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Status and Trends of Ecological Health and Human Use of the Cabrillo National Monument Rocky Intertidal Zone (1990-2005)

Natural Resource Technical Report NPS/PWR/CABR/NRTR—2006/03

ON THE COVER
Conducting photoplots in Zone III of Cabrillo National Monument, San Diego, California.

Status and Trends of Ecological Health and Human Use of the Cabrillo National Monument Rocky Intertidal Zone (1990-2005)

Natural Resource Technical Report NPS/PWR/CABR/NRTR—2006/03

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Executive Summary

Cabrillo National Monument (CABR), a unit of the National Park Service (NPS) within the city of San Diego, California, administers approximately 1 mile (1.5 km) of rocky shoreline. Within this area are among the largest and most diverse rocky intertidal habitats in San Diego County, and arguably the best protected, publicly accessible tidepools on the southern California mainland. In order to gain information to conserve these communities unimpaired for future generations, the NPS has been monitoring the tidepools through the Cabrillo Rocky Intertidal Monitoring Program (CRIMP) since 1990. This report documents the activities and results of CRIMP from 1990 to 2005.

Thirteen key species or species groups are monitored twice per year as part of CRIMP. Information about the size distribution (i.e. "size-frequency" data) is collected for owl limpets (*Lottia gigantea*) in circular plots. Photographed rectangular quadrats are used to determined percent cover of thatched and acorn barnacles (*Tetraclita rubescens*, *Balanus glandula*/*Chthamalus* spp.), mussels (*Mytilus californianus*), rockweed (*Silvetia compressa*, formerly *Pelvetia fastigiata*), and goose barnacles (*Pollicipes polymerus*). Point-intercept transects are used to determine the percent cover of red algal turf, surfgrass (*Phyllospadix* spp.), boa kelp (*Egregia menziesii*), *Sargassum* weed (*Sargassum muticum*), and anemones (*Anthopleura elegantissima/sola)*. Presence or absence of two rare species, black abalone (*Haliotis cracherodii*) and ochre sea stars (*Pisaster ochraceus*) is determined using timed searches. Additionally, birds and visitors are counted during a number of daytime low tides throughout the fall, winter and spring. The study area has been divided into zones that represent different amounts of human usage: Zone I receives high visitation, Zone II receives intermediate visitation, and Zone III received the least visitation and has been closed to visitors since 1996. The study design is repeated in the three zones for maximum comparability.

The results of the first six years of CRIMP, reported in *Ecological Conditions and Public Use of the Cabrillo National Monument Intertidal Zone, 1990-1995* (the "Engle and Davis Report," Engle and Davis 2000b), indicated that 7 of the 13 key intertidal species monitored had either declined or disappeared from the park, 5 were considered stable, and 1 had increased. This finding proved to be quite alarming to park management and led to the enactment of the Tidepool Protection, Education, and Restoration Program (TPERP) in 1996.

CRIMP has now been sustained for over 15 years, making the associated lengthy dataset unique and valuable for both management applications and ecological studies. Monitoring occurred consistently in fall and spring of every year from fall 1990 through spring 2005, except for a missing season in spring 1996 and an extra season in summer 1992, for a total of 31 sampling events. Intertidal monitoring was conducted by a total of 348 volunteers and staff on 145 sampling days. A total of 1754 photoplots were scored, 576 transects were read, and 20,621 owl limpets were measured in 565 circular plots. During 833 bird and visitor censuses, 49,095 visitors and 54,762 birds were counted by more than 85 volunteers and staff.

The purpose of this report is to document the results of the monitoring program through spring 2005. Monitoring activities are described, deviations from and changes to protocol are listed, and relevant site and taxonomic information are updated. In 1997, this program was incorporated into the Multi-Agency Rocky Intertidal Monitoring Network (MARINe), a regional collaborative monitoring effort that includes 23 Federal, State, and local government agencies, universities, and private organizations throughout California. Many changes have been made to the CRIMP protocol to make it consistent with standardized MARINe protocols; this report includes documentation of these changes. Raw data, as well as basic trends and simple comparisons of zones are presented for key species in CRIMP. Since CRIMP is a monitoring (as opposed to research) program, the results can only be presented as observations of change, rather than synthesized as documented causes of change. However as often as possible supplemental

information, such as additional local research or relevant literature of studies done elsewhere, are presented. Some basic recommendations for further study and future management are also provided.

A summary of the results from this report are listed in the table associated with this Executive Summary. With an additional ten years of data since the Engle and Davis Report, the current state of the 13 species was variable and appears to be more complex than originally thought. Four of the species (rockweed, *Sargassum* weed, aggregating anemones, acorn barnacles) considered stable, although variable, in the first five years of CRIMP (as reported in the Engle and Davis Report) were still fairly similar in abundance at the beginning and end of this study period. The amount of area covered by one of the previously-considered “stable” species (red algal turf) was shown to have declined slightly in this report. Although the earlier observed trend of one of the species that had declined “moderately” (goose barnacles) appears to be part of a longer-scale oscillating pattern of increases and decreases, another “moderately” declining species (owl limpets) has continued to decline in Zones II and III and has experienced large fluctuations (with a recent increase) in Zone I. Two of the species that had declined more dramatically in the first five years of monitoring (boa kelp and thatched barnacles) have recently exhibited signs of recovery. A dramatic expansion of surfgrass, mostly into formerly kelp- and turf-dominated habitats, continued throughout much of the study period and appears to be stabilizing or reversing. The cover of mussels, which was reported to have declined dramatically in the Engle and Davis Report, has continued to remain very low in Zones II and III, but has expanded somewhat in Zone I. As reported from 1990-1995, black abalone and ochre sea stars continue to absent from the park.

Specific trends of interest are discussed in more detail and reveal complicated dynamics of different key species. Although owl limpet average size is declining in CABR, a number of additional studies have demonstrated that individuals of this species are particularly large in the park compared to other areas in southern California; this has been attributed to the well-enforced limitation of harvesting at CABR. Additionally, CRIMP data have documented recruitment pulses of owl limpets that occur irregularly in the fall season; particularly large pulses occurred in fall 1996, fall 1998-2000 and fall 2004 in Zone I. Mussels experienced a dramatic decline in Zones II and III from 1990 through 1995, and remain at very low levels in those areas. Possible reasons for this decline were explored in a separate document (Becker 2005). Red algal turf communities, in particular, have been highly impacted by the large amount of human visitation to the tidepools, while the closure of Zone III has led to a richer and more diverse turf habitat in that area. Black abalone continue to be absent from CABR, although external studies indicate that the causes of this disappearance are occurring on a large scale throughout southern California. On the other hand, the recent return of ochre sea stars to other sites in San Diego and not to CABR indicate a mixture of regional and local causes for the current lack of ochre sea stars in the park. Additional study of sea stars, as well as a number of other key species, is recommended in this document.

Regular bird and visitor censuses have elucidated some patterns. Over the past twelve years the number of visitors to the tidepools has remained fairly stable. Sea birds and shore birds declined throughout the park from 1990-1995, but abundances have remained fairly stable thereafter; the exception to this pattern is in Zone III, where shore birds have increased since 1996. The spatial patterns of visitor and bird use have remained fairly consistent: dramatically more people are found in Zone I than in the other zones, while birds tend to be found in Zone III. Even with the zone effect removed, there appears to be a strong negative relationship between birds and people: few birds are found where there are many people while large numbers of birds are only found in the absence of large crowds.

In sum, through CRIMP and associated lines of evidence, it can be concluded that the management policies of CABR (enforced ban on collecting and Zone III closure) are having mostly positive, although somewhat mixed success. For example, some species of snails and limpets are larger within the park compared to less-protected areas in the region, which can be attributed to the strict enforcement of no-harvest rules within the park. The effect of the closure of Zone III in restoring populations is less clear; a human exclusion area will improve the health of populations that were directly impacted by human visitation, with less or no effect on those that were affected by other anthropogenic or natural sources. For example, red algal turf communities, which are highly impacted by human trampling, appear to be thriving in Zone III, and bird abundances are higher and increasing in this area. Other species, such as mussels and owl limpets, have not been successfully recruiting into Zone III for unknown, and potentially anthropogenic, reasons.

The closure of Zone III has resulted in many benefits, including providing many organisms with an undisturbed area for recovery from direct human visitation effects while providing for scientific opportunities to better understand the effects of different types of human use in rocky intertidal habitats. In contrast, the costs of this closure are relatively small, since access to two-thirds of the tidepools remains open, public support for the closure is high, and no individuals depend on this area for economic uses. However, this closure is not a universal panacea; some species do not appear to be positively affected by this management action. Continued monitoring and research in the area (see table below for suggested studies and questions) will assist park managers in their goal of conserving these resources, unimpaired, for the benefit of this and future generations.

Summary of Results of Cabrillo National Monument Rocky Intertidal Monitoring Program from 1990 through 2005, as compared to the Engle and Davis Report (2000b), which documented these trends from 1990 to 1995. See text of this report for more thorough discussion of results. ND=not determined.

	Trend 1990-1995 **(Engle and Davis 2000b)**	**General Trend**	**Comments/Major Findings**
Circular Plots			
Owl limpet abundance	Moderate decline	Continue decline II and III, Highly variable increase in I	Large recent recruitment events, especially in Zone I
Owl limpet average size	Slight decline	Moderate decline	CABR owl limpets much larger than unprotected areas
Number of owl limpets in smallest size class	ND	Highly variable increase	Notable recruitment events
Average size of 10 largest owl limpets	ND	Slight decline	Cause remains unknown
Photoplots			
Acorn barnacles	Little change	Little change	Too variable to draw conclusions, more abundant in Zone III
Thatched barnacles	Sharp decline	Decline with possible recovery	Cause remains unknown
Mussels	Sharp decline	Sharp decline in II and III, Increase in I	Cause remains unknown
Goose barnacles	Moderate decline	Large cycles	Appears to be larger cyclical pattern
Rockweed	Little change	Little change	Expanding into other plot types
Transects			
Red algal turf	Little change	Slight decline	Being outcompeted by surfgrass; Trampling studies stress importance of turf thickness and microscopic community
Surfgrass	Sharp increase	Increase with stabilization/decline	Expanded throughout lower intertidal, stabilizing
Boa kelp	Sharp decline	Decline with stabilization/increase	Replaced by surfgrass, stabilizing
Anemones	Little change	Little change	Too rare to draw conclusions.
Sargassum weed	Little change	Little change	Too variable to draw conclusions
Timed Searches			
Black Abalone	Absent	Absent	None found since 1995. Could be related to disease and overharvest. Not found in the region.
Ochre Sea Stars	Practically Absent	Absent	None found since 1995. Could be related to disease and lack of food. Found in the region.
Censuses			
Birds	Moderate decline	Stable; shorebirds increasing in Zone III	Generally fewer birds after 1995 than before 1995.
People	Slight decline	Stable since 1992	

Summary of Suggested Studies and Questions generated as a result of this report and other work associated with the Cabrillo National Monument Rocky Intertidal Monitoring Program.

Species	Relevant questions
Owl Limpets	Why are owl limpets getting smaller?
	Why are there fewer owl limpets in the park?
	Is there a relationship between fewer mussels and lower limpet recruitment?
	Why are fewer limpets recruiting to the southern parts of the park?
	What is happening to the larger owl limpets?
	Is the reproductive output of CABR limpets declining?
	Is the sex ratio of CABR limpets changing?
	Are large reproducing CABR limpets a source of limpet recruitment outside of the park?
	When are the smallest limpets measured by CRIMP (15mm) spawned?
	Where do CABR limpet recruits come from?
Mussels	What is the cause of the decline and lack of recovery of mussels in CABR?
	What roles do lack of recruitment, lack of food, poor water quality, and/or disease play in the decline and lack of recovery of mussels?
	Does the lack of mussels affect the recruitment or survival of other species?
	Were mussels important components of CABR intertidal communities prior to the 1960s?
	Where do CABR mussel recruits come from?
	Why do mussels not recruit into the park?
	At what part of the life cycle (larvae, metamorphosis) are mussels failing at the park?
	Can mussels survive in CABR?
Surfgrass/ Boa Kelp/ Red Algal Turf	Does natural competition lead to shifts in the mosaic of these three species?
	Is there a relationship between climatic cycles and these shifts?
	Is there a relationship between anthropogenic disturbance and these shifts?
	Does the expansion of surfgrass lead to cascading effects in the resident communities of the other habitat types?
	Has surfgrass always dominated the lower intertidal of CABR?
Abalone	Will outplanting of abalone lead to successful re-introduction of these species?
	Has the abalone wasting disease been eradicated?
Ochre Sea Star	What is the cause of the disappearance and lack of recovery of sea stars in CABR?
	What roles do disease (e.g. wasting), lack of food, and/or temperature play?
	Is there a keystone predator in CABR?
	Is there a competitive dominant in CABR?
	Were sea stars ever important components of CABR intertidal communities?
	Do sea stars recruit to CABR?
	Can sea stars survive in CABR?

Species	Relevant questions
Human Visitation	What is the effect of the new location of the entrance station on visitation rates to CABR tidepools?
	What are the effects of chronic human handling on rocky intertidal organisms?
	What are the effects of chronic rock-turning on rocky intertidal organisms?
	What would be the effects of a "moving" zone closure?
	Are there significant impacts from having a large number of people present during a short time period (e.g. high visitation during an extreme low tide)?
	What are the effects of concentrated human visitation in terms of space and/or time?
	What is the "carrying capacity" of the tidepools in terms of human visitation? On a daily basis? On a yearly basis?
Birds	How important are birds in the CABR food web?
Community	What was the historical composition of the CABR tidepools? 30 years ago? 50 years ago? 100 years ago? 500 years ago?
	Are there seasonal patterns in the existing CRIMP data?
	How do CRIMP trends compare to MARINe trends from San Diego County sites?
	What are the effects of large-scale climate cycles on CABR intertidal communities?
	How are predator abundances changing in the park and how do they affect the community?
Lobsters (not currently studied under CRIMP)	What is the current status and trends of the lobster population within and offshore of CABR administration? What is the relative contribution of CABR lobsters to local populations?
	What is the current take of lobsters within and offshore of CABR?
	Is the current harvest of lobsters offshore of Point Loma sustainable?
Methodological	Create a topological and habitat map of the tidepools that can be repeated through time.
	How to calibrate the visitor census values from shorebird counts with actual annual visitation rates?
	How to better sample line transects to account for the effects of human trampling?
	How to account for methodological problems in the bird legacy data?

Introduction

Cabrillo National Monument (CABR) is a unit of the National Park System that is located in San Diego, California on the tip of Point Loma, a peninsula that separates San Diego Bay from the Pacific Ocean (Figure 1). Although it is a small (160 terrestrial acres) urban park, it receives almost one million visitors every year. CABR contains and conserves many unique plant and animal species that regionally are declining or whose habitats are being rapidly removed or depleted due to development and urban encroachment in southern California. One of the unique habitats within the administration of CABR is the rocky intertidal area that lines the western shore. This small tidepool area (less than 1.5 km of shoreline) is a valuable and valued public resource with tens of thousands of annual visitors, including numerous age groups of students from elementary to college to adult-education. In addition, the high level of management, enforcement, and study this area has received has made it a particularly valuable area for academic and governmental researchers.

The earliest known comprehensive surveys of the CABR tidepools were conducted in the late 1970’s. Two reports (Zedler 1976, Zedler 1978) documented the effects of high visitation in the park. A number of students from San Diego State University (SDSU) conducted discrete, specific experiments to try to determine potential effects using a “snapshot” picture of the tidepools. Within the reports are detailed species lists for the area. At that time, the high level of human visitation and lack of supervision of visitors were cited as a cause of impact to the tidepools. Throughout the 1980s, Joan Stewart published a number of studies of the surfgrass beds (Stewart and Myers 1980) and red algal turf communities (Stewart 1982, Stewart 1989a) and the interaction between them (Stewart 1989b) in the tidepools of Point Loma.

In the 1980’s, the National Park Service (NPS) began to monitor the nearshore ecosystems (kelp forest and intertidal) of the Channel Islands National Park (CHIS) (program described in Davis *et al.* 1994). The basic goals of there monitoring program were to:

- “Determine present and future health of natural area ecosystems
- Establish empirical limits of variation in natural area resources
- Diagnose abnormal conditions to identify issues in time to develop effective mitigation
- Identify potential agents of abnormal change”

(Davis 1993)

This program was intended to be a model for future monitoring programs in NPS and other interested organizations. In 1990, Gary Davis (NPS) and Jack Engle (University of California Santa Barbara [UCSB]), with help from CABR and CHIS staff and other UCSB personnel, extended the CHIS rocky intertidal monitoring program to CABR, beginning the Cabrillo Rocky Intertidal Monitoring Program (CRIMP).

Since 1990, 13 key species of invertebrates and plants in CABR have been monitored using several techniques to yield percent cover, size-frequency, and presence/absence data. Monitoring was conducted biannually by Davis, Engle, CABR and UCSB staff, and volunteers, and was funded by the Cabrillo Historical Society (now the Cabrillo National Monument Foundation [CNMF]). The CRIMP study area within the administrative boundary of CABR was divided into three zones representing different amounts of human use from the highest (Zone I) to the lowest (Zone III). CRIMP has been conducted biannually continually since 1990, except for spring 1996, when a gap in funding led to a gap in sampling. See Table 1 for a summary of monitoring dates and Table 2 for significant events in the history of the program.

After the first five years of monitoring, Engle and Davis produced a report entitled *Ecological Conditions and Public Use of the Cabrillo National Monument Intertidal Zone, 1990-1995* (the "Engle and Davis Report", Engle and Davis 2000b), which stated that 7 of the 13 key species had either declined or disappeared entirely from the area. After the release of this report in 1996, CABR management implemented the Tidepool Protection, Education, and Restoration Program (TPERP) to try to reverse this trend. The purpose of TPERP is to restore the intertidal area under its administration while permitting visitors to continue visiting it. TPERP consists of three parts, each of which is critical to its success—education and enforcement, restoration through area closure, and monitoring and research. Part one emphasizes educating the people who visit the tidepools while simultaneously explaining and enforcing park regulations (such as no collecting or placement of animals in containers) to protect the resources and values found there. Since the fall of 1996, the NPS has been recruiting and training a cadre of Volunteers-In-Parks (VIPs) and increased the number of park rangers in the intertidal area during low tides. The second part of TPERP is the closure of one-third of the tidepools to all visitors; this small no-use reserve, called "Zone III," is currently still closed. The purpose of this closure is to allow the area to recover from the pressures of high visitation (mostly trampling, rock overturning, and poking—restriction of collection and hunting has been very strict since at least 1990). Thirdly, as part of TPERP, the park made a long-term commitment to studying the tidepools. The monitoring program became part of normal park operations (funding came from park base funds), and a commitment to continuing it in the long-term was made, as well as encouraging research activities to help inform management.

In 1995, the U.S. Navy contracted Jack Engle to begin a similar monitoring program north of CABR on Point Loma (Engle and Davis 2000a). In 1997, the Multi-Agency Rocky Intertidal Network (MARINe) was established in order to foster communication among the various governmental and academic bodies that were monitoring the rocky intertidal in southern California (Dunaway *et al*. 1997, Engle *et al*. 1997, www.marine.gov). This network, under the administration of the Minerals Management Service, allows scientists to coordinate their protocols so that a larger scale interpretation of results is possible. The protocols adopted by the other projects were based on the CHIS and CABR programs, and both remain members of the network. Unified MARINe protocols were adopted in 2002-2003 and a centralized database was created in 2003, in order to store all MARINe data in a single location.

In 2001, review of CRIMP was conducted; this review included an external statistical review by Dr. Stephen Schroeter (UCSB) (Schroeter and Smith 2003) followed by a methodological review workshop (Becker 2003). Many of the recommendations from this process have been implemented in the following years. Since specific goals for CRIMP were not explicitly defined at the time of its inception, they were adopted as part of the ten-year review process. The following is a prioritized list of goals developed by Bonnie Becker, CABR Marine Biologist, with input from Gary Davis, Jack Engle, Samantha Weber (former CABR Chief of Natural Resource Science), Terry DiMattio (CABR Superintendent), and Karl Pierce (CABR Chief of Interpretation). The goals of CRIMP are:

- To collect long-term, baseline information on the "ecological health" of the rocky intertidal area, and to determine normal limits of variation.

- To be conducted in perpetuity.
    - *In order to maintain the program in the long-term, all techniques should be doable by volunteers with limited training and basic supervision (by a non-expert) with oversight by a limited number of experienced staff. In addition, the program should be low-cost.*

- To determine differences between the three zones, which experience very different amounts of visitation, and to determine the effects of the closure of Zone III.

- To be comparable and compatible with existing data and similar programs in southern California (e.g. Channel Islands National Park and the Multi-Agency Rocky Intertidal Monitoring Network, MARINe).
    - *Large changes in existing protocols can only be made after consultation with these other programs. Measurements for additional components that are unique to CABR are acceptable.*

- To detect large changes in community structure reasonably quickly.
    - *Correlation of this temporal data with other factors (environmental, anthropogenic) should guide further research to determine causation of trends of concern.*

- To provide for baseline data in case of an acute disturbance (e.g. oil spill, sewage spill, rip rap), and to serve as an opportunity for public education and outreach.

This purpose of this document is to summarize the first 15 years of the program, document the activities and changes associated with CRIMP, interpret the resulting data, and synthesize conclusions based on that analysis.

Methods

Basic Study Approach

Explicit in the goals of CRIMP is the necessity of a design that minimizes the technical expertise needed in the field. Since its inception, the monitoring has been conducted by volunteers who are trained and supervised by at most two professional marine biologists. A complete description of the CRIMP methodology is presented in Becker (2006) and Engle and Davis (2000c), and the MARINe methodology is described in Engle (2005b).

There are a number of general approaches to determining the ecological health of an area, including looking at energy flux, biodiversity, nutrient budgets, and population dynamics. In order to best meet park management goals (Davis *et al*. 1994), the population dynamics of key taxa were monitored as indicators of overall health of the area. These key taxa could be considered as "indicator species" (sensu Caro and O'Doherty 1999), those "whose characteristics… are used as an index of attributes too difficult, inconvenient, or expensive to measure for other species or environments of interest" (Landres *et al.* 1998 as quoted in Caro and O'Doherty 1999). CABR key species were chosen for a variety of reasons, including:

- Ecologically important
- Characteristic of vertical zonation
- Well studied
- Vulnerable to impacts of human pressure
- Practical for long-term study (e.g. long-lived, *sessile*, abundant)

(after Engle and Davis 2000b)

Eleven taxa were specifically targeted, although 13 were consistently monitored (Table 3). When CRIMP adopted a more-expanded MARINe protocol, a number of additional "core" species were added to the photoplots in spring 2000 and transects in spring 2002. Although the taxonomic specificity of the organisms monitored has varied throughout the years, the original 13 taxa are still being monitored. See Table 4 for the current list of MARINe core species, and Table 5 for definitions of MARINe terms. See Table 6 and Table 7 for a description of how each taxon was recorded through time. See Table 2 for a list of dates when significant changes in CRIMP were made. In order to maximize the use of the earlier CRIMP data, only the key taxa were considered in this report.

Study Area

The study area consists of about one kilometer of shoreline within the administration of CABR, consisting mostly of flat, gently-sloping benches with scattered, hard, metavolcanic boulders at the base of soft, eroding sandstone cliffs. It was divided into three zones (I, II, and III, Figure 1, Figure 2, Figure 3, and Figure 4), each about 330 m in length. The northern section of Zone I, where most of the plots are located, consists of a flat bench with numerous large boulders and narrow channels. The southern section has few boulders, and contains a short stretch (<100 m) of permanent sandy beach. Zone I is approximately 40-65 m wide on a fairly low tide. Zone II resembles the northern section of Zone I, although it is a bit wider (40-90 m). Zone III is much wider (90-120 m) and flatter, with few large boulders and many small, flat rocks. There is a single line of large boulders at the southern end of the area where the majority of the photoplots are located. The base of the cliffs in this area is artificially reinforced with granite riprap. These boulders were placed there in the 1960's and dramatically changed the natural sedimentation patterns in the zone (D. Leighton[1], pers. comm.).

Each zone receives a different amount of human visitation. There is a single public access point to the tidepool area, located in the middle of Zone I; since it is the most accessible, this area receives the most visitation. In order to access Zone II, people must amble through a rugged boulder field; therefore, fewer visitors venture into this area. Zone III has traditionally received the least visitation, and has been closed to all visitors since November 1996 as part of TPERP. During most daylight low tides in the fall, winter, and spring, there is a TPERP VIP stationed near the border of Zones II and III to inform and educate visitors about the closure. There is an additional access point into Zone III that is located on property belonging to the U.S. Coast Guard. This pathway is rarely, but occasionally, used. Quantitative data on visitation were taken during all bird censuses, as described below.

Quantifying the differences between the ecological condition of the human use zones is somewhat limited by the necessary condition that there is only one closed area. Although we sampled multiple times within each zone, these samples could not be considered replicates of the experimental unit (the "treatments" in this case would be the different amount of visitation in each zone). These multiple samples are useful in that they increase the precision of the estimation of the populations within the study area, but they do not make that estimate more broadly applicable to the whole reserve or to reserves in general (Hurlbert 1984). Various areas can differ in many ways (biological, physical, chemical, geological, historical, etc.), one of which is the amount of protection; no two areas are exactly alike. It is possible that the differences between the three zones could be attributed to this effect.

Study Design

The same number of fixed sites[2] were established in each zone[3] using a random, stratified experimental design (Table 3) appropriate to the highly patchy and zonated habitat (Miller and Ambrose 2000). Each site was designed to target specific taxa. Circular plots were used to collect size-frequency data on owl limpets (*Lottia gigantea*). Rectangular photoplots were established to target one of the following taxa: barnacles (acorn, *Balanus glandula and Chthamalus* spp.; thatched, *Tetraclita rubescens*), goose barnacles (*Pollicipes polymerus*), mussels (mostly *Mytilus californianus* with few *M. galloprovincialis*[4]), or rockweed (*Silvetia compressa*, formerly *Pelvetia fastigiata*). Linear transects were established to target one of the following taxa: surfgrass (*Phyllospadix* spp.), boa kelp (*Egregia menziesii*), or red algal turf (a mixture of turf-forming coralline and noncoralline red algae, (Stewart 1982). Although plots were not designed to specifically target anemones (*Anthopleura elegantissima* and *A. sola*) and *Sargassum* weed (*Sargassum muticum*), they were always counted when encountered in line transects. Timed searches and censuses are conducted separately in each zone, and these techniques do not require the establishment of permanent plots. Timed searches were conducted to target black abalone (*Haliotis cracherodii*) and ochre

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[1] Dr. David Leighton is a marine aquaculturist. His firm, Marine Bioculture, is located in Leucadia, CA. He worked on Point Loma throughout the 1960s and 1970s, studying green abalone as well as the effects of the desalination plant that was once located here. The information referenced here comes from a letter written to Gary Davis in 1995 and to Bonnie Becker in 1999.
[2] Throughout this document, the term "site" is defined as a single sample, either a circular plot, a line transect, or a rectangular photoplot. Sites are also referred to as "plots".
[3] A "zone" is one of the three larger areas, each with a different visitation pressure "treatment." There are 33 plots in each zone, except Zone II which has 35 plots.
[4] Although Suchanek *et al.* (1997) have confirmed the presence of *M. trossulus* and *M. trossulus/galloprovincialis* hybrids in San Diego Bay, it is not known whether these taxa are present within the boundaries of Cabrillo National Monument. All bay mussels will be referred to as *M. galloprovincialis*.

sea stars (*Pisaster ochraceus*), although other sea star and abalone species were always counted when encountered. Censuses were taken to monitor shorebirds (various species) and visitors. All of these techniques are discussed in more detail below.

Each site was assigned a unique “Site Number”, as well as a “Plot Number” that was more descriptive but was repeated in each zone (Table 8, Table 9, and Table 10). For instance, the northernmost mussel plot in each zone was assigned the plot number “M1”, resulting in three different plots with the same name. These three sites were also assigned the unique site numbers 298, 245, and 024 in Zones I, II, and III respectively. In this report, only the zone and plot number will be used, since these are more intuitive than site numbers.

Sampling was conducted twice per year by a team of park staff and volunteers. On every sampling day, park staff completed a field log documenting basic environmental data. Beginning in fall 2003, eight digital overview panoramic photos were taken from four fixed locations in each zone for each sampling season. Bird and visitor censuses were conducted more often, ideally every negative tide (less than or equal to 0, mean lower low water [MLLW]) that occurred between 10AM and 4PM. In practice, censuses were only done when these criteria were met and staff or volunteers were available.

Circular Plots

Six circular plots were established in the upper intertidal of each zone, three on cliff faces and three on boulders. Pre-measured pieces of line were used to delineate a circle of 1 m radius (with an area of 3.14 m^2) around fixed bolts. All owl limpets greater than or equal to 15 mm within the circle were counted and measured (greatest shell length). Limpets less than 15 mm in size are difficult to identify to species, and were therefore not measured. Care was taken to search all crevices and holes for cryptic animals. This yielded both abundance and size-frequency distribution data. See Appendix A for the current datasheet used to record limpet size frequencies.

Many of the limpet plots are located on the soft sandstone cliffs that border the area. Parts of these cliffs, along with the animals and the plot marker attached to them, would often erode or collapse. When this occurred, the plot marker would be replaced as close to the original location as possible, and the plot would be sampled as is. One plot (L4 in Zone II) has collapsed numerous times since 1998. Although it has been replaced as close as possible to its original location, the ledge on which it was established is now virtually gone. Very few limpets are found in its current location, probably due to the lower tidal elevation of the new replacement plot. In fall 2003, an additional plot (L7) was added just above L4 in more appropriate habitat. At that time another plot (L8) was added just above L5, which has also experienced erosion but not as severely as L4. In this study, data from Zone II L4, L7, and L8 were not included in most analyses due to the incomplete dataset.

Photoplots

Three classes of rectangular photoplots were established in 1990, targeting different organisms: California mussels, acorn and thatched barnacles (in one group of plots targeting “barnacles”), and rockweed. Five plots per type were established in each zone (Table 3). Prior to 1996, three line transects per zone targeting goose barnacles were monitored. In 1996, each goose barnacle line transect was converted into two photoplots, yielding six photoplots per zone targeting these barnacles. Results from the line transects will not be discussed in this report and can be found in Engle and Davis (2000b). In sum, twenty-one photoplots were established in each zone targeting four taxa.

Plots were photographed using a standard single-lens reflex camera with a 28 mm lens and camera-mounted flash, affixed on a polyvinyl chloride (PVC) quadrapod of standard dimensions (photographed area measured 50 cm x 75 cm or 0.375 m^2, see Engle and Davis 2000c and Becker 2006 for details). This set up allowed the exposures to be standardized between plots and within plots over time. All plots were photographed during all sampling events with few exceptions. The exposure and unusual conditions were recorded. See Appendix A for the current datasheet used to record exposures for photoplots. Beginning in fall 2004, a digital camera in a waterproof housing with an external strobe was used for photoplots.

Slides and digital photos were scored using a non-random point contact method. Once developed, the slides were projected on an even grid of 100 points. Digital images were analyzed on a computer monitor using a similar grid with standard image processing software. The type of cover that fell under each point was identified and recorded. This procedure yielded percent coverage data.

Although plots were designed to target specific taxa, the same suite of organisms was scored in every photoplot for a given season. The level of detail of the categories scored varied over time (e.g. identifying species of algae vs. lumping all non-targeted algae into "other algae" category, see Table 6). These changes occurred through time as the program evolved, different people scored the slides, MARINe was formed, and CRIMP became standardized. In spring 1999, two different scorers worked on the slides, so half of the slides were scored using different categories. As of 2005, the scoring categories have been formalized, so the problems associated with changing categories should be eliminated. In order to analyze the existing data with different scoring categories, the lowest level of taxonomic detail was used and all data were lumped into the categories shown in Table 6.

See Appendix A for the current datasheet used to score photoplots.

Line Transects

Line transects were established to target three taxa: red algal turf, surfgrass, and boa kelp, although the same suite of organisms were counted in all transects. Two transects were established per target taxa in each zone, for a total of 18 transects (Table 3).

From 1990 through 2002, ten-meter measuring tapes were placed between fixed bolts in the middle to lower intertidal. An observer traversed the length of the tape, calling out to a recorder the type of cover that dominated under each 1 cm segment of the line. The organism that was on top was recorded, not what was attached on the bottom. This yielded the cover under 1000 segments, which was converted to percent coverage. See Appendix A for the current datasheet used for line transects.

As part of the MARINe protocol standardization, the "line intercept" method described above was replaced by a "point contact" method adopted by the other groups. In the latter method, the type of cover that was found under each 10 cm "point" on the line was recorded. This yielded 100 points of data, which were used as percent cover data. The effects of this change, which was adopted in fall 2002, are more-fully explored in Appendix B. In addition, more taxa were scored in the later seasons; see Table 7 for a full listing of how taxa were reported through time.

Timed Searches

Species that are rare or potentially absent from the park are difficult to sample with transects of a reasonable, workable size. For these species, sampling effort is standardized by time rather than space. In each zone, one person spent 30 minutes looking for abalone and sea stars in habitat that is commonly inhabited by those animals. The standard of effort is 30 person-minutes in each zone, and occasionally 2 people would look for 15 minutes each (or 3 people for 10 minutes each). All abalone or sea stars[5] encountered were identified, measured, and recorded. For abalone, the greatest shell length was measured. Each sea star was measured from the center of its disk to the end of its longest arm. Relevant observations were recorded as well. See Appendix A for the current datasheet used for timed searches.

Bird and Visitor Censuses

Bird and visitor census were conducted on days when the tide was negative (<0 MLLW) between 10am and 4pm. Ideally, samples should have been taken every day that meets these criteria, although personnel limitations restricted the number of counts completed. Daytime low tides rarely occur during the summer months, and therefore most of the censuses were conducted in the fall, winter, and spring. See Table 11 for the number of counts conducted by month and weekday/holiday[6].

Bird and visitor counts were conducted simultaneously. The observer would walk along the cliffs or through the tidepools with a pair of binoculars, counting all visitors and identifying and counting all birds whose feet were touching the substrate in the intertidal. Flying and swimming individuals were not counted unless they stood on the ground during the survey. All counts were completed within half an hour before and after the predicted low tide. Birds were identified to species whenever possible. If species identification was not possible, they were identified by category. Prior to 1995, birds were lumped into the database in four categories: sea bird, shore bird, wading bird, and other. In some cases, the bird counter had particular skill in identifying birds, and occasionally a rare bird was reported in bird counts; inconsistent identifying abilities of counters, most of whom were volunteers, precludes using this species-level data for statistical analysis. These rare sightings are useful indicators of presence, if not absence, of these species. For the purpose of this report, all bird species were lumped into the four categories (Table 12).

Throughout the monitoring period, there has been confusion about the southern limit of the study area, sometimes including a cobble bench at the far southern end of the zone that tends to be an important resting spot for hundreds of sea birds, mostly gulls, pelicans, and terns. Unfortunately, I have been unable to discern whether this bench was consistently included or not in censuses in any time period (likely different answers for different volunteers) prior to the realization of this problem in 2001. Beginning in 2002, the census protocol was revised in a written document (Glenn 2006), and all bird counters, veterans and new recruits, were required to go through training with a staff member and sign a document verifying that they understood this boundary location. In the current protocol, the following description of the southern boundary of Zone III is described as:

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[5]*Asterina miniata* (bat stars) were not always consistently recorded prior to 1998. This species was formerly known as *Patiria miniata*, and recent work (O'Loughlin and Water 2004) has indicated that this species will be returned to the genus *Patiria*. In this paper, *Asterina* will be used.

[6] Holidays were defined as follows. All days between 12/24 and 1/1 were considered a holiday. The Thanksgiving holiday included the official Thursday, as well as the following Friday, Saturday, and Sunday. "Holiday Weekends", those which are always scheduled for a Monday (i.e. Martin Luther King Jr. Day, President's Day, Memorial Day, and Labor Day) included Saturday, Sunday and Monday as the holiday weekend. When Independence Day and Veteran's Day fell on a Tuesday, Wednesday or Thursday, only the actual holiday was included. If either of these two holidays fell on a Monday or Friday, that day in addition to the closest Saturday and Sunday were included as the holiday weekend. If they fell on a Saturday, the Friday and Sunday on either side were considered a holiday weekend; if they fell on a Sunday, the Saturday and Monday were considered a holiday weekend.

> "The southern cliffs at the end of Zone III end in a point. From this point follow the row of boulders south (these boulders contain some of the plots for the Tidepool monitoring and are aligned north to southwest). This row of boulders marks the eastern boundary of Zone III, and the last boulder marks the southern boundary for the purposes of this shorebird monitoring effort. From the last boulder draw a line westward and do not count anything south of this line in the Zone III column. Do not count anything east of the row of boulders. All birds north of this line DO count. <u>DO count birds on this row of boulders and enter in the separate column identified on the data sheet. Any birds on the larger rocky outcrop south of the Zone III boundary can be *estimated* in the appropriate table at the bottom of the data sheet after the one-hour survey time</u>."

As a result of the power analysis conducted in 2001 (Becker 2003), it was decided that the number of bird counts being conducted were in excess of what was needed to collect statistically relevant data. In October 2004, an additional analysis was conducted to determine the total number of samples needed to maximize the statistical integrity of the census, which was approximately 40-50 (Appendix C). Beginning at that time, bird count days were chosen using a randomly-stratified design that assured a representative sample of weekdays, weekends, holidays, higher tides, lower tides, and months (Glenn 2006). The 2004-5 and 2005-6 seasons were conducted in this manner.

Environmental data (water and air temperature, cloud cover, wind speed and direction, wave height) were measured and recorded during every census. Anecdotal information was also recorded when appropriate. Since censuses are conducted more often than the other sampling types, these counts represent a good opportunity to document qualitative changes in the intertidal environment. The analyses presented in this document include data collected through spring 2004, although the censuses have continued uninterrupted throughout the study period.

See Appendix A for the current datasheet used for bird and visitor censuses.

Data Management

All data were collected on paper datasheets. Since 1998, new datasheets have been developed in order to ease record keeping in the field (see Appendix A for the current versions). Legacy datasheets can be found by looking at the original and photocopied filled-in logsheets on file at CABR. Despite the format changes, the information recorded on the different datasheet versions has remained consistent over the study period. In 1998, a database (Tidebase) was created in Microsoft Access format, using the CHIS database as a template. All past and present CRIMP data were compiled from various sources and entered into Tidebase. In 2003, a centralized database was created to store data from all MARINe programs, and all CRIMP data have also been included into MARINe as of the time of this report. In 2005, Tidebase was rebuilt to streamline its compatibility with the MARINe database and to incorporate all of the protocol changes since 1998.

Data Analysis

Descriptive statistics (number per plot, average size, average of the ten largest individuals, number of individuals in the smallest size class), averaged by zone, were determined for all circular owl limpet plots and the trend through time was graphed by sampling event. Basic trends of percent cover, averaged by zone, were graphed for all key species for photoplots (acorn barnacles, thatched barnacles, mussels, rockweed, goose barnacles) and line transects (red algal turf, surfgrass, boa kelp, anemones, *Sargassum* weed). In order to minimize variability, photoplot target types were not pooled when they were analyzed. For example, the percent cover of mussels in only mussel plots was considered. Line transect target types were pooled by zone, since there were only two transects of each target type in each zone. For example, the percent cover of boa kelp in all line transects in each zone was analyzed.

Over the years, different personnel have used different levels of taxonomic specificity during photoplot and line transects (Table 6 and Table 7). For this reason, the lowest common level of specificity was used for these analyses, although the more specific data are being stored in the database.

Circular plots, photoplots, and line transects were all "fixed" or measured in the same location every season. The benefit to this sampling design is that it limits some of the natural variability in the system that can obscure important trends in the data, although the tradeoff is that it is not possible to extrapolate trends in the plots to the whole area without using additional information about the area (Miller and Ambrose 2000, Murray *et al*. 2002). Therefore, results from photoplots, transects, and circular plots should be interpreted with care. In addition, data from the same place at different times are not statistically independent and therefore the types of statistical analyses appropriate for this study are limited (Murray *et al*. 2002). In order to determine if there are differences between plots in zones, or between the trends in the plots in zones (a "Zone x Time" interaction effect), a repeated-measures ANOVA was conducted on all of the trends. The analysis was conducted using SYSTAT 9 software, with seasons as the within-subject variable (dependents), zones as the between-subject variable (factors) and cover or owl limpet statistic as the response variable (independents). If a zone/time interaction was found, the zone and time analyses became meaningless (Underwood 2002, pg 406).

If there was no significant ($p<0.05$) zone effect or zone/time interaction for a given species (or owl limpet statistic), all plots from all zones were averaged into a single trend for the whole park. If there was a significant difference in the time effect among the zones, the trends for each zone were considered separately. Trends were examined using a regression analysis (Microsoft Excel 2002). For each taxon (or owl limpet statistic), the goodness of fit (r^2) of the linear, second, and third-order polynomial were determined. The lowest-order regression for which r^2 was greater than 0.60 was considered to be the simplest line to fit the data. This line was then graphed. If the third-order polynomial fit did not meet the $r^2>0.60$ criteria, then no trend line was assigned to the data. The regression descriptive statistics (slopes and intercepts) were also reported.

Timed searches yielded simple presence/absence data, with the assumption that a higher encounter rate reflects a higher population density (Strayer 1999). This technique was used to document the absence or rarity of abalone and sea stars, and will therefore be reported informally without statistics.

Bird and visitor data will be presented as simple observations without statistical analysis. Since the number of samples differs greatly between different sampling units, it is strongly suggested that the reader refers to Table 11 while considering the figures in bird and visitor census results section. For example, only two samples were taken during the month of June (due to the rarity of daytime lows during the summer), so any figures that indicate anomalous counts during this period will have extremely large confidence intervals around the mean. In addition, counts of zero for July and August[7] reflect the lack of data, not a lack of birds or people. However, it should be noted that the lack of counts is due to a lack of daytime low tides, which would necessarily limit visitation, and the months with the greatest number of daytime low tides allowing for a greater amount of visitation also have the greatest number of censuses. See Table 11 for a list of the number of samples by month and weekday/holiday.

[7] A completed logsheet was found for August 21, 1993, but was not included in the database because there was no low tide below 0 feet on that day and the sheet lists a low tide of -0.2. There is likely some error in the listed date, so these data were not used.

Results

Sampling Effort and Anomalous Events

Monitoring was successfully completed in the fall and spring every year from 1990 to 2005, with two exceptions. In April 1992, a large leak in the nearby outfall pipe led to a closure of the tidepool area for two months. The spring 1992 sampling was conducted just after the spill ended, and an additional field sampling trip was added in June 1992 to access the effects of this event. Results specific to this spill are reported in Engle and Davis (2000b). In spring 1996, a gap in funding led to a break in monitoring. This event is therefore missing from all time series in this report. A total of 31 sampling events were conducted.

In total, sampling was done on 145 sampling days by a total of 348 volunteers and staff. During those sampling events, 1754 photoplots were scored, 576 transects were read, and 20,621 owl limpets were measured in 565 circular plots. The CRIMP sampling dates are listed in Table 1, all personnel are listed in Table 13, and significant events related to CRIMP are listed in Table 2. Bird and visitor censuses were conducted on 833 days (Table 11), by at least 85 volunteers and staff[8]. During those censuses, 49,095 visitors and 54,762 individuals of 45 species or taxa of birds were counted (Table 12).

Circular Plots

For each zone, the average number of individuals, size of individuals, size of ten largest individuals, and number of owl limpets in the smallest size class through time are shown in Figure 5. A total of 8532 individuals were measured in Zone I, 5634 in Zone II, and 6455 in Zone III. The change of owl limpet abundance through time differed significantly among zones (repeated-measures zone x time interaction, $p<0.0001$, Table 14). A simple (i.e. third order polynomial or lower) trend was not detected in owl limpet abundance in any zone (Table 15), although qualitatively it appears as if there are some more complicated increases and decreases in owl limpet abundance through time. There was a fairly dramatic expansion of individuals found in Zone I from fall 1998 through fall 2001 and in fall 2004 through the present. In the other two zones, a less-dramatic increase in abundance appeared to occur from 1992-1994, with a consistent decline in numbers since that time.

The average size of individuals during the sampling period (1990-2005) was 41 mm in Zone I, 48 mm in Zone II, and 43 mm in Zone III. There was no significant difference in average size among zones or in the zone x time interaction of average size (Table 14). For all three zones, there was a clear linear decline in average size corresponding to approximately 0.4 mm per year (Table 15, Figure 6) for a total decline from 50.2 mm in spring 1990 to 42.0 mm in spring 2005.

An observed decline in average size can by attributed to a decrease in larger individuals, an increase in the number of smaller individuals, or in this case, both. There was a linear decline in size of the ten largest individuals in plots in all zones from an average of 60.6 mm in spring 1990 to 57.5 mm in spring 2005, corresponding to an approximate decline of 0.32 mm per year (Table 15, Figure 6). The average size of the ten largest individuals per plot did not differ among zones (Table 14). In addition, an increase in small individuals was observed. The number of individuals in the smallest size class ($\geq$15 mm and <25 mm) through time was significantly different among the three zones (Table 14). Although there was no simple (i.e. third-order polynomial or less) trend detected in the data (Table 15), there appear to be pulses

[8] In earlier data, personnel were not entered into the database. This number is an underestimate.

in the number of small limpets in the plots, especially in Zone I. These pulses can be identified by close visual examination of the trend curves of the average number of limpets in the smallest size class (Figure 5D); peaks in the trend indicate pulses in new individuals entering the plots. In Zone I, pulses occurred in fall 1992 (9.0 individuals ≥15 mm and <25 mm/plot), fall 1996 (12.0), fall 1998 (14.0), fall 1999 (14.3), fall 2000 (12.5), and particularly in fall 2004 (21.7). The pulses are considerably smaller and less clear in Zones II and III. Minor peaks in the trend curve occur in fall 1993 (3.8), spring 2000 (4.0), spring 2002 (3.8), and fall 2004 (4.0) in Zone II and in fall 1992 (6.0), fall 1996 (4.3), fall 1998 (8.0), spring 2002 (5.2), and spring 2003 (4.5) in Zone III.

More detailed size frequency distribution curves can be seen in Figure 7, Figure 8, and Figure 9. These shifts in size-frequency distribution through time were also graphed in contour format in Figure 10.

See Appendix D for the complete owl limpet dataset.

Photoplots

The average percent cover of the photoplot target species for the three zones is plotted as a function of time in Figure 11. The proportional change of the cover of all key species in all plots of each zone are plotted as a function of time in Figure 12. Each species was evaluated separately only in the plots that specifically target the species.

See Appendix D for the complete Photoplot dataset.

Acorn barnacles

The percent cover of acorn barnacles in barnacle plots varied greatly through time (Figure 11A), and the three zones were significantly different through time (Table 14, Figure 14A), with apparently more acorn barnacles in Zone III. There was no simple trend detected in these data (Table 15). The proportions of all organisms in barnacle plots during this time period are shown in Figure 13.

Thatched barnacles

The percent cover of thatched barnacles in barnacle plots in the three zones did not differ significantly or differ in their interaction through time (Table 14, Figure 11B). A declining trend (second-order polynomial) was detected (Table 15, Figure 14B), with a more moderate linear decline from 24.2% in spring 1990 to 6.1% in fall 1995 (separate linear regression, m=-3.2 %/year, b=23.5%, r^2=0.88) and a stabilizing or possibly increasing trend thereafter (separate regression, third-order polynomial r^2<0.60).

The proportions of all organisms in acorn and thatched barnacle plots during this time period are shown in Figure 13. It appears as if declining thatched barnacle cover is being replaced by rockweed in plots in Zone II, acorn barnacles in Zone III, and a combination of covers in Zone I.

Mussels

The percent cover of mussels in mussel plots changed quite differently in the three zones (Table 14, Figure 11C). In Zone I, mussel cover increased linearly at a rate of 2.3% per year from 15.6% in spring 1990 to 36.2% in spring 2005 (Table 15, Figure 14C) although most of the increase occurred from fall 1995 (13.6%) to fall 2000 (38%). In Zones II and III, however, percent cover of mussels in mussel plots declined quite dramatically from spring 1990 (Zone II 55.4%, Zone III 47.4%) to spring 1995 (Zone II 1.4%, Zone III 1.6%), and remained at or near zero for the rest of the survey period. During the decline, this trend was mostly linear (separate linear regression, Zone II: m=-8.9 %/year, b=37.2%, r^2=0.77; Zone III: m=-8.5 %/year, b=41.6%, r^2=0.96).

The proportions of all organisms in mussel plots during this time period are shown in Figure 15. In Zone II, other plants seem to be replacing the disappearing mussels. In Zone III, a combination of bare space, acorn barnacles, thatched barnacles, and other plants seem to have taken over the space once occupied by mussels.

Goose barnacles

The change in time of goose barnacles cover in goose barnacle plots varied differently in the three zones (Table 14, Figure 11D). In Zone I, the barnacle cover increased linearly from 5.17% in spring 1995 to 16.3% in fall 1998 (separate linear regression, m=2.7 %/year, b = -8.0%, r^2=0.88) and then stabilized or declined slightly thereafter. Similarly, goose barnacle cover in plots in Zone II increased during the same time period, although less dramatically, from 7.8% in spring 1995 to 13.7% in fall 1998 (separate linear regression, m=1.1 %/year, b = 3.1%, r^2=0.63), but then sharply declined thereafter to 5.2% in spring 2005 (separate linear regression, m=-1.3 %/year, b=24.9%, r^2=0.70). Goose barnacle cover in plots in Zone III did not notably change during the same time period (Table 15).

The proportions of all organisms in goose barnacle plots during this time period are shown in Figure 16. In Zones I and II, increasing goose barnacle cover appears to have replaced bare space, while declining goose barnacle cover was replaced by other plants.

Rockweed

The percent cover of rockweed in rockweed plots was not significantly different in the three zones (Table 14, Figure 11E). There were no simple trends detected in rockweed cover throughout the study period (Table 15), and qualitatively appeared to be relatively stable.

The proportions of all organisms in rockweed plots during this time period are shown in Figure 17.

Line Transects

The average percent cover of transect target species for the three zones is plotted as a function of time in Figure 18. The changes in all key species in all plots of each zone are plotted as a function of time in Figure 19. Each species was evaluated separately in all transects, regardless of target species.

See Appendix D for the complete transect dataset.

Red algal turf

The cover of red algal turf in transects changed differently in the three zones (Table 14, Figure 18A). There was a slight decline in this species assemblage throughout the period, but a trend (third order polynomial) was only detected in Zone III (Table 15, Figure 20A), where a slight increase from spring 1990 (49.7%) up to spring 1993 (58.0%) was followed by a slight decrease thereafter (47.2% in spring 2005).

The proportions of all organisms in turf transects during this time period are shown in Figure 21. From this graph, it appears that surfgrass cover has replaced declining turf cover. In addition, “other biota” pulses at the end of the time series were mostly cover of ephemeral green algae such as *Ulva*.

Surfgrass

Surfgrass cover in all transects has increased similarly in all zones (Table 14, Figure 18B). A non-linear trend in surfgrass cover in all plots was detected (second-order polynomial, Table 15, Figure 20B), with increasing cover from 22.9% in spring 1990 to 60.7% cover in fall 1999 (separate linear regression, m=2.7 %/year, b=29.1%, r^2=0.63) and then stabilized or declined slightly thereafter.

The proportions of all organisms in grass transects during this time period are shown in Figure 22. It appears that increasing surfgrass cover has replaced declining turf and kelp cover. In addition, “other biota” pulses at the end of the time series were mostly cover of ephemeral green algae such as *Ulva*.

Boa kelp

Boa kelp has declined throughout the three zones with no significant difference among them (Table 14, Figure 18C). A non-linear, declining trend in kelp cover in all plots was detected (second-order polynomial, Table 15, Figure 20C), with decline cover from 21.2% in spring 1990 to 0.1% in spring 1997 (separate linear regression, m=-2.8 %/year, b=17.7%, r^2=0.66), and has stabilized or increased slightly thereafter.

The proportions of all organisms in kelp transects during this time period are shown in Figure 23. From these graphs, it appears that decreasing kelp cover in plots was replaced by increasing surfgrass.

Aggregating anemones

The cover of aggregating anemones in transects was fairly low and variable through time (Figure 18D) with no detectable difference among zones (Table 14) and no detectable trend (Table 15, Figure 20D).

Sargassum weed

The cover of *Sargassum* weed in transects changed differently in the three zones (Table 14, Figure 18E). There was generally more *Sargassum* weed found in Zone III than in the other two zones. Although there was no detectable trend (Table 15, Figure 20E), *Sargassum* weed appeared to have two periods of higher cover (spring 1995 through spring 1998 and spring 2002 through spring 2004).

Timed Searches

Both abalone and sea stars continue to be rare in the park. Table 16, Table 17, and Table 18 summarize the data from the timed searches. The complete dataset can be found in Appendix D.

Abalone

No black abalone, a target species for timed searches, have been seen in the park since at least 1990 (Table 16, Table 17, and Table 18).

Only 13 green abalone (*Haliotis fulgens*) observations were made during the sampling period. Most of these (10 observations) were made in Zone III. Anecdotally, I have recorded at least 6 green abalone observations in the park (mostly in Zone III) during non-sampling days, two of which were rather small individuals (less than 10 cm).

Two pink abalone (*Haliotis corrugata*) have been found, one each in Zones I and III.

Sea stars

In fifteen years of timed searches, only one ochre sea star (*Pisaster ochraceus*) has been found (1 individual in Zone I in spring 1994, Table 16, Table 17, and Table 18). A larger number of bat star observations (165, *Asterina miniata*) have been made during timed searches, mostly in Zone III (102). The number of bat star observations appears to have fallen dramatically after 1992. Knobby sea stars (*Pisaster giganteus*) have occasionally been observed in all three zones (20 observations). There is not enough data to speculate on any changes in their abundance. Fragile stars (*Astrometis sertulifera*) are extremely rare but present in the park. In the past three years, I have observed them 3 times.

Bird and Visitor Censuses

Visitors

Throughout the sample period, an average of 59 and a maximum of 384 people were counted in all three zones during a 1-hour period. The number of visitors appears to be particularly high in 1990, when only 18 surveys were done, which were mostly during December, probably on particularly good low tide and high visitation days. With the exception of this one year, visitation appears to have dipped and then increased to around 60 visitors/census, and remained fairly consistent ever since. The dip in visitation in 1997 might be related to the bad weather that year, which was particularly stormy.

Observationally, the number of people in each zone appears to differ, with most visitors in Zone I and fewest in Zone III. The average number of people counted in Zone I was 44, in Zone II was 12 and in Zone III was 3. The maximum number of visitors found in Zone I was 327, in II was 200, and in III was 120. The visitor count trend data and proportion found in each zone are shown in Figure 24. Since the closing of Zone III in 1996, the number of visitors in that area has declined, with proportional increases in visitation in Zones I and II during that same period. When those visitor data are averaged from 1990 to 1995 (before the closure), 71% of people were found in Zone I, 20% in Zone II and 9% in Zone III. From 1997 to 2004 (after the closure), 76% of people were found in Zone I, 22% in Zone II, and 2% in Zone III. It is important to note that almost all of the people found in Zones II and III had to pass through Zone I at some point.

People tend to visit the tidepools during the winter (Figure 25A). This is because the low tides during the winter months occur during the daytime, while summer tides occur at night when the park is closed. It should be noted that there are more censuses done during the winter months as well (Table 11), since more days meet the predetermined criteria (negative tides between 10am and 4pm) between October and April than between May and September. The maximum number of visitation occurs during December, possibly due to the number of holidays during that month. There were more people counted during weekends and holidays, with particularly high visitation during holidays (Figure 25B).

See Appendix D for the complete visitor census dataset.

Birds

During the average bird census taken from 1990 through 2005, 66 birds were counted in all three zones: 5 in Zone I, 11 in Zone II, and 50 in Zone III. The maximum number of birds counted in one survey was 603, with a maximum of 82 in Zone I, 175 in Zone II, and 537 in Zone III.

The number of birds found in each zone each year is shown in Figure 26. Due to methodological inconsistencies (described in Methods section), the wildly fluctuating bird numbers in Zone III were not considered further. However, in Zones I and II, it appears as if the average number of birds declined from 1990 through 1995, especially in Zone II and has since stabilized.

When considered by category of bird (Figure 27 and Figure 28), it appears as if the number of shore birds and sea birds have declined in Zones I and II, while wading birds have remained mostly consistent. In Zone III, most of the inconsistency in methodology involved sea birds (especially gulls), and therefore the trends in shore birds and wading birds in this area were considered further. Similar to the other two zones, the number of wading birds appears to be fairly stable through time and the number of shore birds declined from 1990 through 1995. However, in this zone it appears as if the number of shore birds has increased since 1996.

See Appendix D for the complete bird census dataset.

Interaction between birds and visitors

There appears to be a negative relationship between the number of birds and the number of people (Figure 29), especially during surveys where a large number of people (and few birds) or a large number of birds (and few people) were found. When the confounding effects of the inconsistent methodology in Zone III and of existing differences between the habitats in the different zones are removed (i.e. only considering Zone I or Zone II, Figure 29), the same relationship is found.

Discussion

Comparison to Engle and Davis Report

The results of the first six years of CRIMP, reported in the Engle and Davis Report, indicated that 7 of the 13 key intertidal species monitored had either declined or disappeared from the park, while five were considered stable and one had increased. In this section, each species will be considered depending on its original trend in the Engle and Davis Report, and specific cases will be discussed in more detail in the sections following. See Table 3 for a list of scientific names of organisms mentioned in this section.

"Stable" in Engle and Davis

The Engle and Davis Report stated that as of 1996, the cover of five species (rockweed, acorn barnacles, aggregating anemones, *Sargassum* weed, and red algal turf) was variable but essentially stable. In this report, we found a similar result for all except red algal turf.

Rockweed, a highly abundant and conspicuous intertidal alga in CABR that serves as habitat for tens of species (Gunnill 1983), still appears to be relatively stable within rockweed plots (Figure 11), and has expanded into other plots targeting other species (e.g. barnacles, Figure 13). Aggregations of this species were similarly found to be relatively stable in La Jolla from 1973 to 1977, and its life history appears to favor long-term persistence and stability (Gunnill 1980). For example, a large amount of recruitment of this species was observed qualitatively in the park in fall 1999, without an obvious long-term increase in abundance within rockweed plots from this cohort; similarly, Gunnill (1980) observed a large recruitment event in La Jolla with subsequent mortality of young plants. After the 1999 recruitment event at CABR, however, rockweed did expand into other plots, especially barnacle plots in Zone II and mussel plots in Zone III.

The percent cover of acorn barnacles in barnacle plots continued to be quite variable through time (Figure 11). Small barnacles have been demonstrated in other studies to have highly variable settlement in space and time with very complex patterns in various scales (Caffey 1985), which is consistent with what was observed at CABR. Alternatively, part of the variability in barnacle cover might be explained by scoring errors or differences in scorers rather than real changes. These small white animals can be one of the more difficult to recognize on a photograph and might require more judgment from the person doing the scoring (see Table 19 for a list of photoplot scorers). In these variable data, a few interesting patterns can still be seen. There appear to be cycles of alternating higher and lower barnacle cover, and a protracted period (1999-2002) of higher cover. Zone III plots consistently contain more acorn barnacles than the other two zones. This greater acorn barnacle cover in Zone III can be seen in other plot types as well (Figure 12), including mussel plots (Figure 15), where increasing barnacle cover has filled the space left by declining mussel populations.

Aggregating anemones are not specific target species and tend to be relatively rare in transects (although they are commonly found in the park). Due to their rarity, it is relatively difficult to detect trends in anemone cover (i.e. the statistical power to detect change is very low), according to a power analysis conducted on the first 10 years of data (Schroeter 2003). Unless anemones experienced a dramatic change, this monitoring program is unlikely to detect a significant trend; therefore a lack of trend in the data can only be reported as inconclusive.

Similarly, *Sargassum* weed is not a target species for transects and is less common than those that are. However, in some cases it is abundant enough so that it would be possible to detect a trend (i.e. the statistical power to detect trends is higher, Schroeter 2003). During the fifteen year time period, *Sargassum* weed varied and was generally more abundant in Zone III. This result is similar to what was reported in the Engle and Davis Report. The abundance of this non-native alga appears to go through cycles, but has been generally stable in the park. *Sargassum muticum* was introduced from Japan to Puget Sound through oyster culturing activities circa 1945 and was first noticed in San Diego County in 1971 (Abbott and Hollenberg 1976, pg. 275). In 1976, Zedler (1976) reported that “this species is commonly the dominant alga in mid-intertidal pools replacing *Phyllospadix* which becomes dominant in the lower intertidal.” It appears as if this species experienced its main expansion in San Diego in the few years from 1971 to 1976 and has remained relatively stable ever since.

Red algal turf, which was reported by Engle and Davis as relatively stable, appeared to have declined in the park over the past fifteen years, most notably in Zone III. This decline is likely related to the expansion of surfgrass throughout the park. Surfgrass can lie on top of turf, and therefore a point could be scored as surfgrass if turf is still underneath it. Red algal turf is a particularly important component of southern California intertidal communities and serves as a rich microhabitat at CABR, and is particularly vulnerable to human trampling due to the location of its habitat along the flats of the intertidal. The state of this taxon will be discussed more fully below in the “Transects” section.

“Moderate decline” in Engle and Davis

In the Engle and Davis Report, the cover or abundance of two species (goose barnacles and owl limpets) was reported to have declined moderately from 1990 to 1995. Prior to 1995, goose barnacles were monitored using a band transect technique, so those data are not directly comparable to the Photoplot data presented here, although the trends are. In their report, they document that initially the total area of this species was highest in Zone I, but declined throughout their study period ending in 1995. In Zone II, the goose barnacle area fluctuated, but declined slightly throughout the five years. The barnacle clump area generally increased and then decreased in Zone III. In the current study, the trends were also different in the three zones, with generally increasing and stabilizing cover in Zone I, increasing and then decreasing cover in Zone II, and little change in Zone III. From these two datasets, it appears as if individual goose barnacle patches go through cycles of expansion and contraction on approximately a half-decadal scale. As the dataset for this species grows through time, long-term trends should be examined within the context of these cycles in order to avoid erroneous conclusions. It is interesting to note that the goose barnacle cover is generally higher in Zone I where mussel populations appear to be fairing better, and the barnacle is commonly found in mussel photoplots in Zone I (Figure 15). Mussels and goose barnacles are commonly found together in large clumps on California rocky shores (Ricketts *et al*. 1985), and in CABR the barnacle strongly dominates the aggregations found on the cliffs, while the mussel beds on the larger boulders are somewhat more mixed with goose barnacles and mussels.

Owl limpet abundances, which were reported to have declined in circular plots from 1990-1995 differed greatly among the zones. Plots in Zones II and III continued to experience a slow and steady decline in the abundance of owl limpets. In Zone I, the number of owl limpets increased greatly from 1998 to 2001, declined sharply until 2003, and appears to be increasing since 2004. These changes in owl limpet abundances were explored more fully using the size-frequency data collected during CRIMP, and will be discussed in that context in the “Owl Limpet Size-Frequency Distribution” section below.

Dramatic decrease or increase in Engle and Davis

Three species in the Engle and Davis Report had declined dramatically in the period from 1990 through 1995: boa kelp, thatched barnacles, and mussels. One taxon, surfgrass, was the only species found to have increased during that period.

Boa kelp cover in transects continued to decline until 1999, but over the past five years has expanded somewhat. Inversely, surfgrass cover into the transects continued to expand through the same time period as the kelp decrease, but more recently has stabilized or possibly started to decline. The relationship between these two taxa will be discussed in more detail in the “Transects” section below.

Thatched barnacle cover also continued to decline steadily until 1999, and has shown signs of recovery over the past five years.

During the Engle and Davis study, mussels in plots Zones II and III declined to practically zero cover, and remained at that level in the current study. In Zone I, however, there was a period of mussel expansion from 1996-1998 and cover has remained stable since that time. The possible causes of this declined have been explored more deeply and are briefly discussed in the “Mussels” section below.

“Absent” in Engle and Davis

Two species that were listed as absent from the park from 1990-1995, black abalone and ochre sea stars, have not been reestablished as of 2005. This disappearance will be discussed in greater detail in the “Abalone” and “Sea star” sections below.

Owl Limpet Size-Frequency Distribution

In addition to changes in owl limpet abundance within plots, CRIMP data documented a decline in the average size of owl limpets in the park (Figure 5B). Further analyses showed that the decrease in size is due in part to the steady decline in the size of the largest limpets (Figure 5D), as well as an increase in the number smaller (recruiting) limpets (Figure 5C).

Loss of largest limpets

There are a number of potential effects of decreasing size of the larger owl limpets in the population. Juvenile owl limpets mature at a minimum of 21 mm (Pombo and Escofet 1996) to 24 mm, when they are approximately three years old (Daly 1975). The majority of owl limpets measured in circular plots were larger than 24 mm, so the decrease in size might not have affected the number of reproductive individuals in the park. However, there is a strong relationship between size and reproductive output; larger animals tend to produce more gametes than smaller ones (Daly 1975), and therefore the population in 2005 probably produced fewer larvae than it did in 1990. In addition, owl limpets are protandric hermaphrodites, they change sex from male to female during their lifetimes. There is no specific age or size at which owl limpets will change sex (Daly 1975, Pombo and Escofet 1996). Although smaller females and larger males can be found, Wright and Lindberg (Wright and Lindberg 1982) found an equal male to female ratio in the 61-70 mm size class. Therefore, there is concern that if the average size of limpets within Cabrillo National Monument is decreasing, the sex ratio of the population could be shifting towards males. If there is a change in sex ratio, a spawning male limpet would be less likely to be near a spawning female, which would lead to decreased reproductive output of the population. However, Phil Fenberg, a doctoral candidate at the University of California at San Diego has found that the sex ratio of owl limpet populations remains consistent at approximately 35% females regardless of the size frequency distribution (Fenberg, unpubl. data).

The cause of this loss of larger limpets is unknown. Natural sources of mortality of owl limpets include predation (by large crabs, birds, small mammals, sea stars, and snails) as well as competition with mussels, which can move into territories and eventually starve and tangle limpets (Stimson 1975). In addition, owl limpets are often the targets of poachers, who use the flesh as a substitute for valuable abalone meat. A number of studies have demonstrated that human collecting, which tends to favor larger owl limpet individuals, has led to smaller average and maximum shell sizes (Pombo and Escofet 1996, Kido and Murray 2003, Roy *et al*. 2003). Although occasionally a poacher is found removing limpets, the

CABR population is protected by strictly enforced laws and these events are quite rare compared to the rest of the southern California mainland.

The owl limpets within circular plots in the park are declining in size, but they are still particularly large when compared to nearby, less-protected areas. Roy *et al.* (2003) compared living owl limpets at CABR to those from nearby areas in Los Angeles, Orange, and San Diego counties and to shells from museums collected before and after 1960. The average owl limpet in CABR was significantly larger than the other areas and was even larger than museum specimens collected prior to 1960 (Figure 30). In this paper, data from CRIMP were also compared to owl limpet measurements from four other Multi-Agency Rocky Intertidal Monitoring Network (MARINe) locations in San Diego County (Navy North and South on Point Loma, Dike Rock in La Jolla, Cardiff Reef) and the size distribution was significantly shifted towards larger individuals (right shifted) among owl limpets from CABR (Figure 31). This size difference was related to the enforced lack of harvesting in the park. In his paper, Roy concluded: “Our results strongly support the growing concern that intertidal species all over the world are being impacted by human activities…Data from CNM (CABR) show that existing conservation laws, if properly enforced, can help protect the intertidal biota from some anthropogenic impacts.”

Other studies have documented smaller owl limpets outside of the park. During their 1997-8 survey in Orange County, Kido and Murray (2003) found no individuals greater than 79 mm in shell length, even in areas that were designated marine protected areas (MPAs). During CRIMP, 47 individuals greater than 80 mm were counted in CABR, the largest being 92 mm. It is interesting to note that Zedler (1978) noticed the large size of owl limpets at Cabrillo National Monument; she notes that the average size of owl limpets at CABR was 50 mm, while at nearby Sunset Cliffs (less than 8 km north of CABR), which experiences more poaching pressure, the average size was 30.5 mm. It is likely protection from harvesting that leads to relatively large owl limpets in CABR compared to the rest of the region.

Owl limpet recruitment

New owl limpet juveniles do not enter the population constantly, rather they appear to arrive in pulses that occur some years. Taken together, the size-frequency graphs (Figure 7, Figure 8, and Figure 9) and the smallest size class graph (Figure 5D) give an indication of when these recruitment pulses occurred, notably in Zone I: fall 1992, fall 1996, fall 1998, fall 1999, fall 2000, and a large pulse in fall 2004. There appears to be a seasonal component to these pulses, which mostly occur in fall. The recruitment pulses were much more pronounced in Zone I than in the other two zones, and likely translated to increased owl limpet abundances in Zone I in 1999-2001 (Figure 5A). It is likely that the reason there are more owl limpets in this area than in the closed areas is related to the recruitment of new individuals into the population. There were also some minor pulses in Zones II and III in fall 1993, spring 2000, spring 2002, and spring 2003.

Small limpets entering the population do not always survive to have an effect on the adult population. The smaller recruitment pulses in fall 1992 and fall 1996 did not appear to have a large effect on the overall size distribution or abundance of limpets in circular plots (Figure 10). The successive pulses of limpets in 1998-2001, however, did appear to have a large effect on the population in Zone I and perhaps in Zone II. The small limpets documented in the recent large recruitment pulse in Zone I in fall 2004 did appear to survive into larger size classes and lead to a peak in owl limpet abundance. The fate of this cohort is yet to be determined.

Since limpets smaller than 15 mm are not counted, it is difficult to draw conclusions regarding timing of settlement[9] into the population without some knowledge of the growth rate and life history of owl limpets. Working backwards from recruitment into the smallest measured size class to the time of fertilization involves knowing how long it takes to grow 15 mm, the planktonic larval duration of owl limpet larvae, and the timing of spawning of adults. Two studies (Stimson 1975 and Daly 1975) indicate that 15 mm limpets are one to two years old, although the growth rate is also related to environmental, seasonal and other factors other than age. Owl limpets in Baja California (locations approximately 130 to 150 km south of Point Loma) spawned in February when the water was at its coldest (Daly 1975). The larval duration of owl limpets is unknown (Pombo and Escofet 1996), although a closely related species of limpet (*Lottia digitalis*) that was raised in the lab metamorphosed within two weeks of spawning at 8^{o}C (Holyoak *et al.* 1999). Taken in sum, it is likely that the pulses of 15-20 mm limpets detected in the fall seasons were spawned the late winter or early spring of the year before. For example, the small animals counted in fall 1998 were probably spawned in February through April of 1997. After a planktonic larval duration, they settled in Cabrillo (probably in spring or summer) and began to grow.

The appearance of small limpets within the study plots is possibly due to increased settlement within the plots themselves, although it is possible that they settled elsewhere in the intertidal and migrated in. Stimson (1975) found that removal of large individuals from a given territory allows a larger number of smaller ones to migrate in to replace them. Therefore, with the decrease in large individuals observed in plots since 1990, more free space has been opened up to allow more small individuals to replace them. In addition, owl limpets are known to preferentially recruit into mussel beds (D. Lindbergh, pers. comm.), and the relationship between decreased mussel populations and lack of owl limpet recruitment at CABR remains an interesting, but unstudied hypothetical mechanism.

In summary, the average size of owl limpets within Cabrillo National Monument plots is decreasing, due to a combination of a loss of the largest individuals and an increase in the number of small individuals. This decrease in size has likely lead to reduced reproductive output due to reduced fecundity of smaller individuals and a lack of females. Although the owl limpets in the park are decreasing in size, they are still notably larger than those found in areas with less protection from harvesting. There were a number of major pulses of new small individuals into the Zone I population of owl limpets, most notably in fall 1998-2000 and 2004. These pulses likely represent spawning and recruitment events of the spring of 1997 through 1999 and spring 2003. The Zone I owl limpet abundance increased correspondingly to these pulses. Zones II and III did not experience nearly as much recruitment of 15 mm individuals during this time period; the average abundance in these two zones continues to decline.

Mussels

CRIMP has documented a dramatic decline in mussels in Zones II and III from 1990 to 1995 with no recovery for at least ten years. Zone I mussel cover increased from 1996 through 1997. The cause, or causes, for this decline remains unknown but could include overharvesting, shoreline alteration, visitation effects, pollution, food limitation, predation, natural variation, regional declines, climate change, disease, and recruitment failure.

From a combination of anecdotal and quantitative evidence, Becker (2005) narrowed this larger list of potential mechanisms leading to the sustained decline of mussels in CABR and discussed the likely importance of each. Based on comparisons with MARINe data, it was determined that it is likely that the scale of the cause of the mussel decline is local rather than regional. Larval recruitment was shown to be

[9] "Settlement" is defined more specifically as the metamorphosis of limpet larvae with a simultaneous conversion from a planktonic mode to a benthic mode.

considerably lower in the park compared to nearby areas in La Jolla and Cardiff Reef in 2000-2003. Water quality was demonstrated to be somewhat compromised in the park using a transplant study of adult mussels in 2005. During the same study, growth and health of mussels transplanted to Point Loma were much lower than areas in San Diego Bay and La Jolla, indicating that water quality and mussel health were not correlated. Starvation, possibly due to lack of food (such as documented in Dahlhoff and Menge 1996), and larval recruitment failure remain the two most likely mechanisms leading to the mussel decline at this time, although more study is needed to determine the deterrent to mussel growth. Ideally, this deterrent can be removed so that recovery can occur.

Transects

Successional patterns of intertidal flats dominants

There are three main taxa that cover the majority of the intertidal flats in CABR—red algal turf, surfgrass, and boa kelp. Over the first ten years of CRIMP monitoring, surfgrass expanded throughout the middle and lower intertidal in areas that are low enough to sustain surfgrass growth; movement of the shoreward boundary of surfgrass beds tended to overgrow turf and movement of the seaward boundary tended to compete with boa kelp. In the lower intertidal transects, replacement of boa kelp by surfgrass was particularly notable. In the last five years, this trend appears to be stabilizing or reversing, with boa kelp moving back into transects once taken over by grass. The mechanism for this change remains unknown and could have a natural cause. One possibility is that the warmer, lower-nutrient conditions that dominated throughout the mid-1990s led to declines in boa kelp growth. The cooler, higher-nutrient conditions that persisted at the end of the 1990s (Figure 32) then favored the faster-growing boa kelp. There are little supplemental data specific enough to explore retroactively the mechanisms behind this change.

The oscillation between these three intertidal flats species (turf, grass, and kelp) appears to be similar to disturbance and succession cycles observed elsewhere. Surfgrass beds are essentially a climax community, slow to colonize and susceptible to disturbance, but quite persistent once established (Stewart 1989b, Menge *et al.* 2005). The observed expansion of surfgrass at CABR during the 1990s could possibly be explained by a disturbance that occurred prior to 1990 that removed some surfgrass, and the natural successional return of the flats to a more surfgrass-dominated habitat. Stewart (1989b) documented a one-meter retreat of surfgrass on Point Loma from March 1983 to December 1986, mostly due to storm damage but also exposure during warm and dry low tides. She observed that red algal turf replaced the surfgrass at that time. In order to experimentally test her hypothesis about the succession of these habitats, she conducted clearings at the turf-grass boundary. In the short-term, red algal turf quickly occupied space left by the removed surfgrass, but at a rate of approximately 10 mm/week, the competitive surfgrass would creep back into the newer turf. Her predictions appear quite consistent with what has been observed at CABR through CRIMP, with slow but persistent encroachment of surfgrass into other habitats near its current tidal range. The initiation of CRIMP in 1990 appears to have occurred in a mid-point of intertidal succession from higher turf levels in the middle intertidal transects, to more-expanded surfgrass beds.

Surfgrass beds are highly productive (Ramirez-Garcia *et al.* 1998) and serve as habitat for a diverse group of algal and invertebrate species (Stewart and Myers 1980), including juvenile lobsters (Engle 1979). Stewart and Myers (1980) quantified the communities found in surfgrass at CABR and other San Diego areas, documenting 28 algal and 49 invertebrate species in their plots inside the park (the highest invertebrate diversity and abundance of all locations measured), although only four species were found to be unique to surfgrass beds. Since there is no evidence that its expansion is due to anthropogenic disturbances, and since surfgrass is native and forms a vibrant microhabitat, these changes should not be a concern to park management. Continual monitoring will allow for early warning if drastic changes in surfgrass beds occur.

Trampling of red algal turf

Red algal turf is found on the flats of the middle intertidal, which is easiest to walk on and is located high enough in the intertidal that it is exposed a lot of the time. Therefore, visitors tend to walk on this mixed species turf the vast majority of the time. It would be expected that the turf in Zone I, where the majority of the visitation occurs, would be less healthy and Zone III would improve after its closure in 1996. Instead, the cover of turf has declined slightly throughout the study period in Zone III with no detectable trend in Zone I. This is easily explained by the way transects are conducted: only the two dimensional cover (area) of the turf is considered, and changes in turf thickness (volume) or species composition, the two factors most likely affected by chronic trampling (Brown and Taylor 1999), are not recorded.

More detailed studies of the specific effects of human trampling on red algal turf at CABR have been conducted by Tonya Huff, a PhD candidate from the Scripps Institution of Oceanography. She has sampled turf communities in Zone I and Zone III, and quantified the biomass and the highly-diverse community of small and juvenile invertebrates that lives within this microhabitat. After ten months of sampling in 2002, Huff documented almost double the algal biomass in turf habitat in Zone III than in Zone I. This type of habitat is utilized by a large number (50-200 individuals/in^2) of small and juvenile invertebrates, and there were almost four times the number of invertebrates in turf samples in Zone III compared to Zone I. These smaller, inconspicuous organisms are of high ecological importance due to their abundance, high productivity, and importance as prey for larger organisms (Brown and Taylor 1999). This research is ongoing and has included experimental trampling in Zone III, in order to isolate the effects of trampling from other anthropogenic and natural disturbances.

Benjamin Pister, a PhD candidate from the University of California, San Diego, found similar results while studying the diversity of small invertebrates in Zones II and III. He documented a greater abundance and diversity of microgastropods when comparing plots in Zone III to very nearby plots in Zone II. Larger snails were also more abundant in Zone III, although they were less diverse than in Zone II. This result might imply that human trampling does not directly impair larger snails as much as smaller snails.

Other dominant taxa that have been shown to be vulnerable to trampling, such as rockweed (Murray and Gibson 1997), are generally not found on the flat bench areas where people walk and are probably protected from this pressure on the tops and sides of boulders. Rockweed is mostly found on the sides and tops of boulders in Zones I and II rather than on the flats, consistent with the notion that this species is being impacted by human trampling. However, in Zone III, where trampling pressure is quite low, this species is also found on boulders and rarely on the flats; from this observation, it does not appear as if this species is limited from the benches by human trampling. The ability to study a habitat which lacks direct human disturbance (through the closure of Zone III), highlights the utility of the human exclusion area to distinguish between natural patterns and anthropogenic impacts.

Black Abalone

Black abalone have been entirely absent from the tidepools of CABR since at least 1990 (Table 16, Table 17, and Table 18), despite a consistent and documented search effort as a part of CRIMP as well as a more casual search effort since 1998. The decline or disappearance of this species throughout southern California has been well described in a number of sources, and has been attributed to overharvesting as well as a bacterial disease, withering syndrome, that has devastated warmer-water populations while spreading from south to north (Alstatt *et al.* 1996, Raimondi *et al.* 2002). Zedler (1976) documented several black abalone in Zone I and northern Zone II during her studies in 1976. Mass black abalone deaths later associated with withering foot disease were believed to have begun in the mid 1980s

(Richards and Davis 1993). It is likely that the disappearance of this species between 1976 and 1990 at CABR was related to this disease as well as overharvesting of nearby seed populations. Green abalone are still occasionally found in the park, although none were found during Zedler's studies in 1976.

Abalone require high densities of breeding stock for successful fertilization (Richards and Davis 1993, Tegner *et al.* 1996), so low local abundances will contribute little to nothing to the recovery of these species. Since the probable mechanisms leading to the declines of abalones are occurring on a regional scale, it is unlikely that additional management actions on the park level will have much effect. Continued timed searches will allow continued documentation of the absence of all abalone species and provide early indication of a future recovery. Possible re-introduction of black abalone into CABR should be considered with caution and consultation with the California Department of Fish and Game; it is possible that the withering syndrome would continue to cause problems for outplanted abalone.

Ochre Sea Stars

Ochre sea stars have been essentially missing from the park since 1990. Despite a consistent effort to look for them as part of CRIMP, only one individual was documented during a timed search in 1994 (Table 16, Table 17, and Table 18). Since 1999, I have trained Tidepool Protection, Education, and Restoration Program (TPERP) volunteers to search for this sea star throughout the year, and despite a number of false reports throughout the years, only one verified individual was found in 1999. Similar timed searches have been conducted at MARINe locations on Point Loma, and only one ochre sea star has been found at the "Navy North" and "Navy South" areas approximately 1-2 miles north on Point Loma, between 1995 and 2005 (Engle 2005a).

Interestingly, this species is present in areas both north and south of Point Loma. Anecdotally, they have been seen, sometimes in great numbers, at the pier at Ocean Beach (approx. 6 miles north of CABR) over the past five years. Further north in San Diego County (La Jolla and Cardiff), these sea stars were absent from timed searches from 1997 through 1999, but increased dramatically thereafter to 223 individuals in La Jolla and 29 in Cardiff in one 30-minute count in spring 2005 (Engle 2005a). While casually searching, I found a number of individuals at Erendira in Baja California (approx. 120 miles south) in 2000. It is interesting to note that at areas at the Channel Islands National Park, sea stars declined during the 1997-1998 El Niño event, but have significantly increased since 1999 (Blanchette *et al.* 2005).

Causes for the disappearance and lack of recovery of ochre sea stars from Point Loma have not been clarified and focused studies are warranted. Potential interacting causes include food scarcity, temperature increases, and disease. It is possible that food limitation has contributed to the continued absence of this species on Point Loma. Ochre sea stars will preferentially eat mytilid mussels (Feder 1970), species that have been in decline in the park since at least 1990. Sea stars have been shown to aggregate quickly in response to mussel recruitment events and to disperse when this prey is scarcer (Robles *et al.* 1995). Although mussels are rare, barnacles are plentiful in CABR, especially in Zone III. Sea star populations have also commonly been observed thriving on acorn and thatched barnacles (Feder 1959), although fecundity and growth rates were determined to be lower for barnacle-fed sea stars compared to those sustained by mussels (Feder 1970).

Ochre sea stars in San Diego are near the southern edge of their natural range, and perhaps warming water has led to the local extinction of this species. Sanford (2002) studied the effects of water temperature on ochre sea stars and found that increased water temperatures were correlated with increased feeding and metabolic rates, although his work was done in cooler waters (usually less than 16^{o}C) than those found in San Diego (Figure 32). He implies that over 20^{o}C the metabolic stress on these sea stars is too high, but doesn't mention specific studies of the effects of higher water temperatures. Feldmeth and Alpert (Feldmeth and Alpert 1977) report that in an area where ochre sea stars are fairly common, they are absent near the warm water outfall (22-25^{o}C) of a powerplant. However, compared to other locations in San Diego where ochre sea stars appear to be recovering, CABR is not notably warmer (Becker *et al*. 2005) and at times can be cooler than the northern areas (Becker 2005). Temperature alone is not likely to have prevented the recovery of ochre sea stars in the park.

Marine diseases have reportedly increased globally (Harvell *et al*. 1999), including echinoderm disease epidemics on the west coast of North America (Dungan *et al*. 1982, Leighton *et al*. 1991, Eckert *et al*. 2000, Schroeter and Dixon unpublished, Engle pers. comm.). In 1978, a widespread die-off (largely unreported in the scientific literature) affected all nearshore sea star species in southern California (Engle pers. comm.), as well as a tropical sea star in the Gulf of California that virtually disappeared within a few years (Dungan *et al*. 1982). During the 1978 epidemic, dead ochre sea stars were documented at Mission Bay, and the previously dense population of bat stars there was decimated (Word *et al.*, unpublished memorandum). This sea star "wasting" disease (possibly caused by a *Vibrio*-type bacterium) further devastated bat star populations from San Diego to Santa Barbara from 1981-1983 (Schroeter and Dixon unpublished). The disease has continued to affect southern California coastal sea star species during warm-water episodes from the 1980's to the present (Eckert *et al*. 2000), Engle pers. comm.). Even though there were no observations of sick sea stars at CABR during 1990-2005 (not surprising since few sea stars were encountered), it is likely that sea star disease contributed to the depletion of sea stars here.

The effects of the disappearance of ochre sea stars are not known, although could potentially be great. Experimental studies of rocky intertidal systems on the west coast of North America have identified this sea star as a "keystone species" (Paine 1974), defined as a species whose impact on its community is "disproportionately large relative to its abundance" (Power *et al*. 1996). Specifically, experimental removal of sea stars in Washington State led to a sharp increase in the abundance of mussels, considered the competitive dominant of that system in the absence of the control by the keystone predator (Paine 1974, Paine *et al*. 1985). Later studies of the same area found that the effect of the removal of the keystone species had long-term consequences for the habitat; mussels continued to dominate the habitat for at least 16 years, even after the return of the sea stars to the experimental area (Paine *et al*. 1985).

Were ochre sea stars abundant at CABR prior to their disappearance? Although ochre sea stars are often cited as an important component of rocky intertidal systems in California, it is possible that CABR has not generally sustained a large number of this species in the past. The species was present in the park during the Zedler's 1976 survey, although she notes "Only a couple of individuals found at the base of large *Mytilus* rocks." The use of the word "only" indicates that ochre sea stars were present but not abundant in the park prior to the CRIMP study period. In their studies of CABR surfgrass habitats, Stewart and Myers (1980) documented one ochre sea star in 15 1-m^2 quadrats, a similar abundance as the other areas in San Diego County.

Did the loss of ochre sea stars at CABR lead to large community changes? The few sea star individuals in the park prior to 1990 could have had a large effect on the community; it has been estimated that individuals eat more than 80 mussels per year in Pacific Grove, California (Feder 1970), and mussels in the warmer waters of San Diego probably have higher metabolic needs (Sanford 2002). The expected effect of lack of sea stars in the intertidal, an uncontrolled increase of mussels, was clearly not observed at CABR where mussels dramatically declined. The intertidal of CABR, now devoid of ochre sea stars and with low levels of mussel cover, might be in a different "stable state," with a different community composition that will remain until a major perturbation changes it again (e.g. Paine and Trimble 2004).

In the absence of ochre sea stars, is there a keystone species in the intertidal of CABR? Possible predators that appear to be important players in the park community include Mexican unicorn snails (*Mexacanthina lugubris*), shorebirds, lobsters, and octopus. There are studies in other intertidal areas that demonstrated that predatory snails (Menge 1976) and birds (Hockey and Branch 1984, Marsh 1986, Meese 1993) could serve this ecological role. Additionally, non-biological factors such as unpredictable sand burial (Menge *et al*. 1994) can serve as a structuring force that controls the community, much like a keystone. Keystone species are usually those that keep a competitive dominant species from becoming a monoculture, so identifying keystones might be expedited by determining the dominant taxa. The identity of the competitive dominant has not been experimentally determined, but in the lower intertidal it is probably surfgrass and could be barnacles, limpets, or red algal turf in the middle intertidal. Since small changes in the abundance of a keystone species can have surprisingly large effects on communities, it is not a trivial management goal to identify these players (Power *et al*. 1996). In addition to continuing to document the lack of ochre sea stars and determine if there is some persistent mechanism that has led to its local extinction, it will be important to further classify the effects of its local disappearance.

People and Bird Censuses

General trends

The number of visitors counted during 1-hour censuses was particularly high during 1990 and 1991, but has remained relatively stable over the past twelve years. The closure of Zone III does not seem to have affected total visitation in the long-term. Less than 10% of visitors used this area prior to the closure, and the lowered visitation in Zone III was absorbed by both Zones I and II after the closure. In January 2004, the park entrance station was moved such that visitors need to pay a fee to visit the tidepools. It will be interesting to revisit the visitation trends in 2006 or 2007 to look for changes.

Higher visitation rates during winter months, weekends, and holidays are consistent with staff observations of human usage patterns.

Although methodological inconsistencies limited the interpretation of much of the bird data, there are indications that the sea bird and shore bird abundances were lower after 1995 than prior to it. The cause and effects of this change are unknown but could be quite important. It is interesting to note that after the closure in 1996, the shore bird population in Zone III has been steadily increasing.

Total visitation rates

These census data represent a “snapshot” sample during an hour of the low tide day and during particular tide conditions. It would be useful for management purposes to convert these “people/count” numbers to actual annual visitation rates to the tidepools. In order to do this, the following additional information will need to be determined: the relationship between tide height and visitation, the number of days per year with different tidal levels, and the number of weekends and holidays per year.

There is an ongoing study that can also be used to calibrate visitor censuses to determine the total visitation in the tidepools. From 2004-2005 Tonya Huff, a PhD candidate from the Scripps Institution of Oceanography, used a time-lapse video camera pointed at the public access point in Zone I to track human use in the tidepools. When her study is completed, we can compare her daily visitation counts with our existing visitor censuses for that day to determine a calibration factor. In addition, since she includes a larger range of tidal heights than the bird census program, her data can be used to determine the relationship between height and visitation. Preliminarily, she has found 300-600 visitors to the tidepools during good low tide days. Using this information, annual visitation is roughly estimated to be 40,000 to 70,000.

Once a total annual visitation rate is calculated, the number of visitors to each zone can be inferred from these census data using the percentage of people found in each zone during CRIMP. Given that there is a single public access point into the tidepools located in Zone I, it can be assumed that all of the visitors an all three zones had to pass through Zone I at some point; therefore the total annual visitation rate (Zone

I% + Zone II% + Zone III % = 100%) and the Zone I visitation rate are equal. It is assumed that the Zone II visitation rate includes those found in Zones II and III, since visitors to Zone III had to pass through Zone II; the Zone II visitation rate is the sum of Zones II and III (Zone II% + Zone III% of total). The Zone III visitation rate only includes the percentage of people found in Zone III (Zone III%). If the actual total visitation rate is approximately 60,000/year, then the annual visitation to each zone (using the average % rate from 2003, 79.1% in I, 19.2% in II, 1.7% in III) is approximately: Zone I 60,000 (100%), Zone II 12,536 (20.9%), Zone III 1,003 (1.7%).

Summary of Management Evaluation

Due to their extremely high accessibility, rocky intertidal habitats worldwide are quite vulnerable to a wide variety of negative anthropogenic impacts, although due to the relative resiliency of these ecosystems, the effects are often more subtle than in other marine habitats (Thompson *et al*. 2002). Negative impacts of human use that have been documented elsewhere include artificial structures (Davis *et al*. 2002, Bulleri and Chapman 2004), invasive species (Castilla *et al*. 2004), sedimentation alteration (Littler *et al*. 1983, Pulfrich *et al*. 2002), pollution (Murray and Littler 1984), harvesting (Pombo and Escofet 1996, Sharpe and Keough 1998, Murray *et al*. 1999, Roy *et al*. 2003, Kido and Murray 2003), and global climate change (Barry *et al*. 1995, Sagarin *et al*. 1999). High levels of human visitation, in the absence of collection pressure, also affects intertidal communities (Addessi 1994) through rock-flipping (Chapman and Underwood 1996), trampling (Ghazanshahi *et al*. 1983, Fletcher and Frid 1996, Keough and Quinn 1998), and displacing mobile species that avoid human contact (Lindberg *et al*. 1998).

The specific effects of these different types of human exploitation and development can vary among taxa and scales (temporal, spatial, and level [i.e. individual vs. population vs. community composition]), and consequently the "vital sign" used to detect that change varies. For example, animals exposed to pollution can often have cryptic physiological symptoms long before an ecological change can be detected (Fishelson *et al*. 2002). In addition, there are often "cascading" effects of human impacts through the levels of the food chain (Lindberg *et al*. 1998, Sharpe and Keough 1998) or effects that interact with other environmental or biological factors (Bertness *et al*. 1999) that can lead to patterns that are more difficult to interpret. The challenge is to discriminate between natural variability and these different types of anthropogenic disturbances in order to manage intertidal habitats in an appropriate and informed manner in order to maintain these resources "unimpaired" for future generations.

There are a number of examples of how different manifestations of human impacts at CABR are well-defined or overlooked by CRIMP. Owl limpet size-frequency information gained from circular plots has great utility to demonstrate the effects of human collection. Line transects, on the other hand, will only quantify the percent cover of red algal turf communities, but further studies have shown that in Zone I, a thinner, less diverse microhabitat can cover the same area as a thicker, richer one in Zone III; the CRIMP approach was supplemented in order to better define this difference.

Ideally, a proven "cause" of an ecological change is determined experimentally through manipulative experiments, although more often a factor or factors that correlates with the observed trend is used to draw conclusions about the likely causative mechanism. CRIMP, by definition, is an observational, mensurative program, which is designed to identify and quantify changes in key populations within the park. Although in some cases, likely causes of those changes can be identified, in other cases only speculative conclusions can be drawn based on other studies and reason. In both cases, some caution should be used in interpretation.

With that caveat, these various lines of evidence indicate that the management policies of TPERP are having mostly positive, although somewhat mixed success. For example, larger gastropods within the park compared to less-protected areas in the region can be attributed to the strict enforcement of no-harvest rules within the park, mostly by TPERP volunteers and law enforcement rangers.

The effect of the closure of Zone III in restoring populations remains unclear at this time. Red algal turf communities, the most affected by human trampling, are not well-sampled by CRIMP, which uses a percent-cover (i.e. area) measure; further studies of biomass and composition have indicated a large positive effect of this management measure on the algal and microinvertebrate communities within turf. Many of the highly-valued mobile species, such as abalone and lobsters, are or have been found in greater numbers in the closed area. In addition, birds are present in much higher numbers in Zone III and are more abundant when fewer people are around; birds that have been declining in the other two zones have actually increased somewhat in Zone III. On the other hand, mussel cover and owl limpet abundance are both lower in the low-use areas, and settlement monitoring and size-frequency analysis indicates that recruitment rates are lower in this area.

The public support of the closure on Zone III is extremely high. In spring 2001, SDSU and NPS conducted a joint survey of visitors to the tidepools at Cabrillo NM. Students from the Recreational Planning and Policy class, supervised by Dr. Larry Beck, interviewed 346 people to determine, among other things, their attitude toward the actions the NPS had taken to restore the tidepools. In response to the question, "Do you approve or disapprove of closing part of the tidepools to allow it to recover?" 99% of those surveyed said they approved. In the follow-up question, "If the Park Service's monitoring program indicates that the closed area has not recovered fully, would you be in favor of closing it for additional tidepool seasons (October through June) to allow more time for the plants and animals to return?" 97% answered "Yes". These results are remarkably similar to a 1997 SDSU/NPS study that asked the same two questions; at that time, 99% answered "yes" to the first question and 96% to the second. Based on this survey, it appears the public supports the program NPS initiated in 1996 to protect and restore the tidepools, and is willing to accept the continued closure of Zone III to allow it more time to recover.

This area is increasingly valued as a scientific resource as well, mostly due to the presence of TPERP and CRIMP. The three zones of Cabrillo are unique representatives of different kinds of human use. Zone I experiences intense visitation but little to no harvesting due to the enforcement of park policies by TPERP volunteers. Zone III experiences no harvesting and little to no visitation, a condition that exists in few to no other places on the southern California coast. Zone II provides an intermediate case of lower intensity visitation. These three "treatments" that exist in the park have increasingly attracted researchers interested in quantifying the effects of human utilization of marine resources, and separating the effects of non-extractive visitation from direct harvesting effects. Since 2002, 21 research permits for studies in CABR's small tidepool area have been approved, 10 of which were submitted by graduate students. In addition, the CRIMP dataset, especially in the context of MARINe, adds value to CABR as a study area. The CABR area is often used as a control in regional MARINe studies looking at the effects of human exploitation.

Conclusion

The long time series associated with CRIMP has put some of the declines described in Engle and Davis (2000b) in perspective. With more time, some of the declining species have either shown signs of recovery (e.g. thatched barnacles) or now appear to part of a larger cycle (e.g. goose barnacles). The interaction between red algal turf, surfgrass, and boa kelp has been tracked for 15 years, and although it is not clear if the expansion of grass into kelp and turf habitat has an anthropogenic cause, it is possible that this shift in abundance is part of a natural successional/disturbance cycle. Owl limpets have been getting smaller in the park over the past 15 years, although they continue to be significantly larger than those at nearby, unprotected sites. Other key species that have been in decline or disappeared from the park, such as mussels, black abalone, and ochre sea stars, remain in poor ecological health and continue to be of particular concern for park management.

The mission of the National Park Service is to conserve unimpaired the natural and cultural resources and values within its care for the enjoyment, education and inspiration of this and future generations. One purpose of Cabrillo NM, as stated in the GMP/FEIS, is to “Preserve, restore, protect, interpret and enhance the significant cultural and natural resources within and adjacent to the park.” With regard to the tidepools, the NPS objective is to “manage visitor use patterns and activities to protect, preserve and restore the tidepools as (closely as) possible to a healthy, functioning ecosystem, allowing visitors to experience and learn without harming the resources.” The TPERP and CRIMP programs allow us to achieve this seemingly inconsistent goal—visitors are given access to most of the tidepools, but part of it is set aside for replenishment and study of the resource. This rocky intertidal habitat is widely considered to be among the best protected in southern California, a highly-urbanized area with an extreme amounts of anthropogenic disturbances, especially along the coast. This protection has lead to demonstrably healthier intertidal communities within the area administrated by the park.

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Table 1. List of sampling dates of the Cabrillo National Monument Rocky Intertidal Monitoring Program from 1990 through 2005.

List of All CRIMP Sampling Dates (1990-2005)		
Season	**Abbreviation**	**Sampling Dates**
Spring 1990	SP90	Feb. 8-10
Fall 1990	FA90	Nov. 28 - Dec. 1
Spring 1991	SP91	Mar. 23-26
Fall 1991	FA91	Nov. 3-5
Spring 1992	SP92	Apr. 11-13
Summer 1992	SU92	Jun. 2-4
Fall 1992	FA92	Nov. 21-23
Spring 1993	SP93	Mar. 6-8
Fall 1993	FA93	Oct. 14-16
Spring 1994	SP94	Mar. 6-8
Fall 1994	FA94	Oct. 5-7
Spring 1995	SP95	Feb. 25-6, Mar. 2
Fall 1995	FA95	Oct. 21-22, 25
Fall 1996	FA96	Nov. 22-25, Dec. 8
Spring 1997	SP97	Apr. 2-6
Fall 1997	FA97	Oct. 14-18
Spring 1998	SP98	Mar. 23-27
Fall 1998	FA98	Nov. 2-5, 12, Dec. 2
Spring 1999	SP99	Mar. 14-17, Apr. 26
Fall 1999	FA99	Nov. 20-24, 26
Spring 2000	SP00	Mar. 2-4, 18-20
Fall 2000	FA00	Nov. 10-13
Spring 2001	SP01	Mar. 5-6, 8, 20, Apr. 5-6
Fall 2001	FA01	Oct. 15-18, Nov. 14-16
Spring 2002	SP02	Mar. 8-10, 12
Fall 2002	FA02	Nov. 2-5
Spring 2003	SP03	Mar. 15-18
Fall 2003	FA03	Oct. 24-26, Nov. 21-25
Spring 2004	SP04	Mar. 16-19
Fall 2004	FA04	Nov. 12-14
Spring 2005	SP05	Mar. 5-7

Table 2. List of significant events related to the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP) from 1990 through 2005.

Significant Events During CRIMP (1990-2005) **What?**	**When?**
Establishment of CRIMP sites	Feb. 4-7, 1990
Rupture in underwater treated effluent outfall that exits the Point Loma Wastewater Treatment Plant, tidepools closed for summer	Feb. 2-Apr. 4, 1992
Extra sampling event post-spill	June 1992
Mild El Niño Event	1992-1994
Monitoring sites established on Navy land north of CABR	Feb. 1995
Goose barnacles transects converted to photoplots	Feb. 1995
No monitoring done, gap in funding	Spring 1996
Zone III closed to all visitors, TPERP established	Nov. 1996
MARINe Established	1997
Strong El Niño event, a lot of storms and rain	Winter 1997-8
CRIMP plots mapped using GPS	Feb. 1998
CRIMP database built and all data compiled	1998
Normal to cooler water temperatures	1999
Workshop to review CRIMP program (10-year review, Becker 2003)	Nov. 13, 2001
PISCO "SWAT" Comprehensive Surveys conducted in Zones I and III (http://cbsurveys.ucsc.edu/)	Mar. 23-28, 2002
Bird protocol with standardized southern border for Zone III was produced and all volunteers required to go through retraining	October 2002- May 2003
First season using point-contact method for transects	Fall 2002
Establishment of Overview Plots by Abram Akradi (CABR VIP)	Summer 2003
Fires throughout San Diego County lead to rescheduling of monitoring and ash falling into tidepools	Oct. 2003
Added circular plots L7 and L8 in Zone II	Fall 2003
Test of digital camera for photoplots, film camera used for monitoring	Spring 2004
Determination of tidal heights of all CRIMP plots by Laurie Anne Victoria (CABR VIP) (see Appendix E)	Spring 2004
Second SWAT survey in Zone I	May 7-8, 2004
Digital camera used for monitoring photoplots	Fall 2004
Bird/visitor census protocol changed to lower the annual number of samples to 40-50 (see Appendix C)	October, 2004
Sewage spill at Point Loma Wastewater Treatment Plant, 2.2 million gallons of raw sewage directly into intertidal	Oct. 27, 2004
Unusually high rainfall year	Fall 2004- Spring 2005
New Database built and integrated into system	Summer 2005

Table 3. List of techniques and key taxa used as part of the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP) from 1990 through 2005. Target taxa are listed after the appropriate technique, taxa in brackets were not targeted, but were considered "key" and always counted when encountered.

Technique/Taxa	Dimensions of Plot	Number per Zone	Type of Data
Circular Plots:	3.14 m^2	6	Size-Frequency
Owl Limpets (*Lottia gigantea*)		(6)	
Line Transects:	10 m	6	% Cover
Red Algal Turf (*Corallina* spp. *et al.*)		(2)	
Surf Grass (*Phyllospadix* spp.)		(2)	
Boa Kelp (*Egregia menziesii*)		(2)	
[Anemones (*Anthopleura elegantissima/sola)*]			
[*Sargassum* Weed (*Sargassum muticum*)]			
Photoplots:	50 x 75 cm	21	% Cover
Acorn Barnacles (*Chthamalus* spp., *Balanus glandula*) Thatched Barnacles (*Tetraclita rubescens*)[10]		(5)	
Rockweed (*Silvetia compressa*, formerly *Pelvetia fastigiata*)		(5)	
Mussels (*Mytilus californianus*, few *M. galloprovincialis*)		(5)	
Goose Barnacles (*Pollicipes polymerus*)		(6)-Began SP95	
Timed Search:	30 person-minutes	1	Presence/Absence
Black Abalone (*Haliotis cracherodii*)			
Ochre Sea Star (*Pisaster ochraceus*)			
Bird/Visitor Censuses (throughout the year):	1 hour/all zones	1/low tide	Census
Birds			
Visitors			

[10] Thatched and acorn barnacles are targeted together in the same set of photoplots.

Table 4. MARINe core species, higher taxa, and substrates, as of summer 2005 (after Engle 2005b). "Core" species are those species, species groups, or substrates that are scored using one or more survey methods by everyone in MARINe. "Target" species (shown in bold) are species or species groups specifically chosen for long-term monitoring. See Table 5 for more MARINe defintitions.

Taxa/Category	Photoplot Core	Transect Core
GREEN ALGAE		
Cladophora columbiana	X	
Ulva/Enteromorpha	X	
Other Green Algae[1]	X	X
BROWN ALGAE		
***Egregia menziesii* (Boa Kelp)**	X	X
Eisenia arborea	X	X
Endarachne/Petalonia	X	
***Fucus gardneri* (= *F. distichus*) (Northern Rockweed)**	X	
Halidrys dioica/Cystoseira spp	X	X
***Hedophyllum sessile* (Sea Cabbage)**	X	X
***Hesperophycus californicus* (=*H. harveyanus*) (Olive Rockweed)**	X	
***Pelvetiopsis limitata* (Dwarf Rockweed)**	X	
Sargassum muticum	X	X
Scytosiphon spp	X	
***Silvetia compressa* (= *Pelvetia fastigiata*) (Golden Rockweed)**	X	
Other Brown Algae (any browns not listed above)[1]	X	X
RED ALGAE		
Chondracanthus canaliculatus (= *Gigartina canaliculata*)	X	
***Endocladia muricata* (Turfweed)**	X	
***Mastocarpus papillatus* (blade) (Turkish Washcloth)**	X	
Mazzaella affinis (= *Rhodoglossum affine*)	X	
***Mazzaella* spp.(= *Iridaea* spp.) (Iridescent Weed)**	X	
***Neorhodomela larix* (Black Pine)**	**X**	
Porphyra sp	X	
Articulated Corallines (Erect Corallines)	X	X
Crustose Corallines (Encrusting Corallines)	X	X
Other Red Algae[1]	X	X
ALGAE/PLANTS		
***Phyllospadix scouleri/torreyi* (Surfgrass)**	X	X
Non-Coralline Crusts (reds and browns)	X	X
Other Plant/Algae[1]	X	X

Taxa/Category	Photoplot Core	Transect Core
ANEMONES		
***Anthopleura elegantissima/sola* (Green Anemone)**	X	X
POLYCHAETE WORMS		
Phragmatopoma californica	X	X
MOLLUSKS		
***Lottia gigantea* (Owl Limpet)**	X	
***Mytilus californianus* (California Mussel)**	X	X
Limpets	X	
Chitons	X	
BARNACLES		
***Chthamalus dalli/fissus* & *Balanus glandula* (White Barnacle)**	X	
***Pollicipes polymerus* (Goose Barnacle)**	X	
***Semibalanus cariosus* (Thatched Barnacle)**	X	
***Tetraclita rubescens* (Pink Barnacle)**	X	
Barnacles		X
Other Barnacles[1]	X	
ECHINODERMS		
***Pisaster ochraceus* (Ochre Star)**	X	X
INVERTEBRATES		
Other Invertebrates (Other Animals)[1]	X	X
SUBSTRATES		
Rock (Bare Rock)	X	X
Sand	X	X
Tar	X	X
UNDETERMINED		
Other Substrate	X	X
Unidentified	X	X

[1]The specific definitions of these categories are different for photoplots compared to transects.

Table 5. MARINe definitions for core higher taxa and substrates. From Engle (2005b).

Articulated (Erect) Corallines: erect, jointed, calcified, red algae of the Family *Corallina*ceae, with flexible, articulate fronds arising from crustose bases.

Barnacles: adults or juveniles of any barnacle (Phylum Arthropoda, Class Crustacea, Subclass Cirripedia) species.

Chitons: adults or juveniles of any chiton (Phylum Mollusca, Class Polyplacophora) species.

Crustose (Encrusting) Corallines: thin, flattened, calcified, crust-like red algae of the Family *Corallina*ceae, having no erect, articulated fronds. Bleached crustose corallines (white) are scored as well because they may be alive.

Limpets: adults or juveniles of any limpet (Phylum Mollusca, Class Gastropoda, Family Acmaeidae) species, including *Lottia gigantea*.

Non-Coralline Crusts: any thin, flattened, crust-like red or brown algae that are not calcified species of the Family *Corallina*ceae.

Other Invertebrates (Other Animals): any invertebrates not listed or not identifiable in other more specific categories on the score sheet.

Other Barnacles: any barnacles not listed or not identifiable in other more specific categories on the score sheet.

Other Brown Algae: any brown algae not listed or not identifiable in other more specific categories on the score sheet (score "non-coralline crusts" separately).

Other Green Algae: any green algae not listed or not identifiable in other more specific categories on the score sheet.

Other Plant (Other Algae): any plants (algae) not listed or not identifiable in other more specific categories on the score sheet.

Other Red Algae: any red algae not listed or not identifiable in other more specific categories on the score sheet (score "non-coralline crusts" separately).

Rock (Bare Rock): bare, unconsolidated substrates larger than sand/gravel (including cobble, rocks, and boulders) and all consolidated substrates (i.e., bedrock) that contain no obvious living organisms or tar (epoxy corner markers and inconspicuous blue-green algal films are scored as "rock").

Sand: granular, particulate (fine sand to gravel) substrate. Photoplots: score "sand" unless you can positively identify what lies under the sand in the photo. Transects: score "sand" whenever sand cover is 2 cm or greater.

Tar: fresh or weathered oil or tar coating on the substrate.

Unidentified: cannot tell if plant, invertebrate, or substrate

Table 6. List of taxa/categories recorded from photoplots during the Cabrillo National Monument Rocky Intertidal Program (CRIMP) throughout the survey period from 1990 to 2005, including the seasons during which those categories were used. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

Taxa/Category	Species included	SP90-FA95	FA96-SP99[1]	SP99[1]-FA99	SP00-SP02	FA02-SP03	FA03-SP05	This report
Acorn Barnacles	*Chthamalus dalli*, *C. fissus*, *Balanus glandula*, no effort made to determine species.	*Chthamalus/ Balanus*	*Chthamalus/ Balanus*	*Chthamalus/ Balanus*	*Chthamalus* spp./ *Balanus glandula*	*Chthamalus* spp./ *Balanus glandula*	*Chthamalus* spp./ *Balanus glandula*	*Chthamalus/ Balanus*
Anthopleura elegantissima/sola	Mostly *A. elegantissima* but could be some *A. sola*[2]	A	*Anthopleura*	A	*Anthopleura elegantissima/ sola*	*Anthopleura elegantissima/ sola*	*Anthopleura elegantissima/ sola*	Other Animals
Articulated corallines	Many species, could include *Corallina* spp., *Bosiella* spp., *Lithothrix* spp., etc.; no effort made to determine species	B	Erect corallines	B	Articulated corallines	Articulated corallines	Articulated corallines	Other Plants
Chitons	Including *Nuttalina fluxa*	A	D	A	Chitons	Chitons	Chitons	Other Animals
Chondracanthus canaliculatus		B	F	B	*Chondracanthus canaliculatus*	*Chondracanthus canaliculatus*	*Chondracanthus canaliculatus*	Other Plants
Cladophora columbiana[3]		B	G	B	*Cladophora columbiana*	*Cladophora columbiana*	*Cladophora columbiana*	Other Plants
Colpomenia spp.	Probably either *C. tuberculata* or *C. sinuosa*	B	E	B	E	*Colpomenia* spp.	*Colpomenia* spp.	Other Plants
Crustose corallines	Unidentified species	B[4]	Coralline Crusts	B	Crustose corallines	Crustose corallines	Crustose corallines	Other Plants
Egregia menziesii		B	E	B	*Egregia menziesii*	*Egregia menziesii*	*Egregia menziesii*	Other Plants
Eisenia arborea[5]		B	E	B	*Eisenia*	*Eisenia*	*Eisenia arborea*	Other Plants
Endarachne binghamiae/ Petalonia fascia	Probably *E. binghamiae*, but no effort made to determine species.	B	E	B	*Endarachne/ Petalonia*	*Endarachne/ Petalonia*	*Endarachne binghamiae/ Petalonia fascia*	Other Plants
Endocladia muricata		B	*Endocladia muricata*	B	*Endocladia muricata*	*Endocladia muricata*	*Endocladia muricata*	Other Plants
Fucus gardneri[6]		B	E	B	*Fucus gardneri*	*Fucus gardneri*	*Fucus gardneri*	Other Plants
Halidrys dioica/ Cystoseira spp.	Probably *H. dioica*, but no effort to determine species.	B	E	B	*Halidrys/ Cystoseira*	*Halidrys/ Cystoseira*	*Halidrys/ Cystoseira*	Other Plants
Hesperophycus californicus[6]		B	*Hesperophycus*	B	*Hesperophycus*	*Hesperophycus californicus*	*Hesperophycus californicus*	Other Plants
Limpets	Many species, could include *Lottia digitalis*, *L. paradigitalis*, *L. pelta*, etc.	A	D	A	Limpets	Limpets	Limpets	Other Animals
Lottia gigantea		A	D	A	*Lottia gigantea*	*Lottia gigantea*	*Lottia gigantea*	Other Animals

Taxa/Category	Species included	SP90-FA95	FA96-SP99[1]	SP99[1]-FA99	SP00-SP02	FA02-SP03	FA03-SP05	This report
Mastocarpus papillatus[6]		B	F	B	*Mastocarpus papillatus*	*Mastocarpus papillatus*	*Mastocarpus papillatus*	Other Plants
Mazzaella affinis[6]		B	F	B	*Mazzaella affinis*	*Mazzaella affinis*	*Mazzaella affinis*	Other Plants
Mazzaella spp. (=*Iridaea* spp.)[7]		B	F	B	*Mazzaella* spp.	*Mazzaella* spp.	*Mazzaella* spp. (=*Iridaea* spp.)	Other Plants
Mexacanthina lugubris		A	D	A	Rock	*Mexacanthina lugubris*	*Mexacanthina lugubris*	Other Animals
Mytilus californianus	Recorded as *M. californianus*, but could also include *M. galloprovincialis*[8]	*Mytilus*	*Mytilus*	*Mytilus*	*Mytilus californianus*	*Mytilus californianus*	*Mytilus californianus*	*Mytilus*
Non-coralline crusts	Unidentified species	B	Non-coralline crusts	B	Non-coralline crusts	Non-coralline crusts	Non-coralline crusts	Other Plants
Other barnacles[3]		A	Other barnacles	A	Other barnacles	Other barnacles	Other barnacle	Other Animals
Other substrate[5]		C	Rock	C	H	H	Other Substrate[9]	Bare
Pelvetiopsis limitata[6]		B	E	B	*Pelvetiopsis limitata*	*Pelvetiopsis limitata*	*Pelvetiopsis limitata*	Other Plants
Phragmatopoma californica		A	*Phragmatopoma*	A	*Phragmatopoma californica*	*Phragmatopoma californica*	*Phragmatopoma californica*	Other Animals
Phyllospadix scouleri/torreyi	Probably only *P. torreyi* found in park, but no effort made to determine species during monitoring	B	None	B	*Phyllospadix scouleri/torreyi*	*Phyllospadix scouleri/torreyi*	*Phyllospadix scouleri/torreyi*	Other Plants
Pisaster ochraceus[6]		A	D	A	*Pisaster ochraceus*	*Pisaster ochraceus*	*Pisaster ochraceus*	Other Animals
Pollicipes polymerus		*Pollicipes*	*Pollicipes*	*Pollicipes*	*Pollicipes polymerus*	*Pollicipes polymerus*	*Pollicipes polymerus*	*Pollicipes*
Porphyra spp.[6]		B	*Porphyra*	B	*Porphyra* spp.	*Porphyra* spp.	*Porphyra* spp.	Other Plants
Rock		Bare Substrate	Rock	Bare Substrate	Rock	Rock	Rock	Bare
Sand		C	Sand	Bare Substrate	Sand	Sand	Sand	Bare
Sargassum muticum[3]		B	E	B	*Sargassum*	*Sargassum*	*Sargassum muticum*	Other Plants
Scytosiphon spp.[3]		B	E	B	*Scytosiphon* spp.	*Scytosiphon* spp.	*Scytosiphon* spp.	Other Plants
Septifer bifurcatus[5]	Mostly *S. bifurcatus*, but could be some *Brachidontes adamsianus* mixed in.	A	*Septifer*	A	Other Invertebrates	Other Invertebrates	Other Invertebrates	Other Animals
Silvetia compressa[10]		*Pelvetia*	*Pelvetia*	*Pelvetia*	*Silvetia compressa*	*Silvetia compressa*	*Silvetia compressa*	*Silvetia*
Tar[6]		C	Tar	C	Tar	Tar	Tar	Bare
Tetraclita rubescens		*Tetraclita*	*Tetraclita*	*Tetraclita*	*Tetraclita rubescens*	*Tetraclita rubescens*	*Tetraclita rubescens*	*Tetraclita*

Taxa/Category	Species included	SP90-FA95	FA96-SP99[1]	SP99[1]-FA99	SP00-SP02	FA02-SP03	FA03-SP05	This report
Turf-forming red algae (non-coralline)	Many species, including *Centroceras clavulatum*, *Laurencia* spp., etc.	B	Turf (low filamentous)	B	Turf or Other Red	Other Red Algae	Other Red Algae	Other Plants
Ulva spp./ *Enteromorpha* spp.	Unidentified species	B	*Ulva/ Enteromorpha*	B	*Ulva/ Enteromorpha*	*Ulva/ Enteromorpha*	*Ulva* spp./ *Enteromorpha* spp.	Other Plants

Lumped as:
A = "Other Animal"
B = "Other Plant"
C = "Bare Substrate"
D = "Misc. Invertebrates"
E = "Other Brown Algae"
F = "Other Red Algae"
G = "Other Green Algae"
H = "Rock"

Blue = Always scored when encountered, printed on logsheets
Red = Written on logsheet consistently, but not printed on logsheets
Green = Not on logsheet, but the logsheet says it should always be recorded when found.

[1] In SP99, half of the plots were scored with the old rules, half with the new.
[2] *Anthopleura sola*, the solitary sunburst anemone, was formerly considered to be a variant of *A. elegantissima*, the aggregating anemone, until reclassified in 2000 (Pearse and Francis 2000). Both species have been lumped together throughout this study.
[3] Very rare in these habitats, less than 5 data points in entire sample period.
[4] When bleached or harder to identify, was scored as rock.
[5] No data points, although can be found in other parts of the park.
[6] No non-zero data points, not usually found in the park.
[7] Probably not present in park, but a few (<5) data points in sampling period. Probably erroneous.
[8] Although Suchanek *et al*. (1997) have confirmed the presence of *M. trossulus* and *M. trossulus/galloprovincialis* hybrids in San Diego Bay, it is not known whether these taxa are present within the boundaries of Cabrillo National Monument. All bay mussels will be referred to as *M. galloprovincialis*.
[9] FA03-SP04 only.
[10] *Silvetia compressa* formerly known as *Pelvetia fastigiata*.

Table 7. List of taxa/categories recorded from transects during the Cabrillo National Monument Rocky Intertidal Program (CRIMP) throughout the survey period from 1990 to 2005, including the seasons during which those categories were used. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

Taxa/Category	Species included	SP90-SP02	FA02-SP05	This report
Acorn Barnacles[1]	*Chthamalus dalli*, *C. fissus*, *Balanus glandula*, no effort made to determine species.	A	Barnacles	Other Biota
Anthopleura elegantissima/sola	Mostly *A. elegantissima* but could be some *A. sola*[2]	Aggregating anemone	*Anthopleura elegantissima/ sola*	*Anthopleura*
Articulated corallines[3]	Many species, could include *Corallina* spp., *Bosiella* spp., *Lithothrix* spp., etc.; no effort made to determine species	B	Articulated corallines	Red Algal Turf[3]
Chitons	Including *Nuttalina fluxa*	A	D	Other Biota
Chondracanthus canaliculatus		B	E	Other Biota
Cladophora columbiana		A	G	Other Biota
Colpomenia spp.	Probably either *C. tuberculata*, *C. sinuosa*	A	*Colpomenia* spp.[4]	Other Biota
Crustose corallines	Unidentified species	C	Crustose coralline	Bare
Egregia menziesii		Boa Kelp	*Egregia menziesii*	*Egregia*
Eisenia arborea		A	*Eisenia arborea*	Other Biota
Endarachne binghamiae/ Petalonia fascia	Probably *E. binghamiae*, but no effort made to determine species.	A	F	Other Biota
Endocladia muricata		B	E	Other Biota
Fucus gardneri[5]		A	F	Other Biota
Halidrys dioica/Cystoseira spp.	Probably *H. dioica*, but no effort made to determine species.	A	*Halidrys dioica/ Cystoseira* spp.	Other Biota
Hesperophycus californicus[5]		A	F	Other Biota
Limpets	Many species, could include *Lottia digitalis*, *L. paradigitalis*, *L. pelta*, etc.	A	D	Other Biota
Lottia gigantea		A	D	Other Biota
Mastocarpus papillatus[5]		A	E	Other Biota
Mazzaella affinis[5]		A	E	Other Biota
Mazzaella spp. (=*Iridaea* spp.)[5]		A	E	Other Biota
Mexacanthina lugubris		A	D	Other Biota

Taxa/Category	Species included	SP90-SP02	FA02-SP05	This report
Mytilus californianus[6]	Recorded as *M. californianus*, but could also include *M. galloprovincialis*[7]	A	*Mytilus californianus*	Other Biota
Non-coralline crusts	Unidentified species	C	Non-coralline crusts	Bare
Other barnacles		A	Barnacles	Other Biota
Other substrate		C	I	Bare
Pelvetiopsis limitata[5]		A	F	Other Biota
Phragmatopoma californica[1]		A	*Phragmatopoma californica*	Other Biota
Phyllospadix scouleri/torreyi	Probably only *P. torreyi* found in park, but no effort made to determine species during monitoring[8]	Surfgrass	*Phyllospadix torreyi/scouleri* Overstory/ Understory	*Phyllospadix*[9]
Pisaster ochraceus[5]		A	D	Other Biota
Pollicipes polymerus		A	D	Other Biota
Porphyra spp.[5]		A	E	Other Biota
Rock		Bare Space	Rock	Bare
Sand		C	Sand	Bare
Sargassum muticum		*Sargassum* Weed	*Sargassum muticum*	*Sargassum*
Scytosiphon spp.		A	F	Other Biota
Septifer bifurcatus	Mostly *S. bifurcatus*, but could be some *Brachidontes adamsianus* mixed in.	A	D	Other Biota
Silvetia compressa		A	F	Other Biota
Tar[5]		C	Tar	Bare
Tetraclita rubescens		A	D	Other Biota
Turf-forming red algae (non-coralline)[3]	Many species, including *Centroceras clavulatum*, *Laurencia* spp., etc.	Red algal turf	Other Red Algae/ Sand Turf[10]	Red Algal Turf[3]
Ulva spp./*Enteromorpha* spp.	Unidentified species	A	G	Other Biota

Lumped as: A = "Other Biota" B = "Red Algal Turf"[3]	[1] Very rare in these habitats, less than 5 data points in entire sample period. [2] *Anthopleura sola*, the solitary sunburst anemone, was formerly

C = “Bare Space” D = “Other Invertebrates” E = “Other Red Algae” F = “Other Brown Algae” G = “Other Green Algae” H = “Other Plant” I = “Rock” Blue = Always scored when encountered, printed on logsheets Red = Written on logsheet consistently, but not printed on logsheets	considered to be a variant of *A. elegantissima*, the aggregating anemone, until reclassified in 2000 (Pearse and Francis 2000). Both species have been lumped together throughout this study. [3] Red algal turf was separated into two categories by MARINe: "Other Red Algae" for non-coralline reds and "Articulated Corallines" for coralline algae. It is not possible to separate former Red Algal Turf in the earlier data. Red algal turf is a mixed assemblage dominated by *Corallina* spp. (Stewart 1982). [4] Lumped as "Other Brown" in FA02. In SP03 was written on sheet consistently, but wasn't added to the log until FA03, where it was mandatory thereafter. [5] Not usually found in the park, wasn’t specifically looked for. [6] No data points, although can be found in other parts of the park. Was specifically looked for. [7] Although Suchanek *et al*. (1997) have confirmed the presence of *M. trossulus* and *M. trossulus/galloprovincialis* hybrids in San Diego Bay, it is not known whether these taxa are present within the boundaries of Cabrillo National Monument. All bay mussels will be referred to as *M. galloprovincialis*. [8] Mostly *Phyllospadix torreyi*. PISCO SWAT teams listed *P. scouleri* in Zone III, although in the current (2005) marine plant inventory being conducted by Kathy Ann Miller (UCB) and Steve Murray (CSUF), only *P. torreyi* is listed. [9] *Phyllospadix* understory not included in this report [10] Only used in FA02, was not on the logsheet but was consistently written down when encountered. Sand turf, low turf embedded into a sand matrix, was removed as a category by MARINe and considered just turf. When turf was split into "Other Red Algae" and "Articulated Corallines", this left sand turf in an amiguous situation. In this case, it would be lumped with "Other Red Algae", which was more general, although coralline algae was also scored as "Sand Turf" in this season.

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Table 8. List of Zone I monitoring plots from the Cabrillo National Monument Rocky Intertidal Monitoring Program. Tidal height measured in inches above MLLW. ND=not determined, n/a=not applicable (measurement is an estimate), Std. Dev.=the standard deviation of the GPS measurements. Standard deviation of the tidal height measurement is approximately 4 inches. See Appendix E for tidal height determination methodology.

CRIMP Plots with Locations—Zone I								
Plot ID	Site ID	Plot Type	Target Species	Bolt	Lat. (°N)	Long. (°W)	Std. Dev.	Tidal Height (inches)
L1	280	Circular Plot	Owl Limpets		32.669477	-117.245499	n/a	61.47
L2	284	Circular Plot	Owl Limpets		32.669396	-117.245625	0.099864	52.22
L3	283	Circular Plot	Owl Limpets		32.669262	-117.245514	0.235812	51.22
L4	282	Circular Plot	Owl Limpets		32.66911	-117.245449	0.092904	65.22
L5	279	Circular Plot	Owl Limpets		32.669154	-117.24528	0.100069	56.72
L6	277	Circular Plot	Owl Limpets		32.669113	-117.245213	n/a	48.22
B1	286	Photoplot	Barnacles		32.669721	-117.245609	0.135574	30.47
B2	299	Photoplot	Barnacles		32.669621	-117.245614	0.116806	38.22
B3	294	Photoplot	Barnacles		32.669486	-117.245829	n/a	28.97
B4	292	Photoplot	Barnacles		32.669211	-117.245595	0.223629	27.72
B5	293	Photoplot	Barnacles		32.669166	-117.245532	0.067995	29.47
M1	298	Photoplot	Mussels		32.669525	-117.245838	n/a	38.47
M2	297	Photoplot	Mussels		32.669516	-117.245832	n/a	27.47
M3	296	Photoplot	Mussels		32.669365	-117.245836	n/a	25.97
M4	289	Photoplot	Mussels		32.669308	-117.245801	n/a	18.47
M5	285	Photoplot	Mussels		32.669291	-117.245657	n/a	31.22
Pe1	291	Photoplot	Rockweed		32.669444	-117.245619	0.150569	20.72
Pe2	290	Photoplot	Rockweed		32.669396	-117.245541	0.073069	31.72
Pe3	295	Photoplot	Rockweed		32.669334	-117.245551	0.110047	18.97
Pe4	288	Photoplot	Rockweed		32.669228	-117.245549	0.223704	24.47
Pe5	287	Photoplot	Rockweed		32.669194	-117.245424	0.133229	38.47
Po1	276N	Photoplot	Goose Barnacles		32.669617	-117.245517	0.121877	53.22
Po2	276C	Photoplot	Goose Barnacles		32.669573	-117.245522	0.521161	55.72
Po3	281N	Photoplot	Goose Barnacles		32.669293	-117.245373	0.170371	64.22
Po4	281S	Photoplot	Goose Barnacles		32.669219	-117.245355	0.139746	16.22
Po5	278N	Photoplot	Goose Barnacles		32.669139	-117.245216	0.112053	54.22
Po6	278S	Photoplot	Goose Barnacles		32.669116	-117.245204	0.098488	56.97
T1	237	Line Transect	Red Algal Turf	N	32.669761	-117.245583	0.304793	23.22
				C	32.669714	-117.245587	0.278975	ND
				S	32.66967	-117.24559	0.199365	19.22
T2	210	Line Transect	Red Algal Turf	N	32.669095	-117.245395	0.095701	14.47
				C	32.669055	-117.245368	0.131361	ND
				S	32.669022	-117.245342	0.189513	8.22
G3	238	Line Transect	Surfgrass	N	32.669669	-117.245651	n/a	14.97
				C	32.669628	-117.245635	n/a	ND
				S	32.669584	-117.245619	n/a	14.97
G4	211	Line Transect	Surfgrass	N	32.669037	-117.245238	n/a	-2.21
				C	32.668999	-117.245228	n/a	ND
				S	32.668959	-117.245217	n/a	10.22
K5	236	Line Transect	Boa Kelp	N	32.669636	-117.245798	n/a	3.22
				C	32.669591	-117.245809	n/a	ND
				S	32.669547	-117.245819	n/a	0.47
K6	212	Line Transect	Boa Kelp	N	32.669022	-117.245342	0.189513	8.22
				C	32.668985	-117.245312	n/a	ND
				S	32.66895	-117.245279	n/a	6.47

Table 9. List of Zone II monitoring plots from the Cabrillo National Monument Rocky Intertidal Monitoring Program. Tidal height measured in inches above MLLW. ND=not determined, n/a=not applicable (measurement is an estimate), Std. Dev.=the standard deviation of the GPS measurements. Standard deviation of the tidal height measurement is approximately 4 inches. See Appendix E for tidal height determination methodology.

CRIMP Plots with Locations--Zone II								
Plot ID	Site ID	Plot Type	Target Species	Bolt	Lat. (°N)	Long. (°W)	Std. Dev.	Tidal Height (inches)
L1	239	Circular Plot	Owl Limpets		32.66819	-117.245128	0.120667	46.14
L2	243	Circular Plot	Owl Limpets		32.667736	-117.245068	n/a	43.64
L3	240	Circular Plot	Owl Limpets		32.667439	-117.245159	0.099441	38.39
L4	242	Circular Plot	Owl Limpets		32.667297	-117.244944	0.095125	29.98
L5	266	Circular Plot	Owl Limpets		32.667191	-117.24492	0.119911	42.26
L6	241	Circular Plot	Owl Limpets		32.667117	-117.24536	0.13157	29.64
L7	242A	Circular Plot	Owl Limpets		n/a	ND	n/a	48.26
L8	266A	Circular Plot	Owl Limpets		n/a	ND	n/a	70.26
B1	247	Photoplot	Barnacles		32.66793	-117.245276	0.098347	21.39
B2	248	Photoplot	Barnacles		32.667938	-117.24522	0.18427	33.14
B3	256	Photoplot	Barnacles		32.667326	-117.245159	0.144025	16.76
B4	259	Photoplot	Barnacles		32.667239	-117.245046	0.118495	16.92
B5	260	Photoplot	Barnacles		32.667113	-117.245055	0.080409	39.76
M1	245	Photoplot	Mussels		32.668002	-117.245313	0.074474	17.64
M2	246	Photoplot	Mussels		32.667916	-117.245302	0.081164	ND
M3	253	Photoplot	Mussels		32.66771	-117.245264	0.127676	22.64
M4	254	Photoplot	Mussels		32.667659	-117.245264	0.067801	23.39
M5	255	Photoplot	Mussels		32.667533	-117.245419	n/a	19.89
Pe1	249	Photoplot	Rockweed		32.667887	-117.245181	0.212161	6.64
Pe2	251	Photoplot	Rockweed		32.667863	-117.245207	0.147188	26.14
Pe3	252	Photoplot	Rockweed		32.6678	-117.245139	0.054098	14.39
Pe4	258	Photoplot	Rockweed		32.667253	-117.2451	0.080494	13.76
Pe5	265	Photoplot	Rockweed		32.667203	-117.24502	0.087944	15.59
Po1	275N	Photoplot	Goose Barnacles		32.667895	-117.245014	0.148883	58.39
Po2	275C	Photoplot	Goose Barnacles		32.667881	-117.245016	0.094434	54.64
Po3	274N	Photoplot	Goose Barnacles		32.667235	-117.244918	0.182115	41.26
Po4	274S	Photoplot	Goose Barnacles		32.667157	-117.244922	0.094743	69.76
Po5	273N	Photoplot	Goose Barnacles		32.667049	-117.244838	0.163687	62.51
Po6	273S	Photoplot	Goose Barnacles		32.667007	-117.244824	0.141477	64.26
T1	244	Line Transect	Red Algal Turf	N	32.668294	-117.245069	0.074744	2.14
				C	32.668251	-117.245063	0.097741	9.14
				S	32.668207	-117.245056	0.153475	15.14
T2	270	Line Transect	Red Algal Turf	N	32.667307	-117.245346	0.072159	5.39
				C	32.667261	-117.245331	0.114567	3.64
				S	32.667223	-117.245314	0.057492	4.89
G3	267	Line Transect	Surfgrass	N	32.668326	-117.245192	n/a	-4.87
				C	32.668281	-117.245188	n/a	ND
				S	32.668234	-117.245181	n/a	-3.37
G4	271	Line Transect	Surfgrass	N	32.667277	-117.245433	n/a	3.39
				C	32.667233	-117.245426	n/a	ND
				S	32.667187	-117.245418	n/a	3.14
K5	268	Line Transect	Boa Kelp	N	32.668323	-117.245207	n/a	-4.12
				C	32.668277	-117.245208	n/a	-4.37
				S	32.668232	-117.245208	n/a	-1.62
K6	272	Line Transect	Boa Kelp	N	32.667314	-117.245521	n/a	-0.87
				C	32.667275	-117.245496	n/a	ND
				S	32.667236	-117.245469	n/a	4.64

Table 10. List of Zone III monitoring plots from the Cabrillo National Monument Rocky Intertidal Monitoring Program. Tidal height measured in inches above MLLW. ND=not determined, n/a=not applicable (measurement is an estimate), Std. Dev.=the standard deviation of the GPS measurements. Standard deviation of the tidal height measurement is approximately 4 inches. See Appendix E for tidal height determination methodology.

CRIMP Plots with Locations--Zone III								
Plot ID	**Site ID**	**Plot Type**	**Target Species**	**Bolt**	**Lat. (°N)**	**Long. (°W)**	**Std. Dev.**	**Tidal Height (inches)**
L1	13	Circular Plot	Owl Limpets		32.665286	-117.243425	0.172549	83.75
L2	26	Circular Plot	Owl Limpets		32.664493	-117.24267	0.114492	48.51
L3	21	Circular Plot	Owl Limpets		32.664446	-117.24261	0.155677	42.26
L4	19	Circular Plot	Owl Limpets		32.664412	-117.242608	0.101589	40.51
L5	18	Circular Plot	Owl Limpets		32.664365	-117.242586	0.13288	58.76
L6	11	Circular Plot	Owl Limpets		32.664326	-117.242424	0.157266	56.01
B1	3	Photoplot	Barnacles		32.66503	-117.243188	0.105446	32.00
B2	16	Photoplot	Barnacles		32.665011	-117.243177	0.125486	30.00
B3	29	Photoplot	Barnacles		32.66468	-117.242701	0.109777	49.01
B4	30	Photoplot	Barnacles		32.664664	-117.242703	0.092104	40.51
B5	20	Photoplot	Barnacles		32.66443	-117.242613	0.148332	44.26
M1	24	Photoplot	Mussels		32.664445	-117.242618	0.204238	35.51
M2	15	Photoplot	Mussels		32.664407	-117.242596	0.070133	28.98
M3	14	Photoplot	Mussels		32.664389	-117.242589	0.159721	43.51
M4	17	Photoplot	Mussels		32.664328	-117.242507	0.147409	36.51
M5	12	Photoplot	Mussels		32.66432	-117.242489	0.076173	42.01
Pe1	9	Photoplot	Rockweed		32.664664	-117.242621	0.125812	29.26
Pe2	10	Photoplot	Rockweed		32.664683	-117.242576	0.171752	27.26
Pe3	28	Photoplot	Rockweed		32.664625	-117.242681	0.153146	24.01
Pe4	27	Photoplot	Rockweed		32.664624	-117.242656	0.100087	30.51
Pe5	25	Photoplot	Rockweed		32.664466	-117.242651	0.120529	25.26
Po1	269N	Photoplot	Goose Barnacles		32.665606	-117.243656	0.216137	64.00
Po2	269S	Photoplot	Goose Barnacles		32.66556	-117.243615	0.12321	91.75
Po3	196	Photoplot	Goose Barnacles		32.665383	-117.243462	0.455776	69.75
Po4	196S	Photoplot	Goose Barnacles		32.665349	-117.243461	0.444158	85.25
Po5	023N	Photoplot	Goose Barnacles		32.665038	-117.242851	0.265373	59.75
Po6	023S	Photoplot	Goose Barnacles		32.665024	-117.242858	0.044647	55.00
T1	1	Line Transect	Red Algal Turf	N	32.665846	-117.244598	0.1341	40.00
				C	32.665808	-117.244576	0.10494	37.50
				S	32.665765	-117.24455	0.220791	29.25
T2	8	Line Transect	Red Algal Turf	N	32.665691	-117.244137	0.106055	31.75
				C	32.665645	-117.244123	0.071978	31.50
				S	32.665601	-117.244109	0.060929	29.50
G3	7	Line Transect	Surfgrass	N	32.665896	-117.244391	0.131219	30.25
				C	32.665869	-117.244432	n/a	27.00
				S	32.665843	-117.244473	0.128153	29.00
G4	5	Line Transect	Surfgrass	N	32.665821	-117.244485	0.154237	32.25
				C	32.665768	-117.244475	0.109003	29.00
				S	32.665733	-117.244476	0.119849	26.75
K5	2	Line Transect	Boa Kelp	N	32.665747	-117.244657	n/a	26.75
				C	32.665701	-117.244652	n/a	ND
				S	32.665657	-117.244646	n/a	24.75
K6	4	Line Transect	Boa Kelp	N	32.665567	-117.244624	n/a	4.73
				C	32.665526	-117.244641	n/a	4.23
				S	32.665481	-117.24466	n/a	1.23

Table 11. Number of bird/visitor censuses conducted as part of the Cabrillo Rocky Intertidal Monitoring Program (CRIMP) from 1990 through May 2004 by (A) month and year and (B) weekday and holidays[11]. ND=No data, - = 0. Data were collected after June 2004, but were not included in this analysis.

A.

Year	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
1990	-	2	-	-	-	-	-	-	-	-	3	13	18
1991	17	9	9	4	-	-	-	-	1	1	5	4	50
1992	7	11	6	5	1	-	-	-	-	2	9	9	50
1993	12	18	6	3	-	-	-	1	4	11	10	17	81
1994	15	11	17	7	2	1	-	-	3	7	14	15	92
1995	10	12	12	2	3	1	-	-	4	5	8	4	61
1996	5	10	14	7	-	-	-	-	1	2	4	6	49
1997	9	9	7	4	2	-	-	-	-	3	3	3	40
1998	8	9	12	5	-	-	-	-	-	1	5	10	50
1999	9	5	8	10	1	-	-	-	-	2	7	8	50
2000	9	10	13	8	3	-	-	-	-	2	5	7	57
2001	9	9	9	6	4	-	-	-	-	2	7	9	55
2002	8	12	10	10	1	-	-	-	-	-	7	7	55
2003	12	10	17	10	4	-	-	-	-	2	6	8	69
2004	12	13	16	12	3	ND	ND	ND	ND	ND	ND	ND	56
TOTAL	142	150	156	93	24	2	0	0	13	40	93	120	833

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B.

Weekday	Not Holiday	Holiday	TOTAL
Sunday	106	22	128
Monday	109	20	129
Tuesday	106	6	112
Wednesday	107	4	111
Thursday	110	10	120
Friday	104	8	112
Saturday	108	13	121
TOTAL	750	83	833

[11] Holidays were defined as follows. All days between 12/24 and 1/1 were considered a holiday. The Thanksgiving holiday included the official Thursday, as well as the following Friday, Saturday, and Sunday. "Holiday Weekends", those which are always scheduled for a Monday (i.e. Martin Luther King Jr. Day, President's Day, Memorial Day, and Labor Day) included Saturday, Sunday and Monday as the holiday weekend. When Independence Day and Veteran's Day fell on a Tuesday, Wednesday or Thursday, only the actual holiday was included. If either of these two holidays fell on a Monday or Friday, that day in addition to the closest Saturday and Sunday were included as the holiday weekend. If they fell on a Saturday, the Friday and Sunday on either side were considered a holiday weekend; if they fell on a Sunday, the Saturday and Monday were considered a holiday weekend.

Table 12. Bird taxa identified during bird censuses conducted as part of the Cabrillo Rocky Intertidal Monitoring Program (CRIMP) from 1990 through May 2004, including categories used for analyses in this report and total number of individuals counted.

Bird Common Name	Scientific Name	Category	Total Counted
Black Phoebe	*Sayornis nigricans*	Other	57
Black Turnstone	*Arenaria melanocephala*	Shore Birds	2181
Black-bellied Plover	*Pluvialis squatarola*	Shore Birds	791
Bonaparte's Gull	*Larus philadelphia*	Sea Birds	1
California Gull	*Larus californicus*	Sea Birds	1776
Common Merganser	*Mergus merganser*	Other	2
Cormorant	*Phalacrocorax spp.*	Sea Birds	47
Double-crested Cormorant	*Phalacrocorax auritus*	Sea Birds	54
Elegant Tern	*Sterna elegans*	Sea Birds	36
European Starling	*Sturnus vulgaris*	Other	71
Forster's Tern	*Sterna forsteri*	Sea Birds	8
Great Blue Heron	*Ardea herodias*	Wading Birds	445
Great Egret	*Ardea alba*	Wading Birds	153
Grebe	Podicipedidae	Other	1
Green Heron	*Butorides virescens*[12]	Wading Birds	1
Heermann's Gull	*Larus heermanni*	Sea Birds	632
Herring Gull	*Larus argentatus*	Sea Birds	126
Kingfisher	*Ceryle alcyon*[13]	Other	2
Least Sandpiper	*Calidris minutilla*	Shore Birds	1
Mallard	*Anas platyrhynchos*	Other	2
Marbled Godwit	*Limosa fedoa*	Shore Birds	968
Merganser	Anatinae	Other	18
Mew Gull	*Larus canus*	Sea Birds	30
Mocking Bird	Mimidae	Other	1
Osprey	*Pandion haliaetus*	Other	2
Oyster Catcher	*Haematopus spp.*	Sea Birds	7
Pelican	*Pelecanus spp.*	Sea Birds	709
Red-breasted Merganser	*Mergus serrator*	Other	1
Ring-billed Gull	*Larus delawarensis*	Sea Birds	354
Royal Tern	*Sterna maxima*	Sea Birds	17
Ruddy Turnstone	*Arenaria interpres*	Shore Birds	917

[12] A green-backed heron was recorded in one count, but it is believed to have been a green heron. The green-backed heron (*Butorides striatus*) is a close relative of the green heron (*Butorides virescens*) found mainly in Southern Africa; some believe they are the same species.

[13] Assumed to be a belted kingfisher since it is the only species found in San Diego County.

Bird Common Name	Scientific Name	Category	Total Counted
Sanderling	*Calidris alba*	Shore Birds	270
Say's Phoebe	*Sayornis saya*	Other	2
Snowy Egret	*Egretta thula*	Wading Birds	2165
Sparrow	Passeriformes	Other	1
Spotted Sandpiper	*Actitis macularius*	Shore Birds	744
Surf Bird	*Aphriza virgata*	Shore Birds	20
Tern	Sterninae	Sea Birds	1672
Unidentified Bird (non-gull)		Other	101
Unidentified Gull	Larinae	Sea Birds	6572
Wandering Tattler	*Heteroscelus incanus*	Shore Birds	645
Western Grebe	*Aechmophorus occidentalis*	Other	1
Western Gull	*Larus occidentalis*	Sea Birds	8546
Western Sandpiper	*Calidris mauri*	Shore Birds	1
Whimbrel	*Numenius phaeopus*	Shore Birds	453
White Crowned Sparrow	*Zonotrichia leucophrys*	Other	1
Willet	*Catoptrophorus semipalmatus*	Shore Birds	1239
Unspecified (earlier data)		Sea Birds	14404
Unspecified (earlier data)		Shore Birds	6887
Unspecified (earlier data)		Wading Birds	1627
TOTAL			54762

Table 13. List of volunteers and staff participating in the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP) from 1990 through 2005.

Last Name	First Name	First Date	Last Date	Total Days
Abella	Karen	3/8/2001	10/25/2003	3
Adams	Craig	3/18/2003	3/18/2003	1
Adessi	Loana	11/29/1990	11/21/1992	3
Aguillar	Nancy	4/2/1997	3/26/1998	6
Aguirre	Marrissa	11/3/1991	11/3/1991	1
Akradi	Abram	3/15/2003	3/15/2003	1
Allen	Jeff	3/14/1999	3/19/2000	11
Allen	S.	10/15/1993	10/16/1993	2
Alstatt	Jessie	4/12/1992	11/22/1996	3
Anczak	Alan	4/3/1997	4/3/1997	1
Anderson	Chris	11/10/2000	11/10/2000	1
Anderson	Rosalynn	3/16/2004	3/19/2004	3
Andrews	Fred	4/12/1992	10/5/1994	2
Aries	David	11/3/2002	11/3/2002	1
Asman	Chris	11/21/1992	11/21/1992	1
Ball	Jon	3/25/1998	3/27/1998	2
Ball	Mike	11/3/2002	11/3/2002	1
Barling	Aaron	3/6/1993	3/6/1993	1
Barsam	Brooke	3/5/2001	3/8/2001	2
Barwick	Kelvin	11/10/2000	11/10/2000	1
Basch	Larry	3/6/1994	3/6/1994	1
Batherson	Barbara	4/11/1992	4/11/1992	1
Becker	Bonnie	11/2/1998	3/7/2005	68
Bedford	Bob	10/6/1994	10/6/1994	1
Behrens	Jim	10/17/2001	11/12/2004	8
Benjamin	Jamie	3/2/2000	3/19/2000	4
Benjamin	Jennifer	3/15/1999	3/15/1999	1
Beyrer	Bob	11/30/1990	3/8/1994	2
Bognall	Shane	11/23/1996	11/23/1996	1
Bond	Dave	4/13/1992	4/13/1992	1
Bower	Anne	10/7/1994	10/7/1994	1
Bowker	Dane	4/5/2001	4/5/2001	1
Boyd	Lorraine	10/16/1993	10/16/1993	1
Bracci	Stephanie	11/12/2004	11/14/2004	3
Brandt	Erin	11/12/2004	11/14/2004	3
Brown	Chris	10/15/1997	3/4/2000	5
Brown	Ed	3/24/1991	3/24/1991	1
Burgan	Anna	4/2/1997	10/15/1997	2
C.	Joe	11/30/1990	11/30/1990	1
Cain	Corinthia	10/26/2003	10/26/2003	1
Calvert	Julie	11/4/2002	11/4/2002	1
Cameron	Lane	11/2/2002	11/5/2002	4
Canterberry	Samantha	3/15/2003	10/26/2003	3
Cantrell	George	11/22/1996	11/22/1996	1
Caprio	Mike	11/30/1990	11/30/1990	1
Catton	Cynthia	11/3/2002	3/16/2004	2
Clark	Becky	10/15/2001	3/8/2002	8
Claypool	Dave	12/1/1990	12/1/1990	1
Clement	Brian	11/11/2000	11/11/2000	1
Cline	Dan	11/4/1991	11/4/1991	1
Compton	Andrea	11/22/1996	3/7/2005	39
Compton	Bobby	11/23/1996	3/5/2005	21
Conlin	Mark	2/25/1995	2/25/1995	1
Cooper	Lisa	11/3/2002	11/3/2002	1
Craig	Kai	3/25/1998	3/27/1998	3
Currie	Rya	11/22/1996	11/22/1996	1
Curtis	Alex	11/11/2000	11/3/2002	2

Last Name	First Name	First Date	Last Date	Total Days
Daddario	Sunshine	3/2/2000	3/3/2000	2
Dant	Bill	11/3/2002	11/3/2002	1
Dargis	Melissa	3/7/1994	2/25/1995	3
Davis	Arwen	6/2/1992	6/4/1992	3
Davis	Dorothy	3/24/1991	4/11/1992	2
Davis	E.	3/7/1993	3/7/1993	1
Davis	Gary	2/5/1990	10/14/1997	43
Dawes	Linda	11/21/1992	11/21/1992	1
Dayton	Paul	4/11/1992	4/11/1992	1
DeMartini	Tim	3/9/2002	3/10/2002	2
Detweiler	Paul	3/6/1994	3/6/1994	1
Dexter	Debbie	3/7/1993	3/7/1993	1
Dillon	Debra	11/24/1996	11/24/1996	1
Dilton	Dave	11/24/1996	11/24/1996	1
Donegan	Jassie	10/16/1993	10/16/1993	1
Downy	Tim	4/5/1997	4/6/1997	2
Duffield	Mark	3/10/2002	11/5/2002	2
Duffield (Luas)	Tiffany	3/8/2002	3/7/2005	23
Duffy	Amy	3/8/1993	3/8/1993	1
Duggan	Ross	4/11/1992	11/23/1992	3
Duke	Ned	11/4/1991	11/4/1991	1
Dulac	Paul	4/6/1997	4/6/1997	1
Dummand	Lee	3/6/1994	3/8/1994	2
Duran	R.	2/3/1995	2/25/1995	2
Edquid	Ely	10/14/1993	10/16/1993	2
Edwards	Claude	2/8/1990	2/8/1990	1
Elbert	Heather	10/15/1997	10/15/1997	1
Engle	Jack	2/5/1990	4/5/1997	41
Ewanchuk	Pat	11/22/1992	11/23/1992	2
Ewers	Kevin	3/6/1993	3/6/1993	1
Fenberg	Phil	11/2/2002	3/17/2003	3
Ferguson	J.P.	11/3/1998	11/3/1998	1
Ferguson	Meghan	3/4/2000	3/4/2000	1
Fish	Rebecca	10/16/1993	10/16/1993	1
Fisher	Bill	11/21/1992	11/22/1992	2
Fodrie	Joel	10/17/2001	10/17/2001	1
Follin	Johnny	3/16/2004	3/19/2004	3
Foss	Ted	11/11/2000	11/11/2000	1
Fradkin	Steve	11/14/2001	11/14/2001	1
Frane	Summer	4/5/1997	4/6/1997	2
Funke	Christina	11/26/1999	11/26/1999	1
G.	Barry	2/5/1990	2/5/1990	1
Gabler	Walt	3/24/1991	3/24/1991	1
Galas	Ryan	3/7/1993	3/7/1993	1
Gallenstein	Stacy	10/25/2003	10/25/2003	1
Gartman	Robin	4/13/1992	3/7/1993	3
Garwood	R.J.	11/22/1992	11/22/1992	1
Gatson	C.Q.	10/5/1994	10/5/1994	1
Gladden	April	2/10/1990	2/10/1990	1
Gladden	Bob	2/5/1990	4/3/1997	33
Glatzhoter	Anette	3/6/2005	3/6/2005	1
Glen	Shelly	11/22/1992	11/22/1992	1
Glennon	Tim	11/11/2000	11/11/2000	1
Goetze	Erica	3/17/2003	3/17/2003	1
Goodingham	Holly	3/18/2004	3/18/2004	1
Goris	Jim	3/7/1993	3/7/1993	1
Gramlich	Constance	11/30/1990	2/25/1995	13
Gray	Tom	11/4/1991	11/4/1991	1
Gregory	Michelle	10/25/2003	3/6/2005	13
Grenda	Chet	3/7/1994	3/7/1994	1
Growney	Valerie	10/17/2001	12/17/2001	2

Last Name	First Name	First Date	Last Date	Total Days
Guerero	Melencio	3/24/1991	3/24/1991	1
Gutierrez	Lynelle	3/19/2004	3/19/2004	1
Gutoff	David	4/12/1992	3/8/1993	4
Guy	Leonard	11/12/2004	11/14/2004	2
Hamner	Charles	12/1/1990	12/1/1990	1
Handalian	Brian	3/5/2005	3/6/2005	2
Harris	Pierce	11/22/1996	4/6/2001	29
Hauth	Nancy	2/26/1995	2/26/1995	1
Hauth	Will	2/26/1995	2/26/1995	1
Hayes	Donald	10/6/1994	10/7/1994	2
Hayes	Emily	10/15/1993	10/15/1993	1
Heilprin	Danny	11/21/1992	3/7/1994	2
Heintzelman	Sara	11/10/2000	10/17/2001	5
Henrick	Michael	11/3/1991	11/3/1991	1
Herring	George	3/8/1994	3/26/1998	3
Herring (Burkett)	Anita	10/14/1997	10/26/2003	24
Herrmann	Richard	3/23/1991	3/23/1991	1
Heusner	Patricia	11/12/2004	11/12/2004	1
Hicks	Jaime	3/9/2002	3/10/2002	2
Hiland	Kim	11/3/2002	11/3/2002	1
Houston	Diane	11/21/1992	11/21/1992	1
Hubbard	David	4/2/1997	4/5/1997	3
Huber	Adrienne	11/12/2000	10/24/2003	10
Huff	Tonya	10/15/2001	3/7/2005	21
Hughes	Dayla	3/18/2004	3/18/2004	1
Hunter	David	4/5/1997	4/6/1997	2
Hyde-Keller	Orya	3/15/2003	3/15/2003	1
Hyduk	Sandra	10/5/1994	10/5/1994	1
Ituarte	Dan	3/26/1991	3/26/1991	1
Jackintell	Lori	11/4/1991	11/4/1991	1
Janousek	Chris	11/26/1999	11/26/1999	1
Jarett	Jessica	3/16/2004	3/18/2004	3
Johnson	Hope	3/15/2003	3/6/2005	4
Jones	Emily	11/16/2001	3/12/2002	4
Josetasky	Fred	11/4/1991	11/4/1991	1
Kalisher	Michelle	10/26/2003	10/26/2003	1
Kangas	Cynthia	11/23/1996	11/24/1996	2
Kay	Sandy	11/22/1996	11/23/1996	2
Kepper	Jeff	3/26/1991	3/26/1991	1
Kim	Katherine	4/2/1997	11/11/2000	4
Kinan	Irene	10/7/1994	10/7/1994	1
King	Ryan	10/15/1993	10/15/1993	1
Knight	Ashley	10/17/2001	3/6/2005	12
Koomen	Larry	11/23/1999	11/23/1999	1
Kranz	Susan	11/24/1996	11/24/1996	1
Kroell	Paul	10/6/1994	10/6/1994	1
Kroellian	Manny	10/6/1994	10/6/1994	1
Kruse	Fred	3/25/1991	3/25/1991	1
Lada	Genevieve	11/3/2002	11/3/2002	1
Lagos	Steve	11/5/1991	6/3/1992	3
Lameck	Marosi	3/15/2003	3/15/2003	1
Lane	Marty	11/28/1990	11/22/1999	14
Leland	Adam	10/17/2001	10/17/2001	1
Lerch	Melissa	11/21/1999	11/21/1999	1
Levesque	Vincent	11/3/2002	11/3/2002	1
Lloyd	Roni	11/4/1991	11/4/1991	1
Long	Mark	3/25/1991	3/25/1991	1
Love	Debbie	10/16/1993	10/16/1993	1
Madrid	William	11/21/1992	11/21/1992	1
Marquez	Marcy	11/5/2002	3/7/2005	2
Martin	Carol	10/24/2003	3/16/2004	2

Last Name	First Name	First Date	Last Date	Total Days
Martin	Dan	2/3/1995	2/26/1995	3
Martin	Mysti	11/12/2004	3/7/2005	6
Martin Jr.	Richard	3/18/2003	3/18/2003	1
Martinez	Ricardo	4/11/1992	4/13/1992	2
Marugg	James	11/2/1998	11/2/1998	1
Massarweh	Anthony	10/24/2003	10/24/2003	1
Mattivi	Mark	10/24/2003	10/24/2003	1
McClelland	Krissy	11/2/1998	11/3/1998	2
McCormick	Rachel	3/5/2001	3/8/2001	2
McCrary	Kim	3/15/2003	3/7/2005	10
McCullough	Roger	4/2/1997	4/2/1997	1
McEntee	Sean	3/6/1993	3/6/1993	1
McKenna	Megan	10/25/2003	10/25/2003	1
McMillan	Pat	10/26/2003	10/26/2003	1
Mellor	Zach	10/25/2003	10/25/2003	1
Mellor (Fajardo)	Liliana	10/15/2001	10/25/2003	9
Mendelsohn	Mark	11/14/2004	11/14/2004	1
Mendelsohn (Pease)	Krista	11/20/1999	11/14/2004	20
Meyer	Joe	11/24/1999	11/12/2000	3
Miller	Jason	11/3/1991	11/3/1991	1
Miller	Sandy	11/30/1990	11/30/1990	1
Miller	Will	11/22/1996	11/22/1996	1
Mills	Mariah	11/13/2004	11/14/2004	2
Millsap	Christy	11/3/2002	11/3/2002	1
Molle	Kristen	3/19/2004	3/19/2004	1
Morghen	Anna	3/9/2002	3/9/2002	1
Muehleman	Cindy	3/25/1991	3/25/1991	1
M*Ulva*nry	Debra	11/30/1990	11/30/1990	1
Munger	Lisa	3/16/2004	11/13/2004	4
Munoz	Rosemarie	10/6/1994	10/6/1994	1
Nellman	Steve	3/8/2001	3/8/2001	1
Nilsson	Peo	2/6/1990	2/10/1990	5
Nizuski	Anna	6/3/1992	6/3/1992	1
Noble	Jenny	4/5/1997	4/6/1997	2
Norris	Dot	11/3/1991	10/15/1993	7
North	Wheeler	3/7/1993	3/7/1993	1
O'Brian	Heather	10/14/1997	10/15/1997	2
Olmstead	Scott	11/12/2004	11/14/2004	3
Oortgiese	Adriana	10/16/1993	10/16/1993	1
Opperman	Josh	3/10/2002	3/10/2002	1
Ortero	Julie	10/16/1993	10/16/1993	1
Osaka	Elizabeth	11/4/1991	11/4/1991	1
Otero	Jose	10/16/1993	10/16/1993	1
Owens	Stephanie	3/8/2002	11/3/2002	3
Palmer	Joyce	10/16/1993	10/16/1993	1
Palumbo	Michelle	3/16/2004	11/14/2004	7
Pander	Miriam	11/30/1990	11/30/1990	1
Parry	Sally	3/4/2000	11/10/2000	2
Partridge	Todd	11/23/1996	3/10/2002	13
Peterson	Jeff	4/11/1992	4/13/1992	3
Picket	Nancy	4/5/1997	4/5/1997	1
Piercy	Susan	11/2/1998	11/12/2004	11
Pister	Ben	3/15/2003	10/25/2003	3
Platter-Reiger	Mary	11/23/1996	11/23/1996	1
Prentice	Teo	3/6/1993	3/6/1993	1
Presnell	Julie	11/30/1990	11/30/1990	1
Proffit	Chris	3/5/2001	3/8/2001	2
Qashu	Susie	11/12/2000	11/13/2000	2
Rader	Unknown	10/15/1993	10/15/1993	1
Randall	Bob	11/28/1990	11/29/1990	2
Ray	Rusty	3/6/1993	3/6/1993	1

Last Name	First Name	First Date	Last Date	Total Days
Rice	Laura	11/3/1991	11/3/1991	1
Richards	Dan	2/5/1990	10/14/1997	7
Rin	Arna	11/21/1992	11/21/1992	1
Robinson	Dean	10/26/2003	10/26/2003	1
Rodgers	Jane	11/22/1996	11/23/1996	2
Rodgers	Terry	10/15/1997	10/15/1997	1
Rogers	Jennifer	11/22/1996	11/2/1998	6
Root	Casey	3/16/2004	3/19/2004	3
Rosner	Bettina	3/15/2003	3/6/2005	4
Rothenberg	Camille	11/23/1996	11/22/2003	18
Rowley	Kylene	11/30/1990	11/30/1990	1
Ruttedge	Patricia	11/24/1996	11/24/1996	1
Santana	Sam	11/28/1990	11/28/1990	1
Santo-Pietro	Gary	10/25/2003	10/25/2003	1
Schieler	Beth	4/5/1997	4/5/1997	1
Schultheis	Charles	3/5/2005	3/5/2005	1
Schultheis	Daniel	3/5/2005	3/5/2005	1
Schultheis	Elise	3/5/2005	3/5/2005	1
Schultheis	JoAnn	3/5/2005	3/5/2005	1
Scott	Michelle	3/6/2005	3/6/2005	1
Searey	Seth	3/24/1991	3/24/1991	1
Seitz	Natalie	3/6/2005	3/6/2005	1
Selkin	Peter	11/12/2000	3/17/2003	5
Shallenberger	Lynn	11/23/1992	11/23/1992	1
Sheldon	Jennifer	3/17/1999	3/17/1999	1
Sheldon	Mark	11/2/1998	11/2/1998	1
Shell	Karen	11/11/2000	11/11/2000	1
Shinn	Annette	3/10/2002	3/10/2002	1
Sick	Deanna	3/15/2003	3/15/2003	1
Simmons	Derek	3/7/1994	3/7/1994	1
Simmons	Rachel	3/19/2004	3/19/2004	1
Sing	Carol	3/6/1993	3/6/1993	1
Smart	Jason	11/11/2000	11/11/2000	1
Smart	Nora	11/11/2000	11/11/2000	1
Smith	Tracie	2/9/1990	2/9/1990	1
Stanaway	Kathryn	3/15/2003	3/15/2003	1
Stebbins	Tim	6/2/1992	6/2/1992	1
Stein	Debbie	11/24/1996	4/6/1997	3
Stevens	Chris	3/24/1991	3/24/1991	1
Stiler	Margot	10/16/2001	10/16/2001	1
Stiles	Margot	10/18/2001	11/3/2002	2
Stone	Rachel	11/21/1992	11/21/1992	1
Stoneham	Walt	4/11/1992	4/11/1992	1
Streeby	Kelsey	3/5/2005	3/5/2005	1
Sullivan	Megan	11/24/2003	11/24/2003	1
Summerfield	Amanda	3/9/2002	3/9/2002	1
Taniguchi	Darcy	3/18/2004	3/18/2004	1
Taylor	Cindy	2/25/1995	4/5/1997	4
Taylor	Steve	11/3/2002	11/3/2002	1
Tegner	Mia	4/11/1992	4/11/1992	1
Thiel	Janice	4/5/1997	4/5/1997	1
Thompson	John	11/12/2004	11/14/2004	3
Tingby	Dave	4/13/1992	4/13/1992	1
Toline	Anna	10/25/2003	10/25/2003	1
Tromborg	Marianne	3/6/1993	3/6/1993	1
Tuck	Nate	11/11/2000	11/11/2000	1
Vallee	Carol Ann	3/8/2002	3/8/2002	1
Van Bonn	Bill	4/5/1997	3/9/2002	8
Vanek	Wayne	3/16/2004	3/17/2004	2
VanGundy	Roberta	2/8/1990	11/29/1990	2
VanPatton	Meleca	11/4/1991	11/4/1991	1

Last Name	First Name	First Date	Last Date	Total Days
Veirs	Steve	6/2/1992	6/2/1992	1
Velarde	Ron	11/5/1991	11/23/1992	4
Velasu	Gina	3/24/1991	3/24/1991	1
Victoria	Laurie Anne	10/25/2003	10/25/2003	1
Vignati	Brian	11/29/1990	11/30/1990	2
Villa Clay	Pam	11/22/1996	11/23/1996	2
Von Dassow	Peter	10/15/2001	3/10/2002	3
Vucich	V.	2/25/1995	2/26/1995	2
Vygrala	Mary Beth	10/14/1993	10/14/1993	1
Wadsworth	Fred	3/6/1994	3/6/1994	1
Watson	Elise	11/12/2004	3/7/2005	6
Weber	Samantha	11/30/1990	11/16/2001	44
Wegner	Nick	10/25/2003	10/25/2003	1
Welch	Biffy	11/21/1992	11/21/1992	1
Weller	Scott	4/5/1997	4/5/1997	1
Whitcraft	Christine	10/17/2001	3/16/2004	2
White	Mary Beth	3/24/1991	3/24/1991	1
Wilcox	Eric	3/15/2003	3/15/2003	1
Williams	Karin	3/6/2005	3/7/2005	2
Wilson	Joe	10/5/1994	10/6/1994	2
Wood	Lisa	4/6/1997	4/6/1997	1
Yates	Jason	3/5/2005	3/5/2005	1
Young	Dave	3/23/1991	3/24/1991	2
Youngerman	Shala	11/4/1991	11/4/1991	1
Younkin	Debbie	3/26/1998	3/27/1998	2
Zillner	Joseph	11/21/1992	11/21/1992	1
Zmarzly	Debbie	4/13/1992	11/23/1992	2

Table 14. Results of repeated measures ANOVA of circular plot, photoplot, and transect data collected from 1990-2005 as part of the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP). Significant *p* values at the 0.05 level are indicated in bold type; significant *p* values at the 0.10 level are shown in italic type. Photoplot taxa were examined only in their target plots (e.g. mussels only in mussel plots, etc.). Transect taxa were lumped with all transects in a specific zone (e.g. surfgrass in all transects). All owl limpet data are exclusive of Zone II L4, L7, and L8 due to an incomplete dataset.

	Repeated Measures ANOVA								
	Zone			Time			Zone*Time		
	F	df	*p*	F	df	*p*	F	df	*p*
Circular Plots									
Owl limpet abundance (#/plot)	1.225	2	0.323	2.087	30	**0.001**	2.162	60	**<0.001**
Owl limpet average size (mm)	1.692	2	0.220	5.767	30	**<0.001**	0.886	60	0.713
Number of owl limpets in smallest size class (15-25 mm) (#)	3.979	2	**0.043**	4.109	30	**<0.001**	1.854	60	**<0.001**
Average size of 10 largest owl limpets (mm)	1.599	2	0.246	1.830	30	**0.006**	0.611	60	0.989
Photoplots									
Acorn barnacles	4.121	2	**0.043**	11.266	30	**<0.001**	1.590	60	**0.006**
Thatched barnacles	1.052	2	0.379	9.046	30	**<0.001**	0.729	60	0.932
Mussels	3.696	2	*0.056*	9.648	30	**<0.001**	12.181	60	**<0.001**
Goose barnacles	2.753	2	*0.096*	3.850	19	**<0.001**	1.941	38	**0.001**
Rockweed	2.821	2	*0.099*	4.818	30	**<0.001**	0.803	60	0.850
Transects									
Red algal turf	0.316	2	0.734	7.170	30	**<0.001**	1.559	60	**0.007**
Surfgrass	0.726	2	0.500	9.201	30	**<0.001**	1.202	60	0.155
Boa kelp	0.234	2	0.794	8.278	30	**<0.001**	0.607	60	0.991
Anemones	0.043	2	0.958	1.409	30	*0.077*	0.769	60	0.896
Sargassum weed	7.565	2	**0.005**	1.880	30	**0.004**	1.577	60	**0.006**

Table 15. Results of regression analysis of circular plot, photoplot, and transect data collected from 1990-2005 as part of the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP). Plots were averaged by zone or all zones depending on whether the Zone x Time interaction in a repeated measures ANOVA (Table 14) was significant to the 0.05 level. Linear (first order), and the second and third order polynomial slope (m), intercept (b) and goodness of fit (r^2) are shown. The resulting equations are: Linear—$y=mx+b$, 2nd order polynomial—$y=m_1x^2+m_2x+b$, 3rd order polynomial—$y=m_1x^3+m_2x^2+m_3x+b$. The simplest trend line is defined as the lowest order regression with a resulting r^2 value >0.60; this value is shown in bold type and resulting trend lines are shown in Figure 6, Figure 14, and Figure 20. Photoplot taxa were examined only in their target plots (e.g. mussels only in mussel plots, etc.). Transect taxa were lumped with all transects in a specific zone (e.g. surfgrass in all transects). All owl limpet data are exclusive of Zone II L2, L7, and L8 due to an incomplete dataset. For boa kelp and anemones, seasons when all plots had 0% cover were changed to 0.01% cover.

		Regression											
		Linear			**2nd Order Polynomial**				**3rd Order Polynomial**				
	Zone	**m**	**b**	**r^2**	**m_1**	**m_2**	**b**	**r^2**	**m_1**	**m_2**	**m_3**	**b**	**r^2**
Circular Plots													
Owl limpet abundance (#/plot)	I	1.40	35.27	0.40	-0.08	2.64	32.26	0.42	-0.03	0.51	-0.96	36.79	0.45
	II	-0.37	35.09	0.16	0.02	-0.61	35.69	0.16	0.00	-0.03	-0.33	35.33	0.16
	III	-0.84	41.02	0.46	0.00	-0.81	40.96	0.46	-0.01	0.18	-1.95	42.39	0.47
Owl limpet average size (mm)	All	-0.40	48.35	**0.74**	0.02	-0.73	49.15	0.77	0.00	0.11	-1.30	49.87	0.79
Number of owl limpets in smallest size class (15-25 mm) (#)	I	0.44	2.98	0.19	-0.04	1.04	1.50	0.21	0.00	-0.15	1.75	0.62	0.22
	II	0.07	1.60	0.08	-0.01	0.23	1.22	0.11	0.00	-0.01	0.21	1.24	0.11
	III	0.15	1.93	0.15	-0.05	0.89	0.14	0.38	0.00	-0.05	0.90	0.12	0.38
Avg. size of 10 largest owl limpets (mm)	All	-0.32	60.84	**0.61**	0.02	-0.59	61.48	0.64	0.00	-0.05	-0.19	60.98	0.65
Photoplots													
Acorn barnacles	I	0.00	9.52	0.00	-0.12	1.76	5.23	0.07	-0.03	0.66	-3.02	11.23	0.15
	II	-0.40	17.72	0.06	-0.04	0.27	16.09	0.08	-0.04	0.83	-5.08	22.82	0.22
	III	0.03	25.35	0.00	-0.21	3.18	17.70	0.07	-0.07	1.32	-6.16	29.44	0.18
Thatched barnacles	All	-0.70	16.12	0.40	0.15	-2.93	21.55	**0.67**	-0.03	0.87	-7.38	27.15	0.86
Mussels	I	2.31	6.27	**0.80**	-0.12	4.07	1.99	0.83	-0.06	1.15	-3.72	11.78	0.94
	II	-1.44	17.16	0.34	0.39	-7.36	31.58	**0.72**	-0.07	2.01	-17.28	44.05	0.91
	III	-1.99	23.23	0.58	0.39	-7.96	37.75	**0.91**	-0.05	1.47	-14.55	46.04	0.99
Goose barnacles	I	0.47	8.26	0.23	-0.27	5.99	-17.65	**0.82**	0.02	-0.96	12.57	-37.35	0.86
	II	-0.56	15.39	0.36	-0.22	3.87	-5.40	**0.77**	0.01	-0.54	6.95	-14.62	0.78
	III	-0.01	4.60	0.00	-0.03	0.67	1.40	0.16	0.01	-0.35	3.70	-7.65	0.27
Rockweed	All	0.41	64.66	0.07	0.13	-1.59	69.52	0.17	-0.02	0.49	-3.81	72.31	0.19
Transects													
Red algal turf	I	-0.57	44.32	0.18	0.12	-2.38	48.72	0.29	-0.02	0.58	-5.20	52.26	0.34
	II	-0.90	37.95	0.37	0.09	-2.27	41.27	0.43	0.01	-0.18	-0.62	39.20	0.44
	III	-1.14	53.81	0.48	-0.05	-0.41	52.03	0.50	0.04	-1.04	5.67	44.40	**0.66**
Surfgrass	All	1.33	34.45	0.42	-0.25	5.10	25.26	**0.64**	0.01	-0.44	6.28	23.78	0.64
Boa kelp	All	-0.81	11.34	0.39	0.18	-3.49	17.88	**0.68**	-0.02	0.55	-5.81	20.79	0.71
Anemones	All	-0.01	0.42	0.10	0.00	-0.03	0.47	0.12	0.00	0.03	-0.19	0.67	0.38
Sargassum weed	I	0.00	0.46	0.00	-0.01	0.13	0.14	0.02	0.00	-0.09	0.60	-0.45	0.08
	II	-0.03	1.22	0.03	0.01	-0.21	1.67	0.09	0.00	0.02	-0.27	1.75	0.10
	III	-0.01	3.95	0.00	-0.01	0.11	3.66	0.00	0.02	-0.42	2.65	0.46	0.18

Table 16. Timed search data collected from 1990 through 2005 in Zone I as part of the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP). Highlighted species are the "target" species for timed searches. ND=No data (i.e. not looked for), - = 0.

Timed Search Data Zone I

	Year	Season	**Bat Star** ***Asterina miniata***	**Knobby Star** ***Pisaster giganteus***	**Ochre Star** ***Pisaster ochraceus***	**Pink Abalone** ***Haliotis corrugata***	**Black Abalone** ***Haliotis cracherodii***	**Green Abalone** ***Haliotis fulgens***
Zone I	1990	Spring	-	-	-	-	-	1
		Fall	-	1	-	1	-	-
	1991	Spring	ND	-	-	-	-	-
		Fall	-	-	-	-	-	-
	1992	Spring	2	1	-	-	-	-
		Summer	1	1	-	-	-	-
		Fall	-	-	-	-	-	-
	1993	Spring	ND	-	-	-	-	-
		Fall	-	-	-	-	-	-
	1994	Spring	-	1	1	-	-	-
		Fall	-	-	-	-	-	-
	1995	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	1996	Fall	-	-	-	-	-	-
	1997	Spring	-	-	-	-	-	-
		Fall	ND	ND	ND	ND	ND	ND
	1998	Spring	-	1	-	-	-	-
		Fall	-	-	-	-	-	-
	1999	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2000	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2001	Spring	ND	ND	ND	ND	ND	ND
		Fall	-	-	-	-	-	-
	2002	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2003	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2004	Spring	-	1	-	-	-	-
		Fall	-	-	-	-	-	-
	2005	Spring	-	1	-	-	-	-

Table 17. Timed search data collected from 1990 through 2005 in Zone II as part of the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP). Highlighted species are the "target" species for timed searches. ND=No data (i.e. not looked for), - = 0.

Timed Search Data Zone II								
	Year	Season	**Bat Star** ***Asterina miniata***	**Knobby Star** ***Pisaster giganteus***	**Ochre Star** ***Pisaster ochraceus***	**Pink Abalone** ***Haliotis corrugata***	**Black Abalone** ***Haliotis cracherodii***	**Green Abalone** ***Haliotis fulgens***
Zone II	1990	Spring	3	1	-	-	-	-
		Fall	6	-	-	-	-	-
	1991	Spring	ND	-	-	-	-	-
		Fall	5	-	-	-	-	-
	1992	Spring	24	1	-	-	-	-
		Summer	4	-	-	-	-	1
		Fall	1	-	-	-	-	-
	1993	Spring	ND	-	-	-	-	-
		Fall	-	1	-	-	-	-
	1994	Spring	5	1	-	-	-	1
		Fall	3	-	-	-	-	-
	1995	Spring	1	-	-	-	-	-
		Fall	1	-	-	-	-	-
	1996	Fall	2	-	-	-	-	-
	1997	Spring	-	1	-	-	-	-
		Fall	ND	ND	ND	ND	ND	ND
	1998	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	1999	Spring	-	-	-	-	-	-
		Fall	-	1	-	-	-	-
	2000	Spring	2	3	-	-	-	-
		Fall	2	-	-	-	-	-
	2001	Spring	ND	ND	ND	ND	ND	ND
		Fall	-	-	-	-	-	-
	2002	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2003	Spring	-	-	-	-	-	-
		Fall	1	-	-	-	-	-
	2004	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2005	Spring	-	-	-	-	-	-

Table 18. Timed search data collected from 1990 through 2005 in Zone III as part of the Cabrillo National Monument Rocky Intertidal Monitoring Program (CRIMP). Highlighted species are the "target" species for timed searches. ND=No data (i.e. not looked for), - = 0.

Timed Search Data Zone III

	Year	Season	Bat Star *Asterina miniata*	Knobby Star *Pisaster giganteus*	Ochre Star *Pisaster ochraceus*	Pink Abalone *Haliotis corrugata*	Black Abalone *Haliotis cracherodii*	Green Abalone *Haliotis fulgens*
Zone III	1990	Spring	12	-	-	-	-	-
		Fall	18	-	-	-	-	-
	1991	Spring	ND	1	-	-	-	-
		Fall	12	-	-	-	-	-
	1992	Spring	19	-	-	-	-	-
		Summer	12	-	-	-	-	-
		Fall	7	-	-	-	-	-
	1993	Spring	ND	-	-	-	-	-
		Fall	-	-	-	-	-	-
	1994	Spring	5	1	-	-	-	-
		Fall	7	-	-	-	-	2
	1995	Spring	1	-	-	-	-	2
		Fall	2	-	-	-	-	1
	1996	Fall	1	1	-	-	-	-
	1997	Spring	-	1	-	1	-	-
		Fall	ND	ND	ND	ND	ND	ND
	1998	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	1999	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	1
	2000	Spring	2	-	-	-	-	1
		Fall	3	-	-	-	-	-
	2001	Spring	ND	ND	ND	ND	ND	ND
		Fall	-	-	-	-	-	1
	2002	Spring	-	-	-	-	-	1
		Fall	-	-	-	-	-	1
	2003	Spring	-	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2004	Spring	1	-	-	-	-	-
		Fall	-	-	-	-	-	-
	2005	Spring	-	-	-	-	-	-

Table 19. List of personnel who scored photoplot photographs as part of the Cabrillo National Monument Rocky Intertidal Monitoring Program. CHIS=Channel Islands National Park, NPS=National Park Service, UCSB=University of California Santa Barbara, UCSC=University of California Santa Cruz, CABR=Cabrillo National Monument. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

Photoplot Scorers by Season	
Event	**Scorer(s)**
SP90	David Kushner (CHIS)
FA90	David Kushner (CHIS)
SP91	David Kushner (CHIS)
FA91	David Kushner (CHIS)
SP92	Gary Davis (NPS)
SU92	Jessica Alstatt (UCSB)
FA92	Gary Davis (NPS)
SP93	Gary Davis (NPS)
FA93	Gary Davis (NPS)
SP94	Gary Davis (NPS)
FA94	Dan Martin (UCSB)
SP95	Melissa Wilson (UCSC)
FA95	Dan Martin (UCSB)
FA96	Dan Martin (UCSB)
SP97	Dan Martin (UCSB)
FA97	Dan Martin (UCSB)
SP98	Dan Martin (UCSB)
FA98	Jessica Alstatt (UCSB)
SP99	Jessica Alstatt (UCSB) and Bonnie Becker (CABR)
FA99	Bonnie Becker (CABR)
SP00	Christie Roe (UCSC)
FA00	Christie Roe (UCSC)
SP01	Christie Roe (UCSC)
FA01	Christie Roe (UCSC)
SP02	Christie Roe (UCSC)
FA02	Bonnie Becker (CABR)
SP03	Bonnie Becker (CABR)
FA03	Bonnie Becker (CABR)
SP04	Bonnie Becker (CABR), Michelle Gregory (CABR) and Tiffany Duffield (CABR)
FA04	Bonnie Becker (CABR)
SP05	Bonnie Becker (CABR)

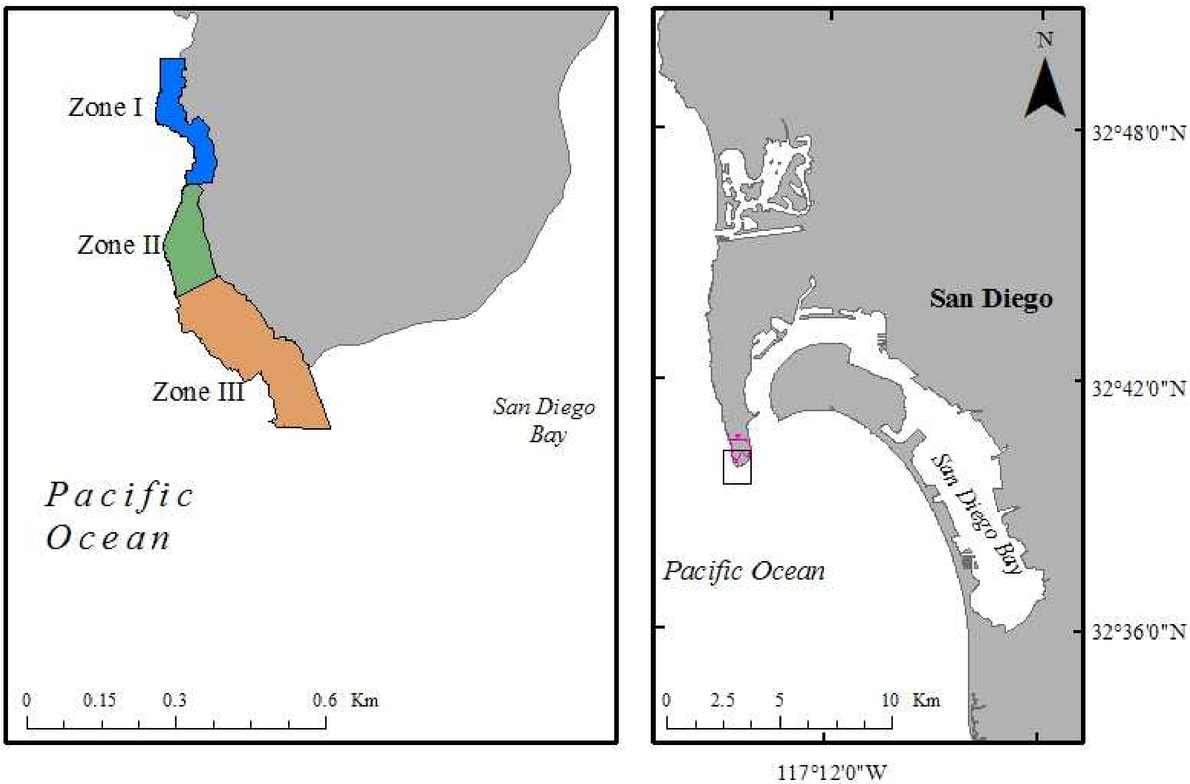


Figure 1. Map of the intertidal of Cabrillo National Monument, in San Diego, CA. The three zones of the park represent different levels of human visitation: Zone I is high use, Zone II is intermediate use, Zone III has been closed to all visitors since 1996.

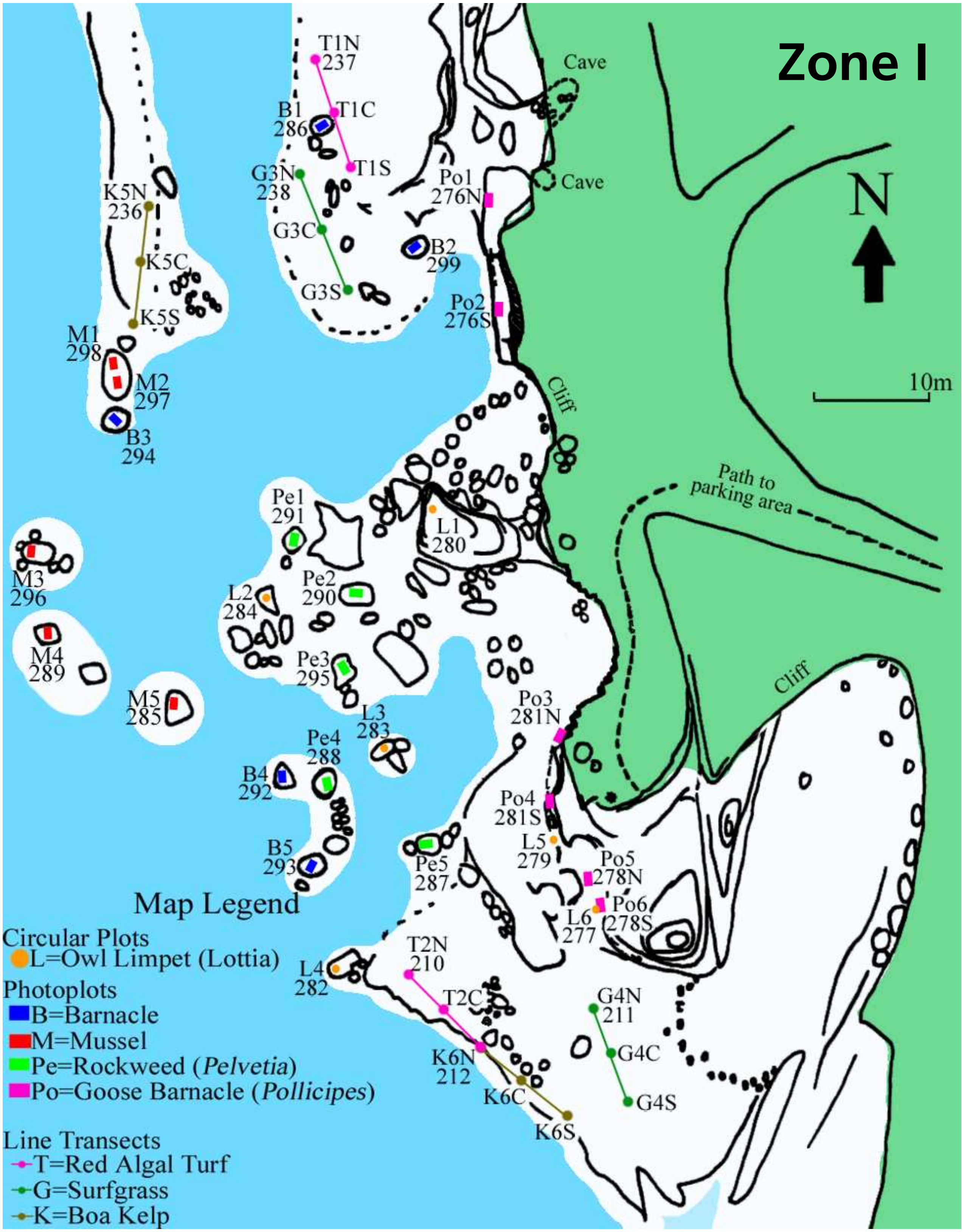


Figure 2. Map of Zone I monitoring sites for the Cabrillo Rocky Intertidal Monitoring Program (CRIMP), updated as of spring 2005.

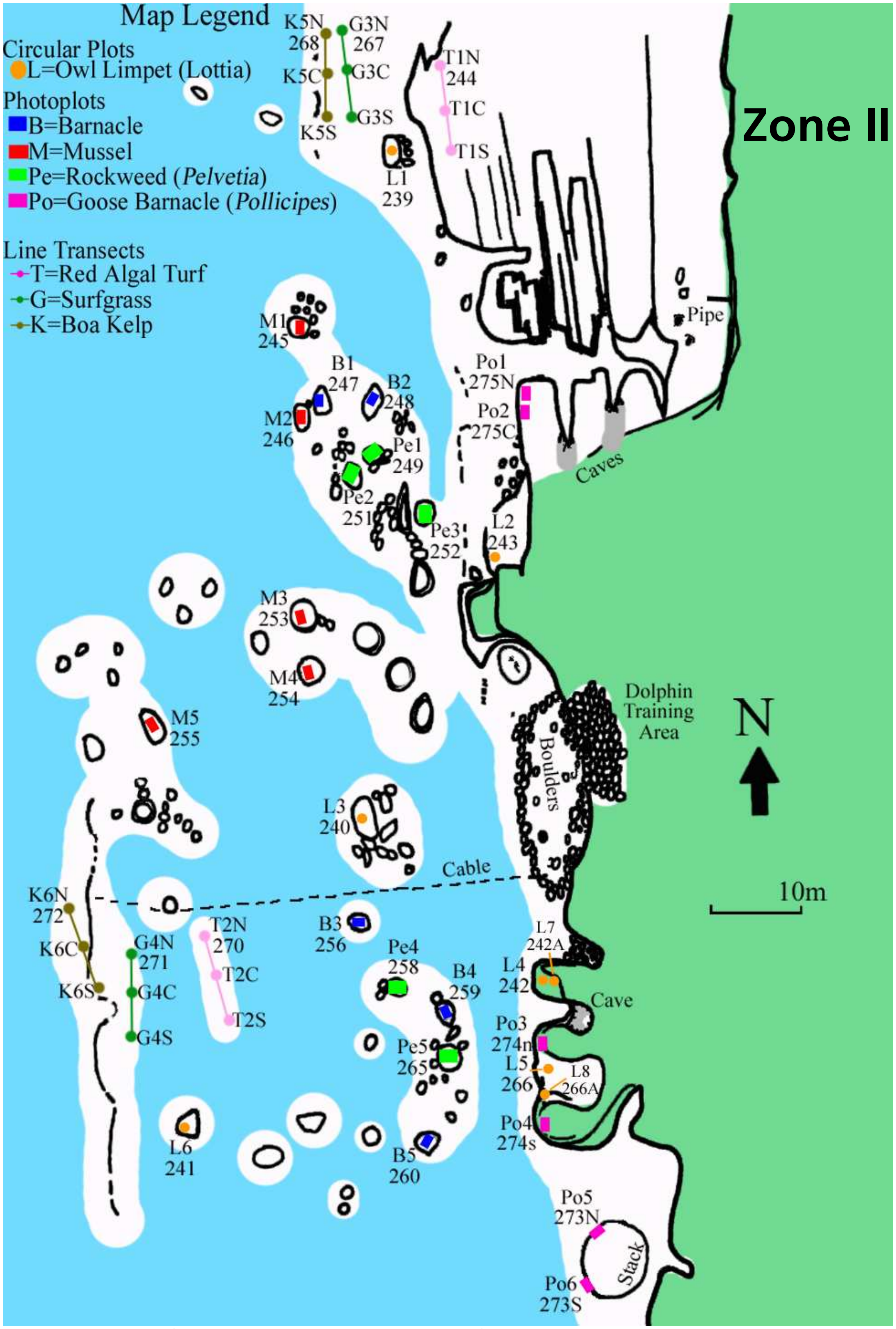


Figure 3. Map of Zone II monitoring sites for the Cabrillo Rocky Intertidal Monitoring Program (CRIMP), updated as of spring 2005.

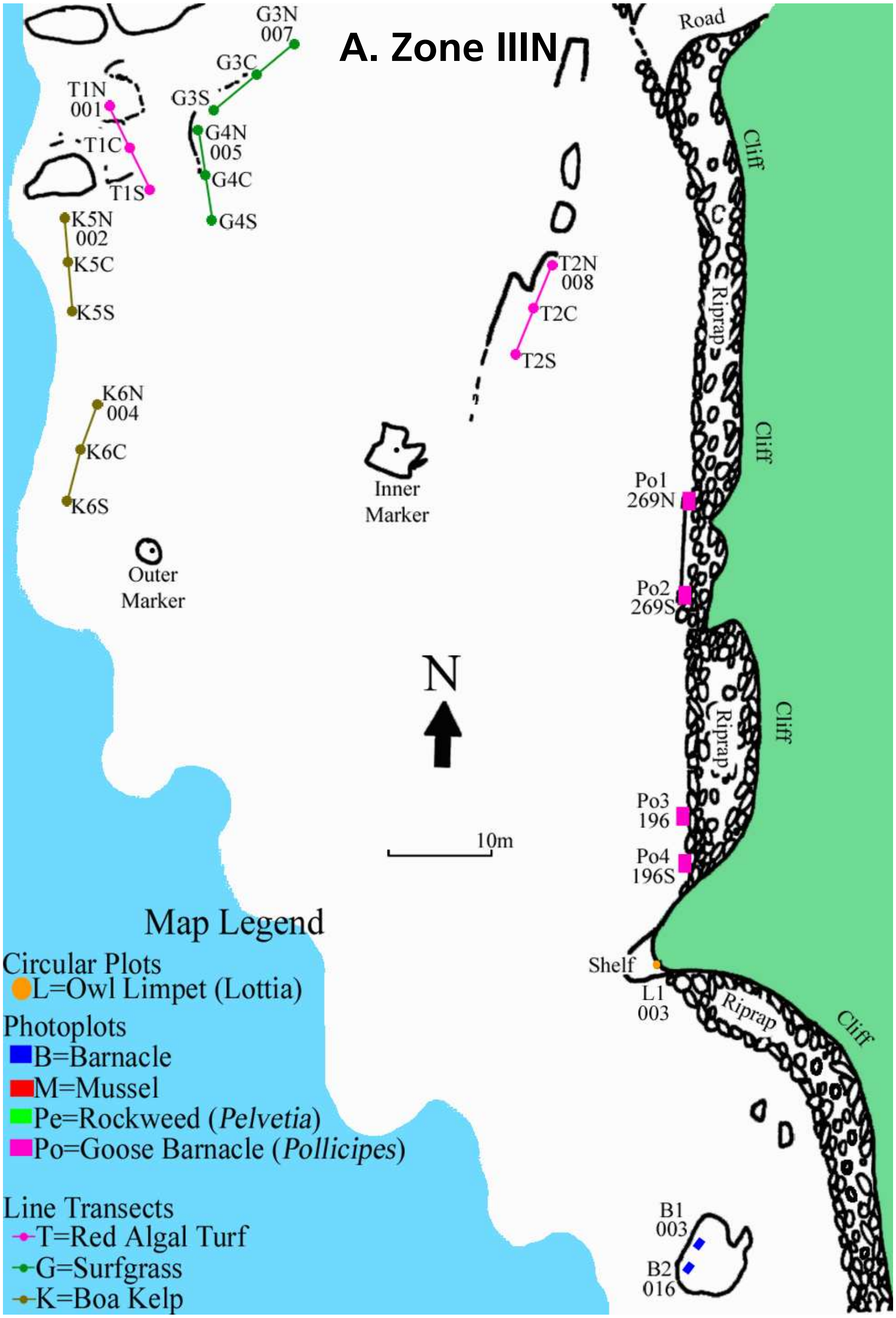
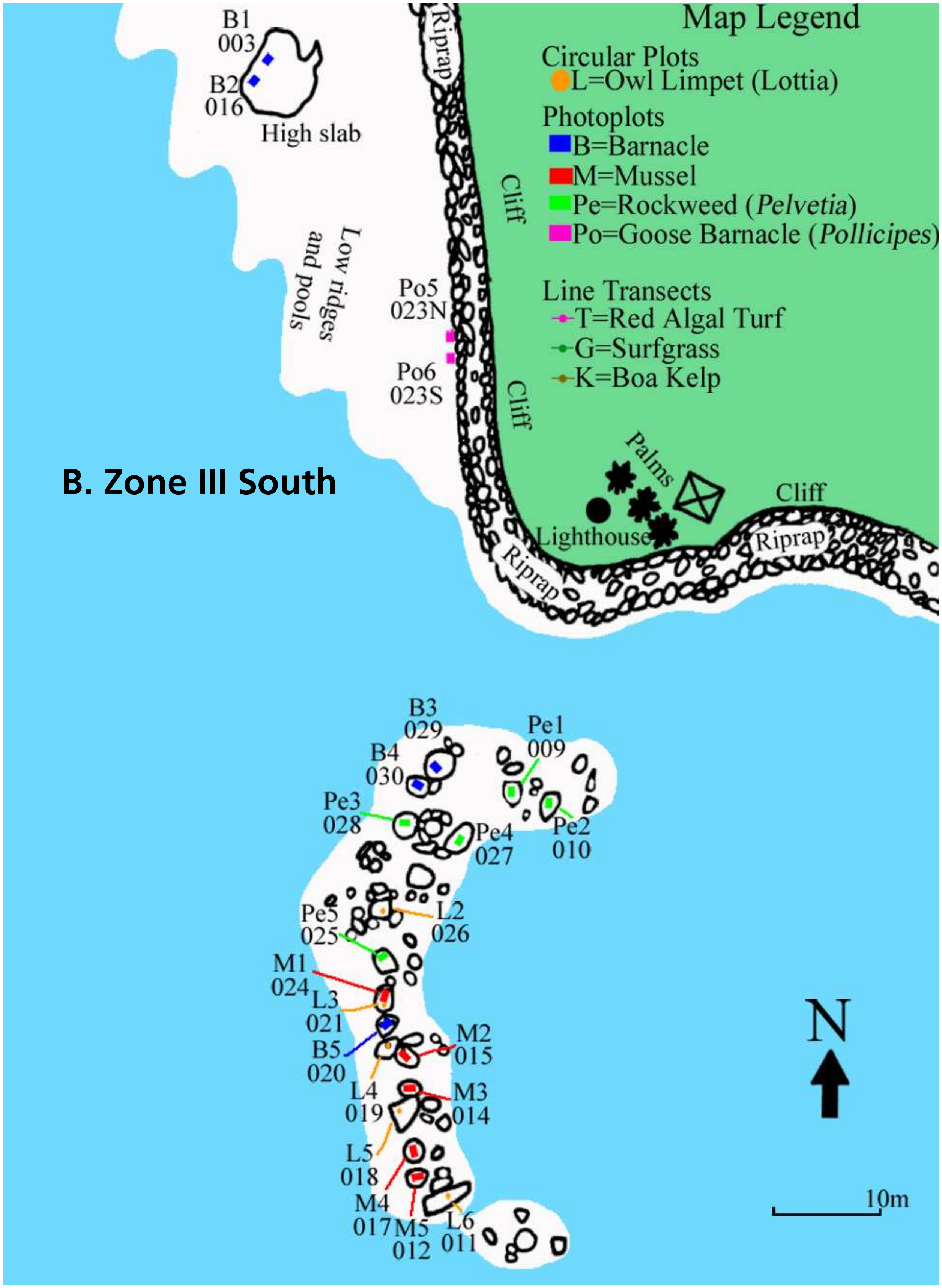


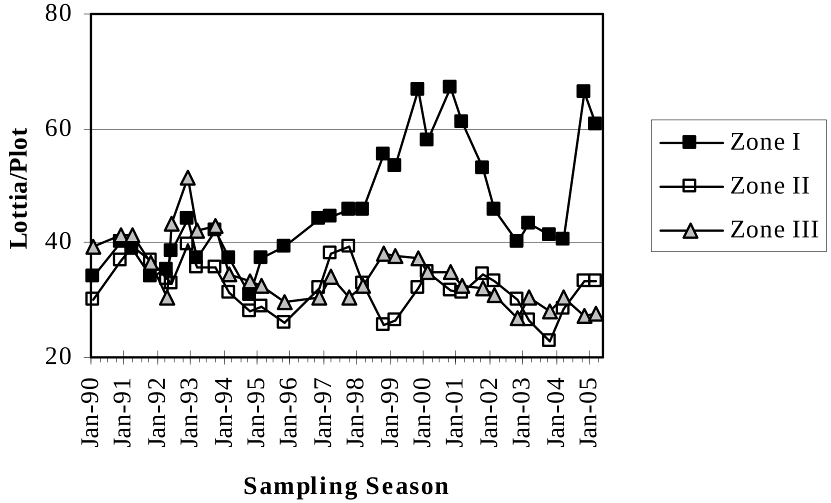
Figure 4. Map of Zone III monitoring sites for the Cabrillo Rocky Intertidal Monitoring Program (CRIMP), updated as of spring 2005. A. Northern Zone III, B. southern Zone III.



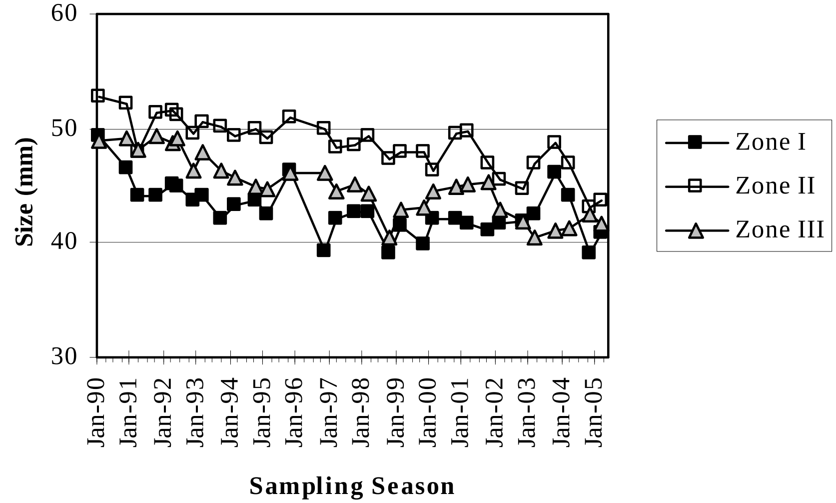
Map Legend
Circular Plots
L=Owl Limpet (Lottia)
Photoplots
B=Barnacle
M=Mussel
Pe=Rockweed (*Pelvetia*)
Po=Goose Barnacle (*Pollicipes*)
Line Transects
T=Red Algal Turf
G=Surfgrass
K=Boa Kelp
B1
003
B2
016
High slab
Riprap
Cliff
Low ridges and pools
Po5
023N
Po6
023S
Cliff
Palms
Lighthouse
Riprap
Cliff
Riprap
B. Zone III South
B3
029
B4
030
Pe1
009
Pe3
028
Pe4
027
Pe2
010
Pe5
025
L2
026
M1
024
L3
021
B5
020
M2
015
L4
019
M3
014
L5
018
M4
017
M5
012
L6
011
N
10m

Figure 5. Trends (by zone) of average owl limpet (*Lottia gigantea*) abundance and size measured in circular plots from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. A. owl limpet abundance, B. average size of owl limpets, C. average size of the ten largest owl limpets in each plot (excluding plots with less then 10 individuals), D. number of individuals in the smallest size class ($\geq$15 mm and <25 mm). All owl limpet data are exclusive of Zone II L4, L7, and L8 due to an incomplete dataset.

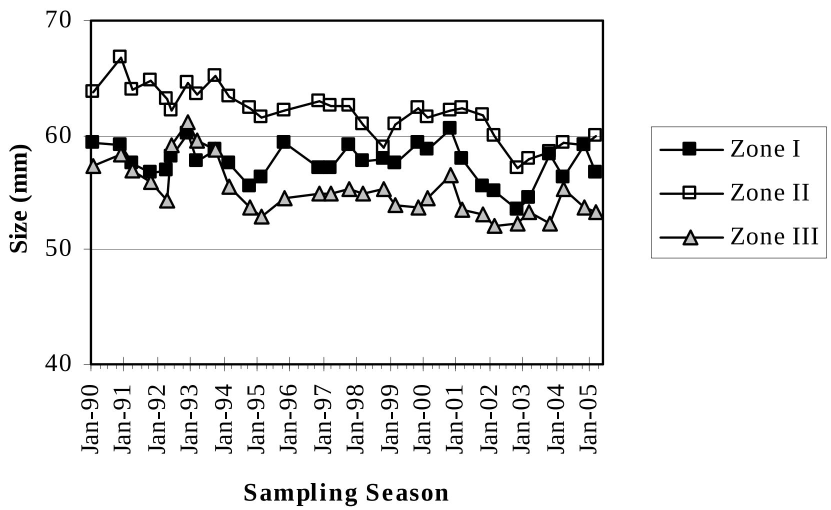
A. **Average Number of Owl Limpets**



B. **Average Size of Owl Limpets**



C. **Average Size of Ten Largest Lottia**



D. **Average Number of Owl Limpets in Smallest Size Class**

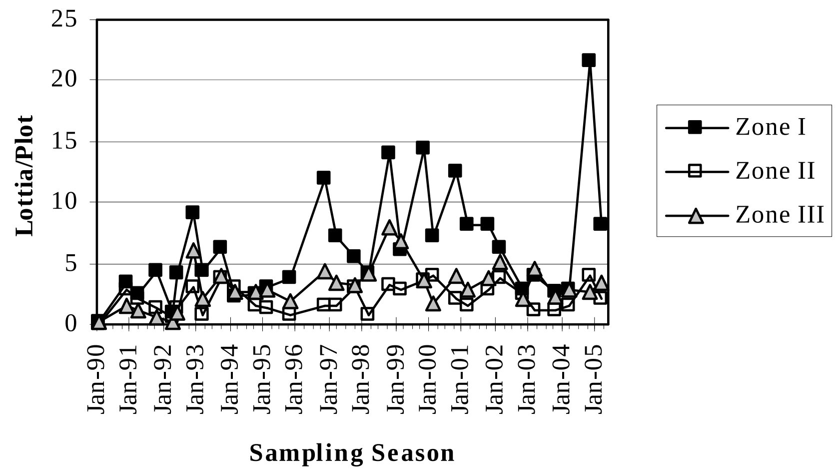
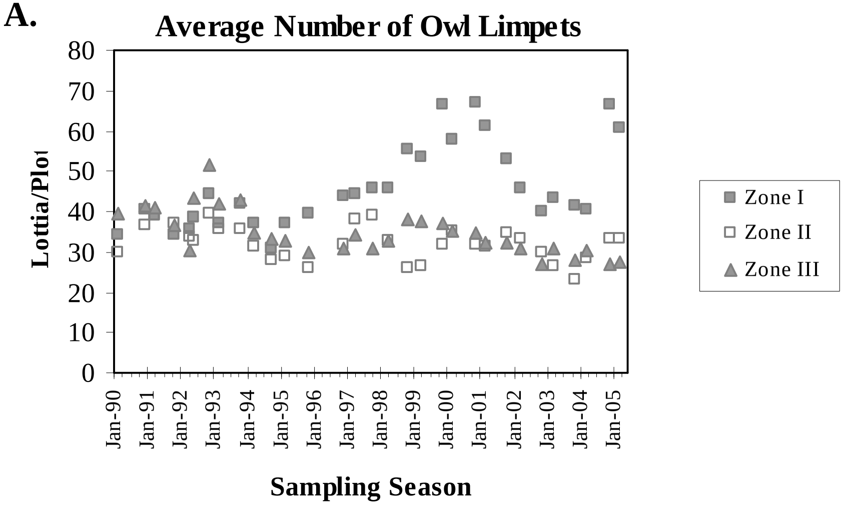
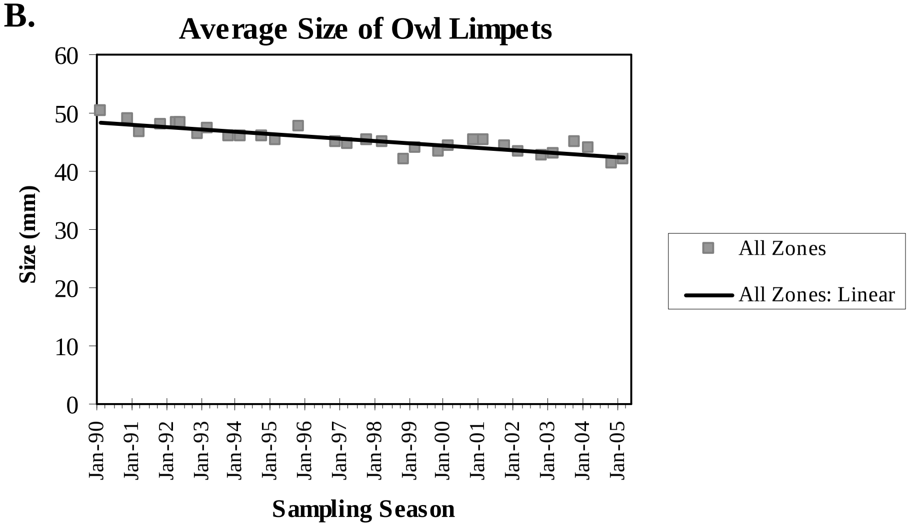


Figure 6. Trends, with regression lines, of average abundance and size of owl limpets (*Lottia gigantea*) measured in circular plots from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Only the lowest order regression with a corresponding r^2 greater than 0.60 is shown. If the r^2 value of the third order polynomial was less than 0.60, no line is shown. A. owl limpet abundance, B. average size of owl limpets, C. average size of the ten largest owl limpets in each plot (excluding plots with less then 10 individuals), D. number of individuals in the smallest size class ($\geq$15 mm and <25 mm). All owl limpet data are exclusive of Zone II L4, L7, and L8 due to an incomplete dataset.

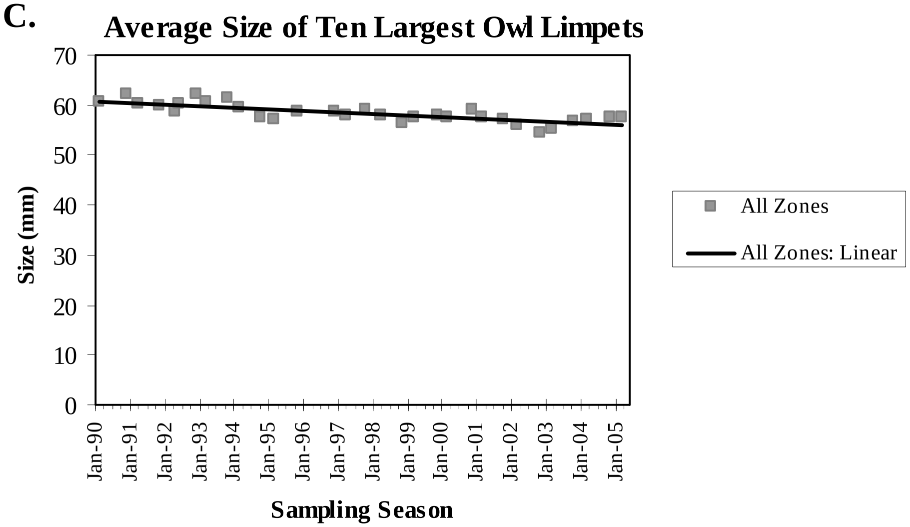
A.


Average Number of Owl Limpets
Lottia/Plot
0
10
20
30
40
50
60
70
80
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Sampling Season
Zone I
Zone II
Zone III

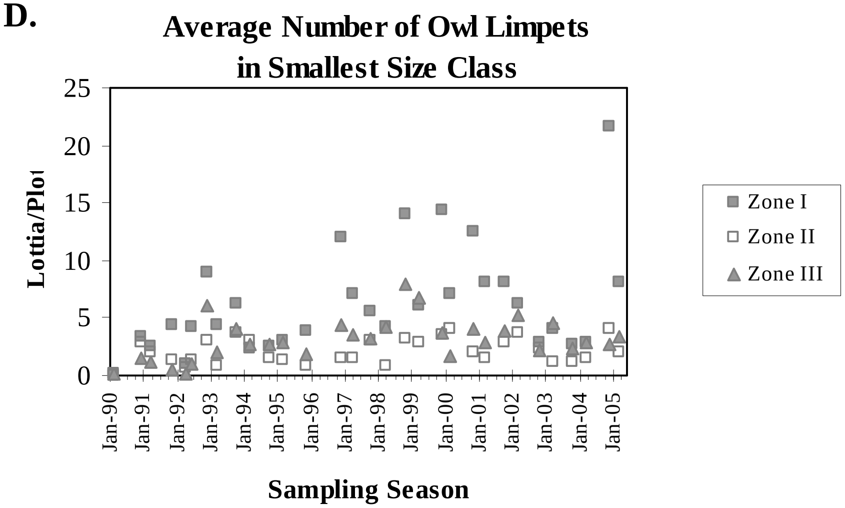
B.


Average Size of Owl Limpets
Size (mm)
0
10
20
30
40
50
60
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Sampling Season
All Zones
All Zones: Linear

C.


Average Size of Ten Largest Owl Limpets
Size (mm)
0
10
20
30
40
50
60
70
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Sampling Season
All Zones
All Zones: Linear

D.


Average Number of Owl Limpets
in Smallest Size Class
Lottia/Plot
0
5
10
15
20
25
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Sampling Season
Zone I
Zone II
Zone III

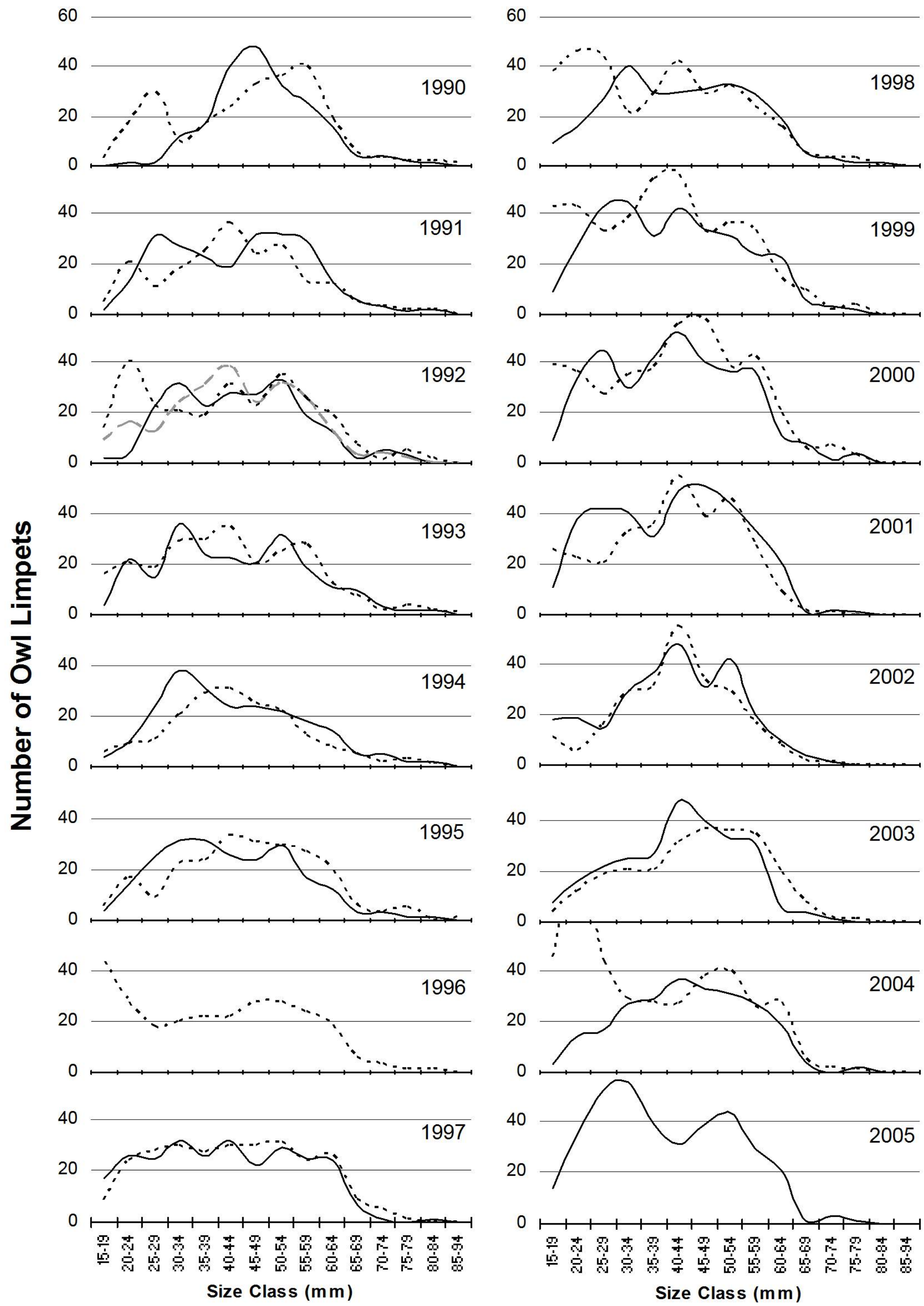


Figure 7. Zone I size-frequency distribution curves of owl limpets (*Lottia gigantea*) measured in circular plots from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Solid line=spring, dotted line=fall, hatched line=summer.

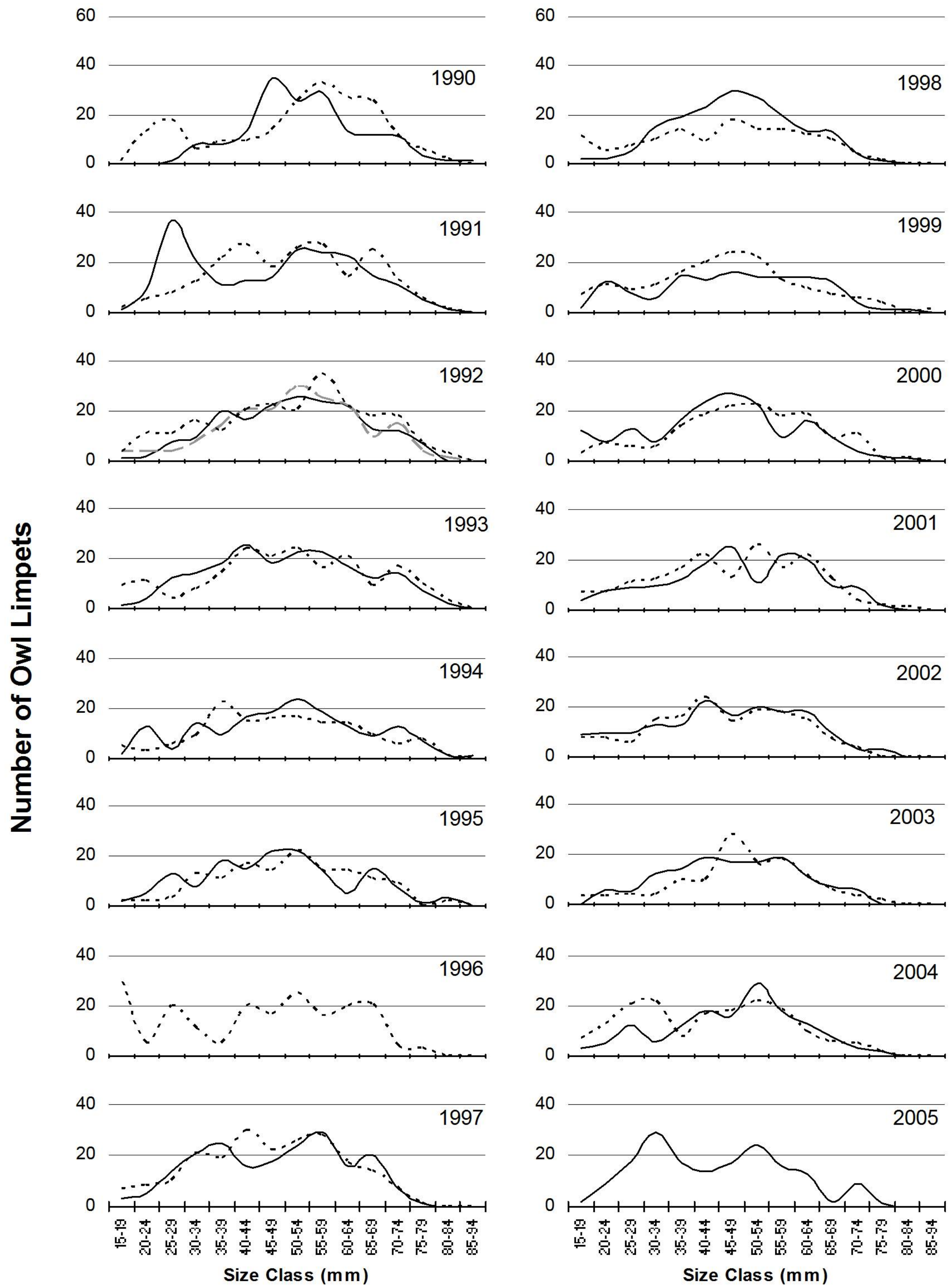


Figure 8. Zone II size-frequency distribution curves of owl limpets (*Lottia gigantea*) measured in circular plots from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Solid line=spring, dotted line=fall, hatched line=summer.

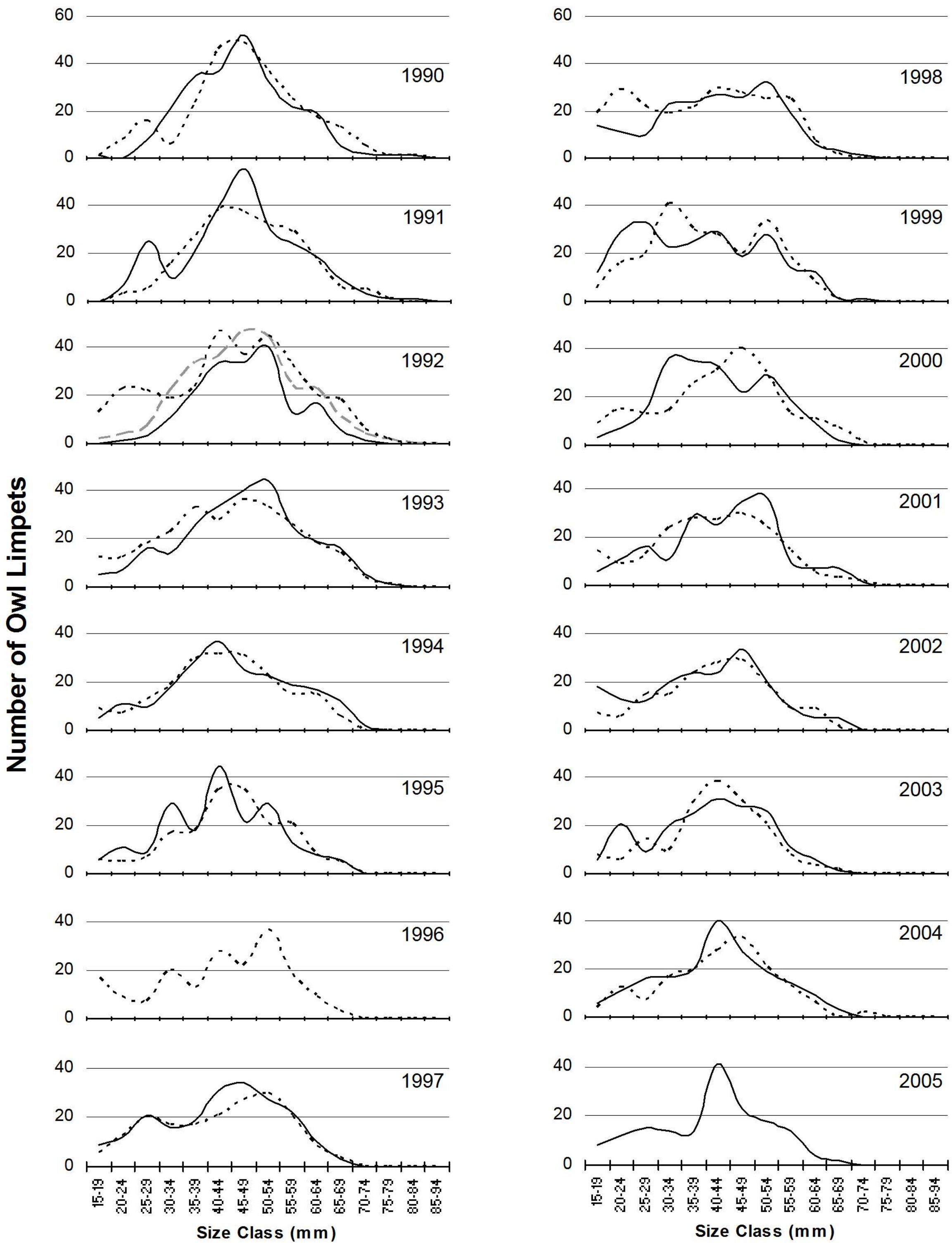
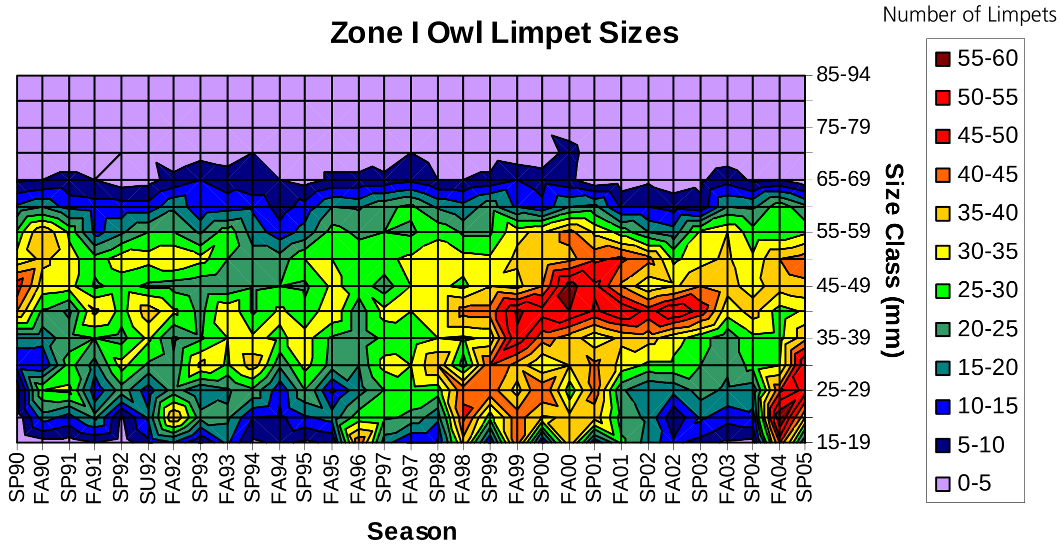
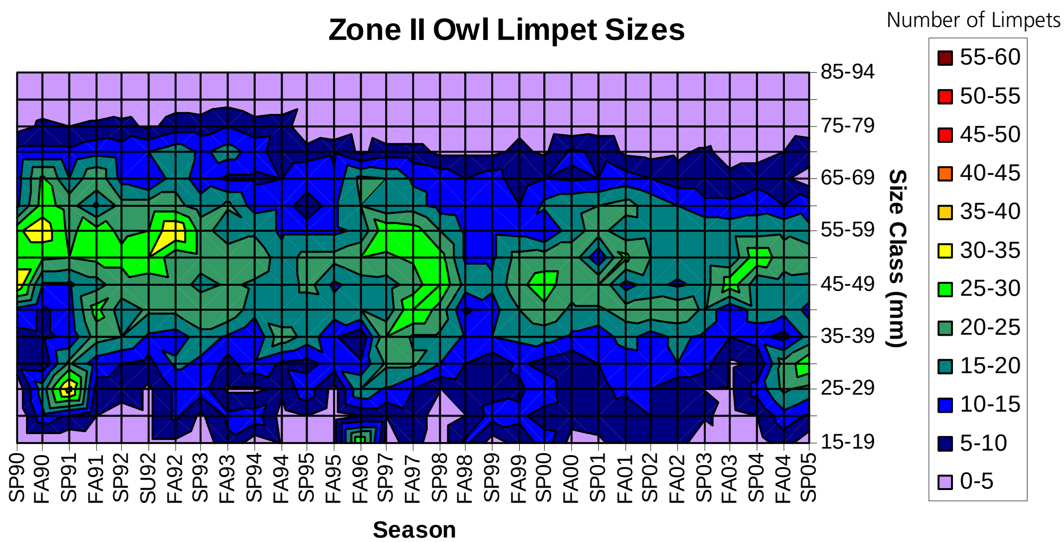


Figure 9. Zone III size-frequency distribution curves of owl limpets (*Lottia gigantea*) measured in circular plots from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Solid line=spring, dotted line=fall, hatched line=summer.

A.



B.



C.

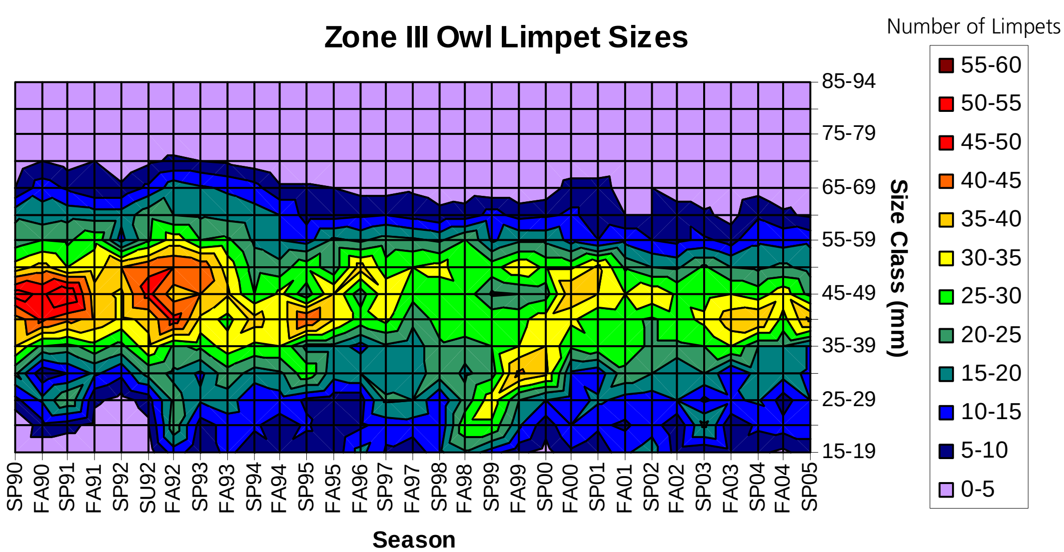
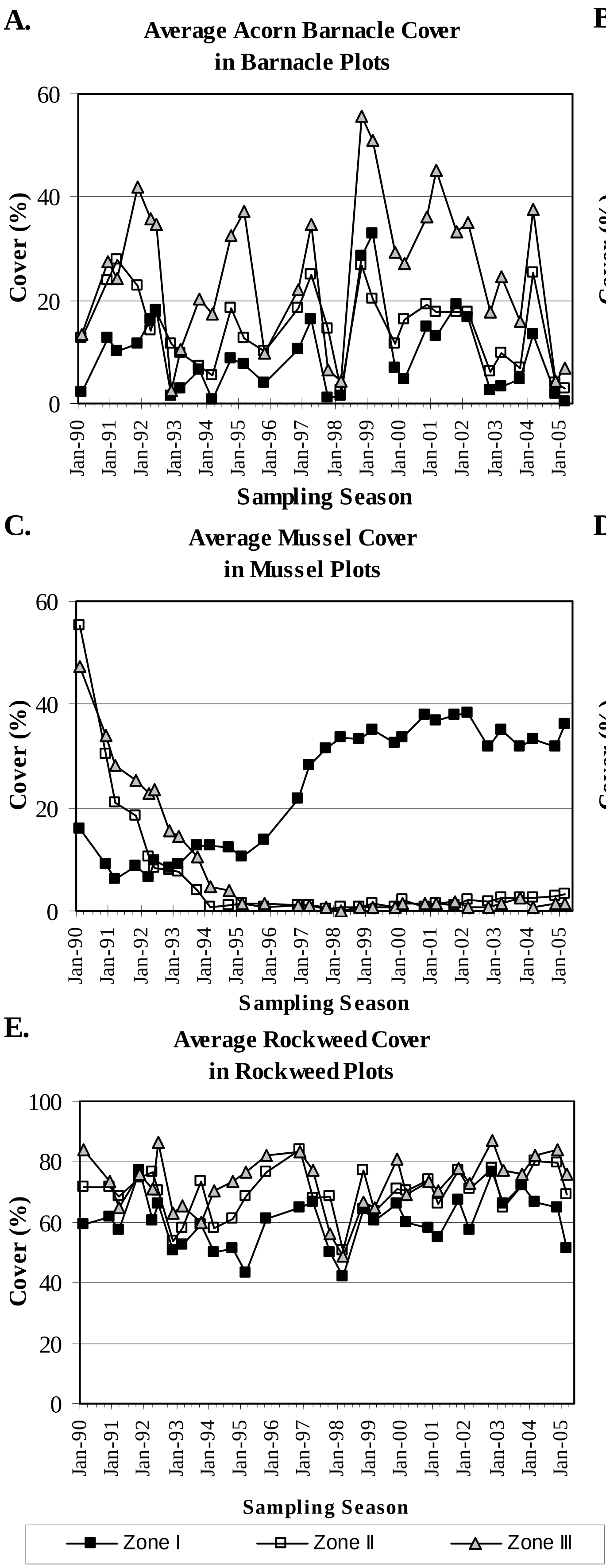


Figure 10. Contour plots of owl limpet (*Lottia gigantea*) size-frequency data collected from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. The colors in the legend represent the number of individuals in all plots in A. Zone I, B. Zone II, C. Zone III within each size class listed on the Y-axis.

Figure 11. Average cover (by zone) of key taxa in photoplots through time as measured from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Percent cover of A. acorn barnacles (*Balanus glandula/Chthamalus* spp.) in barnacle plots, B. thatched barnacles (*Tetraclita rubescens*) in barnacle plots, C. mussel (*Mytilus californianus/galloprovincialis*) in mussel plots, D. goose barnacles (*Pollicipes polymerus*) in goose barnacle plots, E. rockweed (*Silvetia compressa*) in rockweed plots. Missing plots (SP94 Zone I M4, FA98 Zone II M1, FA94 Zone I Pe4, FA94 Zone II Pe3, FA95 Zone I Po6, FA95 Zone III Po4, FA96 Zone I Po2, SP99 Zone III Po4) were replaced by averaging the values immediately before and after the missing point.



A.
Average Acorn Barnacle Cover in Barnacle Plots
B.
Average Thatched Barnacle Cover in Barnacle Plots
C.
Average Mussel Cover in Mussel Plots
D.
Average Goose Barnacle Cover in Goose Barnacle Plots
E.
Average Rockweed Cover in Rockweed Plots
Cover (%)
Sampling Season
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Zone I
Zone II
Zone III

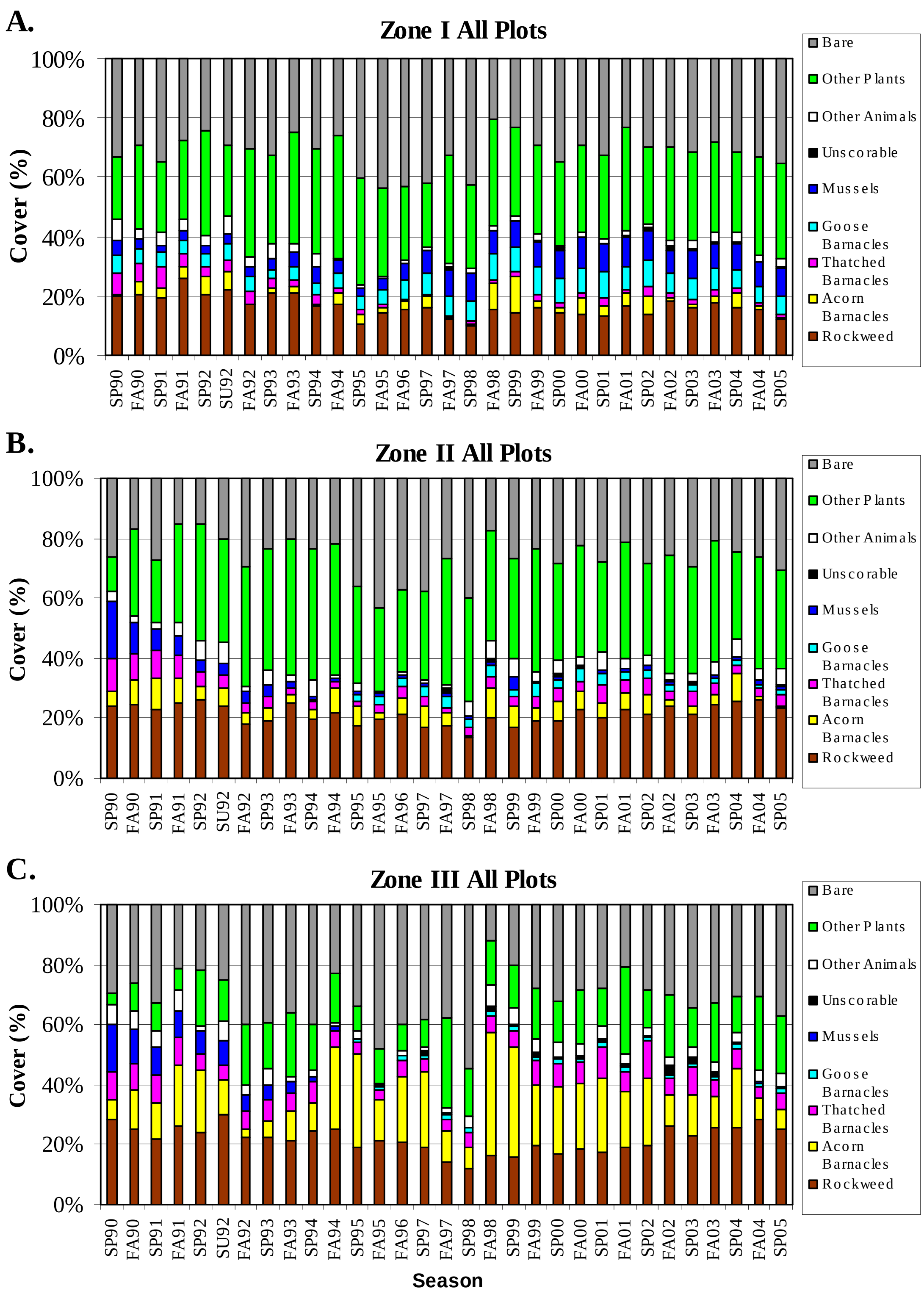


Figure 12. Proportion of each taxon in all photoplots as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Missing plots were replaced by averaging the values immediately before and after the missing point. Note that goose barnacle plots were added in spring 1995 and are included in these plots. Encrusting algae (coralline and non-coralline) are included in the "Other Plants" category. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

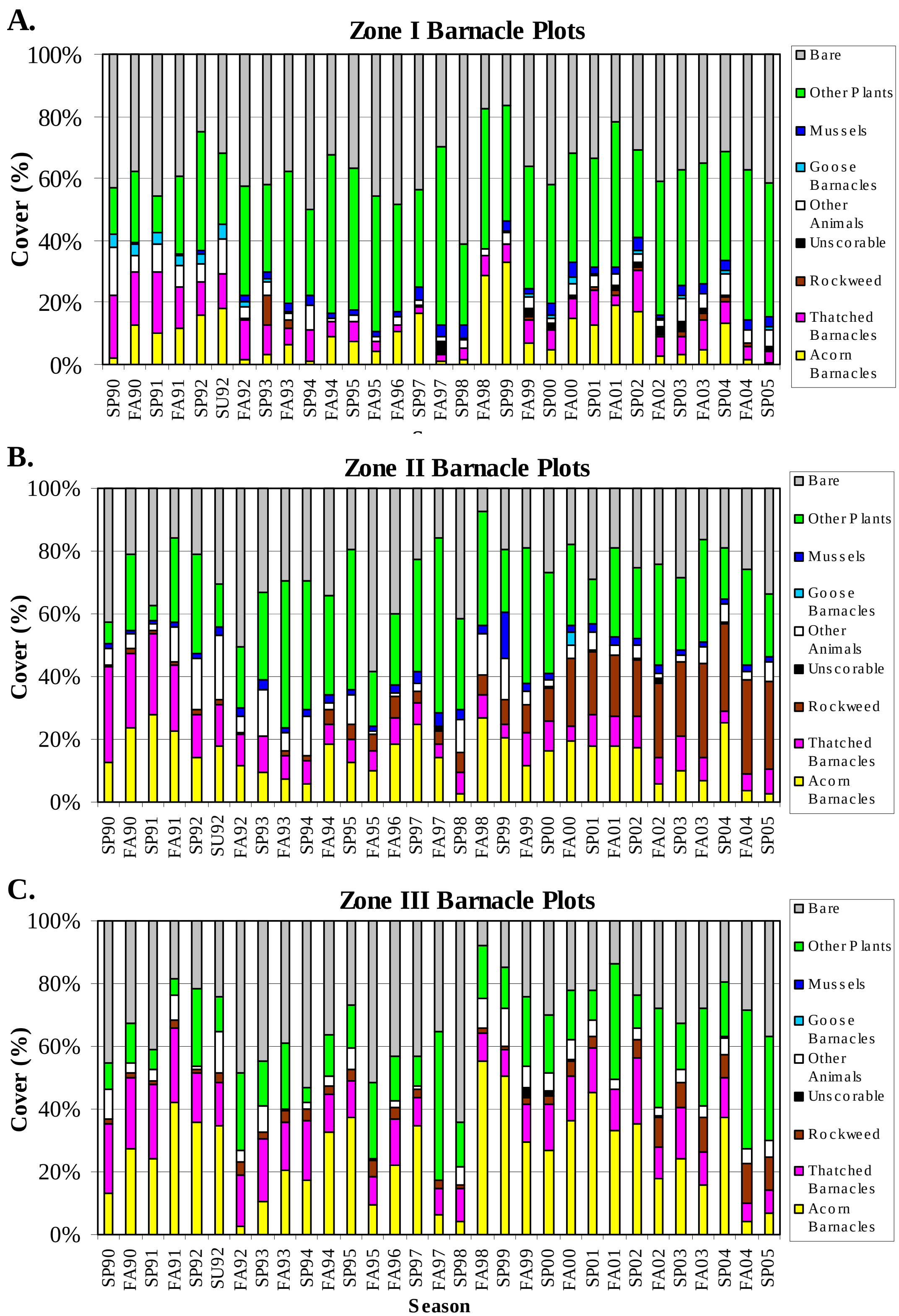
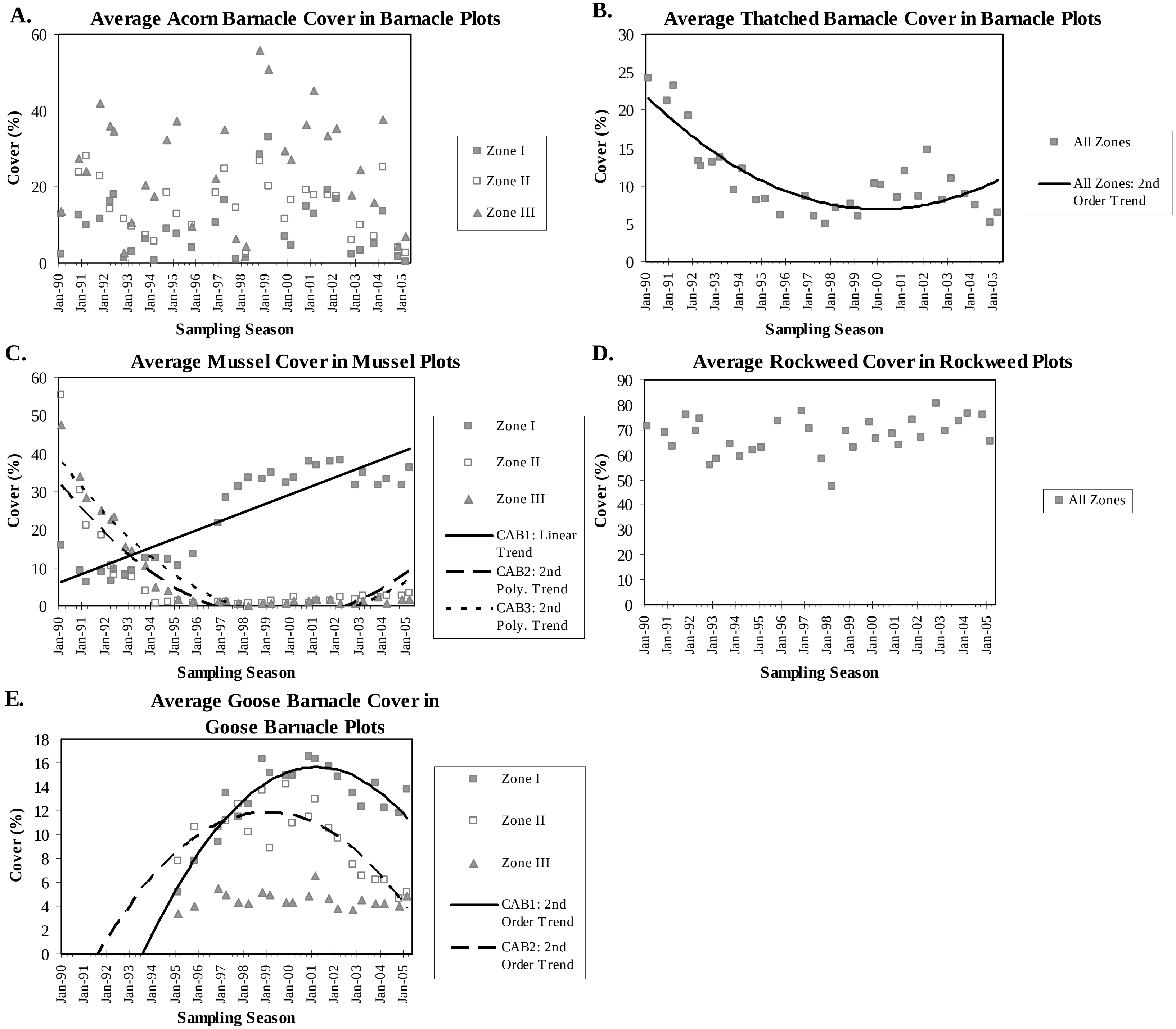


Figure 13. Proportion of each taxon in (acorn and thatched) barnacle photoplots as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Encrusting algae (coralline and non-coralline) are included in the "Other Plants" category. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

Figure 14. Average cover with regression lines of key taxa in photoplots as measured from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Percent cover of A. acorn barnacles (*Balanus glandula/Chthamalus* spp.) in barnacle plots, B. thatched barnacles (*Tetraclita rubescens*) in barnacle plots, C. mussel (*Mytilus californianus/galloprovincialis*) in mussel plots, D. goose barnacles (*Pollicipes polymerus*) in goose barnacle plots, E. rockweed (*Silvetia compressa*) in rockweed plots. Missing plots were replaced by averaging the values immediately before and after the missing point. Only the lowest order regression with a corresponding r^2 greater than 0.60 is shown. If the r^2 value of the third order polynomial was less than 0.60, no line is shown.



A.
Average Acorn Barnacle Cover in Barnacle Plots
Cover (%)
Sampling Season
Zone I
Zone II
Zone III
B.
Average Thatched Barnacle Cover in Barnacle Plots
Cover (%)
Sampling Season
All Zones
All Zones: 2nd Order Trend
C.
Average Mussel Cover in Mussel Plots
Cover (%)
Sampling Season
Zone I
Zone II
Zone III
CAB1: Linear Trend
CAB2: 2nd Poly. Trend
CAB3: 2nd Poly. Trend
D.
Average Rockweed Cover in Rockweed Plots
Cover (%)
Sampling Season
All Zones
E.
Average Goose Barnacle Cover in Goose Barnacle Plots
Cover (%)
Sampling Season
Zone I
Zone II
Zone III
CAB1: 2nd Order Trend
CAB2: 2nd Order Trend

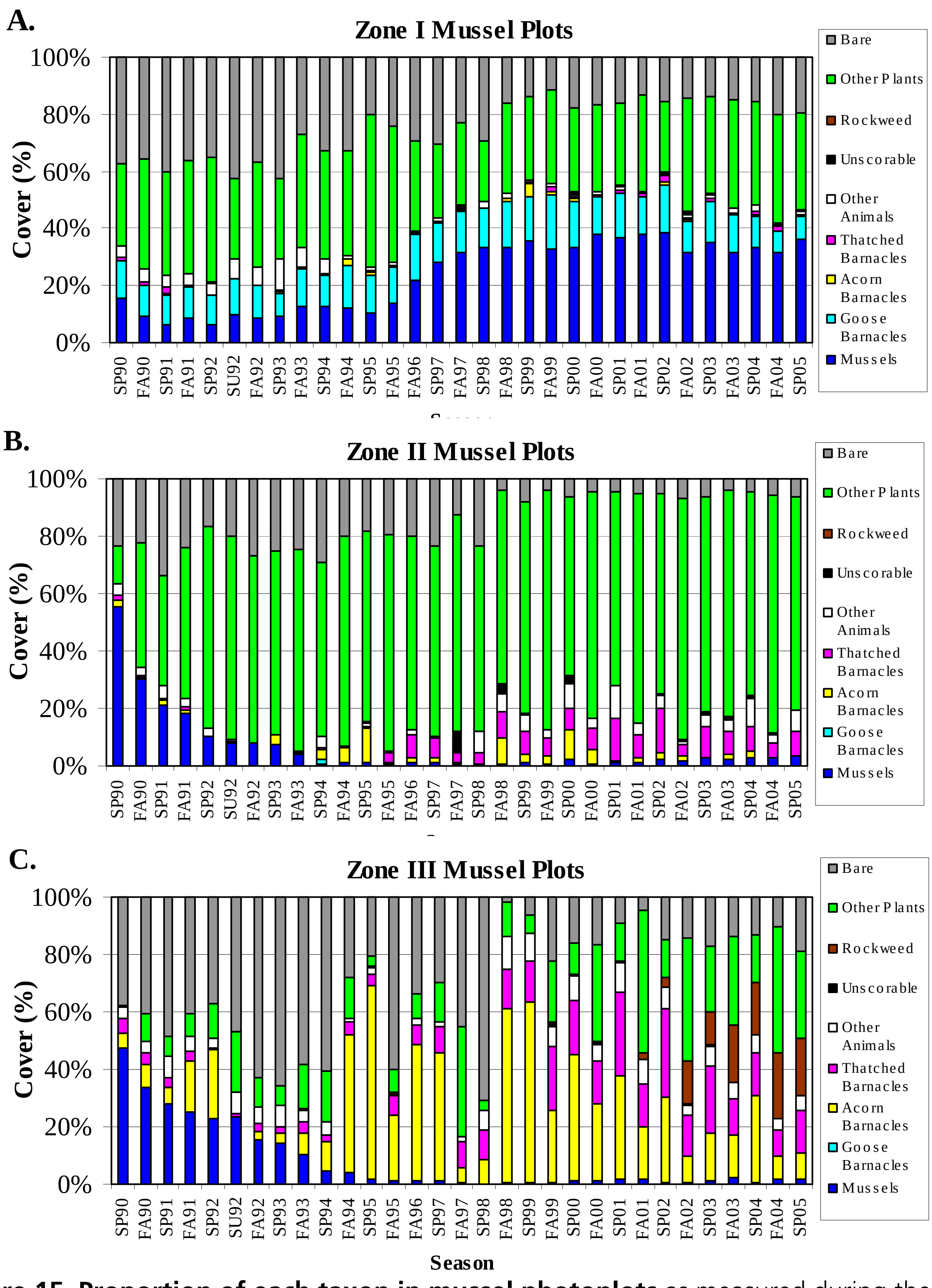


Figure 15. Proportion of each taxon in mussel photoplots as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Missing plots were replaced by averaging the values immediately before and after the missing point. Encrusting algae (coralline and non-coralline) are included in the "Other Plants" category. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

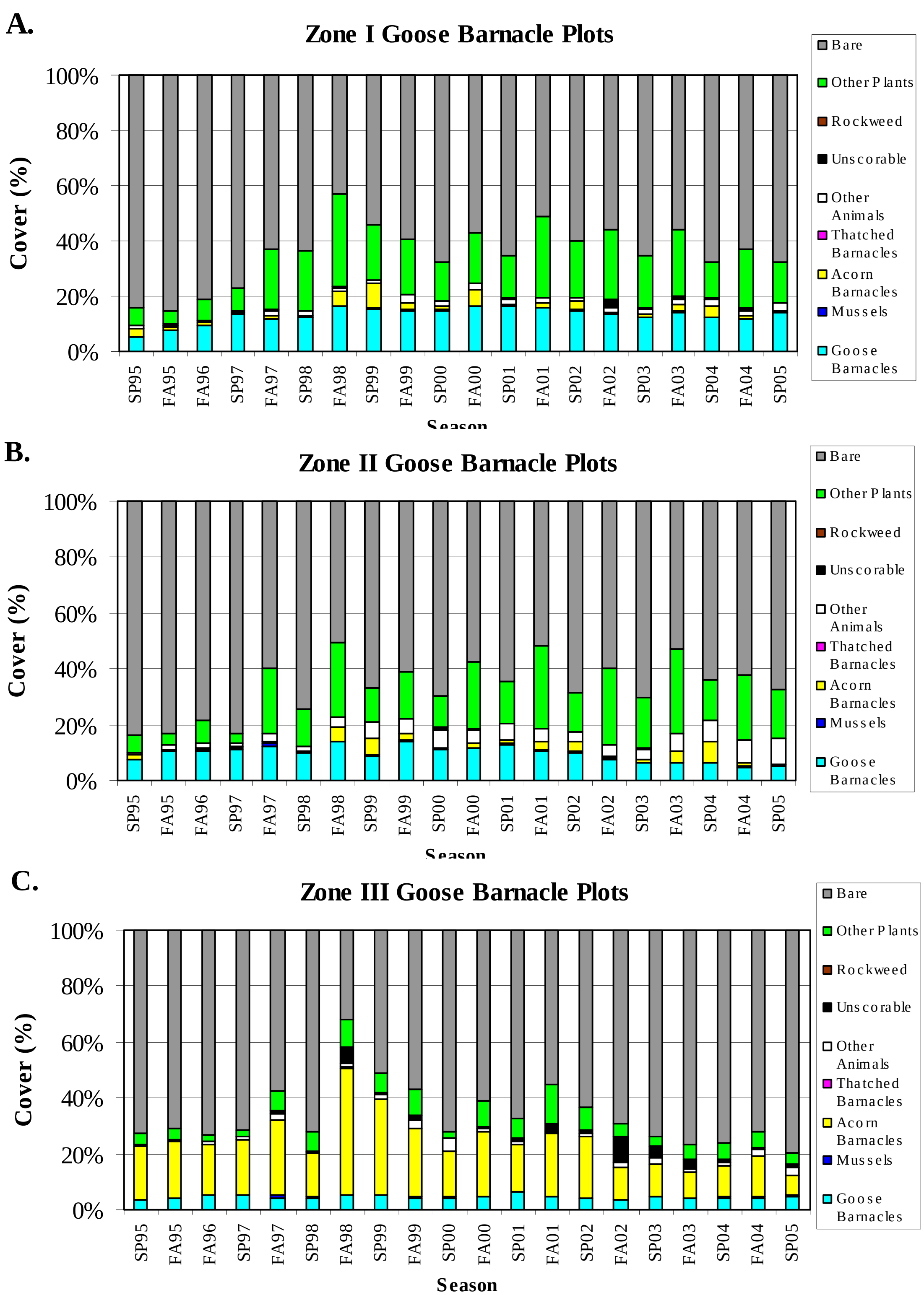


Figure 16. Proportion of each taxon in goose barnacles photoplots as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Missing plots were replaced by averaging the values immediately before and after the missing point. Encrusting algae (coralline and non-coralline) are included in the “Other Plants” category. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

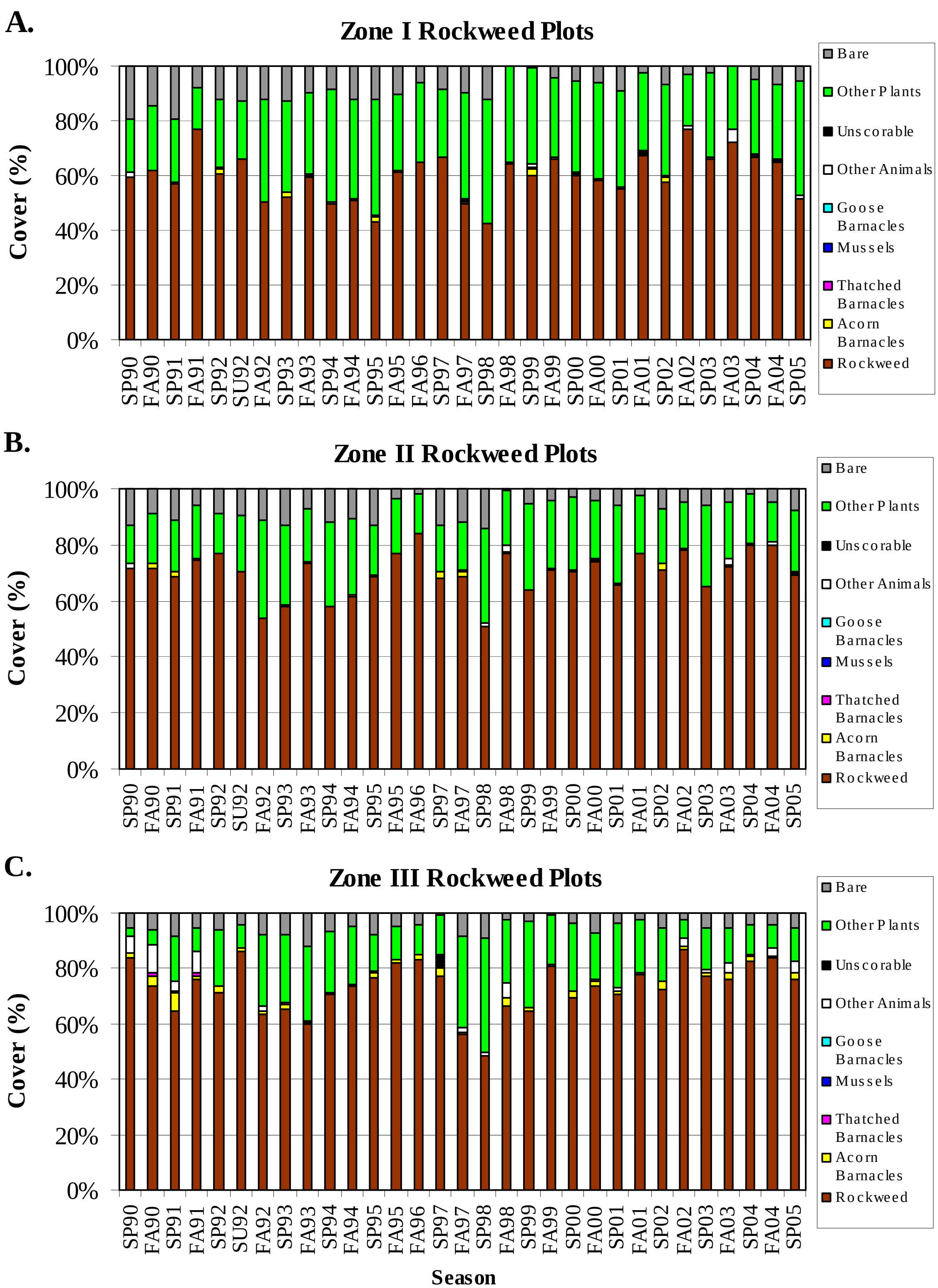
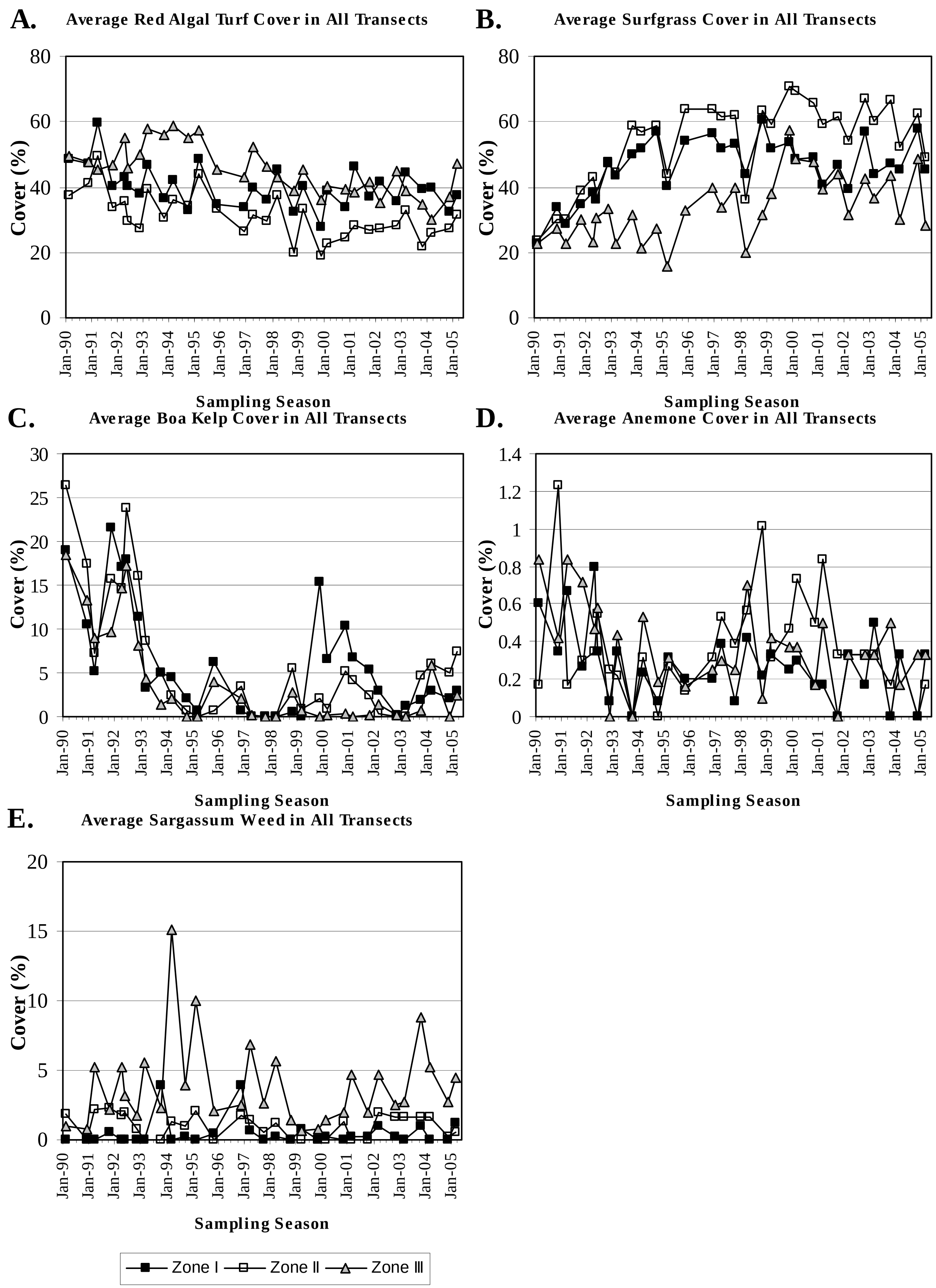


Figure 17. Proportion of each taxon in rockweed photoplots as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Missing plots were replaced by averaging the values immediately before and after the missing point. Encrusting algae (coralline and non-coralline) are included in the "Other Plants" category. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

Figure 18. Average cover (by zone) of key taxa in all transects through time as measured from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Percent cover of A. red algal turf, B. surfgrass (*Phyllospadix* spp.), C. boa kelp (*Egregia menziesii*), D. *Sargassum* weed (*Sargassum muticum*), E. Anemones (*Anthopleura* spp.). One missing plot (FA95 Zone III T2) was replaced by averaging the values immediately before and after the missing point.



A.
Average Red Algal Turf Cover in All Transects
Cover (%)
0
20
40
60
80
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Sampling Season
B.
Average Surfgrass Cover in All Transects
Cover (%)
0
20
40
60
80
Sampling Season
C.
Average Boa Kelp Cover in All Transects
Cover (%)
0
5
10
15
20
25
30
Sampling Season
D.
Average Anemone Cover in All Transects
Cover (%)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Sampling Season
E.
Average Sargassum Weed in All Transects
Cover (%)
0
5
10
15
20
Sampling Season
Zone I
Zone II
Zone III

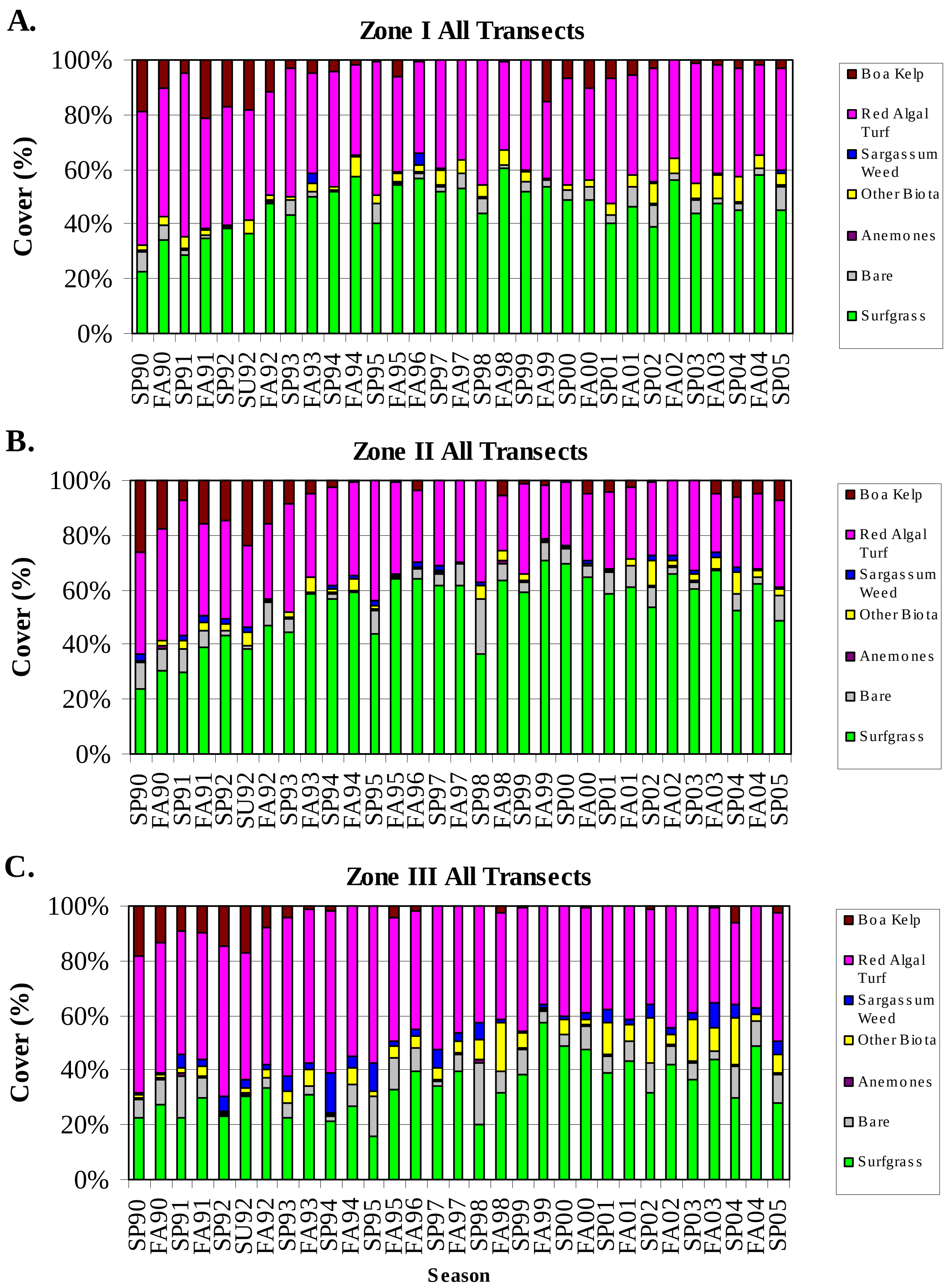
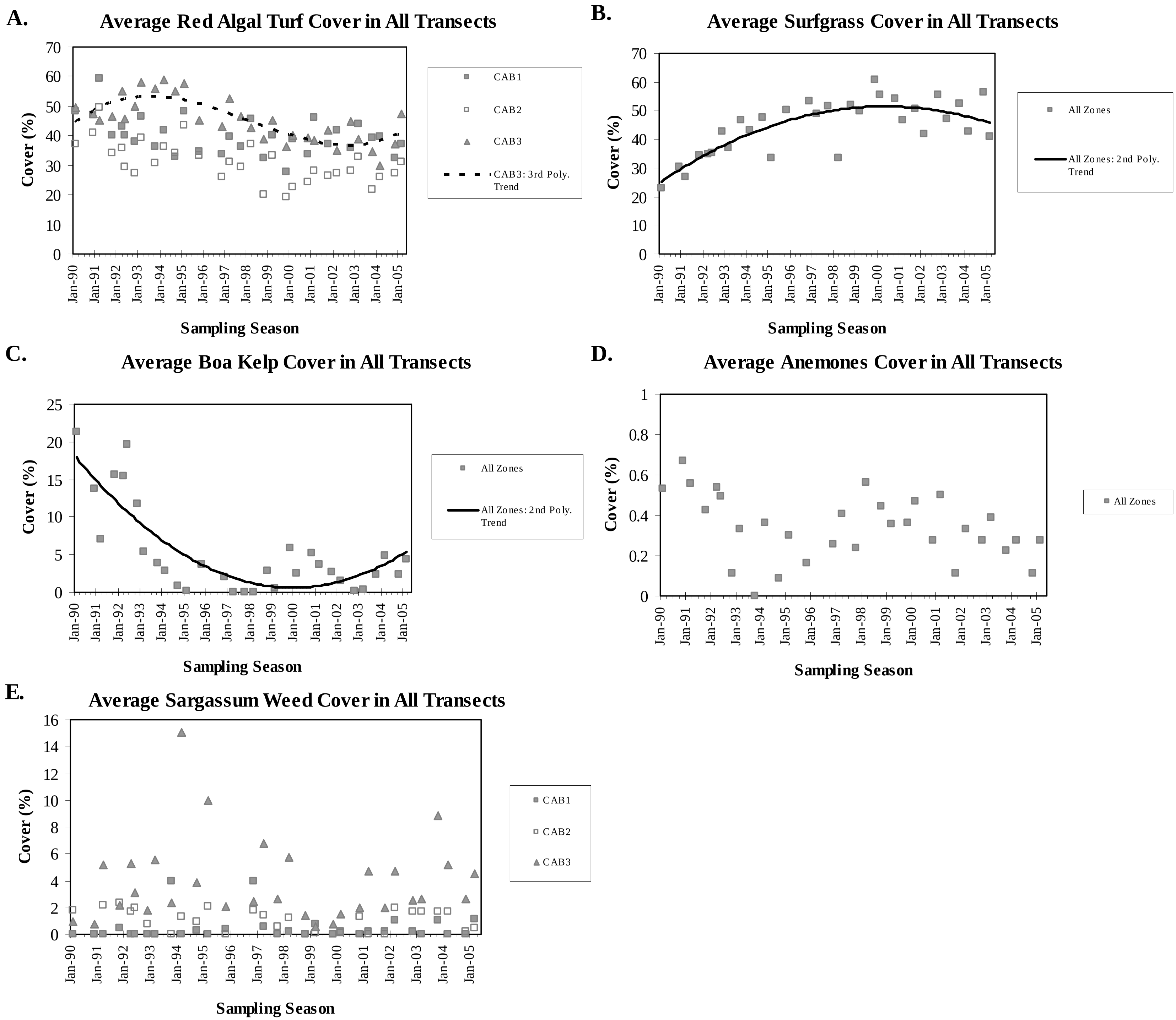


Figure 19. Proportion of each taxon in all transects as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Missing plots were replaced by averaging the values immediately before and after the missing point. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

Figure 20. Average cover with regression lines of key taxa in transects as measured from 1990-2005 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Percent cover of A. red algal turf, B. surfgrass (*Phyllospadix* spp.), C. boa kelp (*Egregia menziesii*), D. Anemones (*Anthopleura* spp.), E. *Sargassum* weed (*Sargassum muticum*). Missing plots were replaced by averaging the values immediately before and after the missing point. Only the lowest order regression with a corresponding r^2 greater than 0.60 is shown. If the r^2 value of the third order polynomial was less than 0.60, no line is shown.


A.
Average Red Algal Turf Cover in All Transects
Cover (%)
Sampling Season
CAB1
CAB2
CAB3
CAB3: 3rd Poly. Trend
B.
Average Surfgrass Cover in All Transects
Cover (%)
Sampling Season
All Zones
All Zones: 2nd Poly. Trend
C.
Average Boa Kelp Cover in All Transects
Cover (%)
Sampling Season
All Zones
All Zones: 2nd Poly. Trend
D.
Average Anemones Cover in All Transects
Cover (%)
Sampling Season
All Zones
E.
Average Sargassum Weed Cover in All Transects
Cover (%)
Sampling Season
CAB1
CAB2
CAB3

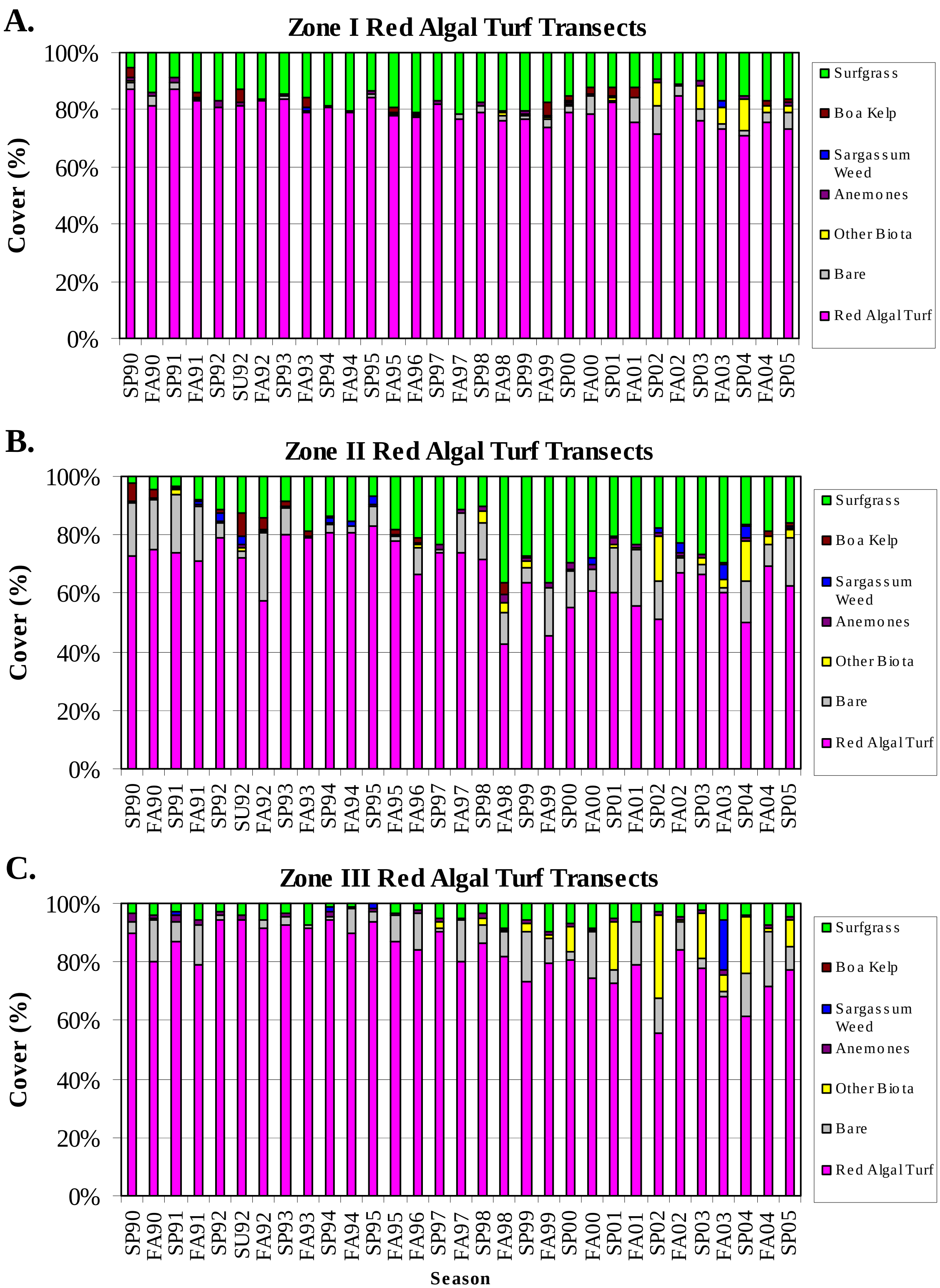


Figure 21. Proportion of each taxon in red algal turf transects as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. Missing plots were replaced by averaging the values immediately before and after the missing point. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

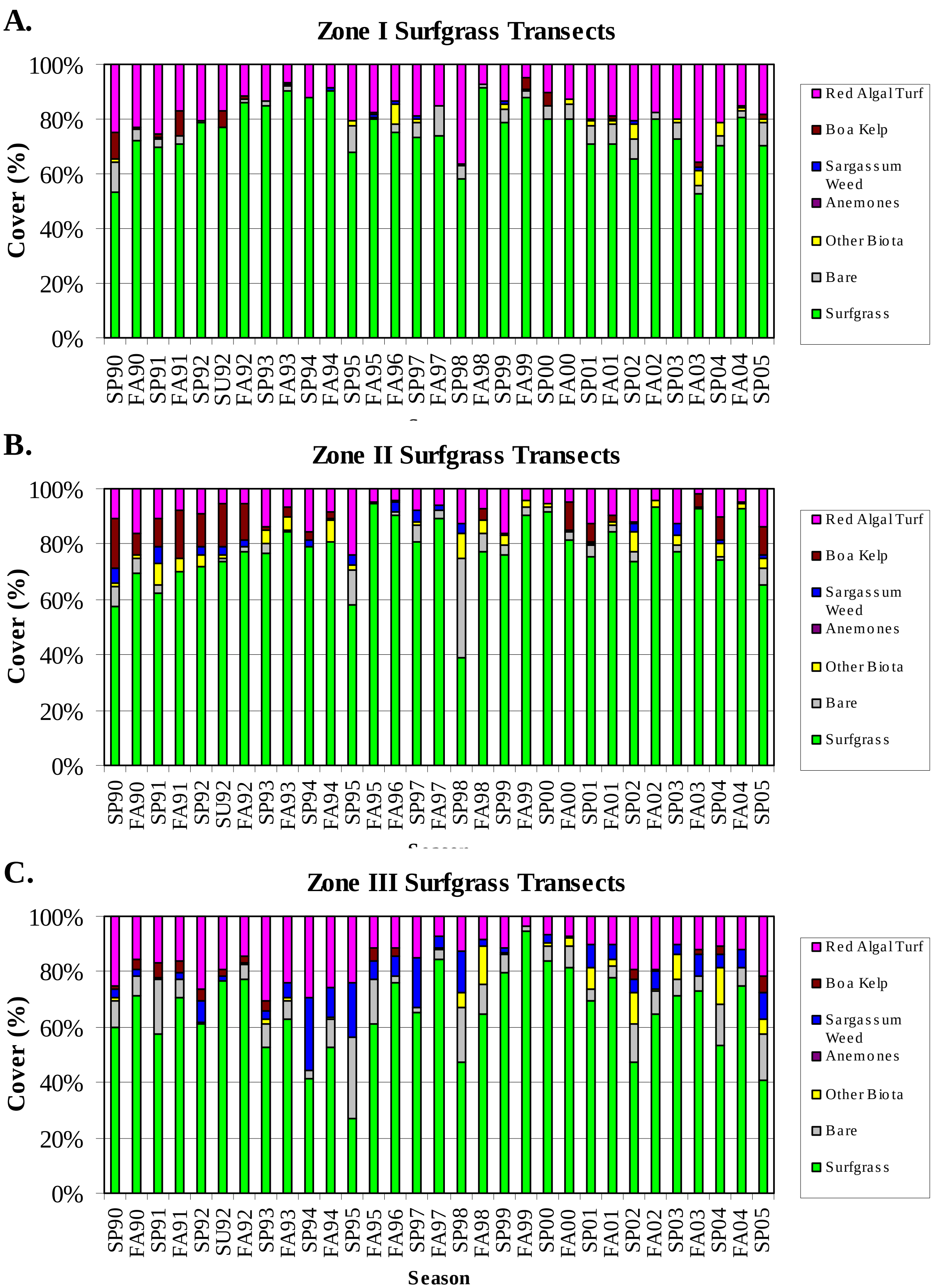


Figure 22. Proportion of each taxon in surfgrass transects as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

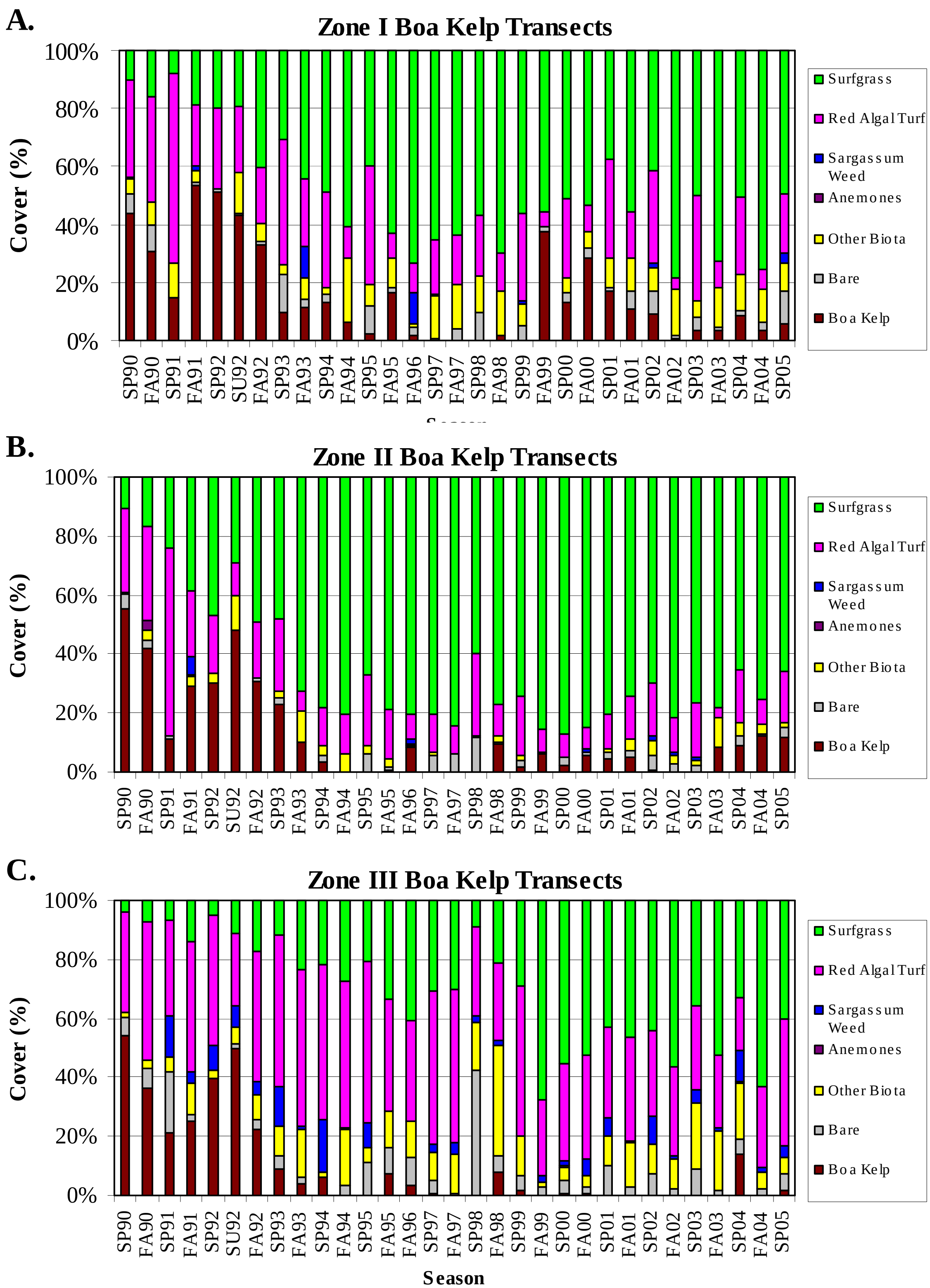
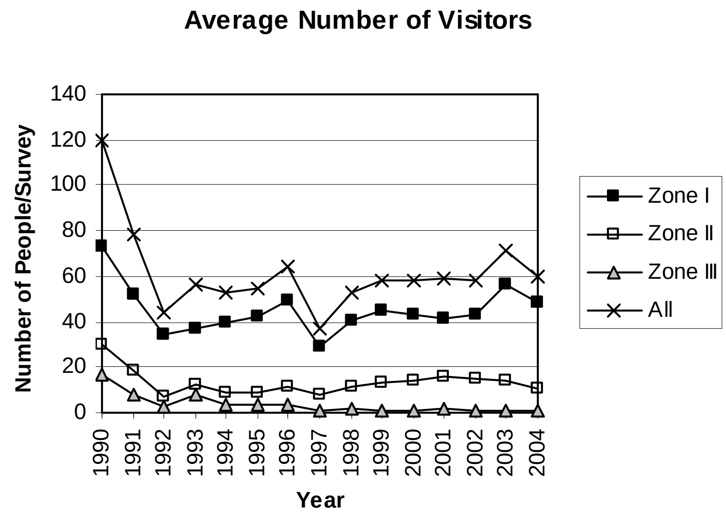


Figure 23. Proportion of each taxon in boa kelp transects as measured during the Cabrillo National Monument Rocky Intertidal Monitoring Program. A. Zone I, B. Zone II, C. Zone III. Seasons are coded by SSYY, where SS is a code for season (SP=spring, SU=summer, FA=fall), and YY is year from 1990 (90) to 2005 (05).

A



B.

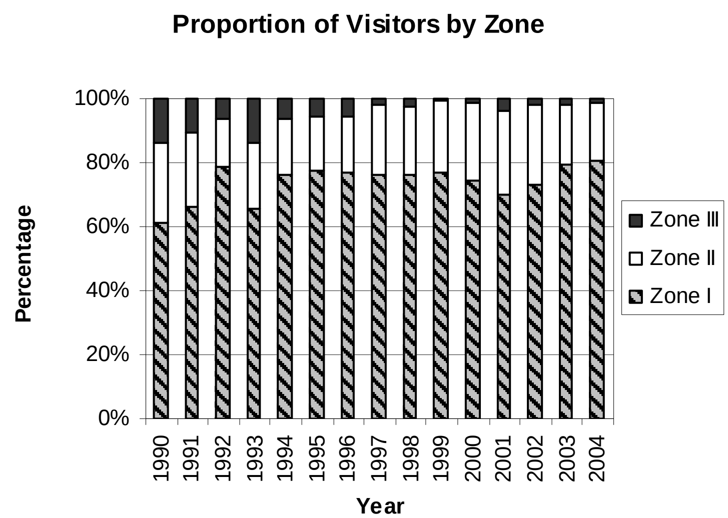


Figure 24. Average number of visitors (by year) counted in each zone of Cabrillo National Monument during 1-hour censuses 1990-2004 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. A. absolute number and B. proportion of the total count.

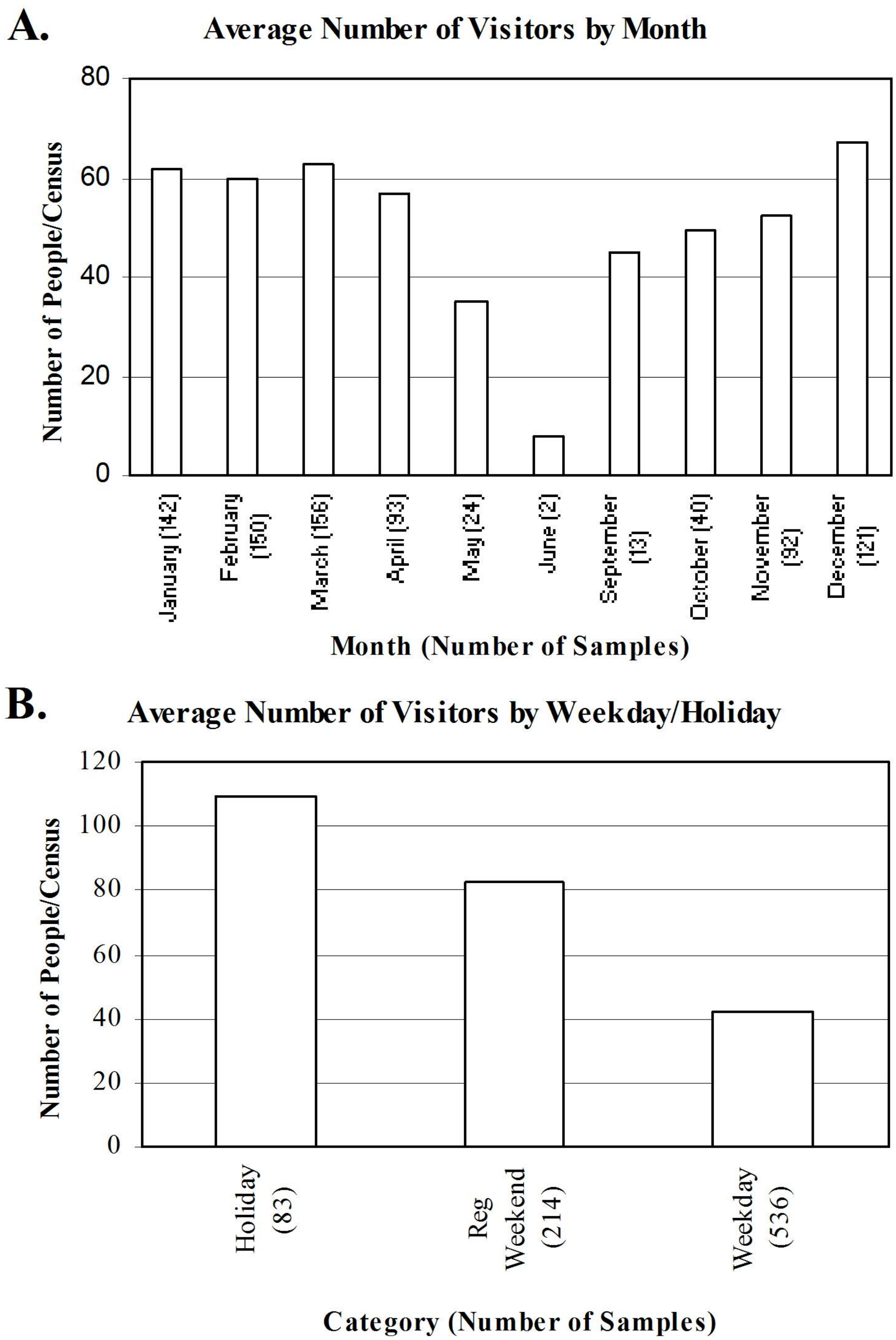
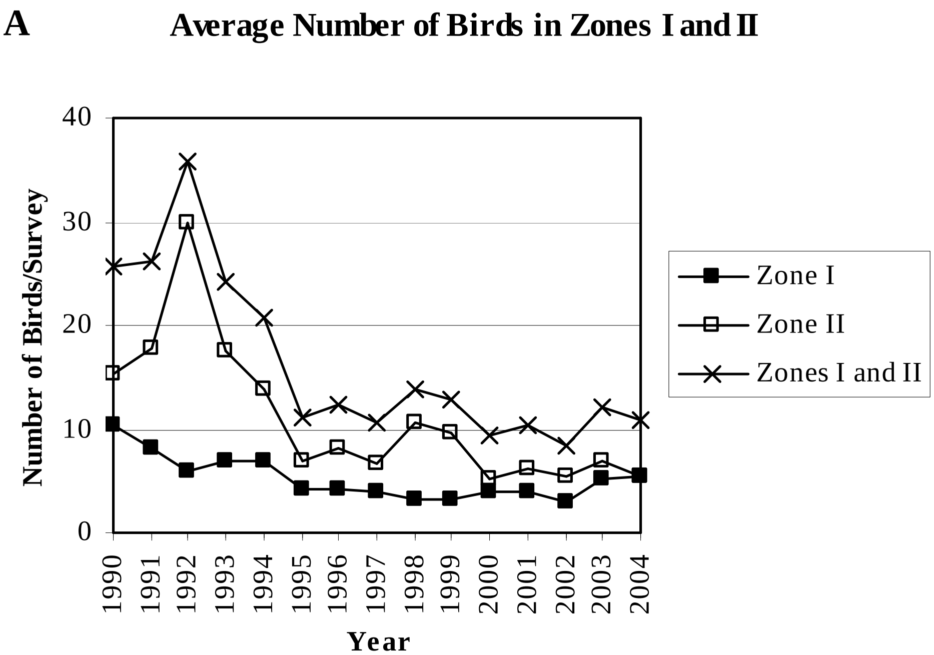


Figure 25. Average number of visitors (by month and weekday/weekend) counted in each zone of Cabrillo National Monument during 1-hour censuses 1990-2004 during the Cabrillo National Monument Rocky Intertidal Monitoring Program. A. month, B. day of the week/holiday (a weekend day that falls on a holiday was included in the holiday category, weekends only include non-holiday Saturdays and Sundays). Note the different number of samples listed on the X-axis in parentheses. July and August there were not counts since no tides met the pre-determined criteria.

A



B.

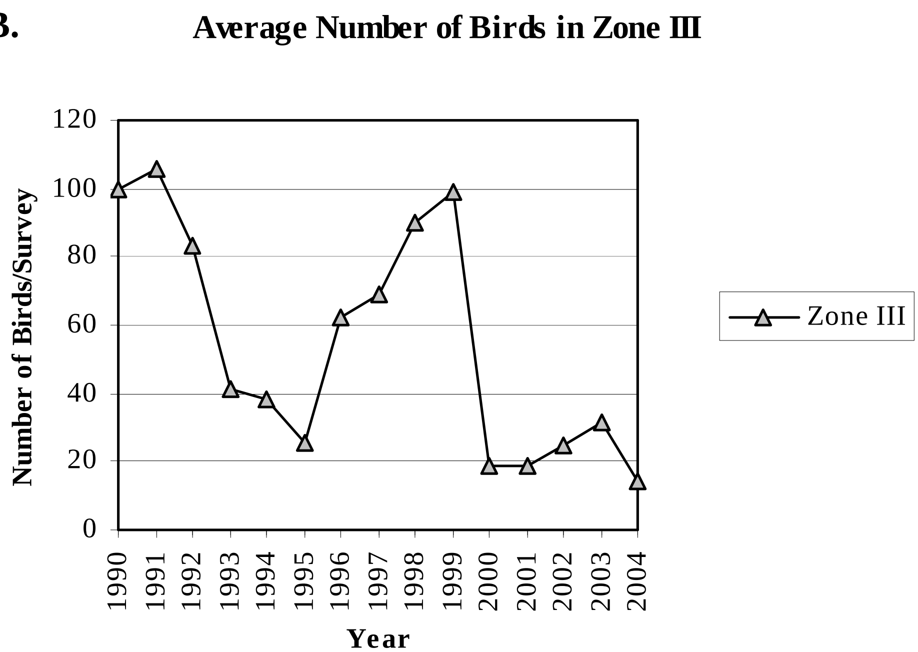


Figure 26. Average number of birds (by absolute number) counted in each zone during 1-hour censuses during the Cabrillo National Monument Rocky Intertidal Monitoring Program from 1990 to 2004. A. Zones I and II, and B. Zone III. The sum of Zone I and 2 is used rather than all three zones due to methodological problems with the data collection for Zone III (see methods).

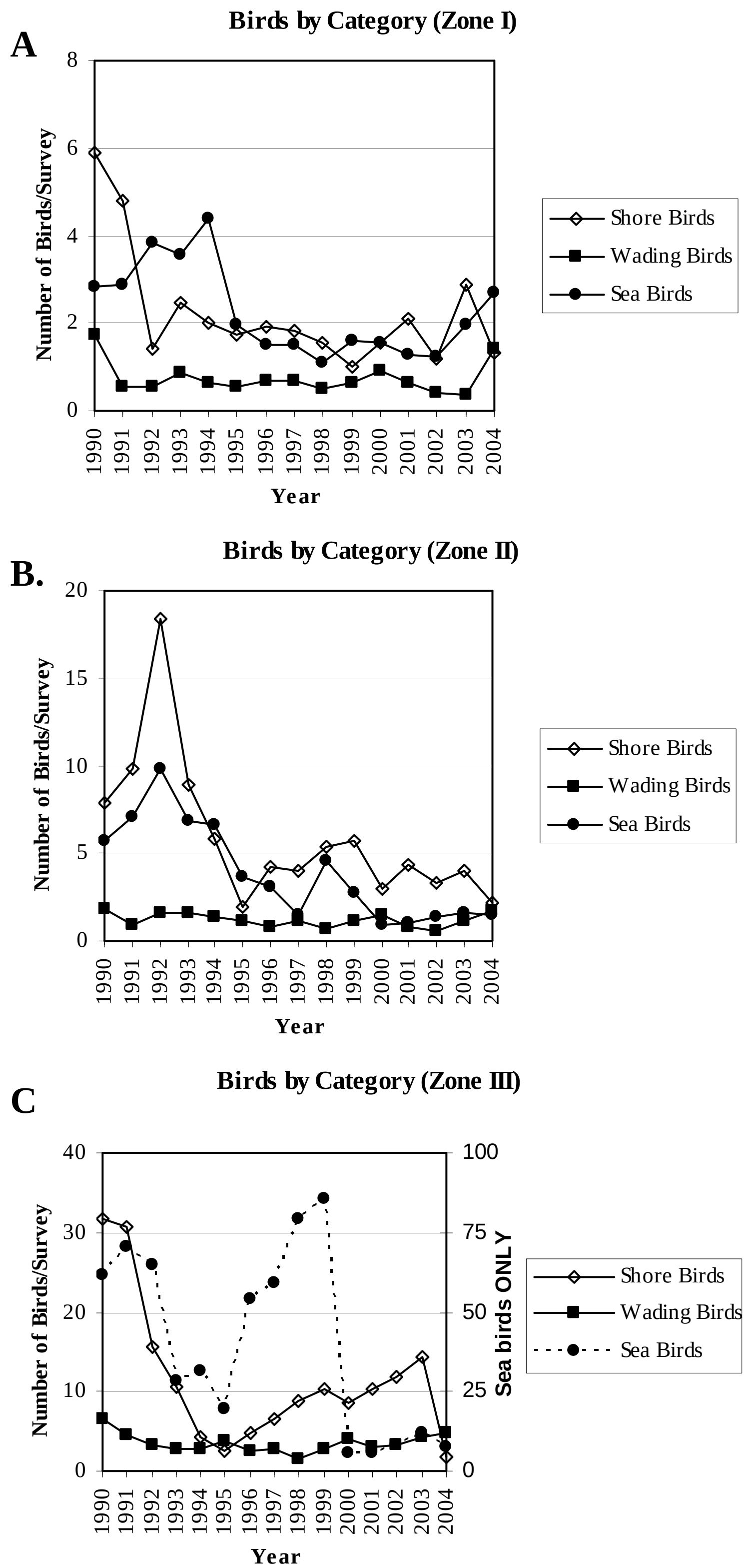


Figure 27. Average number of birds (by category) counted in each zone of Cabrillo National Monument during 1-hour censuses associated with the Cabrillo Rocky Intertidal Monitoring Program from 1990 to 2004. See Table 12 for definitions of categories ("other" was omitted for clarity). A. Zone I, B. Zone II, C. Zone III, note different scale used for sea birds vs. shore and wading birds.

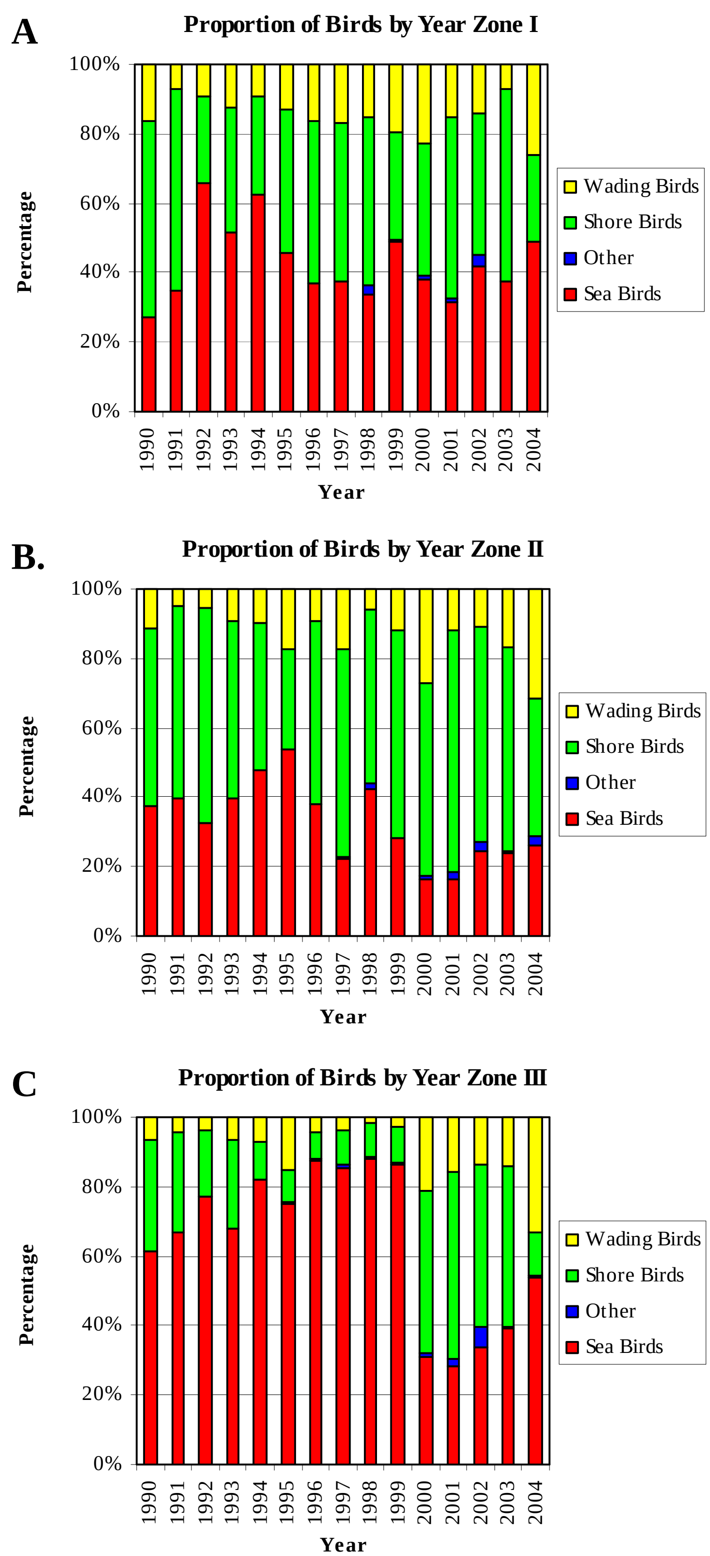


Figure 28. Proportion of each category of birds found in each zone during 1-hour censuses associated with the Cabrillo Rocky Intertidal Monitoring Program from 1990 to 2004 listed by category. See Table 12 for definitions of categories. A. Zone I, B. Zone II, C. Zone III.

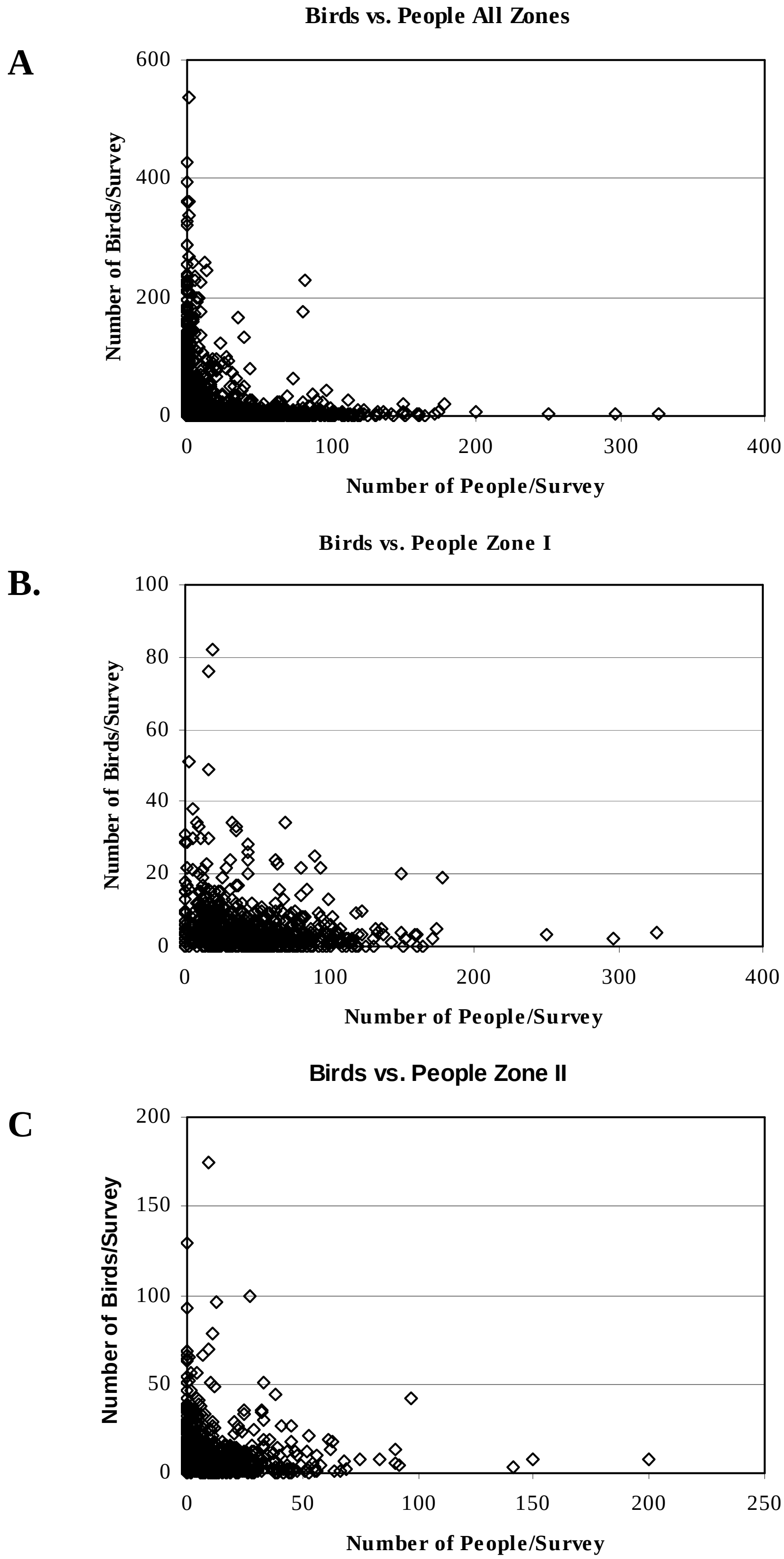


Figure 29. The relationship between the number of people and the number of birds found in each zone during each 1-hour census associated with the Cabrillo Rocky Intertidal Monitoring Program from 1990 through 2004 in A. all zones, B. Zone I, C. Zone II.

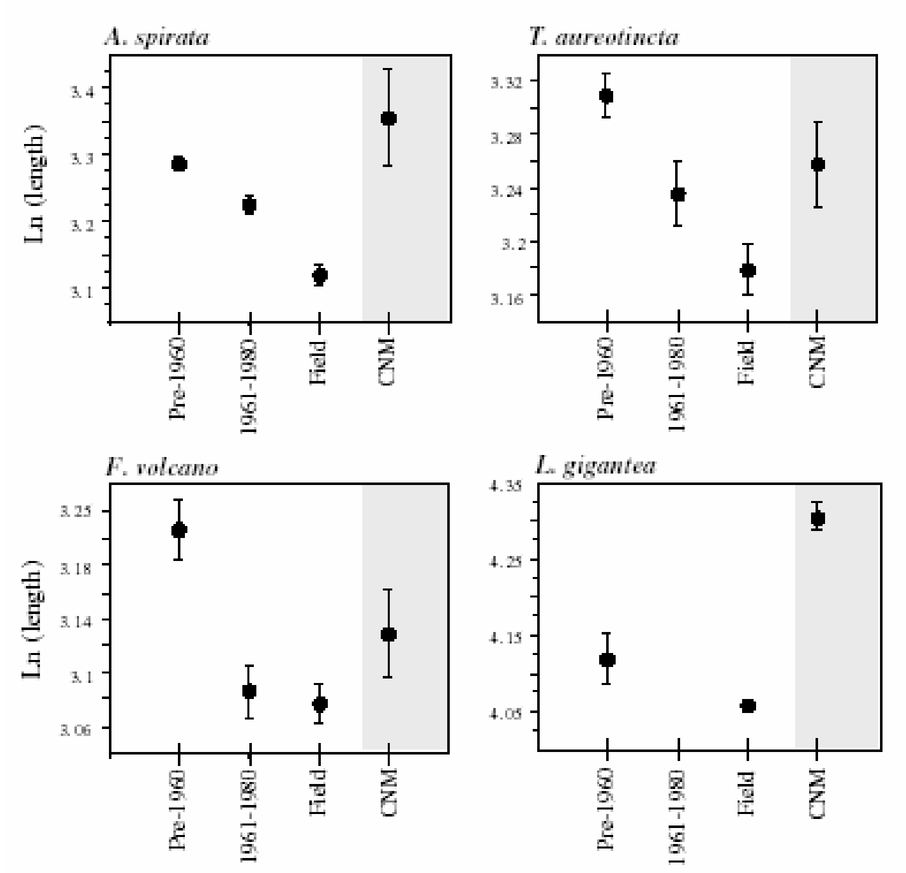


Figure 30. Length of gastropods inside and outside of Cabrillo National Monument. Size of 4 snails and limpets (Acanthina spirata, angular unicorn; Tegula aureotincta, gilded turban snail; Fisurella volcano, volcano limpet; Lottia gigantea, owl limpet) at Cabrillo National Monument (shaded area) compared to current searches at other locations in southern California (14 locations in Los Angles, Orange, and San Diego Counties, "Field") and museum samples collected prior to and after 1960. Mean sizes are log-transformed with 95% confidence intervals. A post-1960 museum baseline was not calculated for L. gigantea due to small sample size. Field data for F. volcano from San Diego County only. All pairwise comparisons of both museum, field, and CABR samples were significant at p<0.05 (Kolmogorov-Smirnov test with sequential Bonferroni corrections) with the exception of F. volcano: Field/Post-1960 (p=0.90) and Field/CNM (p=0.06). From Roy et al. (2003)**.**

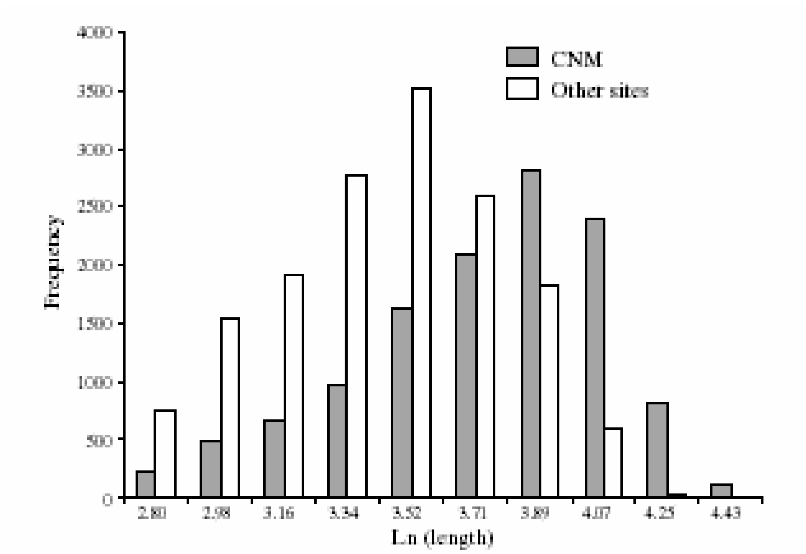
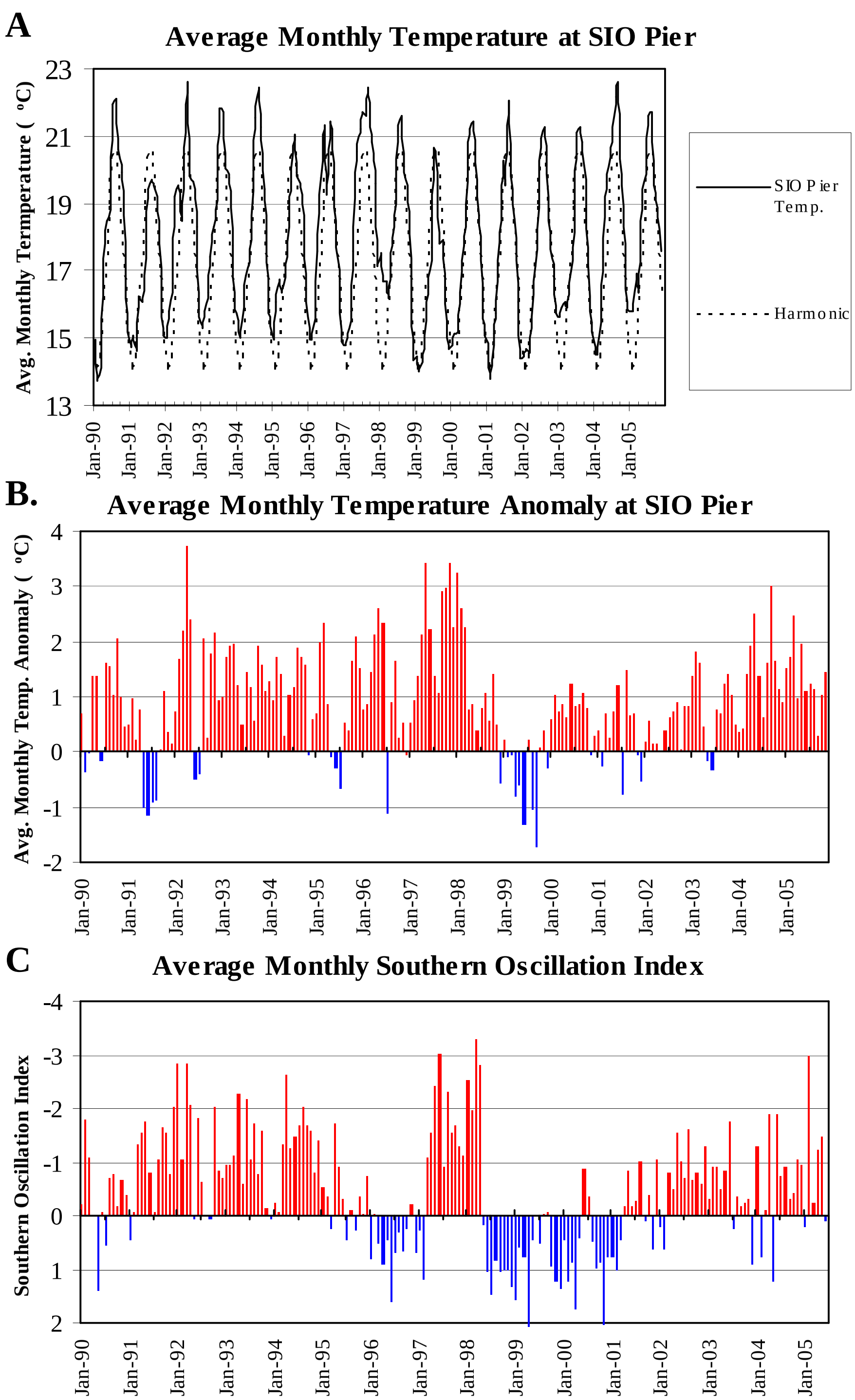


Figure 31. Size-frequency distributions of owl limpets (*Lottia gigantea*) at San Diego MARINe locations (Navy North and South on Point Loma, La Jolla Dike Rock, Cardiff Reef), compared to Cabrillo National Monument (CABR, CNM in this figure) summed from 1990 to 1999 at CABR, 1995-2002 at Navy North and South, and 1997-2002 at La Jolla Dike Rock and Cardiff Reef. The distributions were determined to be significantly different (Kolmogorov-Smirnov, $p< 0.0001$). The median size of individuals from CABR was 45 mm and from the other four areas combined was 32 mm. From Roy *et al.* (2003).

Figure 32. Environmental datasets related to climate cycles. A. Average monthly temperature measured below the Scripps Institution of Oceanography (SIO) Pier, including the harmonic temperature (the average from 1920 to 1988) at this site, B. temperature anomaly (difference between monthly average temperature and average monthly harmonic) from SIO Pier, C. the average monthly Southern Oscillation Index, a predictor of El Niño conditions, with negative values corresponding to El Niño conditions and positive values corresponding to La Niña conditions. SIO Pier Temperature data provided by Kristin Riser (SIO). SOI data from http://www.cru.uea.ac.uk/cru/data/soi.htm.


A
Average Monthly Temperature at SIO Pier
Avg. Monthly Termperature (°C)
SIO Pier Temp.
Harmonic
B.
Average Monthly Temperature Anomaly at SIO Pier
Avg. Monthly Temp. Anomaly (°C)
C
Average Monthly Southern Oscillation Index
Southern Oscillation Index

Appendix A: Current Logsheets

Cabrillo National Monument Rocky Intertidal Monitoring Program

Daily Field Log—Complete one per sampling day (includes all three zones)

Date:___________ **Time:**__________ **to**____________ **Low Tide:** ______(ft) **at** ______(time)

Activities Documentation

Participants (recorder 1st):

Work Report:

Plot marker loss/repair notes:

Bird/Visitor Census Done? (Y/N): _______ **Site Log Done?** (Y/N): ____________

Environmental Conditions

Weather Conditions:

Weather and Sea Conditions (affecting quality of sampling)

Swell/Surge:______ Wind: ______ Rain: ______ Recent Rain: ______ Water Temp (°C): ______

(Fill in all blanks: ---- =no data; 0=none; L=low; M=Med; H=High; or actual value)

Observations

Physical observations:

Biological observations:

Non-Human mammal notes (if any, include number and location; record 0 if none).

Dogs:________________ **Calfornia sea lions:**__________ **Harbor seals:**__________

Sea otters:____________ **Elephant seals:**_____________ **Other:**________________

Cabrillo National Monument daily field log.doc Last printed 6/7/2006 11:48 AM

Figure A-1. Daily Field Log.

Cabrillo National Monument Rocky Intertidal Monitoring Program

Seasonal Observations for a Single Zone—To be filled out one time per season for each Zone

Zone: CAB___________ **Date**:_________

Recorders/Observers:____

(Fill in all blanks: ---- =no data; 0=none; L=low; M=Med; H=High)

Substratum Changes (sediment=sand, gravel, cobble)(magnitude at site)

Sediment Level: ____________ Scour: ____________ Rock Movement: ____________

Debris and Pollutants (magnitude at site):

Plant Wrack: _____ Driftwood: _____ Shells: _____ Dead Animals: ____ Trash: _____ Oil/Tar: _____

Notes on physical conditions:

Notes on biological conditions:

Cabrillo National Monument zone field log.doc Last printed 6/7/2006 11:53 AM

Figure A-2. Zone Observation Log.

Cabrillo National Monument Site-Wide Species Conditions (Site Recon)

To be filled out one time per season for each Zone

Zone: CAB______________ Date:____________________ Recorder(s):____

Species/Taxon FILL IN COMPLETELY NO INTERMEDIATE CATEGORIES	Typical Habitat H=High M=Mid L=Low	Abundance ----=no data 0=Absent R=Rare U=Uncommon P=Present C=Common A=Abundant	Fertility ----=no data 0=Not Fertile L=Low Level M=Med Level H=High Level	Bleached ----=no data ✓=Typical (healthy) L=Low Level M=Med Level H=High Level	Damaged ----=no data ✓=Typical (healthy) L=Low Level M=Med Level H=High Level	Recruitment ----=no data 0=No Recruitment L=Low Level M=Med Level H=High Level	Notes
Anthopleura elegantissima/sola	ML						
Caulacanthus ustulatus	HM						
Chondrocanthus canaliculatus	M						
Chthamalus spp./B. glandula	HM						
Cladophora columbiana	ML						
Egregia menziezii	L						
Eisenia arborea	L						
Enderachne/Petalonia	HM						
Endocladia muricata	HM						
Fucus gardneri	HM						
Halidrys dioica/Cystoseira spp.	L						
Haliotis cracherodii	L						
Hesperophycus californicus	H						
Ligia occidentalis	H						
Littorina spp.	H						
Lottia gigantea	HM						
Mastocarpus papillatus	HM						
Mazzaella affinis	M						
Mazzaella spp (=Iridaea spp.)	ML						
Mexacanthina lugubris	H						
Mytilus californianus	ML						
Pelvetiopsis limitata	H						
Phragmatopoma californica	ML						
Phyllospadix scouleri/torreyi	L						
Pisaster ochraceus	L						
Pollicipes polymerus	HM						
Porphyra sp.	HM						
Postelsia palmaiformis	L						
Sargassum muticum	L						
Scytosiphon spp.	HM						
Silvetia compressa	M						
Strongylocentrotus purpuratus	L						
Tar							
Tegula spp.	L						
Tetraclita reubescens	M						
Ulva/Enteromorpha	HML						

Cabrillo National Monument recon worksheet.xls 6/7/2006

Figure A-3. Site Reconnaissance Logsheet.

Cabrillo National Monument Owl Limpet Data Sheet

Zone:______________ Date:___________ Time (starting):_____________ Plot Size: *1 m radius*

Full name of all participants on this sheet (also initials for each plot):

Plot# L_______/Site#:________				Plot# L_______/Site#:________				Plot# L_______/Site#:________			
Recorder(s):				Recorder(s):				Recorder(s):			
Measurer(s):				Measurer(s):				Measurer(s):			
Size (mm)	#	Size (mm)	#	Size (mm)	#	Size (mm)	#	Size (mm)	#	Size (mm)	#
15		60		15		60		15		60	
16		61		16		61		16		61	
17		62		17		62		17		62	
18		63		18		63		18		63	
19		64		19		64		19		64	
20		65		20		65		20		65	
21		66		21		66		21		66	
22		67		22		67		22		67	
23		68		23		68		23		68	
24		69		24		69		24		69	
25		70		25		70		25		70	
26		71		26		71		26		71	
27		72		27		72		27		72	
28		73		28		73		28		73	
29		74		29		74		29		74	
30		75		30		75		30		75	
31		76		31		76		31		76	
32		77		32		77		32		77	
33		78		33		78		33		78	
34		79		34		79		34		79	
35		80		35		80		35		80	
36		81		36		81		36		81	
37		82		37		82		37		82	
38		83		38		83		38		83	
39		84		39		84		39		84	
40		85		40		85		40		85	
41		86		41		86		41		86	
42		87		42		87		42		87	
43		88		43		88		43		88	
44		89		44		89		44		89	
45		90		45		90		45		90	
46		91		46		91		46		91	
47		92		47		92		47		92	
48		93		48		93		48		93	
49		94		49		94		49		94	
50		95		50		95		50		95	
51		96		51		96		51		96	
52		97		52		97		52		97	
53		98		53		98		53		98	
54		99		54		99		54		99	
55		100		55		100		55		100	
56				56				56			
57				57				57			
58				58				58			
59		TOTAL		59		TOTAL		59		TOTAL	

Notes:

Cabrillo National Monument Lottia_cabr.xls Version 6/7/2006

Figure A-4. Circular Plot (Owl Limpet) Logsheet.

Cabrillo National Monument Rocky Intertidal Photo Log

Date:______________ Page ______ of _______

Area(s): CABR________ Memory card #:____________________

Photographer: ________________________________ Camera:_________________________

Recorder: ____________________________________

Photo #	Zone	Plot ID	Site ID	Comments

Cabrillo National Monument digital photo log.doc Last printed 6/7/2006 11:58 AM

Figure A-5. Photoplot Photograph Logsheet.

Cabrillo National Monument Photoplot Data Sheet

Date Scored:________________ **Season:**____________ **Zone:**_____ **Plot Type (circle)**: B / M / Pe / Po

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Date Photographed:						
Scored By:						
Rock						
Non-Coralline Crusts						
Crustose Corallines						
Other Red Algae (OR)						
Articulated Corallines (AC)						
Silvetia compressa (SI)						
Chthamalus spp/Balanus glandula (CB)						
Tetraclita rubescens						
Mytilus californianus						
Pollicipes polymerus						
Anthopleura elegantissima/sola						
Chitons						
Chondracanthus canaliculatus						
Cladophora columbiana						
Egregia menziesii						
Eisenia arborea						
Endarachne/Petalonia (EP)						
Endocladia muricata						
Fucus gardneri						
Halidrys dioica/Cystoseira spp						
Hesperophycus californicus						
Limpets (LI)						
Lottia gigantea						
Mastocarpus papillatus						
Mazzaella affinis						
Mexacanthina lugubris						
Other Barnacle						
Other Brown Algae						
Other Green Algae						
Other Invertebrates						
Other Plants/Algae						
Pelvetiopsis limitata						
Phragmatopoma californica						
Phyllospadix scouleri/torreyi						
Pisaster ochraceus						
Porphyra spp						
Sand						
Sargassum muticum						
Scytosiphon spp						
Tar						
Ulva spp/Enteromorpha spp						
Unidentified						
Unscorable - not specified						
drift algae						
off rock edge						
shadow						
shoe						
AC on *M. californianus*						
CB on *M. californianus*						
CB on *T. rubescens*						
EP on *M. californianus*						
EP on *T. rubescens*						
LI on *M. californianus*						
OR on *M. californianus*						
OR on *P. polymerus*						
OR on *T. rubescens*						
SI on *M. californianus*						
TE on *M. californianus*						

Cabrillo National Monument Photo Data.xls Revised: 6/7/2006

Figure A-6. Photoplot Data Logsheet.

Cabrillo National Monument Point Intercept Transect Data Sheet

Date: ____________________ Zone: *CABR*____________ Plot #: ________________ Site #: ________________

Recorder: ____ Reader: ____

Cover (circle one): Turf/Grass/Kelp **Read tranects from N to S**

cm	Code	cm	Code	cm	Code	cm	Code
0	START AT 10	250		500		750	
10		260		510		760	
20		270		520		770	
30		280		530		780	
40		290		540		790	
50		300		550		800	
60		310		560		810	
70		320		570		820	
80		330		580		830	
90		340		590		840	
100		350		600		850	
110		360		610		860	
120		370		620		870	
130		380		630		880	
140		390		640		890	
150		400		650		900	
160		410		660		910	
170		420		670		920	
180		430		680		930	
190		440		690		940	
200		450		700		950	
210		460		710		960	
220		470		720		970	
230		480		730		980	
240		490		740		990	
						1000	

For surfgrass plots, record the following (0,L,M,H=none, low, med, high), cover of:

Smithora (red algae):	Melobesia (coralline crust):	
Bleached/brown grass:	Abraded:	Flowers:

Taxa		Code
Anemones		A
Articulated Corallines		AC
Barnacles		B
Boa Kelp		BK
Colpomenia		CO
Crusts	Coralline	CC
	Non-Coralline	NC
Halidrys		H

Taxa		Code
Mussels		M
Other Algae	Brown	OB
	Green	OG
	Red	OR
Other Invertebrates		OI
Other Plant		OP
Rock		R
Sand		SA

Taxa	Code
Sandcastle Worms	SW
Sargassum	S
Sea Palm	SP
Surfgrass Overstory	SG
Surfgrass Understory	SGU
Tar	T
Unidentified	UI

Cabrillo National Monument transect_vertical.doc Last printed 6/7/2006 12:01 PM

Figure A-7. Line Transect Logsheet.

Cabrillo National Monument Abalone/Seastar Timed Search

(Look for all species listed)

Season: ______________________________ **Year:** ______________________________

Date: _________ Time started:__________________ Time ended: __________________

Zone: CABR __________________ Recorder:______________________________________

Description of area searched:

Species	# found	Notes (size, condition, location, etc.)
Black Abalone		
Green Abalone		
Pink Abalone		
Ochre Seastar		
Blue Seastar		
Bat Star		
Fragile Star		
Red Urchin		
Purple Urchin		

Comments:

Date: _________ Time started:__________________ Time ended: __________________

Zone: CABR __________________ Recorder:______________________________________

Description of area searched:

Species	# found	Notes (size, condition, location, etc.)
Black Abalone		
Green Abalone		
Pink Abalone		
Ochre Seastar		
Blue Seastar		
Bat Star		
Fragile Star		
Red Urchin		
Purple Urchin		

Comments:

Date: _________ Time started:__________________ Time ended: __________________

Zone: CABR __________________ Recorder:______________________________________

Description of area searched:

Species	# found	Notes (size, condition, location, etc.)
Black Abalone		
Green Abalone		
Pink Abalone		
Ochre Seastar		
Blue Seastar		
Bat Star		
Fragile Star		
Red Urchin		
Purple Urchin		

Comments:

Cabrillo National Monument timedsearch.doc Created on 9/30/03

Figure A-8. Timed Search Logsheet.

CABRILLO INTERTIDAL VISITOR AND BIRD CENSUS - Study Site *CABR I-III*

Data Sheet # 8 **Date** __________ **Time START** _______ **Time END** _______

Observer(s) ____

Tide Level: _________ft at ________(time) **Temperature**: Air ____°F Water ____°F **Wave Height** ____________ft

Cloud Cover ________% **Wind**: Direction ____ Max. Speed ____ mph Avg. Speed _____ mph

	AREA I	AREA II	AREA III	AREA III Boulders
PEOPLE				
WADING BIRDS				
Great Blue Heron				
Great Egret				
Snowy Egret				
Brown Pelican				
Other				
SHORE BIRDS				
Black-bellied Plover				
Willet				
Wandering Tattler				
Spotted Sandpiper				
Marbled Godwit				
Whimbrel				
Ruddy Turnstone				
Black Turnstone				
Surfbird				
Sanderling				
Other				
GULLS				
Unidentified				
Western				
California				
Heerman's				
Mew				
Herring				
Ring-billed				
Tern (spp. if known)				
Other				
OTHER				

Birds on the Rocky Outcrop South of the Zone III Boundary

	<10	10-24	25-49	50-99	100-199	200-299	>300
Gulls							
Pelicans							
Terns							
OTHER							

Comments and Observations:

J:\Data\animal_eco\birds\shorebird\Data\NEWBCdatasheetsOct05.doc

Figure A-9. Shorebird and Visitor Census Logsheet.

Appendix B: Brief Analysis of Changing Transects from Line Intercept to Point Contact

The following is a brief analysis conducted by Bonnie J. Becker in October 2000 for a Multi-Agency Rocky Intertidal Network (MARINe) meeting. At that time, there were two different ways that MARINe groups were scoring line transects. The purpose of this document was to determine the effects of changing the approach of one group to be in line with the other. It was decided at this meeting for the groups using the "line intercept" method (recording every centimeter) to switch to the "point contact" method (recording every 10 centimeters). Cabrillo National Monument was one of the groups that made the switch.

Every centimeter or every ten centimeters?

<u>The problem:</u>
People have been doing line transects in two different ways:

- "Thousand" = looking at every centimeter, determining what dominated each centimeter for 10 m (e.g. line intercept).
- "Hundred" = looking every ten centimeters, determining what was under each 10 cm point, for 10 m (e.g. point intercept).

Do these two methodologies yield equivalent results? If so, the hundred method is much less labor intensive and would possibly allow for more transects per site. This method, if it does not yield less precise results, would be preferable.

<u>The approach:</u>
There are two different aspects of this problem. First of all, does more points yield a more precise estimate of the transect? I would think it would, especially for rarer (e.g. anemones) or more patchy (e.g. *Egregia*) taxa. The question is to what degree? And is that what we would like to know—precisely what was along our line at the moment we took the transect? I think we would like to be able to say something more about the area at large, and its natural vs. anthropogenically-caused variance. Especially since we are using fixed plots (and therefore can only draw conclusions about the plots, not the whole area), the more plots we have, the more we can describe the area. Counting fewer points would allow us to add more transects.

In order to make a more informed decision, I took the dataset from Cabrillo National Monument, where we have been sampling every centimeter for ten years, and subsampled it to yield data equivalent to the hundred method (except that instead of a "point", I had to use a whole centimeter—unavoidable and probably not too bad of an assumption, except for really small organisms that tend to be biased against in this case). Due to the way the data is stored, I had to use only the last 3 years. I think this is enough data from which to draw conclusions, but I could convert the other years if need be.

I created a spreadsheet with the percent cover of each organism at each plot for both method next to each other. I then subtracted one from the other. If there is a systematic bias, one would expect the average difference between them to be different from 0 in one direction. I determined the mean difference overall, and for various species (some common, some patchy, some rare). I also determined the 95% confidence intervals. Then I graphed the two datasets next to each other for each species over time.

<u>The result:</u>
The difference between the percent covers (thousand-hundred) looked like this. Keep in mind that these were done on percentages, so a mean of 0.006 means that the percent cover yielded was 0.6% different:

Table B-1. Descriptive statistics describing differences between reading transects every centimeter or every 10 centimeters. Using data from CRIMP from 1998-2000, looking at the difference between the calculated values if recorded as is (every 10 cm) or if every 10th point was used.

	All taxa	*Egregia*	*Anemones*	*Surfgrass*	*Sargassum*	Red Algal Turf
Mean	-1.13003E-18	-0.006103425	0.001518196	-0.000367535	0.000301508	-0.002611123
Standard Error	0.000663301	0.002545773	0.001360498	0.001495614	0.00150399	0.001715857
Median	0.001010101	-0.0035	0.004	0.002	0.001	-0.001
Mode	0	0	0.004	0.004	0	-0.004
Standard Deviation	0.014210747	0.013470965	0.007574933	0.014577446	0.007519949	0.017582303
Sample Variance	0.000201945	0.000181467	5.73796E-05	0.000212502	5.65496E-05	0.000309137
Range	0.096	0.068	0.03	0.083	0.037	0.091610611
Minimum	-0.055	-0.055	-0.012	-0.047	-0.016	-0.050610611
Maximum	0.041	0.013	0.018	0.036	0.021	0.041
Sum	-5.18682E-16	-0.170895896	0.047064064	-0.034915783	0.007537711	-0.274167927
Count	459	28	31	95	25	105
Confidence Level(95.0%)	0.001303492	0.005223491	0.002778505	0.002969576	0.003104082	0.003402605

The graphs looked like this:

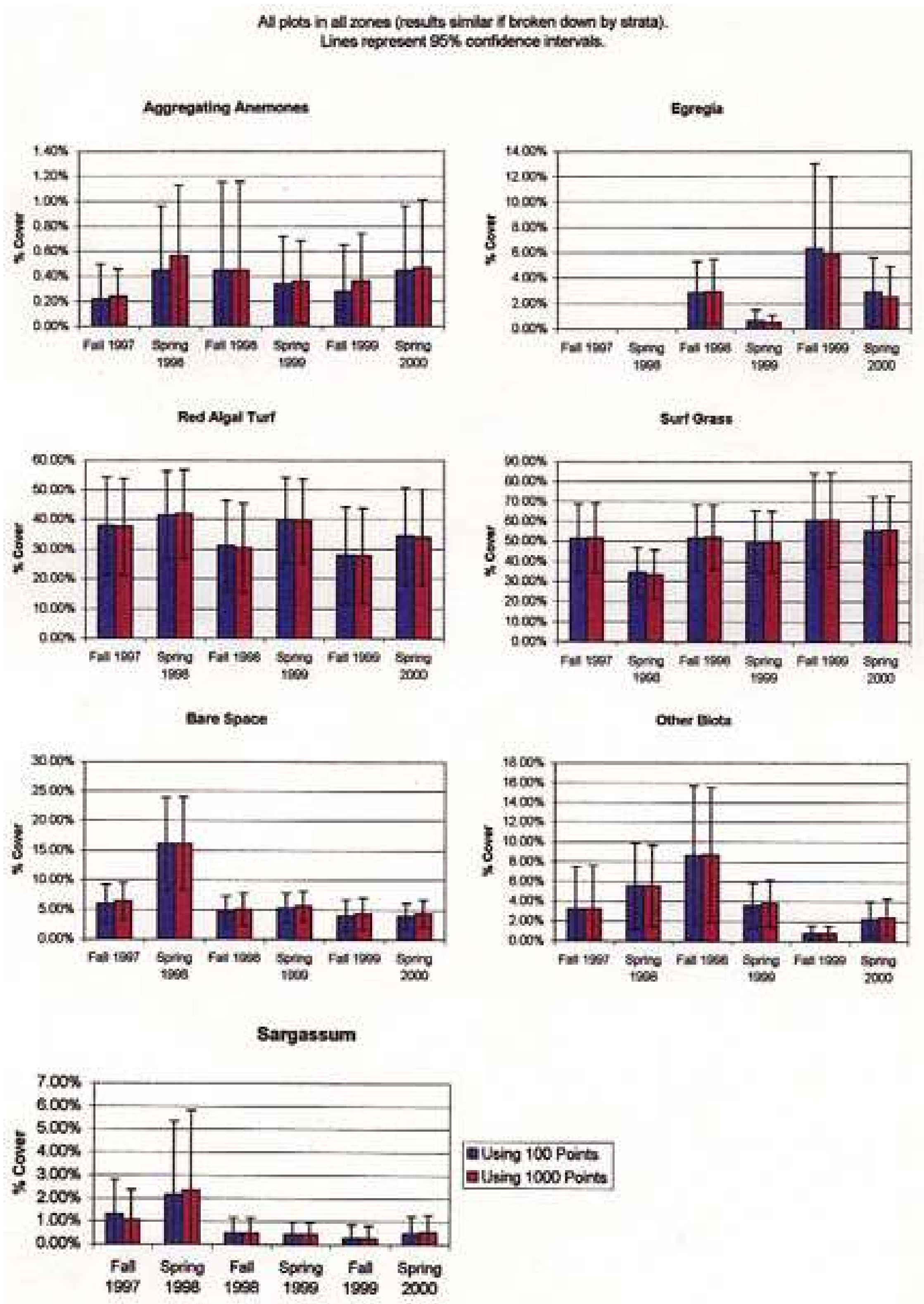


Figure B-1. Comparison of Cover of Various Taxa when Considered Every Centimeter of Every 10 Centimeters. Error bars represent 95% confidence intervals.

The conclusion:

There is very little difference in the resulting percent covers calculated using the two methods (<1% in all cases). Clearly, the 95% confidence intervals indicate that the variability between plots is much greater than that within plots analyzed with the two methods.

One exception might be aggregating anemones, where were often missed entirely by the hundred method. Does this matter much? Using the thousand sampling regime to try to assess an organism such as anemones (which are often <1% of the transect anyway) is probably not viable anyway. For example, knowing that this fall they had 0.7% cover and last spring they had 0.25% cover is not particularly useful information. If we wanted to know simple presence/absence, then the thousand sampling regime would be more appropriate. If we want to know true percent cover of anemones or Sargassum, I think we should adopt an entirely different method.

In sum, I think that the hundred sampling method, where we determine the cover under every 10 cm of a 10 m line is sufficient for our purposes and would allow us to increase the number of transects. This would increase the representativeness of our monitoring without sacrificing substantial precision.

Appendix C: Statistical Determination of the Number of Bird Sampling Days

Bonnie J Becker
October 14, 2004

A practical determination of the number of sample days needed for Bird and Visitor Censuses at Cabrillo National Monument

INTRODUCTION

Defining the problem
Since 1990, Cabrillo National Monument has monitoring the rocky intertidal habitat within its administrative boundaries. In addition to a larger semiannual effort to monitor populations of marine invertebrates, plants, and algae, the park has conducted regular censuses of the bird and visitor abundances within the rocky intertidal zone. The purpose of this document is to evaluate the sample size (in number of days per year) needed for these censuses in order to balance effort exerted with statistical rigor.

Ideally, these "Bird and People Counts" were to be conducted on all days when tides that are 0.0 feet or lower (relative to mean low lower water, MLLW), and fall between 1000 and 1600 hours (see Becker 2006 and Glenn 2006 for sampling details). In the 2004 calendar year, approximately 70 days meet these criteria, mostly between October and May. The actual number of eligible days that were sampled has varied over time due to fluctuations in staff focused on these studies (Table C-1).

Table C-1. The number of bird counts conducted per year between 1990 and 2003.

Year	Number of Counts Conducted
1990	18
1991	50
1992	50
1993	82
1994	92
1995	61
1996	49
1997	40
1998	50
1999	50
2000	57
2001	55
2002	55
2003	69

On sampling days, the census itself takes approximately 1 hour, with an addition half-hour to an hour of preparation and travel time. Due to the limited staffing of the Natural Resource Science (NRS) Division, a large number of these counts are done by trained volunteers. Coordinating and training these volunteers takes a significant amount of time.

In addition, many of the sampling days fall on weekends and holidays, often leading to extra overtime and compensatory time for NRS Staff to cover these days.

Therefore, these counts represent a large amount of effort for NRS staff. At this point, we would like to determine if the number of sample days is too high, too low, or sufficient to meet the goals of the program. If possible, the number of days should be reduced. However we would like to be sure that we continue maintaining enough sampling effort for the program to be useful.

Constraints
Most techniques used to determine the appropriate sample size for a study either implicitly or explicitly depend on the question being asked of the data. The bird and people counts, however, were established as a generic monitoring program designed to answer questions post hoc as they arose.

In November 2001, a workshop was held to evaluate the whole CABR Intertidal Monitoring Program. At that workshop, the following goals for the program were defined as:

- To collect long-term, baseline information on the "ecological health" of the rocky intertidal area, and to determine normal limits of variation.
- To be conducted in perpetuity.
    - o *In order to maintain the program in the long-term, all techniques should be doable by volunteers with limited training and basic supervision (by a non-expert) with oversight by a limited number of experienced staff. In addition, the program should be low-cost.*
- To determine differences between the three zones, which experience very different amounts of visitation, and to determine the effects of the closure of Zone III.
- To be comparable and compatible with existing data and similar programs in southern California (e.g. Channel Islands National Park and the Multi-Agency Rocky Intertidal Monitoring Network, MARINe).
    - o *Large changes in existing protocols can only be made after consultation with these other programs. Measurements for additional components that are unique to CABR are acceptable.*
- To detect large changes in community structure reasonably quickly.
    - o *Correlation of this temporal data with other factors (environmental, anthropogenic) should guide further research to determine causation of trends of concern.*
- To provide for baseline data in case of an acute disturbance (e.g. oil spill, sewage spill, riprap), and to serve as an opportunity for public education and outreach.

With these general goals in mind, the following is a list of possible questions to be tested with this data for the purpose of this analysis. This list is a best approximation and should not be considered all-inclusive.

- Is there a long-term decline or increase in the number of birds in the tidepools of Cabrillo National Monument? Is there a long-term decline or increase in the number of birds in the tidepools of Cabrillo National Monument?
- Is there a difference in the number of birds in the three zones?

- Is there a relationship between the number of people and the number of birds present at the same time?
- Was there a change in the number of birds in Zone III after the closure of the area?
- Was there a change in the number of visitors in the tidepools after the moving of the entrance station in 2003?

It should be noted that species-specific data is collected for bird counts, and these questions (and therefore this analysis) do not consider species separately. It should also be noted that these censuses are not included in the larger scale programs in which Cabrillo participates and therefore changes in this protocol will not affect the goal to be comparable with these existing protocols.

The approach
The first step in this process is to determine if there is existing information to warrant lowering the number of sample days for bird counts. I will re-examine the power analysis conducted by Dr. Steven Shroeter in 2001 for the review workshop mentioned above. The second step is to determine an appropriate number of samples for the study using three different techniques as defined by Ambrose (2002). Finally, I will draw conclusions and make recommendations for the upcoming 2004-2005 tidepool season.

POWER ANALYSIS

Introduction and methods
In 2001, Cabrillo National Monument conducted a review of its rocky intertidal monitoring program, as summarized by (Becker 2003). As part of that review, the park contracted Dr. Stephen Schroeter to perform a power analysis on the data from 1990-2001. In that analysis, Schroeter used a "Before vs. After" approach to determine a. the power of the existing number of samples to determine a 50% change in abundance in all bird categories at p=0.05 (Table C-2), b. the minimum effect size that could be detected with the existing sample size at 80% power and p=0.05 (Table C-3), and c. the number of future samples that would be needed to detect a 50% change if an event were to occur in the future (Table C-4). He applied the same three questions to the visitor census data (Tables C-5, C-6, and C-7).

Results

Table C-2. Power to detect 50% decreases or increases in bird densities for Before/After comparisons, alpha = 0.05. From Schroeter 2003.

	Mean Number per acre			Power				
Category	I	II	III	I	II	III	Mean	Std
Other	0.00	0.00	0.01	10.5	13.4	19.6	14.5	3.8
Sea Birds	0.61	0.92	2.32	100	100	100	100.0	0.0
Shore Birds	0.49	1.19	0.62	100	100	100	100.0	0.0
Wading Birds	0.17	0.26	0.23	99.8	100	100	99.9	0.1

In this table, it appears as if for all major categories of birds and all three zones, the power to detect a 50% change was 100%. The "Other" category are rare birds that don't fit into the other three categories, and include black phoebe, kingfisher, merganser, mocking bird, osprey, white crowned sparrow, and unidentified non-gull birds. Our power to detect change in these species was very low.

Table C-3. Effect size necessary for 80% power to detect decreases or increases in bird densities for Before/After comparisons, alpha = 0.05. From Schroeter 2003.

	Mean Number per acre			I		II		III	
Category	I	II	III	% Δ	power	% Δ	power	% Δ	power
Other	0.00	0.00	0.01	-99	27.12	-99	38.35	-99	58.76
Sea Birds	0.61	0.92	2.32	-19	83.46	-16	80.13	-15	83.12
Shore Birds	0.49	1.19	0.62	-24	81.81	-16	83.98	-20	82.71
Wading Birds	0.17	0.26	0.23	-29	80.11	-23	81.35	-17	79.9

With 80% power, the data could be used to detect a 15-29% change in abundance. Once again, change in species in the "other" category could not be detected with 80% power.

Table C-4. Sample size necessary to detect 50% decreases or increases in bird densities with 80% power for Before/After comparisons, alpha = 0.05. From Schroeter 2003.

	Mean Number per acre			I		II		III	
Category	I	II	III	n	power	n	power	n	Power
Other	0.00	0.00	0.01	456	16	456	22	456	34
Sea Birds	0.61	0.92	2.32	1	100	1	100	1	100
Shore Birds	0.49	1.19	0.62	1	100	1	100	1	100
Wading Birds	0.17	0.26	0.23	1	100	1	100	1	100

In this case, one sample would be needed to detect a 50% change with 80% power in most categories and all zones. It would take 456 samples to detect a 50% change in birds in the "other" category.

Table C-5. Power to detect 50% decreases or increases in visitor densities for Before/After comparisons, alpha = 0.05. From Schroeter 2003.

Mean Number per acre			Power				
I	II	III	I	II	III	Mean	Std
9.4	1.8	0.2	100	100	100	100.0	0.0

In all zones, there is 100% power to detect a 50% change in visitors.

Table C-6. Effect size necessary for 80% power to detect decreases or increases in visitor densities for Before/After comparisons, alpha = 0.05. From Schroeter 2003.

Mean Number per acre			I		II		III			
I	II	III	% Δ	power	% Δ	power	% Δ	power	Mean	Std
9.4	1.8	0.2	7	100	15	100	36	100	19	12.2

With 80% power, we can detect a 7-36% change in visitor numbers, depending on the zone.

Table C-7. Number of surveys in After period needed to detect 50% decreases or increases in visitor densities with 80% power for Before/After comparisons, alpha = 0.05. From Schroeter 2003.

Mean Number per acre			I		II		III			
I	II	III	n	power	n	power	n	power	Mean	Std
9.4	1.8	0.2	1	100	1	100	1	100	1	0.0

As in the birds, a single sample would be needed to detect a 50% change in visitor abundance in an “after” event.

Schroeter than attempted to conduct a power analysis based on a “BACI” (Before-After-Control-Impact) study. This differs from the above “Before-After” study above in that it uses an additional site or sites as a covariate. In other words, in the Before-After case a single site is considered both before and after an event. In the BACI case, a site experiences an impact and that site before and after the event is compared to a comparable site or sites before and after the event.

In order for these analyses to be valid, a few assumptions in the data must be met, such as a lack of temporal trends. None of the visitor count comparisons met these criteria and were not analyzed (probably due to the very large difference in numbers of people between the zones). Most of the bird comparisons did not meet the assumptions; the comparison between “other birds” in Zones I and II and the comparison between shore birds in Zones I and II. The power for the former was quite low and the power for the latter was quite high.

Conclusion

From this power analysis, it is clear that we can greatly reduce the number of samples we are taking per year without reducing our power below an acceptable level. This analysis considered broad categories of bird species, including shore birds, wading birds, and sea birds. The main application from these results are that we can definitely lower the number of sample days per year. However, from these results it is unclear how many samples we should continue to do.

The category “other birds” includes some rare species that are occasionally found (and variably identified), and the power to detect change in these species was quite low. In order to improve the power for these species we would need to add many more additional samples to our current methods, and more practically, we would need greatly alter our training program to increase the range of species our volunteers could identify. This would increase the amount of effort going into this study and would do little to enhance our goals.

Table C-8. Bird Species and Categories Used for Power Analyses

Species	Category
California Gull	Sea Birds
Double-crested Cormorant	Sea Birds
Heermann's Gull	Sea Birds
Mew Gull	Sea Birds
Oyster Catcher	Sea Birds
Pelican	Sea Birds
Ring-Billed Gull	Sea Birds
Tern	Sea Birds
Unidentified Gull	Sea Birds
Western Gull	Sea Birds
Black Turnstone	Shore Birds
Black-Bellied Plover	Shore Birds
Marbled Godwit	Shore Birds
Ruddy Turnstone	Shore Birds
Sanderling	Shore Birds
Spotted Sandpiper	Shore Birds
Wandering Tattler	Shore Birds
Whimbrel	Shore Birds
Willet	Shore Birds
Great Blue Heron	Wading Birds
Great Egret	Wading Birds
Snowy Egret	Wading Birds
Black Phoebe	Other
Kingfisher	Other
Merganser	Other
Mocking Bird	Other
Osprey	Other
Unidentified Bird (non-gull)	Other
White Crowned Sparrow	Other

DETERMINATION OF NUMBER OF SAMPLES

Introduction

In Chapter 4 of Murray, Ambrose, and Dethier, they describe three different approaches to simply determine the number of samples needed in a sample design, relative to the variability in a “pilot” study. Here I try to use each approach on our existing bird data to compare the resulting number of samples. In each case I am using data from 1990-2003.

Approach 1: plotting variability vs. sample size
The first approach was graphical. The concept is to graph the relative amount of variability in a limited number of data points vs. the number of datapoints (i.e. replicates) and determine how many replicates are necessary to cause the variability to level off. In other words, you determine the improvement in estimation with an increase in replicates and at what point increasing the replicates does not significantly improve estimation. The variability is defined as:

$$\text{variabiltilty} = \frac{SE}{\bar{x}} \, where \, SE = \frac{SD}{\sqrt{n}}$$

Using the existing data, I started at the first two samples and calculated the variability, and assigned it a replicate value of 2. Then I looked at the first three samples, etc. For example:

Data set	Variability	Number of replicates
x_1		
x_2	var(x_1-x_2)	2
x_3	var(x_1-x_3)	3
x_4	var(x_1-x_4)	4
x_5	var(x_1-x_5)	5
etc.	etc.	etc.

I did this for each zone and year separately. For example, I did this analysis for Zone I in 1990, Zone II in 1990, Zone III in 1990, Zone I in 1991, etc. I then graphed all of the data in a single plot, which was too messy to be useful. So I then determined the average for each number of replicates. For example, I averaged all Zone/Years with 2 replicates, with 3 replicates, etc., and determined the standard error for that average.

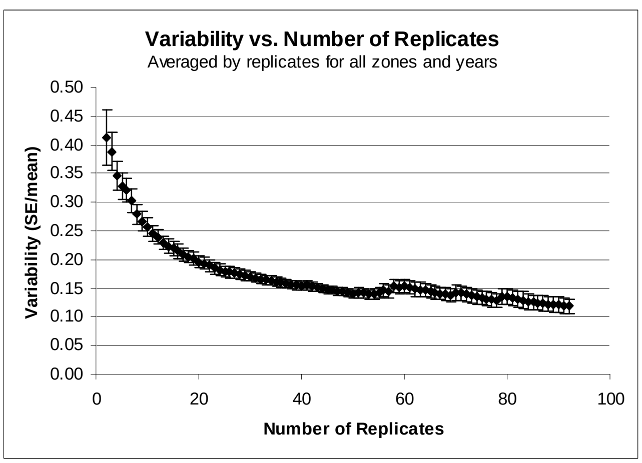


Figure C-1. Variability vs. number of replicates of bird censuses, averaged by replicates for all zones and years.

From this analysis, it appears as if the variability (as a percentage of the mean) levels off at around 40 replicates/year. In other words, increasing the number of replicates over 40 does not significantly reduce the variability and would therefore be unnecessary.

Approach 2: specify the desired precision
The second approach is similar, but allows you to specify a level of precision (as a proportion of the mean) and then calculate the number of replicates needed.

$$n = \left[\frac{SD}{p * \bar{x}} \right]^2$$

Since it is difficult to make a value judgment about the desired precision, I calculated this equation for a variety of precisions, and then graphed the actual values to get a sense of how much precision is necessary to see differences between zones and years. I first considered all Zone/Years by Zone.

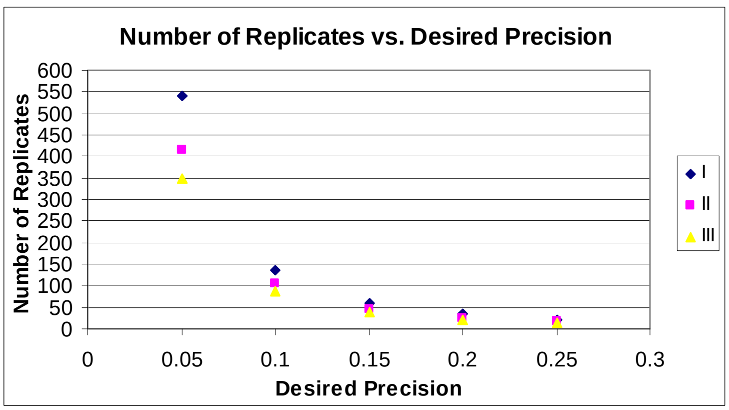


Figure C-2. Number of replicates vs. desired precision of bird censuses, with zones considered separately.

In this case, approximately 50 replicates would lead to a 15% precision around the mean (average is 48). In order to improve to 10% precision, we would need to increase our replicates to over 100 days (108 average). I then graphed the mean number of birds per zone and created error bars that are 5, 10, 15, 20 and 25% around the mean.

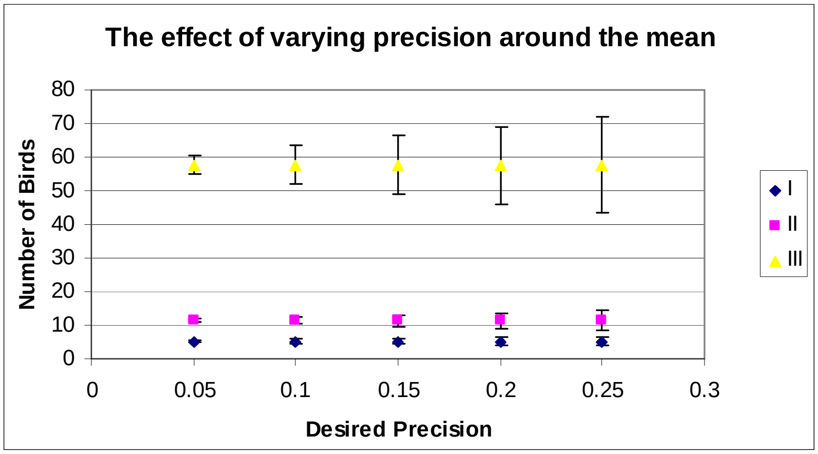


Figure C-3. The effect of varying precision around the mean for bird censuses, zones considered separately.

So in this case, even at 25% precision, the differences between the zones are pretty clear. Therefore, the 0.15 precision level (as determined in both Analysis 1 and this analysis) is more than acceptable in this case.

I repeated this analysis and considered differences between years.

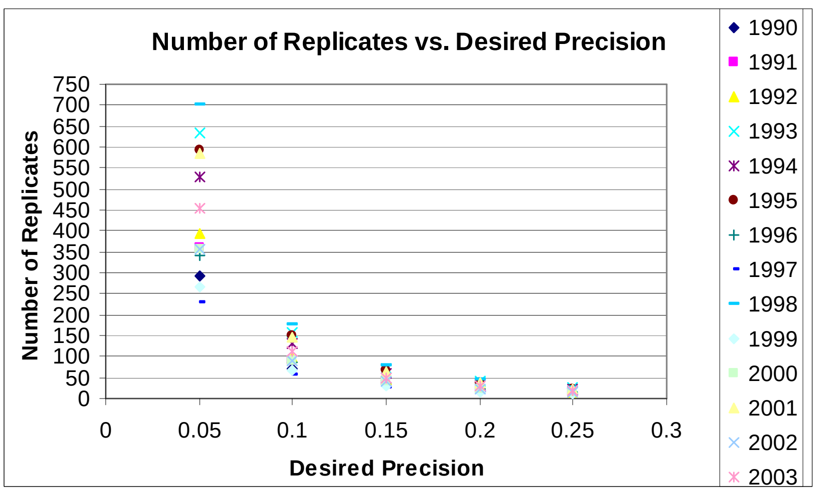


Figure C-4. Number of replicates vs. desired precision of bird censuses, with years considered separately.

Once again, the average number of replicates needed for 15% precision is around 50 (48), with around 100 (108) replicated needed for 10% precision. There was more variability around these numbers, probably because the number of samples considered for each year is lower than the number considered for each zone.

In order to put the 15% precision in context, I also graphed the mean for each year with the error bars representing the various precisions.

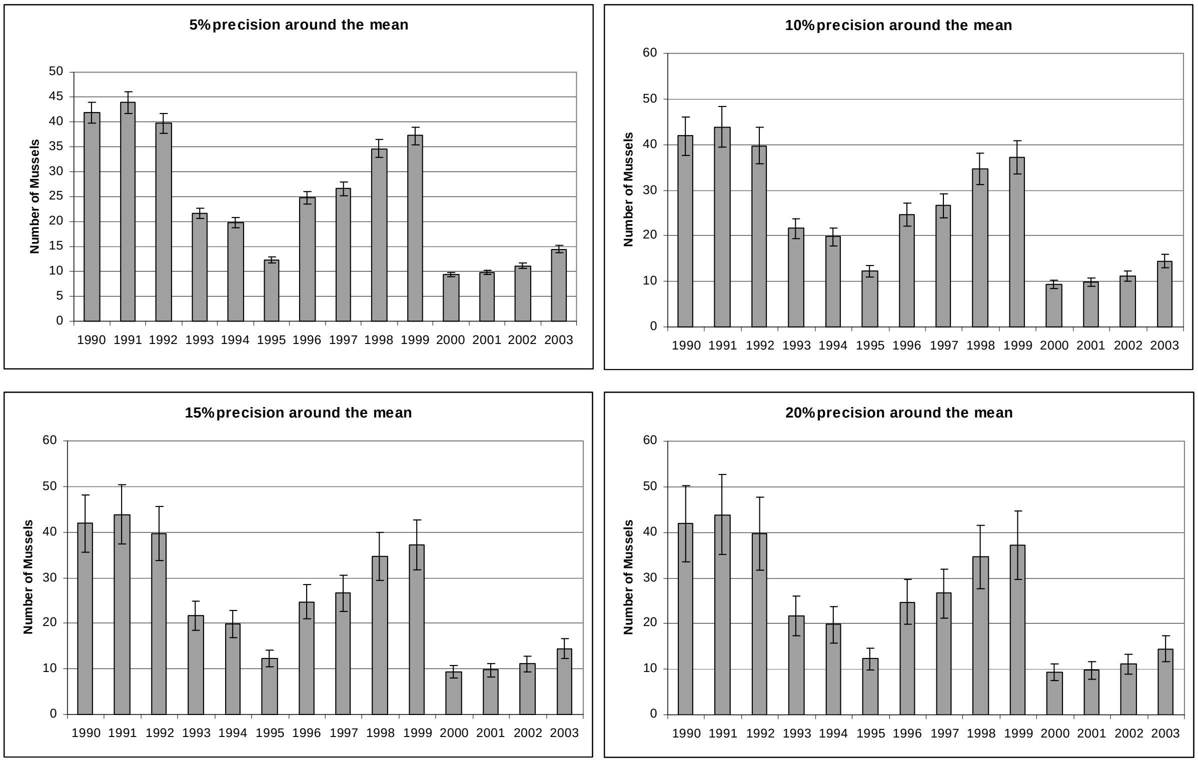


Figure C-5. The mean number of birds by year with various precisions (5%, 10%, 15%, 20%).

These graphs are a little misleading due to the problems that have occurred over the years due to protocol differences in which birds are counted in Zone III (see Methods Section). Nevertheless, the 15% precision level appears sufficient. I redid the yearly analysis for just Zone II.

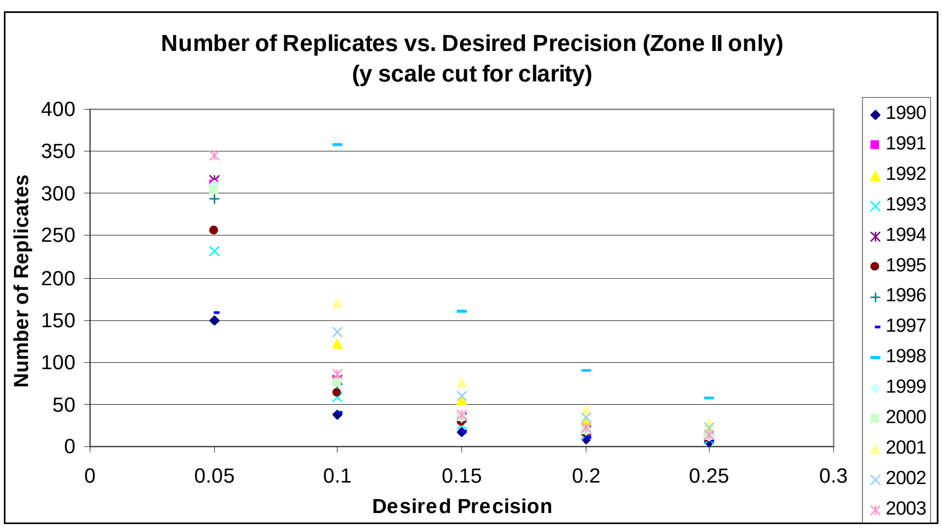


Figure C-6. Number of replicates vs. desired precision of bird censuses in Zone II only, with years considered separately.

The average for 15% precision was 46 replicates. I also repeated the context graphs for just Zone II.

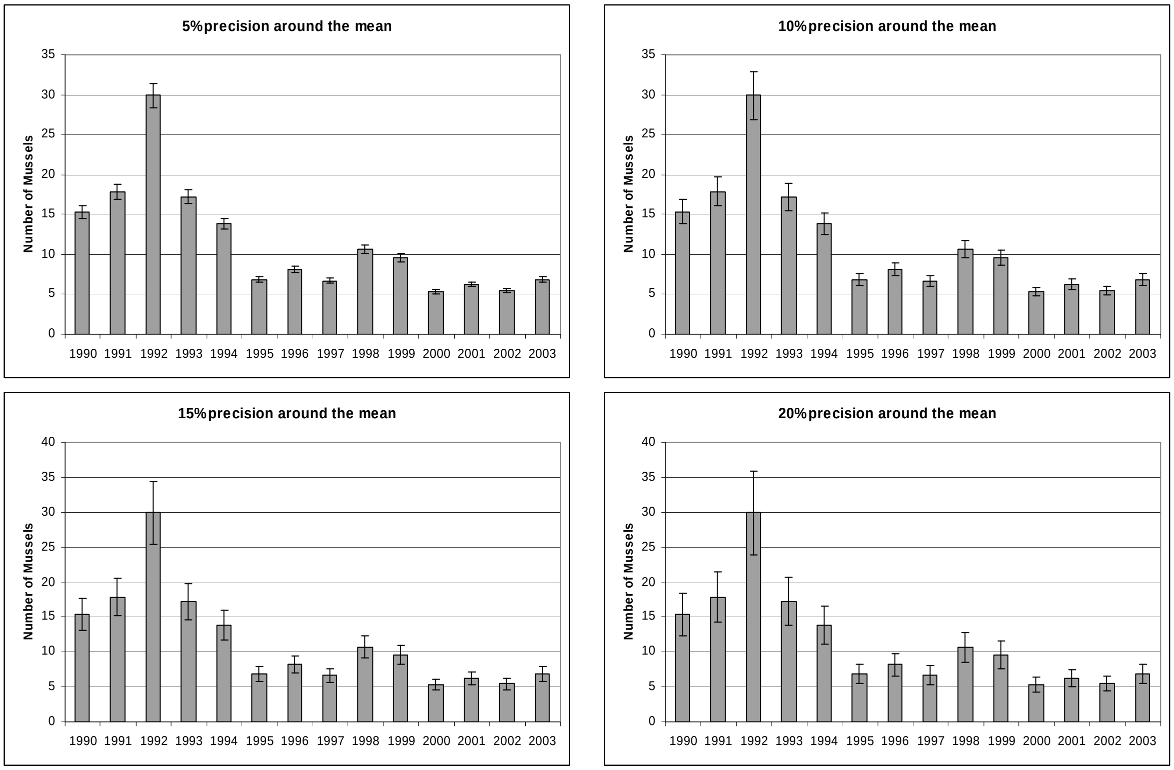


Figure C-7. The mean number of birds in Zone II only by year with various precisions (5%, 10%, 15%, 20%).

In this case, the 15% precision around the mean seems reasonable.

Approach 3: specify the desired confidence intervals
The last approach is similar to the second, but rather than specifying the precision relative to the mean, you specify the size of the 95% confidence intervals (the "allowable error"). The equation for this approach is:

$$n = \frac{4s^2}{L^2}$$

where L is a predetermined allowable error (size of 95% confidence intervals) on the mean and s^2=sample variance. Once again, since the "allowable error" involves a value judgment, I looked at a range of values. In order to make those values relevant to the real data, I determined the actual 95% confidence intervals for each Zone/Year, and used a value of L that was 0.5, 0.75, 1, 1.5, and 2 times that actual value. I once again looked at the results as an average by zone and an average by year.

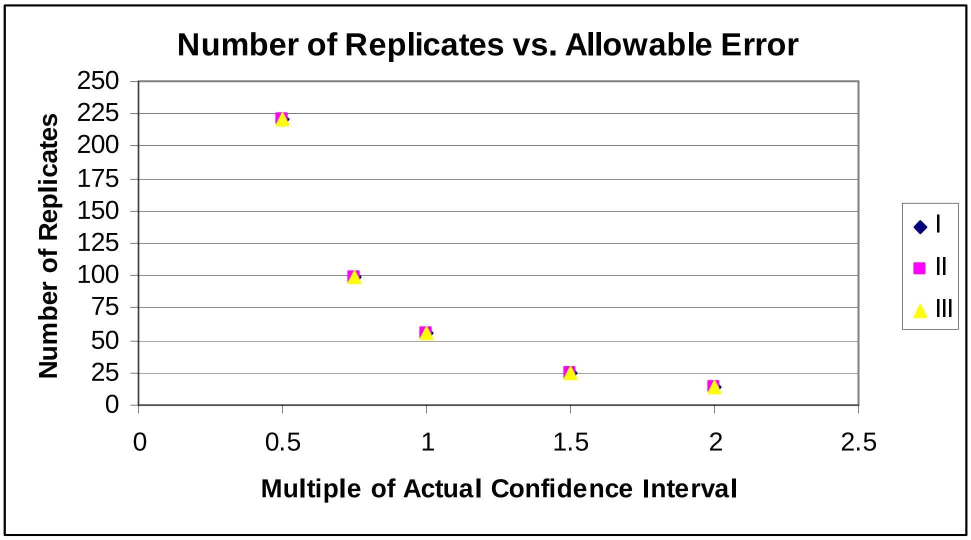


Figure C-8. Number of replicates vs. allowable error, considered by zone.

According to this analysis, using approximately 50 replicates (average is 55), will lead to the SAME 95% confidence intervals as in the existing data. Therefore, a value under 50 would be acceptable, given that the current level of sampling is overpowered. The confidence intervals would be 50% greater if we did as few as 25 replicates. In order to put some context on these "allowable errors", I once again graphed the actual means with the resulting confidence intervals.

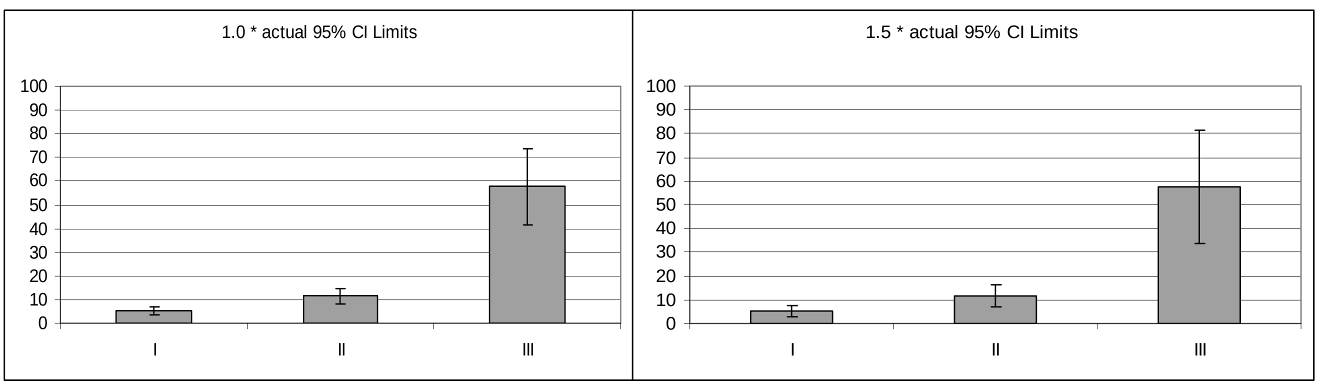


Figure C-9. Average number of birds per zone with existing 95% confidence intervals and 1.5x the existing 95% confidence intervals.

Differences between Zone III and the other zones are still distinguishable at the 1.5 multiple level. However, differences between Zones II and I, which are distinguishable at the 1.0 multiple level are not at the 1.5 level.

I repeated this analysis averaged by year.

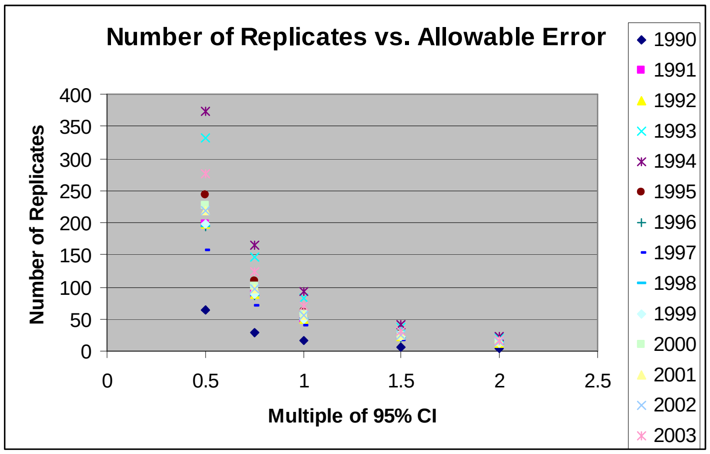


Figure C-10. Number of replicates vs. allowable error, considered by year.

As in the Zone case, the average for 1x was 55, but the variability around that mean was higher. In order to put the allowable error in context, I graphed the averages with the resulting 95% confidence intervals.

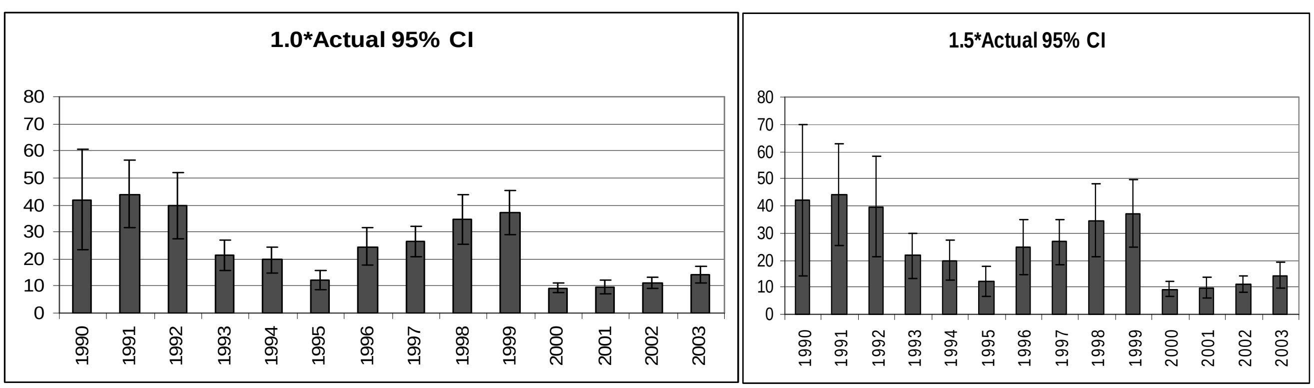


Figure C-11. Average number of birds per zone with existing 95% confidence intervals and 1.5x the existing 95% confidence intervals.

The coarse differences are still distinguishable at the 1.5 level.

In sum, including 25-50 replicates per year would lead to an acceptable amount of effort, according to this analysis.

DISCUSSION

Summary of analyses
All of these analyses lead to a similar conclusion: that little statistical ability to distinguish trends would be lost if the number of samples per year lies somewhere between 40 and 50. This is not a dramatic decline in the number of samples currently being taken (shooting for all possible tides, approximately 70 days in 2004), but would provide some relief to the park staff in their monitoring effort. Indeed all analyses also indicated that as few as 25 samples per year would still provide for the ability to distinguish most differences, but would result in a little loss of statistical ability to distinguish trends.

Therefore, it is up to the discretion of the staff to balance the effort of continuing to sample 40 to 50 days versus the loss of rigor from dropping to 25 samples per year. However, from this analysis it is clear that sampling more than 50 days is of little utility.

How to cut samples
Decreasing the number of sample days was discussed at the 2001 review workshop. The participants suggested that the criteria were biasing our results, since we only track birds and visitors at the same time of day, at the same tide level and during the same seasons every year. They suggested that we create a random stratified design in time that included early and late (including night) tides, holidays, weekends, and high tides. Due to the difficulty in counting birds at night, this was eliminated as a consideration. In addition, it is impossible to count birds using this protocol at tides higher than around 1.5 feet. In addition, the goals of this study are not to determine the effects of tidal level or time of day on bird populations and the increased effort is not justified. It was therefore decided to keep the original criteria (tides 0.0 feet and lower that fall between 1000 and 1600) and perhaps do a separate study to look at these other environmental effects.

It was also suggested that we stratify our sampling in time. All dates that fit our criteria are listed, and are classified as being either a weekday or weekend/holiday. Once we decide the number of samples needed, we could randomly choose the days such that the proportional number of days is maintained. This should be done, as well as stratifying by month or season to be sure that we have a reasonable number of sampling days in the fall, winter and spring.

It should be noted that these analyses were done on a calendar year basis, while the sampling is done on a “tidepool year” basis (starting in September). This should not influence the results, and the choosing of days can be done for a given tidepool year.

Recommendations

- It is recommended that we target 50 days to census birds and visitors, with at least 40 samples per year.
- All days that fit the criteria should be listed in a spreadsheet.
- The days should be classified by season and weekday vs. weekend/holiday.
- Determine the ratio of days in each class.
- Using a random number generator, 50 days should be selected in proportion to the number of days in each class.
- If a volunteer or staff member is not available on a given day, the day should be skipped. The schedule should be revisited regularly to be sure that at least 40 days are being sampled. If 10 of the 50 pre-assigned days are missed, the schedule should be reshuffled to be sure that at least 40 days are sampled.

Appendix D: Data Tables

Table D-1. Data from circular plot (Zone I L1) collected from 1990-2005**.**

	Zone I L1 (280)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15														7				1		4				1	2					1	
16														2						1		1		1	1	1					
17											1							1		3		1		4	2					2	1
18		1										1		1								2		2	1					1	
19			1											2		1														1	1
20																3	1	1	1					2	1					3	
21																2		2	1		2	1			1	1			1	6	
22		1						1						2		2		1		1		1					1	2		6	1
23							1							1		1		1		1	2	1	1		1	1			1	2	
24		2				1	1							1		1		1		1	1								2	2	1
25		3							1					1	2	2		2		3			1					1	1	1	
26		1	2												2	2				1			1							2	2
27			1			2	1								1	1		1	1	1	2	1	2							4	
28	1	1	2	1			2							1				1		1	2	1				1	1		5	2	1
29		2	3		1		1	1			1					1	3	1		1	2	1						1		2	5
30		2	1			1	2	2		1						1		1			3					1	1	1		1	2
31			2				1	1			1			1							2	1	2			1	1			1	2
32	1		1					1	1		1						2		1	2						2			1		4
33	1		2	2			1				1						1		4				1		2		1	2		1	3
34	2	2	1		1			1	1		1	1					3			1		1		1		4					1
35		1			1			1	1							1	1				1	1				1	2		2	2	5
36			2		2			1	1			1		2					4	3			1	1	1	1	1			2	3
37	1	1	1	1		2				2					2	2			1			1	2	1		4	1				1
38	2								1		1					1				2	1	2			1		1			1	
39	2		2	2	3	1		1	1						1			4		2	1	1		2		3	1				1
40	1		2	1	3	1	1				1	2				2	1		3	1	4		1			5	1	1	1	1	1
41	4	1	1	1	1	1	1		1						1	1		3		1		1		1			2	2	1		1
42	2	4	1		1				1			1	2					1	1	1	3	2	1	2	1	3	1	2	1	1	1
43	1	1		4		1		1	1	1	3			1		2	2	1	1			1	2	4	1	4	1	2			1
44	2	2	2	3	1	3		1			1								1	3			1	1	2	2	1	2	2	1	
45	1	2	1	1	2	2	1			1	1			1		1		1	1	1	3	3	2	2	2				1	1	1
46	3		1	3	2	1		1	2	1	2					1		1	2		2	1	2		1		3		2		1
47	5	1	2	1	3	1				2		1				1	1		2	1		2		2	2		3	3		2	4
48	6	2	4		2	2	1	1		1		1	1	1		1	2		1			2	1		3	3	1	3	1	2	1
49	1	1	3	2	1	2		1	1	3	1	3	1							2	1	2	1	2		1	2	2		2	
50	2	2		1	1	2	2	3		1	4	2	2						2	1	3		4	1	2	1	1	2	3		2
51	1	2	1		1	3	2	4	1	1	1		1				1	1	3	2	1	1	1		2	1	2	1	2	1	1
52	3	3	1		1		2	1	2	1	1		2	1	1		1		1	2	2	3	2	3			2	2	1	1	2
53	4	3	1			1	1		2			1		1					1	1	1		1	2	1					2	1
54		3	2	4	2	1	1	1		1		2	3	1	2	1					1		1	1	1		1	2	1	3	3
55	1	3		1			1	1	1	2		1	2	1	2	1			1	3	2		1			1	4		3	1	
56	1	3	2	1		1	1	1						1	1			1		2	1	1		1		1	1	2	1		2
57	1	1	1	1	1		1			1			1	2		1						6	1	2	5		1		3	1	3
58		4	3		2	1	1	1	1	1		1	2	2	1	1		1	1	1	1	1	1	4		1	2	1	1	2	3
59		1	1		1	1			1			2		2	1		3	1		1				1			2	3		1	2
60	2		2						1	1		1	2		3	3			2	1		2			2		1	1	4	3	1
61	2	2					1		2	2			2	1	1	1	1	1			2			1				1	2	1	2
62						1			2	1		1		2	1	2			1					2				2	2	2	1
63		1	1	1								1	1		1	1						2					1	1		1	1
64	1	1										1	1	2	2	2	1	1	1	1		2	1				1	1	1	3	
65				1					1	1	1	1				1	2	1	1		1	1			1			1		2	
66								1					1	2						1							1		1		
67																	1				1			1	2			1	1		
68																			1					1							
69										1	1				1	1		1													
70										1				1				1			1	2									1
71									1				1				1		1												
72																1			2	1		1				1					
73																															
74																															
75																		2		1		2						1			
76																					1								1		
77																			1	1	1										
78																															
79													1																		
80																															
81																															
82																															
83																															
84																															
85																															
Count	54	60	53	32	33	32	27	28	28	27	24	25	26	43	26	46	28	36	44	57	51	55	35	49	41	45	46	46	49	77	70
Min. Size	28	18	19	28	29	24	23	22	25	30	17	18	42	15	25	19	20	15	20	15	21	16	23	15	15	16	22	22	21	15	17
Max. Size	64	64	63	65	59	62	61	66	71	70	69	65	79	70	69	72	71	75	77	77	77	75	64	68	67	72	66	75	76	65	70
Avg. Size	46.6	45.1	42.9	46.4	45.3	45.3	42.9	44.4	49.3	52.1	43.8	50.3	56.4	39.7	49.6	41.9	45.8	41.3	47.3	40.4	43.5	46.8	43.4	43.5	43.0	40.1	47.2	48.8	47.4	38.2	42.3
# $\geq$15 <25	0	4	1	0	0	1	2	1	0	0	1	1	0	16	0	10	1	8	2	11	5	7	1	10	9	3	1	2	4	24	4
Avg. size top 10	58.0	59.7	58.5	56.2	54.2	54.5	54.9	54.5	61.4	61.8	53.2	59.9	64.3	63.3	62.2	64.2	62.2	65.2	67.1	64.3	64.6	68.1	54.6	61.1	60.4	53.5	60.0	63.8	63.9	63.0	61.1

Table D-2. Data from circular plot (Zone I L2) collected from 1990-2005.

	Zone I L2 (284)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15						1			2													1		1	1						
16									1		2					1						2		3						2	
17				1		1	1		4						1	1				1		5			1					2	
18				1			1		1	1	1		1					1				4					1				
19		1		1					1	1	1		1	1	1	1		3		1		3	1			1					
20				2			1	1	2			1	1	4	1	1		2	1	4	1	2	4	1	1						
21				3	1		1		2	1	2		1	3		3	1	1		2	2	2	3	2	2						
22	1	2	1	1	1		4		2	1				3	1	1			1	1	2	4	3	1		1					1
23		1	2	3		1	3	1	2	1	1	1	3					2	1			3	4	1	1			1	1	1	
24		1	1	2			3	1			1	2	2	1		2	1	3	1			3	3	1	2		1				1
25		4		1	2		2	1		1	1	1			1	1		3	2			3	2					3			
26		4	3	1			1	1	1	1	1	1		1	3	2			2	3	1	1					2	1		1	
27		4		2	1		1			3					1	1	1	4				1	5	3	2					1	
28		2			5	1	3	2	1	2		3		1	1		1	4	2		1	1	3	2		1	1	1		1	1
29			2	1	2	2				3	2	2	1				1	1		1	2		1	1	1	1	1	1			
30	1		1		2	1	1	1	1		1	2		3	4	1	1	1	3	1	1		2	2	2	1		1			
31		1	3	1	1	1		1	3	1	1		1		2		3	1	2	1			1		2	2				2	
32	1		2	1	1	2	1	2	1	2	1	3	1	1	2		3		5				4		1	1	1		2		1
33	2		1	1	2	1	2		2			1	1	1		1	1		2	1			1	2		2		2		1	1
34	2		1		2	2		2	1	3	2	1	2			1	1	1	1				1	1	2	1	1		4		1
35	1		1	3	2	2		3	1	1	1		1	3	1	2	1	1	2		1			1			2		3	1	
36	3			3	4	3	1	1	1	1	1		2		1	3	2		1	1				1	1		1		1	1	1
37	1		1	1		1	1	1	1	1	3	1		3	2	1		1	1		1	1		2	1	1					2
38	1	1		1	2	1	1		1			1		1		1	1			2				2	2	1	3		2	1	
39		1	2	3		1		3			4	1	2		2	1	1	4		1	2				1	1	1				1
40	6	1		2		2	2		3	4	3	1	2		2	2	1	1	2	1	1	2	1	2	2	1	3	1	1	1	2
41				1	1		1	3		3	1	1	1	1	3			1	2	1	3	1	2	1	1		1				1
42	3		2	1	3	4	4	2	3	1		3	1	1	1		1		2	5	1	1	1	1		1	1		1		2
43	3	1		1		2	3	1	2			3	1	2	3	1		1	1	2	1		1			1	1		1		
44	1	1	1	2		1	2	1	1	2	4	1		1	2	1	5	1	1	2	1	1			2	3			1	1	
45	4	2	3	1	1		2	2	1			4			1	1		1	1	2	2	3	3	1	1			1	1	3	1
46	2	2	2		1				3	2	1	1	4	2		2			1	1	4	4	1	3			2		1	1	
47	1	3	1	2		1				2	2		1	1			1	3		3		1	4	1		2	2	2	1	3	1
48	2	3	4	2	1		1	1	2	1			2	2	2	2	3	2	3		1	2	1		2	1		1			3
49		5	2		3	2	1		1		3	2	5	2	1	1		2	1	3	2	3		2	2	2				3	2
50	2	3	4	1	5		1		1	2	2	1	2	2	1	3	3	2	3			1	1	1			1	2	1		
51	1		1	1	1	2	1	3	2	3	1	2	1	3	6	2	3		2		4		3	2	2	2	2	1	1	1	3
52	3	1	1	5	1	2	2	1	1		1	1	2	3	2	4	2	3		2	2					1	1	1	1	1	1
53		1		2	3	1	5	2	1	1	1	4	2	1			2		1			3	1	2	2	1	1	1			
54	1	1	2	4	5	7	1	2	1	1		1				3		3		3		1	1	3	2	1	1	1	3	2	1
55		2	1		1	1	2	3	3	2			2			1			2	2	2	2	1		1		1	2	1		1
56	1	2	1	2	1	1	2	1	2	1	1	1		1	1		1		1	2	2	1	3	2	1				1		1
57	1	2	2	1		1	1	1	1		2		2	1			1				4	3	1				1	2		1	
58	2	2	2			3	1	2		1			3				2	2		1			1		1	1				2	
59		1					2	1	5						1	1		1	1				1	1	1	1	1			1	1
60	2		2		1		3	3		1					1	2		1	1			1	1					1	1		1
61	1	1					1	1	1						1							3	3	1				1		1	1
62	1		2	3						1			1				1					1	1	1							
63	2	1		1	1	1										1							1		1					1	
64		1			2	1	1				1		1			1	1		1	1											
65										1		1																			
66			1				1	1	1											1											
67	1	1																			1	1									
68									1																						
69			1					1			1																				
70	1				1					1																					
71											1	1															1				
72						1										2	1	1												1	
73																1															
74								1		1			2									1	1								
75							1				1	1																			
76									1														1								
77																															
78																				1									1		
79																					1	1								1	
80																															
81																															
82																															
83																															
84																															
85																															
Count	54	59	56	65	60	54	69	54	68	55	52	50	55	49	52	56	47	58	53	53	46	73	73	51	44	32	35	27	30	38	32
Min. Size	22	19	22	17	21	15	17	20	15	18	16	20	18	19	17	16	21	18	20	17	20	15	19	15	15	19	18	23	23	16	22
Max. Size	70	67	69	63	70	72	75	74	76	74	75	75	74	57	61	73	72	72	64	78	79	79	76	62	63	59	71	61	78	79	61
Avg. Size	46.0	42.4	43.8	39.4	42.2	43.7	41.3	44.7	39.6	40.8	40.3	41.2	43.3	37.5	39.5	41.9	43.2	37.5	39.1	41.0	43.8	37.1	38.7	38.2	38.9	41.0	41.7	42.9	43.7	43.3	44.1
# >15 <25	1	5	4	14	2	3	14	3	17	5	8	4	9	12	4	10	2	12	4	9	5	29	18	10	8	2	2	1	1	5	2
Avg. size top 10	62.2	60.0	60.9	58.0	59.4	59.5	62.2	62.5	62.3	60.9	60.5	58.5	61.7	52.5	54.4	63.2	58.5	57.3	55.4	59.6	59.6	63.9	63.5	56.2	55.6	52.4	55.3	55.5	56.4	61.5	55.0

Table D-3. Data from circular plot (Zone I L3) collected from 1990-2005.

	Zone I L3 (283)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15																													1		
16														1				1								1					
17														1																	
18									1			1			1			1													
19															1		1									1					
20									2						1		1														
21																						1								1	
22							1						1			1		1		1			1								
23											1					1							1								
24									2	1							1					1									
25				1													1	2		1											
26		1							2					1				3													
27												2			1			1					1				2			2	
28									1					1				1						1							
29												1				2		3			1									1	1
30			1				1	1	1	2				1					1		1			1	1				1	1	
31								1		1		2			1	1			1											1	
32			1					1				1			2		1	1	1					1							1
33										1		1			1			1	1											1	
34		2		1						1						1	1		1						1					1	1
35										1							1	1	1	2					1						
36											1	1						1	1	1	2				1					1	2
37			2																												
38					1										1				3	1		1				1		1			2
39	1	1											4				1			1				1						1	
40	1				1	1							1		1					1	2					1					
41	2		1			1													2	1		1		1		1					
42				1					1			1	1			2	1			2	1				1	2	1				
43									1		3							2		1	3	1	1				1				
44		1	1							1								1		1									1		1
45	1												1	3	1		2			1			1	1	1		1				1
46	3			1					1	1					1		1		1	2	4		2			1	1			1	
47	1						2															1	1	2	1		1		1		
48	2			1						1	3	3						2		1	1	2	1	2			1	1	1		
49	1	1			1								1		1	2						2	2			1					1
50	2	1	1	1	2	2		1		1		1		1			1		2	2	1	1	2		1	1	1		1		
51	2	1	2	1		1					1			1		1	1	1	1		1	2		1	4	2	1	1			
52	1	1	2		2								1		2	2	2	4	1		1	1	2	3		1	3	1			1
53		2		1	1	1	2	1			1	2		3	1	1	2		1			2	1	3	2	1	1	1	1	1	
54		2	3						1	1		1	2	1	1	2	1	1		2	2		1	1	3	3	1	1	2	1	1
55	2	1		2	1	2						2	1	1	2	1		3	4	2	2	3	3	2	2	1	2		1	2	
56	2	1		1				1			1				2		3		1	2	4	2	2		2	1	1		1		
57	1	1	2		1		1		1				1	1	1	1	1	1	1	1	1	2	1		1			1	1	1	3
58		1		1		2					1	1	1	3	1	3	2	3		3	2	2				1		3	1	1	
59		1	1		2		2	1	1	1			2		1	1			1	2		3						1	1		1
60	2			2		1	1	2		1			1	1	1	1		1	2		1			1				1	1	2	
61				1			2			1				1	2	1	1	1									1	2		1	1
62					1		1							2	1		1	1	2	1	1				1	1			1		
63			1	1	1	2	3		1		2	1					1	1										1			1
64		1				1						1								1	1									1	
65								1					1						1	1	1									1	
66				1	1		1	1												1		1									
67																															
68	1																														
69									1	1																					
70																															
71																															
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81																															
82																															
83																															
84																															
85																															
Count	25	19	18	17	15	14	17	11	17	16	14	22	19	23	28	24	28	39	30	35	33	29	23	21	23	21	19	15	16	22	18
Min. Size	39	26	30	25	38	40	22	30	18	24	23	18	22	16	18	22	19	16	30	22	29	21	22	28	30	16	27	38	15	21	29
Max. Size	68	64	63	66	66	64	66	66	69	69	63	64	65	62	62	61	63	63	65	66	65	66	57	60	62	62	61	63	62	65	63
Avg. Size	50.3	49.6	48.6	51.9	53.7	54.4	54.5	51.1	38.2	44.3	48.3	43.4	48.8	47.7	45.8	47.2	46.4	42.1	47.7	48.7	49.5	50.6	47.4	47.4	49.2	46.8	48.2	55.4	50.1	45.2	46.7
# >15 <25	0	0	0	0	0	0	1	0	5	1	1	1	1	2	3	2	3	3	0	1	0	2	2	0	0	2	0	0	1	1	0
Avg. size top 10	57.0	56.3	55.3	58.7	57.8	58.0	61.7	53.2	49.1	52.6	53.1	55.3	57.3	58.5	58.5	57.4	58.1	58.7	59.1	60.6	59.2	58.5	54.5	53.9	55.6	54.9	54.1	58.9	56.8	58.9	55.4

Table D-4. Data from circular plot (Zone I L4) collected from 1990-2005.

	Zone I L4 (282)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15						1	2							2				2				4									1
16														1						3						2	3			1	
17													1	3	1	1	2	1		3		3	2	1		2				1	2
18						1							1	2	1		1	1	1	1		3		2	1						
19				1					2		1		1	2				2		1			1		1	2	1			1	
20				2					1	1			1	1					1	2		3		2			1	1			2
21						1			1					2	1				2	1		3	1	1			2			1	
22			1	1		1		1	1	1	1	1	1			2			1	2	2		1	1			1			1	1
23		1				1	2		1				1	1		1	1	1		3	1		1		1		3	1	1		1
24						2			1			2	1	2	1	1		1		1					1		1	1	1	1	1
25		1					1							1		2			2	1	4		3		2					3	1
26			1		1				1	1	1		1	2		1					1	1		1	1		1	1		3	2
27		1	1				1		1	2		1		1	1		3	1	2	1	1	1		1			1			1	2
28				1	2			1		1		1					3	1	1		2	1			2				2		
29			1									1					1	1	2	1	1		2	2		1	1		1	2	2
30							1	1		2		2		1			1	1	1	2			2			1	1	1	1		5
31					2	1	1	1				1		1	3	1	2	1		1		3	1	2	1		1	1		2	1
32		1	1	1		1	1	1				2		1	3	1	1		2	2			1		1						1
33	1		2	2	1		1					1			1	1			3	1		1		1		2				1	2
34	1		1					3	1		1		1			1	1		1		1		1	1	1	4			1		3
35								1	1			1			1	2		1				3				1					1
36				1		1	1		1	2		1								3			1	3						1	1
37	1			1	1				1					1	1					1	2						1	1	1	1	1
38	1	1	1	1	1	1				2	1	1	1				1	1				3	2					1	1	2	1
39					1	1						1			1		2		1			1			3	1	1	3		1	
40		1			1	1			1	1	1	1	1				4	2	1	1	2	2			1		2	1	2	1	
41	1			1				1	1		1			1	2	1		1		2	1	1	1	3	3		1	1	2		
42					3	1	1		2	1			1			2	2	1	1	2	3	2	1		1	2	1	1		2	2
43	2					1			1	1			4	3		1		1	2	1	1		2	1			2	1	1	2	
44		1		1		2	1		1	1	1		1	1	2	1				1	1	3	1	1	2		1	1	1		3
45			2		1		2	1		1			2			1	1	1		1	2	1	2	2		3		2	3		2
46	1						1		1		1	3					2	1	2	3	1		1	1	1	2	1		1		
47				1		1		3			1	1				1		1	1		1	3	1		1	3	2	2	1	1	1
48	1	1	1	1		1			1	1	1				2		1		1	1		3			2	2	2		1	2	
49				2		2					2		2	2				1				1	1	2		1	2	2		2	1
50								3			2	3				1	4	3	1		1		2	4	1	1	2	2	2	2	2
51	2	1					1		2			4	2	1	1			2	3				2		2	2	1	1	1	2	2
52					2		4	1	1	2			2	1	1	1	2		2		1	2		3	5		2	2	4	2	3
53		1	1				1	1		2		1		1	2			2		2	1	2	1	1	3	1		1	2	3	4
54			1	2			1	2	4	2	3			1	3	3				3	1		4	2	1	3	2	3	2	1	3
55	1	1	4	1				2		1	2	1	3	3	2	2	1	1	2	2	1	2	2	1		2	2	3	3	1	3
56	2	2	4							2		1		2		3	5	3	3	2	3	1	1	1	1	2	3	4	2	5	1
57		3			2	3	2		2		2	1	1		2	2	4			3	4	2	1	6	2	2	3	4	3	1	2
58	1	1	1				1		1						2	2			1	1	1	2	3	1			2	2	2	2	3
59	1	2	2			1	2		2	1		2	2	1	1		2	3	1			2	1	2	1	1	3	2		1	1
60	1	1	1		2	2			4	1		1		2		1	1		8	1	1	2	4		3	1			1	4	2
61	1	3	1	1	1		1	3				1	1	2	4	2	3	2	2	4		3				1	1	2	2	1	6
62		3	1	1	2		1			1	1	1	3	1	2	3	4	1	1	2	2	2	2	2		2				3	
63	1	1			1	1	1			2	2		1	2	1	2	2	4	1		1		1	1	1	1		3	2		3
64		1	1	1		1					1	2	3	2	1		1	2	1		2	1	2		2	2	1			1	
65		2	2		1	2	1				2		3	1	3	3		3		2	3					1	3	1			
66	1	1		2				2		1		1		2					1	1			1		1			2	1	1	
67							1	3	2							1	1		2	2		2							1		1
68							2						1		2	2	1			1	1					1		1			
69	1	1	2	1		1	1		1					1	1	1						1						2		1	
70	2	1	2	1																				1	1					1	1
71		1		2	1	2	1		1	1	1			2		1	1											1			
72					1					1					1							1	1					1			1
73					2			1				1						1		1		1									
74	1	1	1			1		1				1										1									
75		1			1		1	1					1	1		1															1
76	1	1		1		1			1				2																		
77					1				1										1	1											
78			1				2		1	1	1						1	1			1										
79	1			1	1	1	1	1		1	1		1																		
80		1																													
81	1								1	1				1			1														
82				1				2	1		1	1																			
83			2				1																								
84		1		1			1			1					1																
85		1							1				1																		
Count	27	40	39	33	32	37	43	37	47	39	32	43	48	58	51	52	63	52	58	70	51	73	57	53	50	52	58	59	49	65	79
Min. Size	33	23	22	19	26	15	15	22	19	20	19	22	17	15	17	17	17	15	18	16	22	15	17	17	18	16	16	20	23	16	15
Max. Size	81	85	83	84	79	79	84	82	85	84	82	82	85	81	84	75	81	78	77	77	78	74	72	70	70	68	65	72	67	70	75
Avg. Size	56.2	58.3	54.2	50.9	52.3	48.0	52.1	53.0	49.8	49.8	52.5	46.8	50.6	43.4	49.5	49.4	47.7	46.7	46.3	42.4	46.4	42.5	45.4	44.0	45.5	45.5	43.4	51.1	48.4	45.1	44.7
# ≥15 <25	0	1	1	4	0	7	4	1	7	2	2	3	7	16	4	5	4	8	5	17	3	16	6	7	4	6	12	3	2	6	8
Avg. size top 10	70.9	75.0	72.6	73.4	71.0	69.7	75.3	73.2	75.3	71.9	69.2	66.5	71.8	69.2	68.3	67.6	67.9	66.3	64.8	67.2	65.6	67.1	63.3	60.4	62.3	62.8	61.3	67.2	61.4	63.6	65.6

Table D-5. Data from circular plot (Zone I L5) collected from 1990-2005.

	Zone I L5 (279)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15								1						5	2				1	2		1							1	6	1
16									1					1			1	2		5	1	2	1	3	1			1		2	
17						3								2	1	1		7			1	2		3				2		3	
18					1			1	1					1	1		2	5	1	4	1	1		1	2					4	1
19					1	1	1		1					1				4	2	1		2			1	1		1	1	10	1
20						1	1	1							1			5	4		1	1	1	1	2	1			3	7	1
21				1			1	2		1					1	1		5	3	3	1	1	2	1	2		1		1	7	3
22		1						2	1	1	1			1	2		1	8	2	3	2	1				1				15	2
23		2	1	1			3	1				2		1		1	2	7	1		1		2	1				2		8	7
24						1	2	1	1			1	1		2			1	5	5	3	3	1				1			5	5
25			2	1	1		1		1		1	1						2	4	3	3	1	1	2	1		1		1	5	4
26			1				2	1		2					2		2	4	5	2	6	2	2	3					1	5	7
27			2			1	1	1	1	2	1		1	2		1		2	6	1	3	4	4			1				2	6
28		1	1	1	1		1	1	1	1	2	1			1	1		1	2	4	3	3		1	1	2	4			1	4
29			2		1		1	3							1	2			1	1	3	1	2	1	2			1	1	1	7
30							2		1	2	2	1		2	1		2		2	3	3	3	1	1	1	1	1	1	1	2	4
31			1	1	3		1	3	1	1	1			1	2	3	2	3		4	4	1	4	2	2				1		4
32					2	1		1	1		2	1	1	1		1	1	1	3	4	2	4	3		1		4	1	2	3	8
33			1	1	2	1		1	3	4	2		2	1		5	1	1		3	4	4	3	2	1		3		2	1	2
34					1			1	1	3	1	2	2			2	1	3	1	1	2	2		4	1	1	1		1	1	1
35		1	1	1		2	2	1	4	2	1	1	1		2		5	1	2	5	6	2	4	4	4	2	1		4	1	
36								3	2		1	2	3	2	1	2	2	1	1	7	7	4	1	2	5	2	1	4	1	1	5
37	1			1		1			2	2	2	2	1	1	2	3	2	1	2	5	2	4	3	2	1	2	1	2	2		3
38				1			1		1	5	4	2				1	1	2	2	4	4	3	5	4		1		1	1	1	1
39				1		2	1	1	1	2	2	4			3	2	1	1	2	3	4	2		2	3	3	1	2	2	2	
40	4		1	4	3		3	2	1		1	2	1	2			4	3	2	2	4	3	4	5	4	2	4	1	3		1
41	3								2		3		1	2	2		2	3	1	2		3	7	5	5	4	1	1	3	2	1
42	1					2		1	3	2	1	2	3	1	1	4			3	1	3	4	5	1	4	2	4	5	2	4	3
43	1			2	1	1	1	1	2	2	1	2	4	1	3	2	1	3	1	3	3	4	3	5	4	4	2	1		2	3
44	1			2	2	2		1	1	4		3	3	1	4		1	2	3	4	2	7	3	4	3	5	4	1	2		
45				1			2			2	2		3	2	3	4	4	2	4	2	4	3	3	3	4	3	1	1	3	2	2
46	2						1	1	2	2		1	3	4	3	4	4	2	2	4	1	3	3	4	1		5	4	2	1	4
47	4	1	1	1	2	1	2		2		1	1		2		3	2	4	3	1	1	4	4	2	1	2	1	1	3	3	
48	1		1	1	1		1	3	1	1		1	2	2	2		1	1	2	1	4	3	4	3	3	1	4	1	2		2
49	1	2	2	1	1	1			1		1		1		3	2	2	3	4	1	2	1	4	2		2	4	1	2	1	3
50			1		3	2	1	2	1			1	2	3	3	1	5	2	2	2	3	3	3	3	1		1	4		3	4
51	2	1		1	1	2		1	2	2	1		2		2	3		4		5	2	3	1	2	1	2	2	4	1		1
52		3	3		1		4	2			1	1	1				2			1	2	2	1		1	2	1		1	6	2
53	1	2	4	1			1					1	1			1			3	4	2	4	5	4	3		2	2		2	1
54	2	2	1	2							1	1	2		1	1		1	1	1	1	3	1	2	1	2				1	3
55	1	2	1	1	5	2		2			2		3		1	2	1		1	1	4	4	3		1		2	3		1	
56		1		1	2	1			2			1		1		1	3	1		2			1	1		1					
57	1	1				1	2	2	1	3		1	1	1	1			2	1			1	2	1	1				1		
58	2		1			3	1		2	1				1	1					1		1	2	1				1	1	1	1
59		1							1	1		1			1	1					1					1					1
60										1												1	2						1		
61		1							1		1				1	1												2			
62							1					1				1												1	1	1	1
63								1					1							1											
64							1						1																	1	
65									1																						
66																															
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83																															
84																															
85																															
Count	28	22	28	28	35	32	42	45	51	49	39	40	47	45	57	57	58	100	85	112	106	111	101	88	69	51	58	52	54	124	110
Min. Size	37	22	23	21	18	17	19	15	16	21	22	23	24	15	15	17	16	16	15	15	16	15	16	16	16	19	21	16	15	15	15
Max. Size	58	61	58	56	56	58	64	63	65	60	61	62	64	58	61	62	56	57	57	63	59	60	60	58	57	59	55	62	62	64	62
Avg. Size	47.0	47.3	41.3	41.3	41.7	40.7	38.7	37.1	40.2	39.6	39.0	40.8	44.5	35.6	39.2	41.2	39.7	31.6	34.8	35.6	36.8	38.7	40.9	38.8	38.6	41.2	41.1	42.5	38.9	29.5	34.1
# $\geq$15 <25	0	3	1	2	2	6	8	9	5	2	1	3	1	12	10	3	6	44	19	23	11	14	7	10	8	3	2	6	6	67	21
Avg. size top 10	54.0	55.7	53.5	51.2	54.0	54.9	55.9	54.2	57.2	54.4	51.4	53.8	56.2	51.1	54.6	55.7	52.7	52.8	52.3	55.4	54.3	55.7	57.1	54.2	52.6	52.7	51.8	56.4	53.4	55.5	54.9

Table D-6. Data from circular plot (Zone I L6) collected from 1990-2005.

	Zone I L6 (277)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15							1			1				1	2	2	1		1	3			1				1			2	2
16							2			1				2						2	1	2	1	2						2	2
17						1	2					1		3	2			2	2	2	1		2	1	1					1	
18			1	1			1	1				1		2	1	1	1	1	1	2	2		2	1						4	2
19		1					3	1	1				1	1	2			3		4	2				3		2				
20		1		3	1		7	2		2	1				3		3			2	2	2	2	2			1		1	4	3
21		2	2			3	1		1			1	1	1	2		2	3		5	5		1	1	1			1	1	4	2
22		1	1				2	4				2	1	2	4		2				2	1	2	1	2			1		4	1
23			1	1			3	1	1		1	1	1	1	3				2	2	1		1	2		1	1	2		3	1
24		2	3	1	1	4	3	3					1	1	3					3	3	2	3	2	1		2		1	3	1
25			1		1	2	1		1	3		2		2	4	4	1		7	1	2	1	3	2	1		2	4	2		3
26		1	2		1	1	1	1				3		1	1		2	2	2	1	1	1	3	1		2	2	1	1	2	
27			3	1	1		2	1	1	1		3	3	2	2	3	2			4		1	3			2	1	3	1	2	1
28		3	1		1	1			4		1	2	2	1	1		3	1	2		3	1	2		1	2		1	1		2
29		1			2	2		1	2	1			1			2	3	2		1	1		1		1	3	2				1
30				2	3	4		1	1	3	1	2	4	1		1	3	3	5	5	3	2	2	3	2	1		2	3		3
31		1	1	1	4	3	1		3	4			2	1	1	4	2		2	2		4	2	2			4	2		5	1
32		1	2	1	1	1	1	1	1	4		3	1	1	3		3	1		3			2	3	3	1	2	3	3	2	1
33				2	3	2		3	1	2		1	3		3	1	2	1	1		2	4	3	1	3	1	1	2	3	1	2
34			1	1	1	2	3	5	4	1	2	4	2	2	3	3	1	1	1	1	2	5	4	3	1	2	2	2	1	1	
35		2	1		2	4	4	2	1	2	4	3	1	2				1	3	5	1	4	4	5	2	1	1		3	2	2
36	1	2	1	1		1	3	2	1			3	2	3	1	3	1	5	1	2	2	1		1	3		1	4	2	1	1
37		2	3		1	5	3	2	5	2	1		2	2	1	2	1		1	3	1	2	2	1	2	1	4	1	2	3	2
38		1	2	2		1	1	1	1	4	2	1	1	2	2		4	2			1	1	3	1	3	2	1		1	1	1
39	1	3	3	1	2	1			1	2		5	3		1		2	1	2		3	1	3		2	3	1	1	1	1	2
40		1	1	1	1	2	5	2			1		3	3	2	3	1	3	2	4	2	2	2	2	3	4		4	3	1	1
41		2	2	3	1	1		2	1		1		1				2		3	3	3	5	2	4	2	4	5		3		2
42	1	4	3	1	1	2	1	1	2		2	1		1	1	2	1	2	3	2	3	2	2	2	5	4	1		2	1	2
43		2	1	3	4	3	2	2	1		1	2	1		1	2		4	2	5	2	2	2	3	1		3			3	2
44		1		1		3	3	1	2		1		1		1	1	1	5	2		2	4	3	6			3	4	3	4	1
45	2	2		1	2	1	3	2		1	1					1	1		2		1	2	1		1	2		4	5	1	1
46		1	1	1	2	2	1	1	1			1		2						1	1	2	2	1			1	1	1	1	2
47		1				2	1	2			1	1	1	2		2	1	1			1	1	1	1	1	1		1		2	1
48	1	3	1		1			2			1		1		2		2			1		2	2					2		2	2
49	2					2	1			1											1				1	1		2		2	2
50	1				1		2							1			1	3	1	1	1	1	3							1	1
51						2			1	1	1											1								4	1
52						2		1						2		1															
53																					1	1		2	1				1		
54	2					1			2											2	1	1				1	1				
55	2					1	1																							1	
56							1		1										1					1							
57	1																	1					1					1			
58	1											1							1		1	1	1								
59	1										1																				
60							1	1									1			1											
61			1																				2								
62						1				1			1	1	1															1	
63		1																					1								
64																1															
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84																															
85																															
Count	16	42	39	29	38	63	67	49	41	37	24	44	41	46	53	39	50	48	50	73	61	62	77	57	47	39	45	49	45	72	54
Min. Size	36	19	18	18	20	17	15	18	19	15	20	17	19	15	15	15	15	17	15	15	16	16	15	16	17	23	15	21	20	15	15
Max. Size	59	63	61	46	50	62	60	60	56	62	59	58	62	62	62	64	60	57	58	60	58	58	63	56	53	54	54	57	53	62	51
Avg. Size	49.7	36.5	33.7	34.3	35.4	36.9	32.5	34.7	35.6	33.1	38.5	32.7	34.1	32.1	29.1	34.5	32.8	35.0	33.8	31.1	32.9	36.8	34.8	34.5	34.6	36.7	33.9	35.8	36.1	32.9	33.1
# $\geq$15 <25	0	7	8	6	2	8	25	12	3	4	2	6	5	14	22	3	9	9	6	25	19	7	15	12	8	1	7	4	3	27	14
Avg. size top 10	54.0	47.7	44.6	42.9	45.2	52.2	50.3	48.2	47.6	43.7	46.2	43.5	44.4	48.4	44.4	46.9	46.6	47.4	47.0	48.4	49.0	50.1	54.6	47.5	44.7	44.9	44.4	47.9	45.6	51.7	47.9

Table D-7. Data from circular plot (Zone II L1) collected from 1990-2005**.**

	Zone II L1 (239)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15									2																2					1	
16							1											1		1		1									
17									2				1	1	1			3				1			1	1					
18		1					1											2	1		1			2						2	
19														3		1		3	1	1	1				1			1			
20		1	1						2			2						1	2	1		1		1	1						
21		1					1			2									2	2						1	1				
22			3			1			2					1				1	1	2	1		1	2		1				1	1
23					1		1										1		2	1	2								1	2	1
24		2	1						3	1					1			1					1							1	
25	1	1	2				2					2		1	2			1			2		3	1	1		1		1		2
26		3	1				2	1				1	1			2			1		3									1	
27			2					1					1		2	1	1	1	1	1	1	1	1		1	1				1	2
28		2			1		1	1												1	1			1	1				1	1	1
29			3					1			2			1	1	2				1			1	1	1					1	
30				2			2		1	2				2	1								1				1				2
31	2		1			1	1	3			1	1	1	3	3			1		2	2		2	1	1	1				2	
32	1			1	1					1					2	5			1	2	2	1	1		1	2					2
33				1	3		1			1	2		1			4				1		1			1			1		1	1
34				1		1		1	2	1	2	1	1			1	3	2		1		1		1		1	1			1	1
35		1		1	3			1			2				1		1			1	1	2	2	4	1	1					2
36							1		2		1	1	1		2		1			1			1	2	2	2		2	1		
37	1	2				3	1		1	1	1	2	1		1	1		3	2		2	1	1	1	1	1	1	1			
38	1		2	2	2		2		1	1	1	2		1		1	1		4	1	1	2					2		1	1	1
39	1	1	1			1		2	1	2	1	2				1	1	4		2	1		1	1		1	2		2	1	2
40	3	1	1		2		2	1	2	3				1	1		3	2	2		2		3	1	2	2	1	1		1	1
41		1		1		2	4	2	2	2	2	1	1			1	1	2	1	2	3	3	3	1	2	1	1		2	5	1
42	1				1	1	1	2	3			1	2	1	2					1		3		2	3	1			1		1
43	1	1		2	2	1				1			1	3		1	1					1	1	1	1	2	1	1	1		
44		1	3			1	2	2	1	1	2	2	2	1			2	1		1	1			1	1	1	2		2		2
45		1		1		1		1	1	4			1	2	3	2	1	2	1		1	2			2	1	1	3	1	1	1
46		1		1	1		1		2	2		1		1	1		1		3	2		1	3		1	1	2			3	1
47	1		1		1	1	1	1			1	3		1	1	2		2	2	3	3	1	4	3			2	4	1	2	
48	1		1		1		1	1		1	3	2	1		1	1	3	2	1	1	2	1		1		2	1	4	2	1	3
49	1	1				1	1	1	2	1	2	1	2	1	1	2	2	1			1		1	2		1	2		1		1
50	1	1	1	2		2		2		2			1	5	1	3	3	2	1	2	2	2			2		1		1	3	1
51		2	2	3			2	1		1	1	1	2	2	3	1	1		1		1	1	1		1			2	2		1
52	2	1		1	2			1	2		1		1		2	2	2	1	1	3	1				1			1	1	1	4
53	1		1		1	1	1							1	1		1	1		1	3	2	1	3					2	2	
54		1	2	3	1	1	1	2	4		1		1	1		2	2	1	2	2		1		1	1		1	2	2		
55	3	3	1	1	1	2	2		1	3			1	2	2	2		1		1		1	2	1		1	1			2	2
56		1	3		2	1			2					1	3	1	1		1	1			1		2				1		
57	2	2					2	2		1	2		2					2	2		1			1		1			1		
58				1		2	1					1			1	1				1	1				1		1			1	1
59	1					1				1		1								1								1			
60								1	2	1				1			1	1		1	2	1	2								
61			1					1	1														1								2
62		1					1				1		1									1		1				1	1		
63														1										1					1	1	
64	1																														1
65																	1													1	
66							1																								
67																															
68																															
69																															
70																															
71																															1
72																															
73																															
74																															
75																															
76																															
77																															
78																															
79																															
80																															
81																															
82																															
83																															
84																															
85																															
Count	26	34	34	24	26	25	41	32	44	36	29	28	27	38	40	40	35	45	36	45	45	33	39	38	36	27	26	25	30	41	42
Min. Size	25	18	20	30	23	22	16	26	15	21	29	20	17	17	17	19	23	16	18	16	18	16	22	18	15	17	21	19	23	15	22
Max. Size	64	62	61	58	56	59	66	61	61	60	62	59	62	63	58	58	65	60	57	60	60	62	61	63	58	57	58	62	63	65	71
Avg. Size	45.8	40.5	39.3	44.5	41.9	45.5	40.6	43.1	39.5	42.4	42.6	39.9	43.6	41.5	41.3	41.2	44.9	37.0	38.2	39.6	39.4	41.6	40.9	40.1	38.1	38.5	42.6	45.7	45.9	39.8	42.5
# ≥15 <25	0	5	5	0	1	1	4	0	11	3	0	2	1	5	2	1	1	12	9	8	5	3	2	5	5	3	1	1	1	7	2
Avg. size top 10	55.9	55.4	54.7	53.0	51.9	54.8	56.8	54.6	56.4	54.1	52.7	50.0	53.8	54.8	54.4	53.7	54.7	53.7	52.6	55.3	54.7	53.6	54.7	54.8	51.8	47.8	50.3	52.7	55.5	55.4	58.1

Table D-8. Data from circular plot (Zone II L2) collected from 1990-2005.

	Zone II L2 (243)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15																				1	3			1						2	
16									1											1	2									1	1
17															1					1	1								1		
18						1						1		2							1									1	
19							1								1		1								1	1					
20							1															1			1			1		3	
21							1		1	2					1	1										1			1		
22							1											1			1	1			1						
23								2	1							2			2											1	
24			1	1						1												1								1	1
25							1		1	1				1				1					1	2	2		1			3	1
26															1															1	
27			2				1							1		1											2			4	
28							1								1	1			1		1								1		
29		1	3					1						2				3	1	1				1					1		
30			1		1		2			1		1	1	1	1		2				1				1				1	2	3
31		1	1					1												1				1	1				1	4	2
32		1	1				1								1	1	1		1				1	1	1	2			1		1
33	1						2	1							1								1					1		2	2
34		1		1		1	1	2	1	1			1		1												1			1	
35	1						1	2	1		1			1	1				1			1					2				1
36								3			1	1				1	1		1		2		1	1							1
37				1			1	1			3				1							1				1				1	
38			1					1		1					1	2								2		1	1		1		1
39			1								1				1			1							1	1					
40			1		1	2		1			1		2	1			1		1	2	1				1	3	1		1	1	
41	1	1						1	1		2	1	1	1	2										1		1	1		2	
42				2		1		1	2				1			1	1					1		2		1	1		2		1
43				1		1		2	2	1	1			1		2							1			1			1		
44									1	1		1					1	1		1	1			2	2			1	2	1	
45	2		1	3	1				1			1	1	1						1	1			1	1	1		1		2	1
46	2	1		1					1	2			2	1		1		1			3	1	2					1			
47			1	1			1		2	1	1	2	1		1	2		1		1	1		1		1		1	1	1	1	
48	2		1	1			1			1		1		1		2					3				1			1	1	1	
49	1				1			2	1		1	1		1		1					1				1	1					
50	2			1	1		1		1	1	1		1	1	1	1			1	1	1	1			1	2			1		1
51	2	1	1	1	2	1			2	1	2		1		1				1				1	2	1				1	1	
52	1	1	2	3				2		1	2	1			1		1	2		1				2	1	3	2			1	3
53	1		1	1			1	1	1	1	1	2	2	1							1	4			2	1	2			2	2
54	2	1			1	1			1	2	1	3	1		2	1	1	2		1				1		1			2		
55		2	1			1	1				2					1	1	1	1			2	1	1		2				1	1
56	1	1			1			2				1	1			1	1		1			1	4		2		2			1	
57		1		1	2				1			1	1		3	1	1				1	2	1	2	3	1					
58		3	2	2	1								1		1	1				1			2		2		2	3	1	1	
59	3		2		1		1	1	1	1					1	1	1	1	1			1	1	2		1			3	1	1
60		1			1	4					1		1				1	1	1	1	1		1	1		1	1	1	2		
61		2	2						1							1		2			1	2		1	2	2	2		2	1	2
62		1		1	1		1			1	1	2		3				1	1	3		1	1	2		2	2	4	1		
63		1									1			1	1	2	1		1		2	1	2	2	2	2		2			1
64		1	1		1								1		1			1	1			2	1	3	1	1	1		2		1
65		2		2	1			2					1	1			1		1	1	1			2	3		2			1	
66		2	1	2			1			1								1	2		2	1	2	2		2		1	1		
67		1		2			1									2		1	1		1	3	1		1		1			2	
68					1									1	1	1		2						2	3	1	1		1		
69		1		2												1	1					1	2	1	1	1		3	3	1	
70				1				1	1								1	1		1			1				1			1	3
71				1		1	1											1		1		2		1	2		2		1	1	1
72		1																	1			2	2			2	1	1	1	1	1
73									1										2			1				1	1	1			1
74																				1	1										
75																							1	1	1						
76																												1	1	1	
77																								1				1		1	1
78																				1			1						1		
79																															
80																						1									
81																															
82																					1										
83																															
84																															
85																															
Count	22	29	28	32	18	14	25	30	27	22	24	20	21	23	29	32	19	26	24	23	36	35	33	43	45	40	34	26	40	53	35
Min. Size	33	29	24	24	30	18	19	23	16	21	35	18	30	18	17	21	19	22	23	15	15	20	25	15	19	19	25	20	17	15	16
Max. Size	59	72	66	71	68	71	71	70	73	66	63	62	65	68	68	69	70	71	73	78	82	80	78	77	75	73	73	77	78	77	77
Avg. Size	49.3	55.4	45.1	53.7	54.2	49.1	40.2	43.2	45.3	44.0	47.5	48.1	49.1	43.8	43.5	47.7	49.1	52.1	52.0	49.7	44.4	56.5	57.2	53.2	51.6	52.2	53.6	57.8	52.3	41.2	48.3
# $\geq$15 <25	0	0	1	1	0	1	4	2	3	3	0	1	0	2	3	3	1	1	2	3	8	3	0	1	3	2	0	1	2	9	2
Avg. size top 10	54.8	65.9	59.4	67.5	60.6	55.6	57.8	57.7	57.9	54.9	55.7	55.7	57.1	58.2	59.1	63.2	60.8	65.8	67.1	66.2	66.7	70.9	70.4	69.0	68.7	67.6	68.6	69.7	70.2	69.5	69.1

Table D-9. Data from circular plot (Zone II L3) collected from 1990-2005**.**

	Zone II L3 (240)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15																								1	3				1		
16									1																						
17						1	1		1															1		1					
18									1					1										1							
19				1					1	1								1							1						
20		1																							1				1		
21		1																	1				1								
22		1		1	1		2													1		1	1		1			1			1
23		2				1									1	1		1								3					1
24										1		1												1	1						
25			1		1									1					1	1			3					1			
26					1	1			1		1					1													1		1
27		1	1					2		1				1	1		1							1		1			1	2	
28			1							1															1				1		
29			1		1					1			1		1					1	1							1			1
30			1			1			1	1				1				1	1	1					1		1		1		
31			1			1	2				1			1						1				1	1						
32		1			1				1				1		1			1				2		3	1	2	1			2	1
33													1							1	1		1					1			
34	1		1							1	1			1			1									1	1				
35				1			1				1				2						3			1			1	1	1	2	
36			1					1			1	2			2	1									1						
37		1						1			1		1			2		2					1		1	1					
38				1	2					1	1			1			1	1						1	2			2			1
39				2		1							1	1	1	1	1		1			1		1		1	1		2	1	1
40				1	1				1				2	1		1							1		1	1	1	1	1	1	
41				1			2							1	1	1			1		1	1		1					2		1
42				1				1			1	2		1				1	1	1				1	1	1	2			1	1
43									1						1		2							1		1				1	1
44	1				1	1	1				1	1			1	1					1		1				1	1		1	
45	1				1	2			1	1	1	1	2		1	1			1			2	1		1		1			2	
46		2	1		1	1		1		1		1		1	1	2	1	2		1		2				1		1		1	1
47	1				1							1					2		1			1	1			1		2			2
48	2			1	1	2					1	1		1			1	1	1	1			1			1	1		2		
49			2			1		1					1	2	1		1		1			1	1		2	1	1	1	1		1
50		1	1	1	2	1	2	1				1	2											2	2		1		2	1	2
51		1				1	1	1							2		1		1	1	3	1		2		2	3	2		1	1
52			1	1	1		1	1		2	1	1		1		1	2			2		1		2				1	1		1
53							4	1		2	1	2	2	3			2	1				1	2		2	3		3	4	2	
54	1	1	1	1				1	2	1		1	1		1			2	1					1					1		1
55		1		1	1	2		2	1		1			1			1	3			1			1			1	1		3	
56							1		2	2	1					2			2	1	1	1	1						1		1
57	1						1	2		1	1		1		1	1	1	1	2				1				2	2			1
58	3			1	1						1				2	1				1				1	3	3	2	3	1	1	1
59		1	1	1					1	1	1	2		1	1	1		1		1	1				2	2			3	2	1
60									1			1	1	1		1			2	3	1	3	1	1	3	1	1			1	2
61			2	1		1			1						1			1	1		1	1	1	1		1	1			1	
62		1			1	2	1	1					1	3	2	1	1				3	1	2	1		1			1	1	
63		1			2					1				2		2		1	2					2	2						1
64	1		1						1		2						1	1			1		1	1	1		2				1
65		1		2								1			2	1	1				2		2					1	1		
66	2		1						1						1		2	2	1		1	1		1		1	1				
67		2	1												1	1			1			2	1	1		1			1	1	
68											1		1							1					2			1	1		1
69	1						1	1		1		2	1	2		1			1	1	1	1	1	1							
70				1																2		2	3	1			1				
71		2	2			2				2					1					1	1	2		1							
72						1		1	1	1	1		1															1		1	1
73				1	1		1						1	1									1							1	
74					1				1				1		1	1													1		
75							1															1									
76								1				1																			
77				1				1		1	1						1		1						1						
78	1		1		1					1																					
79		1					1		2		1																				
80												1																			
81	1																		1					1							
82		1																													
83																															
84																															
85																															
Count	17	24	23	22	24	23	24	21	24	26	24	23	23	30	31	26	24	24	26	23	24	29	30	36	38	32	27	28	33	30	29
Min. Size	34	20	25	19	22	17	17	27	16	19	26	24	29	18	23	23	27	19	21	22	29	22	21	15	15	17	30	22	15	27	22
Max. Size	81	82	78	77	78	72	79	77	79	78	79	80	74	73	74	74	77	66	81	71	71	75	73	81	77	67	70	72	74	73	72
Avg. Size	57.4	49.7	49.5	50.1	48.3	47.9	48.8	52.6	49.0	50.5	51.3	52.6	51.5	48.8	49.7	50.8	51.4	48.3	53.3	50.5	53.4	54.7	51.3	48.2	44.9	46.0	50.1	48.4	47.6	49.2	48.2
# ≥15 <25	0	5	0	2	1	2	3	0	4	2	0	1	0	1	1	1	0	2	1	1	0	1	2	4	7	4	0	1	2	0	2
Avg. size top 10	65.5	68.6	65.2	63.7	62.8	61.0	63.0	63.4	67.0	67.3	65.4	64.4	64.2	64.2	65.2	64.0	61.8	60.1	66.7	64.5	64.7	68.8	67.5	67.6	64.2	60.8	61.5	60.1	62.7	62.6	61.7

Table D-10. Data from circular plot (Zone II L4) collected from 1990-2005.

	Zone II L4 (242)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15														8												1					
16														8												1					1
17								1						6												1					
18						1								1									1								
19																															
20																															
21									1																						
22																							1								
23														2									1			1					
24														2									1								
25		1												2																	
26		1												2																	
27		1		2										1																	
28		2																													
29			1	1	1												1													1	
30			1							1				1	2		1										1				
31			3																												
32	1						1																1								
33					1										1																
34																															
35		1																													
36					1	1						1								1											
37			1												1																
38				1							1					1															
39					1		1					1																			1
40	1											1				1															
41				1		1																									
42				2			1			1					1	1												1			
43				2		1		1			1																				
44			1		1											1															
45				1								1					2														1
46				1	2		1	1			1					1												1			
47				1				1																							
48		1			1	2	1																								
49		1	1	1					1																			1			
50					1						1	1				2	1														
51	1					1	1																								
52			1		1	4	1	1	1																				2		
53	1				1																										
54	1	1						1	1				1																		
55	1		1	2			1						1																		
56	2					1	1	2	1																						1
57		1	1						1	1		1		2																1	
58		1			1		2	1		1						2	1														1
59		1			2	2	3	1									1												1	1	
60	1												1			1														1	
61			1	2	1	2	2		1	1																					
62			1	1	1		2		1	2																					
63		1		1					1																						
64		1								1	1					2	1														
65							1	1			1			1																	
66	1			1	1	1	1										1														
67				1																											
68		1				1									2	1															
69		2								1				1																	
70	1		1						1																						
71									2						1																
72							1	1		1						1															
73							3																								
74																															
75									1		1																				
76																															
77																															
78																															
79																															
80																															
81																															
82																															
83																															
84																															
85																															
Count	11	17	14	21	17	18	24	12	13	10	7	6	3	37	8	14	9	0	0	1	0	0	5	0	0	4	1	3	3	4	5
Min. Size	32	25	29	27	29	18	32	17	21	30	38	36	54	15	30	38	29	0	0	36	0	0	18	0	0	15	30	42	52	29	16
Max. Size	70	69	70	67	66	68	73	72	75	72	75	57	60	69	71	72	66	0	0	36	0	0	32	0	0	23	30	49	59	60	58
Avg. Size	53.9	48.6	45.6	48.0	49.5	51.3	57.6	52.1	58.6	57.7	54.4	44.5	56.3	23.5	47.4	53.9	49.6	n/a	n/a	36.0	n/a	n/a	23.8	n/a	n/a	17.8	30.0	45.7	54.3	51.3	42.8
# $\geq$15 <25	0	0	0	0	0	1	0	1	1	0	0	0	0	27	0	0	0	0	0	0	0	0	4	0	0	4	0	0	0	0	1
Avg. size top 10	56.1	61.0	51.8	58.6	56.8	58.6	66.8	56.5	64.0	57.7	nd	nd	nd	40.7	nd	59.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table D-11. Data from circular plot (Zone II L5) collected from 1990-2005.

	Zone II L5 (266)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15												1								1			2								
16											1					1		1			1		1								
17											2															2					
18											1					2				1											
19			1	1							1		1			3					1			1				2			
20			1							2	1					1				1	1				2		1				1
21			1				1									1				1				1						1	
22						2				2		1	1		1	2				1	1	1	1	1			2			1	3
23		3					1	1		1	1		1								1	1								2	
24		1	1	2			2	1			1	1							2	1					1						
25		1	2			2	1	1				1				2		1		1	1	2								1	
26		1	4	1			1	2			1	2		2										1	2				1		1
27		1	3		1	1		1	1		2	2		1													1			1	3
28		1	5	1	1			1				1		4	1				1	1	1	1								2	1
29			4	1	1		1		1			2			2		2			1	1	1		1		1					1
30			3		1								2		2	2			2		1			2	2		1			1	4
31				1			1	3		2			1		1	1	3	2					1		1	1				3	3
32		1	3					2		1					2	2	2	2						1	1					1	1
33	1		1	1						1		2	1	1	1	2	1				1					1	1	1		1	1
34		1	2	4	1	2	1	1	2		1	1	2		1	1						1		1		2					
35	1			1	2			2		1	2	1	1		2	1	4		1	2	1		1		2			2	1		1
36			1	6	2	1	1		1		1		2	1	3	2		2	1	1	1	2			1	1			1		1
37		1	1			3	1	2	3		2	1			1	1	1			2		1	1	2		2					1
38		2	1	4	2	3	1	1	2		1	3	1		1	1	3	1		3	3	1	1			2	1		1		
39				2	4	1			2	2		1	1		3	2	4		2	2	1	2	2		1	1	1		1		
40		1	2	3	1	2	3	2	2	2	1	2		5		1	1		4	1	3	2	6	3	1		4				1
41	1	1	1	5	1	2	1	2	1	2	1		2		1	3	1			3	4	1			1	1	2			1	1
42	1	2	2	1	2	1		2	2	1			1		2	4	3	1	2	1	1	1		2	3	1			1		
43	1		1	1			2	1	1	2	1		2		2	5	4			1	3	2		1		1					
44					4	3	2	3	1			3		2	2	5	1		1	3	1	1	1	1	1	4	1				
45	4				1	2	2		2			1		1	1		4	2	1	1	1	2			1						
46	4	1	1	2	2	4	3	1	1	1		1		2	3	1	2	2		2			2	1				1	1		2
47	5	2	1	1	3	1	2	2			2		2		2	1	2	1		6	3	1	3				1	1	1	1	
48	2	2			1	1	2	3	4	2	3	1	1	1		1	3		1	2	1	2	3		1	1	1	1		2	
49	2		2	2	3	2	4	1	1			2				2	3		2		1	3	1	2	2			1			1
50	1	2	1		2	1			1	1	1		1	2	2	3	2	1	3	1		3	2	3	1	1		1	2		
51	2	1	2	2	1	2	3	1	3	1	1	3	1	2	2	3	3			1	2	1		1	2	1	2	1			1
52	2	4	2	1	2	3			1	6	1	1	2	2	4	4				1	1	1	1	2		2	1		1	1	
53	1	3	1	2	1	6			2	1		1	1		1		3		1	2	3	1	1	2		1	1			3	1
54		1	3	2	3	2	2	5	1			3	1	2		1	1			1	4	1		1	1		1	1		1	1
55	1	3	2	2	4		4	3			2			2	2		3					2	1		1	1	1	1			
56	3	1	2	4	2	3	3	1	2	2			2	5	3	3	2			3	1	2	4	2		2	2				
57	3		2	5	2	1	4	1	1	1	1	2		2	4	4	1					2			1	1	1	2			
58	2	3	1	1	1	4	2	1	2	1	1	1			2		3	1	1	1	1	1		1	1			1	2		1
59		2	1	1	2	3	3	3		2		1	2		1	3			1							1	1		1		
60	2		4	1	5	2	3		2				1	2	1	3	3	1	2				1	2							1
61	2	2	3		2	1			1		2		2	3	4	1					1		2		2	2		1	1	1	
62		3	1	3	1	3	3	2	2		2					1	1				2	1		1	1	1	1			1	
63	1	2				2	3	4		1			1		3							2	1	1				1			1
64		3	1		1	1	3	2	1	1		1	1	1	3	1	1					1							1	1	
65		1	1	2		1	2	2				2		1									1								
66		2			3	3	2	1	1	1	1			1						1	1			1		1					1
67			2				2		1			1		1	1																
68	3	1	1	3			1							1	1																
69		3			1							1	1	1													1				
70	1									1				1		1									1	1					
71							1		2	1																					
72							1		1	1		1	2																		
73							1	2	1		1	1																			
74	1	1					1															1									
75											1			2																	
76		1																													
77			1																												
78	1																														
79					1																										
80				1																											
81			1																												
82																															
83		1																													
84																															
85																															
87	1																														
Count	49	62	76	70	67	71	77	63	52	43	40	49	40	51	68	78	67	18	28	50	50	47	40	38	34	36	29	18	16	26	34
Min. Size	33	23	19	19	27	22	21	23	27	20	16	15	19	26	22	16	29	16	24	15	16	22	15	19	20	17	20	19	26	21	20
Max. Size	87	83	81	80	79	66	74	73	73	72	75	73	72	75	68	70	64	60	60	66	66	74	65	66	70	70	69	63	64	64	66
Avg. Size	53.6	51.5	43.6	46.3	49.6	49.0	51.5	47.4	49.7	46.4	42.2	44.4	46.4	50.5	47.6	42.8	45.6	39.8	43.0	41.5	42.9	46.0	44.8	44.7	42.8	45.3	44.4	46.5	47.6	39.3	37.1
# ≥15 <25	0	4	4	3	0	2	4	2	0	5	8	3	3	0	1	10	0	1	2	6	5	2	4	3	3	2	3	2	0	4	4
Avg. size top 10	69.8	70.5	67.3	66.0	65.4	63.9	68.9	65.9	66.9	63.9	63.0	64.9	64.0	68.0	63.8	61.4	59.3	47.7	53.8	55.5	58.1	61.0	58.9	58.8	58.0	60.3	57.3	55.5	54.5	54.8	54.6

Table D-12. Data from circular plot (Zone II L6) collected from 1990-2005.

	Zone II L6 (241)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15																						1							1		
16					1												1				1										
17						1																									
18																															
19										1																					
20				1																								1			
21																															
22															1						1			1							
23										1							1										1				
24									1																1	1	1		2		
25												1			1				1					1					1		
26		1		1																									1	1	1
27				1								1							1							3		2			2
28			1												1									1	1				1		
29																					1	1							1	1	1
30												1							1							1					1
31							1					1					1	1					1								2
32						1														1						1					2
33			1		1											2											2			1	
34	1										1																1		2		
35	1		1		1														1												1
36										1			1		1				1					1				1			1
37																												1		1	
38																					1						1				
39	2						1	1					1			1											1			1	1
40								1								1						1			1			1	1		1
41			1						1					1			1	1		1		1			1				1	1	
42	2			1		1					1									2				1				1			
43				2																	2		2	1						1	
44																						1				2		1			2
45	1																1			1		1	1	1	1	1	1		1		
46	1	1					1		1								1							2			1			1	1
47	1						1												1	1		1			1	1	1	1	1		
48	1		1																	1								1	1		1
49					1			1		2					1			1			5				1			1	1		
50	1	1												1												1					
51	1	1				2								1		1		1			1							1	2		
52	1	1		1	2						1	1					1			1		2	1		1	1	1			1	1
53	1		2			1		1		1									1				1				1			2	
54					1				1							1				1				1	1			1	2		3
55	1			1								1			1	1		1		1	1			1		1				2	
56		1	1			1	1				1				1						1					1	2		1	1	
57	2		1	1								1	1					1	2				1					2			1
58		3		1						1		1	1			1						3	2	1			1		2	1	2
59		2	2	1		1	2	1									2	1						3				2			1
60		1		1	3					1	1						1	1				1	1		2					1	
61	1		2		1	1	1	2		2	1		1						1	1					1						
62	2	1	1	1		1	2		3		1								2	1	1		1	1					1		
63		2			1	1		4	1				1			1									1						
64	2	2	2	2		1			1	1		1	1	2			1	1				1	1			1		1			
65	1		3	1	2	1	1		1	1	1	3	3	1	3	1	1	2	1												
66	1	2	2		1	1	1	1	1	1	3	1	1	2	2	1	1		1	3							1				
67	2	1	1	3		1	1	2	3		1	1		1	3	1			1		1			1							
68		1	1	2	1		1	1		1	2	3	3	2		3	2	1	1												
69	1	3	1	2	2	1	1	1	1	2				4	3		2	1	1												
70	1	1	1	3	3	2		1	1	2	1	1	2	2	1				1		1	1	2	1							
71	2	2	2	3	1	1	2	2		1	1	2	2		2	2	2	2													
72	1		1	2	2	3	2	3	3			2			1	1															1
73	3	1	1		3		4	2	2	3	1					1	1														
74	1	3	3	1	1	5		1			1										1										
75		3	1	2	2		1	2	1	1	2																				
76		1	2	1		3	3	1	3	2										1					1						
77	1			1			1	2	2	1	1				1						2										
78				1	2													1													
79					1	1			1	1	1			1		1				2											
80						1	2	1	1	1		1	1																		
81								1	1				1																		
82							1																								
83									1																						
84											1	1																			
85										1																					
92																				1											
Count	36	35	35	37	33	32	31	32	31	29	23	24	20	18	23	20	20	16	18	19	20	15	14	18	14	15	16	18	23	16	26
Min. Size	34	26	28	20	16	17	31	39	24	19	34	25	36	41	22	33	16	31	25	32	16	15	31	22	24	24	23	20	15	26	26
Max. Size	77	76	76	78	79	80	82	81	83	85	84	84	81	79	77	79	73	78	70	92	77	70	70	70	76	64	66	64	62	60	72
Avg. Size	58.1	63.7	62.0	62.0	63.6	64.4	66.4	66.9	67.5	63.7	65.7	60.5	64.3	64.7	59.4	59.7	55.8	59.6	53.2	58.2	51.3	48.9	54.7	48.7	50.0	41.6	43.9	45.4	41.4	46.0	42.9
# ≥15 <25	0	0	0	1	1	1	0	0	1	2	0	0	0	0	1	0	2	0	0	0	2	1	0	1	1	1	2	1	3	0	0
Avg. size top 10	72.3	73.8	73.6	74.1	75.0	75.7	76.8	76.1	78.0	76.7	74.6	72.4	71.3	69.8	70.2	70.3	68.4	67.0	64.7	70.2	63.8	56.4	60.4	58.9	56.7	48.9	51.8	54.5	54.1	53.1	56.6

Table D-13. Data from circular plots (Zone II L7 and L8) collected from 1990-2005.

	Zone II L7 (242A)				Zone II L8 (266A)			
(mm)	FA03	SP04	FA04	SP05	FA03	SP04	FA04	SP05
15						1		
16	1					2		1
17	2				1	1	3	1
18							1	
19	2	1				1	1	1
20			1		1			
21		1			1	1	1	
22						1	5	
23				1			4	3
24			1				1	3
25					1	1	3	1
26			1	1	1		2	2
27	2		1				5	3
28			1	1			4	2
29			2		1		1	3
30			1		1	2	4	5
31		1	2	1	1		2	5
32	1		1	2		4	1	4
33		1		1		2	3	4
34					1		4	4
35		1	1				6	3
36	1			1			1	5
37				2				2
38			1	2		2	2	
39		1	1	1	1	1	3	5
40	1		1	3		1		3
41			1			1	1	4
42	1				1	1		1
43					1	1		1
44		1		1			1	
45					2	1	2	
46		1			2			
47		1			2	2	3	2
48		1			1		2	2
49					1	3		2
50					1		1	2
51		1				2	2	3
52					2	2	3	
53					3	1	1	2
54			1			1	1	
55	1				3	2		
56	1	2			3	1	3	1
57		2	1	1	5	4	1	3
58	2	1	1		1		1	1
59		1	3	3		1	2	
60	1	2	1			3		2
61	1		1				2	
62	1	1		1	1			
63	1			1	1		1	2
64	1		1		1		3	
65	2	1		1	1		1	2
66			1				1	
67	2	1		1		1		1
68	1	1				2		1
69	1	2		1	1	2	1	
70		1						
71					1			
72								
73						1		
74			1					
75								1
76								
77								
78								
79								
80								
81								
82								
83								
84								
85								
Count	26	26	27	26	44	52	90	93
Min. Size	16	19	20	23	17	15	17	16
Max. Size	69	70	74	69	71	73	69	75
Avg. Size	47.3	51.8	43.4	44.4	48.0	44.8	38.1	39.1
# ≥15 <25	5	2	2	1	3	7	16	9
Avg. size top 10	65.1	64.9	61.7	60.4	62.3	65.3	63.6	64.4

Table D-14. Data from circular plot (Zone III L1) collected from 1990-2005.

Zone III L1 (013)																															
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15						1	1					1		6			1						1		2		1		1		
16						1							1	1	1	4	2	1	1				1								1
17											1			2	1		1							2	1	1	1	1			2
18							1				1		1	2		1	1	3	3	3		1			4		1				
19								1			1			1			1	5				1			2		1				1
20							1				1	1			1			1	2	1		1			1	1			1	3	2
21								1				1	1					5	1	4	1		1		1		3	1		1	1
22								1	1						1	3	1	4		2	1	2	1		1					3	1
23							2	1			1		1			1	1	2	3	3							2		1	1	
24		1	1			1	1				1			2	1	3		1	2	2	2		1		2	1					1
25		1					3	1	1		1		2				2		4	2	1					1	1	1			2
26		1		1	1		2		1		1		1			3		2	4	2	1	2		1					1		
27		1	1			1	1	1					1			3	1	1	5		2			1		1		1	1		2
28			2						2							3	1	2	4	3	1		2	1		2		1		2	1
29		1	1			2	1	1								1	1	3		3	1	3		1		1			1		
30		2						2	1		1		3		1	3	2	2	4	5	5	2		1	2		1		3	1	2
31			1		1		1	1			1	1	1		1		3	2		6	6	1	1	3			3				2
32			1	1	2	2			2	1	1	1		2			3	1	2	5	2	3		3	3	1			1		
33		1			3	2	3	3			1	1		3		2	4	2	3	1	4		1	1	1	1	2		2	1	1
34				1		2	4	1	2		1	2			2	2	1	4	2	5	4	2	2	2	2	2	1	1	1	2	
35	1			1	2		2		2		1	1	1		5		2	1	3	6	3	4	3	3		3	2	2			1
36	1			1		3	1	2	1	1				1	1		1	5	2	3	8	3	3		2	2	2	3	2		3
37	1			1	1	1		2	1	2	1			3			3	2	3	1	1	2	2	3	4			2	3		
38	1					1	1	1	3	3	4	1		2	1	1	4		3	4	1	3	1	4	2	3	1	1	2	3	
39	2	1	1			2	1	1	1	2	3		1	1			2	3		1	4	4	4	3	1	1	2	1	2		1
40	3		2	1	2	2	2		3	2	2	5	4		1		2	3	2	3	1	4	7	1	4	4		2	3	1	1
41	1		1	1	3		1			2	3			2	2		3	3	4	4	5	1	3			2	3	1	1	3	3
42		3		3	1	1						2		2	4	2	2	2	5	1	4	1	1	3	3	1	2	5	4	2	5
43	1	1	1		1	1	2	2				1	1			2	1	1	3	2	2	4	1	2	1	1	2	3	3	3	1
44	1	4	3		1	1	2	2		2	2			1		3	2	2	2			1		3	2	3		2	2	1	1
45		3	1	1	1	2	4	2			1	2	2	1	1	2	1	2	1	1	3	4	5	2	1	3	1	1	2	1	2
46	2		3	2			1	1		1	1		1	1	1			3	2	2	3	4	3	3	4	2	2	4	3	3	3
47	1	1	1		2		2	1	2				4		1	3	2				1	5	1		3	3	3	2	1	1	2
48	1	2	1		1	1		2	2	1					1	2	1	1				3	4	6	1	1	3	2	2	3	
49	2		1			1			2		2			1		1				5	1	2			3	2	2	3	1	3	1
50		1		2	2	1		3					1	1	1	1	1		2	1	4						1	1	3	2	2
51		1	1	1		1	2	1	1		1		1	1	1	1		1	1	3			1	2	1	1	4		2	1	1
52		1	2	2		1	1			1			1	1	1		3		1			1	2	1				1			2
53	1				1							1				1	2	1		1	1										
54				1		1					1	2				1						1	1			1	1	1			1
55	2		1			1	1			1			1	1	1		1	1		2		2		2	1		1	1		1	2
56		2	1	1			2		1			2		3		1	2	4		1	1							1	1		
57	1						1	1	1					1						2			1							1	
58			1					2	1				1		2				2						1				1		
59	1	1			1					1	1							1						1							
60							1	2	2								1		1		2	1					1				
61	1					1					1								3		1										1
62													1					1		1				1		1			1	1	
63						1				1							1	1													
64			1			1								1						1	1					1					
65							1											1			1	2	1	1				1			1
66																						1									
67		1																											1		
68					1	1		1																	1		1				
69					1		1	1																							
70							1		1								1					1									
71								1															1								
72																														1	
73						1																									
74							1		1	1																					
75			1				1	1	1																						
76		1																													
77						1	1																								
78				1																											
79	1																														
80			1																												
81		1																													
82	1																														
83																															
84																															
85																															
Count	26	32	31	22	28	39	54	43	36	22	37	25	32	43	33	50	64	80	80	92	79	72	56	57	57	47	51	46	52	46	53
Min. Size	35	24	24	26	26	15	15	19	22	32	17	15	16	15	16	16	15	16	16	18	21	18	15	17	15	17	15	17	15	20	16
Max. Size	82	81	80	78	69	77	77	75	75	74	61	56	62	64	58	56	70	65	61	64	65	70	71	65	68	64	68	65	67	72	65
Avg. Size	48.4	44.8	45.3	44.9	42.7	42.6	41.4	42.9	43.2	44.6	37.2	39.3	38.5	35.2	38.7	34.4	37.8	35.0	35.3	35.8	38.4	40.7	40.3	40.3	36.4	39.7	39.0	41.9	40.9	40.0	38.1
# ≥15 <25	0	1	1	0	0	3	6	4	1	0	6	3	4	14	5	12	8	22	12	15	4	5	5	2	14	3	9	2	3	8	9
Avg. size top 10	59.9	59.6	59.2	53.5	53.6	61.8	65.9	62.7	61.0	52.6	50.2	49.0	51.6	54.6	51.0	50.3	57.0	58.1	56.2	56.1	56.9	59.1	54.6	54.6	52.1	51.8	54.0	52.7	54.4	54.4	54.5

Table D-15. Data from circular plot (Zone III L2) collected from 1990-2005.

	Zone III L2 (026)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15																		1													
16																	1														
17							1	1		1																					
18									2													1									
19							2																	1							
20										2								1													
21					1					1														1		1					1
22										1	1								1				1								
23																		1													
24								1							1			1		1					1						
25									1		2		1		1																
26							1	1	1											1											
27		1																													1
28			1						1		1																1	1			
29									1	1	1										1										
30			1	1			1			1		1						1								1	2				
31								1		1											1										
32																												1			
33	1					2						1														1	1		1		
34						1					1											1						1	1		
35																			1	1			2		1						
36				1				1				1										1	1	1				1			
37						1					1		1											1	2				1	1	
38					1				2				1								1										
39	2												1	1	1	1				1				1							
40							1														1									1	
41																						1				1					1
42													1			1														1	1
43										1		1													1		1	1			
44							1				1			1	1							1		1			2	1	2		1
45			1		1		1	1						1		1	1						1			1		1	1		
46							1	1		1					1			1			1			1	1						
47									1	2							1													1	
48								1	3	1	1		1	1								1									
49								1				1					1	1													
50			1						1	1	1		1			1			2	1			1	1							
51		2		1				1		1		2			1									1	1						
52	2		1	1	2	1	1							1		1		2		2						1					
53	1	3			2	1		1	1			1	1	1	1		1			1	1	2		1	1	1					
54	1	1	3	3	2	1	2			1							1	1	1								1				
55	2		2	1		2			1				1	1	2	1			2	1			1				1				1
56	1	1		1	1				1	2								1			3							1			
57		1		2	1	1	2	1	1	1	1		2			1															
58				1		2	1		3					1	1									1							
59	1	3	2			1	1	1		1	1	1																			
60	1	1	3	1	1	1	1	1			1		1									1	2						1	1	
61	2	2	2	1	1		1	2	2	1		1		1																	
62	2	1		1	1	1	1			1	1	1					1														
63	3	1	1	1	2	1	1			1					1											1					
64	2	2	3	2	1				1	1						1			1	1	1			1	1	1					
65			1	1		1	1	1											1			1	1								
66		1				1	2	3	2	1	1																				
67	1	1				1	1	1																							
68									1	1	2	1																			
69										1																					
70					1																										
71			1	1				1																							
72		1				1	1																								
73																															
74	1																														
75																															
76																															
77																															
78																															
79																															
80																															
81																															
82																															
83																															
84																															
85																															
Count	23	22	23	20	18	20	25	22	26	27	17	12	12	9	11	8	7	11	9	10	10	10	10	12	9	9	9	8	7	5	6
Min. Size	33	27	28	30	21	33	17	17	18	17	22	30	25	39	24	39	16	15	22	24	29	18	22	19	24	21	28	28	33	37	21
Max. Size	74	72	71	71	70	72	72	71	68	69	68	68	60	61	63	64	62	56	65	64	64	65	65	64	64	64	55	56	60	60	55
Avg. Size	57.0	57.8	56.0	56.2	54.3	54.7	50.4	51.1	47.8	46.6	46.0	49.7	46.8	50.6	46.6	50.5	46.6	38.3	50.0	45.0	46.9	45.2	46.3	43.2	43.3	44.7	40.1	39.8	42.4	45.2	38.3
# ≥15 <25	0	0	0	0	1	0	3	2	2	5	1	0	0	0	1	0	1	4	1	1	0	1	1	2	1	1	0	0	0	0	1
Avg. size top 10	64.3	64.0	63.3	62.5	61.0	63.0	64.1	64.2	61.7	62.5	58.2	53.3	49.9	nd	48.9	nd	nd	40.6	nd	45.0	46.9	45.2	46.3	47.8	nd	nd	nd	nd	nd	nd	nd

Table D-16. Data from circular plot (Zone III L3) collected from 1990-2005.

	Zone III L3 (021)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15										1								1													
16																									1				1		
17															2	1										2				1	
18																		2				1									
19																		1													
20																		3				1					1		1		
21									1							1															
22										2													1								
23															1		2			1											
24							1											1									2		1		
25							1									1														1	
26																							2				1	1	1	2	
27			1					1														1							1		
28																		2							1						
29			1					1			1							1									1				
30	1									1		1			1						1										1
31								1									1									1	1				
32																		1	1									1			
33	1						1	1								1			1	1											
34																				1											
35																					1						1				
36								1								1				1							1				
37	2	1	1			1		1										1										1		1	
38		1							1										1									1			
39		1			1				1	1											1										
40			1			1													1	2	3	1	1		1				2		
41	1	1	1	1	1		1								1		1	1				1						1		1	1
42	1									2		1					1						2						1	1	
43	1		1					1	1	1												1							1		
44		2		1	1	1			2	1	2						1		1	1											2
45	1	1				1	1				1							1						2							
46	1		2	1		1					1				1		2					1				1					
47	2	1			1	1						3	1							1					2	1			1		
48		2	2	2		1	2		1			1				1		1			1		1	1		1		1		1	1
49	3	2	3	1			1				1	1	1		1	1					1					1				1	
50	1		1	2	3	2	1	1		3		1	1	1	1				1				1		1		1				
51	1	3			1		1	2	1		1			1		1	1							1			1				
52	3		1	1	1	2	1	1	1		2	3	2	1			1		1	2				1	1	1		1			
53	2	1	2	1	1		2	2	2	1		1	1			2					1	2	1				2				
54		1				2	1	2		1				2	2						1							1			
55		2	4				1			3	1	1	1		1		1	1		1		1			1			1	1	1	
56	3	1	2	3	2	1			1	1	1		2	2	1	1		1								1			1		1
57	1	2		5		1		1	1	1				2	1		1	4	2										1	1	1
58	1	1	1	1	1	3	1	1	2		1	1	1		2	1	1			1	1										
59			2		1		1	2	1		1	1							2	1				1		1	1			1	
60		3		1	3	1	2	1	1	2	2	2			1	1			1		1	1				1		2			1
61				1	1	1	1			1			1			1	1			1		1	1				2		1		
62						4		2	2	2	2		1								1				1				1	1	
63							3	1	1	1	1			1	1																1
64	1		1		1	3					1			1				1					1						1		
65		1					2	4	1	2		2				1	1														
66	1	1	1					1	4	1		1	2	1	1		1							1							
67							2				1					1						1									
68							1			1			1		1																
69	1									1														1	1						
70																															
71		1																													
72	1																														
73																															
74																															
75																															
76																															
77																															
78																															
79																															
80																															
81																															
82																															
83																															
84																															
85																															
Count	30	29	28	21	19	27	28	28	25	30	20	20	15	12	19	16	16	23	12	14	13	13	11	8	10	11	15	11	16	13	9
Min. Size	30	37	27	41	39	37	24	27	21	15	29	30	47	50	17	17	23	15	32	23	30	18	22	45	16	17	20	26	16	17	30
Max. Size	72	71	66	61	64	64	68	66	66	69	67	66	68	66	68	67	66	64	60	61	62	67	64	69	69	60	61	60	64	62	63
Avg. Size	50.4	52.0	49.9	53.0	53.2	54.3	53.6	52.1	54.0	51.2	53.9	52.9	56.7	56.7	48.5	47.1	47.6	36.7	48.4	45.3	46.8	44.9	43.1	54.4	46.6	43.8	40.9	45.7	42.5	41.8	49.2
# ≥15 <25	0	0	0	0	0	0	1	0	1	3	0	0	0	0	3	2	2	8	0	1	0	2	1	0	1	2	3	0	3	1	0
Avg. size top 10	60.7	61.0	58.3	57.6	58.7	61.9	64.2	63.2	63.5	64.1	61.1	59.3	60.1	57.9	59.5	57.3	55.7	53.7	51.6	50.8	50.4	51.9	45.2	nd	46.6	46.5	49.0	47.7	52.7	47.6	nd

Table D-17. Data from circular plot (Zone III L4) collected from 1990-2005.

	Zone III L4 (019)																													
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15																															
16																															
17							1	3	1				1													1					
18							1																			1					
19																															
20														1																	
21		1																													
22						1																									
23							2																								
24																			1								1				
25							1		1			1				1															
26		1	1				1					1															1				
27	1		1							1									1												
28			1				1		1	1																			1		
29		1					2													1					1						
30			1			1								1														1			
31		1				1			1			1	1																		
32			1	1						1				1																	
33	1			1			1	1				1																	1		
34						1	1													1											
35	1			2	2	1	1	1			1				2																
36		1			1						1	1	1			1	1									1					
37	1			2	1	1											1			1											
38		1	1		1		1		1	1			1															1			
39						1		1	2								1														
40					1								1								1										
41	1							2	1	1			1					2									1		1		
42		2	1	1		2	1			1	1	1	1					2			1									1	
43				1	1	1	3	1	1			1					1		1	1				1							1
44	1		1		1					1											1	1			1						
45				1	1	1				1	1					1	1		3	2		1	1								
46		1											1	2																	
47			1			2		2	1		1	1	1		2			1		2											
48							1				2	1						1					1		1	1					
49	1		1		1		1	1		2	1				1							1	1	1				1			
50		1		1		1		1	1	1											3	1	1	1	2	2	1				
51				1					1		1			1					1								1				
52		1										3		1	1			1		1	1										
53	1				1		1	1	1	1				1	1	2					1		1								
54		1	2		1		1		2	1	2		1	1	1	3	2			1		2									
55			1	1		1			2		1		1		3	1		1	1	1	1			1					1		
56	1	2				1		1		2	1	2	2	3		1	1				1										
57	1					1						1	1				2														
58	2		1	2	1	1			1	1	1	1				1	1	4		1	1										
59	1	1		1	1		2	1	1				2	1		1	1														
60					2		2	2	1	1	1	1		1	2		1	2	2	2			1								
61			1	1		3	2	2			1		2	1		1	1			1		1					1				
62		3	2	3	1		1	1	3	4	1	2	1	2	2	1			1												
63	1			1	2	1	1	1	2						2				1		1	1				1					
64	3		1	2	1	1	1	2	1		2	1	1			1				1					2						
65	1	1	1	2	1	1	4	2		1	1	2				1	1			1			2		2						
66		1	1	2	1	3	1		1	1			1	2									1								
67	1	2	3			3		1	1	1			1					1													
68		2	1						3						1						1	1									
69		1	1		2		1	1		1	1																				
70						1	1	1																							
71			1	2		1	1	1		1																					
72		2		1																				1							
73		1	1					1	1															1							
74				1			1		1										1												
75																															
76						1																									
77																															
78																															
79																															
80																															
81																															
82																															
83																															
84																															
85																															
Count	19	28	27	30	24	33	39	31	33	26	21	22	22	19	18	16	15	15	13	17	13	9	9	6	9	7	6	3	4	1	1
Min. Size	27	21	26	32	35	22	17	17	17	27	35	25	17	20	35	25	36	41	24	29	40	44	45	43	29	17	24	30	28	42	43
Max. Size	67	73	73	74	69	76	74	73	74	71	69	65	67	66	68	65	65	67	74	65	68	68	66	73	65	63	61	49	55	42	43
Avg. Size	52.3	54.0	53.6	55.3	52.8	53.4	48.5	52.2	53.2	52.6	53.5	49.6	50.7	52.0	54.2	53.4	52.1	52.5	50.3	50.4	52.4	54.2	55.7	57.0	53.2	40.3	42.2	39.0	39.3	42.0	43.0
# ≥15 <25	0	1	0	0	0	1	4	3	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	2	1	0	0	0	0
Avg. size top 10	61.9	68.7	67.7	67.8	64.1	68.1	67.4	67.1	67.4	64.6	61.4	60.5	61.2	60.4	60.3	58.8	58.1	57.4	56.0	57.6	55.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table D-18. Data from circular plot (Zone III L5) collected from 1990-2005.

	Zone III L5 (018)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15									1		2				1				1			1						1			
16	1								1					4	1				2						1						
17									1		1	1	1				2		1		1			2				2			1
18							1		1			1								2	1			1		1					
19												1		1	1		1	1	2					1	2	1	1		1		
20		2	1				2	1	1			3	1					2	3				1				3			1	
21			1				1					2		1	1	1		1	3	2		2	1	1	1		3	1			
22							3		1		2			1	1		2	1				1	1				3	1			
23		1		1			3					1	1				1	2	2			4		2		1	1		1		1
24			1	1		1	1	1		1	1		1	1		1	1		1		1	3	1	2	4				1	1	
25		3	3	1				2	1			1	1	2	2	1		1	1		3		5		2		2	1	1		
26	1	1	1					1	1		2				3	1		1	2	2				1					2	1	2
27	3	2	4	1			3		1	2	1			2	1	1	1	2	3		2	1	2	2	1	3					2
28	2	1	2	1	2		1	3	1				1	1		1		1	1	1	2	1	3	1	1			2	2	1	1
29		1	4			2			1	2		2		1	3		1	1	4	1	1	1		1	2	1	1	2	1		
30	2		3	1		2	1	1	2	2		2	2	4	1	1		2	1	1	1			1	2		1			1	1
31	2			1							1	2	1	1	1		1		2	1			1	2	3		1		1	3	3
32			1	2		4			1	2	1	2	1	2	6		1	1	1	3			1		1	4		1	2	1	
33	3			1	3	1	1		3	1	2	2	3	1	1		1		1	2	2	1	2			1				1	1
34	3			1	1	1	1		1	1	1	5		3	1	2	2		1	5	1	1		4	3	1	1	1	2	1	1
35	2		1	4	2	2		1	3	6	4	1	2	1		2		1		1	2	2	2	2	1		4	1	2	1	
36	2	2	2	2	1	4		1	2	5	1	1	1		2	2			3	2	3	2	4	1	1	2	3	1		3	3
37	4	1	3	2	3	1	3	5	3	1	1	2	2	1	1	3	1	2	1	1	1	1	1	1	1	2	1	1	2	1	
38	5	3	3	2	1	4	6	5		2	1			2	1	1	1	1	1	1	5		2	2	3	1	2	2		1	
39	2			5	3	5	3	2	4			3	1		2	3	1	2	1			2	1	2	1	1		3		3	1
40	2	4	4	1	1	5	7	6		2	3	11	2	3			1	1	2	3	2	1		1	2	3	4	2	2	3	3
41	4	3	2	3	3	2	3	3	4	2	8	2	2	2	2	2	2	2		1	1	2	1	2	2	1	1	2	1		2
42	4	6	3	3	4	2	6	3	4	4	3	3	6	2	1	5	3	1	1		1	1	4	1	1	1	1	1	2	1	2
43	4	5	5	2	3	5	3	2	4	5	2		5	1	2				1	1		3		1	1	4	3	3	2		3
44	5	5	4	6	3	4	6	4	2	4	1	7	3	4	5	1	2	2		1	4	1	2	2		1	2	3	3	2	1
45	2	5	5		4	3	3	6	2	2	2	3	2	2	3		2	4	4	2	2	4	2	1	3	1	2	2	2	3	2
46	2	1	4	4	3	7	3	2	4		2	1	4	2	4	3	4	1	1		1	4	4	8	4	3	4	4	1		2
47	3	3		3	1	5	1	3	2	1	1		2	3	4	2	2	2	1	1	1	3	2		2	2	2	3	3	2	
48	7	5	4	4	2	1	2	3	2	2	1	1	2	1	1	1	1	4	1	1	1		1		2		1	1	2	2	2
49	5	3	4	4	2	2	3	2	3	2	2		1	1	4	4	1		1				1			3	1	1	2	2	1
50	5	5	2	1	6	4	4	5	1	3	2		1	4	1		2	3	2	2	1	3	6	1	1	1	2			2	1
51	1	1	2	3	4	4		3	3	1	1	3		1	3	1	6	2	3	3	3	3	5	2			1	2	1	2	
52	3	1	1	2		2	5	2	1			1		2	1	2	1	1	3	2			2	1	3	1	1	1	1	1	1
53		2	2		1	4	1	2				1	2	1	1	2	1	3	3	3	3	2		1	2		2	1	1	3	3
54	1	2	1	1	2	4	3					1	2	2	1		1			4	2	1	1	1		1		2	2	1	
55	1	3	2	2	2		3	1	2	1	1				1	1	1		2	1	1			1	2	1	1		1	2	2
56	1	2	2		1	1	1	2					1	1		2	2	1	1	1		4	1	1	1	1		1		2	1
57		2		2		3	4	2		2			1		2			1		2	3			1			2		2		
58				2				1	1					1		3		2			2		2	1				1			
59																				1		3	3	2	1	1	1				1
60		1	1					1										1				2	1			1	1		1		1
61																			1			1								1	
62																															
63				1		1																1				1					
64				1												1															
65																												1	1		1
66																1													1		
67																															
68																															
69																															
70																															
71																														1	
72																															
73																															
74																															
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76																															
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78																															
79																															
80																															
81																															
82																															
83																															
84																															
85																															
Count	82	76	78	71	58	86	88	76	65	56	50	66	55	62	66	51	49	53	65	54	54	62	66	57	57	46	59	51	49	50	46
Min. Size	16	20	20	23	28	24	18	20	15	24	15	17	17	16	15	21	17	19	15	18	17	15	20	17	16	18	19	15	19	20	17
Max. Size	56	60	60	64	56	63	57	60	58	57	55	54	57	58	57	66	56	60	61	59	58	63	60	59	59	63	60	65	66	71	65
Avg. Size	41.3	43.2	40.4	43.0	43.8	43.7	41.3	43.0	39.0	40.2	37.9	37.0	40.5	38.1	39.3	43.2	41.0	40.4	36.0	40.9	40.6	42.0	41.3	38.8	38.2	40.9	38.8	40.6	41.9	43.0	41.5
# ≥15 <25	1	3	3	2	0	1	11	2	6	1	6	9	4	8	5	2	7	7	15	4	3	11	4	9	8	3	11	5	3	2	2
Avg. size top 10	52.2	55.9	54.5	57.3	53.1	55.9	55.7	55.7	52.1	51.6	49.1	49.6	52.2	53.0	53.1	57.7	53.0	55.1	54.2	55.3	55.6	58.9	56.7	55.4	53.7	54.7	54.7	54.3	57.3	56.7	56.1

Table D-19. Data from circular plot (Zone III L6) collected from 1990-2005.

	Zone L6 (011)																														
(mm)	SP90	FA90	SP91	FA91	SP92	SU92	FA92	SP93	FA93	SP94	FA94	SP95	FA95	FA96	SP97	FA97	SP98	FA98	SP99	FA99	SP00	FA00	SP01	FA01	SP02	FA02	SP03	FA03	SP04	FA04	SP05
15									1	1	1				1					1		1	1	3	1				2	1	
16													1				1							2	1					1	2
17							1		2	1	1	1					2	1				1		1				1	1	1	1
18							3		1			1	1		1		1	1				1			1		1	1			
19		1					1		1	1	1							2	2		1	1	3	1	2			2			
20		1	1				2		3						2	2	1	2						2	1			1	1	1	1
21							1		1					1				1	3				1				1				
22		1	1				1		2	1				2			1				1	1		1			1		1		2
23		1	1	1			2		1	1		1			1	1			4		1		1		1			2	2	1	1
24						1		1	1	2		2			2		1		3							2			1		1
25							1				1	1			4	2		3				1	1			1					1
26			1				1	1			1				1	1			1	1		2		1				1	2		1
27	1			1		1		2	1	1		1			2		2		1	2					2	2		2	1		
28									1	1		1		1	3	1		1	1	1		1	1	2	1	1	1	1			2
29		1		1		1	2	1	1	1	1	1			1		1	1	1					1	1	2			1		
30	1								1	3	3	1				2	1		1	3	2	1	1	2		1	1	2	1	2	
31	1	1		1	1		1	1	4		1	1				2			1		2	1		2		1	1				1
32	1		1	1				1	2	1	1					1			2		1		1	2			1			1	1
33	4	1		2			1		3	2	1	1	3		1	1	2	2		1	2	1			2		2	1	1		
34				1		2	2			1	2	3	2	2			1	1			2		1	1	1		1		1	2	
35	2	2	2	1	1	1		1	2	3	4	1	1		1	2		1	1	2			1	3		2	1	3	2	1	1
36	1	3	2	1	1	2	1				2	1	1					1	1	1	1	1			1	2	2		2	1	
37	2	2	3			1	1		1	2	2	1	1	1			3		1	2				1	3	2	2	4			1
38	1	2	3	2		1	2		2		2	1			1		1	2	2	1	2	1			1	1	1			2	1
39	2	3	1	1	1	1	1		1		1	3	2		1		2		1		1		2			1		2	2	2	2
40	3	2	1	1	1		6	2		2	1	3	4	3	3	1	2	3	3	3	2	2		2	1	1	1	2	1	2	3
41	1	3	4	2		1	1	3				1	3	2		2		2			2	1		2	1		4	1	4	2	3
42	2	1		3	2	3	1		4	2	1	2		2			1	1	3	2		1	2	1	1	5	1	1	2	1	1
43		3	3	4	2	2		2	1	2		3		3	6	1		1			2	1			1		1	1		1	5
44	1	1	3	5	2	2		1	1		2	1	1		3	1	2	1		3		1	1	4	1		2	6	3	1	
45	2	3	5	3	6		4	2	2	1	1	5	3	1	1	1	1	2	3		1		2				1		2	4	1
46	4	5	5	2	5	2	1	1	1		3		1		1	3	1	1		2	2	1	1	1	1	2		1	2	3	2
47	3	7	2	4	1	6		2	4	2	2		3	3		1	2				2	3	2	1	4		3	1	2	2	2
48	7	2	5	3	1	5	1	3	1	3	1	1	4	2	3		1	1	1		1	2	1	1	1			2			2
49	3	2	4	2	1	5	4	3	3	3	3	1	1		3		1	1	1	1		1	1	2	1	1	3			1	
50	2	3		3	3		7	3	4	1	2	1	1	3	1	2	2	2	2	3	4		1	4	2	2	1		1		1
51	2	1	2	2	5	3	4	2	6	1	4	2	1	3	3	3	5	2		2		6	3	2	1	2	3	3	2		1
52	2	2	2	1		3	1	3	1	4	1	5		4	2	4	1	4	3	1	3	1	4	1	2	3	1	3	3	2	1
53	2		1	1	1	3	1	4	2	1			1		2	2	1	1	1	1		2	2		1	2	2	2	3	5	3
54	1	3	3	1	1	3	5	4	3		3	1	3	3	1			1	1			2	3	2	1			1		2	1
55	1	1	1	2		1	3	3	1	1	4		1	1	2		1	1	1		1		1	1	2	1	1		2	2	2
56				1			3	1	1	1		2	2	1	1	2	3	2		3	3					2	1	1	1	1	1
57					1	1	3	4	2			1			1	2	1					2									1
58	1		1			2	2									2			1		1		1		1	1	1	1	2		
59				1			1		1				1		1							1		1			1			1	1
60	1	1					1									1			1			1		1		1		1	2	2	
61	1	2				1																	1								
62			1			1	1	1			1			1				1													
63									2	1					1						1			1	1		1		1		
64	1		1																					1							
65		1					1		1													1				1					
66				1																											
67																							1		1						
68																							1								
69																															
70																															
71																															
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83																															
84																															
85																															
Count	56	62	60	55	36	55	75	52	73	47	54	51	42	39	57	43	45	46	47	36	41	43	42	53	43	42	44	50	54	48	50
Min. Size	27	19	20	23	31	24	17	24	15	15	15	17	16	21	15	20	16	17	19	15	19	15	15	15	15	24	18	17	15	15	16
Max. Size	64	65	64	66	57	62	65	62	65	63	62	57	59	62	63	60	57	62	60	56	63	65	68	64	67	65	63	60	63	60	59
Avg. Size	44.6	43.5	44.0	44.1	45.9	46.4	43.1	46.8	40.5	39.3	41.3	40.2	43.3	44.6	40.1	42.6	40.1	39.6	37.0	40.7	42.2	42.2	43.4	38.3	40.2	42.2	42.3	39.5	41.0	42.7	39.9
# $\geq$15 <25	0	4	3	1	0	1	11	1	13	7	3	5	2	3	7	3	7	7	12	1	3	5	6	10	7	2	3	7	8	5	8
Avg. size top 10	56.2	56.8	55.8	55.2	51.9	56.6	58.9	56.5	58.3	53.6	54.7	53.4	54.2	54.3	55.7	56.0	53.8	54.4	53.6	52.5	55.0	56.4	57.7	56.3	56.0	56.0	55.1	54.1	57.1	55.9	54.7

Table D-20. Data from barnacle photoplots in Zone I collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90			55	5	0	28	0	0	0	11	0
FA90			31	39	0	3	9	0	0	18	0
SP91			34	33	0	10	0	0	0	23	0
FA91			38	29	1	13	3	0	0	16	0
SP92			28	25	2	2	25	0	0	18	0
SU92			26	31	0	18	6	0	0	19	0
FA92			45	5	0	4	14	0	0	32	0
SP93			50	1	0	13	7	0	0	29	0
FA93			42	10	0	1	26	0	0	21	0
SP94			42	3	0	14	9	0	0	32	0
FA94			29	5	0	1	51	0	0	14	0
SP95			51	4	0	2	26	0	0	17	0
FA95			64	6	0	0	19	0	0	11	0
FA96			59	19	0	0	16	0	0	6	0
SP97	**Zone I**	**B1 (286)**	50	30	0	2	14	0	0	4	0
FA97			25	0	0	1	67	0	0	4	3
SP98			69	1	0	1	20	0	0	9	0
FA98			22	42	0	0	27	0	0	4	0
SP99			14	56	0	2	16	1	0	11	0
FA99			42	9	1	4	27	0	0	17	0
SP00			57	0	1	0	21	0	0	20	1
FA00			32	20	1	3	24	0	0	18	2
SP01			39	14	0	4	17	0	0	27	0
FA01			18	28	3	4	42	0	0	5	0
SP02			21	27	1	1	15	0	0	34	0
FA02			43	4	0	4	35	0	0	12	2
SP03			31	2	1	15	38	0	0	10	3
FA03			38	8	0	11	23	0	0	17	3
SP04			28	17	1	12	24	0	0	17	1
FA04			27	5	2	8	51	0	0	7	0
SP05			42	1	1	13	36	0	0	7	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		60	4	0	15	0	0	0	21	0
FA90		52	24	0	0	3	0	0	21	0
SP91		66	13	0	3	0	0	0	18	0
FA91		58	29	0	3	0	0	0	10	0
SP92		40	50	0	1	4	0	0	5	0
SU92		39	48	0	8	2	0	0	3	0
FA92		70	0	0	11	13	0	1	5	0
SP93		78	14	0	2	4	0	0	2	0
FA93		62	9	0	0	13	0	14	2	0
SP94		87	1	0	6	3	0	0	3	0
FA94		33	20	0	0	44	0	1	2	0
SP95		54	30	0	0	13	0	0	3	0
FA95		67	14	0	0	17	0	0	2	0
FA96		56	33	0	0	9	0	0	2	0
SP97	**B2 (299)**	42	52	0	1	1	0	0	4	0
FA97		30	4	0	0	49	0	0	4	13
SP98		79	6	0	3	9	0	0	3	0
FA98		9	76	0	0	9	0	0	6	0
SP99		17	75	0	4	2	0	0	2	0
FA99		60	25	0	4	6	1	0	4	0
SP00		63	13	0	3	18	0	0	2	1
FA00		48	39	0	4	3	0	0	6	0
SP01		45	38	0	3	9	0	0	5	0
FA01		22	62	0	4	9	0	0	3	0
SP02		40	49	0	2	5	0	0	4	0
FA02		66	8	0	1	21	0	0	3	2
SP03		53	13	0	3	25	0	0	5	1
FA03		58	11	0	3	15	0	0	11	2
SP04		45	37	0	2	9	0	1	5	1
FA04		77	3	0	6	11	0	0	3	0
SP05		82	1	0	3	10	0	0	4	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		9	0	1	22	32	0	0	37	0
FA90		12	0	3	15	45	0	0	25	0
SP91		12	0	0	23	42	0	0	23	0
FA91		3	0	3	15	63	0	0	16	0
SP92		1	1	3	23	59	0	0	13	0
SU92		7	6	2	23	43	0	0	19	0
FA92		2	2	7	1	75	0	0	13	0
SP93		4	0	12	3	66	0	0	15	0
FA93		5	13	13	1	68	0	0	0	0
SP94		8	0	16	0	65	0	0	11	0
FA94		2	0	4	0	94	0	0	0	0
SP95		2	0	8	1	83	0	0	6	0
FA95		2	0	7	0	90	0	0	1	0
FA96		2	0	8	1	89	0	0	0	0
SP97	**B3 (294)**	7	0	21	0	70	0	0	2	0
FA97		1	1	18	0	80	0	0	0	0
SP98		12	0	21	0	67	0	0	0	0
FA98		0	0	0	0	79	0	0	21	0
SP99		1	0	15	2	79	0	0	3	0
FA99		1	0	6	1	82	0	0	3	7
SP00		2	1	19	0	74	1	0	3	0
FA00		2	0	18	0	73	0	0	6	1
SP01		2	6	11	1	71	1	0	8	0
FA01		1	0	8	0	85	0	0	5	1
SP02		2	4	21	0	65	0	0	8	0
FA02		1	0	7	0	89	0	0	3	0
SP03		1	2	16	8	68	0	0	6	0
FA03		2	0	14	1	75	0	0	8	0
SP04		4	7	14	6	63	0	0	4	2
FA04		5	0	13	2	76	0	0	4	0
SP05		4	0	15	6	69	0	0	5	1

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		35	2	0	10	24	3	0	26	0
FA90		30	0	0	8	42	3	0	17	0
SP91		43	4	0	8	13	6	0	26	0
FA91		34	0	0	4	40	5	0	17	0
SP92		23	2	1	3	54	6	0	11	0
SU92		33	5	0	0	45	9	0	8	0
FA92		29	0	1	2	56	4	0	8	0
SP93		0	0	0	1	49	0	50	0	0
FA93		19	0	0	2	76	2	0	1	0
SP94		38	0	2	13	47	0	0	0	0
FA94		43	14	0	0	38	0	0	5	0
SP95		16	4	0	5	75	0	0	0	0
FA95		25	0	1	2	71	0	0	1	0
FA96		44	0	0	4	49	0	0	3	0
SP97	**B4 (292)**	40	0	0	2	58	0	0	0	0
FA97		24	0	0	3	70	0	0	2	1
SP98		59	0	0	3	33	1	0	4	0
FA98		13	9	0	0	77	0	0	1	0
SP99		10	14	0	0	62	2	0	11	0
FA99		29	0	0	2	50	4	0	7	8
SP00		23	6	0	2	53	2	0	5	9
FA00		29	9	4	3	44	8	1	1	1
SP01		27	4	0	2	49	3	3	12	0
FA01		17	3	0	2	62	0	5	3	8
SP02		31	2	0	4	39	3	3	10	8
FA02		31	0	0	3	45	1	3	9	8
SP03		36	0	0	7	34	1	8	4	10
FA03		21	1	0	1	55	0	11	9	2
SP04		26	3	1	5	48	3	7	7	0
FA04		21	1	0	0	66	1	5	6	0
SP05		15	0	1	1	72	4	1	1	5

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		57	0	0	0	17	19	0	7	0
FA90		65	0	0	0	15	15	0	5	0
SP91		73	0	0	0	4	13	0	10	0
FA91		64	0	0	0	18	11	0	7	0
SP92		34	3	0	0	48	11	0	4	0
SU92		54	1	0	8	18	13	0	6	0
FA92		67	0	1	0	18	6	0	8	0
SP93		78	0	0	0	14	6	0	2	0
FA93		62	0	0	5	29	1	0	3	0
SP94		74	0	0	6	14	0	0	6	0
FA94		54	5	4	3	30	0	0	4	0
SP95		61	0	0	4	30	0	0	5	0
FA95		72	0	0	5	20	0	1	2	0
FA96		80	0	0	7	12	0	0	1	0
SP97	**B5 (293)**	80	0	0	4	13	0	1	2	0
FA97		69	0	0	4	22	0	1	2	2
SP98		86	0	0	8	3	0	0	3	0
FA98		43	15	0	10	32	0	0	0	0
SP99		41	20	0	11	26	0	0	2	0
FA99		49	1	0	8	32	0	3	7	0
SP00		66	3	0	3	24	2	0	2	0
FA00		49	7	0	6	32	4	1	1	0
SP01		54	3	0	9	30	0	0	4	0
FA01		50	2	0	8	36	1	1	2	0
SP02		59	2	0	7	17	2	1	12	0
FA02		63	0	0	3	26	2	0	6	0
SP03		65	0	0	6	22	3	0	4	0
FA03		57	4	0	9	26	0	0	3	0
SP04		53	3	0	9	32	2	0	1	0
FA04		57	0	0	4	38	0	0	1	0
SP05		64	0	0	5	28	0	0	3	0

Table D-21. Data from barnacle photoplots in Zone II collected from 1990-2005.

Zone II, Plot ID B1 (247)

Event	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	59	0	0	0	26	0	0	15	0
FA90	29	1	0	2	59	0	0	9	0
SP91	78	0	0	2	10	0	0	10	0
FA91	20	4	0	0	68	0	0	8	0
SP92	40	0	0	1	57	0	2	0	0
SU92	63	9	0	2	20	0	2	4	0
FA92	87	0	0	3	5	0	0	5	0
SP93	64	0	0	3	33	0	0	0	0
FA93	50	0	0	4	43	0	0	3	0
SP94	29	0	0	4	67	0	0	0	0
FA94	81	0	0	2	15	0	0	2	0
SP95	4	2	0	2	91	0	0	1	0
FA95	92	0	0	1	6	0	0	1	0
FA96	96	0	0	0	1	0	0	3	0
SP97	10	0	0	0	84	0	0	6	0
FA97	19	0	0	0	78	0	0	3	0
SP98	29	0	0	2	67	0	0	2	0
FA98	12	2	0	1	85	0	0	0	0
SP99	38	12	0	3	46	0	0	1	0
FA99	15	8	0	1	74	0	0	1	0
SP00	26	10	0	1	60	0	0	3	0
FA00	30	11	0	2	51	0	0	6	0
SP01	63	7	0	2	19	0	0	9	0
FA01	24	21	0	3	47	0	0	5	0
SP02	41	7	0	2	44	0	0	6	0
FA02	33	0	0	0	54	0	2	10	1
SP03	38	1	0	3	40	0	4	14	0
FA03	17	6	0	3	54	0	1	17	0
SP04	19	47	0	8	25	0	0	1	0
FA04	27	1	0	3	55	0	2	12	0
SP05	36	0	0	3	47	0	2	12	0

Zone II, Plot ID B2 (248)

Event	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	56	25	1	2	0	0	3	12	0
FA90	25	44	0	1	19	0	4	7	0
SP91	47	43	0	0	0	0	5	5	0
FA91	28	45	0	2	12	0	6	7	0
SP92	43	14	0	33	3	0	2	5	0
SU92	36	20	0	35	4	0	3	2	0
FA92	47	34	0	2	13	0	3	1	0
SP93	43	15	0	22	17	0	0	3	0
FA93	27	21	0	3	46	0	3	0	0
SP94	31	18	0	20	25	0	0	6	0
FA94	43	23	0	0	31	0	0	3	0
SP95	33	21	0	18	24	0	0	4	0
FA95	62	18	0	1	15	0	0	4	0
FA96	59	30	0	0	8	0	0	3	0
SP97	47	41	0	10	1	0	0	1	0
FA97	18	50	0	0	25	0	0	0	7
SP98	79	0	0	14	6	0	0	1	0
FA98	13	56	0	25	5	0	0	1	0
SP99	21	39	1	29	9	0	0	1	0
FA99	34	26	0	8	26	1	0	5	0
SP00	53	26	0	2	13	0	0	6	0
FA00	20	44	0	7	15	0	0	5	0
SP01	21	52	0	13	5	0	0	9	0
FA01	43	5	0	8	37	0	0	7	0
SP02	44	29	0	6	10	0	1	10	0
FA02	29	18	0	3	44	0	0	6	0
SP03	37	32	0	3	19	0	0	9	0
FA03	24	19	0	10	40	0	0	6	0
SP04	26	49	0	12	9	0	0	3	1
FA04	32	5	0	7	46	0	1	9	0
SP05	62	1	0	13	15	0	0	9	0

Zone II, Plot ID B3 (256)

Event	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	31	4	9	9	4	0	0	43	0
FA90	16	8	7	1	25	0	4	39	0
SP91	28	8	6	4	13	0	0	41	0
FA91	9	14	7	21	8	0	0	41	0
SP92	11	18	6	11	18	0	2	34	0
SU92	5	20	13	19	19	0	0	24	0
FA92	23	11	13	1	34	0	1	17	0
SP93	13	14	14	9	31	0	0	19	0
FA93	10	0	7	0	70	0	1	12	0
SP94	15	0	10	3	60	0	2	10	0
FA94	15	1	12	0	46	0	20	6	0
SP95	16	6	10	1	36	0	17	14	0
FA95	29	2	8	0	38	0	21	2	0
FA96	11	5	11	0	41	0	27	5	0
SP97	13	8	17	0	45	0	10	7	0
FA97	14	1	18	0	48	0	16	3	0
SP98	30	2	15	4	15	0	27	7	0
FA98	7	14	11	6	30	0	26	6	0
SP99	12	6	15	2	23	1	27	3	0
FA99	14	5	14	2	23	0	29	13	0
SP00	19	14	11	2	20	0	27	7	0
FA00	12	6	10	3	23	0	34	12	0
SP01	24	11	11	3	8	0	34	9	0
FA01	11	16	11	6	24	0	24	8	0
SP02	16	24	8	2	14	0	22	12	2
FA02	18	3	11	2	32	0	27	4	3
SP03	17	8	6	0	31	0	23	15	0
FA03	14	5	7	8	27	0	35	3	0
SP04	16	17	7	4	12	0	38	6	0
FA04	17	7	10	1	33	0	31	1	0
SP05	13	7	8	8	19	0	39	6	0

Zone II, Plot ID B4 (259)

Event	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	38	29	0	4	0	0	0	29	0
FA90	20	49	0	12	7	0	0	12	0
SP91	12	66	0	3	0	0	0	19	0
FA91	6	30	0	28	18	0	0	18	0
SP92	6	22	0	26	36	0	0	10	0
SU92	29	18	0	34	7	0	0	12	0
FA92	39	8	0	16	26	0	0	11	0
SP93	22	9	0	36	22	0	0	11	0
FA93	17	8	0	20	51	0	3	1	0
SP94	26	3	0	31	34	0	3	3	0
FA94	20	12	0	9	51	0	3	5	0
SP95	20	9	0	25	42	0	0	4	0
FA95	56	6	0	1	23	0	5	9	0
FA96	20	10	0	2	60	0	3	5	0
SP97	14	39	0	3	36	0	6	2	0
FA97	15	5	0	0	77	0	0	3	0
SP98	30	0	0	24	43	0	0	3	0
FA98	3	14	0	25	52	0	4	1	0
SP99	15	8	54	18	0	0	4	1	0
FA99	7	9	0	6	67	0	10	1	0
SP00	11	11	0	5	51	0	18	1	3
FA00	10	5	0	4	17	0	63	1	0
SP01	8	7	0	3	21	0	61	0	0
FA01	6	0	0	0	24	0	70	0	0
SP02	9	7	0	0	23	0	61	0	0
FA02	7	2	0	0	5	0	86	0	0
SP03	7	2	0	1	6	0	84	0	0
FA03	2	0	0	1	3	0	96	0	0
SP04	4	3	0	0	7	0	86	0	0
FA04	7	0	0	0	2	0	91	0	0
SP05	7	1	1	1	4	0	85	1	0

Zone II, Plot ID B5 (260)

Event	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	30	6	0	10	2	0	0	52	0
FA90	14	17	0	6	11	0	0	52	0
SP91	21	23	0	1	1	0	0	54	0
FA91	17	21	0	4	27	0	0	31	0
SP92	6	17	0	12	44	0	1	20	0
SU92	20	22	0	13	17	0	5	23	0
FA92	55	5	0	3	21	0	0	15	0
SP93	24	10	0	4	37	0	0	25	0
FA93	43	8	0	2	25	0	0	22	0
SP94	46	7	0	7	19	0	2	19	0
FA94	13	56	0	0	14	0	0	17	0
SP95	25	26	0	0	29	0	8	12	0
FA95	54	24	0	0	5	0	1	16	0
FA96	14	47	0	5	4	0	4	26	0
SP97	28	36	3	0	13	0	2	18	0
FA97	13	16	2	0	52	0	5	12	0
SP98	40	10	2	8	13	0	4	23	0
FA98	3	47	3	7	8	0	3	29	0
SP99	10	36	2	11	19	0	8	14	0
FA99	25	9	0	2	22	0	6	33	0
SP00	26	21	1	0	15	0	7	30	0
FA00	15	29	1	3	22	20	10	0	0
SP01	28	12	2	9	19	0	5	24	1
FA01	10	47	0	0	12	0	4	27	0
SP02	17	21	3	12	21	0	6	20	0
FA02	35	7	1	4	24	0	4	20	4
SP03	44	6	1	4	20	0	7	18	0
FA03	24	4	1	3	39	0	19	10	0
SP04	31	10	1	6	27	0	17	8	0
FA04	46	6	0	3	16	0	24	5	0
SP05	50	5	0	5	15	0	14	11	0

Table D-22. Data from barnacle photoplots in Zone III collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Zone III	B1 (003)	32	11	0	13	22	0	0	22	0
FA90			25	11	1	4	25	0	0	34	0
SP91			31	13	0	5	13	0	0	38	0
FA91			21	25	0	9	8	0	0	37	0
SP92			30	17	0	0	27	0	0	26	0
SU92			15	25	0	7	33	0	0	20	0
FA92			26	10	0	0	52	0	0	12	0
SP93			23	14	0	30	18	0	0	15	0
FA93			42	19	0	1	26	0	0	12	0
SP94			66	13	0	3	2	0	0	16	0
FA94			44	26	0	6	19	0	0	5	0
SP95			46	11	0	6	34	0	0	3	0
FA95			39	8	0	0	53	0	0	0	0
FA96			46	27	0	1	25	0	0	1	0
SP97			54	35	0	3	6	0	0	2	0
FA97			22	1	0	0	76	0	0	1	0
SP98			64	0	0	4	31	0	0	1	0
FA98			2	54	0	17	27	0	0	0	0
SP99			11	54	0	9	22	0	0	4	0
FA99			21	37	0	6	32	0	0	4	0
SP00			28	25	0	11	29	0	0	4	3
FA00			24	36	0	12	16	0	0	12	0
SP01			22	60	0	6	8	0	0	4	0
FA01			11	38	0	2	47	0	0	2	0
SP02			20	52	0	2	13	0	0	13	0
FA02			45	10	0	4	36	0	0	3	2
SP03			36	22	0	5	25	0	0	12	0
FA03			33	11	0	5	44	0	0	5	0
SP04			17	39	0	10	30	0	0	4	0
FA04			31	0	0	7	61	0	0	1	0
SP05			28	7	0	7	54	0	0	4	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	B2 (016)	45	14	0	12	14	0	0	15	0
FA90		26	26	0	5	25	0	0	18	0
SP91		33	19	0	15	10	0	0	23	0
FA91		6	53	0	10	12	0	0	19	0
SP92		13	40	0	0	30	0	0	17	0
SU92		28	29	0	24	7	0	0	12	0
FA92		34	1	0	4	47	0	0	14	0
SP93		10	14	0	10	49	0	0	17	0
FA93		29	12	0	0	49	0	0	10	0
SP94		73	9	0	2	1	0	0	15	0
FA94		28	19	0	9	33	0	0	11	0
SP95		30	27	0	11	31	0	0	1	0
FA95		38	12	0	0	49	0	0	1	0
FA96		49	19	0	4	28	0	0	0	0
SP97		46	28	0	0	25	0	0	1	0
FA97		23	3	0	0	74	0	0	0	0
SP98		69	0	0	6	23	0	0	2	0
FA98		0	53	0	13	33	0	0	0	0
SP99		11	49	0	23	15	0	0	2	0
FA99		24	25	0	15	28	0	0	8	0
SP00		30	42	0	5	16	0	0	4	3
FA00		22	35	0	12	25	0	0	6	0
SP01		28	50	0	9	4	0	0	9	0
FA01		11	20	0	0	65	0	0	4	0
SP02		33	24	0	5	26	0	0	11	1
FA02		29	18	0	4	44	0	0	4	1
SP03		33	30	1	4	19	0	0	13	0
FA03		17	15	0	3	60	0	0	5	0
SP04		24	30	0	6	30	0	0	10	0
FA04		23	3	0	2	70	0	0	2	0
SP05		42	3	0	3	47	0	0	5	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	B3 (029)	52	13	0	1	1	0	3	30	0
FA90		30	44	0	1	1	0	5	19	0
SP91		38	33	0	0	0	0	4	25	0
FA91		9	52	0	5	2	0	11	21	0
SP92		13	59	0	0	8	0	4	16	0
SU92		16	53	0	5	3	0	9	14	0
FA92		50	2	0	1	15	0	15	17	0
SP93		51	13	0	0	1	0	10	25	0
FA93		25	31	0	0	13	0	12	19	0
SP94		17	35	0	1	15	0	10	22	0
FA94		23	43	0	0	8	0	13	13	0
SP95		27	42	0	0	1	0	12	18	0
FA95		55	12	0	0	6	0	14	13	0
FA96		31	30	0	1	0	0	16	22	0
SP97		47	42	0	0	0	0	11	0	0
FA97		58	16	0	0	10	0	9	7	0
SP98		67	14	0	2	2	0	6	9	0
FA98		14	79	0	0	0	0	6	1	0
SP99		21	63	0	4	1	0	5	7	0
FA99		27	40	0	3	4	0	3	7	16
SP00		40	35	0	1	13	0	7	4	0
FA00		28	44	0	0	2	0	17	9	0
SP01		18	56	0	2	7	0	9	8	0
FA01		20	48	0	0	17	0	0	15	0
SP02		13	63	0	0	3	0	4	17	0
FA02		23	38	0	0	17	0	15	7	0
SP03		27	48	0	1	2	0	13	9	0
FA03		23	33	0	0	15	0	28	2	0
SP04		15	54	0	1	7	0	14	9	0
FA04		21	9	0	1	37	0	28	3	1
SP05		41	18	0	0	22	0	12	7	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	B4 (030)	20	29	0	20	6	0	0	25	0
FA90		17	42	0	0	6	0	3	32	0
SP91		25	47	0	0	6	0	0	22	0
FA91		6	48	0	12	1	0	2	31	0
SP92		2	27	0	1	56	0	3	11	0
SU92		7	34	0	23	12	0	7	17	0
FA92		46	0	0	6	10	0	7	31	0
SP93		49	11	0	0	4	0	1	35	0
FA93		35	26	0	0	5	0	7	27	0
SP94		37	19	0	3	6	0	8	27	0
FA94		38	37	0	0	3	0	0	22	0
SP95		5	47	0	14	1	0	8	25	0
FA95		47	10	0	0	9	0	14	20	0
FA96		27	15	0	4	11	0	1	42	0
SP97		24	31	0	0	13	0	3	29	0
FA97		19	1	0	1	49	0	3	27	0
SP98		42	4	0	15	10	0	0	29	0
FA98		3	32	0	16	18	0	1	34	0
SP99		1	32	0	25	25	0	0	17	0
FA99		6	28	0	7	22	0	8	29	0
SP00		8	15	0	11	17	0	6	42	1
FA00		9	20	0	8	29	0	8	26	0
SP01		12	16	0	4	23	0	9	35	0
FA01		6	33	0	15	16	0	0	30	0
SP02		9	12	1	9	8	0	25	36	0
FA02		10	6	0	5	24	0	32	23	0
SP03		10	10	1	8	17	0	28	26	0
FA03		13	8	0	10	25	0	27	16	0
SP04		9	27	3	7	14	0	25	15	0
FA04		11	5	0	9	30	0	34	11	0
SP05		8	5	1	13	27	0	39	7	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	B5 (020)	76	0	0	2	0	0	4	18	0
FA90		64	14	0	6	6	0	0	10	0
SP91		79	9	0	0	1	0	0	11	0
FA91		49	32	0	5	4	0	0	10	0
SP92		51	36	0	3	2	0	0	8	0
SU92		55	32	0	7	0	0	0	6	0
FA92		86	0	0	5	1	0	0	8	0
SP93		90	0	0	2	0	0	0	8	0
FA93		64	14	0	3	11	0	0	8	0
SP94		73	11	0	2	0	0	0	14	0
FA94		48	37	0	0	3	0	0	12	0
SP95		27	59	0	3	0	0	0	11	0
FA95		78	6	0	1	6	0	0	9	0
FA96		63	19	0	2	6	0	0	10	0
SP97		45	38	0	2	3	0	0	12	0
FA97		55	11	0	1	26	0	0	7	0
SP98		80	3	0	2	4	0	0	11	0
FA98		22	61	0	2	5	0	0	10	0
SP99		29	56	0	0	4	0	0	11	0
FA99		42	16	0	3	24	0	0	14	0
SP00		45	18	0	2	16	0	0	19	0
FA00		28	46	0	1	6	0	0	18	1
SP01		30	44	0	5	5	0	0	16	0
FA01		21	27	0	0	38	0	0	14	0
SP02		44	25	0	1	2	0	0	28	0
FA02		32	17	0	1	37	0	0	13	0
SP03		58	12	0	1	9	0	0	20	0
FA03		52	12	0	1	12	0	0	23	0
SP04		33	38	0	0	6	0	0	23	0
FA04		56	4	0	4	24	0	0	12	0
SP05		66	1	0	3	15	0	0	15	0

Table D-23. Data from mussel photoplots in Zone I collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Zone I	M1 (298)	32	0	16	0	33	19	0	0	0
FA90			31	0	7	0	53	9	0	0	0
SP91			20	0	6	0	60	14	0	0	0
FA91			39	0	7	0	39	15	0	0	0
SP92			44	0	5	0	38	13	0	0	0
SU92			53	0	9	0	17	21	0	0	0
FA92			46	0	6	0	24	24	0	0	0
SP93			42	0	7	0	28	23	0	0	0
FA93			27	0	9	0	38	26	0	0	0
SP94			35	0	10	0	34	21	0	0	0
FA94			31	2	4	3	31	29	0	0	0
SP95			24	3	4	2	48	19	0	0	0
FA95			27	0	8	4	40	21	0	0	0
FA96			35	0	17	0	17	30	0	1	0
SP97			32	0	24	1	18	25	0	0	0
FA97			31	0	26	2	13	28	0	0	0
SP98			24	0	37	3	12	24	0	0	0
FA98			17	2	32	1	24	24	0	0	0
SP99			16	2	28	0	15	29	0	0	0
FA99			15	0	27	2	15	40	0	0	0
SP00			20	0	29	1	19	31	0	0	0
FA00			22	0	31	0	19	28	0	0	0
SP01			20	0	29	4	16	30	0	1	0
FA01			13	0	40	1	21	24	0	1	0
SP02			24	0	36	0	13	27	0	0	0
FA02			16	0	29	0	28	27	0	0	0
SP03			13	0	31	1	23	30	0	0	2
FA03			22	0	24	3	19	32	0	0	0
SP04			19	0	37	3	21	20	0	0	0
FA04			23	0	31	2	28	16	0	0	0
SP05			25	0	41	0	21	13	0	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M2 (297)	37	0	23	13	27	0	0	0	0
FA90		43	0	14	15	28	0	0	0	0
SP91		48	0	5	15	32	0	0	0	0
FA91		35	0	13	16	35	0	0	1	0
SP92		27	0	8	17	48	0	0	0	0
SU92		41	0	10	28	20	0	0	1	0
FA92		28	0	10	24	38	0	0	0	0
SP93		34	1	9	27	29	0	0	0	0
FA93		20	0	12	31	37	0	0	0	0
SP94		42	0	11	20	27	0	0	0	0
FA94		32	0	13	1	36	18	0	0	0
SP95		24	2	12	0	44	17	0	1	0
FA95		37	0	15	0	29	19	0	0	0
FA96		24	0	29	1	20	26	0	0	0
SP97		21	0	36	3	16	24	0	0	0
FA97		24	0	37	1	12	26	0	0	0
SP98		27	0	43	0	4	26	0	0	0
FA98		8	0	43	0	23	26	0	0	0
SP99		7	7	48	0	16	22	0	0	0
FA99		9	0	49	2	22	17	0	0	0
SP00		23	2	51	0	6	18	0	0	0
FA00		9	0	64	2	14	11	0	0	0
SP01		9	0	64	1	12	13	0	0	1
FA01		12	0	59	0	23	6	0	0	0
SP02		9	0	53	1	7	28	0	2	0
FA02		14	0	49	1	29	6	0	0	1
SP03		18	0	58	0	9	15	0	0	0
FA03		15	1	54	1	15	14	0	0	0
SP04		9	0	52	1	30	7	0	1	0
FA04		12	0	50	2	30	6	0	0	0
SP05		15	0	61	1	14	8	0	0	1

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M3 (296)	44	0	17	0	11	28	0	0	0
FA90		42	0	17	0	8	33	0	0	0
SP91		49	3	11	0	11	26	0	0	0
FA91		41	0	15	0	19	25	0	0	0
SP92		39	0	18	0	16	27	0	0	0
SU92		34	0	21	0	18	27	0	0	0
FA92		42	0	18	0	18	22	0	0	0
SP93		35	0	28	24	13	0	0	0	0
FA93		28	0	34	0	13	24	0	1	0
SP94		27	0	33	0	16	24	0	0	0
FA94		26	1	38	0	14	21	0	0	0
SP95		18	0	34	1	24	23	0	0	0
FA95		30	0	39	1	8	22	0	0	0
FA96		11	0	57	0	7	25	0	0	0
SP97		9	0	70	0	1	20	0	0	0
FA97		5	0	75	0	1	19	0	0	0
SP98		4	0	79	0	2	15	0	0	0
FA98		6	0	71	0	2	21	0	0	0
SP99		5	0	77	0	1	17	0	0	0
FA99		3	0	72	0	2	23	0	0	0
SP00		5	0	76	0	0	19	0	0	0
FA00		1	0	77	0	1	21	0	0	0
SP01		1	0	74	0	0	25	0	0	0
FA01		1	0	66	0	7	26	0	0	0
SP02		7	0	78	0	2	12	0	0	1
FA02		3	0	60	0	20	15	0	0	1
SP03		13	0	63	0	11	13	0	0	0
FA03		11	1	55	2	26	5	0	0	0
SP04		11	0	50	0	22	16	0	0	1
FA04		17	0	52	1	19	9	0	0	2
SP05		17	0	54	1	16	12	0	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M4 (289)	43	0	13	0	37	0	0	8	0
FA90		29	0	2	1	66	0	0	2	0
SP91		33	0	2	1	55	0	0	9	0
FA91		26	0	0	3	68	0	0	3	0
SP92		32	0	0	1	65	0	2	0	0
SU92		30	0	3	1	66	0	0	0	0
FA92		23	0	1	0	76	0	0	0	0
SP93		37	1	0	4	58	0	0	0	0
FA93		22	2	1	1	74	0	0	0	0
SP94		nd	nd	nd	nd	nd	nd	nd	nd	nd
FA94		24	2	0	0	74	0	0	0	0
SP95		27	0	0	1	72	0	0	0	0
FA95		17	0	0	1	82	0	0	0	0
FA96		20	0	0	0	79	0	0	1	0
SP97		19	1	0	1	79	0	0	0	0
FA97		7	0	0	0	88	0	0	0	5
SP98		19	0	0	2	78	0	0	1	0
FA98		3	4	0	1	92	0	0	0	0
SP99		7	5	0	1	82	0	0	5	0
FA99		9	2	0	0	85	0	0	4	0
SP00		8	0	0	0	85	0	1	3	3
FA00		10	0	0	0	89	0	0	1	0
SP01		3	0	0	1	92	0	0	4	0
FA01		6	0	1	0	91	0	0	2	0
SP02		7	3	0	0	83	0	0	3	4
FA02		4	0	1	1	90	0	0	2	2
SP03		0	0	0	0	97	0	0	2	1
FA03		0	0	0	2	100	0	0	0	0
SP04		12	1	0	4	77	1	0	4	1
FA04		8	0	0	0	88	0	0	4	0
SP05		6	0	0	1	91	0	0	1	1

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M5 (285)	30	0	10	7	36	17	0	0	0
FA90		34	0	6	9	36	14	0	1	0
SP91		50	0	7	4	25	13	0	1	0
FA91		41	0	9	1	36	13	0	0	0
SP92		33	0	2	3	52	10	0	0	0
SU92		54	0	5	5	20	16	0	0	0
FA92		46	0	7	6	28	13	0	0	0
SP93		65	1	2	0	13	18	0	1	0
FA93		37	1	7	2	37	15	0	1	0
SP94		37	0	8	5	38	11	0	1	0
FA94		51	5	6	1	30	7	0	0	0
SP95		7	2	3	2	80	6	0	0	0
FA95		11	3	6	1	78	1	0	0	0
FA96		56	0	6	1	36	1	0	0	0
SP97		71	0	11	1	16	0	0	1	0
FA97		47	0	19	1	30	1	0	2	0
SP98		72	0	9	5	11	2	0	1	0
FA98		46	0	20	8	17	9	0	0	0
SP99		32	7	22	0	30	7	0	0	0
FA99		22	2	14	3	38	17	0	4	0
SP00		34	3	12	2	35	12	0	0	2
FA00		40	0	18	3	31	7	0	1	0
SP01		47	0	18	1	24	9	0	0	1
FA01		33	0	23	2	29	11	0	2	0
SP02		32	4	25	1	17	16	0	5	0
FA02		34	1	20	4	31	6	0	2	2
SP03		24	0	23	4	31	13	0	5	0
FA03		28	1	26	1	28	14	0	2	0
SP04		27	0	28	3	30	11	0	1	0
FA04		40	0	26	0	25	6	0	3	0
SP05		35	0	25	3	26	6	0	4	1

Table D-24. Data from mussel photoplots in Zone II collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90			13	1	65	0	21	0	0	0	0
FA90			18	0	44	2	36	0	0	0	0
SP91			39	1	41	1	18	0	0	0	0
FA91			8	0	36	2	54	0	0	0	0
SP92			22	0	20	0	58	0	0	0	0
SU92			30	0	16	0	54	0	0	0	0
FA92			37	0	18	0	45	0	0	0	0
SP93			28	1	19	0	52	0	0	0	0
FA93			24	0	9	1	66	0	0	0	0
SP94			14	5	4	3	70	4	0	0	0
FA94			30	1	5	1	63	0	0	0	0
SP95			11	1	4	2	80	0	0	2	0
FA95			15	0	2	1	82	0	0	0	0
FA96			27	0	3	2	68	0	0	0	0
SP97	Zone II	M1 (245)	25	0	2	1	72	0	0	0	0
FA97			11	0	1	0	65	0	1	0	22
SP98			26	0	2	2	70	0	0	0	0
FA98			nd	nd	nd	nd	nd	nd	nd	nd	nd
SP99			11	0	2	0	86	0	0	1	0
FA99			12	1	3	3	80	0	0	1	0
SP00			10	5	8	1	73	0	0	0	3
FA00			9	4	4	1	82	0	0	0	0
SP01			12	0	1	1	82	0	0	4	0
FA01			7	0	3	0	86	0	0	3	1
SP02			10	2	8	1	76	0	0	3	0
FA02			10	0	3	1	84	0	0	2	0
SP03			11	0	4	1	83	0	0	1	0
FA03			11	0	5	4	79	0	0	1	0
SP04			9	0	6	3	78	0	0	4	0
FA04			13	0	7	1	78	0	0	1	0
SP05			16	0	9	0	73	0	0	2	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		10	0	74	1	15	0	0	0	0
FA90		16	0	53	3	28	0	0	0	0
SP91		32	7	43	5	13	0	0	0	0
FA91		22	0	36	4	38	0	0	0	0
SP92		16	0	27	4	53	0	0	0	0
SU92		20	1	23	1	55	0	0	0	0
FA92		37	0	18	0	45	0	0	0	0
SP93		37	11	14	0	38	0	0	0	0
FA93		39	0	10	2	49	0	0	0	0
SP94		39	0	0	2	56	3	0	0	0
FA94		39	0	0	1	60	0	0	0	0
SP95		42	2	1	5	49	0	1	0	0
FA95		32	0	0	1	67	0	0	0	0
FA96		28	0	0	1	71	0	0	0	0
SP97	M2 (246)	52	0	0	1	47	0	0	0	0
FA97		20	0	0	0	70	0	0	0	10
SP98		50	0	0	2	48	0	0	0	0
FA98		0	30	0	2	50	0	0	0	18
SP99		18	7	0	4	59	0	0	12	0
FA99		3	12	0	4	70	0	0	11	0
SP00		14	28	0	3	48	0	0	6	1
FA00		5	10	0	0	66	0	0	19	0
SP01		6	0	1	4	58	0	0	31	0
FA01		10	5	0	4	61	0	1	19	0
SP02		7	5	1	3	59	0	0	25	0
FA02		20	7	1	0	66	0	0	6	0
SP03		2	0	1	6	65	0	3	23	0
FA03		5	3	1	4	60	0	4	23	0
SP04		8	5	1	9	53	0	3	20	1
FA04		9	0	1	3	70	0	1	13	3
SP05		4	0	0	11	64	0	1	20	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		16	10	46	1	21	0	0	6	0
FA90		17	0	17	1	63	0	0	2	0
SP91		16	0	3	4	77	0	0	0	0
FA91		36	4	5	2	53	0	0	0	0
SP92		5	0	0	0	95	0	0	0	0
SU92		8	0	0	0	92	0	0	0	0
FA92		40	0	0	0	60	0	0	0	0
SP93		13	3	0	0	84	0	0	0	0
FA93		32	3	0	0	65	0	0	0	0
SP94		41	12	0	7	38	0	0	2	0
FA94		10	19	0	0	71	0	0	0	0
SP95		18	56	0	0	26	0	0	0	0
FA95		36	2	0	0	43	0	0	19	0
FA96		24	8	0	8	23	0	0	37	0
SP97	M3 (253)	19	9	0	0	37	0	0	35	0
FA97		12	4	0	2	71	0	0	11	0
SP98		21	0	1	30	33	0	0	15	0
FA98		0	7	0	28	32	0	0	33	0
SP99		4	3	5	22	52	0	0	14	0
FA99		0	0	1	4	80	0	0	15	0
SP00		2	17	1	36	18	0	0	25	1
FA00		5	8	0	12	63	0	0	12	0
SP01		2	1	3	45	22	0	0	27	0
FA01		5	1	3	6	68	0	0	17	0
SP02		5	2	2	15	44	0	2	30	0
FA02		0	0	3	3	89	0	0	3	2
SP03		12	0	4	6	53	0	0	24	1
FA03		0	4	2	9	72	0	0	12	2
SP04		3	9	4	24	48	0	0	12	0
FA04		1	0	3	7	77	0	0	12	0
SP05		4	0	5	17	55	0	0	19	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		51	1	18	16	11	0	0	3	0
FA90		42	2	6	4	43	0	0	3	0
SP91		51	0	0	10	35	0	0	4	0
FA91		42	0	0	5	47	0	0	6	0
SP92		34	0	0	8	58	0	0	0	0
SU92		37	0	0	0	63	0	0	0	0
FA92		9	0	1	1	89	0	0	0	0
SP93		24	0	1	0	75	0	0	0	0
FA93		20	0	0	0	80	0	0	0	0
SP94		44	2	0	4	50	0	0	0	0
FA94		13	5	0	1	81	0	0	0	0
SP95		15	0	0	0	85	0	0	0	0
FA95		15	0	0	0	85	0	0	0	0
FA96		20	0	0	0	77	0	0	3	0
SP97	M4 (254)	22	0	0	1	77	0	0	0	0
FA97		17	0	0	0	75	0	0	7	1
SP98		19	0	0	3	72	0	1	5	0
FA98		2	8	1	0	76	0	1	12	0
SP99		7	2	0	3	74	0	1	13	0
FA99		2	0	0	1	92	0	0	5	0
SP00		3	3	0	2	78	0	0	5	9
FA00		1	2	0	5	86	0	0	6	0
SP01		4	1	1	7	74	0	0	12	1
FA01		5	1	0	8	83	0	0	3	0
SP02		3	3	0	5	72	0	0	17	0
FA02		4	1	0	3	84	0	0	8	0
SP03		6	0	2	9	76	0	0	7	0
FA03		3	0	1	4	88	0	0	3	0
SP04		2	0	0	14	80	0	0	4	0
FA04		3	0	1	1	95	0	0	0	0
SP05		7	0	0	9	82	0	0	2	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90		26	0	74	0	0	0	0	0	0
FA90		17	0	31	3	49	0	0	0	0
SP91		30	0	18	2	50	0	0	0	0
FA91		12	0	15	3	70	0	0	0	0
SP92		5	0	5	3	87	0	0	0	0
SU92		6	0	2	2	90	0	0	0	0
FA92		11	0	3	0	86	0	0	0	0
SP93		24	0	4	0	72	0	0	0	0
FA93		7	0	1	0	92	0	0	0	0
SP94		8	0	0	4	88	0	0	0	0
FA94		7	0	0	0	93	0	0	0	0
SP95		4	0	2	0	94	0	0	0	0
FA95		0	0	1	1	98	0	0	0	0
FA96		0	0	2	0	98	0	0	0	0
SP97	M5 (255)	0	0	3	0	97	0	0	0	0
FA97		2	0	1	0	97	0	0	0	0
SP98		2	0	0	0	98	0	0	0	0
FA98		0	0	0	0	100	0	0	0	0
SP99		0	0	0	2	98	0	0	0	0
FA99		2	1	0	0	97	0	0	0	0
SP00		3	0	2	0	95	0	0	0	0
FA00		2	0	0	0	98	0	0	0	0
SP01		0	0	1	0	99	0	0	0	0
FA01		0	0	0	0	100	0	0	0	0
SP02		0	1	0	0	98	0	0	1	0
FA02		0	0	2	0	98	0	0	0	0
SP03		1	0	2	0	97	0	0	0	0
FA03		2	1	3	0	96	0	0	0	0
SP04		2	0	2	0	94	0	0	1	1
FA04		3	0	2	0	94	0	0	1	0
SP05		0	0	2	0	97	0	0	1	0

Table D-25. Data from mussel photoplots in Zone III collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Zone III	M1 (024)	47	2	39	7	0	0	0	5	0
FA90			52	2	28	3	11	0	0	4	0
SP91			57	4	20	6	13	0	0	0	0
FA91			45	15	22	1	15	0	0	2	0
SP92			34	25	16	2	23	0	0	0	0
SU92			40	0	21	8	30	0	0	1	0
FA92			74	4	8	6	7	0	0	1	0
SP93			70	4	9	3	11	0	0	3	0
FA93			55	15	7	4	19	0	0	0	0
SP94			55	9	0	4	31	0	0	1	0
FA94			43	47	0	0	5	0	0	5	0
SP95			25	59	0	3	1	0	0	12	0
FA95			59	18	0	1	10	0	0	12	0
FA96			34	50	0	2	5	0	0	9	0
SP97			24	49	0	0	12	0	0	15	0
FA97			66	9	0	3	14	0	0	8	0
SP98			62	10	0	10	5	0	0	13	0
FA98			3	60	0	14	11	0	0	12	0
SP99			4	58	0	19	9	0	0	10	0
FA99			35	21	0	4	8	0	0	32	0
SP00			19	41	0	8	16	0	1	15	0
FA00			8	18	0	3	58	0	1	12	0
SP01			10	26	0	12	31	0	1	20	0
FA01			5	3	0	11	73	0	4	4	0
SP02			18	17	0	10	20	0	6	29	0
FA02			10	7	0	3	43	0	21	16	0
SP03			8	9	0	7	36	0	14	26	0
FA03			5	0	0	6	52	0	34	3	0
SP04			17	13	0	8	12	0	34	16	0
FA04			11	3	0	4	34	0	45	3	0
SP05			28	6	0	6	19	0	36	5	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M2 (015)	36	8	39	5	0	0	0	12	0
FA90		41	7	32	2	7	0	0	11	0
SP91		43	9	27	7	1	0	0	13	0
FA91		24	34	19	4	5	0	0	14	0
SP92		15	47	21	4	10	0	0	3	0
SU92		54	0	22	8	14	0	0	2	0
FA92		60	2	15	6	5	0	0	12	0
SP93		63	2	19	7	5	0	0	4	0
FA93		55	3	17	5	4	0	0	16	0
SP94		69	1	11	1	8	0	0	10	0
FA94		16	54	7	3	10	0	0	10	0
SP95		8	78	4	3	0	0	0	7	0
FA95		63	13	3	0	8	0	0	13	0
FA96		25	51	3	0	9	0	0	12	0
SP97		25	47	4	5	5	0	0	14	0
FA97		46	2	2	5	35	0	0	10	0
SP98		73	2	0	9	2	0	0	14	0
FA98		2	56	1	15	5	0	0	21	0
SP99		1	63	1	8	8	0	0	19	0
FA99		17	27	1	7	24	0	0	24	0
SP00		8	43	1	15	8	0	0	24	1
FA00		14	27	3	6	35	0	0	15	0
SP01		3	27	1	16	11	0	0	42	0
FA01		0	8	2	5	68	0	5	12	0
SP02		9	25	1	5	20	0	2	38	0
FA02		10	5	2	2	51	0	26	5	0
SP03		26	8	4	5	18	0	16	23	0
FA03		22	13	6	6	14	0	22	18	0
SP04		15	24	2	4	14	0	18	23	0
FA04		6	11	3	5	45	0	18	12	0
SP05		14	9	2	4	36	0	20	15	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M3 (014)	49	4	40	4	1	0	0	2	0
FA90		48	3	30	10	8	0	0	1	0
SP91		53	2	24	7	10	0	0	4	0
FA91		47	10	28	10	3	0	0	2	0
SP92		52	6	25	7	9	0	0	1	0
SU92		46	0	25	11	15	0	0	3	0
FA92		53	1	24	11	11	0	0	0	0
SP93		51	1	22	18	6	0	0	2	0
FA93		53	5	16	5	19	0	0	2	0
SP94		46	5	11	11	27	0	0	0	0
FA94		30	45	9	1	12	0	0	3	0
SP95		47	43	4	1	5	0	0	0	0
FA95		67	15	4	1	8	0	0	5	0
FA96		42	27	1	8	14	0	0	8	0
SP97		27	13	0	5	42	0	0	13	0
FA97		49	10	0	1	25	0	0	15	0
SP98		59	8	0	12	6	0	0	15	0
FA98		1	47	1	18	4	0	0	29	0
SP99		13	39	3	12	5	0	0	28	0
FA99		19	20	1	18	12	0	0	23	7
SP00		14	22	6	13	13	0	0	31	1
FA00		18	25	3	17	9	0	0	26	2
SP01		11	28	5	10	2	2	0	42	0
FA01		3	19	6	23	18	0	0	31	0
SP02		10	22	3	14	8	0	0	43	0
FA02		20	9	2	11	30	0	0	26	2
SP03		16	9	1	15	17	0	0	40	2
FA03		17	18	6	9	26	0	0	23	0
SP04		11	52	2	7	11	0	0	17	0
FA04		13	9	5	10	45	0	0	18	0
SP05		19	7	6	7	38	0	0	22	1

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M4 (017)	32	8	55	0	1	0	0	4	0
FA90		23	17	44	3	11	0	0	2	0
SP91		47	9	33	9	2	0	0	0	0
FA91		43	13	37	3	3	0	0	1	0
SP92		52	7	28	3	10	0	0	0	0
SU92		46	0	26	6	22	0	0	0	0
FA92		75	1	12	3	9	0	0	0	0
SP93		79	0	11	3	7	0	0	0	0
FA93		69	0	8	4	17	0	0	2	0
SP94		81	7	0	1	11	0	0	0	0
FA94		29	60	0	1	8	0	0	2	0
SP95		8	89	0	2	0	0	0	1	0
FA95		49	50	0	0	1	0	0	0	0
FA96		33	65	0	0	0	0	0	2	0
SP97		33	65	0	0	0	0	0	2	0
FA97		28	2	0	0	62	0	0	8	0
SP98		81	15	0	0	0	0	0	4	0
FA98		0	69	0	2	23	0	0	6	0
SP99		5	82	0	3	1	0	0	9	0
FA99		19	32	0	3	21	0	0	25	0
SP00		10	72	0	2	3	0	0	13	0
FA00		19	32	0	2	33	0	0	13	1
SP01		10	54	0	5	11	0	0	20	0
FA01		5	26	0	2	46	0	3	18	0
SP02		16	40	0	3	4	0	10	27	0
FA02		12	6	0	0	45	0	26	11	0
SP03		13	23	0	3	17	0	28	16	0
FA03		9	11	0	2	26	0	43	7	0
SP04		11	26	0	2	14	0	39	8	0
FA04		7	6	0	1	34	0	49	3	0
SP05		19	6	0	2	28	0	36	9	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	M5 (012)	24	3	64	6	0	0	0	3	0
FA90		38	11	36	2	12	0	0	1	0
SP91		44	4	37	8	7	0	0	0	0
FA91		44	15	20	8	13	0	0	0	0
SP92		34	35	24	1	6	0	0	0	0
SU92		49	0	23	5	23	0	0	0	0
FA92		53	7	18	4	18	0	0	0	0
SP93		65	11	11	6	7	0	0	0	0
FA93		58	14	4	1	19	0	3	1	0
SP94		51	29	2	6	12	0	0	0	0
FA94		21	34	4	1	38	0	0	2	0
SP95		15	70	0	2	10	0	3	0	0
FA95		62	18	0	1	13	0	3	3	0
FA96		34	46	1	1	16	0	0	2	0
SP97		39	48	2	0	10	0	0	1	0
FA97		38	2	1	1	54	0	0	4	0
SP98		79	8	0	5	3	0	0	5	0
FA98		3	70	1	9	16	0	0	1	0
SP99		8	72	0	5	10	0	0	5	0
FA99		22	25	1	4	41	0	0	7	0
SP00		28	42	0	5	16	0	0	9	0
FA00		24	31	1	3	32	0	0	7	2
SP01		13	43	2	10	10	0	0	22	0
FA01		11	34	1	1	42	0	0	11	0
SP02		20	42	0	4	14	0	0	20	0
FA02		19	19	0	0	47	0	0	12	2
SP03		23	34	2	4	25	0	0	10	2
FA03		15	31	0	6	35	0	0	11	1
SP04		13	34	0	8	30	0	2	13	0
FA04		14	12	0	1	61	0	4	8	0
SP05		13	17	0	4	33	0	7	26	0

Table D-26. Data from goose barnacle photoplots in Zone I collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP95	**Zone I**	**Po1 (276N)**	76	2	0	0	21	1	0	0	0	**Po2 (276C)**	89	6	0	1	1	3	0	0	0	**Po3 (281N)**	77	4	0	2	9	8	0	0	0
FA95			84	2	0	0	12	1	1	0	0		89	2	0	2	2	5	0	0	0		85	0	0	1	4	10	0	0	0
FA96			80	5	0	1	14	0	0	0	0		nd	nd	nd	nd	nd	nd	nd	nd	nd		73	0	0	0	11	16	0	0	0
SP97			76	3	0	0	21	0	0	0	0		54	0	0	1	8	37	0	0	0		83	0	0	0	3	14	0	0	0
FA97			53	2	0	0	45	0	0	0	0		48	1	3	0	19	29	0	0	0		60	3	0	3	21	13	0	0	0
SP98			48	0	0	0	48	1	0	0	0		44	2	1	0	25	28	0	0	0		63	1	0	2	19	15	0	0	0
FA98			37	9	0	0	51	4	0	0	0		13	8	0	0	44	35	0	0	0		40	9	0	1	31	19	0	0	0
SP99			44	8	0	2	42	4	0	0	0		28	20	0	0	25	27	0	0	0		57	8	1	1	16	17	0	0	0
FA99			44	3	0	6	39	8	0	0	0		47	2	0	4	19	28	0	0	0		51	4	0	4	22	19	0	0	0
SP00			61	2	0	2	31	3	0	0	1		53	4	0	1	18	24	0	0	0		62	2	0	1	12	23	0	0	0
FA00			40	15	0	3	35	4	0	0	1		34	6	0	0	28	31	0	0	1		57	4	0	2	17	20	0	0	0
SP01			64	0	0	3	32	1	0	0	0		45	0	0	0	21	34	0	0	0		56	1	0	1	19	22	0	0	1
FA01			41	4	0	4	45	6	0	0	0		28	1	2	0	38	31	0	0	0		44	0	0	0	36	20	0	0	0
SP02			39	8	0	3	45	5	0	0	0		46	3	0	0	20	31	0	0	0		45	0	0	1	30	24	0	0	0
FA02			43	0	0	3	42	4	0	0	8		38	0	0	0	26	31	0	0	5		46	1	1	0	30	22	0	0	0
SP03			60	1	0	0	34	4	0	0	1		40	1	0	1	32	26	0	0	0		56	3	1	0	20	19	0	0	1
FA03			38	2	1	4	49	4	0	0	1		36	0	2	0	27	33	0	0	2		57	1	0	1	17	22	0	0	0
SP04			74	2	0	3	17	4	0	0	0		48	5	1	1	19	25	0	0	1		51	8	0	3	20	18	0	0	0
FA04			61	0	0	3	33	3	0	0	0		48	1	0	0	28	19	0	0	4		58	3	0	0	24	15	0	0	0
SP05			63	0	0	2	30	5	0	0	0		49	0	2	2	22	25	0	0	0		70	1	0	0	12	17	0	0	0
SP95		**Po4 (281S)**	90	4	0	2	1	3	0	0	0	**Po5 (278N)**	91	0	0	0	5	4	0	0	0	**Po6 (278S)**	81	1	0	1	4	12	0	1	0
FA95			86	3	0	0	0	11	0	0	0		90	0	0	0	3	7	0	0	0		nd	nd	nd	nd	nd	nd	nd	nd	nd
FA96			93	0	0	0	2	4	0	0	1		93	1	0	0	5	1	0	0	0		76	0	0	0	10	14	0	0	0
SP97			93	0	0	0	0	7	0	0	0		92	0	0	2	1	5	0	0	0		66	0	0	0	16	18	0	0	0
FA97			82	0	0	2	8	8	0	0	0		80	1	0	1	10	8	0	0	0		55	0	0	4	28	11	0	0	2
SP98			83	0	0	2	6	9	0	0	0		83	0	0	3	6	8	0	0	0		60	0	0	1	25	14	0	0	0
FA98			69	6	0	2	11	11	0	0	0		57	1	0	2	29	11	0	0	0		40	1	0	2	38	18	0	0	1
SP99			79	4	1	1	5	10	0	0	0		71	5	0	2	8	14	0	0	0		47	8	2	3	21	19	0	0	0
FA99			86	3	0	1	8	4	0	0	0		71	3	0	3	10	13	0	0	0		57	0	1	1	23	18	0	0	0
SP00			87	1	0	2	4	5	0	0	1		75	0	0	2	6	17	0	0	0		68	0	1	0	13	18	0	0	0
FA00			81	6	0	2	6	5	0	0	0		80	2	0	3	2	13	0	0	0		48	1	1	2	21	26	0	0	1
SP01			85	2	0	1	5	7	0	0	0		81	0	0	3	4	11	0	0	1		62	1	1	2	10	23	0	1	0
FA01			80	0	0	4	9	7	0	0	0		68	2	1	3	16	10	0	0	0		47	1	0	1	31	20	0	0	0
SP02			80	5	0	2	8	5	0	0	0		86	1	1	1	3	8	0	0	0		64	2	1	0	17	16	0	0	0
FA02			77	0	0	2	18	3	0	0	0		81	0	0	2	11	5	0	0	1		50	0	0	4	26	16	0	0	4
SP03			89	1	0	4	4	2	0	0	0		86	0	0	2	6	6	0	0	0		60	1	0	3	19	17	0	0	0
FA03			83	3	0	0	14	1	0	1	0		76	3	0	3	8	9	0	0	2		45	5	0	2	31	17	0	0	0
SP04			84	5	0	3	5	3	0	0	0		83	2	0	2	6	7	0	0	0		66	3	1	2	12	16	0	0	0
FA04			83	1	0	2	11	3	0	0	0		73	0	0	4	10	13	0	0	0		53	2	0	2	24	18	0	0	1
SP05			85	0	0	5	6	4	0	0	0		78	2	0	3	2	14	0	1	0		60	0	0	6	16	18	0	0	0

Table D-27. Data from goose barnacle photoplots in Zone II collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP95	Zone II	Po1 (275N)	89	0	0	0	8	3	0	0	0	Po2 (275C)	84	2	0	0	4	10	0	0	0	Po3 (274N)	86	3	0	0	4	7	0	0	0
FA95			89	0	0	3	4	4	0	0	0		81	0	2	3	5	9	0	0	0		93	0	0	2	0	5	0	0	0
FA96			92	1	0	0	3	4	0	0	0		79	0	0	3	4	14	0	0	0		78	1	0	4	14	3	0	0	0
SP97			93	0	0	0	6	1	0	0	0		84	0	1	1	1	13	0	0	0		92	0	0	4	2	2	0	0	0
FA97			63	0	0	1	32	4	0	0	0		53	1	1	2	27	16	0	0	0		72	0	0	2	20	6	0	0	0
SP98			79	0	0	0	20	1	0	0	0		72	0	0	2	10	16	0	0	0		89	0	0	1	10	0	0	0	0
FA98			47	8	0	3	36	6	0	0	0		44	10	2	2	23	19	0	0	0		87	0	0	0	13	0	0	0	0
SP99			65	8	0	4	19	4	0	0	0		64	5	3	3	7	17	0	1	0		76	0	0	3	21	0	0	0	0
FA99			71	2	0	9	11	6	0	0	0		56	4	1	1	16	22	0	0	0		71	2	0	1	14	12	0	0	0
SP00			78	0	0	1	16	2	0	0	3		74	1	0	2	4	17	0	0	2		80	0	0	1	15	4	0	0	0
FA00			54	0	0	3	41	2	0	0	0		57	2	2	4	15	20	0	0	0		57	1	0	3	32	6	1	0	0
SP01			63	0	0	2	32	3	0	0	0		59	1	2	1	13	24	0	0	0		73	1	0	3	18	5	0	0	0
FA01			49	0	0	1	47	3	0	0	0		48	2	2	0	33	15	0	0	0		51	2	0	3	38	6	0	0	0
SP02			71	4	0	1	21	3	0	0	0		61	8	3	1	13	14	0	0	0		72	3	1	3	4	17	0	0	0
FA02			65	0	1	2	29	2	0	0	1		51	0	2	3	33	10	0	0	0		43	1	0	3	48	5	0	0	0
SP03			63	1	0	1	34	1	0	0	0		69	0	0	2	27	0	0	0	2		81	0	0	2	11	6	0	0	0
FA03			52	0	0	1	43	2	0	0	0		39	3	0	1	57	0	0	0	0		59	2	0	3	32	4	0	0	0
SP04			65	8	0	3	23	1	0	0	0		67	7	0	2	24	0	0	0	0		70	8	0	5	14	3	0	0	0
FA04			73	2	0	4	20	1	0	0	0		58	1	0	0	41	0	0	0	0		54	0	0	9	36	1	0	0	0
SP05			79	0	0	4	14	3	0	0	0		59	0	0	6	35	0	0	0	0		67	2	0	9	19	3	0	0	0
SP95		Po4 (274S)	85	1	0	1	4	9	0	0	0	Po5 (273N)	77	0	0	2	12	8	1	0	0	Po6 (273S)	83	2	0	1	4	10	0	0	0
FA95			80	0	0	0	4	16	0	0	0		72	1	0	3	7	17	0	0	0		84	0	0	0	3	13	0	0	0
FA96			72	0	0	1	10	17	0	0	0		61	0	1	2	18	18	0	0	0		88	2	0	1	1	8	0	0	0
SP97			76	0	0	0	1	23	0	0	0		68	0	3	2	12	15	0	0	0		86	1	0	0	0	13	0	0	0
FA97			56	1	0	3	21	19	0	0	0		45	0	3	5	30	17	0	0	0		71	4	0	2	10	13	0	0	0
SP98			69	0	1	2	9	19	0	0	0		58	0	1	4	23	14	0	0	0		79	0	0	1	9	11	0	0	0
FA98			56	4	0	1	20	19	0	0	0		20	2	1	12	39	26	0	0	0		50	7	0	2	29	12	0	0	0
SP99			64	4	1	5	4	22	0	0	0		52	10	0	14	21	3	0	0	0		79	7	0	3	4	7	0	0	0
FA99			55	5	0	0	17	23	0	0	0		35	1	2	15	32	14	0	0	0		75	0	0	5	11	8	0	0	0
SP00			63	1	0	2	11	22	0	0	1		42	0	0	23	20	15	0	0	0		80	2	0	9	3	6	0	0	0
FA00			54	2	0	2	19	21	0	0	2		40	0	0	12	30	16	0	0	2		83	5	0	2	5	4	0	0	1
SP01			67	1	0	2	4	26	0	0	0		44	1	1	16	21	17	0	0	0		81	2	0	12	2	3	0	0	0
FA01			51	2	0	3	23	21	0	0	0		38	0	0	16	30	16	0	0	0		75	11	0	8	4	2	0	0	0
SP02			76	1	0	3	14	6	0	0	0		48	0	0	9	27	16	0	0	0		82	6	0	5	5	2	0	0	0
FA02			63	1	1	0	20	15	0	0	0		58	0	0	7	23	12	0	0	0		80	1	0	9	8	1	0	0	1
SP03			72	2	0	2	8	15	0	0	1		52	0	0	9	25	14	0	0	0		84	2	0	8	3	3	0	0	0
FA03			60	5	0	2	14	18	0	0	0		43	1	0	12	31	12	0	0	0		62	14	0	18	6	1	0	0	0
SP04			70	6	1	2	3	18	0	0	0		50	3	0	14	19	14	0	0	0		61	14	0	19	5	1	0	0	0
FA04			68	2	1	3	9	17	0	0	0		55	0	1	12	24	8	0	0	0		65	2	0	22	10	1	0	0	0
SP05			69	1	1	3	8	17	0	0	1		55	0	1	11	25	8	0	0	0		75	0	0	22	3	0	0	0	0

Table D-28. Data from goose barnacle photoplots in Zone III collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP95	Zone III	Po1 (269N)	77	10	0	0	10	3	0	0	0	Po2 (269S)	77	20	0	0	0	3	0	0	0	Po3 (196)	86	8	0	0	0	6	0	0	0
FA95			70	14	0	1	9	6	0	0	0		62	30	0	1	2	5	0	0	0		84	8	0	2	0	6	0	0	0
FA96			82	3	0	0	0	15	0	0	0		76	17	0	1	0	6	0	0	0		74	20	0	2	0	4	0	0	0
SP97			83	7	0	0	0	10	0	0	0		76	17	0	0	1	6	0	0	0		70	21	0	3	0	6	0	0	0
FA97			75	7	5	1	2	10	0	0	0		59	25	0	4	0	5	0	0	7		66	24	0	5	0	5	0	0	0
SP98			86	3	0	1	1	9	0	0	0		78	12	0	0	5	5	0	0	0		84	7	0	4	1	4	0	0	0
FA98			49	19	1	2	0	14	0	5	10		34	53	0	2	0	5	0	0	6		36	45	0	2	0	7	0	0	10
SP99			63	14	1	4	0	15	0	0	3		50	37	0	3	5	5	0	0	0		54	38	0	4	0	4	0	0	0
FA99			65	16	0	7	0	12	0	0	0		47	30	1	3	13	5	0	0	0		59	23	0	6	1	5	0	0	6
SP00			75	9	0	4	0	12	0	0	0		75	25	0	0	0	4	0	0	0		71	17	0	8	0	4	0	0	0
FA00			75	11	0	3	0	11	0	0	0		64	30	0	0	0	4	0	0	2		69	16	0	5	3	7	0	0	0
SP01			79	6	0	2	0	13	0	0	0		70	21	0	1	0	7	0	0	1		69	17	0	3	1	10	0	0	0
FA01			69	17	0	1	0	11	0	0	2		47	27	1	1	17	5	0	0	2		64	13	0	4	4	8	0	0	7
SP02			65	17	0	0	7	7	0	0	4		68	24	0	2	1	5	0	0	0		70	20	0	3	2	5	0	0	0
FA02			67	9	0	2	0	8	0	0	14		67	11	0	3	1	4	0	0	14		76	10	0	3	0	5	0	0	6
SP03			76	6	1	2	0	10	0	0	4		78	7	1	1	0	6	0	0	7		73	11	0	8	0	5	0	0	3
FA03			79	8	0	3	0	7	0	0	2		75	5	0	0	6	6	0	0	8		81	11	0	0	0	8	0	0	0
SP04			82	7	2	1	1	7	0	0	0		77	10	0	3	4	6	0	0	0		76	8	0	2	7	7	0	0	0
FA04			81	4	3	4	0	7	0	0	1		73	16	0	2	3	6	0	0	0		76	15	0	4	0	5	0	0	0
SP05			82	1	1	3	0	13	0	0	0		81	6	0	5	0	6	0	1	1		81	11	0	2	0	6	0	0	0
SP95		Po4 (196S)	80	3	0	2	11	4	0	0	0	Po5 (023N)	56	36	0	1	5	2	0	0	0	Po6 (023S)	59	39	0	0	0	2	0	0	0
FA95			nd	nd	nd	nd	nd	nd	nd	nd	nd		78	21	0	0	0	1	0	0	0		53	46	0	0	0	1	0	0	0
FA96			75	3	0	1	15	6	0	0	0		71	29	0	0	0	0	0	0	0		60	36	0	1	1	2	0	0	0
SP97			72	8	0	0	13	7	0	0	0		74	26	0	0	0	0	0	0	0		55	42	0	2	0	1	0	0	0
FA97			41	10	0	2	41	6	0	0	0		61	37	0	1	0	0	0	0	1		42	58	0	0	0	0	0	0	0
SP98			63	0	2	0	31	4	0	0	0		72	22	0	0	5	1	0	0	0		48	50	0	0	0	2	0	0	0
FA98			29	20	1	0	41	4	0	0	5		26	52	0	0	17	0	0	0	5		19	80	0	0	0	1	0	0	0
SP99			nd	nd	nd	nd	nd	nd	nd	nd	nd		56	42	0	0	0	2	0	0	0		35	63	0	0	0	2	0	0	0
FA99			66	1	0	0	33	0	0	0	0		67	30	0	1	0	2	0	0	0		39	46	0	3	8	2	0	0	2
SP00			67	7	1	11	13	1	0	0	0		76	21	0	0	0	3	0	0	0		71	22	0	5	0	2	0	0	0
FA00			54	5	0	1	35	5	0	0	0		62	29	0	0	8	1	0	0	0		42	46	0	1	10	1	0	0	0
SP01			51	5	0	1	35	4	0	0	4		67	26	0	1	2	4	0	0	0		70	24	0	0	1	1	0	0	4
FA01			42	13	0	0	43	2	0	0	0		56	33	0	0	6	2	0	0	3		53	31	0	0	13	0	0	0	3
SP02			59	3	0	0	34	3	0	0	1		51	41	0	1	5	2	0	0	0		66	29	0	0	2	1	0	0	2
FA02			57	5	0	0	25	2	0	0	11		68	26	0	1	0	2	0	0	3		79	9	0	1	3	1	0	0	7
SP03			78	2	0	0	19	1	0	0	0		59	29	0	0	0	2	0	0	10		78	15	0	0	2	3	0	0	2
FA03			65	2	0	1	25	3	0	0	4		71	22	0	2	3	0	0	0	4		89	8	0	0	0	1	0	0	2
SP04			70	4	0	1	17	3	0	0	5		72	23	0	1	2	1	0	0	1		81	14	0	0	2	1	0	0	2
FA04			57	5	0	3	28	4	0	0	3		71	28	0	0	0	1	0	0	0		75	20	0	0	2	1	0	0	2
SP05			70	1	0	4	21	3	0	0	1		78	17	0	0	0	1	0	0	4		87	8	0	0	2	0	0	0	3

Table D-29. Data from rockweed photoplots in Zone I collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Zone I	Pe1 (291)	9	0	0	7	12	0	72	0	0
FA90			5	0	0	0	26	0	69	0	0
SP91			4	0	0	2	15	0	79	0	0
FA91			0	0	0	0	27	0	73	0	0
SP92			2	0	0	0	36	0	62	0	0
SU92			1	0	0	0	21	0	78	0	0
FA92			6	0	0	0	67	0	27	0	0
SP93			0	0	0	0	63	0	37	0	0
FA93			0	0	0	0	60	0	40	0	0
SP94			1	0	0	0	69	0	30	0	0
FA94			2	0	0	0	70	0	28	0	0
SP95			5	1	0	0	68	0	25	1	0
FA95			5	0	0	0	59	0	35	1	0
FA96			0	0	0	0	62	0	38	0	0
SP97			1	0	0	0	59	0	40	0	0
FA97			4	0	0	0	68	0	24	0	4
SP98			1	0	0	0	68	0	31	0	0
FA98			0	0	0	0	55	0	45	0	0
SP99			0	1	0	0	65	0	34	0	0
FA99			0	0	0	0	68	0	32	0	0
SP00			4	1	0	0	75	0	19	0	1
FA00			0	0	0	0	85	0	14	0	1
SP01			3	0	0	0	85	0	12	0	0
FA01			0	0	0	0	66	0	34	0	0
SP02			2	1	0	0	64	0	33	0	0
FA02			2	0	0	1	35	0	61	0	1
SP03			0	0	0	0	47	0	53	0	0
FA03			0	0	0	0	20	0	79	0	0
SP04			1	0	0	0	16	0	83	0	0
FA04			3	0	0	0	18	0	79	0	0
SP05			0	0	0	1	25	0	74	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe2 (290)	27	0	0	3	22	0	48	0	0
FA90		18	0	0	0	12	0	70	0	0
SP91		25	0	0	1	18	0	56	0	0
FA91		13	0	0	0	3	0	84	0	0
SP92		14	3	0	1	19	0	63	0	0
SU92		15	0	0	0	13	0	72	0	0
FA92		4	0	0	0	32	0	64	0	0
SP93		11	3	0	0	16	0	70	0	0
FA93		13	0	0	0	16	0	71	0	0
SP94		5	0	0	1	20	0	74	0	0
FA94		11	0	0	0	10	0	79	0	0
SP95		18	3	0	0	26	0	52	1	0
FA95		10	0	0	1	20	0	69	0	0
FA96		5	0	0	0	15	0	80	0	0
SP97		4	0	0	0	11	0	85	0	0
FA97		10	0	0	1	31	0	58	0	0
SP98		8	0	0	1	37	0	54	0	0
FA98		0	0	0	0	18	0	82	0	0
SP99		2	6	0	1	16	0	75	0	0
FA99		5	0	0	1	14	0	80	0	0
SP00		1	0	0	0	16	0	83	0	0
FA00		12	1	0	0	13	0	74	0	0
SP01		15	0	0	0	13	0	72	0	0
FA01		3	0	0	0	12	0	85	0	0
SP02		20	3	0	0	16	0	61	0	0
FA02		6	0	0	3	7	0	84	0	0
SP03		11	0	0	2	35	0	52	0	0
FA03		0	0	0	6	11	0	82	0	1
SP04		6	0	0	1	23	0	70	0	0
FA04		7	1	0	2	26	0	64	0	0
SP05		5	0	0	5	39	0	51	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe3 (295)	2	0	0	0	10	0	88	0	0
FA90		5	0	0	0	13	0	82	0	0
SP91		5	0	0	0	15	0	80	0	0
FA91		0	0	0	0	7	0	93	0	0
SP92		3	1	0	0	20	0	76	0	0
SU92		1	0	0	0	19	0	80	0	0
FA92		3	0	0	0	32	0	65	0	0
SP93		4	0	0	0	26	0	70	0	0
FA93		2	0	0	0	26	0	72	0	0
SP94		3	0	0	0	45	0	52	0	0
FA94		3	1	0	0	37	0	59	0	0
SP95		1	1	0	0	57	0	41	0	0
FA95		1	0	0	0	28	0	71	0	0
FA96		0	0	0	0	20	0	80	0	0
SP97		1	0	0	0	25	0	74	0	0
FA97		0	0	0	0	30	0	70	0	0
SP98		1	0	0	0	44	0	55	0	0
FA98		0	0	0	0	30	0	70	0	0
SP99		0	0	0	3	25	0	72	0	0
FA99		0	0	0	0	26	0	74	0	0
SP00		3	0	0	0	29	0	68	0	0
FA00		0	0	0	0	39	0	61	0	0
SP01		0	0	0	0	38	0	62	0	0
FA01		0	0	0	0	34	0	66	0	0
SP02		0	0	0	0	42	0	58	0	0
FA02		0	0	0	0	27	0	73	0	0
SP03		0	0	0	0	37	0	63	0	0
FA03		0	0	0	0	36	0	64	0	0
SP04		0	0	0	2	54	0	44	0	0
FA04		1	0	0	0	51	0	48	0	0
SP05		1	0	0	0	53	0	46	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe4 (288)	6	0	0	0	34	0	60	0	0
FA90		8	0	0	0	47	0	45	0	0
SP91		13	0	0	0	45	0	42	0	0
FA91		9	0	0	0	33	0	58	0	0
SP92		1	0	0	0	39	0	60	0	0
SU92		6	0	0	0	31	0	63	0	0
FA92		1	0	0	0	47	0	52	0	0
SP93		9	0	0	0	41	0	50	0	0
FA93		6	0	0	0	26	0	68	0	0
SP94		3	0	0	0	51	0	46	0	0
FA94		nd	nd	nd	nd	nd	nd	nd	nd	nd
SP95		0	0	0	0	44	0	56	0	0
FA95		1	0	0	0	25	0	74	0	0
FA96		0	0	0	0	40	0	60	0	0
SP97		1	0	0	0	23	0	76	0	0
FA97		2	0	0	0	54	0	44	0	0
SP98		4	0	0	0	59	0	37	0	0
FA98		0	0	0	0	61	0	39	0	0
SP99		1	2	0	0	51	0	46	0	0
FA99		0	0	0	0	31	0	69	0	0
SP00		0	0	0	0	33	0	64	0	3
FA00		1	0	0	0	36	0	62	0	1
SP01		5	0	0	0	37	0	58	0	0
FA01		0	0	0	0	28	0	64	0	8
SP02		2	2	0	0	35	0	59	0	2
FA02		2	0	0	2	22	0	74	0	0
SP03		0	0	0	0	29	0	71	0	0
FA03		0	0	0	0	25	0	74	0	0
SP04		1	0	0	0	23	0	76	0	0
FA04		2	0	0	2	22	0	74	0	0
SP05		1	0	0	0	59	0	40	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe5 (287)	53	0	0	0	19	0	27	0	0
FA90		38	0	0	0	18	0	44	0	0
SP91		49	0	0	0	22	0	29	0	0
FA91		17	0	0	0	5	0	78	0	0
SP92		40	6	0	1	12	0	41	0	0
SU92		42	0	0	0	21	0	37	0	0
FA92		47	1	0	0	8	0	44	0	0
SP93		41	6	0	1	18	0	34	0	0
FA93		27	4	0	1	22	0	46	0	0
SP94		30	0	0	0	22	0	48	0	0
FA94		44	2	0	0	16	0	38	0	0
SP95		38	2	0	0	17	0	42	1	0
FA95		33	2	0	0	9	0	56	0	0
FA96		26	1	0	0	7	0	66	0	0
SP97		34	0	0	0	9	0	57	0	0
FA97		32	3	0	0	11	0	54	0	0
SP98		47	0	0	0	19	0	34	0	0
FA98		0	2	0	0	12	0	86	0	0
SP99		0	2	0	2	20	0	74	2	0
FA99		15	0	0	1	8	0	76	0	0
SP00		19	0	0	0	14	0	66	0	1
FA00		17	1	0	0	3	0	79	0	0
SP01		22	0	0	3	3	0	72	0	0
FA01		8	0	0	0	4	0	88	0	0
SP02		9	5	0	0	9	0	76	0	1
FA02		4	0	0	0	4	0	92	0	0
SP03		0	0	0	1	8	0	91	0	0
FA03		0	0	0	17	22	0	61	0	0
SP04		17	2	0	2	19	0	60	0	0
FA04		20	2	0	1	19	0	58	0	0
SP05		21	0	0	1	32	0	46	0	0

Table D-30. Data from rockweed photoplots in Zone II collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Zone II	Pe1 (249)	19	2	0	0	7	0	72	0	0
FA90			19	4	0	0	4	0	73	0	0
SP91			17	7	0	0	10	0	66	0	0
FA91			5	0	0	0	5	0	90	0	0
SP92			16	0	0	0	8	0	76	0	0
SU92			12	0	0	0	13	0	75	0	0
FA92			17	0	0	0	39	0	44	0	0
SP93			25	2	0	0	29	0	44	0	0
FA93			5	0	0	0	37	0	58	0	0
SP94			14	0	0	0	27	0	59	0	0
FA94			3	0	0	0	27	0	70	0	0
SP95			25	0	0	0	10	0	65	0	0
FA95			4	0	0	0	17	0	79	0	0
FA96			8	0	0	0	1	0	91	0	0
SP97			20	0	0	0	10	0	70	0	0
FA97			24	2	0	3	14	0	57	0	0
SP98			15	0	0	2	26	0	57	0	0
FA98			2	2	0	0	10	0	86	0	0
SP99			19	0	0	0	21	0	60	0	0
FA99			17	0	0	0	15	0	68	0	0
SP00			10	0	0	0	11	0	79	0	0
FA00			11	1	0	0	18	0	70	0	0
SP01			7	0	0	1	28	0	64	0	0
FA01			5	0	0	0	18	0	77	0	0
SP02			9	3	0	0	15	0	73	0	0
FA02			8	0	0	1	22	0	69	0	0
SP03			13	0	0	0	21	0	66	0	0
FA03			11	3	0	11	18	0	57	0	0
SP04			1	0	0	0	13	0	85	0	1
FA04			7	0	0	5	11	0	77	0	0
SP05			13	1	0	1	15	0	70	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe2 (251)	4	0	0	0	25	0	71	0	0
FA90		1	0	0	0	37	0	62	0	0
SP91		12	0	0	0	26	0	62	0	0
FA91		0	0	0	0	53	0	47	0	0
SP92		1	0	0	0	22	0	77	0	0
SU92		1	0	0	0	63	0	36	0	0
FA92		4	0	0	0	69	0	27	0	0
SP93		3	0	0	0	47	0	50	0	0
FA93		4	0	0	0	27	0	69	0	0
SP94		5	0	0	0	66	0	29	0	0
FA94		4	0	0	0	58	0	38	0	0
SP95		3	1	0	0	37	0	59	0	0
FA95		0	0	0	0	46	0	54	0	0
FA96		2	0	0	0	48	0	50	0	0
SP97		23	0	0	0	11	0	66	0	0
FA97		0	0	0	0	25	0	75	0	0
SP98		1	0	0	1	52	0	46	0	0
FA98		0	0	0	0	23	0	77	0	0
SP99		0	0	0	0	36	0	64	0	0
FA99		0	0	0	0	37	0	63	0	0
SP00		3	1	0	0	47	0	48	0	1
FA00		0	0	0	0	44	0	54	0	2
SP01		2	0	0	0	59	0	39	0	0
FA01		1	0	0	0	57	0	42	0	0
SP02		9	0	0	0	49	0	42	0	0
FA02		1	0	0	0	45	0	53	0	1
SP03		0	0	0	0	68	0	31	0	0
FA03		5	0	0	0	63	0	32	0	0
SP04		1	0	0	0	44	0	55	0	0
FA04		1	0	0	0	33	0	66	0	0
SP05		0	0	0	0	62	0	38	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe3 (252)	9	0	0	0	19	0	72	0	0
FA90		4	0	0	0	30	0	66	0	0
SP91		5	0	0	0	24	0	71	0	0
FA91		0	0	0	0	17	0	83	0	0
SP92		0	0	0	0	19	0	81	0	0
SU92		4	0	0	0	9	0	87	0	0
FA92		14	0	0	0	20	0	66	0	0
SP93		13	0	0	1	30	0	56	0	0
FA93		8	0	0	0	13	0	79	0	0
SP94		17	0	0	0	18	0	65	0	0
FA94		nd	nd	nd	nd	nd	nd	nd	nd	nd
SP95		11	0	0	0	19	0	70	0	0
FA95		0	0	0	0	8	0	92	0	0
FA96		0	0	0	0	4	0	96	0	0
SP97		0	0	0	0	22	0	78	0	0
FA97		0	0	0	0	23	0	77	0	0
SP98		19	0	0	0	41	0	40	0	0
FA98		0	0	0	7	36	0	57	0	0
SP99		0	0	0	0	46	0	54	0	0
FA99		0	0	0	0	24	0	76	0	0
SP00		0	1	0	0	28	0	71	0	0
FA00		1	0	0	0	20	0	79	0	0
SP01		1	0	0	0	28	0	70	0	1
FA01		4	0	0	0	24	0	72	0	0
SP02		4	3	0	0	21	0	72	0	0
FA02		0	0	0	0	10	0	90	0	0
SP03		0	0	0	0	18	0	82	0	0
FA03		0	0	0	0	7	0	94	0	0
SP04		0	0	0	0	19	0	81	0	0
FA04		0	0	0	0	9	0	91	0	0
SP05		1	0	0	1	23	0	75	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe4 (258)	12	0	0	7	12	0	69	0	0
FA90		8	0	0	0	14	0	77	1	0
SP91		11	0	0	0	14	0	75	0	0
FA91		7	3	0	0	8	0	82	0	0
SP92		5	1	0	0	12	0	82	0	0
SU92		16	0	0	0	12	0	72	0	0
FA92		11	0	0	0	32	0	57	0	0
SP93		7	0	0	0	28	0	65	0	0
FA93		5	0	0	0	12	0	83	0	0
SP94		10	0	0	0	25	0	65	0	0
FA94		19	3	0	0	10	0	68	0	0
SP95		15	2	0	0	5	0	78	0	0
FA95		10	0	0	0	13	0	77	0	0
FA96		0	1	0	0	11	0	88	0	0
SP97		2	7	0	0	32	0	59	0	0
FA97		13	2	0	0	19	0	66	0	0
SP98		8	0	0	0	39	0	53	0	0
FA98		0	0	0	2	25	0	73	0	0
SP99		3	0	0	0	31	0	66	0	0
FA99		2	1	0	1	37	0	59	0	0
SP00		0	0	0	0	29	0	71	0	0
FA00		6	3	0	0	12	0	79	0	0
SP01		4	0	0	0	14	0	82	0	0
FA01		0	0	0	0	2	0	98	0	0
SP02		7	4	0	0	8	0	81	0	0
FA02		1	0	0	0	3	0	94	0	0
SP03		0	0	0	0	12	0	88	0	0
FA03		0	0	0	0	3	0	97	0	0
SP04		1	0	0	0	4	0	95	0	0
FA04		3	1	0	0	6	0	90	0	0
SP05		10	0	0	0	2	0	87	0	1

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe5 (265)	21	0	0	1	5	0	73	0	0
FA90		11	4	0	0	5	0	80	0	0
SP91		10	2	0	1	19	0	68	0	0
FA91		17	0	0	0	11	0	72	0	0
SP92		23	0	0	0	9	0	68	0	0
SU92		13	0	0	0	4	0	83	0	0
FA92		10	0	0	0	16	0	74	0	0
SP93		16	0	0	0	10	0	74	0	0
FA93		13	0	0	1	7	0	79	0	0
SP94		14	0	0	0	13	0	73	0	0
FA94		14	0	0	0	23	0	63	0	0
SP95		12	0	0	0	16	0	72	0	0
FA95		5	0	0	0	13	0	82	0	0
FA96		0	0	0	0	6	0	94	0	0
SP97		21	3	0	1	7	0	68	0	0
FA97		21	3	0	0	7	0	69	0	0
SP98		27	2	0	1	13	0	57	0	0
FA98		0	1	0	0	6	0	93	0	0
SP99		5	0	0	0	20	0	75	0	0
FA99		1	0	0	0	9	0	90	0	0
SP00		2	0	0	0	16	0	82	0	0
FA00		2	0	0	0	9	0	88	0	1
SP01		15	0	0	0	10	0	74	0	0
FA01		2	0	0	0	1	0	96	0	1
SP02		7	1	0	0	5	0	87	0	0
FA02		14	0	0	1	2	0	83	0	0
SP03		16	0	0	1	25	0	58	0	0
FA03		7	0	0	0	11	0	82	0	0
SP04		5	0	0	0	11	0	84	0	0
FA04		12	0	0	0	14	0	74	0	0
SP05		14	0	0	0	9	0	77	0	0

Table D-31. Data from rockweed photoplots in Zone III collected from 1990-2005.

Event	Zone	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Zone III	Pe1 (009)	7	6	0	9	0	0	77	1	0
FA90			16	9	0	3	3	0	64	5	0
SP91			19	12	0	5	5	0	56	3	0
FA91			19	3	0	8	2	0	67	1	0
SP92			20	8	0	0	0	0	72	0	0
SU92			8	4	0	0	3	0	85	0	0
FA92			20	5	0	0	16	0	58	1	0
SP93			26	7	0	0	12	0	54	1	0
FA93			30	5	0	1	2	0	62	0	0
SP94			6	3	0	0	12	0	78	1	0
FA94			11	3	0	0	5	0	81	0	0
SP95			14	4	0	1	14	0	67	0	0
FA95			17	3	0	0	5	0	75	0	0
FA96			18	5	0	0	7	0	70	0	0
SP97			0	14	0	0	7	0	64	0	15
FA97			34	4	0	0	24	0	38	0	0
SP98			31	0	0	2	33	0	34	0	0
FA98			13	11	0	1	11	0	65	0	0
SP99			16	5	0	0	20	0	59	0	0
FA99			4	0	0	1	10	0	85	0	0
SP00			13	10	0	0	10	0	66	1	0
FA00			13	4	0	1	5	0	77	0	0
SP01			9	7	0	0	8	0	75	1	0
FA01			9	0	0	0	8	0	83	0	0
SP02			14	6	0	0	1	0	79	0	0
FA02			8	5	0	2	2	0	83	0	0
SP03			18	4	0	2	0	0	76	0	0
FA03			19	3	0	4	1	0	71	0	0
SP04			15	8	0	2	1	0	74	0	0
FA04			10	1	0	1	11	0	77	0	0
SP05			23	7	0	6	7	0	57	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe2 (010)	7	0	0	3	0	0	90	0	0
FA90		0	1	0	18	1	0	79	1	0
SP91		6	3	0	4	25	0	60	2	0
FA91		0	0	0	6	5	0	89	0	0
SP92		2	0	0	0	17	0	81	0	0
SU92		3	0	0	0	20	0	77	0	0
FA92		1	0	0	9	30	0	60	0	0
SP93		1	0	0	0	6	0	93	0	0
FA93		12	0	0	1	1	0	86	0	0
SP94		6	0	0	0	27	0	67	0	0
FA94		6	0	0	0	4	0	90	0	0
SP95		5	0	0	0	7	0	88	0	0
FA95		1	0	0	0	7	0	92	0	0
FA96		1	0	0	0	9	0	90	0	0
SP97		0	0	0	1	12	0	87	0	0
FA97		1	0	0	7	12	0	80	0	0
SP98		0	0	0	5	8	0	87	0	0
FA98		0	0	0	4	11	0	85	0	0
SP99		0	0	0	0	8	0	92	0	0
FA99		0	0	0	0	4	0	96	0	0
SP00		4	0	0	0	16	0	80	0	0
FA00		16	2	0	2	5	0	75	0	0
SP01		3	0	0	4	22	0	71	0	0
FA01		0	0	0	4	11	0	85	0	0
SP02		4	2	0	2	14	0	78	0	0
FA02		1	0	0	6	4	0	89	0	0
SP03		5	0	0	1	9	0	85	0	0
FA03		5	4	0	4	31	0	56	0	0
SP04		3	0	0	0	14	0	83	0	0
FA04		5	0	0	5	13	0	77	0	0
SP05		3	3	0	0	25	0	69	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe3 (028)	3	0	0	3	10	0	84	0	0
FA90		0	2	0	17	12	0	69	0	0
SP91		2	1	0	2	21	0	74	0	0
FA91		2	0	0	15	32	0	47	4	0
SP92		0	0	0	0	54	0	46	0	0
SU92		0	0	0	0	8	0	92	0	0
FA92		2	0	0	0	45	0	53	0	0
SP93		0	0	0	0	38	0	62	0	0
FA93		6	0	0	0	74	0	20	0	0
SP94		5	0	0	0	50	0	45	0	0
FA94		3	0	0	0	66	0	31	0	0
SP95		10	4	0	0	3	0	83	0	0
FA95		2	0	0	0	31	0	67	0	0
FA96		1	0	0	0	22	0	77	0	0
SP97		0	0	0	0	25	0	67	0	8
FA97		2	0	0	1	42	0	55	0	0
SP98		2	0	0	0	60	0	38	0	0
FA98		0	0	0	14	39	0	47	0	0
SP99		0	0	0	0	51	0	49	0	0
FA99		0	0	0	0	34	0	66	0	0
SP00		0	0	0	0	41	0	59	0	0
FA00		5	0	0	0	24	0	71	0	0
SP01		0	0	0	0	22	0	78	0	0
FA01		2	0	0	0	34	0	64	0	0
SP02		1	3	0	0	42	0	57	0	0
FA02		0	0	0	6	23	0	71	0	0
SP03		1	0	0	2	44	0	53	0	0
FA03		0	0	0	3	29	0	68	0	0
SP04		1	0	0	0	31	0	68	0	0
FA04		2	0	0	4	11	0	83	0	0
SP05		0	1	0	0	18	0	81	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe4 (027)	8	1	0	14	1	0	76	0	0
FA90		13	3	0	15	3	0	66	0	0
SP91		12	9	0	6	1	0	72	0	0
FA91		6	3	0	11	2	0	78	0	0
SP92		6	4	0	0	7	0	83	0	0
SU92		10	0	0	0	6	0	84	0	0
FA92		14	2	0	0	9	0	75	0	0
SP93		12	2	0	0	37	0	49	0	0
FA93		10	0	0	0	23	0	67	0	0
SP94		7	0	0	0	13	0	80	0	0
FA94		5	0	0	0	5	0	90	0	0
SP95		8	1	0	0	4	0	86	1	0
FA95		3	0	0	0	4	0	93	0	0
FA96		0	4	0	1	3	0	92	0	0
SP97		4	0	0	0	6	0	90	0	0
FA97		3	0	0	1	44	0	52	0	0
SP98		10	0	0	0	50	0	40	0	0
FA98		0	2	0	9	4	0	85	0	0
SP99		0	0	0	0	17	0	83	0	0
FA99		0	0	0	1	10	0	89	0	0
SP00		1	1	0	0	10	0	88	0	0
FA00		2	0	0	0	13	0	84	0	1
SP01		6	0	0	0	9	0	85	0	0
FA01		1	0	0	0	10	0	89	0	0
SP02		7	4	0	0	5	0	84	0	0
FA02		2	2	0	1	1	0	94	0	0
SP03		4	0	0	2	8	0	85	0	1
FA03		2	3	0	7	3	0	87	0	0
SP04		3	1	0	0	6	0	89	1	0
FA04		2	1	0	6	2	0	88	1	0
SP05		0	1	0	11	5	0	83	0	0

Event	Plot ID	Bare	Chthamalus/Balanus	Mytilus	Other Animals	Other Plants	Pollicipes	Silvetia	Tetraclita	Unscorable
SP90	Pe5 (025)	1	1	0	0	6	0	92	0	0
FA90		0	2	0	0	8	0	90	0	0
SP91		3	6	0	1	28	0	62	0	0
FA91		0	0	0	0	1	0	99	0	0
SP92		1	0	0	0	25	0	74	0	0
SU92		0	0	0	0	6	0	94	0	0
FA92		3	0	0	0	27	0	70	0	0
SP93		0	0	0	0	31	0	69	0	0
FA93		1	0	0	0	36	0	63	0	0
SP94		8	0	0	0	10	0	82	0	0
FA94		0	0	0	0	24	0	76	0	0
SP95		1	0	0	0	39	0	60	0	0
FA95		0	1	0	0	15	0	84	0	0
FA96		0	0	0	0	13	0	87	0	0
SP97		0	0	0	0	22	0	78	0	0
FA97		2	0	0	0	42	0	56	0	0
SP98		2	0	0	0	54	0	44	0	0
FA98		0	0	0	0	48	0	52	0	0
SP99		0	0	0	0	60	0	40	0	0
FA99		0	0	0	0	32	0	68	0	0
SP00		1	0	0	1	44	0	54	0	0
FA00		1	3	0	0	35	0	61	0	0
SP01		0	0	0	0	57	0	43	0	0
FA01		0	0	0	0	32	0	68	0	0
SP02		0	1	0	0	34	0	65	0	0
FA02		0	0	0	0	3	0	97	0	0
SP03		0	0	0	0	12	0	88	0	0
FA03		0	0	0	1	0	0	99	0	0
SP04		0	0	0	0	2	0	98	0	0
FA04		1	0	0	0	5	0	94	0	0
SP05		0	0	0	3	7	0	90	0	0

Table D-32. Data from line transects in Zone I collected from 1990-2005.

Event	Zone	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum
SP90	Zone I	T1 (237)	3	1	0	0	0	96	0	T2 (210)	0	4	7	1	10	78	0	G3 (238)	0	8	0	0	56	36	0
FA90			1	3	0	0	0	96	0		1	4	0	0	28	67	0		0	5	0	0	57	38	0
SP91			4	3	0	0	0	94	0		0	2	0	0	17	81	0		0	2	0	0	58	39	0
FA91			2	1	0	0	0	97	0		0	0	3	0	28	69	0		0	1	2	0	67	30	0
SP92			5	0	0	0	0	95	0		0	0	0	0	34	66	0		0	1	0	0	67	33	0
SU92			2	0	0	0	0	98	0		0	0	9	1	25	65	0		0	0	1	0	69	29	0
FA92			1	0	0	0	0	99	0		0	0	0	0	33	67	0		0	2	0	0	80	18	0
SP93			2	2	0	0	0	96	0		0	0	0	0	29	71	0		0	2	0	0	75	23	0
FA93			0	1	0	1	0	99	0		0	0	7	0	32	60	2		0	1	0	1	85	13	0
SP94			1	0	0	0	0	99	0		0	0	0	0	37	63	0		0	0	0	0	79	21	0
FA94			1	0	0	0	0	100	0		0	0	0	1	40	59	0		0	0	0	0	84	16	0
SP95			1	2	0	0	0	97	0		1	2	0	0	27	71	0		0	4	0	0	66	29	0
FA95			1	1	0	0	0	98	0		0	0	3	0	39	58	0		0	1	0	0	78	21	0
FA96			1	1	0	1	0	97	0		0	0	1	0	42	58	0		0	4	0	5	72	20	0
SP97			2	0	0	0	0	98	0		1	0	0	0	34	66	0		0	4	0	3	67	26	0
FA97			1	2	0	0	0	98	0		0	2	0	0	43	56	0		0	14	0	0	70	16	0
SP98			2	3	0	0	0	95	0		1	0	0	0	35	64	0		0	5	0	1	58	36	0
FA98			1	2	0	0	0	97	0		1	1	0	2	41	56	0		0	1	0	0	86	13	0
SP99			2	1	0	1	0	97	0		1	1	0	1	40	57	0		0	1	0	0	78	20	0
FA99			1	4	0	1	0	94	0		1	2	9	0	35	54	0		0	4	8	0	78	10	0
SP00			2	4	0	1	0	93	0		0	0	3	0	31	65	1		0	1	0	0	80	19	0
FA00			1	6	0	0	0	94	0		0	7	4	0	25	65	0		0	6	1	3	77	13	0
SP01			1	1	0	2	0	97	0		0	0	6	0	25	70	0		0	2	0	1	68	30	0
FA01			0	12	0	0	0	89	0		0	5	7	0	25	64	0		0	5	0	1	71	24	0
SP02			2	10	0	6	0	83	0		0	9	0	11	19	62	0		0	7	0	6	62	25	1
FA02			1	3	0	0	0	96	0		0	3	0	1	22	76	0		0	3	0	0	69	28	0
SP03			3	6	0	7	0	84	0		0	2	0	10	20	68	0		0	4	0	3	63	30	0
FA03			0	2	0	3	0	92	3		0	1	1	9	33	54	1		0	3	0	3	72	20	2
SP04			2	2	0	9	0	87	0		0	1	0	14	30	55	0		0	1	0	3	64	32	0
FA04			0	5	0	0	0	95	0		0	2	3	5	34	56	0		0	5	0	1	68	26	0
SP05			2	4	0	0	0	94	0		0	7	3	5	32	53	0		0	9	0	0	73	18	0
SP90		G4 (211)	0	15	20	2	50	13	0	K5 (236)	0	9	44	0	11	36	0	K6 (212)	1	5	43	11	9	31	0
FA90			0	3	1	0	88	8	0		0	11	33	1	4	51	0		0	7	29	15	27	22	0
SP91			0	4	2	1	82	12	0		0	0	16	0	4	80	0		0	0	13	24	12	51	0
FA91			0	4	17	0	75	3	0		0	0	43	0	19	38	0		0	1	64	9	19	4	3
SP92			0	0	1	0	91	9	0		0	2	21	0	36	40	0		0	0	81	0	3	16	0
SU92			0	0	11	0	85	5	0		0	1	33	0	28	39	0		0	0	54	28	11	7	0
FA92			0	0	2	0	92	6	0		0	0	20	0	52	28	0		0	3	45	12	29	10	0
SP93			0	1	0	0	95	4	0		0	5	0	3	32	60	0		0	21	20	4	29	26	0
FA93			0	3	1	0	96	1	0		0	0	6	0	68	27	0		0	6	17	15	21	20	22
SP94			0	0	0	0	96	4	0		0	0	0	0	57	43	0		0	5	27	6	41	22	0
FA94			0	0	0	0	97	1	2		0	0	0	0	91	9	0		0	0	12	45	31	13	0
SP95			0	16	0	3	69	12	0		0	6	0	0	40	54	0		0	14	5	15	39	27	0
FA95			0	1	2	0	82	13	2		0	2	0	0	94	5	0		0	2	33	21	33	12	0
FA96			0	3	0	10	78	7	2		0	2	0	1	90	8	0		0	4	3	2	57	12	21
SP97			0	7	0	1	79	11	2		0	1	0	0	79	21	0		0	1	0	29	52	16	1
FA97			0	7	0	0	78	15	0		0	1	0	0	82	17	0		0	7	0	31	46	17	0
SP98			0	5	0	0	58	36	1		0	5	0	1	57	37	0		0	14	0	24	56	5	0
FA98			0	1	0	0	97	2	0		0	0	0	0	87	12	0		0	0	3	30	51	15	0
SP99			0	9	0	4	79	6	2		0	9	0	1	59	31	0		0	2	0	14	54	29	2
FA99			0	1	1	1	97	0	0		0	1	45	0	51	3	0		0	2	31	0	60	8	0
SP00			0	8	10	0	80	2	0		0	1	10	0	73	16	0		0	6	17	10	29	39	0
FA00			0	5	0	0	84	12	0		0	5	11	3	65	16	0		0	2	46	8	42	3	0
SP01			0	12	0	2	75	11	1		0	1	0	9	43	48	0		0	2	34	11	33	21	0
FA01			0	10	3	1	72	14	1		0	4	0	1	72	24	0		0	8	22	22	41	8	0
SP02			0	8	0	5	70	17	1		0	10	2	0	50	38	1		0	6	16	16	34	26	3
FA02			0	2	0	0	92	7	1		0	1	0	7	93	0	0		0	1	1	25	65	8	0
SP03			0	8	0	0	82	10	0		0	3	0	0	55	41	0		0	6	7	11	44	32	0
FA03			0	4	3	8	33	52	0		0	1	0	0	87	12	0		0	1	7	27	58	6	0
SP04			0	6	1	6	77	10	0		0	2	0	8	53	37	0		0	2	17	16	48	17	0
FA04			0	0	2	1	93	4	0		0	0	1	0	94	5	0		0	5	6	23	57	9	0
SP05			0	7	4	3	68	18	0		0	12	0	0	52	29	7		0	11	11	19	47	12	0

Table D-33. Data from line transects in Zone II collected from 1990-2005.

Event	Zone	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum
SP90	Zone II	T1 (244)	1	13	0	0	0	86	0	T2 (270)	0	24	12	0	5	59	0	G3 (267)	0	12	17	0	64	5	2
FA90			1	18	0	0	2	79	0		0	16	6	0	7	71	0		0	5	1	0	78	16	0
SP91			1	7	0	0	0	92	0		0	33	0	3	7	56	1		0	0	4	3	84	8	1
FA91			1	34	2	0	0	63	0		0	4	0	0	16	79	2		0	0	4	0	94	2	0
SP92			2	2	0	0	0	96	0		0	8	3	0	23	62	5		0	0	6	0	87	7	0
SU92			3	1	0	0	1	93	1		0	3	16	2	23	51	5		0	0	4	0	93	4	0
FA92			1	26	0	1	4	68	0		0	20	8	0	25	47	0		0	0	7	0	92	1	0
SP93			1	3	0	0	0	96	0		0	16	3	0	17	64	0		0	2	2	1	87	9	0
FA93			0	0	0	0	8	92	0		0	1	3	0	29	66	0		0	0	0	1	99	0	0
SP94			2	0	0	0	3	95	0		0	5	1	0	24	66	3		0	0	1	0	94	5	0
FA94			0	1	0	0	7	92	0		0	3	0	0	24	69	4		0	0	0	3	96	0	2
SP95			2	1	0	0	3	95	0		0	12	0	0	11	71	5		0	18	0	2	70	9	1
FA95			1	1	0	0	3	96	0		0	3	3	0	34	60	0		0	0	0	2	96	2	0
FA96			1	9	0	2	9	80	0		0	10	4	0	33	53	0		0	0	0	0	94	1	5
SP97			3	0	0	0	5	92	0		0	2	0	0	42	56	0		0	6	0	3	85	5	0
FA97			1	20	0	0	13	66	0		1	8	0	0	10	81	0		0	0	0	0	95	2	3
SP98			3	5	0	0	8	84	0		0	20	0	8	13	59	0		0	38	0	16	37	9	0
FA98			6	11	0	1	31	51	0		0	10	7	6	42	34	0		0	3	2	9	76	10	0
SP99			2	4	0	2	9	82	0		0	6	1	2	46	45	0		0	6	0	6	69	18	0
FA99			3	21	0	0	12	65	0		0	12	0	0	62	26	0		0	3	0	5	88	4	0
SP00			4	5	0	0	5	86	0		0	21	0	1	54	24	0		0	2	0	1	94	3	0
FA00			3	12	0	0	6	80	0		0	3	0	0	50	43	5		0	2	12	1	86	0	0
SP01			4	19	0	2	2	74	0		0	12	2	0	39	48	0		0	6	1	1	91	2	0
FA01			2	23	0	0	1	75	0		0	16	0	2	46	37	0		0	2	0	2	96	1	0
SP02			2	14	0	13	0	70	2		0	13	0	18	36	33	1		0	5	1	8	81	2	4
FA02			2	1	0	0	2	90	6		0	9	0	1	44	46	1		0	0	0	3	96	2	0
SP03			2	2	0	2	2	92	0		0	5	0	2	52	42	0		0	3	0	8	74	8	7
FA03			1	2	0	2	1	88	6		0	2	1	3	58	32	4		0	0	3	0	96	1	0
SP04			2	4	0	15	0	79	0		0	24	1	13	33	21	8		0	1	5	4	87	3	0
FA04			0	6	0	3	5	86	0		0	8	4	3	32	53	0		0	0	0	3	94	2	1
SP05			1	9	0	3	2	85	0		0	24	2	3	30	40	1		0	7	0	3	82	8	0

Event	Zone	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum
SP90	Zone II	G4 (271)	0	2	19	2	51	16	9	K5 (268)	0	1	76	0	1	22	0	K6 (272)	0	9	34	1	21	35	0
FA90			0	5	14	3	61	17	0		0	1	52	4	13	30	0		6	5	32	2	21	34	0
SP91			0	7	17	12	40	13	11		0	0	16	0	9	74	0		0	3	6	0	39	53	0
FA91			0	0	30	9	47	14	0		0	0	31	7	25	24	13		1	0	27	0	52	21	0
SP92			0	0	20	9	56	10	5		0	0	35	7	36	23	0		0	0	25	0	58	17	0
SU92			0	2	28	2	55	7	6		0	0	48	24	13	14	0		0	0	47	1	44	8	0
FA92			0	3	20	1	63	10	4		0	0	47	0	36	17	0		1	2	15	0	62	21	0
SP93			0	5	1	8	66	19	0		0	0	43	5	33	20	0		0	4	3	0	64	29	0
FA93			0	1	7	9	71	14	0		0	0	8	22	70	1	0		0	0	12	0	76	12	0
SP94			0	0	6	0	63	26	5		0	1	2	7	88	3	0		0	4	5	0	68	23	0
FA94			0	0	4	13	66	17	0		0	0	0	12	87	2	0		0	0	0	0	75	25	0
SP95			0	8	0	1	46	39	6		0	4	0	5	83	9	0		0	9	0	0	52	39	0
FA95			0	0	0	0	93	7	0		0	0	1	5	93	1	0		0	2	0	0	64	33	0
FA96			0	3	1	0	87	8	2		0	0	0	1	97	1	2		1	1	16	1	64	16	2
SP97			0	6	0	0	76	10	8		0	2	0	2	95	0	0		0	9	0	0	66	25	0
FA97			0	6	0	0	83	11	0		0	12	0	0	86	1	0		0	0	0	0	83	17	0
SP98			0	34	0	2	40	16	7		0	7	0	1	76	16	0		0	17	0	0	43	40	0
FA98			0	9	5	2	77	5	0		0	0	1	3	96	0	0		0	2	18	1	58	21	0
SP99			0	1	1	1	82	14	0		0	3	0	2	91	4	0		0	2	4	1	58	35	0
FA99			0	3	0	0	93	4	0		0	0	0	0	100	0	0		0	1	13	0	71	15	0
SP00			0	1	0	1	89	8	0		0	2	0	0	98	0	0		0	3	5	0	76	16	0
FA00			0	4	8	0	79	10	0		0	0	1	0	96	1	3		0	2	10	0	76	13	0
SP01			1	3	13	0	61	23	0		0	3	0	2	92	4	0		0	2	9	0	71	19	0
FA01			0	2	5	1	75	18	0		0	3	0	8	81	9	0		0	2	10	0	69	20	0
SP02			0	2	0	7	68	22	2		0	6	1	11	71	12	0		0	4	0	0	70	24	3
FA02			0	0	0	2	92	6	0		0	0	0	5	87	5	3		0	6	0	0	80	19	0
SP03			0	1	0	0	80	17	1		0	1	0	1	91	6	1		0	4	0	2	62	31	1
FA03			0	0	7	1	89	2	0		0	0	6	19	75	0	0		0	0	11	1	81	7	0
SP04			0	1	12	6	62	17	2		0	0	17	1	77	5	0		0	7	1	7	54	31	0
FA04			0	0	1	0	92	7	0		0	1	3	5	91	0	0		0	0	22	1	60	17	0
SP05			0	5	20	5	48	20	2		0	3	6	1	84	6	0		0	4	17	2	48	29	0

Table D-34. Data from line transects in Zone III collected from 1990-2005.

Event	Zone	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum	Plot ID	Anthopleura	Bare	Egregia	Other Biota	Phyllospadix	Red Algal Turf	Sargassum
SP90	Zone III	T1 (001)	3	4	0	0	7	86	0	T2 (008)	2	4	0	0	0	94	0	G3 (007)	0	13	0	2	54	28	3
FA90			1	14	0	1	8	76	0		1	15	0	0	0	84	0		0	11	0	0	67	17	5
SP91			2	11	0	0	6	79	2		3	2	0	0	0	95	0		0	27	5	1	46	20	1
FA91			2	0	0	0	11	86	0		2	27	0	0	0	71	0		0	13	0	0	66	15	6
SP92			1	3	0	0	6	90	0		2	0	0	0	0	99	0		0	1	5	0	49	37	8
SU92			2	0	0	0	8	89	0		1	0	0	0	0	99	0		0	0	2	0	68	26	4
FA92			0	1	0	0	12	87	0		0	5	0	0	0	95	0		0	5	2	0	75	19	0
SP93			2	5	0	0	7	86	0		1	0	0	0	0	100	0		0	7	6	3	42	36	6
FA93			0	2	0	0	15	83	0		0	1	0	0	0	99	0		0	4	0	0	72	22	1
SP94			2	2	0	0	3	90	3		1	0	0	0	0	99	0		0	1	0	0	43	32	24
FA94			1	16	0	0	2	81	0		0	1	0	0	0	99	0		0	7	0	0	64	24	5
SP95			2	7	0	0	0	87	4		0	0	0	0	0	100	0		0	34	0	0	28	25	13
FA95			1	6	0	0	7	86	0		nd	nd	nd	nd	nd	nd	nd		0	25	6	0	48	16	6
FA96			1	0	0	0	5	93	0		0	25	0	0	0	75	0		0	2	5	0	66	12	15
SP97			1	1	0	0	10	87	0		1	1	0	5	0	94	0		0	3	0	0	53	16	28
FA97			1	10	0	0	10	79	0		0	18	0	0	0	81	0		0	6	0	0	78	8	9
SP98			3	10	0	0	7	80	0		0	3	0	4	0	93	0		0	23	0	5	35	7	29
FA98			1	3	0	1	17	78	0		0	15	0	1	0	85	0		0	18	0	26	46	6	5
SP99			2	16	0	1	12	69	0		0	18	0	4	0	77	0		0	7	0	0	79	11	4
FA99			2	12	0	0	20	66	0		0	4	0	2	0	93	0		0	3	0	0	91	6	0
SP00			1	4	0	4	14	77	0		1	1	0	13	0	85	0		0	6	0	1	82	5	6
FA00			1	6	0	1	17	76	0		0	27	0	0	0	74	0		0	12	0	5	78	6	0
SP01			2	7	0	12	10	70	0		1	2	0	21	0	77	0		0	4	0	7	65	9	16
FA01			0	11	0	0	13	77	0		0	18	0	0	0	83	0		0	7	1	2	80	8	3
SP02			2	10	0	24	6	59	0		0	14	0	33	0	54	0		0	14	8	5	53	12	7
FA02			1	10	0	1	9	80	0		1	10	0	0	0	89	0		0	7	1	1	71	15	5
SP03			1	5	0	18	5	71	0		1	2	0	12	0	85	0		0	5	0	8	72	10	5
FA03			3	4	0	3	11	71	8		0	0	0	8	0	65	27		0	2	0	0	79	11	8
SP04			0	16	0	20	8	55	1		0	13	0	19	0	68	0		0	6	2	11	72	7	2
FA04			2	6	0	1	15	76	0		0	32	0	1	0	67	0		0	8	0	0	84	8	0
SP05			2	16	0	2	9	71	0		0	0	0	17	0	83	0		0	21	0	5	56	18	0
SP90		G4 (005)	0	6	3	0	66	22	3	K5 (002)	0	7	47	3	8	35	0	K6 (004)	0	6	61	0	0	33	0
FA90			0	3	7	0	76	14	0		0	10	28	3	14	45	0		0	4	44	3	0	49	0
SP91			0	12	6	0	69	13	0		0	16	22	2	12	43	6		0	26	21	8	2	22	22
FA91			0	1	7	0	74	18	0		0	2	23	10	17	47	1		1	2	28	11	11	41	7
SP92			0	0	4	0	73	16	7		0	0	32	5	10	49	5		0	0	48	1	0	39	11
SU92			0	0	2	0	85	13	0		0	3	42	6	10	34	6		0	1	58	5	13	15	9
FA92			0	6	2	0	80	10	2		0	5	17	6	17	53	2		0	1	28	11	18	36	7
SP93			0	10	1	0	63	25	0		0	5	10	4	18	54	9		0	4	8	16	6	48	18
FA93			0	8	0	2	54	26	10		0	2	7	9	24	57	2		0	2	2	24	23	49	1
SP94			0	5	0	0	39	27	29		0	1	7	0	26	54	12		0	0	5	3	17	51	24
FA94			0	13	0	1	42	28	17		0	6	0	18	28	49	0		0	2	0	19	27	51	2
SP95			0	24	0	0	26	23	27		0	13	0	6	22	54	5		0	10	0	4	19	56	11
FA95			0	8	4	0	75	7	7		0	8	12	14	24	42	0		0	10	3	11	43	34	0
FA96			0	3	0	0	86	11	0		0	19	7	20	22	31	0		0	0	0	5	60	36	0
SP97			0	0	0	0	78	14	8		0	5	1	10	23	56	5		0	3	0	10	39	48	0
FA97			0	1	0	2	92	6	0		0	2	0	24	22	46	7		0	0	0	3	39	58	0
SP98			0	16	0	6	60	17	1		0	24	0	26	11	35	4		0	62	0	6	7	25	0
FA98			0	3	0	1	84	11	0		0	8	3	42	19	25	4		0	3	13	33	23	28	0
SP99			0	6	0	2	80	12	0		0	7	0	17	16	60	0		0	3	4	10	41	42	0
FA99			0	0	0	0	99	1	0		0	4	0	4	54	34	5		0	2	0	0	81	18	0
SP00			0	4	0	2	86	8	0		0	5	1	6	47	39	2		1	5	0	3	64	27	1
FA00			0	3	1	1	87	9	0		0	2	1	7	42	35	12		0	3	0	0	63	35	0
SP01			0	5	0	9	75	12	0		0	5	0	14	38	35	9		0	15	0	7	49	27	3
FA01			0	2	0	2	77	12	8		0	4	0	24	32	41	0		0	2	0	6	62	30	1
SP02			0	13	0	18	42	26	2		0	11	0	13	31	33	13		0	4	0	7	58	26	6
FA02			0	10	0	0	59	24	8		0	3	0	20	47	31	1		0	2	0	0	68	31	1
SP03			0	8	0	9	70	10	3		0	13	0	31	27	28	1		0	5	0	14	45	29	7
FA03			0	9	4	0	67	13	7		0	3	0	33	41	20	2		0	0	0	7	64	28	1
SP04			0	25	5	15	34	14	7		1	5	22	18	23	21	10		0	5	6	20	43	15	11
FA04			0	5	0	0	66	16	13		0	3	0	8	61	25	3		0	2	0	3	65	30	0
SP05			0	13	12	6	25	25	19		0	5	0	11	35	41	8		0	6	3	1	45	45	0

Table D-35. Data from bird and visitor censuses collected in Zones I, II and III from 1990-2005.

		Zone I					Zone II					Zone III				
Date	Type of Day	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
08-Feb-90	Weekday	53	0	4	6	0	20	0	11	3	0	0	0	92	15	0
10-Feb-90	Reg Weekend	107	0	1	0	0	29	11	7	6	0	12	14	18	9	0
28-Nov-90	Weekday	4	3	3	2	0	6	5	19	2	0	0	0	4	0	0
29-Nov-90	Weekday	9	1	5	5	0	4	4	14	1	0	4	200	51	9	0
30-Nov-90	Weekday	36	17	14	1	0	33	15	10	5	0	16	22	19	3	0
01-Dec-90	Reg Weekend	172	2	0	0	0	92	4	0	0	0	34	7	56	0	0
02-Dec-90	Reg Weekend	250	1	2	0	0	75	8	0	0	0	39	100	27	6	0
11-Dec-90	Weekday	27	1	10	0	0	56	7	2	1	0	8	37	17	8	0
12-Dec-90	Weekday	16	4	3	0	0	2	3	19	0	0	0	16	61	8	0
13-Dec-90	Weekday	5	5	24	1	0	0	3	2	2	0	2	13	50	9	0
14-Dec-90	Weekday	17	2	7	3	0	2	9	1	1	0	0	306	48	6	0
15-Dec-90	Reg Weekend	98	0	0	0	0	0	6	3	2	0	0	36	19	8	0
17-Dec-90	Weekday	2	5	7	5	0	1	4	10	2	0	1	25	7	6	0
18-Dec-90	Weekday	1	2	19	8	0	0	8	24	6	0	2	74	20	13	0
27-Dec-90	Holiday	41	0	6	0	0	3	3	11	0	0	0	15	23	5	0
28-Dec-90	Holiday	159	3	0	0	0	14	2	6	1	0	13	13	27	10	0
30-Dec-90	Holiday	297	2	0	0	0	0	5	0	0	0	81	210	15	4	0
31-Dec-90	Holiday	28	3	1	0	0	200	6	2	0	0	87	17	18	1	0
01-Jan-91	Holiday	23	6	6	0	0	150	4	3	1	0	73	33	29	2	0
09-Jan-91	Weekday	3	4	11	1	0	0	4	16	0	0	0	4	22	1	0
10-Jan-91	Weekday	18	0	8	2	0	10	3	3	1	0	2	15	23	9	0
11-Jan-91	Weekday	0	7	0	2	0	24	12	8	3	0	4	82	70	15	0
12-Jan-91	Reg Weekend	93	2	3	1	0	30	2	3	1	0	11	14	17	7	0
13-Jan-91	Reg Weekend	151	0	0	0	0	23	7	0	4	0	16	12	15	6	0
14-Jan-91	Weekday	8	7	27	0	0	41	11	15	1	0	7	100	74	17	0
15-Jan-91	Weekday	10	7	4	4	0	32	8	21	5	0	3	52	74	19	0
16-Jan-91	Weekday	18	2	8	1	0	5	2	5	0	0	0	30	8	6	0
17-Jan-91	Weekday	35	1	11	0	0	0	6	16	2	0	1	504	28	5	0
25-Jan-91	Weekday	0	0	6	0	0	6	2	0	0	0	7	150	49	0	0
26-Jan-91	Reg Weekend	114	1	0	0	0	17	0	0	0	0	10	203	19	2	0
27-Jan-91	Reg Weekend	125	0	0	0	0	7	3	1	0	0	14	200	36	9	0
28-Jan-91	Weekday	12	7	6	0	0	25	12	19	2	0	2	25	86	18	0
29-Jan-91	Weekday	25	2	3	1	0	8	9	5	1	0	17	18	5	1	0
30-Jan-91	Weekday	13	1	3	1	0	2	5	6	0	0	4	20	3	1	0
31-Jan-91	Weekday	35	2	2	1	0	4	3	6	1	0	4	150	6	5	0
07-Feb-91	Weekday	11	3	3	0	0	0	0	13	0	0	1	9	26	0	0
08-Feb-91	Weekday	43	2	17	1	0	2	3	13	5	0	0	201	33	6	0
09-Feb-91	Reg Weekend	99	1	12	0	0	15	2	11	0	0	6	204	30	1	0
10-Feb-91	Reg Weekend	98	0	0	0	0	33	6	9	0	0	8	7	11	11	0
11-Feb-91	Weekday	90	9	14	2	0	12	12	35	2	0	4	37	113	11	0
13-Feb-91	Weekday	40	0	3	0	0	2	2	17	0	0	0	4	19	5	0
21-Feb-91	Weekday	22	3	5	0	0	1	2	1	0	0	1	19	66	0	0
22-Feb-91	Weekday	8	2	10	0	0	0	4	18	0	0	0	4	24	1	0
24-Feb-91	Reg Weekend	48	4	2	0	0	97	12	30	0	0	80	75	95	5	0
02-Mar-91	Reg Weekend	59	0	9	0	0	0	0	7	0	0	0	3	9	2	0
09-Mar-91	Reg Weekend	67	1	2	0	0	5	0	1	0	0	6	4	55	3	0
10-Mar-91	Reg Weekend	53	3	3	0	0	5	1	37	1	0	1	12	48	6	0
16-Mar-91	Reg Weekend	82	0	0	0	0	20	1	5	1	0	7	22	8	5	0
17-Mar-91	Reg Weekend	75	0	4	0	0	23	0	2	0	0	10	8	47	0	0
23-Mar-91	Reg Weekend	22	7	2	1	0	0	4	16	2	0	0	8	31	3	0
24-Mar-91	Reg Weekend	74	2	7	0	0	30	1	1	0	0	18	21	72	2	0
28-Mar-91	Weekday	78	0	7	0	0	6	0	0	0	0	15	12	37	4	0
31-Mar-91	Reg Weekend	81	1	2	0	0	8	5	5	0	0	1	51	37	1	0
08-Apr-91	Weekday	21	0	0	0	0	7	3	18	2	0	0	2	22	1	0
10-Apr-91	Weekday	27	2	0	0	0	0	2	7	0	0	0	39	20	2	0
14-Apr-91	Reg Weekend	98	3	1	0	0	16	7	6	0	0	2	150	59	0	0
21-Apr-91	Reg Weekend	51	3	0	0	0	20	2	2	0	0	30	28	22	1	0
02-Sep-91	Holiday	60	1	2	0	0	11	58	21	0	0	3	2	11	1	0
20-Oct-91	Reg Weekend	75	1	5	0	0	6	17	16	0	0	0	9	10	0	0
03-Nov-91	Reg Weekend	80	0	14	0	0	10	19	31	1	0	8	1	6	0	0
04-Nov-91	Weekday	22	4	0	0	0	18	5	2	1	0	16	38	7	9	0
05-Nov-91	Weekday	26	4	0	0	0	32	35	0	0	0	2	321	12	4	0
21-Nov-91	Weekday	39	0	0	0	0	6	13	10	3	0	8	5	15	3	0
22-Nov-91	Weekday	21	0	3	0	0	2	16	16	4	0	1	57	0	2	0
05-Dec-91	Weekday	25	3	3	3	0	16	8	3	0	0	0	388	5	2	0
07-Dec-91	Reg Weekend	36	17	13	3	0	23	3	9	0	0	4	15	8	4	0

		Zone I					Zone II					Zone III				
Date	Type of Day	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
21-Dec-91	Reg Weekend	178	15	0	4	0	63	17	1	0	0	9	65	7	5	0
22-Dec-91	Reg Weekend	120	3	0	0	0	30	3	2	1	0	0	81	6	6	0
03-Jan-92	Weekday	40	1	0	1	0	7	9	20	3	0	1	4	22	8	0
17-Jan-92	Weekday	39	11	1	0	0	1	5	25	1	0	0	309	12	8	0
18-Jan-92	Holiday	327	3	0	1	0	33	14	4	1	0	24	4	4	4	0
19-Jan-92	Holiday	85	3	0	0	0	39	10	4	0	0	12	189	59	9	0
20-Jan-92	Holiday	164	0	0	0	0	23	4	5	1	0	5	153	68	8	0
29-Jan-92	Weekday	15	8	0	0	0	0	3	0	0	0	0	0	0	0	0
30-Jan-92	Weekday	17	4	1	0	0	0	7	11	2	0	0	5	37	0	0
02-Feb-92	Reg Weekend	75	1	1	1	0	12	10	5	0	0	6	112	27	1	0
04-Feb-92	Weekday	17	7	2	0	0	2	5	23	0	0	0	121	18	4	0
05-Feb-92	Weekday	14	2	1	0	0	0	17	6	1	0	0	110	0	6	0
13-Feb-92	Weekday	0	1	5	1	0	0	6	31	1	0	0	0	21	0	0
14-Feb-92	Weekday	0	3	1	1	0	0	5	53	5	0	0	4	12	3	0
16-Feb-92	Holiday	0	5	1	1	0	0	6	2	5	0	0	3	2	3	0
17-Feb-92	Holiday	0	2	0	0	0	0	30	0	0	0	0	95	0	0	0
19-Feb-92	Weekday	0	2	0	0	0	0	5	2	5	0	0	120	1	3	0
27-Feb-92	Weekday	0	4	1	0	0	0	8	32	2	0	0	6	36	1	0
28-Feb-92	Weekday	0	6	2	1	0	0	6	62	0	0	0	20	7	4	0
29-Feb-92	Reg Weekend	10	2	2	0	0	2	7	47	2	0	0	1	56	4	0
01-Mar-92	Reg Weekend	0	6	3	1	0	0	5	4	3	0	0	7	4	1	0
13-Mar-92	Weekday	0	12	0	1	0	0	10	57	1	0	0	7	11	3	0
14-Mar-92	Reg Weekend	0	3	2	1	0	0	5	83	5	0	0	7	38	2	0
15-Mar-92	Reg Weekend	0	4	1	1	0	0	5	47	2	0	0	18	18	3	0
17-Mar-92	Weekday	8	5	0	0	0	0	10	0	0	0	0	110	0	0	0
19-Mar-92	Weekday	0	3	12	0	0	0	0	2	2	0	0	15	21	2	0
03-Apr-92	Weekday	0	0	10	0	0	0	0	3	0	0	0	33	3	0	0
04-Apr-92	Reg Weekend	0	1	8	0	0	0	1	4	0	0	0	5	1	0	0
11-Apr-92	Reg Weekend	57	0	0	0	0	12	4	14	0	0	0	12	119	1	0
12-Apr-92	Reg Weekend	40	0	0	0	0	13	7	89	0	0	8	156	40	3	0
13-Apr-92	Weekday	55	1	0	0	0	5	3	38	0	0	0	107	12	1	0
09-May-92	Reg Weekend	23	7	0	0	0	0	2	1	0	0	0	9	7	1	0
24-Oct-92	Reg Weekend	83	6	2	0	0	17	5	1	1	0	7	16	10	4	0
27-Oct-92	Weekday	8	6	1	0	0	0	13	10	4	0	0	20	2	8	0
09-Nov-92	Weekday	92	0	0	0	0	14	5	0	4	0	11	4	4	6	0
10-Nov-92	Weekday	24	6	4	0	0	11	9	12	0	0	0	5	10	3	0
11-Nov-92	Holiday	50	1	2	0	0	0	22	39	3	0	9	7	4	0	0
20-Nov-92	Weekday	25	0	0	0	0	0	2	37	0	0	0	1	13	0	0
21-Nov-92	Reg Weekend	29	6	2	0	0	27	13	81	5	0	6	7	8	2	0
23-Nov-92	Weekday	25	4	0	0	0	17	5	3	0	0	23	117	2	3	0
24-Nov-92	Weekday	25	6	1	5	0	3	2	27	4	0	0	3	13	8	0
25-Nov-92	Weekday	0	11	1	3	0	0	3	1	0	0	0	211	0	2	0
26-Nov-92	Holiday	53	4	0	1	0	16	2	0	1	0	2	27	5	7	0
08-Dec-92	Weekday	17	2	1	1	0	7	3	5	2	0	0	111	2	6	0
09-Dec-92	Weekday	14	10	0	2	0	4	2	3	3	0	4	98	3	3	0
19-Dec-92	Reg Weekend	27	12	0	1	0	6	9	11	2	0	1	11	9	4	0
20-Dec-92	Reg Weekend	40	1	0	0	0	30	2	1	0	0	3	106	11	7	0
21-Dec-92	Weekday	44	2	1	1	0	6	2	2	2	0	2	21	9	2	0
22-Dec-92	Weekday	55	3	2	0	0	9	1	0	0	0	6	6	0	1	0
23-Dec-92	Weekday	36	3	0	0	0	3	12	8	0	0	2	247	11	9	0
24-Dec-92	Holiday	23	1	1	0	0	9	164	6	5	0	0	419	4	3	0
25-Dec-92	Holiday	63	1	0	2	0	6	6	1	4	0	0	52	1	6	0
04-Jan-93	Weekday	9	2	1	0	0	4	4	8	0	0	2	83	9	0	0
05-Jan-93	Weekday	40	4	3	1	0	4	4	52	0	0	0	257	30	2	0
08-Jan-93	Weekday	54	1	1	1	0	3	7	2	2	0	7	30	10	1	0
09-Jan-93	Reg Weekend	47	2	0	2	0	19	3	11	1	0	8	4	4	1	0
17-Jan-93	Holiday	0	6	0	0	0	0	10	8	0	0	0	0	0	0	0
18-Jan-93	Holiday	0	2	4	0	0	0	4	2	0	0	0	1	1	0	0
19-Jan-93	Weekday	10	2	0	0	0	0	3	0	4	0	0	9	0	4	0
20-Jan-93	Weekday	8	2	3	0	0	0	4	3	1	0	2	19	6	6	0
21-Jan-93	Weekday	12	5	1	0	0	2	8	5	2	0	2	17	35	6	0
22-Jan-93	Weekday	0	2	0	1	0	2	6	19	3	0	2	62	21	10	0
23-Jan-93	Reg Weekend	35	2	0	0	0	4	12	5	1	0	2	0	17	0	0
24-Jan-93	Reg Weekend	30	2	0	1	0	4	12	13	3	0	4	108	42	8	0
01-Feb-93	Weekday	12	1	3	0	0	0	1	24	0	0	0	1	1	0	0
02-Feb-93	Weekday	18	2	2	0	0	45	4	14	0	0	21	4	6	1	0
03-Feb-93	Weekday	6	3	2	1	0	0	5	11	0	0	0	0	5	7	0
04-Feb-93	Weekday	41	0	0	0	0	3	4	0	0	0	0	105	10	1	0
05-Feb-93	Weekday	35	0	2	0	0	6	2	11	0	0	13	1	90	2	0
06-Feb-93	Reg Weekend	84	3	0	0	0	29	7	0	0	0	39	47	0	4	0
07-Feb-93	Reg Weekend	50	4	6	0	0	1	8	44	0	0	0	0	22	0	0
08-Feb-93	Weekday	12	0	11	0	0	0	4	9	0	0	0	1	1	0	0
09-Feb-93	Weekday	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0

Date	Type of Day	Zone I					Zone II					Zone III				
		People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
14-Feb-93	Holiday	56	0	0	0	0	0	1	4	1	0	1	3	4	2	0
15-Feb-93	Holiday	70	4	0	0	0	43	12	0	0	0	7	0	5	4	0
16-Feb-93	Weekday	57	9	0	0	0	47	7	1	4	0	0	0	0	0	0
18-Feb-93	Weekday	12	5	8	0	0	0	8	27	0	0	0	0	0	0	0
19-Feb-93	Weekday	2	19	2	1	0	0	16	8	2	0	0	0	0	0	0
20-Feb-93	Reg Weekend	37	0	2	2	0	4	4	2	5	0	0	0	3	1	0
21-Feb-93	Reg Weekend	85	1	0	0	0	2	2	2	5	0	3	11	12	6	0
22-Feb-93	Weekday	4	1	0	0	0	0	3	5	3	0	0	58	17	5	0
23-Feb-93	Weekday	5	3	6	0	0	0	0	5	0	0	0	1	4	3	0
06-Mar-93	Reg Weekend	118	0	0	0	0	141	1	2	0	0	20	54	41	0	0
08-Mar-93	Weekday	26	2	0	1	0	5	1	31	0	0	2	79	19	0	0
09-Mar-93	Weekday	6	0	3	1	0	5	1	2	1	0	0	0	22	0	0
18-Mar-93	Weekday	54	0	0	0	0	2	2	5	0	0	0	5	27	0	0
19-Mar-93	Weekday	0	1	0	0	0	0	0	0	0	0	0	3	7	0	0
22-Mar-93	Weekday	23	0	0	0	0	2	1	10	0	0	0	0	11	1	0
03-Apr-93	Reg Weekend	48	1	8	0	0	11	1	0	0	0	7	3	18	2	0
04-Apr-93	Reg Weekend	120	0	0	0	0	7	4	8	1	0	0	1	16	0	0
05-Apr-93	Weekday	76	0	0	0	0	20	0	2	0	0	0	0	7	0	0
15-Sep-93	Weekday	36	0	0	0	0	2	41	5	0	0	0	34	7	1	0
18-Sep-93	Reg Weekend	21	0	0	0	0	0	24	0	0	0	0	0	0	0	0
29-Sep-93	Weekday	18	2	1	0	0	0	0	6	0	0	0	13	0	0	0
30-Sep-93	Weekday	28	1	5	1	0	0	4	8	0	0	0	12	3	1	0
12-Oct-93	Weekday	34	0	5	0	0	0	0	2	0	0	0	0	0	0	0
13-Oct-93	Weekday	62	0	1	0	0	25	15	20	0	0	1	4	7	1	0
14-Oct-93	Weekday	63	0	5	2	0	45	23	3	0	0	17	70	3	1	0
15-Oct-93	Weekday	22	6	1	0	0	16	5	2	0	0	9	48	2	3	0
16-Oct-93	Reg Weekend	37	2	1	0	0	22	2	24	0	0	3	10	1	1	0
17-Oct-93	Reg Weekend	70	0	0	0	0	5	5	3	1	0	0	3	0	1	0
27-Oct-93	Weekday	36	1	1	0	0	4	21	5	6	0	0	6	2	0	0
28-Oct-93	Weekday	7	0	3	0	0	0	46	16	4	0	0	0	6	5	0
29-Oct-93	Weekday	47	4	4	1	0	5	12	14	4	0	0	14	2	1	0
30-Oct-93	Reg Weekend	51	1	0	3	0	18	4	5	0	0	0	0	2	3	0
31-Oct-93	Reg Weekend	53	1	2	0	0	0	4	13	0	0	4	8	7	3	0
02-Nov-93	Weekday	8	1	1	2	0	0	5	3	5	0	0	49	24	7	0
11-Nov-93	Holiday	50	1	1	0	0	11	13	1	3	0	11	2	1	1	0
13-Nov-93	Reg Weekend	9	14	16	3	0	62	6	6	1	0	120	4	0	0	0
15-Nov-93	Weekday	0	1	2	2	0	27	3	3	3	0	4	76	63	8	0
16-Nov-93	Weekday	33	23	9	2	0	0	8	2	1	0	0	104	2	7	0
25-Nov-93	Holiday	63	0	0	2	0	11	6	21	2	0	0	179	1	5	0
26-Nov-93	Holiday	89	1	0	1	0	20	4	15	3	0	2	3	13	2	0
28-Nov-93	Holiday	56	8	0	0	0	7	13	4	0	0	10	5	1	2	0
29-Nov-93	Weekday	28	19	3	0	0	4	10	3	3	0	0	115	2	4	0
30-Nov-93	Weekday	12	6	11	2	0	6	10	5	2	0	1	29	0	4	0
01-Dec-93	Weekday	12	1	8	2	0	0	3	3	3	0	0	26	4	4	0
02-Dec-93	Weekday	10	4	14	2	0	0	3	16	1	0	0	0	6	7	0
09-Dec-93	Weekday	10	0	1	1	0	0	0	18	2	0	0	0	7	0	0
10-Dec-93	Weekday	37	11	0	6	0	3	5	27	3	0	3	2	1	0	0
11-Dec-93	Reg Weekend	25	3	1	0	0	8	8	18	1	0	4	11	0	4	0
12-Dec-93	Reg Weekend	52	0	0	0	0	83	8	0	0	0	43	65	10	6	0
13-Dec-93	Weekday	35	5	2	4	0	15	3	2	0	0	0	8	17	5	0
14-Dec-93	Weekday	23	3	1	3	0	0	14	1	9	0	2	96	0	8	0
15-Dec-93	Weekday	10	6	6	0	0	0	5	2	8	0	0	14	3	7	0
16-Dec-93	Weekday	0	4	0	0	0	2	3	11	1	0	0	15	1	4	0
24-Dec-93	Holiday	68	6	3	4	0	4	10	31	1	0	4	3	5	3	0
26-Dec-93	Holiday	62	4	1	5	0	38	15	20	9	0	10	58	63	14	0
27-Dec-93	Holiday	102	2	0	3	0	30	3	6	2	0	0	65	3	4	0
28-Dec-93	Holiday	19	54	23	5	0	29	2	4	1	0	103	1	0	2	0
29-Dec-93	Holiday	85	0	0	0	0	8	3	6	6	0	0	147	3	5	0
30-Dec-93	Holiday	115	1	0	1	0	15	4	11	3	0	111	3	20	3	0
31-Dec-93	Holiday	75	0	0	0	0	11	3	2	4	0	0	4	32	6	0
07-Jan-94	Weekday	26	1	0	0	0	3	2	2	3	0	7	0	11	0	0
08-Jan-94	Reg Weekend	89	0	0	0	0	17	0	0	2	0	36	160	4	3	0
09-Jan-94	Reg Weekend	52	3	0	2	0	4	2	1	4	0	0	222	0	2	0
10-Jan-94	Weekday	80	1	3	1	0	5	8	1	3	0	0	217	2	1	0
11-Jan-94	Weekday	18	6	2	4	0	17	4	3	1	0	0	4	17	3	0
12-Jan-94	Weekday	38	8	0	2	0	6	17	17	4	0	2	4	1	2	0
13-Jan-94	Weekday	20	2	4	3	0	2	8	14	5	0	0	1	8	2	0
14-Jan-94	Weekday	15	1	0	0	0	0	5	6	2	0	0	62	16	6	0
23-Jan-94	Reg Weekend	45	3	2	1	0	7	8	3	2	0	0	160	8	2	0
24-Jan-94	Weekday	40	6	0	2	0	0	9	1	1	0	0	136	0	4	0
25-Jan-94	Weekday	71	0	0	2	0	0	5	0	1	0	0	80	0	4	0
27-Jan-94	Weekday	32	0	1	0	0	11	2	11	0	0	0	3	2	4	0
28-Jan-94	Weekday	41	2	1	0	0	0	4	1	1	0	0	78	0	9	0

		Zone I					Zone II					Zone III				
Date	Type of Day	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
29-Jan-94	Reg Weekend	45	3	0	1	0	11	7	1	1	0	1	124	7	16	0
30-Jan-94	Reg Weekend	54	0	0	2	0	5	4	2	3	0	5	3	4	5	0
05-Feb-94	Reg Weekend	46	1	3	1	0	6	0	7	1	0	0	0	0	3	0
06-Feb-94	Reg Weekend	74	1	0	0	0	16	4	6	0	0	3	4	5	4	0
07-Feb-94	Weekday	0	26	1	2	0	0	9	0	1	0	0	122	0	4	0
08-Feb-94	Weekday	22	2	1	1	0	1	3	4	1	0	1	54	1	4	0
09-Feb-94	Weekday	20	2	11	2	0	4	3	0	2	0	2	1	2	1	0
11-Feb-94	Weekday	53	1	9	1	0	0	2	2	1	0	0	25	0	3	0
13-Feb-94	Reg Weekend	111	2	0	0	0	5	4	5	2	0	5	6	6	4	0
22-Feb-94	Weekday	46	0	1	0	0	21	3	10	1	0	0	0	0	1	0
24-Feb-94	Weekday	32	2	0	0	0	16	1	6	0	0	11	95	8	3	0
26-Feb-94	Reg Weekend	52	1	1	0	0	64	0	0	1	0	0	3	15	4	0
28-Feb-94	Weekday	17	1	3	1	0	3	0	1	0	0	0	3	11	4	0
05-Mar-94	Reg Weekend	49	1	0	0	0	8	3	29	1	0	0	2	0	4	0
06-Mar-94	Reg Weekend	43	26	0	0	0	5	3	5	0	0	0	2	0	2	0
07-Mar-94	Weekday	0	2	2	0	0	9	11	1	2	0	8	2	0	1	0
08-Mar-94	Weekday	17	2	0	0	0	0	1	6	1	0	1	4	0	4	0
09-Mar-94	Weekday	32	7	0	2	0	5	9	13	1	0	1	30	0	3	0
10-Mar-94	Weekday	25	4	0	0	0	17	0	0	0	0	0	7	0	3	0
11-Mar-94	Weekday	25	0	3	0	0	0	1	4	0	0	0	1	1	2	0
12-Mar-94	Reg Weekend	58	0	0	1	0	33	3	10	1	0	3	0	5	2	0
13-Mar-94	Reg Weekend	131	0	0	0	0	20	1	10	1	0	6	0	0	0	0
14-Mar-94	Weekday	36	0	0	0	0	0	4	15	1	0	0	7	5	0	0
21-Mar-94	Weekday	72	0	1	0	0	0	0	1	1	0	0	2	2	1	0
22-Mar-94	Weekday	37	2	0	0	0	0	10	36	0	0	0	4	1	0	0
23-Mar-94	Weekday	47	0	0	0	0	3	3	5	1	0	0	2	0	0	0
24-Mar-94	Weekday	58	9	0	0	0	2	6	0	0	0	0	2	0	0	0
26-Mar-94	Reg Weekend	109	0	0	0	0	14	2	3	1	0	6	54	1	2	0
27-Mar-94	Reg Weekend	123	6	4	0	0	48	4	6	0	0	11	0	0	0	0
28-Mar-94	Weekday	52	1	0	0	0	14	0	8	1	0	0	2	1	1	0
02-Apr-94	Reg Weekend	41	2	0	0	0	0	0	15	0	0	0	61	8	0	0
03-Apr-94	Reg Weekend	37	3	0	0	0	0	4	6	0	0	0	0	5	0	0
07-Apr-94	Weekday	17	1	0	0	0	0	1	4	0	0	3	14	4	0	0
09-Apr-94	Reg Weekend	48	4	0	0	0	2	15	5	0	0	0	0	0	0	0
23-Apr-94	Reg Weekend	67	0	0	0	0	5	0	2	2	0	0	1	1	0	0
24-Apr-94	Reg Weekend	23	0	0	0	0	2	2	0	0	0	0	0	0	0	0
25-Apr-94	Weekday	0	4	0	0	0	0	5	0	0	0	0	0	0	0	0
01-May-94	Reg Weekend	12	3	18	0	0	1	9	1	0	0	0	1	5	1	0
02-May-94	Weekday	19	3	1	0	0	0	7	6	0	0	0	0	2	0	0
13-Jun-94	Weekday	12	1	0	2	0	4	11	3	12	0	0	69	0	12	0
06-Sep-94	Weekday	10	3	1	0	0	0	16	6	0	0	0	1	1	0	0
19-Sep-94	Weekday	3	48	1	2	0	1	26	12	0	0	4	29	6	1	0
20-Sep-94	Weekday	0	4	0	0	0	0	7	1	1	0	1	3	2	0	0
03-Oct-94	Weekday	12	6	0	0	0	0	46	4	1	0	0	26	0	0	0
04-Oct-94	Weekday	22	2	3	0	0	7	60	6	0	0	0	6	1	1	0
05-Oct-94	Weekday	27	2	2	0	0	0	5	4	0	0	5	51	3	0	0
06-Oct-94	Weekday	37	0	4	0	0	12	5	1	0	0	0	5	2	0	0
17-Oct-94	Weekday	17	4	6	0	0	7	13	4	0	0	1	15	4	2	0
18-Oct-94	Weekday	8	3	0	0	0	0	10	3	0	0	5	4	10	0	0
19-Oct-94	Weekday	25	2	0	0	0	4	6	0	0	0	2	7	4	1	0
01-Nov-94	Weekday	62	6	18	0	0	1	3	62	0	0	3	5	2	1	0
02-Nov-94	Weekday	44	22	0	6	0	1	10	0	2	0	3	7	2	1	0
03-Nov-94	Weekday	44	22	1	1	0	36	13	6	0	0	40	21	6	2	0
04-Nov-94	Weekday	49	2	0	0	0	4	3	2	4	0	0	4	13	3	0
05-Nov-94	Reg Weekend	55	2	2	1	0	10	1	5	2	0	15	75	2	6	0
13-Nov-94	Holiday	34	2	5	1	0	2	2	6	3	0	0	6	4	2	0
14-Nov-94	Weekday	12	2	0	2	0	1	3	5	0	0	1	31	12	4	0
16-Nov-94	Weekday	17	2	8	0	0	0	9	13	0	0	0	3	2	0	0
17-Nov-94	Weekday	11	27	1	2	0	20	17	10	2	0	5	1	19	5	0
18-Nov-94	Weekday	35	14	0	3	0	0	12	14	4	0	0	171	2	10	0
19-Nov-94	Reg Weekend	50	1	1	1	0	2	17	7	3	0	1	7	5	13	0
20-Nov-94	Reg Weekend	67	2	8	0	0	22	5	5	2	0	6	27	11	7	0
29-Nov-94	Weekday	15	4	3	0	0	13	2	4	1	0	1	40	2	2	0
30-Nov-94	Weekday	34	3	4	1	0	6	7	1	0	0	1	25	27	1	0
01-Dec-94	Weekday	19	3	1	1	0	3	5	3	0	0	0	54	35	1	0
02-Dec-94	Weekday	70	3	4	0	0	43	1	0	0	0	7	2	10	1	0
03-Dec-94	Reg Weekend	67	5	0	0	0	68	7	0	0	0	20	20	10	0	0
04-Dec-94	Reg Weekend	94	3	19	0	0	53	11	9	1	0	26	89	0	1	0
05-Dec-94	Weekday	18	11	2	2	0	5	3	2	2	0	3	7	4	1	0
13-Dec-94	Weekday	5	2	0	1	0	3	1	4	1	0	0	5	0	4	0
15-Dec-94	Weekday	11	5	4	1	0	0	7	2	0	0	0	71	0	11	0
16-Dec-94	Weekday	23	5	3	1	0	0	6	2	0	0	0	48	0	8	0
17-Dec-94	Reg Weekend	71	0	0	0	0	28	9	5	1	0	3	24	15	8	0

Date	Type of Day	Zone I					Zone II					Zone III				
		People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
18-Dec-94	Reg Weekend	29	4	1	0	0	8	6	8	4	0	0	10	3	9	0
19-Dec-94	Weekday	19	2	3	0	0	0	3	6	5	0	0	24	0	4	0
20-Dec-94	Weekday	16	10	6	0	0	0	1	2	13	0	0	0	0	6	0
27-Dec-94	Holiday	34	1	0	0	0	2	7	14	0	0	1	1	0	0	0
29-Dec-94	Holiday	80	6	2	0	0	17	4	5	2	0	20	63	0	3	0
31-Dec-94	Holiday	109	1	0	0	0	40	10	0	0	0	20	75	0	1	0
01-Jan-95	Holiday	160	0	0	0	0	34	5	0	1	0	12	62	0	7	0
02-Jan-95	Weekday	118	4	2	3	0	38	1	4	2	0	11	68	0	11	0
14-Jan-95	Holiday	48	3	2	0	0	2	0	1	0	0	3	1	0	7	0
16-Jan-95	Holiday	48	0	0	0	0	18	6	2	2	0	0	10	1	11	0
17-Jan-95	Weekday	17	4	1	0	0	5	2	0	7	0	1	57	0	4	0
18-Jan-95	Weekday	13	3	10	3	0	0	8	1	2	0	0	3	0	7	0
27-Jan-95	Weekday	47	3	4	0	0	31	6	0	3	0	18	34	3	6	0
29-Jan-95	Reg Weekend	31	8	5	3	0	19	0	0	1	0	6	33	0	7	0
30-Jan-95	Weekday	21	1	0	1	0	12	25	0	0	0	5	88	0	4	0
31-Jan-95	Weekday	26	2	1	2	0	6	1	0	0	0	3	10	0	2	0
10-Feb-95	Weekday	29	3	3	0	0	0	3	0	2	0	0	20	3	5	0
11-Feb-95	Reg Weekend	84	0	0	0	0	7	2	0	0	0	0	13	0	3	0
13-Feb-95	Weekday	13	2	0	0	0	8	7	1	2	0	0	2	1	3	0
14-Feb-95	Weekday	12	1	0	1	0	11	0	0	0	0	3	34	0	2	0
15-Feb-95	Weekday	38	1	2	0	0	5	2	2	2	0	23	0	0	2	0
16-Feb-95	Weekday	46	0	0	0	0	0	1	2	1	0	0	1	0	3	0
23-Feb-95	Weekday	36	3	2	0	0	3	4	3	0	0	0	5	0	6	0
24-Feb-95	Weekday	13	0	0	0	0	1	3	3	2	0	2	0	0	0	0
25-Feb-95	Reg Weekend	64	21	2	0	0	16	5	2	1	0	3	4	0	2	0
26-Feb-95	Reg Weekend	103	2	0	0	0	29	1	0	0	0	13	4	0	2	0
27-Feb-95	Weekday	77	0	0	0	0	4	5	3	1	0	0	3	1	7	0
28-Feb-95	Weekday	21	2	3	4	0	7	6	0	2	0	0	2	0	3	0
01-Mar-95	Weekday	27	0	1	3	0	2	4	1	4	0	0	3	0	6	0
02-Mar-95	Weekday	16	4	4	0	0	5	0	0	4	0	2	2	0	3	0
13-Mar-95	Weekday	57	1	0	1	0	1	10	0	1	0	0	4	0	1	0
14-Mar-95	Weekday	57	0	0	0	0	5	2	1	0	0	0	2	1	2	0
15-Mar-95	Weekday	28	0	0	0	0	20	1	8	0	0	0	1	0	1	0
16-Mar-95	Weekday	51	0	0	0	0	13	5	2	3	0	0	3	0	4	0
17-Mar-95	Weekday	57	1	0	0	0	2	0	3	0	0	0	42	6	7	0
24-Mar-95	Weekday	53	0	0	0	0	0	1	5	0	0	0	19	10	4	0
26-Mar-95	Reg Weekend	56	0	0	1	0	4	0	1	0	0	0	44	12	6	0
28-Mar-95	Weekday	65	0	0	0	0	30	0	0	1	0	32	2	2	1	0
29-Mar-95	Weekday	24	0	0	0	0	23	0	1	0	0	0	3	0	0	0
30-Mar-95	Weekday	42	0	1	1	0	16	2	2	0	0	2	1	4	0	0
12-Apr-95	Weekday	54	0	0	0	0	10	2	5	0	0	5	3	2	0	0
21-Apr-95	Weekday	8	0	0	0	0	5	20	6	4	0	4	30	10	4	0
20-May-95	Reg Weekend	13	0	0	0	0	1	5	0	1	0	2	0	0	4	0
21-May-95	Reg Weekend	36	2	1	0	0	0	0	5	1	0	0	67	13	6	0
22-May-95	Weekday	56	0	1	0	0	0	1	0	0	0	0	0	0	0	0
18-Jun-95	Reg Weekend	0	2	0	1	0	0	4	0	1	0	0	1	0	1	0
09-Sep-95	Reg Weekend	84	3	0	0	0	0	7	0	0	0	0	2	0	0	0
10-Sep-95	Reg Weekend	49	3	0	0	0	0	8	0	0	0	0	7	0	0	0
24-Sep-95	Reg Weekend	66	3	1	0	0	7	4	0	0	0	0	0	0	1	0
25-Sep-95	Weekday	25	6	0	2	0	0	4	0	0	0	0	1	0	0	0
05-Oct-95	Weekday	0	1	1	0	0	0	0	3	0	0	0	1	1	0	0
06-Oct-95	Weekday	15	2	2	0	0	4	1	8	4	0	0	0	3	1	0
08-Oct-95	Holiday	80	0	0	0	0	26	2	0	0	0	0	10	0	6	0
09-Oct-95	Holiday	23	2	0	0	0	4	6	0	4	0	0	22	3	1	0
22-Oct-95	Reg Weekend	93	5	0	0	0	16	3	11	2	0	7	13	4	0	0
03-Nov-95	Weekday	16	0	1	0	0	0	7	6	1	0	0	0	1	2	0
04-Nov-95	Reg Weekend	37	5	1	1	0	25	3	1	0	0	4	14	2	8	0
05-Nov-95	Reg Weekend	82	1	0	0	0	12	0	0	0	0	0	60	8	5	0
06-Nov-95	Weekday	19	1	0	1	0	2	10	2	1	0	1	105	0	11	0
08-Nov-95	Weekday	12	3	4	3	0	2	8	4	2	0	0	9	4	5	0
20-Nov-95	Weekday	41	1	0	0	0	7	2	3	3	0	0	3	1	7	0
21-Nov-95	Weekday	30	1	0	0	0	25	4	1	0	0	0	10	0	5	0
22-Nov-95	Weekday	56	3	0	0	0	9	1	6	1	0	28	86	2	6	0
03-Dec-95	Reg Weekend	35	0	0	1	0	0	2	4	1	0	5	3	1	5	0
04-Dec-95	Weekday	6	4	15	2	0	1	2	3	3	0	0	35	21	10	0
06-Dec-95	Weekday	5	2	36	0	0	17	1	3	0	0	0	36	6	3	4
07-Dec-95	Weekday	26	0	1	0	0	2	1	0	0	0	0	73	22	7	0
17-Jan-96	Weekday	20	5	0	1	0	0	0	3	1	0	0	179	15	2	0
18-Jan-96	Weekday	54	1	1	0	0	0	1	2	0	0	0	16	18	2	10
19-Jan-96	Weekday	22	1	1	2	0	28	4	1	3	0	2	18	14	5	0
30-Jan-96	Weekday	13	0	0	0	0	2	2	3	0	0	0	14	16	1	0
31-Jan-96	Weekday	16	0	0	0	0	2	0	3	0	0	0	70	0	0	0
01-Feb-96	Weekday	3	1	3	0	0	2	15	1	0	0	1	33	6	1	0

Date	Type of Day	Zone I					Zone II					Zone III				
		People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
02-Feb-96	Weekday	26	0	11	0	0	7	3	7	0	0	0	151	3	2	0
03-Feb-96	Reg Weekend	53	0	0	0	0	10	3	15	1	0	6	6	5	1	0
04-Feb-96	Reg Weekend	123	2	0	1	0	8	3	3	2	0	6	34	2	4	0
14-Feb-96	Weekday	69	2	0	0	0	7	9	7	5	0	0	95	2	3	10
15-Feb-96	Weekday	102	2	3	3	0	14	3	0	1	0	10	63	15	5	0
16-Feb-96	Weekday	57	2	0	3	0	18	0	3	1	0	27	71	5	3	0
17-Feb-96	Holiday	98	2	0	1	0	38	0	0	0	0	14	14	12	3	0
18-Feb-96	Holiday	87	1	0	1	0	46	1	0	1	0	10	6	7	7	0
19-Feb-96	Holiday	150	6	12	2	0	51	1	0	0	0	18	82	2	4	0
01-Mar-96	Weekday	42	1	3	3	0	0	1	1	1	0	5	8	7	3	1
02-Mar-96	Reg Weekend	57	0	0	0	0	6	1	0	0	0	1	3	8	2	0
03-Mar-96	Reg Weekend	77	0	1	0	0	10	2	5	0	0	0	2	4	1	0
04-Mar-96	Weekday	28	0	2	0	0	2	1	5	1	0	0	71	4	2	1
05-Mar-96	Weekday	19	0	2	0	0	16	0	5	0	0	4	86	5	2	0
06-Mar-96	Weekday	7	1	0	0	0	0	1	23	0	0	0	70	3	0	0
13-Mar-96	Weekday	7	1	5	0	0	0	0	12	0	0	0	7	1	0	0
14-Mar-96	Weekday	59	1	0	0	0	20	1	4	0	0	2	13	3	5	0
15-Mar-96	Weekday	32	3	1	0	0	43	1	1	0	0	8	45	8	1	0
16-Mar-96	Reg Weekend	77	1	0	0	0	9	7	3	0	0	0	2	9	5	0
17-Mar-96	Reg Weekend	130	1	1	0	0	21	3	1	4	0	7	0	9	1	0
18-Mar-96	Weekday	100	2	3	1	0	19	3	0	0	0	11	2	5	4	0
19-Mar-96	Weekday	20	0	2	1	0	13	1	3	0	0	0	92	4	2	1
20-Mar-96	Weekday	47	1	0	0	0	25	0	11	0	0	0	25	6	0	0
01-Apr-96	Weekday	31	0	0	0	0	0	2	0	0	0	0	10	20	0	0
10-Apr-96	Weekday	21	1	2	0	0	0	3	1	0	0	0	0	4	0	0
11-Apr-96	Weekday	63	7	0	0	0	2	6	5	0	0	0	4	0	0	0
12-Apr-96	Weekday	61	4	0	0	0	0	26	2	0	0	0	68	0	2	0
13-Apr-96	Reg Weekend	35	3	0	0	0	0	22	7	0	0	0	53	1	0	0
14-Apr-96	Reg Weekend	45	1	0	0	0	2	3	7	0	0	0	86	2	0	0
15-Apr-96	Weekday	22	0	0	0	0	2	0	9	0	0	1	17	0	1	0
26-Sep-96	Weekday	84	2	1	0	0	42	1	1	0	0	31	70	2	0	0
24-Oct-96	Weekday	17	4	6	0	0	0	1	7	1	0	0	105	6	0	0
25-Oct-96	Weekday	54	4	0	0	0	43	2	0	0	0	0	65	4	0	0
21-Nov-96	Weekday	18	3	3	5	0	8	4	3	2	0	0	39	1	9	0
22-Nov-96	Weekday	34	2	0	1	0	4	3	3	3	0	0	6	0	4	0
24-Nov-96	Reg Weekend	160	1	0	2	0	20	5	0	2	0	10	75	0	1	0
25-Nov-96	Weekday	68	0	8	1	0	8	0	0	0	0	0	250	0	4	0
02-Dec-96	Weekday	0	2	2	1	0	0	1	1	1	0	0	30	0	7	0
20-Dec-96	Weekday	4	0	1	2	0	0	2	2	3	0	0	34	0	2	0
21-Dec-96	Reg Weekend	0	0	7	0	0	0	0	19	0	0	0	2	2	9	0
22-Dec-96	Reg Weekend	0	2	2	1	0	0	1	1	1	0	0	30	0	7	0
23-Dec-96	Weekday	45	0	0	0	0	0	0	12	1	0	0	215	0	3	0
24-Dec-96	Holiday	63	1	10	1	0	4	4	7	3	0	0	208	0	4	0
05-Jan-97	Reg Weekend	0	6	11	1	0	0	4	1	6	0	0	50	6	7	0
06-Jan-97	Weekday	31	1	0	3	0	4	2	6	4	0	0	110	0	3	0
07-Jan-97	Weekday	12	2	0	0	0	1	3	9	2	0	0	50	2	4	15
08-Jan-97	Weekday	56	1	0	0	0	9	1	1	0	1	1	80	7	5	0
09-Jan-97	Weekday	57	0	0	1	0	19	3	0	1	0	0	80	2	5	0
20-Jan-97	Holiday	0	1	3	0	0	0	1	6	7	0	0	55	17	6	0
21-Jan-97	Weekday	74	0	5	1	0	7	3	9	0	0	0	38	5	3	0
22-Jan-97	Weekday	16	2	1	1	0	3	2	8	1	0	0	102	2	4	0
23-Jan-97	Weekday	10	4	1	0	0	0	0	2	4	0	0	102	2	3	0
04-Feb-97	Weekday	15	2	0	0	0	4	2	0	1	0	0	22	5	5	0
05-Feb-97	Weekday	36	2	0	2	0	22	0	4	0	0	0	71	4	0	0
06-Feb-97	Weekday	45	4	0	1	0	48	1	0	0	0	20	64	11	4	0
07-Feb-97	Weekday	91	1	0	2	0	13	1	1	1	0	0	155	19	3	0
18-Feb-97	Weekday	0	1	1	0	0	0	2	0	0	0	0	60	12	6	0
19-Feb-97	Weekday	2	2	1	2	0	5	1	11	2	0	0	40	5	3	0
20-Feb-97	Weekday	21	1	6	3	0	7	1	5	1	0	0	52	10	3	0
21-Feb-97	Weekday	39	1	0	1	0	3	0	5	1	0	0	2	7	3	0
23-Feb-97	Reg Weekend	0	2	0	1	0	0	1	4	1	0	0	19	2	5	0
04-Mar-97	Weekday	22	2	7	0	0	0	0	4	0	0	1	33	15	1	0
05-Mar-97	Weekday	13	2	7	0	0	0	1	3	0	0	0	164	11	1	0
06-Mar-97	Weekday	27	0	3	0	0	0	4	3	1	0	0	36	26	0	5
07-Mar-97	Weekday	31	2	3	0	0	6	1	2	1	0	0	45	7	1	1
10-Mar-97	Weekday	0	2	2	0	0	0	1	5	1	0	0	32	0	0	0
18-Mar-97	Weekday	0	1	0	0	0	0	1	4	0	0	0	40	1	0	0
22-Mar-97	Reg Weekend	95	1	1	0	0	2	0	5	0	0	2	80	4	0	0
02-Apr-97	Weekday	29	2	1	0	0	10	0	5	0	0	0	21	1	0	0
05-Apr-97	Reg Weekend	61	0	1	0	0	53	0	0	0	0	4	19	0	1	0
06-Apr-97	Reg Weekend	28	0	2	0	0	16	1	2	0	0	0	24	1	1	0
30-Apr-97	Weekday	23	2	1	0	0	16	0	2	0	0	0	79	5	2	0
01-May-97	Weekday	7	0	1	0	0	0	2	8	0	0	0	31	2	1	0

Date	Type of Day	Zone I					Zone II					Zone III				
		People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
02-May-97	Weekday	36	2	0	1	0	0	2	2	1	0	2	33	4	2	0
14-Oct-97	Weekday	0	0	0	0	0	9	0	2	1	0	1	35	0	3	0
15-Oct-97	Weekday	20	1	1	0	0	0	2	5	2	0	0	73	4	4	0
31-Oct-97	Weekday	13	0	4	0	0	0	0	5	0	0	0	7	1	1	0
12-Nov-97	Weekday	11	1	1	0	0	0	7	8	1	0	0	42	4	2	3
13-Nov-97	Weekday	0	0	0	0	0	0	4	6	0	0	1	51	10	0	0
30-Nov-97	Holiday	27	0	2	1	0	0	0	1	1	0	0	105	0	3	0
12-Dec-97	Weekday	37	2	2	0	0	5	3	7	2	0	0	37	1	3	0
14-Dec-97	Reg Weekend	65	6	4	6	0	10	3	6	2	0	0	32	23	7	0
29-Dec-97	Holiday	83	1	1	0	0	58	0	2	2	0	0	194	27	4	0
08-Jan-98	Weekday	10	1	4	0	0	0	1	11	1	1	0	79	14	3	1
09-Jan-98	Weekday	2	2	2	1	0	0	0	6	2	0	0	80	6	2	1
12-Jan-98	Weekday	14	2	2	0	0	0	106	20	3	0	0	213	12	5	0
24-Jan-98	Reg Weekend	45	1	0	1	0	16	0	5	1	0	0	20	19	0	1
25-Jan-98	Reg Weekend	59	0	0	1	0	2	0	14	0	1	0	148	10	1	1
26-Jan-98	Weekday	24	0	0	0	0	5	0	2	0	1	0	114	17	4	0
27-Jan-98	Weekday	44	0	0	0	0	7	0	3	0	0	0	84	6	1	0
28-Jan-98	Weekday	30	1	3	0	0	3	2	5	0	0	0	69	9	2	1
07-Feb-98	Reg Weekend	56	3	0	0	0	0	0	2	0	0	0	12	4	0	1
08-Feb-98	Reg Weekend	61	0	1	0	0	0	0	2	0	0	3	31	15	0	0
09-Feb-98	Weekday	32	8	3	2	0	9	61	9	0	0	0	44	5	1	0
10-Feb-98	Weekday	37	0	0	0	0	1	4	5	2	0	1	356	3	2	0
11-Feb-98	Weekday	39	1	1	0	0	1	1	6	1	0	1	134	7	4	0
24-Feb-98	Weekday	10	2	4	0	0	8	0	4	1	0	2	15	2	0	1
25-Feb-98	Weekday	93	3	3	3	0	37	4	6	1	0	5	144	22	7	0
26-Feb-98	Weekday	37	0	3	3	0	28	0	3	1	0	0	67	3	3	0
27-Feb-98	Weekday	30	1	1	2	0	43	1	3	0	0	0	45	6	1	0
02-Mar-98	Weekday	76	0	0	0	0	22	0	9	0	0	3	21	9	1	0
07-Mar-98	Reg Weekend	64	0	0	0	0	15	1	2	0	0	7	109	0	2	0
08-Mar-98	Reg Weekend	61	0	0	0	0	18	2	3	0	0	0	31	6	1	0
09-Mar-98	Weekday	27	2	0	1	0	66	0	1	0	0	0	149	9	1	1
10-Mar-98	Weekday	12	0	0	0	0	29	0	3	0	1	0	60	5	3	0
11-Mar-98	Weekday	46	0	0	0	0	22	2	7	1	0	0	56	7	4	1
13-Mar-98	Weekday	32	0	1	0	0	0	0	4	0	0	0	28	7	1	0
23-Mar-98	Weekday	21	0	0	0	0	8	0	6	0	0	5	10	9	0	0
24-Mar-98	Weekday	99	1	0	0	0	6	1	3	0	0	0	27	7	0	0
25-Mar-98	Weekday	11	4	5	0	2	0	1	32	0	1	0	76	5	0	1
26-Mar-98	Weekday	0	0	0	0	0	19	1	1	0	0	34	12	2	0	0
28-Mar-98	Reg Weekend	29	1	6	0	0	2	4	4	0	0	0	13	4	0	0
05-Apr-98	Reg Weekend	65	2	0	0	0	2	0	1	2	0	0	6	11	0	0
06-Apr-98	Weekday	51	0	2	0	0	7	0	7	0	0	0	27	6	0	0
22-Apr-98	Weekday	101	2	0	0	0	0	2	3	0	0	0	2	0	0	0
24-Apr-98	Weekday	52	0	0	0	0	9	2	5	0	0	4	30	0	0	1
25-Apr-98	Reg Weekend	60	0	0	0	0	4	1	4	0	0	0	12	0	0	0
05-Oct-98	Weekday	68	2	7	0	0	5	4	11	0	1	2	76	4	2	0
02-Nov-98	Weekday	28	2	1	0	0	3	0	6	3	2	5	58	2	1	0
18-Nov-98	Weekday	43	0	3	0	1	1	0	1	0	0	0	115	12	1	0
19-Nov-98	Weekday	10	1	3	0	0	0	1	1	0	0	0	132	9	0	0
30-Nov-98	Weekday	12	0	0	0	0	2	1	5	0	0	0	102	13	2	1
01-Dec-98	Weekday	10	2	10	0	0	1	0	4	0	1	0	98	9	0	0
02-Dec-98	Weekday	15	0	5	0	0	7	1	5	0	0	0	38	8	0	1
03-Dec-98	Weekday	29	2	0	0	0	3	3	2	0	0	0	146	9	3	0
16-Dec-98	Weekday	17	1	2	4	0	3	3	3	1	0	0	140	19	3	0
17-Dec-98	Weekday	10	1	1	2	0	0	3	4	2	0	0	3	14	0	0
18-Dec-98	Weekday	9	1	0	1	1	0	2	12	3	0	0	109	13	5	0
19-Dec-98	Reg Weekend	17	1	4	2	0	4	3	3	4	0	0	106	6	0	0
29-Dec-98	Holiday	113	2	0	0	0	23	2	4	0	0	0	192	25	5	0
30-Dec-98	Holiday	81	0	0	1	0	46	0	0	1	0	0	140	20	3	0
31-Dec-98	Holiday	85	2	0	0	0	55	2	0	1	0	0	112	20	2	0
01-Jan-99	Holiday	79	4	0	2	0	56	1	0	0	0	0	81	6	0	0
02-Jan-99	Reg Weekend	77	5	0	1	0	33	7	2	0	0	0	90	11	1	0
13-Jan-99	Weekday	19	1	2	0	1	6	2	7	1	0	0	92	22	6	0
14-Jan-99	Weekday	33	6	0	1	0	7	0	9	1	1	0	127	21	4	1
16-Jan-99	Holiday	55	1	0	0	0	33	48	3	0	0	0	153	12	10	0
26-Jan-99	Weekday	84	0	0	1	0	7	2	5	1	0	0	290	30	1	0
28-Jan-99	Weekday	86	1	0	2	0	23	4	3	1	0	2	87	11	1	0
29-Jan-99	Weekday	0	1	0	0	0	32	4	1	1	0	0	165	14	1	0
31-Jan-99	Reg Weekend	28	2	0	2	0	19	3	2	1	0	0	108	1	1	0
12-Feb-99	Weekday	68	1	1	0	0	4	1	9	4	0	0	162	14	3	0
13-Feb-99	Holiday	38	1	0	1	0	10	0	8	1	0	0	195	11	2	0
14-Feb-99	Holiday	94	4	4	0	0	32	1	2	1	0	0	269	13	5	0
15-Feb-99	Holiday	84	2	0	0	0	21	1	3	0	0	0	112	14	0	0
25-Feb-99	Weekday	24	0	4	0	0	4	1	27	0	0	0	109	3	0	2

Date	Type of Day	Zone I					Zone II					Zone III				
		People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
01-Mar-99	Weekday	29	2	2	1	0	0	0	0	2	0	0	47	33	3	0
02-Mar-99	Weekday	14	0	8	0	0	0	8	17	0	0	0	59	10	3	0
13-Mar-99	Reg Weekend	85	2	0	0	0	18	1	10	0	0	0	39	13	1	0
15-Mar-99	Weekday	101	0	0	1	0	5	0	4	0	0	0	217	12	6	0
16-Mar-99	Weekday	31	3	5	0	0	14	1	3	3	0	0	119	33	3	0
17-Mar-99	Weekday	31	2	1	0	0	9	5	9	0	0	0	70	5	0	1
30-Mar-99	Weekday	75	0	0	0	0	1	1	15	0	0	0	50	17	0	0
31-Mar-99	Weekday	33	0	0	0	0	8	0	7	0	0	3	7	12	0	0
11-Apr-99	Reg Weekend	62	0	5	0	0	0	3	10	0	0	0	12	7	0	0
12-Apr-99	Weekday	14	2	3	0	0	2	0	13	0	0	0	36	4	0	0
13-Apr-99	Weekday	19	2	1	0	0	0	0	12	0	0	0	32	2	0	0
14-Apr-99	Weekday	97	2	2	2	0	17	5	11	0	0	0	189	6	1	0
15-Apr-99	Weekday	10	3	2	2	0	0	0	12	2	0	0	47	2	0	0
22-Apr-99	Weekday	16	1	0	0	0	0	0	5	0	0	0	39	3	0	0
23-Apr-99	Weekday	27	1	0	0	0	29	3	9	0	0	0	29	2	0	0
24-Apr-99	Reg Weekend	33	1	0	0	0	9	0	5	0	0	0	35	1	1	0
25-Apr-99	Reg Weekend	58	0	0	0	0	15	0	1	0	0	0	145	6	1	0
26-Apr-99	Weekday	11	2	0	0	0	8	3	9	0	0	2	2	0	1	0
22-May-99	Reg Weekend	16	1	0	0	0	3	1	0	0	0	1	1	0	4	0
23-Oct-99	Reg Weekend	67	1	0	0	0	38	1	1	1	0	0	74	4	1	0
24-Oct-99	Reg Weekend	53	1	0	0	0	10	0	1	0	0	0	122	8	5	0
06-Nov-99	Reg Weekend	33	3	1	0	0	6	1	7	4	0	8	113	2	1	0
07-Nov-99	Reg Weekend	58	2	1	2	0	7	1	1	2	0	0	194	9	5	2
08-Nov-99	Weekday	5	4	4	1	0	0	1	1	2	0	0	86	6	5	0
20-Nov-99	Reg Weekend	29	1	0	2	0	3	4	1	4	0	2	4	13	4	0
21-Nov-99	Reg Weekend	54	3	0	1	0	25	1	3	3	0	1	4	8	4	0
22-Nov-99	Weekday	34	1	0	1	0	12	1	4	1	0	2	10	7	5	1
23-Nov-99	Weekday	40	2	4	4	0	22	6	1	2	0	0	12	10	6	0
05-Dec-99	Reg Weekend	41	0	0	1	0	12	2	1	4	0	1	7	14	8	2
06-Dec-99	Weekday	22	1	0	2	0	0	1	3	1	0	0	5	14	1	1
07-Dec-99	Weekday	13	1	0	1	0	10	0	5	3	0	0	9	20	4	1
08-Dec-99	Weekday	13	0	0	1	0	0	5	14	4	0	0	12	9	7	1
19-Dec-99	Reg Weekend	23	1	0	0	0	9	2	3	4	0	0	165	14	6	0
20-Dec-99	Weekday	36	3	0	0	0	12	3	5	2	0	0	113	4	3	0
21-Dec-99	Weekday	45	2	0	0	0	15	0	2	0	0	2	42	14	5	0
22-Dec-99	Weekday	143	1	0	0	0	37	0	0	1	0	1	85	13	4	0
03-Jan-00	Weekday	28	2	0	2	0	8	0	1	2	0	0	7	10	3	0
04-Jan-00	Weekday	25	4	0	2	0	6	1	2	1	0	0	13	8	5	0
05-Jan-00	Weekday	25	1	14	0	0	5	0	2	1	0	0	6	6	3	0
06-Jan-00	Weekday	23	3	7	1	0	8	3	0	0	0	0	32	8	3	0
17-Jan-00	Holiday	88	2	0	1	0	25	2	3	2	0	0	4	11	6	0
18-Jan-00	Weekday	75	5	0	1	0	10	6	0	2	0	0	8	9	4	0
19-Jan-00	Weekday	24	1	0	5	0	12	2	0	2	0	0	14	6	4	0
20-Jan-00	Weekday	66	3	0	1	0	30	0	0	2	0	0	6	5	6	0
21-Jan-00	Weekday	50	3	0	2	0	28	0	0	0	0	0	4	8	4	0
01-Feb-00	Weekday	12	2	15	0	0	2	0	0	1	0	0	8	6	7	0
02-Feb-00	Weekday	19	1	0	1	0	0	0	13	2	0	0	4	4	7	0
03-Feb-00	Weekday	17	1	1	1	0	5	2	0	1	1	0	10	6	4	0
04-Feb-00	Weekday	32	6	1	2	0	7	1	3	1	0	1	4	5	9	1
05-Feb-00	Reg Weekend	45	5	1	1	0	41	0	0	3	0	2	9	3	10	0
15-Feb-00	Weekday	22	0	0	1	0	2	0	0	0	0	0	4	2	5	0
16-Feb-00	Weekday	16	2	0	1	0	12	2	1	6	0	0	2	3	3	0
17-Feb-00	Weekday	55	0	0	1	0	4	1	0	4	0	0	5	0	8	0
18-Feb-00	Weekday	33	3	0	1	0	18	1	1	6	0	0	9	2	8	0
19-Feb-00	Holiday	56	1	1	0	0	44	0	0	0	0	0	2	4	5	0
01-Mar-00	Weekday	15	1	2	0	0	22	0	1	1	0	0	4	10	3	0
02-Mar-00	Weekday	32	1	0	0	0	0	2	12	2	0	0	1	0	5	0
03-Mar-00	Weekday	37	0	1	2	0	7	2	2	0	0	0	0	15	4	2
04-Mar-00	Reg Weekend	51	1	1	0	0	26	0	4	1	0	3	2	16	5	2
05-Mar-00	Reg Weekend	49	0	3	0	0	5	0	3	0	0	0	6	12	0	2
06-Mar-00	Weekday	44	2	3	0	0	3	0	16	2	0	1	4	4	1	1
16-Mar-00	Weekday	115	0	0	0	0	21	0	0	0	0	0	7	12	8	0
17-Mar-00	Weekday	35	0	0	0	0	40	0	0	1	0	0	7	17	6	0
18-Mar-00	Reg Weekend	87	0	0	0	0	44	0	0	0	0	2	3	8	5	0
19-Mar-00	Reg Weekend	80	1	0	0	0	19	0	0	0	0	1	3	12	5	0
20-Mar-00	Weekday	25	1	0	0	0	6	0	3	3	0	0	2	3	4	0
30-Mar-00	Weekday	44	0	0	1	0	18	0	2	1	0	2	1	6	0	0
31-Mar-00	Weekday	37	1	0	1	0	15	2	6	0	0	0	3	5	3	0
01-Apr-00	Reg Weekend	59	1	0	0	0	21	0	1	0	0	0	3	5	3	0
02-Apr-00	Reg Weekend	98	1	0	2	0	23	1	1	1	0	1	2	23	5	0
03-Apr-00	Weekday	17	2	0	0	0	1	1	0	1	0	0	4	10	5	0
11-Apr-00	Weekday	59	0	0	0	0	11	2	6	7	0	0	8	1	0	0
12-Apr-00	Weekday	104	3	0	0	0	8	0	7	2	1	10	11	1	0	0

		Zone I					Zone II					Zone III				
Date	Type of Day	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
14-Apr-00	Weekday	22	1	0	2	0	5	1	3	1	0	0	0	0	0	0
16-Apr-00	Reg Weekend	60	1	0	1	0	19	0	0	1	0	0	3	5	3	0
17-Apr-00	Weekday	35	4	1	1	0	14	2	0	1	0	0	0	2	0	0
10-May-00	Weekday	9	1	0	0	1	0	0	1	0	0	0	1	2	1	1
11-May-00	Weekday	13	1	0	1	0	0	0	2	0	0	0	2	1	3	0
12-May-00	Weekday	59	1	0	0	0	3	1	1	1	0	2	1	3	0	0
25-Oct-00	Weekday	9	0	0	1	0	1	0	3	0	0	0	9	6	2	0
26-Oct-00	Weekday	19	1	0	0	0	18	1	9	3	0	2	9	9	2	1
10-Nov-00	Weekday	26	1	1	0	0	11	0	5	0	0	0	11	5	4	0
11-Nov-00	Holiday	34	4	3	1	0	25	2	4	3	0	9	11	6	3	0
12-Nov-00	Holiday	23	2	1	0	2	52	2	9	1	0	0	7	5	8	1
23-Nov-00	Holiday	71	2	0	1	0	7	1	0	1	0	0	32	11	4	0
24-Nov-00	Holiday	49	0	0	4	0	4	3	5	2	0	0	1	21	4	0
08-Dec-00	Weekday	21	1	2	1	0	4	1	5	1	0	0	0	19	2	0
09-Dec-00	Reg Weekend	40	2	0	0	0	17	1	1	3	0	0	3	14	2	0
10-Dec-00	Reg Weekend	32	1	0	2	0	29	2	4	1	0	2	8	17	4	0
22-Dec-00	Weekday	70	2	30	2	0	6	1	8	4	0	2	1	32	4	0
23-Dec-00	Reg Weekend	52	1	0	1	0	8	0	3	0	0	0	2	14	4	0
24-Dec-00	Holiday	78	1	0	2	0	8	1	2	0	0	0	4	16	6	5
25-Dec-00	Holiday	62	1	0	3	0	19	0	13	1	0	0	2	40	6	0
06-Jan-01	Reg Weekend	49	0	0	0	0	19	2	1	0	0	0	2	40	5	0
07-Jan-01	Reg Weekend	106	1	0	3	0	37	0	0	2	0	0	3	29	8	0
08-Jan-01	Weekday	29	3	1	2	0	9	3	4	0	0	0	2	9	0	0
09-Jan-01	Weekday	58	1	1	2	0	55	0	0	1	0	0	3	8	5	0
19-Jan-01	Weekday	7	0	1	0	0	0	2	8	0	5	0	1	4	0	9
20-Jan-01	Reg Weekend	62	2	0	0	0	2	0	3	0	0	0	0	8	4	0
21-Jan-01	Reg Weekend	70	2	0	1	0	31	2	0	1	0	0	5	21	2	0
23-Jan-01	Weekday	34	2	1	2	0	7	0	8	1	0	0	3	11	3	0
24-Jan-01	Weekday	16	3	25	2	0	0	2	7	7	0	0	44	19	7	0
04-Feb-01	Reg Weekend	53	0	0	0	0	19	0	0	3	0	4	2	9	4	3
07-Feb-01	Weekday	35	1	2	2	0	26	0	0	1	0	0	2	5	1	0
08-Feb-01	Weekday	37	1	3	0	0	45	0	0	0	0	0	6	6	3	0
17-Feb-01	Holiday	67	1	1	0	0	8	0	1	0	0	5	2	11	7	0
18-Feb-01	Holiday	100	0	0	0	0	19	1	0	0	0	0	3	5	8	0
19-Feb-01	Holiday	95	1	2	0	0	42	0	0	0	0	5	3	9	1	0
20-Feb-01	Weekday	33	0	0	0	0	0	0	0	0	0	0	0	6	1	0
22-Feb-01	Weekday	36	0	2	0	0	8	2	7	0	0	0	4	3	3	0
23-Feb-01	Weekday	0	2	8	5	0	5	6	9	0	0	17	1	2	0	0
06-Mar-01	Weekday	4	2	2	2	0	8	0	0	0	0	17	0	2	0	0
09-Mar-01	Weekday	23	1	1	0	0	0	1	3	0	0	0	4	2	4	0
10-Mar-01	Reg Weekend	68	1	1	0	0	11	0	2	0	1	0	11	7	3	0
19-Mar-01	Weekday	12	2	3	0	0	11	0	24	2	0	0	0	5	1	0
20-Mar-01	Weekday	101	0	2	0	1	9	5	10	1	1	0	0	7	1	0
21-Mar-01	Weekday	29	1	5	0	0	0	1	8	1	0	0	4	12	1	0
22-Mar-01	Weekday	50	0	0	0	0	0	2	3	1	0	0	2	11	0	0
23-Mar-01	Weekday	65	0	0	0	0	10	0	0	0	0	0	9	12	2	0
24-Mar-01	Reg Weekend	0	11	19	1	0	25	1	0	0	0	61	0	0	0	0
03-Apr-01	Weekday	64	1	2	0	0	69	1	0	1	0	0	2	5	1	0
05-Apr-01	Weekday	49	2	0	0	0	14	0	0	0	0	0	2	5	1	0
06-Apr-01	Weekday	40	1	1	0	0	11	3	0	0	0	0	16	4	1	0
07-Apr-01	Reg Weekend	14	0	6	0	0	3	0	6	0	0	0	5	4	2	0
19-Apr-01	Weekday	46	0	4	0	0	49	0	2	2	0	0	2	9	3	2
30-Apr-01	Weekday	75	0	2	0	0	8	0	1	1	0	0	10	2	0	0
01-May-01	Weekday	87	2	0	0	0	22	1	9	0	0	0	1	2	2	0
03-May-01	Weekday	14	1	0	1	0	0	1	0	0	0	0	3	5	1	0
04-May-01	Weekday	20	0	0	0	0	1	0	1	0	0	0	4	2	1	0
05-May-01	Reg Weekend	69	1	0	0	0	20	0	1	0	0	0	1	4	2	1
15-Oct-01	Weekday	3	0	0	0	0	2	1	2	3	0	0	10	5	0	0
16-Oct-01	Weekday	26	3	0	1	0	9	0	2	0	0	2	3	1	1	0
01-Nov-01	Weekday	14	0	13	0	1	1	1	9	2	0	0	30	9	4	0
12-Nov-01	Holiday	77	0	0	0	0	7	0	4	0	0	0	6	9	0	0
14-Nov-01	Weekday	24	2	1	0	0	20	0	2	0	0	0	3	7	1	0
15-Nov-01	Weekday	58	1	1	2	0	7	0	6	0	0	0	2	13	4	0
28-Nov-01	Weekday	19	2	1	0	0	1	1	37	2	0	0	7	5	11	0
29-Nov-01	Weekday	0	2	1	0	0	0	8	13	1	0	0	10	11	4	0
30-Nov-01	Weekday	28	0	0	2	0	5	0	0	1	0	0	3	4	5	0
01-Dec-01	Reg Weekend	44	2	0	1	0	0	0	0	1	0	0	13	17	5	0
11-Dec-01	Weekday	17	1	1	1	1	5	0	9	0	0	0	3	13	5	0
12-Dec-01	Weekday	10	1	0	1	0	24	1	2	3	0	5	3	41	12	0
13-Dec-01	Weekday	15	3	0	0	0	0	2	29	1	0	4	5	23	7	1
14-Dec-01	Weekday	0	1	0	1	0	0	0	2	0	0	0	6	28	1	0
27-Dec-01	Holiday	16	1	0	0	0	27	0	0	2	0	0	2	25	5	1
28-Dec-01	Holiday	54	3	3	1	0	11	2	3	0	0	0	15	13	4	1

Date	Type of Day	Zone I					Zone II					Zone III				
		People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
29-Dec-01	Holiday	85	1	0	1	0	44	2	0	0	0	0	2	21	4	0
30-Dec-01	Holiday	69	1	0	0	0	90	3	2	0	0	0	13	13	6	0
09-Jan-02	Weekday	0	0	0	0	0	0	1	5	0	0	0	0	10	0	0
10-Jan-02	Weekday	27	2	0	1	0	2	0	5	0	0	0	9	18	2	1
12-Jan-02	Reg Weekend	30	0	0	0	0	46	0	0	2	0	0	10	12	5	0
13-Jan-02	Reg Weekend	71	2	0	0	0	19	2	4	0	0	1	12	7	11	0
25-Jan-02	Weekday	15	1	0	1	0	0	2	2	1	1	2	6	18	3	7
26-Jan-02	Reg Weekend	100	2	0	0	0	39	1	0	1	0	0	16	14	9	1
27-Jan-02	Reg Weekend	84	4	10	2	0	51	1	0	0	0	0	12	17	8	1
28-Jan-02	Weekday	22	1	1	3	0	10	1	0	0	0	0	55	1	4	0
07-Feb-02	Weekday	12	1	4	2	0	8	1	4	2	0	0	3	7	3	0
08-Feb-02	Weekday	27	0	1	1	0	26	0	0	0	0	0	2	6	4	11
09-Feb-02	Reg Weekend	59	2	1	1	0	39	0	0	0	0	3	4	18	7	0
10-Feb-02	Reg Weekend	55	1	0	0	0	17	1	0	1	0	0	7	6	9	0
11-Feb-02	Weekday	55	3	4	1	0	6	1	5	0	0	0	4	6	5	5
12-Feb-02	Weekday	22	0	2	1	0	5	0	3	0	0	7	9	13	7	0
22-Feb-02	Weekday	62	1	2	0	0	28	1	11	0	0	2	10	11	2	15
23-Feb-02	Reg Weekend	50	1	0	0	0	15	0	0	0	0	0	26	7	2	0
24-Feb-02	Reg Weekend	87	2	0	0	0	19	1	0	0	0	0	22	20	0	0
25-Feb-02	Weekday	46	0	0	1	0	32	4	2	0	2	1	7	12	2	3
26-Feb-02	Weekday	18	2	3	0	1	35	0	9	0	1	11	5	12	2	0
27-Feb-02	Weekday	45	1	3	1	0	7	1	3	1	0	0	4	13	4	3
07-Mar-02	Weekday	71	0	3	0	0	2	0	2	1	0	0	5	11	6	0
08-Mar-02	Weekday	52	1	0	1	0	6	0	10	1	0	6	3	4	0	0
09-Mar-02	Reg Weekend	41	0	3	0	0	21	0	2	1	0	2	1	17	1	11
11-Mar-02	Weekday	67	0	0	0	1	0	0	0	2	1	0	24	13	5	0
12-Mar-02	Weekday	49	2	5	0	0	7	1	0	0	2	2	3	24	4	8
13-Mar-02	Weekday	19	2	0	0	0	0	0	4	0	0	0	3	4	0	0
24-Mar-02	Reg Weekend	43	0	0	0	0	22	0	0	0	0	1	11	4	3	0
25-Mar-02	Weekday	80	2	0	0	0	12	2	0	3	0	6	12	2	1	0
26-Mar-02	Weekday	77	2	0	1	0	90	8	4	1	0	5	9	6	4	6
28-Mar-02	Weekday	71	0	0	0	0	8	0	1	1	0	1	11	1	3	3
05-Apr-02	Weekday	72	0	0	0	0	5	0	3	0	0	0	2	1	0	0
06-Apr-02	Reg Weekend	34	4	0	0	0	15	2	1	0	0	0	15	1	5	0
08-Apr-02	Weekday	36	1	0	0	0	17	0	0	1	0	0	2	2	1	0
09-Apr-02	Weekday	29	2	0	2	0	9	0	0	0	0	0	1	3	1	0
10-Apr-02	Weekday	15	2	9	0	0	10	0	2	1	0	0	1	4	2	0
20-Apr-02	Reg Weekend	42	0	0	0	0	0	1	3	0	0	0	0	0	5	0
21-Apr-02	Reg Weekend	20	1	0	0	0	18	0	1	0	0	0	0	0	3	0
22-Apr-02	Weekday	35	0	0	0	0	18	0	1	0	0	1	4	1	3	0
23-Apr-02	Weekday	26	3	0	0	0	3	1	0	2	0	0	6	4	5	0
24-Apr-02	Weekday	11	2	1	1	0	0	1	2	2	0	0	0	1	4	1
19-May-02	Reg Weekend	17	0	0	0	0	4	0	2	0	0	3	0	0	2	0
02-Nov-02	Reg Weekend	34	2	2	0	0	5	0	5	0	1	2	7	30	0	0
03-Nov-02	Reg Weekend	73	2	0	0	0	14	0	4	1	0	7	1	29	0	0
04-Nov-02	Weekday	23	3	2	1	1	4	2	0	0	0	6	16	10	2	0
05-Nov-02	Weekday	35	1	2	0	1	5	4	1	0	0	2	3	26	3	0
18-Nov-02	Weekday	14	2	1	0	0	0	19	17	0	0	0	0	35	1	0
19-Nov-02	Weekday	17	1	0	1	0	2	3	0	1	0	0	4	44	2	0
20-Nov-02	Weekday	29	2	3	1	0	2	0	16	4	0	0	23	18	3	0
01-Dec-02	Holiday	37	1	3	0	0	5	1	13	0	0	0	12	13	9	0
03-Dec-02	Weekday	28	1	0	0	0	6	0	0	0	0	1	11	17	5	2
18-Dec-02	Weekday	15	0	1	0	0	4	1	2	1	0	0	7	24	2	0
19-Dec-02	Weekday	17	1	0	0	1	2	0	7	0	0	0	4	23	3	1
29-Dec-02	Holiday	52	1	0	0	0	6	3	6	2	0	0	5	6	1	1
30-Dec-02	Holiday	72	0	0	0	0	22	1	23	0	0	0	2	15	5	1
31-Dec-02	Holiday	79	1	0	0	0	54	6	0	0	0	0	28	24	1	0
01-Jan-03	Holiday	152	2	0	0	0	53	3	0	0	0	2	15	29	6	0
02-Jan-03	Weekday	87	3	1	0	0	25	11	0	1	0	4	97	13	6	0
14-Jan-03	Weekday	20	2	1	0	0	9	0	0	1	0	0	9	26	1	0
15-Jan-03	Weekday	14	1	0	0	0	8	1	0	0	0	0	11	7	5	0
16-Jan-03	Weekday	23	2	1	0	0	5	2	2	1	0	0	24	35	9	0
17-Jan-03	Weekday	50	1	0	0	0	29	0	0	0	0	4	8	30	5	0
18-Jan-03	Holiday	115	1	0	0	0	30	2	1	2	0	1	4	16	7	0
27-Jan-03	Weekday	63	0	1	0	0	5	1	2	1	0	0	4	41	3	0
28-Jan-03	Weekday	16	3	1	2	0	17	1	3	0	0	0	9	36	3	0
29-Jan-03	Weekday	59	2	1	2	0	19	0	0	2	0	0	7	19	1	0
30-Jan-03	Weekday	53	1	0	1	0	11	0	0	1	0	4	13	46	3	0
31-Jan-03	Weekday	58	1	1	1	0	31	2	2	0	0	3	5	26	7	0
01-Feb-03	Reg Weekend	149	2	2	0	0	29	0	7	0	0	6	6	16	1	0
13-Feb-03	Weekday	21	0	0	0	0	6	3	21	2	0	0	5	22	3	1
14-Feb-03	Weekday	33	1	0	0	0	7	0	0	0	0	0	2	24	5	0
15-Feb-03	Holiday	107	1	0	1	0	38	0	0	0	0	0	5	20	6	0

Date	Type of Day	Zone I					Zone II					Zone III				
		People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
16-Feb-03	Holiday	108	3	1	1	0	31	3	0	0	0	0	31	18	4	0
17-Feb-03	Holiday	95	0	0	0	0	40	2	0	1	0	0	19	25	1	0
24-Feb-03	Weekday	45	0	0	0	0	0	0	5	0	0	0	0	15	1	0
26-Feb-03	Weekday	8	1	2	0	0	3	1	10	0	0	0	6	25	4	0
27-Feb-03	Weekday	27	0	3	0	0	4	0	0	1	0	0	7	33	3	2
28-Feb-03	Weekday	45	1	2	0	0	18	0	0	1	0	2	5	15	4	0
01-Mar-03	Reg Weekend	95	2	0	0	0	8	0	1	0	0	1	11	21	3	0
02-Mar-03	Reg Weekend	70	1	0	1	0	42	0	0	0	0	0	69	29	5	0
03-Mar-03	Weekday	12	1	3	1	0	7	0	5	1	0	0	4	23	3	0
13-Mar-03	Weekday	83	0	1	0	0	0	0	7	1	0	0	5	18	3	0
14-Mar-03	Weekday	35	0	1	0	0	9	3	9	3	0	0	5	18	6	0
15-Mar-03	Reg Weekend	25	0	3	1	0	0	1	1	0	0	0	2	4	0	1
16-Mar-03	Reg Weekend	37	6	0	0	0	23	1	1	0	0	4	2	21	5	0
17-Mar-03	Weekday	30	0	0	0	0	2	1	5	0	0	5	5	3	1	1
18-Mar-03	Weekday	55	2	0	0	0	32	0	0	1	0	1	6	17	4	6
19-Mar-03	Weekday	56	3	1	0	0	5	1	2	0	0	0	1	7	2	0
25-Mar-03	Weekday	52	0	2	0	0	4	7	12	2	0	0	17	8	2	0
26-Mar-03	Weekday	91	3	0	0	0	1	0	1	2	0	0	9	24	9	0
27-Mar-03	Weekday	47	3	2	1	0	10	1	2	1	0	1	10	13	4	0
28-Mar-03	Weekday	65	6	0	1	0	22	4	0	1	0	4	7	18	6	0
29-Mar-03	Reg Weekend	82	2	1	0	0	28	1	8	1	0	1	16	28	5	0
30-Mar-03	Reg Weekend	136	4	1	0	0	9	2	0	4	0	2	12	24	3	0
31-Mar-03	Weekday	21	4	0	0	0	7	0	5	2	0	3	2	17	4	0
11-Apr-03	Weekday	40	2	2	1	0	8	0	4	1	0	0	2	6	4	0
12-Apr-03	Reg Weekend	82	4	4	0	0	18	1	11	0	0	0	4	5	7	0
13-Apr-03	Reg Weekend	61	4	3	0	0	5	3	7	1	0	2	2	7	4	0
14-Apr-03	Weekday	23	2	13	0	0	6	11	10	0	0	0	0	16	0	0
15-Apr-03	Weekday	81	3	1	0	0	3	1	6	2	0	0	4	23	2	0
16-Apr-03	Weekday	174	3	2	0	0	9	2	5	0	0	0	4	20	1	0
23-Apr-03	Weekday	75	1	2	0	0	12	1	9	1	0	3	0	0	5	1
24-Apr-03	Weekday	45	2	0	0	0	5	2	4	4	0	0	5	8	5	0
25-Apr-03	Weekday	43	3	0	0	0	8	0	6	1	0	3	2	6	10	0
27-Apr-03	Reg Weekend	58	0	0	0	0	4	0	4	4	0	0	3	14	5	0
10-May-03	Reg Weekend	42	1	1	0	0	1	1	2	3	0	0	1	0	3	0
11-May-03	Reg Weekend	77	3	0	1	0	16	5	0	3	0	0	1	0	3	0
12-May-03	Weekday	15	1	0	0	0	0	3	0	1	0	0	4	1	3	0
22-May-03	Weekday	18	0	0	0	0	0	4	0	2	0	0	1	0	2	0
25-Oct-03	Reg Weekend	76	2	8	0	0	61	2	17	0	0	0	10	1	3	0
26-Oct-03	Reg Weekend	26	3	16	0	0	12	3	6	0	0	3	136	1	2	0
07-Nov-03	Weekday	16	4	43	2	0	0	0	7	1	0	0	4	2	6	0
08-Nov-03	Reg Weekend	105	2	1	1	0	7	1	22	4	1	0	17	1	9	0
09-Nov-03	Reg Weekend	87	2	1	1	0	12	1	0	4	0	0	6	46	7	0
22-Nov-03	Reg Weekend	70	3	0	0	0	20	0	0	2	0	6	23	0	4	0
23-Nov-03	Reg Weekend	80	3	18	1	0	31	0	0	1	0	3	15	0	6	0
24-Nov-03	Weekday	46	3	7	2	0	15	4	0	1	0	2	7	1	3	0
05-Dec-03	Weekday	11	3	10	2	0	0	2	13	0	0	0	6	1	1	0
07-Dec-03	Reg Weekend	15	2	21	0	0	1	1	4	1	0	3	1	0	4	1
08-Dec-03	Weekday	9	3	1	0	0	1	1	1	2	0	1	1	0	11	1
19-Dec-03	Weekday	7	3	5	0	0	0	1	2	2	0	0	4	2	6	0
20-Dec-03	Reg Weekend	23	1	5	0	0	10	0	21	2	1	1	2	3	6	0
21-Dec-03	Reg Weekend	58	3	2	0	0	13	0	0	0	0	2	9	0	6	0
22-Dec-03	Weekday	42	3	0	0	0	38	1	1	1	0	0	74	4	10	0
23-Dec-03	Weekday	36	1	0	2	0	0	9	3	2	0	5	20	0	9	0
03-Jan-04	Reg Weekend	98	2	0	1	0	16	1	3	1	1	0	10	1	6	1
04-Jan-04	Reg Weekend	49	2	2	2	0	8	3	2	0	0	0	6	0	4	0
05-Jan-04	Weekday	44	3	1	4	0	7	4	1	1	0	0	12	0	5	0
06-Jan-04	Weekday	16	64	1	11	0	0	12	1	0	0	1	13	0	4	0
07-Jan-04	Weekday	14	3	1	1	0	0	2	0	2	0	1	8	0	5	0
08-Jan-04	Weekday	45	1	0	6	0	23	2	2	3	0	0	9	3	8	0
17-Jan-04	Holiday	53	0	0	1	0	0	1	6	1	0	0	3	2	7	0
18-Jan-04	Holiday	75	2	0	0	0	31	0	0	2	0	1	1	1	9	0
19-Jan-04	Holiday	138	3	0	0	0	28	1	0	2	0	3	14	2	5	0
20-Jan-04	Weekday	36	0	0	2	0	5	2	0	0	0	4	9	1	5	0
21-Jan-04	Weekday	23	4	3	6	0	16	2	0	0	0	4	5	0	5	0
22-Jan-04	Weekday	31	3	14	7	0	3	3	1	3	1	1	6	3	4	0
01-Feb-04	Reg Weekend	31	1	0	0	0	22	0	0	3	0	2	5	5	5	0
02-Feb-04	Weekday	10	0	0	2	0	0	3	9	2	0	0	22	3	11	0
03-Feb-04	Weekday	8	3	2	2	0	0	2	0	1	0	2	2	0	3	0
04-Feb-04	Weekday	14	4	1	5	0	3	2	3	1	0	2	3	0	5	0
05-Feb-04	Weekday	12	3	6	2	0	0	0	2	1	0	2	12	5	7	0
06-Feb-04	Weekday	34	1	1	3	0	0	2	4	3	0	1	2	0	5	0
07-Feb-04	Reg Weekend	80	3	2	2	0	19	0	0	5	0	0	5	9	2	0
13-Feb-04	Weekday	38	2	4	0	0	31	2	0	0	1	0	90	1	3	1

		Zone I					Zone II					Zone III				
Date	Type of Day	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds	People	Sea Birds	Shore Birds	Wading Birds	Other Birds
15-Feb-04	Holiday	132	3	0	2	0	9	0	2	1	0	0	1	0	6	0
18-Feb-04	Weekday	58	2	1	3	0	2	0	1	4	0	0	12	0	3	0
19-Feb-04	Weekday	47	4	1	2	0	24	0	0	1	0	2	4	2	7	0
20-Feb-04	Weekday	40	3	2	2	0	8	4	3	2	2	0	14	0	8	0
21-Feb-04	Reg Weekend	34	1	1	1	0	3	1	4	0	0	0	106	0	3	0
01-Mar-04	Weekday	26	2	0	0	0	6	0	1	2	0	0	1	0	5	1
02-Mar-04	Weekday	34	1	1	1	0	0	1	3	1	0	0	0	0	6	0
03-Mar-04	Weekday	6	2	1	0	0	0	1	5	3	0	0	1	0	4	0
04-Mar-04	Weekday	30	2	1	0	0	25	0	2	0	0	0	0	0	4	0
05-Mar-04	Weekday	59	3	0	2	0	3	0	1	0	0	0	5	0	4	0
06-Mar-04	Reg Weekend	134	3	0	1	0	10	4	1	3	0	1	2	0	6	0
07-Mar-04	Reg Weekend	73	3	4	1	0	24	0	0	2	0	0	1	0	5	0
08-Mar-04	Weekday	22	1	2	0	0	2	0	0	1	0	0	3	0	2	0
14-Mar-04	Reg Weekend	45	1	1	1	0	0	4	1	3	0	3	0	1	4	0
16-Mar-04	Weekday	89	0	0	0	0	16	2	2	3	0	3	1	0	6	0
17-Mar-04	Weekday	38	3	0	1	0	43	2	1	1	0	4	7	0	9	0
18-Mar-04	Weekday	57	2	1	0	0	8	1	2	7	0	0	5	0	4	0
19-Mar-04	Weekday	37	1	2	0	0	19	0	1	2	0	3	0	0	4	0
20-Mar-04	Reg Weekend	70	0	3	0	0	28	1	1	4	2	0	2	0	6	0
21-Mar-04	Reg Weekend	71	2	1	1	0	27	1	5	0	0	0	2	0	6	0
31-Mar-04	Weekday	93	0	0	0	0	0	0	6	1	0	0	3	0	3	0
01-Apr-04	Weekday	0	0	0	0	0	2	0	2	0	0	0	5	5	4	0
02-Apr-04	Weekday	111	0	0	0	0	4	1	2	0	0	0	1	3	2	0
03-Apr-04	Reg Weekend	102	0	1	0	0	0	0	0	0	0	0	2	0	4	0
04-Apr-04	Reg Weekend	87	2	2	1	0	17	0	3	1	0	0	2	2	3	0
05-Apr-04	Weekday	64	1	3	1	0	23	2	1	1	1	0	0	9	1	0
11-Apr-04	Reg Weekend	8	1	3	0	0	7	2	2	2	0	0	0	4	3	0
12-Apr-04	Weekday	20	1	1	0	0	6	0	6	3	0	0	1	2	6	0
13-Apr-04	Weekday	45	0	0	0	0	18	2	9	2	0	0	2	6	7	0
14-Apr-04	Weekday	19	0	0	0	0	11	2	4	2	0	0	2	4	5	0
15-Apr-04	Weekday	44	0	0	0	0	28	0	1	3	0	0	3	6	0	0
16-Apr-04	Weekday	41	0	1	1	0	11	2	3	2	0	1	3	5	2	0
17-Apr-04	Reg Weekend	12	0	3	1	0	2	1	12	2	0	0	2	14	3	0
10-May-04	Weekday	5	2	1	0	0	0	1	2	2	0	0	2	1	1	0
11-May-04	Weekday	6	0	0	1	0	4	0	0	2	1	2	5	2	8	0
12-May-04	Weekday	77	0	0	0	0	0	2	0	3	0	3	0	0	8	0

Appendix E: Tidal Height Study by L.A. Victoria

Laurie Anne Victoria
SDSU Special Study
Spring 2004

Summary of Study

Cabrillo National Monument has an ongoing intertidal monitoring program. This program monitors over 130 fixed points in the park twice per year (Fall and Spring). The scope of the study was to measure the height of the substrate at the fixed points using a laser leveler. At the same time, the latitude and longitude of each point was measured using the Trimble GPS system. The data was collected on several different occasions during February and March 2004 when the tide was at its lowest point for the month.

A laser leveler is a device that indirectly measures the height of the substrate. The device sits on a tripod and shoots out a beam in a 360° rotation. An eight-foot long ruler was placed perpendicular to the plot surface that was to be measured and another device that can detect the laser beam is run up and down the ruler until it connects with the beam. This height was recorded on data sheets. Several points could be measured with the same beam as long as there was direct contact with it. At the same time that the points were being measured, the stillwater height of the tide was also recorded in the same fashion. One to three different stillwater heights were recorded at different times to ensure a more accurate measurement. These heights and times were also recorded on data sheets. This was done for all the points in the tidepool area.

The low tide measurement was obtained from the NOAA website for verified coastline data. The closest data collection point for actual tidal heights was the San Diego Station (9410170) located at the following location:

> To reach the tidal bench marks, proceed south on I-5 to 10th Avenue exit Downtown San Diego. Turn right on Broadway and proceed to water front (Broadway Pier). Turn left at Harbor Drive; then right to the southern face of the Navy Pier (one pier south of Broadway Pier). The tidal bench marks are located on the navy facility in the vicinity. Tide gauge is located in room 5A of the Naval supply center.

To be sure that these data were within our accuracy requirements, the predicted tidal heights for this San Diego location and the study area were compared. The difference in measurements for this comparison was less than one inch and fell with the range of accuracy for the study data.

In order to obtain the substrate heights the following formula (obtained from UCSC) was used:

CALIBRATE:
Stillwater Measurement – Low Tide Measurement = Conversion Factor
Remember that subtracting a negative tide is the same as adding!!!
Stillwater Measurement – Conversion Factor = Low Tide Measurement
Plot Measurement – Conversion Factor = Substrate Height

Plot Measurement- this measurement refers to the height of stadia pole as you move along transect line or study plot

Stillwater Measurement- this measurement refers to the height of stadia pole at the waters edge. Record the time that this measurement was taken. Take several Stillwater measurements at different edges along the bench to assure accuracy. This measurement is subject to your belief of where the tide actually is still and topographic features such as pools and slope may confuse your perception.

Low Tide Measurement- look up the actual height of the tide on a tide table for the time and location of the Stillwater measurement

After all these data were collected, the values were entered on an Excel Spreadsheet. Several data checks were done to ensure proper input of the data. The points were labeled according to the system used by Cabrillo National Monument. There are three Zones I, II, III and within each zone are 17 photoplots (Po, Pe, M, B), 6 line transects (T, G, K) and 6 circular owl limpet transects (L). The calibration was done for each point and the average of each calibration was used as the substrate height for the points. The standard deviation for the measurements was also calculated. When the data were analyzed it was determined that the point height for Zone II M2 was not recorded correctly on the original field sheets, this value is omitted from the final data. It was also determined that the second substrate height on February 8th at 4:20pm was not accurate and this value was excluded when calculating the average substrate height and the standard deviation.

The GPS location of each point was also recorded. The points were also labeled according the Cabrillo labeling system. These labels were entered in the handheld data collection unit (computerized) as the location was being recorded via a satellite reception device placed on the study point. Each location was recorded within six centimeters of accuracy. This Trimbel device used more than six satellites to fix the position. For the photoplots, the center of each plot was recorded. For the line transects the beginning and end points were used and for the Limpet transects the center point was measured. After the data was collected in the field, it was then downloaded in the Pathfinder software. The latitude, longitude and point labeled were then be uploaded successfully into Arcview (a Geographic Information Software GIS).

The Excel spreadsheet was converted to a dbase file and this was also uploaded into the Arcview program. The data from both the pathfinder program and the excel program were then linked together according to their unique points and a detailed map was created. The map shows all the points measured in the study along with color coded points for five different levels of the substrate heights. The map shape files were obtained from US Navy. When the points from the study were layered with the maps from the US Navy they did not line up correctly. After considerable work on placing the points in the State Plane 1927 CA Zone VI projection the points never did line up. When the UTM NAD 1983 projection was used the points line-up beautifully so this projection was used. It was the consensus of the experts in the CESAR lab that the US Navy maps was not labeled with the proper projection. This a matter that should be looked into to be assured of accurate maps in the future.

Conclusion:

This study was a great experience for me and I appreciate all of the people who helped me to take the measurements, to learn the various devices and computer programs and to make the map. The study was labor intensive. In order to take the measurements four to five people were needed each time. Some of the points were located in awkward positions (i.e. on top of rocks that were difficult to reach) or hard to find (i.e. the kelp transects). Other constraints included only be able to work when the tide was low (every other week) and the weather was fair enough to not damage the equipment. To ensure more accurate results, I make the following suggestions:

1. Use a watch that is in sync with the satellites and take reading at the same time as the NOAA website times.

2. Take three readings of the Stillwater height for each time recording.

3. Be sure the stadia pole is perpendicular to the ground.

4. Use the same team that measured the points for the entire project.

Table E-1. Tidal heights of CRIMP sites as determined by L.A. Victoria in spring 2004. All heights are in inches above MLLW.

ID#	Zone	Plot	#	Bolt	Site ID	Location	Substrate Height Category	Date Recorded	Substrate Height Average	Standard Deviation	Substrate Height 1	Substrate Height 2	Substrate Height 3
1	1	T	1	N	237N	Area 1 T1n	2	3/4/2004	23.22	3.94	24.25	26.55	18.87
2	1	T	1	S	237S	Area 1 T1s	2	3/4/2004	19.22	3.94	20.25	22.55	14.87
3	1	B	1		286	Area 1 B1	3	3/4/2004	30.47	3.94	31.50	33.80	26.12
4	1	B	2		299	Area 1 B2	3	3/4/2004	38.22	3.94	39.25	41.55	33.87
5	1	PO	1		276N	Area 1 PO1	4	3/4/2004	53.22	3.94	54.25	56.55	48.87
6	1	PO	2		276C	Area 1 PO2	4	3/4/2004	55.72	3.94	56.75	59.05	51.37
7	1	PE	1		291	Area 1 PE1	2	3/4/2004	20.72	3.94	21.75	24.05	16.37
8	1	PE	2		290	Area 1 PE2	3	3/4/2004	31.72	3.94	32.75	35.05	27.37
9	1	PE	3		295	Area 1 PE3	2	3/4/2004	18.97	3.94	20.00	22.30	14.62
10	1	PE	4		288	Area 1 PE4	2	3/4/2004	24.47	3.94	25.50	27.80	20.12
11	1	PE	5		287	Area 1 PE5	3	3/4/2004	38.47	3.94	39.50	41.80	34.12
12	1	L	1		280	Area 1 L1	4	3/4/2004	61.47	3.94	62.50	64.80	57.12
13	1	L	2		284	Area 1 L2	4	3/4/2004	52.22	3.94	53.25	55.55	47.87
14	1	L	3		283	Area 1 L3	4	3/4/2004	51.22	3.94	52.25	54.55	46.87
15	1	L	4		282	Area 1 L4	4	3/4/2004	65.22	3.94	66.25	68.55	60.87
16	1	L	5		279	Area 1 L5	4	3/4/2004	56.72	3.94	57.75	60.05	52.37
17	1	L	6		277	Area 1 L6	3	3/4/2004	48.22	3.94	49.25	51.55	43.87
18	1	PO	3		281N	Area 1 PO3	4	3/4/2004	64.22	3.94	65.25	67.55	59.87
19	1	PO	4		281S	Area 1 PO4	2	3/4/2004	16.22	3.94	17.25	19.55	11.87
20	1	PO	5		278N	Area 1 PO5	4	3/4/2004	54.22	3.94	55.25	57.55	49.87
21	1	PO	6		278S	Area 1 PO6	4	3/4/2004	56.97	3.94	58.00	60.30	52.62
22	1	B	4		292	Area 1 B4	2	3/4/2004	27.72	3.94	28.75	31.05	23.37
23	1	B	5		293	Area 1 B5	2	3/4/2004	29.47	3.94	30.50	32.80	25.12
24	1	T	2	N	210N	Area 1 T2n	2	3/4/2004	14.47	3.94	15.50	17.80	10.12
25	1	T	2	S	210S	Area 1 T2s, K6n	1	3/4/2004	8.22	3.94	9.25	11.55	3.87
26	1	K	6	S	212S	Area 1 K6s	1	3/4/2004	6.47	3.94	7.50	9.80	2.12
27	1	G	4	N	211N	Area 1 G4n	1	3/19/2004	-2.21	2.45	-3.94	-0.48	
28	1	G	4	S	211S	Area 1 G4s	2	3/4/2004	10.22	3.94	11.25	13.55	5.87
29	1	G	3	N	238N	Area 1 G3n	2	3/4/2004	14.97	3.94	16.00	18.30	10.62
30	1	G	3	S	238S	Area 1 G3s	2	3/4/2004	14.97	3.94	16.00	18.30	10.62
31	1	K	5	N	236N	Area 1 K5n	1	3/4/2004	3.22	3.94	4.25	6.55	-1.13
32	1	K	5	S	236S	Area 1 K5s	1	3/4/2004	0.47	3.94	1.50	3.80	-3.88
33	1	M	1		298	Area 1 M1	2	3/4/2004	38.47	3.94	39.50	41.80	34.12
34	1	M	2		297	Area 1 M2	2	3/4/2004	27.47	3.94	28.50	30.80	23.12
35	1	B	3		294	Area 1 B3	2	3/4/2004	28.97	3.94	30.00	32.30	24.62
36	1	M	3		296	Area 1 M3	2	3/4/2004	25.97	3.94	27.00	29.30	21.62
37	1	M	4		289	Area 1 M4	2	3/4/2004	18.47	3.94	19.50	21.80	14.12
38	1	M	5		285	Area 1 M5	3	3/4/2004	31.22	3.94	32.25	34.55	26.87
39	2	T	1	N	244N	Area 2 T1n	1	2/8/2004	2.14	2.79	0.16		4.11
40	2	T	1	C	244C	Area 2 T1c	2	2/8/2004	9.14	2.79	7.16		11.11
41	2	T	1	S	244S	Area 2 T1s	2	2/8/2004	15.14	2.79	13.16		17.11
42	2	L	1		239	Area 2 L1	3	2/8/2004	46.14	2.79	44.16		48.11
43	2	M	1		245	Area 2 M1	2	2/8/2004	17.64	2.79	15.66		19.61
44	2	M	2		246	Area 2 M2		2/8/2004	n/a	n/a	-24.09		-20.14
45	2	M	3		253	Area 2 M3	2	2/8/2004	22.64	2.79	20.66		24.61
46	2	M	4		254	Area 2 M4	2	2/8/2004	23.39	2.79	21.41		25.36
47	2	B	1		247	Area 2 B1	2	2/8/2004	21.39	2.79	19.41		23.36
48	2	B	2		248	Area 2 B2	3	2/8/2004	33.14	2.79	31.16		35.11
49	2	PO	1		275N	Area 2 PO1	4	2/8/2004	58.39	2.79	56.41		60.36
50	2	PO	2		275C	Area 2 PO2	4	2/8/2004	54.64	2.79	52.66		56.61
51	2	PE	1		249	Area 2 PE1	1	2/8/2004	6.64	2.79	4.66		8.61
52	2	PE	2		251	Area 2 PE2	2	2/8/2004	26.14	2.79	24.16		28.11
53	2	PE	3		252	Area 2 PE3	2	2/8/2004	14.39	2.79	12.41		16.36
54	2	L	3		240	Area 2 L3	3	2/8/2004	38.39	2.79	36.41		40.36
55	2	L	4		242	Area 2 L4 (est pnt)	3	2/8/2004	30.14	2.79	28.16		32.11
56	2	L	4		242	Area 2 L4	2	3/19/2004	29.98	0.03	30.00	29.96	
57	2	L	5		266	Area 2 L5	3	2/7/2004	42.26	n/a	42.26		
58	2	L	6		241	Area 2 L6	2	2/8/2004	29.64	2.79	27.66		31.61
59	2	L	7			Area 2 L7	3	2/7/2004	48.26	n/a	48.26		
60	2	L	8			Area 2 L8	5	2/7/2004	70.26	n/a	70.26		
61	2	B	3		256	Area 2 B3	1	2/8/2004	16.76	2.79	23.16		27.11
62	2	B	4		259	Area 2 B4	1	2/8/2004	16.92	2.79	23.41		27.36
63	2	B	5		260	Area 2 B5	3	2/7/2004	39.76	n/a	39.76		
64	2	PE	4		258	Area 2 PE4	1	2/8/2004	13.76	2.79	18.66		22.61
65	2	PE	5		265	Area 2 PE5	1	2/8/2004	15.59	2.79	21.41		25.36
66	2	PO	3		274N	Area 2 PO3	3	2/7/2004	41.26	n/a	41.26		
67	2	PO	4		274S	Area 2 PO4	4	2/7/2004	69.76	n/a	69.76		
68	2	PO	5		273N	Area 2 PO5	4	2/7/2004	62.51	n/a	62.51		
69	2	PO	6		273S	Area 2 PO6	4	2/7/2004	64.26	n/a	64.26		
70	2	T	2	N	270N	Area 2 T2n	1	2/8/2004	5.39	2.79	3.41		7.36
71	2	T	2	C	270C	Area 2 T2c	1	2/8/2004	3.64	2.79	1.66		5.61
72	2	T	2	S	270S	Area 2 T2s	1	2/8/2004	4.89	2.79	2.91		6.86
73	2	G	3	N	267N	Area 2 G3n	1	2/8/2004	-4.87	2.79	-6.84		-2.89
74	2	G	3	S	267S	Area 2 G3s	1	2/8/2004	-3.37	2.79	-5.34		-1.39

ID#	Zone	Plot	#	Bolt	Site ID	Location	Substrate Height Category	Date Recorded	Substrate Height Average	Standard Deviation	Substrate Height 1	Substrate Height 2	Substrate Height 3
75	2	K	5	N	268N	Area 2 K5n	1	2/8/2004	-4.12	2.79	-6.09		-2.14
76	2	K	5	C	268C	Area 2 K5c	1	2/8/2004	-4.37	2.79	-6.34		-2.39
77	2	K	5	S	268S	Area2 K5s	1	2/8/2004	-1.62	2.79	-3.59		0.36
78	2	L	2		243	Area2 L2	3	2/8/2004	43.64	2.79	41.66		45.61
79	2	M	5		255	Area2 M5	2	2/8/2004	19.89	2.79	17.91		21.86
80	2	G	4	N	271N	Area 2 G4n	1	2/8/2004	3.39	2.79	1.41		5.36
81	2	G	4	S	271S	Area 2 G4s	1	2/8/2004	3.14	2.79	1.16		5.11
82	2	K	6	N	272N	Area 2 K6n	1	2/8/2004	-0.87	2.79	-2.84		1.11
83	2	K	6	S	272S	Area 2 K6s	1	2/8/2004	4.64	2.79	2.66		6.61
84	3	T	1	N	001N	Area 3 T1n	3	2/7/2004	40.00	3.53	42.49	37.50	
85	3	T	1	C	001C	Area 3 T1c	3	2/7/2004	37.50	3.53	39.99	35.00	
86	3	T	1	S	001S	Area 3 T1s	2	2/7/2004	29.25	3.53	31.74	26.75	
87	3	G	3	N	007N	Area 3 G3n	3	2/7/2004	30.25	3.53	32.74	27.75	
88	3	G	3	C	007C	Area 3 G3c	2	2/7/2004	27.00	3.53	29.49	24.50	
89	3	G	3	S	007S	Area 3 G3s	2	2/7/2004	29.00	3.53	31.49	26.50	
90	3	G	4	N	005N	Area 3 G4n	3	2/7/2004	32.25	3.53	34.74	29.75	
91	3	G	4	C	005C	Area 3 G4c	2	2/7/2004	29.00	3.53	31.49	26.50	
92	3	G	4	S	005S	Area 3 G4s	2	2/7/2004	26.75	3.53	29.24	24.25	
93	3	T	2	B	008N	Area 3 T2n	3	2/7/2004	31.75	3.53	34.24	29.25	
94	3	T	2	C	008C	Area 3 T2c	3	2/7/2004	31.50	3.53	33.99	29.00	
95	3	T	2	S	008S	Area 3 T2s	2	2/7/2004	29.50	3.53	31.99	27.00	
96	3	PO	1		269N	Area 3 PO1	4	2/7/2004	64.00	3.53	66.49	61.50	
97	3	PO	2		269S	Area 3 PO2	5	2/7/2004	91.75	3.53	94.24	89.25	
98	3	PO	3		196N	Area 3 PO3	4	2/7/2004	69.75	3.53	72.24	67.25	
99	3	PO	4		196S	Area 3 PO4	5	2/7/2004	85.25	3.53	87.74	82.75	
100	3	PO	5		023N	Area 3 PO5	4	2/7/2004	59.75	3.53	62.24	57.25	
101	3	PO	6		023S	Area 3 PO6	4	2/7/2004	55.00	3.53	57.49	52.50	
102	3	L	1		013	Area 3 L1	5	2/7/2004	83.75	3.53	86.24	81.25	
103	3	B	1		003	Area 3 B1	3	2/7/2004	32.00	3.53	34.49	29.50	
104	3	B	2		016	Area 3 B2	3	2/7/2004	30.00	3.53	32.49	27.50	
105	3	K	5	N	002N	Area 3 K5n	2	2/7/2004	26.75	3.53	29.24	24.25	
106	3	K	5	S	002S	Area 3 K5s	2	2/7/2004	24.75	3.53	27.24	22.25	
107	3	K	6	N	004N	Area 3 K6n	1	3/19/2004	4.73	4.37	9.58	3.51	1.09
108	3	K	6	C	004C	Area 3 K6c	1	3/19/2004	4.23	4.37	9.08	3.01	0.59
109	3	K	6	S	004S	Area 3 K6s	1	3/19/2004	1.23	4.37	6.08	0.01	-2.41
110	3	K	6	C	004C	Area 3 K6c	2	2/7/2004	21.75	3.53	24.24	19.25	
111	3	K	6	S	004S	Area 3 K6s	2	2/7/2004	19.50	3.53	21.99	17.00	
112	3	PE	1		009	Area 3 South PE1	2	2/7/2004	29.26	3.08	26.41	28.85	32.52
113	3	PE	2		010	Area 3 South PE2	2	2/7/2004	27.26	3.08	24.41	26.85	30.52
114	3	PE	3		028	Area 3 South PE3	2	2/7/2004	24.01	3.08	21.16	23.60	27.27
115	3	PE	4		027	Area 3 South PE4	3	2/7/2004	30.51	3.08	27.66	30.10	33.77
116	3	PE	5		025	Area 3 South PE5	2	2/7/2004	25.26	3.08	22.41	24.85	28.52
117	3	B	3		029	Area 3 South B3	3	2/7/2004	49.01	3.08	46.16	48.60	52.27
118	3	B	4		030	Area 3 South B4	3	2/7/2004	40.51	3.08	37.66	40.10	43.77
119	3	B	5		020	Area 3 South B5	3	2/7/2004	44.26	3.08	41.41	43.85	47.52
120	3	M	1		024	Area 3 South M1	3	2/7/2004	35.51	3.08	32.66	35.10	38.77
121	3	M	2		015	Area 3 South M2	3	2/7/2004	35.51	3.08	32.66	35.10	38.77
122	3	M	2		015	Area 3 South M2	2	3/19/2004	28.98	4.37	33.83	27.76	25.34
123	3	M	3		014	Area 3 South M3	3	2/7/2004	43.51	3.08	40.66	43.10	46.77
124	3	M	4		017	Area 3 South M4	3	2/7/2004	36.51	3.08	33.66	36.10	39.77
125	3	M	5		012	Area 3 South M5	3	2/7/2004	42.01	3.08	39.16	41.60	45.27
126	3	L	2		026	Area 3 South L2	3	2/7/2004	48.51	3.08	45.66	48.10	51.77
127	3	L	3		021	Area 3 South L3	3	2/7/2004	42.26	3.08	39.41	41.85	45.52
128	3	L	4		019	Area 3 South L4	3	2/7/2004	40.51	3.08	37.66	40.10	43.77
129	3	L	5		018	Area 3 South L5	4	2/7/2004	58.76	3.08	55.91	58.35	62.02
130	3	L	6		011	Area 3 South L6	4	2/7/2004	56.01	3.08	53.16	55.60	59.27

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National Park Service
U.S. Department of the Interior

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