HOW TO USE THIS MARE GUIDE

The MARE Teacher's Guide To The Open Ocean is intended for use in the middle school grades, especially grade 5. It is the fifth volume of an eight-part series of marine habitat curriculum guides covering grades K–8. The curriculum was developed by the MARE program, a whole-school, interdisciplinary, marine science program for elementary and middle schools.

The MARE curriculum focuses each grade on a different marine environment and integrates language arts, language development, social studies and art with science and mathematics. Crossing disciplines and linking subject areas, the curriculum helps students understand the overarching themes of science. Within each curriculum guide, you will find in-depth teacher reference information, hands-on activities, teaching strategies, children's literature connections, planning materials for developing a comprehensive whole-school science program based on the study of the ocean, and instructions for assembling student portfolios and conducting performance tasks to assess student achievement. Each activity in the MARE curriculum identifies and develops students' related prior knowledge through a rich variety of language experiences, before introducing new topics.

Each of these guides can be used, minimally, as a six- to eight-week science unit, or can be expanded and integrated into a comprehensive, year-long science curriculum covering the disciplines of earth, physical, biological and environmental sciences.

Other guides in this series are listed in the "MARE Scope & Sequence" table at the end of this section.

The MARE curriculum has been tested and used in thousands of classrooms around the country from inner city San Francisco schools to the suburbs of Grand Rapids, Michigan, to rural, reservation schools in Nevada. It embraces the latest science education reform efforts proposed in California and nationally. You will find constructivist, inquiry-based, hands-on activities; cooperative learning strategies; a highly integrated, interdisciplinary approach; strategies for including language minority students; and suggestions for alternative, performance-based assessment in place of traditional tests. This guide is divided into eight sections:

About the Habitat
This lively, entertaining background article describes the open ocean and introduces the major concepts and organisms focused on throughout the rest of the guide. The intended audience for this article is the teacher, however it is not necessary to read it before trying the activities. Each individual activity contains concise, specific background information needed by the teacher to help students understand the activity.

Teaching Strategies
MARE regularly uses a number of generic activity "structures," which are described here. These activity structures are referenced and utilized throughout the curriculum and are designed to help students talk, write, and draw about their related prior knowledge of a topic, or to distill and summarize what they have recently learned. These generic structures emphasize short, small group discussions, cooperation and social skills development. They can be used with any subject or content area in addition to MARE.

Earth/Physical Science Activities
Biological Science Activities
People And The Sea Activities
Each of these sections contains cooperative, hands-on science and environmental education activities that focuses on the polar seas. These activities are correlated with and based on the *California Science Framework*, the *California Language Arts Framework,* and *Project 2061: Science For All Americans*. Each activity is broken into three pieces:
INTO THE ACTIVITIES helps students to recall how much they already know about the activity topic. Teachers may be pleasantly surprised by the wealth of knowledge students bring to the classroom, and may also become aware of significant misconceptions that need to be addressed.
THROUGH THE ACTIVITIES contains experiments, simulations, demonstrations, games, and facts to help students acquire, construct, and reflect on new information.
BEYOND THE ACTIVITIES provides opportunities for students, usually in groups, to explore the content further, applying what they have learned to new situations through projects, research, home activities, etc.
Although the activities are clustered by content area, we recommend that you do not teach them strictly by discipline. Your polar seas unit will be more effective and comprehensible if you develop your own thematic instructional sequence which interrelates activities from different disciplines, and fits the particular needs of your classroom. Since all activities focus on the same habitat, and that habitat itself is not organized into neatly separated disciplines (this is a human construct to help us organize our knowledge), virtually any thoughtful sequence of activities will make sense to students. It will also demonstrate to them the relationships between disciplines. For example, it may make more sense to follow an earth science activity about rocks at the rocky seashore with a biology activity about the adaptations many animals

have for hanging onto rocks. You could then follow those activities with another earth science activity about water.
At the end of this section is a sample sequence, and in the Ocean Week section is a worksheet to help you plan your own original sequence.

Interdisciplinary Ideas
Here are several activities and ideas related to language arts, social studies, art, puppetry, music, among others, as well as an annotated bibliography of children's literature related to polar seas.

Marine Science Resources
Ordering information for recommended marine science curricula, posters, videos, and outreach programs/guest speakers that complement the MARE program and enhance your study of the polar seas can be found here. All the materials and programs have been reviewed by the MARE staff, and all materials are available for loan from the MARE library. The Outreach Guide includes storytellers, biological illustrators, musicians, museum and aquarium educators, environmental experts, etc.— all who will come to schools to perform assemblies or work with single classes.

Ocean Week
All the planning information needed to organize a whole school Ocean Week or Ocean Month celebration is here. You will find a timeline to guide your planning, scheduling forms, suggestions for teacher and parent planning committees, and lists of possible Ocean Week projects and events collected from MARE teachers across the country. You will also find a worksheet to help you plan your own instructional sequence.

Teaching in Culturally Diverse Classrooms
The MARE curriculum is especially designed to be used with no modification in culturally diverse classrooms with large percentages of language minority students. The activities were created with rigorous science content and language development in mind. They meet the criteria established by linguists and language acquisition experts for Specially Designed Academic Instruction in English (SDAIE), also known as sheltered instruction. SDAIE refers to curriculum and courses in content areas (science, mathematics, social studies, etc.) designed to be delivered in English to language minority students that have reached intermediate proficiency in English. These students will find MARE activities comprehensible and academically challenging at or above their grade level. They will also find that the activities help build their English language skills.

Students already fluent in English will enjoy the richness and depth of understanding that comes with integrating poetry, literature, discussions, art, music, video, journal writing, brainstorming, graphics, and cooperative projects with their study of science.

For students just beginning the long process of acquiring English, it is best, when possible, to provide primary language instruction in the content areas and a comprehensive English as a Second Language (ESL) program. Research has found that learning content in the primary language will dramatically speed students' acquisition of English. In fact, the greatest predictor of a student's ability to acquire English is their fluency and literacy in their native language. In addition, primary language instruction will prevent students from falling behind in their subjects as they acquire English, and will serve to build their self-esteem and love of learning. Most importantly, a primary language program will serve to build and enhance a sophisticated, valuable, and marketable skill— which these students come by naturally—bilingualism, rather than strip it away from them. To these ends, the entire MARE curriculum is in the process of being translated into Spanish and Chinese. Until the translations are complete, we encourage teachers working with students in their primary language to use the MARE curriculum in English, to translate key portions, if you are able, and to take advantage of other primary language marine science support materials that you have identified (or the ones available from the MARE library).

ABOUT MARE

MARE is a program of the University of California at Berkeley's Lawrence Hall of Science. MARE was originally conceived as a yearlong, whole school program, highlighted at each school by an Ocean Week or Month. It engages the entire staffs and student bodies, parents, and communities of hundreds of schools in a comprehensive study of the ocean. In addition to providing this curriculum, MARE offers teacher education in-services and summer institutes based on the most up-to-date scientific and educational research. The program focuses specifically on helping culturally, linguistically, and academically diverse schools to implement high-caliber science education that is accessible to all students. Customized on-site, whole-faculty in-services introduce teachers to new methods for developing their own integrated unit plans based on the MARE curriculum, present marine science content, and help the entire school to plan for their Ocean Week. At MARE's two-week, residential Summer Institute, teacher leaders sample hands-on activities; plan schoolwide programs; learn from leading scientists and educators and participate in exciting field experiences.

MARE's Ocean Week is a whole school/whole school day "immersion" experience that transforms an entire school into a laboratory for the discovery and exploration of the ocean. This intensive educational event creates an exciting atmosphere schoolwide and serves as the centerpiece for yearlong ocean studies. Ocean Week builds a sense of inclusion throughout the school community and improves the general climate and educational culture of the school. Special education, language minority and mainstream students work side by side across grade levels, peer teaching, and tackling special projects. Students have long uninterrupted blocks of time to explore areas of interest in

depth. Teachers receive on-site support from MARE staff, who work at the school every day of Ocean Week coaching, model teaching, coordinating, and dispensing materials from MARE's extensive multi-media library.
If you are interested in more information about MARE teacher in-services and having an Ocean Week at your school, please contact:

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Thanks to the **Banana Slug String Band** for their inspirational performances at hundreds of MARE schools, and for allowing us to use their song, "Tidepool Boogie," in the activity of the same name; and thanks to **Bill Oliver** for use of his song, "The Habitat Song," in the activity, "A Snail's Place."

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MARE SCOPE & SEQUENCE

AND ABBREVIATED CONCEPTUAL FRAMEWORK

GRADE	HABITAT	KEY SCIENCE THEMES	SAMPLE CONCEPTS
K-1	Rocky Seashore	Diversity & Unity Scale & Structure Patterns of Change	properties of water, tides, waves, rocks, seasons, adaptation, homes, types of organisms, litter, safety, care and respect
2	Sandy Beach	Patterns of Change Scale & Structure Energy	tides, waves, formation and transportation of sand, food chains, adaptation, life cycles, litter, pollution, oil spills
3	Wetlands	Energy Systems & Interactions Scale & Structure	tides, sedimentation, water mixing, food webs, resource partitioning, adaptation, life cycles, bioaccumulation, habitat loss
4	Kelp Forest	Patterns of Change Systems & Interactions Energy	seasonal productivity, light, waves, density currents, diversity, adaptation, food webs, niche, natural/cultural resources, endangered species
5	Open Ocean	Systems & Interactions Evolution Stability	seasons, weather patterns, currents, properties of sea water, natural selection and evolution, food pyramids, oil development, marine debris
6	Islands	Evolution Diversity & Unity Systems & Interactions	tides, plate tectonics, volcanism, evolution of sand, bathymetry, colonization, succession, adaptation, speciation, biodiversity, life cycles, habitat loss, conservation
7	Coral Reefs	Evolution Scale & Structure Diversity & Unity Systems & Interactions	light transmission, changing sea level, coral formation, biodiversity, adaptation, symbiosis, loss of biodiversity
8	Polar Seas	Energy Evolution Patterns of Change Systems & Interactions	productivity, seasons, density-driven currents, food webs, migration, habitat loss, global climate change, ozone depletion

A THEMATIC INSTRUCTIONAL SEQUENCE

Name: MARE

Gr./Habitat: 5th/Open Ocean

School: Lawrence Hall of Science

Theme	Concept	Activity	Subject
Systems & Interactions	Our earth is a water planet covered by one interconnected world ocean.	*1. APPLES AND OCEANS*	Earth and Physical Science
Transition: Currents circulate nutrients, pollution and organisms throughout the one world ocean. Let's do some experiments with seawater to see how the currents are formed.			
Energy Systems & Interactions	Ocean currents are formed by the force of the wind as well as by temperature and salinity changes in the ocean affecting the density of seawater.	*2. CURRENT TRENDS*	Physical Science
Transition: Plankton are plants and animals that drift with the currents we have just studied. Let's build some imaginary plankton that are adapted to stay near the sunlit surface waters.			
Scale & Structure	Plankton have a variety of unique adaptations which help them avoid sinking below the photic zone.	*3. THE GREAT PLANKTON RACE*	Biological Science
Transition: Plankton form the base of the open ocean food pyramid. Now let's look at the adaptations of an animal that plays a critical role in the center of the open ocean food pyramid.			
Scale & Structure	The adaptations for a completely aquatic existence can be studied by looking closely at an open ocean animal.	*4. SQUID DISSECTION*	Biological Science
Transition: Squid are very efficient predators of the open ocean, but are also the preferred prey for many other predators. Let's look at some of these predators, the marine mammals, that take advantage of the global abundance of squid.			