	1	On
046		303	30 Nov 02	727	N25:00.76	W146:49.91	4	224	4	On
046		304	30 Nov 02	1316	N25:01.58	W146:03.89	4	94	1	On
046		306	30 Nov 02	1515	N25:04.09	W145:58.13	4	225	1	Off
046		313	2 Dec 02	1604	N25:00.32	W137:26.28	1	73	6	On
046		316	4 Dec 02	914	N25:00.75	W130:27.98	4	98	1	Off
046		320	5 Dec 02	1426	N26:42.15	W126:48.48	3	73	1	On
Kogia breviceps										
047		271	7 Nov 02	1838	N22:59.75	W173:39.19	0	94	1	On
047		273	7 Nov 02	1850	N22:59.18	W173:37.19	0	73	1	On
Kogia sima										
048		203	13 Oct 02	846	N26:07.85	W166:57.84	1	73	1	On
048		256	5 Nov 02	1430	N25:29.12	W176:43.14	2	126	2	On
048		258	5 Nov 02	1708	N25:22.30	W176:15.93	2	208	3	On
048		259	5 Nov 02	1752	N25:20.64	W176:08.28	2	94	1	Off
048		270	7 Nov 02	1821	N23:00.88	W173:40.61	0	4	1	Off
ziphiid **whale**										
049		14	27 Oct 02	900	N19:09.97	W157:09.80	2	215	1	On
049		26	28 Jul 02	753	N32:36.10	W120:03.39	1	168	5	On
049		53	28 Jul 02	1408	N32:35.66	W121:05.75	1	168	4	On
049		83	29 Jul 02	934	N32:34.42	W124:24.69	1	126	1	On
049		97	29 Jul 02	1522	N32:33.96	W125:16.84	1	73	2	On
049		106	30 Jul 02	1808	N32:31.67	W130:42.00	3	15	1	On
049		107	31 Jul 02	1148	N32:30.57	W133:34.51	2	126	1	On
049		112	1 Aug 02	1217	N30:22.24	W137:14.63	1	168	4	On
049		137	27 Aug 02	622	N25:36.73	W168:01.22	2	200	1	On
049		218	17 Oct 02	759	N24:57.02	W171:55.00	0	73	3	Off
049		312	2 Dec 02	1555	N25:00.37	W137:27.97	1	126	3	On
Mesoplodon sp.										
051		120	12 Aug 02	1501	N21:13.03	W153:38.70	5	73	2	On
051		176	16 Sep 02	1006	N27:25.88	W179:01.18	4	208	2	On
051		186	25 Sep 02	1149	N27:34.47	W166:39.00	5	200	2	On
051		254	5 Nov 02	1149	N25:33.57	W177:11.69	3	208	1	On
Mesoplodon densirostris										
059		178	17 Sep 02	1032	N27:52.99	E178:48.01	1	224	2	On
059		179	17 Sep 02	1214	N28:00.12	E178:29.90	1	126	2	On
059		222	17 Oct 02	1557	N24:48.13	W171:17.89	1	99	1	Off
Ziphius cavirostris										
061		30	28 Jul 02	834	N32:36.29	W120:11.24	1	225	2	Off
061		110	1 Aug 02	701	N30:58.12	W136:30.41	2	73	3	On
061		135	26 Aug 02	1028	N24:49.51	W164:46.35	4	200	1	On
061		136	27 Aug 02	622	N25:36.73	W168:01.22	2	73	3	On
061		155	1 Sep 02	1037	N31:31.53	W179:45.48	2	98	1	Off
061		164	3 Sep 02	816	N30:23.15	W174:26.38	5	208	1	On

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
061		322	6 Dec 02	1040	N28:25.03	W123:38.62	3	225	1	Off
Indopacetus pacificus										
065		262	6 Nov 02	907	N23:42.38	W176:33.78	4	73	4	On
Balaenoptera sp.										
070		37	28 Jul 02	1030	N32:36.24	W120:25.84	1	214	1	On
070		41	17 Nov 02	1633	N25:46.47	W172:10.83	3	215	1	On
070		48	30 Nov 02	1451	N21:19.96	W157:02.45	5	7	1	On
070		56	3 Dec 02	1556	N25:30.58	W142:46.79	4	197	1	On
070		92	29 Jul 02	1500	N32:33.58	W125:12.45	2	73	1	On
070		96	29 Jul 02	1518	N32:33.96	W125:16.10	1	73	1	On
Balaenoptera acutorostrata										
071		267	7 Nov 02	1209	N23:10.07	W174:28.74	4	224	1	Off
Balaenoptera edeni										
072		145	29 Aug 02	614	N27:39.77	W173:13.29	3	225	1	Off
072		146	29 Aug 02	653	N27:40.56	W173:15.46	3	126	1	On
072		147	29 Aug 02	1409	N27:57.12	W174:25.92	3	223	1	On
072		158	1 Sep 02	1818	N31:32.12	W179:17.35	4	208	1	On
072		166	10 Sep 02	1831	N28:04.02	W178:08.51	4	200	1	On
072		169	12 Sep 02	1559	N25:55.53	W179:47.61	5	94	1	On
072		177	17 Sep 02	937	N27:54.70	E178:52.57	1	200	1	On
072		181	21 Sep 02	712	N28:55.79	W175:32.88	2	208	1	On
072		197	10 Oct 02	726	N24:44.45	W157:47.63	4	225	1	Off
072		212	16 Oct 02	809	N25:36.10	W174:37.47	1	126	2	Off
072		213	16 Oct 02	1144	N25:32.36	W174:19.49	0	200	1	On
072		224	17 Oct 02	1808	N24:42.76	W170:59.24	0	208	2	On
072		225	17 Oct 02	1853	N24:39.62	W170:57.11	0	208	1	On
072		238	21 Oct 02	919	N22:26.66	W161:51.44	4	94	1	Off
Balaenoptera borealis										
073		104	29 Jul 02	1856	N32:34.25	W125:58.10	1	208	1	On
073		275	8 Nov 02	1419	N22:32.34	W171:45.83	3	208	1	On
073		283	20 Nov 02	1259	N21:29.78	W156:18.86	4	126	1	Off
073		284	20 Nov 02	1602	N21:26.20	W156:00.89	4	94	1	On
073		285	21 Nov 02	1157	N20:25.85	W155:14.56	4	73	1	Off
073		287	22 Nov 02	1027	N19:20.87	W154:12.43	4	208	1	On
073		288	22 Nov 02	1220	N19:19.15	W154:05.85	4	200	1	On
073		302	29 Nov 02	1348	N24:27.55	W149:55.68	5	73	2	On
Balaenoptera physalus										
074		40	13 Nov 02	1613	N25:06.25	W169:24.02	4	196	1	On
074		62	8 Dec 02	1322	N32:18.38	W119:10.19	3	196	1	On
074		81	29 Jul 02	816	N32:34.34	W124:12.13	0	200	1	On
074		82	29 Jul 02	928	N32:34.31	W124:23.64	1	126	2	On
074		185	24 Sep 02	1535	N27:05.34	W167:34.41	4	73	1	On
074		243	28 Oct 02	1710	N20:39.03	W157:40.93	4	225	1	Off
074	36	261	5 Nov 02	1824	N25:20.96	W176:08.12	2	225	15	Off
074		265	7 Nov 02	738	N23:16.97	W174:45.49	3	224	1	Off
Balaenoptera musculus										
075		6	27 Jul 02	1808	N32:37.72	W117:24.34	3	126	1	On
075		32	28 Jul 02	907	N32:36.17	W120:17.65	1	73	2	On
075		34	28 Jul 02	926	N32:36.05	W120:21.33	1	126	1	On
075		36	28 Jul 02	1028	N32:36.27	W120:25.56	1	168	1	On

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
075		56	28 Jul 02	1421	N32:35.64	W121:08.37	1	168	1	On
075		77	28 Jul 02	1903	N32:35.30	W122:00.42	2	98	1	Off
075		84	29 Jul 02	952	N32:34.70	W124:28.12	1	126	1	On
075		86	29 Jul 02	1249	N32:34.09	W124:58.32	1	73	1	On
075		87	29 Jul 02	1355	N32:31.99	W125:02.22	1	73	1	On
075		89	29 Jul 02	1429	N32:32.46	W125:06.55	2	214	1	On
075		93	29 Jul 02	1505	N32:33.79	W125:13.57	1	168	1	On
075		95	29 Jul 02	1515	N32:33.96	W125:15.50	1	73	1	On
Megaptera novaeangliae										
076		60	8 Dec 02	857	N32:02.68	W119:44.01	3	216	1	On
076		286	21 Nov 02	1445	N20:20.38	W154:54.58	4	126	1	On
unid. dolphin										
077		1	12 Oct 02	1105	N36:08.74	W131:20.94	5	7	1	On
077		24	28 Jul 02	737	N32:36.09	W120:00.28	1	168	1	On
077		27	9 Nov 02	703	N20:28.73	W156:47.50	2	197	5	On
077		31	28 Jul 02	838	N32:36.27	W120:12.00	1	200	15	On
077		33	9 Nov 02	1713	N20:57.10	W157:44.75	2	196	24	On
077		50	1 Dec 02	929	N22:27.89	W153:13.68	2	216	1	Off
077		58	7 Dec 02	1243	N30:49.23	W123:53.69	2	168	30	On
077		74	28 Jul 02	1822	N32:35.36	W121:52.67	2	168	3	On
077		109	31 Jul 02	1816	N32:21.56	W134:45.53	3	73	3	On
077		117	8 Aug 02	626	N19:58.15	W154:57.69	3	225	1	Off
077	36	121	12 Aug 02	1615	N21:11.04	W153:30.11	4	126	6	Off
077		131	24 Aug 02	730	N22:31.39	W158:45.36	4	73	2	On
077		140	27 Aug 02	824	N25:40.85	W168:18.72	3	94	1	On
077		237	21 Oct 02	904	N22:28.02	W161:50.64	4	224	28	Off
077		239	22 Oct 02	835	N21:48.80	W159:31.77	5	94	1	On
077		257	5 Nov 02	1436	N25:29.69	W176:42.39	2	126	1	On
077		277	9 Nov 02	810	N22:01.80	W169:45.04	3	126	3	On
077		278	12 Nov 02	1345	N20:57.44	W165:32.94	6	126	2	On
077		300	28 Nov 02	1358	N23:23.88	W154:03.22	4	225	1	Off
077		310	1 Dec 02	751	N25:01.97	W143:01.70	3	126	1	On
unid. small whale										
078		139	27 Aug 02	718	N25:38.86	W168:09.66	2	225	1	Off
078		144	28 Aug 02	1612	N26:37.36	W172:12.95	4	99	3	Off
078		156	1 Sep 02	1341	N31:31.34	W179:30.34	4	94	1	On
078		264	6 Nov 02	1439	N23:39.14	W176:14.27	3	224	1	On
078		268	7 Nov 02	1411	N23:08.05	W174:23.34	3	73	1	On
078		269	7 Nov 02	1746	N23:02.44	W173:46.84	1	126	1	On
078		311	2 Dec 02	704	N25:00.50	W139:05.03	3	224	1	On
078		319	5 Dec 02	834	N26:14.85	W127:32.04	2	200	1	Off
unid. large whale										
079		46	25 Nov 02	935	N22:02.51	W158:52.54	5	215	1	On
079		53	2 Dec 02	825	N23:40.08	W149:08.04	2	168	1	Off
079		55	3 Dec 02	1237	N25:19.14	W143:26.60	4	215	1	On
079		161	2 Sep 02	1447	N30:45.01	W176:19.12	4	200	1	On
079		173	15 Sep 02	845	N26:32.73	W175:29.87	4	99	1	Off
079		187	25 Sep 02	1601	N27:23.38	W165:52.23	4	225	1	Off
079		307	30 Nov 02	1623	N25:03.18	W145:45.49	4	94	1	On
***Kogia* sp.**										
080		255	5 Nov 02	1209	N25:34.41	W177:08.56	2	4	1	Off

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
unid. cetacean										
096		29	28 Jul 02	817	N32:36.33	W120:07.84	1	200	2	On
096		30	9 Nov 02	1242	N20:48.26	W157:05.40	2	215	1	On
096		232	19 Oct 02	1604	N23:22.67	W165:37.20	3	73	1	Off
096		272	7 Nov 02	1849	N22:59.22	W173:37.34	0	208	1	On
096		274	8 Nov 02	1008	N22:44.93	W172:26.24	2	225	3	Off
096		314	3 Dec 02	747	N25:00.27	W134:51.60	2	208	1	On
unid. whale										
098		143	28 Aug 02	1332	N26:31.57	W171:50.59	4	200	1	On
098		148	29 Aug 02	1635	N28:00.14	W174:37.86	3	208	1	Off
098		150	30 Aug 02	1849	N28:53.52	W178:08.75	3	94	1	On
098		207	14 Oct 02	1459	N27:05.24	W170:57.80	5	94	1	On
Balaenoptera borealis/edeni										
099		88	29 Jul 02	1427	N32:32.38	W125:06.13	2	225	1	Off
099	21	90	29 Jul 02	1449	N32:33.19	W125:10.34	2	73	37	On
099		98	29 Jul 02	1534	N32:33.94	W125:19.23	1	168	1	On
099		101	29 Jul 02	1549	N32:33.91	W125:22.11	1	168	1	On
Stenella longirostris **(Gray's)**										
102		31	9 Nov 02	1531	N20:55.26	W157:34.43	2	215	32	On
102		32	9 Nov 02	1626	N20:55.79	W157:38.07	2	168	4	On
102		119	10 Aug 02	1343	N20:06.69	W152:29.17	4	168	19	On
102		128	23 Aug 02	1157	N21:16.14	W158:09.21	4	126	5	On
102		132	24 Aug 02	1444	N22:48.43	W159:54.00	4	94	4	On
102		208	15 Oct 02	745	N25:48.55	W171:51.86	5	73	25	Off
102		229	19 Oct 02	751	N23:51.56	W166:21.51	4	98	19	Off
102		231	19 Oct 02	1204	N23:37.10	W166:13.12	4	200	8	On
unid. small *delphinid*										
177		3	27 Jul 02	1755	N32:37.70	W117:21.90	3	73	1	On
177		7	27 Jul 02	1820	N32:37.69	W117:26.71	3	200	50	On
177		8	27 Jul 02	1821	N32:37.69	W117:26.89	3	126	6	On
177		9	27 Jul 02	1826	N32:37.82	W117:27.90	3	126	9	On
177		11	27 Jul 02	1839	N32:37.97	W117:30.37	3	200	17	On
177		13	27 Jul 02	1848	N32:37.85	W117:32.03	3	168	20	On
177		14	27 Jul 02	1854	N32:37.76	W117:33.34	3	168	1	On
177		16	27 Jul 02	1911	N32:37.73	W117:36.64	3	168	22	On
177		17	27 Jul 02	1927	N32:37.66	W117:39.54	2	126	3	On
177		25	2 Nov 02	1410	N19:25.53	W159:34.81	3	196	6	On
177		28	28 Jul 02	815	N32:36.33	W120:07.52	1	208	6	On
177		38	28 Jul 02	1110	N32:36.53	W120:31.88	1	126	7	On
177		49	28 Jul 02	1338	N32:35.73	W121:00.12	2	200	6	On
177		80	29 Jul 02	701	N32:34.49	W123:57.95	1	208	16	On
177		99	29 Jul 02	1539	N32:33.94	W125:20.14	1	168	1	On
177		103	29 Jul 02	1836	N32:33.64	W125:54.39	1	168	15	On
177		108	31 Jul 02	1547	N32:30.10	W134:20.92	2	126	19	On
177		111	1 Aug 02	1126	N30:28.09	W137:07.61	1	126	17	On
177		113	1 Aug 02	1647	N29:53.21	W137:50.94	3	208	7	On
177		116	5 Aug 02	1814	N19:24.35	W150:11.89	4	126	2	On
177		174	15 Sep 02	1456	N26:53.48	W176:20.54	5	99	2	Off
177		180	20 Sep 02	1307	N27:40.91	W176:15.55	4	200	1	Off
177		188	25 Sep 02	1720	N27:19.58	W165:37.17	4	126	4	On
177		196	9 Oct 02	1623	N23:58.44	W158:12.91	4	225	7	Off
177		227	18 Oct 02	1043	N24:16.03	W168:55.87	3	126	19	Off
177		230	19 Oct 02	1020	N23:43.37	W166:19.91	4	99	2	Off

Table 5. Marine mammal sightings during HICEAS 2002 (continued)

Code	Other Codes	Sighting Number	Date	Time	Latitude	Longitude	Bft.	Obs. no.	School size	Effort
177	21	247	31 Oct 02	1306	N21:18.04	W163:39.61	6	94	5	On
177		323	6 Dec 02	1143	N28:30.49	W123:28.68	3	126	13	On
177		326	7 Dec 02	1044	N30:25.32	W119:54.46	4	126	2	On
177		327	7 Dec 02	1339	N30:44.81	W119:31.74	4	208	1	On
unid. medium *delphinid*										
277		5	27 Jul 02	1802	N32:37.72	W117:23.16	3	73	1	On
277		13	26 Oct 02	836	N19:47.28	W156:08.41	4	7	2	On
277		51	1 Dec 02	1531	N22:47.63	W152:06.56	2	215	6	On
277		52	28 Jul 02	1353	N32:35.66	W121:02.96	2	126	3	On
277		308	1 Dec 02	653	N25:02.07	W143:12.32	4	94	5	On
277		309	1 Dec 02	723	N25:02.01	W143:06.84	4	208	1	On
unid. large *delphinid*										
377		193	7 Oct 02	1508	N22:56.04	W153:59.96	4	126	4	On
Arctocephalus townsendi										
AT		54	28 Jul 02	1411	N32:35.65	W121:06.31	1	126	1	On
Callorhinus ursinus										
CU		41	28 Jul 02	1209	N32:35.92	W120:43.21	2	208	2	On
CU		43	28 Jul 02	1225	N32:35.86	W120:46.23	2	208	2	On
CU		44	28 Jul 02	1236	N32:35.85	W120:48.32	2	208	1	On
CU		61	28 Jul 02	1527	N32:35.62	W121:17.95	1	73	2	On
CU		62	28 Jul 02	1549	N32:35.57	W121:22.10	2	73	7	On
CU		63	28 Jul 02	1603	N32:35.54	W121:24.85	2	208	1	On
CU		66	28 Jul 02	1638	N32:35.50	W121:31.78	2	73	1	On
CU		67	28 Jul 02	1646	N32:35.46	W121:33.36	2	214	3	On
CU		68	28 Jul 02	1646	N32:35.46	W121:33.44	2	73	2	On
CU		70	28 Jul 02	1655	N32:35.47	W121:35.20	2	73	1	On
CU		72	28 Jul 02	1740	N32:35.44	W121:44.40	2	168	1	On
CU		91	29 Jul 02	1456	N32:33.45	W125:11.71	2	73	1	On
Mirounga angustirostris										
MA		40	28 Jul 02	1148	N32:36.16	W120:39.16	1	73	1	On
MA		60	28 Jul 02	1526	N32:35.63	W121:17.74	1	73	1	On
MA		61	8 Dec 02	1118	N32:08.24	W119:31.10	1	215	1	On
unid. *pinniped*										
PU		27	28 Jul 02	813	N32:36.33	W120:07.23	1	200	1	On
PU		35	28 Jul 02	1018	N32:36.47	W120:23.61	1	126	1	On
PU		51	28 Jul 02	1346	N32:35.69	W121:01.73	2	126	2	On
PU		73	28 Jul 02	1806	N32:35.38	W121:49.55	2	168	1	On
unid. fur seal										
UA		55	28 Jul 02	1421	N32:35.63	W121:08.29	1	214	1	On
UA		65	28 Jul 02	1636	N32:35.52	W121:31.32	2	73	2	On
UA		78	28 Jul 02	1935	N32:35.42	W122:02.81	2	73	1	On
unid. sea lion										
UO		21	28 Jul 02	652	N32:36.19	W119:52.04	1	126	1	On
UO		46	28 Jul 02	1259	N32:35.81	W120:52.90	2	73	1	On
UO		58	28 Jul 02	1446	N32:36.09	W121:10.11	1	126	1	Off
Zalophus californianus										
ZC		20	28 Jul 02	615	N32:36.24	W119:45.00	1	126	3	On

Table 6. Acoustic recordings of single-species sightings of cetaceans obtained using the towed hydrophone array on the *Jordan* during HICEAS (including non-sighted unidentified dolphins, sperm whales, and minke whales).

Species	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Leg 6	Total
Unidentified dolphin	34	22	20	42	1	44	163
Unidentified cetacean	0	0	0	1	0	1	2
Physeter macrocephalus	8	24	16	37	11	47	143
Balaenoptera acutorostrata	0	0	0	0	2	44	46
S. coeruleoalba	3	2	4	3	2	0	14
Steno bredanensis	1	0	1	3	1	2	8
Globicephala macrorhynchus	0	1	0	2	1	3	7
S. attenuata	0	2	0	2	0	2	6
Delphinus delphis	5	0	0	0	0	0	5
Tursiops truncatus	1	3	0	0	0	1	5
Grampus griseus	0	0	0	1	1	2	4
S. longirostris	1	1	0	1	0	0	3
Feresa attenuata	0	0	0	1	0	0	1
Megaptera novaeangliae	0	0	0	0	0	1	1
Total	53	55	41	93	19	147	408

Table 7. Acoustic recordings of cetaceans obtained using sonobuoys on the *Jordan* during HICEAS.

Species	Recordings
B. edeni	7
B. physalus	1
B. borealis	4
Total	12

Table 8. Sightings Photographed by Species. List the species and corresponding sighting numbers for 35 mm and digital photo-ID pictures taken on the HICEAS survey. Sighting numbers preceded by M refer to sightings from the R/V McArthur.

Species	# of Sightings Photographed	Sighting #s
Balaenoptera acutorastrata	1	267
Balaenoptera borealis	3	88, 275, 284
Balaenoptera edeni	6	146, 147, 181, 197, 212, 238
Balaenoptera musculus	4	34, 84, 86, 87
Balaenoptera physalus	8	185, 243, 265, 275, 284, 287, M40, M62
Feresa attenuata	1	214
Globicephala macrorhynchus	12	123, 183, 199, 219, 228, 242, 253, M28, M35, M43, M44, M54
Grampus griseus	2	215, 266
Indopacetus pacificus	1	262
Lagenodelphis hosei	2	249, M42
Megaptera novaeangl1ae	1	286
Mesoplodon densirostris	2	179, 222
Orcinus orca	1	M36
Peponocephala electra	3	214, 240, 249
Physeter macrocephalus	18	133, 134, 141, 142, 149, 151, 154, 171, 201, 206, 217, 220, 221, 235, 250, 276, 281, M19
Pseudorca crassidens	1	184
Stenella attenuata	7	138, 202, 280, 296, M11, M12, M47
Stenella ceruleoalba	3	189, 205, 211
Stenella longirostris	3	M31, M32, M31, & Midway Island
Steno bredanensis	7	241, 297, M22, M34, M45, M22, M34
Tursiops truncatus	8	165, 184, 279, 293, M22, M15, M22, M34

Table 9. Number of biopsy samples obtained from cetacean species aboard the R/V *David Starr Jordan* (DSJ) and R/V *McArthur* (MAC).

	Ship		Grand
Species	**DSJ**	**MAC**	**Total**
Balaenoptera acutorostrata	1		1
Balaenoptera borealis	8		8
Balaenoptera edeni	6		6
Balaenoptera musculus	2		2
Balaenoptera physalus	3	3	6
Delphinus delphis	7		7
Globicephala macrorhynchus	26	16	42
Lagenodelphis hosei	4		4
Megaptera novaeangliae	1		1
Orcinus orca		5	5
Physeter macrocephalus	19		19
Stenella attenuata	5	2	7
Steno bredanensis	5	1	6
Tursiops truncatus	12		12
Stenella longirostris longirostris	12	5	17
Grand Total	**111**	**32**	**143**

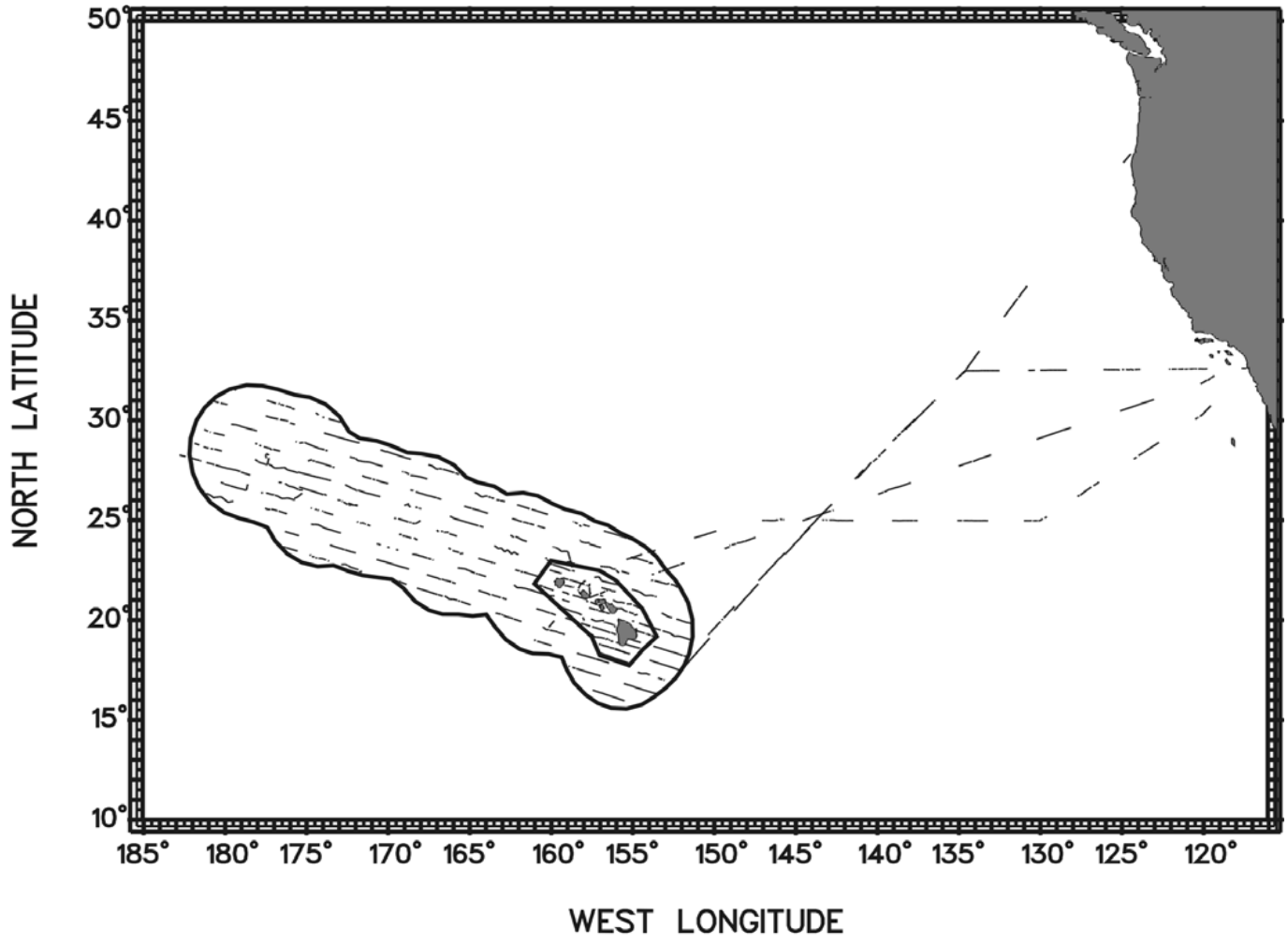

Figure 1. Coverage of survey tracklines during HICEAS 2002, including unplanned segments such as departures from ports. Bold lines indicate the boundaries of the Main Island Stratum and the Outer EEZ stratum.

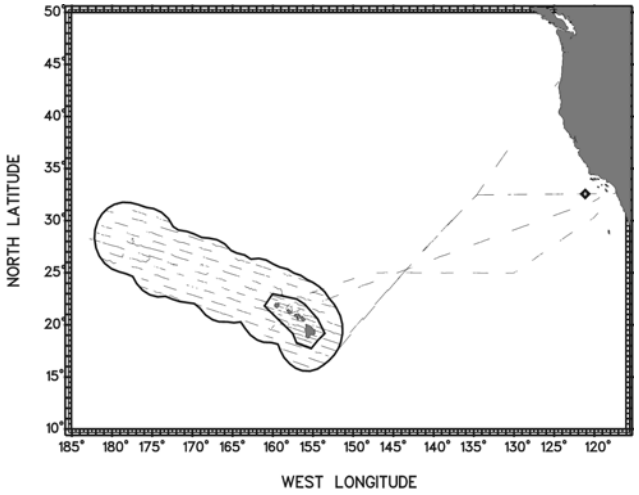

Figure 2. On-effort sighting of *Arctocephalus townsendi*
Species code AT, n=1

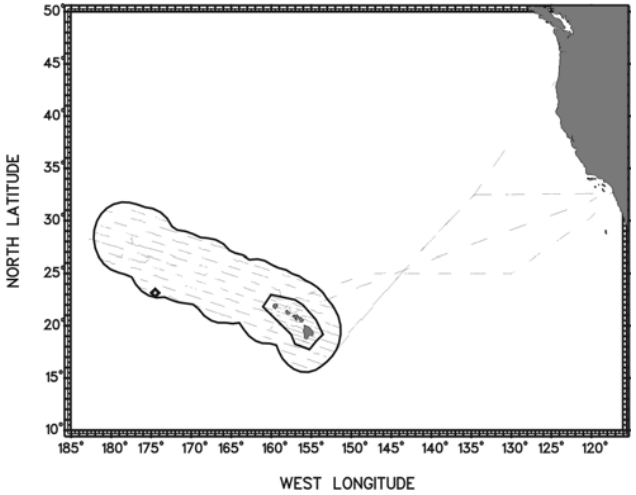

Figure 3. **Off**-effort sighting of *Balaenoptera acutorostrata*
Species code 071, n=1. There were no on-effort sightings of this species.

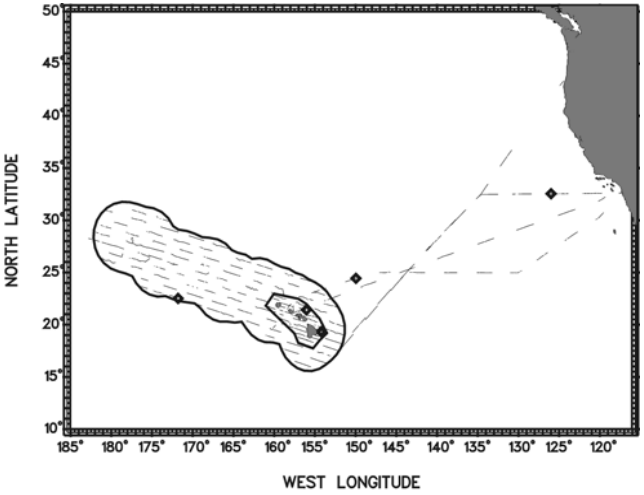

Figure 4. On-effort sightings of *Balaenoptera borealis*
Species code 073, n=6

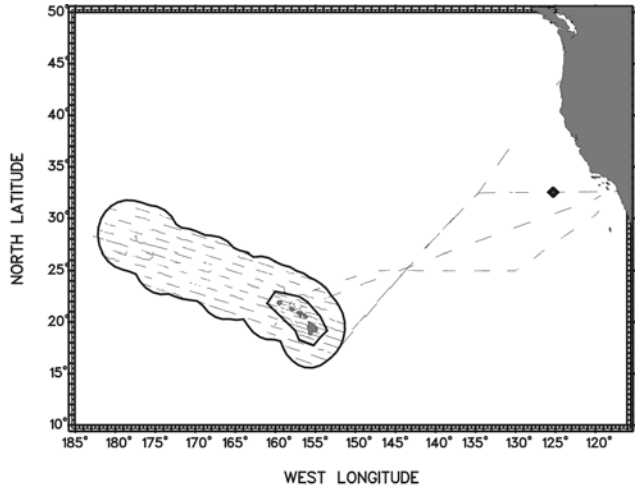

Figure 5. On-effort sightings of *Balaenoptera borealis/edeni*
Species code 099, n=3

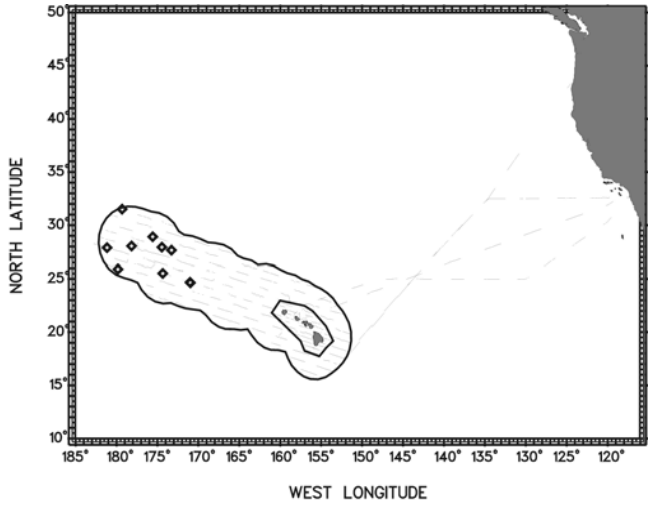

Figure 6. On-effort sightings of *Balaenoptera edeni*
Species code 072, n=10

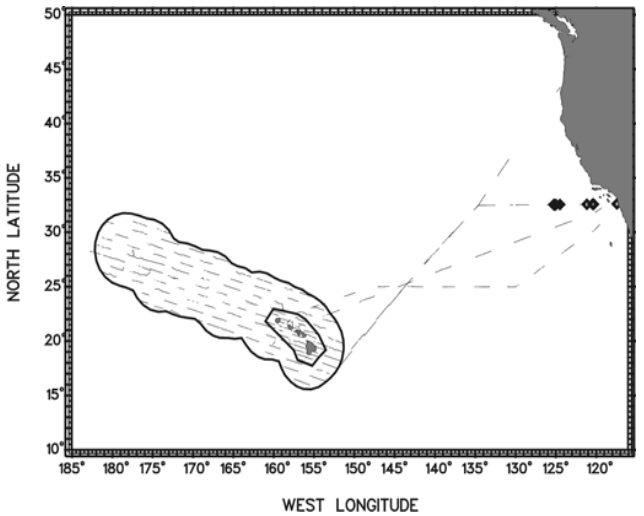

Figure 7. On-effort sightings of *Balaenoptera musculus*
Species code 075, n=11

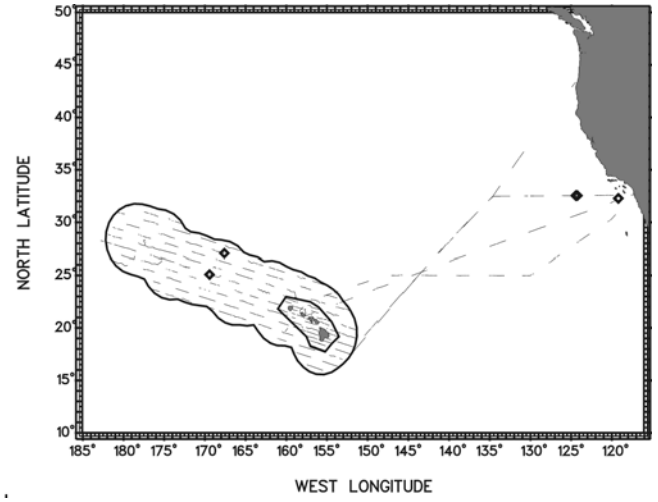

Figure 8. On-effort sightings of *Balaenoptera physalus*
Species code 074, n=6

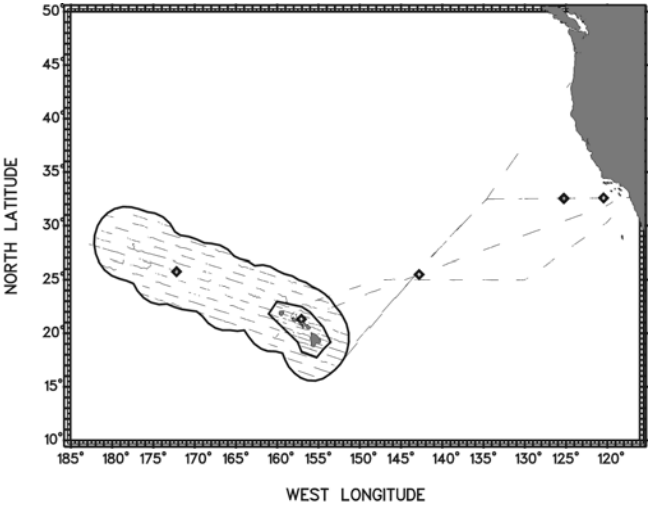

Figure 9. On-effort sightings of *Balaenoptera* species
Species code 070, n=6

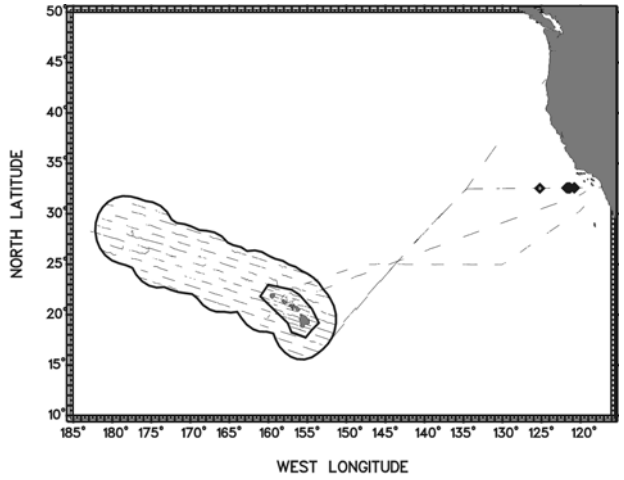

Figure 10. On-effort sightings of *Callorhinus ursinus*
Species code CU, n=12

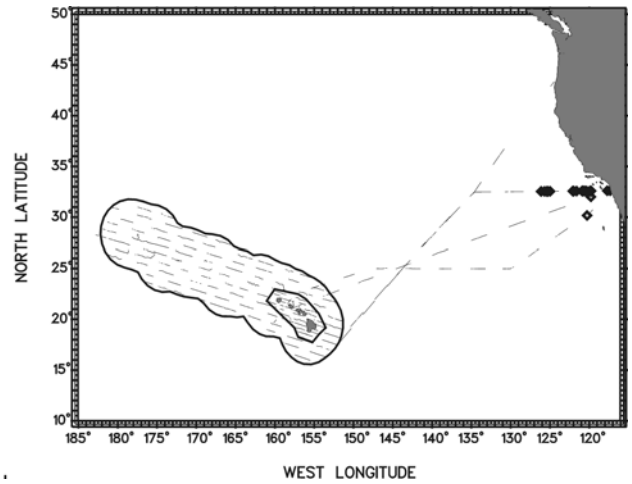

Figure 11. On-effort sightings of *Delphinus delphis*
Species code 017, n=21

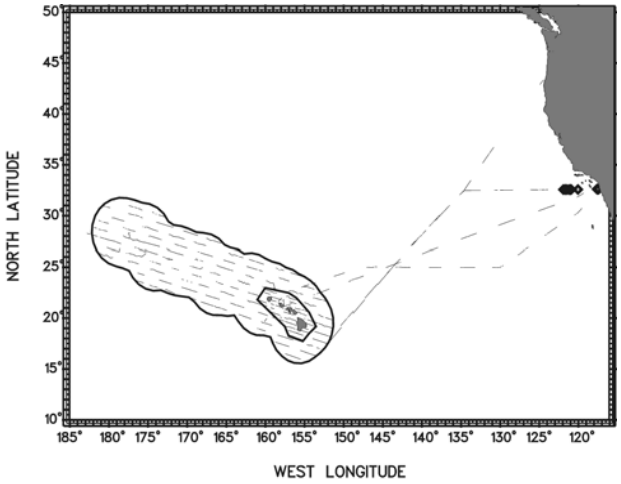

Figure 12. On-effort sightings of *Delphinus* species
Species code 005, n=10

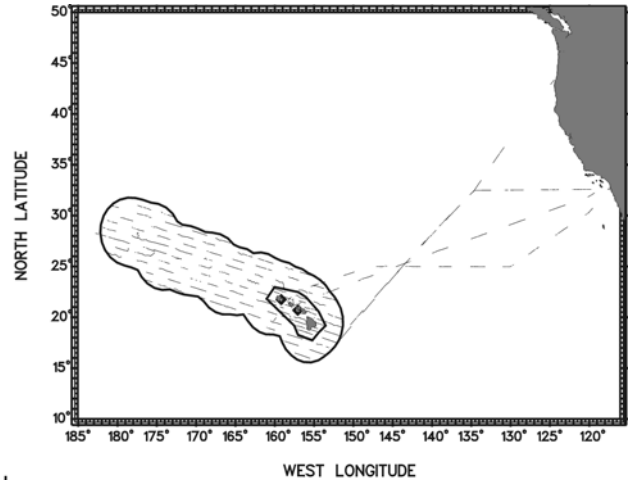

Figure 13. On-effort sightings of *Feresa attenuata*
Species code 032, n=2

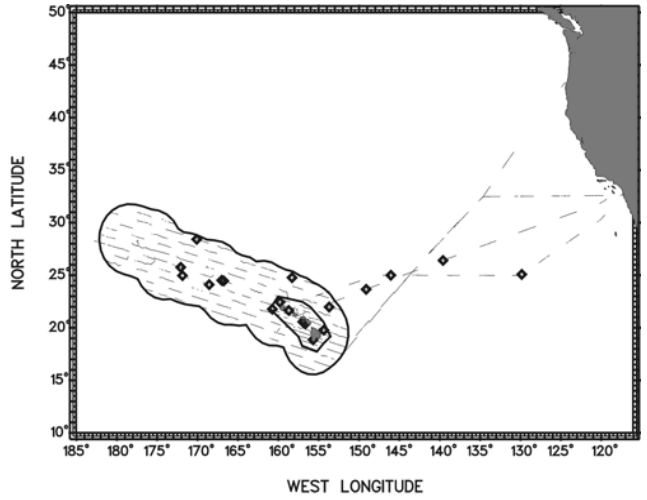

Figure 14. On-effort sightings of *Globicephala macrorhynchus*
Species code 036, n=20

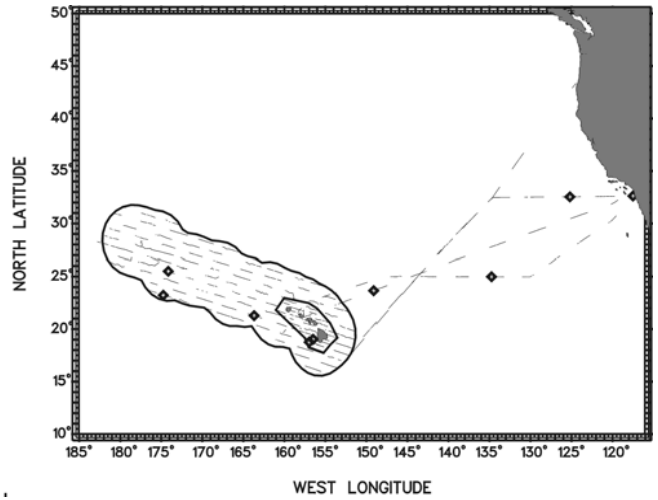

Figure 15. On-effort sightings of *Grampus griseus*
Species code 021, n=9

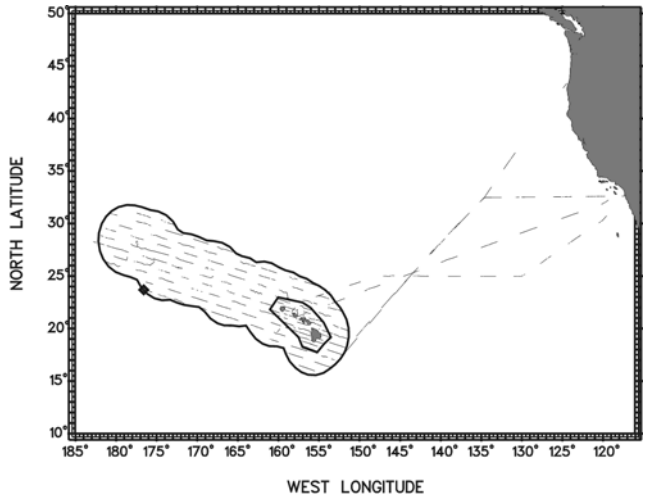

Figure 16. On-effort sighting of *Indopacetus pacificus*
Species code 065, n=1

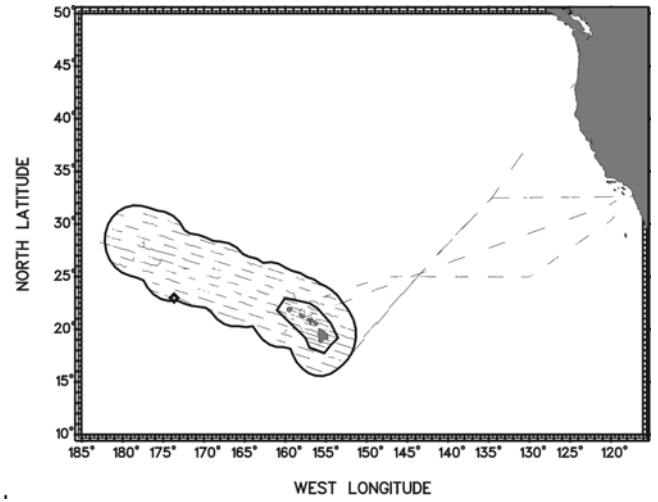

Figure 17. On-effort sightings of *Kogia breviceps*
Species code 047, n=2

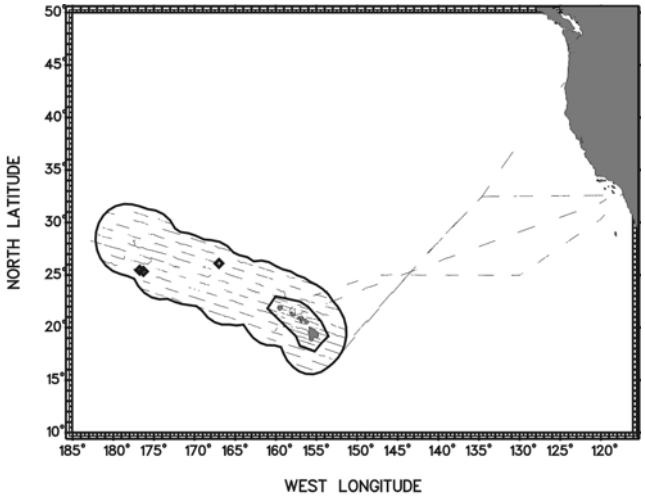

Figure 18. On-effort sightings of *Kogia sima*
Species code 048, n=3

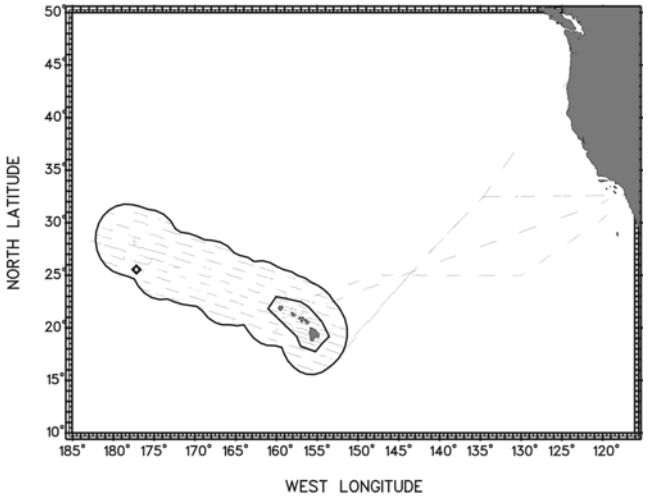

Figure 19. **Off**-effort sighting of *Kogia* species
Species code 080, n=1. There were no on-effort sightings of this species.

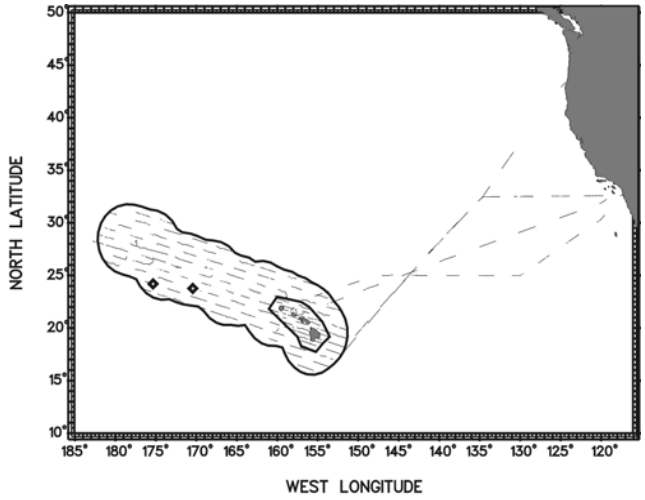

Figure 20. On-effort sightings of *Lagenodelphis hosei*
Species code 026, n=2

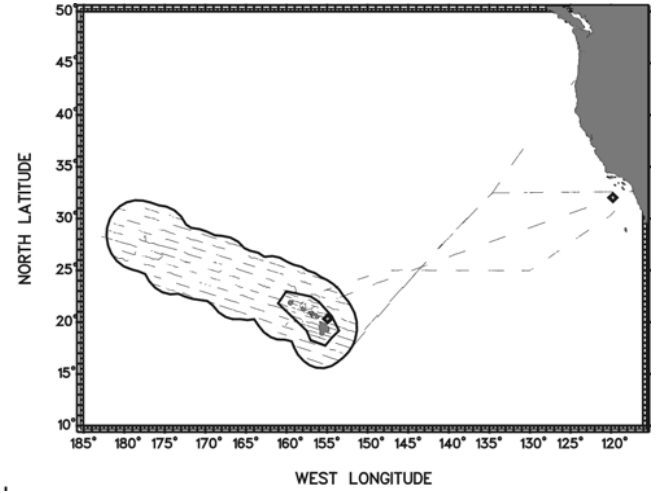

Figure 21. On-effort sightings of *Megaptera novaeangliae*
Species code 076, n=2

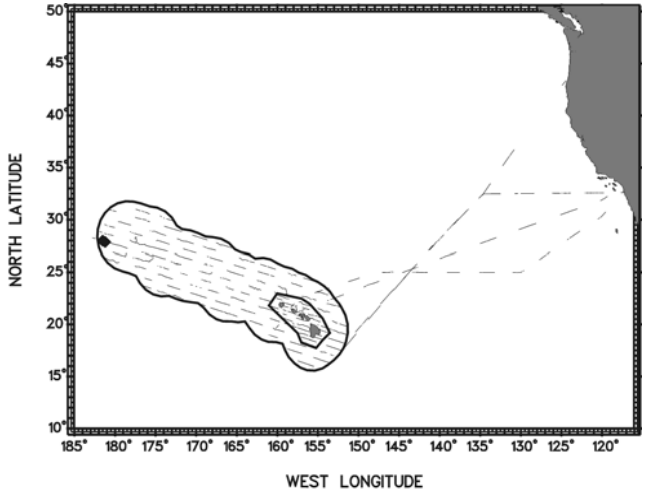

Figure 22. On-effort sightings of *Mesoplodon densirostris*
Species code 059, n=2

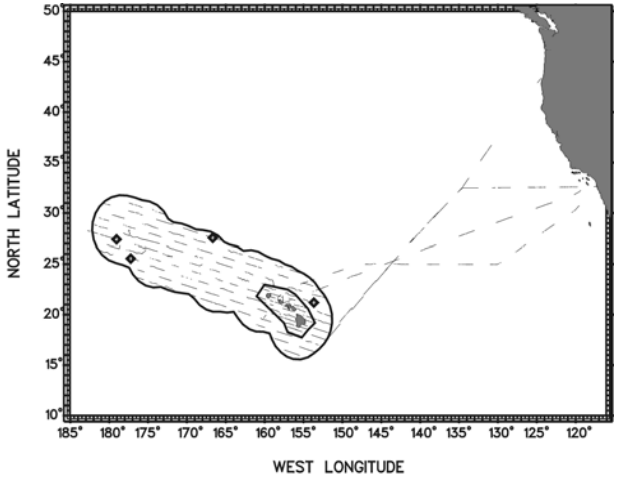

Figure 23. On-effort sightings of *Mesoplodon* species
Species code 051, n=4

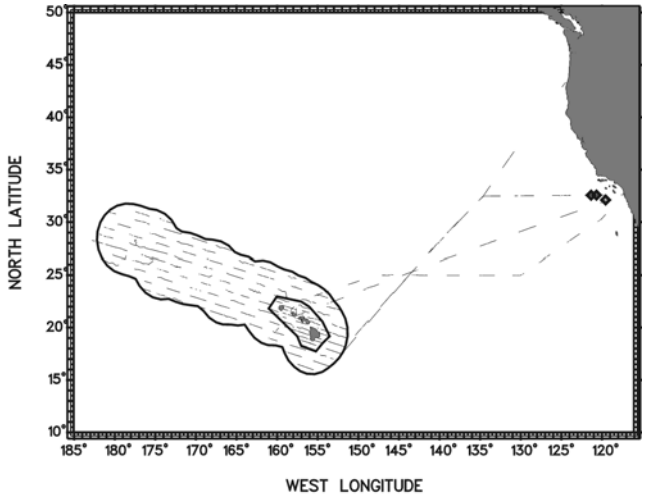

Figure 24. On-effort sightings of *Mirounga angustirostris*
Species code MA, n=3

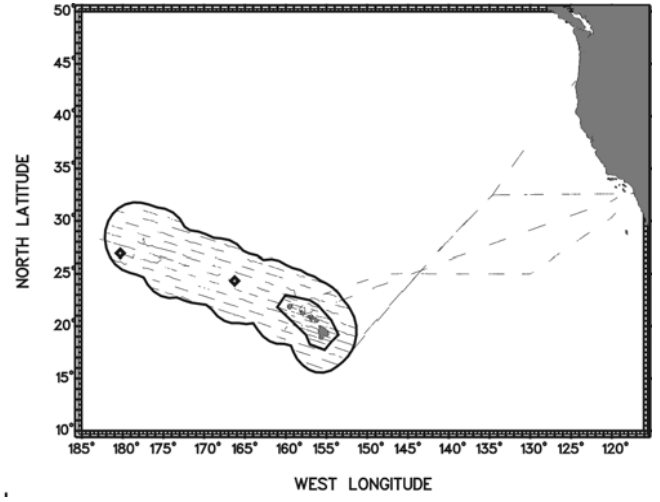

Figure 25. On-effort sightings of *Orcinus orca*
Species code 037, n=2

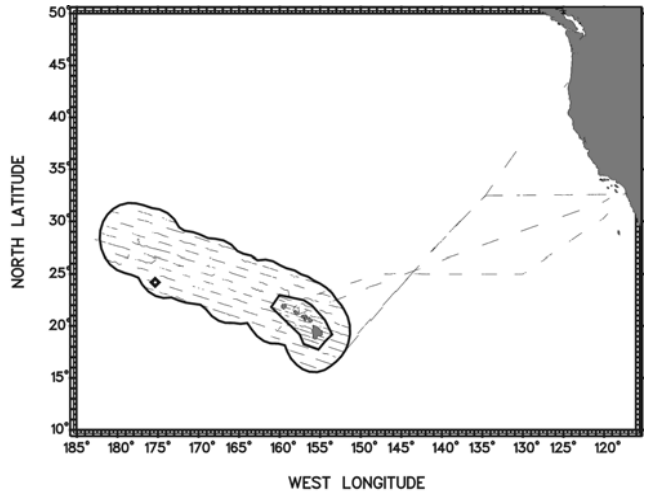

Figure 26. On-effort sighting of *Peponocephala electra*
Species code 031, n=1

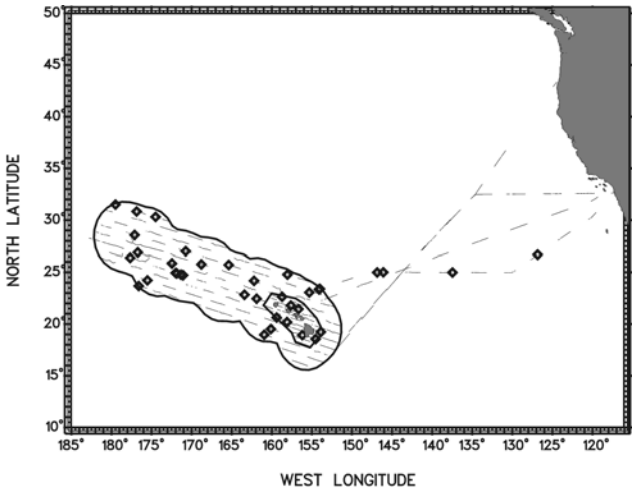

Figure 27. On-effort sightings of *Physeter macrocephalus*
Species code 046, n=37

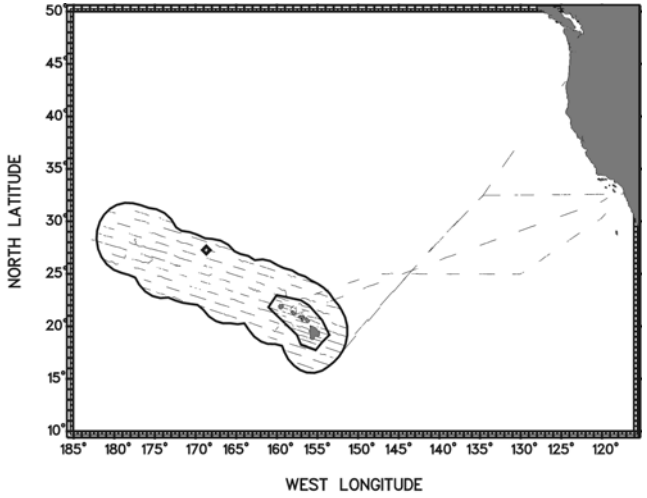

Figure 28. On-effort sighting of *Pseudorca crassidens*
Species code 033, n=1

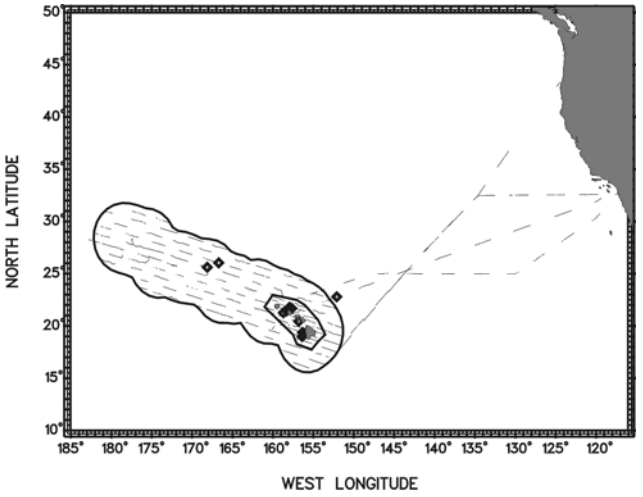

Figure 29. On-effort sightings of *Stenella attenuata*
Species code 002, n=11

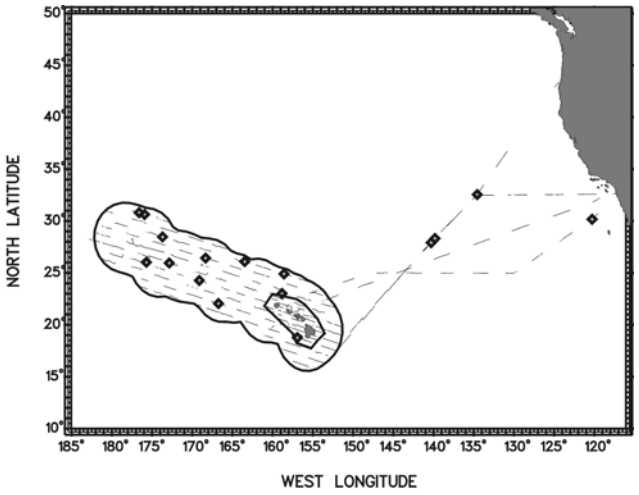

Figure 30. On-effort sightings of *Stenella coeruleoalba*
Species code 013, n=16

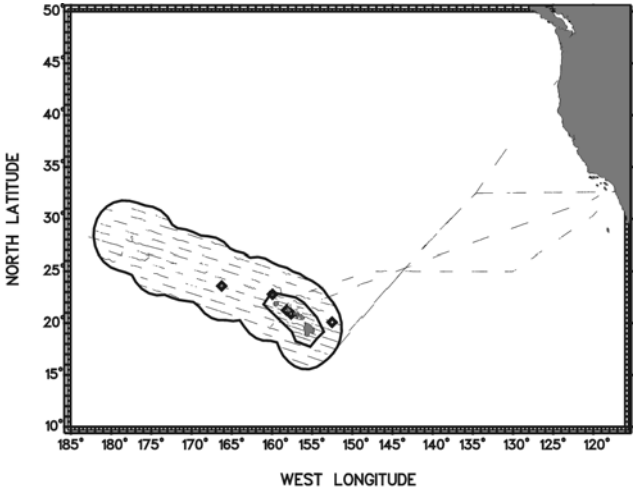

Figure 31. On-effort sightings of *Stenella longirostris*
Species code 102, n=6

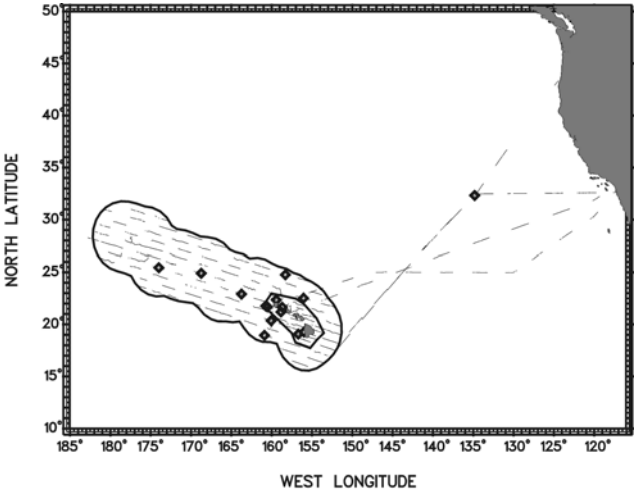

Figure 32. On-effort sightings of *Steno bredanensis*
Species code 015, n=15

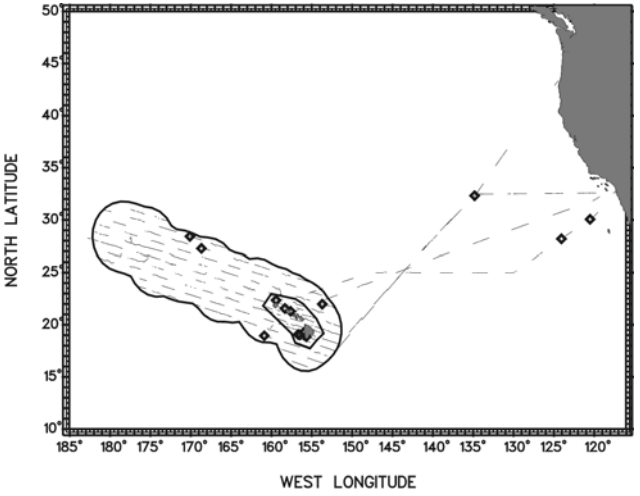

Figure 33. On-effort sightings of *Tursiops truncatus*
Species code 018, n=14

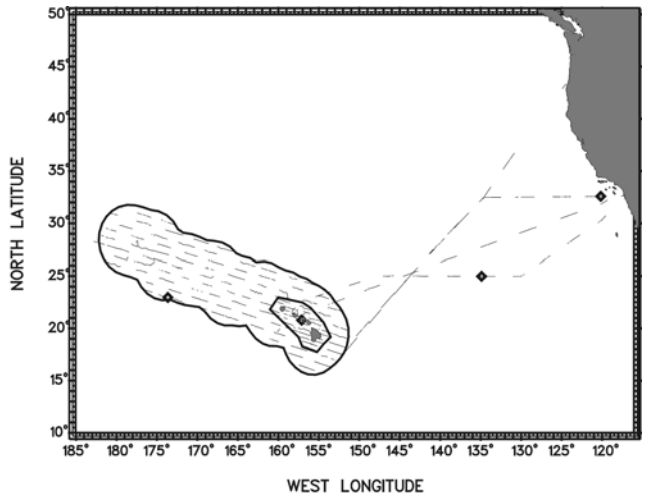

Figure 34. On-effort sightings of unidentified cetacean
Species code 096, n=4

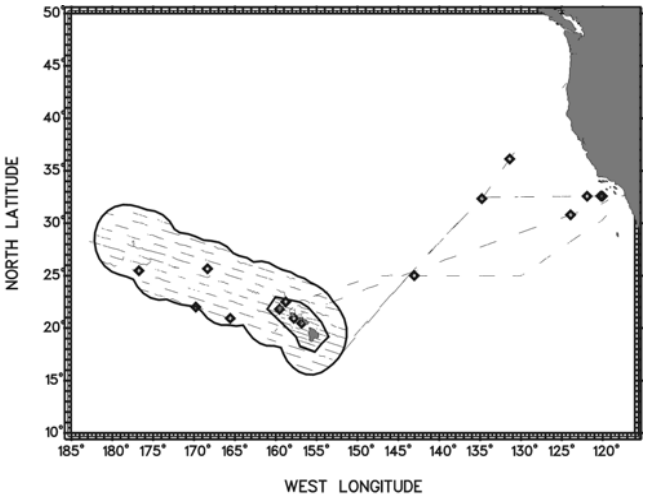

Figure 35. On-effort sightings of unidentified dolphin
Species code 077, n=15

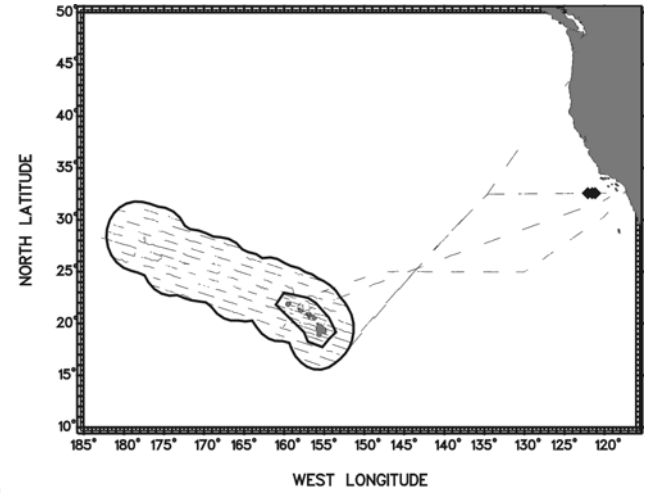

Figure 36. On-effort sightings of unidentified fur seal
Species code UA, n=3

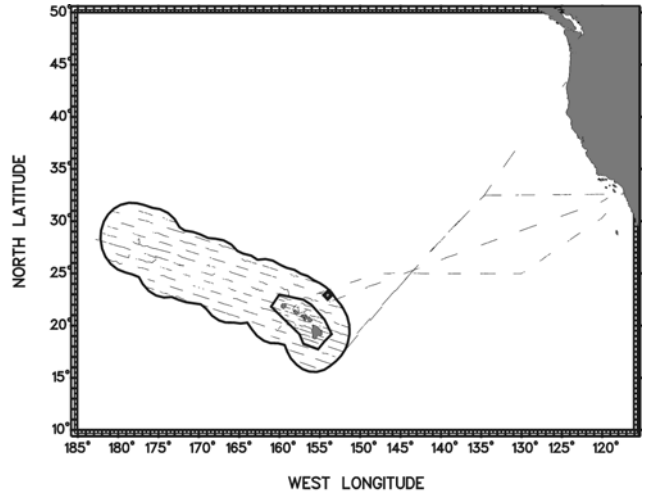

Figure 37. On-effort sighting of unidentified large delphinid
Species code 377, n=1

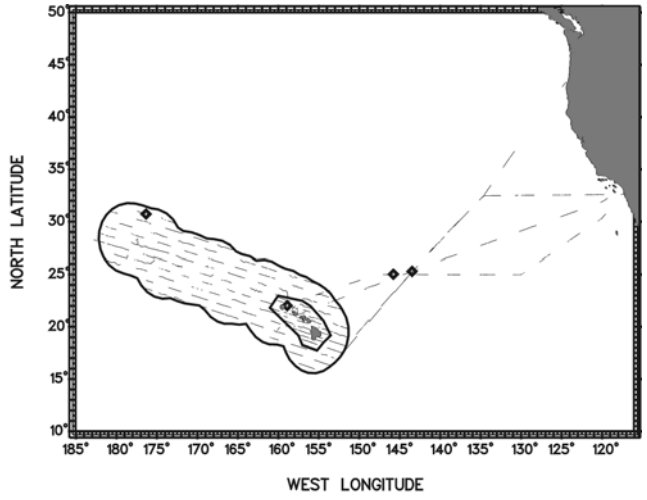

Figure 38. On-effort sightings of unidentified large whale Species code 079, n=4

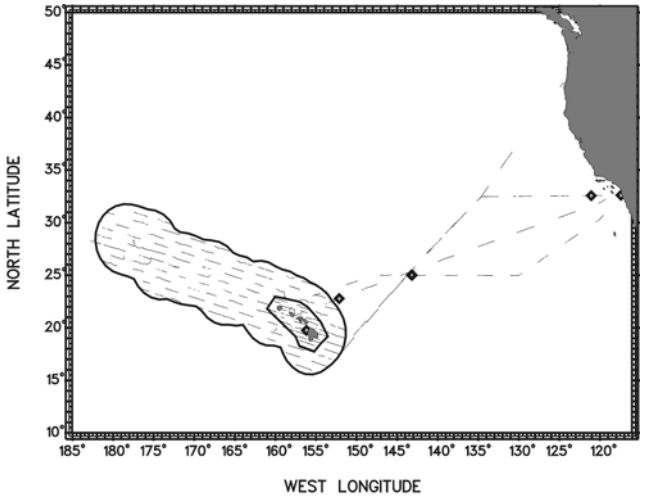

Figure 39. On-effort sightings of unidentified medium delphinid Species code 277, n=6

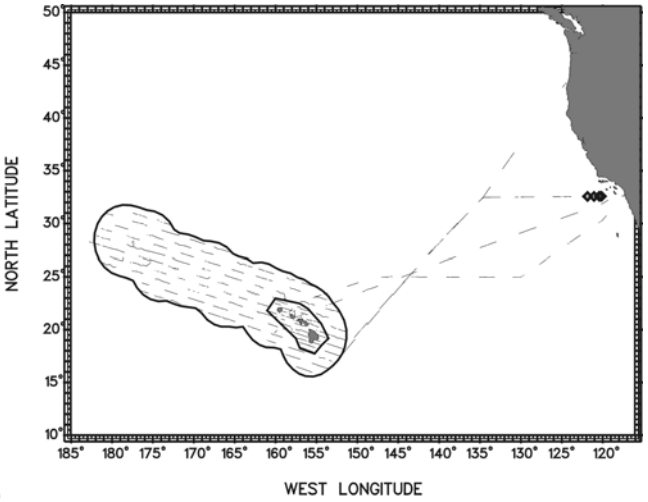

Figure 40. On-effort sightings of unidentified pinniped Species code PU, n=4

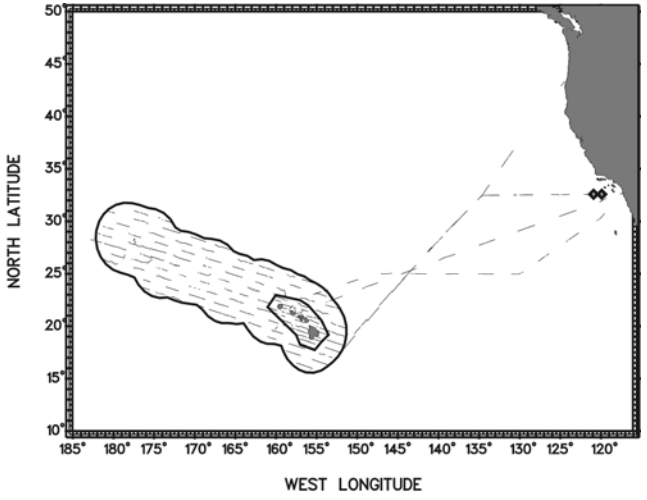

Figure 41. On-effort sightings of unidentified sea lion Species code UO, n=2

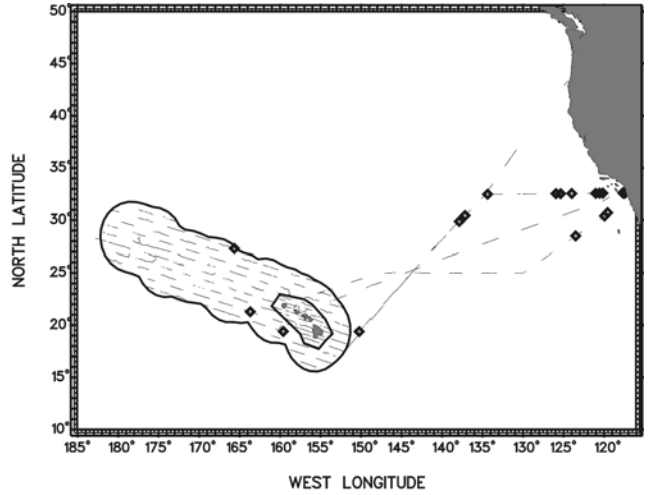

Figure 42. On-effort sightings of unidentified small delphinid
Species code 177, n=25

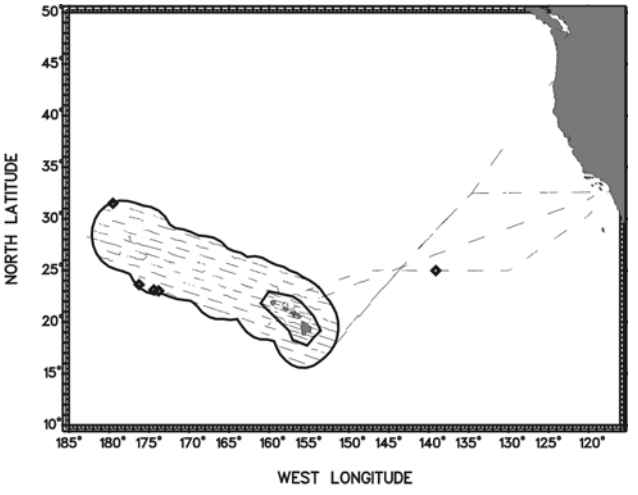

Figure 43. On-effort sightings of unidentified small whale
Species code 078, n=5

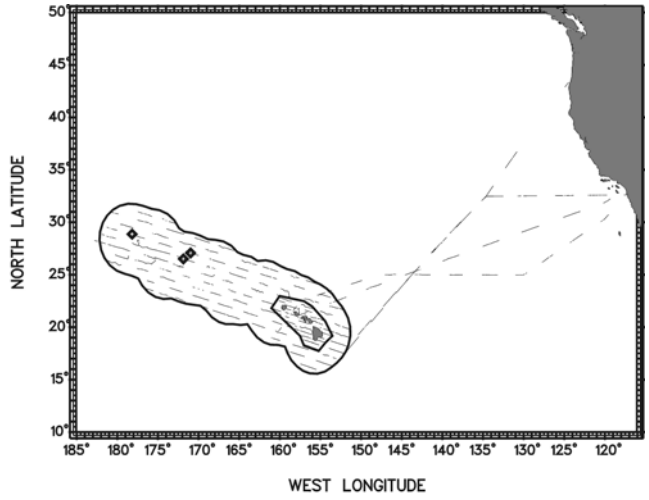

Figure 44. On-effort sightings of unidentified whale
Species code 098, n=3

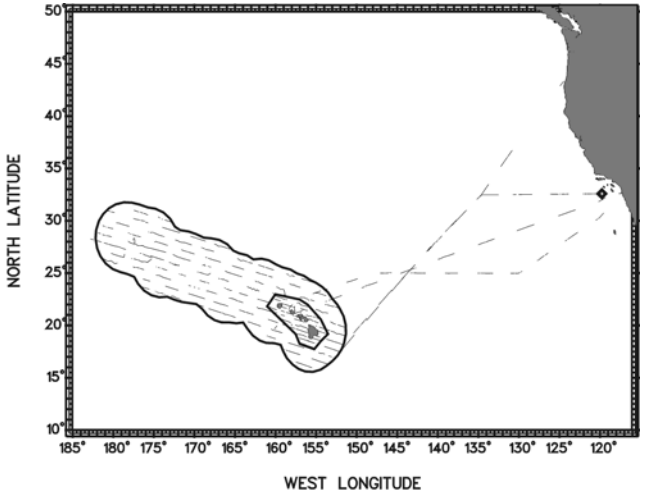

Figure 45. On-effort sighting of *Zalophus californianus*
Species code ZC, n=1

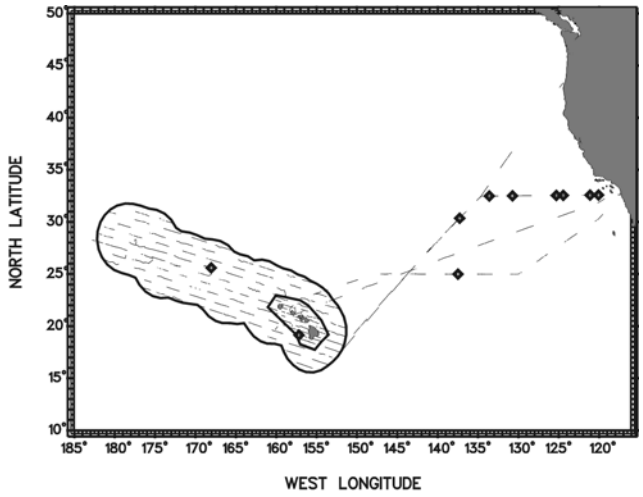

Figure 46. On-effort sightings of ziphiid whale
Speices code 049, n=10

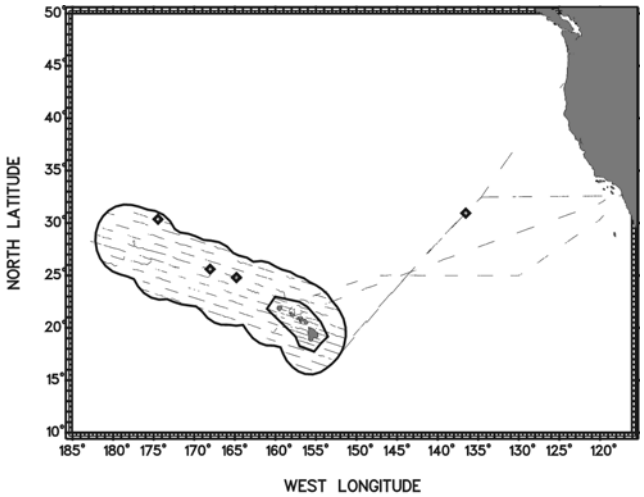

Figure 47. On-effort sightings of *Ziphius cavirostris*
Species code 061, n=4

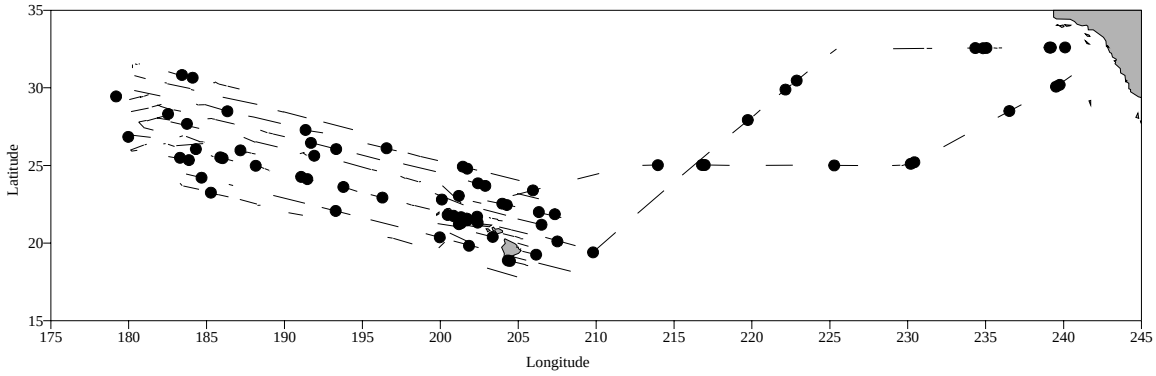

Figure 48. Acoustic survey effort using a towed hydrophone array (line segments), and locations where clear delphinid whistles of sighted animals were noted (dark circles).

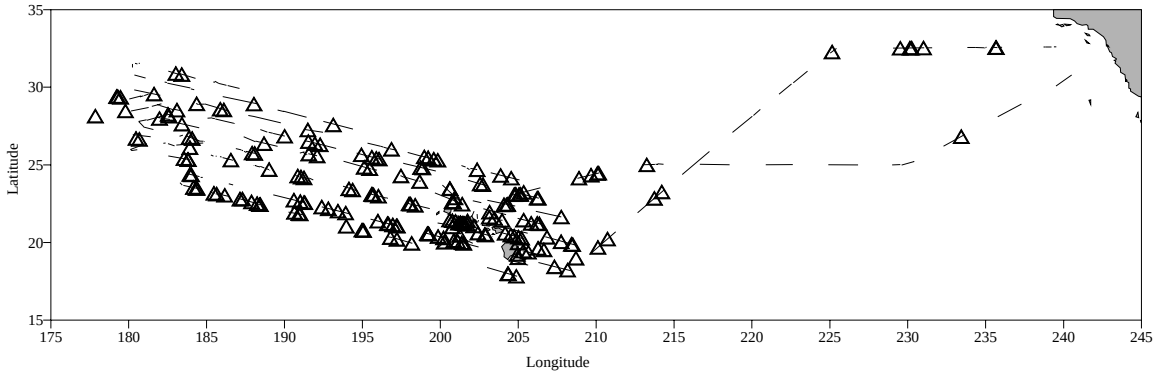

Figure 49. Acoustic survey effort using a towed hydrophone array (line segments), and locations where clear delphinid whistles of non-sighted animals were noted (triangles).

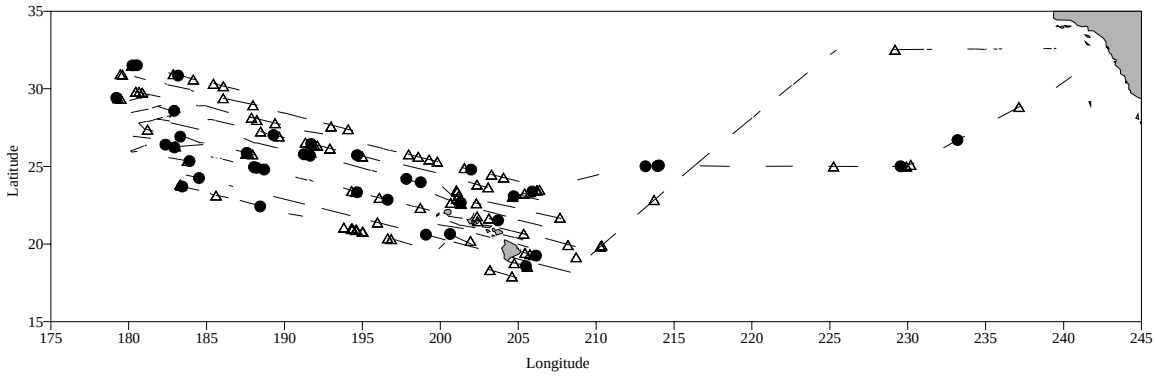

Figure 50. Acoustic survey effort using a towed hydrophone array (line segments), and locations where clicks from sighted sperm whales were detected (dark circles) and non-sighted sperm whales were detected (triangles).

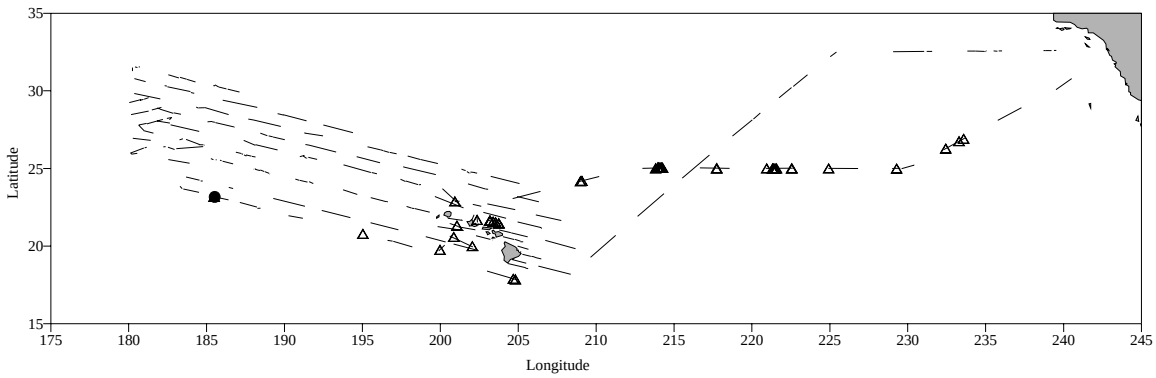

Figure 51. Acoustic survey effort using a towed hydrophone array (line segments), and locations where boings from sighted minke whales were detected (dark circles) and non-sighted minke whales were detected (triangles).

APPENDIX A. HICEAS 2002 Personnel

Leg 1 (*Jordan*):

Name[1]	Position
Jay Barlow	Cruise Leader
Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist
Jorge A Del Angel	Mammal Observer
Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer
Jennifer N. Latusek	Mammal Observer
Brett Jarrett	Seabird Observer
Michael Force	Seabird Observer
Kerry Kopitsky	Oceanographer
Valerie Philbrick	Oceanographer
Shannon Rankin	Acoustician
Allison Walker	Acoustician
Claire Debever	Visiting Scientist

Leg 2 (*Jordan*):

Name[1]	Position
Eric Archer	Cruise Leader
Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist
Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer
Jason Appler	Mammal Observer
Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer
Shannon Rankin	Acoustician
Julie Oswald	Acoustician
	Visiting Scientist
	Visiting Scientist

Leg 3 (*Jordan*):

Name[1]	Position
Sergio Escorza	Cruise Leader
Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist
Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer
Holly Fearnbach	Mammal Observer
Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer
Shannon Rankin	Acoustician
Tom Norris	Acoustician
	Visiting Scientist

Leg 4 (*Jordan*):

Name[1]	Position
Sarah Mesnick	Cruise Leader
Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist
Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer
Holly Fearnbach	Mammal Observer
Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer
Anne Allen	Asst. Oceanographer
Shannon Rankin	Acoustician
Jenna Borberg	Acoustician

APPENDIX A. (continued).

Leg 5 (*Jordan*):

Name[1]	**Position**
Lisa Ballance	Cruise Leader
Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist
Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer
Holly Fearnbach	Mammal Observer
Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer
Bob Pitman	Asst. Oceanographer
Shannon Rankin	Acoustician
Tony Martinez	Acoustician

Leg 6 (*Jordan*):

Name[1]	**Position**
Bob Pitman	Cruise Leader
Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist
Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer
Holly Fearnbach	Mammal Observer
Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer
Shannon Rankin	Acoustician
Katie Crammer	Acoustician

Leg 1 (*McArthur*):

Name[1]	**Position**
Karin Forney	Cruise Leader
Jim Cotton	ID Specialist
Jorge A Del Angel	ID Specialist
Susanne Yin	Mammal Observer
Isabel Beasley	Mammal Observer
Susan Rickards	Mammal Observer
Candice Emmons	Mammal Observer
Dawn Breese	Seabird Observer
Sophia Webb	Seabird Observer
Sam DuFresne	Oceanographer

Legs 2 & 3 (*McArthur*):

Name[1]	**Position**
Tim Gerrodette	Cruise Leader
Jim Cotton	ID Specialist
Jorge A Del Angel	ID Specialist
Susanne Yin	Mammal Observer
Isabel Beasley	Mammal Observer
Susan Rickards	Mammal Observer
Candice Emmons	Mammal Observer
Dawn Breese	Seabird Observer
Sophie Webb	Seabird Observer
	Oceanographer