

**Non-Harvest Human Impacts to
Rocky Intertidal Habitats -
A Pilot Project**

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Acknowledgments

This project would not have been possible without the dedicated volunteers that conducted the field work. Special thanks go to Corrina Chase who showed the interest and energy to lead the other volunteers on the project. Nancy Chase also deserves special thanks for helping me organize the project and for securing many of the volunteers. In addition to Corrina and Nancy Chase, volunteers on the project included Cindy Guschov, Dave Prekering, Chris Anderson, Chuck Richmond, and Randy Nelson.

Introduction

Oregon's rocky intertidal habitats have been subjected to gradually increasing human-use pressures as the coastal and tourist populations have risen over the years. Brosnan and Crumrine (1991,1992) have documented impacts to intertidal communities at Yaquina Head, Sunset Bay, and Haystack Rock that have resulted from people walking on the intertidal habitat. Link (pers. comm, 1993) has observed significant impacts at Arch Cape from past commercial mussel harvest. Impacts on most of the coast have not been documented. Unlike impacts from a catastrophic event or effects of a rapidly growing commercial fishery, most of Oregon's intertidal habitat impacts are subtle and difficult to see. Because of the subtlety of impacts, we have only begun to recognize there is a potential for human impact problems in rocky intertidal areas. If we look to Washington and California for examples, there is clearly a need to begin closer examination of intertidal areas before human impacts become significant and irreversible.

We have begun to examine the types and amounts of potential impacts that may be occurring in intertidal areas. We have generally divided impact categories into harvest and non-harvest impacts. Harvest impacts include personal use collection of invertebrates for food or souvenirs, and commercial harvest of invertebrates such as mussels. Non-harvest impacts include physically walking on intertidal areas, prying off and picking up organisms for observation, intentionally harming organisms, and intentionally or unintentionally disturbing seabird and marine mammals. John Johnson, ODFW, has conducted pilot projects at Seal Rock and Yachats to test methods for using volunteers to document amounts of harvest. This report summarizes a pilot project to begin to test methods for using volunteers to document non-harvest impact levels.

The goal and objectives of this pilot project are as follows:

Goal: Begin documenting non-harvest human impacts to rocky intertidal habitats

Objectives:

- 1) Develop procedures for observing and recording impacts
- 2) Design the project for participation by volunteers
- 3) Begin documenting low tide human use of sites in person-hours
- 4) Begin documenting activities that may impact marine invertebrates and algae such as picking up, touching, moving, turning over, kicking, etc.
- 5) Begin documenting the intertidal visitor profile.

Methods

Data collection employed volunteers to count, observe, and interview intertidal users. The volunteers worked in pairs and sampled for several hours during selected morning low tides. We choose the marine gardens at Otter Crest for conducting this pilot project. Since this site is a marine garden, personal use and commercial harvest of invertebrates (except a single mussel for bait) is prohibited. Therefore, only non-harvest uses occur at the site.

In order to document low tide human use in person-hours (objective 3), volunteers counted the total number of people in the rocky intertidal area every one-half hour in each of three categories:

- adults
- children (not with school groups)
- children in school groups.

Ideally the counts were to begin 1 hour before the low tide and end 2 hours after low tide. In this pilot project, we varied from this schedule. Weather observations were also made during each count. All data were recorded on a data form (Appendix A).

Counts at half hour intervals were averaged over each hour and then summed for the day to estimate person-hours per day.

The volunteers documented types of human impacts by observing individuals from a discrete location using binoculars. We assumed individuals' behavior was not influenced by the observer because most people did not know they were being observed. The volunteers endeavored to sample different types of individuals (adult, child, school child) and selected people at random using a procedure that employed a table of random digits (Appendix B). The volunteers observed each individual for a period of 5 minutes each and recorded various types of behavior such as picking up organisms on the data form in Appendix B. The volunteers attempted to observe at least 10 people per low tide.

In order to collect the visitor profiles as part of objective 5, volunteers walked throughout the intertidal area and used a standard set of questions and data form (Appendix C) to interview individuals. Carney and Kvitek (1991), Cogan Owens Cogan (1993), and Clevenger (1992) provided models for the types of interview questions asked.

Results and Discussion

Volunteers sampled a total of eight morning low tides from July 6 through August 31, 1993. All samples were collected on weekdays. Some of the sample days were cut short due to rain. Results for the human use counts, behavior observations, and interviews are summarized below.

Human Use Counts

In a fully implemented study, we can use the count data to estimate total person hours of use, determine if use levels are systematically related to external factors, and determine if single low tide pressure counts are representative of total use. Data were not adequate in this pilot project to estimate total person hours of use. The sampling period was different each day and people generally continued to use the intertidal area after the volunteer sampler had to leave. Future studies need to be designed to obtain counts over the entire span of low tide use. This would generally occur from about 1 hour before the morning low tide to as much as 4 hours after the low. During the 8 days sampled, the daily average hourly use ranged from 11 to 36 person hours.

We plotted the user counts against number of hours before or after low tide and against time of day to examine patterns in use. Figure 1 shows that the highest counts generally occurred between one and two hours after low tide. Figure 2 shows a general trend of higher counts later in the morning regardless of the time of low tide. Figure 3 shows that low tide counts were generally high during later low tides. None of the above count-versus-time relationships were statistically significant.

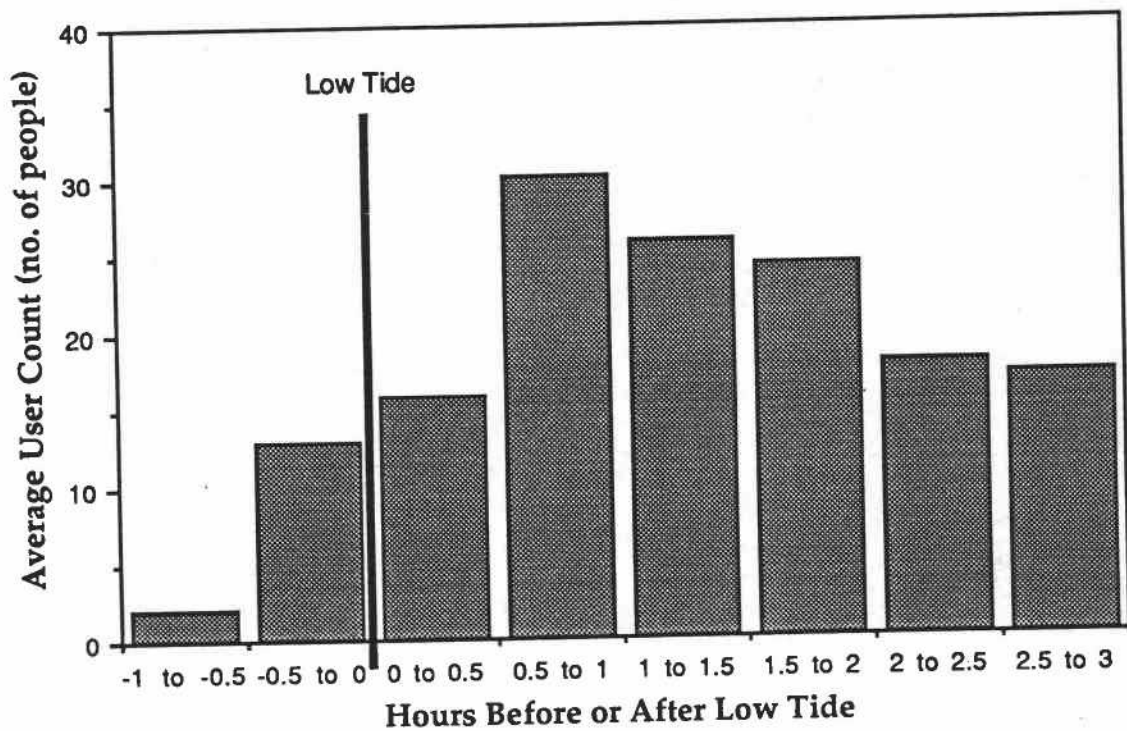
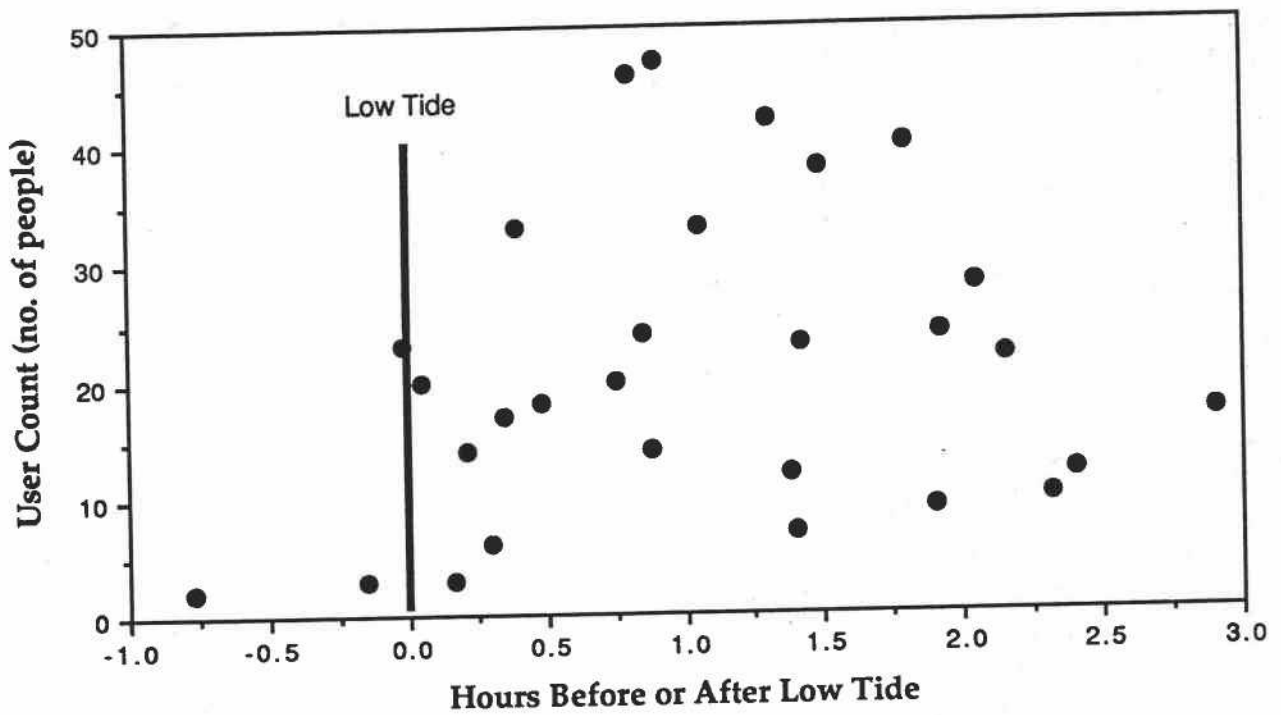


Figure 1. User count levels before and after low tide. Upper graph is a point plot of individual counts; lower graph shows summarized counts.

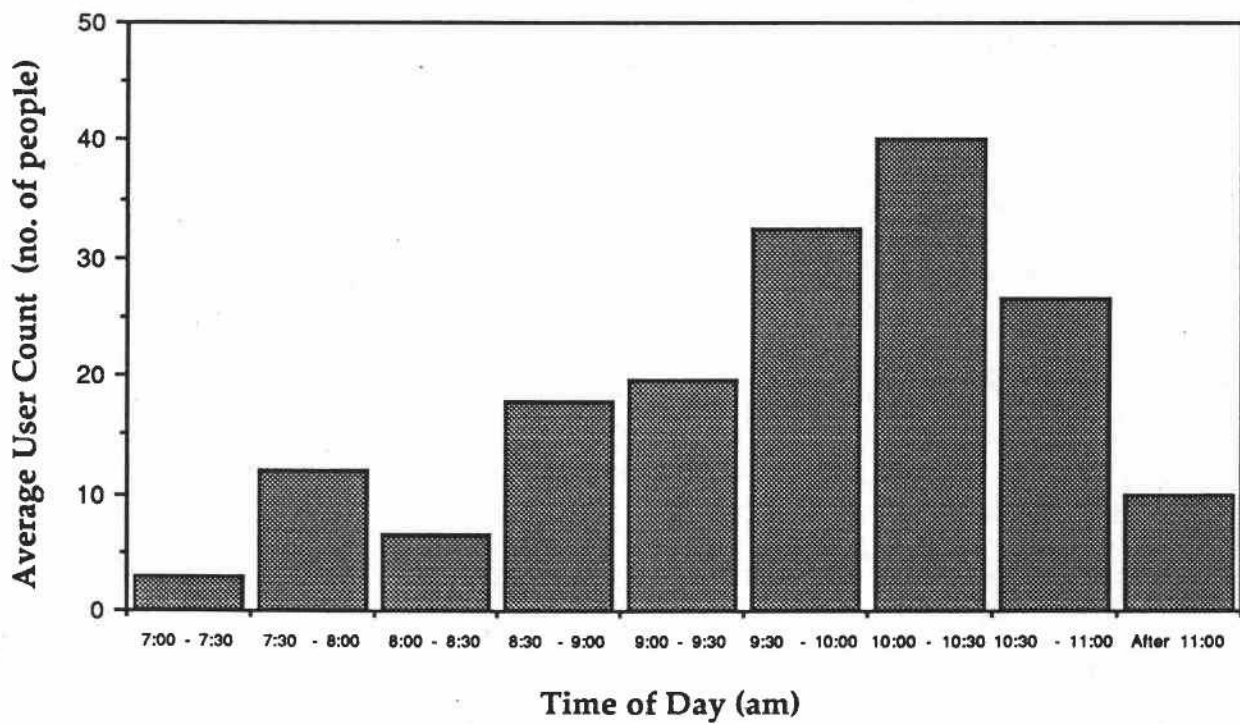
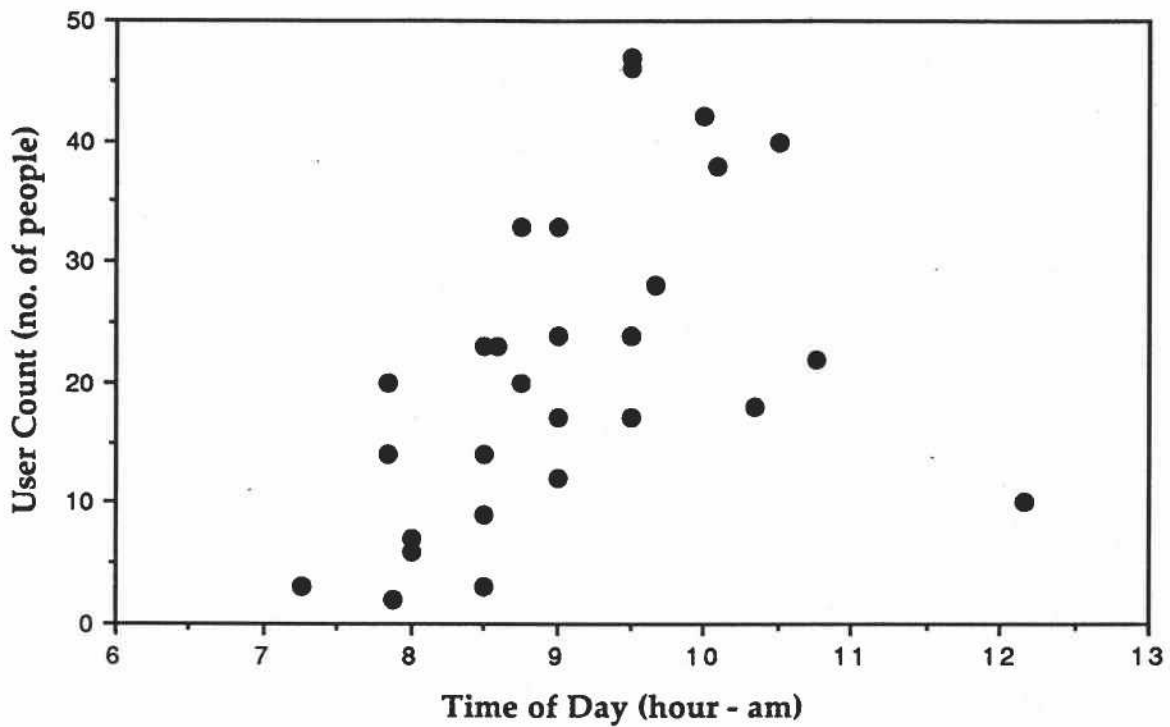


Figure 2. User count levels as a function of time of day. Upper graph is a point plot of individual counts; lower graph shows summarized counts.

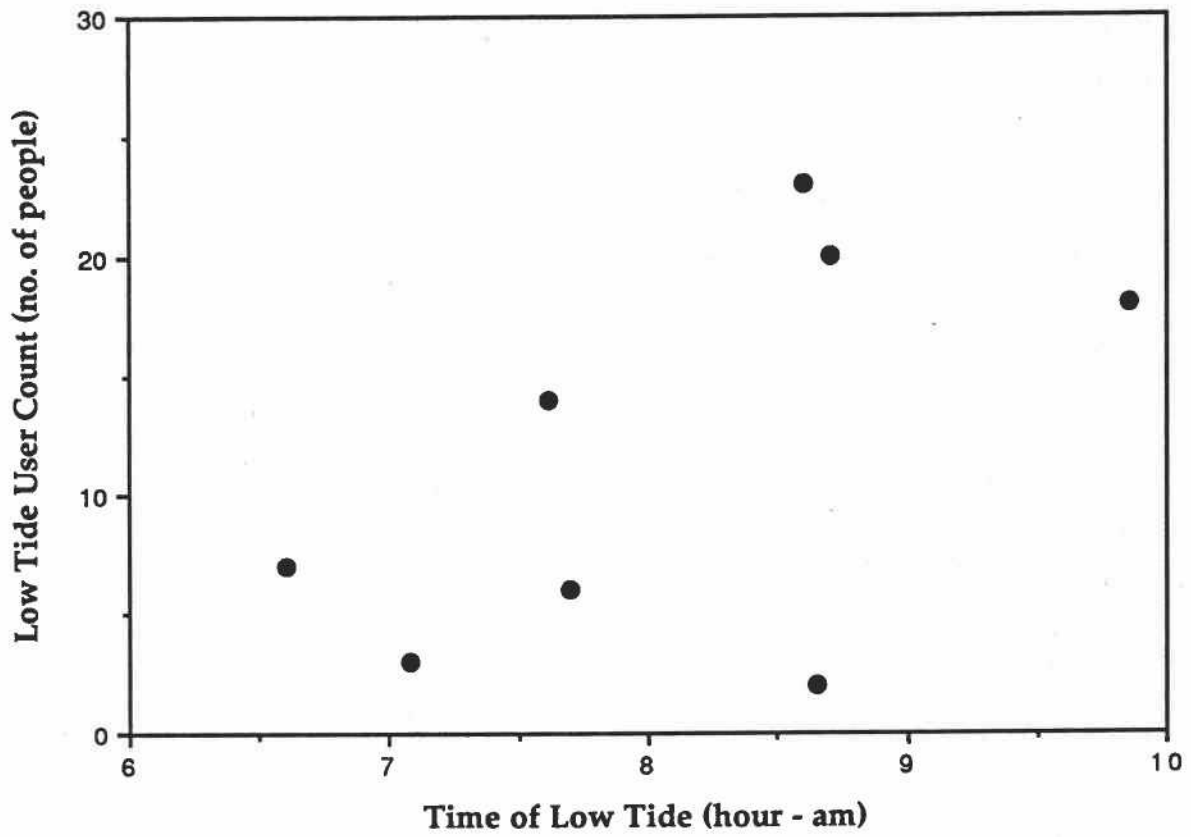


Figure 3. User count levels during peak low tide as a function of time of low tide.

There are not enough data to draw any conclusions from this analysis; however, it is reasonable to expect that many non-harvest users are not concerned about arriving on site at the peak low tide, but tend to visit areas during more convenient times of day. Most previous marine/estuarine invertebrate harvest creel studies rely on single low tide pressure counts to determine trends in use. Single counts may not be an accurate indicator of non-harvest use. Estimating total person hours of use during an entire low tide period may be the only way to accurately portray amounts of use.

Behavior Observation Data

Volunteers observed a total of 72 people and recorded 110 behavior 'events'. Of the 72 observed, 47 were adults and 25 were children. The total observation time was 5 hours and 45 minutes. We divided types of disturbances into animal/plant and habitat disturbances (see Appendix B). The following animal/plant disturbance events were recorded:

- touch - 118
- pick up/ release - 14
- pick up/ move - 5
- pick up/ keep - 7
- pick up/ throw - 7
- kick - 8
- disturb harbor seals - 1
- other - 12

Most animals/plants that were disturbed were not identifiable through binoculars. Where they were identifiable, species groups included:

- seaweeds/seagrasses - 6
- urchins - 2
- sea stars - 2
- shelled organisms - 4

The following habitat disturbances were recorded:

- Reach in tidepool - 29
- flip rock and replace - 1
- flip rock and leave - 0
- throw rock - 3
- kick rock - 0
- move algae and replace - 0
- Move algae and leave - 5
- other - 8

It is difficult to draw conclusions from these data. They begin to show what types of disturbance may be occurring and where we might focus future education efforts. For example, there was not as much manipulation of rocks that one might expect. Flipping over rocks is generally cited as a major type of human impact to intertidal areas and past education efforts have been designed to inform people of the impacts of moving rocks.

Observation data collected at a distance are limited because individuals' fine hand manipulations and types of organisms disturbed are almost impossible to see. In addition, people often reach behind rock outcroppings that block the observer's view.

Interviews

Volunteers interviewed a total of 49 people/parties. The total number of people in all parties was 191, of which 165 were adults and 26 children. The people/parties were from the following locations:

- Canada - 4
- California - 6
- Florida - 1
- Idaho - 3
- Massachusetts - 1
- Minnesota - 1
- New Jersey - 1
- New York - 1
- Oregon - 21
- Texas - 1
- Washington- 9

Of those from Oregon, 15 were from the Portland area, only 2 from the coast, and 4 from other areas. More than one-half of the people were from out of state, and nearly all the Oregon people were from the Portland area. This may be due primarily to the proximity of the large hotel (Inn at Otter Crest) at the site. It also shows we have to target education efforts in many areas in addition to the coast.

Of the 49 people/parties interviewed, 21 were first time visitors to the site. People/parties averaged 3 visits per year with a range of 0 to 36 visits per year. Access to the site was primarily from the hotel (37 parties) and secondarily from the state park access (12 parties).

The series of interview questions about reasons for visiting the intertidal (Appendix C) were not very useful because most individuals answered yes to all of the questions.

Responses to questions about the intertidal signs and suggestions for management improvement provided valuable information. Of the 49 people/parties interviewed, 29 could describe a sign at the access point and 43 indicated they generally knew the meaning of Marine Garden. Of the 29 that could describe a sign, 28 came from the hotel access where there is an ODFW intertidal conservation sign, a marine garden sign, and 2 or 3 signs put up by the hotel. The other access has a marine garden sign only. This indicates that the ODFW intertidal conservation sign is at least somewhat memorable and that the marine garden sign may need improvement. It also suggests that having a number of different signs at an access helps ensure that they are noticed. Suggestions for management improvement also focused on signs. Of the 49 parties interviewed, 32 offered suggestions. Twenty-two individuals said we need more and/or simpler signs. Five said there needs to be guided tours and four said there is a need for information pamphlets. Several agreed the hotel would be a good focal point for distributing information. Interpretive efforts seemed to be very important to the users interviewed.

Conclusions and Recommendations

- 1) The use of peak pressure counts versus total person hours of use needs to be examined in more detail, especially at sites with a combination of harvest and non-harvest users.
- 2) The sampling period needs to be extended to encompass the total time span of use on each site.
- 3) The design of the behavior observation portion of the program needs to be re-examined. It might be more productive to observe several people simultaneously in a given segment of the intertidal area and record the frequency of each disturbance type. Since organisms are almost impossible to identify at a distance, this part of the procedure can be dropped.
- 4) The interview portion of the program seems useful and is the most interesting part of the sampling for the volunteers. We should re-examine the wording on the questions to ensure we do not lead the interview subjects to an answer.
- 5) Future sampling needs to be stratified over time (weekdays versus weekends, etc.) and over space (different types of sites).
- 6) The non-harvest survey procedures should be combined with the harvest survey procedures at several sites on the coast to gain a more complete picture of human activity in intertidal areas.
- 7) It would be useful to survey behavior before and after an education effort is implemented at a site to help determine the effectiveness of the effort.

8) The non-harvest and harvest studies can only provide information about the potential for impact; they do not measure the actual impact. After we conduct studies to gain an understanding of the impact potential, we need to define further research to measure and monitor the actual impacts. The results of these studies can then be translated into specific management actions to reduce impacts.

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Appendix A: Data Form A - Use Counts

Data Form A: Use Counts

Date _____

Observer _____

Low Tide _____ Time of Low Tide _____

Time	Counts			Weather Conditions		
	Adults	Children	Sch. Child.	General	Wind	Temp.

General Comments:

Instructions:

Time - enter time of day
 Counts - enter total count of each group
 Weather - enter the following codes

General - CLR = Clear; CLD = Cloudy; FOG = Foggy; RNG = Raining
 Wind - LIT = little or no wind; BRZ = Breezy (moderate wind); WND = very windy
 Temp. - CLD = cold (below 45°); MOD = moderate (45° - 65°); WRM = warm (over 65°)

Appendix B: Procedures for Conducting Behavior Observations and Data Form B - Observations

Instructions for Data Form B: Observations

Basic Information

Group - enter AD for adult; CH for child; SC for school child

Total Obs. - enter the total time the person was observed

On Intertidal - enter the total time the person was on the rocky intertidal habitat

Walking - enter the approximate total time the person was walking (or running)

Standing - enter the approximate total time the person was standing (or crouching, kneeling, etc.)

Animal/Plant Disturbances

Count - enter a tick mark for each time the person touches, picks up, etc. an animal or plant.

Species - if possible, identify the species or general animal/plant type the person disturbs. Examples: sea star, urchin, algae (seaweed), seagrass, chiton, etc. Enter UNK for unknown species. Disturbance to seals should be noted anytime a person moves close enough to cause the seals to move away from them.

Habitat Disturbances

Count - enter a tick mark for each time the person reaches into a tide pool, flips over a rock, etc.

Data Form B: Observations Date _____ Observer _____

Basic Information		Animal/Plant Disturbance		Habitat Disturbance	
Group	Type	Count	Species	Type	Count
Total Obs.	Touch			Reach in tidepool	
On Intertidal	Pick Up/Replace			Flip Rock/Replace	
Walking	Pick Up/Move			Flip Rock/Leave	
Standing	Pick Up/Keep			Throw Rock	
	Pick Up/Throw			Kick Rock	
	Kick			Move Algae/Replace	
	Disturb seals			Move Algae/Leave	
	Other			Other	

Comments _____

Basic Information		Animal/Plant Disturbance		Habitat Disturbance	
Group	Type	Count	Species	Type	Count
Total Obs.	Touch			Reach in tidepool	
On Intertidal	Pick Up/Replace			Flip Rock/Replace	
Walking	Pick Up/Move			Flip Rock/Leave	
Standing	Pick Up/Keep			Throw Rock	
	Pick Up/Throw			Kick Rock	
	Kick			Move Algae/Replace	
	Disturb seals			Move Algae/Leave	
	Other			Other	

Comments _____

Appendix C: Procedures for Conducting Interviews and Data Form C - Interviews

Questions and Instructions for Data Form C - Interviews

Interview # - enter the number of the interview

Time - enter the time of the interview

Interview Questions

General Information Section

- 1) How many adults and children are in your party?
in party - enter the number of adults and children in the party
(adults/children)
- 2) Where are you from?
City, state - enter the city and state
- 3) Are you a first time visitor to this tide pool area?
1st time visitor - enter Y (yes) or N (no)
- 4) (If not a first time visitor) How many times do you visit the site per year?
visits/year - enter the number of times per year
- 5) Did you access this area from the state park or from the hotel?
Access point - enter P (state park) or H (hotel)
- 6) What is your planned length of stay in this tide pool area?
Planned time - enter the planned time in hours or minutes (indicate
hr. or min.)

Reasons Section

- 7) Had you made plans to visit the tide pool area prior to coming here today, or did you decide after you arrived?
Planned visit - enter Y (yes) if they had made plans to visit the tide pool area or N (no) if they did not.
- 8) What are the main reasons for visiting the tide pool area?

Reasons - check all that apply and enter any other reason(s) that the subject gives.

Knowledge section

9) At the top of the access trails, there are signs that refer to this tide pool area. Do you remember what these signs said?

Describe Signs - enter Y (yes) if can describe what is on signs or N (no) if can't describe what is on sign. Acceptable answers include marine garden sign, sign that indicates marine animals are protected, sign that describes tide pool life, animals, etc.

10) This tide pool area has been designated a Marine Garden. Do you know what that means?

Marine Garden - enter Y (yes) if can describe what a Marine Garden is or N (no) if can't describe . The acceptable answer is 'an area where marine animals are protected' or something similar to that.

11) Have you read or seen anything that indicates that the plant and animal life in tide pool areas is sensitive to disturbance? If yes, as them what.

Know sensitivity - enter Y (yes) or N (no). Write down what they read or saw on the second page of the form.

12) Have you read or seen anything on how to enjoy your visit to tide pool areas while minimizing the amount of disturbance to animals and plants? If yes, ask them what.

Know 'etiquette' - enter Y (yes) or N (no). Write down what they read or saw on the second page of the form.

13) Do you have any suggestions for ways of improving how we manage tide pool areas like this one? For example, can we improve our signs or should there be nature walks, programs, etc. Any suggestions for changes in regulations?

Made suggestions - enter Y (yes) if they made suggestions or N (no) if they did not. Write their suggestion down on the second page of the form.

Collection - Write down whether or not they collected plants or animals. If so, indicate what they collected.

General Information about Subject										Reason(s) for visiting intertidal	Knowledge	Other	
										interview #			
										Time			
										# in party ad/ch			
										city			
										state			
										1st time visitor			
										# visits/year			
										Access point			
										Planned time			
										Planned visit			
										Take a walk			
										Sightseeing			
										Wildlife Watching			
										Tide Pooling			
										See what others doing			
										Other			
										Describe Signs			
										Marine Garden			
										Know sensitivity			
										Know 'etiquette'			
										Made suggestions			
										Collected Plant or Animal and type			