BRINGING THE OCEAN TO THE PUBLIC AT THE MONTEREY BAY AQUARIUM

By Julie Packard

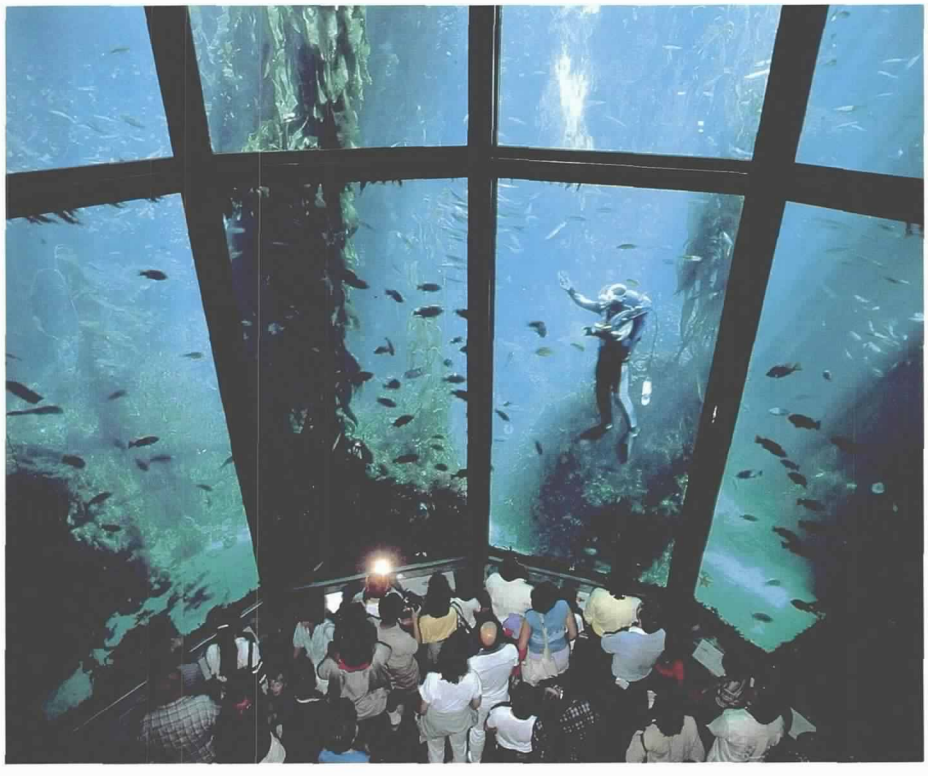
A GROUP of four marine biologists at Stanford's Hopkins Marine Station in Pacific Grove, California, first conceived the Monterey Bay Aquarium. They hoped to share their interest and enthusiasm for Monterey Bay with the public on a broad scale. The biologists' ideas were melded with those of the aquarium's founders and benefactors, David and Lucile Packard, and a unique set of goals for the institution evolved.

First, it would be a regional aquarium, focusing only on Monterey Bay. While the bay's exceptional species diversity and variety of habitats provided a wealth of exhibit topics, an exhibit program of the magnitude envisioned based solely on one region was a revolutionary concept. Most aquariums had evolved from the traditional menagerie approach on which zoos were founded: a collection of exotic animals from around the globe.

Additional goals for the exhibits were based on this regional theme. The aquarium would present the bay's organisms in as realistic a setting as possible, in naturally occurring species assemblages. The exhibits would recreate an undersea tour of the bay, an approach that mandated an emphasis on algae and invertebrates unprecedented among public aquariums.

Visits to other institutions resulted in further guidelines. "Hands on" interpretive exhibits which invite the visitor to participate were to be emphasized. The aquarium would provide a wide variety of indoor and outdoor experiences for visitors. And it would take full advantage of the striking waterfront site on which it was to be built.

Perhaps the most important mandate put forward by the aquarium's founders, however, was that the non-profit institution should attract and sustain a level of paid attendance that would make it operationally self-sufficient. This mandate made it essential that the exhibits offer significant entertainment value. Since learning is most effective when it is fun, maximizing the entertainment value of the exhibits would logically serve to enhance their educational effectiveness as well.



A forest of giant kelp in a 8.5m tall tank greets visitors at the Monterey Bay Aquarium. Photo: © 1988 Monterey Bay Aquarium

From the start, achieving the above goals would clearly require considerable research and ingenuity. As teams of design consultants and biologists worked on exhibit concepts and details, design constraints and conflicts often seemed insurmountable. Sometimes, they were.

An early idea for a massive acrylic panel providing an underwater viewing gallery into an impounded tidal basin open to the sea was abandoned after engineering and other technical studies proved it infeasible. Another idea for a raised public walkway meandering among the rocky tide pools below the aquarium was also abandoned. Winter storm conditions, control of biofouling to maintain a safe walking surface, and a limited number of days per year when the trail was exposed at low tide made the idea impractical.

Hands-on exhibits allowing the public to interact with a live animal and observe a predictable behavior were also easier said than done. Only a handful of numerous original ideas passed the tests of reliability, ease of maintenance, and ability to stand up to thousands of daily visitors. One successful example was a visitor-activated surge tank showing how surge channel fish respond to changes in current direction. More easily designed were exhibits providing magnified views of animals that otherwise would be overlooked, animals that are rarely even interpreted in most public aquariums.

Of all proposed exhibits, the Kelp Forest exhibit posed the greatest challenge. The

Julie Packard, Executive Director, Monterey Bay Aquarium, 886 Cannery Row, Monterey, CA 93940.

planning team envisioned a huge tank with massive windows surrounding the viewer. Inside, a forest of giant kelp *Macrocystis pyrifera* was to be perfectly recreated, teeming with fish and carpeted with invertebrates and understory algae.

Although colleagues at other public aquariums offered copious advice on how to maintain other species, they were notably silent on the subject of kelp. No other aquarium had attempted to exhibit a live kelp forest; most had in fact devoted themselves to eradicating algae from their systems.

The handful of phycologists who had conducted research on *Macrocystis* cultivation in Southern California provided a starting point on design parameters for the tank. First and foremost was meeting the physiological requirements of the kelp plants. A rapid seawater turnover rate and surge machine provided current flow across the fronds sufficient to prevent nutrient depletion. The tank was open to the sky and oriented in the building to maximize solar irradiance.

Public viewing imposed an additional set of criteria on the tank not required when designing an experimental system strictly for research. Windows were fabricated from cast acrylic, which allowed the largest panel size, lightest weight and best clarity at the 18cm thickness required.

In order to encourage growth of filter-feeding invertebrates and settlement of naturally occurring larvae and algal spores, the 1.5-million-liter tank was supplied with unfiltered sea water at night. During the day, high-pressure sand filters maintained water clarity for optimal public viewing.

On October 20, 1984, the Monterey Bay Aquarium opened its doors to the public. Since then, more than seven million visitors have experienced an undersea tour of the bay. Their tour begins with the 8.5m deep Kelp Forest exhibit, viewed from two levels of the building. Next, the 27m long, hourglass-shaped Monterey Bay Habitats tank recreates a transect through the bay's deep reef, sandy bottom, shale outcrop and wharf habitats. Monterey Bay's Elkhorn Slough and sandy beaches are interpreted in a walk-in aviary. Visitors experience the rocky intertidal zone through a recreated outcrop of rocky tide pools complete with crashing waves, a large invertebrate touch tank, and a visitor-operated video camera providing magnified views of intertidal animals.

Four California sea otters cavort in an exhibit providing above- and below-water viewing, and models of the bay's marine mammals are complemented by outside views of nearby wild harbor seals and California sea lions. During the winter months, California gray whales are easily viewed from the aquarium's decks.

Throughout the aquarium, interpretive graphics and videos, stations with magnifiers or microscopes, and attending interpretive guides encourage the visitor to ask questions and learn more. In-depth education is provided through on-site classroom, outreach and teacher training programs reaching more than 75,000 participants per year. Behind the scenes, research staff conduct husbandry and pathology studies on the exhibit species, are engaged in long-term field studies on California sea otter behavior, and are studying the stability of kelp forest communities and export of algal biomass to the deep sea. In all, 240 staff members and 500 volunteers are required to maintain the aquarium's exhibits and programs, contributing to a total operating cost of $13 million in 1988.

Since opening, public response to the aquarium has far exceeded expectations. Its goal of financial self-sufficiency has been surpassed, making possible expanded education and exhibit programs. The aquarium's building design and programs have been widely acclaimed. Its exhibits have become the standard from which all new aquariums are modeled. Certainly, the Monterey Bay Aquarium has gone a long way toward achieving its original goals of public education and research in marine science.

So much more remains to be done, though: the continued development of the institution as a resource for teachers of marine science at all levels, the development of new exhibits on the bay's most challenging deep-sea and open-ocean habitats, ongoing exploration of ways to impart more information to visitors, and much more.

Public aquariums hold an awesome responsibility: to help the public become more informed about the marine environment and better able to wisely manage its resources and ensure its preservation, as well as our own. For most of the aquarium's 1.7 million annual visitors, a view of the Kelp Forest exhibit is as close as they will ever come to seeing a real kelp forest firsthand. Although each visitor has his or her own interpretation of the aquarium, all leave with a new awareness of the great diversity and wealth of life under the surface of the bay. ❑

WHOI Names Sixth Director

By WHOI Public Information Office

CRAIG E. Dorman, 48, a physical oceanographer with more than 20 years of administrative and field experience in the U.S. Navy, has been named the sixth Director of the Woods Hole Oceanographic Institution, succeeding Dr. John H. Steele, who has served in the position since October 1977. The Board of Trustees voted January 5, 1989 to appoint Dr. Dorman upon the recommendation of an Institution Advisory Committee and a Trustee Search Committee. Dr. Dorman, who recently retired from the U.S. Navy, assumed his new position February 1, 1989.

Dr. Dorman has served in the U.S. Navy for 26 years, most recently as a Rear Admiral and Program Director for Antisubmarine Warfare in the Space and Naval Warfare Systems Command. A 1958 graduate of Bedford High School in Bedford, MA, Craig Dorman received his bachelor's degree with highest honors in geography from Dartmouth College in 1962. He received a master's degree with distinction in oceanography from the Naval Postgraduate School in Monterey, CA, in 1969.

His affiliation with Woods Hole Oceanographic Institution began more than twenty years ago. He was one of the first students in the Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Graduate Education Program, and in 1972 he was awarded a Ph.D. in physical oceanography from that program. His thesis research focused on coastal processes and air-sea interaction. Since 1972 he has worked with Institution staff on several naval projects.

Dr. Dorman has had several years of operational experience in the U.S. Navy, serving with the Underwater Demolition Teams and the SEALS (Sea Air Land Teams) both in the U.S. and Vietnam. Following assignment to Washington, DC, in 1977 he became involved in the research and development aspects of antisubmarine warfare. He was promoted to Rear Admiral in September 1987. Born in Cambridge, MA, Dr. Dorman is married to the former Cynthia E. Larson of Bedford, MA. They have three sons, Clifford, Clark and Curt.

WHOI Public Information Office, Shelley Lauzon, Publications and Information Manager, Woods Hole Oceanographic Institution, Woods Hole, MA 02543.