Exxon Valdez Oil Spill
Restoration Project Annual Report

Patterns and Processes of Population Change in Sea Otters

Restoration Project 99423
Annual Report

This annual report has been prepared for peer review as part of the *Exxon Valdez* Oil spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in this annual report.

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Study History: This project began in April 1999 with the approval of a 5 year plan by the *Exxon Valdez* Oil Spill (EVOS) Trustee Council. The project is an extension of Restoration Project 93043-2, designed to develop an aerial survey method for sea otters in 1993, and the Nearshore Vertebrate Predator Project, 95025 designed to assess recovery of the nearshore ecosystem affected by the Exxon spill. This project supports an annual survey of sea otter abundance in Prince William Sound, population estimates from intensive surveys in an oiled and unoiled area and estimates of the density and sizes of green sea urchins from those same intensive study areas. In this report we present the results of the first year of field work under this project, but in the context of previous years work.

Abstract: The purpose of this study is to track the recovery process of sea otters (*Enhydra lutris*) in western Prince William Sound through annual aerial surveys of abundance and to monitor the abundance and size distribution of a preferred sea otter prey, the green sea urchin (*Stronglycentrotus droebachiensis*). Estimates of sea otter abundance were obtained through a standardized aerial survey methodology. A single survey of Prince William Sound and a series of replicate aerial surveys at Knight and Montague Islands were completed in July 1999. Surveys of sea urchin populations at Knight and Montague Island were completed in August 1999.

In July 1999 we estimated the Prince William Sound sea otter population at 8,355 individuals (se=1086), the Orca Inlet population at 4,879 (se=2391) and the Western Prince William Sound population (a subset of the Prince William Sound population) at 2,475 (se=381). Prior estimates for Prince William Sound and Orca inlet were 9,092 (se=1422) and 5,260 (se=1956) respectively, in 1994. The previous comparable estimates for Western Prince William Sound were 2,852 (se=440) in 1998 and 2,228 (se=256) in 1994. We estimated population sizes of 81 (se=15) at Northern Knight Island and 586 (se=109) at Montague Island in 1999. At Northern Knight Island the mean estimated summer population size has remained unchanged since 1993 (mean=71, se=7). During this same period we have seen a significant increasing trend in population size at Montague Island from about 300 in 1993 to about 600 in 1999 (avg. annual increase=12% adj, R^2=0.77, $P<0.01$).

The relative stability of the larger Prince William Sound sea otter population over the past 5 years and the significant increases we have detected since 1993 in and around the spill area are indicating progress toward recovery of the EVOS injured sea otter population. However, the lack of a concurrent increase around Northern Knight Island, where sea otter mortality was highest, indicate that recovery may not be occurring where oil spill effects were greatest.

Between 1996 and 1999, we also examined changes in sea urchin populations at Knight and Montague Islands. In 1996 and 1997 at Knight Island, more than 40% of the sea urchins examined (N=2176) were larger than 20 mm (the minimum size generally consumed by sea otters) compared to the less than 20% (N=678) at Montague Island. However, in 1998 and 1999, there was a marked increase in the number of large sea urchins, especially at Montague Island, and there was a higher proportion of large sea urchins at Montague Island compared to Knight Island. In 1999, 77% (N=265) of the sea urchins at Montague were larger than 20 mm compared to 54% (N=794) at Knight. The increasing proportion of large sea urchins at Montague was in spite of high, and increasing density of sea otters there compared to Knight Island.

Key words: *Enhydra lutris*, *Exxon Valdez*, oil spill, population status, Prince William Sound, sea otters, sea urchin, *Stronglycentrotus droebachiensis*

Project Data: will be addressed in the Final Report.

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INTRODUCTION

The nearshore environment of Prince William Sound (PWS) received about 40% of the oil spilled after the *Exxon Valdez* ran aground (Galt et al. 1991). Concerns about nearshore recovery and restoration have resulted in a suite of studies sponsored by the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC), including the Nearshore Vertebrate Predator project (NVP). Principal findings include an apparent lack of recovery among sea otters and harlequin ducks, both invertebrate feeders in the nearshore ecosystem. A finding consistent with this conclusion was a common pattern among several sea otter prey species consistent with reduced predation, through increased proportions of large individuals where sea otters populations were reduced. We have continued the sea otter components of previous research that were most effective and statistically powerful at identifying if, where, and how recovery may be constrained among EVOS affected sea otters populations in the nearshore. We address the need to refine and focus efforts on study components that provide the greatest resolution to ecosystem function.

We focus on sea otters (*Enhydra lutris*) through aerial surveys, and on ecological interactions between sea otters and green sea urchins, a preferred invertebrate prey. We selected sea otters because they were (1) injured by the oil spill and continue to show evidence for lack of a full recovery, (2) are presumably reflective of the health and recovery status of the nearshore system generally, and (3) are represented by abundant postspill information that can be utilized for long-term restoration monitoring. For sea otters we are monitoring both the patterns of population change and the processes underlying change in the nearshore system.

Sea Otters:

Sea otter populations in WPWS were injured as a result of the *Exxon Valdez* oil spill (EVOS). Estimates of sea otter mortality due to the spill range from 750 to 2,650 individuals (Garrott et al. 1993, Garshelis 1997). A population model (Udevitz et al. 1996) predicted recovery of the Western Prince William Sound (WPWS) sea otter population in 10 to 23 years, projecting maximum annual growth rates from 0.10-0.14. Surveys to date (1993-1999) have shown a significant increasing trend in the WPWS sea otter population, averaging about 4% per year since 1993 (power > 0.80 to detect a 1% annual change in 5 annual WPWS surveys). However, the northern Knight Island area numbers remain below pre-spill estimates, and have not shown a significant increasing trend (Holland-Bartels et al. 1999) though our power to detect change is lower for these surveys.

Studies conducted in 1996-1998 as part of the NVP program provided evidence that sea otters in WPWS, in at least the area of northern Knight Island, had not fully recovered from oil spill injury (Holland-Bartels et al. 1997, Holland-Bartels et al. 1998, Holland-Bartels et al. 1999). Shortly after the spill, in April 1989, a total of 33 sea otters were captured or recovered from Herring Bay, a heavily oiled embayment on northern Knight Island (Bodkin and Udevitz 1994). Fourteen aerial surveys conducted in 1996 found a maximum of 11 sea otters (mean = 3) in this same location. Through 1998, sea otter abundance at northern Knight Island remained at about 50% of the estimated pre-spill abundance (Dean et al. 2000). Constraints to recovery most likely are demographic, either through reduced survival among residents, or higher emigration from the oiled area.

This project builds on previous EVOS research to develop a statistically sensitive and cost-effective program that will continue to track the WPWS sea otter population and nearshore ecosystem recovery through two avenues. First, continued aerial surveys of sea otter abundance at appropriate intervals will allow population monitoring and testing of the predictions of a previously developed EVOS Trustee Council sea otter population model (Udevitz et al. 1996). Further, the return of sea otter âbundance to estimated pre-spill levels could define a recovery endpoint. Second, monitoring abundance and size of a key invertebrate species may allow an independent assessment of sea otter recovery through predicted responses in a prey population.

Sea otters:
Sea otters occupy an invertebrate consuming trophic level in the nearshore and are a conspicuous component of the nearshore ecosystem. In 1995, the NVP Project was initiated to examine the status or recovery of nearshore vertebrates (including sea otters, harlequin ducks, river otters and pigeon guillemots), and to examine possible causes for the apparent lack of recovery. Results of the NVP project clearly suggest that complete recovery may not have occurred, for at least the invertebrate-feeding sea otter and harlequin duck. This likely reflects similarities in trophic pathways or perhaps simply greater power to detect differences or change with these species. Additionally, we have observed an apparent response among several invertebrates to reduced sea otter densities. This finding represents a shift in the ecological processes structuring the nearshore community and provides a unique opportunity to test predictions related to sea otter recovery and their prey.

Sea urchins:
The status of sea otter recovery has been assessed, in part, by conducting aerial surveys of sea otter abundance in WPWS, comparing pre- and post-spill estimates of abundance, and comparing estimates of abundance in oiled and unoiled parts of the Sound. While these data provide a foundation for assessment of recovery status, there were few pre-spill data and there were known biases in pre-spill estimates that precluded using pre- vs. post-spill comparisons in making a definitive quantitative assessment of the extent of recovery. Furthermore, recovery status could not be based solely on post-spill comparisons of oiled and unoiled areas because there are known differences in habitat between these areas, and it is uncertain whether sea otters in oiled areas could ever achieve population levels observed in unoiled parts of the Sound. As a result, in the NVP study, and subsequently in this study, we examine prey populations as an ancillary means of assessing recovery.

Sea otters are considered keystone predators within coastal marine systems of the North Pacific that exert strong top-down control on the structure of the nearshore community (Power *et al.* 1996). Throughout their range, sea otters reduce densities of large sea urchins that are a preferred prey. Observations of sea urchins and kelp in nearby areas with and without sea otters (Estes & Palmisano 1974, Estes *et al.* 1978, Duggins 1980, Breen *et al.* 1982, Estes & Duggins 1995), and in a given area before and after recolonization by sea otters after decades of absence (Lowry & Pearse 1973, Laur *et al.* 1988, Watson 1993, Estes & Duggins 1995, Kvitek *et al.* 1998) indicate that large sea urchins are rare where sea otters are abundant but can be locally abundant where sea otters are absent. Fewer studies have examined the transitions during recolonization by sea otters (Laur *et al.* 1988, Watson 1993, Estes & Duggins 1995, Konar 2000), and only two recent studies (Estes *et al.* 1998, Konar 2000) have examined community response to a reduction in the abundance of sea otters. The observations made during transitional phases have generally indicated an inverse relationship between densities of sea otters and large sea urchins, but this has not always been the case (Konar 2000).

In our previous work, we described responses of sea urchin populations to reduction in sea otters following the *Exxon Valdez* oil spill based on sampling conducted in 1996 and 1997 (Dean *et al.* 2000). In spite of the approximately 50% or greater reduction in sea otter abundance in oiled area that persisted for nearly a decade, there was little evidence of a strong response by sea urchins to the reduction in sea otters. In the Knight Island region where sea otter densities were reduced, there were proportionally more large sea urchins, but except in some widely scattered aggregations, both density and biomass of sea urchins were similar in an area of reduced sea otter density compared to Montague Island where sea otters remained about ten times more abundant. We speculated that in oiled areas of Prince William Sound, the number of surviving sea otters may have been high enough to suppress sea urchin populations. However, we also speculated that a future strong recruitment year for sea urchins could result in an increase in sea urchin biomass in oiled areas of Prince William Sound, and that this may have strong cascading effects on the nearshore system that could lead to a reduction in algae that are grazed by sea urchins.

In this report, we extend our earlier work on interactions between sea otters and sea urchins by including observations made in 1998 and 1999. During this period, there was no increase in sea otter density in northern Knight Island and sea otters remained about ten times more abundant at Montague Island than at Knight Island.

Continued prey assessment provides a unique opportunity to complete the testing of an innovative approach for estimating the status of a predator population. When sea otter populations near complete recovery, we predict that differences in prey sizes between areas should diminish.

In summary, continued monitoring of sea otter distribution and abundance and otter prey populations in WPWS will be valuable in (1) providing insight into potential demographic constraints to recovery which may improve future recovery models, (2) documenting actual recovery time for the nearshore system including sea otters, (3) providing long-term population trend data which may be used in assessing initial damage and subsequent recovery of sea otter populations in the event of future oil spills.

PROJECT OBJECTIVES

Sea otters:

A. Estimate and compare sea otter abundance and population trends over time Between an oiled and unoiled area within WPWS and over all of WPWS.

Sea urchins:

B. Estimate abundance and size class composition of green sea urchins in an oiled
and unoiled study site.

STUDY AREA

We surveyed sea otters at two geographical scales, WPWS and an oiled and unoiled area within WPWS. The WPWS study area includes all oiled areas of Prince William Sound as well as areas that are contiguous to oiled areas (Figure 1). Intensive survey areas include an oiled area identified as the shorelines of the northern Knight Island archipelago between NW Herring Bay and SE Bay of Islands (Figure 2). Oiling was heaviest here, and population levels of sea otters are generally lower here than in other areas of PWS that were not oiled. The unoiled area is along the northwestern shore of Montague Island between Graveyard Point and southern Stockdale harbor. Sampling of sea urchins took place in the oiled area at Herring Bay and Bay of Islands on Knight Island and within the shoreline surveyed for sea otters at Montague Island.

METHODS

Sea otters:

The aerial sea otter survey methodology consists of two components: (1) strip transect counts and (2) intensive search units and are fully described in Bodkin and Udevitz 1999. Sea otter habitat was sampled in two strata, high density and low density, distinguished by distance from shore and depth contour. Survey effort was allocated proportional to expected sea otter abundance by adjusting the systematic spacing of transects within each stratum. Transects with a 400 meter strip width on one side of a fixed -wing aircraft were surveyed by a single observer at an airspeed of 65 mph (29 m/sec) and altitude of 300 feet (91 m). The observer searched forward as far as conditions allow and out 400 m, indicated by marks on the aircraft struts, and recorded otter group size and location on a transect map. A group was defined as one or more otters spaced less than three otter lengths apart. Intensive search units (ISU's) were used to estimate the proportion of sea otters not detected on strip transect counts. ISU's were flown at intervals dependant on sampling intensity throughout the survey period, and were initiated by the sighting of a group, then followed by five concentric circles flown within the 400 m strip perpendicular to the group which initiated the ISU.

Replicate surveys in the intensive oiled and unoiled areas, using the same techniques described in Bodkin and Udevitz (1999) were conducted to gain precision in estimates.

Sea urchins:
Sea urchin density and size distributions were compared between a heavily oiled area with reduced sea otter densities (northern Knight Island) and an unoiled area (Montague Island) where sea otter densities were unaffected by the spill and remained high. Sampling was conducted yearly in the summers of 1996 through 1999. In 1996 and 1997, densities and size distributions were estimated from approximately 68 km of shoreline in Bay of Isles and Herring Bay, on northern Knight Island, and along approximately 51 km of shoreline on Montague Island using methods described in Dean *et al.* (2000). Briefly, twenty-nine to 30 different systematically selected shoreline segments, each 200-m long, were sampled in each year. Sea urchins from within a 50-m long by 0.5-m wide transect, placed parallel to shore, were counted and measured. All movable rocks were turned to search for sea urchins. Sampling from these systematically selected sites was supplemented by sampling in preferred sea urchin habitat (the lower intertidal zone on gently sloping cobble beaches) where we observed widely scattered aggregations of sea urchins.

In 1998, 15 new systematically selected transects were sampled in each of the Knight Island and Montague areas, and preferred sea urchin habitats identified previously were resampled in both 1998 and 1999. Sampling conducted in 1996 and 1997 included nearshore subtidal as well as intertidal areas and found that much higher densities were observed in the intertidal zone. Therefore, we restricted sampling in 1998 and 1999 to the intertidal and present only intertidal data here.

RESULTS

Sea otters:
During July 1999 we surveyed all of Prince William Sound (including the WPWS oiled area) to estimate sea otter abundance. During July 1999 we also conducted replicate aerial surveys within the intensive oiled and unoiled areas at Knight and Montague Islands, respectively.

In July 1999 we estimated the Prince William Sound sea otter population at 13,234 (se=2625) individuals, including pups. This total included 8,355 (se=1,086) individuals from Prince William Sound, and 4,879 (se= 2,391) from Orca Inlet. We estimated the WPWS population (a subset of the Prince William Sound population) at 2,475 (se=381). We estimated population sizes of 81 (se=15) at our oiled Northern Knight Island study site and 586 (se=109) at our unoiled Montague Island study site in 1999.

Sea urchins:

In 1996 through 1998, sea urchins were relatively rare at both the northern Knight Island and Montague study areas. On systematically selected transects sampled in 1996 through 1998, the mean density never exceeded 0.5 individuals m^{-2} (Table 1). In almost all cases, sea urchins were found under cobble or boulders, and were not visible unless rocks were overturned. Mean densities differed significantly between years, but not between areas (Knight and Montague). At sites where there were moderate densities of sea urchins in 1997, we found no significant difference between areas, and no increase in sea urchin density between 1997 and 1999 (Table 2).

Relatively few large (greater than 40 mm) sea urchins were found at either Knight or Montague Island in any year (Figure 3). Sea urchins were larger on average in areas with few sea otters (Knight Island) in 1996 and 1997, but were on average slightly larger in the area with high densities of sea otters (Montague Island) in 1999.

The changes in the relative proportion of smaller *vs.* larger sea urchins within each area over time appeared related to the timing of recruitment events. We do not have good estimates of the growth, but preliminary data from tagged sea urchins suggests that individuals 10 to 20 mm in size grow in the range of 2 to 8 mm per year. Similar estimates have been given for *S. droebachiensis* in Kodiak (Munk & McIntosh 1993) and for *S. pallidus* in the Aleutian Islands (Estes & Duggins 1995). Thus, we suspect that the different modes in size frequency distributions represent different cohorts. Size distributions for the population at Knight Island were unimodal in 1997 and 1998, suggesting dominance by a single cohort of sea urchins that had recruited sometime prior to 1996. A second cohort was evident in 1999. At Montague, the size frequency distribution was strongly dominated by 10 to 14 mm individuals in 1997. A secondary peak (mode = of 11 mm individuals) appeared in 1998 suggesting a second recruitment event.

DISCUSSION

Sea otters:

A remnant PWS sea otter population survived the commercial fur harvest of sea otters that ended early in the 20th century. This remnant population probably numbered less than 50 animals and was centered in southwest PWS and the long term average annual growth rate of the population was 0.099 (Bodkin et al. 1999). Recolonization of PWS was apparently complete by 1980, although our recent survey data indicate very low densities in the far northwest portions of the Sound. In 1994 and 1999, our estimates of the entire PWS sea otter population were similar, 12,289 in 1994 and 13,234 in 1999, with broadly overlapping confidence intervals. Although changes in abundance are evident at smaller geographic scales within PWS, our data suggest a relatively stable population of sea otters within the larger PWS area.

It has generally been accepted that the WPWS sea otter population was at or near equilibrium density at the time of the spill (Bodkin et al. 2000) Within WPWS, including principally oiled areas, we have observed a significant trend of increasing sea otter abundance between 1993 and 1999 (Fig. 3). The lowest estimate was obtained in 1993 (2,054) and the highest in 1998 (2,852). The average annual rate of growth during this period is 0.04, far less than the long term growth rate observed in PWS (Bodkin et al.

1999). This trend is consistent with a population recovering from the population decline that resulted from the 1989 oil spill. The reduced growth rate may reflect residual density dependent effects on food (Fukuyama et al. 2000) or space availability, or possibly residual spill effects such as continued low-level exposure to sea otters and/or their prey. We have inadequate data to determine if the estimate of 2,475 in 1999 represents a change in the trend or simply a single comparatively low estimate. Further surveys in WPWS will resolve this issue.

At Montague Island we have seen the mean estimated summer population size significantly increase from about 300 in 1993 to about 600 in 1999 (avg. annual increase = 0.12 adj, R^2= 0.77, P<0.01). During this same period at northern Knight Island sea otter abundance has remained unchanged since 1993 (mean=71, se=7), about half the estimated pre-spill abundance (Dean et al. 2000). This result suggests that recovery of sea otters at northern Knight remains delayed, relative to the remainder of the spill affected areas. Causes for the delayed recovery at northern Knight likely include increased mortality and/or emigration rates. Sea otters captured at Knight have exhibited elevated levels of the cytochrome P450 enzyme, a biomarker of oil exposure, compared to Montague Island (Holland-Bartels 1999). It also appears that residual oil may be adversely affecting some of the sea otters prey by increasing mortality and decreasing growth rates in some clam species (Fukuyama et al. 2000).

Sea urchins:

Based on the relative lack of large sea urchins in both Knight and Montague Islands, it appears that sea otters in both areas continue to structure these preferred prey by consuming larger individuals. Thus, in spite of the reduction in the number of sea otters in heavily oiled portions of Knight Island, and the continued lack of recovery of sea otters, predation by remaining sea otters is apparently sufficient to suppress sea urchin population growth. Even though sea urchin densities within our study areas were low, sea otters continued to prey on sea urchins. In a collection of 102 sea otter scats from WPWS in winter 1998, 29% had sea urchin remains (JL Bodkin, unpublished data).

The lack of response by sea urchins to a reduction in sea otters is similar to the lack of a response noted following a similar reduction in sea otters in the Semichi Islands (Konar 2000), but in contrast to the boom in sea urchin biomass following a nearly 90% reduction in sea otters in the Western Aleutian Islands (Estes *et al.* 1998). Thus, it appears that community response to changes in predator abundance may relate in part to the magnitude of the change and the non-linear nature of the response by prey.

The differences in size distributions of sea urchins, both between areas and between times within an area, were due mostly to fluctuations in sizes of sea urchins that were smaller than those generally consumed by sea otters. These fluctuations were apparently due to recruitment that did not occur in equal strength in the same years at both Montague and Knight Island. A particularly strong cohort of small individuals (approximately 11 mm test diameter) dominated the size frequency distribution of sea urchins at Montague Island in 1997, and continued to have a strong influence on the population structure through 1999. Also, a second relatively strong recruitment at Montague was evidenced by a second cohort in 1998. In contrast, there was little evidence of small (less than 14 mm test diameter) individuals at Knight Island in 1997 or 1998 suggesting a relative lack of recruitment there in the recent past. While these data suggest potentially interesting comparisons with respect to factors regulating recruitment, the overriding influence on sea urchin community structure appears to be predation by sea otters that prevents survival of larger individuals.

We can not dismiss the possibility that the lack of a stronger response by sea urchins in Prince William Sound was related, in part, to impacts associated with the oil spill. While Dean *et al.* (1996) found no evidence of an impact of oil on sea urchin populations, very few sea urchins were found at either oiled or unoiled sites, and the power to detect differences was low. For several more abundant intertidal and subtidal animals, for which differences were more easily detected, higher densities were observed in unoiled *vs.* heavily oiled areas (Dean *et al.* 1996, Highsmith *et al.* 1996, Jewett *et al.* 1999).

While we observed no substantial increase in sea urchins following the reduction in sea otters in 1989, future changes are possible. The number of sea otters at northern Knight Island has remained low, and a strong recruitment year for sea urchins could result in an eventual increase in sea urchin biomass and a reduction in algae. However, given that there were relatively few small sea urchins in the Knight Island population in 1999, and that it takes several years for sea urchins to reach a size large enough to substantially affect sea urchin biomass, it is unlikely that such an increase will occur in the next several years.

CONCLUSIONS

Results of aerial surveys of sea otter abundance have identified a significant increase of about 800 animals since 1993 in the oiled portions of WPWS. However, at Knight Island where oiling and sea otter mortality was highest we have detected no similar increases, suggesting recovery has been delayed for more than a decade. The overall PWS sea otter population appears stable at about 13,000 since 1994. Recent evidence of continued exposure to oil at Knight Island sea otters and adverse effects of residual oil on the growth and survival of clams strongly support the role of oil in delaying recovery of the nearshore marine community, at least at northern Knight Island. It appears as though episodic, and possibly localized recruitment of sea urchins, as well as continued predation may confound predictions of prey population responses to reduced predator densities.

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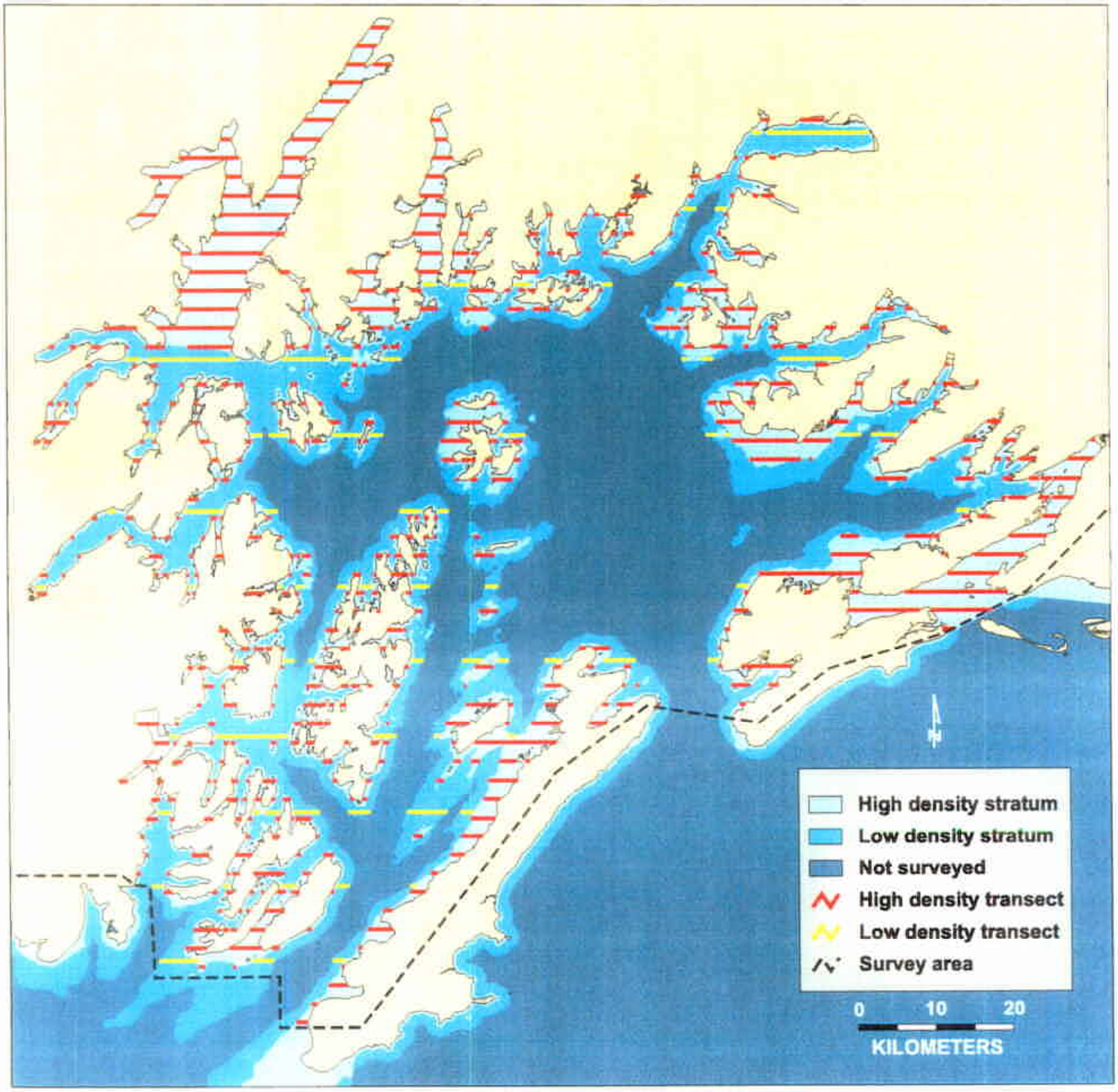

Fig. 1. Prince William Sound sea otter survey area, 1999.

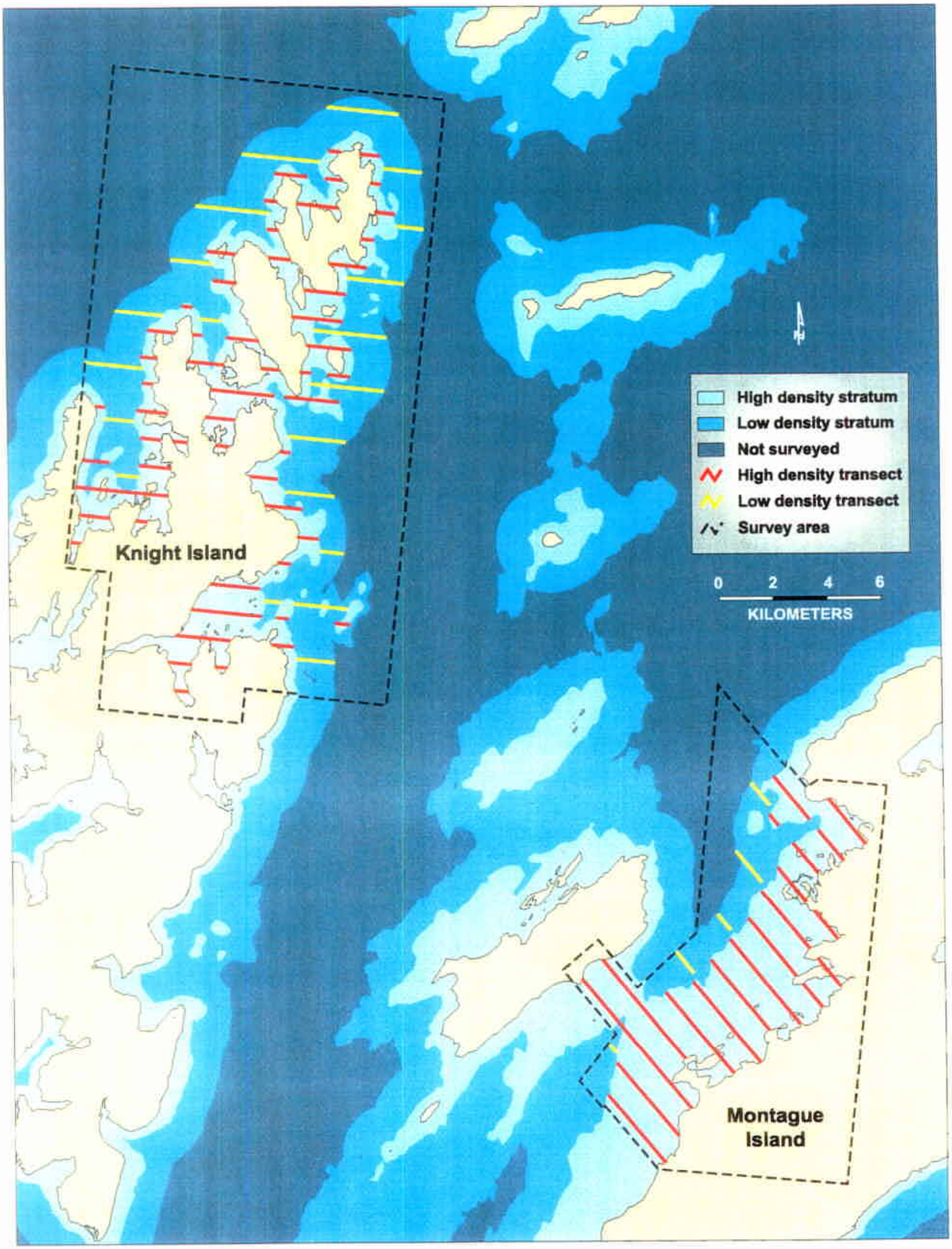

Fig. 2. Knight (oiled) and Montague (unoiled) study areas.

Table 1. Mean density of sea urchins (number m^{-2}) from selected intertidal sites on northern Knight Island and Montague Islands from 1996 through 1998.

	Knight Island			**Montague Island**		
	N	Mean	SD	N	Mean	SD
1996	30	0.17	0.26	30	0.05	0.17
1997	30	0.19	0.64	29	0.47	1.09
1998	15	0.03	0.05	15	0.04	0.11

ANOVA Results Summary

Source	F	Probability
Year	3.02	0.03
Area	0.72	0.54

Table 2. Changes in mean sea urchin density at preferred sites in Knight and Montague Islands sampled in both 1997 and 1999.

	Knight Island			Montague Island		
	N	Mean	SD	N	Mean	SD
1997	8	0.23	0.18	8	1.58	1.68
1999	8	0.99	0.84	8	0.54	0.45

ANOVA Results Summary

Source	F	Probability
Year	0.14	0.71
Area	1.40	0.25

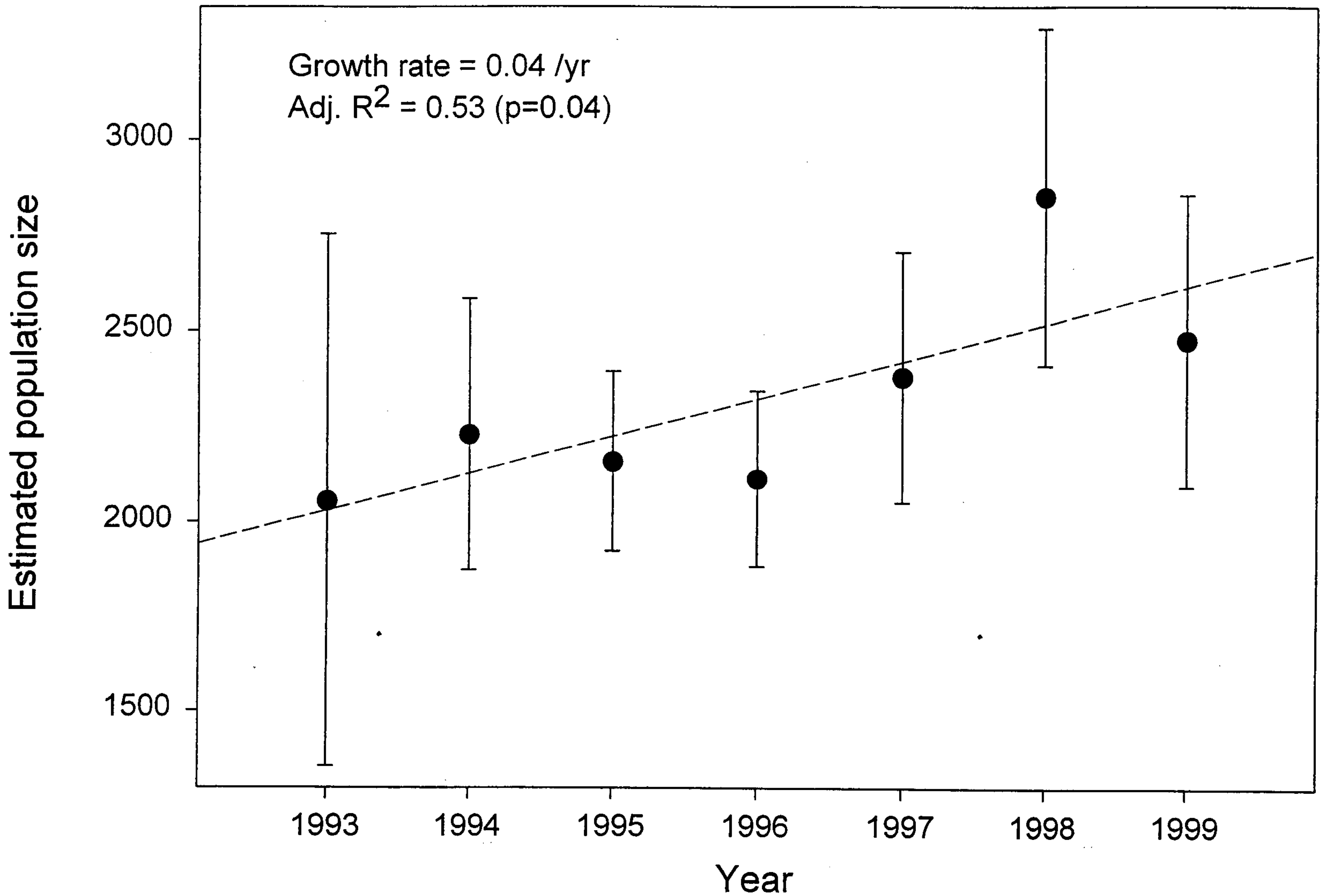

Figure 3. Estimates of sea otter abundance (± se) in western PWS 1993-1999

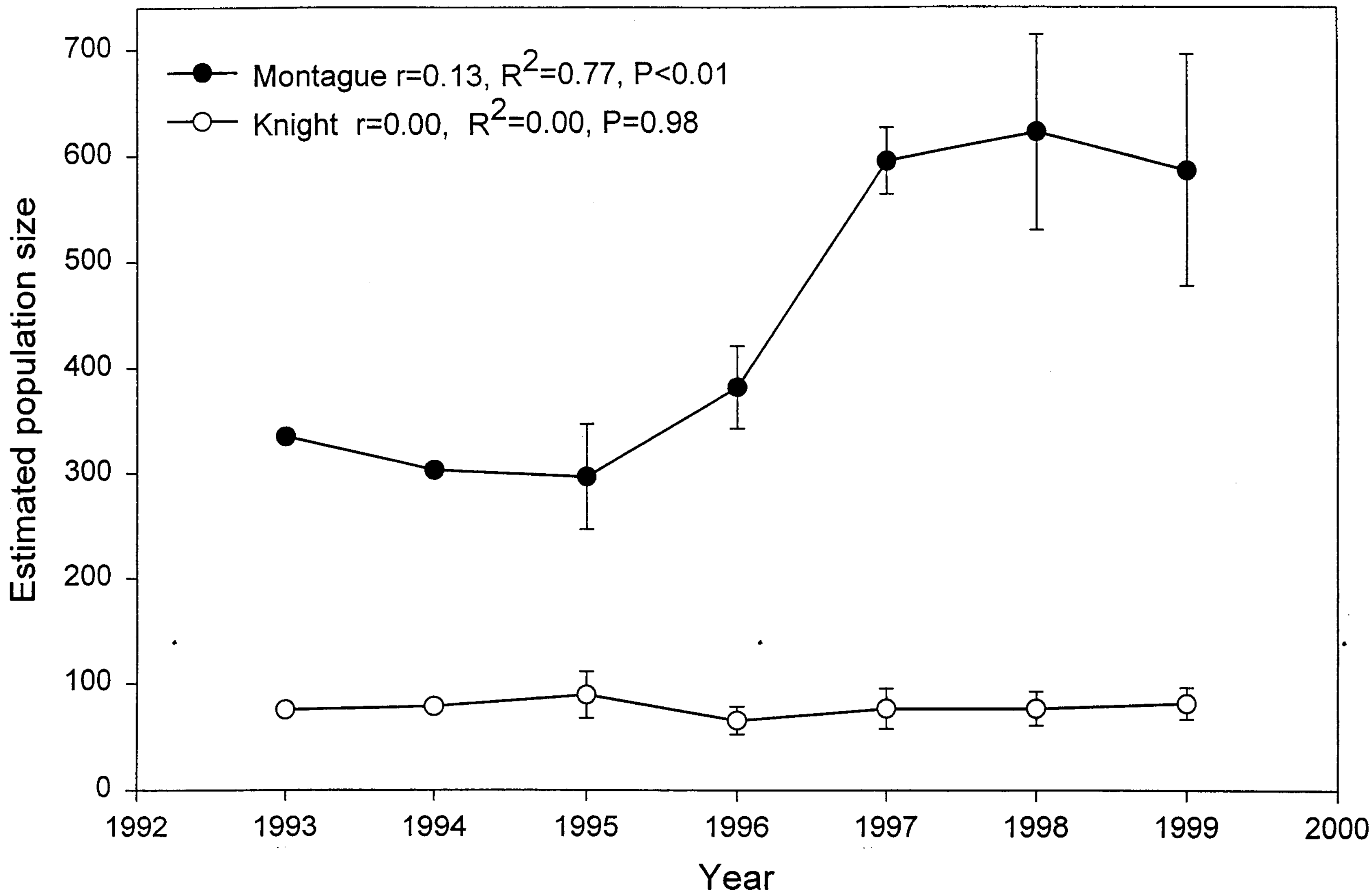

Fig. 4. Estimates of sea otter abundance (± se) for intensive study sites at Knight and Montague Is., 1993-1999 (no estimates of precision in 1993 and 1994).

Figure 5. Size frequency distributions for sea urchins at Knight and Montague Islands from 1996 through 1999.