Foraging Distribution and Post-Breeding Dispersal of the Xantus' Murrelet in the Southern California Bight

Progress Report

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INTRODUCTION

The Xantus' Murrelet *(Synthliboramphus hypoleucus) is* one of the rarest seabirds in the world with a population of less than 10,000 breeding individuals (Drost and Lewis 1995). It is distributed in a restricted area from the Channel Islands of southern California to Guadalupe Island in northwestern Baha California. Mexico. The northern subspecies (S. *h. scrippsi)* has been designated a federal candidate species to be considered for listing under the Endangered Species Act. The largest Xantus' Murrelet breeding colony in southern California is at Santa Barbara Island (Figure 1) in Channel Islands National Park (Carter et al. 1992), which lies on the border of the Naval Air Weapons Center Sea Test Range.

Xantus' Murrelets are vulnerable to a host of anthropogenic threats. The Santa Barbara Island colony is near petroleum shipping lanes and drilling platforms, as well as discharge sources from the Los Angeles metropolitan area. Xantus' Murrelets may be affected through direct mortality or injury from introduced predators, gill nets and oil spills, reduced breeding success, displacement from preferred foraging areas, separation of parents from chicks during at-sea rearing, and reduced long-term breeding success and survival.

Presently, knowledge of the murrelet's at-sea distribution and natural history is insufficient to fully identify threats to its survival. This radio telemetry project was designed to help us better understand murrelet at-sea ecology and assess the species' vulnerability, In 1995, Xantus' Murrelets from Santa Barbara Island were radio-marked to examine murrelet foraging distribution, colony attendance patterns and post-breeding dispersal. This report documents progress made during the first year of the three-year study.

METHODS

CAPTURE AND RADIO ATTACHMENT

Capture.-- We developed a new procedure for capturing Xantus' Murrelets at-sea. During the breeding season, Xantus' Murrelets formed loose congregations at night on the waters adjacent to breeding areas. Birds were captured along the east side of Santa Barbara Island (< 1 km from shore) on 26-29 April and 19-21 May 1995. Three-person crews patrolled the area in a 4.25 m Zodiac inflatable boat powered by a 25 hp Mariner© outboard motor. The crew consisted of a driver. spotlight operator, and dipnet handler. If only two crew members were available. the driver also served as the spotlight operator. Generally one capture team worked throughout the night. but when available, a second team captured birds in an adjacent area.

We traversed areas of high murrelet density at night while scanning ,360" around the craft with a 100,000/200,000 candlepower Brinkman Q-Beam© Spot/Floodlight. The spotlight was powered by a 12-volt marine battery through a pigtail extension. When a murrelet was located in the beam of the spotlight, the driver approached slowly (<2 knots) and the spotlight operator leaned to the side of the Zodiac and kept the beam focused on a single bird. Once the murrelet was within one meter of the bow of the boat. the handler attempted to net the murrelet from the water using a dipnet with a 1.25 m aluminum handle, 0.5 m diameter basket and a 4 cm nylon mesh net. The spotlight operator tracked the birds underwater or in the air if they dove or flew away until the driver could move closer. Multiple capture attempts were sometimes required, but to minimize stress to a bird, it was not approached more than 5 times. Murrelets were transported in cardboard holding boxes (Port-a-Pet© boxes) divided into three compartments to the 14.6 m chartered research vessel, the *Instinct*, anchored in Landing Cove.

Radio Attachment --We originally intended to radio-mark breeding birds (as indicated by the presence of a brood patch or cloacal protuberance) greater than 170 g. However, none of the murrelets inspected during April and May 1995 had visible brood patches, and we reduced the minimum weight criteria to 160 g to obtain an adequate sample. All murrelets were banded with U. S. Fish and Wildlife Service #2 stainless steel bands and weighed with an Avinet© 300 g spring scale. In addition, standard morphological measurements were taken on birds not included in the raidio-marking sample.

A radio-marking protocol was developed in 1995 with the assistance of S. Newman, a wildlife veterinarian from the University of California at Davis. Murrelets that were not included in the radio-marking sample were used in blood chemistry studies (S. Newman, unpub. data), although one radio-marked murrelet was sampled (see Results). A handler wearing latex gloves held the bird, and a thin fabric hood was placed over the murrelet's head and body. A window was made in the fabric hood to expose the location for the transmitter. Transmitters (model PD-2©; 15 cm external whip antenna; 3-month life; front and rear suture channels; Holohil Systems Ltd., Ontario, Canada) were attached with a small amount of glue (Titan marine epoxy #332), and two sutures (3-0 Prolene© monofilament non-absorbable sutures).

We mixed the epoxy and hardener about 3-4 minutes prior to application. We used alcohol to prepare the site for radio attachment on the murrelet's dorsal midline between and slightly posterior to the scapula. Feathers were clipped to a length of 2 mm in an area about 2.0 cm long by 15 cm wide. The skin was pinched lateral to the midline to create a 1.5 cm fold. A 25-gauge hypodermic needle was inserted through the skin fold, and suture was threaded through the needle from the sharp end to the hub. Then, the needle was withdrawn, leaving the suture placed subcutaneously. A second subcutaneous suture was placed 2.0 cm posterior to the first suture, aligned with the caudal suture channel on the transmitter.

The sutures were threaded through the transmitter channels before glue was applied. A thin coat of epoxy (1 mm) was placed on both the bottom of the transmitter and the attachment area on the murrelet's back. The transmitter was placed on the bird's back, and needle holders were used to tie the sutures into four surgical square knots. Once the glue appeared to be bonding and the attachment was inspected, the bird was placed in a holding box for about 30 minutes (see Results) until it was released. Birds were brought to areas more than 100 m From the lighted research vessel, but near their capture sites. Most birds were released by lofting them into the wind, so they could fly away.

RADIO TRACKING

Radio tracking was conducted over a three-month period (26 April - 26 July) after the first birds were radio-marked. Three tracking methods were employed, scanning from a tower, aircraft, and boat.

Tower Monitoring. -- A remote telemetry system was stationed on North Peak (elevation 171 m), the highest point on the north end of Santa Barbara Island from late March to late July. The system consisted of an ATS Model R-4000 scanning receiver and an ATS DCCII Model D5041 data logger (Advanced Telemetry Systems Inc., Isanti MN). The receiver was connected to four 4-element Yagi directional antennas through a four-way multiplexer by coaxial cables. The antennas were oriented NW, NE, SW, and SE and attached to a 4-m sectional tower with steel 'L' brackets and hose clamps. The tower was secured with guylines attached from the top of the tower to 0.5 m metal stakes. The system was powered by a 12-V marine battery charged by a 0.5 m^2 solar panel. The receiver, data logger. battery and multiplexer were stored in a watertight cooler.

We located nearshore obstructed areas and determined detection range from the monitoring station by circumnavigating the island with a transmitter at known distances on 18-2 1 March. The station was activated on 26 April, the first release date for radio-marked murrelets. Frequencies were monitored for 40 s (10 s per antenna, 3 s pause) every 20-30 min each day. Several variables were stored when a signal was received including: year, Julian date, hour, minute. frequency, antenna number, pulses, and signal strength. Data was retrieved with a laptop computer (Program GETDATA) and the station was inspected on 29 April, 20 May, 26 June and 24 July. The station was not active continuosly because of reduced power (17-20 May) or insufficient recharging (22 May -- 26 June) and was removed on 24 July.

Aircraft Surveys. --Eleven aerial surveys (45.25 h total) were conducted during the 1995 season on: 1, 8, 10, 18, 19, 22, and 25 May; and 6, 13, 14 and 27 June. Surveys were flown in twin engine Cessna Skvmasters or in a Partanavia provided by California Department of Fish and Game and supplemented by a private contractor. Flights were conducted out of Camarillo Airport (Figure l), except flights on 18, 19 and 22 May which originated from or terminated at Long Bleach Airport. Survey routes were varied depending on outer Sea Test Range operations, weather conditions. and results from previous surveys (see Figures 4-13). Surveys were flown at altitudes ranging from 450 to 1400 m and speeds of 120 to 140 knots.

Receivers were connected through a left/right switch box to two antennas mounted onto wing struts or brackets of the aircraft by coaxial cables. Four-element Yagis or H-antennas were used depending on the aircraft. One or two observers listened for frequencies, generally scanning each for 2 s. Signal location was determined by flying a box and assessing relative signal strengths from the left and right antennas. Location coordinates (latitude and longitude) were obtained from an onboard Global Positioning System (GPS) unit. Location coordinates and time were recorded on data sheets.

Boat Surveys.-- Boat surveys were performed from a Zodiac inflatable boat (27 April) and the charter vessel *Instinct* (28 April) as they circumnavigated Santa Barbara Island at 500 m (Zodiac) and 11 km *(Instinct)* following capture and radio-marking of Xantus' Murrelets on the previous nights. The receiver was Connected to a hand-held, 4-element antenna mounted on a 2.5 m pole, Observers noted time, direction and relative strength of all signals detected.

RESULTS

CAPTURE AND RADIO-MARKING

Capture Method. -- In 1995, we were unsuccessful in catching birds with the technique of luring murrelets to the research vessel at night with bright deck lights. This technique had been successful on several nights in 1994 at Santa Barbara, San Clemente, and Santa Cruz Islands (H. Carter, unpub. data). Scott *et al.* (1972) also reported wintering murrelets off the coast of Oregon being attracted to bright lights. However, weather conditions were heavy fog with low visibility in 1994 when this technique was successfully used. Weather conditions were clear in our early efforts to capture murrelets in late March and early April 1995. Few murrelets were present during the early capture efforts, and nesting had not yet commenced on Santa Barbara Island. Therefore, we developed a different method of capture with a portable spotlight (see Methods).

A total of 134 Xantus' Murrelets were captured in 1995 at Santa Barbara Island (Table 1). Capture efforts on 26-27, 27-28, and 28-29 April, yielded 12, 36 and 31 birds (including 1 recapture) for a total of 79 birds. In May, 55 murrelets were captured including 26 birds on 19-20 May and 29 birds (including 2 recaptures) on 20-21 May. Our capture technique averaged 3 birds/h and was relatively consistent through the night (Figure 2), although effort differed among nights. Forty-six of the murrelets were radio-marked, 38 in April and 8 in May. The remaining murrelets were used in blood chemistry studies (the last blood sampled bird was also radio-marked because it had a swollen cloaca, which indicated reproductive activity).

Handling and Marking. -- The actual time for transmitter attachment was 5 to 10 min. Mean handling time for radio-marked murrelets was 51 min, ranging from 17 to 125 min. Mean handling times of radio-marked murrelets on nights when blood samples were not taken (26-27 April, 19-20 May) was 41 min (n = 38; range = 19-63 min). Mean handling times of radio-marked birds on those nights when blood samples were taken (27-28 April, 28-29 April) was 61 min (n = 67; range = 17- 125 min). Birds in the non-radio-marked sample were divided into groups and held for set periods of time to examine differences in stress evidenced in their blood chemistry (S. Newman, unpub. data).

The weight of the murrelets was similar to results from previous studies at Santa Barbara Island (Murray *et al.* 1983). The mean weight of all murrelets was 167.8 g (n= 131; range 135.5-207 g). We generally chose murrelets heavier than 170 g for radio-marking (x= 179.3 g; n=46; range 154-207 g), although three birds that weighed less than 170 g were radio-marked late in the season to increase our sample size.

Only one radio-marked murrelet was recaptured because it didn't fly when it was released, but it flew successfully when released a second time. One radio-marked mm-relet was recaptured on 21

May, one night after its initial capture. and it appeared to be healthy and the radio was still firmly attached. We were able to locate 13 radio-marked birds for at least 10 days after marking, three birds for 25 days, and one bird for 40 days.

RADIO TRACKING

We located 39 radio-marked Xantus' Murrelets and recorded 745 detections over a 41 -day period (Figure 3). No data -were received from seven transmitters, but signal reception was poor for two of those transmitters because of radio interference.

Island Monitoring. -- The island monitoring station accounted for most detections in the local area (724 detections, 38 transmitters). A valid detection was defined as a signal received during a 10 s scan in which 3-10 pulses were recorded with a signal strength reading (ranging from 0 to 255) above 90. Valid signals received on different antennas during the same scan period were lumped as one detection. Radio-marked murrelets within 8 km could be detected, however Signal Peak blocked signals within a 5° arc south of the station and the steep cliffs surrounding the island hampered signal reception within 100 m of the island. Determining locations from the characteristics of signals received by the monitoring station proved difficult. Generally, only relative distance, but not direction, could be inferred from the data based on signal strength and the number of antennas by which a signal was detected.

The time period over which transmitters were detected by the station ranged from 2.5 h to 18 d. We had hoped to verify all 46 radio-marked murrelets by the monitoring station on the night of their release. However, no detections were recorded for eight transmitters. Two transmitters were not detected because of radio interference, while the remaining six transmitters were not detected because the transmitter had not been entered in the datalogger or the station was not active on the night of the bird's release.

Most murrelets remained in the vicinity of the island following release at night. then moved away quickly by daybreak, out of detection range. The few murrelets which remained within range of the station after sunrise, did so at a considerable distance (7-8 km) from the island, but they also moved out of detection range by late afternoon. This movement pattern was observed both in the 21 murrelets that were relocated after the initial release night and the 17 other murrelets that were not relocated. Seventeen murrelets returned to Santa Barbara Island at least once during the breeding season. Time of return to the island and the duration of stay varied (Table 2). Some birds were relocated near the island for short periods during the day, but most returned at night. Some patterns suggestive of breeding were noted but unconfirmed. Seven murrelets were relocated near the island for extended periods of 12 - 18 days.

Aerial Surveys. -- Aerial surveys resulted in 19 location fixes of 13 different birds (Figures 4) 'between 8 May and 6 June. Three murrelets were located more than once: two murrelets were located three times and one murrelet was located twice. No birds were located during surveys on 1 May and 13, 14 and 27 June (Figures 5,12,13). Survey flights after 27 June were canceled because of the low probability of locating murrelets.

Locations of radio-marked murrelets were distributed throughout the Bight, up to 100 km from Santa Barbara Island (Figure 4). Three murrelets were located less than 10 km from the island, one between 10-20 km, four between 20-50 km, two between 50-75 km, and nine > 75 km from the island. No directional preferences were displayed in the murrelets' movements, although movements to the east and northeast were avoided by all but one murrelet. Five locations were made to the northwest, three to the north, four to the southwest and five to the south. Murrelets did seem to exhibit a preference for waters at the boundary of the 500 m depth contour near Santa Barbara Island (Figure 4).

Boat Surveys. -- Boat surveys proved to be of little value in locating radio-marked murrelets. Only two frequencies were located, both of these on the morning following the birds' release. The limited reception range (<2 km) of the boat-based receiving system made these surveys impractical.

DISCUSSION

CAPTURE TECHNIQUES

The spotlighting method for catching Xantus' Murrelets developed in this study has proven to be the most effective at-sea method reported for capturing alcids. We also used this method to capture five recently fledged Pigeon Guillemots *(Cepphus columba)* and a Common Murre *(Uria aalge)* at Ano Nuevo State Reserve in August 1995 (D. Whitworth, unpubl. data). The ability to capture seabirds away from the colony may greatly facilitate studies while minimizing colony disturbance (see Burger and Gochfeld 1994). This technique could be used for capturing alcid species which congregate nocturnally near breeding colonies (e.g. *Synthliboramphus* spp.) or fledge chicks nocturnally (most Alcidae). However, Quinlan and Hughes (1992) were not able to locate Marbled Xlurrelets *(Brachramphus marmoraius)* with a spotlight at night in Kelp Bay, Alaska.

Our average capture rate of 3.0 birds/h was more than 12 times higher than those reported for other at-sea capture methods. This capture rate also was a conservative estimate because we were developing marking and sampling procedures and conducting nocturnal vocalization surveys (H. Carter, unpubl. data) at the same time. Rates of one bird per 4-12 h of effort were reported for Marbled Murrelets *(Brachyramphus marmoratus)* captured with net guns or mist nets (Ralph *et al.* 1989, Quinlan and Hughes 1992, Bums *et al.* 1994): Capture success also seems to be less dependent on ambient conditions, unlike results reported for mist net and light attraction captures (Bums *et al.* 1994; D. Whitworth, unpubl. data). Since our capture efforts were not continuous and were restricted by the number of birds that could be handled for radio-marking, we believe higher capture rates could be achieved.

We were given approval by Channel Islands National Park to trap murrelets at nest sites in 1995 However. the extremely late nesting phenology and low egg-laying effort precluded it. We plan to try this technique again in 1996

RADIO ATTACHMENT

The radio-marking technique seemed to be a reliable and practical method of transmitter attachment. Total handling time (5 I min) compared favorably with the other alcid studies (Burns *et al.* 1994) in which the technique was used, although Burns *et al.* radio-marked and anaesthetized Marbled Murrelets. In 1996 and 1997, we hope to reduce handling time further by optimizing the number of murrelets being captured, number of personnel available to process murrelets and amount of concurrent work.

Short-term effects of the transmitter and suture-glue attachment on the murrelet appeared negligible. The murrelets' post-release behavior and movements were encouraging and indicative of healthy, mobile birds. However, the long-term effects were not clear, Mm-relet relocations indicated that at least some birds were capable of rapid movements near the island and long distance movements over a few days. The maximum confirmed duration of attachment in this study (40 days) surpasses that for Marbled Murrelets by 14 days (Bums *et al.* 1994). In 1996 and 1997, we intend to improve our techniques (see Future Research) to increase the number of Xantus' Murrelets for which longer-term data is obtained.

RADIO TRACKING

We had difficulty relocating the radio-marked murrelets a week after marking. Three possible explanations may explain the lack of relocations: (1) the mm-relets died or were taken by predators soon after release; (2) the transmitters fell off or failed; and (3) we were unable to detect the radios or the mm-relets moved quickly away from the central study area.

We didn't locate transmitters at any terrestrial locations in nearby islands. If birds were taken or scavenged by predators, we would expect to hear signals from nests or roosts of raptors and gulls (Quinlan and Hughes 1992, Bums *et al.* 1994). We can't detect signals beneath the surface of the water, but aquatic predators are not known to be a significant cause of mm-relet mortality. In future years, murrelet band returns and recaptures will be carefully checked to confirm survival of previously radio-marked birds.

Radio failure or suture-glue dissolution within 24-72 hours of release seemed improbable, especially since our relocation data indicate that transmitters remained attached and functional for prolonged periods of time (10-40 days). We also tested the suture in salt water and found it did notdeteriorate within a month. Radio failure also is unlikely, since studies of Western Sandpipers *(Calidris mauri)* in marine environments with similar transmitters noted little radio failure (Warnock and Takekawa, in *press).*

Although we relocated birds 19 times widely distributed through the Southern California Bight (Figure 4), we expected many more locations in the vicinity of Santa Barbara Island. Aerial surveys were hampered by radio interference and aircraft noise. It may have masked signals, particularly those at the edge of the reception range. We could not mount Yagi antennas, which generally have a wider range than 'H' antennas on the aircraft, because the aircraft lacked the necessary mounting points. Survey flights. scheduled far in advance of the field season, were not well coordinated with the capture periods. and flights were often excluded from preferred survey areas because of naval operations in the outer Sea Test Range. Much of the data recorded by the monitoring station was interference identifiable by the high number of pulses, However, transmitter signals masked by interference could not be detected. The monitoring system didn't function from late May until late June, the major period of the delayed and reduced breeding season in 1995, because of power failure.

We suspect that much of the reason that we couldn't relocate many Xantus' Murrelets in the vicinity of Santa Barbara Island was because they dispersed rapidly after radio-marking. The late breeding season may have significantly affected dispersal patterns. Low occupancy of monitoring sites and delayed breeding were reported on Santa Barbara Island in 1995 (Point Reyes Bird Observatory, unpubl. data). Murrelet egg-laying initiation (1st egg, 11 May) was one of the latest years ever reported at Santa Barbara Island. Non-breeding birds radio-marked near Santa Barbara Island may have quickly left the Bight. Locating murrelets which dispersed that widely would be almost impossible, given the enormous survey area. Outside the breeding season, Xantus' Murrelets are usually found scattered far offshore (Briggs et *al.* 1987), well outside the confines of our study area.

The radio-marked Xantus' Murrelets may also have moved south to areas in Mexico where conditions were better. Preliminary boat surveys near the Los Coronado Islands in April 1995 recorded large numbers of Xantus' Murrelets. Our aerial surveys were limited to American waters within portions of the Southern California Bight because we were in state aircraft. In 1996 and 1997, we would like to perform aerial surveys in Mexico to investigate possible interchange between murrelet colonies in Mexico and California if additional funds are obtained.

FUTURE RESEARCH

On the basis of our 1995 work, we plan to improve several aspects of the study:

1. Three groups of murrelets (10-30 transmitters each) will be radio-marked: late March to mid April (offshore), late April to mid May (offshore). and late April to mid May (at the colony).

2. Flights will be scheduled for intensive periods within a few days after marking and for up to 3-6 weeks thereafter.

3. Transmitter specifications will be changed to obtain a stronger signal with a shorter lifespan. Possible changes include decreasing the lifespan to 6 weeks. increasing pulse. and elevating the antenna angle to 30°, and reducing transmitter weight.

4. We will continue to concentrate on radio-marking breeding birds to increase our chances of relocating birds near the colony.

5. Radio noise in the Santa Barbara Island area will be documented to avoid radio interference problems in subsequent years.

6. The monitoring station will be checked more often to insure it is working.

7. We will continue working with the wildlife veterinarian (S Newman, U. C. Davis) to reduce handling stress during marking and consider the use of anesthesia.

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Table 1. Number of Xantus' Murrelets captured and radio-marked near Santa Barbara Island. 1995.

Date	Number Captured	Number Radio-marked
26-27 April	12	10
27-28 April	36	15
28-29 April	31	13
19-20 May	26	7
20-21 May	29	1
TOTAL	134	46

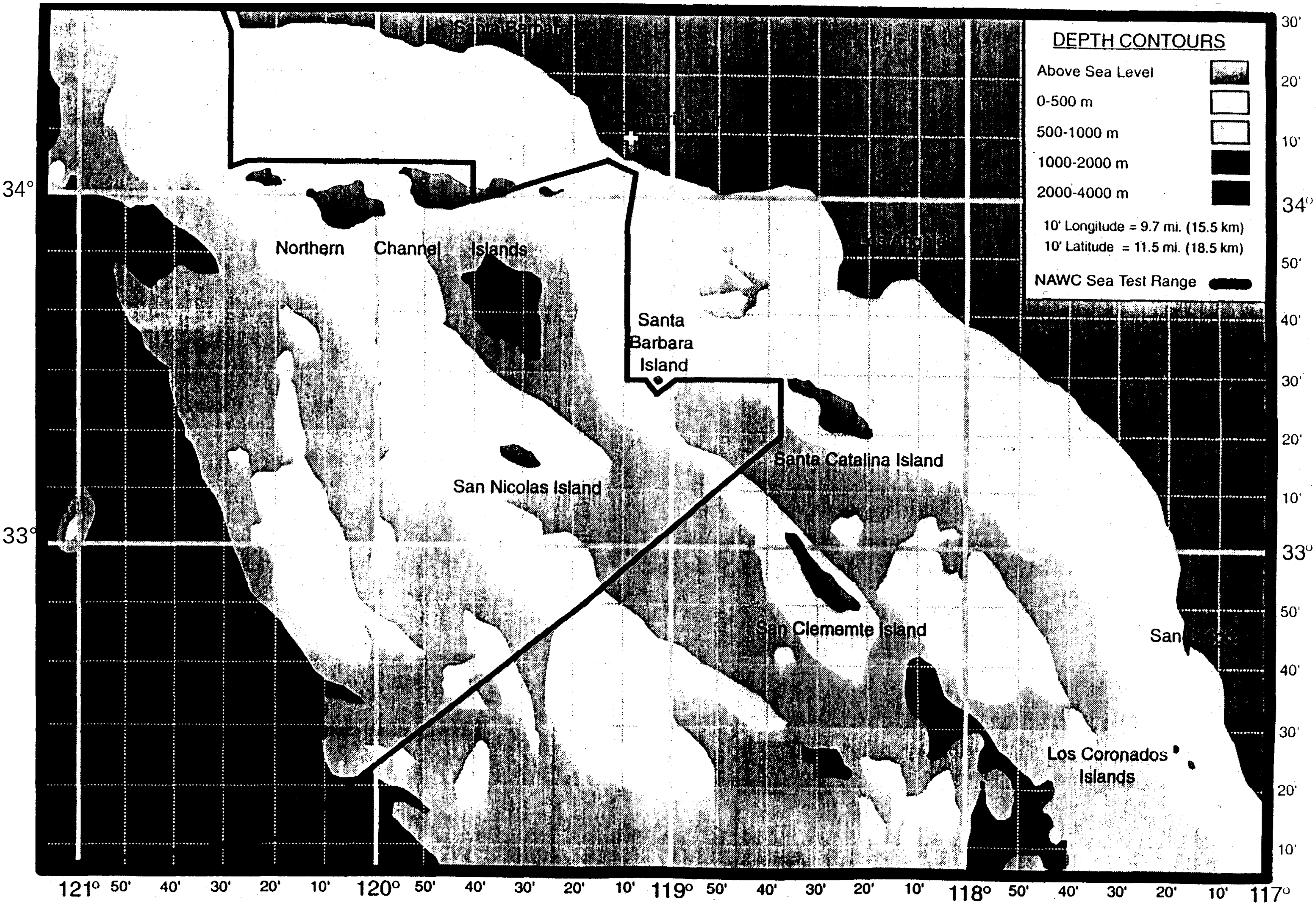
Table 2. List of Xantus' Murrelets captured in 1995, including identification number, capture date, last location date, duration (hours, h or days, d), and number of times detected.

Bird Number	Capture Date	Last Location Date	Duration	Number of Detections
5336	29 April	29 April	7 h	9
5535	28 April	28 April	11 h	18
5569	20 May	--	0	0
5597	29 April	29 April	10 h	19
5611	28 April	28 April	3 h	5
5976	20 May	22 May	2 d	5
5996	29 Apnl	29 April	6 h	13
6024	26 April	8 May	12 d	22
6033	28 April	--	0	0
6060*	26 April	28 April	2 d	28
6066	17 April	8 May	11 d	6
6090*	27 April	--	0	0
6129	26 April	27 April	7 h	11
6145	27 April	27 April	5 h	1
6186	27 April	8 May	11 d	31
6226	27 April	28 April	2 d	32
6305	27 April	6 June	40 d	18
6344	20 May	--	0	0
6383	27 April	27 April	5 h	3
6425*	27 April	--	0	0
6464	20 May	6 June	17 d	16
6726	28 April	10 May	12 d	11
6739	21 May	--	0	0
6764	28 April	28 April	6 h	11
6769	27 April	28 April	6 h	10
6788	27 April	22 May	25 d	13
6802	20 May	--	0	0
6813	28 April	29 April	8 h	12
6821	29 April	29 April	15 h	31
6853	29 April	29 April	6 h	12
6864	28 April	29 April	2 d	25
6872	27 April	28 April	2 d	2
6888	28 April	28 April	5 d	11
6893	27 April	13 May	16 d	33
6902	29 April	12 May	13 d	76
6914	20 May	22 May	2 d	2
6923	28 April	28 April	4 h	5
6927	28 April	16 May	18 d	24
6938	27 April	22 May	25 d	24
6945	28 April	28 April	6 h	10
6954	29 April	30 April	2 d	41
6965	29 April	1 May	2 d	29
6970	29 April	29 April	8 h	17
6988	20 May	25 May	5 d	1
6997	29 April	12 May	13 d	74

*Transmitter signal lost in radio interference

SOUTHERN CALIFORNIA BIGHT

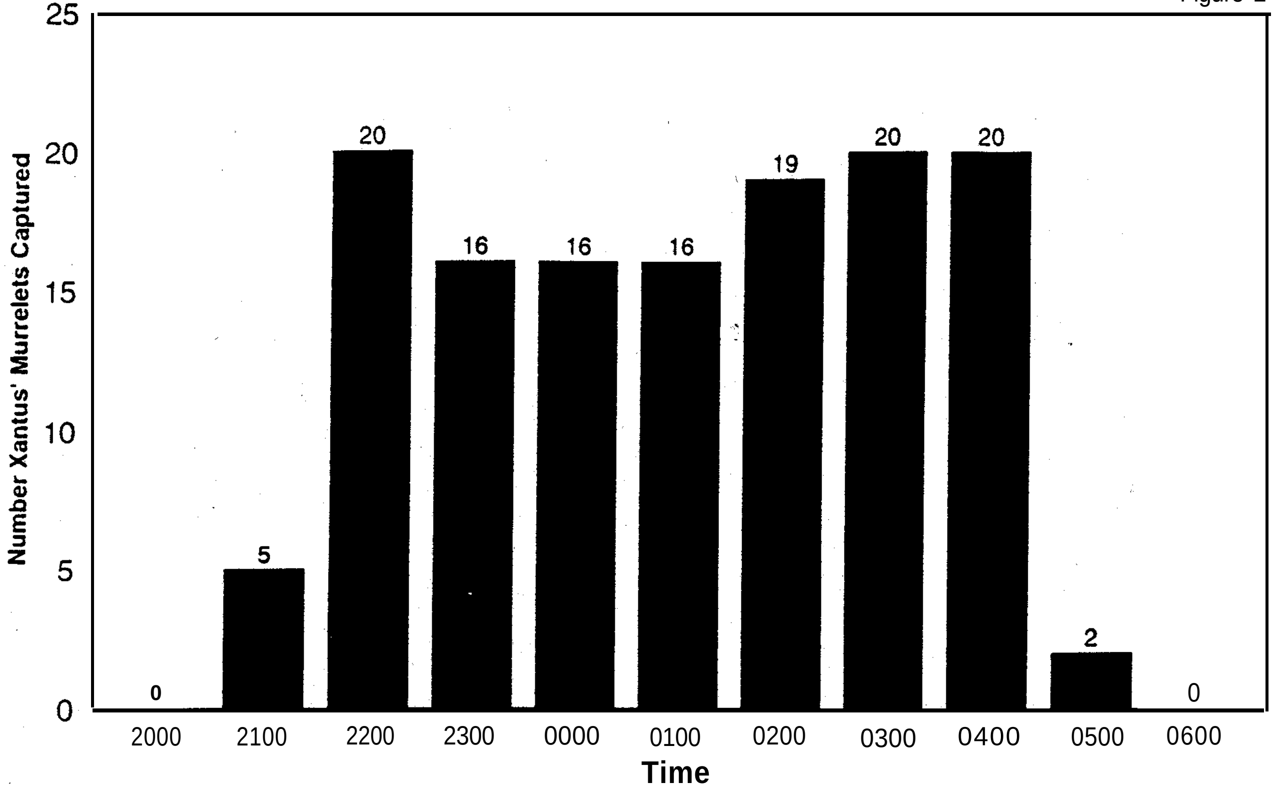
Figure 1



Xantus' Murrelet Captures by Hour

April-May 1995

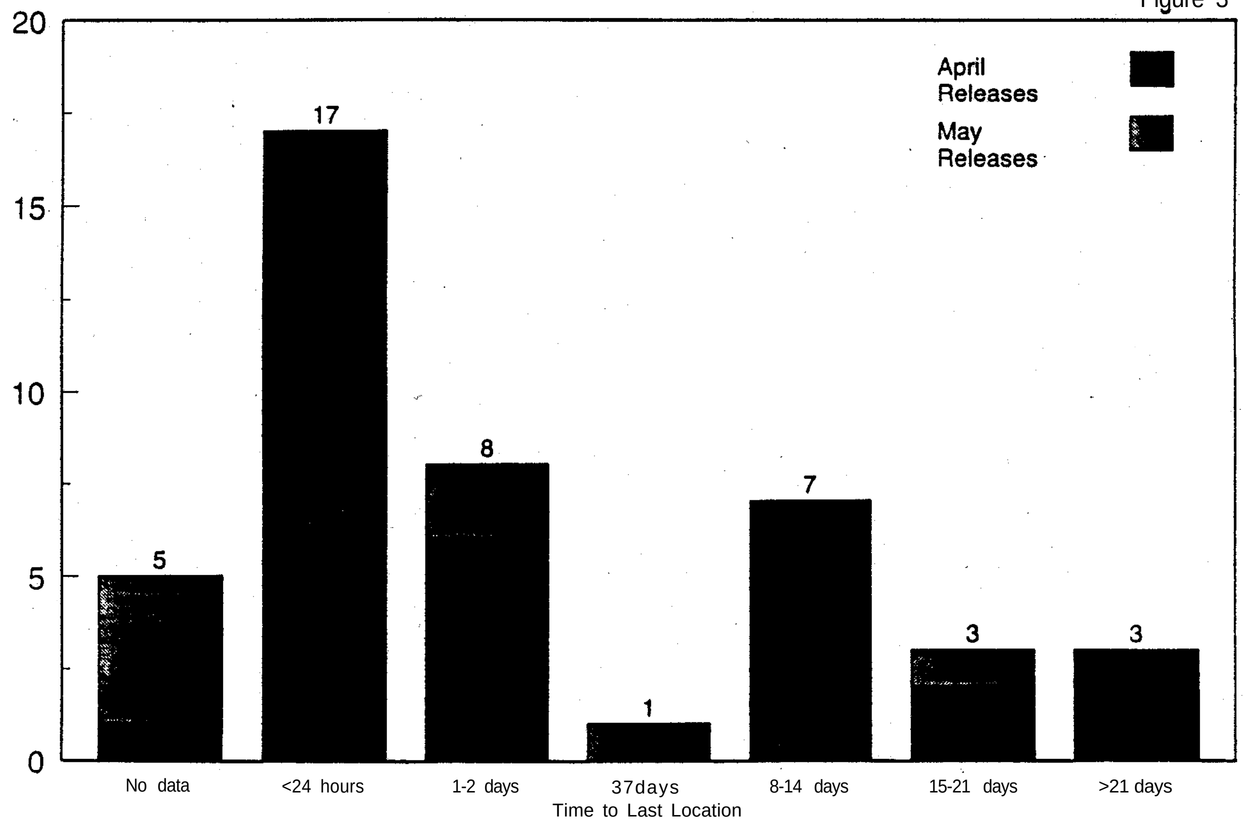
Figure 2



Xantus' Murrelet Telemetry Tracking Data

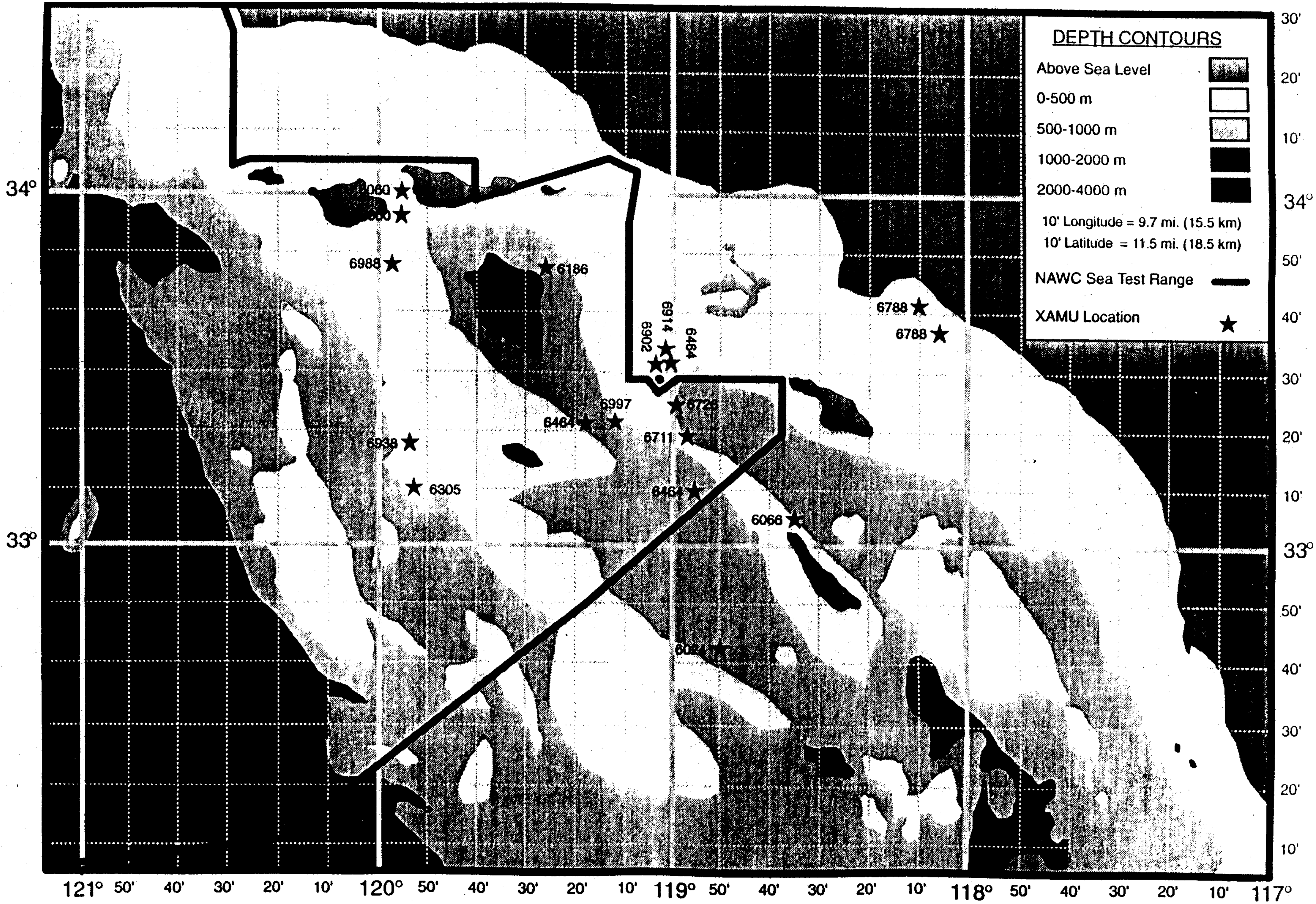
April-June 1995

Figure 3



All Aerial Locations-1995

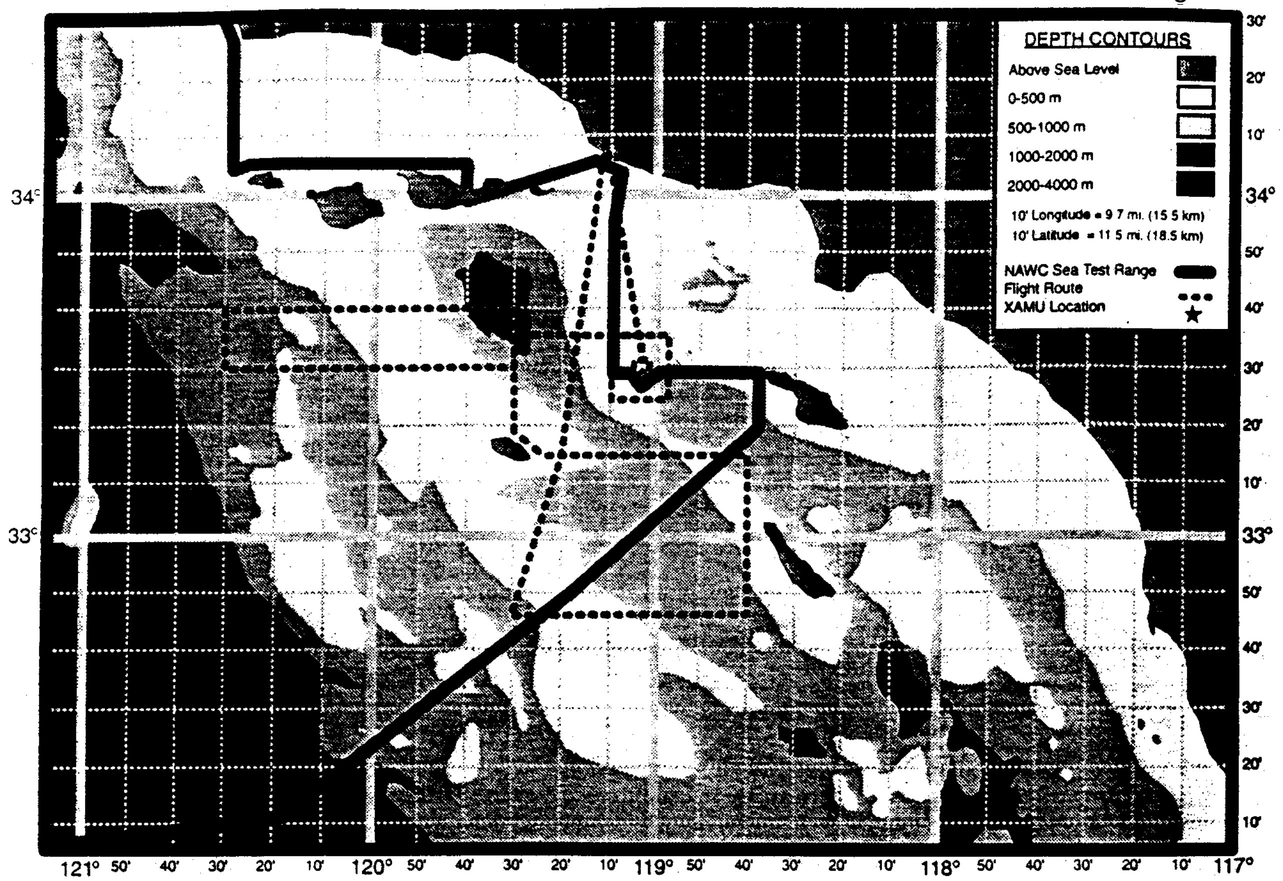
Fig. 4



XANTUS' MURRELET TELEMETRY TRANSECTS

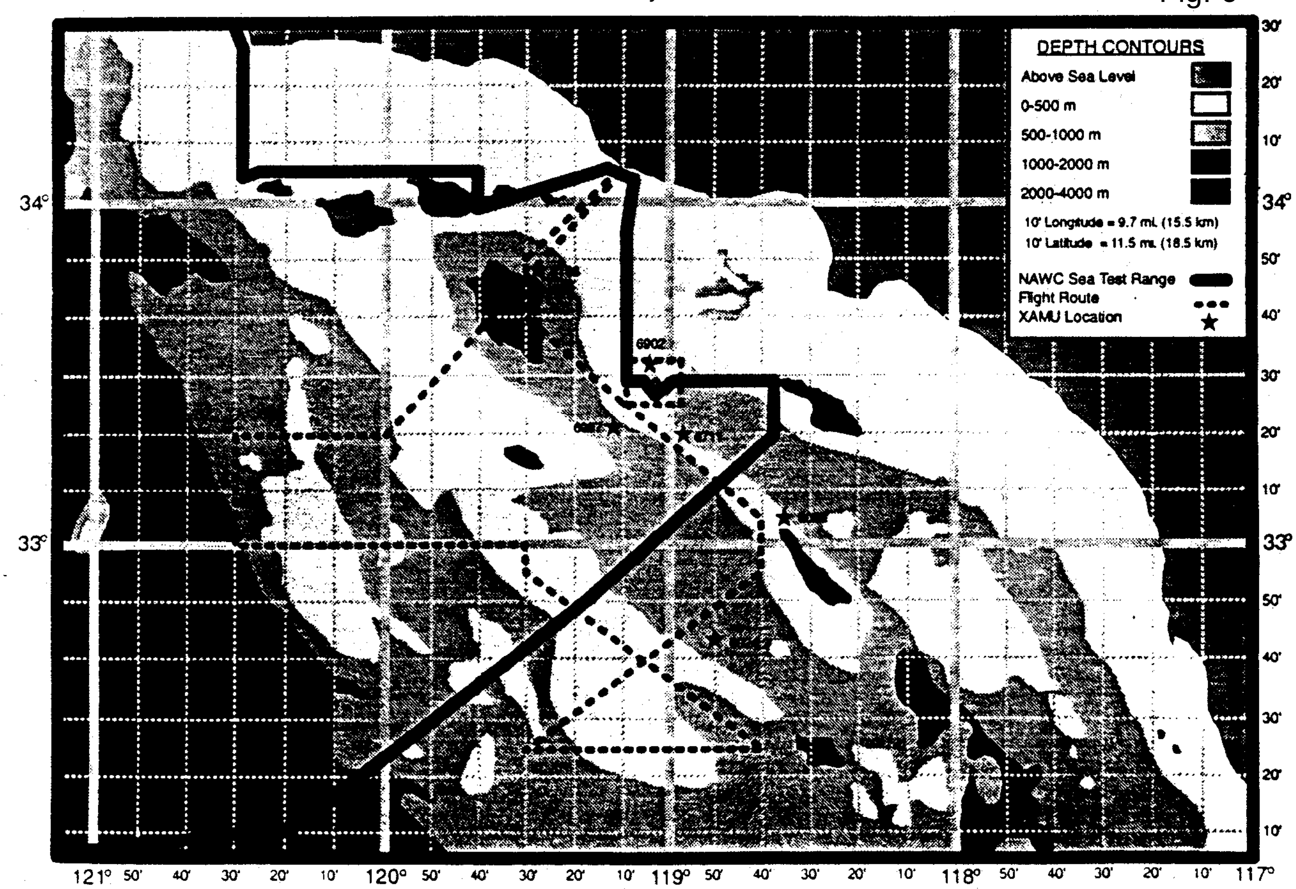
1 May 1995

Fig. 5



8 May 1995

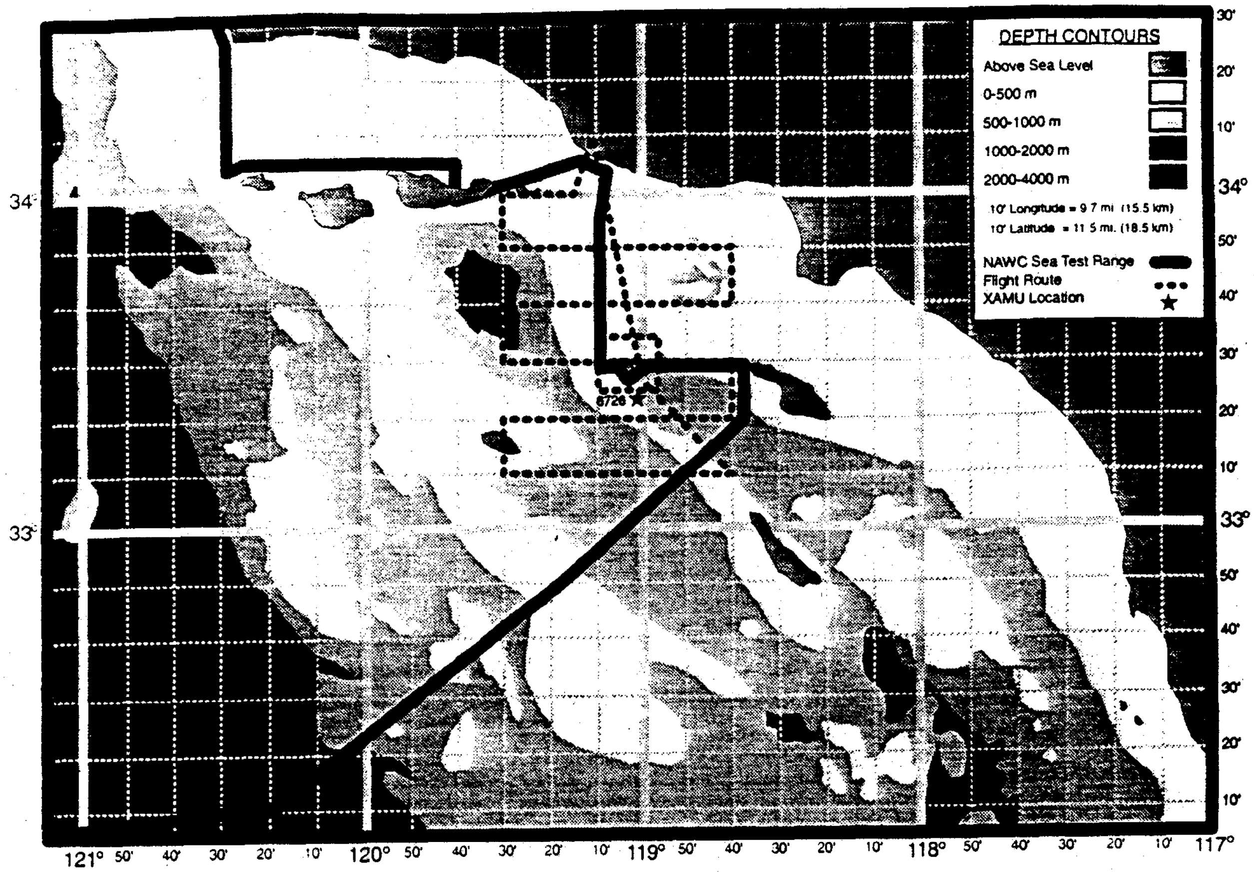
Fig. 6



XANTUS' MURRELET TELEMETRY TRANSECTS

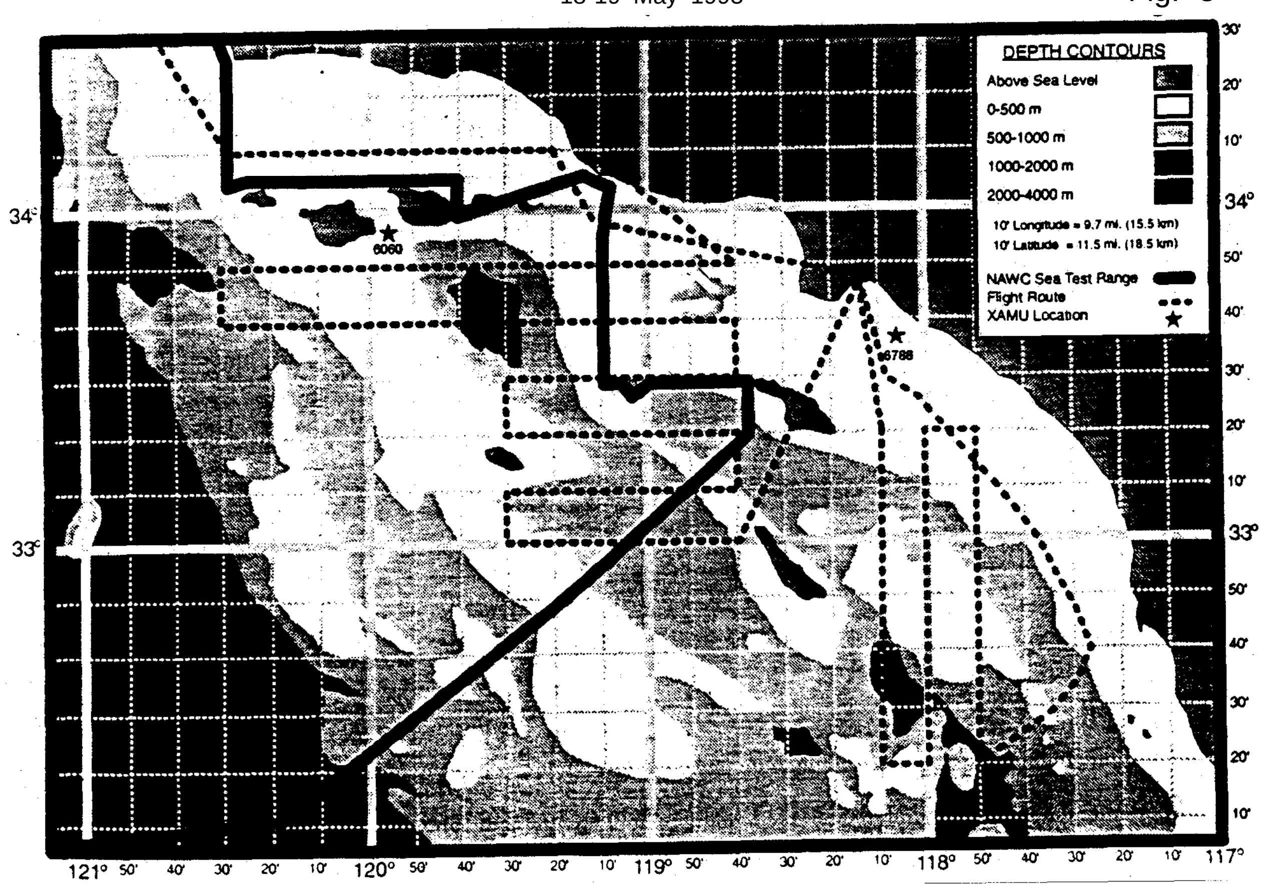
10 May 1995

Fig. 7



18-19 May 1995

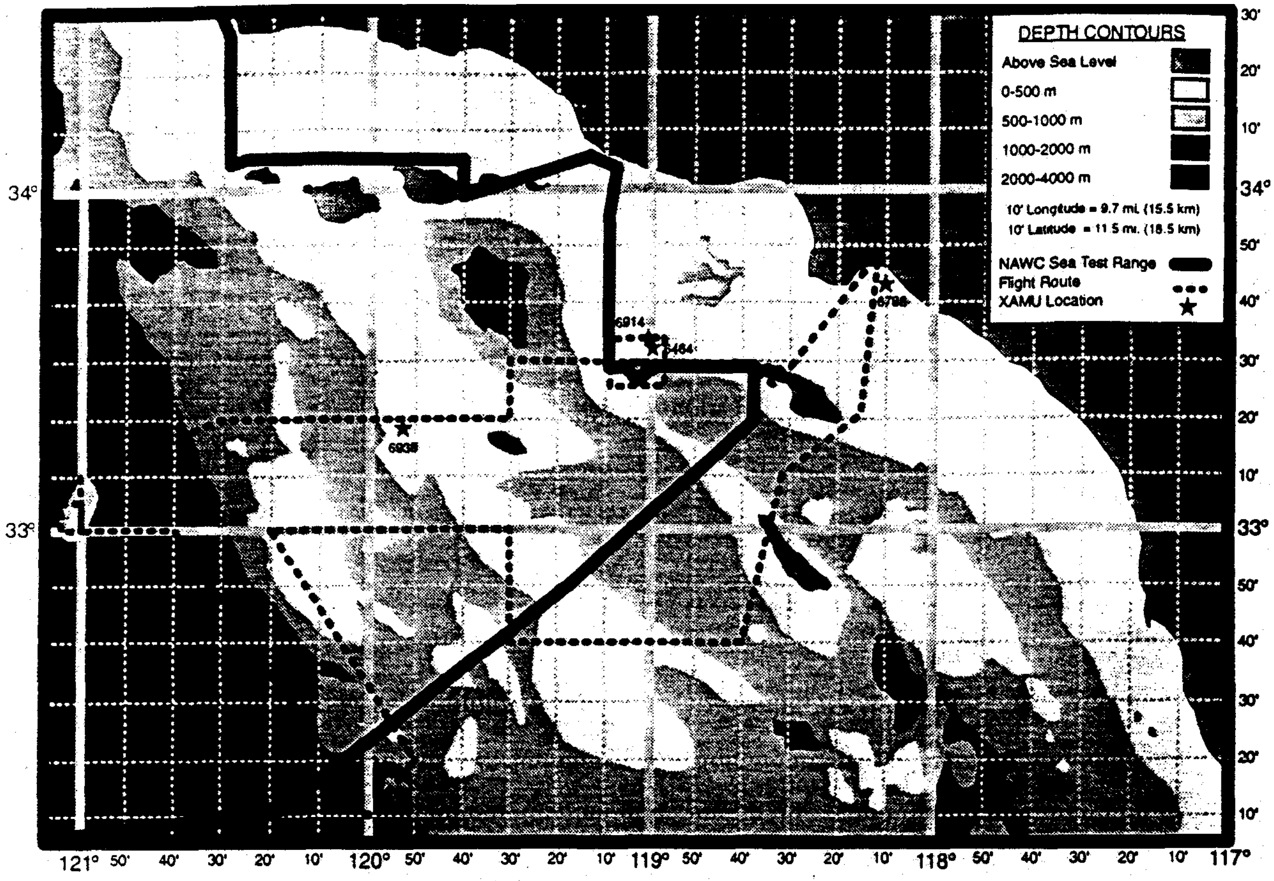
Fig. 8



XANTUS' MURRELET TELEMETRY TRANSECTS

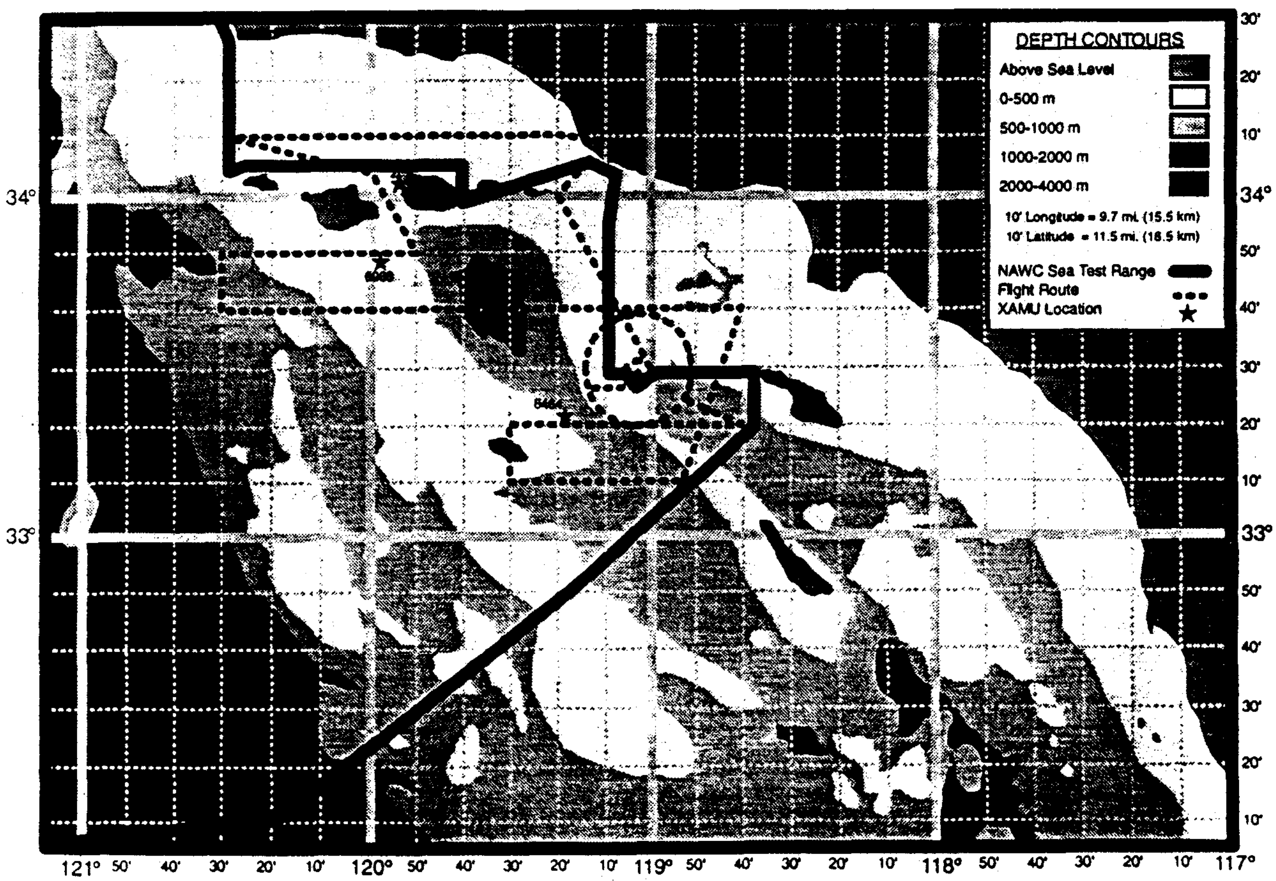
22 May 1995

Fig. 9



25 May 1995

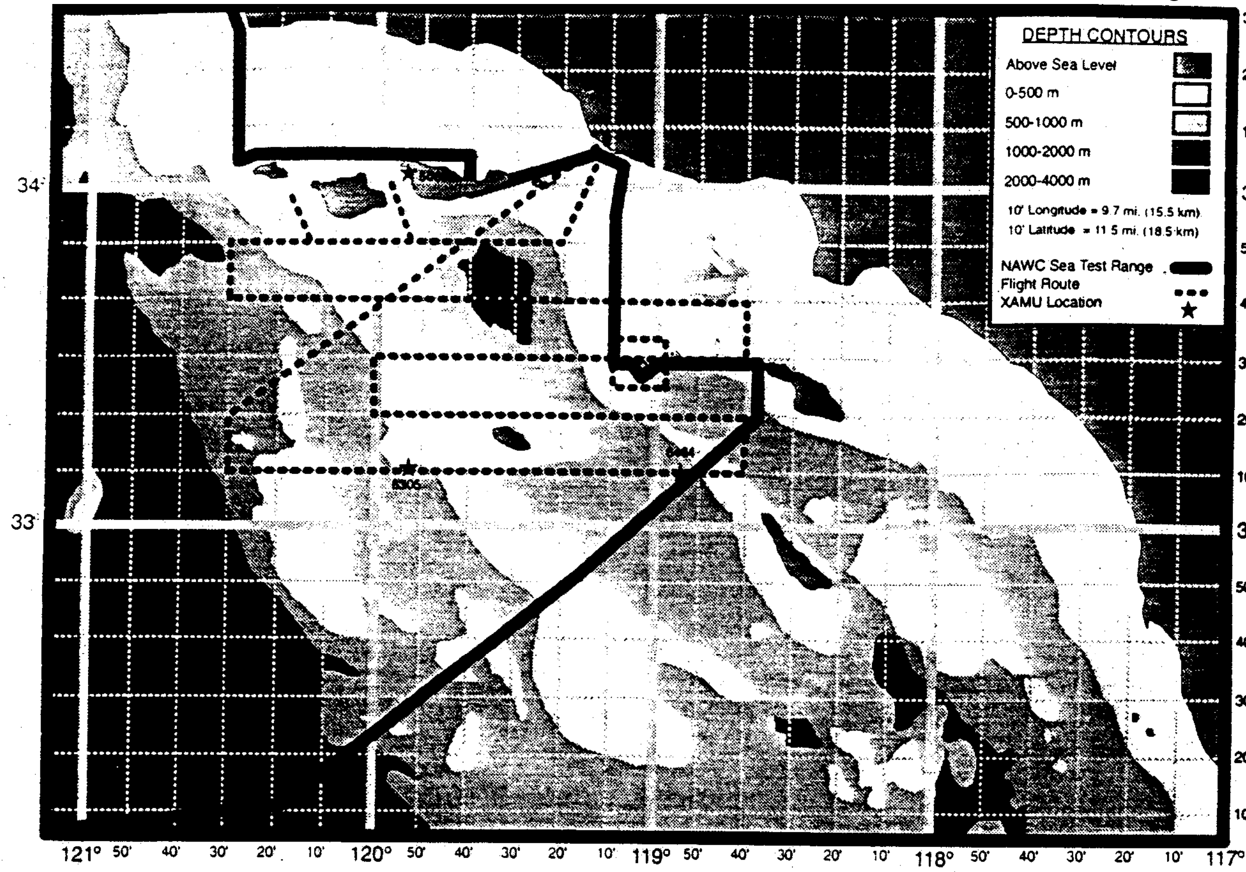
Fig. 10



XANTUS' MURRELET TELEMETRY TRANSECTS

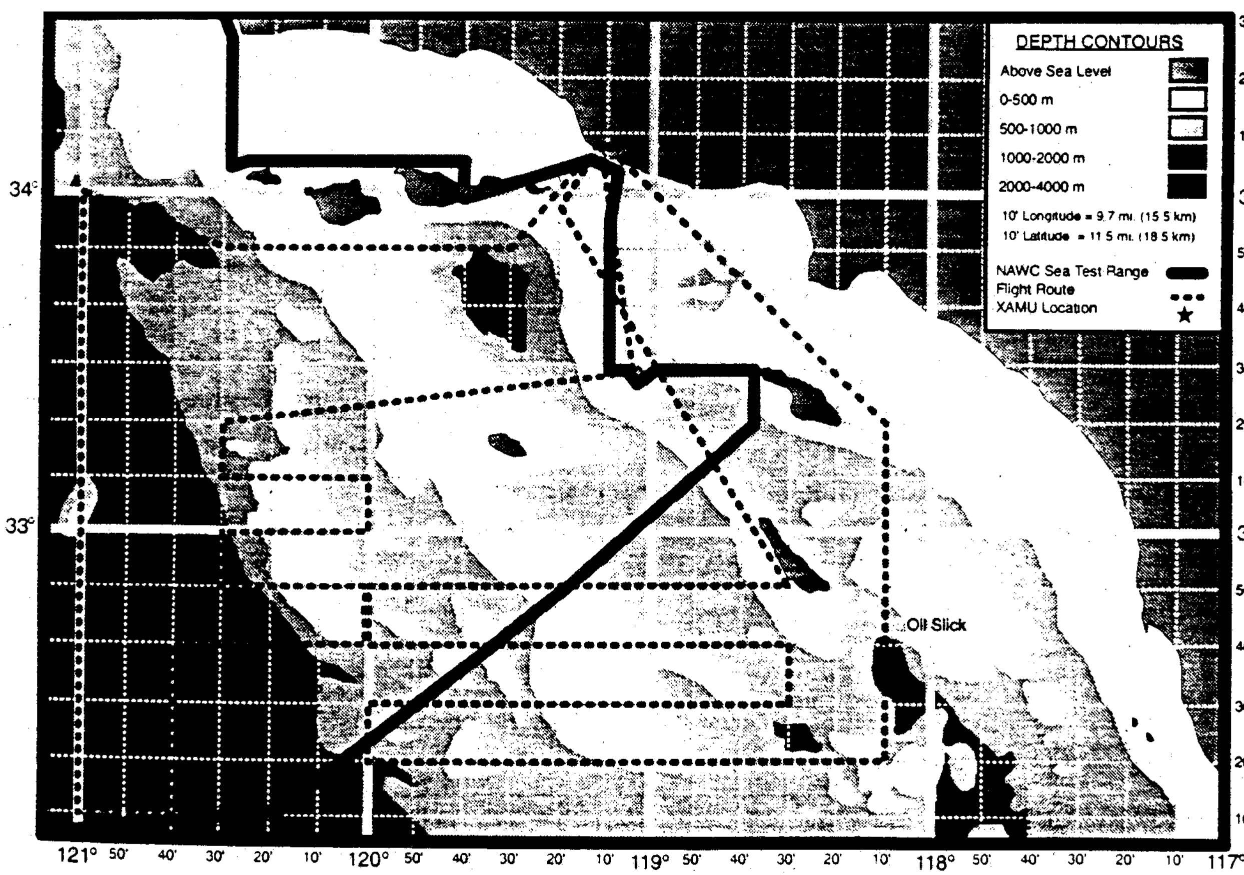
6 JUNE 1995

Fig. 11



13-14 JUNE 1995

Fig. 12



XANTUS' MURRELET TELEMETRY TRANSECTS
27 JUNE 1995

Fig. 13