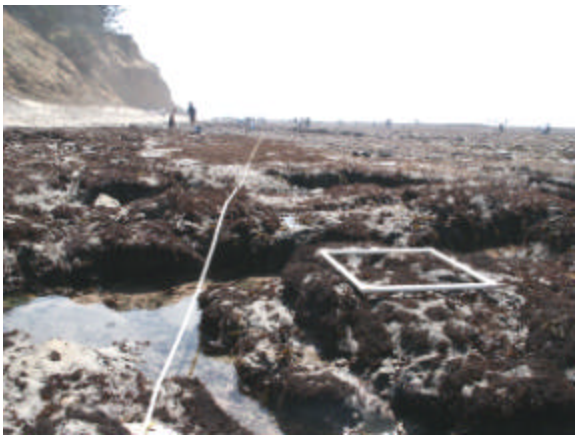
San Mateo County Parks and Recreation Division

James V. Fitzgerald Marine Reserve: Resource Assessment



Moss Beach Reef, Fitzgerald Marine Reserve.

November 17, 2004

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ESLO2004-58.1

Table of Contents

LIST OF TABLES ..... **iv**
LIST OF FIGURES ..... **v**
PREFACE ..... **ix**
PROJECT ORGANIZATION ..... **x**
ACKNOWLEDGEMENTS ..... **xi**
SUMMARY ..... **xii**

1.0 INTRODUCTION **1-1**
1.1 Purpose 1-1
1.2 Background 1-1
1.3 Rationale for the Study 1-3
1.4 Environmental Setting 1-5
1.5 Current Resource Management 1-8
1.6 Study Approach 1-10
1.7 Scope of Work 1-11
1.8 Report Organization 1-13

2.0 VISITOR USE DESCRIPTIONS **2-1**
2.1 Attendance Levels 2-1
2.2 Visitor Distribution 2-8
2.3 Visitor Activities 2-13
2.4 Questionnaire Information 2-14
2.5 Surveillance, Collecting Violations, and Advisories 2-19
2.6 Comparison of Visitor Attendance with Other Areas 2-23

3.0 BIOLOGICAL DESCRIPTIONS **3-1**
3.1 Gradient Study 3-6
3.2 Tidepool Study 3-21
3.3 Historical Park Study of Roped and Unroped Test Plots 3-31
3.4 Comparison of the Park Test Plots Including Other Unroped Areas Sampled in 2004 3-38
3.5 Mussel Bed Studies–Roped and Unroped Test Plots and Baseline Mapping 3-51
3.6 Sea Star Study 3-56
3.7 Owl Limpet Population Study 3-58
3.8 Invertebrate Composition Associated With Turnable Substrate Habitat 3-61
3.9 Finfish Fishery Resources Study 3-65
3.10 GIS Coastal Habitat Mapping of the San Mateo County Shoreline 3-74

4.0 OTHER HUMAN INFLUENCES 4-1
4.1 San Vicente Creek 4-1
4.2 Sewage 4-7
4.3 Oil Spills 4-8
4.4 Motorized Personal Water Craft (MPWC) for Tow-In Surfing 4-9
4.5 Low-Altitude Aircraft Flyovers 4-10
4.6 Desalination Plant 4-11

5.0 INTEGRATED DISCUSSION OF VISITOR USE AND BIOLOGICAL IMPACTS 5-1
5.1 Background of Human Use Impacts 5-1
5.2 Study Approach 5-2
5.3 Limitations of the Study 5-2
5.4 Resource Assessment 5-3
5.5 Natural Resource Values to User Groups 5-7
5.6 Separating Potential Effects of San Vicente Creek from Visitor Use 5-9
5.7 Biodiversity at the Fitzgerald State Marine Park Compared to Other Areas of High Use 5-10
5.8 Assessment of the Ecological Significance of the Findings 5-12

6.0 COUNTY PARK MANAGEMENT AND THE MARINE LIFE PROTECTION ACT PROCESS 6-1
6.1 County Park Management 6-1
6.2 State Marine Resource Management 6-3
6.3 Consistency Between County Actions and the MLPA Process 6-5

7.0 MANAGEMENT CONSIDERATIONS FOR THE FITZGERALD STATE MARINE PARK 7-1
7.1 Non-Extractive Uses 7-1
7.2 Extractive Uses 7-6

8.0 LITERATURE CITED 8-1

List of Tables

Table 1-1. Current CDF&G regulations for the Fitzgerald State Marine Park 1-9

Table 2-1. Number of days that visitor attendance exceeded 500 people 2-5

Table 2-2. Summary of collecting violations (Park ranger records: 1999-2004)..... 2-21

Table 2-3. Annual attendance among popular rocky intertidal areas in central and southern California 2-25

Table 3-1. Sampling locations for plots and transects..... 3-6

Table 3-2. Results of SIMPER showing algal taxa responsible for similarity among transect segments at: a) Moss Beach; and b) Distillery Reef..... 3-14

Table 3-3. Results of SIMPER showing algal taxa responsible for dissimilarity between transects at Moss Beach and Distillery Reef..... 3-14

Table 3-4. Results of SIMPER showing invertebrate taxa responsible for similarity among transect segments at: a) Moss Beach; and b) Distillery Reef..... 3-18

Table 3-5. Results of SIMPER showing invertebrate taxa responsible for dissimilarity between transects at Moss Beach and Distillery Reef 3-18

Table 3-6. Results of SIMPER showing algal taxa responsible for similarity among tidepools at: a) Moss Beach Reef; and b) Distillery Reef..... 3-28

Table 3-7. Results of SIMPER showing algal taxa responsible for dissimilarity between tidepools at Moss Beach Reef and Distillery Reef 3-28

Table 3-8. Results of SIMPER showing invertebrate taxa responsible for similarity among tidpools at: a) Moss Beach Reef; and b) Distillery Reef..... 3-29

Table 3-9. Results of SIMPER showing invertebrate taxa responsible for dissimilarity between tidepools at Moss Beach Reef and Distillery Reef..... 3-30

Table 3-10. Results of ANOSIM analyses of foliose algal abundances from Park 100 m^2 plots comparing the two roped plots against each and the two unroped plots with each other 3-45

Table 3-11. Results of SIMPER analysis showing algal taxa responsible for dissimilarity between quadrats in the first 100 m^2 roped plot and set of four 100 m^2 unroped plots, including three plots sampled for this study (Plots D, E-0, E-1, E-2, E-3.. 3-46

Table 3-12. Results of ANOSIM analyses of invertebrate abundances from Park 100 m^2 plots comparing the two roped plots against each, and the two unroped plots against each other 3-47

Table 3-13. Results of SIMPER analysis showing the invertebrate taxa responsible for dissimilarity between quadrats in first set of one 100 m^2 roped plot and four 100 m^2 unroped plots, including three plots sampled for this study..... 3-48

Table 3-14. Location and attributes of mussel and Postelsia patches 3-55

Table 3-15. Summary of intertidal fish abundance and mean sizes between Moss Beach (MB) and Frenchman's Reef (FR) low intertidal study sites..... 3-71

List of Figures

Figure 1-1. Location of the Fitzgerald State Marine Park and coastal segments used in visitor surveys 1-2

Figure 1-2. Wide bench platforms characteristize the Fitzgerald State Marine Park intertidal zone 1-3

Figure 1-3. Actual and predicted population growth for San Mateo County and neighboring counties 1-4

Figure 1-4. Poke-pole fishers north of the main access 1-5

Figure 1-5. Main access path and crossing over San Vicente Creek 1-5

Figure 1-6. Neighborhood footpath north of the main access 1-6

Figure 1-7. Access from California Street to Seal Cove beach 1-6

Figure 1-8. Path from Distillery Restaurant parking lot to Seal Cove beach 1-7

Figure 1-9. Footpaths from Pillar Point Marsh parking lot that is opposite the bluff 1-7

Figure 1-10. Recent landslide onto Moss Beach 1-8

Figure 1-11. Coastline north of Reef Point characterized by high relief rocks 1-8

Figure 1-12. Park roped area (10m x 10m) on Moss Beach Reef 1-10

Figure 2-1. Changes in annual attendance at the Fitzgerald State Marine Park 2-3

Figure 2-2. Monthly variations in public and school attendance 2-4

Figure 2-3. Total number of people counted on Moss Beach Reef and Surfgrass Flats in each of the census surveys 2-5

Figure 2-4. Overall distribution of people in the Fitzgerald State Marine Park corrected to 100 m length of shore 2-10

Figure 2-5. Distribution of people along and across the shore in the Fitzgerald State Marine Park, excluding fishers, kayakers, and surfers 2-11

Figure 2-6. One cone forming a line of cones on Moss Beach Reef to deter access to the seal haulout on Nye's Rocks 2-12

Figure 2-7. Primary purpose of visit stated by 39 interviewees 2-16

Figure 2-8. Answers for Park improvements from 39 interviewees 2-17

Figure 2-9. Sign notifying that reservations are required for groups of 10 or more 2-18

Figure 2-10. Changes in numbers of collectors and estimates of the total number of organisms illegally collected 2-20

Figure 2-11. Comparison of annual attendance among popular intertidal areas in California 2-24

Figure 3-1. Sampling locations on Moss Beach Reef 3-3

Figure 3-2. Sampling locations on Distillery Reef 3-4

Figure 3-3. Sampling locations on Frenchman's Reef 3-5

Figure 3-4. Sampling using 0.25 m^2 quadrats 3-7

Figure 3-5 Algal abundances in the 230 m transects on Moss Beach Reef and Distillery Reef 3-9

Figure 3-6. Upright algal abundances along the 230 m transects on Moss Beach Reef and Distillery Reef 3-10

Figure 3-7. Invertebrate abundances in the 230 m transects on Moss Beach Reef and Distillery Reef 3-11

Figure 3-8. Invertebrate abundances along the 230 m transects on Moss Beach Reef and Distillery Reef 3-12

Figure 3-9. MDS analysis of average foliose algal abundances with: a) symbols representing transect locations on the Moss Beach Reef and Distillery Reef transects with b) values indicating the meter position of the symbols along each transect 3-13

Figure 3-10. MDS analysis of average foliose algal abundances from: a) Moss Beach Reef; and b) Distillery Reef transects 3-16

Figure 3-11. MDS analysis of average invertebrate abundances with: a) symbols representing transect locations on the Moss Beach Reef and Distillery Reef transects with b) values indicating the meter position of the symbols along each transect 3-17

Figure 3-12. MDS analysis of average invertebrate abundances from: a) Moss Beach Reef; and b) Distillery Reef transects 3-19

Figure 3-13. Tidepool on Moss Beach Reef 3-21

Figure 3-14. Algal abundances in tidepools sampled on Moss Beach Reef and Distillery Reef 3-24

Figure 3-15. Invertebrate and fish abundances in tidepools sampled on Moss Beach Reef and Distillery Reef 3-25

Figure 3-16. Shell size distribution of black turban snails sampled from tidepools on Moss Beach Reef and Distillery Reef 3-26

Figure 3-17. MDS analysis of upright algal abundances in tidepools on Moss Beach Reef and Distillery Reef 3-26

Figure 3-18. MDS analysis of invertebrate abundances in tidepools sampled on Moss Beach Reef and Distillery Reef 3-29

Figure 3-19. Dial caliper used to measure black turban snail shell sizes 3-30

Figure 3-20. Average abundance of algae in roped Plots D and F compared to unroped plots E and G for May 1994 and June 1998 3-33

Figure 3-21. Change in algal cover in Park roped plots D and F relative to Park unroped plots E and G between 1994 and 1998 3-34

Figure 3-22. Average abundance of invertebrates in roped Plots D and F compared to unroped Plots E and G for May 1994 and June 1998 3-36

Figure 3-23. Change in invertebrate abundance in Park roped plots D and F relative to Park unroped plots E and G between 1994 and 1998 3-37

Figure 3-24. Abundance of algae in Roped D Plot and associated Unroped E Plots 3-40

Figure 3-25. Abundance of algae in Roped F Plot and associated Unroped G Plots 3-41

Figure 3-26. Abundance of invertebrates in Roped D Plot and associated Unroped E Plots 3-42

Figure 3-27. Abundance of invertebrates in Roped F Plot and associated Unroped G Plots..... 3-43

Figure 3-28. MDS analysis of foliose algal abundances for quadrats in first set of 100 m^2 plots (Plots D, E-0, E-1, E-2, E-3) with scores for quadrats in roped and unroped plots..... 3-45

Figure 3-29. MDS analysis of foliose algal abundances for quadrats in second set of 100 m^2 plots (Plots F, G-0, G-1, G-2, and G-3) with scores for quadrats in roped and unroped plots..... 3-46

Figure 3-30. MDS analysis of invertebrate abundances for quadrats in the first set of 100 m^2 roped and unroped plots 3-48

Figure 3-31. MDS analysis of invertebrate abundances for quadrats in the second set of 100 m^2 roped and unroped plots 3-49

Figure 3-32. Mussels (above photo) and *Postelsia* (below photo) that occasionally occurs in the same areas of mussels 3-51

Figure 3-33. Abundance of mussels in the roped and unroped plots..... 3-52

Figure 3-34. Locations of mussel beds and stands of *Postelsia* 3-54

Figure 3-35. Abundance of sea stars (*Pisaster* spp.) in the mussel bed test plots 3-56

Figure 3-36. Abundance of bat stars at a shallow subtidal control station near the Diablo Canyon Power Plant in San Luis Obispo County..... 3-57

Figure 3-37. Owl limpet (*Lottia gigantea*) 3-58

Figure 3-38. Comparison of shell size distributions of owl limpets sampled in the Fitzgerald State Marine Park and Point Pinos, Monterey Peninsula 3-60

Figure 3-39. Invertebrates on and underneath turnable substrates 3-63

Figure 3-40. Invertebrates on and underneath turnable substrates in a high use area at Point Pinos, Monterey Peninsula 3-64

Figure 3-41. Monkeyface eel juvenile 3-66

Figure 3-42. Angler use of the Moss Beach site for eel (poke pole) fishing, 1973-2002..... 3-68

Figure 3-43. Total catches of monkeyface eel and rock prickleback, and catch per unit of effort at the Moss Beach site, 1973-2003 3-68

Figure 3-44. Angler use of the Moss Beach site for surf fishing, 1978-2002 3-70

Figure 3-45. Total catches of cabezon, and lingcod, and surfperches at FMR Moss Beach site, 1977-2002 3-70

Figure 3-46. Surf fishing catch per unit of effort for cabezon, lingcod and surfperches at the Moss Beach site, 1978-2002 3-71

Figure 3-47. Example of coastal GIS mapping and analysis of substrate classifications in the Fitzgerald State Marine Park 3-75

Figure 4-1. Weekly bacteria concentrations of *Escherichia coli* (CFU / 100 ml) in water samples taken at the mouth of San Vicente Creek and from the adjoining surf zone from Sep. 29, 1998 to Aug. 2, 2004 4-4

Figure 4-2. Sign on main access warning not to contact San Vicente Creek water 4-7

Figure 5-1. Bare rock area of the Moss Beach Reef platform near the main access and the mouth of San Vicente Creek 5-9

Figure 5-2. Evidence of chronic trampling on a footstep in the intertidal zone at Point Pinos, Monterey County 5-10

Figure 5-3. Intertidal invertebrate abundances at the Fitzgerald State Marine Park (Plots E0-E3, G0-G3) and Point Pinos, Monterey County 5-11

Figure 5-4. Outer edge of reef platform characterized by greater habitat diversity with surge channels, ledges, cuts, and overhangs 5-12

Figure 5-5. Long-term changes in common intertidal species in permanent 1 m^2 quadrats at a control transect (n=10 per transect) located near the Diablo Canyon Power Plant, San Luis Obispo County 5-14

Figure 5-6. Influence of sand scour and changes in sand cover creating and exposing bare rock on Moss Beach Reef 5-15

Figure 7-1. Tidepool touch tank of the Seashore Wonders-Tidepool Treasures Program 7-3

Preface

The James V. Fitzgerald Marine Reserve (as of January 1, 2002) is classified by the California Department of Fish and Game as the James V. Fitzgerald State Marine Park (see below, *Section 6.0 – County Park Management*). This change was brought about by the re-classification of all marine protected areas in California into a common system of designations that reflects the levels of protection to the resources in the areas and the allowable and non-allowable uses. Previously, the names of California's marine protected areas included terminology such as 'refuges', 'reserves', and 'parks', but these terms were not consistently applied and did not reflect the level of protection. We anticipate that many people will continue to refer to the area as the James V. Fitzgerald Marine Reserve. However, in this report we use the new classification system, which is being used by the State's resource agencies. In addition, in the new classification system 'reserves' (i.e. State Marine Reserves) are fully protected from all extractive uses including fishing; hence, the term 'reserve' does not reflect the current level of resource protection in the James V. Fitzgerald Marine Reserve. Therefore, we will refer to the James V. Fitzgerald Marine Reserve as the James V. Fitzgerald State Marine Park or 'Park' in this report.

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Acknowledgments

This project could not have been completed without the assistance of many people. We would especially like to recognize the Friends of Fitzgerald organization. This volunteer organization, which is dedicated to enhance educational outreach and habitat preservation at the Fitzgerald State Marine Park, provided valuable assistance in successfully completing several components of the project. Many 'Friends' worked on the visitor count surveys. This work required nearly a daily presence at the Park, and would not have been completed without their assistance. Special thanks go to Tom and Linda Ciotti who helped with scheduling volunteers for the visitor counts. In addition, Justin Holl and Sara Kimberlin donated a considerable amount of time on computer entry of Park data.

We also relied on others to provide us with background and orientation to the Park, historical information, and access to Park records. Ken Vicknaire used knowledge gained from leading many classes to the Park to orient us on the ecological setting. Park Ranger Steve Durkin updated and summarized the Park's visitor attendance logs and furnished enforcement and surveillance records for this report.

Two students assisted in the project, and used their studies to partially fulfill college requirements. Aura DeMare (graduate studies, San Francisco State University) provided much of the Geographic Information System resource mapping and associated aerial photography. Nancy Levine (undergraduate studies, U.C. Berkeley) completed an owl limpet (*Lottia gigantea*) population study at the Park, which is summarized in this report.

All of the Technical Advisory Committee members for the project are also to be thanked for donating their time to help refine project objectives, study approaches, the resource assessment, and management considerations.

Lastly, Mr. Bob Breen, a former ranger at the Park, provided a wealth of information for this project gained from his long-term contributions to resource monitoring, enforcement, and education. Throughout his career, he was self-directed and realized at an early stage the importance of establishing documentation on attendance at the Park and data on biodiversity. His professional role at the Park will be missed, but his sharing of knowledge and interest for the health of the Park continues.

Executive Summary

Intertidal areas along rocky shorelines have become increasingly popular attractions for tourists, students, and the general public because they provide easy access to a wide variety of interesting marine life in tidepools and other habitats, including shoreline areas for fishing. The intertidal zone is the portion of shore that becomes covered and uncovered with water with the changing tides. However, the increased numbers of visitors to these areas can result in environmental impacts through trampling, rock turning, mishandling organisms, and collecting.

Study Purpose

This study was initiated as a result of concerns by the California State Department of Fish and Game (CDF&G) and the County of San Mateo (County) about the potential impacts from current levels of visitor use, potential increases in future visitor use, and the effectiveness of present management and regulations in protecting the health and viability of the marine life in the James V. Fitzgerald State Marine Park. The need for the study was one of the recommendations in the Fitzgerald Marine Reserve Master Plan (Master Plan) (Brady/LSA 2002), and was the basis for obtaining a grant from the National Oceanographic and Atmospheric Administration (NOAA) to support the project. Tenera Environmental (San Luis Obispo, CA) completed the study during the spring and summer of 2004. The study summarizes existing data on visitor use and marine life in the Park, provides new data on the distribution and abundance of marine life relative to visitor use, and offers suggestions for future monitoring and management of Park visitation to protect marine resources.

Background

Formerly known as the James V. Fitzgerald Marine Reserve, the State Marine Park is located in San Mateo County and within the Monterey Bay National Marine Sanctuary. The Park is approximately 3 mi (5 km) long, and includes a complex of broad intertidal rock platforms and small pocket beaches. The San Mateo County Parks and Recreation (County Parks) and the California State Department of Fish and Game (CDF&G) share joint custodianship for the natural resources in the Park. CDF&G has regulatory authority within the Park below the mean high tide level, and County Parks has regulatory authority above the mean high tide level. County Parks has assumed the overall day-to-day protection of the Park's natural marine resources. State Marine Park regulations prohibit the collecting of algae (seaweeds) and invertebrates (e.g., abalone), but recreational fishing is allowed.

Levels of Visitor Use

The Fitzgerald State Marine Park receives over 100,000 visitors each year, and is one of the most frequently visited rocky shorelines in California. There are several reasons for the high levels of visitation. The State Marine Park is within easy driving distance from dense metropolitan areas of San Francisco Bay. Above the mean high tide line, San Mateo County owns and maintains a parking lot with restrooms, a picnic area, and an access path that leads to the intertidal zone. The flat, rocky intertidal platforms nearby make it easy for visitors to access and explore tidepools. The most concentrated visitor use occurs along Moss Beach Reef adjacent to the main access path. Our census surveys and questionnaire poles substantiated that the main attraction of the Park is its natural resource values coupled with ease of access. Most visitors explore the richly diverse tidepools for education, relaxation, or simply out of curiosity. The Park is a particular strong attraction for school children, which can account for half of the attendance during spring.

Study Approach

During spring and summer 2004, we conducted surveys with the Friends of Fitzgerald volunteer organization on visitor numbers and their activities, and obtained public input on use of the Park through a questionnaire. We also sampled the condition of the shoreline biological communities using standard biological sampling methods. The high use area of Moss Beach Reef at the main access trail was sampled and compared to areas located south in the proximity of Frenchman's Reef where visitor levels tend to be much lower. Our study included data analysis of a unique study done by County Park rangers of intertidal areas that have been periodically roped off from visitor access since 1994. These areas were compared with unroped areas exposed to visitor access.

Findings

Our studies did not produce conclusive evidence that current levels of visitor use are negatively impacting the intertidal biota at the Fitzgerald State Marine Park, Moss Beach Reef in particular. This included algal and invertebrate assemblages, mussel beds, sea stars, and intertidal fishes. One of the most important findings was the variation in the numbers and types of plants and animals found over relatively small areas. This variation can result from a number of natural factors (e.g., substrate differences, wave exposure, biological community interactions), which can mask effects from visitor use. Therefore, in this study we could only attribute differences between areas of high and low use to the effects of visitor use if the differences involved a large number of species that were susceptible to collecting, handling, and trampling. Using these criteria, our studies did not detect any differences that could be conclusively linked to visitor use. Overall, we found the Moss Beach Reef intertidal zone to be as diverse and variable in species composition, abundance, and distribution as comparable areas with lower levels of visitor use.

However, this finding should be treated with caution, due to the short duration of the study and the absence of prior data enabling rigorous tests of impact hypotheses. Even though our studies were not able to detect statistically significant effects of visitor use, we do not conclude that there were no impacts. With over 100,000 people visiting the State Marine Park each year, there are undoubtedly impacts that likely occur on a constant basis from trampling, handling, and collecting. While our results showed that Moss Beach Reef was as diverse as areas with less visitor use, it could have been more diverse historically, and could have declined in diversity to levels similar to the areas we studied with less visitor use. There was no means to determine historical levels of species diversity, other than assuming that current conditions in low use areas represented natural conditions. Also, impacts have probably been reduced due to a bus reservation system started in 1994 to control visitor numbers, an increased number of docent-led school trips assisted by the Friends of Fitzgerald, and surveillance enforcement efforts by San Mateo County Park rangers, which has reduced the number of collectors and number of organisms collected over time. If not for these efforts, negative impacts could have been greater during our study and more apparent.

We hypothesized that the study of roped and unroped plots would yield some evidence of visitor impacts, but no strong conclusions could be drawn regarding the effectiveness of limiting visitor access as a means to increase the abundance of intertidal biota. We analyzed the data from the 1994 and 1998 study years and found that while the abundances of some species in the roped plots increased relative to the unroped plots, others decreased. The mixed results indicated that excluding visitors did not substantially alter the nature of the biological communities in the test plots. We sampled other areas of Moss Beach Reef exposed to visitor use, and found species that were actually higher in abundance in other unroped areas than in the roped test plots. This further demonstrated the presence of large spatial variation of marine life on Moss Beach Reef, which is why it was difficult to attribute any of the differences between the roped and unroped areas to different levels of visitor use.

Certain edible invertebrate species, such as black abalone and owl limpets, are at risk of depletion through illegal collecting. We found both species to be generally scarce in the Park, probably in part because of limited suitable habitat. If substantial collecting were to occur, the populations would be at risk of depletion.

According to Park rangers, black turban snails were among the species most commonly collected illegally. Of the areas that we sampled we found that black turban snails were least abundant on Moss Beach Reef (high use area), suggesting that the lower abundances may have been due to illegal collecting. However, by examining the shell size distribution among areas we found greater numbers of small individuals in the areas outside of Moss Beach Reef. Hence, the observed differences in turban snail abundance may have been related to spatial variation in recruitment within the Park and not to visitor impacts.

The recreational shore fishery at the Park remains popular even though the number of anglers per year has dropped by nearly 80% since records were first kept in the early-1970s. The Park is

unique in supporting a 'poke-pole' fishery for monkeyface eels and rock pricklebacks. Surfperch, lingcod, cabezon, greenling, and rockfish are also caught in the Park. Records collected by Park rangers for the period 1980-2002 revealed that 'catch per time spent fishing' for monkeyface eels and rock pricklebacks has been variable from year to year, but has declined slightly over time, first noted in data reported up through 1992 by HLA (1993). A decline also occurred in surfperch catches. However, occasional peaks in catch per time spent fishing for these species reveal that the area still provides good fishing opportunities. Fishing success has always been low for lingcod and cabezon because of their naturally lower abundances, but recent restrictions on catch sizes of these species throughout California have also contributed to lower overall catches. All of the fish species targeted by shore fishers have populations that extend over broad areas of the near- and offshore subtidal. Therefore, there is a low likelihood that areas closely fringing the Park could become fully depleted of fish through shore fishing activities alone, as movement of fishes from unfished areas could potentially replenish local populations. However, size measurements of the fishes caught were not obtained in the fisher interviews over time, so there is no information on how the quality of fish (weight and lengths) may have changed. A decline in fish lengths could be indicative of overfishing.

Park Values and County Management Plans

In recognition that much of the Park use is related to educational activities, the Parks and Recreation Division of San Mateo County has been active in developing a comprehensive management plan (Fitzgerald Marine Reserve Master Plan (Brady/LSA 2002) to increase both educational opportunities and resource stewardship at the Park. Prior to this document, there has never been a guiding management plan for the Park. A Master Plan was proposed in the 1970s, but was never adopted. The current Master Plan was developed over the period 1997-2004, which included a number of environmental reviews and 17 public workshops and meetings. The adoption of the Master Plan by the County Board of Supervisors is scheduled for December 2004.

The current Master Plan approach focuses management actions on ways to foster marine science appreciation and greater awareness of the sensitivity of the marine life to visitor disturbances. Among the action items is the design and construction of a Marine Science Education Center at the Park to not only enhance visitor education but also to allow visitors to experience some of the shoreline resources without directly accessing the tidepools, thus potentially lessening negative impacts.

The following management considerations were developed with an expected change in use in mind and the same commitment to the Fitzgerald Marine Reserve Master Plan objectives in protecting the natural resources. Greater detail on management considerations is provided at the end of this report in **Section 7**.

The Marine Science Education Center could change how people use the area. Currently, peak visitation occurs for 1-3 hours around low tide during daylight hours coupled with nice weather. The Education Center could result in overall visitation levels in the area becoming spread over longer periods of the day, over more days, and independent of weather and tides.

A challenge in managing visitor attendance will be the Fitzgerald Marine Reserve Master Plan's goal of limiting visitor use to 500 people per day with a not-to-exceed maximum of 300 people on the shore at any given time, as past levels have frequently exceeded these limits. This 'carrying capacity' goal was recommended by HLA (1993), and the limits were incorporated in the Master Plan. The recommended limits were 'targets' for reducing visitor use, but were not expected to eliminate the concerns for visitor impacts and the need for management. In order to limit visitor levels to 500 people per day, school field trips could be limited to 300 students per day or lower, which would allow for an additional 200 non-school related visitors per day.

Because the Education Center could change how people use the area, new visitor counting methods may likely be needed to distinguish the numbers of people visiting the Center from those visiting the intertidal zone. Historically, numbers of people visiting the intertidal zone were estimated by counting cars in the parking lot. However, many people may only use the Education Center. Therefore, another method will be needed to distinguish counts of those visiting the intertidal zone from those only visiting the Center. For example, a turnstile or infrared counter at the head of the main access path would provide direct counts of people using the intertidal zone.

Many other rocky intertidal zones in California that are near urban areas also experience high levels of visitation. Resource managers in these areas are confronted with similar issues of balancing resource conservation with continued access. Accordingly, we feel that the planning and implementation of additional resource conservation measures at the Park to minimize impacts, including continued biological and visitor monitoring are warranted.

We suggest that San Mateo County actively collaborate with other agencies and groups with similar management goals to refine management objectives, action priorities, and monitoring methods. We include a set of management considerations in **Section 7** for collaborating with others to help ensure protection of existing resource conditions with the possible changes in visitation, future management changes, and operation of the Park.

Because over 99 % of the use in the State Marine Park is centered on education, an additional goal of the Fitzgerald Marine Reserve Master Plan is to have the area designated exclusively for this use by the CDF&G. An increased level of resource protection would exclude recreational fishing, which presently accounts for 1 % of the use in the Park. Restricting fishing would effectively change the State Marine Park to a 'no-take' area (i.e., State Marine Reserve). This change in status could only occur through the CDF&G Marine Life Protection Act (MLPA) process, which was established to create an improved network of marine protected areas in the State. The current MLPA process is focused on central California, and may include the James V. Fitzgerald State Marine Park.

1.0 Introduction

1.1 Purpose

The results of this project provide a quantitative description of species diversity and visitor use in the intertidal zone of the James V. Fitzgerald State Marine Park. The purpose of the project was to:

- Describe the historical status and trends of visitor use profiles and intertidal marine resources in the Park area.
- Identify what relationships exist between levels of visitor use in rocky intertidal habitats and potential visitor impacts (e.g., trampling, gathering, and fishing) on the condition of the Park's natural resources.

We also use the information contained in this report as the basis for a resource stewardship program to:

- Provide management options for limiting visitor impacts to the best extent practical in concurrence with the Fitzgerald State Marine Park's Master Plan objectives (Brady/LSA 2002).
- Provide a framework for a long-term monitoring plan to improve baseline data for future scientific research, and to evaluate the effectiveness of Master Plan objectives.
- Evaluate the match between the long-term goals and objectives of the San Mateo County Parks and Recreation and resource protection goals of the Marine Life Protection Act.

1.2 Background

The James V. Fitzgerald State Marine Park was created as the James V. Fitzgerald Marine Reserve in 1969 through legislative action. Beginning in about 1908, when the Ocean Shore Railroad was constructed through the town of Moss Beach, the reefs of the Moss Beach area were widely used for gathering food. In the 1960s, San Mateo County managers realized that continuing population growth in the area and the harvesting of marine organisms from the rocky reefs had the potential to deplete local marine populations. Accordingly, San Mateo County proposed that the State of California acquire the Moss Beach reefs as a state reserve in recognition of the need for increased resource management and protection. The reserve (Park) was named after a former chairman of the San Mateo County Board of Supervisors.

The Fitzgerald State Marine Park is located in Moss Beach, California, approximately 17 miles (27 km) south of San Francisco (**Figure 1-1**). The Park is approximately 3 miles (5 km) long and extends 1,000 ft (305 m) offshore from the mean high tide line to include subtidal habitats to

Figure 1-1. Location of the State Marine Park and coastal segments used in visitor surveys. Arrows indicate access paths.

depths of approximately 20 ft (6 m). The Park has long been recognized for its extensive reef systems (**Figure 1-2**) and for being among the most biologically diverse habitats in California. It has been and remains a popular area for school groups, tourists, and the general public, and offers a variety of opportunities for education, scientific research, relaxation, and recreation. Indeed, a large part of its biological recognition stems from the amount of research completed in

the area. For example, many 'type specimens' in museums and herbaria that were used for original descriptions of species were collected from the reefs of Moss Beach (Smith 1969, Smith and Carlton 1975, Abbott and Hollenberg 1976, Sparling 1977, Morris et al. 1980).

The proximity of the Park's rocky intertidal habitats to the densely populated areas of San Francisco Bay is a large reason for the extraordinarily large numbers of visitors. It is estimated that approximately 100,000 people visit the Park each year. Population growth in San Mateo County and the surrounding communities is expected to further increase (**Figure 1-3**), and coastal tourism in the area will likely continue to rise resulting in increased visitor use. School field trips to the Fitzgerald State Marine Park and other rocky shore areas will also likely increase, as marine science education is included in curricula at all school levels. Due to the high visitation and public interest in the area, there has been a concern that the diversity and abundance of the intertidal marine biota in the Park has become degraded, or is at imminent risk of becoming significantly degraded as a direct result of visitor impacts.

Figure 1-2. Wide bench platforms characterize the Fitzgerald State Marine Park intertidal zone. Top photo is view of Moss Beach Reef looking south. Bottom photo is Distillery Reef looking north.

1.3 Rationale for the Study

While the Park's shoreline is a very popular area for a variety of reasons, the most popular activity in the Park is tidepool exploring. However, the large numbers of visitors can both knowingly and unknowingly harm shoreline habitats and intertidal biota.

Visitor impacts can occur from a variety of activities. The most widespread impact occurs from trampling, where people walking on the rocky intertidal reefs crush and dislodge algae and invertebrates. Impacts also occur when people remove and handle organisms. Handling can

cause stress to the organisms, and mortality can result not only from high levels of stressful handling, but also when organisms are not returned to appropriate habitats. Turning rocks to inspect under-substrate biota also can crush organisms and expose the species underneath to stressful bright sunlight and desiccation. Many species that live under turnable substrates require constant moisture and shade to survive. Many other types of organisms live in cracks, crevices, and under shady overhangs to reduce desiccation stress when the tide recedes. These organisms can be harmed if not properly returned to these types of habitats. Collecting obviously removes species from their habitats on a permanent basis. Poaching is another concern, in which edible species, such as abalone, owl limpets, and mussels, are illegally harvested for consumption, bait, or sale. People may be unaware that their actions can have impacts on species populations and that their activities often are unlawful.

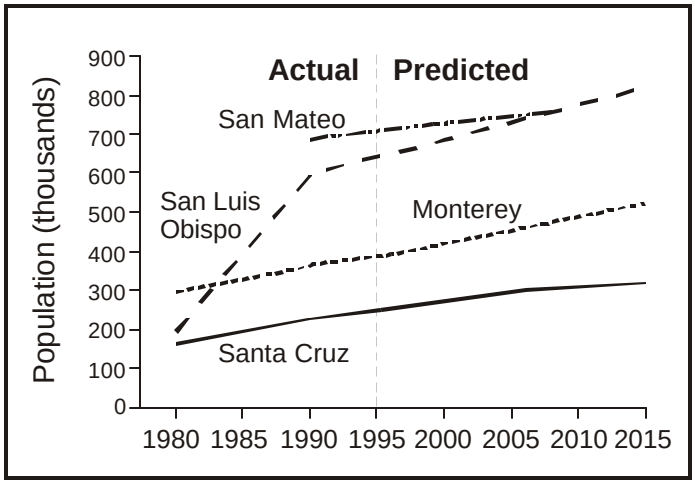

Figure 1-3. Actual and predicted population growth for San Mateo County and neighboring counties. (source: http://www.mbnms.nos.

While it is recognized that impacts from trampling and collecting at the Fitzgerald State Marine Park have occurred, and continue to occur, the magnitude and spatial scale of these impacts have yet to be rigorously assessed. A previous study done by Harding, Lawson, and Associates (HLA 1993) included a review of Park information and data collected by Mr. Robert Breen (head ranger, retired). The study also included the results from observations by HLA. Their conclusion was the intertidal zone at the Park was being degraded by visitor use. The HLA (1993) conclusion was based on low abundances of organisms that would be expected to be abundant, low abundances of certain fauna that live mainly underneath cobbles and small boulders (under-rock fauna), and apparent trampling impacts on algal species.

The Park is also a popular site for poke-pole fishing, mainly for monkeyface eels (*Cebidichthys violaceus*) and rock pricklebacks (*Xyphister mucosus*) (**Figure 1-4**). HLA (1993) presented Park data on shore catch statistics for these two species (1972 to 1991), which indicated a decline in catch-per-unit effort. New data are available (through 2003), and the updated findings are presented in this report.

The potential of continuing impacts, due to the variety of visitor uses, created the need for further studies on the status of the James V. Fitzgerald State Marine Park to provide information to the San Mateo County Parks and Recreation Division. This information will be used to finalize management goals presented in the Fitzgerald Marine Reserve Master Plan (Brady/LSA 2002) to

ensure a balance between human use and the protection of the area's natural marine resources. The Master Plan, which should be adopted by the San Mateo County Board of Supervisors in December 2004, was developed over the period 1997-2004, and involved 17 public workshops and meetings to complete.

This report includes analyses of historical data not previously reported, including Park data collected since the HLA report. New studies were also completed specifically to supplement and broaden the knowledge of baseline conditions of the intertidal marine populations in the Park.

Figure 1-4. Poke-pole fishers north of the main access.

1. 4. Environmental Setting

Access

The Park is convenient to visit not only because it is immediately off coastal Highway 1, but it also has a parking lot that can accommodate 39 cars, a picnic area, restrooms, and a direct path to the shore. The locations of all established paths to the intertidal zone in the Park are shown in **Figure 1-1**. The main path at the parking lot gently slopes from the parking area to the shore, and is the easiest path to access the intertidal zone for many people (**Figure 1-5**). The path runs along the top of the bank of San Vicente Creek. It is maintained and has seating areas, signs, refuse cans, and a stairway down to the bank of San Vicente Creek. The base of the path terminates at the entrance to the sandy beach backing Moss Beach Reef. Access to the reef is achieved by using a series of broken concrete slabs that provide dry footing when crossing over the creek (**Figure 1-5**). The beach that backs the Moss Beach Reef platform is used for walking

Figure 1-5. Main access path and crossing over San Vicente Creek.

and picnicking, and an expansive low-relief, rock platform extending off the beach provides for safe walking across the intertidal zone to explore tidepools and view intertidal organisms.

There are several other paths in the Park that lead to the intertidal zone, but these receive less use. These paths are used mainly by local residents, since they originate in the neighborhoods around the Park and parking is generally limited to the narrow streets in the area. These trails are not maintained, but remain open due to levels of usage that prevent them from being overgrown by vegetation.

Figure 1-6. Neighborhood footpath north of the main access.

The most northern neighborhood footpath that leads to the intertidal zone in the Park occurs north of Reef Point (**Figure 1**). The path is very narrow and steep, and is marked with a sign saying 'danger'. The path leads to a small pocket sand beach. Another neighborhood path (**Figure 1-6**) meanders down the small drainage of 'Sunshine Creek' (**Figure 1**), and terminates just north of the main access. A footpath to the south of the main access is used to access Seal Cove beach, located south of Moss Beach Reef. The trailhead for this path originates within Park property at the north end of Seal Cove beach (**Figure 1-7**). However, this path is also used mainly by local residents because there is no parking nearby. A trail at the south end of Seal Cove Beach originates at the Distillery Restaurant parking lot. While parking is available there, the path is relatively steep, and there is a warning sign for anyone using that path (**Figure 1-8**). The next trail is located immediately south of the Distillery Restaurant parking lot, but was largely overgrown with vegetation during the study. Two footpaths are present near the southernmost end of the Park (**Figure 1-9**), which provide access to Ross's Cove, an area located immediately north of the Pillar Point headland. An unpaved parking lot is over the bluff shown in **Figure 1-9**. The lot is near Pillar Point Marsh. The parking lot accommodates approximately 30 vehicles. Many who park there, however, use the sand beach areas on the south side of the Pillar Point headland, rather than Ross's Cove. The lot, however, provides a place for people to park their cars and walk over the cliff bluff to Ross's Cove, a distance of approximately 0.5 mi

Figure 1-7. Access from California Street to Seal Cove beach.

(0.8 km) from the parking lot. There are likely other footpaths to the intertidal zone that have been created by local residents, but these are more obscure and more difficult to traverse.

Figure 1-8. Path from Distillery Restaurant parking lot to Seal Cove beach. The sign warns of extreme danger and states that this access is closed and to use California Street access.

Shoreline Geomorphology

The intertidal shoreline of the Fitzgerald State Marine Park is mainly a system of expansive elevated rock bench platforms backed by tall cliffs. The geology of the shoreline is mostly of two types, separated by the Seal Cove fault that bisects the shore near Reef Point (**Figure 1-1**). The majority of the Park's shoreline occurs south of Reef Point, and is characterized by 300-600 ft (91-182 m), wide, flat, rocky platforms (**Figure 1-2**). These rocky platforms and the sea cliffs that back the shore are composed of sandstone, siltstone, and mudstone (Tertiary-Pliocene-Purisima formation) and are highly prone to erosion. Erosion rates of the sea cliffs have been as high as 1-4 ft (0.3-1.2 m) per year in some places (Brady/LSA 2002), resulting in landslides (**Figure 1-10**) and even the collapse of homes built close to the bluff. Seawalls and rock armoring are used in some places to protect shoreline property boundaries. In contrast, the shoreline north of Reef Point is composed mostly of granodiorite (hard substrate) rock outcops that are high in relief (**Figure 1-11**). The steep rocks provide little in the way of an intertidal zone and, therefore, the shoreline north of Reef Point receives less visitation, except for a small pocket beach used by local residents. Also, some people may fish from the tall rocks.

Figure 1-9. Footpaths from Pillar Point Marsh parking lot that is opposite the bluff. (source: Californiacoastline.org)

Most of the Pillar Point headland at the south end of the Park is not within the Park boundaries (**Figure 1-1**). While the Fitzgerald State Marine Park is well known for its expansive reef systems and biodiversity, the Pillar Point headland is world-renowned as a famous surf spot. 'Mavericks' at Pillar Point is famous for some of the largest waves in California. In addition to

surfers who paddle to catch waves, there are also tow-in surfers that use personal watercraft (jet-skis and waverunners) to catch waves.

Figure 1-10. Recent landslide onto Moss Beach.

Upland Property and Pillar Point Marsh

The Park also includes approximately 32 acres (13 ha) of cliff bluff above the mean high tide level. Walking trails with scenic lookout points on the cliff bluffs above the intertidal zone extend throughout most of the distance of the Park. Pillar Point Marsh (41 acre, 17 ha) near the south end of the Park is a recent addition to the Park, acquired in 1997 (**Figure 1-1**).

Figure 1-11. Coastline north of Reef Point characterized by high relief rocks.

1.5 Current Resource Management

Presently, the San Mateo County Parks and Recreation Division (County Parks) and the California Department of Fish and Game (CDF&G) share joint custodianship of the Park's natural resources. County Parks has jurisdiction of Park shoreline areas above the mean high tide line, and the areas above this line (32 acres, 13 ha) are currently classified as a County Park. CDF&G has jurisdiction for the marine resources below the mean high tide line, which encompasses the Fitzgerald State Marine Park. The Monterey Bay National Marine Sanctuary (MBNMS) has primary jurisdiction of the geological features in the sanctuary, including resource management oversight. This includes the Fitzgerald State Marine Park up to the mean high tide level. In 2004, the Gulf of the Farallones National Marine Sanctuary (GFNMS) was made the sanctuary manager of the MBNMS north of the San Mateo/Santa Cruz County line where the Fitzgerald State Marine Park is located.

Numerous regulations at the Fitzgerald State Marine Park were enacted to help preserve the natural diversity of marine life and Park habitats. All of the marine biological resources in the Park are protected from collecting through existing CDF&G regulations (**Table 1-1**). The collecting of algae and invertebrates, including substrates, within the Park for recreational and commercial purposes, is prohibited, but some collecting of marine species for education and research is allowed with a scientific collecting permit issued by the CDF&G. Recreational fishing is also allowed with a valid fishing license from the CDF&G. Any alteration to the substrates in the Park requires a permit issued by the GFNMS. The Fitzgerald State Marine Park is also within a California State Water Resources Control Board Area of Special Biological Significance (currently a State Water Quality Protection Area, see below *Section 6.2 – State Marine Resource Management*). This designation affords special protection to the Park (and other State Water Quality Protection Areas) through the prohibition of point-source waste discharges.

While multiple agencies have regulatory authority over the Fitzgerald State Marine Park, San Mateo County Parks has taken on the responsibility of monitoring and managing the day-to-day use and protection of the Park's marine resources. County Park rangers are present on a daily basis to provide surveillance and enforcement, including marine education outreach to visitors. Other groups also assist with resource stewardship, but not in the form of regulatory protection and enforcement. Volunteer docents (Friends of Fitzgerald, a non-profit education outreach organization) assist in field trips and provide onsite marine science education, on nearly a daily basis during the school term. The Gulf of the Farallones National Marine Sanctuary also contributes to education outreach, seal monitoring, and beach watch programs.

Table 1-1. Current CDF&G regulations for the Fitzgerald State Marine Park. (source: www.dfg.ca.gov/mrd/mlpa/mpa.html)

Species Allowed for Recreational Take	Species Prohibited for Recreational Take	Species Allowed for Commercial Take	Species Prohibited for Commercial take
Rockfish (family Scorpaenidae), lingcod, surfperch (family Embiotocidae), monkeyface eel, rock eel, white croaker, halibut, cabezon, kelp greenling, and smelt (Families Osmeridae and Atherinidae)	All marine aquatic plants; All invertebrates; All fishes except rockfish (family Scorpaenidae), lingcod, surfperch (family Embiotocidae), monkeyface eel, rock eel, white croaker, halibut, cabezon, kelp greenling, and smelt (Families Osmeridae and Atherinidae)	None	All

1.6 Study Approach

Assessments of visitor impacts are often made from studies that are started after the impacts have already been occurring for some time. Since there is no baseline describing pre-impact conditions, these studies rely on comparisons with reference areas that have reduced levels of impact or no impact. However, this approach has many limitations because areas being compared probably had differences that existed prior to any impacts. This is a particular problem in rocky intertidal studies where it is often difficult to find comparable reference/control areas, due to the highly variable environment. Differences between areas can exist due to habitat differences (e.g., wave exposure, substrate composition, habitat relief) and historical disturbances (e.g., storms, landslides), which are not related to the impact being studied (e.g., visitor impacts).

A more robust study design for impact studies includes data collected concurrently in control and impact areas before, during, and after the impact has occurred (Stewart-Oaten et al. 1986, Schiel et al. 2004). This provides a quantitative baseline to measure changes in impact areas relative to changes in control areas. However, this type of study requires commitment of substantial resources to a long-term study and the foresight to institute a study program prior to the occurrence of the impact. Numerous robust statistical methods are available for this type of study to compare species abundances in impact areas relative to their abundances in non-impacted, control areas.

Another type of study design to specifically determine visitor impacts would be to exclude visitor use from an area of prior use and monitor responses in the marine community relative to un-manipulated controls. This type of field experiment can provide strong evidence for visitor impacts if differences are detected between treatments. However, this type of study also requires commitment to a long-term study, and can be plagued by habitat differences resulting in biological differences between open and exclusion areas.

Senior Park ranger Robert Breen (retired) began a manipulative field experiment in 1994 on Moss Beach Reef, the area with the highest visitor use. Two 10 m x 10 m plots were randomly selected on Moss Beach Reef with each 100 m^2 plot fixed by installing corner bolts into the substrate. At every daytime low tide, Park rangers roped off each plot using yellow polypropylene line attached to the corner bolts (**Figure 1-12**). The yellow line laid on the substrate, and formed a 100 m^2 square area. The roped plots were periodically sampled

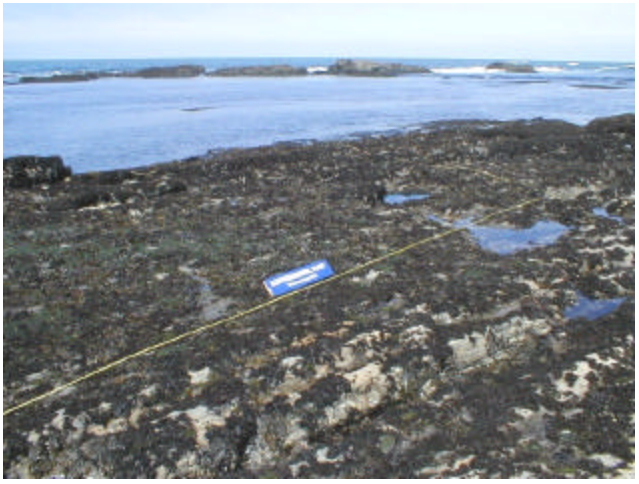

Figure 1-12. Park roped area (10m x 10m) on Moss Beach Reef.

over time from 1994 through 2001. Within each roped plot, five 1 m^2 quadrat locations were initially randomly selected and then fixed, using bolts. Each roped plot had in place an adjoining unroped area of equal size in which five 1 m^2 quadrat locations were also sampled. An additional 100 m^2 roped plot was established in a mussel bed on Moss Beach Reef with two unroped mussel plots of the same size located nearby on Moss Beach Reef.

The data from this sampling design have never been rigorously analyzed. As part of this study, we analyzed these data and present the results for the first time. To augment this study, we completed other field studies in high use areas (Moss Beach Reef) to develop a database to specifically compare species composition and abundance between the roped and unroped plots to other high use areas on Moss Beach Reef. We also studied specific species (owl limpets and prickleback eels) known to be extracted by Park visitors, and completed visitor shoreline counts (census surveys) to identify current patterns of visitor use and activity in different areas of the Park.

We completed other supplemental studies that consisted of sampling areas of high use on Moss Beach Reef and areas of lower visitor use downcoast but still within the Park. In our supplemental studies, however, we expected that it would be difficult to conclude that visitor use contributed to any differences observed between areas. This was because we expected to find large spatial variation in species composition and abundance within and between areas that might not be due to visitors. For example, a difference in a single species found between areas in these supplemental studies would not provide strong evidence to conclude that the difference was caused by visitor use. In this type of study design, differences between areas in a large number of species needed to be detected to provide strong evidence of visitor impacts.

1.7 Scope of Work

The present study consisted of visitor use surveys combined with biological sampling that involved analysis of existing data and records and new studies to fill knowledge gaps.

Visitor Use Surveys

Analysis of Existing Data

- Update of annual attendance records (Park data)
- Compilation of surveillance and enforcement reports (Park records)

New Studies

- Census counts of people in the intertidal zone throughout the Park made during low tides (spring-summer 2004)
- Visitor questionnaire surveys for park management

Biological Surveys

Analysis of Existing Data

- Park data for the roped and unroped plots
- Shore fishing catch statistics

New Studies

- Sampling and analysis of impacts with distance from the main access based on transect and quadrat sampling data
- Sampling and analysis of tidepool biota in high and low use areas
- Sampling and comparison of additional unroped plots to the Park plots
- Sampling of Park plots for changes in mussel abundances and geographic information system (GIS) mapping of mussel beds
- Sampling of Park plots for changes in sea star abundances
- Owl limpet survey of population densities and shell size distributions
- Sampling and analysis of under-rock fauna in high and low use areas using transect and quadrat sampling methods
- Eel recruitment sampling using transect and quadrat sampling methods to assess habitat utilization
- GIS mapping and analysis of substrate habitat classifications in the Park and comparison to other shores in San Mateo County

Other Potential Human Influences

Tasks to assess other human influences that potentially affect the marine resources at the Park were included in the study:

- San Vicente Creek water quality
- Sewage
- Oil spills
- Tow-in surfing
- Low flight aircraft
- Desalination Plant

1.8 Report Organization

The tasks are reported individually in their appropriate sections and each task description includes a purpose statement, rationale, background, methods, results, and discussion subsections:

- **Section 2.0 - Visitor Use Descriptions:** This section describes Park attendance records through summer 2004, description of how visitors tend to be distributed along the shore, and results from our visitor questionnaire surveys. This section includes a compilation of collecting citations and warnings logged by Park rangers. Visitor numbers are also compared to other popular intertidal areas in California.
- **Section 3.0 – Biological Descriptions:** This section contains the sampling results and findings from our biological surveys and analysis of existing biological data collected by Park rangers.
- **Section 4.0 – Other Potential Human Influences:** This section contains a description of potential risks to marine life from factors other than visitor use in the intertidal zone.
- **Section 5.0 – Integrated Discussion of Visitor Use and Biological Impacts:** This section incorporates the findings from all of the studies to evaluate potential impacts related to all human influences.
- **Section 6.0 – County Park Management and the Marine Life Protection Act Process:** This section describes how County management goals and objectives for the Fitzgerald State Marine Park align with the goals and objectives of the Marine Life Protection Act.
- **Section 7.0 – Management Considerations:** This section describes components for future Park operations, monitoring, and evaluation.
- **Section 8.0 – Literature Cited:** This section contains all of the references used in the report.

2.0 Visitor Use Descriptions

Approach

Several tasks were completed to develop a description of visitor use in the Fitzgerald State Marine Park. The study approach and findings are described below for:

- Attendance levels
- Visitor distribution
- Visitor activities
- Personal visitor information
- Surveillance, collecting violations, and advisories
- Comparison of visitor attendance with other areas

2.1 Attendance Levels

Purpose

Park rangers have kept daily logs of total attendance at the Park since 1969. We reviewed available data to provide a description of attendance levels from 1969 through 2003.

Background

Records of the actual numbers of people who visit intertidal zones are rare, as acquiring and maintaining these types of records requires some form of continuous system to account for visitor use in the intertidal zone. Many parks and reserves have entry gates that allow visitors to be counted as they arrive, but most areas have other attractions, in addition to the rocky intertidal zone, that bring people to the park or reserve (e.g., hiking trails, picnic areas, wildlife). There are few locations where the primary attraction is the rocky intertidal zone. As a result, a total attendance number for areas with multiple attractions would tend to be an over estimate of the number of visitors just visiting tidepools or rocky intertidal areas. Many areas also have school visit registration systems that allow them to track the numbers of students utilizing an area, but these numbers alone would tend to underestimate the total numbers of visitors because the counts do not include unscheduled visits by the general public whose members arrive by car, bike, and foot. Also, many areas have multiple access points that are not monitored, and many popular intertidal areas do not have the staff or means to monitor use. Therefore, long, continuous records of visitor use of shoreline areas are generally not available and numerous assumptions must be considered when interpreting the available data.

Surveys of the numbers of people on the shore can also be used to estimate total numbers of visitors for an area. If these surveys are to target intertidal visitation, they are most often done at low tide when visitors have access to the lower intertidal areas and tidepools. The numbers from these surveys can then be extrapolated to estimate total visitor use. However, total attendance levels derived using this approach can produce misleading results, as most surveys do not account for visitor turnover throughout the day or changes in numbers due to tidal conditions, weather, the day of the week, and time of year. Although surveys could be designed to account for all of these potential factors, they are time consuming and require considerable resources to complete. Consequently, estimates based on survey methods can only, at best, provide a rough approximation of visitor attendance (Tenera 2003).

The database on visitor attendance at the Fitzgerald State Marine Park is unique and was made possible by several factors. First, almost all of the Park's visitors tend to visit the rocky intertidal zone since it is the main attraction. Second, the Park has a main parking lot located at the primary access point to the shoreline. Although there are other access trails to the Park's beaches, very few people use these trails, which mostly serve the people in the neighborhood who know their locations. Even though the Park does not have a ticketing system for parking, because parking at the Park is free, one of the daily duties of the Park rangers has been to count the numbers of cars in the parking lot. This has allowed car counts to be used as an index of visitor use and these data can be extrapolated to provide an estimate of the numbers of visitors to the Park's rocky intertidal zone.

Methods

Since 1969, Park rangers have logged total attendance records. The numbers of vehicles in the main parking lot have been counted daily to provide an estimate of total daily attendance. The numbers of people arriving at the Park on school visits have been counted separately.

Each day, the parking lot is monitored on several occasions, and the maximum number of public vehicles observed is recorded. This maximum vehicle number is multiplied by two and that product multiplied by five to provide a daily estimate of the number of public visitors to the Park. The 'two' represents the number of passengers per vehicle. The 'five' was developed by Park rangers as a factor and multiplier to account for turnover in cars, walk-ins, and bike-ins, and was selected based on continuous observations and counts throughout the day to obtain actual estimates.

Park rangers also record the number of people arriving at the Park on school visits by bus, van, and car. School visits in cars and vans are treated separately from the car counts for the general public. The actual numbers of people with schools and groups are added to the attendance estimates for the general public to provide a total attendance record for the day.

This method of estimating total daily attendance may be criticized, due to the assumptions used in the multipliers in the formula, which were derived without a thorough analysis. However, the

rangers who have worked at the Park for many years derived this formula and believe it to be a reasonably accurate in representing the extent of visitor use (R. Breen and S. Durkin, pers. com.). These rangers have compared this method of estimating daily attendance on several occasions with general counts and visual interpretation of visitors for the day, and both numbers were within approximately 15 % of each other (R. Breen and S. Durkin, pers. com.). Nevertheless, the Park's method of estimating visitor numbers provides values for attendance that are probably within an order of magnitude of actual levels, and can serve as an excellent index of changes in visitor attendance levels over time since data have been consistently taken with this methodology since 1969.

Results

Total annual attendance estimates, including the component of these visits designated as group visits, are portrayed for 1969-2003 in **Figure 2-1**. Only the records that were readily available are shown. Some records remain in archived storage, and were not accessible. Since 1969, estimates of annual attendance have risen, peaking slightly over 132,000 people in 1997. From 1997 through 2003, annual attendance estimates dropped to approximately 100,000-110,000 people per year.

Group visits have been normally associated with school trips (elementary through college). Group visits have totaled approximately 20,000 people per year (**Figure 2-1**), but were higher in the 1980s (data not shown), peaking near 30,000 people per year (R. Breen, pers. com.). The decrease in school visits since the 1980s is thought to be associated with reductions in school budgets to support class field trips (R. Breen, pers. com.).

Total attendance levels tend to be highest during the year in spring when school visits can account for approximately one-half of the visiting population (**Figure 2-2**). Visits by school

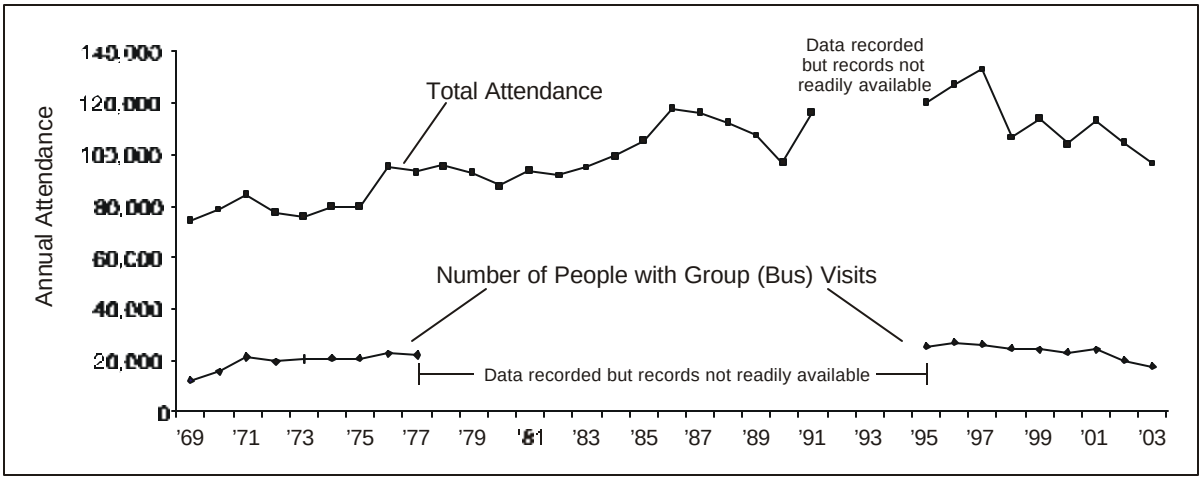

Figure 2-1. Changes in annual attendance at the Fitzgerald State Marine Park. School visits are portrayed as a component of total annual attendance.

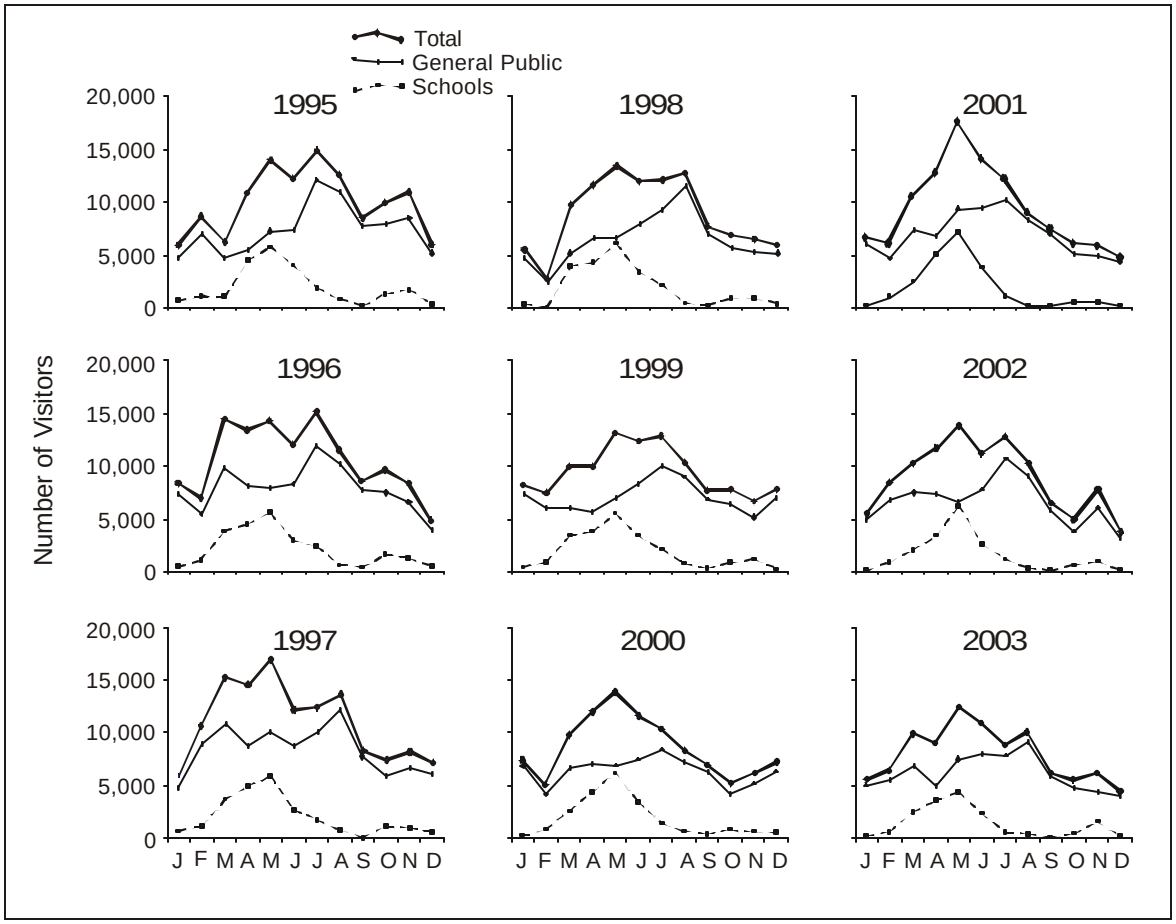

Figure 2-2. Monthly variations in public and school attendance.

groups are more common during the spring because there is generally good weather and the lowest low tides occur during daylight during these months. During summer, the number of school visits decreases but tourism increases at the Park (**Figure 2-2**). Although daily peak attendance can be similar between spring and summer, overall attendance in summer is slightly lower because the increase in summer tourism is generally not as great as the decline in school visits. Visitor levels tend to be lowest in winter.

A Master Plan objective for the Park is to limit total daily attendance to 500 people with a limit of 300 people at any given time. In the past, daily attendance commonly exceeded 500 people per day, particularly in spring (**Table 2-1**). Visitor census surveys conducted as part of this study have also shown that the number of simultaneous visitors has exceeded 300 people on a number of occasions (**Figure 2-3**). These results can be used to assess the Master Plan objective of limiting visitation on the shore to 300 people at any given time. The most appropriate shoreline area for this assessment is the combined area of Moss Beach Reef and Surfgrass Flats, as these

Table 2-1. Number of days that visitor attendance exceeded 500 people. (ND = no data)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Jan	3	7	2	1	6	5	3	3	2	6
Feb	5	3	9	0	4	2	1	4	4	4
Mar	2	13	12	9	7	6	7	6	8	12
Apr	10	13	18	11	9	9	12	8	6	9
May	15	14	21	12	17	14	21	15	13	20
Jun	11	10	9	12	12	10	12	12	8	10
Jul	14	15	10	10	7	3	8	8	4	ND
Aug	7	6	11	7	4	3	6	4	5	ND
Sep	4	4	3	6	5	3	6	3	3	ND
Oct	6	6	5	3	6	2	3	1	2	ND
Nov	7	4	5	3	3	3	1	5	2	ND
Dec	3	1	4	4	2	3	0	1	1	ND

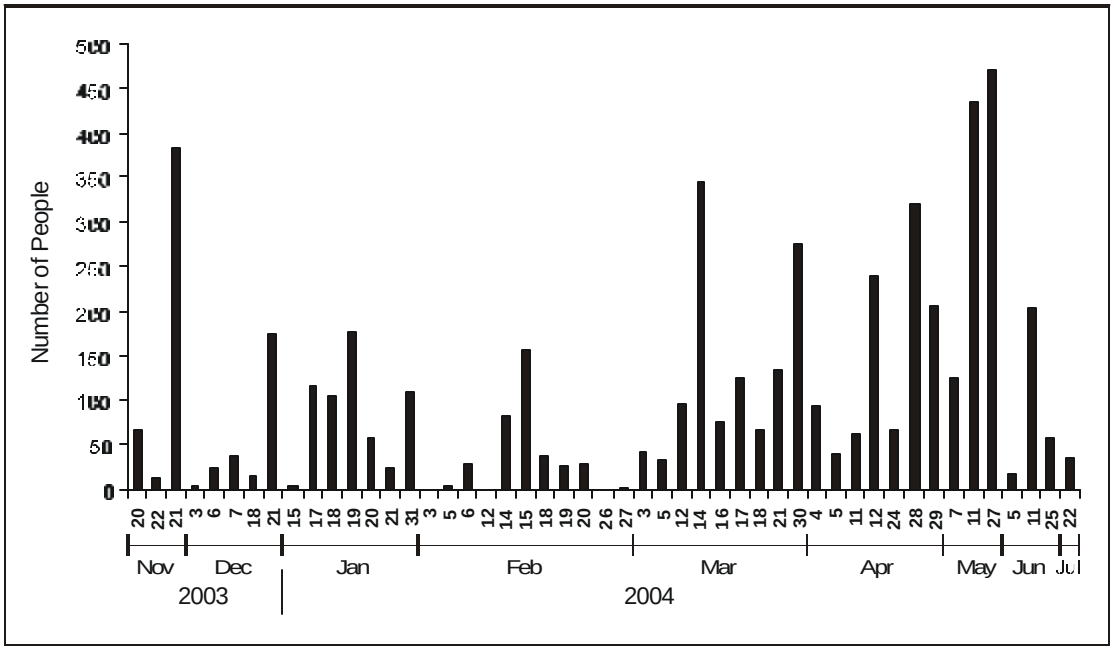

Figure 2-3. Total number of people counted on Moss Beach Reef and Surfgrass Flats in each of the census surveys.

areas receive the highest use (see below, *Section 2.2 – Visitor Distribution*). The days when the number of visitors exceeded 300 were all weekdays when school visits occurred simultaneously with periods of high public use. Total counts for all other sections of the Park (combined) at any given time were always less than 300 people, the largest being 50 people.

The results of the visitor census surveys were used to estimate the total number of days that visitor use could have exceeded 300 people per day. We assumed that weekdays in spring are the most likely days when total visitor use can exceed 300 people from combined school groups and public use. We completed 14 census surveys on weekdays in spring, and counted greater than 300 people on Moss Beach Reef and Surfgrass Flats in four of the 14 surveys (29 % of the surveys). Therefore, if there are 60 weekdays in spring, we estimate that there could be 17 days (29% of 60) when total visitor use could exceed 300 people. This estimate was only based on the spring months when visitor levels were highest. This is probably an underestimate since visitor levels can also be high during the summer and other days, such as holidays, that result in large numbers of public visitors to the Park.

Discussion

The same methods to estimate visitor attendance at the Fitzgerald State Marine Park have been used consistently on a daily basis since 1969 allowing descriptions of long-term changes in visitor attendance by both the general public and schools. Minimum numbers of approximately 80,000 people per year occurred in the 1970s and 1980s, but attendance then rose to consistent levels of about 100,000 people per year, with a peak of over 130,000 people in 1997. A slight decrease in visitor attendance occurred after 1997, but visitor numbers were still near 100,000 people per year.

Although the reason for this decrease in visitor use over the past several years remains unknown, a possible explanation is the change in the signage for the Park on Highway 1. A large billboard advertising the Park was damaged in an automobile accident around 1997/98. The sign was removed and replaced by a smaller sign. The decrease in visitor attendance since 1997 could have been due, in part, to the replacement of the large billboard with a less visible sign. Other possible factors include fewer class visits, due to reductions in school budgets and less media and news coverage on the Park's attractions (R. Breen, pers. com.).

The estimates do not include counts of visitors that may have entered the Park using other access points and, therefore, surely underestimate the total annual attendance levels for the entire Park. However, our surveys of visitor use showed that the number of visitors to other areas of the Park tend to be much lower than Moss Beach Reef (see below, *Section 2.2 – Visitor Distribution*). Although the total annual attendance estimates are most likely to be underestimates of the total number of visitors, we believe that our estimates would not be increased substantially by including visitors from other parts of the Park.

A goal described in the Fitzgerald Marine Reserve Master Plan is to limit total daily attendance on Moss Beach Reef to 500 people per day with a limit of 300 people at any given time. This level was based on a recommendation from a previous study (HLA 1993). There was no basis for the number other than to serve as a 'target' to lower visitor use. Prior to 1994, as many as 40 buses arrived at the Park on a single day (R. Breen, pers. com.). The bus reservation system employed since 1994 was implemented to avoid this high level of use, and the associated problem of vehicle congestion in the parking lot and adjoining neighborhoods. The reservation system schedules school bus visits to avoid exceeding 500 visitors per day from schools or other group visits. However, the system has no controls on levels of visitation by the general public. In addition, unscheduled groups may also arrive at the Park, increasing group visitor levels above the goal of 500 (R. Breen, pers. com.). The unannounced group visits have been included in the daily counts by the rangers, and have contributed to pulses of visitor use exceeding 500 people per day, and probably the 300 maximum at any given time.

Our census surveys also documented occasions when the total number of people in shoreline areas near the main access points (Moss Beach Reef and Surfgrass Flats) exceeded 300 people. Since the surveys were relatively infrequent, there were likely many additional days when total visitation on Moss Beach Reef and Surfgrass Flats exceeded 300 people at any given time, especially during the spring when we estimated the total numbers of visitors can exceed 300 people on 29% of the weekdays.

Historically, up to 2,000 people per day visited the Moss Beach Reef intertidal zone. This occurred on weekends and holidays during periods with good weather and tide conditions. In more recent years, peak levels have dropped to a maximum of about 1,000 people per day (R. Breen, pers. com.). During these days, the number of visitors during any time period likely exceeded the goal of 300. The decline in overall peak numbers from historical levels is probably the result of the group reservation system. In July 2004, the reservation system was made more stringent. Any group with greater than 10 people is now required to have a reservation to visit the Park. This was intended to further limit (group) visitor use, and was done because measures to limit access for the general public have been difficult to implement.

In conclusion, the information on visitor attendance demonstrates that other management measures need to be explored and implemented to meet the objective of 500 people per day with a limit of 300 people at any time. Although group visits can be managed, access to the Park remains open to the general public, and public use and unscheduled group visits can easily exceed the visitor limits. While methods for estimating total attendance have been used with success, and can be continued, future management measures should include methods to monitor the instantaneous 300 people limit. Although there will always be the potential that unscheduled group visits will cause attendance levels to exceed Park limits, the frequency of unscheduled group visits should decline as more and more groups become aware of the group reservation system. The Park could also encourage unannounced trips to redirect their visit for the day to other coastal areas. To avoid these situations, the Park should develop a program to inform all

school districts and tourist charter companies within the counties surrounding San Mateo County of new policies that involve the group reservation system for the Park.

2.2 Visitor Distribution

Purpose

Visitor census surveys were completed to describe patterns of visitor distribution in the Fitzgerald State Marine Park intertidal zone.

Background

Visitor use in different sections of the Park shoreline were previously classified as heavy, moderate, and low (HLA 1993). The categories were based on field observations made in a limited number of surveys without actual numbers of people reported. In our study, the Friends of Fitzgerald organization counted people on the shore and developed a database on the distribution of people along the Park shoreline.

The surveys were conducted to determine the distribution along the shoreline of the visitors that were at the Park at that time. The data were primarily used to determine the areas of the shoreline that receive heavy, moderate, and low use, and to validate that our biological sampling stations corresponded to areas of 'high' and 'low' use. The numbers were not collected to derive total daily estimates of people on the shore, since they only represented the numbers of visitors during a limited time period.

Methods

The approximate 3 mi (5 km) shoreline of the Fitzgerald State Marine Park was divided into 11 segments extending from the northern to the southern boundaries of the Park (**Figure 1-1**). These segments were separated and identified by geographical features (mainly headlands), and ranged in length from 173 m to 916 m (189 yd to 1,002 yd). Geographic features determined the length of each segment with the criterion that there was no fundamental change in the nature of access along each shoreline length. For example, a segment with difficult access to the intertidal zone (steep drop off from the cliff to the ocean) was separated from an adjoining segment with easier shore access provided by, for example, a footpath. The Moss Beach Reef area, located at the terminus of the main access, was subdivided into three segments to obtain better resolution on the distribution of people along this portion of the shore.

Counts of people were made from the cliff top for each segment. Numbers were recorded in 'snapshot' counts. It took about two-hours to walk the length of the Park to make all of the 'snapshot' counts. The surveys were done during days when the weather was appropriate for

visiting tidepools, and during tide levels at or below about +1.5 ft mean lower low water (MLLW). Days when people would not tend to visit the tidepools were not surveyed, which included days of rain, heavy fog, low temperatures, high winds, and high tides.

Forty-nine surveys were completed over a nine-month period (November 20, 2003 to July 22, 2004). In each survey, people were counted in each segment. People on the sandy beaches were counted separately from those on the rock bench platforms. The width of the bench platforms varied between segments. Therefore, the width of the rock bench platform in each segment was divided into three zones, and the people counted in each zone as follows:

- Upper bench (near the cliff bases)
- Mid-bench (mid-section of the bench platform characterized by foliose algae)
- Lower bench (near the outer edge of the bench platforms)

The surveys were made on foot using binoculars by observers who walked the entire shoreline of the Park. Counts of harbor seals and people fishing from the shore and the numbers of fishing boats working in nearshore waters were also included in the surveys. Weather and sea state were also recorded.

Volunteers from the Friends of Fitzgerald, a non-profit, marine science education outreach organization, completed all of the visitor surveys. Due to the use of volunteers, the actual survey days were based on volunteer availability. Under ideal circumstances, visitor use surveys would be completed to account for differences due to the day of the week, holidays, seasons, time of the day, tidal levels, weather, etc. (Underwood and Kennelly 1990). Under these circumstances, the data could be used to provide more accurately based estimates of visitor use. Although not conforming to this ideal sampling scheme, the surveys were completed at various times of the day to correspond to the low tide for the day and included weekends and weekdays. Since the results were only used to provide relative counts of people for locating the biological sampling in areas with high and low visitor use, the surveys did not need to be completed during all types of weather conditions and tidal levels.

Results

Distribution of People Along the Shore

A total of 5,873 people was observed in the surveys. Counts for each segment were corrected for length of shore in order to compare numbers of people among the segments, which differed in their lengths. As expected, the main access had the largest influence on the overall distribution of people in the Park. People were most concentrated on Moss Beach Reef, particularly in the two segments immediately south of the main access (**Figure 2-4**). Surfgrass Flats was another commonly used area, although the number of visitors was less than the Moss Beach Reef

segments, which were closer to the main access to the Park shoreline. Visitor use was much lower in all the other segments.

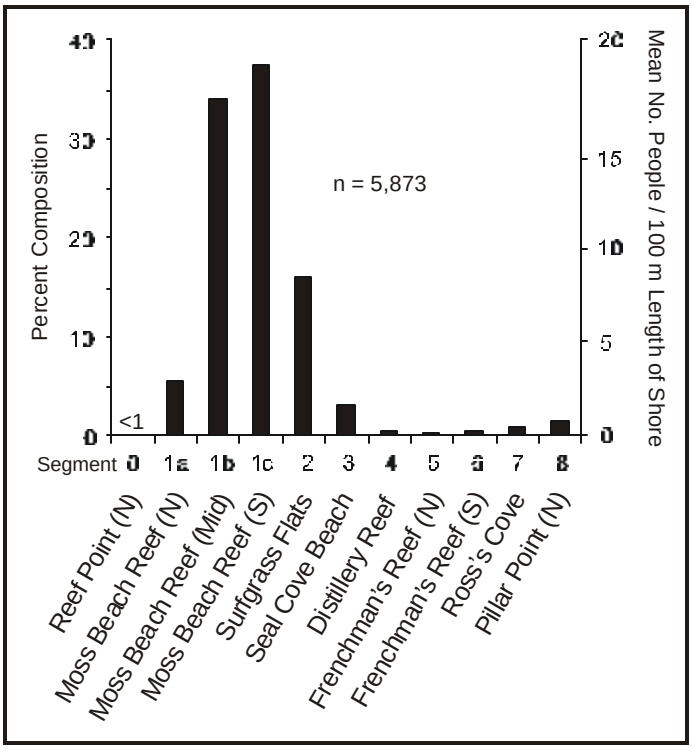

Figure 2-4. Overall distribution of people in the Fitzgerald State Marine Park corrected to 100 m length of shore. (Surveys = 49, and excludes fishers, surfers, and kayakers.)

Distribution of People Across the Shore

Most of the people were on the sandy beaches backing the rock bench platforms and on the upper and middle zones of the rock bench platforms (**Figure 2-5**). The numbers were much lower on the outermost lower zone on the rocky bench platforms. The number of people in the outer zone was highest in Segment 1c (Moss Beach Reef) and Segment 2 (Surfgrass Flats). The southernmost region of Moss Beach Reef is Segment 1c. The rock bench platform there rises slightly in elevation. Consequently, people are able to venture closer to the water without getting wet. Surfgrass Flats is relatively protected from waves, which also allows visitors to venture out near the waterline without the fear of getting wet during low tides. Although Segment 1b on Moss Beach Reef was directly off the main entry to the beach, access to the outer edge of the reef in that segment is restricted (by cones placed at low tide) to prevent people from encroaching on the harbor seal haulout directly offshore (**Figure 2-6**). There is also a broad, low-elevation surge channel directly off the main access to the shore that separates the outer edge of the bench platform from the inner region. Therefore, the seaward edge of the rocky bench in Segment 1b is often inaccessible, except during extremely low tides.

The distribution of people across the shore in other segments was largely determined by the presence of a sandy beach. For example, the area north of Reef Point has a small sandy beach with access from the local neighborhood. While rocks surround the area, they are very steep and not very accessible for exploring tidepools (**Figure 1-10**). The main attractions at Seal Cove Beach and Ross's Cove are the large sandy beach areas that are used for picnicking, sunbathing, and walking dogs, all non-tidepooling activities. Other areas (e.g., Distillery Reef and Frenchman's Reef) have less beach area, plus they are more difficult to access.

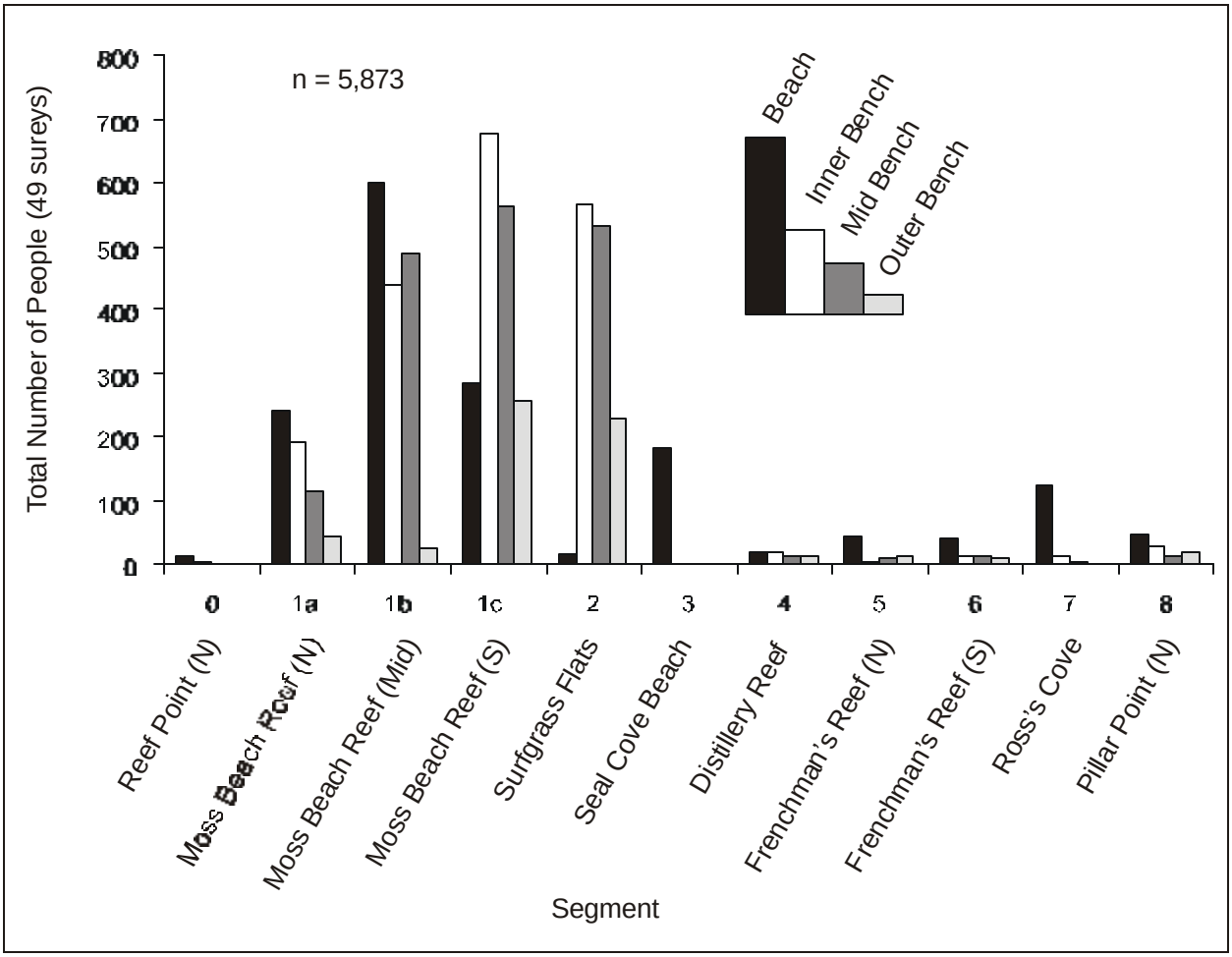

Figure 2-5. Distribution of people along and across the shore in the Fitzgerald State Marine Park, excluding fishers, kayakers, and surfers.

Discussion

A purpose of these surveys was to obtain data on visitation throughout the Fitzgerald State Marine Park in order to locate our biological sampling stations in areas of 'high' and 'low' visitor use. These data could then be use to set up a study to determine if any effects of increased use could be detected. The locations and assumptions of our biological sampling acknowledge that the entire Park is accessible, and that it is highly unlikely that any area has been completely r

emoved from visitor impacts. The results of the study demonstrated that access, including parking, strongly influences how people tend to be distributed along the shore.

Distribution of People Along the Shore

The results of the surveys supported our expectation that the Moss Beach Reef area was the area with the highest visitor use, particularly the segments immediately south of the main access to the Park shoreline (**Figure 2-4**). Levels of use were also high at Surfgrass Flats (Segment 2). Levels of use in other segments were much less with Segment 3 (Seal Cove Beach) and Segment 7 (Ross's Cove), and Segment 8 (Pillar Point north) having similar levels of use with over 100 total visitors for the 49 surveys. The last two areas are accessible from trails down the cliffs after an approximate 0.5 mi (0.8 km) hike over the bluff from the Pillar Point Marsh parking lot. Therefore, these areas require more effort to visit than Moss Beach Reef. Seal Cove Beach is accessed via a footpath that originates on Park property. Neighborhood residences are the primary users of Seal Cove Beach, because there is no parking lot in close proximity.

Figure 2-6. One cone forming a line of cones on Moss Beach Reef to deter access to the seal haulout on Nye's Rocks. Harbor seals are in the background.

Sections 4, 5, and 6 were south of the Distillery Restaurant, and included Distillery Reef and Frenchman's Reef. These segments do not have easily accessible paths to the intertidal zone, and were found to have the lowest visitor levels. Because of low visitation and the similar nature of the rocky benches to more heavily used portions of the Park's shoreline, Section 4 (Distillery Reef) was the area where we conducted our reference/control biological sampling (see *Section 3.0 – Biological Descriptions*).

Distribution of People Across the Shore

We found most people in the Park utilized all the zones across the shoreline, except in areas where the lower zone was exposed to wave surge. Only where the rock bench platforms were relatively protected from surf conditions did people wander out to the most seaward edges of the platforms. The presence of sandy beaches also had a large influence on concentrating visitor in the upper intertidal zone along the beach.

We found that even during relatively 'poor' low tide conditions (approx. +1 ft MLLW) that large areas of the rock bench platform were still exposed for exploring tidepools, but for shorter periods of time. Consequently, there are many times of the year when the areas on the rock bench platforms are exposed to potential visitor impacts.

The potential for visitor impacts on exposed rock bench platforms is much greater than on intertidal areas that are steeply sloped and composed of boulders, cobbles, and high relief rocks

that are more difficult to traverse. These characteristics limit visitor access, due to the more difficult footing and greater chances of getting wet (Clowes and Coleman 2000, Tenera 2003). Consequently, potential visitor impacts in these intertidal areas tend to occur within a narrower band in the upper intertidal zone. In contrast, elevated rock bench platforms, such as those in the Fitzgerald State Marine Park, tend to be exposed to potential visitor impacts over a broader area.

2.3 Visitor Activities

Purpose

Observations and records of visitor activities were made during the census surveys to quantify the activities of people visiting the Park's intertidal zone.

Background

People will engage in a range of activities in the rocky intertidal zone, from passively standing, walking, and looking, to turning rocks, handling, and collecting animals. We recorded observations on visitor activities to acquire baseline data on the frequencies of these types of behaviors.

Methods

The activities of people on the rock bench platforms and on the beaches observed by the Friends of Fitzgerald in the census surveys were classified into non-extractive and extractive activities:

Non-Extractive

- 'Picnicking' (chairs, ice chests, and/or umbrellas on the sand beaches)
- 'Passive' (standing, kneeling, walking, observing without turning rocks)
- 'Active' (handling organisms, rock turning)

Extractive

- Fishing

Results

The 5,873 people observed in the surveys included 155 people picnicking on the beaches and 41 shore fishers. Of the remaining 5,677 people on the shore, 28 % of them were engaged in some form of 'active' tidepool activity at the time of observation (e.g., handling or touching organisms, lifting rocks) versus a 'passive' activity (e.g., looking, walking, standing). Shore fishers represented less than 1 % of the total visitors observed, and were observed in all areas of

the Park, with the exception of Seal Cove Beach, Ross's Cove, and the area immediately offshore of the main access.

Observations of inappropriate activities were noted independent of the present study. These included harassing the harbor seals that frequent the Moss Beach Reef area, carving into the soft sandstone cliffs, and climbing on the unstable cliffs along the shore.

Discussion

Although the census surveys did not provide a comprehensive evaluation of visitor activities, it did indicate that the overwhelming majority (> 99%) of the activities in the Park were non-extractive. In constrast, less than 1 % of the people observed were fishers. Twenty-eight percent of the people observed in the rocky intertidal zone was engaged in some form of tidepool exploring, which included handling or touching organisms. The actual percentage of people engaged in this activity is probably much higher, since we expect that most people who traverse the intertidal zone will eventually be involved in some form of active involvement in touching and handling organisms when exploring tidepools. Our observations of people engaged in 'active' tidepool exploring (28%), however, is similar to that found by Addessi (1994) in San Diego where she noted that approximately 20 % of the visitors observed at any given time were actively involved in exploring the intertidal, which included turning rocks.

The potential impacts to the intertidal community from tidepool activities, aside from trampling effects, will depend on the severity of the action and the frequencies with which they occur. Although the action of someone picking up an animal and then replacing it is a form of collecting, it is less severe than someone carrying the animal to a different location or collecting it and removing it from the Park. Records of illegal collecting from Park records are presented in **Section 2.5**.

During the census surveys, Friends of Fitzgerald docents documented only three incidences of illegal collecting. When one of the people involved in the collecting was questioned by one of the docents, the person did not even know what organism he had collected, but collected it because it was 'interesting'. We did not observe illegal collecting, but observed improper tidepool etiquette during our sampling. In addition, docents have observed children carving letters and objects into the cliff base.

2.4 Questionnaire Information

Purpose

Visitors were interviewed using a questionnaire to obtain a variety of information from the people who visit the Park. The questions included the purpose of the visit, knowledge of the

marine resources, understanding of conservation, opinions on Park amenities and areas for improvement, including Park operation and management.

Background

Planners and managers seek ways to include public input in decision-making. This is especially important when the public is the principal user group. Public input helps to guide and prioritize areas needing improvement. Information from a questionnaire survey is one way to obtain public input.

The majority of people who use the Park include residents, tourists, and school groups. Interviews were conducted with residents and tourists. Interviews with school groups were not included because the needs of school groups are being addressed separately in the curricula planning and design of a proposed new interpretive center at the Park. The Acorn Group completed a questionnaire survey in 2004, largely to acquire input for the interpretive center.

Methods

Friends of Fitzgerald volunteers took opportunities during the census surveys to complete the individual questionnaires. All surveys were completed in the Moss Beach Reef area near the main access. The interviewees were not selected at random, but were chosen as opportunities arose.

Results

The Friends of Fitzgerald interviewed 39 individuals in the field. The following provides an overview of the results that includes information on demographics, purpose of visit, and input most directly related to Park operation, maintenance, amenities, and conservation awareness.

Demographics

Only two of the 39 interviewees did not live in California. The other 37 all lived locally or in the general San Francisco Bay area.

Purpose of Visits

When given a multiple-choice list for primary purpose of their visit, the number one answer was 'to visit the tidepools' (**Figure 2-7**). This is similar to the results obtained in the Acorn Group questionnaire (unpublished data).

Time, Frequency, and Duration of Visits

The survey indicated that people typically spend about 1-3 hours visiting the tidepools when at the Park. Many of those interviewed indicated that they visit the Park multiple times each year, and some local residents visit the Park's intertidal zone up to 60 times per year. Most respondents said they time their visits to coincide with low tides.

Ideas for Park Improvements

The majority of respondents chose 'no ideas' for Park improvements (**Figure 2-8**). The second most common answer for improvement was to increase educational outreach. The third most common suggestion was the need for more parking. All other responses were related to other types of improvements related to restrooms, access paths, signs, benches, etc.

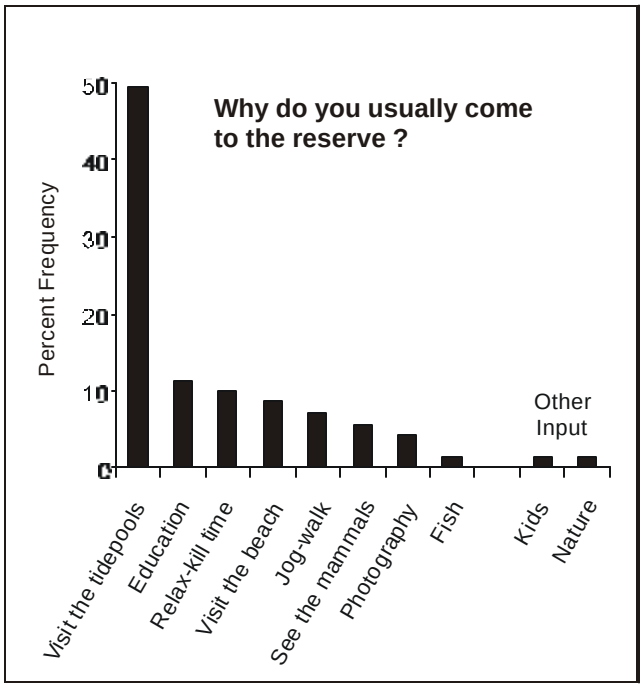

Figure 2-7. Primary purpose of visit stated by 39 interviewees.

Areas Most Visited

The majority of respondents stated that Moss Beach Reef was the area that they visited most often. However, these responses were biased, as all of the interviews were completed at Moss Beach Reef. Seal Cove Beach and Ross's Cove are two other popular areas in the Park (see *Section 2.1 – Visitor Distribution*). Neighborhood residences are the primary users of Seal Cove Beach. Ross's Cove is also commonly visited with the primary purpose likely being the use of its large sandy beach.

Awareness of Signs and Regulations on Resource Protection

Nearly all respondents said they were familiar with the signs and regulations at the Park, since most of them had been to the Park before. One respondent indicated that the signs were becoming faded and in need of replacement and upgrading.

Observations of Inappropriate Tidepool Behaviors

The majority of respondents stated that they do not see or notice illegal collecting occurring when they visit the Park. However, six respondents stated that they see shells being taken on nearly every visit. Several have also seen children carving on and climbing the cliff faces.

Beach Picnicking

Two-thirds of the respondents stated that they would be supportive of no picnicking on the beaches, provided that picnic areas were established and improved in other areas of the Park.

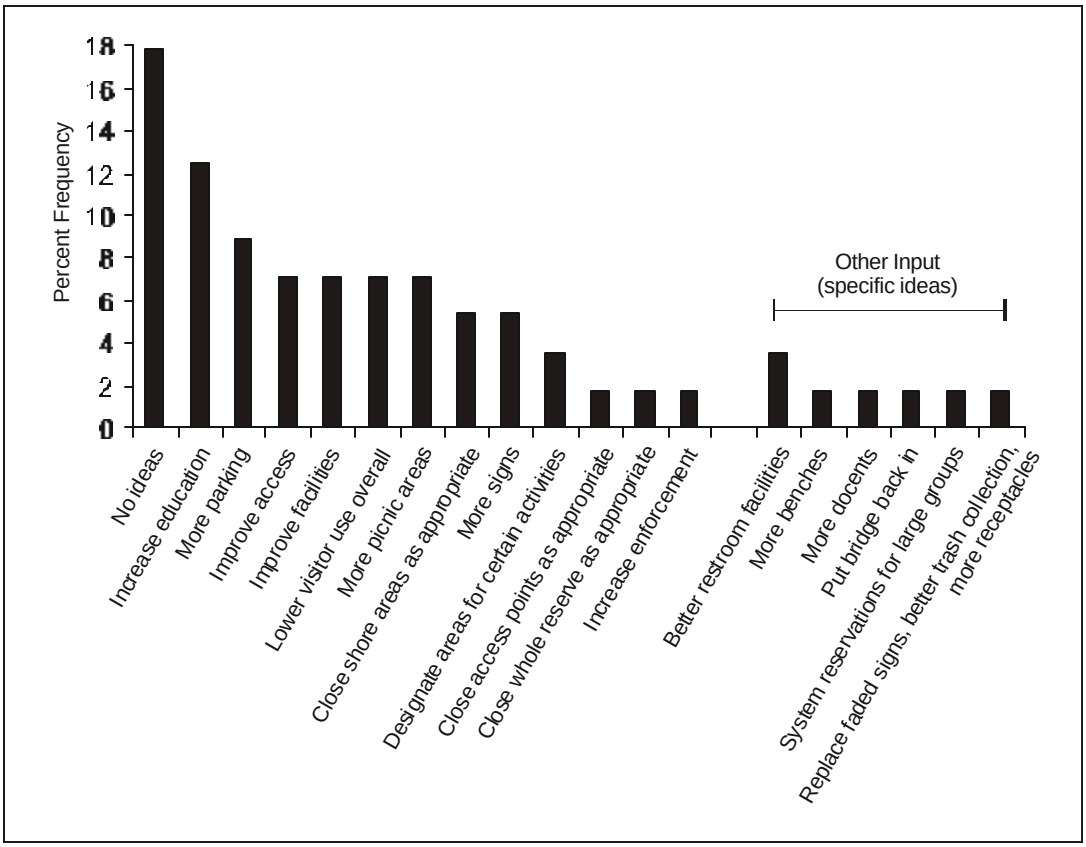

Figure 2-8. Answers for Park improvements from 39 interviewees.

Institution of Access Fees

Respondents were about equally divided between supporting and not supporting an access fee. About half responded that they would support an access fee, while the other half stated that they would not be in favor of an access fee. However, the majority responded that if an access fee were instituted that the fee would not deter them from visiting the Park. One respondent suggested including a family fee (discount).

Group Reservation Requirement

Similar to the bus reservation system, a management objective stated in the Fitzgerald Marine Reserve Master Plan (Brady/LSA 2002) includes a group reservation requirement for groups as small as four people. When asked, interviewees were about equally divided in their support of a group reservation requirement to help limit visitor numbers. However, a group of four would be equivalent to one family, which was concluded by Park management to be too stringent to warrant a reservation, and would not likely be enforceable. In July 2004, Park management instituted a group reservation requirement for groups greater than 10 people (**Figure 2-9**).

Public Views on Biological Changes

Very few people (9) had any personal input on types of biological changes that have occurred in the Park. The majority of these few people indicated that species abundances were declining. However, one person believed that sea stars had increased in abundance, in comparison to two people who specifically stated that they believed that sea stars had decreased in abundance. These types of conflicting statements make it difficult to incorporate anecdotal information into resource assessments.

Figure 2-9. Sign notifying that reservations are required for groups of 10 or more.

Discussion

Our results characterizing the viewpoints of the general public on the Park are limited, as only 39 people were interviewed. As expected, however, the questionnaires revealed that the people who visit the Park are mainly those who live nearby or in the San Francisco Bay area. The responses clearly indicated that people enjoy the Park, and will return on multiple occasions, indicating that management actions to preserve the marine resources and improving Park amenities are highly valued. Approximately half of the interviewees stated that their primary purpose of coming to the Park was to visit the tidepools. The other people stated other reasons (e.g., walking, photography, picnicking, etc.). However, it is likely that this latter group of people also visit the tidepools during their visits. The responses indicate that the primary activities in the Park are overwhelmingly non-extractive in nature, and the resources that make the Park attractive to these users should be protected.

The questionnaires also indicated that many people want the Park to be improved. Suggestions included improved access, restrooms, garbage receptacles, signs, picnic areas, and parking. The restrooms have been recently upgraded. Access across San Vicente Creek would require a bridge or permanent concrete pillars/footings (stepping structures) placed in the creek bed to allow water to bypass and allow for foot traffic without the fear of stepping into the creek. Modifying the crossing over San Vicente Creek would require an extensive permitting process, as a wetland might be involved. Improving signage at the Park is the most technically feasible improvement. Increasing the number and maintenance of garbage receptacles could also easily be accomplished.

An important suggestion from the public was to increase the number of public parking spaces. Public parking may become more limited with the development and operation of the marine science interpretive center, which is planned to be constructed in the existing parking lot. Parking spaces will also be needed for the center employees. Bus parking may become a larger problem, as school groups, including the general public, will now have the interpretive center as another attraction to the Park, in addition to visiting the tidepools. Reducing the availability of parking on County property could increase parking along the neighborhood streets .

Potential parking problems could be reduced with the addition of an offsite parking lot. An offsite parking lot nearby could be used for buses (and cars) for temporary parking while people visit the Park. A shuttle van service between the offsite lot and the Park could be provided, as well. To encourage offsite parking (for the general public), a parking fee could be charged for use of the main parking lot, while there would be no fee for parking in the offsite lot or use of the shuttle service.

It is our opinion that the management recommendation to restrict picnicking on the beach may become contentious. While beach picnickers represent only a fraction of the total visiting population, picnicking on the beach is likely the sole purpose of many people for visiting the shore. Furthermore, we believe it would be very difficult to enforce a no-picnicking rule, since it would be difficult to distinguish picnicking from other passive beach activities.

A 'no ice chests' rule may be more enforceable to limit beach picnickers. This type of rule is employed at other locations, but usually to support on-site concessionaires and to control alcohol. Another means to curtail beach picnickers might be to provide warning signs that the cliffs backing the shore are highly prone to erosion and landslides. During all of our field visits, we witnessed and heard rock falling from the cliffs. In one instance, a rock (soccer ball size) fell within about 15 ft of a beach picnicker on Moss Beach. In addition, children should be strongly discouraged from climbing and carving the cliffs. Warnings about the unstable cliffs should be posted at all access points and along the base of the cliffs.

2.5 Surveillance, Collecting Violations, and Advisories

Purpose

This section presents a description of surveillance and enforcement in the Park and a review of available collecting citations and advisories.

Background

Enforcement and advisory records provide information on illegal collecting, the species collected, and types of inappropriate tidepool behaviors. These types of data were available only

because of the daily presence of Park rangers and their record keeping. Nevertheless, the number of documented infractions observed by Park rangers will always be underestimated because of infractions that occur after they have left the Park.

Methods

The Park records on collecting citations and observations were made available for our review and are described below. The California Department of Fish and Game (CDF&G) is also a key enforcement agency responsible for the protection of marine resources and keeps records of infractions. However, CDF&G enforcement records were not available for our review, because these records are confidential.

Results

Based on Park ranger records, there has been a steady decline in the number of people caught illegally collecting since 1969 (**Figure 2-10**). While it is recognized that not all perpetrators are caught, the consistent observations of the rangers can be used to determine whether a general trend in the frequency of illegal collecting has occurred. Illegal collecting includes poachers who were intentionally harvesting organisms for consumption, plus the general public and school visitors who were found collecting organisms for curiosity, souvenirs, and education (casual collecting). Citations were issued in only the most overt cases of collecting; in most cases only an oral advisory was issued.

The decline in the number of collectors has resulted in an overall decline in the number of organisms collected (**Figure 2-10**). Mollusks, particularly mussels, limpets, and turban snails, were the most common species collected (**Table 2-2**). Other species commonly collected included crabs and sea stars.

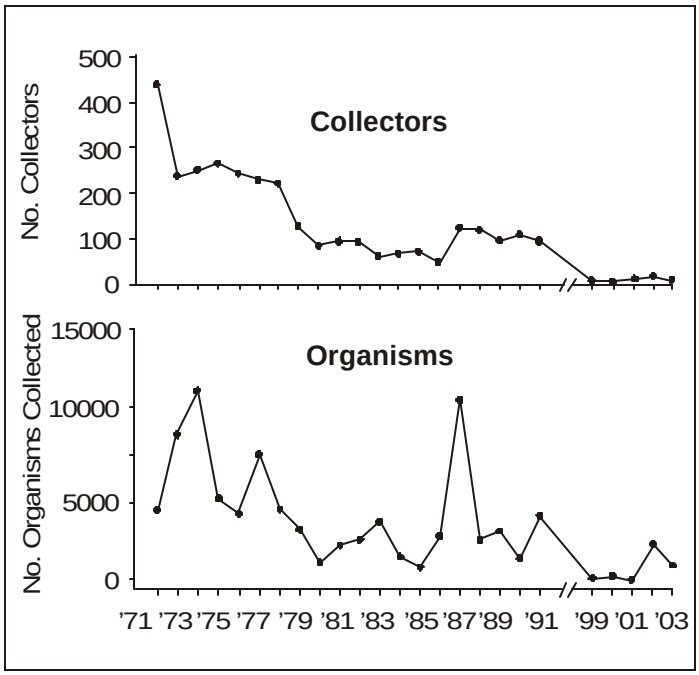

Figure 2-10. Changes in numbers of collectors and estimates of the total number of organisms illegally collected.

Discussion

Although every instance of inappropriate tidepool behavior cannot be stopped before it has happened, there is, in general, an effective

Table 2-2. Summary of collecting violations (Park ranger records: 1999-2004).

Date	Collectiors	Turban Snails	Limpets	Urchins	Mussels	Hermit Crabs	Tidepool Fishes	Rock Crabs	Sea Stars	Anemones	Shore Crabs	Abalone	Nudibranchs	Porcelain Crabs	Other Gastropods	Isopoda	Worms	Barnacles	Sponges	Tunicates	Shells	Algae	Rocks
5/31/99	1							1															
7/10/99	1	15	3			10				1													
7/11/99	1	7	11		7	45																	
7/27/99	5	75			7																		
8/21/99	3	100																					
8/25/99	2	10				10																	
8/28/99	2	6				5																	
12/23/99	2		2		5																		
12/24/99	4		3	1	15									2	1	1					X		
1/20/00	1	25			3																	X	
3/16/00	2		1	256			12		2	1			7	1			1		X	X			
4/1/00	2								2														
4/10/00	1	35																					
4/27/00	1	2		3		2	1		1		2	1											
6/4/00	1	2						1	2													X	
7/4/00	1	11																					
7/24/00	1										1												
9/3/00	3																					X	
12/10/00	1									1													
1/11/01	1	41	3			5																	
3/5/01	1	20																					
4/2/01	1								1														
5/12/01	2	15				10				1												X	
5/14/01	2	8				10																X	
5/19/01	2								1												X		X
5/21/01	1							1															
5/26/01	3	4	5	5				5	2	3		6									X		
6/16/01	15	1 lb	5			25																	
3/12/02	6	252	52		59	17												X				X	
6/24/02	5		19																				
7/6/02	6	50			30		7															X	
7/7/02	3				10																	X	
7/14/02	3																					X	X
7/28/02	3	1331	431																				
8/25/02	1																					X	
9/1/02	6	20			14																	X	
11/27/02	1							3															
1/1/03	1	12																					
3/11/03	2						1				4												
3/28/04	4				15 lb																		
4/8/03	2	50																					
4/19/03	2				35 lb					1												X	
5/26/03	2	50+																X			X	X	X
10/23/03	4																						
1/19/04	2				lrg bag																		
Total	**116**	**2091**	**535**	**265**	**150**	**139**	**21**	**11**	**11**	**8**	**7**	**7**	**7**	**3**	**1**	**1**	**1**						

network of presence, surveillance, and enforcement in the Park that has likely helped to lower potential impacts from visitor activities over time. Park rangers are present daily, and Friends of Fitzgerald docents assist in providing a presence at the Park.

There are several other possible reasons for the data depicting an overall decline in collectors and numbers of organisms taken. The general public might have gained an overall greater appreciation for marine resource conservation from educational outreach efforts, literature, and television. Poaching may have decreased, due to stiffer fines, the possibility of imprisonment, and lack of tolerance to collecting by enforcement agencies. In addition, significant numbers of poaching incidents may still occur in the Park, but poachers are more adept at avoiding being caught. Another reason may be that the area is no longer a good source area for poaching, due to a decline in the quality and abundance of organisms.

While enforcement and advisory records provide documentation on unlawful and inappropriate actions in the intertidal zone, the records, however, only represent a portion of the inappropriate actions that likely occur. Enforcement staff and docents, including informed citizens, are not present at all times in all places. Furthermore, some form of inappropriate tidepool behavior can eventually be seen during any prolonged observation of the area.

Southern California rocky shorelines that are popular visitor destinations have larger records of citations and advisories than the Fitzgerald State Marine Park. The advisories issued by lifeguards at many places in Orange County have averaged 25,532 annually over two years (Murray et al. 1999). This high number is due to the on-site presence of lifeguards for most hours of the day during summer months, and the high numbers of visitors to the shore. However, the lifeguards are generally not present in the field during the fall and winter months when low tides occur during daylight hours and tidepool visitation is also high. Consequently, many more incidences have likely gone undetected. The high number of incidents and advisories is not unusual because, in these areas, an average of nearly one individual every 10 minutes has been observed engaged in some form of inappropriate tidepool activity (Murray et al. 1999).

CDF&G scientific collecting reports are also another source of information on organisms removed from their habitats. This form of collecting is legal, however, and is regulated under the scientific collecting permit issued to an individual by the CDF&G. Holders of scientific collecting permits are required to submit a report of the organisms collected every two years upon expiration of their permit. However, the collecting reports are not archived in a way that allows the data to be retrieved by location. Consequently, it is largely impossible to construct a complete database on past amounts of scientific collecting in the Park, or any other location.

2.6 Comparison of Visitor Attendance with Other Areas

Purpose

The purpose of this portion of the study was to compare visitor numbers at the Fitzgerald State Marine Park with other popular intertidal areas, which are easily accessible.

Background

People frequent other rocky intertidal areas in California in addition to the Fitzgerald State Marine Park. Many of these areas also experience heavy use because, like the Fitzgerald State Marine Park, they have parking lots that are close to the shore with walking trails leading to the intertidal zone, and are close to urban areas. Several of these shoreline areas were compared in a previous assessment of visitor use (Tenera 2003). Below we summarize the information described by Tenera (2003) to describe numbers of visitors among areas with similar access and coastal resources.

Methods

We compiled estimates of visitor attendance for other areas from a number of sources; referred to by the names used prior to the State's re-classification of MPA types:

- Point Pinos (Monterey County): source/ Tenera 2003
- Natural Bridges State Beach (Santa Cruz County): source/ Martha Nitzberg, Education Outreach Specialist
- Point Lobos State Reserve (Monterey County): source/ Pat Clark-Gray, Monterey State Parks; Chuck Bancroft, Ranger
- Little Corona del Mar (Orange County): source/ Cheri Schonfeld, Marine Life Refuge Supervisor
- Crystal Cove Marine Life Refuge (Orange County): source/ Winter Bonnin, State Park Interpreter
- Dana Point Marine Life Refuge (Orange County): source/ John Lewengrub, Marine Life Refuge Project Manager
- Cabrillo National Monument (San Diego County): source/ Engle and Davis (2000)

Total annual attendance estimates were used for comparison to provide a generalized representation of overall visitor use. Other types of attendance estimates may be used to compare areas (such as maximum daily attendance levels), but these were judged to be unreliable for

comparison purposes. For example, some areas may experience equivalent maximum daily levels of attendance during holidays or during the lowest tides of the year, but total annual attendance may be substantially different and, therefore, more relevant for comparison purposes.

Annual visitation levels for other areas were obtained from literature accounts and through interviews with associated management staff. We found that some areas had programs with visitor counts that had been compiled or a sufficient number of field observations completed to derive general estimates of total annual visitor attendance. The annual attendance level for each area was adjusted for shoreline distance, in order to compare visitor densities based on a common shoreline span (100 m of shore). The distance of the shoreline most affected for each area was based on an approximation made by staff or the distance measured from maps.

Results

Fitzgerald State Marine Park Annual Visitation

While Park records indicate that visitor use at the Fitzgerald State Marine Park peaked at over 130,000 people in 1997, we chose to use 100,000 people per year as an overall value of recent annual attendance at the Park.

Annual Visitation at Other Areas

Annual attendance estimates among all areas are compared in **Figure 2-11** with the information summarized in **Table 2-3**. The numbers are for general comparisons only, because different methods were used to estimate total annual visitor attendance. The visitor estimates in **Figure 2-11** and **Table 2-3** are all based on the numbers of visitors in the intertidal zone. If our estimates included people on cliffs and on walking trails, annual attendance estimates would be greater for some areas (e.g., Point Pinos).

The Fitzgerald State Marine Park, Little Corona del Mar in Orange County, and the Cabrillo National Monument in San Diego County appear to have the highest numbers of visitors per year per length of shoreline (**Figure 2-11**).

While annual attendance at the Fitzgerald State Marine Park has been reported to be approximately 110,000-135,000 visitors per year along approximately 500 m of shoreline by Breen (1998), we chose 100,000

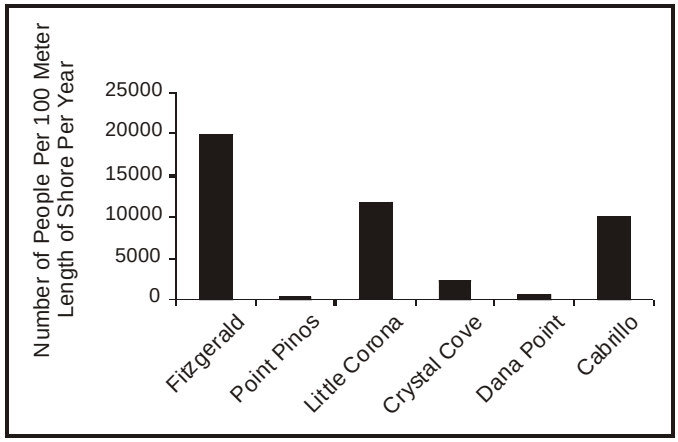

Figure 2-11. Comparison of annual attendance among popular intertidal areas in California.

Table 2-3. Annual attendance among popular rocky intertidal areas in central and southern California. (Note that the areas and names are those used prior to the State's re-classification of MPA types.)

Unit (County)	Estimates of Attendance	Length of Rocky Shore Most Visited	Data Source	Methods	Comments
Fitzgerald Marine Reserve (San Mateo Co.)	100,000+ total visitors/year	500 m (0.31 mi)	Park records	Counts of buses, cars, and walk-ins.	General public use exceeds school use. Limit Goal: 300-500/day
Point Pinos (Monterey Co.)	30,000 – 50,000 per year	1.3 km (0.80 mi)	Annual attendance extrapolated from data collected in the present study and from data in Clowes and Coleman (2000)	Data from extrapolations.	Use high, but not as high as other areas. Attendance probably closer to 50,000 people/yr
Natural Bridges State Beach (Santa Cruz Co.)	Approx. 200,000/yr visit the beach and park but unknown numbers visit the rocky intertidal Approx. 4,000 students/yr visit the intertidal zone through docent-led education programs	0.4 km (0.25 mi)	Martha Nitzberg (Education Outreach Specialts, pers. com.)	Tallies of cars and entry passes.	No estimates of total visitor use for intertidal zone, although considered high.
Point Lobos State Reserve (Monterey Co.)	Daily Intertidal Use Max: 20-25 people/any time Total: 50-75 people/day 30,000-50,000 total visitors/year, but few go into the intertidal	Weston Beach: 100 m (0.06 mi)	Pat Clark-Gray (District Interpretive Specialist, Calif. State Parks, Monterey District, pers. com.) Chuck Bancroft (Park Ranger, Point Lobos, pers. com.)	Numbers from gate records of groups, cars, walk-ins.	Intertidal use mainly at Weston Beach. Most use is nature trails.
Little Corona Marine Life Refuge -Robert E. Badham Marine Life Refuge- (Orange Co.)	2000-01: 7,800 in classes plus 7,800 not in classes 2001-02: 6,000 in classes plus 6,000 not in classes 2002-03: 4,000 in classes plus 1,000 not in classes Summer wkends: 500-1000/day Summer wkdays: 500-800/day Historical max: 1,200-1,500 in classes/day No estimates of total visitors/year	0.8 km (0.50 mi)	Cheri Schonfeld (Marine Life Refuge Supervisor, City of Newport Beach, pers. com.)	Numbers from school visits that go through reservations and the marine science program.	Attempting to lower visitor use each year. General public use well exceeds school use. Limit: Goal: 200-300/day
Irvine Coast Marine Life Refuge -Crystal Cove- (Orange Co.)	1996: 7,690 in classes 2003: 9,000 in classes (anticipated) Multiple access points No estimates of total visitors/year	4.0 km (2.5 mi)	Winter Bonnin (State Park Interpreter, Crystal Cove State Park, pers. com.)	Numbers are from school visits that go through reservations and the marine science program.	Scheduled bus visits are nearly booked for the year by mid-Feb.
Dana Point Marine Life Refuge (Orange Co.)	1,000-2,000 students/yr via the Ocean Institute interpretive program. More students via other programs. Up to 4,000 total visitors/day during good days with 600 people in smaller groups One main access 100,000 total visitors/year, based on extrapolations from visitor counts collected 5 years ago	1.2 km (0.75 mi)	John Lewengrub (Project Manager, Dana Point Marine Life Refuge, pers. com.)	Total annual visitor counts based on extrapolated data from visitor census surveys from planned programs.	Visitor count surveys are not as numerous as five years ago. Beginning a tidepool biological monitoring program.
Cabrillo National Monument (San Diego Co.)	1990-95: Max. 384 people/day 100,000 total visitors/year	1 km (0.62 mi)	Engle and Davis (2000)	Annual attendance extrapolated from data in Engle and Davis (2000).	Most use concentrated in Area 1 (300 m). Most counts made during minus tides.

people per year as the number for Fitzgerald State Marine Park to be compared with other areas, because total attendance has decreased slightly from the highest values reported by Breen (1998). We estimate that the intertidal area at Cabrillo National Monument also has approximately 100,000 visitors per year. We derived this estimate from extrapolating census counts of people made by Engle and Davis (2000). They counted people in 288 surveys from 1990 through 1995. The annual estimate for the Cabrillo National Monument is likely high because most counts were made during minus tides when visitor use was probably greatest. The annual attendance for Point Pinos was calculated by extrapolating visitor counts in the shoreline made by Clowes and Coleman (2000) and Tenera (2003), as this was the only means to determine annual attendance levels.

Annual visitor estimates were not available for most areas in Orange County because they did not have census programs (**Table 2-3**). The most definitive information was on school bus visits organized through the local education outreach programs. However, many visitors arrived independently, and there were no reliable data on shoreline use by the general public. Despite the lack of reliable data, it was roughly estimated that approximately one million people visit the seven Orange County marine protected areas (MPAs) collectively over the course of a year (John Lewengrub, Project Manager, Dana Point Marine Life Refuge, pers. com.). Therefore, well over 100,000 people on average may visit each of the seven Orange County MPAs each year. We used the value of 100,000 people per year for each of the two Orange County MPAs in **Figure 2-11**. Point Lobos has tended to have the smallest numbers of people visiting the intertidal zone. Most people stay on the nature trails located above the intertidal zone (Chuck Bancroft, Park Ranger).

Discussion

Based on numbers of people per unit of shoreline, the Fitzgerald State Marine Park ranked among the highest visited areas among popular intertidal sites in California. The high attendance at the Park is likely associated with its proximity to the densely populated San Francisco Bay area and its historical identification as an accessible intertidal site. Furthermore, the rocky intertidal zone at the Fitzgerald State Marine Park consists of a flat rock bench platform. The low topographical relief provides for a convenient and safe tidepooling experience compared to steep rocks at many other places (e.g., Point Pinos). This combined with the parking lot and restroom facilities likely account for the popularity of the Fitzgerald State Marine Park.

The high attendance in southern California is likely associated with consistently nicer weather, compared to areas in central California, and the proximity of the areas to large urban regions. In addition, there is a scarcity of rocky habitats to visit in the southern California region, which tends to concentrate visitors interested in tidepools at only a few sites. Natural Bridges State Beach in Santa Cruz County is another area that receives high visitor use, although there are no reliable estimates on the numbers of people that visit the rocky intertidal zone annually (Martha Nitzberg, Education Outreach Specialist, pers. com.). High attendance at Natural Bridges State Beach is likely associated with convenient parking, ease of access, and the adjoining upland State Park.