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AREA OF SPECIAL BIOLOGICAL SIGNIFICANCE #32
2013 PUBLIC USE SURVEYS
August 18th-November 16th, 2013

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1.0 INTRODUCTION

1.1 PROJECT OBJECTIVES

The objectives of the 2013 Areas of Special Biological Significance (ASBS) Public Use Impact Study were to: (1) identify the types of human activities within the Robert C. Badham ASBS site (#32) at both Little Corona and Morning Canyon locations and (2) compare the results of the 2007 Public Use Impact Study to determine if there have been any differences observed in the ways in which the public uses the ASBS.

1.2 PROJECT RESULTS IN 2007-2008

Coastal Resources Management, Inc.(2009) conducted public use surveys at four sites within three central Orange County, California Areas of Special Biological Significance (ASBS) were conducted between January 30th, 2007 and February 18th, 2008. 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. 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. The following conclusions were drawn from that survey:

1. Visitor use was highest at Heisler Park, followed by Little Corona, Crystal Cove, and Moring Canyon. Heisler Park and Little Corona were characterized as high use sites.

2. 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.

3. 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.

4. 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 of the people were located. Trampling was the most observed destructive behavior. When tides were higher, more people concentrated within a smaller area of rocky intertidal habitat than during low tides.

5. 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.

6. Little Corona (ASBS 32) was a high use rocky intertidal area and was the most publically accessible site, receiving 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 staff and tide pool docents. Commercial lobster fishing activity was high at this site.

7. 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 the 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.

8. Morning Canyon rocky intertidal (ASBS 32) was the least-publically 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.

9. 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.

10. 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.

2.0 FIELD METHOLODOGY

2.1 SURVEY SITES

Surveys were conducted at two locations within ASBS #32 (Figures 1 and 2). The original specific public use observation areas within each of these sites during the 2007-2008 survey 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. Both the Little Corona and Morning Canyon sites were scoped out and checked by each of the field observers to again be acquainted with conditions prior to the intiation of the 2013 surveys. Field observers included Jeff Rosaler, Tom Gerlinger, Nicholas Dasilva, and Rick Ware.

2.2 SAMPLING INVERVALS

Surveys were conducted during 16 weekdays and 16 weekend days at the two locations between August 18th and November 16th, 2013. A single observer was assigned to a site. Both sites were surveyed either simultaneously or prior to the day of the assigned field day. Survey methods replicated those of the 2007-2008 CRM study (Coastal Resources Management, Inc. 2009).

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 mid-to-late fall surveys, it was possible to collect data at tides of +0.5 feet Mean Lower Low Water or lower (ft, MLLW) during daylight hours. However, during the summer surveys, survey data were collected at tides up to about +2.0 ft MLLW.

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;

Figure 1. Location of Central Orange County ASBS Areas

Figure 2. Robert C. Badham/Newport Beach Marine Park/ASBS Study Sites, #32

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 prior to 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.

In order to establish comparisons between survey areas, the linear length of shoreline and the area of rocky intertidal habitat were determined for both Little Corona and Morning Canyon. 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). The linear survey area for Little Corona was 146 meters and 175 linear meters for Morning Canyon.

Species Identification of Impacted Organisms By Public Use

If visitors were observed collecting and/or handling organisms, the field observer tried to determine 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.

2.4 DATA REDUCTION AND ANALYSIS

Survey data were collected on pre-printed forms for each of the four data sets. In the office, the field data sheets were checked for accuracy and tabulated into pre-formatted Excel spreadsheets for each day of sampling and by survey area. Each data set was 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 both 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 these data to be representative of actual conditions that occur during high-use summer periods. Ambrose and Smith (2005) calculated data based on tides only +0.5 ft and lower. Data comparisons were made based upon (1) mean numbers of visitors counted in each of 10 replicate samples over a 2.5 hour period standardized to 100 meters of shoreline length. 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.) was not standardized to linear area of shoreline but did include all fishermen and vessels that would be considered nearshore in the general vicinity of either Little Corona or Morning Canyon.

In order to compare information collected in 2007 with that collected in 2006, all data collected between August and November 2007 were reanalyzed statistically, so that mean data for the two sites could be compared within equal time frames. Data for 2007 were then graphically presented along with the data collected in 2013, with both sets standardized to the same sampling periods of August through November.

3.0 RESULTS

3.1 STUDY AREA CHARACTERISTICS

Table 1 summarizes the characteristics of each study site as observed during the 2007 survey. There were no changes in access, parking, or restroom facilities in 2013 compared to 2007. There was however, a greater amount of educational materials available to the public and better signage at Little Corona in 2013 compared to 2007. 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). Signs have been provided that present tide pool law collecting and/or fishing information. There is limited, active monitoring of Morning Canyon by City of Newport Beach personnel or docents. Their main focus is the more crowded shoreline of the Little Corona tide pools. Morning Canyon is an active research site for California State University, Fullerton. Creek flow into the study site is year-around.

Table 1. General Attributes of ASBS Public Use Study Sites

Attributes	Parking Fee	Access to Tide Pools	Restrooms	Enforcement and Docent Programs	Educational Groups and Researchers	Habitat Description, Linear Length, and Area of ASBS Study Site
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. Tidepool literature available at kiosk and lifeguard tower.	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 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.

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

Location	Linear Meters of Shoreline Within The Public Use Study Area	Square Meters of Rocky Intertidal Habitat Within Public Use Study Area
Little Corona (Corona del Mar)	146	4,657
Morning Canyon	175	3,592

Habitat length and rocky intertidal areal cover varied between the two sites based upon the geography of the shoreline and the amount of continual rocky intertidal habitat.

3.2 WEATHER, SEA STATE, AND TIDAL CHARACTERISTICS

Table 3 summarizes the physical attributes of both study sites, the number of docents/MLP officers, and researchers by weekday and weekend periods for 2007 and 2013. With the exception of sea temperatures, all physical conditions at the sites were similar in 2013 compared to 2007. Docent/MLP Officers, and Researcher information is summarized graphically in Figure 3.

Table 3. Summary of Physical Data, Docents/MLP Officers, and Researchers August-November, 2007 and 2013

	Tide Height (ft, MLLW)	% Cloud cover	Sea State (Beaufort Scale)	Estimated Surf Height (Ft)	Sea Temp (F)	Air Temp (F)	Wind Speed (kts)	Wind Direction	Mean Number of Docents/MLP Officers Per 2.5 hrs	Mean Number of Researchers per 2.5 hrs
CDM 2007 WD n=8	0.6	24.7	1.8	2.1	63.6	74.6	4.0	Variable	6.1	4.4
CDM 2007 WE=7	1.2	25.2	1.4	1.7	63.7	69.6	2.9	Variable	3.9	0.0
MC 2007 WD n=8	0.5	3.1	2.3	1.6	62.9	70.7	4.3	Variable	0.0	2.2
MC 2007 WE n=8	1.0	13.2	1.6	1.6	64.0	74.0	5.1	Variable	0.0	1.8
CDM 2013 WD n=8	0.4	17.8	1.1	1.4	66.4	73.4	2.1	Variable	0.5	0.5
CDM 2013 WE n=8	0.8	29.4	1.8	1.4	67.8	66.9	3.6	Variable	1.4	0.2
MC 2013 WD n=8	0.6	15.5	1.8	1.3	68.1	74.5	3.5	Variable	0.0	0.2
MD 2013 WE n=8	0.5	39.0	1.4	1.3	65.7	73.0	2.4	Variable	0.0	0.0

3.3 USE INTENSITY ON STUDY AREA SHORELINES.

3.3.1 Docent and Enforcement Personnel. Figure 3 illustrates the numbers of docents/enforcement officers, and researchers on site during the ASBS public use surveys between comparable survey dates in 2007 and 2013. In 2013, Docents/MLP officers were on site during 4 of 16 surveys (25%) at Little Corona in 2013, primarily during the weekend. Docents/MLP officer numbers were higher in 2007 by a factor of five in compared to 2013 (Figure 3). None were present during any of the Morning Canyon Surveys in 2013. Researchers (excluding high school or college classes) were present in small numbers at both sites during 2013. Compared to 2007, the level of both docent/MPL officer activity and researchers in 2013 was less than 50% that observed during 2007 on both weekdays and weekends.

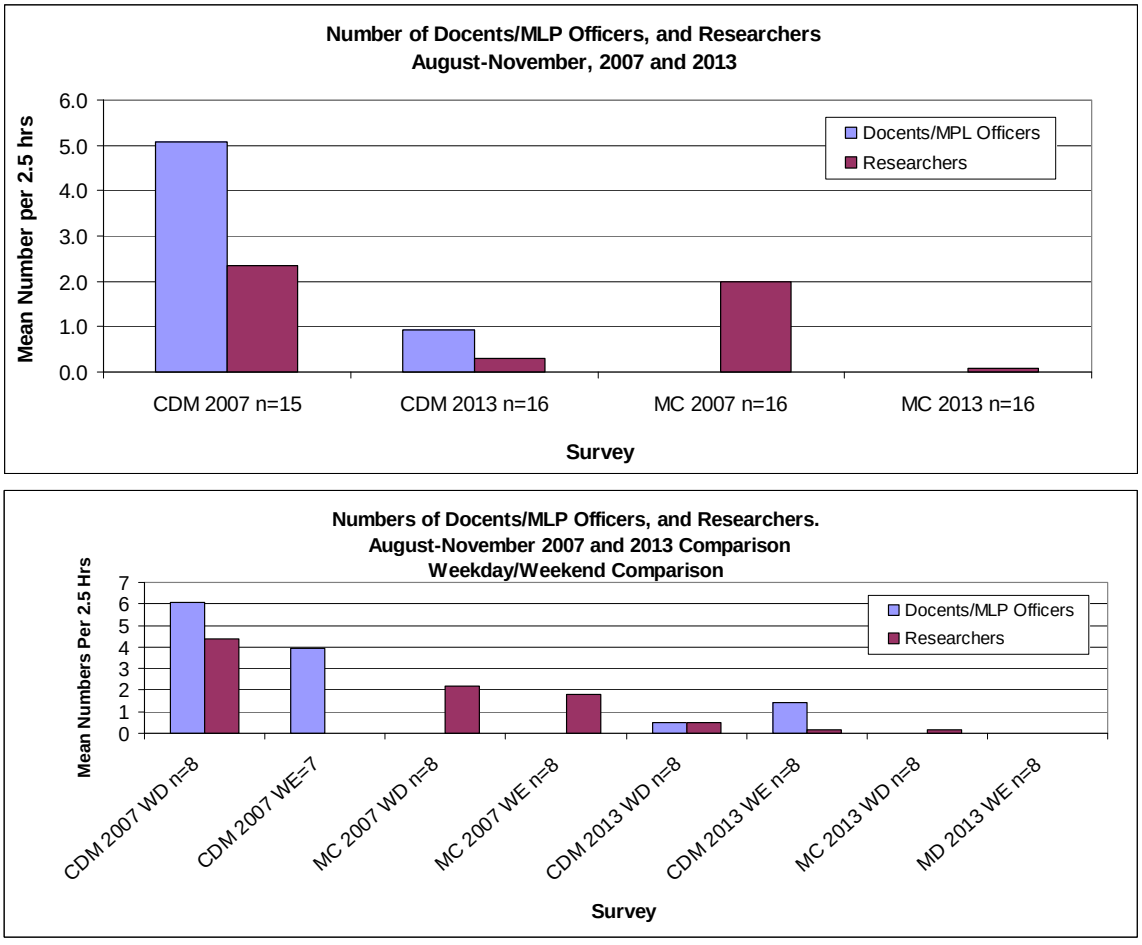


Figure 3. Number of Docents/MLP Officers and Researchers,
All Surveys and Weekday and Weekend Periods

3.3.2 Public Use Intensity Quotients. A total of 3,603 individuals were counted in the rocky intertidal zone at the two sites and another 2,493 were counted on the sandy beaches next to the tide pools. Fifty-nine percent of the visitors were recorded in the rocky intertidal habitat, while 41% remained on the adjoining sandy beaches.

Eighty percent of the visitors were observed at Little Corona and 20 percent were present at Morning Canyon. The number of people that visited Little Corona was higher than Morning Canyon by a factor of four.

Figure 4 presents summary data, for all surveys. In 2013, the mean number of people on the shoreline (combined rocky and sandy intertidal) was 19.8 per 10 min replicate at Little Corona, and 5.0 per replicate at Morning Canyon. Compared to 2007, the number of people on the shoreline was greater in 2013 at both Little Corona and at Morning Canyon. Similarly, public use in the rocky intertidal in 2013 was elevated at Little Corona (13.1) compared to 2007 (11.2), and also higher at Morning Canyon (1.9) compared to 2007 (0.9). In both years, Morning Canyon's numbers were characterized by low numbers of individuals due to its inaccessibility and limited public access. Lastly, public use on the sandy beach at Little Corona in 2013 was slightly higher (6.7) compared to 2007 (5.1). The number of people who frequented the sandy beach habitat at Morning Canyon was similar in 2013 (1.8) compared to 2007 (2.0). Overall, public use quotients between the two survey years were consistent in terms of (1) greater numbers of people using the shoreline at both sites in 2013 than in 2007, and generally consistent in the ratio of people using both the rocky intertidal and the sandy intertidal.

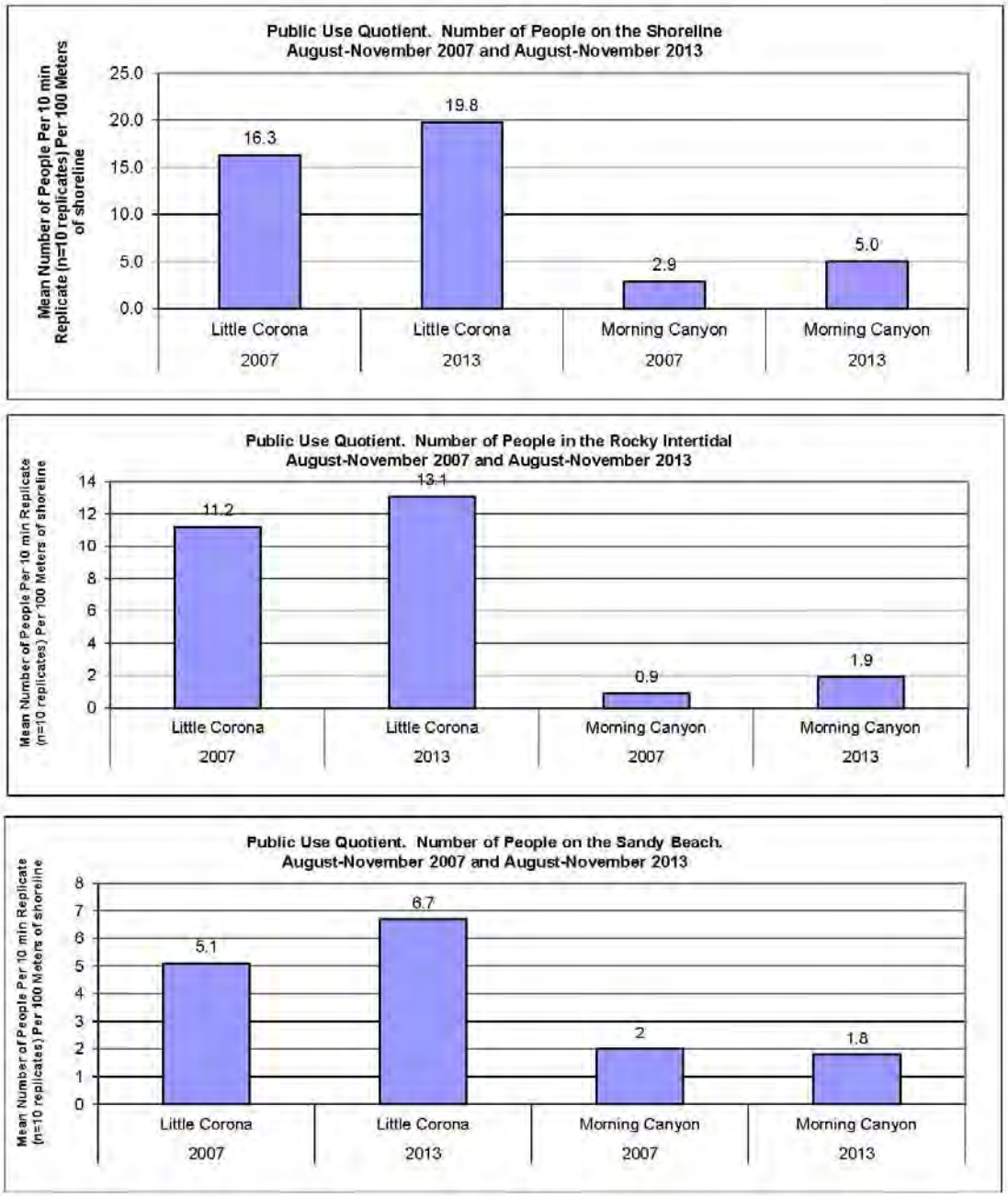


Figure 4.
Mean Number of People on the Shoreline. Standardized to 100 meter of shoreline per 10 minute interval (n=10 replicates per day per site over a 2.5 hr sampling period).

Comparisons by day type (weekday and weekend) are shown in Figure 5. Public use on weekdays at Little Corona in 2013 was more than twice that observed in 2007 (9.9 individuals per 10 minute replicate in 2013 compared to 4.0 in 2007 but more similar in nature during weekend periods (16.3 and 14.1 in 2013 and 2007 respectively). Public use was also higher during both weekdays and the weekends at Morning Canyon in 2013.

Weekday use increased by a factor of 3 in 2013, while weekend use did not increase as much as weekday use.

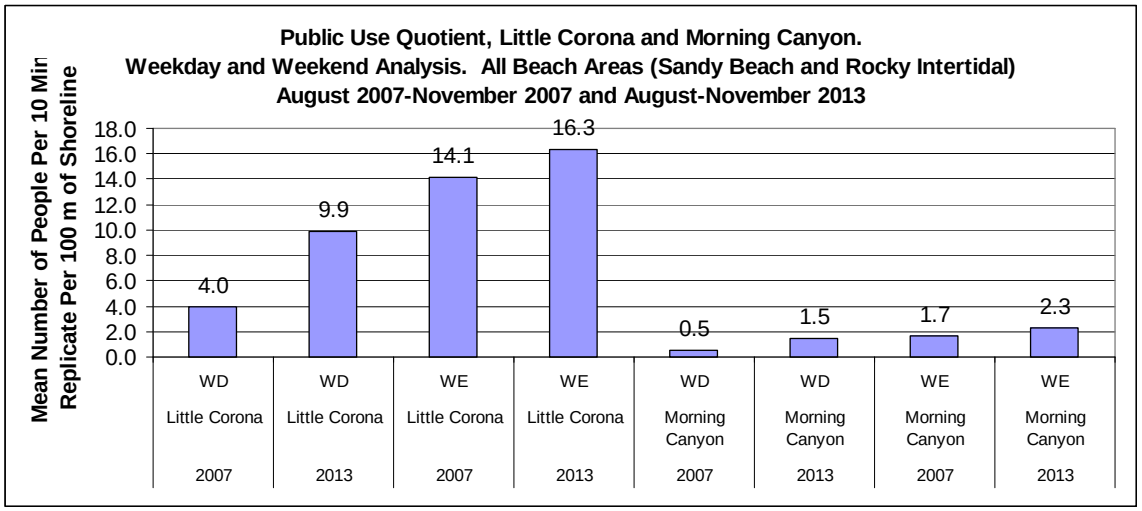


Figure 5
Mean Number of People on the Beach During Weekdays and Weekends.
Standardized to 100 meter of shoreline per 10 minute interval (n=10 replicates per day per site over a 2.5 hr sampling period).

3.3.3. Bird Use. The numbers of seabirds and shorebirds that were observed to be resting or foraging in the rocky intertidal were counted during each of the surveys. Only the shorebird data are presented in this report, since this group would be more affected by public use of the shoreline. Shorebirds were combined into a single category, although several species are known to be present based upon the 2007-2008 public use surveys (Coastal Resources Management, Inc. 2009). Recorded birds included black-bellied plover, ruddy turnstones, sanderlings, sand pipers, willets, marbled godwit, whimbrels, and snowy egrets. The overall number of shorebirds per replicate (10 replicates per survey) in 2013 was considerably less than the number observed in 2007 for both Little Corona and Morning Canyon overall and by day type. The number of shorebirds per replicate in 2007 was 1.3 (Little Corona) and 1.8 (Morning Canyon) and in 2013, the mean values dropped to less than 1 per replicate at both sites. Similar decreases were observed on weekdays and on the weekends.

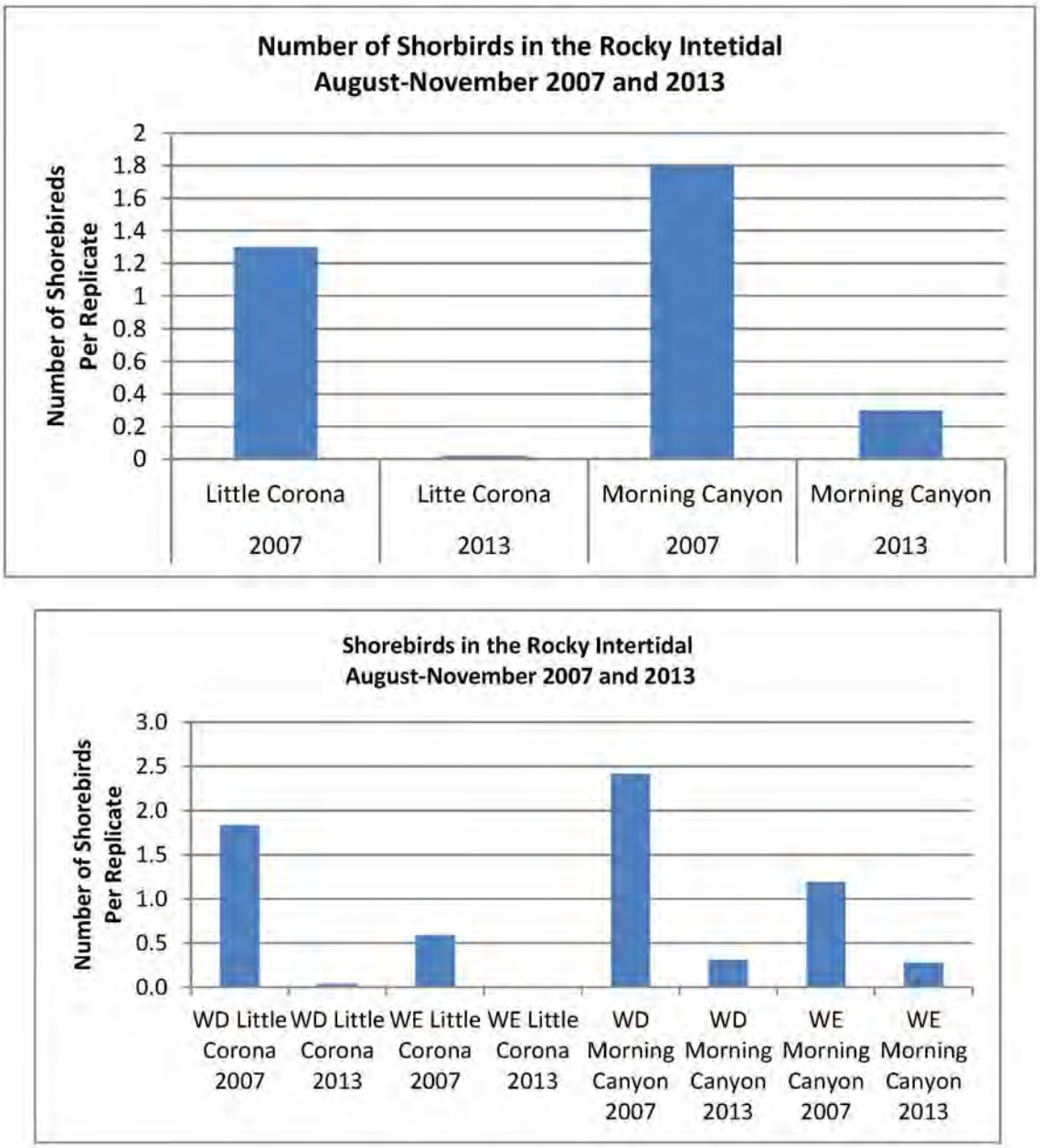


Figure 6. Number of Shorebirds Per Replicate (10 replicates per survey) in the Rocky Intertidal Habitat. August-November 2007 and 2013. All Surveys and Weekday and Weekend Periods.

3.3.4 Dog Use Intensity.

People walked their dogs on-and-off their leashes along both beaches. Twenty-one dog occurrences were recorded on both beaches over 32 surveys, 15 of which were at Little Corona and six were at Morning Canyon. Eight were observed on the sandy intertidal at Little Corona and seven of these extended into the rocky intertidal. At Morning Canyon, only one of the six occurrences was observed in the rocky intertidal. Equal numbers were

seen on-and-off the leash on the sandy beach at Little Corona, while five of the seven were leashed as they walked in the rocky intertidal. At Morning Canyon, all of the dogs were observed off-leash.

During the same period in 2007, 32 dogs were observed at both Little Corona and Morning Canyon during 30 surveys. At Little Corona, all were observed on-leash; 5 in the rocky intertidal and 2 on the sandy beach. At Morning Canyon, 22 were off-leash, and 3 were on leash.

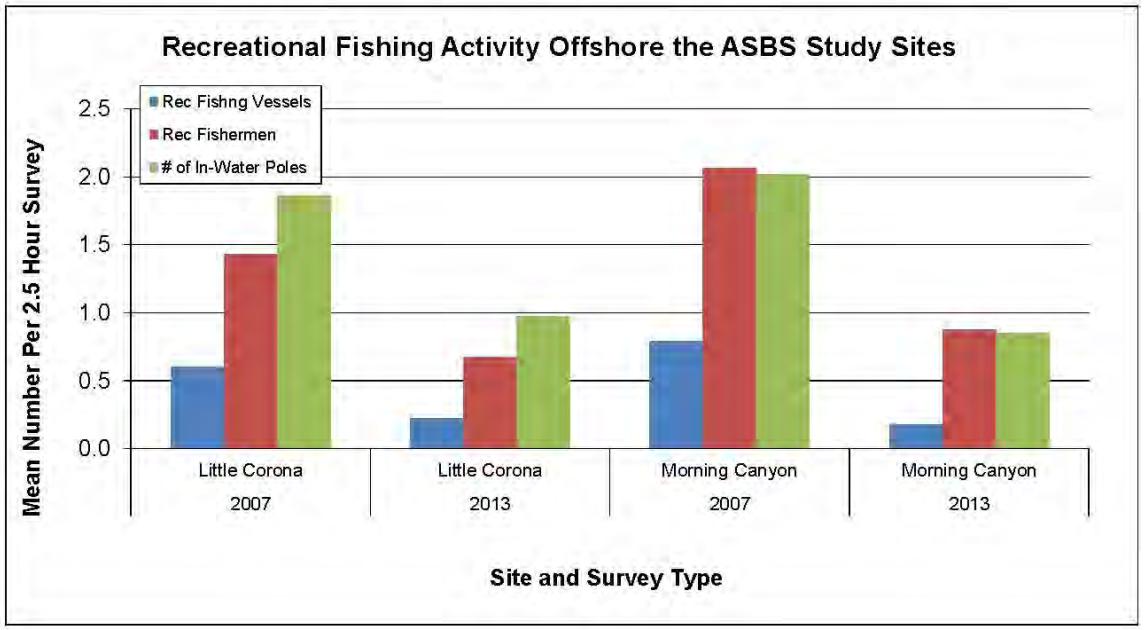
Overall, the number of dogs observed in 2013 was greater in 2007 but there was a noticeable decrease in the number of dogs at Morning Canyon. Dogs tended to be leashed to a greater extent in 2013 than in 2007 at Little Corona, whereas at Morning Canyon, owners always walked their dogs off the leash in 2013.

3.4 USE INTENSITY IN THE WATERS OFFSHORE OF THE ASBS SITES

The waters offshore of the Little Corona and Morning Canyon ASBS sites were used for several purposes: recreational fishing, commercial fishing, sailing, kayaking, stand-up paddle boarding, operation of motorized personal water craft (i.e., wave runners), snorkeling, SCUBA diving, and swimming. Summaries of the most frequent in-water activities are presented below.

3.4.1 Recreational Fishing

The average number of recreational fishing vessel sightings per 2.5 hr survey was 0.2 at both Little Corona and Morning Canyon. In 2007, fishing vessel sightings were three to four times higher (0.6 and 0.8 vessels), while the number of fishermen in 2013 (0.7 at Little Corona and 0.9 per 2.5 hr survey) was less than 50% of the numbers observed in 2007. Similarly, the number of active fishing poles observed decreased proportionately. Recreational fishing was at a higher intensity level offshore of Little Corona on weekdays in 2013 whereas fishing occurred more often on weekends at Morning Canyon.



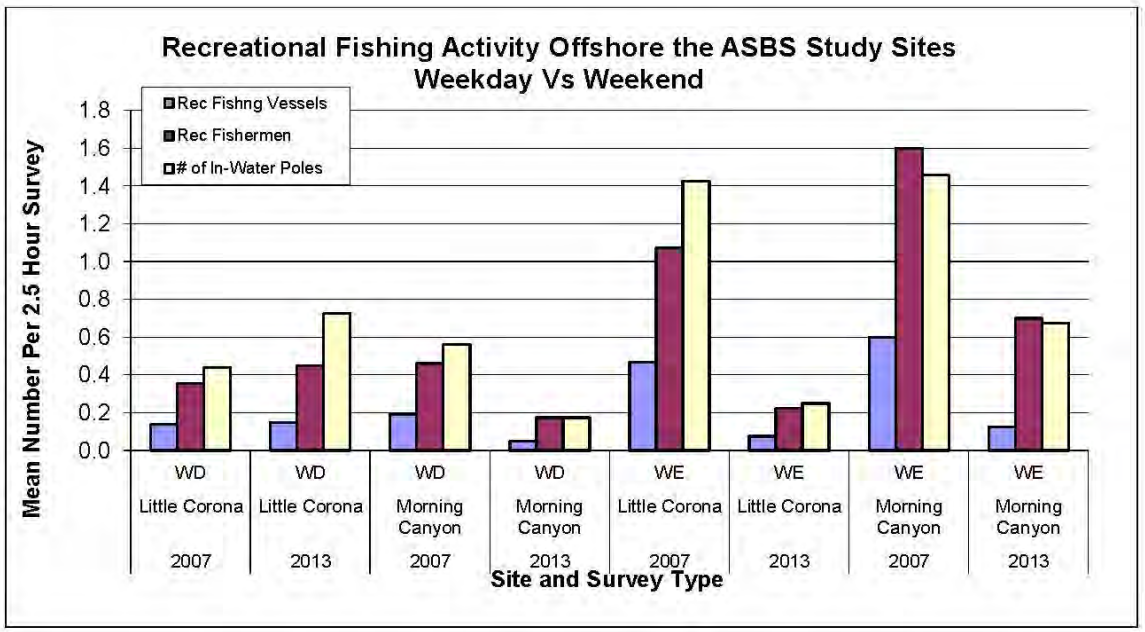


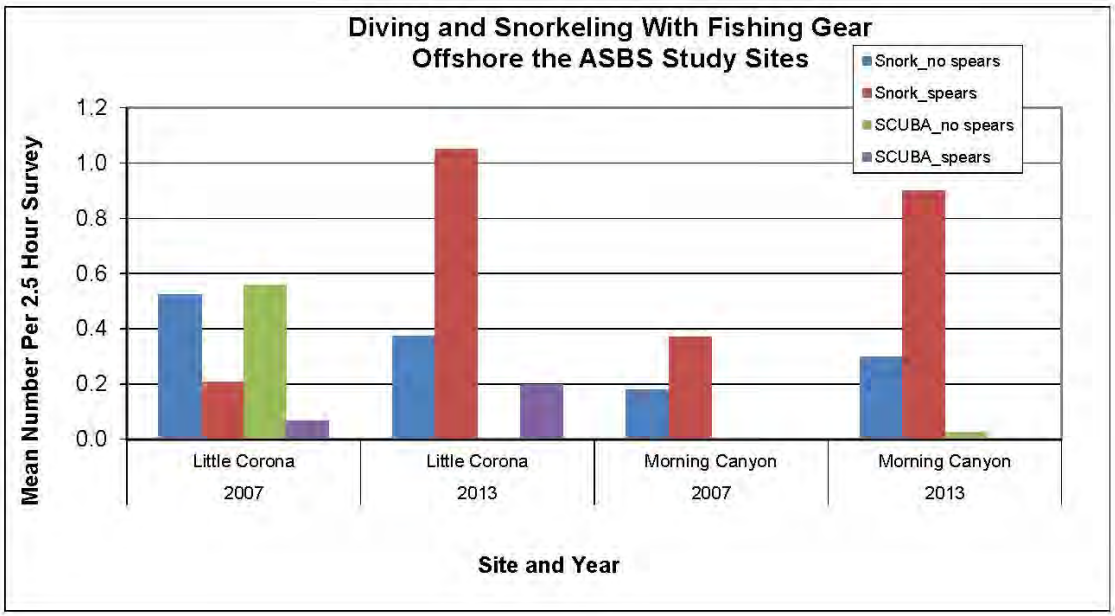
Figure 7. Recreational Fishing Use Intensity
Offshore Little Corona and Morning Canyon.
All Surveys and Weekday and Weekend Periods

3.4.2 Recreational Diving

Snorkeling and SCUBA diving activity is illustrated in Figure 8. Most diving activity in 2013 was skewed toward snorkeling, and more snorkelers carried spear guns than not at both Little Corona and Morning Canyon. The number of spearfishing snorkelers increased by five times at Little Corona between 2007 and 2013 with a mean value of 1.1 snorkelers per survey with spears in 2013. At Morning Canyon, spearfishing with snorkeling gear increased by a factor of 2.5 with a mean of 0.9 snorkelers with spears per survey. SCUBA diving activity (with-and-without spears) declined at both beaches between 2007 and 2013. Most diving activity occurred on weekends and the majority of diving involved snorkeling with spears. Snorkeling with spears increased on weekdays at both Little Corona and Morning Canyon between 2007 and 2013 while the intensity of SCUBA activity declined on weekends.

3.4.3 Personal Water Craft

Several types of personal water craft (PWC) were observed during the surveys, of which kayaks, stand-up paddle boards (SUPs), and wave-runners were the most common. PWC use patterns indicated that in 2007, most activity occurred offshore of Little Corona, while in 2013, this trend was reversed with most occurring off of Morning Canyon (Figure 9) rather than offshore of Little Corona. Weekends were periods of much higher PWC usage compared to weekdays at both locations (Figure 9). Similar to 2007, many kayakers engaged in fishing activity. Many of the kayakers used more than one pole and were outfitted with fish finders.



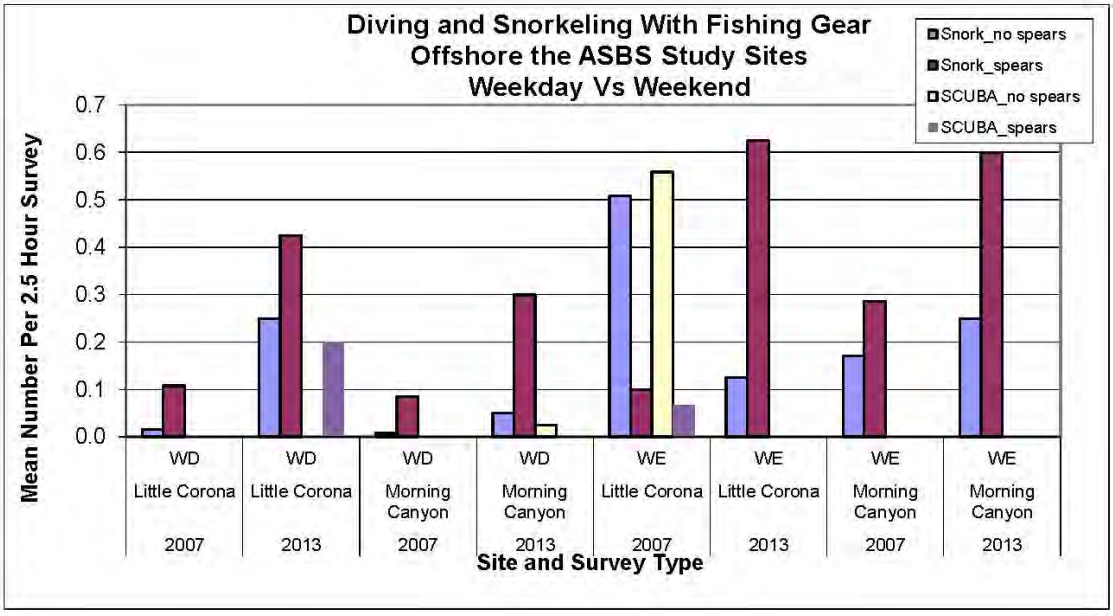
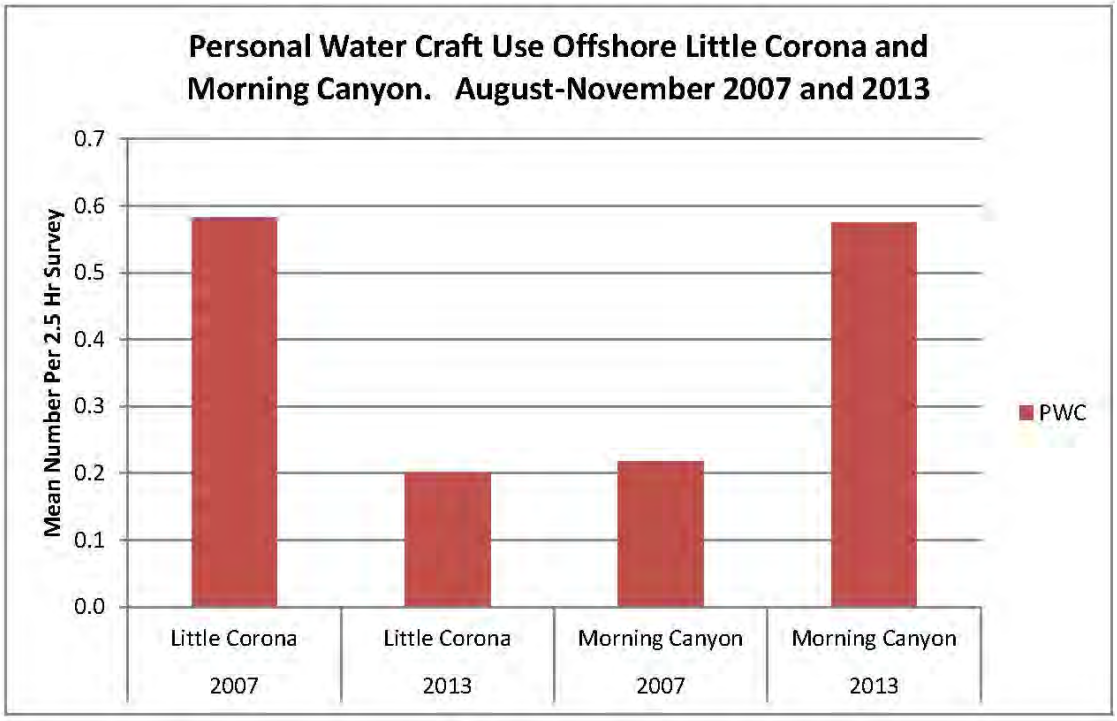


Figure 8. Snorkeling and Diving Activities.
All Surveys and Weekday and Weekend Periods. August-November 2013.



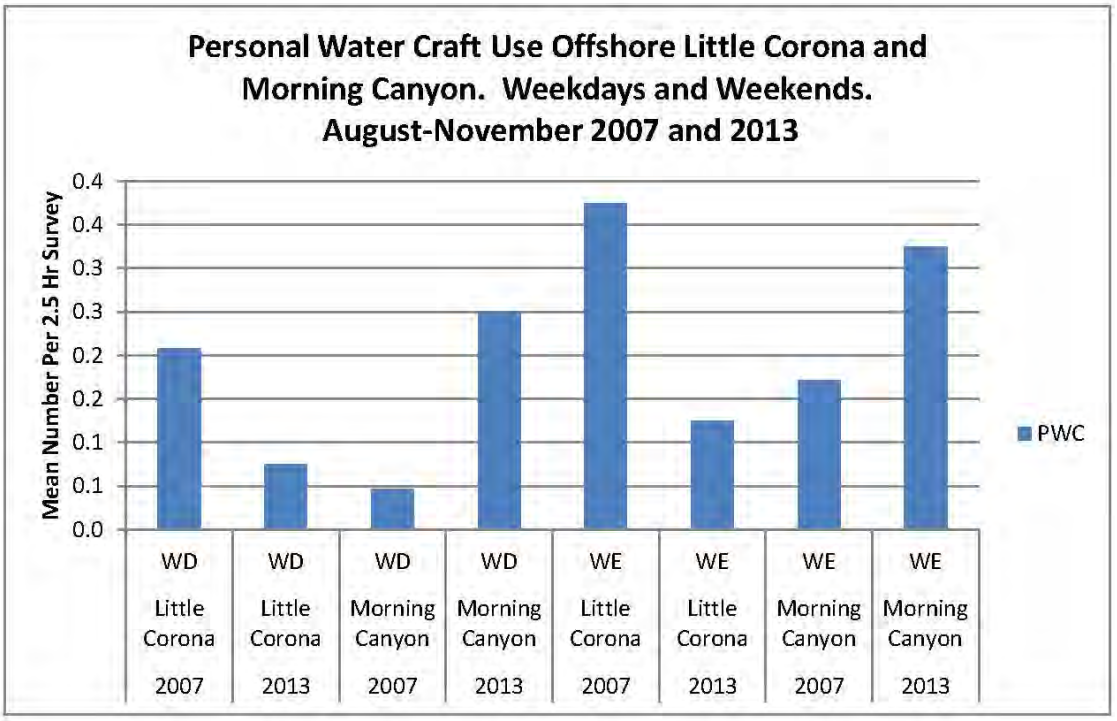


Figure 9. Personal Water Craft (PWC) Offshore Use.
All Surveys and Weekday and Weekend Periods.

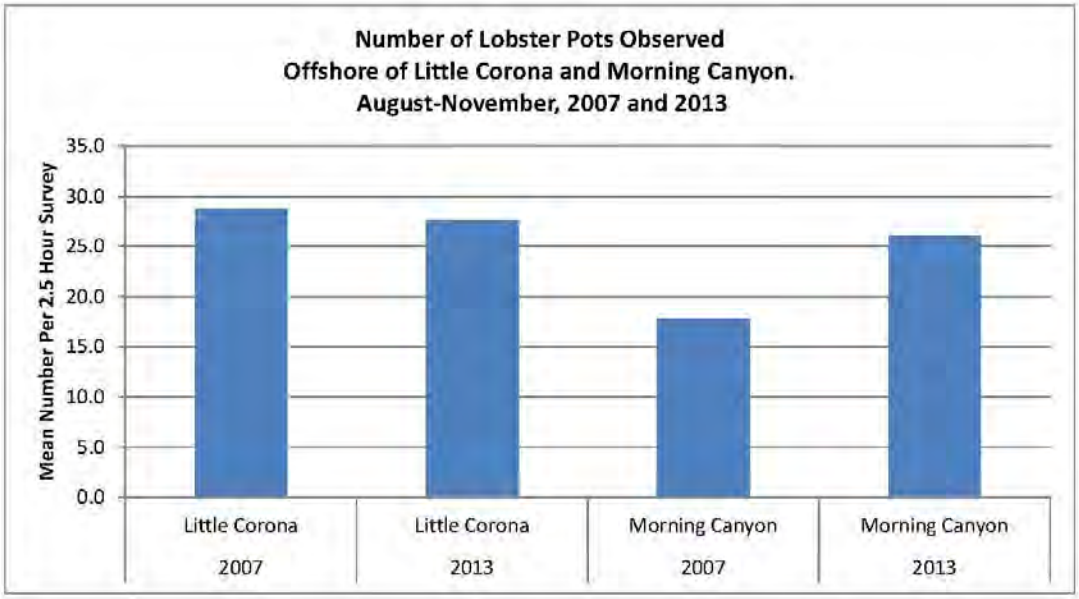
3.4.4 Commercial Fishing Activity

Figures 10 summarizes commercial fishing activity offshore based upon the number of lobster pot buoys observed offshore of Little Corona and Morning Canyon. The only inshore commercial fishing activity observed was lobster fishing. We assume that there was one lobster pot for each lobster pot buoy observed. 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 conducted offshore of both sites during the season with the daily range in lobster pots varying between 6 and 38 (mean=27.6) at Little Corona and 20 and 34 at Morning Canyon (mean=26.1). The mean number of lobster pots was comparable at Little Corona during 2007 and 2013, while lobster fishing intensity increased at Morning Canyon compared to 2007 by an average of 5 pots. Weekday sightings nearly doubled between 2007 and 2013 at Morning Canyon, and while the weekend sightings were higher than in 2007, they were not as abundant as during the weekday surveys.

3.5 PUBLIC USE OF ROCKY INTERTIDAL HABITATS

3.5.1 Proportion and Number of Visitors By Tide Zone

Figure 11 illustrates the distribution of individuals, by percent and by density per 100 linear meters of shoreline at Little Corona and Morning Canyon. The distribution by tidal zone varied from 6.4% in the low intertidal to 35.7% in the splash zone at Little Corona, and between 18.5% in the low intertidal to 30.6% in the splash zone at Morning Canyon (Figure 11). Although absolute numbers were lower at Morning Canyon, a greater percentage visited the lower tidal zone at Little Corona. In 2013, the visitors was more evenly distributed among the various tidal levels compared to 2007, when more people remained in the splash and high tide zones who did not venture lower to the mid and low tide zones. The mean number of people (per 2.5 hr period, n=16 surveys per site) at Little Corona ranged between 11.2 (low tide zone) and 62.6 (splash zone) in 2013, while at Morning Canyon, the number of people varied between 5.9 and 9.8 in the low and mid tide zones, respectively. Compared to 2007, there was an increase in the numbers of visitors to the mid and low tide zones in 2013, at both Little Corona and Morning Canyon (Figure 11).



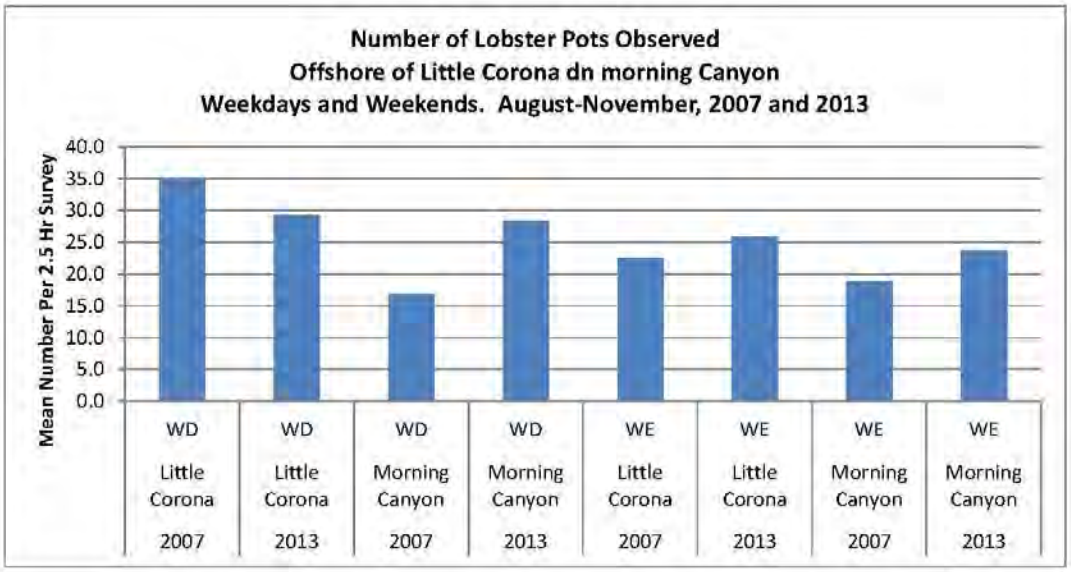


Figure 10. Commercial Fishing Activity. November-August 2007 and 2013. All Surveys and Weekend/Weekday Periods.

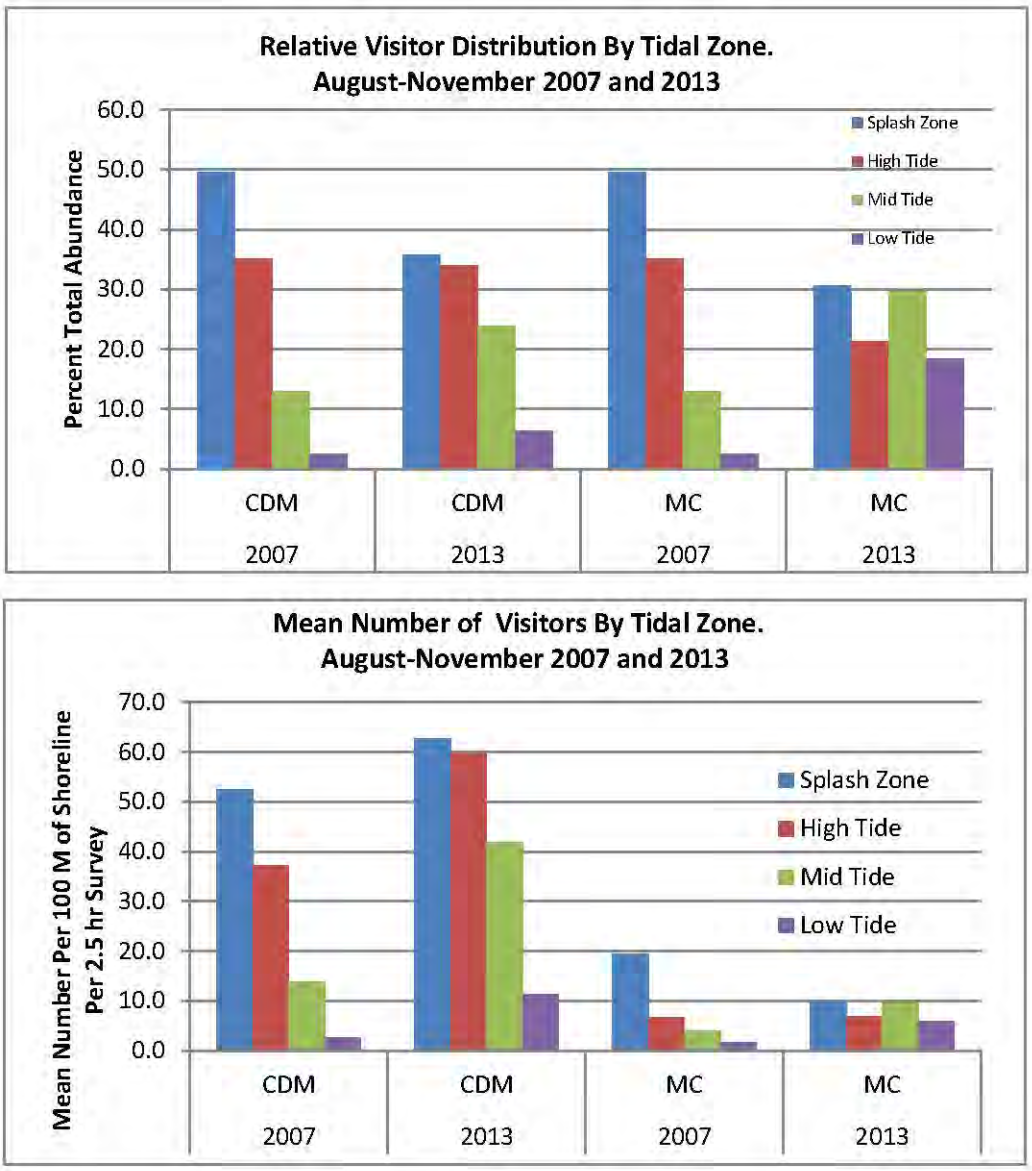


Figure 11. Relative Distribution and Mean Number of Visitors By Tidal Zone.

August-November 2007 and 2013

The breakdown of visitor use by weekday or weekend is illustrated in Figure 12. In 2013, weekday and weekend distribution at both Little Corona and Morning Canyon extended lower in the tidal zones than that observed in 2007. This trend was particularly evident at Morning Canyon during the weekend surveys in 2013 when the proportion of individuals was nearly equally spread between the splash and low tide zones, compared to the same period in 2007. Weekday and weekend visitor use was higher in all zones at Little Corona compared to 2007, while weekday numbers at Morning Canyon in 2013 were similar in distribution compared to 2007, while weekend visitor use was more evenly distributed throughout all tidal zones compared to weekends in 2007.

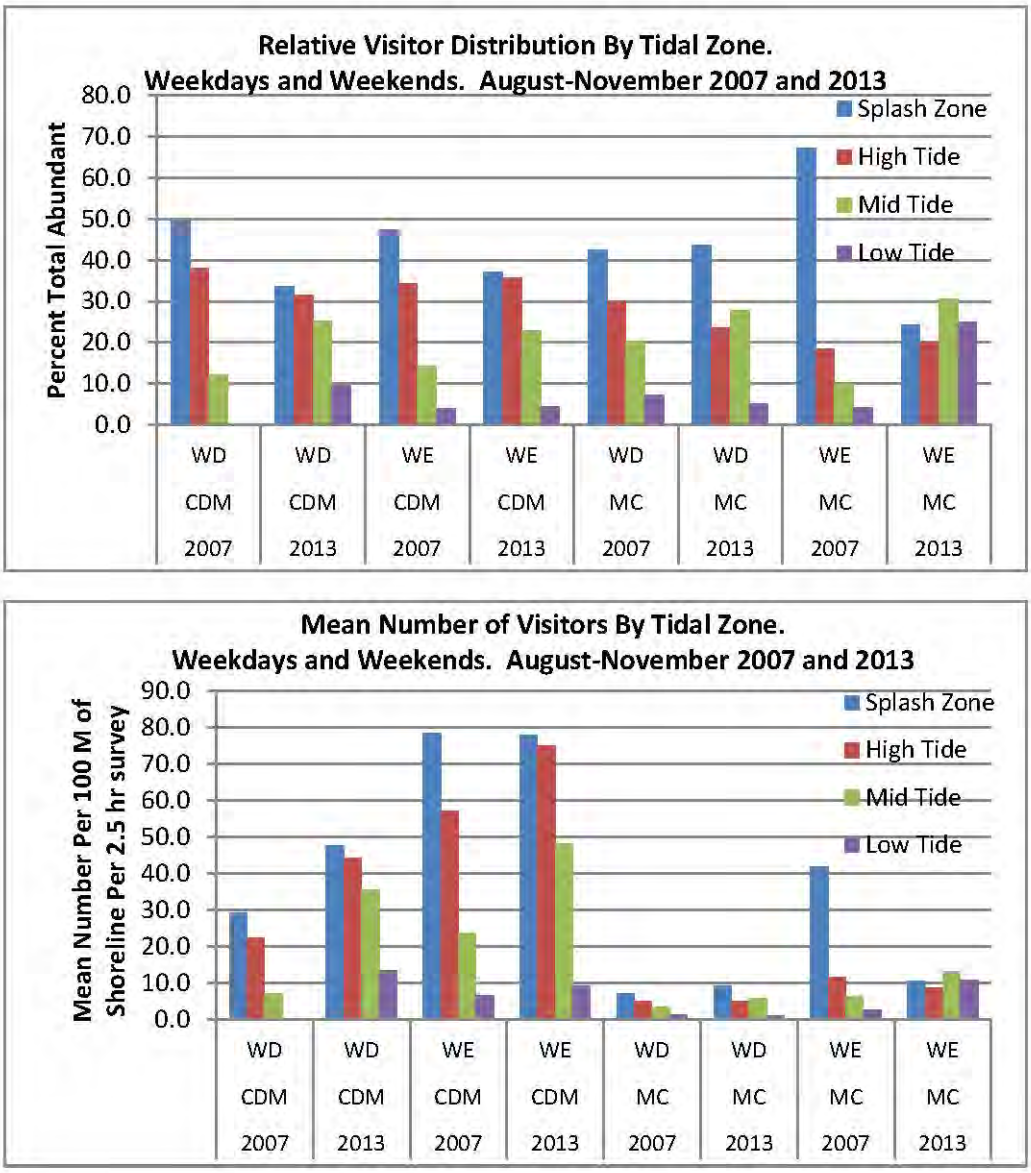


Figure 12. Relative Distribution and Mean Number of Visitors By Tidal Zone. August-November 2007 and 2013. Weekday and Weekend Periods

3.5.2 Public Use Activities in the Tidepools

Walking (Trampling) and Sitting/Standing. The mean number of people walking/trampling, and sitting/standing in the rocky intertidal habitat standardized to 100 meters of shoreline during each survey at Little Corona and Morning Canyon are shown in Figure 13. Both classes of behaviors reflect potentially adverse effects on intertidal organisms due to direct mortality or damage to rocky structures. Walking/trampling occurrences at Little Corona and Morning Canyon were 87.5 and 17.1 per survey (n=16

surveys per site) respectively in 2013, and 77.1 and 17.5 respectively in 2007 (n=15 surveys per site). Sitting and standing activity decreased in 2013 at both sites compared to 2007. Weekday walking/trampling levels were three times higher in 2013 at Little Corona and these activities were about 1.5 times greater during weekends in 2013 compared to 2007. Walking/trampling at Morning Canyon was twice as intense on weekdays in 2013 compared to 2007, but approximately 50 percent less intense on weekends.

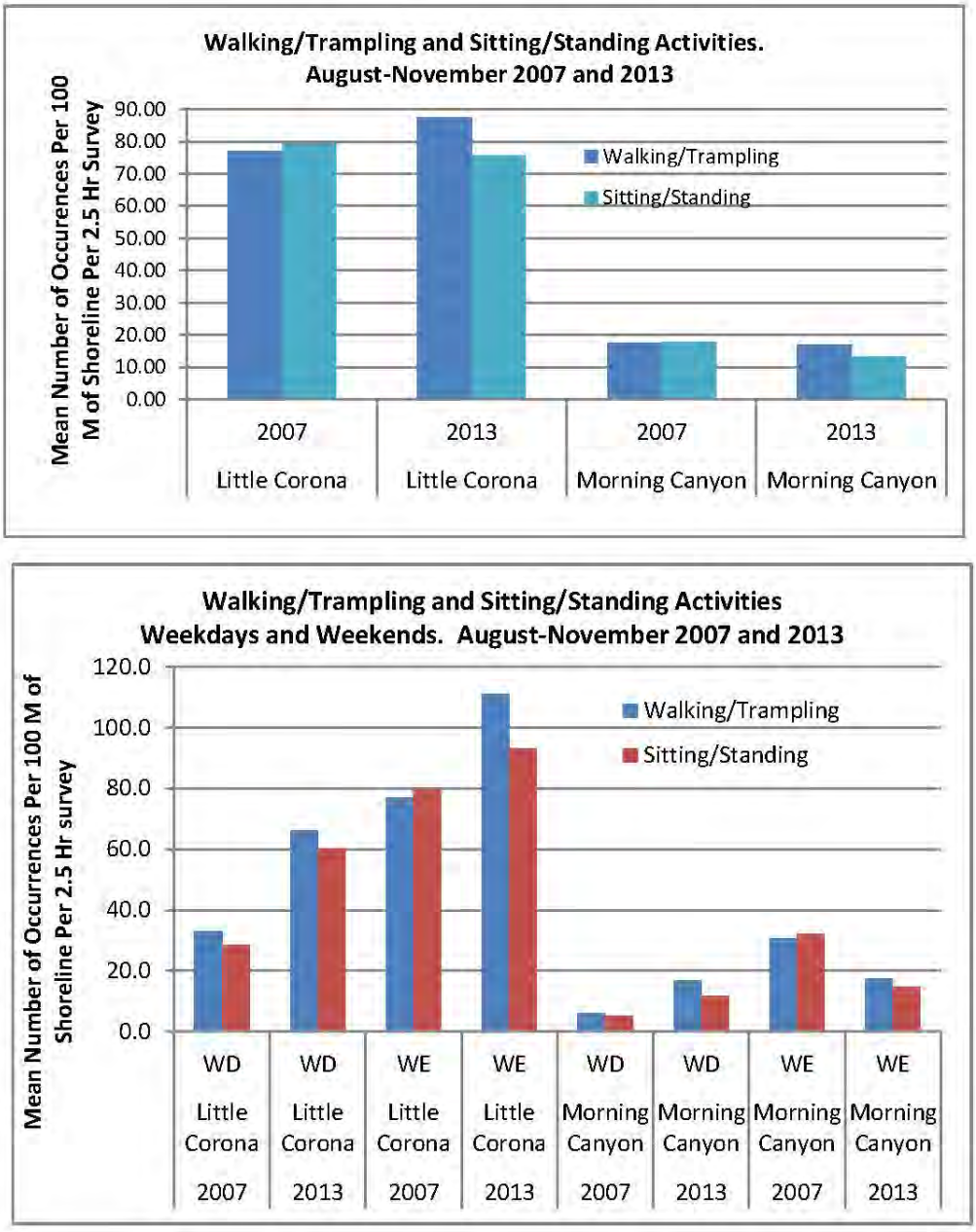


Figure 13. Walking/Trampling and Sitting/Standing Behaviors.
All Surveys and Weekday/Weekend Periods.

Handling, Collecting, and Rock Turning. Figure 14 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. In 2013, handling organisms was the most frequent activity at Little Corona (8.5 times/survey) and at Morning Canyon (4.3 times/survey). These levels were elevated over those observed in 2007. Visitors also turned over rocks much more frequently at Little Corona and Morning Canyon in 2013 (1.9 and 1.7 times/survey) compared to 2007 (0.1 and 0.2 times/survey). Visitors collected live organisms at Little Corona at similar levels in 2013 and 2007. While observers did not record any live animal collecting at Morning Canyon in 2013 low-levels of collecting were seen at Morning Canyon in 2007. Handling and rock turning were the prevalent activities at Little Corona and Morning Canyon on both weekdays and weekends with handling/touching occurring more frequently during weekdays in 2013 than during weekdays in 2007. Collecting live organisms and shells/rocks was less common on weekends at Morning Canyon in 2013 compared to 2007.

Organisms Handled and Collected. The identifiable taxa handled and/or collected by tide pool visitors including hermit crabs (*Pagurus* sp.), shore crabs (*Pachygrapsus crassipes*), turban snails (*Tegula* [*Chlorostoma*]), sea stars (*Pisaster ochraceus*), and sea urchins (*Strongylocentrotus purpuratus*). Hermit crabs were the most frequent animal handled and/or collected, followed by turban snails, sea stars, and sea urchins. Numbers of individual species handled or collected were not tallied; only the occurrences of each handling and/or collecting activity.

Shore Fishing. Figure 15 summarizes shore fishing activity at Little Corona and Morning Canyon. Minimal shore fishing occurred at Little Corona in 2013, (0.04 times per 2.5 hr survey, n=16 surveys, while most occurred at Morning Canyon, averaging 1.04 times per 2.5 hr survey. The most common fishing areas included the headland between Little Corona and Morning Canyon; the shoreline of Morning Canyon; and the headland immediately east of Morning Canyon. The intensity of fishing declined at Little Corona in 2013 compared to 2007, while fishing intensity at Morning Canyon doubled between 2007 and 2013. Fishermen brought their own bait when fishing at Little Corona, while at Morning Canyon about 50% brought their own bait while the other 50% collected bait from the intertidal zone. Observers were not able to determine the type of bait collected from the intertidal zone, but based on data from 2007, most of the bait collected at that site were mussels.

Shore fishing occurred primarily on weekends at both sites although the fishing intensity was higher at Morning Canyon. Fishing intensity at Morning Canyon on weekends was about two times greater than that observed at Little Corona (Figure 15).

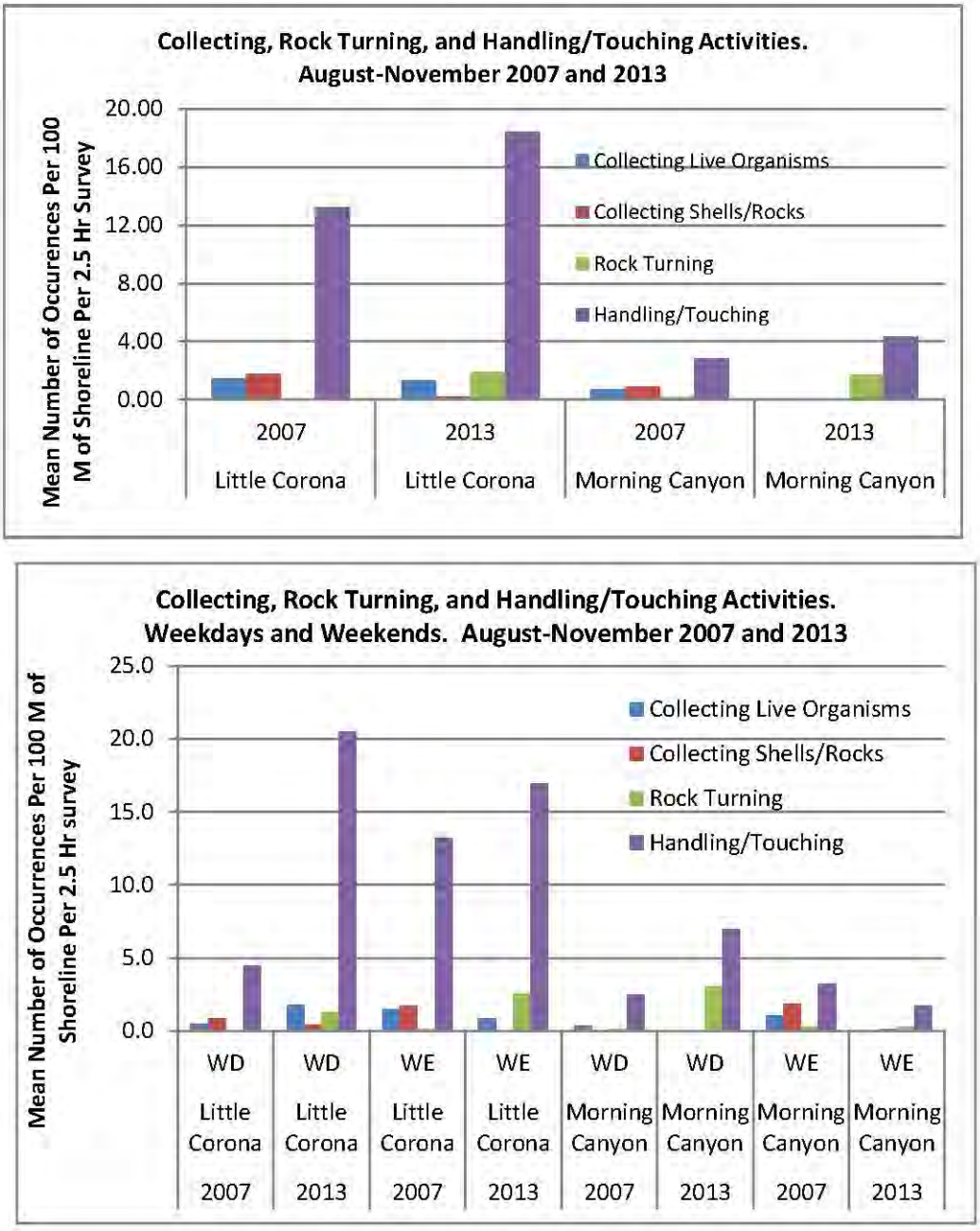


Figure 14. Collecting, Rock Turning, and Handling/Touching Organisms. All Surveys and Weekday and Weekend Periods. August-November 2007 and 2013.

Figure 15. Shoreline Fishing Activity, August-November 2007 and 2013 All Surveys and Weekday and Weekend Periods.

3.5.3 Docent and Enforcement Activity

Figure 16 illustrates the intensity of docent and enforcement interactions with the public. Overall, the mean number of docent and enforcement contacts with the public was 0.13 times/survey at Little Corona. No interactions were observed at Morning Canyon in 2013. Substantially higher numbers of enforcement/docent interactions with the public occurred during 2007 at Little Corona, when an average of 4.5 contacts were made with the public. Only a few researchers were observed at Corona del Mar and Morning Canyon during 2013; most research activity occurred at Morning Canyon in 2007.

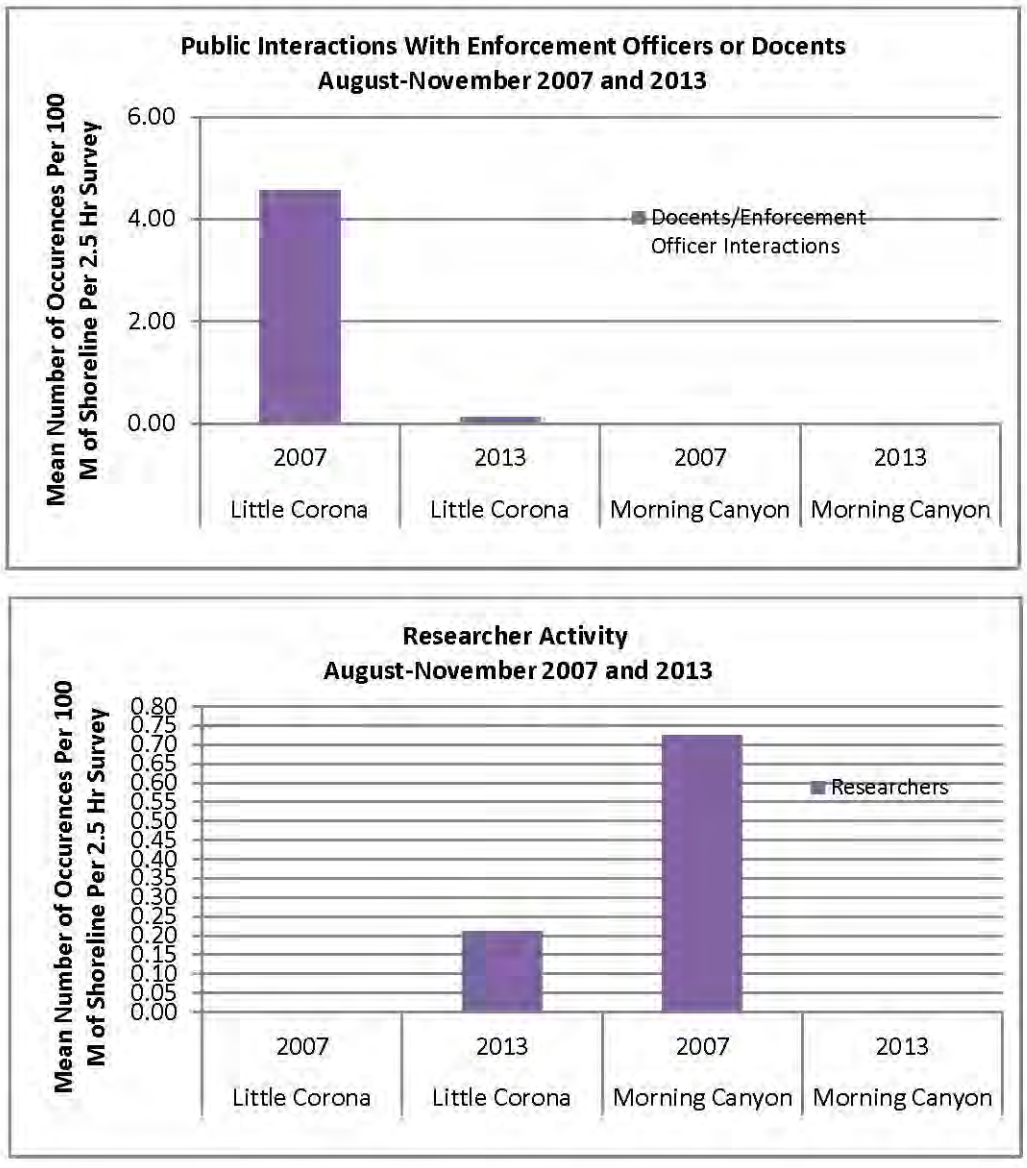


Figure 16. Enforcement and Researcher Activity, August-November 2007 and 2013. .

Docent and enforcement contacts with the public were very limited during weekdays and weekends at Little Corona in 2013 (Figure 17). Fewer numbers of contacts with the public on weekdays reflect the absence of public school groups that come to the tide pools later in the school year, between May and June. No docent/enforcement officer contacts occurred either on weekdays or weekends at Morning Canyon in 2013, and such contacts occurred sporadically at Morning Canyon during 2007 as well. Research activity at both Little Corona and Morning Canyon was low by survey and during weekdays and weekends compared to the same time period in 2007.

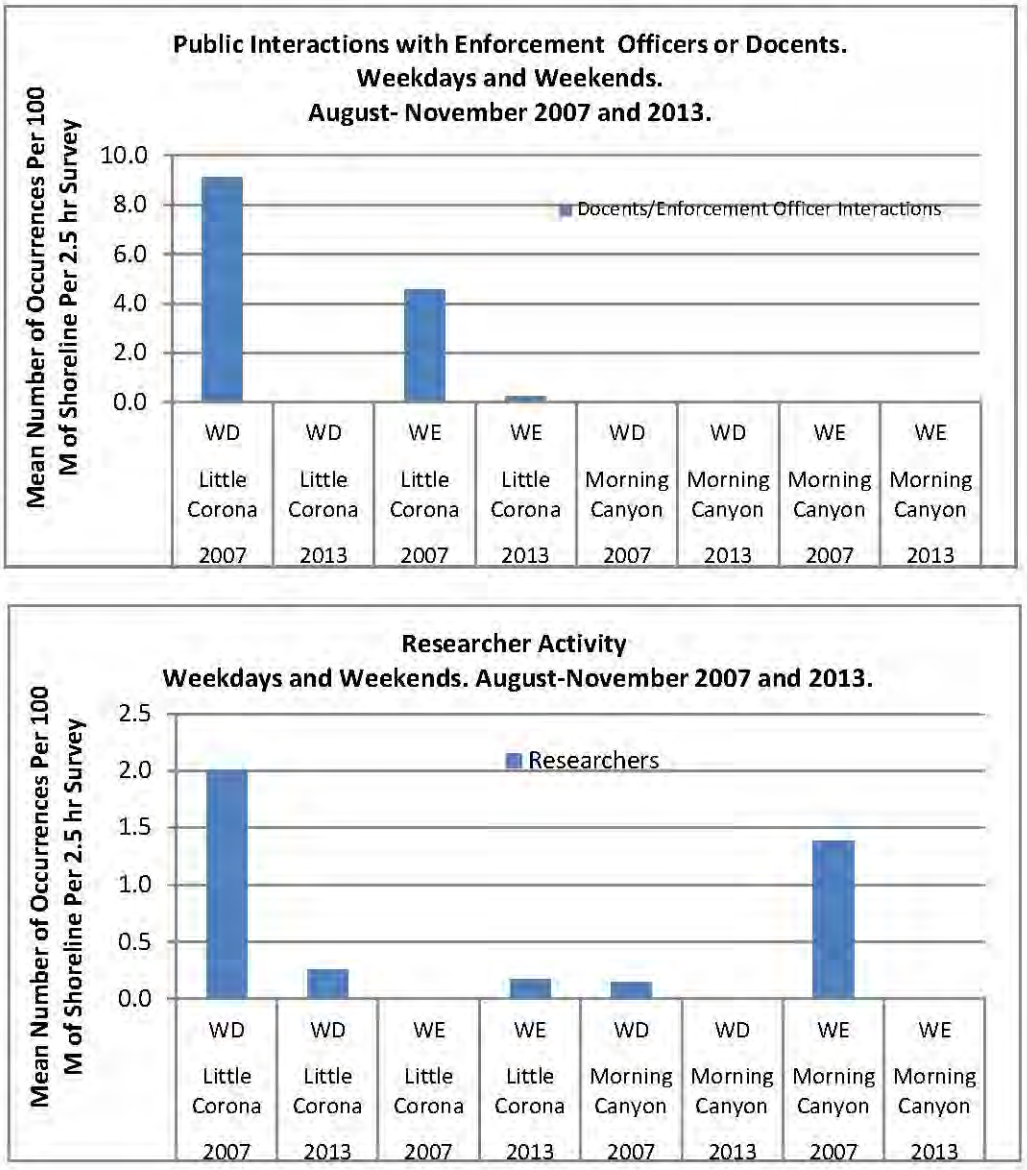


Figure 17. Weekday and Weekend Docent and Enforcement Contacts With the Public. August-November, 2007 and 2013.

4.0 DISCUSSION AND CONCLUSIONS

Public use surveys were conducted in Area of Special Biological Significance (ASBS) #32 at Little Corona and Morning Canyon between August 18th and November 16th, 2013. The results of these surveys were compared with ASBS surveys conducted between August 11th and November 23rd, 2007 (Coastal Resources Management, Inc. 2009) using the same methodologies and occupying the same survey sites. Sixteen surveys were conducted at each site in 2013. Fifteen surveys were conducted at Little Corona and 14 surveys were conducted at Morning Canyon between August and November 2007. Each survey was conducted over a 2.5 hour period beginning one-half hour before the low tide The survey effort included 32 field days and 80 field-hours of observations in 2013, compared to 29 field days and 72.5 hours in 2007 to quantify the number of visitors, dogs, and birds, and to identify the types of, and amount of onshore-and-offshore visitor use activities.

4.1 Physical Conditions

- While most data collection occurred during daily low tides of +0.5 ft MLLW or lower, it was also necessary to collect data during summer periods when low tides were greater than 1.5 ft. Physical data indicated the surveys were conducted during fair to warm weather, and low surf conditions. Thus, the public use data collected at the two sites within ASBS #32 were unlikely influenced by small variations in weather and sea conditions.

4.2 Site Attributes

Table 4 summarizes the ASBS data collected during the sixteen-week survey period. Both sites 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 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 12th grade use of the intertidal as a teaching site. However, teaching activities at this level were non-existent during the survey period.

- A few junior college and four-year college classes were present during the 2013 surveys. While the tidepools are actively managed by City of Newport Beach staff with assistance from City lifeguards during both weekdays and weekends, very few interactions were observed between enforcement personnel or docents with the public between August and November 2013.

Table 4. Comparison of Attributes and Rank Order of Attributes Among Survey Sites

Attribute	**Little Corona ASBS #32**	**Morning Canyon ASBS #32**
Habitat	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
Parking	Free	No Public Parking
Access	Easy from Ocean Ave	Difficult for the public; locked gate, must walk from Little Corona over high relief rocks
Restrooms	Yes at base of access path to beach	No
Enforcement on Site; And Docent Programs	Yes, City employees and lifeguards, City employees and docents; few contacts observed with the public during the survey period	None observed
Educational Groups	2 college classes during the surveys	3 college classes during the surveys
Level of Docent/Enforcement Enforcement Activity	Very limited	None
Period of Highest Enforcement and Docent Contact	Weekends	none
Level of Scientific Research	Low	Low
Public Use Intensity- Number of Visitors	High	Low
Rocky Tide Zone Use (Number of People per 100 meters of shoreline)		
Splash Zone	High	low
High Tide Zone	High	low
Mid Tide Zone	Moderate	low
Low Tide Zone	Low (except during class outings)	Low (except during class outings
Shorebird Use Intensity		
Shorebird Use Intensity (Numbers)	Low	Moderate-to-High
Dog Use (Numbers)	Low- All on the leash	Low-to-moderate- All off the leash

Table 4 (Continued)	Little Corona ASBS #32	Morning Canyon ASBS #32
Visitor Behaviors in the Tide Pools		
Weekend Walking/Trampling	High	Low
Weekday Sitting/Standing	High	Low
Handling/touching Organisms	High	Low
Collecting Shells/Rocks	Low	Low
Rock turning	Low	Low
Collecting Live Organisms	Low	Low
Period of Most Handling, Collecting, and Rock Turning	Weekdays/Weekends for handling; weekends for others	Weekdays/Weekends for handling; weekends for others
Dominant Species Handled	Hermit crabs, snails, shore crabs;	Snails, hermit crabs, shore crabs
Species Most Frequently Collected	Hermit crabs	Hermit crabs
Shoreline Fishing		
Period of Most Frequent Shoreline Fishing	Weekends	Weekends
Shoreline Fishing Intensity	Low	High
Shoreline Fishing With Collected Bait	Low	Moderate
Shoreline Fishing With Bait Brought to ASBS	Low	Moderate
Public Use in Waters Offshore of ASBS		
Recreational Fishing		
Recreational Fishing Intensity	Low	Moderate
Most Intense Period of Fishing	Weekends	Weekends
Number of vessels	Low	Moderate
Number of fishermen	Low	Moderate
Number of fishing poles in water	Low	Moderate
Recreational Snorkeling/diving	Low	Moderate
Commercial Fishing		
Type of Activity	Lobstering	Lobstering
Number of Lobster Buoys/Arrays	Equal to Morning Canyon	Equal to Little Corona

- Morning Canyon rocky intertidal is 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, and limited educational outreach. Tide pool enforcement and/or docent activity during the survey period did not occur, likely since the majority of public use was at Little Corona tidepools. Two docents were observed during one survey at this site, but there were no interactions with the public. This site was visited by a few tide poolers during each survey. Recreational fishermen were more common here than tide poolers during many of the surveys.

4.3 Public Use Intensity (PUI) in the Rocky Intertidal Zone

- A total of 3,603 individuals were counted in the rocky intertidal zone at the two sites during the year-long investigation and another 2,493 were counted on the sandy beaches next to the tide pools. Fifty-nine percent of the visitors were recorded in the rocky intertidal habitat, while 41% remained on the adjoining sandy beaches. Public use of the tide pools increased in 2013 compared to 2007. Table 2 summarizes the Public Use Intensity (PUI) quotients. Weekends continued to be higher periods of public use.

Table 5. Summary of Public Use Intensity (PUI)

Area	Total Number in Rocky Intertidal 16, 2.5-hour surveys,	Total Number in Rocky Intertidal Per 100 Linear Meters of Tide Pool Shoreline Per Survey (2.5 hrs). 16 surveys	% of Total
Little Corona ASBS #32	3101	2124	86.1
Morning Canyon ASBS #32	502	286.9	13.9
All Sites	3603	2410.8	100

4.4 Visitor Use Relative to Zonation and Tidal Height

- At both sites, the splash zone and the high intertidal zone were the most frequently visited areas parts of the tide pools, with fewer people venturing towards the low tidal zone. However, the distribution of people among the tidal zones at Morning Canyon showed a distinct trend of greater relative abundances in the low and mid intertidal zones than at Little Corona, although absolute numbers of visitors in the low and mid intertidal zones were higher at Little Corona. Higher numbers of visitors in the mid and low intertidal zones at Morning Canyon was partially due to a greater proportion of shore fishermen using the habitat with low overall numbers of tide poolers at this site.

4.5 Visitor Behaviors

- 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 of Little Corona and Morning Canyon which are included in the State of California Crystal Cove Marine Conservation Area.

- Some activities are legal (walking, sitting, and standing in rocky intertidal areas) but can have unintentional detrimental impacts on rocky intertidal systems (trampling of organisms and habitat disruption) while other activities/behaviors are partially restricted or prohibited and may result in adverse impacts on the intertidal community.

- Prohibited behaviors include the taking of marine resources from tide pools, and the take of all marine resources species by hook-and-line or by spearfishing except those specifically allowed under the California Fish and Game Code subsection 632(a)(2) and Section 1.76, as summarized in Table 6 summarizes the prohibited and allowed recreational takes for ASBS #32.

Table 6. Take Prohibited and Allowed at Project Area Sites

Source: http://www.dfg.ca.gov/mlpa/mpa_regs.asp	**SPECIES PROHIBITED For Recreational Take**	**SPECIES ALLOWED For Recreational Take**
Robert E. Badham State Marine Conservation Area (ASBS 32); is part of the Crystal Cove Marine Conservation Area and includes both Little Corona and Morning Canyon Study Sites	Take of all living marine resources from inside tidepools is prohibited. For purposes of this section, tidepools are defined as the area encompassing the rocky pools that are filled with seawater due to retracting tides between the mean higher high tide line and the mean lower low tide line	Take of all living marine resources is prohibited except: 1. The recreational take of finfish* [subsection 632(a)(2)] by hook-and- line or by spearfishing [Section 1.76], and lobster and sea urchin is allowed.

- The frequency of behaviors potentially detrimental to rocky intertidal systems was higher at Little Corona than at Morning Canyon. Fewer incidences of detrimental behaviors were observed at Morning Canyon due to the fewer number of individuals present at this site through the 16 week surveys. However, the numbers of detrimental behaviors increased at both Little Corona and Morning Canyon in 2013 compared to 2007.

Walking/Trampling. This activity was the most common form of potential damage to the intertidal, primarily to soft bodied animals and macrophytes.

- In 2013, this activity was consistently high at Little Corona and by virtue of lower numbers present at Morning Canyon, not as much trampling was noticed. The incident of walking/trampling was higher in 2013 than in 2007.

- Shore fishermen at Morning Canyon tended to trample more and collect more in comparison to Little Corona, which is more regulated by enforcement and docent personnel. Most fishing took place on weekends.

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. The frequency of handling and collecting during the surveys constituted only a minor percentage of all observations.

- In 2013, handling organisms was the most frequent activity at both Little Corona and at Morning Canyon. These levels were elevated over those observed in 2007. Visitors also turned over rocks much more frequently at Little Corona and Morning Canyon in 2013 compared to 2007.

- Hermit crabs *(Pagurus* spp), gastropods (i.e., *Tegula* sp. and shore crabs (*Pachygrapsus crassipes*) were the most common organisms handled at both sites, although the handling/touching occurred more often at Little Corona than at Morning Canyon.

Collecting. Tide pool collecting is highly restricted.

- In 2013, the intensity of tidepool collecting was low-to-moderate. Common taxa collected included hermit crabs, turban snails, sea stars, and sea urchins. However, the take of larger macroinvertebrates was rarely observed.

Rock Turning. This behavior can disrupt the habitat of organisms living on the undersides of the rocks, and expose species to desiccation and predation.

- While this behavior was not common, it occurred throughout the surveys at both Little Corona and to a lesser extent, Morning Canyon. This and other adverse behaviors were more frequently encountered in 2013 than in 2007, due to (1) an increase in the number of tidepool visitors, and secondly, less frequent occurrences of tide pool enforcement and docent personnel at Little Corona.

4.6 Sport Fishing From Shore

- Fishing with hook and line gear for finfish is legal within ASBS #32. Shore fishing activity was more prevalent at Morning Canyon than Little Corona, and most of all fishing activity occurred on weekends. As with other activities, shore fishing was more common in 2013 than in 2007. Although fishers used bait brought with them, they also frequently and illegally collected organism for bait, of which mussels were the most likely organism affected.

4.7 Utilization of the Waters Offshore of the ASBS Sites

- The waters offshore of the rocky intertidal zone were frequented by recreational fishers, commercial lobster fishers, and to a lesser degree, snorkelers and SCUBA divers. The number of recreational fishers and in-water pole fishing activity was less at both Little Corona and Morning Canyon compared to 2007. However, the intensity of fishing activity in 2013 at both sites was comparable. Fishing occurred from both small recreational craft, as well as kayaks.

- Commercial lobster pot buoys were observed within the October to March fishing period. The observed numbers of lobster pot buoys was similar between sites in 2013; however, increases were evident between 2007 and 2013 at Morning Canyon. In terms of the intensity of lobster fishing, we assume that one lobster pot was associated with each lobster pot buoy.

- Recreational diving (snorkeling and SCUBA) was generally a weekend activity and occurred primarily at Morning Canyon. Contrary to the results in 2007, most snorkelers carried spear guns in 2013.

4.8 Docent and Enforcement Activity

- The number of docent and enforcement contacts with the public was very low during the August-November 2013 surveys at Little Corona, despite periods of very busy activity in the tide pools. No interactions were observed at Morning Canyon. The degree of interaction with the public was substantially less in 2013 than it was during the 2007 public use surveys. Combined with greater number of visitors, there were higher incidences of behaviors that could be detrimental to intertidal marine habitats and organisms, including trampling, collecting, handling/touching, and rock turning.

5.0 LITERATURE CITED

Ambrose R.F. and J. Smith. 2005. Restoring rocky intertidal habitats in the Santa Monica Bay. Technical Report for the Santa Monica Bay Restoration Commission.

Coastal Resources Management, Inc. 2009. Central Orange County Areas of Special Biological Significance Public Use Monitoring Program. Prepared for the City of Newport Beach Public Works Department and Weston Solutions, Inc. June 14th, 2009. 75 pp.

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APPENDIX 1. SITE PHOTOGRAPHS

Little Corona Tide Pools, Facing East Towards Morning Canyon

Morning Canyon, Facing West Towards Little Corona