

**CENTRAL ORANGE COUNTY  
AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE  
PUBLIC USE MONITORING PROGRAM**



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## **PUBLIC USE IMPACT STUDY**

### **1.0 INTRODUCTION**

#### **1.1 PROJECT OBJECTIVES**

The objectives of the Areas of Special Biological Significance (ASBS) Public Use Impact Study are to: (1) identify the types of human activities within ASBS areas; (2) identify the degree to which public use affects marine resources within ASBS areas; and (3) identify techniques and methods that can be used by the cities of Newport Beach and Laguna Beach in the implementation of long-term ASBS monitoring surveys.

#### **1.2 PROJECT RESEARCH LITERATURE**

The proposed methods used in the study are based on public use effect studies conducted by several organizations over the last five years throughout southern and central California marine protected areas. Ambrose and Smith (in press) conducted human use impact analysis in Santa Monica Bay intertidal habitats, Murray et al. (1999) and Coastal Resources Management, Inc. (CRM 2005, 2008) conducted public use impact surveys along the Orange County shoreline and Tenera Environmental (2003, 2004) conducted human use impact surveys in central California that Pt Pinos (Monterey Bay National Marine Sanctuary) and James V. Fitzgerald Marine Reserves (San Mateo County). Generally, public use surveys collect information on sandy shoreline and rocky intertidal habitat public use by quantifying the numbers of groups and/or the total number of individuals to identify public use intensity. Habitats where people are observed collecting or disrupting habitat are identified and the frequency of tide pooling, trampling activities, collecting (food, bait collecting, or general), handling/returning organisms to rocks, rock overturning, SCUBA diving, snorkeling, spear fishing, shore fishing, party boat fishing, commercial fishing, and enforcement activities have been recorded during the various public use surveys. Public use information surveys of people exiting the area have also been conducted (Tenera 2003).

### **2.0 FIELD METHODOLOGY**

#### **2.1 SURVEY SITES**

Surveys were conducted at four locations within three Central Orange County ASBS areas located between Corona del Mar and Laguna Beach, California (Figure 1). Locations of each of the sites are shown in Figures 2, 3, and 4, and Appendix 1. These included Robert C. Badham/Newport Beach Marine Park (Little Corona Tide Pools, ASBS #32, Figure 2), Morning Canyon (ASBS #32, Figure 2), Crystal Cove ASBS #33, Figure 3), and Heisler Park (ASBS #31, Figure 4). The sites identified for study include: 1) areas that have high occurrence public use (LCTP and Heisler Park), low-to-moderate public use (Crystal Cove), and minimal public use (Morning Canyon).



Figure 1. Location of Central Orange County ASBS Areas



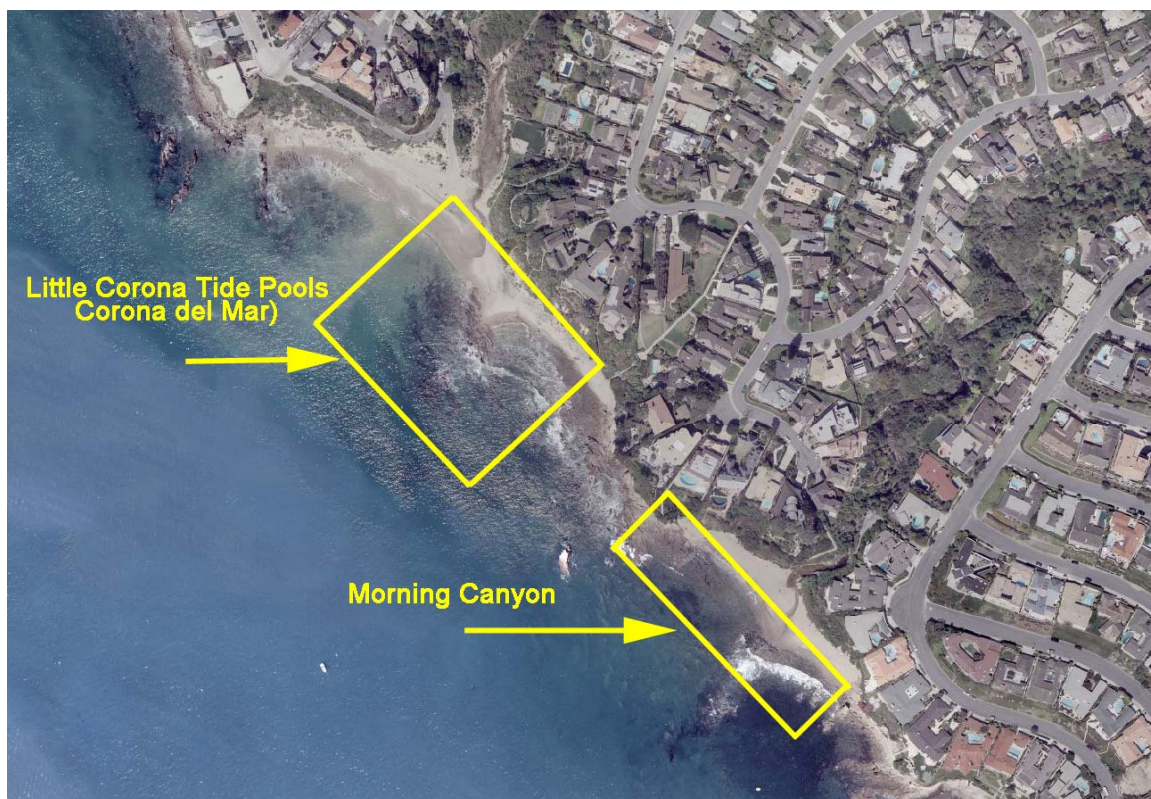


Figure 2. Robert C. Badham/Newport Beach Marine Park/ASBS Study Sites, #33



Figure 3. Rocky Bight Study Site in the Irvine Coast ASBS





Figure 4. Heisler Park Study Site in the Heisler Park ASBS

The specific public use observation areas within each of these sites were identified based upon (1) overlapping sampling zones for the Weston Solutions, Inc. rocky intertidal investigations (2) Cal State University Fullerton rockweed experimental site locations, and discussions with City of Newport Beach, City of Laguna Beach, and California State Parks marine life park and ASBS management personnel that addressed where from the managers' perspectives, sampling sites should be located.

## 2.2 SAMPLING INTERVALS

Surveys were conducted during 26 weekdays and 24 weekend-days at each of the four locations between January 30<sup>th</sup>, 2007 and February 18<sup>th</sup>, 2008. A single observer was assigned to a site, and for the majority of surveys, all four sites were surveyed either simultaneously or prior to the day of the assigned field day. Survey methods were based upon those of Smith (in press) for Santa Monica Bay public use surveys, although some modifications were made to the ASBS program based upon the focus of the project and the temporal differences in survey periods between the two studies.



## 2.3 FIELD DATA COLLECTION TECHNIQUES

Within each survey day, replicate data sets of information were collected during daylight hours over a 2.5 hour period; 60 minutes before low tide, 30 minutes before low tide, at low tide, 30 minutes after low tide, and 60 minutes after low tide period. During winter and fall surveys, it was possible to collect data at tides of +0.5 feet Mean Lower Low Water (ft, MLLW) during daylight hours. However, it was the purpose of the study to also collect public use data during the spring and summer when it was not always possible to collect data at tidal heights of +0.5 ft MLLW during daylight hours. Therefore, during many of the late spring and summer surveys, survey data were collected at tides of +2.0 ft MLLW. In once instance, a survey was conducted on a tide of 2.9 ft MLLW, but it was deemed representative of the survey period, and not rejected from the data base of information.

The data sets collected included:

1. Data Set 1: Cloud conditions, air and sea temperatures, sea state (Beaufort Scale), estimated wind speed and direction, number of researchers and number of docents/park rangers (five replicates, prior to the collection of Data Set 4 information (see below);
2. Data Set 2: Total number of people, birds, and dogs (on leash and off leash) on sandy beach and on rocky shoreline preceding and proceeding Data Set #3 (see below, 10 replicates per survey, collected prior to Data Set 4;
3. Data Set 3: Activities in the waters offshore of the ASBS. The number of and types of fishing vessels, number of lobster pots, number of fishing poles in the water, number of snorkelers and divers with and without spear guns, and numbers of marine mammals (pinnipeds, bottlenose dolphin, and gray whales (five replicates per survey (collected before Data Set 4);
4. Data Set 4: Documentation of public use activity and behavior within rocky intertidal habitats within the five, 10-minute observation periods over a 2.5 hour period. The information collected included the time each visitor spent and their behaviors and activities within the low, mid, high, and splash zone and their activities within the replicate 10-minute period. The types of behaviors and activities recorded for each individual included collecting live organisms, collecting shells, rock turning, fishing with collected bait, fishing with non-collected bait, handling, walking, or sitting/standing. Trampling was implied by walking, sitting, or standing in zones where soft-bodied organisms and plants were present. If an individual was engaged in more than one activity during the observation period, the most destructive activity was assigned to that individual. Enforcement activities by tide pool docents and park rangers were also recorded, when contact was made with an individual or group of individuals;
5. Data Set 5: Focused Surveys of selected individuals and their tide pool activities.

In order to establish comparisons between survey areas, the linear length of shoreline and the area of rocky intertidal habitat were determined for each of the four ASBS study

areas. This was accomplished by conducting a GPS survey of each site. A survey was conducted in December 2006 at each of the sites using a Thales Mobile Mapper PRO GPS unit with differential GPS post-processing accuracy of less than one meter. These data were then used to calculate the linear area of shoreline and the amount of rocky intertidal habitat to provide a measure of public use intensity (PUI) for each ASBS study site.

### **2.3.3 Public Access Points**

Ambrose and Smith (in press) noted the importance of public access in their study of Santa Monica Bay human use impacts. Consequently, access to the tide pools (trails, walkways, stairs) and parking were documented for each of the four survey sites to assess how access to the site affects public use of ASBS areas.

### **Species Identification of Impacted Organisms By Public Use**

If visitors were observed collecting and/or handling organisms, the field observer determined the number of times and the types of organisms handled and collected by means that had the least potential for bias in data collection through (1) using binoculars to observe from a distance, (2) walking over to and observing the individual's buckets or bags, but not identifying themselves as researchers, or lastly (3) interviewing the individuals after they leave the survey area. Random surveys of fishermen and spear fishers were conducted and their catch examined to determine the number and types of fishes caught (or caught and released), gear used, and for the onshore fishermen, the type of bait used and where the bait was collected. When feasible, photos of species collected were be taken to document collecting activity.

### **General Public Use Exit Interviews**

The public use field personnel randomly selected an individual or group as they exited the survey area to determine (1) where they are from (zip code), their reason for visiting the ASBS, their knowledge of tidepool collecting regulations, collecting activities, etc. This survey utilized a form modified from field-interview forms used by Tenera (2003, 2004) for their Pt Pinos Intertidal and User Survey.

## **2.4 DATA REDUCTION AND ANALYSIS**

Survey data were collected on pre-printed forms for each of the five data sets. In the office, the field data sheets were checked for accuracy and tabulated into a pre-formatted Excel spreadsheets for each day of sampling and by survey area. Each data set were summarized by replicate, survey, and year and where appropriate, standardized to numbers per linear meters of shoreline, in order to compare the uses of visitors within each of the four ASBS areas. Estimates for visitor use for the entire year were calculated based on all tidal ranges encountered. While daylight summer low tides were higher than

other periods (up to +2.3 ft MLLW), we considered that these data to be representative of actual conditions that occur during high-use summer periods. Smith et al (2007) calculated data based on tides only +0.5 ft and lower. Yearly estimates were made based upon (1) mean numbers of visitors counted in each of 10 replicate samples over a 2.5 hour period (2) data standardized to 100 meters of shoreline length and (3) an estimate of a four-hour period of visitor use for each person. Visitor behaviors were summarized by category to obtain a summary of the amount of time spent in each activity according to the use category. Offshore information (fishermen, vessels, etc) were not standardized to linear area of shoreline but included all fishermen and vessels that would be considered nearshore in the general vicinity of each ASBS site.

Randomly-collected survey data of tidepool visitors, divers/snorkelers, fishermen, and collectors were summarized in tabular format to provide additional information on species that are taken from the area (species and numbers of individuals). These data were used to rank the most destructive activities and the potential impacts to the various species of plants, invertebrates, and fish in Central Orange County ASBS areas.

### 3.0 RESULTS

#### 3.1 STUDY AREA CHARACTERISTICS

Table 1 summarizes the characteristics of each study site. Located in Corona del Mar (City of Newport Beach), the Little Corona tide pools are characterized by accessible, free parking along Ocean Blvd and residential streets and a paved access road to the shoreline. The ease-of-access accounts for constant year-around use. The shoreline consists of a city-maintained sandy beach, an extensive rocky intertidal platform reef, and low-relief boulder/cobble fields. Numerous signs are posted along the paved access road to the beach way explaining tide pool regulations. The City of Newport Beach manages a year-around tide pool educational program and has on-site city employees (rangers) that patrol the tide pools and provide educational material and information during the week and on weekends. Numerous K-12 and college classes use Little Corona tide pools for their field trips and this area is a long-term intertidal research site. Most fishing occurs at the eastern end of Little Corona, that separates Little Corona and Morning Canyon. Creek flow into the study site is constant year-around. A sea stack, located between Little Corona and Morning Canyon is a major seabird roosting area in the local area.

Morning Canyon is located at the base of a gated community and public access to the site is extremely limited. Public access is only obtained by hiking east from the Little Corona tide pools along the base of the cliff which is difficult and dangerous during mid to high tides and during moderate wave activity. The site is primarily used by local residents on weekends and by people walking their dogs who enter through a locked community gate. Recreational shore fishermen commonly access Morning Canyon from Little Corona to fish from the rocks and from areas located east of Morning Canyon (Cameo Shores). There are no signs on the beach that provide tide pool law collecting and/or fishing information. There is limited active monitoring of Morning Canyon by City of Newport Beach tidepool rangers although they will occasionally patrol the site. Their main focus is the more crowded shoreline of the Little Corona tide pools. The site is a research site for California State University, Fullerton. Creek flow into the study site is year-around.

The Rocky Bight survey area, located in Crystal Cove State Park, is accessed by walking from fee-based public parking (\$10.00/day) along paved trails and access roads leading to Crystal Cove. Parking lots are located at Pelican Point, Reef Point, and the main Crystal Cove State Park Parking lot at Los Trancos. The beach is becoming a popular tourist destination as a result of recent development to Newport Coast and the Crystal Cove State Park cottage rental program. The walk from access points to Rocky Bight is about 200 meters, along a wide, open coast sandy beach. Creek flow does not enter directly into the Rocky Bight study site, but does flow to the ocean approximately 200 meters west of Rocky Bight. Administered by the State Parks, there is an extensive educational and docent program year-around.



**Table 1. General Attributes of Each of the Four ASBS Public Use Study Sites**

<b>Attributes</b>	<b>Parking Fee</b>	<b>Access to Tide Pools</b>	<b>Restrooms</b>	<b>Enforcement and Docent Programs</b>	<b>Educational Groups and Researchers</b>	<b>Habitat Description, Linear Length, and Area of ASBS Study Site</b>
Little Corona ASBS #32	Free parking along Ocean Avenue and Corona del Mar residential streets	Easy paved City of Newport Beach access road as well as stairs to beach. Handicapped accessible	Available at site	Yes; actively managed by extensive City of Newport Beach Tide Pool Rangers assisted by the City of Newport Beach Lifeguards	K through 12 and college classes. Limited by reservations. Most research being conducted as part of the ASBS grant studies, CSUF; and MMS Intertidal Monitoring Program	Highly used recreational sandy beach; extensive low-to-high relief rocky intertidal platforms with one large tide pool located in the center of the study area; low relief boulder/cobble intertidal in front of creek that flows year-around that drains into either the low-relief boulder/cobble intertidal or sometimes directly in front of the low-to-high relief intertidal. Some seepage from cliffs. 146 linear meters and 4,657 square meters survey area
Morning Canyon ASBS #32	No public parking; parking only for residents	Difficult for the public. Private community access through locked gate at back of tide pools; public access extremely limited from Little Corona; cannot access on higher tides or during high waves. Not handicapped accessible	None for the public	Extremely limited, mostly during the weekend. City of Newport Beach tide pool rangers will occasionally walk from Little Corona	No educational groups; limited number of researchers.	Limited recreational beach use except for local residents; backshore sandy to cobble beach; low-to-high relief intertidal platform and extensive tide pools. Creek flow year-around directly into rocky intertidal zone. 175 linear meters of shoreline and 3,592 square meters of rocky intertidal habitat within the survey area.
Crystal Cove, Rocky Bight ASBS #33	\$10.00 Daily State Park Parking Fee	Moderate. Long walk from public parking on Pacific Coast Highway, but good access on paved access roads to sandy beaches and tide pools along the shoreline. Handicapped accessible	Available on site near Beachcomber Restaurant and in public parking lots on Coast Highway	Yes, actively managed by park rangers and docents. Docents present during low tides on weekends and with school groups	Primary grade educational groups; reservations required; some research being conducted.	Moderate use of the sandy beach by the public year around; low-to-high relief, extensive rocky intertidal outcrops. Rocky Bight is the nearest tide pools to the Crystal Cove Visitor Center, restaurant, and State-leased cottages. Creek flow 200 meters west of the tide pools. Localized ravine flows during rainstorms. 211 linear meters of shoreline and 8,815 square meters of rocky intertidal habitat within the study area.
Heisler Park, ASBS #31	\$0.25 per hour meter parking; maximum of 2 hours	Easy to Moderate. Paved access from Cliff Drive; stairs to beach from two access points, and short walk to ASBS tide pools.	None on site; closest is at the top of cliff and on Main Beach	Yes, by the Laguna Beach Marine Life Protection Officer, with assistance from lifeguards and Oceans Laguna NGO	K through 12 school groups; reservations required through the Marine Protection Officer	Highly used sandy beach next to tide pools. high relief platform outcrops near the backshore fronted by wide low-to-mid relief boulder and platform reef. Creek flow at Main Beach; some seepage from the cliffs. 158 linear meters of shoreline, and 6,259 square meters of rocky intertidal habitat

Heisler ASBS is located within the City of Laguna Beach immediately west of Main Street and south of Pacific Coast Highway. Due to its proximity to Main Beach, Heisler Park rocky intertidal areas are heavily utilized by the public. Parking is extremely limited during the summer. Parking meter rates are \$0.25 per hour with a maximum limit of 2 hours although parking in residential areas is common on the north side of Coast Highway. The shoreline is characterized by extensive low-intertidal platforms and boulder/cobble fields, and moderate to high relief platforms. “Bird Rock”, a rocky islet, is separated by a shallow channel from the main platform reef and it is rarely accessed by the public except at extreme low tides, and by kayak. This is a major seabird roosting area. Laguna Creek flows into the ocean at Main Beach, but does not directly flow into the tide pools. However, there are several fresh water seepages that drain from the bluff into the backshore rocky intertidal areas.

Table 2 lists the linear length of shoreline and the area of the rocky intertidal habitat within each of the four ASBS study sites.

**Table 2. Study Area Length and Area**

<b>Location</b>	<b>Linear Meters of Shoreline Within The Public Use Study Area</b>	<b>Square Meters of Rocky Intertidal Habitat Within Public Use Study Area</b>
<b>Little Corona (Corona del Mar)</b>	146	4,657
<b>Morning Canyon</b>	175	3,592
<b>Rocky Bight (Crystal Cove)</b>	211	8,815
<b>Heisler Park</b>	158	6,259

Habitat length and rocky intertidal areal cover varied from site to site, based upon the geography of the shoreline and the amount of continual rocky intertidal habitat. For example, the shoreline length at Rocky Bight/Crystal Cove was the longest, as a consequence of two rocky intertidal platforms interspersed by sandy beach except at the very low tide zone. During the year, however, amount of rocky habitat in this mid-section increased as a result of seasonal beach erosion at the site. Shoreline lengths within the study area ranged from 146 meters (Little Corona) to 211 meters (Rocky Bight/Crystal Cove). Based on surface area of the rocky intertidal habitats, rocky intertidal habitat covered between 3,592 square meters at Morning Canyon, to 8,815 square meters at Crystal Cove. For data analysis and comparison purposes, the number of people present on the sandy and/or rocky shoreline (the Public Use Intensity Quotient, PUI), behaviors, and activities were standardized to linear area of shoreline.

### 3.2 WEATHER, SEA STATE, AND TIDAL CHARACTERISTICS

Table 3 summarizes the physical data collected, by weekday, weekend, and for all surveys. Air temperatures, by survey and site are provided in Figure 5. For all surveys, the surveys were conducted on tides that averaged 0.3 to 0.4 ft MLLW, with averages varying from 0.1 to 0.2 ft (MLLW) during weekday surveys to 0.6-0.6 ft MLLW during weekend surveys. Sixty-two percent (62%) of the surveys were conducted during tides of +0.5 ft MLLW or lower. The remaining 38% of the time, surveys were conducted during tides of between 0.6 and +2.3 ft (MLLW)

**Table 3. Summary of Physical Data, ASBS Public Use Surveys**

<b>Week Day Analysis</b>	Mean of 5 replicates per site, over 2.5 hours per survey, 26 surveys			
	<b>Corona del Mar</b>	<b>Morning Canyon</b>	<b>Crystal Cove</b>	<b>Heisler Park</b>
Number of Surveys	26.0	26.00	26.00	26.00
Tide (ft, MLLW)	0.1	0.2	0.20	0.1
% Cloud cover	35.9	24.14	27.50	25.87
Sea State (Beaufort Scale)	1.8	2.21	2.20	2.32
Estimated Surf Height	2.1	1.78	2.39	2.18
Sea Temp	61.2	61.10	61.12	61.32
Air Temp	67.2	67.19	67.18	65.61
Wind Speed	4.9	6.00	7.09	7.74
Wind Direction	variable	variable	variable	variable
<b>Week End Analysis</b>	Mean of 5 replicates per site, over 2.5 hours per survey, 24 surveys			
	<b>Corona del Mar</b>	<b>Morning Canyon</b>	<b>Crystal Cove</b>	<b>Heisler Park</b>
Number of Surveys	24.0	24.00	24.00	24.00
Tide (ft, MLLW)	0.6	0.7	0.7	0.6
% Cloud cover	41.4	43.39	45.30	45.13
Sea State (Beaufort Scale)	1.5	1.54	1.89	1.59
Estimated Surf Height	1.6	1.70	1.87	1.64
Sea Temp	60.9	61.17	61.92	60.99
Air Temp	66.9	68.6	66.20	65.17
Wind Speed	4.2	4.63	4.78	5.07
Wind Direction	variable	variable	variable	variable
<b>All Surveys</b>	Mean of 5 replicates per site, over 2.5 hours per survey, 50 surveys			
	<b>Corona del Mar</b>	<b>Morning Canyon</b>	<b>Crystal Cove</b>	<b>Heisler Park</b>
Number of Surveys	50	50	50	50
Tide (ft, MLLW)	0.4	0.4	0.4	0.3
% Cloud cover	39	33	36	35
Sea State (Beaufort Scale)	2	2	2	2
Estimated Surf Height	2	2	2	2
Sea Temp	61.0	61.1	61.5	61.2
Air Temp	68.0	67.9	66.7	65.4
Wind Speed	4.6	5.3	6.0	6.5
Wind Direction	variable	variable	variable	variable

The range in tidal variation was between -1.8 ft to 2.3 ft MLLW at Little Corona, -1.7 ft to 2.3 ft MLLW at Morning Canyon, -1.8 ft to 2.9 ft MLLW at Crystal Cove, and -1.8 to 2.2 ft MLLW at Heisler Park.

Cloud cover was higher on weekdays at all sites than on weekends, as was Beaufort Sea State, estimated surf height, and wind speeds. The  $\Delta T$  (thermal gradient) between the air and sea temperatures varied from 4.2 (Heisler) to 7 (Little Corona). Air temperatures, over the course of the year-long study at each site (Figure 5) exhibited differences, related to site-specific differences in wind patterns, and microclimates. Sea temperatures at the four sites ranged from averages of 61 to 61.2 degrees F at the four sites (n=50 surveys), and air temperatures showed an upcoast to downcoast gradient, with survey site averages ranging between 68 Degrees F (Little Corona) to 65.4 Degrees F (Heisler Park) over the 50 surveys. The range in air temperatures observed at all sites varied between 55.5 (Morning Canyon and Heisler Park) to 86.5 (Heisler Park).

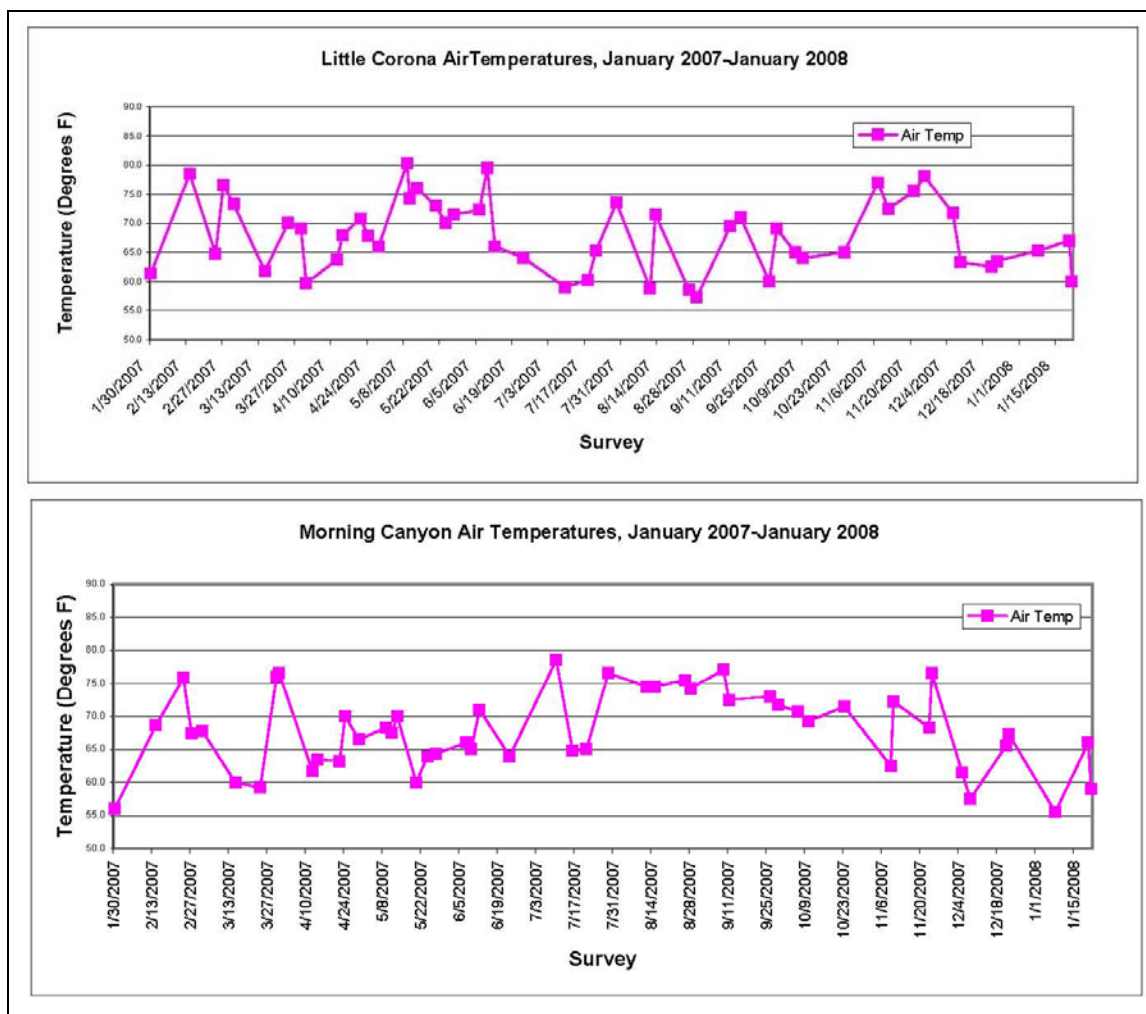


Figure 5a. Air Temperatures at Little Corona and Morning Canyon



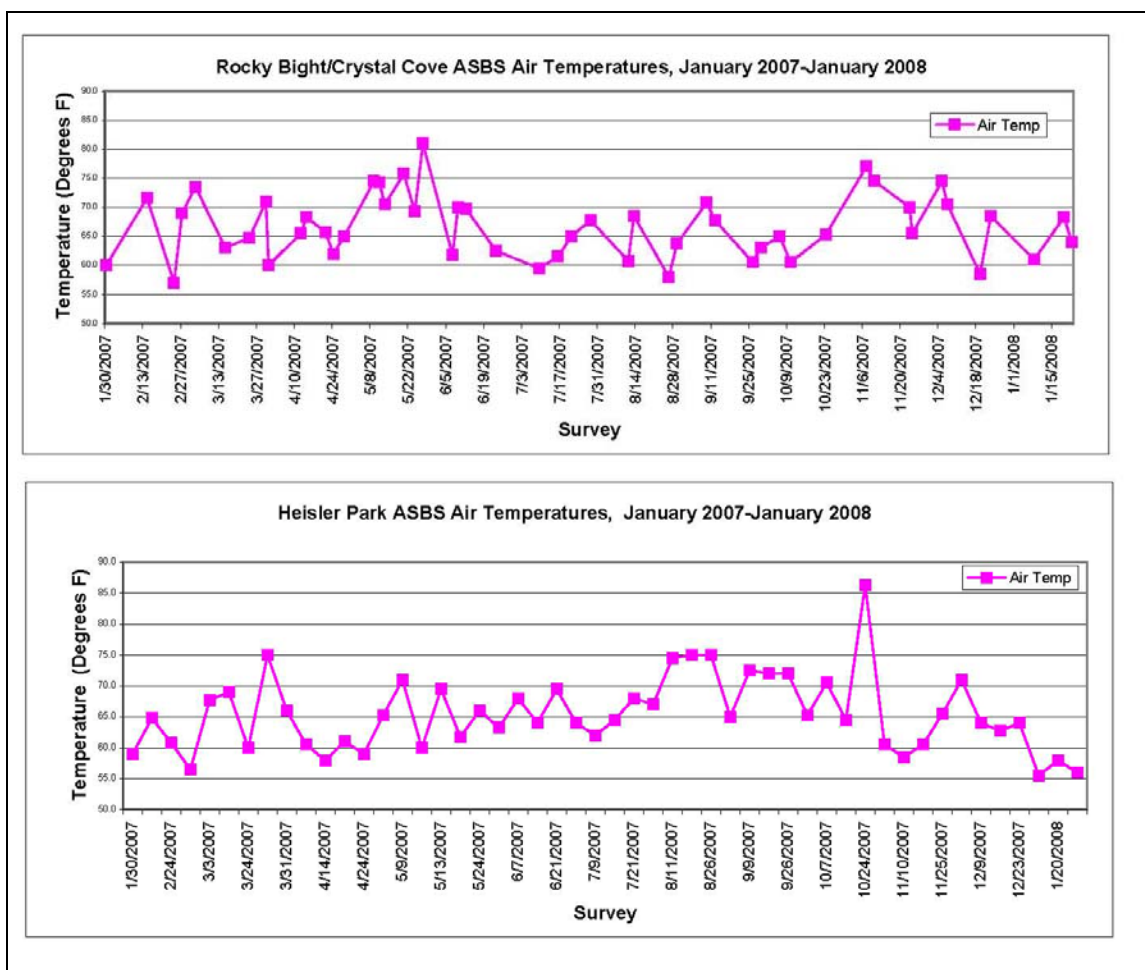


Figure 5b. Air Temperatures at Rocky Bight and Heisler Park

### 3.3 USE INTENSITY ON STUDY AREA SHORELINES.

**3.3.1 Docent and Enforcement Personnel.** Figure 6 illustrates the level of docent and enforcement activity on site during the ASBS public use surveys. Actual contacts made between docents and enforcement personnel are discussed in Section 3.5. Overall, docent and enforcement personnel numbers ranged from a high of 2.8 individuals per survey at Little Corona, to a low of 0.15 individuals at Morning Canyon (Figure 6). Enforcement personnel were similar at Little Corona during weekdays and weekends. Conversely, the number of docents and enforcement personnel at both Crystal Cove and Heisler were substantially higher on the weekends. The level of enforcement at Morning Canyon was 3% of that observed at Little Corona during weekdays and 7.5% on the weekends, whereas the level of enforcement at both Crystal Cove and Heisler Park was about 17% and 37% respectively, of Little Corona enforcement activity on the weekdays, and 56% and 79%, respectively, of Little Corona during the weekends.

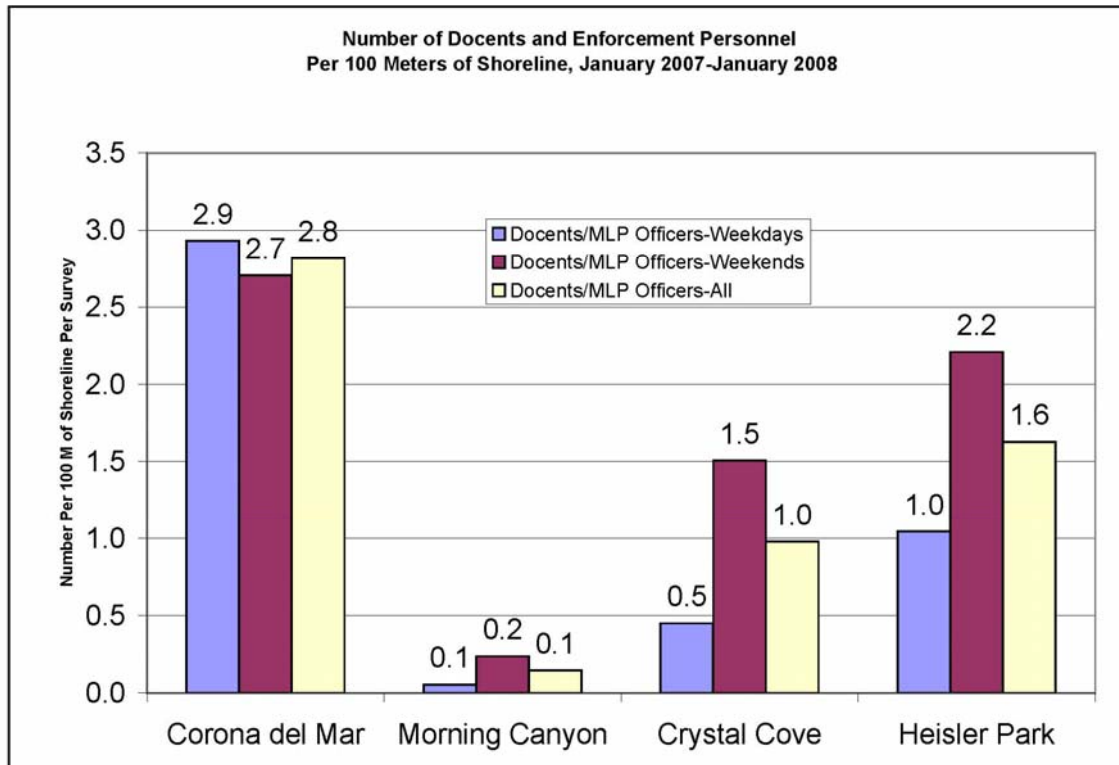


Figure 6. Mean Number of Docent and Enforcement Personnel at Each ASBS Site

**3.3.2 Public Use Intensity Quotients.** A total of 37,017 people were observed either on the sandy shoreline or within the tide pools at the four sites between January 2007 and February 2008. Of this total, 40.2% were observed at Heisler Park, 32.2% were observed at Little Corona, 20.9% were present at Crystal Cove, and 6.8% were present at Morning Canyon. Sixty-nine percent were within the tide pools, while 31% were on the sandy beaches. The highest percentage of people counted in the tide pools was at Heisler Park (46.5%), while the highest number of people counted on the sandy beaches was at Little Corona (32.4%). The lowest percentage of people counted in the tide pools and on the sandy beaches was at Morning Canyon (3% and 15%, respectively).

A seasonal summary for all surveys, by site and day type (weekday and weekend) is presented in Figure 7. Seasonally, the PUI quotient in the rocky intertidal zone was highest at Little Corona, Crystal Cove, and Heisler Park during early winter to late spring (February to June) and late autumn to early winter (November to early January). A secondary summer peak occurred during late summer (August). The mean maximum and minimum numbers per 100 linear meters of shoreline at Little Corona ranged between 0.1 and 48.2; Crystal Cove PUI varied between 0 and 21.2; Heisler Park PUI varied from 1.3 to 47, and the Morning Canyon rocky intertidal PUI was low year-around, with ranges between 0.0 and 4.9 people per 100 linear meters of shoreline. Similar seasonal trends were observed for sandy beach habitats at each of the four sites (Figure 7). The sandy beach PUIs varied from 0.0 to 25.1 for Little Corona, 0.1 to 9.5 at Crystal Cove; 0.2 to 19.7 at Heisler Park; and 0.0 to 21.0 at Morning Canyon. On a per

replicate basis, however, the upper range limit of individuals in the rocky intertidal zone was considerably greater. At Little Corona the maximum number of individuals per replicate on May 19<sup>th</sup>, 2007 was 144 (98 per 100 meters of shoreline); at Heisler Park, the maximum number of individuals recorded during a single replicate was 106 on December 19<sup>th</sup>, 2007 (58 per 100 meters of shoreline); at Crystal Cove, the maximum was 78 individuals on November 24<sup>th</sup>, 2007 (37 per 100 meters of shoreline); and at Morning Canyon, the maximum was 17 individuals on September 9<sup>th</sup>, 2007 (9.8 per 100 meters of shoreline).

Summary data for all surveys are illustrated in Figure 8 and 9 that presents the mean and 95% confidence values for each site. Heisler Park and Little Corona were the most frequented and intensely used ASBS sites. Rocky Bight in Crystal Cove was intermediate, exhibiting about 50% the PUI of both Heisler Park and Little Corona. The remote part of ASBS #32 (Morning Canyon) was frequently used (primarily by local residents) but by low numbers of individuals due to its inaccessibility and limited public access. The rank order of PUI quotients for rocky intertidal habitats at each of the four sites from highest to lowest order was Heisler Park (15.2 individuals per 100 linear meters), Little Corona (11.2), Crystal Cove (4.5), and Morning Canyon (0.9). For sandy beaches, the rank order was Little Corona (5.1), Heisler Park (3.8), Crystal Cove (2.9), and Morning Canyon (2.0). The rank order of PUI quotients for combined rocky intertidal and sandy beach habitats at each of the four sites from highest to lowest order was Heisler Park (18.8 individuals per 100 linear meters), Little Corona (16.3), Crystal Cove (7.3), and Morning Canyon (2.9).

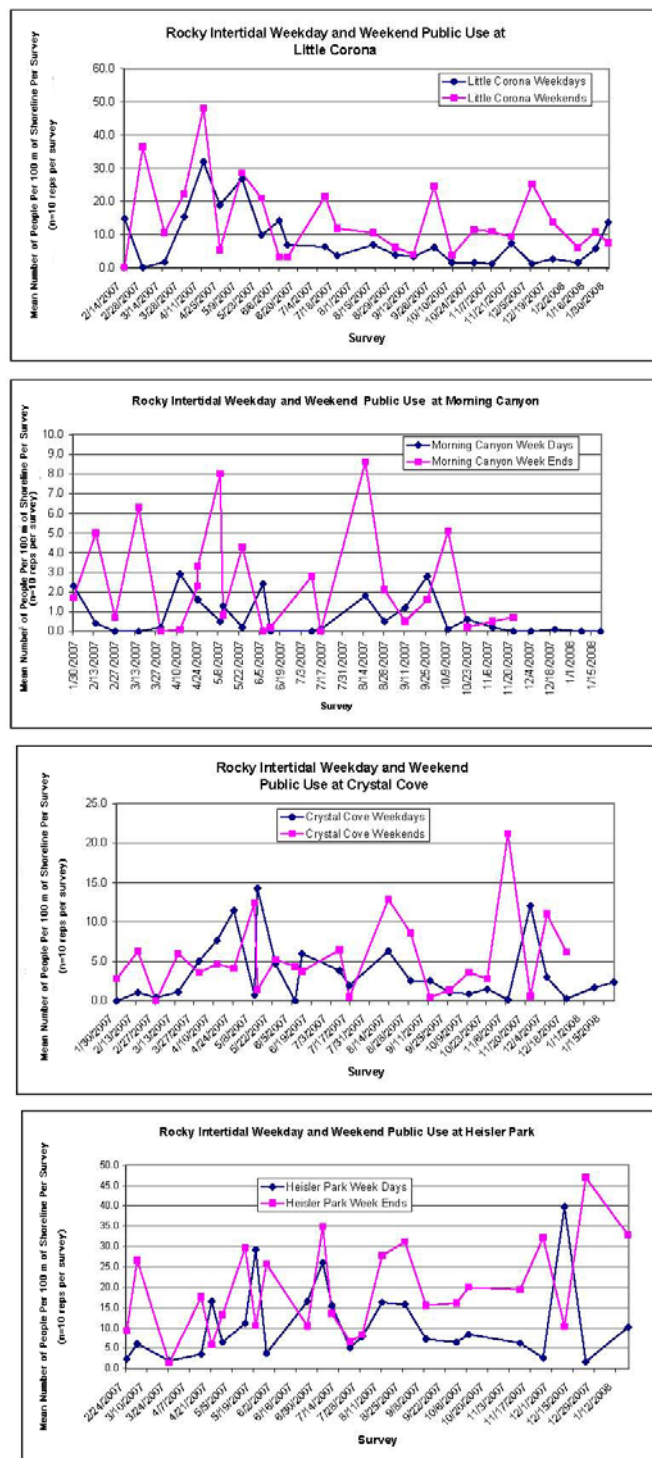


Figure 7. Mean Counts Per Day of People in the Rocky Intertidal Within Each of the ASBS Study Sites Standardized to 100 meter of shoreline. N=50 surveys, 10 replicates per survey



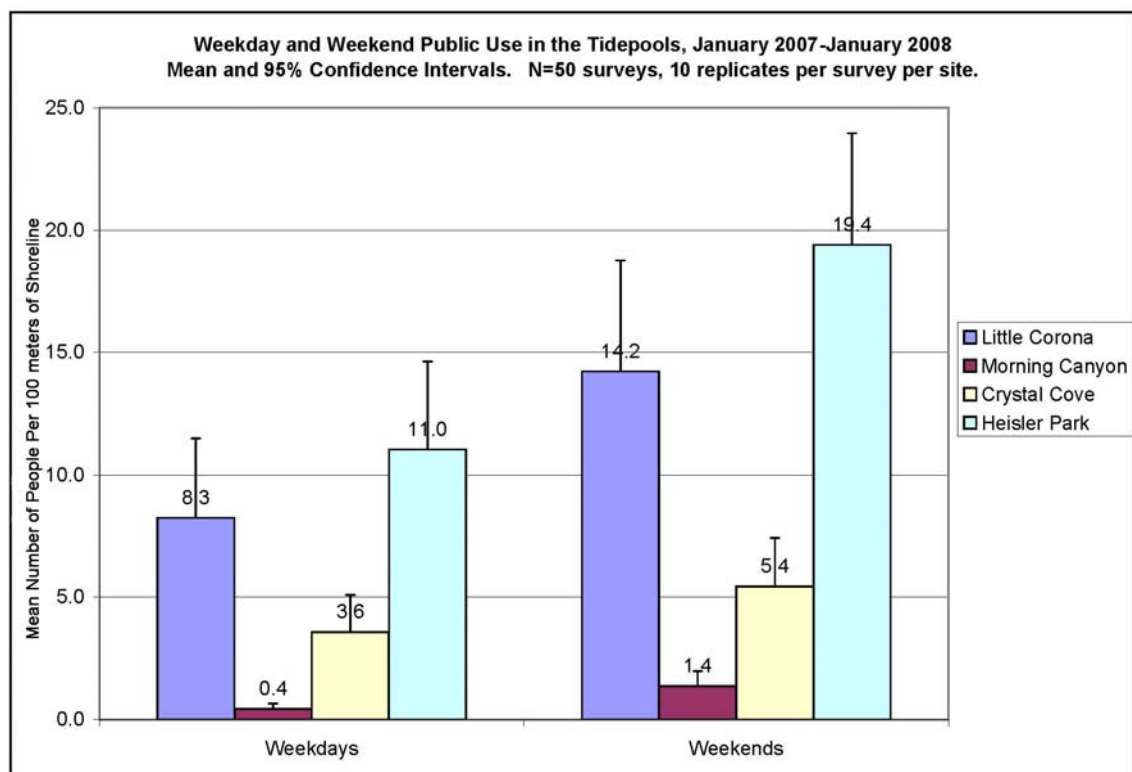


Figure 8. Public Use Intensity (PUI) in the Rocky Intertidal Zone During Weekdays and Weekends.

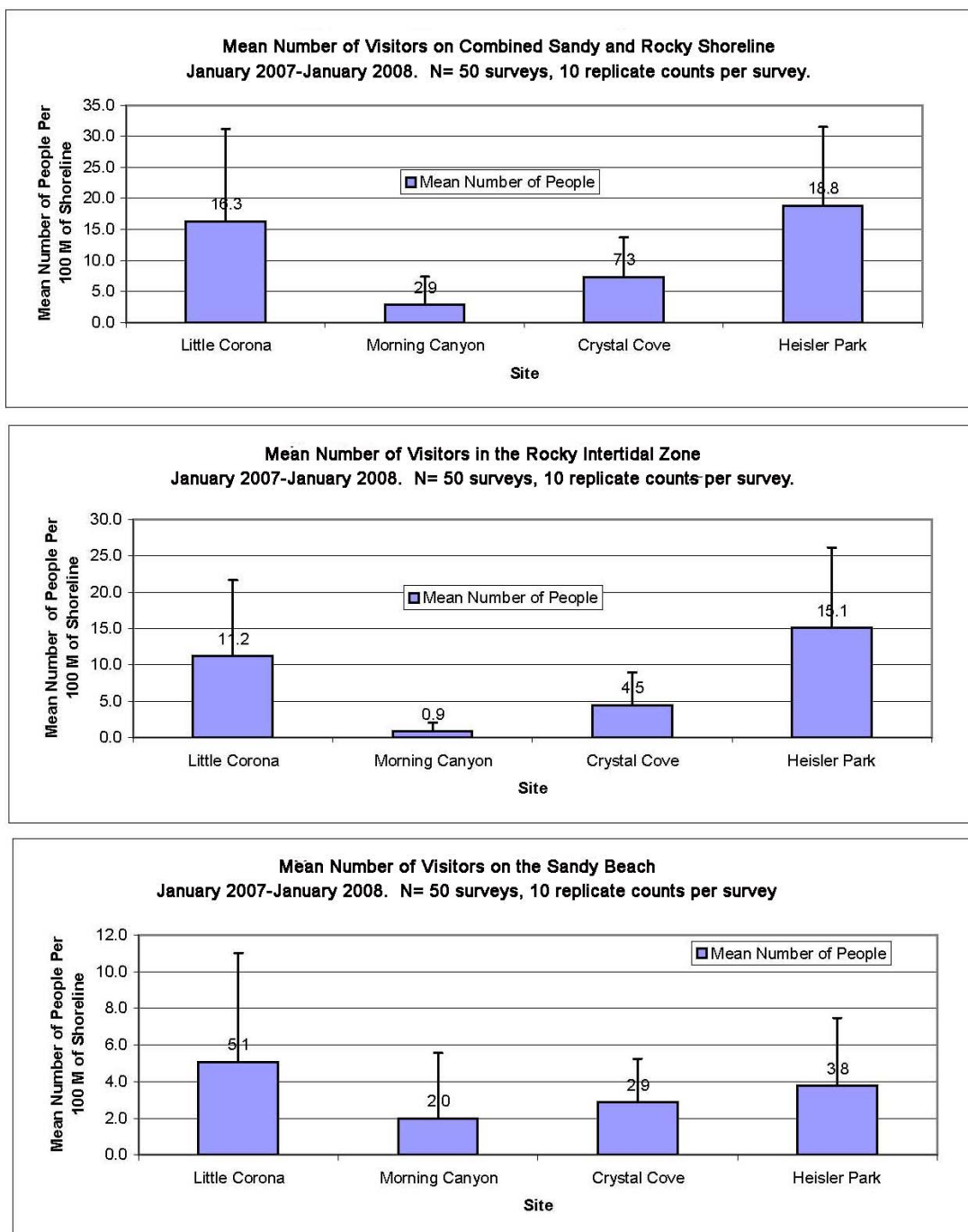


Figure 9. Comparison of the Number of People Per Replicate (n=50 surveys, 10 replicates per survey) on the Rocky and Sandy Shorelines Within Each of the Four ASBS Study Sites

**3.3.3. Bird Use.** The numbers of seabirds and shorebirds that were observed to be resting or foraging in the rocky intertidal and on the sandy shorelines were counted during each of the surveys. Shorebirds were combined into a single category, although the most frequently observed species that were observed included black-bellied plover, ruddy turnstones, sanderlings, sand pipers, willets, marbled godwit, whimbrels, and snowy egrets.

Figure 10 illustrates the seasonal use of the ASBS shorelines by shorebirds. Shorebird use exhibited substantial variation between site, although seasonal trends were similar within sites; highest shorebird numbers occurred between January and April, and then a second peak occurred between late August and December. Maximum numbers per 100 meter of shoreline occurred at Little Corona in February (12.2 per 100 meters of shoreline), and at Morning Canyon in October (7.1 per 100 meters of shoreline).

Numbers of shorebirds per replicate in rocky habitats were similar among each of the four sites, ranging between 0.9 (Little Corona) to 1.5 birds per 100 meters (Heisler Park). The numbers of shorebirds observed on the sandy shoreline were approximately five times less than on the rocky shorelines. For both rocky and sandy shorelines, the highest numbers of shorebirds were observed at Heisler Park.

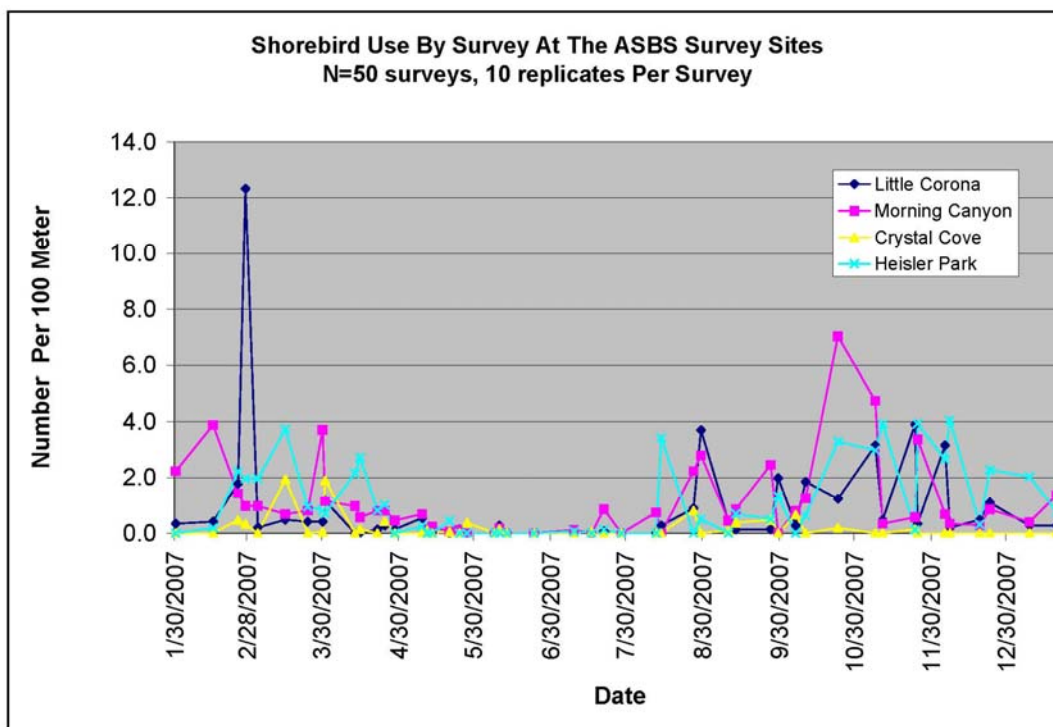


Figure 10. Seasonal Use of the ASBS Rocky Intertidal Survey Sites. January 2007 to February 2008.

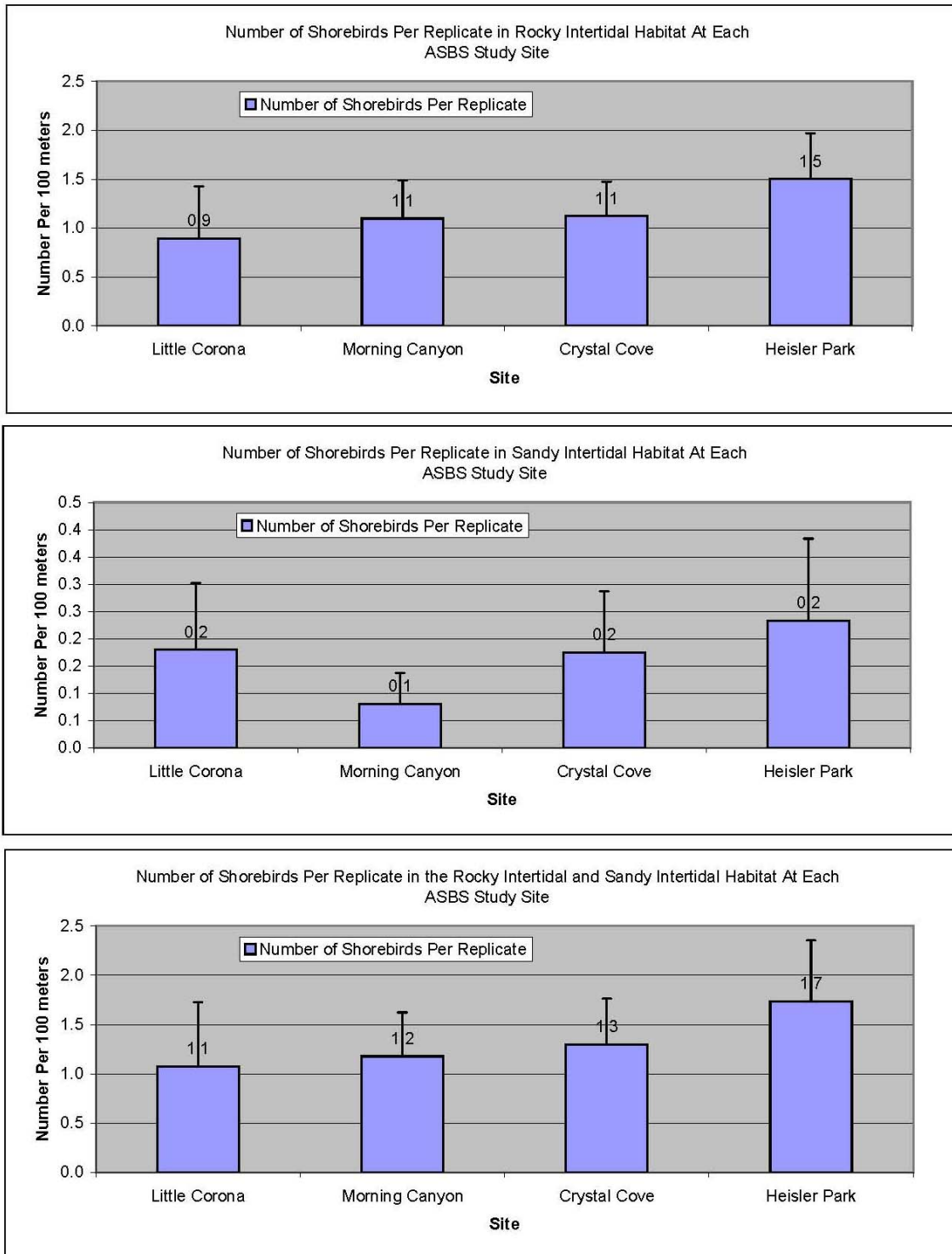


Figure 11. Number of Shorebirds (Only) Per Replicate (n=50 surveys, 10 replicates per survey) in Rocky and Sandy Intertidal Habitats. January 2007-February 2008

The types of seabirds tallied within the project area included brown pelicans (*Pelecanus occidentalis occidentalis*), cormorants (*Phalacrocorax* spp.), and gulls (*Larus* spp). No attempt was made to speciate either the cormorants or the gulls. When data for both shorebird and seabird use were combined, the numbers of birds observed were highest in Heisler Park intertidal habitats (Figure 12). However, compared to the other sites, the use of the sandy shoreline by seabirds was minimal at Heisler compared to Crystal Cove and Little Corona. Most birds were observed on “Bird Rock”, separated from the Heisler Park study site. Comparatively, there was a greater overall use of both the rocky shoreline and the sandy shoreline by birds at Little Corona and Morning Canyon than either Crystal Cove or Heisler Park.

**Yearly Dog Use Intensity.** People walked their dogs on-and-off their leashes at each of the four sites. Data for the four sites are summarized in Figure 13. These numbers reflect yearly totals, since dog walking events were not major occurrences during any one survey at any one site. A total of 397 dogs were observed on the four beaches over the 50 surveys. Fifty-two percent (205) occurred at Heisler Park; 33% (134) were observed were at Morning Canyon; 13.9% (55) were observed at Little Corona, and 0.8% (3) were at Rocky Bight in Crystal Cove. Except for Heisler Park, leashed dogs were more prevalent in both the rocky intertidal zone and on the sandy beaches than unleashed dogs. At Heisler Park most dogs were leashed (67.1 dogs per 100 meters of shoreline). The high incidence of dogs within the rocky intertidal zone at Heisler Park compared to the sandy intertidal was reflective of the limited amount of backshore sandy beach compared to the other three sites. The frequency of dog use on the beaches was similar between weekday and weekends at each of the four sites.

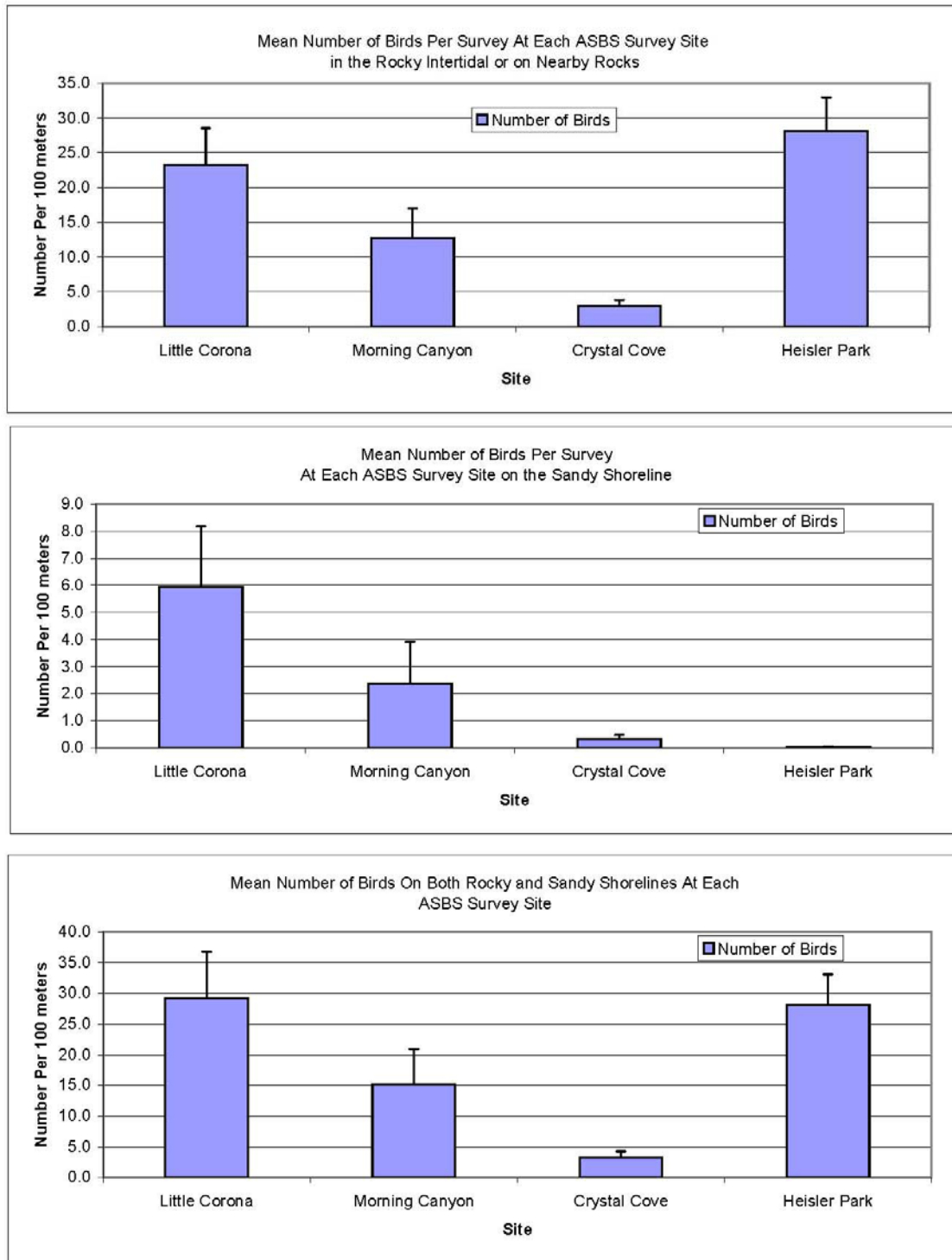


Figure 12. Number of Shorebirds and Seabirds Per Replicate (n=50 surveys, 10 replicates per survey) in Rocky and Sandy Intertidal Habitats. January 2007-February 2008.



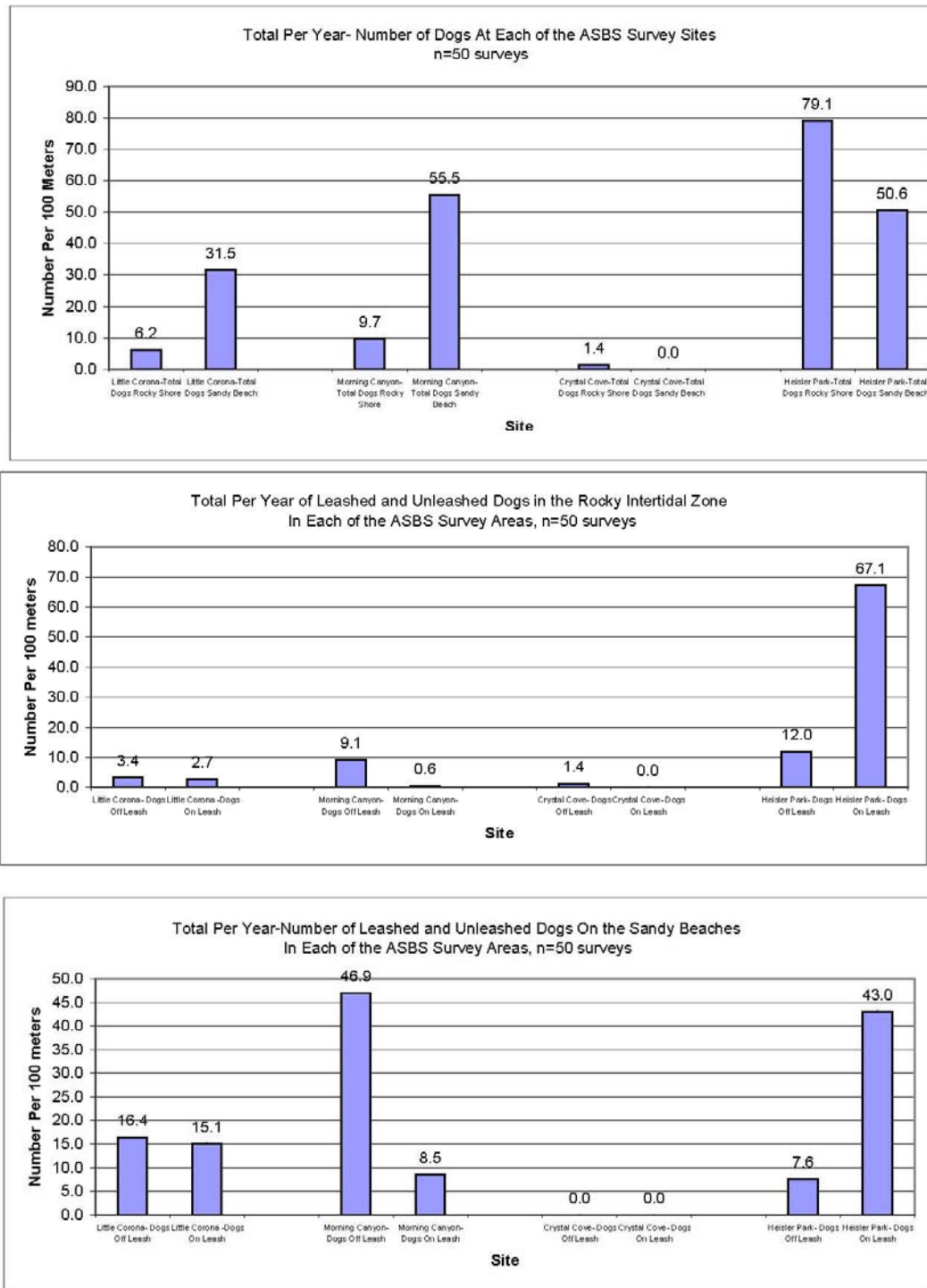


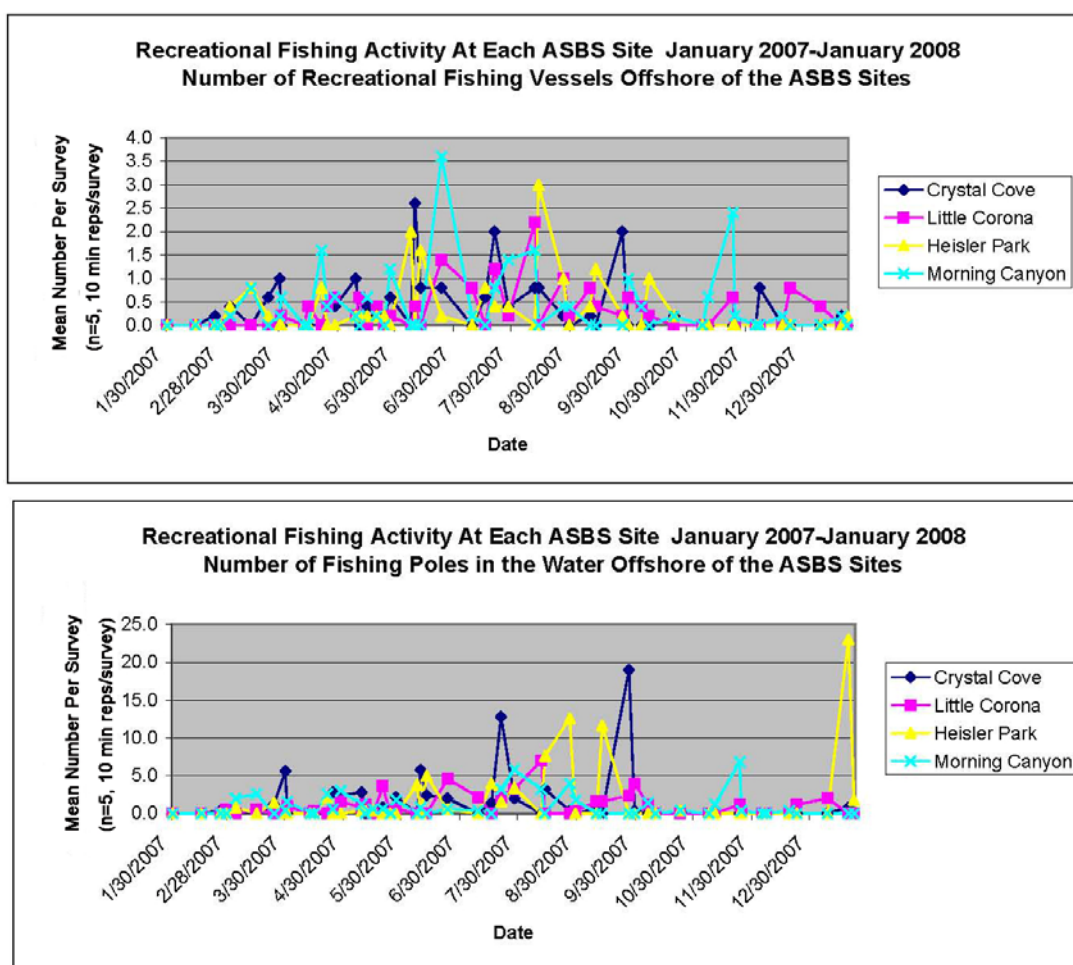
Figure 13. Number of Dogs in the Rocky Intertidal and Sandy Beach Habitats at Each ASBS Survey Site, n=50 surveys (summed overall all replicates).  
January 2007-February 2008.

### 3.4 USE INTENSITY IN THE WATERS OFFSHORE OF THE ASBS SITES

The waters offshore of the ASBS sites were used for several purposes: recreational fishing, commercial fishing, sailing, kayaking, use of motorized personal water craft (i.e., Sea Doos), diving, and swimming. Summaries of these activities are presented below.

#### 3.4.1 Recreational Fishing

Seasonality of offshore recreational fishing, based on the number of recreational fishing vessels, and the number of in-water fishing poles offshore each of the four ASBS sites is exhibited in Figure 14. Most sport fishing occurred between April and late September 2007 although fishing occurred year around each of the sites.



**Figure 14. Recreational Fishing Use Intensity Offshore Each of the ASBS Study Sites**

Recreational fishing exhibited spring and summer peaks offshore each of the four sites, with a mean/day maximum of 3.5 vessels per day at Morning Canyon in June 2007. Fishing intensity, based upon the number of in-water fishing poles varied between 0 and a maximum of 24 poles at Heisler Park in February 2008 (Figure 14), which reflected half-day boat fishing activity. Analysis of yearly means (Figure 15) indicate the number of recreational fishing vessels observed were similar among the four sites and ranged between means of 0.3 to 0.4 vessels per survey. The number of fishermen varied between 0.7 to 1.36 per/day, and the number of in-water fishing poles ranged from 0.91 to 1.62 per day. While the number of vessels tended to be greater offshore of Corona del Mar (Little Corona) and Morning Canyon (due to the closeness of Newport Bay), the number of fishermen and in-water pole fishing activity was greater at Crystal Cove and Heisler Park, reflecting greater half-day boat charters that fished offshore of the reefs at these ASBS sites.

Recreational fishing was primarily a weekend activity between Little Corona and Morning Canyon (Figure 16), although fishing intensity (based upon the number of in-water fishing poles) tended to be more equally distributed between weekdays and weekends at Crystal Cove and Heisler Park as a consequence of fewer, but larger half-day and day-boat fishing charters to these sites.

### **3.4.2 Recreational Diving**

Snorkeling and SCUBA diving activity is illustrated in Figures 17. Almost exclusively a weekend activity, most divers preferred Corona del Mar (Little Corona), with substantially less recreational diving activity at the other four sites. Up to nine divers were observed at one time at Little Corona (29 July, 2007). Most snorkelers and SCUBA divers did not carry or use spear guns.

### **3.4.4 Personal Water Craft**

Several types of personal water craft were observed during the surveys, of which kayaks and wave runners were the most common, followed by surfboards and paddleboards. Personal water craft usage occurred year-around, but was greater during the late-summer at Corona del Mar and Heisler Park. Weekends were periods of much greater PWC usage than on weekdays at all sites (Figure 18), exhibiting increases by factors between 1 and 6 times at Crystal Cove and Heisler Park, respectively.

People engaged in personal water craft usage at the nearly the same intensity offshore of Corona del Mar, Morning Canyon, and Heisler, (0.3 times/2.5 hrs over the 50 surveys, Figure 19) whereas the PWC use at Crystal Cove was three times less than the other sites. Many of the kayakers offshore of Corona del Mar and Morning Canyon also engaged in fishing activity, many of which used more than one pole.

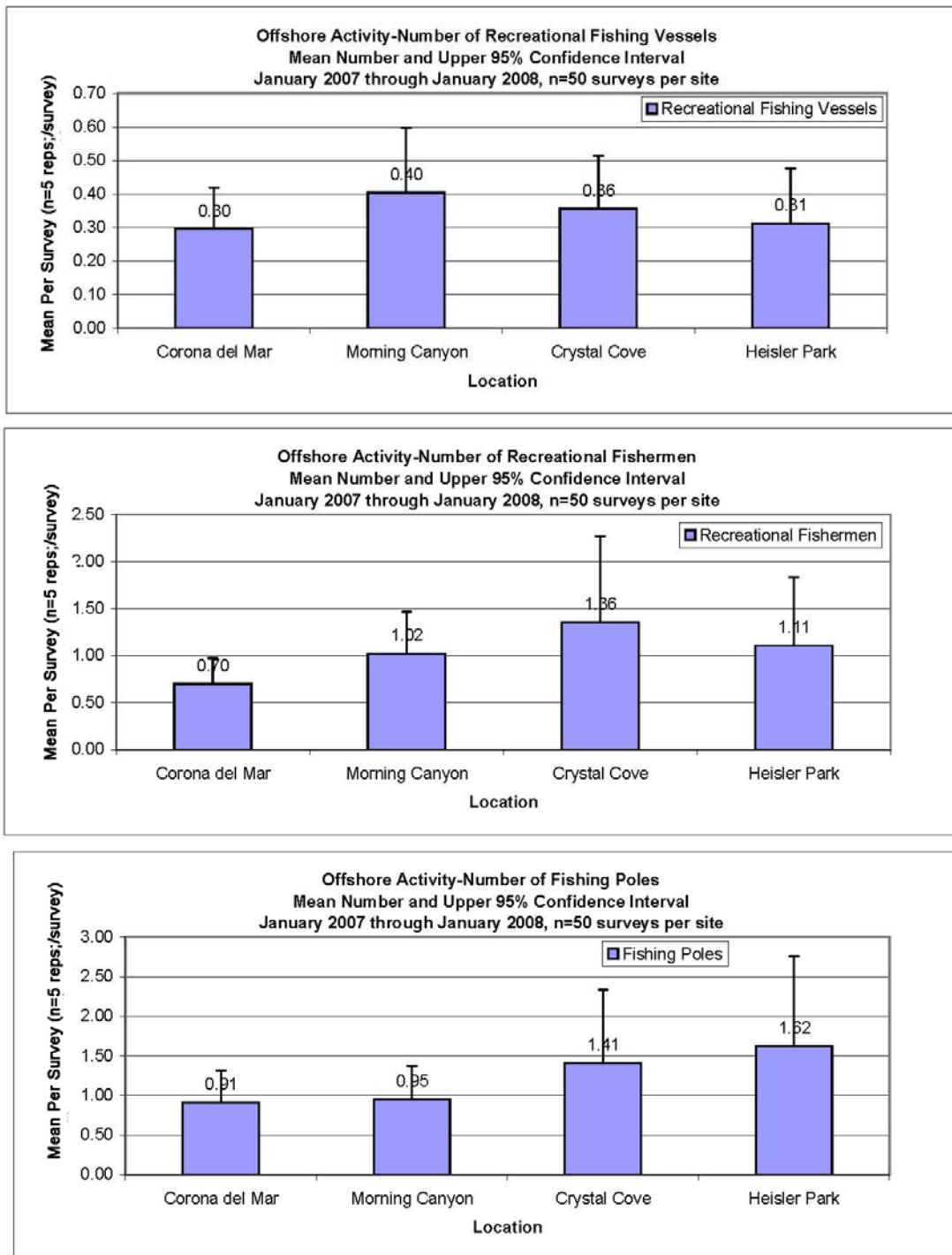


Figure 15. Offshore Recreational Fishing Activity, Summary By ASBS Site.

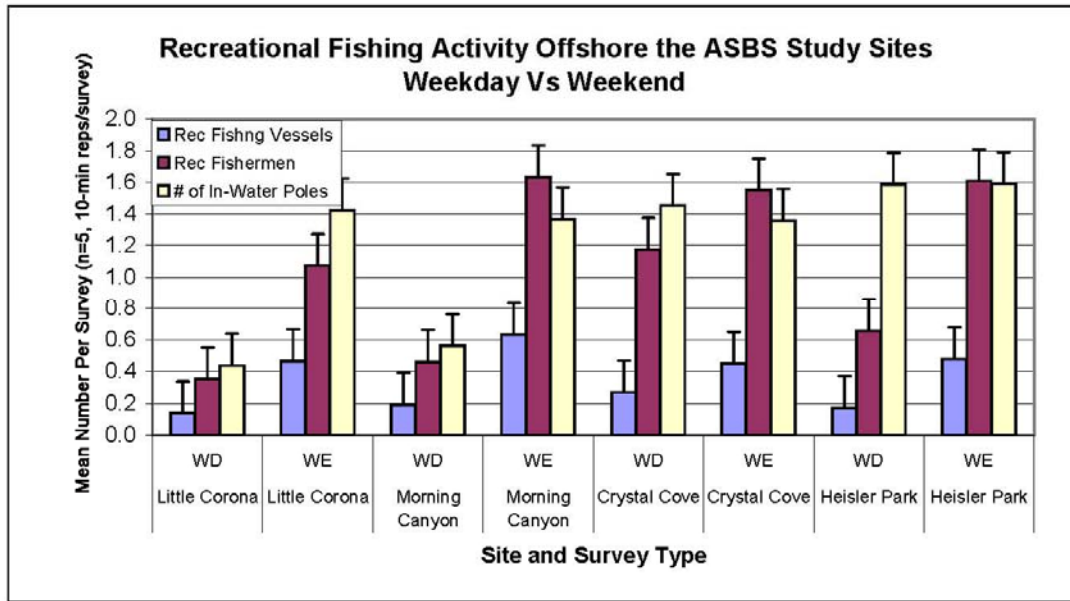


Figure 16. Recreational Fishing Offshore of the ASBS Study Sites, By Survey Type (Weekday vs Weekend)

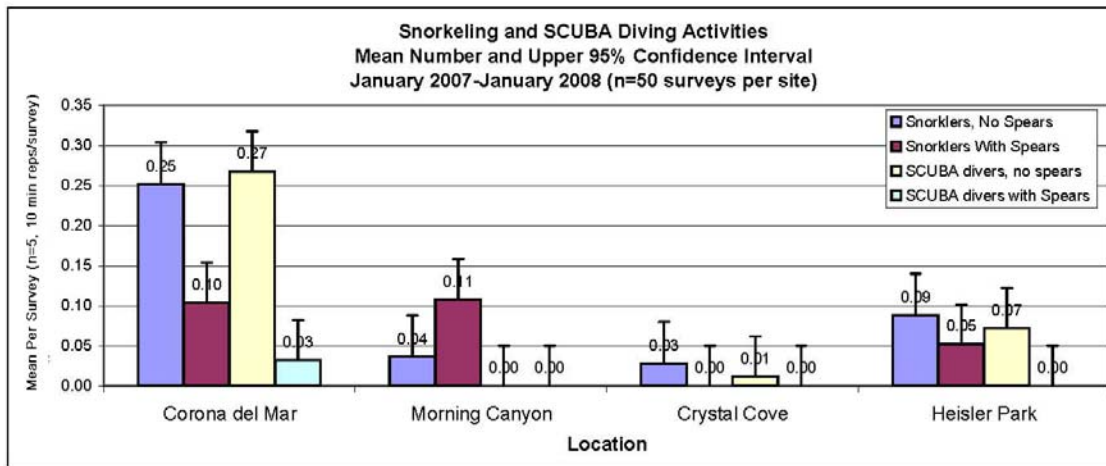


Figure 17. Recreational Diving Activity, January 2007-February 2008

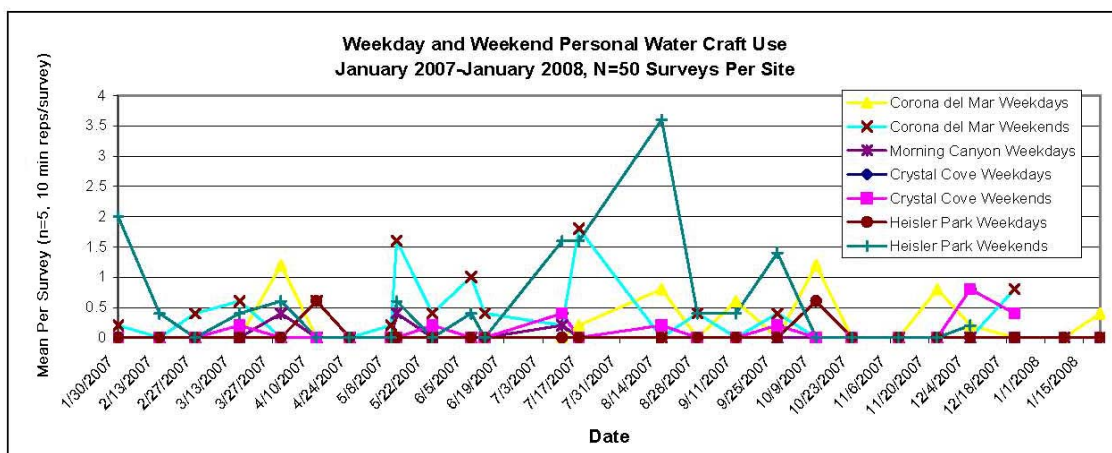


Figure 18. Weekday and Weekend Personal Water Craft Use

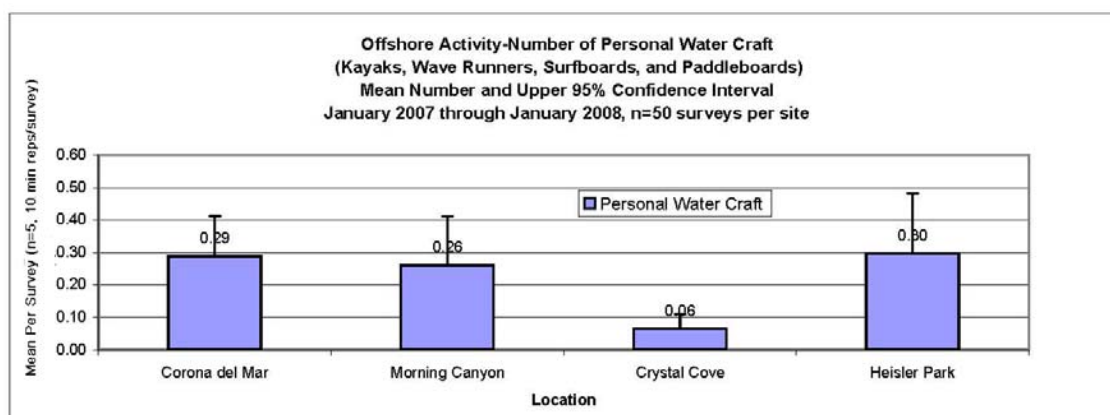


Figure 19. Personal Water Craft (PWC) Offshore of the ASBS Study Sites by Survey and Over All Surveys.

### 3.4.5 Commercial Fishing Activity

Figures 20 and 21 summarize commercial fishing activity offshore the study sites. Fishing vessels were identified as commercial operations by their Cal Fish and Game fishing registration numbers. The primary type of inshore commercial fishing activity within ASBS areas was lobster fishing. Lobster fishing season extends between the Saturday preceding the first Wednesday in October through the first Wednesday after the 15th of March. Commercial lobster fishing was prevalent at each of the four sites throughout the season with the maximum number of lobster fishing buoy/pot arrays observed was 90 buoy/pot arrays at Crystal Cove and 90 buoy/pot arrays at Heisler in December 2007 (Figure 16). Incidental commercial fishing was observed at all sites except Corona del Mar. It was not clear if the catch was lobster or crab during off season. A commercial fishing vessel out of Newport Bay was observed fishing offshore of Crystal Cove in April (1 time), June (2 times), and July (1 time); and off of Morning Canyon in May (1 time). Another vessel was observed setting traps off of Heisler Park in



July (1 time). Some buoys could not be positively identified as commercial fishing buoys. One buoy offshore of Crystal Cove is believed to mark a kelp restoration area.

Nearly twice as many commercial fishing vessels were observed to fish the Crystal Cove site than the other sites (Figure 20 and 21), although the actual number of commercial fishermen observed was higher at Heisler Park than at the other three sites, and the mean number of buoy/pot arrays during lobster season at Little Corona and Heisler was over twice the number of buoy/pots arrays observed on a daily basis at Morning Canyon and Crystal Cove.

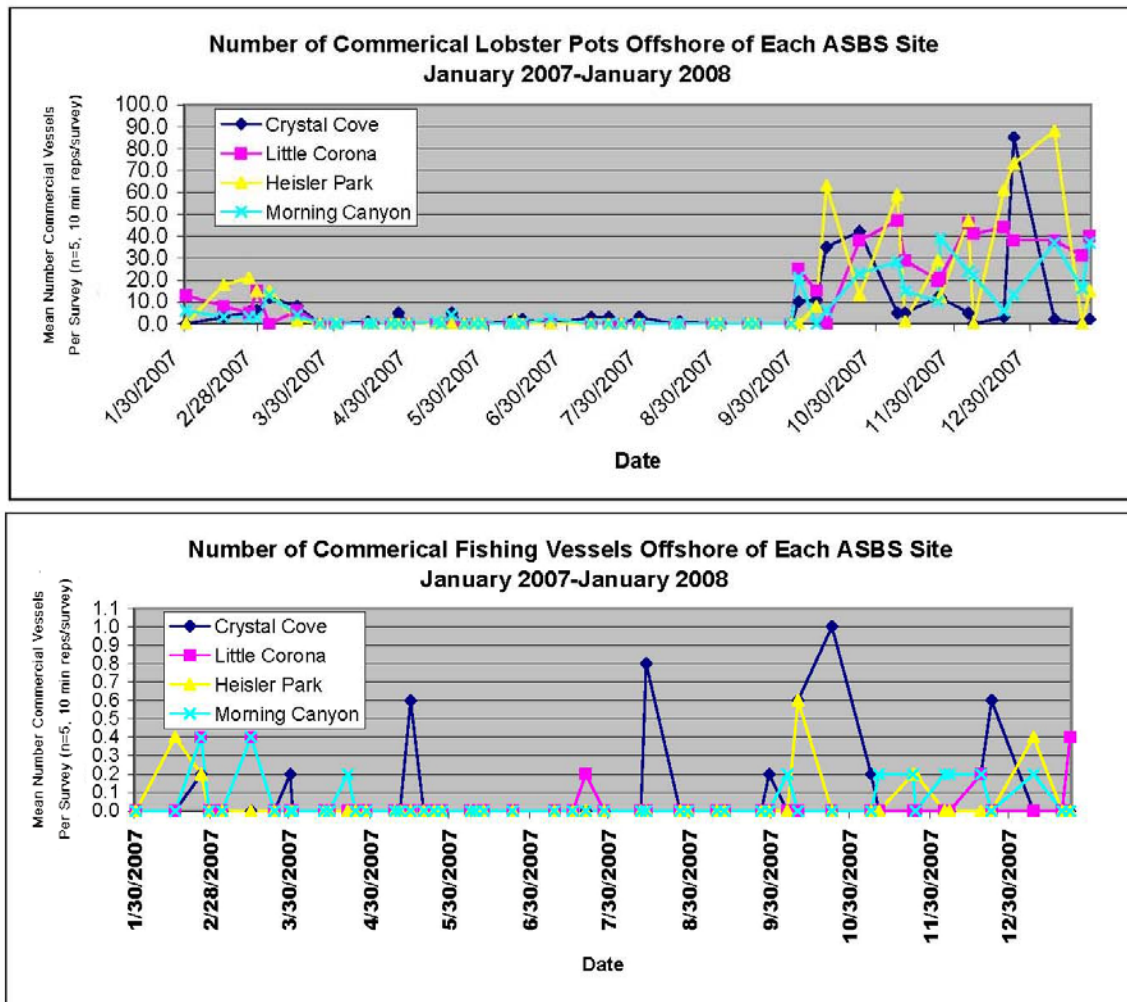


Figure 20. Seasonal Commercial Fishing Activity at the ASBS Study Sites

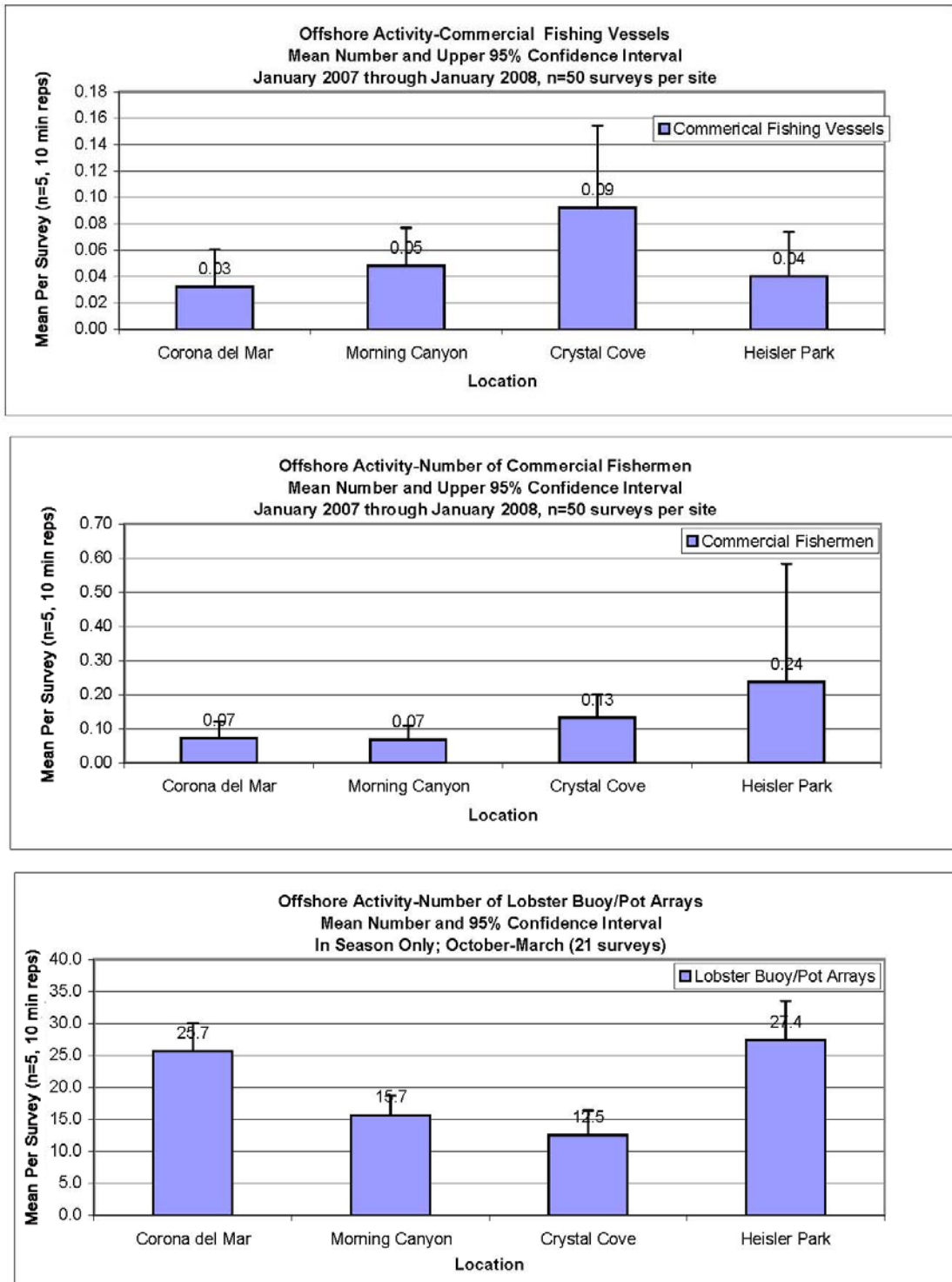


Figure 21. Yearly Summary of Commercial Lobstering Activity at the ASBS Study Sites

### 3.5 PUBLIC USE OF ROCKY INTERTIDAL HABITATS

**3.5.1 Proportion and Number of Visitors By Tide Zone.** Figure 22 illustrates the distribution of individuals, by percent and by density per 100 linear meters of shoreline at each of the four sites. Proportionally, lower percentages of visitors at Morning Canyon and Crystal Cove were present in mid and low tide areas closer to the water line than at Corona del Mar or Heisler Park. Between 4 and 5% of the visitors (1.2 and 3.0 visitors per 100 m of shoreline) were observed in the low tide areas at Morning Canyon and Crystal Cove, while between 9.21% and 11.3 % of the visitors were observed in the low tide zones at Corona del Mar and Heisler Park (13.7 and 19.2 individuals/100 sq m), respectively. Proportions and numbers of visitors at both Corona del Mar and Heisler Park were more equally distributed throughout the tide zones compared to Morning Canyon and Crystal Cove.

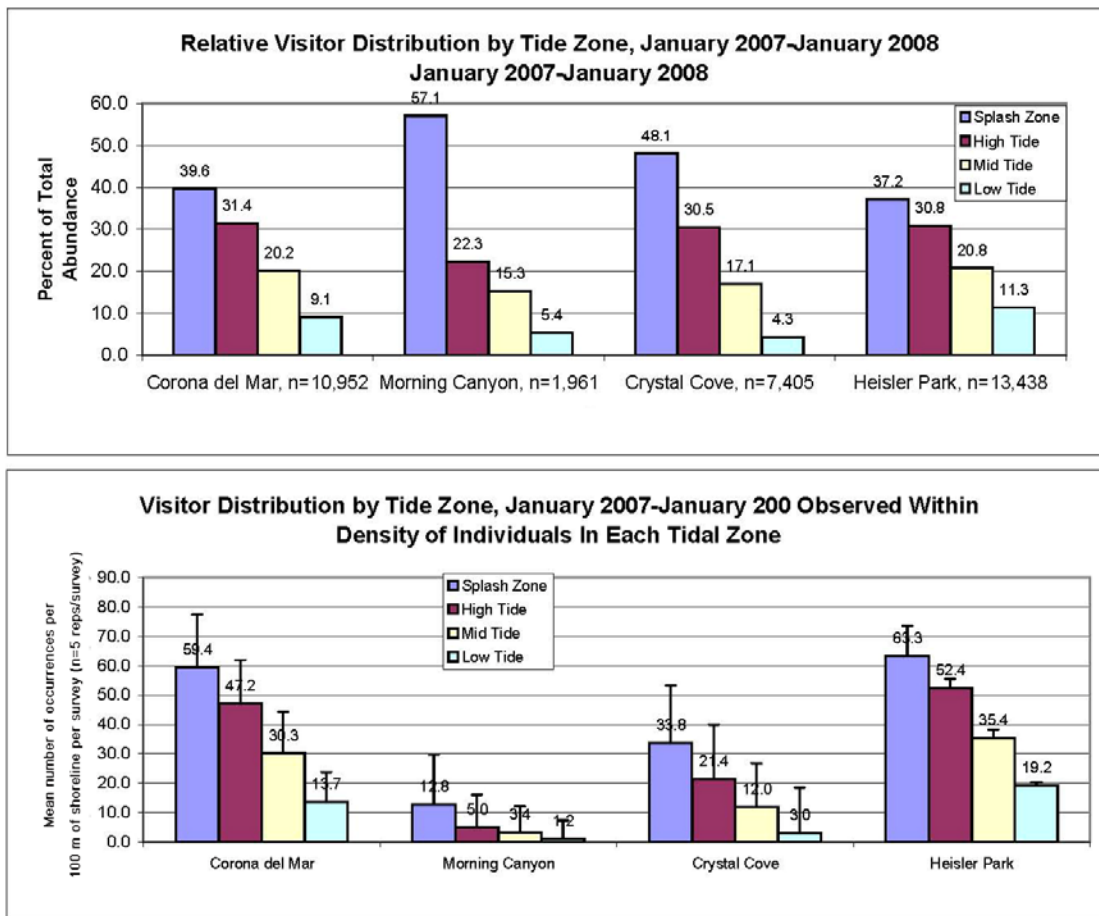


Figure 22. Distribution of Visitors By Tidal Zone, January 2007-February 2008

The breakdown of visitor use by weekday or weekend-day is shown in Figure 23. At Little Corona and Heisler Park, visitor use distribution was similar for weekdays and weekends. However, the distribution of visitors to Morning Canyon was highly skewed towards the splash zone near the sandy beach and rocky intertidal interface during weekends than during weekdays, with substantially lower visitor use of the low tide zone during weekends. This discrepancy was a result of higher numbers of younger children on the shoreline during weekends that did not venture towards the water line. Visitor distribution at Crystal Cove was skewed towards greater use of the splash and high tide zones and less visitor use in the low tide zone during weekdays than on weekends, with 10 times greater use of the low tide zone on weekends than during weekdays. This was the result of greater beach walking activity during the weekdays with more interest in the tidal pools, likely by more families on weekends than during weekdays.

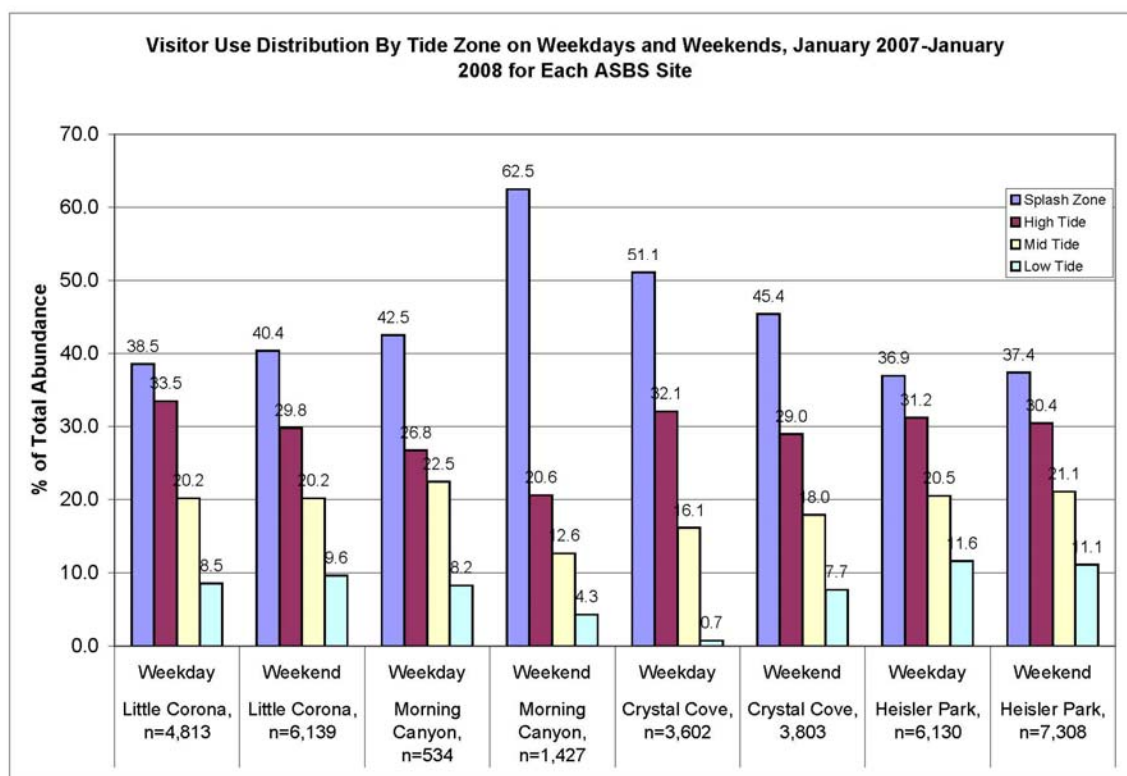


Figure 23. Comparison of Weekday and Weekend Visitor by Tidal Level at Each of the Study Sites. N=26 weekday and 24 weekend surveys

### 3.5.2 Public Use Activities in the Tidepools

**Walking (Trampling) and Sitting/Standing.** The mean number of occurrences of people walking and trampling (trampling on organisms observed), and sitting or standing in the rocky intertidal habitat standardized to 100 meters of shoreline during each survey (five, ten-minute replicate surveys) at each site are shown in Figure 24. Both classes of behaviors reflect potentially adverse effects on intertidal organisms due to direct mortality or damage to structures. The highest rate of trampling per survey (n=50) occurred at Heisler Park (88.3) and Corona del Mar (72.7). Trampling activity at Crystal Cove was less than one-half of Heisler Park (41) while the intensity of trampling at Morning Canyon was extremely low (12.6). Sitting and standing behaviors followed similar trends as walking and trampling at each of the four sites (Figure 25). Weekend trampling was greater than weekday trampling, with the greatest differential at Heisler Park. Over all surveys, trampling intensity was lowest over the summer periods when tides were highest (Figure 26). However, the density of trampling likely increased within the mid and high tide zones since the area of the rocky intertidal decreased with the influx of higher tides.

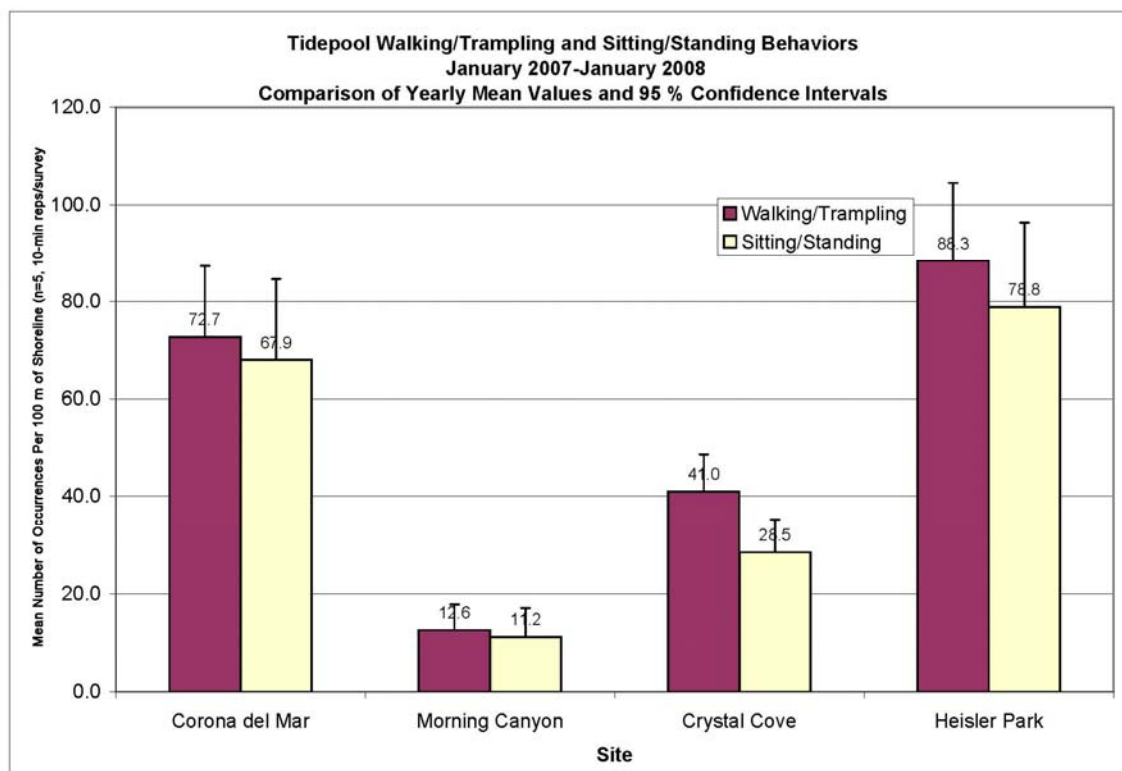


Figure 24. Walking/Trampling and Sitting/Standing Behaviors in the Rocky Intertidal Zone

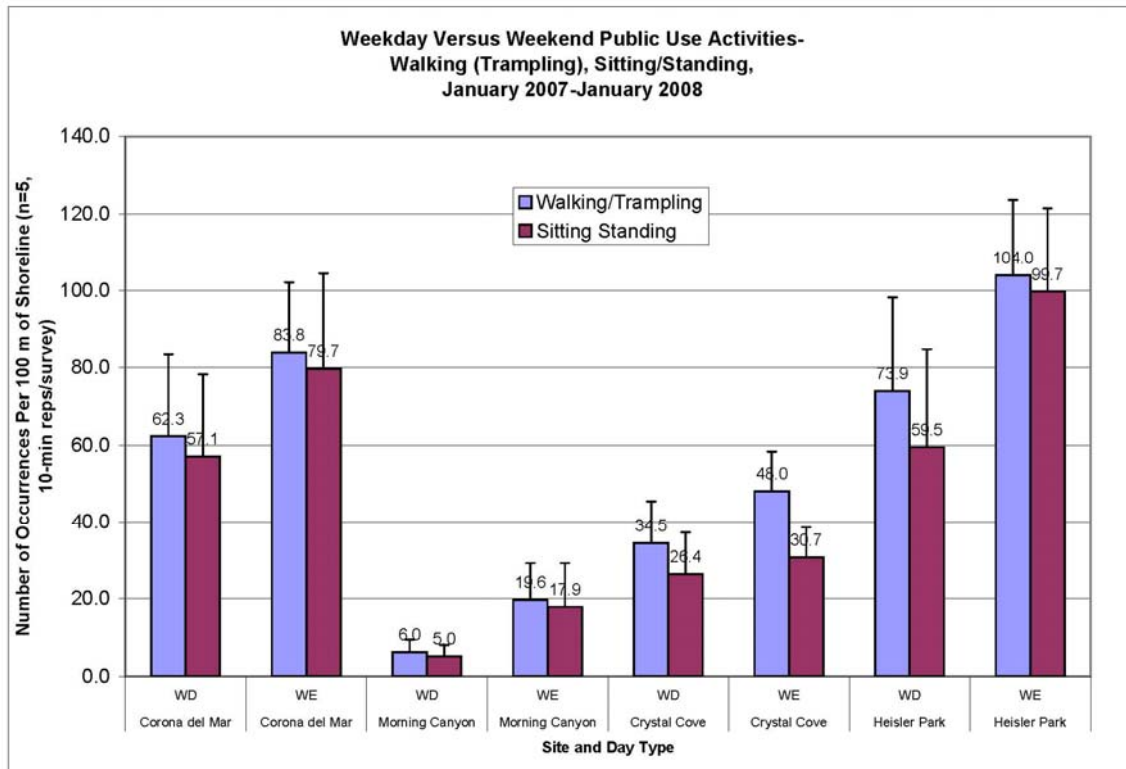


Figure 25. Comparison of Weekday and Weekend Walking/Trampling and Sitting/Standing Behaviors at Each of the ASBS Sites

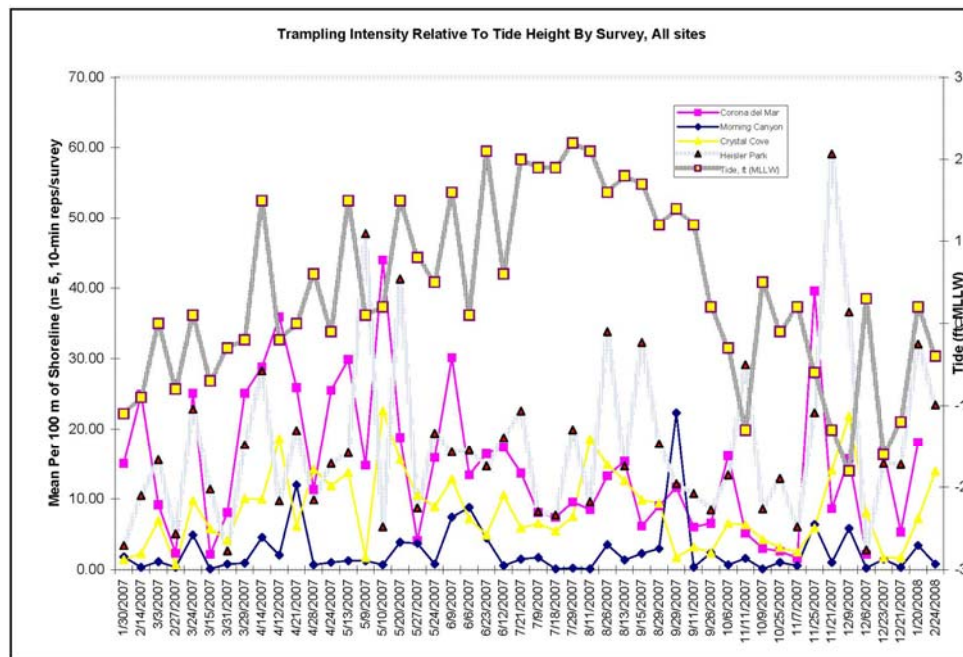


Figure 26. Mean Trampling Intensity By Survey, All Sites, Relative to Tidal Height



**Handling, Collecting, and Rock Turning.** Figure 27 illustrates the intensity of handling and picking up or touching intertidal organisms; collecting identifiable live organisms or shells and rock; or turning rocks over to observe marine life during the five, replicated DS4 surveys at each ASBS site. Handling constituted the majority of the four activities, and most handling was concentrated at Heisler Park (18 times/survey) and Corona del Mar (16.2 times/survey). Visitors collected live organisms the most at Heisler Park (1.2 times/survey) and at the least-visited site, Morning Canyon (1.1 times/survey)-twice as often than at Crystal Cove and Little Corona. Visitors also turned over rocks more frequently at Heisler Park (0.7 times/survey) than at the other three sites-Morning Canyon (0.4 times/survey), and Corona del Mar and Crystal Cove, (0.3 times/survey each). Higher levels of handling, collecting, and rock turning occurred during weekends than weekdays at all sites, although at Heisler Park, collecting was marginally higher on weekdays than weekends (Figure 28).

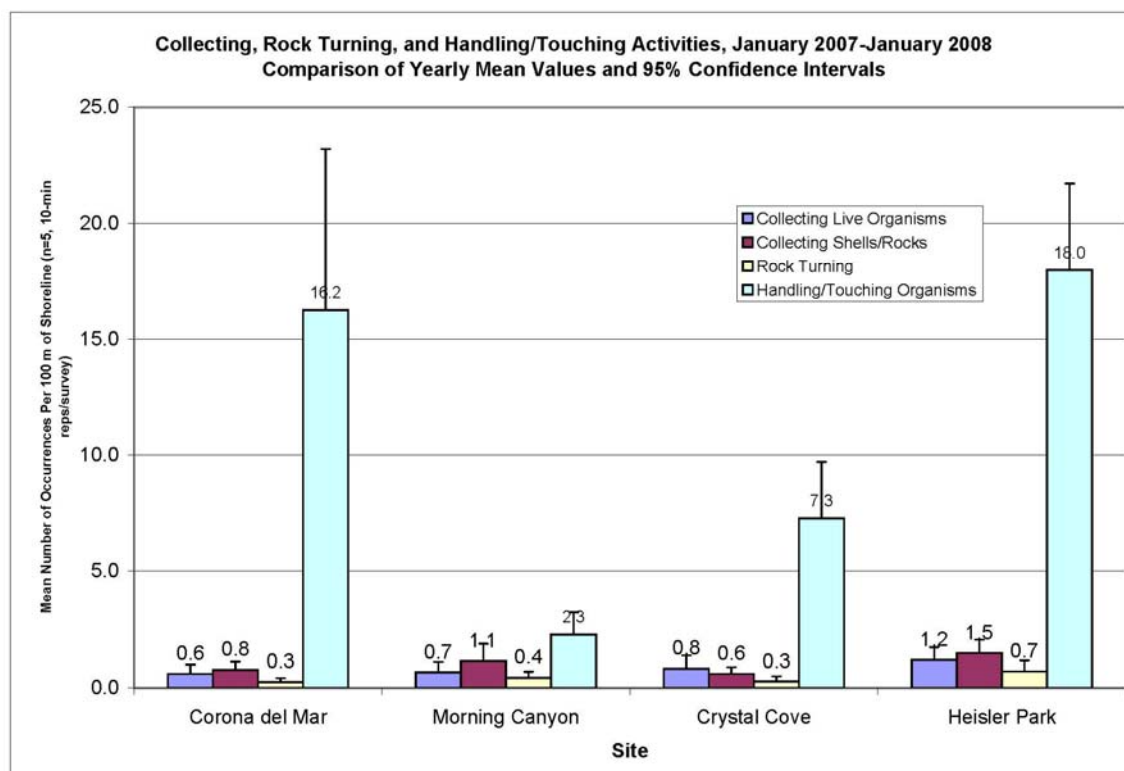


Figure 27. Frequency of Collecting Organisms, Rock Turning, and Handling/Touching Organisms, January 2007-February 2008.

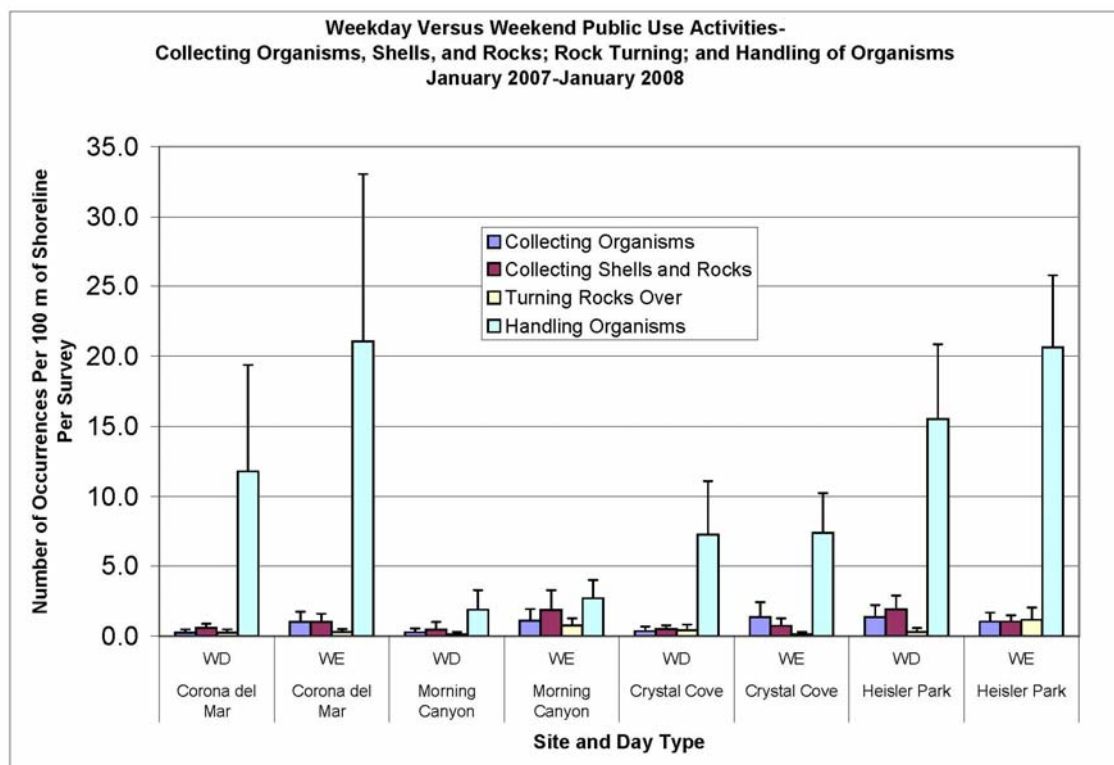


Figure 28. Weekday and Weekend Intensity  
of Collecting, Rock Turning, and Handling of Organisms

**Counts of Organisms Handled and Collected.** The number of identifiable taxa handled by individuals, and the frequency handling each taxa is presented in Table 4 for information collected during the public use behavior data collection activity (Data Set-4). Sixteen plant, invertebrate, and fish groups were handled of which many more individual species were included but not identified. Hermit crabs (*Pagurus* spp), gastropods (i.e., *Tegula* spp., *Lottia* spp., *Littorina* spp.), and shore crabs (*Pachygrapsus crassipes*) accounted for 84% of the handling observations. Most taxa were handled at all sites, although numerically, the most handling occurred at Heisler Park (57.8%) where handling was more than three times the level of handling observed at the other sites. Visitors also often handled and picked up shells in the tide pools, particularly at Crystal Cove and Heisler Park.

Handling and collecting organisms was also documented during focused surveys of individual visitors, following the collection of Data Set-5 information. During four, 10-minute periods during each survey (n=50 surveys), the organisms handled and collected by individuals randomly selected by the field personnel were enumerated. These data are summarized in Table 5. Ten taxa of plants and invertebrates were handled of which hermit crabs, gastropods, and anemones were the most frequently handled or touched organisms. The frequency of handling during the focused surveys was more than twice the level at Heisler Park (52.8%) compared to the other three sites. However, the intensity

of handling organism at Morning Canyon, 27.2%, (where the least amount of visitors were found) was greater than at either Corona del Mar or Crystal Cove.

**Collected Taxa.** Collection data were obtained during the four, 10 minute-focused surveys (Data Set 5) as well as during post-period interviews of individuals observed collecting in the tidepools. These data are summarized in Table 5 and 6. The California mussel (*Mytilus californianus*) was the most abundantly collected organism (76% of the total numbers collected). This species was collected primarily at Heisler Park and Crystal Cove (15.2 and 14.6% of the total abundance) although mussel collecting occurred at all four sites. Brittle stars, opaleye perch (*Girella nigricans*), and rocks and shells were also collected, but in substantially lower proportions than mussels.

Counts of collected organisms obtained during collecting interviews indicated that mussels were also the most commonly collected species (at Heisler Park only), followed by gooseneck barnacles (*Pollicipes polymerus*) at Heisler Park, and hermit crabs (*Pagurus samuelis*) at Corona del Mar. One of the interviewees was uncooperative and would not speak with the field observer. Of the three others, two lacked scientific collecting permits and knew that the areas were protected, and two of four were aware of tidepool etiquette signage even though they collected organisms. Three of the four individuals interviewed said they collected for “show and tell”, of which one was for a high school class. Shell and rock handling collecting was common at all sites. Significant storm and well activity dislodged large amounts of mussels and other marine life such as kelp (*Egregia menziesii*, *Macrocystis pyrifera*), wavy-turban snails *Lithopoma undosa*), and Kellet’s whelk (*Kelletia kelletii*) from the intertidal and subtidal reef platforms, particularly at Morning Canyon and Heisler Cove. Consequently, visitors were observed during and after these episodes to handle and collect moderate-to-high numbers of shells strewn about the tidepools and the sandy/gravel beach backshores.

**Table 4. Intensity of Handling Organisms at Each of the ASBS Sites  
(n=total number of observations in 50 surveys) Per 100 Meters of Shoreline Length**

<b>Taxa</b>	<b>Corona del Mar</b>	<b>Morning Canyon</b>	<b>Crystal Cove</b>	<b>Heisler Park</b>	<b>Total</b>	<b>Mean</b>	<b>Std Dev</b>	<b>N</b>	<b>Min</b>	<b>Max</b>	<b>% Total</b>
<b>hermit crabs</b>	169.2	153.1	312.8	417.7	1052.8	263.2	125.6	4	153.1	417.7	36.0
<b>gastropods (other than California mussels)</b>	123.3	140.0	325.1	434.2	1022.6	255.6	150.1	4	123.3	434.2	34.9
<b>shore crabs</b>	0.0	48.0	141.7	189.2	378.9	94.7	86.2	3	0.0	189.2	12.9
<b>anemones</b>	54.1	33.1	48.8	65.2	201.3	50.3	13.3	4	33.1	65.2	6.9
<b>mussels</b>	14.4	20.0	18.5	24.7	77.6	19.4	4.3	4	14.4	24.7	2.6
<b>macro algae</b>	18.5	9.1	8.5	11.4	47.6	11.9	4.6	4	8.5	18.5	1.6
<b>sea hares</b>	4.1	0.6	17.5	23.4	45.6	11.4	10.8	4	0.6	23.4	1.6
<b>sea urchins</b>	6.8	4.0	8.5	11.4	30.8	7.7	3.1	4	4.0	11.4	1.1
<b>turban snails</b>	0.0	0.0	7.6	10.1	17.7	4.4	5.2	2	0.0	10.1	0.6
<b>sea stars</b>	8.2	2.9	6.6	8.9	26.6	6.6	2.7	4	2.9	8.9	0.9
<b>limpets</b>	8.2	2.3	0.5	0.6	11.6	2.9	3.6	4	0.5	8.2	0.4
<b>barnacles</b>	0.7	4.0	0.0	0.0	4.7	1.2	1.9	2	0.0	4.0	0.2
<b>tide pool fish</b>	0.0	4.0	0.0	0.0	4.0	1.0	2.0	1	0.0	4.0	0.1
<b>colonial polychaetes</b>	2.7	1.1	0.0	0.0	3.9	1.0	1.3	2	0.0	2.7	0.1
<b>chitons</b>	0.7	0.0	0.0	0.0	0.7	0.2	0.3	1	0.0	0.7	0.0
<b>sea slugs</b>	0.7	0.0	0.0	0.0	0.7	0.2	0.3	1	0.0	0.7	0.0
<b>Total</b>	453.4	228.8	541.8	1398.6	2927.0	655.7	512.5	4	228.8	1398.6	100.0
<b>Mean</b>	25.7	26.4	56.0	74.8							
<b>Std Dev</b>	49.6	48.9	108.5	144.9							
<b>Number of Groups</b>	13	13	11	11							
<b>% of Total Count</b>	15.5	7.8	18.5	47.8							
<b>Empty shells in tide pools</b>	41.8	29.7	71.6	95.6	59.7	29.7	4	29.7	95.6		

**Table 5. Intensity of Handling and Collection of Identifiable Groups of Organisms During 10-minute Focused Surveys  
(4 reps/survey, 50 surveys)**

<b>Focused Surveys</b>											
<b><u>Handling</u></b>	<b>Corona del Mar</b>	<b>Morning Canyon</b>	<b>Crystal Cove</b>	<b>Heisler Park</b>	<b>Total</b>	<b>Mean</b>	<b>Std Dev</b>	<b>N</b>	<b>Min</b>	<b>Max</b>	<b>% Total</b>
hermit crabs	21.9	20.6	22.3	32.7	87.2	24.4	5.6	4	20.6	32.7	21.4
gastropods (other than California mussels	30.1	22.3	14.2	26.5	80.1	23.3	6.8	4	14.2	30.1	19.7
anemones	7.5	1.1	10.0	26.5	42.7	11.3	10.8	4	1.1	26.5	10.5
mussels	8.9	4.6	8.1	11.8	29.9	8.3	3.0	4	4.6	11.8	7.3
sea hares and sea slugs	4.1	0.0	0.9	24.6	28.4	7.4	11.6	4	0.0	24.6	7.0
shore crabs	6.8	4.0	4.3	13.3	25.6	7.1	4.3	4	4.0	13.3	6.3
macro algae	4.1	2.3	2.8	9.0	16.6	4.6	3.1	4	2.3	9.0	4.1
sea urchins	3.4	2.3	0.0	9.5	13.7	3.8	4.0	4	0.0	9.5	3.4
sea stars	2.1	1.1	0.9	4.7	8.1	2.2	1.7	4	0.9	4.7	2.0
barnacles	1.4	0.0	1.4	2.8	5.2	1.4	1.2	4	0.0	2.8	1.3
<b>Total</b>	<b>90.4</b>	<b>110.9</b>	<b>97.1</b>	<b>214.9</b>	<b>406.9</b>	<b>128.3</b>	<b>58.3</b>	<b>4</b>	<b>90.4</b>	<b>214.9</b>	<b>100.0</b>
<b>Mean/Survey (n=50)</b>	<b>1.8</b>	<b>2.2</b>	<b>1.9</b>	<b>4.3</b>	<b>8.1</b>						
<b>% of Total Observations</b>	22.2	27.2	23.9	52.8							
shells	13.0	52.6	15.6	16.6	84.8	24.5	18.8	4	13.0	52.6	20.8
<b><u>Collecting</u></b>	<b>Corona del Mar</b>	<b>Morning Canyon</b>	<b>Crystal Cove</b>	<b>Heisler Park</b>	<b>Total</b>	<b>Mean</b>	<b>Std Dev</b>	<b>N</b>	<b>Min</b>	<b>Max</b>	<b>% Total</b>
California mussels	5.5	3.4	9.0	13.3	28.9	7.8	4.3	4	3.4	13.3	76.3
brittle stars	1.4	0.0	0.0	0.0	0.9	0.3	0.7	4	0.0	1.4	2.5
opaleye surfperch	0.0	0.0	3.3	0.0	3.3	0.8	1.7	4	0.0	3.3	8.8
rocks/shells	0.0	0.6	1.9	2.4	4.7	1.2	1.1	4	0.0	2.4	12.5
<b>Total</b>	<b>6.8</b>	<b>4.0</b>	<b>14.2</b>	<b>15.6</b>	<b>37.9</b>	<b>10.2</b>	<b>5.6</b>	<b>4</b>	<b>4.0</b>	<b>15.6</b>	<b>100.0</b>
<b>Mean/Survey (n=50)</b>	<b>0.1</b>	<b>0.1</b>	<b>0.4</b>	<b>0.5</b>	<b>0.3</b>						
<b>% of Total Observations</b>	<b>18.1</b>	<b>10.6</b>	<b>37.5</b>	<b>41.3</b>							

Table 6. Results of Interviews of Individuals Observed Collecting Organisms at Corona del Mar and Heisler Park					
Organism Collecting Interviews		<u>Corona del Mar</u>			<u>Heisler Park</u>
Date	3/3/07	3/15/07	8/26/07		1/30/08
<b>Species</b>					
<i>Pagurus samuelis</i> (hermit crab)		19			
<i>Strongylocentrotus purpuratus</i> (purple sea urchin)	1				
<i>Ophioplocus esmarkii</i> (brittle star)	1				
<i>Lottia gigantea</i> (owl limpet)	1				
<i>Lottia scabra</i> (rough limpet)	1				
<i>Tegula eiseni</i> (turban snail)		1			
<i>Lepidochitona hartwedgii</i> (chiton)		1			
<i>Mytilus californianus</i> (California mussel)					200
<i>Pollicipes polymerus</i> (goose-neck barnacle)					50
<b>mussel shells</b>					35
<b>Gear</b>	butter knife	bucket			none
<b>Valid Sci. Collect. Permit?</b>	yes	no			none
<b>Knew Area Was Protected?</b>	yes	yes			no
<b>Did They See Tide Pool Signage?</b>	yes	yes	no		no
<b>Cooperative?</b>	yes	yes	no		yes
Collecting Reasons:	show and tell for high school	show and tell; because son likes them			show and tell; decorate table
Zip Code of Residence:	92806	92657			92315



Shorefishing Activity. Visitors fished at several locations at or immediately nearby each of the four ASBS sites. These included: (1) the shoreline to the west of the Little Corona tidepools; the point between Little Corona and Morning Canyon; the shoreline of Morning Canyon; the point immediately east of Morning Canyon; the sandy beach immediately upcoast of the Rocky Bight (Crystal Cove) rocky intertidal outcrop; Reef Point (Crystal Cove); and the point located west of Bird Rock (Heisler Park) that was out of the Heisler Park ASBS study area. Methods of fishing observed included spinning reels and hook and line.

The intensity of shore fishing at each of the four sites is summarized in Figure 29. No fishing was observed at Heisler Park during either weekdays or weekends. Shoreline fishing was most common at Morning Canyon (0.5 times/survey), which was nearly twice as often as either Corona del Mar or Crystal Cove. Shorefishing occurred primarily on weekends at each of the three sites (Figure 30). Fishermen collected bait (mussels) more often at Morning Canyon (0.3 times/survey) than either Corona del Mar (0.1 times/survey) or at Crystal Cove (0.2 times/survey). Fishermen brought bait to Corona del Mar and Crystal Cove more often than Morning Canyon. Bait bought from stores included squid, anchovy, shrimp. Fishermen also fished with peas.

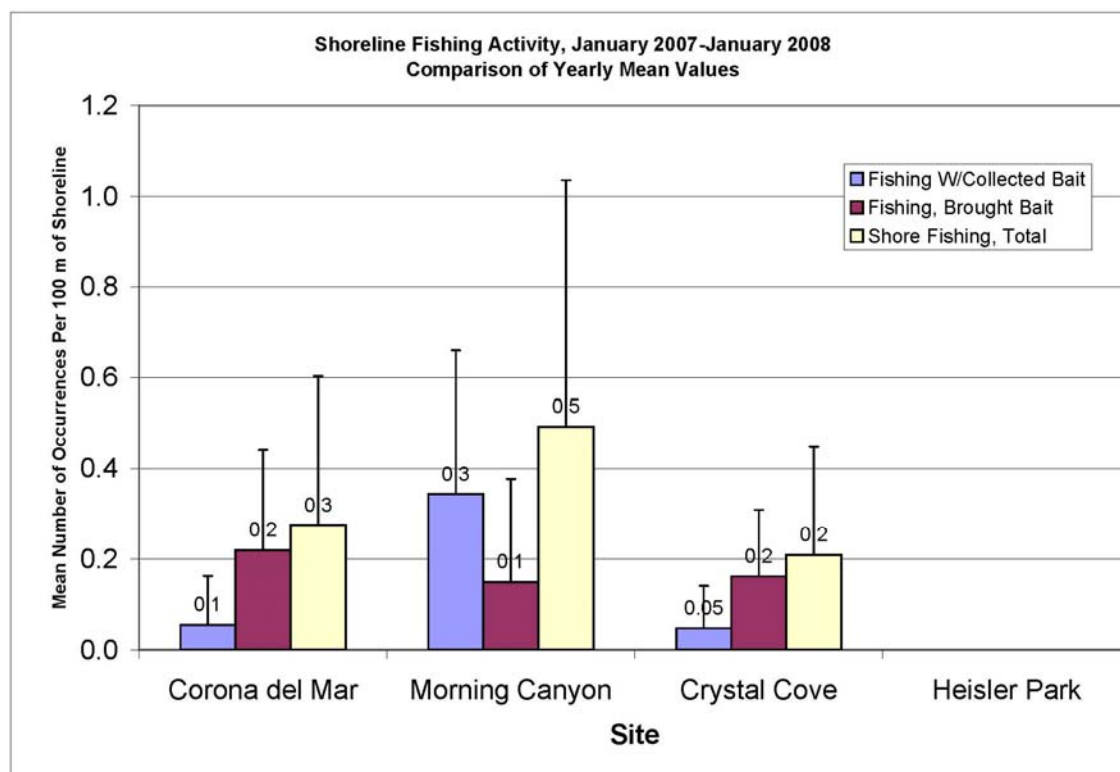


Figure 29. Shoreline Fishing Activity, January 2007-February 2008

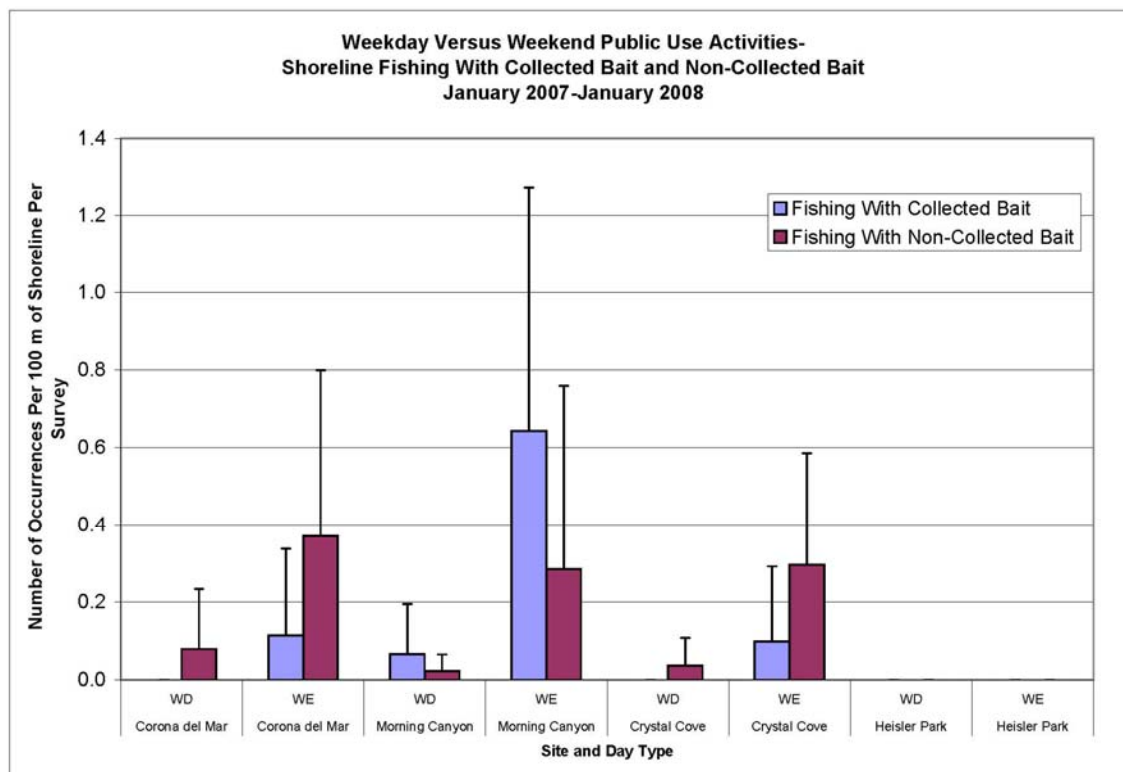


Figure 30. Comparison of Shoreline Fishing on Weekdays and Weekends

The catch of two Crystal Cove fishermen standing on the Rocky Bight intertidal platform on June 23<sup>rd</sup>, 2007 included three kelp bass (*Paralabrax clathratus*), one surf perch (*Embiotocidae*, unid.), one lobster (*Panulirus interruptus*), and one leopard shark (*Triakis semifasciata*). One of the fishermen had collected mussels as bait for the entire survey while the other used peas. Both fishermen were aware of bag limits and had valid DFG fishing licenses.

In contrast to these fishermen that were fishing legally, five fishermen were fishing illegally at Morning Canyon on May 20<sup>th</sup>, 2007. Four did not have licenses, and one had an incompletely filled out license (no name). One of the fishermen had pulled off a sea star (*Pisaster ochraceus*), and had it out of the water next to his pole. Upon examination of their catch which was in a five-gallon bucket, the CRM field observer found three black surfperch (*Embiotoca jacksoni*), of which two were adults and one was a juvenile; two female rock wrasse (*Halichoeres semicinctus*); a bag of 24 detached California mussels (*Mytilus californianus*) which they had collected from the rocks; and one fully gutted, California garibaldi (*Hypsypops rubicundus*) that was hidden beneath the bag of mussels (the perch and the wrasse were laying on top of the bag of mussels). The fishermen did not speak English. The CRM field observer informed the City of Newport Beach tidepool ranger because of the catch and gutting of the garibaldi. She then

contacted the City of Newport Beach Police and the California Department of Fish and Game. No citations were given by either the California Department of Fish and Game nor the City of Newport Beach Police, despite the serious nature of the infractions.

**Docent and Enforcement Activity** Figure 31 illustrates the intensity of docent and enforcement interaction with the public during the ASBS public use surveys. Overall, the mean number of docent and enforcement contacts with the public ranged from a high of 6.9 contacts with the public per survey at Little Corona, to a low of less than 0.1 contacts with the public at Morning Canyon. The degree of docent and enforcement contact with the public at Little Corona was consistently higher than other sites during most of the 50 surveys (Figure 32). Researchers were present primarily at Corona del Mar and Morning Canyon, and secondarily, Crystal Cove and Heisler Park (Figure 31).

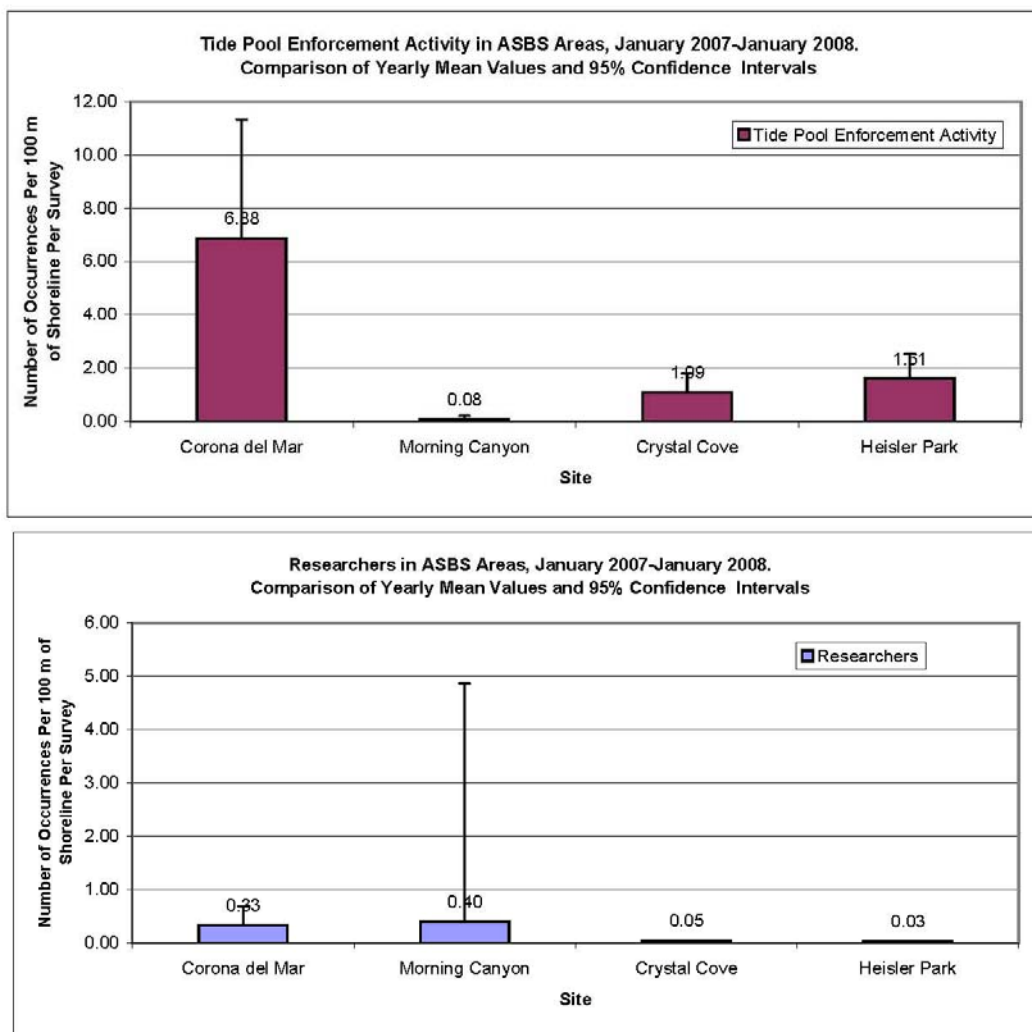


Figure 31 Enforcement and Researcher Activity, January 2007-February 2008

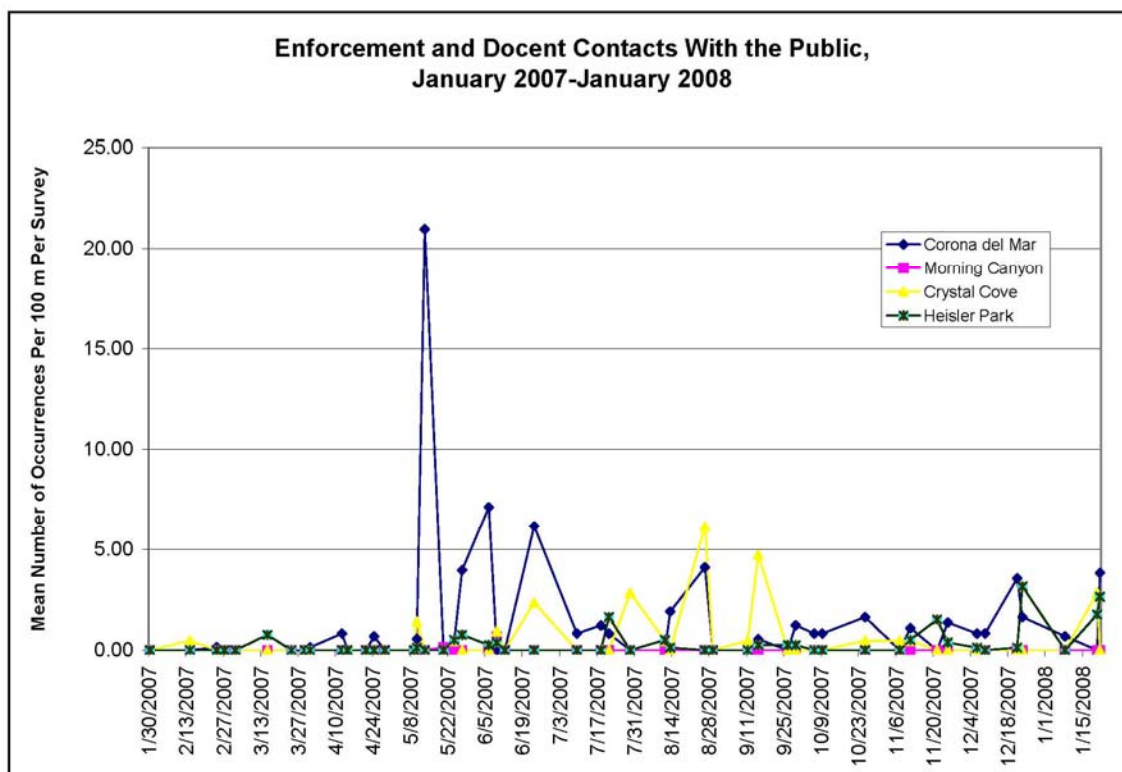


Figure 32. Enforcement and Docent Contacts With the Public By Survey, January 2007-February 2008.

Docent and enforcement contacts with the public were greater at Little Corona during the weekdays, a reflection of the consistently high number of public school groups that came to the site during the school year between May and June (Figure 32). Weekend contact with the public was also the highest at Corona del Mar compared to the other sites (Figure 32).

The level of enforcement and docent contacts at Crystal Cove and Heisler Park was higher on weekends than during the week (Figure 33). No enforcement activity was observed at Morning Canyon during weekdays; however, the level of enforcement on weekends compared to Corona del Mar was approximately 3%. The level of enforcement at Crystal Cove was about 3% of Corona del Mar on the weekdays, and Heisler Park enforcement and docent contacts with the public were 15% of those at Corona del Mar during weekdays. On weekends, the levels of enforcement activity at these two sites were 62% and 61% that of Little Corona, respectively.

Research activity at the ASBS sites was observed during both weekdays and weekends at Corona del Mar and Morning Canyon, but only on weekends at the other two ASBS sites.

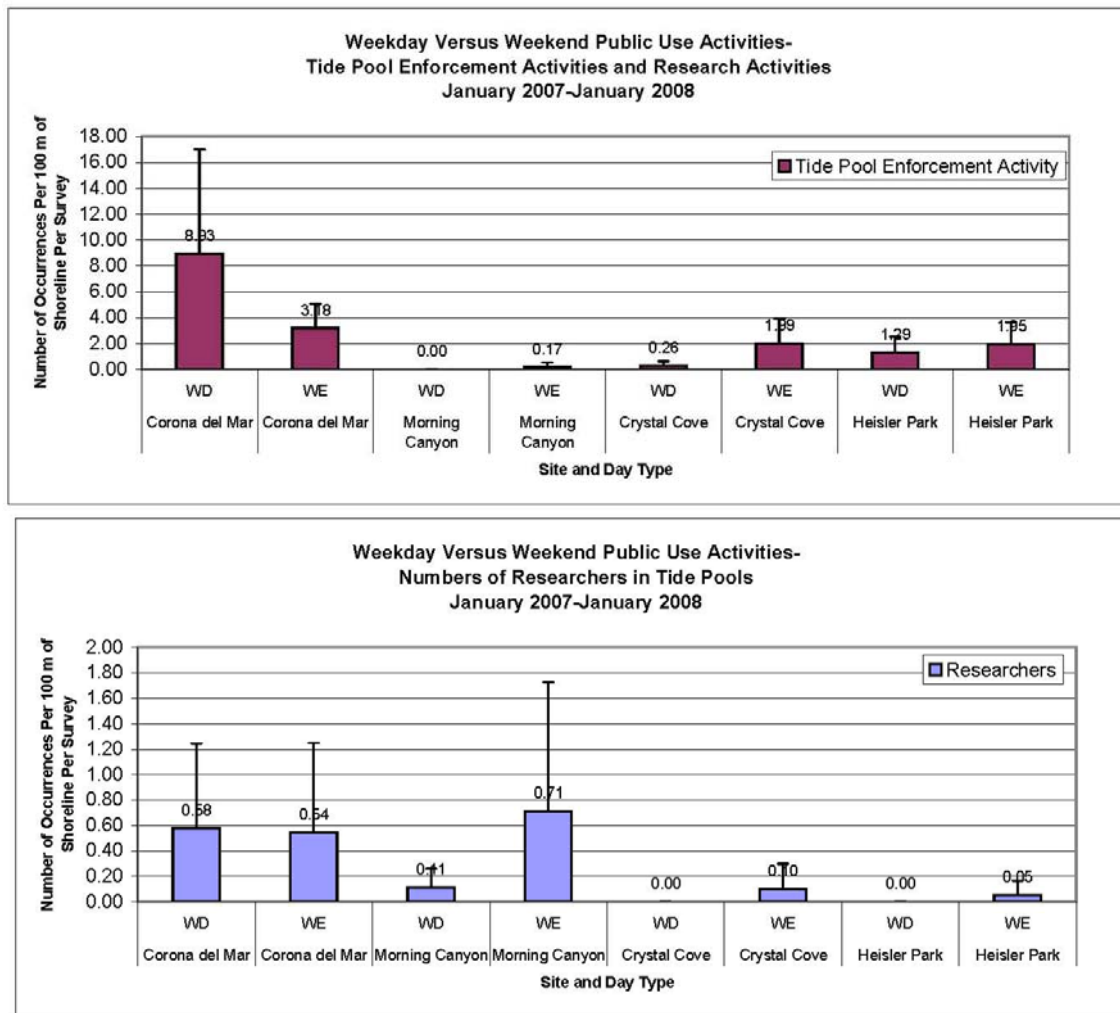


Figure 33. Comparison of Weekday and Weekend Docent and Enforcement Contacts With the Public, January 2007-February 2008

### 3.6. EVALUATION OF VISITOR EXIT QUESTIONNAIRES

Random interviews of visitors exiting the rocky shoreline were conducted at each of the four ASBS Sites. The questionnaires provided a general profile of the individuals, and their usage of the ASBS rocky intertidal zones. Tables 7a and 7b summarize the results of the exit surveys.

**Question: Have you been to this location before?** Corona del Mar (Little Corona) had the highest rate of repeat visitors (87.5%), followed by Morning Canyon (78%), Heisler Park (70.4%), and Crystal Cove (50%). The lower rate of repeat visitors at Crystal Cove likely corresponds to its high parking fee (\$10/day), accessibility, and high numbers of out of area visitors.

**Question: Do you plan to come back?** Between 89% and 100% of the respondents planned to return one of the ASBS sites.

**Question: Does it matter if it is a low tide?** Respondents at three of the four sites (Corona del Mar, Morning Canyon, and Heisler Park) generally felt that tidal height was not a factor in their visiting the tidepools (67% to 80%), whereas respondents at Crystal Cove believed that low tide conditions were important (70%).

**Question: Did you know this was a protected marine habitat?** Between 10% (Crystal Cove) and 44% (Morning Canyon) of the respondents were unaware that the areas they were visiting were protected in some manner as a State Park, State Marine Parks or an ASBS. The State Parks docent and informational handouts may have been a factor in the relatively high number of individuals that knew the area was protected, although the name “Crystal Cove State Park” may be the greatest factor. Conversely, a vast majority of visitor respondents at Morning Canyon-a private residential community in Corona del Mar with limited general public access-did not know that the beach at Morning Canyon was a protected area.

**Question: Have you seen the signs explaining tidepool etiquette?** Tidepool etiquette signs at Heisler Park were seen 81.5% of the time, compared to Corona del Mar (62.5%), Crystal Cove (40%), and Morning Canyon (33%).

**Question: How often do you visit (days)?** Visitors (primarily resident of the gated community) at Morning Canyon use the shoreline most often, averaging 85.5 days/year. This beach is commonly used for walking, walking dogs, and sitting on the sandy beach on weekends by the residents. At the other extreme, visitors to Crystal Cove responded that their average visitation lasted 7.6 days a year.

**Question: How long is each visit?** The average visit at each ASBS site was relatively similar and ranged from 2.5 hours (Morning Canyon) to 3 hours (Heisler Park).

**Question: How far out on the rocks do you go?** All of the tide zones were visited in nearly equal proportions at Corona del Mar, between the splash zone to the water line. In contrast, the distribution tended to be skewed to mid tide zone at Morning Canyon, and between the mid tide zone to the water line at Crystal Cove and Heisler Park.

**Question: Where else do you like to tidepool?** Table 7b summaries the demographics of where the respondents also like to tidepool. Most respondents from Little Corona indicated that their tidepooling activity was generally restricted to that site (72.4%). A total of 96.6% of Corona del Mar respondents tidepooled in Orange County, and all tidepooled in California. Similarly, respondents from Morning Canyon tidepooled preferred to stay in Morning Canyon to tidepool (57.1%), and all of those who responded tidepooled within Orange County.

Conversely, substantially greater number of respondents at Crystal Cove and Heisler Park liked to tidepool outside of Orange County and California. Only 54.8% of the respondents at Crystal Cove tidepooled in Orange County; 76.8% liked to tidepool within California. C Respondents at Heisler Park liked to visit more tidepool areas that the respondents at the other three ASBS site (15 sites), although 74% tidepooled within Orange County, and 93% liked to tidepool within the State. The differences in tidepooling preferences between Corona del Mar/Morning Canyon and Crystal Cove/Heisler Park reflect the destination resort influence of both Crystal Cove and Laguna Beach (Heisler Park) compared to more use by local residents at Corona del Mar and Morning Canyon.



**Table 7a. Tidepool Exit Questionnaire Summaries**

Have you been here before?	Yes	No	Total	%Y	%No	Total
Little Corona/Corona del Mar	28	4	32	87.5	12.5	100
Morning Canyon	7	2	9	78	22	100
Crystal Cove	5	5	10	50	50	100
Heisler Park	19	8	27	70.4	29.6	100
Do you plan to come back?	Yes	No	Total	%Y	%No	Total
Little Corona/Corona del Mar	30	2	32	93.8	6.3	100
Morning Canyon	8	1	9	89	11	100
Crystal Cove	10	0	10	100	0	100
Heisler Park	26	0	26	100.0	0.0	100
Does it matter if it is low tide?	Yes	No	Total	% Yes	% No	Total
Little Corona/Corona del Mar	10	22	32	31.3	68.8	100
Morning Canyon	3	6	9	33	67	100
Crystal Cove	7	3	10	70	30	100
Heisler Park	5	21	26	19.2	80.8	100
Did you know this is a protected marine habitat?	Yes	No	Total	% Yes	% No	Total
Little Corona/Corona del Mar	22	9	31	71.0	29.0	100
Morning Canyon	4	5	9	44	56	100
Crystal Cove	9	1	10	90	10	100
Heisler Park	16	11	27	59.3	40.7	100
Have you seen the signs explaining tidepool etiquette?	Yes	No	Total	% Yes	% No	Total
Little Corona/Corona del Mar	20	12	32	62.5	37.5	100
Morning Canyon	3	6	9	33	67	100
Crystal Cove	4	6	10	40	60	100
Heisler Park	22	5	27	81.5	18.5	100
How often do you visit? (days)	Total	Mean	Std Dev	N	Min	Max
Little Corona/Corona del Mar	385.0	15.4	28.4	25.0	1.0	100.0
Morning Canyon	515	85.5	123.0	9	1	365
Crystal Cove	53	7.6	10.1	7	1	30
Heisler Park	634.0	33.4	85.8	19.0	1.0	365.0

Table 7a (Continued)

How long is each visit? (hours)	Total	Mean	Std Dev	N	Min	Max
Little Corona/Corona del Mar	82.5	2.7	1.7	31.0	1.0	8.0
Morning Canyon	21	2.5	1.2	9	1	4
Crystal Cove	30	3.3	1.6	9	2	7
Heisler Park	75.5	3.0	2.0	25.0	1.0	8.0

**How far out on the rocks do you usually go?**

Little Corona/Corona del Mar		<b>Sandy Beach</b>	<b>Splash</b>	<b>High</b>	<b>High and Splash</b>	<b>Mid</b>	<b>Tide Line</b>	<b>All Zones</b>	<b>Total</b>
	<b>N</b>	0	1	6	3	9	7	2	28
	<b>%</b>	0	3.6	21.4	10.7	32.1	25.0	7.1	<b>100.0</b>
Morning Canyon		<b>Sandy Beach</b>	<b>Splash</b>	<b>High</b>	<b>High and Mid</b>	<b>Mid</b>	<b>Tide Line</b>	<b>All Zones</b>	<b>Total</b>
	<b>N</b>	1	0	1	1	3	1	0	7
	<b>%</b>	14.3	0	14.3	14.3	42.9	14.3	0	100
Crystal Cove		<b>Sandy Beach</b>	<b>Splash</b>	<b>High</b>	<b>High and Mid</b>	<b>Mid</b>	<b>Tide Line</b>	<b>All Zones</b>	<b>Total</b>
	<b>N</b>	0	1	1	0	5	3	0	10
	<b>%</b>	0	10	10	0	50	30	0	100
Heisler Park		<b>Sandy Beach</b>	<b><u>Splash</u></b>	<b><u>High</u></b>	<b><u>High and Splash</u></b>	<b><u>Mid</u></b>	<b>Tide Line</b>	<b><u>All Zones</u></b>	<b>Total</b>
	<b>N</b>	0	1	3	0	10	12	0	26
	<b>%</b>	0	3.8	11.5	0.0	38.5	46.2	0.0	100.0

Table 7b . Locations Where Interviewees Also Tidepooled

Corona del Mar			Morning Canyon			Crystal Cove			Heisler Park		
<u>Location</u>	<u>N</u>	<u>% Total</u>	<u>Location</u>	<u>N</u>	<u>% Total</u>	<u>Location</u>	<u>N</u>	<u>% Total</u>	<u>Location</u>	<u>N</u>	<u>% Total</u>
Corona del Mar	21	72.4	Little Corona	1	14.3	Little Corona	1	9.1	Any local area	1	3.7
Crystal Cove	3	10.3	Morning Canyon Only	4	57.1	Oregon	2	18.2	Catalina	1	3.7
Morning Canyon	1	3.4	Laguna	1	14.3	Malibu	1	9.1	Corona del Mar	1	3.7
Laguna	2	6.9	Crystal Cove	1	14.3	Dana Point	2	18.2	Crystal Cove	3	11.1
Dana Point	1	3.4	Total	7	100.0	Monterey	1	9.1	Dana Point	3	11.1
Venice	1	3.4				Canada	1	9.1	Laguna	2	7.4
Total	29	100.0	OC	7	100	Only Here	3	27.3	Heisler Park	6	22.2
			Other	0	0	Total	11	100.0	Northwest US	1	3.7
									Palos Verdes	1	3.7
<b>OC</b>	<b>28</b>	<b>96.6</b>	<b>OC</b>	<b>7</b>	<b>100</b>	<b>OC</b>	<b>54.6</b>		Point Loma	1	3.7
<b>Other</b>	<b>1</b>	<b>3.4</b>	<b>Other</b>	<b>0</b>	<b>0</b>	<b>Other</b>	<b>45.5</b>		Salt Creek/Strands	1	3.7
									San Pedro	1	3.7
<b>CA</b>	<b>28</b>	<b>100</b>	<b>CA</b>	<b>7</b>	<b>100</b>	<b>Cal</b>	<b>72.8</b>		Swami's	1	3.7
<b>Other</b>	<b>0</b>	<b>0</b>	<b>Other</b>	<b>0</b>	<b>0</b>	<b>Other</b>	<b>27.2</b>		Treasure Island	3	11.1
									Ventura	<u>1</u>	<u>3.7</u>
									Total	<b>27</b>	
									<b>OC</b>	<b>20</b>	<b>74.1</b>
									<b>Other</b>	<b>7</b>	<b>25.9</b>
										27	100.0
									<b>CA</b>	<b>26</b>	<b>96.3</b>
									<b>Other</b>	<b>1</b>	<b>3.7</b>

## **4.0 DISCUSSION**

Public use surveys at four sites within three central Orange County, California Areas of Special Biological Significance (ASBS) were conducted between January 30<sup>th</sup>, 2007 and February 18<sup>th</sup>, 2008. Fifty surveys were conducted at each site. Each survey was conducted over a 2.5 hour period beginning one-half hour before the low tide. Twenty-six weekday and 24 weekend-day surveys were conducted at Little Corona and Morning Canyon sites in ASBS #32, at Rocky Bight [Crystal Cove] in the Irvine Coast ASBS #33, and at Bird Rock [Heisler Park] in ASBS #31. This encompassed an Orange County study area extending 5.9 mi (9.5 kilometers) between Corona del Mar and Laguna Beach, California. The survey effort included 200 field days and 500 field-hours of observations to quantify the number of visitors, dogs, and birds, and to identify the types of, and amount of onshore-and-offshore visitor use activities.

Observations were made throughout the year during most weather conditions except heavy rains. While most data collection occurred during daily low tides of +0.5 ft MLLW or lower, it was also necessary to collect data during spring and summer periods when low tides less than +0.5 ft MLLW usually occurred in the dark, or very early in the morning when the public was not present. Therefore, our data sets also included surveys when the tides were +2.3 ft or less in order to assess year-around public use of ASBS areas. Physical data displayed minimal variability with respect to tide levels, cloud cover, sea state, surf height, sea temperature, air temperature, and wind speed. The only noticeable trend observed was a slight decrease in air temperature with concurrent increases in wind speeds along an upcoast-to-downcoast gradient between Little Corona and Heisler Park. Never-the-less, the differences were slight, and the public use data collected at the four sites along the 6-mile stretch of Orange County shoreline were unlikely influenced by small variations in weather and sea conditions.

### **4.1 Site Attributes**

Table 8 summarizes the ASBS data collected during the year-long survey. Each site differed with respect to how easy or difficult it was for the public to access the shoreline, relative to parking, the type of road access (paved or not; long or short trail access), the present of support facilities (i.e., restrooms), and educational programs or docent support.

Little Corona (ASBS #32) was the most public-accessible site with free parking above the beach on Ocean Avenue and side streets, paved access to the tidepools, a year-round tidepool management program, tidepool educational programs, and heavy Kindergarten through 12<sup>th</sup> grade use of the intertidal as a teaching site. The tidepools were actively managed by City of Newport Beach staff with assistance from City lifeguards during both weekdays and weekends, although weekday encounters with the public were greater due to school-group encounters. With the exception of the school groups, visitors tended to be from the Orange County area that frequently returned to the Little Corona tidepools.

Table 8. Comparison of Attributes and Rank Order of Attributes Among All Survey Sites. (1=Highest Intensity 4=Lowest Intensity)

<b><u>Attribute</u></b>	<b><u>Little Corona ASBS #32</u></b>	<b><u>Morning Canyon ASBS #32</u></b>	<b><u>Crystal Cove, Rocky Bight ASBS #33</u></b>	<b><u>Heisler Park, ASBS #31</u></b>
<b><u>Habitat</u></b>	Backshore sandy beach to the west, limited sandy shoreline shoreward of rocky intertidal. Extensive low to high rocky intertidal platforms, one large tide pool	Sandy/cobble backshore beach, low to high rocky intertidal platforms, extensive tidepools	Extensive backshore sandy beach and low-to-high intertidal outcrops	Limited backshore sandy beach but highly used, wide low-to-mid relief boulder and platform reef
<b><u>Parking</u></b>	Free	No Public Parking	\$10/day	\$0.25/hr, limit of two hours or free in residential areas
<b><u>Access</u></b>	Easy from Ocean Ave	Difficult for the public; locked gate, must walk from Little Corona over high relief rocks	Walk to beach along paved access road, tram ride for \$1.00	Easy to moderate from Cliff Drive
<b><u>Restrooms</u></b>	Yes at base of access path to beach	No	Yes, nearby at Visitor Center	At top of bluff, on Cliff Drive
<b><u>Enforcement on Site: And Docent Programs</u></b>	Yes, City employees and lifeguards, City "tidepool rangers"	None	Yes, State Rangers and Lifeguards, and docent program	Yes, Marine Protection Officer (roaming) and lifeguards, and docent program
<b><u>Educational Groups</u></b>	Yes, extensive	None	Yes, extensive	Yes, moderate
<b><u>Level of Docent/Enforcement Enforcement Activity</u></b>	1	4	3	2
<b><u>Period of Highest Enforcement and Docent Contact</u></b>	Weekdays, spring, summer, and fall	Low year around	Weekends and summer	Weekends, spring, summer, and fall
<b><u>Level of Scientific Research</u></b>	1	1	3	4
Public Use Intensity- Number of Visitors	2	4	3	1
Period of Highest People PUI	Early winter to late spring	Low year around; peaks in summer	Early winter to late spring	Early winter to late spring
<b><u>Rocky Tide Zone Use (Number of People per 100 meters of shoreline)</u></b>				
Splash Zone	2	4	3	1
High Tide Zone	2	4	3	1
Mid Tide Zone	2	4	3	1
Low Tide Zone	2	4	3	1
<b><u>Shorebird Use Intensity</u></b>				
Season of Most Shorebird Use	Winter and Fall	Winter and Fall	Winter and Fall	Winter and Fall
Shorebird Use Intensity (Numbers)	4	3	2	1
<b><u>Dog Use (Numbers)</u></b>	3	2	4	1

<b>Table 8 (Continued)</b>		(1=Highest Intensity 4=Lowest Intensity)		
<b>Visitor Behaviors in the Tide Pools</b>				
Period of Most Frequent Trampling***	Winter/Fall	Winter/Fall	Winter/Fall	Winter/Fall
Weekend Walking/Trampling	2	4	3	1
Weekday Sitting/Standing	2	4	3	1
Handling Organisms	2	4	3	1
Collecting Shells/Rocks	3	2	4	1
Rock turning	3	2	4	1
Collecting Live Organisms	3	4	2	1
Period of Most Handling, Collecting, and Rock Turning	Weekdays/Weekends for handling; weekends for others	Weekdays/Weekends for handling; weekends for others	Weekdays/Weekends for handling; weekends for others	Weekdays/Weekends for handling; weekends for others
Number of Species or Taxa Observed Collected	13	13	11	11
Dominant Species Handled	Hermit crabs, snails, mussels, sea hares, sea slugs, shorecrabs	Snails, hermit crabs, mussels, shore crabs	hermit crabs, mussels, anemones, mussels, shore crabs	hermit crabs,snails, mussels, sea hares, sea slugs, shore crabs, macroalgae, sea urchins
Species Most Frequently Collected	Mussels, brittle stars	Mussels	Mussels, opaleye perch	Mussels
<b>Shoreline Fishing</b>				
Period of Most Frequent Shoreline Fishing	Weekends	Weekends	Weekends	Weekends
Shoreline Fishing Intensity	3	1	2	4 (none observed)
Shoreline Fishing With Collected Bait	3	1	2	None observed
Shoreline Fishing With Bait Brought to ASBS	2	1	3	None observed
<b>Public Use in Waters Offshore of ASBS</b>				
<b>Recreational Fishing</b>				
Highest Recreational Period of Fishing	April through late September	April through late September	April through late September	April through late September
Maximum Period of Fishing	Weekend	Weekend	Weekdays/weekends	Weekdays/weekends
Number of vessels	4	1	2	3
Number of fishermen	4	3	1	2
Number of fishing poles in water	4	3	2	1
<b>Recreational Diving</b>	1	3	4	2
<b>Commercial Fishing</b>				
Type of Activity	Lobstering	Lobstering	Lobstering	Lobstering
Number of Fishing Vessels	4	2	1	3
Number of Fishermen	4	3	2	1
Number of Lobster Buoys/Arrays	2	3	4	1

At the opposite access extreme, Morning Canyon rocky intertidal habitat (ASBS #32) was located in front of a private community with a locked-access gate for residents only. The general public had to walk across high-relief rocks from Little Corona at lower tides. This site has no public facilities, no educational outreach, and limited tidepool enforcement activity from City of Newport Beach staff, since the majority of public use was at Little Corona tidepools. This site was rarely visited by the general public for tidepooling but commonly visited over the course of the year in low numbers by Morning Canyon residents. The residents rarely visited other tidepool habitats other than Little Corona.

Access to Crystal Cove State Beach (ASBS #33) was either by a paved trail from the State Parks parking lot on Coast Highway (\$10.00 daily fee), or by shuttle bus that charged a \$1.00 fee in addition to a parking fee. The State Parks' extensive educational program was extensive (self-guided and guided tours) and was assisted by local tidepool docents. This site, similar to Heisler Park, attracted more out-of-county residents and out-of-state visitors than either Corona del Mar or Morning Canyon, reflective of the destination resort's influence. In addition, Crystal Cove had the lowest rate of return visitors (50%) that may have corresponded with the parking fees for local residents, and/or as high numbers of out of area visitors.

The Bird Rock study site within Heisler Park ASBS (#31) was located nearby Main Beach in Laguna Beach. Public metered parking was available on nearby streets above the beach, or free parking on the north side of Coast Highway. There was adequate stair access to the beach, or from the sandy beach from Main Beach. Restrooms were located at the top of the cliff. Tidepool docents from Oceans Laguna Foundation monitored the site along with City's Marine Life Protection Officer (MPO) who also had to patrol the entire City of Laguna Beach shoreline. The limited amount of time that the MPO could spend at the site appeared to limit the officer's effectiveness for this particular area of Heisler Park, due to the MPO's city-wide jurisdiction. Visitors were a mix of local, out-of County, and out-of-state visitors.

## **4.2 Public Use Intensity (PUI)**

A total of 25,561 individuals were counted in the rocky intertidal zone at the four sites during the year-long investigation and another 11,456 were counted on the sandy beaches next to the tide pools. Sixty-nine percent of the visitors were recorded in the rocky intertidal habitat, while 31% remained on the adjoining sandy beaches. The highest percentage of people counted within rocky intertidal habitat was at Heisler Park (46.5%), while the highest number of people counted on the sandy beaches was at Little Corona (32.4%). The lowest percentage of people counted in the rocky intertidal and on the sandy beaches was at Morning Canyon (3% and 15%, respectively).

Table 9 summarizes the Public Use Intensity (PUI) quotients within the rocky intertidal at each of the four ASBS sites. The range of PUIs varied between 8.6 visitors per 100



Table 9.  
Summary of Public Use Intensity (PUI) Quotients for Each ASBS Rocky Intertidal Site.  
All Surveys (50 surveys Per Site)

<u>Area</u>	Total Number in Rocky Intertidal 50, 2.5-hour surveys, 10 Replicate Counts Per 100 Metes of Shoreline Per Survey	Total Number in Rocky Intertidal Per 100 Linear Meters of Tide Pool Shoreline Per Survey (2.5 hrs)	% of Total	Extrapolated Number of People in Rocky Intertidal Per 100 Linear Meters of Shoreline Per Year (4 hours/8 hours)
<u>Little Corona ASBS #32</u>	8,203	112.4	32.1	<b>65,642/13,1283</b>
<u>Morning Canyon ASBS #32</u>	756	8.6	3.0	<b>5,022/10,044</b>
<u>Crystal Cove ASBS #31</u>	4,707	44.6	18.4	<b>26,046/52,093</b>
<u>Heisler Park ASBS #33</u>	11,895	135.9	46.5	<b>79,366/158,731</b>
<u>All Sites</u>	25, 561	72.3	100	<b>42,223/84,446</b>

meters at Morning Canyon per survey) to 135.9 visitors per 100 meters of shoreline per 2.5 hr survey at Heisler Park. Extrapolating these data to yearly numbers (based on, four-hour per day visits) the range in yearly use varied between 5,022 visitors (Morning Canyon), and a high of 79,366 visitors at Heisler Park. These numbers are within general non-normalized data per shoreline length reported for Little Corona between 2002-2006 (Table 10). Data provided for Crystal Cove are not directly comparable (Table 10), but provide an indication of the importance of Crystal Cove State Park's educational programs. The PUI quotients for Central Orange County ASBS sites are also within observed public use visitor ranges reported at Treasure Island in Laguna Beach between 2002 and 2006 (Coastal Resources Management, Inc., 2007). Yearly estimates normalized to 100 m of shoreline and four-hour tidepool visits varied between a low of 15,618 (2002, prior to the opening of the Montage Resort) to 65,310 (2004), the year following the opening of the Montage Resort. Data for Treasure Island were calculated based upon all tide ranges and full eight-hour sampling periods.

The number of visitors at Central Orange County ASBS high use intensity sites (Heisler Park and Little Corona) during this investigation was higher than at "high use" sites in Santa Monica Bay (Leo Carrillo and Point Fermin) based on results of studies conducted by Ambrose and Smith (2005). In Santa Monica Bay visitor use studies, when normalized to shore length, the Leo Carrillo high use area had an estimated 49,054 visitors per year per 100 m of shoreline. The Point Fermin high use area had a slightly higher normalized number, 51,795 visitors per year per 100 m of shoreline. Visitation at the five "high use" areas ranged from 30,000 to 50,000 visitors per year per 100 m of shoreline. Although the number of people that visited "low use" areas was substantially lower than high use areas, visitation at the low use areas was actually substantial, ranging from 5,000 to 12,000 visitors per year per 100 m of shoreline.

Table 10. Estimates of Public Use Numbers at Corona del Mar  
(Robert C. Badham Marine Park) And at Treasure Island  
Source: Amy Stine, City of Newport Beach Refuge Supervisor and Coastal Resources;  
Winter Bonin, Crystal Cove State Park

<b>Year</b>	<b>Little Corona</b>	<b>Number Breakdown</b>	<b>Methods of Counts</b>	<b>Crystal Cove</b>	<b>Methods of Counts</b>
2002-03	5,000	4,000 in classes plus 1,000 not in classes	Numbers from school visits that go through reservations	7,276	Total of guided and unguided tidepool walks
2003-2004	83,000 max	8,000- 10,000 students, 73, 000 not in classes	Numbers from school visits that go through reservations.	6,165	Total of guided and unguided tidepool walks
2004-2005	83,000 max	8,000- 10,000 students, 73, 000 not in classes	Numbers from school visits that go through reservations.	5,348	Total of guided and unguided tidepool walks
2005-2006	83,000 max	8,000- 10,000 students, 73, 000 not in classes	Numbers from school visits that go through reservations.	6,037	Total of guided and unguided tidepool walks
2006-2007	83,000 max	8,000- 10,000 students, 73, 000 not in classes	Numbers from school visits that go through reservations.	6,238	Total of guided and unguided tidepool walks

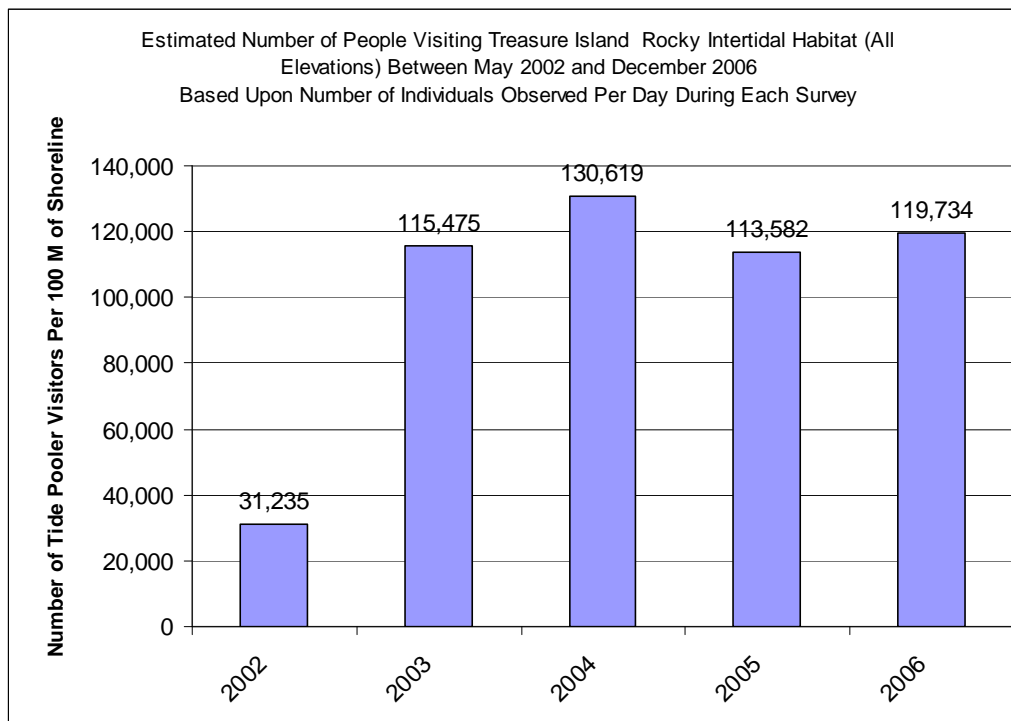


Figure 34. Estimated Number of Tidepool Visitors to Treasure Island in Laguna Beach, California; 2002-2006 Per 100 Meters of Shoreline Source: Coastal Resources Management, Inc. 2007. *Note:* Eight-hour sampling periods; 218 surveys were conducted over five years of monitoring. Eight-hour yearly data (above) were divided by 2 to determine numbers per four-hour periods to compare data with previous studies (Ambrose and Smith, 2007) and the present study.

We note that there were differences in how yearly numbers are calculated between investigations. This study, Ambrose and Smith's Santa Monica Bay Study (2005), and Coastal Resources Management, Inc. 2002-2006 Treasure Island Study (CRM, Inc. 2007) normalized data per 100 m of shoreline and for four-hour visit periods. However, Ambrose and Smith data included days when tides were +0.5 ft or lower; this study included data where tides ranged up to +2.3 ft MLLW, as did the Treasure Island study. Thirty-eight percent of the tides during the current ASBS surveys were greater than +0.5 ft. However, the data reflex seasonal changes in daylight tides that occur over the course of a year, that will ultimately influence the number of, and the ways in which visitors use the ASBS rocky intertidal habitats.

**Comparison to Central California Protected Intertidal Areas.** The Fitzgerald State Marine Park, located in Moss Beach, California-approximately 27 km (17 miles) south of San Francisco-was established in 1969. Fitzgerald Park Rangers began calculating total annual attendance estimates in 1969 (Tenera Environmental, 2004). The attendance estimates between 1969 and 1997 increased from 80,000 to 132,000 per year. However, between 1997 and 2004, the average was approximately 100,000 people per year. A majority of the visitation occurred in the spring and summer. In the spring, groups of

school children visited the park for educational programs, but in the summer, during school recess, most of the visitation was by tourists.

Point Pinos is located in Pacific Grove, California—approximately 192 km (120 miles) south of San Francisco. The Point is located within several jurisdictions including, Monterey Bay National Marine Sanctuary and the Pacific Grove Marine Gardens Fish Refuge. Point Pinos had an annual visitation of approximately 283,000 people a year, but only about 5% may actually ventured into the intertidal areas (Tenera Environmental, 2003). Public use surveys conducted over a 16-month period did not find that disturbances due to visitor use exceeded the range of naturally occurring disturbances along the Point Pinos intertidal area. However, the study did find that in areas at or near access points there was evidence of chronic trampling effects to the algal assemblages but these effects were not widespread (Tenera Environmental, 2003).

#### **4.3 Seasonal and Weekday/Weekend Visitor Distribution with the Central ASBS Sites**

All Central Orange County ASBS sites investigated were visited year-round, however, peak periods of visitation occurred during three periods: (1) during early winter-to-late spring, (2) late summer, and (3) between late-autumn to early-winter. This tri-modal distribution represented periods influenced by several factors: (1) low tides between late fall and early spring, (2) spring periods when Kindergarten through Grade 12 schools utilized the tidepools for education programs, and (3) summer school recess/vacation periods. Weekend visitation at each site was more than twice that observed during weekdays. However, tidepool management activity and docent contacts with the public exhibited weekend/weekday differences among the four sites as a result of K through 12 educational programs. Management and enforcement of tidepool regulations by on-site personnel was highest during weekdays at Little Corona due to the greater number of school-age children attending tide pool educational programs, while enforcement and docent contacts with the public was higher during weekends at the other three sites.

#### **4.4 Visitor Use Relative to Zonation and Tidal Height**

At each ASBS site, visitors were more abundant at the interface of the rocky intertidal habitat (splash zone and high intertidal), and in decreasing numbers towards the tide line. The percentages of visitors within the splash zone ranged from 37.2% (Heisler Park) to 57.1% (Morning Canyon), while the percentage of visitors in the low tide zone varied between 4.3% (Crystal Cove) and 11.3% (Heisler Park). Visitor exit interviews conducted at each of the ASBS sites provided a somewhat contradictory picture that indicated visitors at Little Corona, Morning Canyon, and Crystal Cove “preferred” the mid tide zone, while the majority of interviewees at Heisler Park responded that they would rather venture to the limits of the tide. Ambrose and Smith (2005) concluded that more people were found in the middle intertidal zone than the splash, high, or low zones in Santa Monica Bay rocky intertidal habitats. Tenera Environmental (2003) concluded that people observed at the Point Pinos Ecological Reserve rocky intertidal

areas were also skewed in their abundances between the beaches and the upper and middle zones on the rocky platforms. The Tenera researchers found that visitors utilized all zones, except in areas where the lower zones were exposed to wave surge. This is also likely the case at Little Corona, Morning Canyon, and Crystal Cove where it is exceedingly more difficult to access the low tide zone due to elevated rocky platforms than in the Bird Rock/Heisler Park lower intertidal zone that is more protected from wave exposure because of Bird Rock, and the relief is lower than the other three ASBS sites evaluated.

Thirty-eight percent (38%) of the ASBS surveys were conducted during tides of +0.6 to +2.3 ft MLLW. This analysis is important to note because other studies utilized data only for tides +0.5 ft MLLW and lower. We included data on higher tides because (1) the purpose of our study was to investigate year-around use of the ASBS sites; (2) higher tides occur during summer daylight hours; (3) high numbers of people visit the ASBS areas during summer; and (4) people are more concentrated in the mid-to-splash zones (in less area) during high tides than during low tides. Overall, numbers per linear 100 m of shoreline will not reflect density increases due to more limited, available habitat for visitors. However, more people in a concentrated area within the mid-to-splash zones increase the potential for detrimental effects (i.e., trampling pressure) on marine life, specifically soft-bodied organisms (i.e., anemones) and algal (i.e., rockweed) communities.

As a secondary measure of public use at the four sites located in the three Central Orange County ASBS, we also documented the number of dogs that people brought to the beach and the number of shorebirds and seabirds on the shoreline. While dogs were observed both on-and-off leashes, most were leashed in both rocky and sandy intertidal habitats. Over 50% of the dogs counted during the year-long survey were found at Heisler Park. At all sites, the frequency of dogs on the shoreline was similar between weekdays and weekends. Variations in the number and types of birds observed related to habitat type (sandy beach, rocky shoreline, or offshore rocks), as well as seasonal influences. Shorebird and seabird abundances were highest between fall and early spring at each of the four sites. For both rocky and sandy intertidal shorelines, most shorebirds were observed at Bird Rock (Heisler Park).

#### **4.5 Management Activity (Enforcement and Educational Awareness)**

The level of management activity was highly variable between sites and between weekday and weekend surveys. Overall, tidepool regulation enforcement contacts with the public by city personnel, lifeguards, and/or tidepool docents was highest at Little Corona during weekdays (due to high numbers of school groups), although contact with the public was also high on weekends. Conversely, highest docent and tidepool regulation management contacts at Heisler Park and Crystal Cove occurred during weekends. Few City of Newport Beach personnel visited the semi-private beach at Morning Canyon, because of its inaccessibility and the substantially higher numbers of visitors to manage at Little Corona. On the occasions they did visit Morning Canyon

during the Central Orange County ASBS surveys, city personnel were contacted by CRM staff who had called to report fishing take violations (Appendix 1). In addition, the number of tidepool regulation management contacts made with the public was extremely variable between sites. On average, tidepool management contacts with the public at Little Corona averaged six times per survey; less than two times per survey at Heisler Park and Crystal Cove; and less than 0.1 times per survey at Morning Canyon. Although the City of Laguna Beach adopted a new ordinance that states it is “unlawful to disturb the tidepool habitat” which assists to clarify jurisdictional issues, (Rosaler, 2007), the ability of the Marine Protection Officer (MPO) to respond to specific violations called in by the Tidepool Educators and CRM field biologists during public use surveys at Treasure Island (Rosaler, 2007; CRM, 2007; CRM this study) or others that call in for assistance was extremely prolonged because of the MPO’s need to patrol the entire Laguna Beach shoreline.

For all instances, “management activity” included either warnings to the public regarding the take of organisms, rock turning, or trampling in the tidepools, or secondly, the dissemination of educational information (written or verbal). Even during a serious violation (illegal fishing/killing of garibaldi) at Morning Canyon on May 20<sup>th</sup>, 2007 no ticket was written either by the Newport Beach Police or the California Department of Fish and Game Warden, after being called to the site to assist by the Newport Beach Marine Life Refuge Manager (See photographs, Appendix 2).

Although verbal warnings and dissemination of educational material are important methods to manage the ASBS areas, there is clearly a greater need to actively enforce City ordinances and State Fish and Game Code violations in Newport Beach and Laguna Beach for the most serious violators of fishing and collecting laws and regulations.

#### **4.6 Visitor Behaviors**

Biological impacts of public use disturbance have been addressed with increased interest in recent years in regards to the management of tide pool resources in general and more specifically, in relation to better management and enforcement of California’s Marine Managed Areas (MMAs). Addressi (1994) documented reduced density of macro invertebrate species (i.e., snails, crabs, anemones) in heavily visited intertidal areas along the San Diego coastline comparing data collected in 1971 and 1991. In general, collecting decreased abundances of many species which resulted in lower densities and altered age sizes within a population, and instigated changes in intertidal community structure (Murray et al. 1999; Kido and Murray 2003). Differentiating the actual level of impacts by human use on species abundance patterns can be difficult (Sapper and Murray 2003), because of complex interactions of physical, chemical, and biological factors combined with visitor use.

Over the last 50 years, various investigators have concluded that human disturbance have resulted in substantial changes in southern California rocky intertidal plant communities (Dawson 1959, 1965; Widdowson 1971; Littler, 1977; Murray and Littler 1984). One of

the major changes observed has been a shift from high abundances of large to mid-sized, fleshy macrophytes to high abundances of less productive, small, turf-forming and crustose algae (Widdowson, 1971; Murray et al. 2001). These changes can potentially result in the decline of other species, and changes in community structure and function as a consequence of reduced productivity.

A primary purpose of this investigation was to identify the level and extent of potential adverse public behaviors (passive or active) that can be used as a metric to compare human-induced effects and water quality effects on intertidal resources. Some activities are legal (walking, sitting, and standing in rocky intertidal areas) but can have unintentional detrimental impacts on rocky intertidal systems, while others are partially restricted or prohibited and whether either intentional or unintentional, may result in adverse impacts if unregulated (Table 11; taking of specific invertebrates and fishes; take regulations are specific to each site). Use of the coast and public access to rocky intertidal habitats is encouraged through the California Coastal Act (PRC Section 30210).

The frequency of behaviors potentially detrimental to rocky intertidal systems was highest at Heisler Park and Little Corona. Fewer incidences of detrimental behaviors were observed at Crystal Cove and Morning Canyon. Visitors at Heisler Park also displayed the highest number of potentially adverse activities within each specific category.

The level and intensity of potentially detrimental behaviors was likely correlated to the numbers of visitors at each site; however there were some individual differences in public use activities among sites that were not correlated to the numbers of visitors. For example, visitors at the least-managed site (Morning Canyon) exhibited the second highest level of rock and shell collecting, and rock turning. Local residents were responsible for these behaviors. In addition, tidepool law “signage” was absent at the site. Visitor exit interviews conducted at Morning Canyon indicated that many respondents (56% of the total) did not know that the beach at Morning Canyon was a managed marine area that had specific tidepool regulations. At the same time, the majority of people interviewed (90%) at Crystal Cove were well aware that the area was a protected marine but still engaged in a high level of organism collecting second only to Heisler Park.

**Walking/Trampling.** Walking (trampling) accounted for 47.2% of all behavioral observations, followed by sitting/standing (41% of the observations). Heisler Park visitors trampled the most (17.7 occurrences per replicate/100 meters of shoreline) while visitors at Little Corona trampled at the second highest level (14.5%). Trampling at Crystal Cove (8.2%), and Morning Canyon (2.5%) was less severe by at least a factor of two. Comparatively, half of the people surveyed along the Santa Monica rocky intertidal were walking, with another 8% sitting or standing (Ambrose and Smith, 2005).



**Table 11. Take Prohibited and Allowed at Project Area Sites**

Source:	<b><u>SPECIES PROHIBITED For Recreational Take</u></b>	<b><u>SPECIES ALLOWED For Recreational Take</u></b>
<a href="http://www.dfg.ca.gov/mlpa/mpa_regs.asp">http://www.dfg.ca.gov/mlpa/mpa_regs.asp</a>	All marine aquatic plants All invertebrates EXCEPT lobster All fishes EXCEPT rockfish (family Scorpaenidae), greenling, lingcod, cabezon, yellowtail, mackerel, bluefin tuna, kelp bass, spotted sand bass, barred sand bass, sargo, croaker, queenfish, California corbina, white seabass, opaleye, halfmoon, surfperch (family Embiotocidae), blacksmith, Pacific barracuda, California sheephead, Pacific bonito, California halibut, sole, turbot and sanddab	Lobster; Rockfish (family Scorpaenidae), greenling, lingcod, cabezon, yellowtail, mackerel, bluefin tuna, kelp bass, spotted sand bass, barred sand bass, sargo, croaker, queenfish, California corbina, white seabass, opaleye, halfmoon, surfperch (family Embiotocidae), blacksmith, Pacific barracuda, California sheephead, Pacific bonito, California halibut, sole, turbot and sanddab by hook and line or by spear fishing gear only
Robert E. Badham State Marine Conservation Area (ASBS 32); includes both Little Corona and Morning Canyon Study Sites	All marine aquatic plants All invertebrates EXCEPT chiones, clams, cockles, rock scallops, native oysters, crabs, lobster, ghost shrimp, sea urchins, mussels, and marine worms	Chiones, clams, cockles, rock scallops, native oysters, crabs, lobster, ghost shrimp, sea urchins, mussels, and marine worms <sup>1</sup> ; Finfish
Crystal Cove State Marine Conservation Area (overlaps Irvine Coast SMCA); includes Rocky Bight Crystal Cove ASBS #33	All marine aquatic plants All invertebrates EXCEPT lobster All fishes EXCEPT rockfish (family Scorpaenidae), greenling, lingcod, cabezon, yellowtail, mackerel, bluefin tuna, kelp bass, spotted sand bass, barred sand bass, sargo, croaker, queenfish, California corbina, white seabass, opaleye, halfmoon, surfperch (family Embiotocidae), blacksmith, Pacific barracuda, California sheephead, Pacific bonito, California halibut, sole, turbot and sanddab	Lobster; Rockfish (family Scorpaenidae), greenling, lingcod, cabezon, yellowtail, mackerel, bluefin tuna, kelp bass, spotted sand bass, barred sand bass, sargo, croaker, queenfish, California corbina, white seabass, opaleye, halfmoon, surfperch (family Embiotocidae), blacksmith, Pacific barracuda, California sheephead, Pacific bonito, California halibut, sole, turbot and sanddab by hook and line or by spear fishing gear
Irvine Coast State Marine Conservation Area (overlaps Crystal Cove SMCA) (overlaps Irvine Coast SMCA); includes Rocky Bight Crystal Cove ASBS #33	Same as above	Same as above
Laguna Beach State Marine Conservation Area (overlaps Heisler Park SMR) includes Bird Rock/Heisler Park ASBS #31 Study Site;	All	None

Mid-and-upper intertidal macrophytes are extremely susceptible to trampling since most visitors will congregate in these areas, safely away from wave surges. During high summer-use periods when daylight low tides were higher, we documented high numbers of visitors concentrated in these zones. Such concentrations of individuals during these periods, as well as high-use low tides periods are likely to result in deleterious effects on macrophytes and associated invertebrates that aggregate under the cover of the macrophytes. Unique efforts to counter the effects of trampling and human disturbances are being tested in ASBS #32 (Robert C. Badham/Newport Beach Marine Park) by California State University at Fullerton biologists, by re-establishing populations of the rockweed *Silvetia compressa*. To date, several restoration methods appear promising (Whitaker et al., 2009).

**Handling/Touching.** Handling and touching intertidal plants and animals constituted the majority of four distinct behaviors where direct contact was made—handling/touching organisms, collecting live organisms, collecting shells and rocks, and rock turning. Handling can be non-destructive *if* organisms are not repeatedly handled, held for a long-period of time, or replaced within a different zone or microhabitat from where the organisms were removed. However, repeated handling, and misplacement of organisms can result in the desiccation of macrophytes and soft-bodied animals, increased threat of predation, or increased physical damage from people and/or wave and tide activity.

The frequency of handling and collecting during the surveys constituted only 2% of all observations. However, one instance of collecting may include the removal of many individuals; therefore, collecting observations were further enumerated during focused surveys of single individuals that identified both the types and numbers of organisms handled and/or removed from the rocky intertidal.

Sixteen plant, invertebrate, and fish taxa were handled of which many more individual species were included but were not identified. Hermit crabs (*Pagurus* spp), gastropods (i.e., *Tegula* spp., *Lottia* spp., *Littorina* spp.), and shore crabs (*Pachygrapsus crassipes*) accounted for 84% of the handling observations. Most handling occurred at Heisler Park (57.8% of the total)—more than three times the level of handling observed at the other sites. Focused surveys of individual visitors at each site yielded similar results, although anemones were also frequently touched or handled. Importantly, it was found that handling intensity at Morning Canyon could be as intense as handling levels observed at either Corona del Mar or Crystal Cove.

**Collecting.** Collecting is highly restricted for all species at all four sites for all species, except for lobsters. Murray et al. (1999) noted that most species that are collected along the Orange County coastline are mussels, trochid snails, limpets, urchins, and octopuses. The California mussel (*Mytilus californianus*) was the most abundantly collected species in this study (76% of the total numbers collected), and according to interviews, these were collected primarily for bait. This species was collected in highest numbers at Heisler Park and Crystal Cove (15.2% and 14.6% of the total abundance). Gooseneck barnacles (*Pollicipes polymerus*), brittle stars (*Ophioplocus*), opaleye perch (*Girella*

*nigricans*), rocks, and shells were also collected, but in substantially lower proportions than mussels. Most collecting occurred during weekends, although marginally higher numbers of collecting occurred during the week at Heisler Park.

**Rock Turning.** Visitors turned over rocks more frequently at Heisler Park (0.7 times/survey) than at the other three sites—Morning Canyon (0.4 times/survey), and Corona del Mar and Crystal Cove, (0.3 times/survey each). These activities also occurred more during weekends than during weekdays. Rock turning can result in desiccation, predation, and loss of biological diversity of species that are typically cryptic, light-sensitive, and secretive (i.e., ophiuroids, polychaete worms, flatworms, crabs, and shrimp).

**Sport Fishing From Shore.** Shoreline fishing was generally an under-documented activity during the study. Observations suggest fishing was prevalent outside the survey area boundaries. This was especially true (1) east of Morning Canyon between Cameo Shores and Crystal Cove State Park, (2) west of the Little Corona tide pools to Big Corona, (3) and east of Rocky Bight to El Moro (Crystal Cove). No shore fishing was observed at Heisler Park; it is a prohibited activity in the Heisler Park State Marine Ecological Reserve. Fishers preferred fishing in the vicinity of the least-managed site, Morning Canyon (0.5 times/survey, 0.1 times/replicate), and fished there twice as often than at either Corona del Mar or Crystal Cove. Shore fishing occurred primarily on weekends at each of the three sites. Although fishers used bait brought with them, they also frequently and illegally collected mussels for bait.

#### 4.7 Utilization of the Waters Offshore of the ASBS Sites

The waters offshore of the rocky intertidal zone at the four Central Orange County ASBA sites were frequented by recreational fishers, commercial lobster fishers, and to a lesser degree, skin and SCUBA divers during the year-long public use survey. Because fishing and diving will occur along a much greater length of shoreline on a daily basis than that within our ASBS survey sites, the data collected during this study underestimates the relative contribution of, and potential effects of these activities on Central Orange County ASBS areas.

Given that assumption, some general conclusions can be drawn from this study. While the number of recreational vessels tended to be greater offshore of Corona del Mar (Little Corona) and Morning Canyon due to the closeness of Newport Bay, the number of recreational fishers and in-water pole fishing activity was greater at Crystal Cove and Heisler Park, reflecting greater numbers of half-day boat charters that fished the reefs offshore of these ASBS sites. Additionally, recreational fishing was spread throughout the week and not as concentrated on weekends at Crystal Cove and Heisler Park, due to half-day charters that fished throughout the week. Recreational fishing was generally concentrated between spring and summer periods.

Commercial lobstering was common within each of the four ASBS survey sites, although the degree of “fishing intensity” was difficult to measure within the limits of this study. While twice as many commercial fishing vessels were sighted offshore of Crystal Cove than at the other sites, the actual number of commercial fishermen fishing at Heisler Park was greater than the other three sites. Based on buoy/pot arrays, most pots were concentrated in the vicinity of Little Corona and Heisler Park. This likely provides the best measure of commercial lobster fishing intensity within the ASBS areas, although the actual take from each site is unknown. We observed commercial lobster pots generally within the required October to March fishing period; however, we also observed incidental commercial fishing activity and commercial fishing buoy arrays within the ASBS sites outside this time period.

Recreational diving (skin and SCUBA) was a weekend activity and occurred primarily between the Little Corona and Morning Canyon survey sites (76.1% of the total counts). Most divers and snorkelers did not carry a spear gun. Those that did carry spear guns frequented Little Corona and Morning Canyon. The bulk of diving, however, occurred outside of the Little Corona study site at Big Corona where diver training was prevalent throughout the year (R. Ware, pers. obs).

#### **4.8. Future Monitoring in Central Orange County Areas of Special Biological Significance**

The basic methods and techniques employed during these surveys are directly applicable to conducting future public use monitoring studies with ASBS areas by city staff, docents, or volunteers. Data forms in Excel format used during this survey can be used for future monitoring. Using these methods, future data bases can be compared previous studies. Some details or survey data types can be eliminated for simplicity and logistical purposes. However, the basic format and information used in this report and Ambrose and Smith (2005) can be applied to future monitoring. With minimal training, a long-term but useful monitoring program can be focused for example, to evaluate (1) rockweed restoration success (2) the effectiveness of docent programs and management programs to protect ASBS habitats and (3) if exclusion zones within rocky intertidal habitats are an effective tool to restore damaged rocky intertidal habitats.

Shoreline fishing from both rocks and sandy habitats and spear fishing in the ASBS areas should be a major focal point for future monitoring. These surveys should be conducted within larger sections of the Central Orange County coastline (i.e., the coves and outcrops between Morning Canyon and Crystal Cove) preferred by many fishermen and divers because of their inaccessibility and limited wildlife management by the Department of Fish and Game. In addition, multilingual specialists should be used to assist in conducting the studies because many fishermen speak only limited English.

## **5.0 CONCLUSIONS**

1. Public use surveys at four sites within three central Orange County, California Areas of Special Biological Significance (ASBS) were conducted between January 30<sup>th</sup>, 2007 and February 18th, 2008.
2. The sites studied included Little Corona and Morning Canyon in ASBS #32, Rocky Bight (Crystal Cove) in the Irvine Coast ASBS #33, and Bird Rock (Heisler Park) in ASBS #31.
3. Fifty surveys were conducted at each site over a 2.5 hour period during each survey beginning one-half hour before the low tide. The purpose of the study was to quantify the number of visitors and identify the types of, and amount of onshore-and-offshore visitor use activities at each ASBS site.
4. Visitor use was highest at Heisler Park, followed by Little Corona, Crystal Cove, and Morning Canyon. Heisler Park and Little Corona were characterized as high use sites.
5. Comparatively, visitor use at Heisler Park and Little Corona was greater than levels observed in earlier public use studies conducted along the Palos Verdes Peninsula and four sites along the Malibu coast in 2002, and comparable to levels observed at Treasure Island in Laguna Beach between 2001 and 2006.
6. Weekend use of rocky intertidal areas was greater at all sites than during weekdays than weekends although significant numbers of students visited Little Corona and Crystal Cove during educational field trips during weekdays. All sites were visited year-round.
7. All tidal levels were accessed by visitors. However, the highest percentages of visitors frequented the splash-to-middle tide zones. This has implications for the management of rockweed, since it is most prevalent in areas where most people were located. Trampling was the most observed destructive behavior observed. When tides were higher, more people concentrated within a smaller area of rocky intertidal habitat than during low tides.
8. Bird Rock (Heisler Park, ASBS #31) was a high use rocky intertidal habitat characterized by good public access. This site was the most intensively used rocky intertidal area of the four areas studied and visitors exhibited the highest levels of behaviors potentially damaging to rocky intertidal organisms (handling, collecting, trampling) of all four sites. No shoreline fishing was observed and although minimal skin and SCUBA diving activity was observed during the surveys, these activities occur throughout other areas of Heisler Park. Visitor use exhibited the greatest mix of local residents and out-of-area visitors. Commercial lobster fishing was high at this site, and concentrated around Bird Rock.

9. Little Corona (ASBS 32) was a high use rocky intertidal area and the most public-accessible site with equally heavy use from public and school groups. The area was used mostly by Orange County and nearby area residents. The site is a long-term biological research site. The most detrimental effect exhibited by visitors was trampling. Moderate-to-high levels of recreational/commercial fishing and recreational diving occurred in the area. Overall, this site was second only to Heisler Park in terms of public use. Collecting and rock turning activities were less common than at Heisler Park due to the presence of City of Newport Beach tide pool ranger staff. Commercial lobster fishing activity was high at this site.
10. Crystal Cove (ASBS #33) was a moderately used rocky intertidal area, although seasonal use during the summer is high. Access was more difficult and expensive than at Heisler Park or Little Corona, due to parking fees and the distance to walk from the State Park parking lot. It is located in an area of increasing development along Newport Coast and is a destination resort that attracts numerous out-of-area visitors, similar to Heisler Park. The State of California (State Parks) manages the area and there are well-defined and focused educational programs for the general public and school groups. Visitors at this site exhibited low-to-moderate levels of activities potentially detrimental to rocky intertidal organisms, although this site ranked second only to Heisler Park in collecting activity as a result of shore fishing activity and tourists not knowing tide pool regulations. Extensive rocky intertidal habitat along entire shoreline likely reduces public use stress within any one section of this ASBS. Commercial lobster fishing intensity and sport fishing activity at this site was high.
11. Morning Canyon rocky intertidal (ASBS 32) was the least-public accessible site and was used primarily by the residents of the Morning Canyon gated-community. General public access was limited. People could only access Morning Canyon from across high-relief rocky intertidal habitat during mid-to-low tides. Despite its relatively low public use, collecting and rock turning commonly occurred at levels that were equal to those exhibited at Little Corona and Heisler Park. Tidepool management signage was lacking and was nominally patrolled by City of Newport Beach staff. In addition, this portion of ASBS #32 was a favorite shore fishing site. Collecting bait and illegal fishing was greater in this section of ASBS #32 than at Little Corona Tide Pools, where there was a greater degree of active shoreline management.
12. Sixteen taxa of marine invertebrates and fish were observed, handled, or collected. The most handled organisms included hermit crabs, snails, and shore crabs. Mussels, gooseneck barnacles, brittle stars, opaleye perch, rocks and shells were the most commonly collected items. Collecting and handling, although accounting for a small over percentage of adverse behaviors can result in substantial reductions of individual species, and alter community structure.

13. Future ASBS public use monitoring can be conducted by docents, city and State Parks staff. It is recommended that focused studies be conducted at all sites, in similar manners to assess public use impacts on rocky intertidal communities.



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## **APPENDICES**

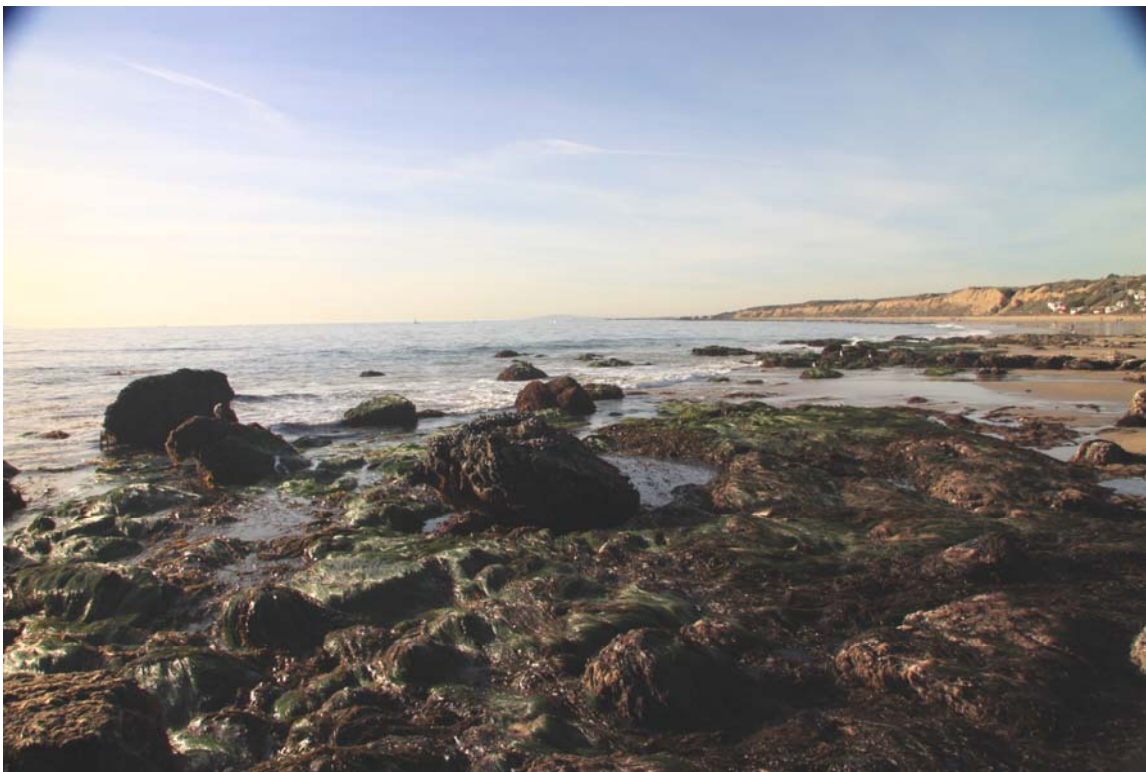
## APPENDIX 1. SITE PHOTOGRAPHS



Little Corona Tide Pools, Facing East Towards Morning Canyon



Morning Canyon, Facing West Towards Little Corona



Rocky Bight, Crystal Cove Rocky Intertidal, Facing West



Bird Rock, Heisler Park Rocky Intertidal.



## APPENDIX 2.



Photograph of Fishermen at Morning Canyon, May 20<sup>th</sup>, 2007



Photograph of sub-adult garibaldi, fully gutted by fishermen in the first photograph on May 20<sup>th</sup>, 2007. City of Newport Beach Police and California Department of Fish and Game were notified of the take by the City of Newport Beach Tide Pool Ranger