NOAA Technical Memorandum NMFS

MARCH, 1995

REPORT OF 1993-1994 MARINE MAMMAL AERIAL SURVEYS CONDUCTED WITHIN THE U.S. NAVY OUTER SEA TEST RANGE OFF SOUTHERN CALIFORNIA

James V. Carretta
Karin A. Forney
Jay Barlow

NOAA-TM-NMFS-SWFSC-217

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

NOAA Technical Memorandum NMFS

NOAA Technical Memorandum NMFS

This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information. The TMs have not received complete formal review, editorial control, or detailed editing.

MARCH 1995

REPORT OF 1993-1994 MARINE MAMMAL AERIAL SURVEYS CONDUCTED WITHIN THE U.S. NAVY OUTER SEA TEST RANGE OFF SOUTHERN CALIFORNIA

James V. Carretta
Karin A. Forney
Jay Barlow

La Jolla Laboratory, SWFSC
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, California 92038-0271

NOAA-TM-NMFS-SWFSC-217

U.S. DEPARTMENT OF COMMERCE
Ronald H. Brown, Secretary

National Oceanic and Atmospheric Administration
D. James Baker, Under Secretary for Oceans and Atmosphere

National Marine Fisheries Service
Rolland A. Schmitten, Assistant Administrator for Fisheries

CONTENTS

LIST OF TABLES

LIST OF FIGURES

REPORT OF 1993-1994 MARINE MAMMAL AERIAL SURVEYS CONDUCTED WITHIN THE U.S. NAVY OUTER SEA TEST RANGE OFF SOUTHERN CALIFORNIA

James V. Carretta
Karin A. Forney
Jay Barlow
Southwest Fisheries Science Center
National Marine Fisheries Service
P.O. Box 271, La Jolla, CA 92038

ABSTRACT

Aerial line-transect surveys were conducted during 1993-1994 to determine the relative spatial and seasonal distribution and abundance of marine mammals within a portion of the U.S. Navy Outer Sea Test Range, west of San Nicolas Island, California. A total of 13,734 km were surveyed within a 10,173 km^2 study area during a 17-month period, resulting in 462 on-effort sightings of 18 marine mammal species. Of 462 on-effort sightings, 89% were represented by 10 species or species groups: California sea lion, *Zalophus californianus* (237 on-effort sightings, 51% of all on-effort sightings); common dolphin, genus *Delphinus* (54, 12%); northern right whale dolphin, *Lissodelphis borealis* (26, 6%); Risso's dolphin, *Grampus griseus* (24, 5%); Pacific white-sided dolphin, *Lagenorhynchus obliquidens* (17, 4%); northern elephant seal, *Mirounga angustirostris* (13, 3%); fin whale, *Balaenoptera physalus* (11, 2%); all beaked whales (11, 2%); Dall's porpoise, *Phocoenoides dalli* (10, 2%); and blue whale, *Balaenoptera musculus* (8, 2%). Blue whales were encountered only in summer, while fin whales were present in every season. Gray whales were rarely encountered seaward of the Channel Islands. Numerically, common dolphins (26.45 animals/100 km) and northern right whale dolphins (26.24 animals/100 km) were the most abundant species, although northern right whale dolphins were absent from the study area in summer and fall. Seasonal encounter rates for all species combined were highest in summer (4.93 sightings/100 km), and lowest in fall (1.98 sightings/100 km). Group encounter rates (# sightings/100 km) and animal encounter rates (# animals/100 km) were highest in the eastern part of the study area, near the Santa Rosa-Cortes Ridge. The lowest group and animal encounter rates were found in the southwest portion of the study area, near the Patton Ridge and Patton Escarpment. Group encounter rates during calm sea states (4.81 sightings/100km, Beaufort 0-2) were nearly double that of rough sea states (2.51 sightings/100 km, Beaufort 3-4).

INTRODUCTION

In 1994, the U.S. Navy conducted two ship-shock trials utilizing 4,536 kg (10,000 lb) charges, detonated at sites within the Outer Sea Test Range (OSTR), approximately 167 km (90 nmi) southwest of San Nicolas Island, California. The trials were conducted on the Aegis-class destroyer *U.S.S. John Paul Jones* to test the structural integrity of the ship's hull, as well as electronic and fixed-structure systems. In order to minimize potential impact to marine mammals, the U.S. Navy requested information on their spatial and temporal distribution within a portion of the OSTR prior to the shock trials, so that trials could be conducted in those areas with the fewest marine mammals. Aerial surveys were conducted by the Southwest Fisheries Science Center (SWFSC) to meet this goal.

The aerial survey data collected during 1993-1994 were used by the SWFSC to recommend suitable shock trial sites to the U.S. Navy. Prior to the scheduled shock trials, a lawsuit was filed by the *Natural Resources Defense Council* (NRDC), challenging the SWFSC's choice of recommended shock trial sites. A U.S. District Court ruling and subsequent legal agreement resulted in the shock-trial sites being moved approximately 120 km (65 nmi) southwest of the SWFSC study area. The new shock-trial sites were then surveyed in April and May of 1994 prior to completion of the shock trials. It is not the intention of this report to review the legal processes or opinions which resulted in the movement of trial sites, but merely to report the marine mammal sighting data collected during aerial surveys. In addition to completing pre-trial surveys for the U.S. Navy, the SWFSC also placed marine mammal observers on board the *U.S.S. John Paul Jones* and in survey aircraft during the actual shock trial events to ensure that no marine mammals were within a 2 nmi radius of the vessel. A separate report detailing activities on the days of the shock trials and marine mammal mitigation efforts has been presented to the National Marine Fisheries Service by the U.S. Navy (Department of the Navy 1994).

MATERIALS AND METHODS

Study Areas

Three study areas (plus two analyzed sub-areas within one area) are described in this report. An emphasis is placed on the SWFSC study area and its two stratified sub-areas, since a majority of survey effort was conducted there. A brief summary of each area follows:

1. SWFSC study area

The original study area that was surveyed by the SWFSC from January 1993 through May 1994 comprises 10,173 km^2. Twenty-nine transects, totalling 2,345 km and ranging in length from 15 to 126 km were spaced 9 km apart to provide uniform coverage of the area (Figure 1). An attempt was made to survey the complete transect grid at least once each month. Frequently poor weather conditions in the study area prevented this from being accomplished. Additionally, military range operations within the OSTR eliminated approximately one quarter of all potential survey dates.

SWFSC Area "A"

This sub-area of the SWFSC study area covers 7,588 km^2 (Figure 2). Area A was eliminated from consideration as a ship-shock trial site based on its consistently higher animal encounter rates and group encounter rates of marine mammals.

SWFSC Area "B", recommended shock trial area

This other sub-area of the SWFSC study area covers 2,585 km^2 (Figure 2). Area B was recommended by the SWFSC to the Navy as a site suitable for shock trials, based on data collected through May of 1994[1]. Area B was chosen as the most suitable shock trial location based on overall lower animal and group encounter rates.

2. Area "C"

This 1,746 km^2 area is located approximately 120 km southwest of Area B (Figure 2). Area C is where ship-shock trials were eventually conducted. Surveys were flown here only in April and May of 1994, totalling 1,344 km of effort. Sixteen transects, totalling 525 km, and ranging in length from 8 to 58 km were spaced 9 km apart to provide uniform coverage of this area.

3. "Inshore Area"

This 33,403 km^2 area lies mostly east of the OSTR and was surveyed on an opportunistic basis when transiting to and from the SWFSC study area or, when poor weather conditions offshore precluded effective surveying within the SWFSC study area (Figure 3). Surveys here were done opportunistically, not along fixed transect lines.

Scientific Personnel

Wes Armstrong	NMFS/SWFSC	Marine Mammal Observer
Dr. Jay Barlow	NMFS/SWFSC	Program Leader/Marine Mammal Observer
Scott Benson	NMFS/SWFSC	Marine Mammal Observer
James Carretta	NMFS/SWFSC	Survey Coordinator/Observer
Susan Chivers	NMFS/SWFSC	Marine Mammal Observer
Terry Farley	NMFS/SWFSC	Marine Mammal Observer
Daniel Fink	NMFS/SWFSC	Data Recorder
Karin Forney	NMFS/SWFSC	Survey Coordinator/Observer
James Gilpatrick	NMFS/SWFSC	Marine Mammal Observer/Photogrammetrist
Fred Julian	NMFS/SWFSC	Data Recorder
Carrie LeDuc	NMFS/SWFSC	Marine Mammal Observer
Tim Lee	NMFS/SWFSC	Marine Mammal Observer
Mark Lowry	NMFS/SWFSC	Marine Mammal Observer
Morgan Lynn	NMFS/SWFSC	Marine Mammal Observer/Photogrammetrist
Joyce Sisson	NMFS/SWFSC	Marine Mammal Observer
Robin Westlake	NMFS/SWFSC	Marine Mammal Observer/Photogrammetrist

All marine mammal observers, with the exception of one, had prior experience with

[1] - In the Department of the Navy's final report to NMFS (Department of the Navy 1994), the SWFSC recommended shock trial areas shown differ from those presented here. The initially recommended areas were based on aerial survey data collected for the period January through June of 1993. Additional data were collected through May of 1994, which were used to update recommended trial areas. These recommended areas collectively represent "Area B".

identifying marine mammals in the field, either from aerial platforms, shipboard platforms, or both. The one observer without prior experience was limited to data recording duties during a period of marine mammal identification training.

Pilots

John Drust	Aspen Helicopters, Oxnard, CA.
Barry Hansen	Aspen Helicopters, Oxnard, CA.
Rick Throckmorton	Aspen Helicopters, Oxnard, CA.

Aircraft

Two models of *Partenavia* aircraft were utilized for the surveys. A twin-engine, turbo-prop *Partenavia Spartacus* was used on most surveys. When the *Spartacus* aircraft was not available, a twin-engine *Partenavia* P-68 was used. Both aircraft models were fitted with left and right side bubble windows just forward of the wings. The bubble windows provided observers with unobstructed viewing from the horizon (0° declination angle) to the trackline directly beneath the aircraft (90°), and approximately 10° of visual overlap directly below the aircraft. The bubble windows allowed observers to search ahead of and behind the aircraft as well. A rectangular viewing hole (30 x 50 cm) in the bottom of the *Spartacus* aircraft was fitted with optical glass to allow a third observer to monitor the trackline directly below the aircraft. A similar belly window in the P-68 model (25x30 cm) was covered with plexiglass. The aircraft maintained an altitude of approximately 213 m (700 ft) and airspeeds of 167-185 km/hr (90-100 knots) while surveying. The survey altitude was occasionally reduced to as low as 152 m (500 ft) due to low clouds.

Duty Stations

The aerial survey team consisted of three observers, one data recorder, and the pilot. Three observers rotated through three duty stations (left bubble window, right bubble window, and belly window) approximately every 45 minutes. The data recorder remained in his or her position for the duration of each flight. The left and right bubble windows were designated as "primary observer" stations, and the belly window observer was designated as a "secondary observer."

Primary Observers

The left and right observers searched with unaided eye through bubble windows on each side of the aircraft. To increase sighting efficiency near the trackline, primary observers limited their search for marine mammals out to a declination angle of 12° (1004 m perpendicular distance from the trackline). When marine mammals were sighted, the observer waited until the animals were perpendicular to the aircraft, and then measured a declination angle to the center of the group. The pilot was then instructed to direct the aircraft towards the group, so that observers could make species identifications and school size estimates.

Secondary Observer

A third observer searched with unaided eye through a rectangular belly window located in the tail section of the aircraft. This observer had a clear view of the trackline directly below and slightly forward of the aircraft out to approximately 65° declination angle (100 meters perpendicular distance) on each side of the trackline. The role of the secondary observer was to sight marine mammals near the trackline that were missed by primary observers. The secondary observer waited approximately 5-10 seconds to announce the presence of marine mammals when sighted, to ensure that they were well out of the view of the primary observers. These data are used to calculate the fraction of sightings missed by both observer teams. Bias caused by the fraction of sightings missed on a previous aerial survey is discussed by Forney *et al.* (1995) for various species groups and school sizes.

Data Recorder

The data recorder entered and updated all effort, environmental, and sighting data into a laptop computer. The types of effort, environmental, and sighting data recorded during the surveys were summarized in Carretta and Forney (1993). The data recorder terminated effort when the aircraft diverted from the transect line and ensured that observers were prepared to search before resuming effort. The data recorder did not actively search for marine mammals, and any sightings that were detected by the recorder were classified as "off-effort" sightings if they were not detected by primary or secondary observers (see explanation of on- and off-effort classifications in "Data Collection Procedures" section).

Data Collection Procedures

Aerial surveys were conducted during Beaufort sea states 0-4, following the sea state definitions from Bowditch (1966) (Table 1). Survey effort was normally terminated when conditions reached Beaufort 5, although 408 km of Beaufort 5 data were collected. These Beaufort 5 data were not used in the calculations of marine mammal group or animal encounter rates. Surveys within the OSTR were restricted primarily to weekends and occasional Fridays due to scheduled military operations the remainder of the week, although not all weekends were free of military operations.

A Toshiba[2] T-1000 or Sager[2] NP-500 laptop computer was used to record all effort and sighting data. The computer was linked to the aircraft's LORAN navigation system via a 25-to-9 pin serial port connector to obtain continuous location data. An event-driven, Pascal program was used to record effort and sighting data. The program captured current LORAN position data every minute and again when any survey events were recorded. These events included changes in altitude, airspeed, environmental conditions, observer positions, comments, and sighting information.

The left and right primary observers used Suunto[2] optical clinometers to measure the declination angle from the aircraft to sighted animals. Declination angles were used to calculate the perpendicular distance of sighted animals from the trackline. Due to space limitation, the secondary observer used hatch marks on the belly window to measure declination angles to sightings. These hatch marks were calibrated using a clinometer prior to the surveys. A table showing perpendicular distances from the trackline relative to declination angle is given in Appendix 1 of Carretta and Forney (1993).

Sightings were recorded as either "on-effort" or "off-effort". "On-effort" sightings were those made by primary and secondary observers while the aircraft was flying along a predetermined transect line and all three observers were actively searching for marine mammals. Sightings were categorized as "off-effort" in the following four cases:

1. Sightings made while the three observers were not actively searching along the transect line (i.e. when in transit).

2. Sightings made by the pilot or the data recorder, but missed by the primary and secondary observers.

3. Additional sightings made while circling to re-locate an on-effort sighting.

4. Sightings made beyond 12° declination angle (1004 m perpendicular distance).

Off-effort sightings are not used in the calculation of encounter rates presented in this report.

When marine mammals were sighted, the observer who first detected the animals announced their presence to the data recorder, who terminated effort and entered the sighting information into the computer. At this time, the belly window observer released a fluorescein dye marker from the aircraft to aid the pilot in relocating the marine mammals. After the declination angle was measured, the pilot was then instructed to direct the aircraft back to the location of the marine mammals. The computer program also provided dynamic distance and bearing information to the location where animals were first sighted.

During a sighting, the aircraft typically made several passes over the animals. Observers made species identifications at this time, and took notes on the features they observed. After a consensus was reached on the species identification, the pilot continued to circle the aircraft around the area so that observers could obtain school size estimates. Observers made three estimates: a best, high, and low estimate of the number of animals thought to be present. The observers entered their estimates into personal notebooks without discussing them, to avoid biasing or influencing each other. These estimates were entered into the data files at the end of the day by the survey leader.

---

[2]- Reference to trade names does not imply endorsement by the NMFS.

Occasionally, it was not possible to identify marine mammals to species. In these cases, the animals were assigned to various unidentified categories (i.e. "unidentified dolphin" or "unidentified whale"). In some cases, the observer could narrow the identification down to one of two species, for example,"common dolphin" (species code DD) or "Pacific white-sided dolphin" (species code LO). In this case, the codes for both species were combined: (DDLO). Two species of common dolphin (*Delphinus delphis* and *Delphinus capensis*) could not be distinguished by aerial observers and were both assigned the species code DD.

Aerial photogrammetry was used to obtain length data for cetaceans, and also to verify some species identifications. A 127 mm format, KA-45 military reconnaissance camera was mounted in the belly window of the plane. The camera has a 152 mm focal length lens, and a forward motion compensator to eliminate blurring by forward aircraft motion. Photographs were taken on Kodak 3404 Plus-X black-and-white film, which was exposed through a Wratten 9 filter to increase contrast between subject and water. A second Toshiba T-1000 laptop computer was linked to the aircraft's radar altimeter to obtain accurate and continuous altitude data during photographic operations. Photogrammetric methods of length determination are reviewed by Perryman and Lynn (1993). Photographs obtained during the surveys will be analyzed at a later date, and used to distinguish short-beaked and long-beaked common dolphins (*Delphinus delphis* and *Delphinus capensis*), which have recently been recognized as two distinct species based on genetic and morphological evidence (Rosel et al. 1994, Heyning and Perrin 1994).

Data Presentation

Bathymetry contours (200, 500, 1,000, 2,000, and 3,000 meters) and the major submarine features (Patton Escarpment, Patton Ridge, Santa Rosa-Cortes Ridge, and San Juan Seamount) are shown for the Southern California Bight (SCB) in Figure 4. Bathymetric contours also appear in all subsequent species plots.

Seasonal data presented in this report are based on the following monthly divisions: winter (December - February), spring (March - May), summer (June - August), and fall (September - November).

Two types of encounter rates are presented. *Group encounter rates* represent the number of on-effort marine mammal schools or groups detected per 100 km of survey effort. *Animal encounter rates* refer to the number of individual animals detected per 100 km of survey effort. Only *on-effort* sightings are used in the calculation of both encounter rate types.

Species plots are not consistent with regard to effort-type. For the frequently encountered species (such as California sea lion and common dolphins), only on-effort sightings are plotted. Plotting of numerous off-effort sightings of these species would have confounded effort-based distributional patterns due to the large number off-effort sightings recorded during transit flights to and from the study areas, and between transect lines. Endangered species (such as blue, fin, and sperm whales), and rarely encountered species (such as Cuvier's beaked whale and pygmy sperm whale) are represented by *both* on and off-effort sightings in their respective plots.

RESULTS

Effort

Surveys were cancelled and/or aborted on approximately half of all available weekends due to poor weather. Additionally, approximately a quarter of all weekends were unavailable for surveying due to military operations. Surveys effort was conducted on a total of 58 dates. Of these 58 dates, there were 45 in which survey effort was conducted within the SWFSC study area. A summary of survey dates and kilometers surveyed for each date is given in Table 2.

A total of 17,650 km were searched within the entire Southern California Bight (SCB). Within the SWFSC study area, 13,734 km were surveyed from January 1993 through May 1994. The relative spatial survey effort within the SWFSC study area is shown in Figure 5. Survey effort was most concentrated in the southeast portion of the study area. Winter and spring survey effort was double that of summer and fall because of the greater number of winter and spring survey dates available during the 17-month study. The total number of kilometers surveyed within each area, season, and sea state category are given in Table 3.

Spatial and Temporal Overview

Group and animal encounter rates are summarized by area in Table 3. The highest group encounter rate (8.50 sightings/100 km) occurred in the Inshore Area, the lowest in Area C (0.89 sightings/100 km). Animal encounter rates were highest in the Inshore Area (542 animals/100 km) and lowest within Area B (37.2 animals/100 km). Area B is that which the SWFSC recommended for shock trials.

Relative spatial group encounter rates within the SWFSC study area are shown in Figure 6. Within the SWFSC study area, group encounter rates were highest in the northeastern extreme near the Santa Rosa-Cortes Ridge (corresponding to Area A). Generally, group encounter rates were higher in the northern half of the SWFSC study area. The lowest group encounter rates were found in the southwest quarter of the SWFSC area, which corresponds to Area B. Group encounter rates in Area A (3.54 sightings/100 km) were nearly double that of Area B (1.88 sightings/100 km). Seasonally, the overall SWFSC area group encounter rate was highest in summer (4.93 sightings/100 km), and lowest in fall (1.98 sightings/100 km).

Relative spatial animal encounter rates within the SWFSC study area are shown in Figure 7. Animal encounter rates within the SWFSC study area were also highest near the northeastern extreme, with a second area of relatively high animal encounter rates east of the San Juan Seamount. Areas of relatively low animal encounter rates were found near the center of the SWFSC study area, over the Patton Ridge. The animal encounter rate in Area A (169.3 animals/100 km) was approximately 4.5 times greater than in Area B (37.2 animals/100 km). Seasonally, animal encounter rates were highest within the SWFSC study area in spring (189.4 animals/100 km), and lowest in winter (78.0 animals/100 km).

Effects of Beaufort Sea State

Group encounter rates within the SWFSC study area were approximately twice as high (4.81 sightings/100 km) in calm sea states (Beaufort 0-2) than in rough sea states (Beaufort 3-4, 2.51 sightings/100 km). Previous studies have shown that sighting rates decline with an increase in Beaufort sea state (Holt and Cologne 1987, Forney *et al.* 1991). Additionally, it has been shown that apparent densities of harbor porpoise are reduced with increasing cloud cover, due to decreased light penetration of the sea-surface (Barlow *et al.* 1988, Forney *et al.* 1991). This is intuitively obvious, as marine mammals are more difficult to detect in poor conditions. The sea state effect on encounter rates is confounded within the SWFSC study area due to the large weather gradient found there. Sea state (and marine fog) conditions were consistently worse in the western half of the study area, while group encounter rates also decreased with increasing distance from shore. Although other researchers have also shown that cetaceans are more abundant in the productive coastal waters than in the offshore waters of the California Current (Smith *et al.* 1986), it is unknown how much the observed differences in inshore/offshore group encounter rates are based on real marine mammal abundance or reduced observer effectiveness in higher sea states. This is not easily determined due to geographic biases in both parameters. It may be possible to establish group encounter rate correction factors for differing Beaufort sea states (as well as other environmental variables such as cloud cover) if the analysis is confined to an area small enough to eliminate the effects of spatial heterogeneity in weather and marine mammal abundance.

Species Accounts

Within the SWFSC study area, 18 marine mammal species were identified, which included 15 cetacean and 3 pinniped species. Sighting information for these 18 species is summarized in Table 4. Bottlenose dolphins, striped dolphins, and humpback whales were only identified outside of the SWFSC study area.

The highest group encounter rate was found for California sea lions (1.82 sightings/100 km), followed by common dolphins (0.394 sightings/100 km) and northern right whale dolphins (0.189 sightings/100 km). Common dolphins had the highest animal encounter rate (26.45 animals/100 km), followed closely by northern right whale dolphins (26.24 animals/100 km). Northern right whale dolphin had the largest mean school size (138.8 animals, range= 2-2,263), which was more than double than that of the common dolphin (67.3 animals, range= 1-2,000). California sea lions were the most frequently detected marine mammal (1.82 sightings/100 km), although their mean school size was small (1.4 animals, range= 1-16). Fin whales were the most commonly detected large whale and were detected during all seasons (0.081 sightings/100 km). As a group, the beaked whales (Cuvier's, Baird's, *Mesoplodon* spp., and unidentified ziphiids) were seen just as frequently (0.081 sightings/100 km) as fin whales. Blue whales were the next most commonly encountered whale (0.059 sightings/100 km), with all of the sightings occurring in summer.

Detailed sighting information for each species seen within the SWFSC study area is given in the following sections. Species sighting data are summarized by season and school size in Tables 5-6. A summary of the species codes used during the surveys is given in Table 7, and a summary of all on and off-effort coded sightings is given in Table 8. Abundance estimates provided in the following species summaries are for California waters only, unless otherwise specified. Estimates are based on 1991-1992 winter and spring aerial surveys (Carretta and Forney 1993, Forney *et al.* 1995) and a 1991 summer and fall ship survey (Hill and Barlow 1992, Barlow 1995), unless noted otherwise. All associated confidence intervals (C.I.) are log-normal and are given at the 95% level. Mean school sizes and ranges are given for on-effort sightings within the SWFSC study area only.

Dolphins and Porpoises

Common dolphins (*Delphinus delphis* and *Delphinus capensis*): Common dolphins were the most frequently encountered cetacean (54 on-effort sightings, 0.394 sightings/100 km) within the SWFSC study area. Seasonally, common dolphins were encountered much more frequently in summer and fall (0.734 sightings/100 km), than in winter and spring (0.227 sightings/100 km). The highest group encounter rate occurred in summer (1.19 sightings/100 km), and the lowest (0.17 sightings/100 km) in winter. The locations of all on-effort common dolphin sightings are shown in Figure 8.

Common dolphins are the most abundant cetacean in California waters, occurring in large schools throughout the SCB (Forney *et al.* 1995, Barlow 1995). Two species of common dolphins, the "short-beaked" *Delphinus delphis*, and "long-beaked" *Delphinus capensis*, occur within the SCB (Heyning and Perrin 1994, Rosel *et al.* 1994). Current abundance estimates based on aerial surveys of common dolphins for the winter and spring period are 305,694 (C.I.= 159,864-584,552, Forney *et al.* 1995). Because short-beaked and long-beaked common dolphins are indistinguishable from the air, this abundance estimate combines of both forms. Summer and fall abundance estimates (Barlow 1995) are 225,821 short-beaked (C.I. = 132,139-385,918) and 9,472 long-beaked common dolphin (C.I. = 2,817-31,842), based on a ship survey. An additional 10,286 unclassified common dolphin (C.I.= 2,539-41,664) were estimated, bringing the total summer and fall common dolphin estimate to 245,579 animals (Barlow 1995). During this summer and fall ship survey, fourteen sightings of long-beaked common dolphin were recorded (Hill and Barlow 1992). Twelve of the 14 long-beaked sightings were clustered around the northern Channel Islands of San Miguel, Santa Rosa, and Santa Cruz (the remaining two were within 10 nmi of the mainland). Sightings of short-beaked common dolphin were also found near the northern Channel Islands, but a majority of the 155 short-beaked sightings reported were spread far offshore to approximately 300 nmi, and north to latitude 39^0 N. This distribution pattern is consistent with the known "nearshore" habits of long-beaked common dolphin (Heyning and Perrin 1994). Previous work has suggested evidence of mixing of "nearshore" and "pelagic" forms over the Santa Rosa-Cortes Ridge and Patton Escarpment, and that west of the Patton Escarpment, only the pelagic form is found (Dohl *et al.* 1986). Although aerial observers are not able to differentiate the two species of common dolphin, aerial photogrammetry has allowed for the differentiation of common dolphin stocks within the eastern tropical Pacific (Perryman and Lynn 1993). Aerial photographs taken during the present study will be analyzed for this purpose, and this information will be presented in a later report.

Northern right whale dolphin (*Lissodelphis borealis*): Within the SWFSC study area, twenty six on-effort sightings of northern right whale dolphin were recorded in winter and spring. No northern right whale dolphin were seen during summer, and only one on-effort group of two animals was detected in the fall, just outside of the SWFSC area. Group encounter rates for the winter and spring were similar (0.30 and 0.26 sightings/100 km, respectively). Northern right whale dolphin occurred in the largest schools, averaging 138.8 animals (range 2-2,500). The average school size increased from 13.9 animals (14 sightings) in winter to 284.3 animals (12 sightings) in spring, possibly in response to warming water temperatures and as a precedent to migration out of the region. Additional analyses of northern right whale dolphin school sizes relative to season and water temperature may reveal if there is a true seasonal component. The locations of all on-effort northern right whale dolphin sightings are shown in Figure 9.

The observed sighting patterns during this study are consistent with previous observations that indicate that northern right whale dolphins are a winter/spring visitor to the shelf waters of the SCB, when sea-surface temperatures are generally coldest, and less abundant during seasonal warm-water periods (Leatherwood and Walker 1979, Dohl *et al.* 1980, Carretta and Forney 1993). The observed seasonal distributions are reflected in recent abundance estimates. Winter and spring abundance estimates are 21,332 northern right whale dolphin (C.I.= 9,548-47,658), while summer and fall estimates are lower; 9,342 (C.I. = 3,322-26,272); (Forney *et al.* 1995, and Barlow 1995, repectively).

Risso's dolphin (*Grampus griseus*): Twenty four on-effort sightings of Risso's dolphins were recorded within the SWFSC study area,. Risso's dolphin were encountered within the SWFSC study area in all seasons except fall, and were the third most encountered cetacean (0.173 sightings/100 km). The mean school size ranked third among all species at 34.3 animals (range= 3-238). Group encounter rates were highest in winter (0.30 sightings/100 km) and lowest in summer (0.10 sightings/100 km). The locations of all on-effort Risso's dolphin sightings are shown in Figure 10.

Risso's dolphin are commonly encountered near the Channel Islands and their abundance is apparently linked to warm-water periods (Leatherwood *et al.* 1980). Abundance estimates for the winter and spring (Forney *et al.* 1995) are 32,376 (C.I.= 13,812-75,891), and 8,496 (C.I. = 3,890-18,555) for the summer and fall (Barlow 1995). This difference in seasonal estimates may be due to movement of animals from Oregon and Washington into California waters in winter (Green *et al.* 1992, Forney *et al.* 1995).

Pacific white-sided dolphin (*Lagenorhynchus obliquidens*): Pacific white-sided dolphin were the fourth most commonly encountered cetacean species (0.124 sightings/100 km) within the SWFSC study area, and were seen in all seasons. The highest group encounter rate (0.30 sightings/100 km) occurred in summer, and the lowest group encounter rate (0.04 sightings/100 km) occurred in the fall. The mean school size was 24.2 animals (range= 2-163), which ranked fourth among all species. The locations of all on-effort Pacific white-sided dolphin sightings are shown in Figure 11.

Seasonal movements of Pacific white-sided dolphin along the U.S. west coast have been described by Dohl *et al.* (1980), Leatherwood *et al.* (1984), Green *et al.* (1992), and Carretta and Forney (1993). The observed seasonal trends within the SCB indicate that Pacific white-sided dolphin increase in abundance with decreasing water temperatures. Recently published abundance estimates of 121,693 animals (C.I. = 51,041-290,144) for the winter and spring (Forney *et al.* 1995) and 12,310 animals (C.I. = 4,590-33,010) for the summer and fall (Barlow 1995) support these observations.

Dall's porpoise (*Phocoenoides dalli*): Dall's porpoise were encountered within the SWFSC study area a total of 10 times and in every season except summer. The highest group encounter rate (0.10 sightings/100 km) occurred in spring. Most sightings occurred along the western edge of the Santa Rosa-Cortes Ridge, near the 1,000 m isobath. The mean school size for all groups was 4.0 animals (range= 1-8). The locations of all on-effort Dall's porpoise sightings are shown in Figure 12.

Dall's porpoise are infrequently seen in the SCB during warm-water periods (Dohl *et al.* 1980), while they can be found as far south as Baja California during cold-water periods (Leatherwood *et al.* 1972). During winter and spring aerial surveys in 1991 and 1992, Dall's porpoise was the most commonly sighted cetacean (Carretta and Forney 1993). Recent seasonal abundance estimates of Dall's porpoise are 8,460 (C.I.=5,320-13,453) for the winter and spring (Forney *et al.* 1995) and 78,422 (C.I. = 40,026-153,649) for the summer and fall (Barlow 1995). Although these two abundance estimates appear to contradict the observed seasonal distributions for this species, Forney *et al.* (1995) stated that the winter and spring aerial estimate of Dall's porpoise is likely to be biased downward considerably. This is due to the large fraction of time that Dall's porpoise spend diving, thus increasing the chances that an observer in a fast-moving aircraft would fail to detect the animals. Regardless of the seasonal disparity in abundance estimates, there were marked distributional differences for this species between the two studies. The summer and fall survey (Hill and Barlow 1992) showed that all 128 sightings of Dall's porpoise occurred north of Pt. Conception, while the winter and spring distribution was fairly uniform from the SCB north to the California/Oregon border (Carretta and Forney 1993).

Killer whale (*Orcinus orca*): Three on-effort sightings of killer whales were recorded within the SWFSC study area, two of which occurred on consecutive days 32 miles apart and may have represented some of the same animals. The mean school size for the three on-effort sightings was 2.3 animals (range= 1-4). Two off-effort sightings were recorded outside of the SWFSC study area, including a group of 6 to 8 animals just south of San Miguel Island in March of 1994. The locations of *all* (on and off-effort) killer whale sightings are shown in Figure 13.

Killer whale sightings in California waters are relatively rare and no resident populations have been identified (Forney 1994). Current abundance estimates are 65 animals (C.I. = 19-220) for the winter and spring (Forney *et al.* 1995) and 307 animals (C.I. = 48-1,947) for the summer and fall (Barlow 1995).

Short-finned pilot whale (*Globicephala macrorhynchus*): One off-effort sighting of nine pilot whales was recorded within the SWFSC study area in July of 1993 (Figure 14). Pilot whales were once common residents of the SCB, but have been infrequently sighted since the 1982-83 El Niño (Shane 1994). Twenty-five animals were observed and photographed off central California in the fall of 1991 (Jones and Szczepaniak 1992), and one sighting of four animals was reported in the SCB in 1992 (Carretta and Forney 1993). No pilot whales were sighted during an extensive ship survey in 1991 of California waters out to 555 km (300 nmi) (Barlow 1995). Five sightings of pilot whales were recorded off of central California during a 1993 ship survey (Mangels and Gerrodette 1994).

Baleen whales

Minke whale (*Balaenoptera acutorostrata*): Two minke whale sightings (one on effort) were recorded within the SWFSC study area. An additional five sightings were recorded in the Inshore Area. Six of the seven minke whale sightings contained single animals; the remaining sighting contained two. The locations of *all* (on and off effort) minke whale sightings are shown in Figure 15. Within the SCB, minke whales are usually seen over continental shelf waters, and are reported to be most common around the Channel Islands (Leatherwood *et al.* 1982). Current abundance estimates of minke whales are 73 (C.I.= 24-223) for the winter and spring (Forney *et al.* 1995) and 526 (C.I.= 106-2,596) for the summer and fall (Barlow 1995).

Blue whale (*Balaenoptera musculus*): Thirty one total sightings of blue whales were recorded, although only eight were on-effort sightings within the SWFSC area. All sightings within the SWFSC area occurred in summer, and most occurred along the Santa Rosa-Cortes Ridge. The mean school size for the eight on-effort sightings was 1.5 animals (range= 1-3). The location and timing of blue whale sightings in southern California waters suggests that they may be encountered any time of the year; however, they appear rare in winter and spring and become abundant in the study area and in surrounding waters in the summer and fall. The locations of all thirty-one blue whale sightings are shown in Figure 16.

In the SCB, blue whales are reported to be common from July through October, west of the Channel Islands along the Patton Escarpment (Leatherwood *et al.* 1982). North-to-south seasonal movements of blue whales have been documented with photo-identification of individuals. Whales that have been photographed off of Baja California in March and April have been resighted off central California near Monterey Bay and the Gulf of the Farallones in September and October (Calambokidis *et al.* 1990). Concentrations of up to 40 whales occur in September near San Miguel and Santa Rosa Islands, where the whales have been seen feeding on large krill swarms (NMFS, unpublished data). An abundance estimate of 2,250 blue whales (C.I.= 1,093-4,632) in California waters was recently reported by Barlow (1995), based on a 1991 summer and fall ship survey and a study area that extended out 555 km (300 nmi) from the coast. During 1991-1992 winter and spring aerial surveys, two blue whale sightings were recorded off southern California in February and March of 1992, during which time waters were warmer than normal due to an El Niño event (Carretta and Forney 1993).

Fin whale (*Balaenoptera physalus*): The fin whale was the most commonly encountered whale species within the SWFSC study area (0.081 sightings/100 km). Fin whales were encountered in every season, and most frequently in fall. Eleven on-effort sightings were recorded within the SWFSC study area. The mean school size for all seasons was 1.9 animals (range= 1-4). One off-effort sighting of at least 8 whales was recorded in the SWFSC study area. All of the sightings were recorded east of the Patton Escarpment, over the continental shelf. The locations of all (on and off-effort) fin whale sightings are shown in Figure 17.

Within the range of central California south to Baja California, fin whales are most often found just outside (west) of the Channel Islands (Leatherwood *et al.* 1982). The year-round presence of fin whales in California suggests the possibility of a resident population (Barlow 1994). A total of 935 fin whales (C.I.= 299-2,925) were estimated during a 1991 summer and fall ship survey (Barlow 1995).

Gray whale (*Eschrichtius robustus*): Two gray whale sightings were recorded within the SWFSC study area (the one on-effort sighting was a cow-calf pair). The locations of *all* (on- and off-effort) gray whale sightings during this study are shown in Figure 18. A review of gray whale sightings recorded during Minerals Management Service (MMS) surveys from 1975-1983 and NMFS surveys from 1991-1994 shows that a majority of the gray whales migrate east of the SWFSC study area (Minerals Management Service 1993, NMFS unpublished data). A combined total of 473 MMS and NMFS gray whale sightings are shown in Figure 19, reflecting survey effort that extended well west of the Channel Islands. During winter and spring 1991-1992 aerial surveys, 29 sightings of gray whales were reported; none of these were recorded within the SWFSC study area (Carretta and Forney 1993).

The gray whale is the most common whale species found in California coastal waters during the winter and spring. The most recently published population estimate for the California gray whale is 20,869 (C.I.= 19,200 - 22,700), based on 1987-1988 counts of gray whales passing the Monterey area (Buckland *et al.* 1993). The population has reached pre-whaling population levels, and therefore recently has been taken off the endangered species list. Gray whales migrate very near to the coast, and from northwest to southeast along the axis of the Channel Islands, usually avoiding very deep water. Some gray whales use a migratory route west of the Channel Islands, although a majority of the whales pass inshore of the islands (Rice 1965, Leatherwood 1974).

Toothed Whales

Baird's beaked whale (*Berardius bairdii*): Four sightings (two on effort) of Baird's beaked whale were recorded within the SWFSC area, near the Patton Escarpment and Patton Ridge. Two of the sightings occurred in May, and two in July. The locations of all four Baird's beaked whale sightings are shown in Figure 20.

Baird's beaked whale is infrequently encountered along the continental slope in California waters. The distribution of Baird's beaked whale in Japanese waters has been described as being limited to the continental slope at a depth of 1,000 to 3,000 meters (Kasuya 1986). Sightings along the U.S. west coast appear to follow the same pattern. Green *et al.* (1992) reported five sightings of Baird's beaked whale off the coast of Oregon, four of which were in close proximity to the 2,000 m contour, and the fifth occurring in deeper water westward. Three sightings of Baird's beaked whale were reported during a 1991 ship survey (Hill and Barlow 1992); all three sightings occurred in August, in water depths 1,000 m or greater. Dohl *et al.* (1983) found this species to be most abundant off California from June through October. No Baird's beaked whales were seen during 1991-1992 aerial surveys in winter and spring (Carretta and Forney 1993). A ship survey in 1993 resulted in five Baird's beaked whale sightings in August, four of which occurred in water deeper than 1,000 m (Mangels and Gerrodette 1994). The only available abundance estimate of Baird's beaked whale in California waters is 38 whales (C.I. = 7-203, Barlow 1995), which is based on one on-effort sighting. This estimate is likely to be negatively biased due to the species' deep-diving habits.

Pygmy sperm whale (*Kogia breviceps*): One sighting of a single pygmy sperm whale was recorded approximately 89 km (48 nmi) southwest of San Nicolas Island (Figure 21). From a survey aircraft, the pygmy sperm whale can be distinguished from the dwarf sperm whale based on size, if a large animal is encountered. The maximum reported length for *K. breviceps* is 4.28 meters, for a specimen from the Indian Ocean (Chantrapornsyl *et al.* 1991). The animal that was sighted during our surveys was estimated to be approximately 3.6-3.9 meters by one observer (JVC), well above the maximum reported length (2.7 m) for the dwarf sperm whale, *K. simus* (Caldwell and Caldwell 1989). The length estimate was based on the observation that the animal was nearly identical in size to an adult Risso's dolphin (*Grampus griseus*), a species that all observers had frequently seen from the air. Another observer on board the aircraft had seen *K. simus* numerous times from aerial platforms in the eastern tropical Pacific, and concurred that the animal in question was not that species.

Pygmy sperm whales are rarely identified at sea due to their cryptic habits and similarity to the dwarf sperm whale (*Kogia simus*). The only available abundance estimate for pygmy sperm whales in California waters is 870 (C.I.= 220-3,433), based on 2 on-effort sightings during a 1991 ship survey (Barlow 1995). Although both species of *Kogia* occur in California waters and further north, [as evidenced by stranded animals; Hubbs (1951), Roest (1970), Jones (1981), Nagorsen and Stewart (1983) and Eliason and Houck (1986)], only *K. breviceps* has been identified at-sea in California waters despite extensive cetacean surveys by both the SWFSC and other researchers. *K. simus* has however, been commonly identified by SWFSC observers in the eastern tropical Pacific, being sighted 84 times during ship surveys between 1986-1990 (Wade and Gerrodette 1993). By comparison, *K. breviceps* was sighted only four times during the same study, with all four sightings occurring north of 24° N latitude. These data are in agreement with the observed tendency of *K. simus* to occur more frequently in warmer seas (Caldwell and Caldwell 1989), while *K. breviceps* occurs in more temperate waters.

Sperm whale (*Physeter macrocephalus*): Eleven sightings of sperm whales were recorded in the SWFSC study area, and one (off effort) in Area C. Most of these sightings occurred along the Patton Escarpment near the 2,000-3,000 meter contour. The locations of *all* (on and off-effort) sperm whale sightings are shown in Figure 22.

Off of southern California, sperm whales may be encountered during any season in offshore waters, most often seaward of the continental shelf. Current abundance estimates of sperm whales in California waters are 892 (C.I.= 176-4,506) for the winter and spring (Forney *et al.* 1995) and 756 (C.I.= 303-1,886) for the summer and fall (Barlow 1995). Sperm whales are deep-divers, reaching depths as great as 2,000 m, and possibly 3,000 m (Rice 1989, Watkins *et al.* 1993). Most deep dives are made by large males (Rice 1989). Watkins *et al.* (1985) reported a maximum dive time of 138 minutes for a group of whales. Lockyer (1977) reported that most dives (77.1%) are less than 500 m, and that 96.7% are less than 30 minutes. Due to the deep-diving habits of this species, Barlow (1994) noted that abundance estimates from aerial surveys are likely to be biased downward by a factor of three to eight.

Cuvier's beaked whale (*Ziphius cavirostris*): Twelve sightings of Cuvier's beaked whale were recorded within the SWFSC study area, and one within Area C. Cuvier's beaked whale was encountered in every season except summer. Eight of the SWFSC study area sightings were on-effort. Two of these eight sightings were recorded during Beaufort 5 conditions, and are therefore not included in calculation of encounter rates. The locations of all on and off effort (n=14) Cuvier's beaked whale sightings are shown in Figure 23.

The general rarity of sightings prevents seasonal movements to be determined within California waters. Leatherwood *et al.* (1982) reported that Cuvier's beaked whale sightings were rare in continental shelf regions of California, even where survey effort had been extensive. Four sightings from the present study occurred over the continental shelf, in waters 500 to 1,000 meters deep, near the Santa Rosa-Cortes Ridge and the Patton Ridge, while the remaining ten sightings occurred in waters greater than 1,000 m deep. An abundance estimate of 1,621 (C.I. = 396-6,637) Cuvier's beaked whales was reported by Barlow (1995). The true number of Cuvier's beaked whales is likely to be much higher, due to the deep-diving habits of the species.

Mesoplodont beaked whales (*Mesoplodon* spp): Two sightings of *Mesoplodon* species (one in the SWFSC study area, the other in Area C) were recorded, and the locations are shown in Figure 24. The SWFSC study area sighting contained one animal and the Area C group contained two animals. At least five species of *Mesoplodon* occur off the U.S. west coast (Forney 1994), but the species are difficult to distinguish in the field. The only available population estimate of *Mesoplodon* spp. in California waters is 250 (C.I.= 60-1,040, Barlow 1995). This estimate is also likely to be negatively biased due to the deep-diving habits of the genus. Members of the genus *Mesoplodon* are similar in their sighting characteristics to Cuvier's beaked whale (low, often barely visible blow, and tendency to remain at the surface for brief periods). The infrequency of *Mesoplodon* sightings in comparison with Cuvier's beaked whale during this study may suggest that mesoplodont beaked whales are less numerous within the SCB, or perhaps spend more time at depth than do Cuvier's beaked whale.

Pinnipeds

Northern elephant seal (*Mirounga angustirostris*): Elephant seals were seen in every season within the SWFSC study area. All sightings were of single animals, and the locations of all sightings are shown in Figure 25. The most recent (1991) population estimate for elephant seals along California and Baja California is 127,000 animals (Stewart *et al.* 1994). The largest elephant seal rookeries in southern California occur on San Miguel and San Nicolas Islands, respectively. Elephant seals are difficult to detect from an aircraft because they spend the majority of their time at sea diving. DeLong and Stewart (1991) reported that adult male elephant seals were submerged 86% of the time that they were at sea, reaching depths as great as 1,529 m. Because of this, the group encounter rates presented in this report are likely to be biased downward by a factor of seven or greater.

Harbor seal (*Phoca vitulina*): Two sightings of single harbor seals were recorded within the SWFSC study area, and these sighting locations are shown in Figure 26. The relative scarcity of harbor seal sightings within the SWFSC study area is probably linked to this species' coastal habits, and the fact that they are less abundant than other pinniped species. A combined 1993 count of 3,166 seals for all 8 California Channel Islands was reported by Hanan and Beeson (1994). This number is an index of abundance, which is estimated to represent approximately 50 to 70 percent of the peak seasonal abundance.

California sea lion (*Zalophus californianus*): California sea lions were the most frequently encountered species within the SWFSC area (1.82 sightings/100 km), although the mean school size was only 1.4 animals (range= 1-16). Sea lions were sighted throughout the study area, and were encountered most frequently over the Santa Rosa-Cortes Ridge and west of San Nicolas Island. The highest group encounter rates were in summer (2.54 schools/100 km) when animals are breeding and pupping, and nursing females make frequent foraging trips to sea. The locations of all on-effort sightings are shown in Figure 27. California sea lions are the most abundant pinniped species in southern California. The largest breeding rookeries occur at San Miguel and San Nicolas Islands, respectively. Based on growth rates obtained from yearly pup counts at breeding colonies, an assumed stable age structure, and a hypothetical survivorship schedule, the population estimate for the U.S. stock in 1990 was 111,016 individuals[3] (C.I.= 101,361-143,211).

Sightings that were not identified to species and species that were only seen outside of the SWFSC area are shown in Figures 28-34.

[3] - Lowry, M.S. *et al.* (1992). Status of the California sea lion (*Zalophus californianus californianus*) population in 1992. Administrative Report LJ-92-32, available from the Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038, 34 pp.

ACKNOWLEDGEMENTS

This project was made possible through the dedication of many people. The field biologists who collected the marine mammal data were: Wes Armstrong, Scott Benson, Susan Chivers, Terry Farley, Daniel Fink, Jim Gilpatrick, Fred Julian, Carrie LeDuc, Tim Lee, Morgan Lynn, Mark Lowry, Joyce Sisson, Robin Westlake (and J.B, J.V.C. and K.A.F.). Tim Gerrodette and Tim Lee (and J.B.) wrote the computer programs used to plot marine mammal sighting and effort data. Software for recording transect data was written by Jim Cubbage (and J.B.). Rich Cosgrove provided the bathymmetry data used in sighting plots. Aspen Helicopters of Oxnard, CA provided the aircraft support, and they were willing to cut holes in their aircraft numerous times to accomodate our needs. We thank pilots John Drust, Barry Hansen, and Rick Throckmorton for their enthusiasm and professionalism. Sami Adlay and Joe Kimbrough helped coordinate flight scheduling within the Outer Sea Test Range. Chuck Elsbury provided technical expertise in setting up an aerial expendable thermograph system. This project was funded by the U.S. Navy's Naval Air Warfare Center in Pt. Mugu, California. Data collected near the Channel Islands were collected under permit CINMS-01-93, issued to the Southwest Fisheries Science Center. All of the data were collected under marine mammal permit #748 issued to the Southwest Fisheries Science Center. This report was improved by the reviews of Andy Dizon and Sue Moore.

LITERATURE CITED

Barlow, J., C. Oliver, T.D. Jackson, and B.L. Taylor. 1988. Harbor porpoise (*Phocoena phocoena*) abundance estimation in California, Oregon, and Washington: II. Aerial surveys. Fishery Bulletin U.S. 86:433-444.

Barlow, J. 1994. Recent information on the status of large whales in California waters. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-203. Available from NMFS, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, California, 92038. 27 pp.

Barlow, J. 1995. The abundance of cetaceans in California waters. Part I: Ship surveys in summer and fall 1991. Fishery Bulletin U.S. 93:1-14.

Bowditch, N. 1966. American practical navigator, an epitome of navigation. U.S. Naval Oceanographic Office. H.O. Pub. No. 9. Washington, DC. 1524 pp.

Buckland, S.T., J.M. Breiwick, K.L. Cattanach, and J.L. Laake. 1993. Estimated population size of the California gray whale. Marine Mammal Science 9(3):235-249.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, C. Ewald, S. Kruse, R. Wells, and R. Sears. 1990. Sightings and movements of blue whales off central California 1986-1988 from photo-identification of individuals. Rept. Int. Whal. Commn., Special Issue 12:343-348.

Caldwell, D.K. and M.C. Caldwell. 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville, 1838): Dwarf sperm whale *Kogia simus* Owen, 1866. In: Ridgway, S.H. and Harrison, R. (eds), Handbook of Marine Mammals, Vol. 4. p. 235-260. Academic Press Limited.

Carretta, J.V. and K.A. Forney. 1993. Report of two aerial surveys for marine mammals in California coastal waters utilizing a **NOAA** DeHavilland Twin Otter Aircraft, March 9 - April 7, 1991 and February 8 - April 6, 1992. NOAA Technical Memorandum-NOAA-TM-NMFS-SWFSC-185. Available from NMFS, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, California, 92038. 77 pp.

Chantrapornsyl, S., C.C. Kinze, S. Leatherwood, and W.P. Prematunga. 1991. Notes on the genus *Kogia* in the northern Indian Ocean. Mar. Mammal Tech. Rep. 3:79-88. (In: Leatherwood S. and G.P. Donovan (eds.). 1991. Cetaceans and Cetacean Research in the Indian Ocean Sanctuary. Nairobi, Kenya. United Nations Environment Programme, Marine Mammal Technical Report Number 3. viii + 287 pp.).

DeLong, R.L. and B.S. Stewart. 1991. Diving patterns of northern elephant seal bulls. Marine Mammal Science 7(4):369-384.

Department of the Navy. 1994. Marine mammal protection/mitigation and results summary for the shock trial of USS John Paul Jones (DDG 53). Prepared By: Commander, Naval Air Warfare Center, Weapons Division 521 9th St. Point Mugu, CA 93042-5001. Available from Office of Protected Resources, National Marine Fisheries Service, 1335 East-West Highway, Silver Spring, MD 20910-3226. 26 pp.

Dohl, T.P., K.S. Norris, R.C. Guess, J.D. Bryant and M.W. Honig. 1980. Cetacea of the Southern California Bight. Part II, Summary of marine mammal and seabird surveys of the Southern California Bight area, 1975-1978. Final Report to the Bureau of Land Management, NTIS Rep. No. PB81248189. 414 pp.

Dohl, T.P., M.L. Bonnell, and R.G. Ford. 1986. Distribution and abundance of common dolphin (*Delphinus delphis*), in the southern California Bight: A quantitative assessment based upon aerial transect data. Fishery Bulletin U.S. 84:333-343.

Eliason, J.J. and W.J. Houck. 1986. Notes on the biology of a gravid pygmy sperm whale (*Kogia breviceps*) from California. Cetology (51):1-5.

Forney, K.A., D.A. Hanan, and J. Barlow. 1991. Detecting trends in harbor porpoise abundance from aerial surveys using analysis of covariance. Fishery Bulletin U.S. 89(3):367-377.

Forney, K.A. 1994. Recent information on the status of odontocetes in Californian waters. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-202. Available from NMFS, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, California, 92038. 87 pp.

Forney, K.A., J. Barlow, and J. Carretta. 1995. The abundance of cetaceans in California waters: Part II: Aerial surveys in winter and spring of 1991 and 1992. Fishery Bulletin U.S. 93:15-26.

Green, G., J.J. Brueggeman, R.A. Grotendt, C.E. Bowlby, M.L. Bonnell, and K.C. Balcomb, III. 1992. Cetacean distribution and abundance off Oregon and Washington. Chapter 1 In: Oregon and Washington Marine Mammal and Seabird Surveys. Final Report prepared for Pacific OCS Region, Minerals Management Service, U.S. Department of the Interior, Los Angeles, California, May 1992.

Hanan, D.A. and M.J. Beeson. 1994. Harbor seal, *Phoca vitulina richardsi*, census in California, May-June 1993. Final Report Cooperative agreement No. NA27FX0273-01. Submitted to NOAA/SWR, January 1994, 61 pp.

Heyning, J.E. and W.F. Perrin. 1994. Evidence for two species of common dolphins (genus *Delphinus*) from the eastern north Pacific. Contr. Nat. Hist. Mus. L.A. County, 442:1-35.

Hill, P.S. and J. Barlow. 1992. Report of a marine mammal survey of the California coast aboard the research vessel *McArthur*, July 28-November 5, 1991. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-169. Available from NMFS, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, California, 92038. 103 pp.

Holt, R.S., and J. Cologne. 1987. Factors affecting line transect estimates of dolphin school density. Journal of Wildlife Management 51:836-843.

Hubbs, C.L. 1951. Eastern Pacific records and general distribution of the pygmy sperm whale. Journal of Mammalogy Vol 32(4):403-410.

Jones, R.E. 1981. Food habits of smaller marine mammals from Northern California. Proc. Calif. Acad. Sci. 42:409-433.

Jones, P.A. and I.D. Szczepaniak. 1992. Report on the seabird and marine mammal censuses conducted for the long-term management strategy (LTMS), August 1990 through November 1991, for the U.S. Environmental Protection Agency, Region IX, San Francisco. July 1992.

Kasuya, T. 1986. Distribution and behavior of Baird's beaked whales off the Pacific coast of Japan. Sci. Rep. Whales Res. Inst. Tokyo No. 37, pp 61-83.

Leatherwood, J.S. 1974. Aerial observations of migrating gray whales, Eschrichtius robustus, off southern California. Mar. Fish. Rev. 36(4):45-49.

Leatherwood, S., and W.A. Walker. 1979. The northern right whale dolphin *Lissodelphis* *borealis* Peale in the eastern North Pacific. In Winn, H.E., and B.L. Olla (eds.), Behavior of Marine Mammals, p. 85-141. Plenum Press, New York-London.

Leatherwood, S., W.F. Perrin, V.L. Kirby, C.L. Hubbs, and M. Dahlheim. 1980. Distribution and movements of Risso's dolphin, *Grampus griseus*, in the eastern north Pacific. Fishery Bulletin U.S. 77(4):951-963.

Leatherwood, S., R.R. Reeves, W.F. Perrin, and W.E. Evans. 1982. Whales, dolphins, and porpoises of the Eastern North Pacific and adjacent arctic waters: A guide to their identification. NOAA Tech. Rep. NMFS Circular 444, 245 pp.

Leatherwood, S., R.R. Reeves, A.E. Bowles, B.S. Stewart, and K.R. Goodrich. 1984. Distribution, seasonal movements, and abundance of Pacific white-sided dolphins in the eastern north Pacific. Sci. Rep. Whales Res. Inst. 35:129-157.

Lockyer, C. 1977. Observations on diving behavior of the sperm whale, *Physeter catodon*. Pages 591-609 *in* M. Angel, ed. A voyage of discovery. Pergamon Press, Oxford and New York.

Mangels, K.F., and T. Gerrodette. 1994. Report of cetacean sightings during a marine mammal survey in the eastern Pacific Ocean and the Gulf of California aboard the NOAA ships *McArthur* and *David Starr Jordan*, July 28 - November 6, 1993. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-211. Available from NMFS, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, California, 92038. 88 pp.

Minerals Management Service. 1993. Marine Mammal and Seabird Computer Database Analysis System California OCS 1975-1985. MMS U.S. Department of the Interior Minerals Management Service Pacific OCS Region Contract No:14-35-0001-30596. Prepared by Ecological Consulting, Inc. Portland, Oregon January 1993; available on CD-ROM.

Nagorsen, D.W. and G.E. Stewart. 1983. A dwarf sperm whale (*Kogia simus*) from the Pacific coast of Canada. Journal of Mammalogy 64(3):505-506.

Perryman, W.L. and M.S. Lynn. 1993. Identification of geographic forms of common dolphins (*Delphinus delphis*) from aerial photogrammetry. Marine Mammal Science 9(2):119-137.

Rice, D.W. 1965. Offshore southward migration of gray whales off southern California. Journal of Mammalogy 46(3):504-505.

Rice, D.W. 1989. Sperm whale *Physeter macrocephalus* Linnaeus, 1758. pp. 177-233 *In*: Handbook of marine mammals volume 4: River dolphins and the larger toothed whales. Eds. Sam H. Ridgway and Sir Richard Harrison.

Roest, A.I. 1970. *Kogia simus* and other cetaceans from San Luis Obispo County, California. Journal of Mammalogy Vol. 51(2):410-417.

Rosel, P.E., A.E. Dizon, and J.E. Heyning. 1994. Population genetic analysis of two forms of the common dolphin (genus *Delphinus*) utilizing mitochondrial DNA control region sequences. Marine Biology 119:159-167.

Shane, S.H. 1994. Occurrence and Habitat Use of Marine Mammals at Santa Catalina Island, California from 1983-91. Bull. Southern California Acad. Sci. 93(1):13-29.

Smith, R.C., P. Dustan, D. Au, K.S. Baker, and E.A. Dunlap. 1986. Distribution of cetaceans and sea-surface chlorophyll concentrations in the California Current. Marine Biology 91:385-402.

Stewart, B.S., P.K. Yochem, H.R. Huber, R.L. DeLong, R.J. Jameson, W.J. Sydeman, S.G. Allen, and B.J. Le Boeuf. 1994. History and Present Status of the Northern Elephant Seal Population. pages 29-48 In: B.J. LeBoeuf and R.M. Laws (eds) Elephant Seals: Population Ecology, Behavior, and Physiology, pages 29-48. University of California Press.

Wade, P.R., and T. Gerrodette. 1993. Estimates of Cetacean Abundance and Distribution in the Eastern Tropical Pacific. Report of the International Whaling Commission 43:477-493.

Watkins, W.A., K.E. Moore and P. Tyack. 1985. Investigations of sperm whale acoustic behaviors in the southeast Caribbean. Cetology 49:1-15.

Watkins, W.A., M.A. Daher, K.M. Fristrup, and T.J. Howald. 1993. Sperm whales tagged with transponders and tracked underwater by sonar. Marine Mammal Science 9(1):55-67.

Table 1. Sea state conditions measured by the Beaufort scale (from Bowditch, 1966).

Wind force (Beaufort)	Knots	Descriptive	Sea Conditions	Probable wave height in feet
0	0- 1	Calm	Sea smooth and mirror-like	-
1	1- 3	Light air	Scale-like ripple without foam crests	1/4
2	4- 6	Light breeze	Small short wavelets; crests have a glassy appearance and do not break	1/2
3	7-10	Gentle breeze	Large wavelets; some crests begin to break; foam of glassy appearance. Occasional white foam crests	2
4	11-16	Moderate breeze	Small waves, becoming longer; fairly frequent white foam crests	4
5	17-21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white foam crests; there may be some spray	6
6	22-27	Strong breeze	Large waves begin to form; white foam crests are more extensive everywhere; there may be some spray	10

Table 2. Numbers of kilometers surveyed in the SWFSC study area and other areas on each of 58 survey dates. Dates where attempted survey flights were aborted due to poor weather are not included.

DATE	SWFSC STUDY AREA	OTHER AREAS	TOTAL
January 23, 1993	408	70	478
January 24, 1993	349	0	349
January 30, 1993	392	86	479
January 31, 1993	467	31	498
February 12, 1993	128	141	269
February 13, 1993	327	19	346
March 6, 1993	401	3	404
March 7, 1993	0	209	209
March 12, 1993	78	237	316
April 9, 1993	0	16	16
April 10, 1993	0	208	208
May 1, 1993	191	28	219
May 7, 1993	0	184	184
May 8, 1993	0	147	147
May 9, 1993	679	3	682
May 15, 1993	273	13	286
May 28, 1993	209	4	213
May 29, 1993	495	10	505
May 30, 1993	492	1	493
June 19, 1993	304	7	311
July 24, 1993	390	8	398
July 25, 1993	180	5	185
July 30, 1993	453	4	457
July 31, 1993	276	4	280
August 21, 1993	69	0	69
August 27, 1993	337	6	343
October 2, 1993	0	17	17
October 16, 1993	418	0	418
October 22, 1993	436	10	446

Table 2 (continued).

DATE	SWFSC STUDY AREA	OTHER AREAS	TOTAL
October 23, 1993	465	8	473
October 24, 1993	446	10	456
November 20, 1993	362	5	367
November 21, 1993	349	2	351
December 4, 1993	0	327	327
December 5, 1993	225	92	317
December 30, 1993	285	4	289
December 31, 1993	0	124	124
January 1, 1994	0	97	97
January 8, 1994	208	1	209
January 15, 1994	277	6	283
January 16, 1994	177	2	179
January 29, 1994	397	0	397
February 15, 1994	207	0	207
February 25, 1994	169	38	207
February 26, 1994	605	4	609
February 27, 1994	0	192	192
March 13, 1994	196	30	226
March 29, 1994	263	115	377
April 16, 1994	179	1	180
April 29, 1994	0	316	316
May 6, 1994	125	112	237
May 7, 1994	40	191	231
May 14, 1994	23	48	71
May 16, 1994	629	8	637
May 18, 1994	210	213	423
May 21, 1994	0	42	42
May 23, 1994	160	209	369
May 29, 1994	0	371	371

Table 3. Effort, group encounter rate, and animal encounter rate information for the three geographic and two sub-areas analyzed. Group encounter rates are the number of on-effort sightings per 100 km searched. Animal encounter rates represent the number of animals per 100 km searched. 17,650 km were surveyed in all areas.

Study Area	SWFSC[1]	Area A	Area B[2]	Area C[3]	Inshore
Size of Area (km^2)	10173	7588	2585	1746	33403
Km Surveyed (total)	13734	9795	3939	1344	2572
Beaufort 0-2 (calm)	4016	3257	759	133	1353
Beaufort 3-4 (rough)	9718	6538	3180	1211	1219
Winter	4615	3111	1504	-	1204
Spring	4639	3141	1499	1344	1306
Summer	2006	1639	368	-	30
Fall	2473	1904	569	-	32
Group Encounter Rate (overall)	3.07	3.54	1.88	0.89	8.50
Beaufort 0-2 (calm)	4.81	5.40	2.24	3.01	4.98
Beaufort 3-4 (rough)	2.51	2.86	1.79	0.66	7.63
Winter	3.01	3.70	1.60	-	11.50
Spring	3.06	3.25	2.67	0.89	4.98
Summer	4.54	5.24	1.36	-	23.00
Fall	1.98	2.31	0.88	-	22.10
Animal Encounter Rate (overall)	131.4	169.3	37.2	78.9	542.4
Beaufort 0-2 (calm)	140.9	167.6	26.1	327.9	142.6
Beaufort 3-4 (rough)	34.6	43.3	16.8	7.8	414.0
Winter	78.0	101.3	29.8	-	302.6
Spring	189.4	256.7	48.3	78.9	238.1
Summer	102.1	114.0	48.6	-	1653.0[4]
Fall	146.0	183.6	20.3	-	21120.0[5]

[1]- Original Southwest Fisheries Science Center Study Area = (Area A + Area B).

[2]- SWFSC recommended shock trial area.

[3]- Area where shock trials occurred as part of consent decree.

[4]- Value based on only 30 kilometers of effort.

[5]- Value based on only 32 kilometers of effort.

Table 4. On-effort sighting information for all species encountered during 13,734 km surveyed within the SWFSC study area. The category "unidentified whale" includes "unidentified large whale" and "unidentified small whale".

Species	# Sightings	Sightings per 100 km	# Animals per 100 km	Mean School Size	School size range
Dolphins and porpoises					
Common dolphins	54	0.394	26.45	67.3	1-2,000
Northern right whale dolphin	26	0.189	26.24	138.8	2-2,263
Risso's dolphin	24	0.173	5.99	34.3	3-238
Pacific white-sided dolphin	17	0.124	3.00	24.2	2-163
Dall's porpoise	10	0.070	0.29	4.0	1-8
Killer whale	3	0.022	0.05	2.3	1-4
unidentified delphinid	9	0.065	0.39	5.9	1-15
Whales					
Sperm whale	7	0.049	0.18	3.6	1-11
Pygmy sperm whale	1	0.005	0.005	1.0	-
(All beaked whales)	11	0.081	0.12	1.5	1-4
Cuvier's beaked whale	6	0.043	0.07	1.7	1-4
Baird's beaked whale	2	0.016	0.03	2.0	-
mesoplodont beaked whale	1	0.005	0.005	1.0	-
unidentified beaked whale	2	0.016	0.02	1.0	-
Fin whale	11	0.081	0.13	1.6	1-4
Blue whale	8	0.059	0.09	1.5	1-3
Minke whale	1	0.005	0.005	1.0	-
Gray whale	1	0.005	0.005	2.0	-
unidentified whale	9	0.065	0.08	1.2	1-2
Pinnipeds					
California sea lion	237	1.820	2.44	1.4	1-16
Northern elephant seal	13	0.097	0.09	1.0	-
Harbor seal	1	0.005	0.005	1.0	-
unidentified pinniped	5	0.032	0.03	1.0	-
Other					
unidentified marine mammal	3	0.022	0.022	1.0	-

Table 5. Seasonal group encounter rates for species encountered on-effort within SWFSC study area. Only species (or species groups) detected a minimum of five times within the study area are included.

Species	# Sightings (all seasons)	Sightings per 100 km Winter	Spring	Summer	Fall
Dolphins and porpoises					
Common dolphin[1]	54	0.17	0.28	1.19	0.36
Northern right whale dolphin	26	0.30	0.26	-	-
Risso's dolphin	24	0.30	0.17	0.10	-
Pacific white-sided dolphin	17	0.13	0.09	0.30	0.04
Dall's porpoise	10	0.06	0.10	-	0.08
Whales					
Sperm whale	7	-	0.04	-	0.04
Cuvier's beaked whale	6	0.06	0.02	-	0.08
(All beaked whales[2])	11	0.06	0.06	-	0.20
Fin whale	11	0.08	0.02	0.10	0.16
Blue whale	8	-	-	0.40	-
Pinnipeds					
California sea lion	237	1.67	1.96	2.54	0.73
Northern elephant seal	13	0.10	0.13	0.05	0.04

[1] - The combined winter/spring encounter rate for common dolphin is 0.227 schools/100 km. The combined summer/fall rate is 0.734 schools/100 km.

[2] - Includes Cuvier's beaked whale (6 sightings), Baird's beaked whale (2), *Mesoplodon* sp. (1), and unidentified beaked whales (2).

Table 6. Seasonal mean school sizes for species encountered on-effort within SWFSC study area. Only species detected a minimum of five times within the study area are included.

Species		**Mean School Size**			
	All seasons	Winter	Spring	Summer	Fall
Dolphins and porpoises					
Common dolphin	67.3	109.9	20.9	31.7	192.0
Northern right whale dolphin	138.7	13.9	284.3	-	-
Risso's dolphin	34.3	27.9	43.3	43.3	-
Pacific white-sided dolphin	24.2	26.5	42.8	12.0	10.0
Dall's porpoise	4.0	4.3	4.7	-	2.0
Whales					
Sperm whale	3.6	-	5.8	-	1.5
Cuvier's beaked whale	1.7	2.0	1.0	-	1.5
Fin whale	1.6	1.1	1.0	2.5	1.9
Blue whale	1.5	-	-	1.5	-
Pinnipeds					
California sea lion	1.4	1.5	1.4	1.3	1.6
Northern elephant seal	1.0	1.0	1.0	1.0	1.0

Table 7. Marine mammal species codes used during 1993-1994 aerial surveys.

Code	Common Name	Scientific Name
BA	Minke whale	*Balaenoptera acutorostrata*
BD	Baird's beaked whale	*Berardius bairdii*
BM	Blue whale	*Balaenoptera musculus*
BP	Fin whale	*Balaenoptera physalus*
DD	Common dolphin	*Delphinus* spp. (*D. delphis* or *D. capensis*)
ER	Gray whale	*Eschrichtius robustus*
GG	Risso's dolphin	*Grampus griseus*
GM	Short-finned pilot whale	*Globicephala macrorhynchus*
KB	Pygmy sperm whale	*Kogia breviceps*
LB	Northern right whale dolphin	*Lissodelphis borealis*
LO	Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
LR	Unidentified large rorqual	
LW	Unidentified large whale	
MA	Northern elephant seal	*Mirounga angustirostris*
MM	Unidentified marine mammal	
MN	Humpback whale	*Megaptera novaeangliae*
OO	Killer whale	*Orcinus orca*
PD	Dall's porpoise	*Phocoenoides dalli*
PM	Sperm whale	*Physeter macrocephalus*
PU	Unidentified pinniped	
PV	Harbor seal	*Phoca vitulina*
SC	Striped dolphin	*Stenella coeruleoalba*
SD	Unidentified small delphinid	
SDUP	small delphinid/unidentified porpoise	
SW	Unidentified small whale	
SZ	Unidentified small ziphiid	
TT	Bottlenose dolphin	*Tursiops truncatus*
UB	Unidentified baleen whale	
UD	Unidentified delphinid	
UM	Unidentified Mesoplodont beaked whale	*Mesoplodon sp.*
US	Unidentified seal	
UW	Unidentified whale	
WB	Unidentified common/white-sided/striped dolphin	
ZC	California sea lion	*Zalophus californianus*
ZI	Cuvier's beaked whale	*Ziphius cavirostris*
ZU	Unidentified ziphiid (beaked whale)	

Table 8. All on and off-effort cetacean and pinniped sighting information for 1993-1994 aerial surveys. Sightings are listed alphabetically by species code ("SPEC1", "SPEC2"...), and secondarily by sighting number (SI#). The percent composition (%) of each species within the school is given, as well as sighting types: "O" (=off-effort), "P" (=primary observer), or "S" (=secondary or belly window observer). The observer ("OBS") who detected the animals is given by a two-letter code. Independant best school size estimates (up to five) are anonymously given.

															BEST	ESTIMATES			
SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	1	2	3	4	5
199	BA	100							P	930312	1128.73	3344.95	11931.67	JC	2	2	2		
339A	BA	100							O	930529	0919.83	3354.43	11928.98	KF	1				
363E	BA	100							S	930724	0958.55	3248.11	11946.14	KF	1				
709	BA	100							O	931230	1545.42	3256.89	11942.38	SB	1	1	1		
727	BA	100							P	931231	1327.33	3322.07	11857.15	SB	1				
762	BA	6	ZC	88	ER	6			P	940101	1429.33	3347.96	11913.01	SB	17				
997	BA	16	TT	17	ER	67			O	940313	1455.17	3324.26	11834.11	MO	6				
286	BD	100							P	930516	1502.47	3307.25	12024.24	JG	2				
502	BD	100							O	930725	1017.57	3236.90	12017.26	KF	12	11	12	12	
539	BD	100							O	930731	1522.68	3309.57	12028.17	TF	4	4	4	4	
1063	BD	100							P	940506	1512.13	3250.50	12015.92	KF	3	2	1		
308	BM	100							O	930528	0945.60	3352.11	11944.57	KF	1	1			
363H	BM	100							O	930724	1018.07	3256.20	11948.30	KF	3				
381	BM	100							O	930724	1130.70	3316.27	11955.76	KF	1				
382	BM	33	LO	67					O	930724	1135.00	3322.83	11953.09	KF	3	3			
385	BM	100							O	930724	1137.52	3324.42	11951.66	KF	1				
386	BM	100							O	930724	1137.88	3324.92	11951.36	KF	2				
389A	BM	100							O	930724	1140.03	3328.13	11953.21	KF	1				
389C	BM	100							O	930724	1140.03	3328.13	11953.21	KF	2				
389B	BM	100							O	930724	1140.03	3328.13	11953.21	TF	1				
390	BM	100							O	930724	1144.58	3332.59	11951.61	TF	1				
391	BM	100							O	930724	1144.75	3332.92	11951.41	KF	1				
393	BM	100							O	930724	1152.52	3346.26	11938.66	KF	2	2			
409	BM	100							P	930724	1554.97	3315.09	12030.89	TL	1	1	1		
411	BM	100							O	930724	1609.60	3328.66	12015.22	TL	2	2			
470	BM	100							O	930725	1152.57	3323.23	11951.10	KF	1	1			
471	BM	100							O	930725	1155.92	3331.81	11947.33	KF	1				
473	BM	100							O	930725	1419.18	3321.68	11949.85	KF	2				
476	BM	100							O	930725	1422.97	3317.53	11955.64	KF	2				
518	BM	100							O	930730	1426.47	3334.46	11942.69	TF	1	1			
531	BM	100							O	930730	1603.85	3311.18	11948.60	KF	1	1			
532	BM	100							O	930730	1609.00	3313.82	11945.60	KF	3	3	3		
533	BM	100							O	930730	1612.78	3313.26	11943.29	KF	1	1	1		
537	BM	100							O	930731	1451.12	3318.47	12053.19	KF	2	2	2		
541	BM	100							P	930731	1603.47	3250.58	11941.95	WA	1	1	1	1	
552	BM	100							P	930827	1045.53	3312.90	11950.89	JC	1	1			
554	BM	100							P	930827	1053.52	3316.73	11956.64	TF	2	2			
556	BM	100							P	930827	1108.75	3330.07	12012.10	TF	1	1			
559	BM	100							P	930827	1533.22	3255.76	11958.65	TF	3	3			
560	BM	100							P	930827	1541.32	3257.31	11956.70	JC	1	1			

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
561	BM	100							P	930827	1550.80	3300.17	11953.34	JC	2	2			
590	BM	100							O	931022	1632.60	3333.96	12001.26	JC	1	1			
5	BP	100							P	930123	1436.20	3311.87	11948.16	CL	1	1	1		
28	BP	100							O	930124	0948.48	3240.09	12005.84	KF	1				
39	BP	12	LB	88					P	930130	1548.27	3325.70	12011.26	KF	11	7	7		
118	BP	7	LB	94					P	930212	1606.13	3343.41	11937.42	JG	12	21			
120	BP	100							P	930213	1021.42	3256.04	12014.51	JC	1				
175	BP	10	LB	90					P	930307	1152.75	3334.55	11943.21	MO	27	19	18		
224	BP	11	DD	89					O	930410	1147.32	3234.28	11740.98	WA	27	22	12		
264	BP	100							O	930509	1551.02	3331.16	11956.68	JC	1	1			
287	BP	100							P	930516	1525.20	3328.46	12000.01	WA	1	1			
343	BP	50	LO	50					O	930530	1014.90	3301.68	12002.20	JS	6	15	8		
363D	BP	100							O	930619	0949.48	3245.13	11936.30		2				
380	BP	100							O	930724	1126.77	3314.40	11953.68	KF	2				
401	BP	100							P	930724	1446.35	3335.76	12022.66	KF	2				
424	BP	100							P	930724	1652.25	3311.28	12020.22	TL	3	3	3		
426	BP	100							O	930724	1656.70	3311.79	12019.45	TF	1				
545	BP	100							O	930731	1617.70	3301.42	11938.52	TL	1	1	1	1	
557	BP	100							O	930827	1409.88	3306.58	11939.02	TL	2				
568	BP	100							P	931016	1028.75	3301.83	11953.76	JC	1	1			
571	BP	100							P	931016	1103.72	3328.68	12025.62	JC	1	1			
572	BP	100							O	931016	1114.03	3335.39	12034.11	JG	2	2			
582	BP	100							P	931022	1157.10	3329.01	12010.67	JC	2				
619	BP	100							P	931120	1005.02	3306.33	11959.37	JG	4	4	3	4	
708	BP	1	ZC	1	LB	31	DD	67	P	931230	1537.33	3257.00	11942.67	KF	130	80	180		
941	BP	100							P	940227	1142.80	3346.90	11923.81	KF	1	1			
975	BP	100							O	940313	1414.12	3308.45	12013.44	ML	7	10	8		
1048	BP	100							O	940429	1402.47	3309.93	11929.30	JB	5	3	5		
1105	BP	100							O	940529	1540.00	3314.10	11940.20	WA	2				
4	DD	100							S	930123	1201.75	3315.02	11958.19	JC	30	45	35		
22	DD	100							P	930124	1048.67	3315.78	12018.64	CL	26	24			
54	DD	100							O	930131	1020.38	3235.98	12022.95	KF					
55	DD	100							P	930131	1028.13	3239.98	12016.64	KF	65	30	37		
104	DD	98	GG	1	PU	1			O	930212	1317.42	3325.57	11935.22	RW	1217	1200	2060		
111	DD	100							O	930212	1339.95	3355.25	11923.81	JC	500	550			
121	DD	100							P	930213	1037.03	3311.60	11956.36	JG	5	3	5		
153	DD	100							P	930306	1138.73	3245.29	11959.15	JG	75	50			
165	DD	100							O	930307	0932.05	3356.01	11947.14	JG	900	225	400	675	
179	DD	100							O	930307	1433.97	3358.72	11928.68	JG	25				
182	DD	100							P	930312	1002.13	3308.77	11840.18	JC	250	200	140		
224	DD	89	BP	11					O	930410	1147.32	3234.28	11740.98	WA	27	22	12		
231	DD	100							O	930501	1557.73	3358.36	11941.27	CL	85	85	140	225	
235	DD	100							O	930507	1340.38	3357.66	11927.38	RW	1200	1500			

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
243	DD	91	ZC	9					P	930507	1439.00	3351.47	11928.49	TF	31	30	45		
248	DD	99	ZC	1					P	930508	0959.62	3324.90	11842.46	TF	40	37	30	51	
250	DD	100							O	930508	1053.23	3333.84	11805.78	RW	35	75	48		
251	DD	99	ZC	1					O	930508	1117.53	3343.76	11827.18	JC	85	175	66		
256	DD	89	LO	7	LB	5			P	930509	1113.53	3256.76	12020.27	RW	20	25	23	35	
266	DD	100							P	930509	1558.13	3319.97	11953.85	JC	60	56	38		
270	DD	100							O	930515	1448.27	3356.20	11936.38	JG	400	200			
273	DD	100							O	930515	1505.47	3358.23	11927.94	WA	3250	2000			
274	DD	100							O	930515	1520.90	3359.53	11923.74	WA	2250	2000			
293	DD	100							P	930521	1059.30	3335.43	11817.94	TF	155	120	225	150	
300	DD	67	LB	33					P	930528	1547.15	3253.74	12032.64	KF	19	20	18		
301	DD	100							P	930528	1557.55	3301.55	12023.38	KF	13	10	8		
319	DD	100							P	930529	1138.12	3317.63	12051.83	KF	55	33			
326	DD	72	LO	20	ZC	9			P	930529	1544.98	3330.06	12029.04	KF	14	12	11		
330	DD	18	LO	82					P	930529	1608.05	3314.25	12048.33	KF	5	7	5		
336	DD	40	ZC	4	GG	56			P	930529	1712.15	3248.82	11951.22	JG	30	20			
340	DD	100							O	930529	0920.28	3353.34	11929.88	JG	250				
341	DD	100							O	930529	0926.25	3343.18	11937.46	KF	20				
359	DD	100							P	930619	1603.48	3255.90	12038.00	MO	45	63	45		
360	DD	100							P	930619	1612.48	3259.73	12033.39	TF	33	45	30		
363F	DD	>99	ZC	<1					P	930724	1009.87	3257.32	11956.85	JS	61	50	55		
364	DD	93	ZC	7					P	930724	1028.45	3253.86	11936.18	TF	14	13	16		
367	DD	99	ZC	1					P	930724	1042.83	3302.66	11946.31	JS	176	201			
375	DD	100							P	930724	1109.68	3309.60	11947.75	KF	14	12			
376	DD	97	ZC	3					S	930724	1115.28	3311.55	11950.24	JS	27	52			
405	DD	94	ZC	6					P	930724	1500.58	3320.71	12040.61	KF	18	17	20		
413	DD	100							P	930724	1614.23	3331.64	12011.46	KF	7	10	8		
414	DD	100							P	930724	1619.07	3334.74	12007.59	TL	12	11	8		
416	DD	100							P	930724	1624.20	3336.81	12005.27	KF	25	30	12		
417	DD	100							P	930724	1627.90	3337.44	12004.95	KF	4				
418	DD	100							P	930724	1628.58	3338.06	12003.52	KF	12	12			
419	DD	100							O	930724	1633.12	3336.74	12000.58	TL	25	27	23		
425	DD	100							P	930724	1652.28	3311.28	12020.22	TL	15				
436	DD	100							P	930725	1013.73	3313.68	12016.12	KF	10	8			
437	DD	65	ZC	35					O	930725	1016.83	3313.38	12015.25	JS	25	50			
453	DD	100							O	930725	1114.38	3340.53	12025.19	TF	20				
469	DD	100							P	930725	1148.08	3321.78	11952.55	TF	240	135			
503	DD	100							P	930730	1039.83	3255.73	12041.94	KF	5	7	6		
504	DD	100							O	930730	1045.95	3300.19	12045.19	WA	35	10			
505	DD	100							P	930730	1110.02	3306.77	12039.96	KF	16	15	18	25	
506	DD	100							P	930730	1119.62	3305.33	12038.09	WA	55	45			
522	DD	100							O	930730	1431.90	3322.31	11951.19	KF					
525	DD	100							P	930730	1531.05	3259.24	12002.69	KF	90	75	68	100	

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
526	DD	100							P	930730	1543.52	3306.37	11954.46	WA	28	17	22		
527	DD	100							P	930730	1550.10	3307.03	11953.66	WA	12	16	9		
534	DD	100							O	930730	1615.75	3307.80	11939.16	TF					
535	DD	100							O	930730	1617.58	3304.56	11941.36	WA					
536	DD	100							P	930730	1626.88	3253.64	11953.54	WA	3				
543	DD	100							O	930731	1610.62	3257.42	11934.59	KF	12	12	12		
544	DD	100							O	930731	1612.95	3257.73	11935.53	KF	65	75	35	100	
546	DD	100							O	930731	1621.02	3302.02	11938.48	WA					
550	DD	100							P	930731	1635.52	3316.34	11955.82	TL	60	13	25	22	
551	DD	100							P	930827	1038.35	3311.54	11950.30	JC	45	38	50		
555	DD	100							P	930827	1055.93	3318.45	11958.46	TF	14	10			
580	DD	100							P	931022	1137.58	3306.90	11944.42	JC	2000	2000			
583	DD	100							O	931022	1159.48	3328.65	12010.59	JC	400				
588	DD	100							O	931022	1548.47	3306.44	12032.33	TL	175	200			
600	DD	100							P	931023	1149.47	3323.44	12005.76	JG	15	19	12		
601	DD	100							O	931023	1428.57	3405.46	11922.50	JC	300				
605	DD	100							O	931023	1553.72	3321.65	11951.51	JC	15	10			
608	DD	100							P	931023	1626.05	3340.71	12015.79	TL	30	40	80		
609	DD	100							P	931023	1640.40	3337.60	12028.26	TL	35	28	40	15	
610	DD	100							O	931024	0951.73	3246.95	11944.89	TL	110	110	185	89	
613	DD	100							P	931024	1105.00	3309.74	12043.21	JG	390	475			
615	DD	100							P	931024	1505.20	3300.11	12009.77	JC	35	38	85		
618	DD	100							P	931024	1532.90	3257.01	11943.11	TF	22	17	18		
622	DD	100							P	931120	1212.07	3338.84	12002.38	MO	1000	1800	1200		
626	DD	100							P	931120	1501.75	3318.59	11955.76	JG	600	850			
628	DD	100							P	931121	0935.35	3300.85	11945.55	MO	100	62	75		
636	DD	100							P	931121	1410.52	3335.99	12018.95	JC	35	48	45		
640	DD	100							P	931121	1436.17	3320.15	11959.72	TF	375	250	300		
646	DD	100							P	931204	1015.90	3332.60	11910.44	MO	550	575	260		
670	DD	100							S	931205	0920.28	3305.34	11949.84	JG	10	5	23		
679	DD	100							P	931205	1051.60	3309.16	11947.27	TF	1100	850	300	400	
692	DD	100							O	931205	1509.65	3317.83	11832.82	MO	300	200			
708	DD	67	BP	1	ZC	1	LB	31	P	931230	1537.33	3257.00	11942.67	KF	130	80	180		
710	DD	>99	ZC	1					O	931230	0928.97	3310.35	11903.24	KF	1200	1500			
711	DD	100							P	931231	0950.98	3248.37	11827.94	KF	45	25	30		
748	DD	100							O	931231	1425.03	3317.36	11821.54	SB	1200				
752	DD	100							O	931231	1032.02	3356.09	11956.85		500	950			
769	DD	100							P	940101	1500.85	3335.14	11905.47	KF	35	40	75		
785	DD	100							O	940101	1002.08	3245.89	11909.85	TF	10				
794	DD	100							O	940108	1420.92	3331.11	11855.68	JG	650				
799	DD	100							O	940108	1520.82	3332.01	11836.53	WA					
832	DD	100							O	940129	1211.62	3323.15	11952.82	JC					
879	DD	>99	ZC	1					P	940225	1303.00	3332.73	11955.67	TF	400	700			

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
889	DD	100							O	940225	1343.90	3359.18	11955.18	TF	60				
892	DD	100							O	940225	1406.92	3406.63	11927.64	JC	2800				
910	DD	11	LO	65	ZC	24			P	940226	1206.48	3310.85	12044.43	JG	85	80	38		
966	DD	100							O	940227	1509.40	3305.82	11749.59	KF	250	240			
984	DD	100							O	940313	1322.02	3315.42	11747.47	JC	250				
993	DD	100							O	940313	1424.62	3331.31	11828.84	JC	100				
1001	DD	100							O	940313	1508.25	3318.17	11831.75	JC	100				
1024	DD	100							P	940329	1556.32	3257.61	11729.74	JB	20	20	24		
1064	DD	100							P	940506	1523.20	3259.84	12012.09	KF	15	12	9		
1071	DD	100							O	940506	1601.08	3231.88	12045.00	JB	25				
1073	DD	38	ZC	13	LO	49			P	940507	1321.08	3303.91	11816.11	TF	400	88	75		
1074	DD	97	ZC	3					P	940507	1346.47	3307.70	11847.28	KF	33	37	21		
1078	DD	100							P	940507	1558.37	3205.92	12047.68	KF	14	11			
1081	DD	100							S	940518	1514.97	3237.18	12020.20	KF	8				
1082	DD	100							S	940518	1538.35	3248.10	12020.54	TF	12				
1083	DD	100							P	940518	1544.67	3244.57	12012.07	KF	16	17			
1088	DD	100							P	940523	1402.20	3227.27	12054.15	JG	11	11	16		
1096	DD	100							O	940523	1229.87	3239.99	12016.90	WA	20				
1097	DD	100							P	940529	1318.38	3214.21	12040.71	TF	7	5	15	8	
1098	DD	100							P	940529	1402.33	3208.51	12046.18	JG	20	14	12	8	
1099	DD	100							P	940529	1415.53	3210.34	12036.25	WA	7	6	8		
1100	DD	100							O	940529	1427.85	3220.57	12038.98	KF	3				
1101	DD	100							P	940529	1435.40	3210.42	12045.94	JG	30	70	18	38	
1102	DD	85	SC	15					P	940529	1442.60	3207.06	12047.40	JG	400	450	350	320	
1107	DD	100							O	940529	1633.80	3244.37	12024.51	JG	5				
10	ER	100							O	930123	0858.12	3348.00	12002.47	KF	1				
17	ER	100							O	930124	1004.92	3317.10	12004.19	JG	1				
64	ER	100							O	930131	1211.97	3342.78	11920.69	JC	8				
66	ER	100							O	930131	1219.97	3355.47	11920.88	JC	3				
71	ER	100							O	930131	1349.53	3343.31	11925.95	KF	4				
74	ER	100							O	930131	1357.85	3325.75	11936.03	JC	3				
76	ER	100							O	930131	1402.50	3315.83	11938.18	KF	2				
99	ER	100							O	930131	1052.85	3344.69	11927.00	JG	1				
106	ER	100							O	930212	1327.50	3334.37	11931.50	JG	1				
108	ER	100							O	930212	1330.30	3340.02	11930.04	JG	1				
109	ER	100							O	930212	1334.40	3347.86	11927.75	JC	3				
131	ER	100							O	930213	0942.13	3332.47	11917.05	JC	7				
167	ER	100							S	930307	1008.90	3353.38	11937.52	MO	3				
178	ER	100							O	930307	1227.17	3343.34	11930.78	JC	1				
180	ER	100							O	930307	1507.97	3358.23	11926.47	JC	2				
189	ER	100							O	930312	1049.05	3312.42	11912.14	TF	3	3			
202	ER	100							P	930312	1402.35	3353.79	11946.56	TF	4	4	4		
203	ER	100							O	930312	1406.62	3353.91	11947.17	WA	10	10	10		

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
704	ER	100							O	931230	1155.90	3405.77	11956.81	KF	2				
705	ER	100							O	931230	1423.43	3402.11	11920.13	SB					
706	ER	100							O	931230	1446.15	3324.94	11941.18	KF					
723	ER	34	PD	59	LO	8			P	931231	1300.78	3305.70	11840.49	KF	10	15			
745	ER	100							O	931231	1401.75	3326.29	11834.99	JG	2				
747	ER	100							O	931231	1416.07	3319.73	11828.87	JG					
749	ER	100							O	931231	1444.02	3326.92	11750.14	KF	1				
750	ER	100							O	931231	1455.70	3326.16	11749.89	KF	1				
751	ER	100							O	931231	0944.78	3402.04	11920.18	KF	1				
753	ER	100							O	931231	1053.03	3412.38	11926.25	KF	2				
762	ER	6	BA	6	ZC	88			P	940101	1429.33	3347.96	11913.01	SB	17				
781	ER	100							O	940101	1529.92	3325.64	11835.01	JG	3				
795	ER	100							O	940108	1422.83	3330.88	11854.32	TF	1				
797	ER	100							O	940108	1444.97	3320.67	11831.44	WA	1				
798	ER	100							O	940108	1447.08	3320.76	11831.87	WA	3				
800	ER	100							O	940108	0935.58	3355.58	12009.59	TF	4				
801	ER	100							O	940108	0947.88	3400.65	12015.57	TF	3				
802	ER	100							O	940108	1007.32	3403.84	12002.14	TF	1				
804	ER	100							O	940108	1014.98	3403.83	12000.61	WA	4				
805	ER	100							O	940108	1027.55	3400.95	11957.03	TF	3				
806	ER	100							O	940108	1029.97	3357.28	11950.92	WA	2				
807	ER	100							O	940108	1032.70	3357.21	11951.11	JG	3				
808	ER	100							O	940108	1042.87	3355.31	11948.47	JG	4				
821	ER	100							O	940115	1514.90	3355.63	11936.49	JC	1				
834	ER	100							O	940129	1224.25	3345.25	11937.70	JC	6				
835	ER	100							O	940129	1237.02	3403.13	11926.23	JG	3				
846	ER	100							O	940129	0946.22	3312.45	11927.58	TF	3				
847	ER	100							P	940130	0956.40	3317.57	11927.31	JG	2				
868	ER	15	LB	79	ZC	7			O	940215	1117.95	3306.48	11911.50	JC	31	24			
886	ER	100							O	940225	1333.62	3353.54	12000.39	JG	4				
890	ER	100							O	940225	1344.57	3359.37	11953.76	JC	1				
891	ER	100							O	940225	1349.80	3359.12	11953.57	JS	1				
934	ER	100							O	940226	1052.68	3355.28	11943.50	TF	6	6			
936	ER	100							O	940226	1108.72	3354.07	11936.66	JS	2	2			
961	ER	100							O	940227	1429.68	3358.68	11933.93	KF	2	2			
967	ER	100							O	940227	1515.97	3305.02	11749.14	KF	3	3			
973	ER	100							O	940313	1149.33	3401.41	11955.88	JC	4				
974	ER	100							O	940313	1152.53	3401.85	11954.99	JC	4				
985	ER	100							O	940313	1322.58	3314.48	11747.42	JC	3				
987	ER	100							O	940313	1342.07	3317.29	11755.21	TL	19				
988	ER	100							O	940313	1354.62	3317.92	11759.24	JC	3				
994	ER	100							O	940313	1434.47	3328.86	11838.87	TL	3				
995	ER	100							O	940313	1445.55	3325.30	11835.43	TL	5				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
996	ER	100							O	940313	1453.67	3325.89	11835.68	MO	4				
997	ER	67	BA	16	TT	17			O	940313	1455.17	3324.26	11834.11	MO	6				
998	ER	83	PD	17					O	940313	1459.93	3323.45	11834.18	TL	6				
999	ER	100							O	940313	1501.12	3323.45	11834.00	JC	3				
1000	ER	100							O	940313	1505.47	3319.67	11830.47	JC	3				
1002	ER	100							O	940313	1519.92	3317.01	11824.30	TL	1				
1004	ER	100							O	940313	1527.85	3316.08	11823.15	JC	4				
1005	ER	100							O	940313	1543.30	3306.63	11803.50	JC	4				
1006	ER	100							O	940313	1559.08	3301.10	11740.90	RW	5				
1007	ER	100							O	940313	1614.70	3253.03	11721.57	RW	2				
1044	ER	100							S	940416	1141.98	3319.03	11958.82	JC	2				
2	GG	96	LB	4					P	930123	1038.42	3335.64	12006.00	CL	47	59	52		
9	GG	100							O	930123	0856.83	3352.40	11953.60	KF					
11	GG	100							O	930123	0900.65	3345.14	12009.57	KF	1				
20	GG	92	LB	8					P	930124	1016.33	3328.92	12018.58	JC	90	92	66		
27	GG	100							O	930124	0945.33	3245.87	12006.13	JG	12				
34	GG	100							O	930130	1432.27	3337.86	12012.16	JG	6				
43	GG	100							O	930130	0850.78	3345.04	11949.09	JG	8				
62	GG	100							O	930131	1205.70	3329.94	11921.93	JG	12				
63	GG	100							O	930131	1206.52	3331.53	11921.91	JC	3				
95	GG	100							P	930131	1541.83	3332.77	12014.69	JC	6	6	6		
104	GG	1	PU	1	DD	98			O	930212	1317.42	3325.57	11935.22	RW	1217	1200	2060		
110	GG	100							O	930212	1339.65	3354.70	11923.80	RW	5				
112	GG	100							P	930212	1524.10	3350.14	11935.63	JC	16	16	17		
141	GG	100							P	930306	1059.97	3317.22	12036.15	JG	17	14	13		
144	GG	100							O	930306	1110.88	3314.64	12033.08	MO					
162	GG	100							P	930306	1234.18	3312.19	12046.10	JG	11	10			
168	GG	100							P	930307	1053.57	3347.41	11925.84	MO	10	11	7	15	
184	GG	66	TT	34					P	930312	1016.52	3309.48	11849.07	JC	28	38	35		
208	GG	100							P	930312	1505.65	3306.96	11959.79	JC	10	10	10		
209	GG	100							O	930312	0927.67	3258.51	11746.64	JG	15				
218	GG	100							P	930410	1043.27	3320.32	11840.97	CL	10	10	10	10	
226	GG	100							O	930410	1327.82	3308.24	11926.00	JG	20				
234	GG	99	SD	1					P	930501	1616.10	3359.05	11937.44	CL	16	16	15		
244	GG	100							O	930507	1450.98	3351.79	11926.88	JC	10				
262	GG	80	LW	20					O	930509	1550.30	3332.79	11957.20	JC	7	17			
272	GG	100							O	930515	1503.72	3358.02	11932.73	JG	4				
290	GG	100							O	930516	0944.78	3248.60	11742.94	JB	10				
291	GG	100							O	930516	1026.97	3322.57	11831.83	JB	22	22	25	27	
307	GG	100							O	930528	0942.80	3356.62	11937.24	KF	25				
309	GG	100							O	930528	0952.22	3340.10	12000.82	JG	3	3			
321	GG	100							O	930529	1512.12	3355.65	11939.50	KF	20				
335	GG	100							P	930529	1659.28	3247.36	11952.92	JG	9	12	11		

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
336	GG	56	DD	40	ZC	4			P	930529	1712.15	3248.82	11951.22	JG	30	20			
339B	GG	100							O	930529	0920.00	3354.05	11929.29	KF	30				
347	GG	65	LB	35					P	930530	1147.17	3259.56	12031.37	KF	64	65	65		
351	GG	100							O	930530	1123.63	3252.78	11903.60	RW	15				
352	GG	100							O	930530	1125.58	3252.60	11908.78	RW	25				
358	GG	100							P	930619	1529.45	3329.79	12021.31	JC	36	38	38		
392	GG	100							O	930724	1150.92	3343.13	11942.25	KF	9	8			
396	GG	100							O	930724	1436.93	3345.91	12010.22	TF	10				
397	GG	100							O	930724	1437.82	3344.53	12011.93	KF	30				
415	GG	100							P	930724	1622.13	3335.89	12006.53	TL	45	56	47		
511	GG	100							O	930730	1222.87	3339.68	11950.61	TL					
516	GG	100							O	930730	1426.08	3335.51	11942.30	KF	3				
519	GG	100							O	930730	1427.53	3331.71	11944.11	KF	7				
563	GG	100							P	931002	1058.87	3330.76	11936.50	JC	10	12	8		
591	GG	100							O	931022	1645.35	3335.95	11959.83	JG	1				
622	GG	100							O	931120	1459.87	3337.23	11943.20	JG	5				
648	GG	100							S	931204	1400.45	3335.09	11846.97	MO	2	2	2		
649	GG	100							P	931204	1406.22	3336.16	11849.52	JC	5	5	5		
697	GG	100							P	931230	1000.00	3323.96	11957.49	KF	11	18	15		
698	GG	54	LB	46					S	931230	1011.37	3322.87	11959.05	JG	80	75	50		
700	GG	100							P	931230	1052.13	3254.57	12031.64	KF	31	17	20		
736	GG	70	TT	16	ZC	15			P	931231	1332.47	3327.82	11900.89	KF	130	80			
738	GG	100							P	931231	1346.75	3328.49	11858.79	KF	10				
742	GG	67	TT	33					P	931231	1351.75	3327.09	11850.72	KF	3				
754	GG	100							O	931231	1105.82	3410.80	11923.01	KF	8				
755	GG	100							O	931231	1115.43	3401.12	11919.86						
766	GG	71	TT	30					P	940101	1443.13	3340.48	11907.95	KF	27	27			
767	GG	20	TT	80					O	940101	1450.88	3341.10	11907.80	SB	26	30			
812	GG	100							O	940108	1140.60	3320.56	11830.07	WA	60				
813	GG	80	TT	20					O	940108	1149.67	3317.12	11822.23	WA	100				
814	GG	100							S	940115	1024.20	3251.72	12022.53	TL	3				
815	GG	100							P	940115	1032.93	3254.61	12025.67	JC	3				
816	GG	100							P	940115	1037.55	3254.62	12025.63	WA	33	33			
819	GG	100							O	940115	1510.40	3348.44	11943.58	TF	6				
820	GG	100							O	940115	1512.02	3350.67	11940.67	WA	5				
823	GG	100							P	940116	1052.93	3251.85	12003.14	WA	8	8	8	8	
825	GG	100							O	940129	1030.03	3247.91	11952.59	JC	4				
829	GG	100							O	940129	1131.02	3306.67	12036.88	JC	18				
830	GG	100							P	940129	1133.28	3305.57	12038.04	JG	5				
833	GG	100							O	940129	1222.43	3342.08	11940.00	JG					
839	GG	88	LB	12					P	940129	1452.73	3249.39	11955.40	JC	100	140	78		
845	GG	100							O	940129	0938.35	3311.03	11944.20	JG	10				
865	GG	100							O	940215	1015.90	3257.09	12020.18	JC	75	40	60		

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
867	GG	100							O	940215	1115.65	3310.06	11906.26	JC					
869	GG	100							O	940215	1133.58	3306.93	11913.14	TF	6				
887	GG	100							O	940225	1334.85	3355.21	11959.14	TF	12				
888	GG	100							O	940225	1341.75	3356.28	11958.48	JC	6				
905	GG	50	UD	50					S	940226	1107.77	3310.13	12027.63	KF	2	2			
922	GG	100							P	940226	1457.25	3318.53	12027.12	TF	33	31	47	41	
958	GG	100							P	940227	1227.75	3353.24	11904.70	KF	11	11			
963	GG	100							O	940227	1455.52	3329.99	11826.08	TF	1				
964	GG	100							O	940227	1456.35	3329.10	11823.30	KF	9				
965	GG	100							O	940227	1508.38	3307.57	11752.24	TF	4				
986	GG	100							O	940313	1336.95	3316.89	11753.89	JC	12				
990	GG	72	TT	28					O	940313	1400.60	3320.00	11806.76	JC	35				
1021	GG	100							P	940329	1521.53	3317.01	11823.95	KF	2	5			
1045	GG	10	LB	91					P	940416	1154.30	3317.13	11956.69	JC	3300	1700			
1050	GG	100							O	940429	1410.90	3308.57	11944.06	JC	37	35			
1051	GG	57	LB	44					O	940429	1416.58	3306.51	12000.12	JB	50	95			
1055	GG	100							P	940506	1422.60	3302.38	12005.51	TF	7	7	7		
1058	GG	100							O	940506	1454.07	3236.89	12018.85	TF	90				
1077	GG	100							S	940507	1538.00	3224.42	12044.82	TF	13	13	13		
1087	GG	100							P	940523	1349.05	3213.16	12059.64	KF	25	27	22		
1106	GG	90	LB	10					O	940529	1623.80	3310.40	11947.50	JG					
538	GM	100							O	930731	1451.88	3319.79	12052.60	KF	9	10	9	9	
629	KB	100							S	931121	1010.18	3248.46	12018.60	JC	1	1	1		
1	LB	100							P	930123	1020.00	3323.20	12021.47	JC	2				
2	LB	4	GG	96					P	930123	1038.42	3335.64	12006.00	CL	47	59	52		
20	LB	8	GG	92					P	930124	1016.33	3328.92	12018.58	JC	90	92	66		
38	LB	100							S	930130	1542.03	3324.51	12012.71	JC	10	10			
39	LB	88	BP	12					P	930130	1548.27	3325.70	12011.26	KF	11	7	7		
42	LB	100							P	930130	1610.55	3325.94	11955.90	JG	32	27	35		
58	LB	100							S	930131	1111.77	3258.55	11940.97	KF	24	28	45		
78	LB	100							O	930131	1409.08	3301.47	11936.72	KF					
79	LB	100							O	930131	1425.85	3242.91	11945.20	KF	4				
96	LB	100							S	930131	1550.02	3324.45	12005.29	KF	2				
105	LB	100							O	930212	1326.72	3332.72	11931.96	JC	15				
116	LB	100							P	930212	1557.77	3337.58	11943.04	RW	31	31			
118	LB	94	BP	7					P	930212	1606.13	3343.41	11937.42	JG	12	21			
132	LB	100							S	930306	1005.93	3249.22	11947.63	JG	3				
143	LB	100							S	930306	1106.55	3314.12	12032.24	JC	12	12			
163	LB	100							P	930306	1535.45	3302.11	11959.20	JG	75	75			
171	LB	99	LO	1					P	930307	1115.60	3342.53	11936.28	MO	665	575			
175	LB	90	BP	10					P	930307	1152.75	3334.55	11943.21	MO	27	19	18		
176	LB	100							S	930307	1205.33	3334.91	11937.87	JG	5	6	6		
177	LB	100							P	930307	1210.38	3335.37	11933.86	MO	25	30	21		

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
200	LB	100							O	930312	1138.57	3345.74	11931.99	JC	800	725			
256	LB	5	DD	89	LO	7			P	930509	1113.53	3256.76	12020.27	RW	20	25	23	35	
269	LB	100							P	930509	1703.73	3302.24	11951.17	JC	7	7	4		
300	LB	33	DD	67					P	930528	1547.15	3253.74	12032.64	KF	19	20	18		
315	LB	100							P	930529	1051.90	3327.67	12047.58	KF	470	750	1050		
316	LB	100							P	930529	1124.67	3326.52	12041.68	JG	75	27	75		
325	LB	100							P	930529	1535.30	3335.82	12022.14	KF	8	10	9		
347	LB	35	GG	65					P	930530	1147.17	3259.56	12031.37	KF	64	65	65		
598	LB	100							P	931023	1116.62	3253.30	12040.99	TF	2	2			
671	LB	100							S	931205	0941.42	3318.70	12005.47	JG	6	8			
673	LB	100							O	931205	0959.72	3323.39	12010.68	TF	8				
680	LB	100							P	931205	1119.47	3320.24	12000.44	JG	5				
698	LB	46	GG	54					S	931230	1011.37	3322.87	11959.05	JG	80	75	50		
708	LB	31	DD	67	BP	1	ZC	1	P	931230	1537.33	3257.00	11942.67	KF	130	80	180		
787	LB	100							O	940101	1008.57	3245.57	11929.86	TF	2				
839	LB	12	GG	88					P	940129	1452.73	3249.39	11955.40	JC	100	140	78		
868	LB	79	ZC	7	ER	15			O	940215	1117.95	3306.48	11911.50	JC	31	24			
872	LB	100							P	940225	1242.73	3332.82	12006.78	TF	5	5			
968	LB	>99	ZC	1					P	940313	1015.68	3329.01	12007.75	TF	300	200	110	188	
1045	LB	91	GG	10					P	940416	1154.30	3317.13	11956.69	JC	3300	1700			
1051	LB	44	GG	57					O	940429	1416.58	3306.51	12000.12	JB	50	95			
1106	LB	10	GG	90					O	940529	1623.80	3310.40	11947.50	JG					
23	LO	100							P	930124	1130.77	3242.72	11956.70	KF	40	40	35		
25	LO	100							S	930124	1223.15	3325.49	12046.00	JC	70	50	60		
29	LO	100							P	930130	0953.97	3244.34	12013.80	KF	4	8	5		
164	LO	100							P	930306	1602.70	3245.30	12018.84	JG	200	125			
171	LO	1	LB	99					P	930307	1115.60	3342.53	11936.28	MO	665	575			
223	LO	100							P	930410	1134.23	3235.80	11755.83	CL	4	4	2	7	
256	LO	7	LB	5	DD	89			P	930509	1113.53	3256.76	12020.27	RW	20	25	23	35	
292	LO	78	ZC	23					P	930521	1048.78	3333.87	11819.40	TF	10	8			
299	LO	100							P	930528	1426.53	3307.42	11952.73	KF	2				
326	LO	20	ZC	9	DD	72			P	930529	1544.98	3330.06	12029.04	KF	14	12	11		
330	LO	82	DD	18					P	930529	1608.05	3314.25	12048.33	KF	5	7	5		
343	LO	50	BP	50					O	930530	1014.90	3301.68	12002.20	JS	6	15	8		
353	LO	84	ZC	16					P	930619	1137.87	3255.82	11938.29	JC	35	33	20		
354	LO	86	ZC	14					S	930619	1147.47	3258.41	11941.52	RW	7				
378	LO	100							P	930724	1121.75	3313.25	11951.85	KF	8	11			
382	LO	67	BM	33					O	930724	1135.00	3322.83	11953.09	KF	3	3			
447	LO	100							P	930725	1041.13	3311.04	11956.05	KF	6	12	10	6	
448	LO	67	ZC	33					O	930725	1044.47	3311.35	11956.78	KF	3	3			
455	LO	98	ZC	2					S	930725	1118.33	3341.33	12017.13	KF	36	55			
463	LO	93	ZC	7					P	930725	1136.28	3332.78	12006.34	TF	11	19			
529	LO	62	ZC	38					P	930730	1555.77	3311.22	11948.64	KF	23	8	13		

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
621	LO	100							P	931120	1205.10	3337.00	12005.17	TF	10	8	9	13	
647	LO	100							P	931204	1046.25	3338.86	11922.63	TF	8	9	7	9	
657	LO	100							P	931204	1436.02	3349.91	11918.35	JC	18	45	18		
662	LO	100							P	931204	1510.47	3349.92	11918.40	JC	4	4	4		
685	LO	100							P	931205	1447.92	3316.67	11855.27	JC	37	55			
720	LO	92	ZC	8					P	931231	1006.45	3302.75	11838.52	KF	14	20	9		
723	LO	8	ER	34	PD	59			P	931231	1300.78	3305.70	11840.49	KF	10	15			
746	LO	50	ZC	50					O	931231	1412.57	3325.11	11831.54	SB	8				
782	LO	100							O	940101	1540.52	3322.95	11831.45	SB					
822	LO	57	ZC	43					S	940116	0952.68	3315.18	11952.00	WA	18	15	14		
870	LO	100							S	940225	1223.45	3333.98	12024.23	JG	2	2			
910	LO	65	ZC	24	DD	11			P	940226	1206.48	3310.85	12044.43	JG	85	80	38		
1073	LO	49	DD	38	ZC	13			P	940507	1321.08	3303.91	11816.11	TF	400	88	75		
1108	LO	100							O	940529	1638.58	3233.87	12034.37	WA	6				
350	LR	100							O	930530	1115.22	3254.39	11844.07	TF	1	1			
431	LR	100							O	930724	0947.77	3339.08	12028.21	KF	1				
262	LW	20	GG	80					O	930509	1550.30	3332.79	11957.20	JC	7	17			
263	LW	100							O	930509	1550.95	3331.37	11956.75	JC	1	1			
569	LW	100							P	931016	1037.03	3308.57	12001.57	TF	1				
570	LW	100							P	931016	1048.37	3315.79	12009.91	JC	1				
574	LW	100							O	931016	1540.38	3318.70	12042.99	TL	1				
575	LW	100							O	931016	1614.22	3310.64	12036.46	JC	1				
576	LW	100							P	931016	1621.42	3317.04	12028.80	JC	1				
577	LW	100							P	931022	1101.23	3256.68	12005.54	TL	2				
12	MA	100							P	930124	0916.27	3329.21	11959.85	KF	1				
134	MA	100							P	930306	1025.93	3307.01	12008.35	JC	1				
135	MA	100							P	930306	1031.55	3313.65	12015.86	JC	1				
151	MA	100							P	930306	1136.70	3247.72	12002.00	JG	1				
252	MA	100							S	930509	0937.02	3312.70	11951.46	MO	1				
331	MA	100							P	930529	1623.65	3305.47	12045.72	KF	1				
553	MA	100							P	930827	1052.37	3315.52	11955.12	TF	1				
635	MA	100							S	931121	1408.73	3337.82	12021.33	MO	1				
675	MA	100							P	931205	1033.78	3326.38	11958.54	TF	1				
702	MA	100							S	931230	1133.72	3326.60	12017.66	KF	1				
828	MA	100							P	940129	1114.37	3250.21	12012.07	TF	1				
924	MA	100							P	940226	1508.03	3309.86	12037.67	TF	1	1			
976	MA	100							O	940313	1449.07	3254.00	12007.93	JC	1				
1022	MA	100							P	940329	1538.20	3309.03	11758.93	KF	1				
1032	MA	100							P	940416	1059.53	3325.21	12029.83	JC	1				
31	MM	100							P	930130	1101.13	3255.70	12034.42	JC	1				
72	MM	100							O	930131	1353.62	3334.42	11929.78	KF	1				
612	MM	100							O	931024	1055.43	3318.56	12055.80	TL	1				
672	MM	100							S	931205	0952.50	3323.01	12010.78	JG	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
674	MM	100							P	931205	1021.52	3334.38	12008.66	TF	1				
949	MM	100							P	940227	1209.58	3331.90	11906.11	TF	3				
959	MN	100							O	940227	1410.47	3408.85	11935.84	KF	1				
1079	MN	100							O	940507	1740.37	3256.21	11753.74	JB	2	2			
32	OO	100							P	930130	1109.70	3249.04	12026.93	JC	3	4	4		
81	OO	100							P	930131	1440.68	3257.17	11948.43	JC	1	2	1		
82	OO	100							P	930131	1449.48	3259.08	11950.86	KF	2	2	2		
119	OO	100							O	930212	0922.20	3326.17	11954.57	JC	1				
972	OO	100							O	940313	1123.33	3352.90	12021.47	ML	6	6			
45	PD	100							P	930131	0914.92	3339.99	12023.55	KF	1				
166	PD	100							O	930307	0943.20	3356.58	11946.03	JC	1				
169	PD	100							O	930307	1104.90	3344.70	11926.68	JC	8	8			
185	PD	100							P	930312	1041.90	3311.21	11904.70	JC	2	2	2		
188	PD	100							P	930312	1048.52	3312.01	11912.32	JC	4	4	4		
213	PD	100							O	930410	1032.82	3333.85	11855.09	JC	4				
254	PD	100							P	930509	0943.98	3321.76	12001.97	RW	4				
275	PD	100							P	930516	1004.63	3310.94	11956.40	WA	5				
280	PD	100							P	930516	1016.13	3319.97	12007.34	WA	3				
288	PD	100							O	930516	1530.22	3325.46	11958.62	WA	5				
338	PD	100							P	930529	1730.63	3257.46	11942.16	JG	3	3			
607	PD	100							P	931023	1610.28	3325.59	11958.00	TF	1				
627	PD	100							P	931121	0933.38	3301.63	11944.79	JC	3				
647	PD	100							O	931204	1350.77	3330.14	11830.83	MO	2				
655	PD	100							P	931204	1427.43	3347.61	11912.80	JC	2	2	2		
668	PD	100							P	931204	1522.65	3339.22	11910.11	JC	2	2			
683	PD	100							P	931205	1437.50	3315.88	11906.28	JC	8				
696	PD	100							O	931205	0937.53	3304.95	11848.56	KF	15				
696	PD	100							O	931205	0937.53	3310.75	11859.81	KF	15				
701	PD	100							P	931230	1059.53	3251.56	12035.15	KF	2	2			
723	PD	59	LO	8	ER	34			P	931231	1300.78	3305.70	11840.49	KF	10	15			
810	PD	100							O	940108	1125.45	3328.28	11841.07	JG	6				
840	PD	100							P	940129	1510.97	3255.97	11956.19	JC	3	3			
899	PD	100							P	940226	1034.20	3326.58	12031.35	KF	8				
969	PD	100							P	940313	1035.58	3338.07	12013.17	ML	9	6	10		
989	PD	100							O	940313	1358.12	3318.97	11804.64	JC	1				
992	PD	100							O	940313	1421.92	3327.75	11825.51	TL	2				
998	PD	17	ER	83					O	940313	1459.93	3323.45	11834.18	TL	6				
1003	PD	100							O	940313	1521.73	3317.00	11823.38	MO	1				
1019	PD	100							O	940329	1516.23	3323.46	11834.36	KF	1				
1020	PD	100							O	940329	1516.47	3323.14	11833.56	KF	1				
1023	PD	100							P	940329	1544.03	3305.28	11747.50	KF	2	3			
24	PM	100							P	930124	1213.62	3323.77	12043.93	KF	5	5	5		
577B	PM	100							O	931022	1025.55	3235.36	12026.07	JC	14				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
620	PM	100							P	931120	1128.57	3305.50	12042.52	TF	2	2	1	1	
898	PM	100							P	940226	1025.02	3322.01	12025.86	KF	1	1			
904	PM	100							P	940226	1101.67	3311.70	12029.94	TF	1	1			
926	PM	100							P	940226	1508.97	3308.81	12038.88	KF	6	5			
979	PM	100							O	940313	1507.55	3304.48	12037.24	ML	26	17	16		
980	PM	100							O	940313	1517.68	3301.81	12034.31	ML	1	1			
981	PM	100							P	940313	1525.18	3300.16	12032.18	ML	9	12			
982	PM	100							O	940313	1539.22	3251.41	12021.27	ML	2	3			
1011	PM	100							P	940329	1218.93	3321.29	12001.79	KF	1	1	1	1	
1047	PM	100							O	940429	1130.55	3205.02	12054.57	KF	1				
14	PU	100							P	930124	0948.37	3301.69	11945.45	KF	1				
68	PU	100							O	930131	1225.50	3403.00	11918.56	RW	1				
69	PU	100							O	930131	1225.90	3403.76	11918.06	JG	1				
70	PU	100							O	930131	1339.97	3405.21	11919.18	KF	1				
104	PU	1	DD	98	GG	1			O	930212	1317.42	3325.57	11935.22	RW	1217	1200	2060		
114	PU	100							P	930212	1547.47	3330.82	11949.63	RW	20				
777	PU	100							P	940101	1516.72	3329.86	11855.92	KF	2				
864	PU	100							P	940215	1012.63	3253.58	12016.05	JC	1				
915	PU	100							P	940226	1220.55	3321.24	12057.23	JG	1				
1059	PU	100							P	940506	1500.82	3241.06	12020.20	TF	1				
604	PV	100							P	931023	1547.02	3318.22	11956.37	JG	1				
707	PV	100							P	931230	1500.65	3311.89	11947.74	KF	1				
733	PV	100							P	931231	1330.80	3325.09	11859.37	KF	1				
780	PV	100							P	940101	1526.63	3328.63	11841.20	KF	1				
1102	SC	15	DD	85					P	940529	1442.60	3207.06	12047.40	JG	400	450	350	320	
26	SD	100							O	930124	0939.55	3257.80	12003.70	KF	8				
225	SD	100							O	930410	1307.75	3400.37	11912.57	JG					
234	SD	1	GG	99					P	930501	1616.10	3359.05	11937.44	CL	16	16	15		
306	SD	100							O	930528	0938.40	3403.55	11925.74	KF	50				
344	SD	100							P	930530	1041.50	3243.95	11957.46	JG	10				
346	SD	100							O	930530	1115.15	3316.01	12034.54	JG	150				
363A	SD	100							O	930619	0905.00	3249.00	11745.00	KF					
363C	SD	100							O	930619	0932.22	3247.90	11840.39	KF	3				
384	SD	100							O	930724	1137.28	3324.09	11951.89	KF					
394	SD	100							O	930724	1158.68	3358.03	11925.76	TF	250				
408	SD	100							P	930724	1549.87	3312.58	12033.66	KF	3				
421	SD	100							O	930724	1636.02	3330.99	11957.72	TL					
430	SD	100							O	930724	0944.87	3343.92	12021.51	KF	02				
444	SD	100							O	930725	1034.87	3307.29	11951.83	KF	5				
512	SD	100							O	930730	1233.22	3401.60	11929.22	WA	30	12			
517	SD	100							O	930730	1426.33	3334.84	11942.24	TF					
540	SD	100							O	930731	1600.10	3246.79	11945.69	KF	1				
1075	SDUP	100							P	940507	1355.30	3309.67	11859.55	TF	2				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
156	SW	100							P	930306	1205.13	3247.12	12016.99	JC	1				
320	SZ	100							O	930529	1202.12	3327.98	12051.08	JG	3	4	3		
184	TT	34	GG	66					P	930312	1016.52	3309.48	11849.07	JC	28	38	35		
736	TT	16	ZC	15	GG	70			P	931231	1332.47	3327.82	11900.89	KF	130	80			
742	TT	33	GG	67					P	931231	1351.75	3327.09	11850.72	KF	3				
766	TT	30	GG	71					P	940101	1443.13	3340.48	11907.95	KF	27	27			
767	TT	80	GG	20					O	940101	1450.88	3341.10	11907.80	SB	26	30			
772	TT	100							P	940101	1507.35	3333.42	11904.03	KF	5	7	7		
809	TT	100							O	940108	1112.75	3335.31	11852.39	TF	16				
813	TT	20	GG	80					O	940108	1149.67	3317.12	11822.23	WA	100				
990	TT	28	GG	72					O	940313	1400.60	3320.00	11806.76	JC	35				
991	TT	100							O	940313	1411.90	3321.91	11816.33	MO	25				
997	TT	17	ER	67	BA	16			O	940313	1455.17	3324.26	11834.11	MO	6				
100	UB	100							O	930131	1057.62	3334.43	11930.86	JG	1				
363G	UB	100							O	930724	1017.72	3256.43	11949.29	KF	1				
410	UB	100							O	930724	1608.15	3326.86	12017.22	JS	1				
65	UD	100							O	930131	1217.53	3351.30	11919.25	JG					
67	UD	100							O	930131	1220.82	3356.73	11922.29	JC	600	1275	500		
73	UD	100							O	930131	1353.75	3334.27	11929.91	JG					
133	UD	100							O	930306	1016.03	3255.46	11954.99	MO					
210	UD	100							O	930312	0935.75	3247.31	11807.05	WA					
265	UD	100							O	930509	1555.03	3324.27	11952.18	TF	3				
441	UD	100							O	930725	1030.22	3309.61	11956.59	TL					
457	UD	100							P	930725	1123.33	3340.58	12016.15	TL					
611	UD	100							P	931024	1044.97	3319.90	12055.56	JG	15				
630	UD	100							O	931121	1019.33	3247.97	12019.00	MO	4				
796	UD	100							O	940108	1438.85	3326.59	11837.16	WA					
811	UD	100							O	940108	1129.38	3322.13	11831.91	JG	1				
866	UD	100							O	940215	1113.97	3311.35	11902.16	TF					
905	UD	50	GG	50					S	940226	1107.77	3310.13	12027.63	KF	2	2			
933	UD	80	ZC	20					O	940226	1006.80	3243.66	12017.55	KF	40				
1062	UD	100							P	940506	1507.63	3248.80	12017.02	TF	1				
1067	UD	100							O	940506	1546.18	3301.15	12021.19	JB	75				
1068	UD	100							O	940506	1548.22	3256.98	12024.28	JB	60				
1069	UD	100							O	940506	1552.22	3248.62	12029.29	JB	100				
1070	UD	100							O	940506	1553.13	3246.63	12030.66	JB	50				
1072	UD	100							P	940506	1643.78	3221.88	12046.07	JB	15				
639	UM	100							P	931121	1430.75	3323.36	12003.80	JC	1	1	1		
1103	UM	100							P	940529	1503.85	3217.39	12052.75	JG	2	2	2	2	
91	US	100							O	930131	1526.77	3335.90	12034.51	KF	1				
1094	US	100							P	940523	1652.93	3250.50	12013.82	KF	1				
30	UW	100							P	930130	1027.53	3319.30	12055.00	KF	2				
35	UW	100							P	930130	1515.68	3308.88	12030.29	JG	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
107	UW	100							O	930212	1329.68	3338.79	11930.37	RW	1				
240	UW	100							P	930507	1406.77	3356.58	11911.34	TF	2				
314	UW	100							O	930529	1034.13	3316.44	12058.28	JG	1	1	1		
631	UW	100							P	931121	1038.37	3302.64	12034.88	MO	1				
790	UW	100							P	940108	1053.72	3324.82	12037.99	WA	1				
880	UW	100							O	940225	1324.15	3345.76	11958.54	JC	1				
1066	UW	100							O	940506	1542.68	3307.93	12016.50	KF	5				
289	WB	100							P	930516	1614.50	3242.46	12030.60	JC	5				
363B	WB	100							O	930619	0929.33	3248.03	11830.85	KF					
363J	WB	100							O	930724	1025.22	3253.40	11938.00	TL					
363I	WB	100							O	930724	1023.88	3254.61	11941.13	KF					
387	WB	100							O	930724	1138.70	3326.30	11951.17	TF	60				
395	WB	100							O	930724	1434.65	3348.57	12004.44	KF	100				
420	WB	100							O	930724	1635.10	3332.63	11959.18	KF	8	10			
428	WB	100							O	930724	0931.97	3356.42	11942.93	KF	80				
429	WB	100							O	930724	0934.22	3354.05	11949.54	KF	20				
433	WB	100							P	930725	0958.33	3326.26	12030.74	KF	6	30	8		
439	WB	100							O	930725	1025.52	3314.69	12008.08	KF	15				
442	WB	100							O	930725	1030.60	3309.22	11955.77	KF	3				
443	WB	100							O	930725	1031.35	3308.33	11953.71	KF	10				
445	WB	100							P	930725	1036.03	3308.79	11953.86	KF	4	2			
474	WB	100							O	930725	1419.60	3322.31	11949.54	JS	10				
475	WB	100							O	930725	1422.42	3318.75	11955.96	TF	45				
1104	WB	100							O	940529	1524.00	3245.00	12024.00	KF	150				
6	ZC	100							O	930123	1526.67	3237.46	12011.40	KF	1				
7	ZC	100							P	930123	1545.85	3306.00	11940.00	KF	1				
13	ZC	100							P	930124	0944.93	3257.58	11940.70	KF	1				
15	ZC	100							P	930124	0951.98	3303.89	11948.16	KF	1				
16	ZC	100							S	930124	1000.07	3312.78	11958.61	JC	1				
18	ZC	100							S	930124	1005.68	3318.20	12005.42	JC	1				
19	ZC	100							P	930124	1015.63	3328.12	12017.45	JC	1				
21	ZC	100							S	930124	1030.73	3336.18	12032.80	KF	1				
37	ZC	100							P	930130	1541.60	3324.20	12013.20	KF	1				
41	ZC	100							O	930130	1603.85	3330.27	11958.42	JC	2				
44	ZC	100							O	930131	0912.52	3342.27	12025.41	JC	2				
46	ZC	100							P	930131	0941.38	3314.83	11952.00	JC	1				
47	ZC	100							P	930131	0953.32	3303.51	12005.76	KF	1				
49	ZC	100							P	930131	0955.33	3301.18	12008.31	JG	1				
50	ZC	100							P	930131	1000.77	3254.50	12016.25	KF	1				
51	ZC	100							P	930131	1009.77	3243.75	12028.82	KF	1				
52	ZC	100							S	930131	1011.93	3241.17	12031.90	JC	1				
53	ZC	100							O	930131	1015.30	3237.87	12030.96	JG	1				
57	ZC	100							S	930131	1046.32	3252.05	12002.96	JC	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
59	ZC	100							S	930131	1123.50	3248.39	11952.16	KF	1				
60	ZC	100							P	930131	1126.02	3245.08	11955.55	JG	1				
61	ZC	100							P	930131	1141.40	3247.69	11937.38	JG	2				
75	ZC	100							O	930131	1400.80	3319.34	11939.48	KF	1				
77	ZC	100							O	930131	1407.50	3305.33	11935.90	KF	6				
80	ZC	100							O	930131	1429.75	3244.88	11938.33	KF	1				
83	ZC	100							P	930131	1501.18	3307.62	12000.76	JG	1				
84	ZC	100							P	930131	1503.37	3310.14	12003.35	KF	1				
85	ZC	100							P	930131	1507.15	3314.34	12008.41	KF	1				
86	ZC	100							P	930131	1509.27	3316.72	12011.31	KF	1				
87	ZC	100							P	930131	1509.62	3317.17	12011.73	KF	2				
88	ZC	100							P	930131	1513.17	3321.06	12016.35	KF	3				
89	ZC	100							P	930131	1513.63	3321.57	12017.03	JG	2				
90	ZC	100							P	930131	1522.52	3331.31	12028.82	KF	1				
92	ZC	100							P	930131	1534.27	3341.35	12025.11	JC	1				
93	ZC	100							P	930131	1534.75	3340.81	12024.65	JG	1				
94	ZC	100							P	930131	1537.43	3337.96	12020.72	JC	1				
97	ZC	100							P	930131	1603.85	3313.73	11952.39	JG	1				
98	ZC	100							P	930131	1604.67	3312.71	11951.42	JG	1				
101	ZC	100							S	930212	1155.25	3318.12	12029.41	JC	1				
102	ZC	100							S	930212	1157.50	3320.42	12032.51	JC	1				
113	ZC	100							P	930212	1536.77	3340.66	11950.72	JG	1				
115	ZC	100							P	930212	1557.10	3336.75	11943.87	RW	1				
122	ZC	100							S	930213	1057.27	3305.24	11954.07	JC	1				
123	ZC	100							P	930213	1106.13	3253.42	12004.94	JG	1				
136	ZC	100							P	930306	1034.13	3316.79	12019.63	JC	1				
137	ZC	100							S	930306	1038.73	3322.34	12026.67	JG	1				
138	ZC	100							S	930306	1044.97	3330.42	12036.11	JG	1				
139	ZC	100							S	930306	1055.23	3322.78	12042.74	JC	1				
140	ZC	100							S	930306	1057.48	3320.23	12039.59	JC	7				
142	ZC	100							P	930306	1105.47	3315.32	12033.88	JG	1				
145	ZC	100							P	930306	1114.90	3314.02	12032.16	JG	1				
146	ZC	100							P	930306	1116.85	3311.53	12029.57	JG	1				
147	ZC	100							P	930306	1117.10	3311.21	12029.18	JG	6				
148	ZC	100							P	930306	1117.93	3310.26	12028.12	TF	6				
149	ZC	100							P	930306	1124.75	3302.06	12018.50	JG	1				
150	ZC	100							P	930306	1136.35	3248.12	12002.51	JG	1				
152	ZC	100							P	930306	1138.67	3245.36	11959.22	JG	1				
154	ZC	100							O	930306	1156.42	3238.03	12003.88	JG	1				
157	ZC	100							P	930306	1215.50	3249.82	12020.35	JG	1				
158	ZC	100							P	930306	1216.95	3251.59	12022.29	JG	1				
159	ZC	100							P	930306	1220.52	3255.94	12027.28	JG	1				
160	ZC	100							P	930306	1224.02	3300.13	12032.28	JG	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
161	ZC	100							P	930306	1233.23	3311.15	12044.93	JG	2				
173	ZC	100							P	930307	1146.30	3337.30	11949.24	MO	1				
174	ZC	100							S	930307	1150.12	3334.48	11948.53	JG	1				
181	ZC	100							P	930312	1001.77	3308.65	11839.35	JC	35				
183	ZC	100							S	930312	1015.83	3309.44	11847.72	MO	1				
186	ZC	100							P	930312	1047.35	3311.92	11910.00	JC	1				
187	ZC	100							P	930312	1048.28	3312.04	11914.20	JC	1				
190	ZC	100							O	930312	1100.40	3312.56	11913.24	JC	1				
192	ZC	100							P	930312	1116.80	3325.11	11933.75	JC	1				
193	ZC	100							P	930312	1118.87	3328.73	11933.40	JC	1				
194	ZC	100							P	930312	1119.78	3330.36	11933.31	JC	2				
195	ZC	100							P	930312	1120.50	3331.53	11932.97	JC	4				
196	ZC	100							P	930312	1121.73	3333.62	11932.60	JC	3				
197	ZC	100							P	930312	1124.53	3338.15	11932.30	JC	1				
198	ZC	100							P	930312	1125.35	3339.37	11932.17	JC	3				
204	ZC	100							O	930312	1411.90	3354.33	11948.31	JC	1				
205	ZC	100							P	930312	1417.47	3352.80	11953.31	JC	3				
206	ZC	100							O	930312	1420.60	3352.36	11959.74	JC	100				
207	ZC	100							P	930312	1430.38	3351.15	12009.94	JC	1				
211	ZC	100							P	930410	1030.63	3336.52	11858.18	WA	1				
212	ZC	100							S	930410	1031.58	3335.36	11856.88	JG	5				
214	ZC	100							S	930410	1034.23	3332.05	11853.11	JG	1				
215	ZC	100							P	930410	1034.48	3331.69	11852.71	CL	1				
216	ZC	100							P	930410	1034.92	3331.13	11852.08	CL	1				
217	ZC	100							S	930410	1036.02	3329.79	11850.57	JG	1				
219	ZC	100							P	930410	1102.77	3313.67	11834.07	WA	1				
220	ZC	100							P	930410	1113.60	3259.19	11819.54	CL	4				
221	ZC	100							P	930410	1119.97	3254.46	11814.72	CL	1				
227	ZC	100							S	930501	1358.62	3246.53	12003.01	JG	1				
228	ZC	100							O	930501	1412.88	3304.10	11942.19	CL	1				
229	ZC	100							P	930501	1455.40	3313.97	11952.73	CL	1				
230	ZC	100							S	930501	1555.37	3357.45	11946.47	JG	1				
232	ZC	100							O	930501	1603.35	3357.31	11940.63	KF	1				
233	ZC	100							P	930501	1613.98	3358.91	11939.49	TF	18	45			
236	ZC	100							P	930507	1402.95	3357.02	11919.76	RW	6				
237	ZC	100							P	930507	1403.95	3356.85	11917.56	RW	1				
238	ZC	100							P	930507	1404.52	3356.80	11916.35	RW	1				
239	ZC	100							P	930507	1406.58	3356.58	11911.73	RW	2				
241	ZC	100							P	930507	1421.27	3354.60	11907.52	RW	1				
242	ZC	100							P	930507	1422.47	3354.51	11909.88	RW	1				
243	ZC	9	DD	91					P	930507	1439.00	3351.47	11928.49	TF	31	30	45		
245	ZC	100							P	930507	1456.25	3352.74	11916.08	RW	2				
246	ZC	100							P	930507	1457.87	3353.08	11912.63	RW	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
247	ZC	100							P	930507	1458.20	3353.17	11911.80	RW	1				
248	ZC	1	DD	99					P	930508	0959.62	3324.90	11842.46	TF	40	37	30	51	
249	ZC	100							P	930508	1015.63	3323.31	11840.75	TF	3				
251	ZC	1	DD	99					O	930508	1117.53	3343.76	11827.18	JC	85	175	66		
253	ZC	100							S	930509	0940.98	3317.77	11957.52	MO	1				
255	ZC	100							P	930509	1047.75	3250.75	11949.21	MO	1				
258	ZC	100							P	930509	1134.47	3304.74	12029.79	RW	1				
259	ZC	100							P	930509	1137.78	3308.93	12034.48	MO	1				
260	ZC	100							P	930509	1145.63	3318.94	12046.00	RW	1				
261	ZC	100							S	930509	1534.37	3318.86	12019.04	JC	1				
267	ZC	100							P	930509	1612.58	3310.81	12004.51	JC	1				
268	ZC	100							P	930509	1701.73	3259.75	11953.99	JC	1				
271	ZC	100							O	930515	1502.90	3357.92	11934.70	JC	6				
276	ZC	100							P	930516	1014.02	3317.49	12004.57	JC	1				
277	ZC	100							P	930516	1014.23	3317.77	12004.82	WA	1				
278	ZC	100							S	930516	1014.48	3317.98	12005.10	JG	1				
279	ZC	100							P	930516	1015.10	3318.71	12005.94	WA	1				
281	ZC	100							P	930516	1024.82	3328.15	12017.35	WA	1				
282	ZC	100							S	930516	1025.73	3329.08	12018.74	JG	1				
283	ZC	100							S	930516	1030.80	3334.75	12025.45	JG	1				
284	ZC	100							P	930516	1112.43	3248.27	11953.76	JG	1				
285	ZC	100							P	930516	1156.55	3315.86	12050.72	JC	1				
292	ZC	23	LO	78					P	930521	1048.78	3333.87	11819.40	TF	10	8			
294	ZC	100							P	930521	1108.07	3336.34	11818.25	TF	1				
305	ZC	100							P	930528	1629.38	3325.14	11955.73	JG	3	3			
310	ZC	100							P	930529	0956.87	3334.70	12007.39	KF	3				
311	ZC	100							P	930529	0957.80	3333.57	12008.81	TF	1				
312	ZC	100							S	930529	1002.17	3328.94	12014.72	JG	1				
313	ZC	100							O	930529	1032.83	3313.18	12058.24	JG	10				
317	ZC	100							P	930529	1129.12	3324.55	12043.79	JG	1				
322	ZC	100							O	930529	1523.05	3343.33	12012.72	TF	1				
323	ZC	100							P	930529	1525.18	3341.27	12015.54	KF	1				
324	ZC	100							S	930529	1533.52	3338.02	12019.98	JG	1				
326	ZC	9	DD	72	LO	20			P	930529	1544.98	3330.06	12029.04	KF	14	12	11		
327	ZC	100							P	930529	1559.63	3324.21	12036.19	KF	2				
328	ZC	100							P	930529	1559.85	3323.95	12036.48	TF	1				
329	ZC	100							S	930529	1600.08	3323.57	12036.84	JG	1				
332	ZC	100							S	930529	1644.93	3239.68	12015.66	TF	1				
333	ZC	100							P	930529	1645.87	3238.65	12014.34	KF	1				
334	ZC	100							S	930529	1657.52	3244.99	11955.62	KF	1				
336	ZC	4	GG	56	DD	40			P	930529	1712.15	3248.82	11951.22	JG	30	20			
342	ZC	100							S	930530	1007.37	3312.09	12014.03	JG	1				
345	ZC	100							S	930530	1052.77	3249.43	12003.79	KF	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
348	ZC	100							P	930530	1529.70	3326.03	12010.54	TF	1				
349	ZC	100							S	930530	1628.62	3321.20	11952.35	KF	2				
353	ZC	16	LO	84					P	930619	1137.87	3255.82	11938.29	JC	35	33	20		
354	ZC	14	LO	86					S	930619	1147.47	3258.41	11941.52	RW	7				
355	ZC	100							P	930619	1208.32	3314.43	12000.61	JC	1				
356	ZC	100							P	930619	1219.72	3328.55	12017.44	JC	2				
357	ZC	100							P	930619	1226.30	3332.07	12022.03	JC	1				
361	ZC	100							P	930619	1620.15	3304.12	12028.50	TF	1				
362	ZC	100							P	930619	1624.50	3308.92	12022.39	TF	1				
363F	ZC	<1	DD	>99					P	930724	1009.87	3257.32	11956.85	JS	61	50	55		
364	ZC	7	DD	93					P	930724	1028.45	3253.86	11936.18	TF	14	13	16		
365	ZC	100							P	930724	1038.43	3257.15	11939.83	JS	1				
366	ZC	100							P	930724	1042.38	3302.10	11945.66	TF	1				
367	ZC	1	DD	99					P	930724	1042.83	3302.66	11946.31	JS	176	201			
368	ZC	100							P	930724	1053.63	3302.80	11946.52	JS	2				
369	ZC	100							P	930724	1054.18	3303.52	11947.19	JS	1				
370	ZC	100							S	930724	1056.22	3306.01	11950.42	KF	1				
371	ZC	100							P	930724	1057.40	3307.30	11952.19	TF	2				
372	ZC	100							P	930724	1104.52	3306.19	11943.81	KF	1				
373	ZC	100							P	930724	1108.32	3308.05	11945.84	TF	1				
374	ZC	100							S	930724	1109.50	3309.45	11947.58	JS	1				
376	ZC	3	DD	97					S	930724	1115.28	3311.55	11950.24	JS	27	52			
377	ZC	100							S	930724	1121.48	3312.88	11951.43	JS	1				
379	ZC	100							P	930724	1126.32	3313.73	11952.72	KF	1				
383	ZC	100							O	930724	1137.08	3323.74	11952.16	KF	1				
388	ZC	100							O	930724	1138.90	3326.51	11951.45	JS	3				
398	ZC	100							P	930724	1440.32	3341.54	12015.70	KF	1				
399	ZC	100							P	930724	1444.15	3338.59	12019.59	KF	1				
400	ZC	100							P	930724	1445.98	3336.27	12022.13	KF	1				
402	ZC	100							P	930724	1454.40	3328.25	12031.41	KF	1				
404	ZC	100							S	930724	1500.02	3321.43	12039.15	TL	1				
405	ZC	6	DD	94					P	930724	1500.58	3320.71	12040.61	KF	18	17	20		
407	ZC	100							P	930724	1547.30	3309.48	12037.66	KF	1				
412	ZC	100							O	930724	1611.47	3329.70	12013.91	KF					
422	ZC	100							S	930724	1647.15	3317.59	12012.76	KF	2				
423	ZC	100							S	930724	1648.30	3316.16	12014.36	KF	1				
427	ZC	100							O	930724	0926.03	3402.82	11926.70	KF	4				
432	ZC	100							O	930724	0952.98	3332.69	12038.48	TF	3				
434	ZC	100							P	930725	1003.68	3325.60	12029.97	KF	1				
435	ZC	100							P	930725	1004.05	3325.08	12029.59	KF	1				
437	ZC	35	DD	65					O	930725	1016.83	3313.38	12015.25	JS	25	50			
440	ZC	100							O	930725	1029.80	3310.11	11957.59	KF	1				
446	ZC	100							S	930725	1040.37	3309.86	11955.20	TF	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
448	ZC	33	LO	67					O	930725	1044.47	3311.35	11956.78	KF	3	3			
452	ZC	100							O	930725	1113.42	3339.60	12027.45	TL	1				
454	ZC	100							P	930725	1118.13	3341.92	12017.79	TF	1				
455	ZC	2	LO	98					S	930725	1118.33	3341.33	12017.13	KF	36	55			
458	ZC	100							S	930725	1130.82	3335.82	12010.20	KF	1				
459	ZC	100							S	930725	1131.68	3334.79	12008.94	KF	1				
460	ZC	100							S	930725	1132.72	3333.62	12007.57	KF	1				
463	ZC	7	LO	93					P	930725	1136.28	3332.78	12006.34	TF	11	19			
464	ZC	100							P	930725	1141.82	3328.78	12001.75	TF	1				
465	ZC	100							P	930725	1141.92	3328.64	12001.48	TL	1				
466	ZC	100							P	930725	1147.52	3322.35	11953.40	TF	1				
467	ZC	100							P	930725	1147.77	3322.13	11953.02	TF	1				
468	ZC	100							S	930725	1147.88	3322.02	11952.84	KF	1				
472	ZC	100							O	930725	1157.32	3335.30	11945.66	KF	2				
507	ZC	100							S	930730	1140.60	3244.33	12013.74	KF	1				
508	ZC	100							P	930730	1159.25	3301.38	12000.36	TF	1				
509	ZC	100							P	930730	1207.73	3310.66	12011.82	TF	1				
510	ZC	100							O	930730	1210.17	3313.58	12015.44	KF	1				
515	ZC	100							O	930730	1237.18	3408.63	11918.90	KF	1				
520	ZC	100							O	930730	1430.50	3325.01	11948.26	KF	1				
521	ZC	100							O	930730	1431.60	3322.80	11950.55	KF	2				
523	ZC	100							P	930730	1433.20	3320.54	11953.08	KF	1				
524	ZC	100							P	930730	1437.07	3316.18	11958.42	TF	1				
528	ZC	100							P	930730	1554.78	3309.96	11950.13	KF	1				
529	ZC	38	LO	62					P	930730	1555.77	3311.22	11948.64	KF	23	8	13		
542	ZC	100							P	930731	1606.80	3252.56	11939.87	TL	1				
547	ZC	100							S	930731	1625.62	3306.19	11943.75	WA	1				
548	ZC	100							S	930731	1633.37	3313.96	11952.99	WA	1				
549	ZC	100							P	930731	1635.02	3315.73	11955.10	TL	2				
558	ZC	100							P	930827	1518.97	3238.21	12018.53	JC	1				
562	ZC	100							P	931002	1058.55	3330.30	11936.88	JC	1				
564	ZC	100							P	931002	1109.77	3335.82	11933.90	ML	1				
565	ZC	100							S	931002	1109.92	3335.92	11933.87	JG	1				
566	ZC	100							P	931016	1018.53	3250.07	11940.00	TF	1				
577A	ZC	100							S	931022	0958.33	3304.17	11948.96	JG	1				
581	ZC	100							P	931022	1145.17	3315.31	11954.74	JC	1				
589	ZC	100							P	931022	1625.12	3328.21	12008.12	TL	5				
595	ZC	100							S	931023	1038.37	3318.14	12028.18	JG	1				
596	ZC	100							P	931023	1040.23	3320.56	12030.55	JC	1				
603	ZC	100							P	931023	1532.37	3259.27	12018.57	TL	1				
616	ZC	100							P	931024	1519.77	3314.51	11952.98	JC	4				
617	ZC	100							S	931024	1521.12	3316.14	11950.94	JG	1				
623	ZC	100							P	931120	1459.87	3320.69	11952.27	JC	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
624	ZC	100							P	931120	1500.83	3319.94	11954.26	JG	1				
625	ZC	100							S	931120	1501.35	3319.21	11955.06	TF	1				
633	ZC	100							S	931121	1106.03	3317.97	12053.21	JG	1				
634	ZC	100							P	931121	1132.97	3311.43	12021.51	JG	2				
638	ZC	100							P	931121	1423.08	3326.98	12008.94	TF	1				
641	ZC	100							P	931121	1444.33	3316.07	11955.28	TF	3				
642	ZC	100							P	931121	1444.85	3315.61	11954.54	JC	1				
643	ZC	100							S	931121	1446.82	3312.97	11951.81	MO	1				
644	ZC	100							P	931121	1447.50	3312.21	11950.87	TF	1				
645	ZC	100							S	931204	0952.77	3331.44	11932.74	MO	1				
650	ZC	100							P	931204	1411.47	3337.21	11850.99	JC	6				
651	ZC	100							P	931204	1418.97	3341.04	11859.29	JG	7				
652	ZC	100							P	931204	1423.77	3344.72	11906.78	JC	1				
653	ZC	100							P	931204	1425.73	3346.15	11910.07	JC	1				
654	ZC	100							P	931204	1426.83	3347.13	11911.88	JC	2				
656	ZC	100							P	931204	1433.38	3348.04	11913.89	JG	1				
658	ZC	100							P	931204	1447.55	3350.86	11919.75	JC	1				
659	ZC	100							P	931204	1448.42	3351.58	11921.87	JG	4				
660	ZC	100							P	931204	1448.92	3351.97	11922.73	JG	1				
661	ZC	100							P	931204	1450.93	3353.65	11926.16	JG	3				
663	ZC	100							P	931204	1517.15	3347.27	11916.42	JC	4				
664	ZC	100							P	931204	1517.63	3346.61	11915.87	JC	2				
665	ZC	100							P	931204	1518.42	3345.41	11914.96	JC	2				
666	ZC	100							P	931204	1520.05	3342.99	11913.05	JC	1				
667	ZC	100							P	931204	1520.32	3342.57	11912.73	JC	1				
676	ZC	100							P	931205	1037.17	3322.21	11953.47	TF	1				
681	ZC	100							P	931205	1433.53	3315.60	11914.58	MO	1				
682	ZC	100							P	931205	1433.68	3315.61	11914.19	JC	1				
684	ZC	100							P	931205	1443.33	3316.30	11904.62	JC	1				
686	ZC	100							O	931205	1451.92	3317.73	11855.20	JC	1				
687	ZC	100							P	931205	1500.98	3317.01	11849.80	JC	1				
688	ZC	100							P	931205	1501.75	3317.03	11848.20	MO	1				
689	ZC	100							P	931205	1501.87	3317.08	11847.97	JC	1				
690	ZC	100							P	931205	1503.15	3317.08	11845.56	JC	1				
691	ZC	100							P	931205	1507.08	3317.47	11837.90	MO	1				
703	ZC	100							P	931230	1136.92	3330.17	12013.11	SB	1				
708	ZC	1	LB	31	DD	67	BP	1	P	931230	1537.33	3257.00	11942.67	KF	130	80	180		
710	ZC	1	DD	>99					O	931230	0928.97	3310.35	11903.24	KF	1200	1500			
712	ZC	100							P	931231	0956.72	3250.89	11830.27	SB	1				
713	ZC	100							P	931231	0958.25	3253.29	11832.14	SB	1				
714	ZC	100							P	931231	1002.62	3256.57	11834.49	KF	1				
715	ZC	100							P	931231	1003.60	3258.21	11835.28	SB	10				
716	ZC	100							P	931231	1004.67	3259.86	11836.43	SB	2				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
717	ZC	100							P	931231	1005.03	3300.39	11836.81	SB	1				
718	ZC	100							P	931231	1005.22	3300.63	11837.12	KF	1				
719	ZC	100							P	931231	1006.08	3302.06	11838.04	KF	7				
720	ZC	8	LO	92					P	931231	1006.45	3302.75	11838.52	KF	14	20	9		
721	ZC	100							P	931231	1011.02	3304.21	11839.72	SB	1				
722	ZC	100							P	931231	1300.43	3305.10	11840.07	KF	1				
725	ZC	100							P	931231	1318.17	3315.14	11850.37	SB	8	13			
726	ZC	100							P	931231	1323.55	3318.29	11853.68	KF	8				
728	ZC	100							P	931231	1328.83	3322.09	11857.55	SB	3				
729	ZC	100							P	931231	1329.38	3322.84	11858.05	SB	3				
730	ZC	100							P	931231	1330.02	3323.95	11858.67	KF	2				
731	ZC	100							P	931231	1330.27	3324.32	11858.87	SB	2				
732	ZC	100							P	931231	1330.63	3324.89	11859.25	SB	8				
734	ZC	100							P	931231	1331.25	3325.81	11859.86	KF	1				
735	ZC	100							P	931231	1332.23	3327.27	11900.73	SB	1				
736	ZC	15	GG	70	TT	16			P	931231	1332.47	3327.82	11900.89	KF	130	80			
739	ZC	100							P	931231	1350.40	3326.92	11853.65	SB	1				
740	ZC	100							P	931231	1350.65	3326.85	11853.05	KF	1				
741	ZC	100							P	931231	1351.08	3326.94	11852.06	SB	1				
743	ZC	100							P	931231	1357.03	3327.72	11843.15	KF	1				
746	ZC	50	LO	50					O	931231	1412.57	3325.11	11831.54	SB	8				
756	ZC	100							P	940101	1420.82	3401.45	11921.34	SB	1				
757	ZC	100							P	940101	1421.67	3400.04	11920.45	KF	1				
758	ZC	100							P	940101	1421.98	3359.51	11920.10	KF	1				
759	ZC	100							P	940101	1422.23	3359.17	11919.87	SB	1				
760	ZC	100							P	940101	1425.63	3353.72	11916.99	KF	1				
761	ZC	100							P	940101	1428.70	3348.88	11913.62	SB	1				
762	ZC	88	ER	6	BA	6			P	940101	1429.33	3347.96	11913.01	SB	17				
763	ZC	100							P	940101	1440.73	3345.01	11910.62	SB	1				
764	ZC	100							P	940101	1442.25	3342.15	11908.84	SB	31				
768	ZC	100							P	940101	1459.40	3337.73	11906.90	KF	2				
770	ZC	100							P	940101	1506.78	3334.47	11904.64	SB	1				
771	ZC	100							S	940101	1507.27	3333.66	11904.17	JG	1				
773	ZC	100							P	940101	1513.50	3331.26	11901.90	KF	1				
774	ZC	100							S	940101	1513.88	3330.48	11901.55	JG	1				
775	ZC	100							P	940101	1515.03	3330.08	11859.43	KF	1				
776	ZC	100							P	940101	1515.15	3330.07	11859.16	KF	1				
778	ZC	100							P	940101	1520.42	3329.96	11855.03	SB	3				
779	ZC	100							P	940101	1524.40	3329.25	11846.12	SB	2				
786	ZC	100							O	940101	1006.82	3245.59	11924.56	TF	1				
788	ZC	100							P	940108	1018.12	3244.24	11949.27	TF	1				
789	ZC	100							P	940108	1032.08	3300.18	12008.11	TF	1				
791	ZC	100							P	940108	1128.22	3318.14	11957.80	WA	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
792	ZC	100							P	940108	1132.82	3312.35	11950.53	JG	1				
793	ZC	100							P	940108	1135.38	3308.94	11946.85	WA	1				
817	ZC	100							S	940115	1044.95	3259.19	12031.18	TL	1				
818	ZC	100							S	940115	1447.02	3333.92	12024.32	WA	1				
822	ZC	43	LO	57					S	940116	0952.68	3315.18	11952.00	WA	18	15	14		
824	ZC	100							S	940129	1007.83	3304.18	11955.12	JG	1				
826	ZC	100							S	940129	1042.15	3301.68	12006.90	JG	1				
836	ZC	100							P	940129	1448.47	3254.44	11949.30	JC	1				
837	ZC	100							P	940129	1449.18	3253.59	11950.35	JG	1				
838	ZC	100							P	940129	1449.73	3252.89	11951.22	JC	1				
841	ZC	100							P	940129	1514.53	3256.51	11955.63	JC	1				
842	ZC	100							P	940129	1524.92	3303.53	11955.31	JG	1				
843	ZC	100							P	940129	1527.03	3301.28	11958.37	JC	1				
844	ZC	100							P	940129	1531.62	3255.97	12004.80	JC	1				
848	ZC	100							P	940130	1001.50	3323.89	11928.77	TF	1				
849	ZC	100							S	940130	1001.72	3324.24	11928.83	JC	1				
850	ZC	100							P	940130	1003.45	3327.13	11929.18	TF	4				
851	ZC	100							S	940130	1003.65	3327.45	11929.27	JC	1				
852	ZC	100							P	940130	1004.90	3329.43	11929.50	JG	2				
853	ZC	100							P	940130	1004.98	3329.50	11929.49	JG	1				
854	ZC	100							S	940130	1005.30	3329.97	11929.43	JC	1				
855	ZC	100							P	940130	1006.05	3331.18	11929.59	TF	2				
856	ZC	100							P	940130	1008.13	3334.38	11930.19	JG	1				
857	ZC	100							P	940130	1009.58	3336.78	11930.17	TF	1				
858	ZC	100							S	940130	1011.70	3340.16	11930.22	JC	1				
859	ZC	100							P	940130	1011.73	3340.16	11930.22	JG	1				
860	ZC	100							P	940130	1012.27	3341.20	11930.43	TF	1				
861	ZC	100							P	940130	1013.08	3342.46	11930.72	TF	1				
863	ZC	100							P	940215	0934.70	3304.52	11955.40	JC	1				
868	ZC	7	ER	15	LB	79			O	940215	1117.95	3306.48	11911.50	JC	31	24			
871	ZC	100							P	940225	1236.07	3340.83	12017.18	TF	1				
873	ZC	100							O	940225	1255.13	3320.90	11952.04	JC	1				
874	ZC	100							S	940225	1258.68	3325.49	11953.51	JG	1				
875	ZC	100							P	940225	1259.12	3326.24	11953.90	TF	1				
876	ZC	100							P	940225	1300.13	3327.93	11954.50	JC	1				
877	ZC	100							P	940225	1300.45	3328.54	11954.60	TF	1				
878	ZC	100							P	940225	1301.58	3330.36	11954.96	TF	3				
879	ZC	1	DD	>99					P	940225	1303.00	3332.73	11955.67	TF	400	700			
881	ZC	100							O	940225	1328.33	3345.49	11958.11	TF	1				
882	ZC	100							P	940225	1330.97	3349.06	11959.94	TF	1				
883	ZC	100							P	940225	1331.70	3350.26	12000.17	TF	1				
884	ZC	100							P	940225	1332.43	3351.57	12000.33	TF	2				
885	ZC	100							P	940225	1332.52	3351.66	12000.35	JC	30				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
893	ZC	100							P	940226	0959.40	3251.30	11950.11	TF	2				
894	ZC	100							P	940226	1002.40	3255.08	11954.13	KF	1				
895	ZC	100							P	940226	1003.30	3256.13	11955.48	KF	1				
896	ZC	100							P	940226	1016.15	3311.44	12013.38	KF	1				
897	ZC	100							P	940226	1016.48	3311.75	12013.77	KF	1				
900	ZC	100							P	940226	1039.08	3330.01	12035.48	KF	1				
901	ZC	100							P	940226	1049.15	3323.60	12044.23	JG	1				
902	ZC	100							P	940226	1055.98	3314.93	12033.73	TF	6	6			
903	ZC	100							P	940226	1100.75	3312.72	12031.35	JG	1				
907	ZC	100							P	940226	1116.63	3305.68	12022.98	TF	2				
908	ZC	100							P	940226	1203.98	3307.52	12040.01	JG	1				
909	ZC	100							P	940226	1206.03	3310.22	12043.77	KF	5				
910	ZC	24	DD	11	LO	65			P	940226	1206.48	3310.85	12044.43	JG	85	80	38		
911	ZC	100							S	940226	1215.30	3316.29	12051.13	TF	1	1			
912	ZC	100							P	940226	1215.47	3316.47	12051.39	KF	1				
913	ZC	100							P	940226	1216.63	3318.04	12053.15	KF	1				
916	ZC	100							O	940226	1224.03	3319.40	12058.16	KF	1				
917	ZC	100							P	940226	1225.00	3320.49	12056.46	JG	1				
918	ZC	100							P	940226	1226.37	3322.31	12054.29	JG	1				
919	ZC	100							P	940226	1226.88	3322.91	12053.37	KF	1				
920	ZC	100							P	940226	1227.12	3323.22	12052.95	JG	1				
921	ZC	100							S	940226	1447.78	3329.51	12014.00	JG	3				
923	ZC	100							P	940226	1507.35	3310.64	12036.73	TF	2				
928	ZC	100							O	940226	1516.05	3308.39	12039.19	TF	2				
929	ZC	100							P	940226	1525.05	3303.90	12044.65	KF	1				
930	ZC	100							P	940226	1608.28	3255.00	12007.52	TF	1				
931	ZC	100							P	940226	1608.43	3255.21	12007.27	JG	1				
932	ZC	100							O	940226	0946.52	3333.60	12025.01	KF	1				
933	ZC	20	UD	80					O	940226	1006.80	3243.66	12017.55	KF	40				
939	ZC	100							P	940227	1126.05	3400.71	11922.20	KF	1				
942	ZC	100							P	940227	1203.88	3339.10	11911.99	KF	8				
943	ZC	100							P	940227	1204.42	3338.30	11911.35	KF	18				
944	ZC	100							P	940227	1205.50	3336.65	11910.02	KF	13				
945	ZC	100							P	940227	1205.77	3336.23	11909.68	TF	3				
946	ZC	100							P	940227	1206.13	3335.72	11909.29	KF	1				
947	ZC	100							P	940227	1206.42	3335.31	11908.95	KF	11				
948	ZC	100							P	940227	1206.97	3334.42	11908.27	KF	8				
950	ZC	100							O	940227	1213.93	3330.98	11902.92						
951	ZC	100							O	940227	1215.67	3333.72	11900.99	TF	1				
952	ZC	100							P	940227	1216.65	3335.31	11901.17	KF	15				
953	ZC	100							P	940227	1217.82	3337.22	11901.39	KF	3				
954	ZC	100							P	940227	1218.48	3338.16	11901.52	KF	5				
955	ZC	100							P	940227	1219.15	3339.48	11901.64	KF	1				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
956	ZC	100							P	940227	1221.43	3343.16	11902.45	TF	3				
957	ZC	100							P	940227	1223.17	3345.92	11903.06	KF	1				
962	ZC	100							O	940227	1443.17	3341.58	11907.64	TF	1				
968	ZC	1	LB	>99					P	940313	1015.68	3329.01	12007.75	TF	300	200	110	188	
970	ZC	100							P	940313	1052.53	3338.31	12017.57	ML	1				
971	ZC	100							P	940313	1053.58	3339.90	12017.74	ML	1				
977	ZC	100							S	940313	1449.95	3254.81	12009.32	MO	1				
978	ZC	100							P	940313	1456.40	3302.35	12017.51	ML	1				
983	ZC	100							P	940313	1543.15	3249.62	12019.79	TF	1				
1009	ZC	100							O	940329	1212.65	3328.96	12010.59	JB	4				
1010	ZC	100							P	940329	1218.40	3322.12	12002.55	JB	1				
1012	ZC	100							P	940329	1226.48	3315.26	11954.43	JB	1				
1013	ZC	100							P	940329	1230.20	3310.64	11948.68	JB	1				
1014	ZC	100							P	940329	1232.12	3308.11	11946.19	JB	1				
1015	ZC	100							P	940329	1232.55	3307.67	11945.45	JB	1				
1016	ZC	100							P	940329	1254.98	3321.83	11953.00	JB	1				
1017	ZC	100							P	940329	1255.60	3322.59	11953.75	JB	1				
1018	ZC	100							S	940329	1259.52	3326.97	11959.04	KF	1				
1026	ZC	100							P	940416	1027.45	3247.83	11945.48	JC	1				
1027	ZC	100							P	940416	1028.98	3249.50	11947.46	JC	1				
1028	ZC	100							P	940416	1032.05	3252.98	11951.78	JC	1				
1029	ZC	100							P	940416	1036.08	3257.60	11957.13	JC	1				
1030	ZC	100							P	940416	1040.57	3302.70	12003.18	JC	1				
1031	ZC	100							S	940416	1043.95	3306.99	12007.96	JG	1				
1033	ZC	100							P	940416	1103.77	3330.15	12035.68	JC	1				
1034	ZC	100							P	940416	1126.55	3338.42	12021.79	ML	4				
1035	ZC	100							P	940416	1129.92	3334.34	12017.13	ML	1				
1036	ZC	100							P	940416	1130.23	3333.90	12016.59	JG	4				
1037	ZC	100							P	940416	1130.48	3333.60	12016.30	JG	1				
1038	ZC	100							P	940416	1130.57	3333.42	12016.13	JG	4				
1039	ZC	100							P	940416	1133.77	3329.53	12011.16	JG	1				
1041	ZC	100							P	940416	1134.67	3328.54	12009.73	ML	1				
1042	ZC	100							P	940416	1135.73	3327.27	12008.48	ML	2				
1043	ZC	100							P	940416	1139.03	3322.99	12003.52	JG	4				
1052	ZC	100							O	940429	1418.00	3305.50	12003.63	TF	2				
1054	ZC	100							P	940506	1421.32	3304.34	12003.85	JB	1				
1057	ZC	100							P	940506	1430.70	3255.78	12008.27	TF	1				
1060	ZC	100							P	940506	1503.93	3242.47	12019.43	TF	1				
1061	ZC	100							P	940506	1506.88	3247.55	12017.51	KF	1				
1065	ZC	100							P	940506	1528.80	3301.84	12010.94	KF	1				
1073	ZC	13	LO	49	DD	38			P	940507	1321.08	3303.91	11816.11	TF	400	88	75		
1074	ZC	3	DD	97					P	940507	1346.47	3307.70	11847.28	KF	33	37	21		
1076	ZC	100							P	940507	1355.30	3309.67	11859.55	KF	2				

Table 8 (continued).

SI#	SPEC1	%	SPEC2	%	SPEC3	%	SPEC4	%	TYP	DATE	TIME	LATITUDE	LONGITUDE	OBS	BEST ESTIMATES 1	2	3	4	5
1084	ZC	100							P	940518	1549.37	3242.16	12006.38	KF	1				
1089	ZC	100							P	940523	1605.07	3303.46	12016.89	TF	1				
1091	ZC	100							O	940523	1620.90	3250.52	12028.67	KF	1				
1092	ZC	100							O	940523	1621.85	3249.10	12029.48	TF	1				
1093	ZC	100							O	940523	1649.08	3248.84	12016.27	JG	1				
1095	ZC	100							O	940523	1227.37	3244.90	12010.52	WA	1				
33	ZI	100							P	930130	1428.43	3337.35	12012.23	KF	4	3	4		
36	ZI	100							P	930130	1534.17	3318.10	12019.97	JG	1	1	1		
103	ZI	100							P	930212	1229.72	3304.02	12028.67	JC	2				
155	ZI	100							O	930306	1201.37	3242.67	12011.79	MO	4				
257	ZI	100							O	930509	1115.73	3256.64	12020.91	JC	1				
578	ZI	100							P	931022	1104.93	3257.12	12004.79	JG	1	1			
593	ZI	100							O	931023	1007.08	3249.03	11954.14	JC	2	2	2		
632	ZI	100							P	931121	1057.68	3316.34	12051.40	MO	2	2	2		
637	ZI	100							O	931121	1423.07	3326.98	12008.94	JC	2	2	2		
784	ZI	100							O	940101	0957.82	3246.39	11856.65	WA	1				
827	ZI	100							P	940129	1050.70	3305.03	12020.15	JG	1	1			
831	ZI	100							P	940129	1136.50	3303.09	12035.74	TF	4	4	4		
1053	ZI	100							P	940506	1418.23	3305.42	12003.90	JB	1	1	1		
1080	ZI	100							P	940518	1233.35	3210.34	12058.14	TF	2	2			
587	ZU	100							P	931022	1539.27	3258.36	12042.44	TL	1	1			
599	ZU	100							P	931023	1142.22	3318.18	12012.23	JG	1				
602	ZU	100							O	931023	1453.73	3316.71	12005.75	JG	1				
783	ZU	100							O	940101	0954.17	3246.77	11845.36	JG	1				

Figure 1. Southwest Fisheries Science Center (SWFSC) study area and transect grid.

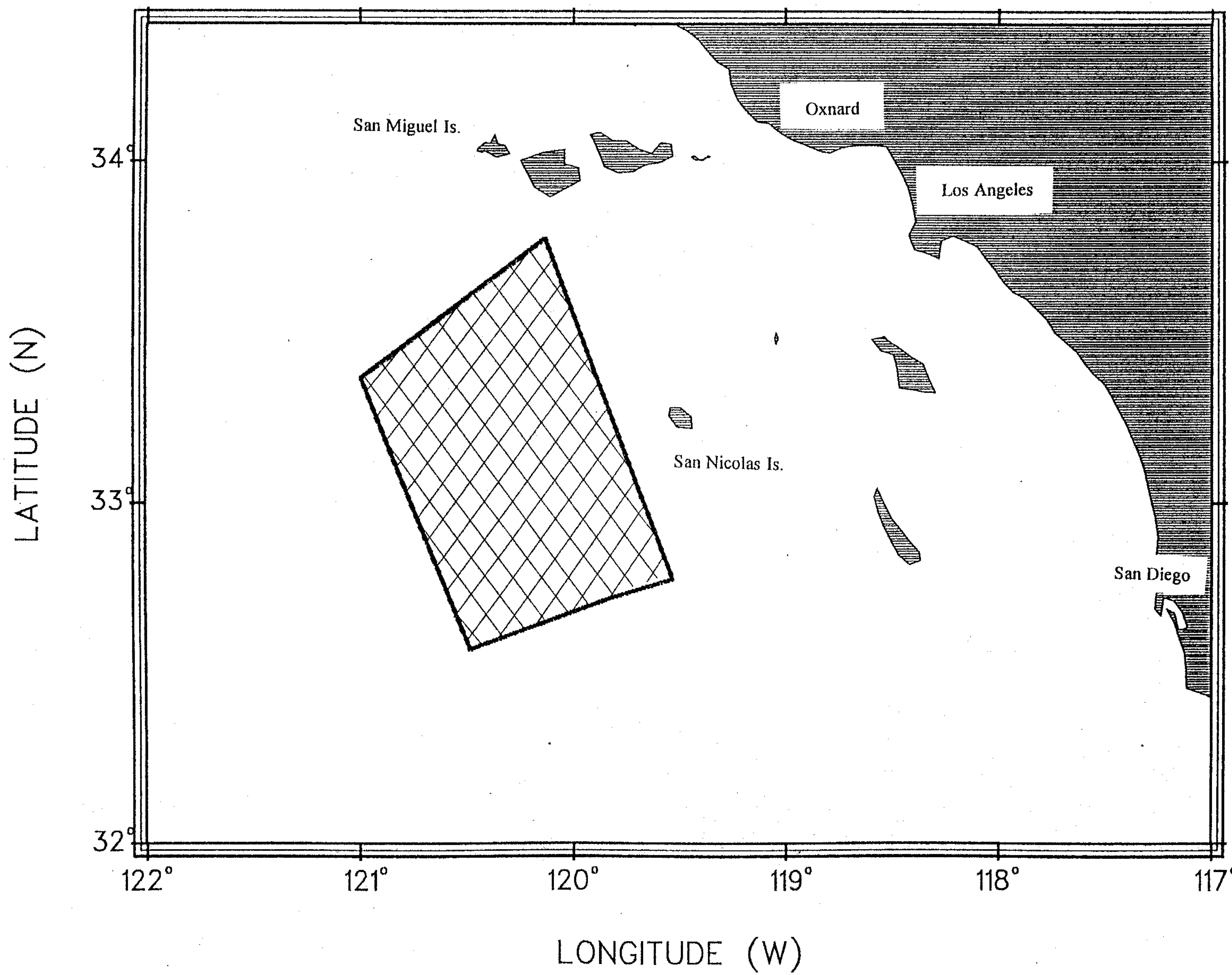


Figure 2. Sub-areas "A" and "B", which collectively represent the SWFSC study area, and Area "C", with transect grid. Area "C" is where ship-shock trials occurred.

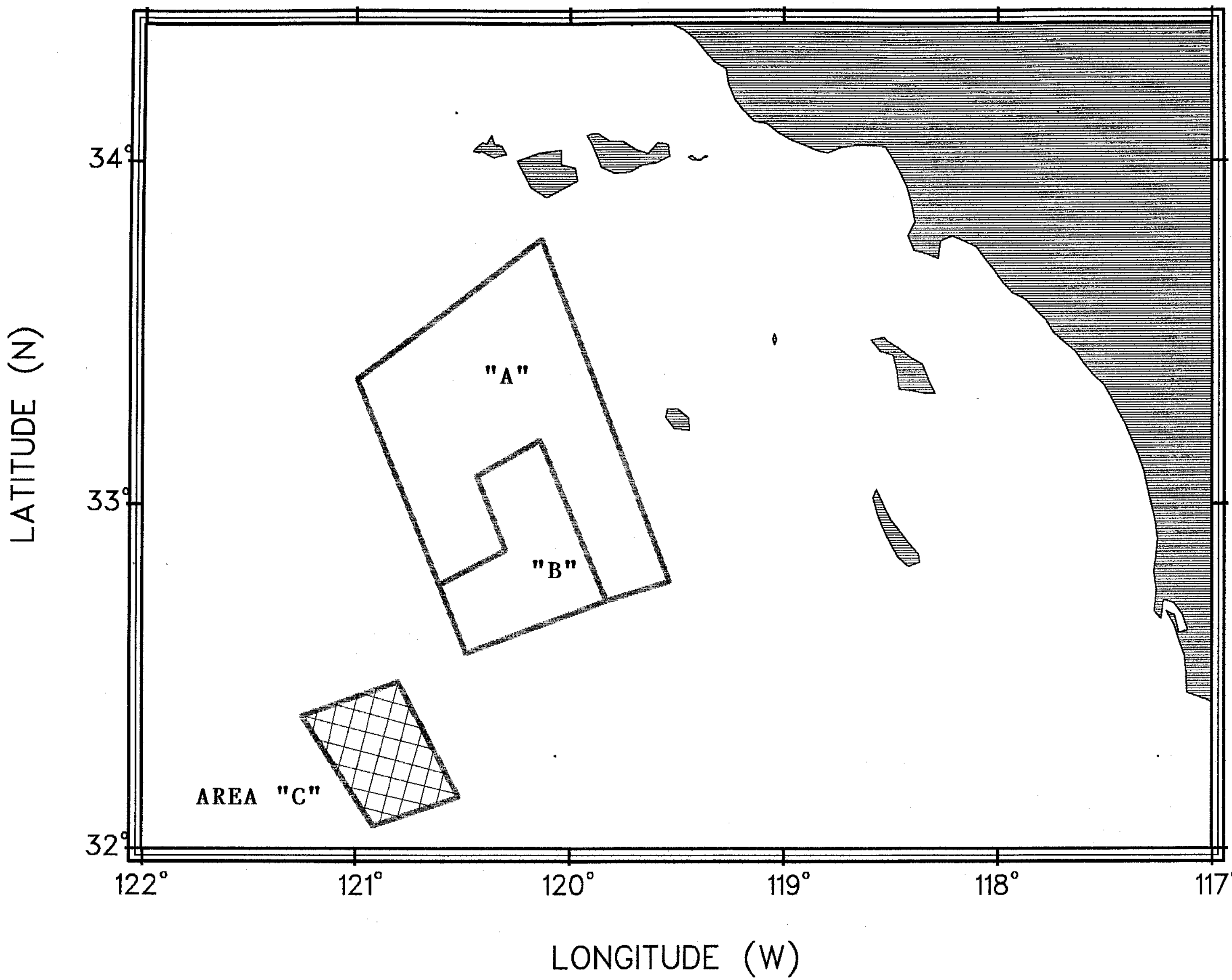


Figure 3. Survey boundaries for the "Inshore Area".

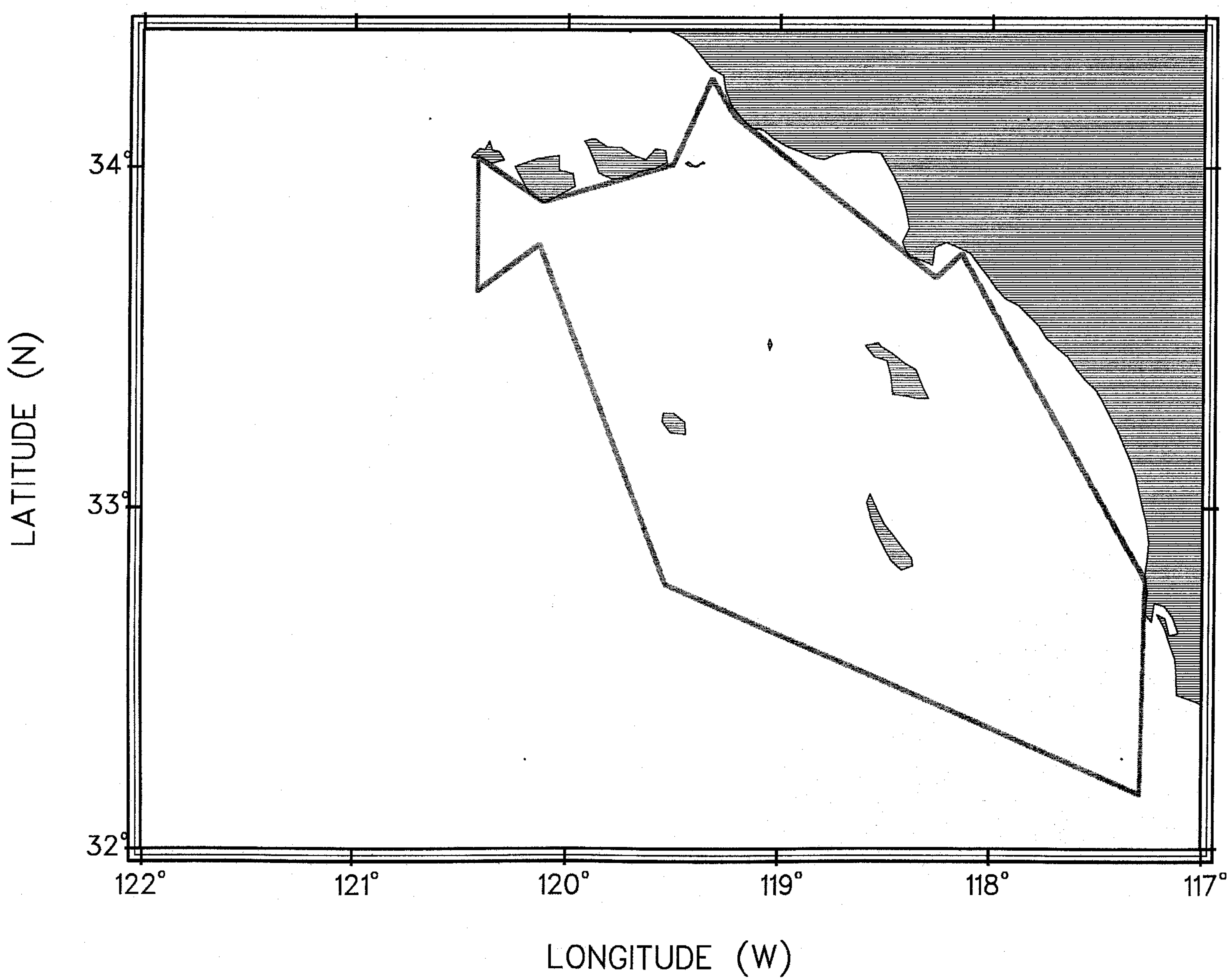


Figure 4. General bathymetric features of the study region, showing the 200, 500, 1000, 2000, and 3000 meter contours.

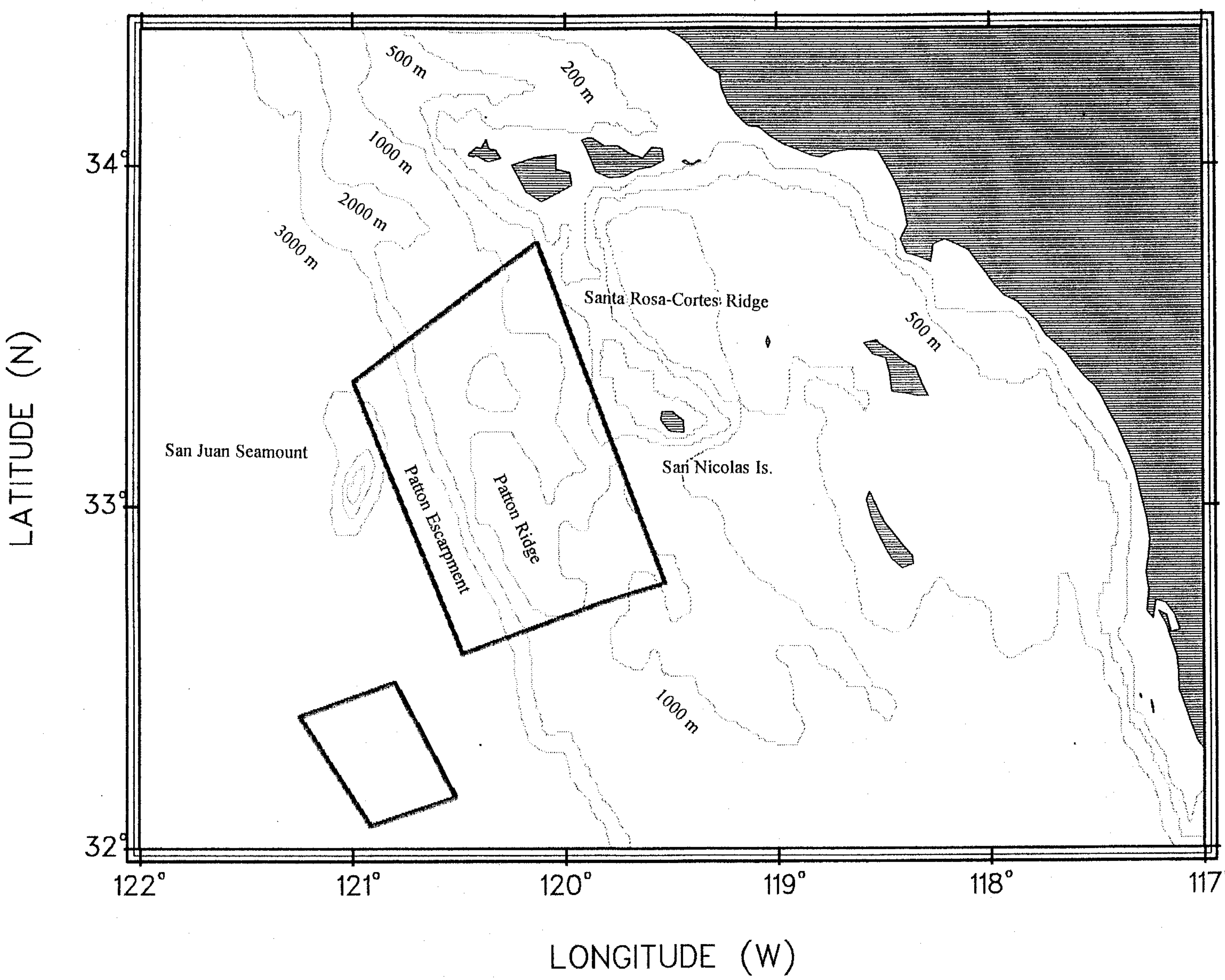


Figure 5. Spatial plot of relative effort (kilometers surveyed) within the SWFSC study area during 1993-1994.

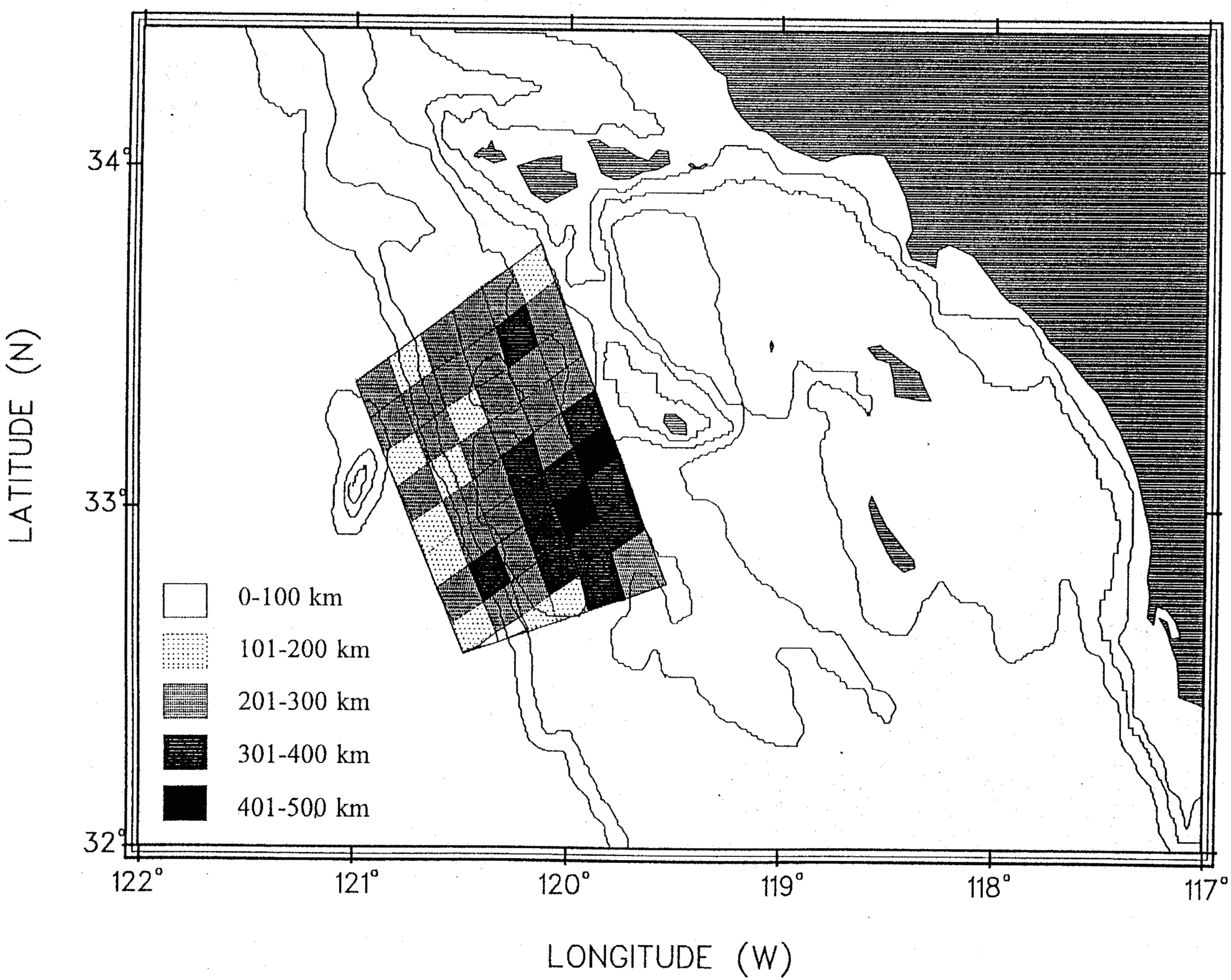


Figure 6. Spatial plot of relative group encounter rates (sightings/100 km) within the SWFSC study area during 1993-1994.

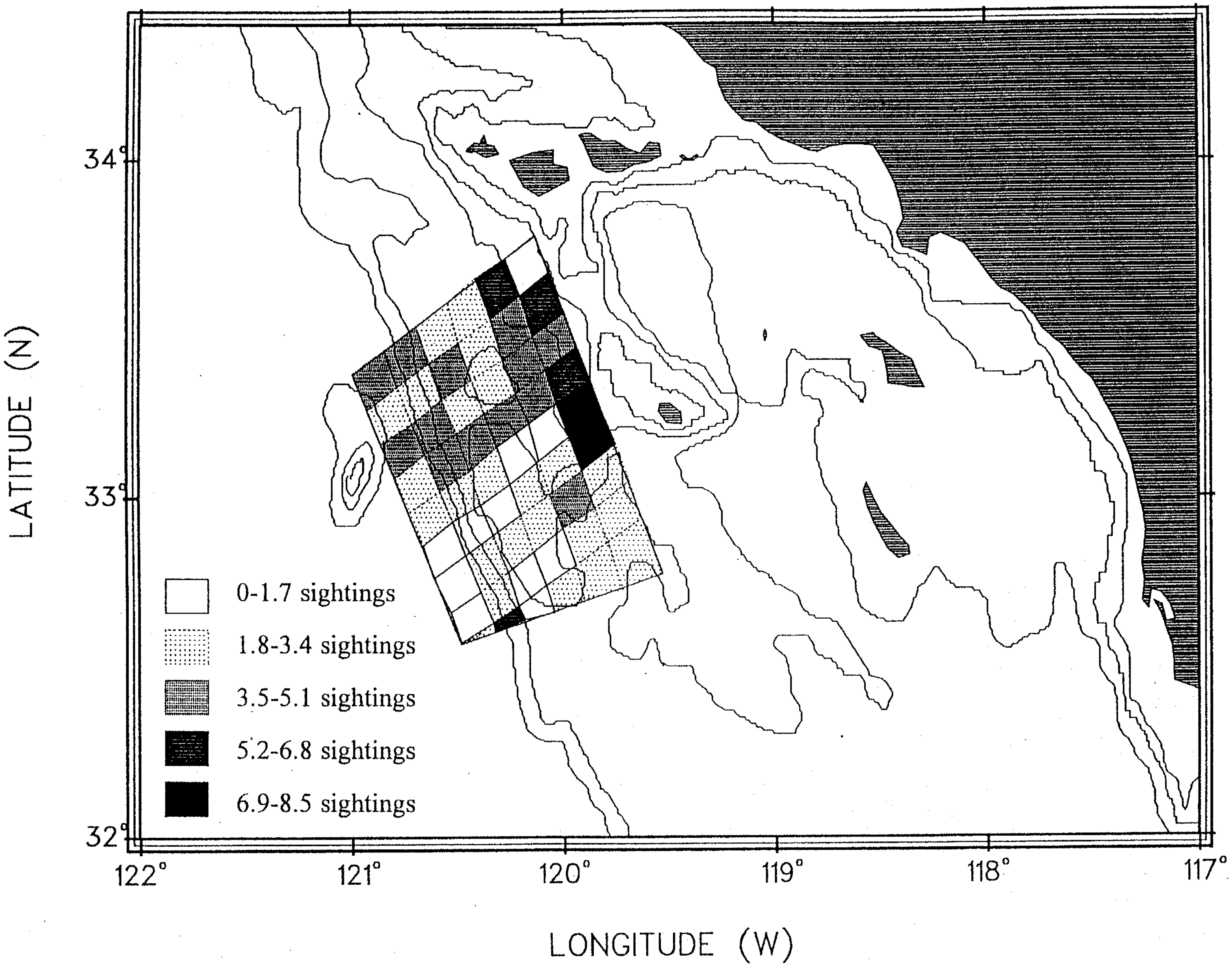


Figure 7. Spatial plot of relative animal encounter rates (animals/100 km) within the SWFSC study area during 1993-1994.

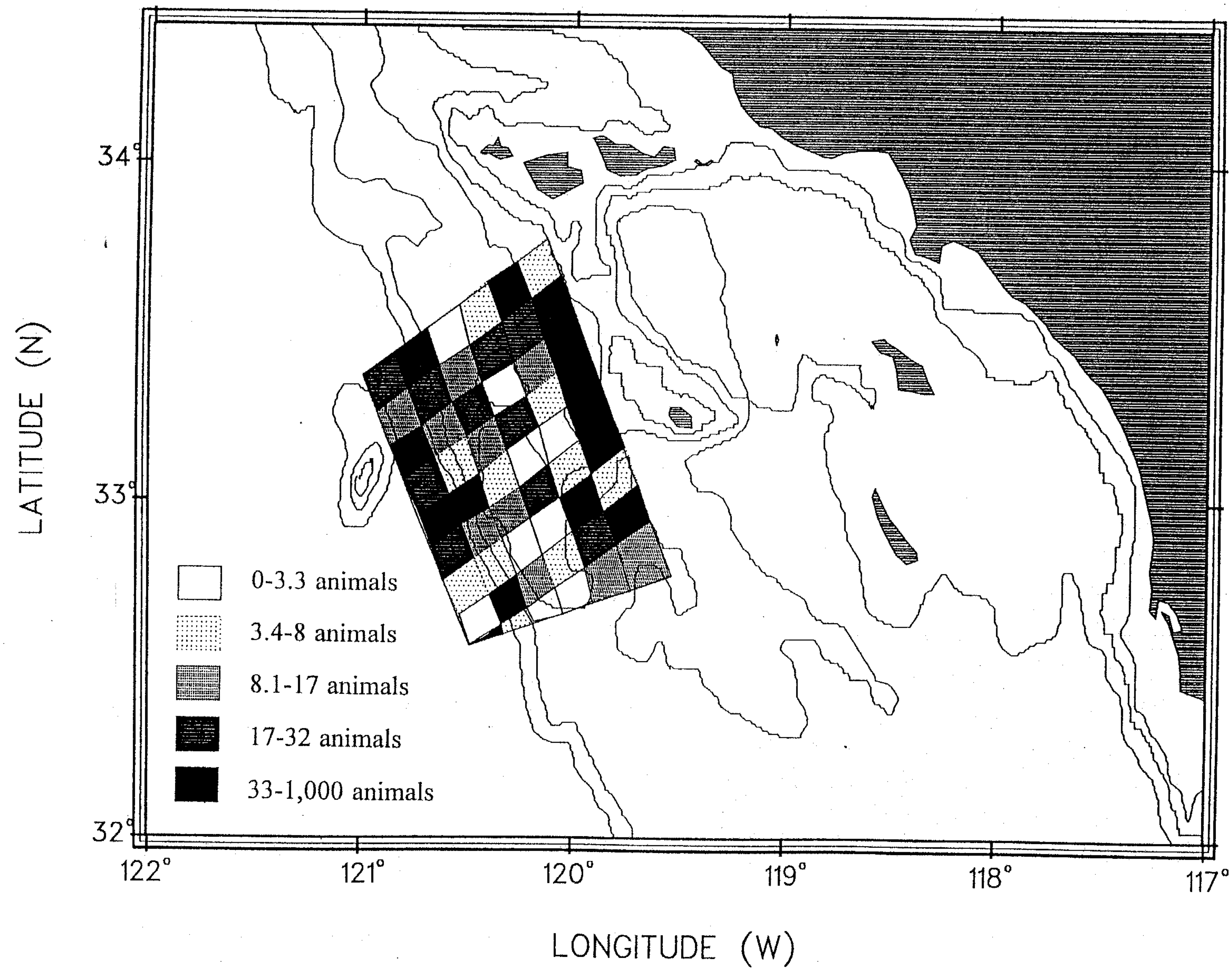


Figure 8. Locations of 77 on-effort common dolphin sightings.

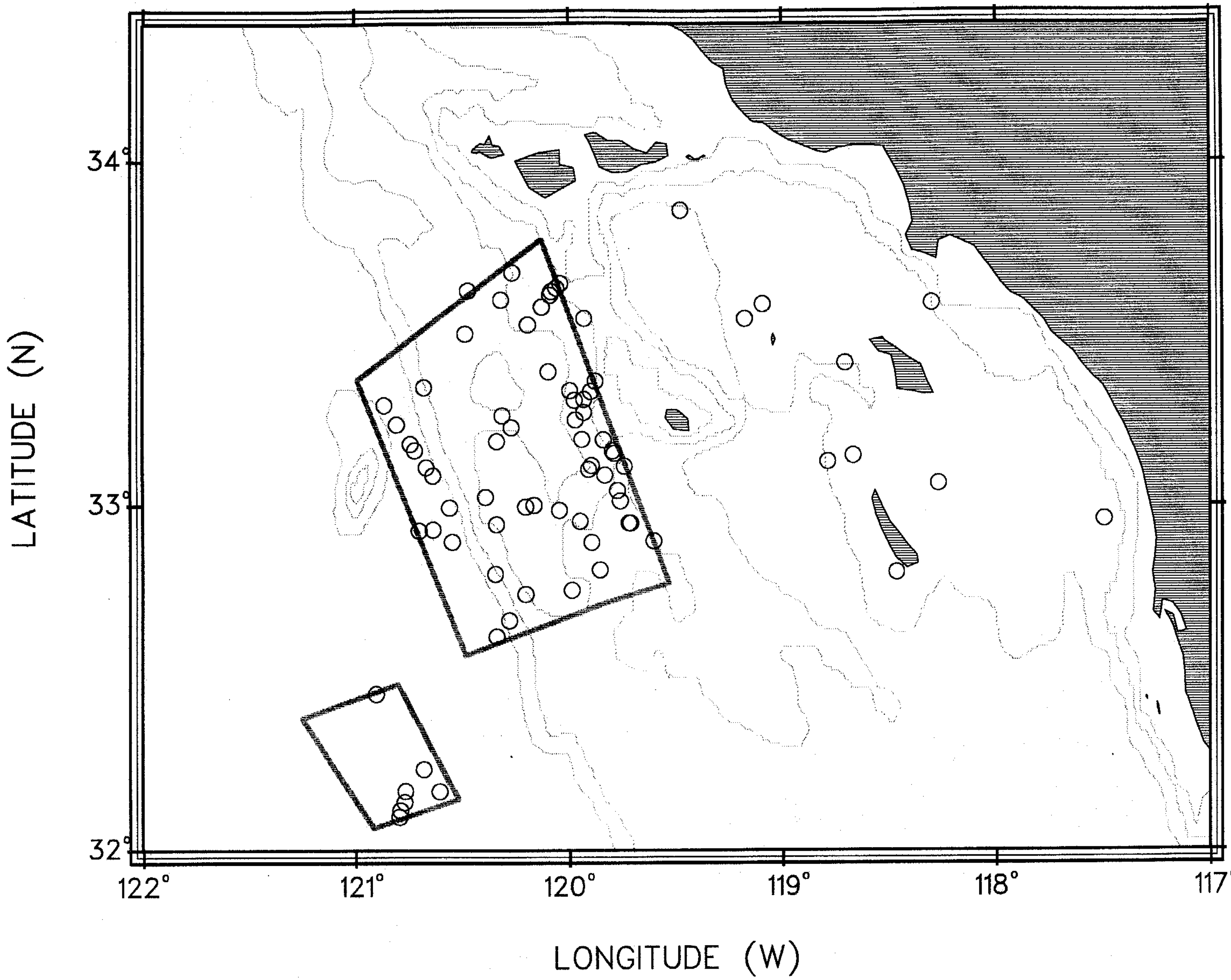


Figure 9. Locations of 33 on-effort northern right whale dolphin sightings.

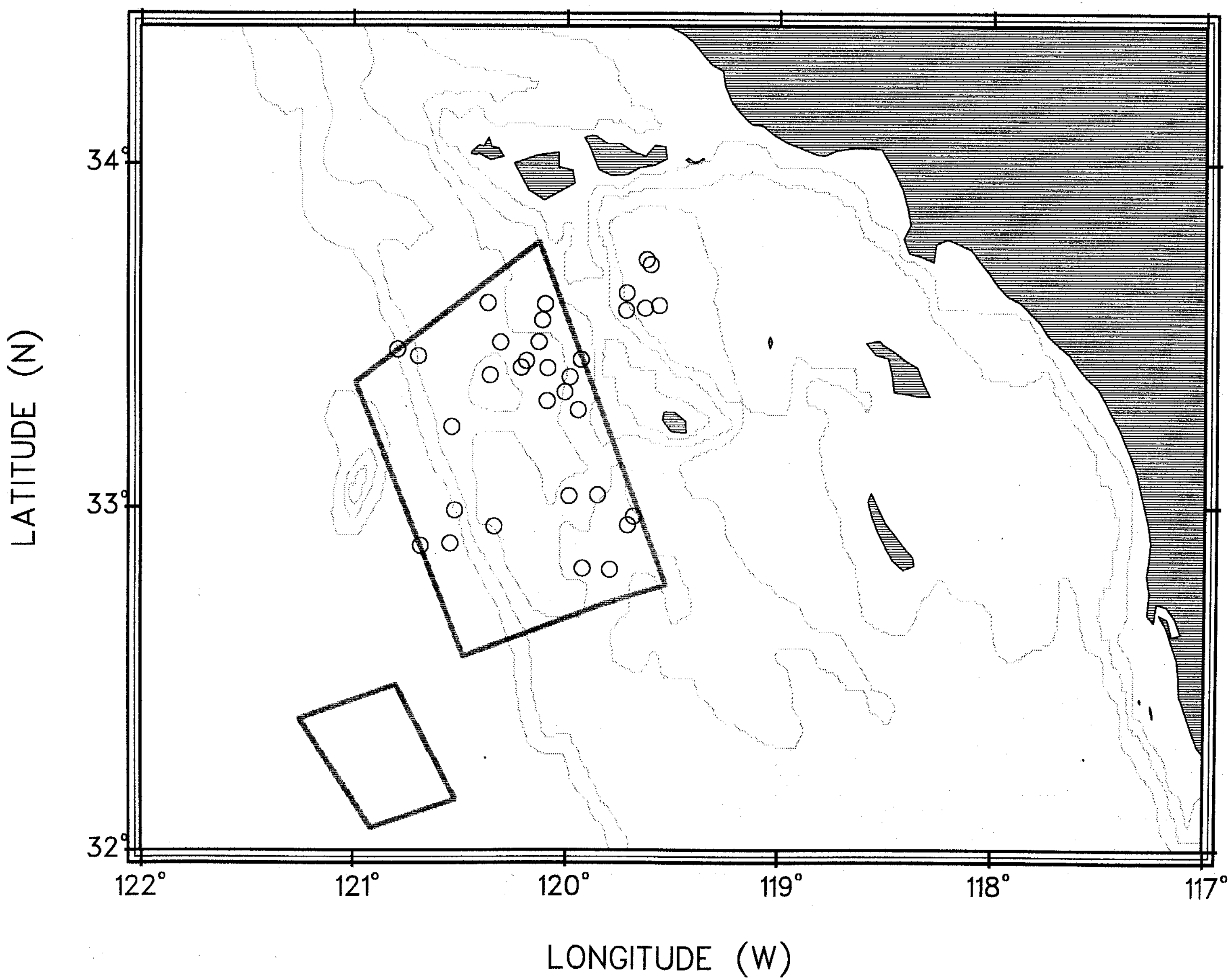


Figure 10. Locations of 40 on-effort Risso's dolphin sightings.

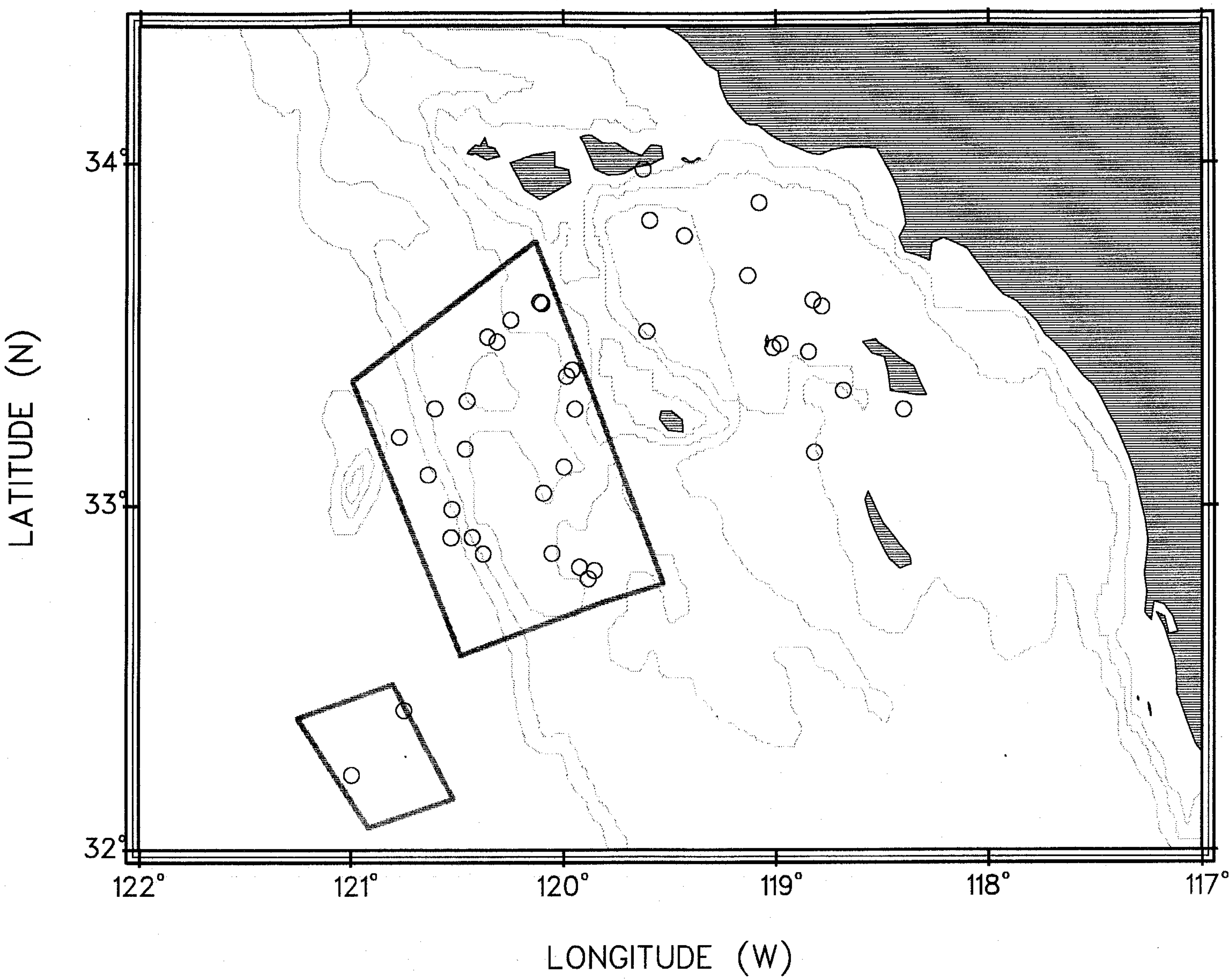


Figure 11. Locations of 28 on-effort Pacific white-sided dolphin sightings.

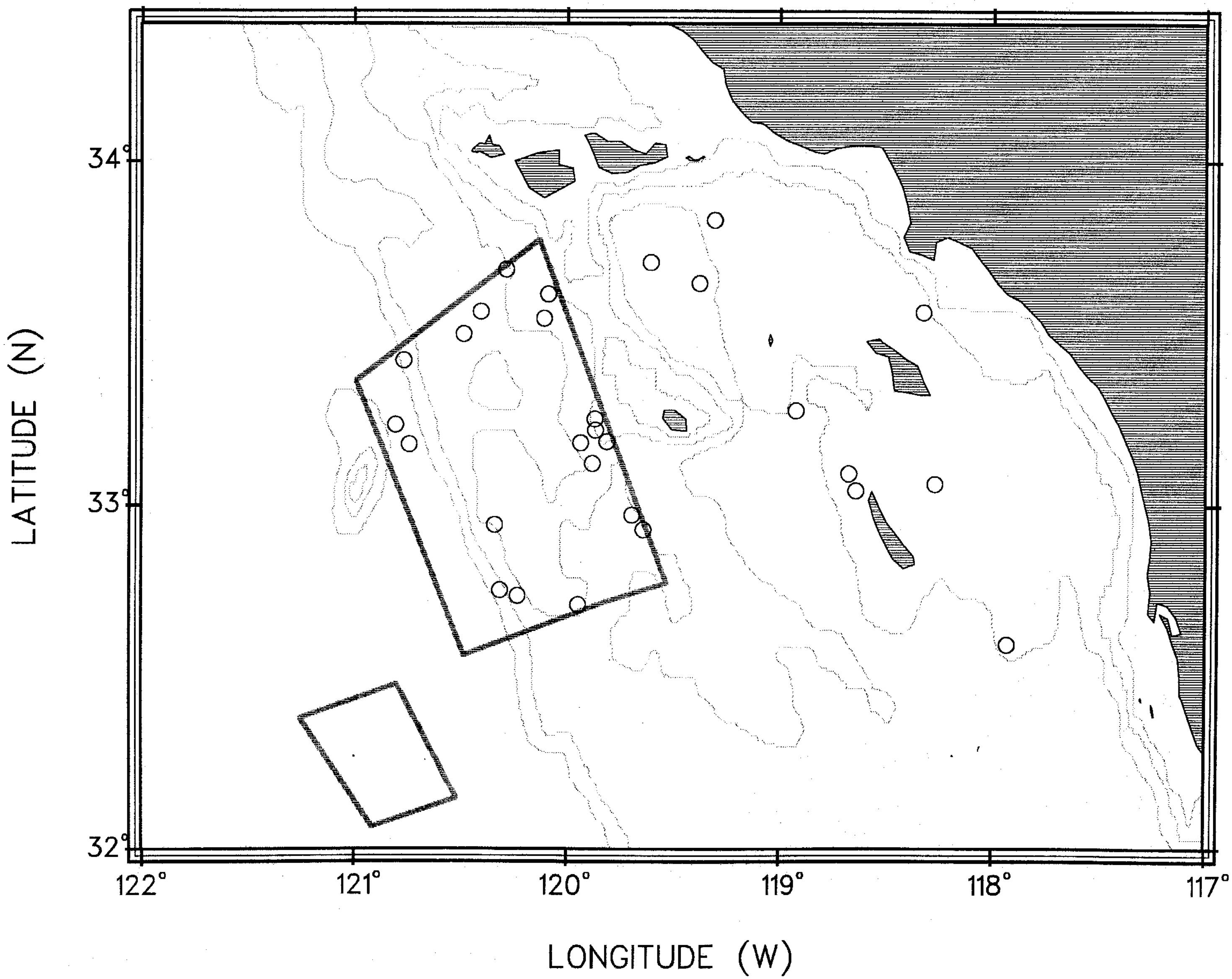


Figure 12. Locations of 18 on-effort Dall's porpoise sightings.

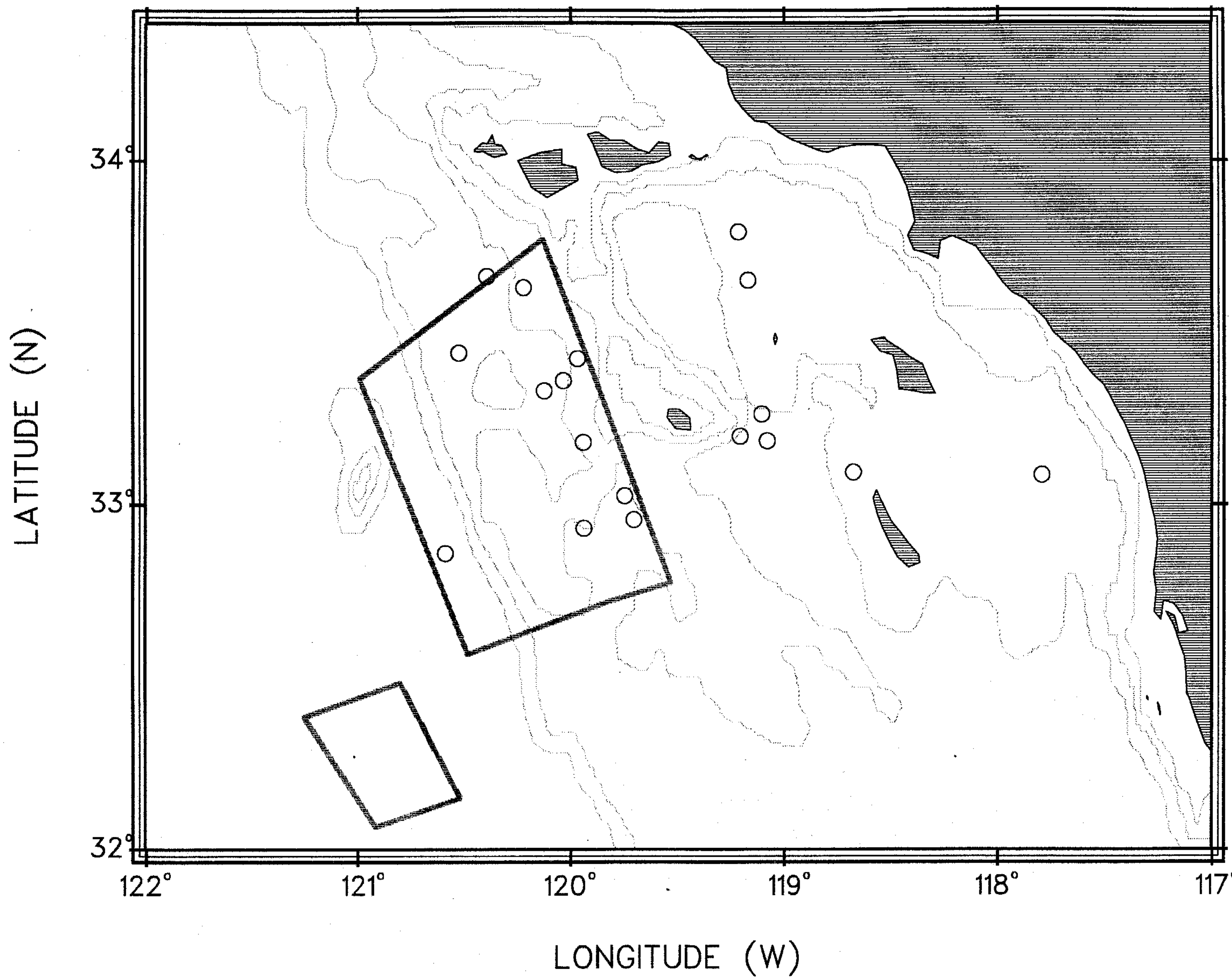


Figure 13. Locations of all (n=5) killer whale sightings.

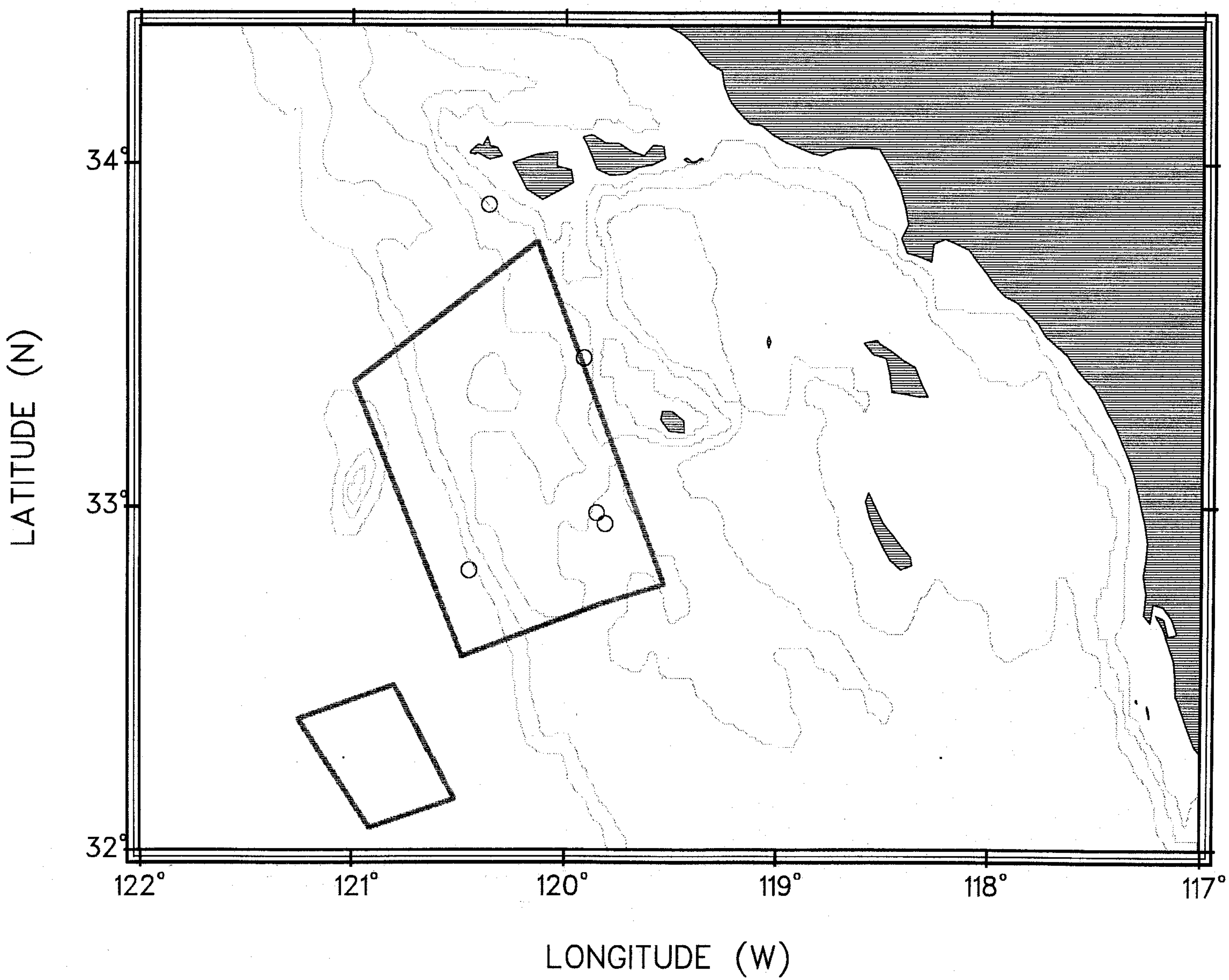


Figure 14. Location of one off-effort short-finned pilot whale sighting.

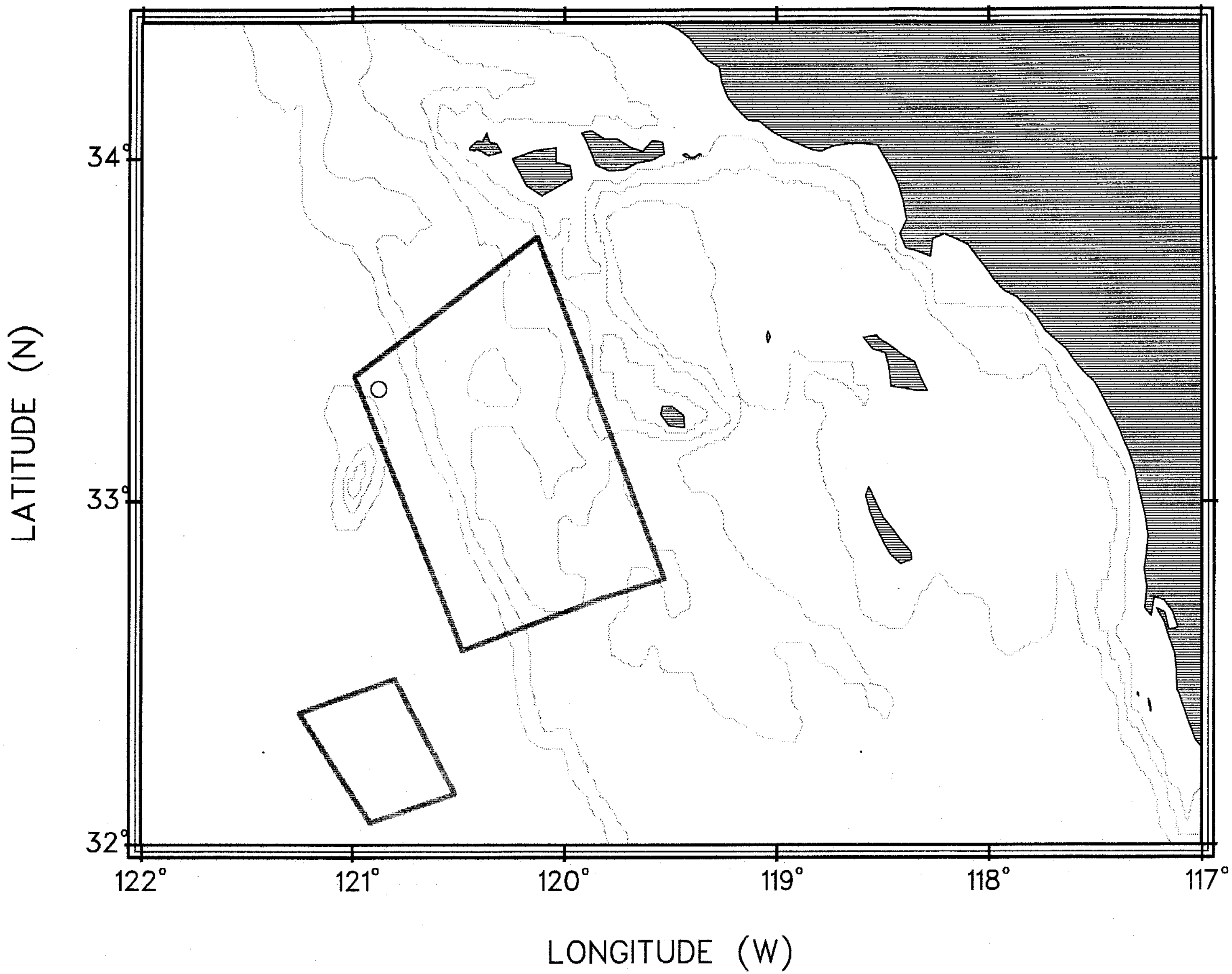


Figure 15. Locations of all (n=7) minke whale sightings.

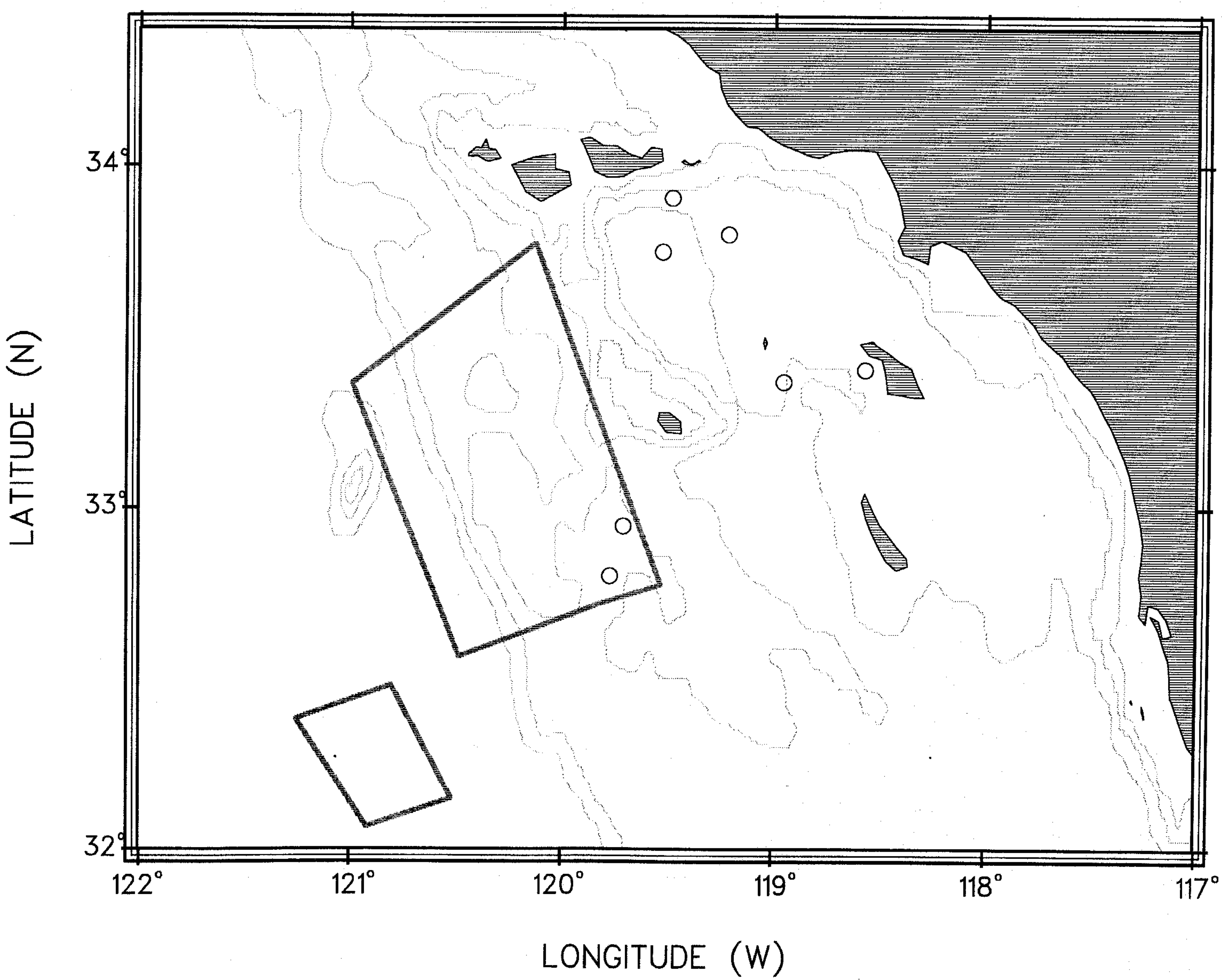


Figure 16. Locations of all (n=31) blue whale sightings.

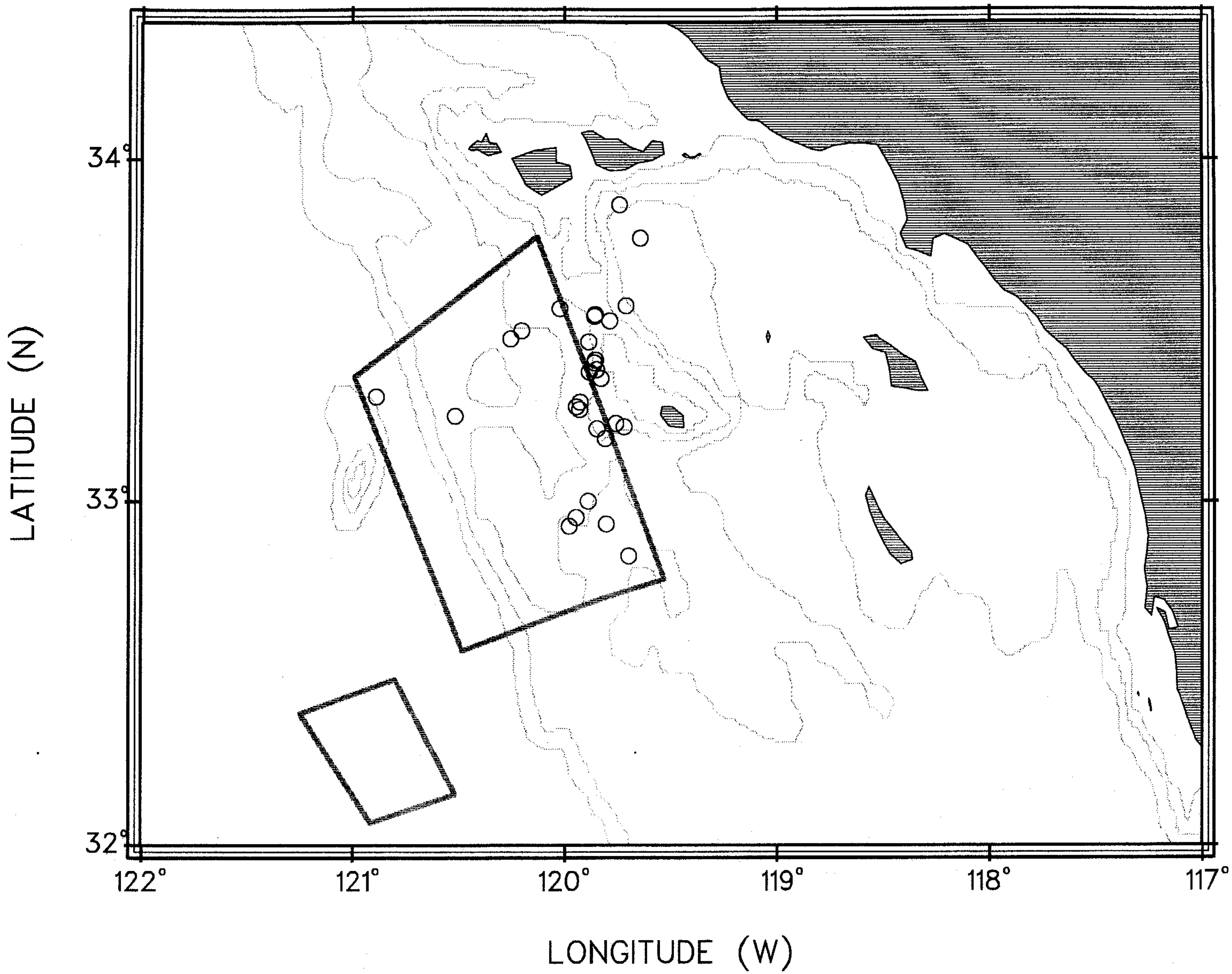


Figure 17. Locations of all (n=27) fin whale sightings.

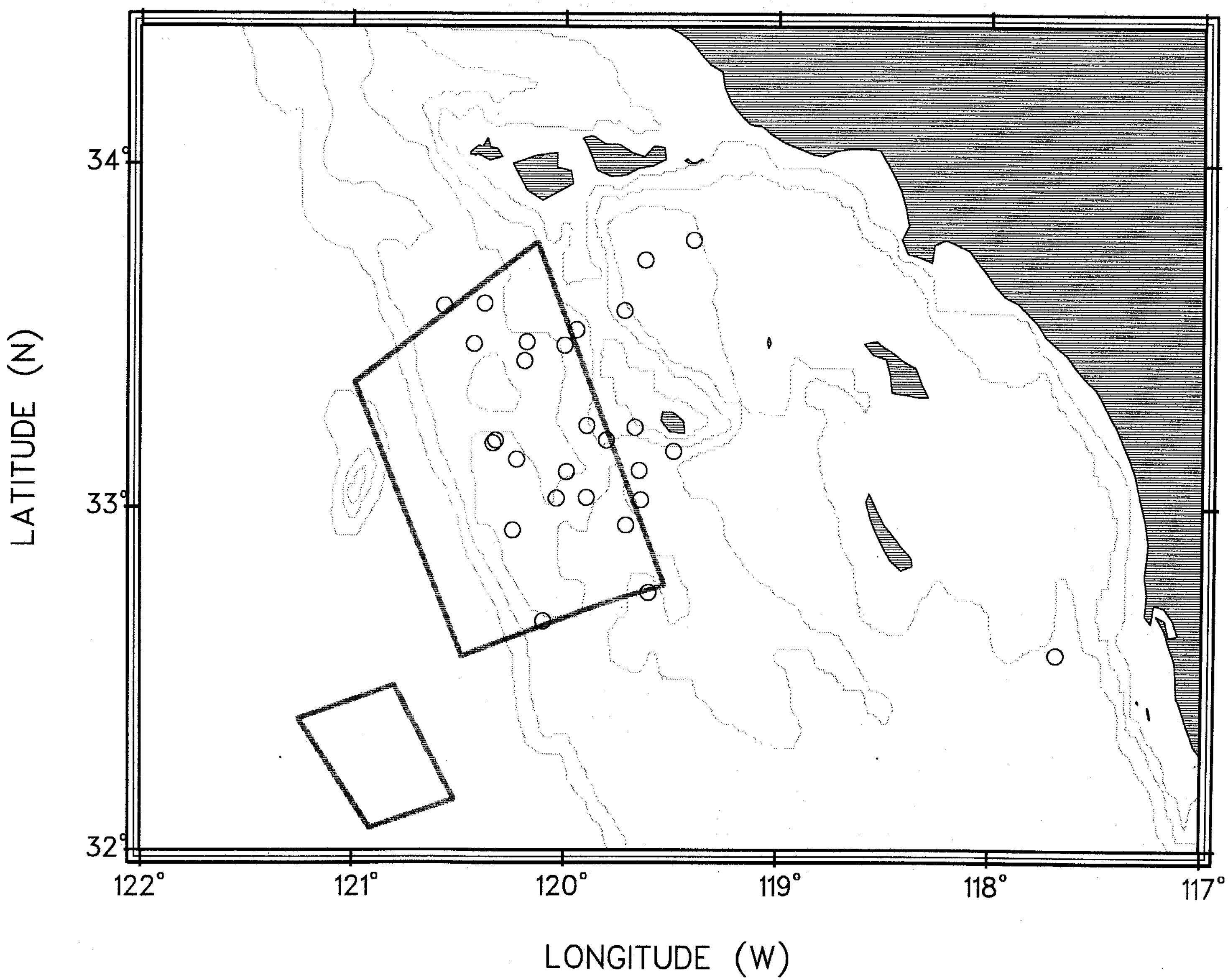


Figure 18. Locations of all (n=72) gray whale sightings.

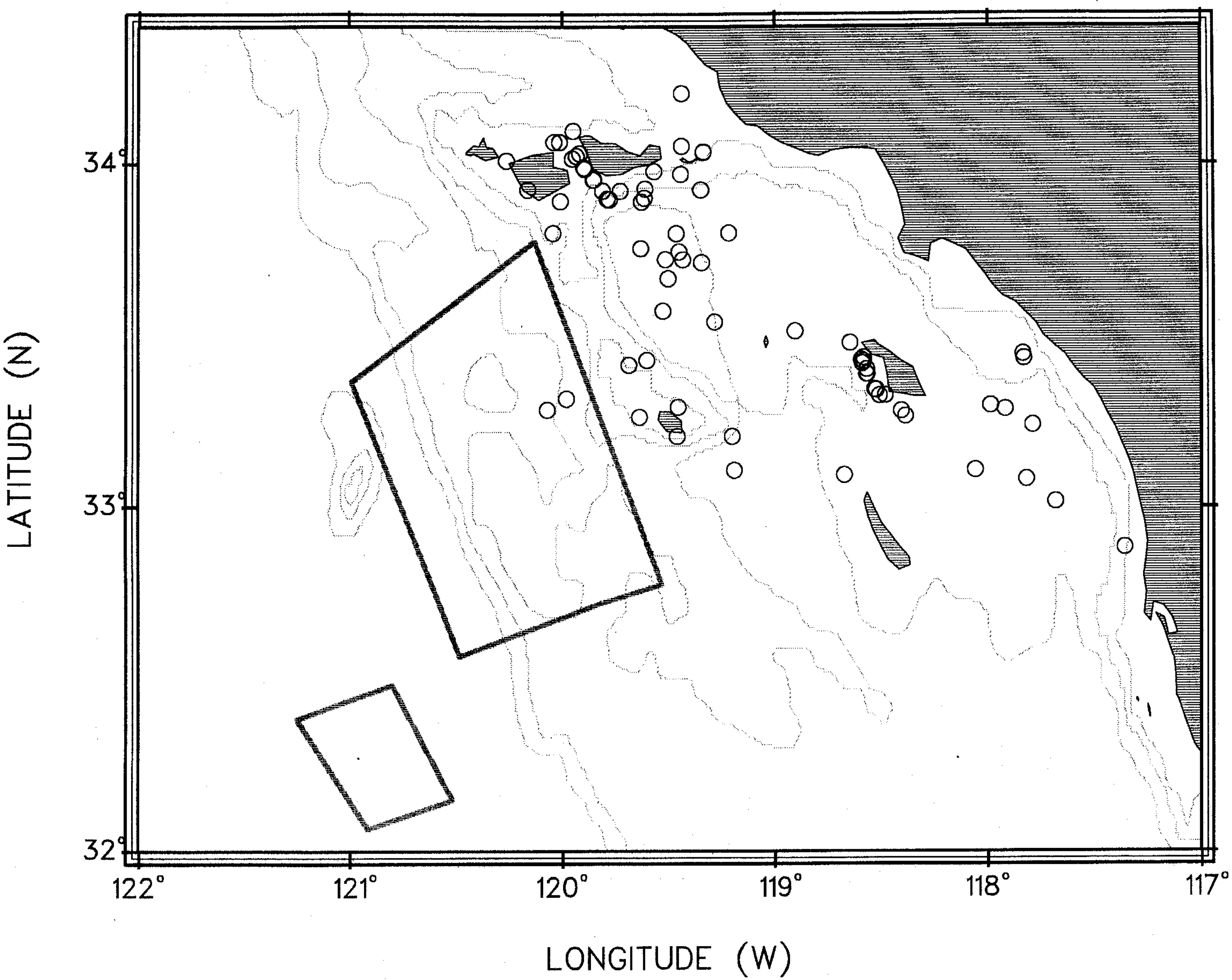


Figure 19. Locations of 473 gray whale sightings recorded during Minerals and Management Service (MMS) and Southwest Fisheries Science Center (SWFSC) surveys conducted during the periods 1975-1983, and 1991-1994, respectively.

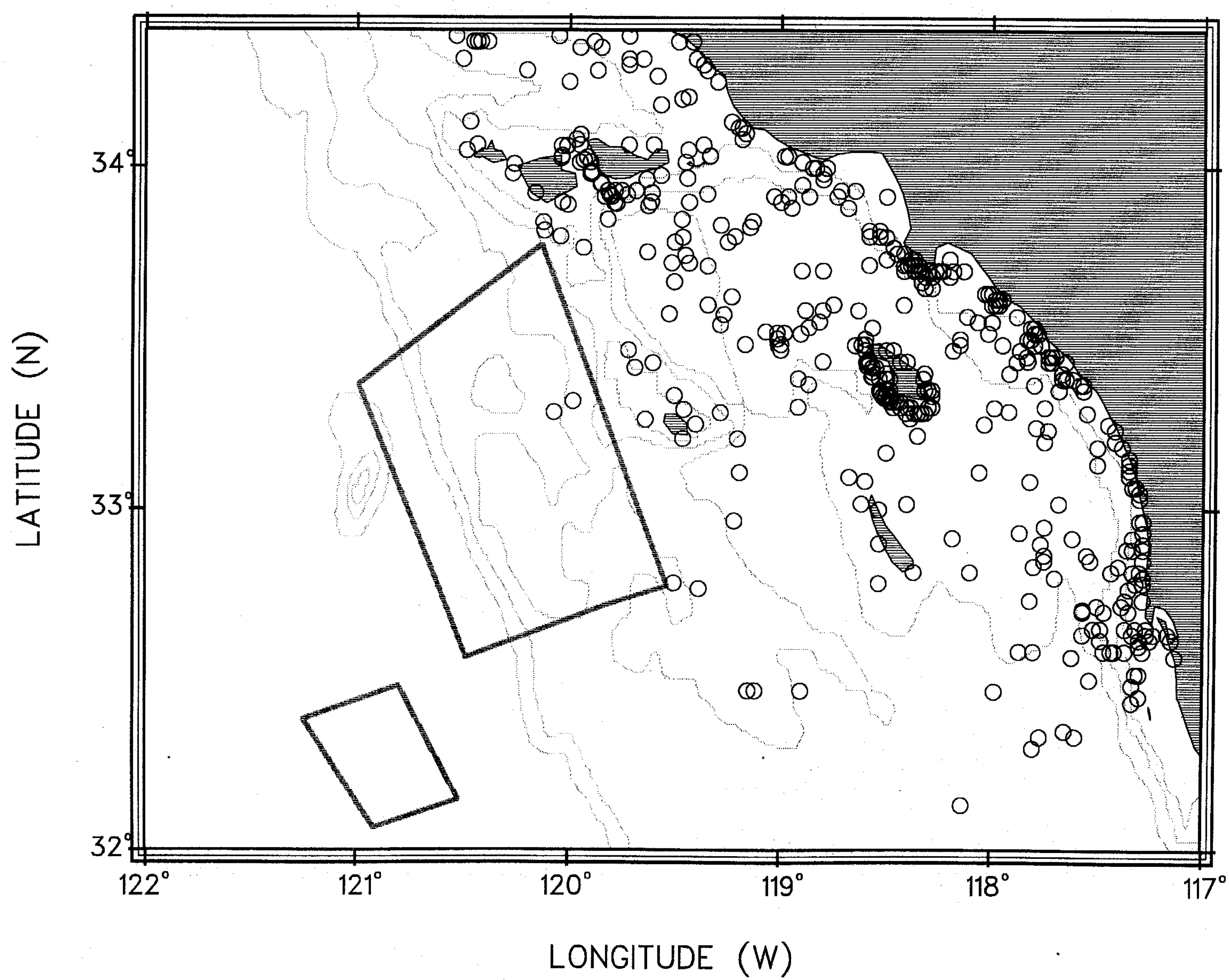


Figure 20. Locations of all (n=4) Baird's beaked whale sightings.

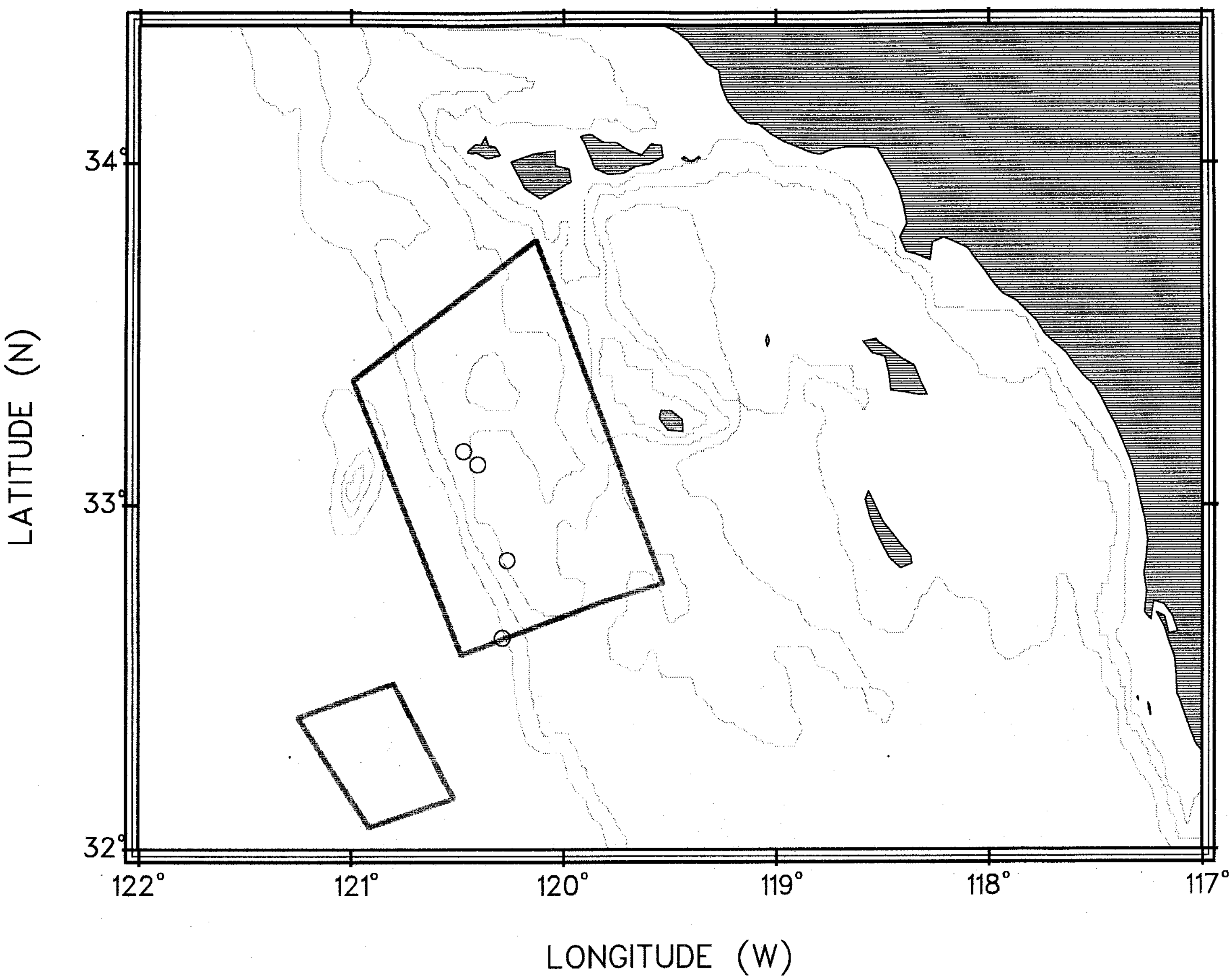


Figure 21. Location of one on-effort pygmy sperm whale sighting.

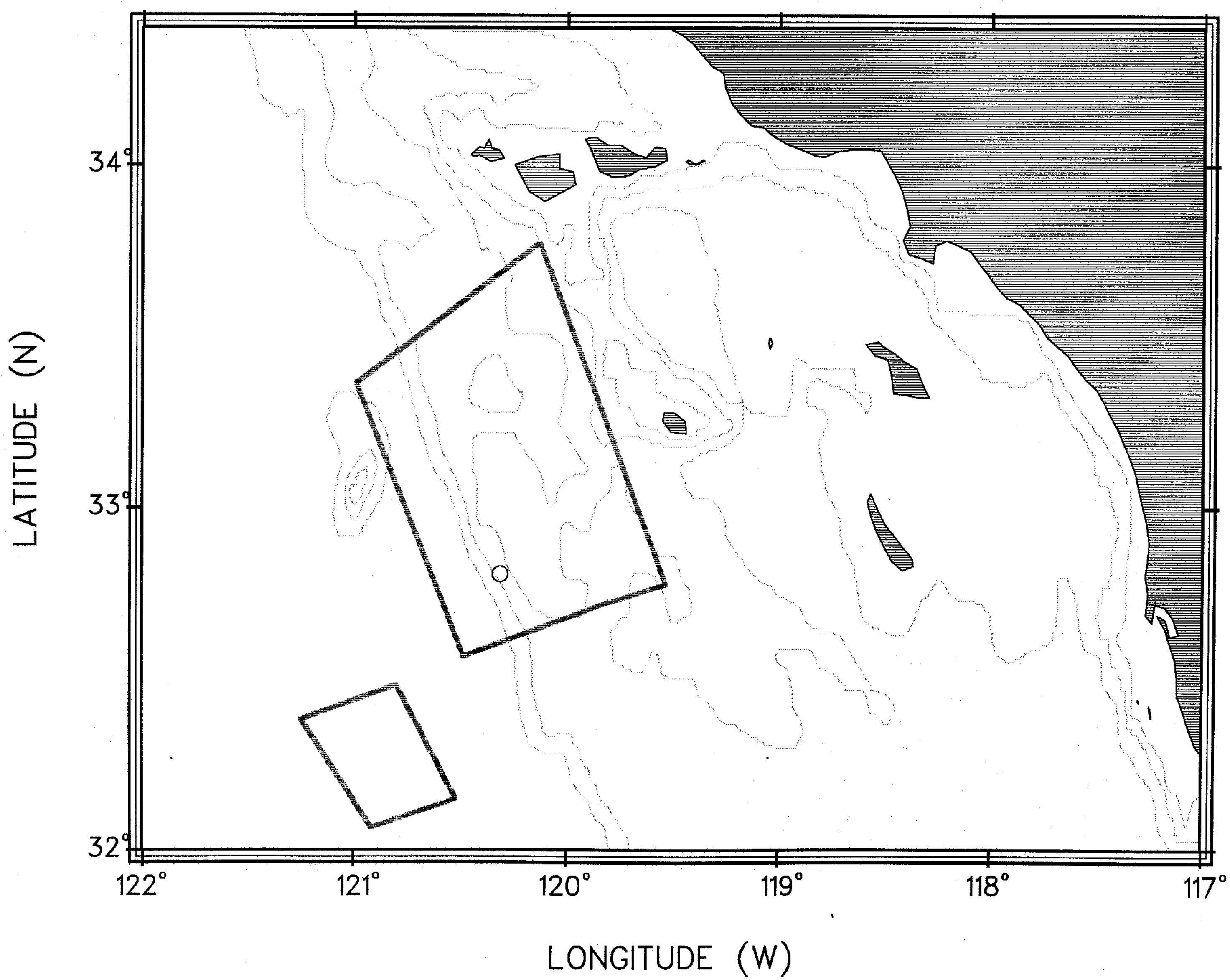


Figure 22. Locations of all (n=12) sperm whale sightings.

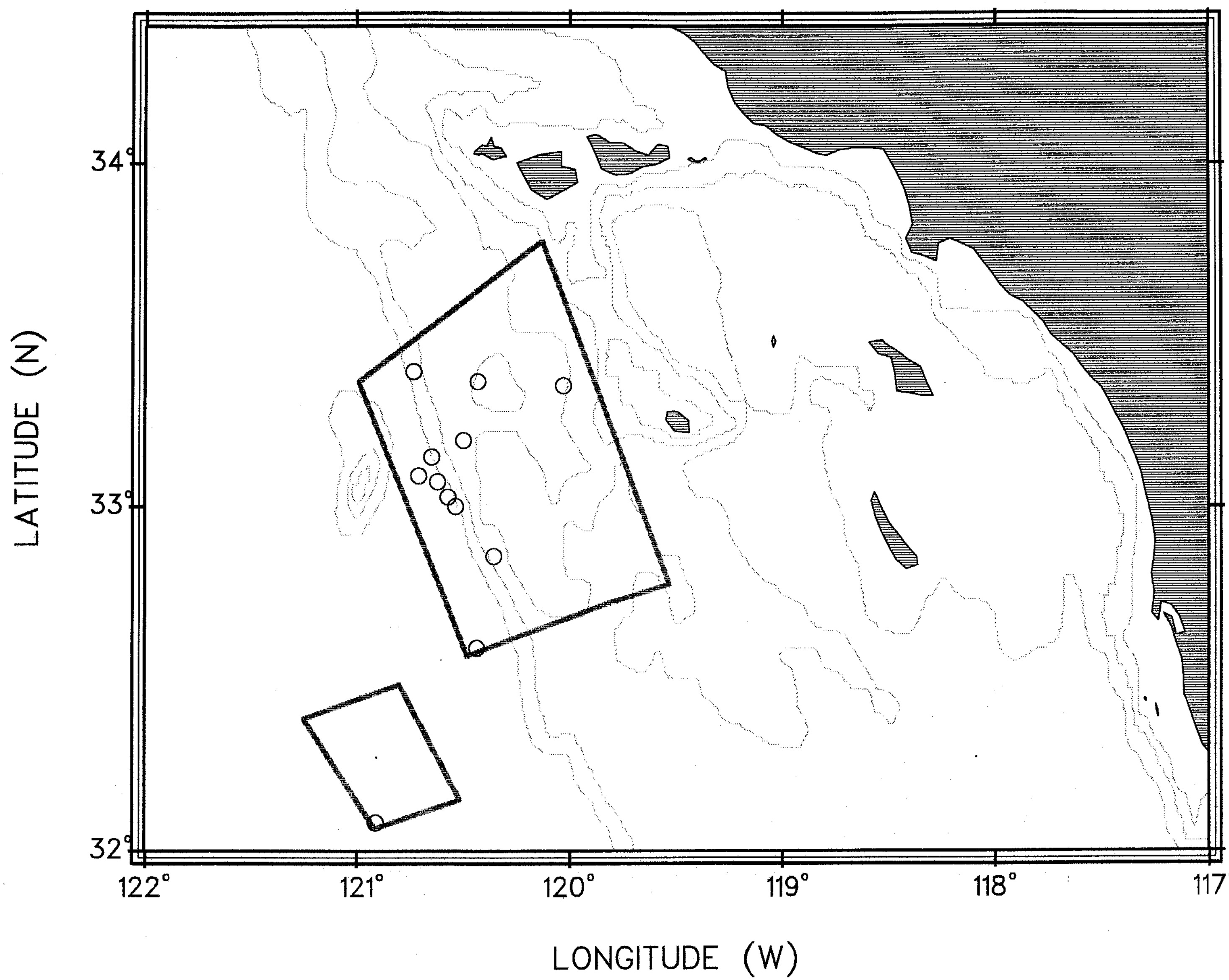


Figure 23. Locations of all (n=14) Cuvier's beaked whale sightings.

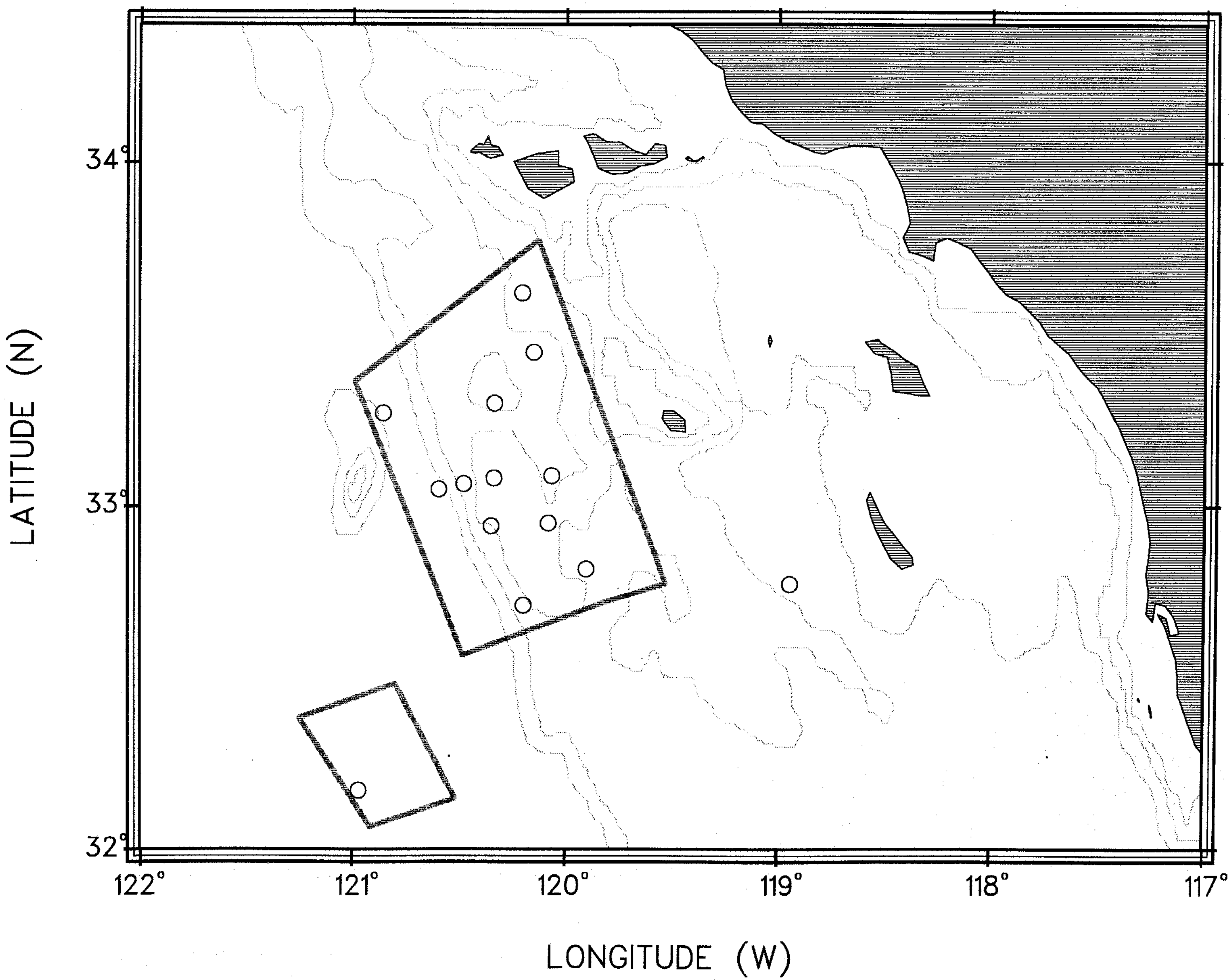


Figure 24. Locations of all (n=2) mesoplodont beaked whale sightings.

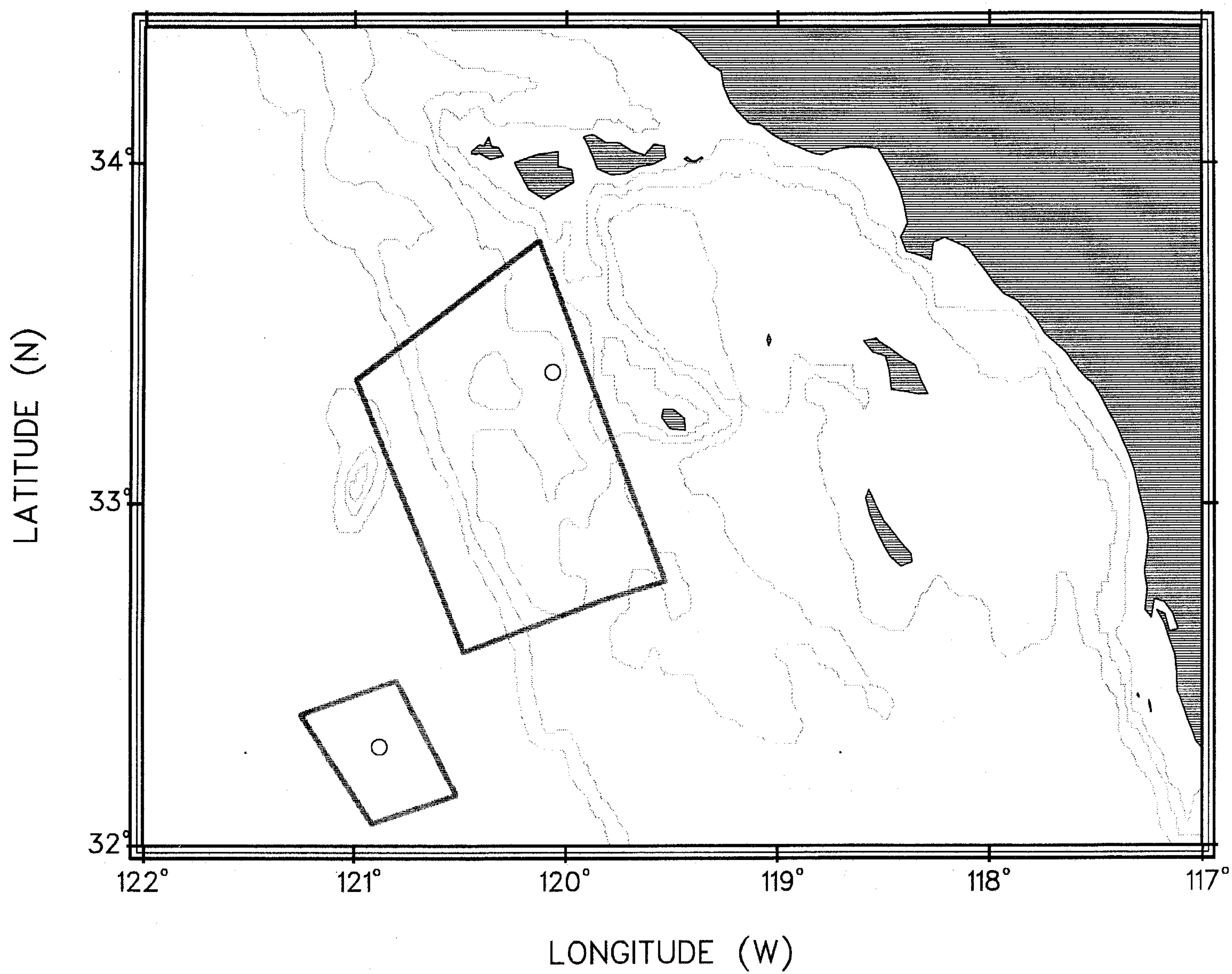


Figure 25. Locations of all (n=15) northern elephant seal sightings.

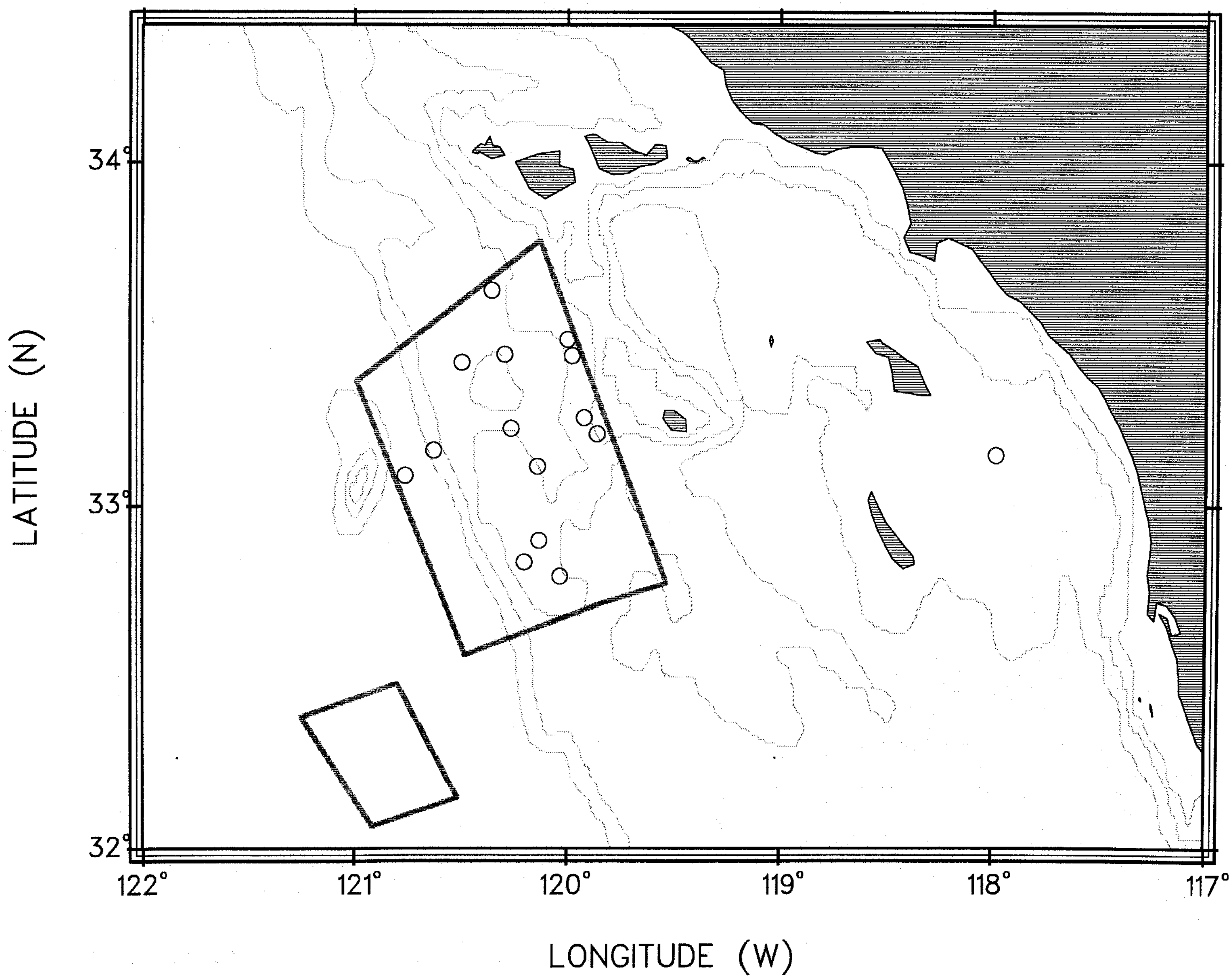


Figure 26. Locations of all (n=4) harbor seal sightings.

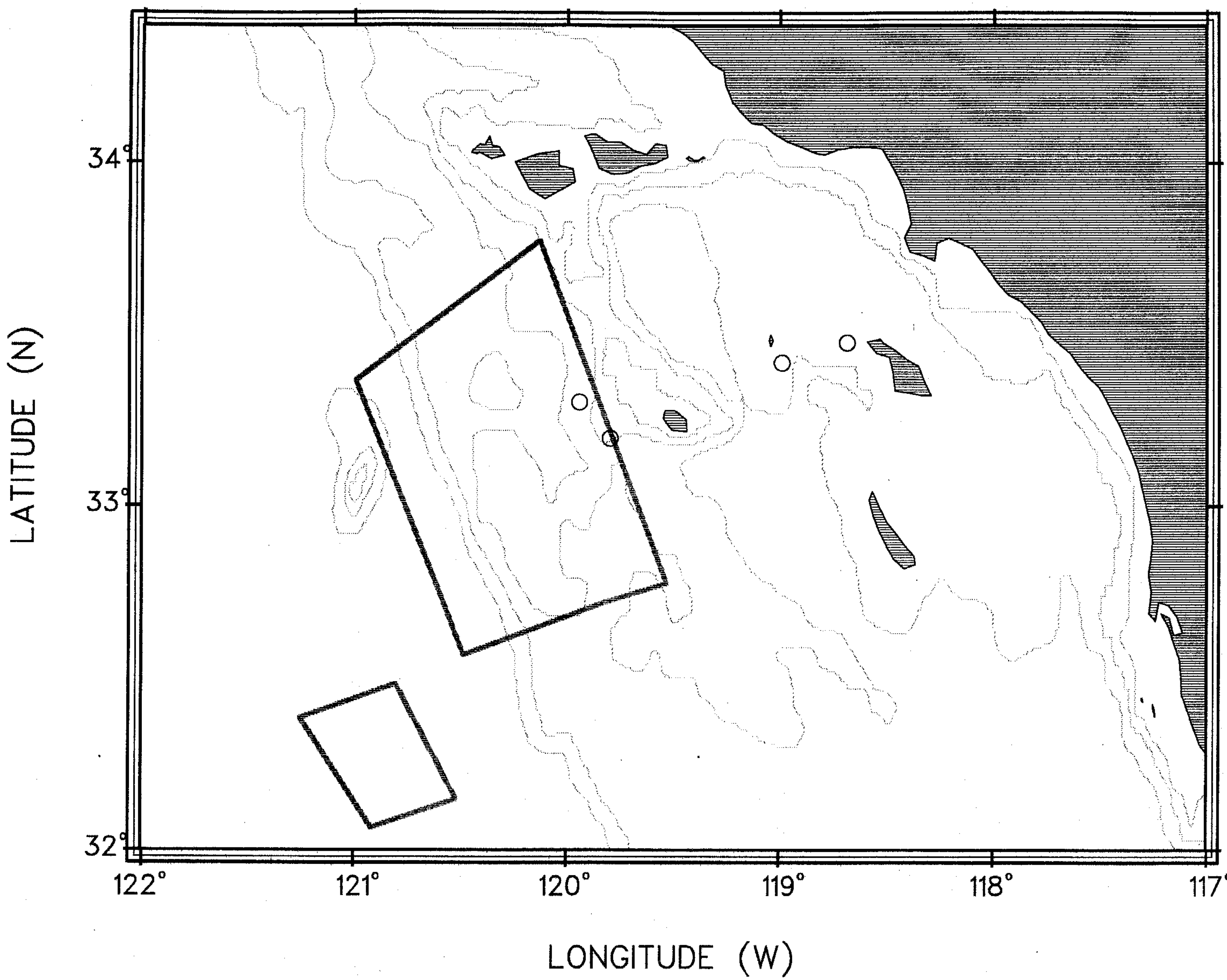


Figure 27. Locations of all on-effort (n=400) California sea lion sightings.

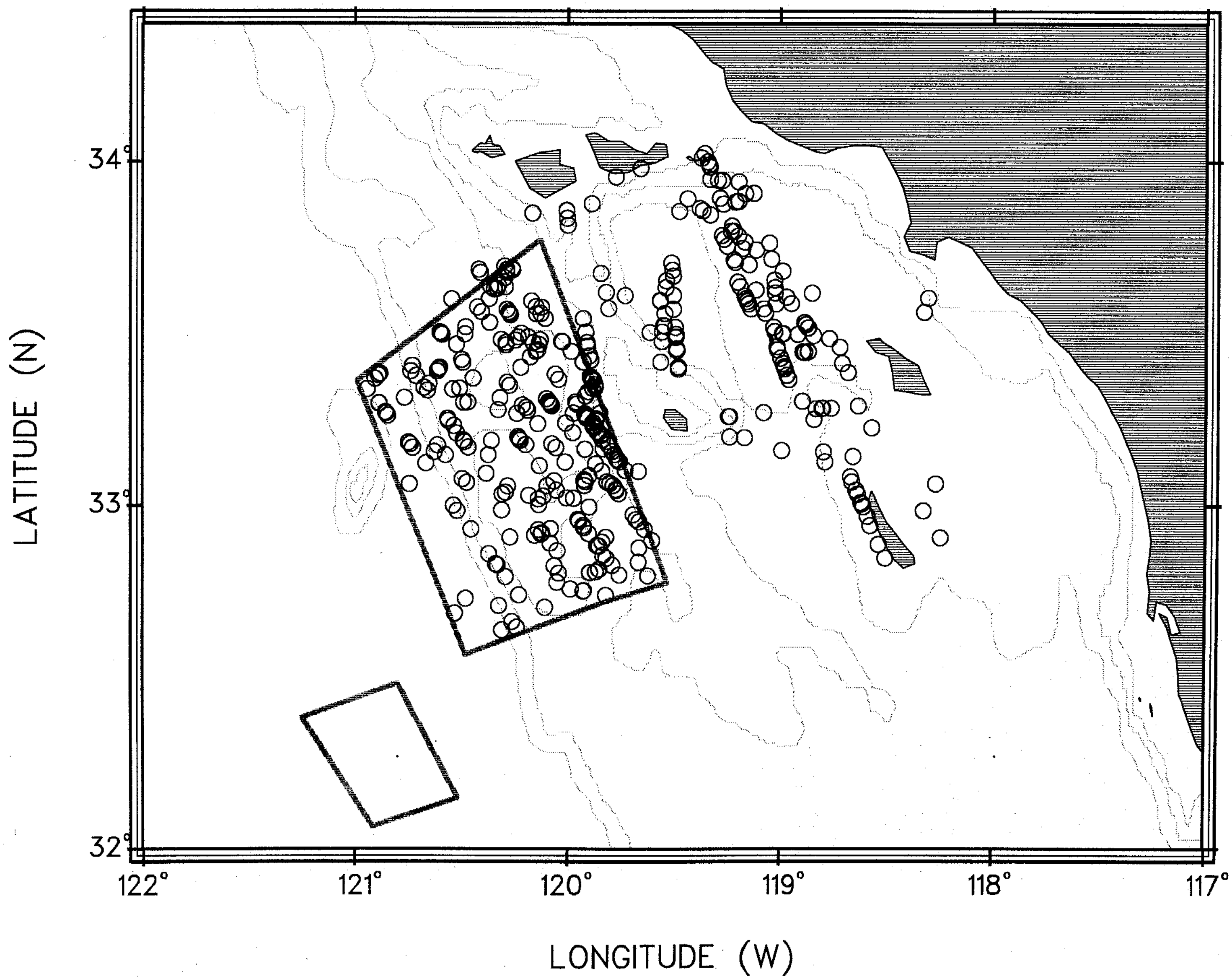


Figure 28. Locations of all on-effort (n=7) unidentified pinniped sightings (○=unidentified pinniped, □=unidentified seal).

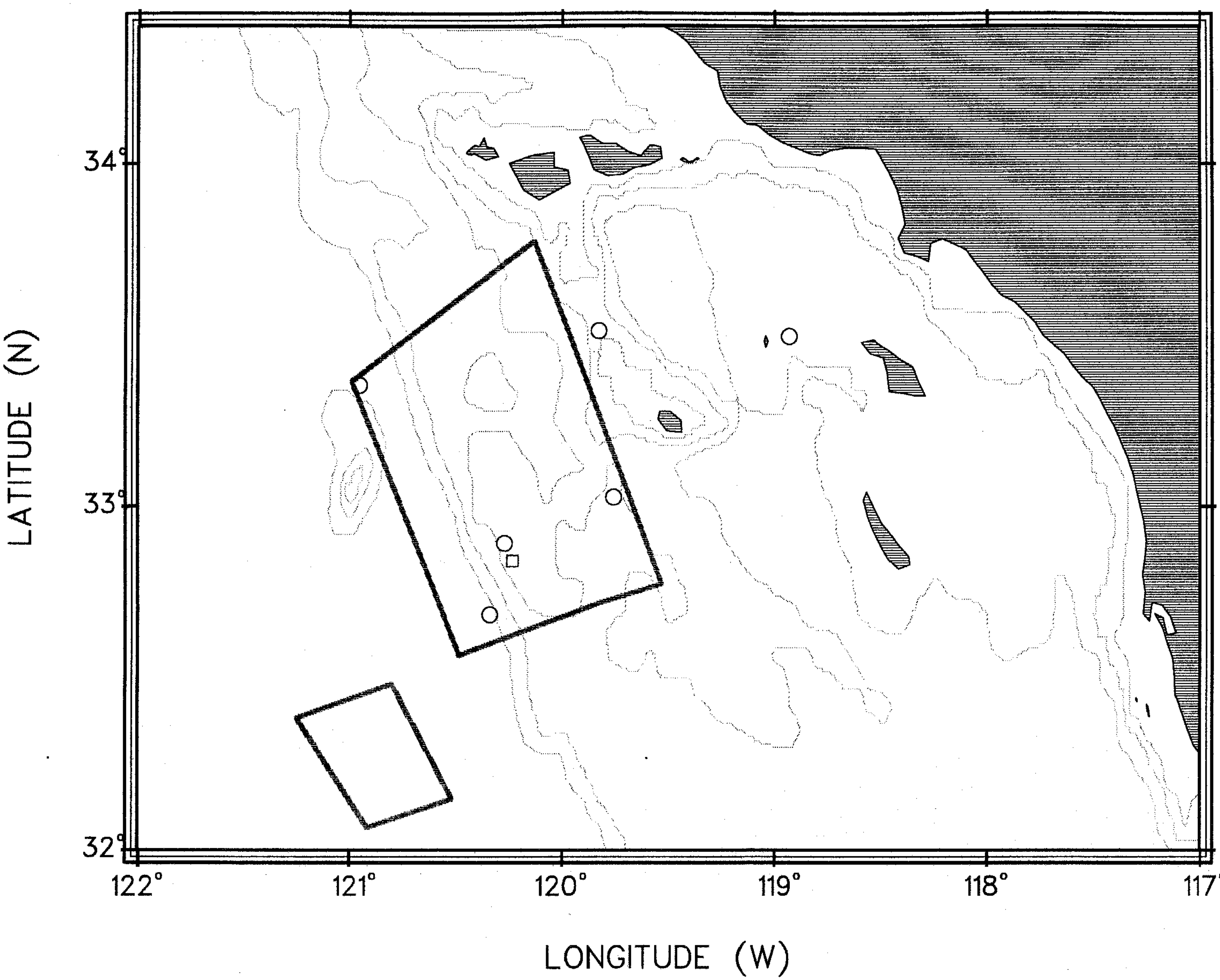


Figure 29. Locations of all on-effort (n=12) unidentified dolphin sightings (○=unidentified whitebelly dolphin, ◇=unidentified delphinid, □=unidentified small delphinid, △=unidentified small delphinid or porpoise).

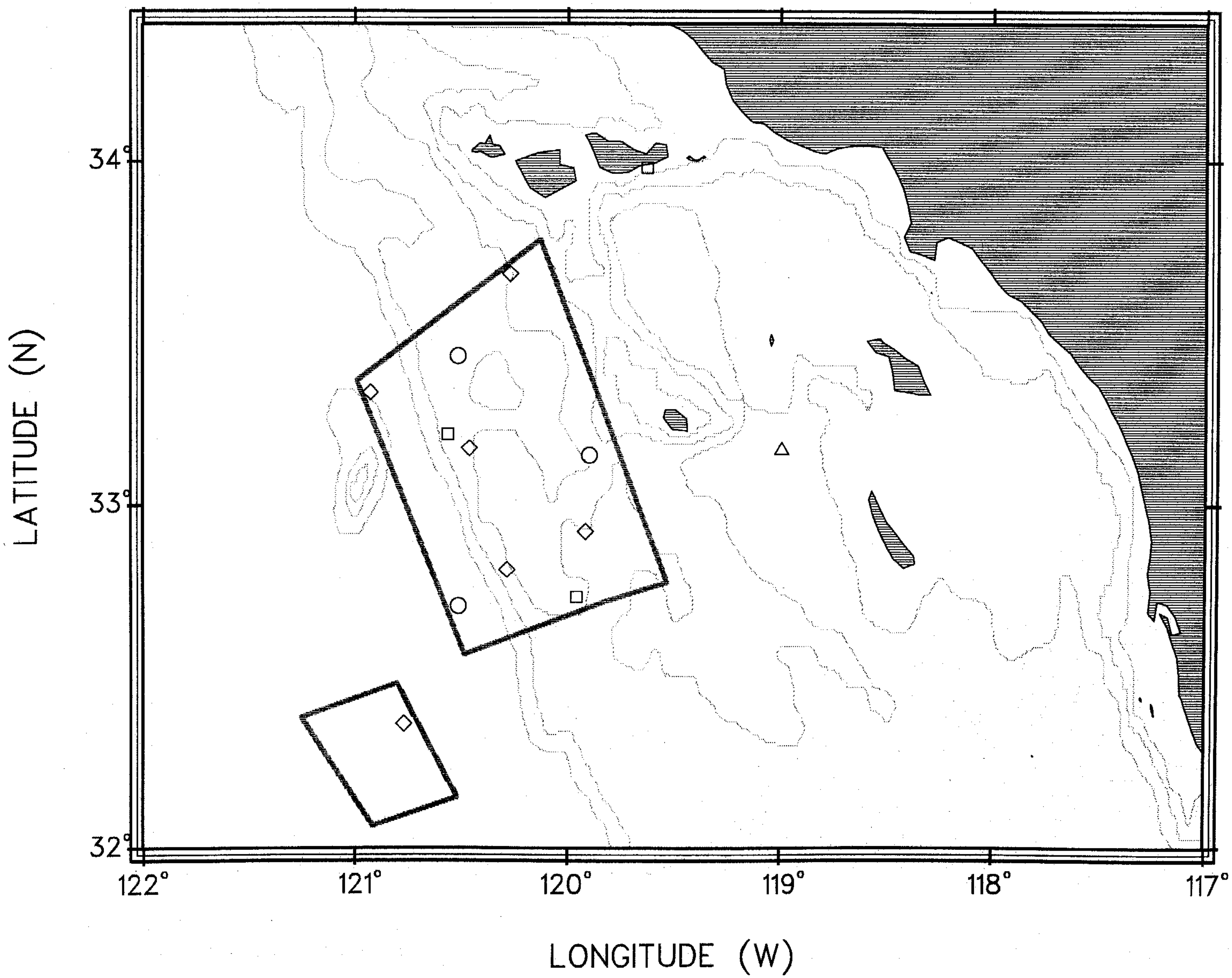


Figure 30. Locations of all on-effort (n=14) unidentified whale sightings (○=unidentified whale, ◇=unidentified small whale, □=unidentified large whale, ▽=unidentified ziphiid).

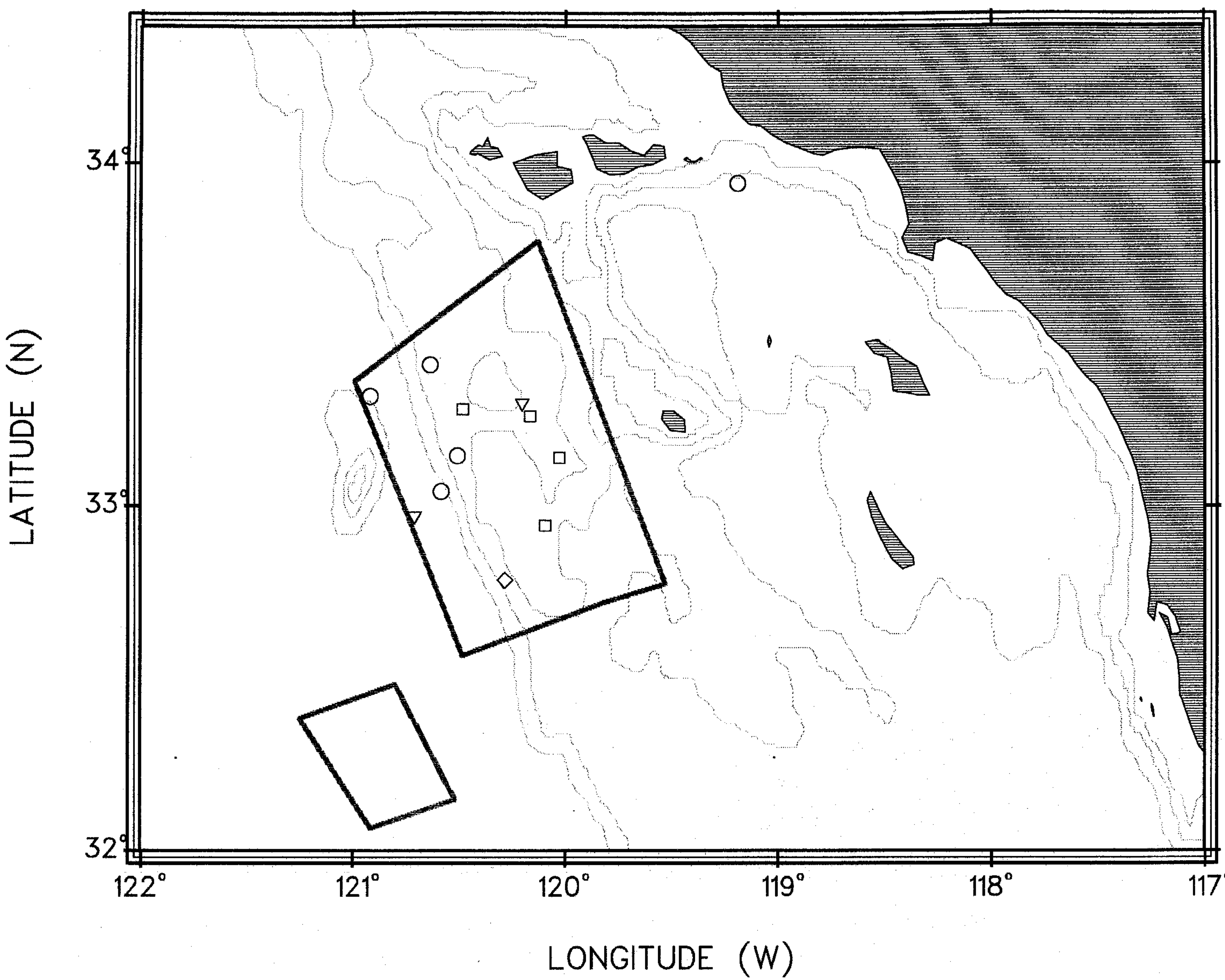


Figure 31. Locations of all on-effort (n=4) unidentified marine mammal sightings.

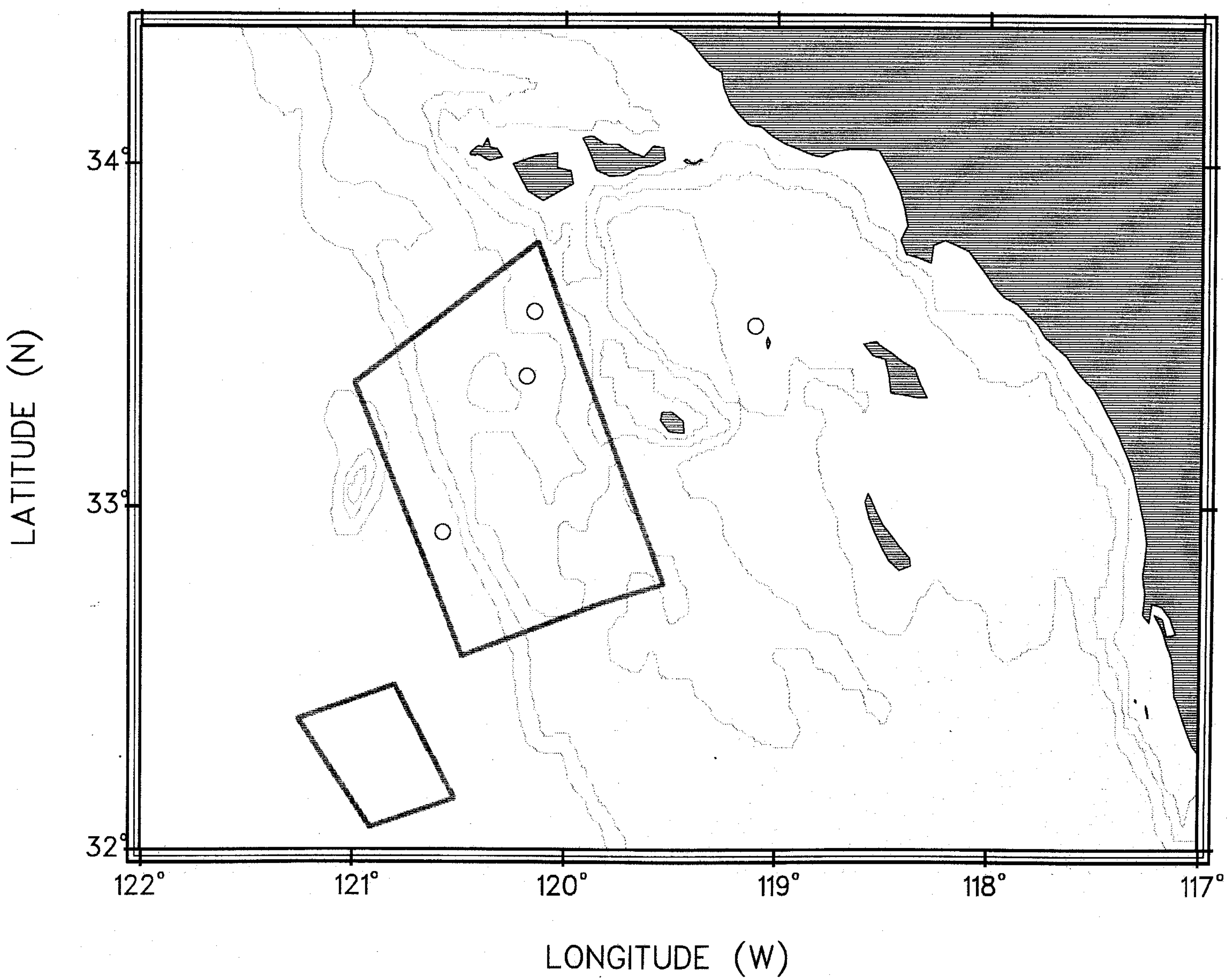


Figure 32. Location of one on-effort striped dolphin sighting.

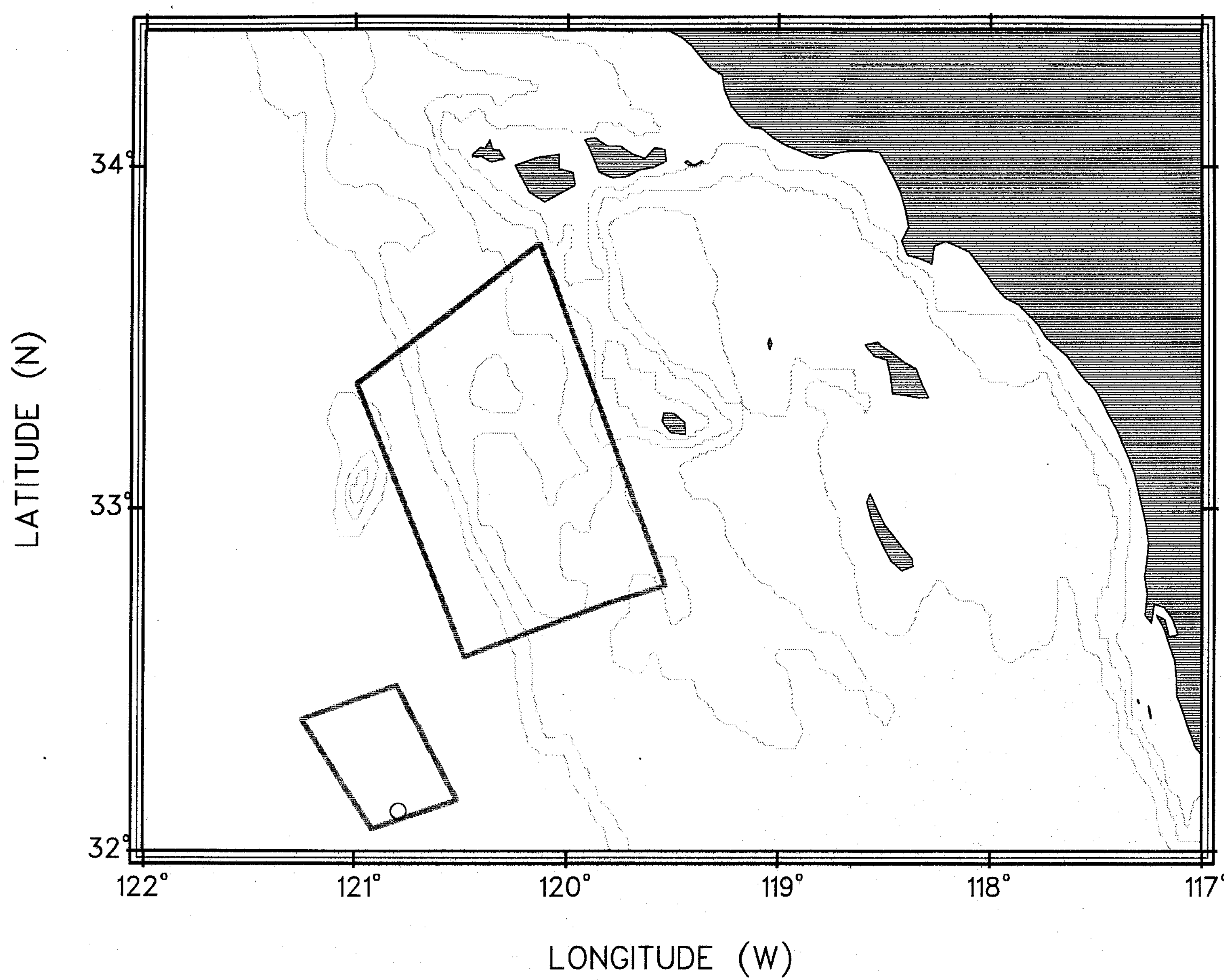


Figure 33. Locations of all (n=11) bottlenose dolphin sightings.

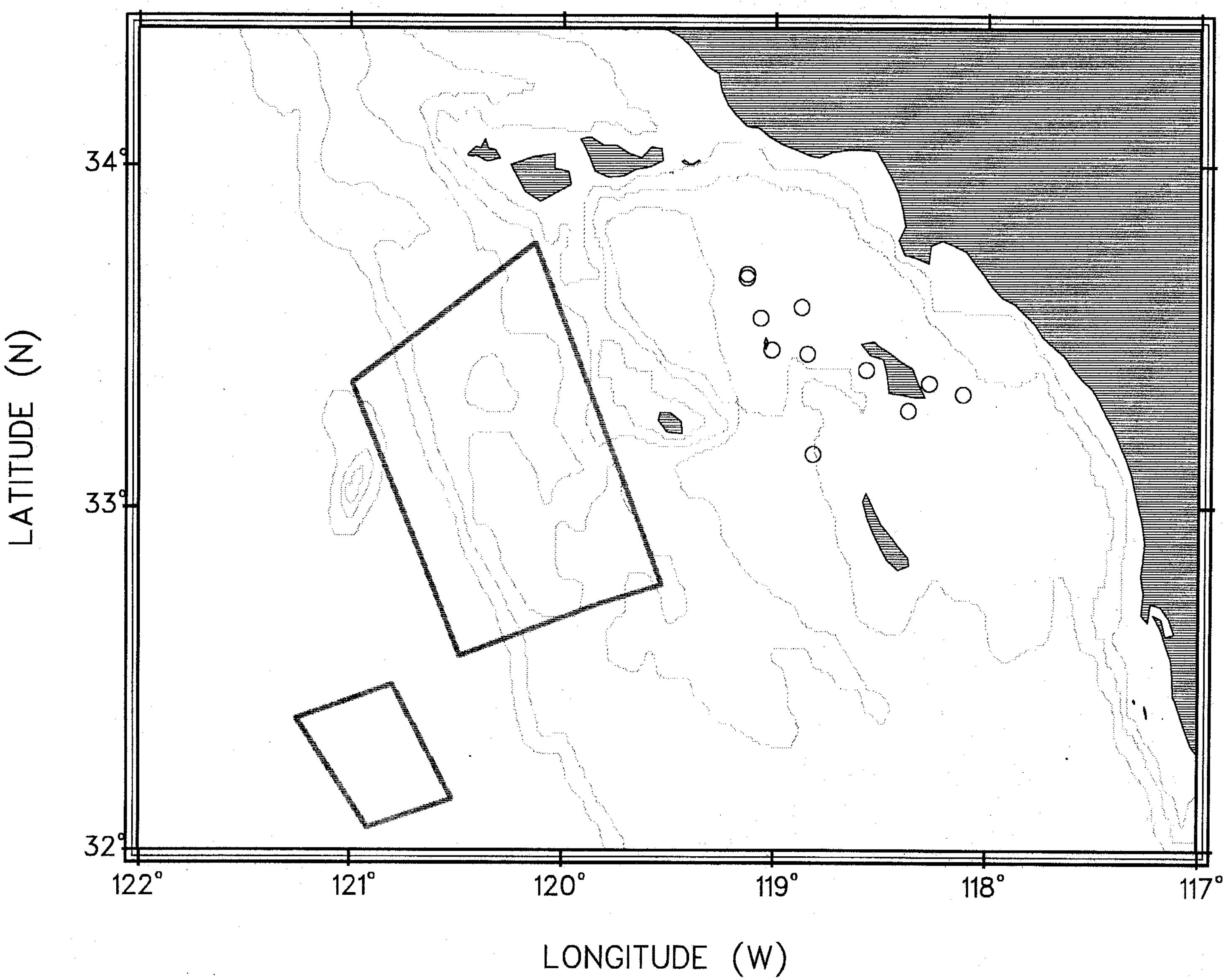
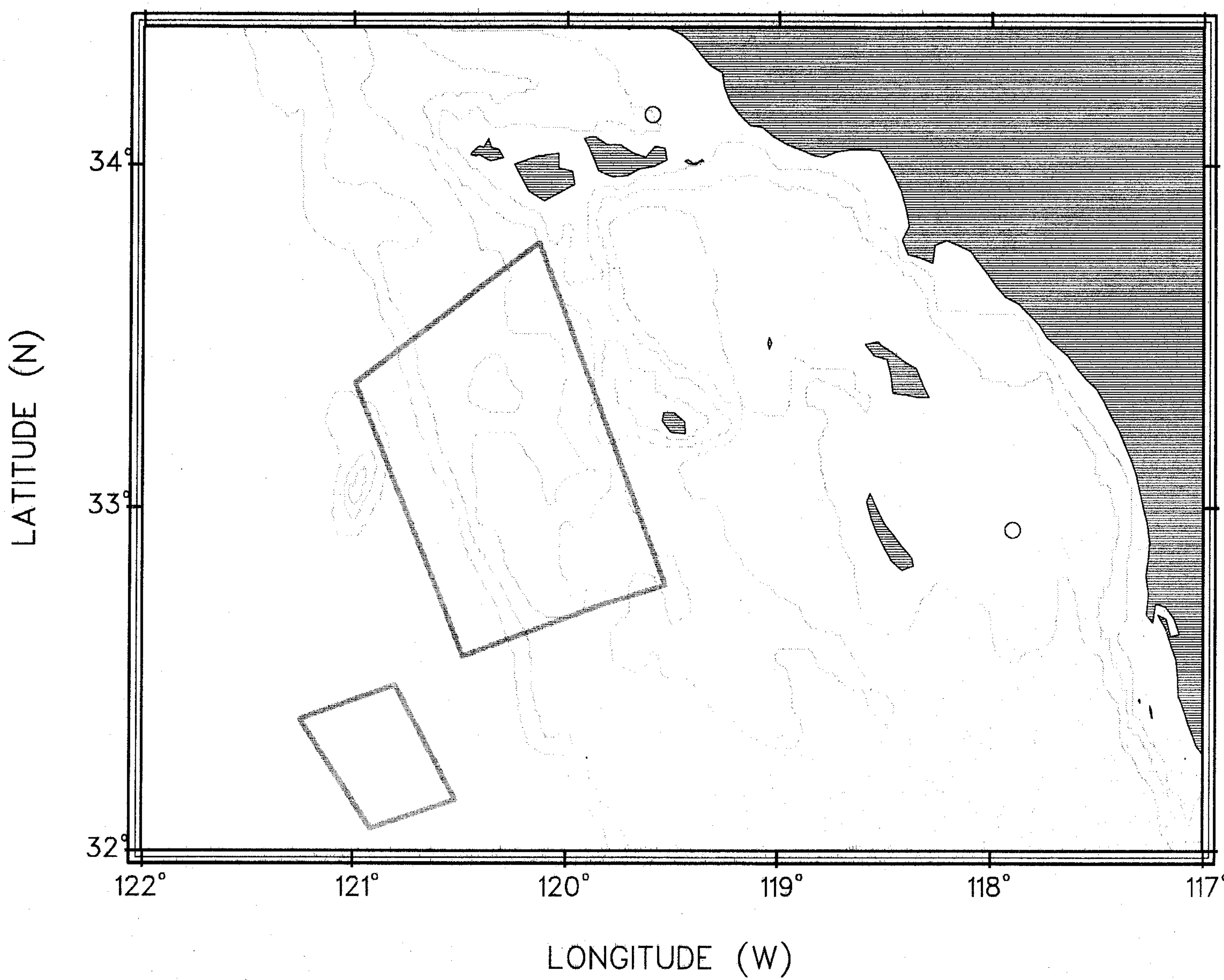


Figure 34. Locations of all (n=2) humpback whale sightings.



RECENT TECHNICAL MEMORANDUMS

Copies of this and other NOAA Technical Memorandums are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22167. Paper copies vary in price. Microfiche copies cost $9.00. Recent issues of NOAA Technical Memorandums from the NMFS Southwest Fisheries Science Center are listed below:

NOAA-TM-NMFS-SWFSC-207 The estimation of perpendicular sighting distance on SWFSC research vessel surveys for cetaceans: 1974 to 1991.
J. BARLOW and T. LEE
(August 1994)

208 The physical oceanography off the central California coast during February-March and May-June 1992: a summary of CTD data from pelagic young-of-the-year rockfish surveys.
K.M. SAKUMA, H.A. PARKER, S. RALSTON, F.B. SCHWING, D.M. HUSBY, and E.M. ARMSTRONG
(September 1994)

209 The physical oceanography off the central California coast during March and May-June, 1993: a summary of CTD data from pelagic young-of-the-year rockfish surveys.
K.M. SAKUMA, H.A. PARKER, S. RALSTON, F.B. SCHWING, D.M. HUSBY, and E.M. ARMSTRONG
(September 1994)

210 The Hawaiian monk seal at French Frigate Shoals, 1990-91.
M.P. CRAIG, J.L. MEGYESI, C.S. HALL, J.L. GLUECK, L.P. LANIAWE, E.A. DELANEY, S.S. KEEFER, M.A. McDERMOND, M. SCHULZ, G.L. NAKAI, B.L. BECKER, L.M. HIRUKI, and R.J. MORROW
(September 1994)

211 Report of cetacean sightings during a marine mammal survey in the eastern Pacific ocean and the gulf of California aboard the NOAA ships *McArthur* and *David Starr Jordan* July 28-November 6, 1993.
K.F. MANGELS, T. GERRODETTE
(October 1994)

212 An evaluation of oocyte size in multiple regressions predicting gonad weight from body weight: A test using Hawaiian ehu, *Etelis carbunculus*.
B.B. LAU and E.E. DeMARTINI
(Ocotober 1994)

213 The Hawaiian monk seal on Laysan Island, 1987 and 1989.
B.L. BECKER, P.A. CHING, L.M. HIRUKI, and S.A. ZUR
(October 1994)

214 The Hawaiian monk seal on Laysan Island, 1991.
B.L. BECKER, K.E. O'BRIEN, K.B. LOMBARD, and L.P. LANIAWE
(February 1995)

215 Seasonal, vertical, and horizontal distribution of four species of copepods around Oahu, Hawaii: Data report
R.P. HASSETT, and G.W. BOEHLERT
(February 1995)

216 The Hawaiian monk seal in the northwestern Hawaiian Islands, 1992.
T.C. JOHANOS, L.M. HIRUKI, and T.J. RAGEN
(March 1995)