A Guide to the Side of the Sea:
A Teacher's Guide for Field Trips to Rocky Intertidal Areas

by
Michael Roa
A Guide to the Side of the Sea:
A Teacher’s Guide for Field Trips to Rocky Intertidal Areas

Written by
Michael Roa

and

Illustrated by
Gail Stumpf Nsentip

Supported by
a Whale Tail Grant from the California Coastal Commission

Administered by the California State Parks Foundation

Supported by the California Coastal Commission’s Whale Tail License Plate Grants Program
© California State Parks, 2005

No part of this Guide may be reproduced for sale.

Teachers or others leading groups on intertidal field trips may copy all or part of this Guide for use in their classes or with their groups.

Printed or electronic copies of this Guide can be obtained by contacting California State Parks Interpretation and Education Division at:
PO Box 942896
Sacramento CA 94296-0001
(916) 654-2249
interp@parks.ca.gov

This Guide may also be downloaded from the Internet at www.parks.ca.gov
About the Author

Michael Roa has been a classroom teacher for over 35 years. He has taught at the elementary, middle school, high school, and college levels. Environmental issues have been a central concern throughout his teaching career, and his students have undertaken numerous award-winning conservation projects. He is the author of *The Environmental Science Activities Kit*. He currently teaches science and math at Kenilworth Junior High School in Petaluma, California. He can be reached at <mroa@sonic.net>.

Acknowledgments

Douglas Seekatz was the Supervising Ranger for the Mendocino District of the California State Park System when this project started. This *Guide* was his idea, and he wrote the grant proposal that was funded by the California Coastal Commission. He conceived it, nurtured its development, and helped with its production even after his retirement. This is his baby!

Rouvaishyana was the State Park Interpreter Assistant at MacKerricher State Park. His input has been invaluable, as he sees the need for such a *Guide* every day.

Gail Stumpf Nsentip, who illustrated this *Guide*, was not only a creative and helpful illustrator, but a pleasure to work with. She made many helpful suggestions and contributed her ideas to help produce this *Guide*. Gail has worked extensively in the field of archaeological illustration, and illustrated the *Abalone Cookbook* and other projects at Van Damme State Park. She resides in Fort Bragg, California, and can be reached at <gails@mcn.org> or 707-964-3379.

Mike Bankert is the Vice President for Finance and Administration at the California State Parks Foundation. His management of the grant funds made this *Guide* possible.

The California Coastal Commission provided the funds for the creation of this *Guide*.

The following people reviewed this *Guide* and provided valuable suggestions both with the science content and the educational pedagogy:

- Dr. Vic Chow, Research Data Manager and Lecturer at the University of California Davis Bodega Marine Laboratory, Bodega Bay, California.
- Mr. Greg Grantham, Professor of Marine Science at the College of the Redwoods, Mendocino Campus, Fort Bragg, California.
- Dr. John De Martini, Professor Emeritus of Biological Sciences at Humboldt State University, Arcata, California.
- Mr. Bob Lounibos, Fifth Grade Teacher at Blosser Lane Elementary School, Willits, California.
- Ms. Heather McCummins, Graduate Student Assistant, California State Parks Interpretation and Education Division, Sacramento, California.
- Ms. Mary Monroe, Third Grade Teacher at Redwood Valley Elementary School, Redwood Valley, California.
- Mr. Peter Olson, Science Teacher at Fort Bragg Middle School, Fort Bragg, California.
- Ms. Jenan Saunders, State Park Interpreter III, California State Parks Interpretation and Education Division, Sacramento, California.
- Mr. Jim Wesley, Science Teacher at Arena Elementary School, Point Arena, California.
# Contents

**Introduction** .......................................................... 1  
Why This Guide? .......................................................... 1  
How to Use This Guide ............................................... 1  
About State Standards ............................................... 2  

**Science Background for the Teacher** ....................... 5  
Physical (Abiotic) Factors ........................................... 5  
  Geology ...................................................................... 5  
  Types of Shores ...................................................... 6  
  Zonation .................................................................... 8  
  Tides .......................................................................... 12  
  What is “Sea Level?” ................................................ 14  
Waves .......................................................................... 15  
Temperature .................................................................. 16  
Water Chemistry ......................................................... 16  

**Coastal Ecology** ..................................................... 19  
  What is Ecology? ...................................................... 19  
  Cycles ....................................................................... 19  
  Energy ....................................................................... 21  
  Niches ....................................................................... 22  
  Food Chains and Food Webs ..................................... 23  
  Populations ................................................................ 25  
  Habitat, Community, and Ecosystem ...................... 27  
  The Role of People ................................................... 27  

**Environmental Concerns** ........................................ 29  

**Vocabulary** .............................................................. 33  

**Organisms** ................................................................. 35  
  What’s in a Name? ...................................................... 35  
  What’s a “Species?” ................................................ 36  
  Adaptations for Survival .......................................... 39  
  Common Intertidal Organisms ................................... 43  
    Bacteria .................................................................. 43  
    Protista (Including Algae) ........................................ 43  
    True Plants ........................................................... 49  
    Common Animals .................................................. 50
Contents

Field Trips ................................................................. 67
How to Arrange for a Field Trip to the Mendocino Coast ............... 67
  Visits Not Led by an Interpretive Specialist ................................ 67
Field Trip Preparation .................................................. 68
  What Should Students Know Before Coming to the Coast? .......... 68
While on the Field Trip ................................................ 71
Coastal Cleanup Day .................................................... 72

Lessons ................................................................. 73
Pre-Trip Lessons and Activities ........................................ 73
  Underwater Viewers ..................................................... 75
  The Name Game .......................................................... 76
  Food Chains .................................................................. 77
  Food Webs .................................................................... 79
  Slow Motion Ocean (Making Waves) .................................... 83
  Planet Water ............................................................... 86
  What is Salt Water? ....................................................... 89
  Hot Stuff! Tide Pool Temperatures .................................... 92
  Drying Out in the Water? .............................................. 96
  Wet is Wonderful! ......................................................... 100
  Now You See Me, Now You Don’t ................................... 103
  Virtual Field Trip ......................................................... 105
  Research Teams of Experts .......................................... 105
  Notebooks and Journals ............................................... 106
  Checklists .................................................................... 107
  Sensory Awareness ..................................................... 109
During the Trip .......................................................... 112
  Litter Getters ............................................................... 112
  In the Zone .................................................................... 113
  Holdfast Hideouts ....................................................... 115
  The Pyramid of Numbers ............................................ 117
  Sea Star Surprise…How Does That Grab You? ...................... 120
  Alone Activities .......................................................... 122
  Group Activities .......................................................... 123
Post-Trip Lessons and Activities ............................................. 124
  Adopt-A-Beach ............................................................ 124
  Oil on the Water! .......................................................... 125
  Like Water off a Duck’s Back? ........................................ 128
  You Can Help! ............................................................. 131
  Letter Writing .............................................................. 134
  Debates ..................................................................... 135
  Reports ..................................................................... 135
| Storytelling | 136 |
| Gotta Love It! | 137 |
| Who am I? | 137 |
| Bulletin Boards | 138 |
| Skits | 138 |
| Models | 139 |
| Dioramas | 139 |
| Create a Critter | 140 |
| Sea Songs | 141 |
| See Sea Art | 142 |

**Appendices** .......................................................... 143

Appendix A: California State Standards ............................................. 143
  - Grade Three ................................................................. 143
  - Grade Four ................................................................. 144
  - Grade Five ................................................................. 145
  - Grade Six ................................................................. 146

Appendix B: Glossary .......................................................... 147
  - Basic Vocabulary ......................................................... 147
  - More Advanced Vocabulary ........................................... 150

Appendix C: Organizations and Agencies ........................................ 155
  - Organizations with a National or Worldwide Focus .................. 155
  - Organizations with a Focus on California ............................... 156
  - Organizations with a Focus on the Central/North Coast of California ............ 157

Appendix D: Resources ....................................................... 158
  - Books ........................................................................... 158
  - Other Resources .......................................................... 160

Appendix E: Sources of Books and Other Materials: ...................... 165
  - Books ........................................................................... 165
  - Science Education Materials ............................................... 165
  - Other ............................................................................. 166
Introduction

Why This Guide?

As the human population increases, the strain on all resources increases. Natural areas are no exception, and the fascinating tide pools of the ocean shores are especially threatened by over use and inappropriate use. Many popular areas for “tide pooling” are in danger of being loved to death. One purpose for this Guide is to help teachers and other group leaders learn to protect this unique habitat when they bring students to visit, enjoy, and learn about the intertidal areas of the coast.

Not only does the environment need protection, but students must be taught how to explore the tide pools safely. This Guide provides information about how to be safe while visiting the rocky coast.

State Park Rangers and Interpretive Specialists have noticed that some elementary teachers have a strong background in science and natural history, while others have little science training. Elementary teachers may have majored in social science, English, or any one of a number of other areas other than science. This Guide provides a brief summary of major ecological principles and other information that all teachers (indeed, all educated citizens!) ought to have to understand the environment upon which we all depend. The scientific information included below goes beyond what teachers should expect elementary students to know and understand, but is important for teachers’ understanding of the coastal environment. The scientific information is a quick review of some of the ecological principles taught in most high school science classes.

A trip to the intertidal area should not be an isolated activity. Rather, it should be part of a larger unit of study. It is important that students view their visit to the intertidal zone not as just a day out of the classroom or as just a day at the coast. A field trip to the coast should, of course, be enjoyable, but it should also provide the student with opportunities to learn about and to increase their appreciation for the plants and animals inhabiting the intertidal zone.

It is hoped that by learning about the natural environment, children (and adults!) will increase their appreciation of the natural world and will become more willing to actively protect our environment.

How to Use This Guide

While a teacher does not have to be an expert on coastal organisms or ecology, a basic understanding of ecological principles will enable the teacher to help students to maximize their learning during the precious time spent visiting intertidal areas. This
Guide provides that basic knowledge, and teachers and other users of this Guide should use it to review the basic science content before taking students on a field trip to the coast.

The teacher should not attempt to be a “fountain of knowledge” for the students. Rather, it is the teacher’s job to expose the students to the wonders and beauty of nature and to help the students learn, and to learn how to learn, not to provide them with all of the answers to their questions. Hence, the title of this guide has a double meaning. It is a guide to learning about the coast—the side of the sea—but it also reminds the teacher to try to be a guide on the side, guiding the students to discovering knowledge, rather than being an encyclopedia of knowledge or “sage on the stage.”

To help students prepare for their visit to the coast, a number of pre-trip activities are provided. Many of these activities are intended to be “discovery” activities, in which the teacher helps students discover things. Teachers should select activities that are appropriate for their students and, of course, should feel free to modify them as they see fit.

The study of the coast should not end when the students get on the bus to go back to school. Several post-trip activities are provided; some of these, too, are discovery activities. As with the pre-trip activities, teachers should select and modify the activities as appropriate for their students.

Interspersed throughout the science background are “Teaching Ideas” that you might find useful. Look for them in italics.

This Guide also includes the information needed for a teacher to arrange for a tide pool visit led by California State Park Interpreters, Rangers, other staff, or volunteers.

Appendices include a partial listing of California State Standards, in abbreviated form, a glossary, and listings of a variety of resources that the teacher might find useful.

While this Guide was written primarily for the rocky coast in northern California, it will be useful in other areas. Certainly most of the activities can be used elsewhere, many in a variety of environments.

About State Standards

While many California teachers support the concept of having standards to guide our instruction, some are concerned that there is too much emphasis on cognitive learning... memorizing facts without allowing time for the development of the whole child. The study of nature provides a wonderful opportunity for the teacher to encourage the development of affective and kinesthetic learning.
Many of the lessons in this *Guide* can be used to help teach California State Content Standards through visits to tide pools. For those lessons, standards are listed by number. Those standards, in abbreviated form, are listed in Appendix A. Science Standards are, of course, the focus of most visits to the tide pools. Many teachers focus almost exclusively on the cognitive (knowledge) Science Standards. It is important to emphasize the Investigation and Experimentation Standards that are listed at the end of the Science Standards documents.

While the emphasis in this *Guide* is on science, other standards can be addressed while studying science. Some of the standards that can be addressed through tide pool visits are listed on pages 143-146. Learning generally occurs best in context, and the study of science provides an interesting context for many subjects. Creative teachers can surely find ways to use a trip to the coast to teach still more standards.