

CUIMR-Q-88-001

California Sea Grant:

*COASTAL OCEAN
SCIENCE AND TECHNOLOGY*



Sea Grant is a statewide, multiuniversity program of marine research, education, and advisory services. Sea Grant-sponsored research contributes to the growing body of knowledge about our coastal and ocean resources and, consequently, to the solution of many marine-related problems facing our nation. Through its Marine Advisory Services, Sea Grant transfers information and technology developed in research efforts to a wide community of interested parties and actual users of marine information in California and throughout the nation. Sea Grant also supports a broad range of educational programs for university students, public school teachers and students, and the general public so that our coastal and ocean resources can be understood and used judiciously by this and future generations.

ROSEMARY AMIDEI
COMMUNICATIONS COORDINATOR

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A Report to the Resources Agency Sea Grant Advisory Panel

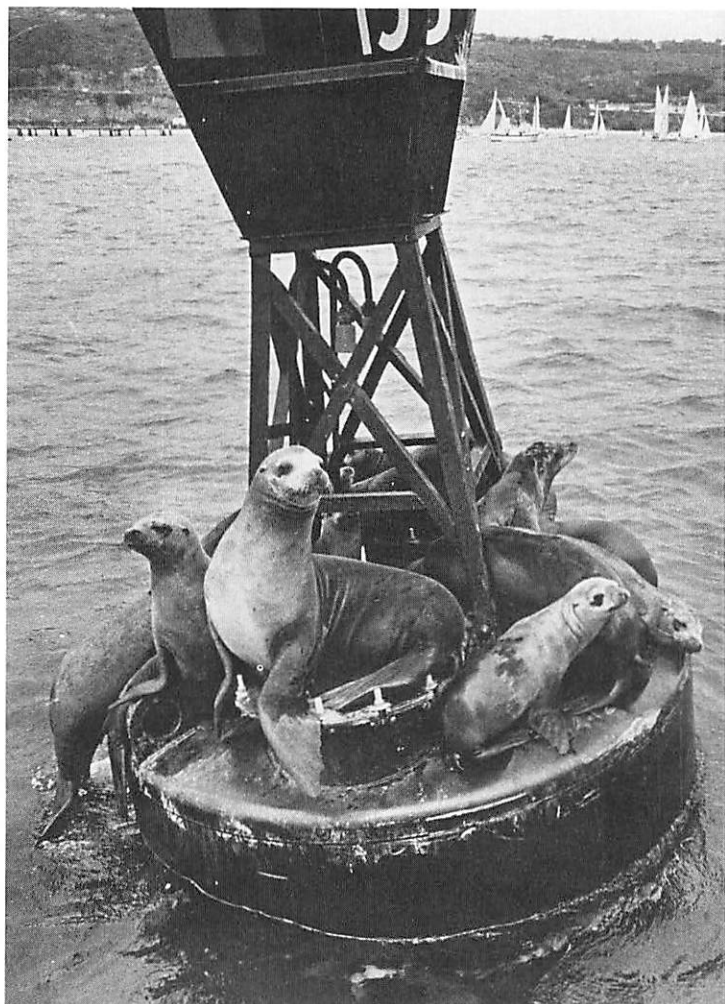
California Sea Grant
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"Almost everyone professionally acquainted with ocean matters agrees with me that the most urgent problems the nation has with the ocean are those centering in the coastal zone, a few miles either side of the interface between sea and land. Here are the estuarine, pollution, multiple-use, aesthetic, industrial, recreation, social, and economic problems so complex, difficult, and interdigitating as to try the patience of Job and the wisdom of Solomon."

Wilbert M. Chapman, 1969



Los Angeles Times photo

Introduction

The National Sea Grant College Program is just over 20 years old, yet it has become the nation's principal source of academic research in the coastal zone and nearshore ocean.

At present, the national Sea Grant network, part of the National Oceanic and Atmospheric Administration, comprises 29 programs in the coastal and Great Lakes states. Of these, the California Sea Grant College Program, administered by the University of California, is the largest, with a proven record of high productivity in marine science and technology. Together with the University of Southern California Sea Grant Institutional Program, directed by Dr. Robert Friedheim, it addresses a variety of marine-related problems and opportunities that are important to the State, the nation, and the broader international community.

In recognition of Sea Grant's benefits to the people of California, the State legislature has since 1973 voted support to Sea Grant. The legislature also established an advisory panel, the Resources Agency Sea Grant Advisory Panel (RASGAP), to identify State needs that might be met through Sea Grant. It is as part of our accountability to RASGAP (and through it, the people of California) that we offer this report, covering the fiscal period 1982–1987. In it we have selected for highlighting some program activities that emphasize Sea Grant's accomplishments in the context of the problems and opportunities confronting California.

Before the arrival of the Spanish colonists in the 19th century, the human population (numbering perhaps 300,000 Native Americans) had little effect on the State's diverse coastal habitats. But today, California ranks first in population in the Union, with some 28 million people. And the numbers continue to swell. Present estimates put the State's population at nearly 40 million by the year 2020.

This rapid growth of population, largely hugging the shoreline, has created numerous intractable problems: 90 percent of the State's highly productive wetlands have been destroyed and almost every major coastal river dammed. Along portions of densely populated Southern California, intensive urban development has resulted in a nearly continuous wall of homes and industries along a fragile coast that is susceptible both to flooding and erosion. Further, coastal waters receive the vast majority of pollutants, both from waste disposal and from such "nonpoint" sources as agricultural and urban runoff.

The sheer press of population and of competing interest groups has created numerous conflicts over resource allotment and management: witness today's disputes over offshore oil development, over continued coastal development, and over water allocation. Moreover, the increased level of human activity along the coast has made us more vulnerable to natural and man-made accidents—failure of oil platforms, storms, and sewage-system breakdowns, for example.

At the same time, there are unprecedented opportunities for marine research to contribute to the State's and the nation's economic vitality and environmental health.

Marine science and technology, to cite some examples, provide promise for the development of new and more productive aquaculture

enterprises; for improved fishing and new and better quality fisheries products; for increased commercial activity based on new marine products; for better methods for disposing of wastes.

In addition, I see two opportunities that deserve special mention . . . topics that we have explored in recent Annual Summaries. First, the Exclusive Economic Zone (EEZ)—a largely unknown ocean frontier extending 200 miles from our coast—presents us with special opportunities for growth of scientific understanding and marine resource development. Prudent development of the resources of the EEZ will require not only comprehensive scientific investigation of this domain, but also new technologies, including advanced submersibles, robotics, and techniques for better seafloor mapping.

And second, there are the robust opportunities presented by California's pivotal role within the Pacific Rim. Home to half the world's population and contributing more than 40 percent of the gross world product, the Pacific Basin has become the most dynamic region of the globe. Within this region, California is central to our national presence, with more than half of all American trade with the Pacific passing through California ports. The State has the third largest economy in the Pacific Basin, smaller only than those of Japan and China. In fact, California is Japan's second largest trading partner—after the United States.

California Sea Grant is continuing to build bridges between scientific colleagues in the United States and the nations of the Pacific. For it is our belief that greater openness, greater internationalism—always the hallmark of productive science—will allow the community of the Pacific to develop to its fullest potential.



James J. Sullivan
Director*
California Sea Grant
College Program

*Dr. Sullivan is on leave for the 1987-88 academic year, during which he is a visiting professor at the University of Tokyo and a Fulbright Research Scholar.

Sea Grant and the New Economic Era

The United States has been moving into an economic era that is fundamentally different from what has prevailed since the end of World War II. Marked by rapid technological change and intense international competition, it has been called the "information age" because of its reliance on the continuous generation of scientific knowledge and technological innovation.

In a report for the Economic Policy Institute,* David Osborne argues that America's future is tied to its ability to innovate: "In a world of low-wage labor," he says, "our competitive advantage lies in our ability to create research breakthroughs in the laboratory, to translate those breakthroughs into new products and processes, and to manufacture the results using a combination of technological sophistication and skilled labor that is still rare in the developing world."

Thus, America's economic position will in large part derive from the strength of our science and technology and from our ability to move the fruits of research quickly from the laboratory to the marketplace. It is no coincidence that high-growth areas are almost invariably clustered around major research universities or institutions.

The need to integrate the respective strengths of academia and industry so as to facilitate the discovery and transfer of knowledge and technology between the two is a continuing national challenge. Recognition of this is shown, for example, by the fact that the National Science Foundation is planning to initiate new Science and Technology Centers. These new multidisciplinary centers will be organized on university campuses, but have strong industrial participation. States, too, are working to heighten their competitiveness, one widespread strategy being to speed the commercialization of research results by increasing interaction between universities and businesses.

Though the emphasis on increasing economic competitiveness and the social benefits of science through stronger linkages between academia, industry, and government is greater than in the past, the theme is not new. Indeed, the desire to increase the benefits to the nation from its marine resources was central to the creation of Sea Grant by Congress in 1966.

Part of the National Oceanic and Atmospheric Administration, the National Sea Grant College Program now comprises 29 state programs that conduct activities in marine science and technology at more than 300 universities and affiliated institutions.

In the two decades since its inception, Sea Grant has become America's principal source of academic research on the coastal ocean, and a primary national resource in aquaculture, marine biotechnology, seafood and other marine products, fisheries recruitment and productivity, ocean and coastal engineering, and ocean policy. Nationally, the program has also become a major source of marine scientific and management personnel, having supported nearly 7,500 undergraduate and graduate students specializing in marine disciplines.

**Economic Competitiveness: The States Take the Lead* by David Osborne. Economic Policy Institute, Washington, D.C., 1987.

From the beginning, Sea Grant's solution-oriented focus made it multidisciplinary in approach and allied it in partnership programs with government and industry. These partnerships are maintained and strengthened by a variety of mechanisms, notable among which are joint projects, industry advisory committees, communications programs, and the outreach activities provided by its advisory services to a wide variety of client groups.

Sea Grant is a successful model for university/industry/government cooperation for scientific advancement, application-oriented work, and economic development. It has contributed to the competitiveness of the nation's economy, to the pool of skilled manpower, to scientific achievement, to technology transfer, and to public education on critical resource and environmental issues. It will continue to contribute in important new ways to the states' and the nation's economic strength and vitality.

Tracking Diseases of Salmon

When an outbreak of a salmonid kidney disease called PKD (for proliferative kidney disease) first occurred at the Mad River Hatchery in Northern California, it was the first known occurrence of the disease in Pacific salmon. Unfortunately, before the disease had been detected and identified, over one million infected chinook salmon had been released into the lower Klamath and Mad rivers. Of the remaining 100,000 chinook at the hatchery, 95% later died of the disease. Subsequently, PKD was found among several wild and hatchery populations of Pacific salmon in British Columbia, California, and Washington.

Ronald P. Hedrick from UC Davis set out to discover the source of the infection in salmon and trout, its mode of transmission, and its effect on salmon during their downstream migration and adaptation to seawater.

Hedrick was able to determine that the amoeba-like protozoan that causes PKD is a member of the phylum Myxozoa and to describe previously unknown stages of the parasite's complex life cycle, including early spore-forming stages. He was also able to show that the infective stage (as yet unknown) is most prevalent in the summer months, and that fish that survive a first infection become strongly immune to the disease—findings that have affected the Department of Fish and Game's trout restocking practices.

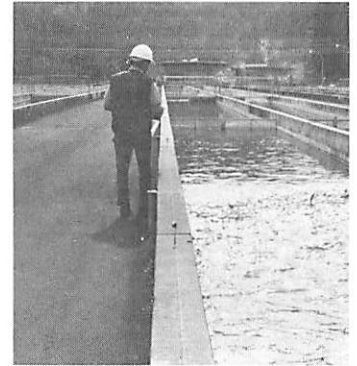
As a result of the knowledge of when to expect the first and most severe parasite infections, fish aquaculturists now manage the disease better, and mortality rates have dropped. Recently, his research has led to an effective therapeutic treatment for the disease—the first clearly successful medicinal approach to preventing a disease caused by a myxozoan parasite in salmonid fish.

Although Hedrick was able to show that the disease can be transmitted through water containing the infective stage, he is still not sure of the original source, though present studies strongly point to nonsalmonid fish, possibly chub. He has, however, shown that seawater adaptation does not seem to be impaired in infected laboratory fish, though they are anemic.

His workshops and publications have greatly increased consciousness of PKD and, therefore, its identification, and the Fish Pathology Laboratory at UC Davis has become internationally known as the lead laboratory for studying this kind of disease.

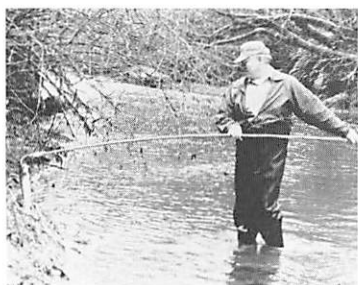
At Humboldt State University, Gary L. Hendrickson has been tracking the salmonid parasite that causes a disease known as ceratomyxosis. Though no one knows why, only certain rivers contain the infective stage of the parasite. He has been able to identify rivers from which the infective stage is absent, as well as describe where this stage exists in the Klamath and Sacramento river systems. This information is important in the containment and management of the parasite because there is no cure for the disease.

Other important research at Humboldt State University and UC Berkeley has been addressing a very different cause of impaired growth and mortality in salmon—the "stunting" that often occurs when hatchery-reared juvenile salmon are transferred to seawater. Scientists have been studying ionic and endocrine factors related to stunting in order to determine the best times and conditions for hatchery releases, an important management issue.



...the Fish Pathology Laboratory at UC Davis has become internationally known as the lead laboratory for studying this kind of disease.

...youngsters hauled 7½ tons of rock by hand to provide better spawning gravel for local chinook on a Smith River tributary.



Enhancing California's Salmon Resources

Salmon have been called key indicators of the health of California's water resources. So when the Eel River ran thick with fish last fall, the excellent run was seen at least partially as a testimonial to efforts by numerous enhancement groups to restore the watershed.

School children in California are gaining awareness of the importance of healthy stream environments as a result of a project initiated by Chris Toole, Marine Advisor for Humboldt County (and, newly, Mendocino County), who is also active in lending technical assistance to local enhancement groups such as the Humboldt Fish Action Council.

As part of the education project, Toole obtained a grant from the California Department of Education covering materials for 30 aquarium-incubators for classrooms in Humboldt County. With these, students could hatch steelhead and salmon eggs as a starting point for learning about the fishes' life cycle, habitat needs, and economic importance. Toole also held a teachers' workshop and organized a "buddy system," pairing each teacher with a fisheries support person. Classes went to hatcheries and stream restoration sites, and several teachers organized K-8 study units around local creeks. The program is now being expanded to other parts of the State.

Advisor James Waldvogel (Del Norte County) has worked on 4-H projects where members essentially "adopt a stream" and try to improve its salmonid productivity by, for example, removing log jams or building weirs. In one project, youngsters hauled 7½ tons of rock by hand to provide better spawning gravel for chinook on a Smith River tributary. Waldvogel is also involved in a decade-long study of chinook spawning on the Smith River that will help agencies establish escapement objectives.

The Marine Advisors also initiated a series of "California Salmon and Steelhead Restoration Conferences" for volunteer and nonprofit enhancement groups. The conferences, which Sea Grant cosponsored with the Department of Fish and Game from 1983 to 1985, are now sponsored by a federation of enhancement groups. Topics have ranged from salmonid genetics to working with land owners, and the meetings usually attract more than 200 participants. "We set up the meetings as a means of exchanging practical information, but also infuse a good bit of science," notes Bruce Wyatt, Advisor for Sonoma and Marin counties, who has been instrumental in organizing the conferences and who has also worked on a salmon enhancement program for the Garcia River watershed.

In Monterey and Santa Cruz counties, where watersheds have been badly degraded, Advisor Ed Melvin has been working closely with the Monterey Bay Salmon and Trout Project, a nonprofit group. He is also involved in a research project to estimate steelhead populations in the Scott Creek watershed to determine the success of local enhancement efforts.

California Sea Grant's Marine Advisors, who are administered through the University of California Cooperative Extension, have also worked closely with local groups to develop individual river basin plans throughout the State. These plans have become part of a statewide California Citizens Advisory Committee report on salmon and steelhead resources, which will be presented to the State Legislature to help direct resource enhancement efforts and management plans.

Providing Historical Perspective on Pacific Fisheries

The period since the end of World War Two has witnessed a vast expansion of fishing effort and harvest in the Pacific, accompanied by a series of important shifts in the roles of the United States and Japan.

Seeking to illuminate the effects of U.S. ocean policy in this period of rapid change, Harry N. Scheiber, professor of law at UC Berkeley's Boalt Hall, and his trainees have been examining from the perspectives of law, international relations, and ocean science, the postwar evolution of America's West Coast fisheries industry and its relations with Japan.

Scheiber's work has concentrated on the postwar development of the new management and commercial fishing regimes in the Pacific. His studies cast fresh light on how technology, law, governmental actions, and global trade relationships have shaped the fate of the Pacific fisheries, and how the area's resource regimes continue to change.

He has been documenting just how the resurgence of Japan's distant-water fisheries, in an era marked by rapid technological innovation and advances in ocean fisheries research, has interacted with the expansion (and then the relative decline) of the California-based American distant-water tuna fishery and the tuna industries more generally. General MacArthur's occupation policies, as Scheiber shows, marked the beginnings of Japan's revival as the world's leading fishing nation; and the subsequent record of Japanese-U.S. relationships has been deeply influenced by American foreign trade policies, particularly with regard to tuna imports.

Scheiber argues that the record since the 1940s of subsidies, cartelization, and coordinated marketing strategy of Japan, on the one side, and the responses of the U.S. government to global economic change as well as political pressures, on the other, has set in place the current institutional and policy framework of U.S.-Japanese economic relations. Against this background, he has also examined the impact of Pacific region rivalries on the Law of the Sea negotiations of the last two decades.

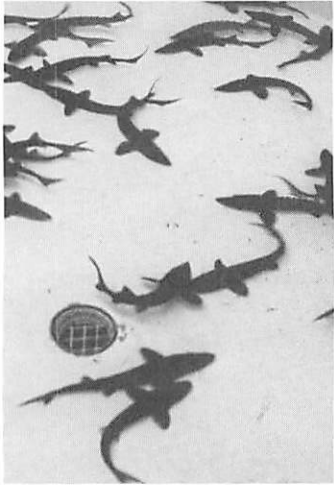
Scheiber and his associates have produced a number of publications on these themes that are of interest to policy officials and resource managers, as well as to scholars specializing in Pacific Rim relations. Some of his work has examined the effectiveness of scientific advising in California State ocean policy development.

With support from California Sea Grant and other funding sources, Scheiber and associates at the School of Law, UC Berkeley, will be hosting a conference of specialists from the U.S., Canada, Japan, and Korea on "Japan, the United States, and Pacific Resources." The papers will be published by the *Ecology Law Quarterly*.

"A new regionalism is emerging in Pacific Rim ocean management," Scheiber says, "and this conference will examine the vital issues that this new regime has raised." Canadian-Japanese-U.S. relations before and after the formation of the Exclusive Economic Zone (EEZ); the Antarctic and its future; and emergence of the new South Pacific regime for fisheries will be considered.

General MacArthur's occupation policies . . . marked the beginnings of Japan's revival as the world's leading fishing nation

Sturgeon—An Aquaculture Success Story



It has a snout only a mother could love, but gourmets the world over extol its caviar and the flavor of its firm flesh. The sturgeon is an ancient animal. It is also a giant, commonly weighing 400 pounds, and it may live more than 100 years. Many species are freshwater fish. But some, like the white and green sturgeons of the Pacific Coast, are anadromous, leaving the ocean and bays to spawn in freshwater streams. Once, in the late 1800s, the U.S. was the world's second largest producer of caviar, but sturgeon stocks were soon destroyed by overfishing and habitat destruction.

Serious efforts are being made to domesticate sturgeon, and some believe that sturgeon farming will be among California's biggest aquaculture success stories. The effort is spurred by the product's value: steaks can sell for \$8 a pound or more.

Sturgeon aquaculture in California began in 1977 when a group of UC Davis researchers, participating in a newly established aquaculture program, decided to develop a prototype sturgeon hatchery. The work was supported by California Sea Grant, the Fish and Wildlife Service, the National Marine Fisheries Service, and the Department of Agriculture, and done in cooperation with the Department of Fish and Game and several private aquaculturists.

With fishermen's help, the scientists captured ripe, wild sturgeon, which they were able to maintain successfully in captivity and to induce to spawn at the Davis facility. Several hundred of the resulting "fingerlings" were kept for growth studies, but many thousands were released to replenish natural stocks or given to hatchery programs. During the following years, with support from California Sea Grant,* a large interdisciplinary group of scientists investigated the animal's reproduction, nutrition, physiology, and disease. Aquaculturists became interested in the sturgeon, adopting techniques developed by the project.

California presently has 12 sturgeon hatcheries and 10 growers. Hatcheries routinely spawn domestically raised males, but they must still capture mature females (which in nature take 15 to 20 years to mature). Bringing cultured females to maturity is now a top priority of industry.

Information on the hatchery technology developed through efforts by UC Davis researchers and cooperating commercial growers will soon be available in a manual prepared by Fred Conte, Extension Aquaculture Specialist, in collaboration with Serge Doroshov and other Davis colleagues, with support from the U.S. Fish and Wildlife Service.

Developing a cost-effective commercial feed and efficient feeding strategy remains essential for successful farming; Silas Hung of UC Davis is conducting research on macro-nutrient requirements and optimum feeding rates when the fish is raised at different temperatures.

California aquaculturists are now marketing fingerling sturgeon to other growers in the U.S. and Europe and to the aquarium trade, and the fish is being planted in lakes for recreational fishing. With the increase in 8- to 12-pound inventories, a test market for food-sized fish has been expanded into "white tablecloth" restaurants in Sacramento, San Francisco, and the East. Demand is described as tremendous.

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*Project leaders have been Joseph J. Cech, Jr., Wallis H. Clark, Jr., Serge I. Doroshov, and Graham A. E. Gall.

Nature's Amazing Diving Machines

They can dive rapidly to depths more than twice the height of the Empire State Building, so deep that pressure is 90 times that at sea level. They can stay under for as long as half an hour, returning to the surface to "catch their breath" for only 2 to 4 minutes between dives. As more is learned about them, the elephant seals off California's coast are astonishing scientists with their incredible behaviors.

Early research on elephant seals at UC Santa Cruz, supported by California Sea Grant, was sparked by the mystery of where the animals went after leaving the beaches in the spring. "We were trying to determine the impact of marine mammals on commercial fisheries," says project leader Daniel Costa. "We were intrigued that only a tenth of the elephant seals observed on the beaches later showed up in aerial surveys of the ocean. We wanted to know where they went and what they were up to."

With Burney LeBoeuf and Anthony Huntley, Costa began tracking the mammals, using recoverable depth recorders. The scientists were able to glue the devices to females, which leave the beaches a month after weaning their pups in order to feed in the open ocean for 10 weeks. Then they come back to the rookery to molt.

What the researchers found when they examined the recorders of returning females was astounding. The animals had routinely plunged to more than 1,000 feet and occasionally exceeded 2,800 feet—the deepest range recorded for any pinniped. And they were under water 85% of the time—which explained why they had been so hard to observe from the air.

The scientists are not sure what the animals are doing at such great depths. Since the evidence suggests that females eat an average of 440 pounds a day during this period, it's probable that they feed on deep-dwelling prey, such as squid. Another possibility is that at these depths they can avoid their major predator, the great white shark. They may also sleep or lower their body temperature; energy conservation could be important to females that are recovering from giving birth and nursing their young.

Understanding the habits of elephant seals is important to resource managers from around the Pacific Basin who are interested in interactions between marine mammals and fisheries. The UCSC scientists believe that the work may also one day have important spin-offs for deep-sea divers and tunnel drillers.

"We don't know how elephant seals are able to move from low to high pressures so rapidly, how they are able to withstand high pressures, or why their tissues don't build up an 'oxygen debt' during their deep dives," says Costa. "There is still a lot to learn about these remarkable mammals."

They can dive rapidly to depths more than twice the height of the Empire State Building, so deep that pressure is 90 times that at sea level.



Biotechnology is one of California's and the nation's most dynamic young industries....

Developing New Products from Marine Organisms

Scientific advances often follow unpredictable paths. One example is the work of Daniel E. Morse and his associates at UC Santa Barbara on the reproduction and growth of red abalones. Who could have predicted that research on shellfish would lead to the discovery of compounds that may one day be used for treating human nervous disorders?

For some years California Sea Grant had supported Morse's highly successful research on abalone reproduction. Morse had found, among other things, that abalone could be made to produce eggs by adding a small amount of the hormone prostaglandin to the surrounding seawater. Later, he discovered that hydrogen peroxide causes production of prostaglandin, and thus also stimulates spawning.

But inducing spawning solved only a part of the challenge in abalone reproduction. A second problem was controlling the high mortality rate of larvae. Morse found that the free-swimming larvae are normally stimulated by chemical compounds in specific red seaweed to settle down and get on with their lives—that is, to undergo metamorphosis to their non-mobile juvenile form. He was later able to isolate these compounds and found that the most powerful was a simple amino acid known as GABA (for gamma-amino-butyric acid). GABA has proved to be a safe and efficient way for aquaculturists to bring about rapid metamorphosis in shellfish, with high survival rates.

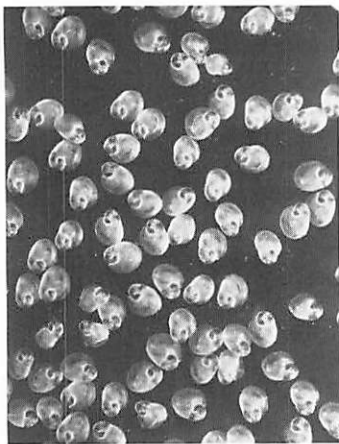
Morse's work has been used to improve the production of more than 15 different kinds of abalone and more than 20 different commercially valuable molluscs, including oysters and mussels, both in the United States and abroad. Intriguingly, research on GABA also led Morse into the realm of human nervous disorders.

GABA is known to control the transmission of impulses between nearly half the nerve cells in the human brain and spinal cord. In fact, many of the drugs prescribed for control of convulsions, sleep, psychological disorders, and other functions of the central nervous system affect GABA receptors and sites of uptake in the brain. Presently available drugs, however, often produce undesirable side effects or lack needed specificity. So discovery of specific new GABA-like compounds would be a boon for medical diagnosis and therapy.

Morse found that, in addition to red seaweeds, certain marine bacteria also create compounds that mimic the action of GABA. With Sea Grant support, he has identified mutant strains of the bacteria and seaweeds that produce particularly high levels of these novel compounds and has set about chemically purifying them.

The pharmaceutical potential of GABA-related compounds from marine algae has excited the participation of three biotechnology firms in this project, which also receives matching support from the State's Biotechnology Research and Education Program.

Biotechnology is one of California's and the nation's most dynamic young industries, and Dr. Morse, who heads the new Marine Biotechnology Center at UCSB, feels confident that the development of new products from marine organisms will make an important contribution to this fast-growing industrial sector.



Responding to Offshore Oil Development

The upsurge in oil exploration and drilling in the Santa Barbara Channel and Santa Maria Basin during the 1980s heightened public concern over air and water quality, aesthetics, and effects on marine life. In addition, at least one group became fearful of impact on its livelihood: commercial fishermen.

The oil industry argues that harvesting both energy and living resources from the sea is compatible, but fishermen have worried about the effects of drilling operations, including loss of fishing grounds, disruption to their activities, and water pollution.

Other concerns have focused on seismic survey ships, which discharge blasts of compressed air into the ocean from which geologists learn about rock strata beneath the seafloor. Fishing boats must yield right of way to survey ships, and they must take care to avoid the 2-mile long cable that the ships tow beneath the surface, recording vibrations from the blast. The cable can damage crab pots and other gear, tangle with troll lines from salmon vessels, or damage the nets of boats trawling for rockfish. Fishermen have been fearful, too, that blasting would drive fish away from traditional grounds or injure vulnerable eggs and larvae.

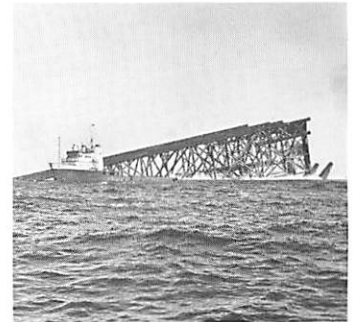
Believing that many conflicts could be avoided if the two industries began communicating, John Richards, Marine Advisor for the South/Central region, began organizing conferences between the groups in the early 1980s. In 1983, he introduced the idea of using professional mediators to help negotiate solutions. Also, in concert with the Mediation Institute and a number of federal and state agencies, he helped to organize a Joint Oil/Fisheries Committee, through which the industries could share information and identify topics where research was needed.

He also initiated an *Oil and Gas Project Newsletter for Fishermen and Offshore Operators*,* which has a distribution of nearly 900 and receives financial support from a number of fisheries groups, the offshore oil industry, and from Santa Barbara and San Luis Obispo counties. The newsletter receives high marks. The executive director of the Pacific Coast Federation of Fishermen's Associations advised concerned citizens of Washington State that newsletters of this type be established wherever offshore oil development is present or proposed. "In the Santa Barbara Channel, one of the greatest aids fishermen and geophysical contractors have in eliminating conflicts is the *Oil and Gas Newsletter*," he said.

Biliana Cicin-Sain of UC Santa Barbara has been looking at the impact of offshore development on local communities and their governments. She observes that "the crux of the policy dilemma posed by increased offshore oil development is that the benefits from oil production tend to be distributed nationally, while the costs tend to be concentrated locally."

Meanwhile, researchers at UC Berkeley and UC Santa Barbara have been investigating the capsizing of drilling platforms and methods for evaluating platform safety. And a USC scientist has been studying corrosion fatigue in the welded joints of platforms and other structures. A new UCSB project will seek ways of assessing the resistance of platforms to vessel collision, probably the greatest cause of offshore accidents.

*Co-edited by Carrie Culver and Debbie Haberland.



Los Angeles Times photo

"...the crux of the policy dilemma posed by increased offshore oil development is that the benefits from oil production tend to be distributed nationally, while the costs tend to be concentrated locally."

Exploring Sea Life for Potential Drugs

Since 1977, scientists from the University of California have been searching for potential new drugs from marine algae and invertebrate animals, with support from California Sea Grant. Members of the marine chemistry and pharmacology program have collected organisms in the Pacific Ocean and the Caribbean Sea, extracted promising compounds, and brought them home for extensive and refined tests of biological activity. These compounds can then be developed by the pharmaceutical industry and others to provide new medicinal products.

The scientists are working closely with industry on several potential pharmaceuticals, one of the most exciting of which is a new class of compounds, called pseudopterosins, from a Caribbean soft coral. The compounds were discovered and identified by chemist William H. Fenical of UCSD's Scripps Institution of Oceanography and Robert S. Jacobs of UC Santa Barbara. Pseudopterosins have been shown both to reduce inflammation and to eliminate pain and thus may one day be used to treat arthritis, psoriasis, and other inflammatory ailments.

The University of California has obtained patents on the pseudopterosins, and the National Institutes of Health is funding several chemists who are attempting to synthesize them. Fenical and Jacobs are continuing to study the drugs' "mechanism of action" (that is, the precise chemical pathways by which they act in the body). This research is particularly exciting since the compounds have unique structures and behave in novel ways. The scientists are also working closely with three pharmaceutical companies to further test the medical potential of these compounds.

Chemist D. John Faulkner, also of Scripps, has been working with Jacobs on a compound called manoalide, originally extracted from a Pacific sponge, and another potential drug for fighting inflammation and skin diseases. The compound's potent anti-inflammatory activity has been confirmed by an industrial collaborator, which is now evaluating the toxicity of the compound prior to an eventual test on human skin diseases. In addition, some 40 analogs—that is, compounds having the same vital functions or groups—have been isolated. Manoalide, which the University of California has also patented, has become one of the most important "lead" compounds in the field of inflammation.

Phillip Crews of UC Santa Cruz, whose work on natural products chemistry is also supported by Sea Grant, is working on a number of compounds collected from sponges that show promising tumor- and parasite-fighting activity.

"Nature is so much more creative than we," says Fenical, "and the marine world is still so largely unexplored, that we're very excited about the possibilities of obtaining many useful substances from the sea."



"Nature is so much more creative than we, and the marine world is still so largely unexplored, that we're very excited about the possibilities of obtaining many useful substances from the sea."

Shallow Water Diving Accidents

Ocean swimmers may associate diving accidents with plunges from rocks or piers, not with the "shallow" dive that some people use when running into the surf. But University of Southern California geologist Robert Osborne, his trainee, and colleagues have looked into the locations and frequencies of shallow-water diving accidents at Southern California beaches, and last summer they issued an advisory:

"Shallow-water diving accidents from beaches can cause severe injuries," Osborne said. "We have data showing that these accidents have resulted in death in some cases and in paralysis (both paraplegia and quadriplegia, due to spinal injuries) in others."

The accidents usually occur when a person runs seaward and then makes a "shallow" dive under a wave. The dive may transport the person to a depth of over three feet. If his head should strike the gently sloping seafloor or the face of a sandbar, the impact of the still-moving body against the head and neck may cause serious injury.

The researchers, who were funded by the USC Sea Grant Program, found some common characteristics among accidents at Southern California beaches over the past 11 years. Most victims are young men; for the 125 accidents studied, 86% of the victims were male. Also, the beaches with the highest accident rates are those facing south to southwest, and the peak accident time is July and August, the months of greatest beach usage.

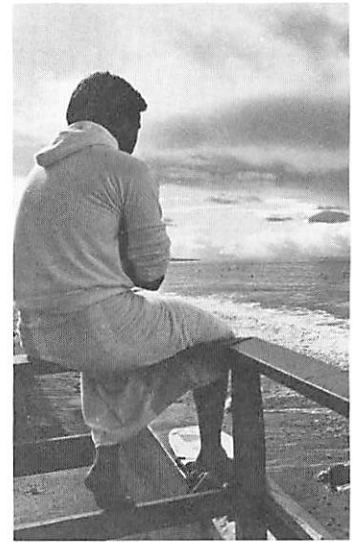
Osborne notes that the difference in accident rate between males and females is no accident. "We conducted a survey at several beaches last summer to find out whether people were aware of the hazards of these dives," he says. "We asked people how they enter the water. Nine times out of 10, women will duck down and get themselves wet before walking further, up to their waist, to swim. Teenage and adult males are more likely to enter the water by making shallow dives under oncoming waves."

To obtain these results, the investigators pored over accident reports made by lifeguards from beaches under the jurisdiction of several cities and counties in Southern California. In all, data were analyzed from 125 accidents occurring at 14 beaches between 1976 and 1986.

The conditions of the victims of those accidents included 3 deaths, 9 quadriplegics, 14 paraplegics, and 12 other "very serious" injuries. Osborne cautions that these data do not tell the whole story. Accident reports that did not describe how the victim entered the water were not used. Also, the victim's condition was reported at the time of removal from the beaches; information on later condition often was not available.

Osborne was assisted by Carley Ward, a biomechanics expert from Biodynamics/Engineering Inc., and C. D. Porterfield, a communications authority from the University of Texas at San Antonio.

The researchers are now studying ways to increase public awareness of the danger, mostly through education. They hope this will lead to a reduction in accidents and in the great human costs associated with them.



Los Angeles Times Photo

"We have data showing that these accidents have resulted in death in some cases and in paralysis . . . in others."

Predicting Sea Level Extremes

The coastlines of the world have been described as a battleground between the land and the inexorable ocean forces of winds, waves, tides, and sea level. And, in virtually all regions of the world, the coasts must lose during times of sea level rise. Today they are in relentless retreat.

In California, all of the thousand-mile shoreline is subject to erosion. Beaches in the southern part of the state are in a delicate balance, victims of river damming and of the construction of seawalls, jetties, and other coastal structures, but beneficiaries of massive harbor dredging works and other projects designed to nourish them.

Storms cause the most serious erosion of beaches and sea cliffs. During one storm in the disastrous winter of 1982-83, a section of slowly eroding sea cliff at Santa Cruz suddenly collapsed, losing 46 feet. Such episodic cliff failures are common throughout the State.

Reinhard Flick of the California Department of Boating and Waterways and Daniel Cayan of UCSD's Scripps Institution of Oceanography and their Sea Grant trainee have been evaluating some of the factors that lie behind California's destructive episodes of coastal flooding and erosion. In particular, they have been analyzing the oceanographic and meteorological factors that contributed to the extremely high sea levels that marked the stormy winter of 1982-83, with the aim of forecasting such extreme conditions a few days in advance.

Far and away the largest contributor to sea level fluctuation in California is high tides, which are predictable if not controllable. Of the record 8.35-foot sea level recorded in San Diego on January 27, 1983, high tides alone accounted for 7.6 feet.

But there were other factors contributing to sea level that winter. The warm ocean waters that characterized the El Niño, a recurring Pacific-wide weather disturbance, increased sea level at San Diego by as much as 6 inches in 1983—and twice that at San Francisco.

In addition, the El Niño conditions generated particularly vigorous North Pacific storms that were much farther south than usual, lashing hundreds of miles of California coast. Flick and Cayan have found that the low barometric pressures and winds associated with these storms also raised sea level anywhere from 2 to 7 inches at San Diego. The storms' unusually strong winds, spread over thousands of miles of the North Pacific, generated extremely high and destructive waves as well.

This coincidence of factors spelled disaster: At the end of the storm season, property destruction along California's coast exceeded \$100 million.

All of this was made worse by the accumulation of a continuing global rise in sea level that has averaged about 6 inches a century on the West Coast. Many scientists believe that the rate of rise may increase to double or even sixfold, possibly as a result of global warming. Sea level rise is both misunderstood and exaggerated as a component of the erosion problem, at least in the short run, Flick believes. "On the scale of 20 to 100 years—that is, the lifetimes of people and engineering projects—the mean sea level increase in California is not that significant," he says. "The shorter and much more intense effects of peak tides, storms, and extreme waves are much more destructive to the California coast."



In California, all of the thousand-mile shoreline is subject to erosion.

Protecting California's Endangered Wetlands

In a major mitigation project, the Port of Los Angeles has agreed to restore tidal flushing to Carlsbad's Batiquitos Lagoon. The project was proposed by the port as compensation for wetlands that will be destroyed as a result of its construction in San Pedro Harbor.

Behind the port's actions lie State and Federal law requiring local governments and private developers to make up for significant environmental damage by creating or improving habitats to closely resemble those they destroy. The policy is controversial; even among supporters there is widespread concern about whether mitigation will remain possible because of the diminishing number of sites available for restoration.

Beyond this issue looms the larger one of how well mitigation actually works. Do restored or artificially created wetlands function like natural ones? Can they survive, or are they merely ephemeral solutions to legal dilemmas? Joy B. Zedler of San Diego State University, her trainees, and associated staff are examining whether created wetlands can support native populations of plants and animals and maintain nutrient dynamics, and whether they can survive floods and droughts.

The project grows out of her previous Sea Grant studies of the coastal wetlands of Southern California, particularly Tijuana Estuary and the San Diego River Marsh. There she has shown, for example, that the rare episodes of droughts and flooding that characterize Southern California wetlands actually determine plant distribution and that the structure of California's coastal marshes can be explained only by understanding a system's history of tidal action and freshwater flow, including reservoir discharge and wastewater release. By demonstrating that even a single major change in water flow can have lasting impacts on wetlands, she has enlarged management focus to the whole watershed. Her work has substantially improved regional planning, and is being applied to Goleta Slough, Ballona Wetland, Los Peñasquitos Lagoon, and Santa Clara Estuary.

According to Zedler, standards for judging the likely success of proposed mitigation projects are needed. Thus, she is developing a set of standards (a protocol) to determine how well artificial salt marshes duplicate natural functions.

In another project on wetlands functioning, Thomas G. Dickert of UC Berkeley looked at how urbanization, agricultural development, and forestry practices in upland watersheds affect estuaries. Earlier work by Christopher Onuf, then at UC Santa Barbara, and his colleagues focused on the effects of storms, particularly sedimentation, on plants and animals at Mugu Lagoon, which is relatively undisturbed and can serve as a yardstick for more modified systems.

"For a decade now, California Sea Grant has been the most important sponsor of coastal wetland research in Southern California," Zedler says. "Findings from several coastal water bodies have helped shape management plans and assess environmental impacts of activities along the coast, as well as in adjacent ecosystems and the upstream watersheds. Information exchange between scientists and managers has been especially effective because of the practical orientation of research projects."



Union-Tribune Publishing Co.

"For a decade now, California Sea Grant has been the most important sponsor of coastal wetland research in Southern California."

Exploring the Seafloor with RUM III

Just as unmanned spacecraft are probing the distant planets of our solar system, so unmanned underwater vehicles will soon permit oceanographers to safely explore the deepest and most hostile environments of the sea without risk to human life.

An unmanned submersible called RUM III (for Remote Underwater Manipulator), designed and built with partial funding from California Sea Grant, is allowing scientists to investigate regions of the ocean floor that are relatively easy to see with cameras and sonar, but difficult to sample directly. Capable of working to depths of about 20,000 feet, RUM III can not only map the seafloor but also take biological samples and collect fairly heavy rocks or sediment cores.

Developed by Victor C. Anderson and his associates at UCSD's Scripps Institution of Oceanography, the submersible successfully passed field tests in the deep waters halfway between San Clemente and Catalina Island this summer, and next year will be used to survey deposits of manganese nodules south of Hawaii.

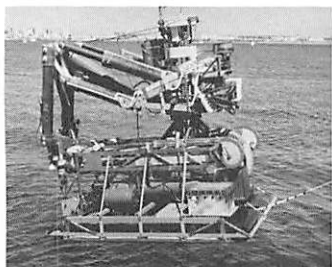
RUM III is a "remotely operated vehicle." That is, it is powered and computer-controlled from the research ship to which it is tethered by a coaxial cable. It therefore requires no life-support systems and can work in deep waters for extended periods.

The vehicle is compact—the size of a small car—and is constructed primarily of titanium, fiberglass, and plastic, all substances that can withstand the highly corrosive action of saltwater. It consists of a main chassis, or underbody, mounted by a turret to which are attached TV booms and cameras, sonar instruments, thrusters, and a manipulator boom with a "hand" and "wrist" for coring, lifting samples, and placing instruments.

RUM III may be towed from one position to another by its cable, or it can crawl along the bottom for shorter distances on the two smooth conveyor-belt tracks that cover the entire underbody. To move the vehicle significant distances, it is lifted off the bottom by the cable and propelled with the aid of thrusters. An added plus, says Anderson, is that RUM III is virtually pollution-free because it uses seawater as both hydraulic fluid and lubricator.

With its wide range of uses—mapping, coring, investigating spreading centers and deep sea vents, surveying minerals and biological communities, and placing and recovering instruments—RUM III represents exactly the kind of technological advance called for recently in a national symposium on the U.S. Exclusive Economic Zone. "We will need all kinds of new technologies for mapping, monitoring, sampling, and exploring if we are going to explore the resources of our coastal oceans," Anderson agrees.

Looking to the future, Anderson is exploring the feasibility of obtaining geothermal power from the energetic hot water vents called "black smokers" found along spreading zones on the seafloor. "The notion of obtaining power from hydrothermal vents at first sounds farfetched," he says. "But the numbers work, and the cold, remote, deep seafloor environment is an almost ideal one for a thermal energy conversion unit."



SIO photo

"We will need all kinds of new technologies for mapping, monitoring, sampling, and exploring if we are going to explore the resources of our coastal oceans."

Sea Grant Traineeships—A Commitment to the Future

Virtually all of the research projects supported by Sea Grant involve at least one student trainee, who works alongside the project's leader while completing a marine-science-related degree. Over the years, this program has become a major source of scientific and management talent: since its inception, the California Sea Grant College Program (CSGCP) alone has supported nearly 600 graduate students in fields as diverse as oceanography, ecology, engineering, geology, law, and food science and technology.

In a 1987 survey of those former trainees who had completed their educations, 125 respondents answered questions about the impact of the traineeship on their subsequent careers. The survey showed that more than half of the respondents (57%) had, as trainees, obtained doctorates, and 42% master's degrees. The greatest number of degrees were in the biological sciences and oceanography, but a wide variety of other fields were reported.

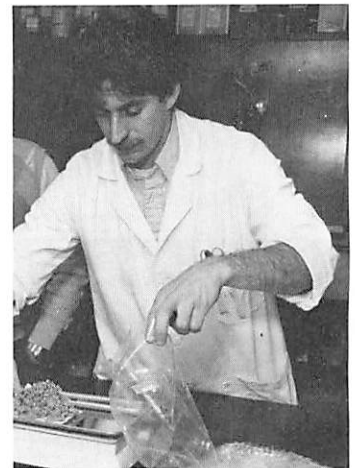
Not surprisingly, the largest percentage of respondents (46%) is in faculty or research positions at colleges and universities, teaching the next generation of scientists and conducting research on fundamental issues with broad scientific and social implications. The next largest group (36%) has entered private industry, and another 18% is working in the public sector.

The executive director of the Monterey Bay Aquarium Foundation is a former trainee, as are the director of the Sea World Research Institute and the manager of the Ballona Wetland Project.

Former trainees are staff scientists at Eli Lilly and Company, the Salk Institute, the Battelle Marine Research Laboratory, NASA's Jet Propulsion Laboratory, and the Smithsonian Environmental Research Center. They are post-doctoral research associates at the National Cancer Institute and the Brain and Cognitive Sciences Department at MIT. And they serve in administrative capacities in the California Department of Health Services, the U.S. Department of Agriculture, and the National Institutes of Health. One is a senior engineer for Chevron; another supervises 41 geologists as a division head for Amoco Production Company.

A former trainee is senior oceanographer with the Instituto de Investigaciones Eléctricas in Cuernavaca, Mexico; another is an associate scientist with the International Institute of Tropical Agriculture in Ibadan, Nigeria; and a third, a statistical consultant for the Forest Research Institute in East Malaysia, where he assesses traditional fishing methods in mangrove forests. Most have stayed closer to home (60% in California). They work for the California Coastal Commission, for the State Water Quality Control Board, and for the California Department of Fish and Game.

In their questionnaires, they speak of the relevance of their traineeship, a full 80% reporting that their present work is directly related to their Sea Grant experience. Commented one Sea Grant director, "We're especially pleased with the effectiveness of our trainees in providing industry with the latest scientific and technical developments."



In a 1987 survey of former trainees, respondents answered questions about the impact of the traineeship on their subsequent careers.

Sea Grant Activities in Education

As part of its commitment to public understanding of marine issues, California Sea Grant supports ocean education programs at five university-based institutions: Humboldt State University, the Moss Landing Marine Laboratories, UC Santa Cruz, UC Santa Barbara, and the Aquarium-Museum at UCSD's Scripps Institution of Oceanography. Through workshops, displays, and outreach activities, these programs educate students and the public about California's marine resources.

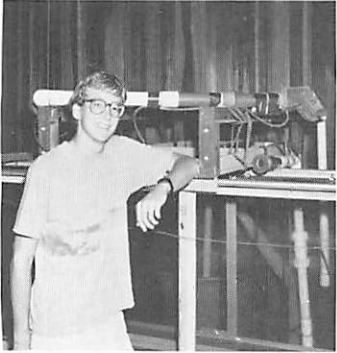
Teachers are a primary focus of these programs, and meetings designed for them strive to integrate practical classroom activities with current scientific information. Recent teacher workshops and conferences have been organized around a variety of themes, including: "Perspectives in Santa Barbara Oil Development"; "Sharks"; "The Oceans and the Economy of San Diego"; and "The Geology of Monterey Bay." Some conferences, such as those for elementary teachers at Humboldt State, have lead to development of comprehensive curriculum materials.

USC Sea Grant has been very active in marine education. Its widely disseminated bilingual curriculum guides, "Wet and Wild," include multidisciplinary lesson plans on the Physical Ocean, the Biological Ocean, the Economic Sea, Research, Ocean Management, and Marine Ecology.

California Sea Grant also provides a four-year college scholarship each year to a high school senior who shows particular interest and aptitude in marine science as demonstrated in a science fair project. Of the four winners of this "John D. Isaacs Memorial Sea Grant Scholarship" since 1984, one, Steen G. Trump, a graduate of McKinleyville High School, is studying at UC Santa Cruz. Three others are presently at Stanford University. They are Mwenda Kudumu, a graduate of Gompers Secondary School, San Diego; Michael Topolovac of Torrey Pines H.S. in Del Mar; and James T. Randerson of Pt. Loma High School, San Diego.

An educational experience of a very different kind is provided by the National Sea Grant Fellowship Program. Each year Sea Grant programs around the nation nominate graduate students for an extraordinary year-long fellowship in the nation's capital. The fellowship matches graduate students who have demonstrated interest both in ocean policy and marine science with government "hosts" in Washington, D.C., including government agencies and Congressional committees. The California Sea Grant College Program and USC Sea Grant have been honored to have ten nominees selected as fellows between 1982 and 1987. They are Robert H. Diebel (from Humboldt State University); Victoria J. Fabry (UC Santa Barbara); Justin Lancaster (UCSD's Scripps Institution of Oceanography); Daniel W. Smith (UC Santa Barbara); Keith R. Criddle (University of California, Davis); and Pablo Arenas (University of Washington and Scripps). The USC Sea Grant fellows have been: Patience Whitten, Jeanne Grasso, Jill Zucker, and Jennifer Smith.

In 1987, the California Sea Grant College Program initiated a California State Internship Program modeled on the national program. Craig Denisoff, who is completing a master's in Public Administration at San Francisco State University, was named the first intern and is presently working with the California legislature's Joint Committee on Fisheries and Aquaculture and the Senate Natural Resources Committee.



SIO photo

In 1987, the California Sea Grant College Program initiated a California State Internship Program modeled on the national program.

Providing Outreach Through Marine Advisory Services

California Sea Grant's Marine Extension Program

Duncan McMartin
Program Director
Sea Grant Extension Program
University of California
Davis, CA 95616
(916) 752-1306

Marine Advisors

Del Norte and Curry Counties

James Waldvogel
Del Norte County
Courthouse Annex
981 H Street
Crescent City, CA 95531
(707) 464-4711

Jim Waldvogel has been active in salmonid enhancement projects. He is now in the eighth year of a decade-long study of chinook salmon spawning on a tributary of the Smith River that will aid State agencies in establishing spawning escapement objectives. He has also been involved in identifying ocean-related recreational opportunities that could be important in promoting "off-season" tourism in Northern California, and has participated in comprehensive Sea Grant management studies of the ports of Gold Beach, Brookings, Eureka, and Crescent City, which provided technical advice and direction for future development of these ports. Waldvogel produces the newsletter "Curry Currents."

Humboldt and Mendocino Counties

Christopher Toole
Foot of Commercial Street
Eureka, CA 95501
(707) 443-8369

Chris Toole has initiated test fisheries in Northern California for such species as rock crab, spot prawns, and octopus. He wrote the initial proposal for a program that is now providing \$900,000 in low-interest loans for California fishermen to help them improve fuel efficiency on their vessels, and he has participated in at-sea experiments to document the efficiency of new bottom paints and hydrodynamically designed trawl doors. He is presently testing optimal methods for holding live Dungeness crabs, and generating computerized analyses of water- and meat-quality samples for Humboldt Bay oyster growers. Toole started a popular education project in which Humboldt school children raise steelhead in their classrooms. He is also serving on the offshore oil advisory committee of the Humboldt County Board of Supervisors. Toole, who produces a supplement to the "MAP Newsletter" called "North Coast Currents," has recently been assigned to cover Mendocino County in addition to Humboldt. He has summarized observations from a 1987 study trip to

Japan in a recently published report on mollusc and salmonid aquaculture and fisheries activities.

Marin and Sonoma Counties

Bruce Wyatt
2604 Ventura Avenue, Room 100-P
Santa Rosa, CA 95401
(707) 527-2621

Bruce Wyatt has been working with Cooperative Extension specialists to find new marketing approaches for herring and albacore, such as jointly promoting Sonoma County wine and seafood. He has completed a similar project on Pacific Whiting, a potentially valuable but underutilized species, developing three new whiting-in-sauce products and identifying ways of marketing them. Wyatt is also concerned about the utilization of seafood wastes and is exploring the potential for composted fish processing waste and investigating waste sea urchin shells as fertilizer for coastal forage and food crops. With Advisor Chris Toole, he organized the first four California Salmon and Steelhead Restoration Conferences, which continue today under the sponsorship of a federation of enhancement groups. He produces a quarterly newsletter, "The Norwester."

San Francisco Bay Counties

Connie Ryan
P.O. Box 34066
San Francisco, CA 94134
(415) 586-4115

Connie Ryan served on the Cooperative Extension Water Policy Task Force, the goal of which was to provide State and local leaders with information on water policy issues. She also chaired a session of a conference on water policy for county supervisors from all areas of the State and helped to organize a tour for community leaders of water use in the San Francisco Bay area. She and Advisor Ed Melvin have been active in increasing the awareness of Vietnamese-speaking fishermen about safety practices. Recently she completed a safety videotape in Vietnamese that is being used throughout the State and is available nationally. She has also worked with Advisor John Richards and fishermen and government agencies to identify alternative gear for nearshore gillnet fishermen, who have lost significant fishing areas as a result of regulations designed to protect marine mammals and birds.

Monterey and Santa Cruz Counties

Edward Melvin
Moss Landing Marine Laboratories
7711 Sandholdt Road
Moss Landing, CA 95039
(408) 633-2092

Ed Melvin is working with Specialist Robert Price to develop techniques for handling fresh and frozen albacore tuna for noncannery products. This follows on a similar project by the two to improve handling of salmon by

California's commercial fishermen. Melvin has helped to resolve gear conflicts between gillnetters and trawlers in his area and written a curriculum for Vietnamese-speaking fishermen on marine electronics and navigation that was utilized in making a safety video for this group. He has been active in wetland restoration projects and serves on an advisory committee (of which he was formerly chairman) that advises the California Department of Fish and Game on conduct of research and education programs, as well as area land management, in the Elkhorn Slough National Estuarine Research Reserve.

San Luis Obispo, Santa Barbara, and Ventura Counties

John Richards
377 Storke Road
Goleta, CA 93117-2949
(805) 968-2149

John Richards has been active in resolving conflicts between fishermen and offshore oil developers, and also worked with Advisor Connie Ryan on identifying alternative gear for nearshore gillnet fishermen. He helped to establish and continues to advise the Fisheries/Offshore Oil Joint Committee and publishes the "Oil and Gas Newsletter." Mariculture, particularly of shellfish, is increasing in the area, and Richards is working to increase cooperation between commercial fishermen and mariculture operators. Richards has recently helped to establish the Channel Islands Marine Education Consortium, a cooperative project of Santa Barbara and Ventura County educators, the Santa Barbara Museum of Natural History, and the Channel Islands National Marine Sanctuary office, whose aim will be to improve awareness by teachers and community members of the marine environment.

San Diego, Los Angeles, and Orange Counties

Leigh Taylor Johnson
5555 Overland Avenue, Bldg. 4
San Diego, CA 92123
(619) 694-2845

Leigh Taylor Johnson has completed a survey of marina managers and harbor masters to learn their education and research needs. Johnson is also interested in the issue of onboard handling and packaging procedures for sport-caught albacore on commercial passenger fishing vessels; she recently conducted onboard research and extensive interviews with 200 recreational anglers on their fish-handling and utilization practices. She has presented tax and financial management seminars for commercial fishermen, and is working with Specialist Chris Dewees on a videotape for the National Marine Fisheries Service on the new South Pacific Tuna Treaty. Johnson is also developing a publication and slide show for high school students and guidance counselors on ocean-related careers. She produces a newsletter called "Tidelines."

Marine Specialists

Chris Dewees
Marine Fisheries Specialist

University of California
Davis, CA 95616
(916) 752-1497

Chris Dewees, California Sea Grant's Marine Fisheries Specialist, has been studying the modernization of California's fisheries. In one project, he identified those factors that cause commercial fishermen to adopt or reject new technologies. And he is leading a statewide project aimed at evaluating fuel-saving alternatives for commercial fishing vessels—for example, self-polishing bottom paints and proper propeller design. He has also been working on strategies to increase recreational fishermen's use of underutilized species such as mackerel. Dewees has studied at firsthand the early impacts of New Zealand's Individual Transferable Quota (ITQ) fishery management system, a large-scale effort by that nation to assign property rights for marine fish to fishermen, and he is providing results of his study nationally to a wide variety of industry and agency groups. He is producing a videotape for fishermen on the new South Pacific Tuna Treaty and publishes the "Marine Advisory Program Newsletter."

Robert J. Price
Food Science and Technology Specialist
University of California
Davis, CA 95616
(916) 752-2193

California's seafood industry is large and diverse, with an estimated 134 seafood processing and wholesale plants. Food Science and Technology Specialist Robert Price works with fishermen, processors, and retailers to improve the quality of seafood products available to the consumer. For example, he participates in a continuing series of workshops for processors on sanitation, quality control, and freezing technology. He also works with retailers and institutional buyers on a range of concerns, from designing facilities to identifying good quality seafood. He is also developing guidelines for commercial and recreational fishermen on optimal handling and chilling of fresh-caught tuna to ensure that the fish that reaches the dock is as fresh and wholesome as possible.

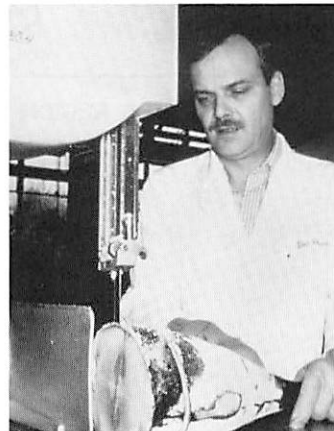
Fred S. Conte
Aquaculture Specialist
University of California
Davis, California 95616
(916) 752-7490

Aquaculture Specialist Fred Conte, who publishes the "California Aquaculture Newsletter," has worked closely with California State legislators and agencies to develop legislation important to the aquaculture industry. One of Conte's areas of concentration has been regulations relating to shellfish sanitation. And, as a member of the State Aquaculture Disease Committee, he has worked with a number of groups to identify significant aquatic disease outbreaks, develop protocol to control infected sites, and relay information about the disease to industry members. He has also been involved in increasing public knowledge about paralytic shellfish poisoning (PSP) and establishing an effective early warning system.

USC Sea Grant Marine Advisory Services

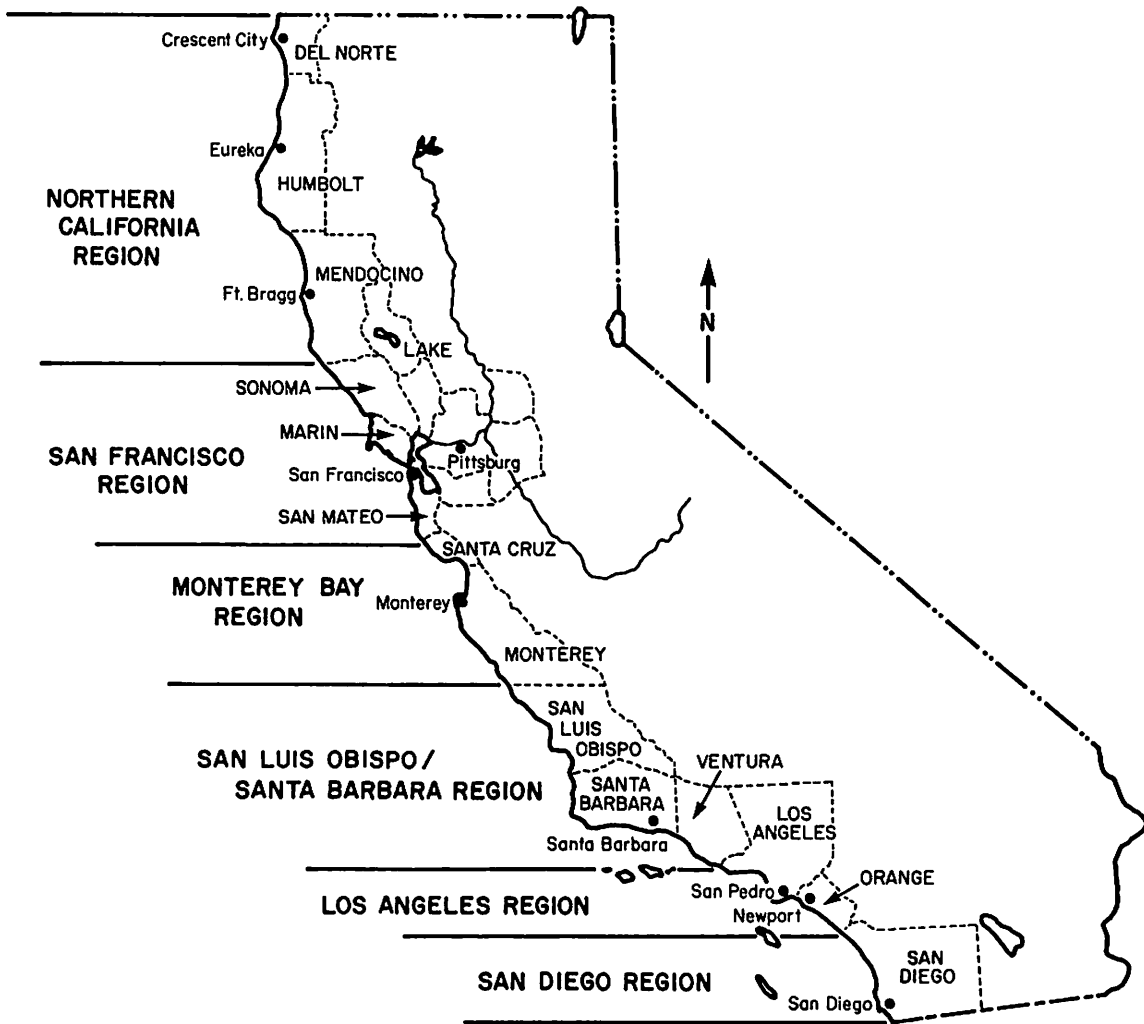
James A. Fawcett
Coastal Planning/Port Management Specialist
820 South Seaside
Terminal Island, CA 90731
(213) 743-4236

Marine Advisory Services at USC Sea Grant have concentrated on seaport management, marine recreation, and marine education, with program emphasis influenced strongly by the urban character of Southern California. The program has sponsored three major conferences designed to identify the research needs of large and small maritime ports and non-maritime ports. A fourth conference explored the demand for services at the ports of Los Angeles and Long Beach. As part of its marine education effort, the project has developed a bilingual K-12 marine curriculum, "Wet and Wild," that has been widely distributed to Southern California school districts. The program has also published a pocket guide to Los Angeles area beaches, and is developing a beach safety film for secondary school students, using the results of the study on shallow-water diving accidents.



*Food Science and
Technology Specialist
Robert Price works with
fishermen, processors, and
retailers to improve the
quality of seafood
products available to the
consumer.*

California Sea Grant Benefit Regions



NORTHERN CALIFORNIA REGION

Humboldt State University

- R/F-72 Vital Statistics of the Female Stock of Dungeness Crab (*Cancer magister*) in Northern California (Hankin, 1980-83)
- R/F-77 Artificial Imprinting of Chinook and Coho Salmon in a Multispecies Hatchery (Hassler, 1981-83)
- R/NP-1-11F The Effects of Environmental Factors on the Ability of Chemical Cues to Trigger Settlement and Metamorphoses of Bivalve Larvae (Shaw, 1982-83)
- R/A-55 Spore Release in Two Species of *Porphyra* (Rasmussen, 1982-83)
- R/NP-1-12L Histology and Ultrastructure of the "Jellied" Condition in Dover Sole, *Microstomus pacificus* (Hendrickson, 1982-83)
- R/F-89 Ecology and Possible Causes of the "Jellied" Condition in Dover Sole, *Microstomus pacificus* (Hendrickson/Fritzsche, 1983-84)
- R/NP-1-13A Chinook Salmon Spawning Behavior (Hankin, 1983-84)
- R/NP-1-13E An Investigation of the Physiological Cause of Parr Reversion in Coho Salmon (*Oncorhynchus nerka*) (Kerstetter, 1983-84)
- R/F-103 Chinook Salmon Spawning Behavior (Hankin, 1984-85)
- R/NP-1-13K Natural Setting of Purple-hinged Rock Scallop, *Hiniites multirugosus* in Northern California (Shaw, 1983-85)
- R/F-104 Stunting in Coho Salmon: An Investigation of Apparent Abnormalities in Ion Regulation (Kerstetter, 1985-87)
- R/F-105 *Ceratomyxa shasta*: Geographic and Seasonal Distribution, Salmon Strain Susceptibility, and Transmission (Hendrickson 1985-87)

SAN FRANCISCO REGION

Bodega Marine Laboratory/University of California, Davis

- R/F-68 Seafood Science and Technology: Modified Atmosphere Storage (Brown, 1980-83)
- R/MA-4 Analysis of Industrial Organization of Commercial Pacific Marine Fishery Markets (Garoyan, 1980-83)
- R/MA-16 Chinook Salmon Abundance in California (Botsford, 1980-84)
- R/F-76 Genetic Structure of Coho Salmon Populations on the Pacific Coast (Gall/Utter, 1981-83)
- R/A-45 Aquatic Animal Production (Clark/Conklin, 1981-84)
- R/A-47 Variation in Intracellular pH and Its Effect on Hatchability of the Brine Shrimp *Artemia salina* (Crowe, 1981-84)
- R/NP-1-12A An Economic Analysis of Hatchery and Commercial Production of Sturgeon (Logan, 1982-83)
- R/NP-1-12C Stock Assessment in Aggregating Fisheries (Mangel/Plant, 1982-83)
- R/NP-1-12D Freezing Induced Changes in Fish Tissue (Reid, 1982-83)
- R/F-82 Genetic Analysis of Spatial and Temporal Structure in Anchovy Populations (Hedgecock, 1982-84)
- R/F-83 Effect of Modified Atmospheres on the Potential of *Clostridium botulinum* Growth at Low Temperatures (Genigeorgis, 1982-84)
- R/NP-1-13C Seafood Science: Basic Understanding of Technological Problems and Their Solution (Ogrydziak, 1983-84)
- R/NP-1-13G Detection of Infectious Stage of the Parasite Causing Proliferative Kidney Disease in Pacific Salmon (Hedrick, 1983-84)
- R/MA-20 Comparative Study of Dungeness Crab Fisheries (Botsford, 1983-85)

*Five-year listing; by institution of first-listed project leader.

- R/A-58 Evaluation of Protective Antigens of *Aeromonas salmonicida* (Hedrick, 1983-85)
- R/F-87 Contributions of Coho and Chinook Spawning Populations to Mixed Fisheries: A Management Study (Gall, 1983-86)
- R/F-90 Establishment of Parameters Critical to Sturgeon Management in the Pacific Northwest (Doroshov, 1983-85)
- R/F-95 Freezing Induced Changes in Fish Tissue (Reid, 1983-85)
- R/F-96 Genetic Improvement of a Chitinase-Producing Microorganism (Ogrydziak, 1983-85)
- R/NP-1-14B Relationships Among Ploidy, Success of Eyed-Larval Settlement and Early Growth in the Pacific Oyster (Hedgecock, 1984-85)
- R/F-98 Genetic Analysis of Anchovy and Sardine Populations in the California Current System (Hedgecock, 1984-86)
- R/F-99 Quantitative Evaluation of *Clostridium botulinum* Growth Risk in Seafood Stored at Low Temperatures under Modified Atmospheres (Genigeorgis, 1984-86)
- R/F-100 Kidney Diseases of Pacific Salmon (Hedrick, 1984-87)
- R/A-61 Reproduction and Growth in Crustacean Aquaculture (Chang, 1984-87)
- R/A-62 Cryopreservation of Crustacean Gametes (Crowe, 1984-87)
- R/OT-13 Ocean Wave Induced Effective Stresses in an Elasto-Plastic Seafloor (Shen, 1985-86)
- R/A-65 Development of Pacific Oyster Broodstock (Hedgecock, 1985-87)
- R/F-110 The Effects of Freezing and Frozen Storage on the Status of Fish Tissue (Reid, 1985-87)
- R/F-109 New Methods in Stock Abundance Estimation (Mangel, 1985-88)
- R/MA-27 Forecasting Commercial Passenger Fishing Vessel Angler Participation (Johnston/Wilen, 1986-88)
- R/A-67 Determination of Optimum Dietary Protein, Lipid, and Carbohydrate Levels of Hatchery Produced Juvenile Sturgeon (Hung, 1986-89)

California State University, Hayward

- R/NP-1/16C Western Regional Conference on Comparative Endocrinology (Tullis, 1986-87)

University of California, Berkeley

- R/CZ-57 Planning Methods for California's Coastal Wetland Watersheds: A Composite Report (Dickert, 1980-83)
- R/MA-13 Law, Ecology, and Economic Change: The California Fisheries, 1850-1980 (Scheiber, 1981-83)
- R/F-78 Endocrine Control of Salmonid Development and Seawater Adaptation (Bern/Nicoll, 1981-84)
- R/OT-11 Development of a Methodology for the Design of an Offshore Oil Production Platform on the Alaskan Arctic Ocean Continental Shelf (Gerwick, 1983-85)
- R/CZ-68 Development of a Remote Sensing-Aided Procedure for Water Quality Monitoring (Colwell/Knight, 1983-85)
- R/MA-25 The California Fisheries and Ocean Policy: State and Federal Dimensions, 1945-1985 (Scheiber, 1984-85)
- R/NP-1-14D Wave Groups in Surface Gravity Waves (Sobey, 1984-85)
- R/F-101 Endocrine Control of Salmonid and Seawater Adaptation (Bern/Nicoll, 1984-87)
- R/MP-36 Molecular Probes for Improving Marine Algal Polysaccharide Quality (Laetsch, 1985-87)
- R/MP-35 Insect Control Agents from Marine Organisms (Kubo, 1985-87)
- R/OE-1 Evaluating the Fatigue Behavior of High Strength Reinforced and/or Prestressed Concrete, Both Normal-weight and Light-weight, Under Marine Conditions (Gerwick/Hester, 1986-87)
- R/MA-28 The U.S., Japan, and the Pacific Fisheries: Economic Relations, Diplomacy and Ocean Law, 1945-85 (Scheiber, 1986-87)
- R/CZ-70 Wave Groups in Surface Gravity Waves (Sobey, 1984-86)
- R/OE-2 Stability of Submarine Pipelines Against Breakout Failure (Foda, 1986-88)

MONTEREY BAY REGION

Moss Landing Marine Laboratories (Administered by San Jose State University; a consortium of six California State University campuses: Fresno, Hayward, Sacramento, San Francisco, San Jose, and Stanislaus.

- R/F-84 Age Determination and Confirmation in Large Pelagic Fishes (Sharks and Billfish) from Californian and Hawaiian Waters (Cailliet, 1982-83)
- R/CZ-63 Use of the Nimbus-7 CZCS to Evaluate Circulation and Productivity Processes Along the Central California Coast (Austin/Broenkow, 1982-84)
- R/F-81 Age Verification and the Application of Aging Techniques to Emerging Elasmobranch Fisheries (Cailliet, 1982-84)
- R/NP-1-13D Age Determination and Verification of Native and Cultured White Sturgeon in San Francisco Bay (Cailliet, 1983-84)
- A/S-2 Tag Return Analysis of California Sturgeons and Elasmobranchs: Technique Verification and Transfer (Cailliet, 1985-86)

University of California, Santa Cruz

- R/MP-24 Marine Chemistry and Pharmacology Program: Natural Products from Toxic Marine Organisms (Crews, 1980-83)
- R/A-53 Seaweed Mariculture for the Herring Eggs-on-Seaweed Fishery (Moser/Hansen, 1982-84)
- R/MA-22 An Assessment of Shoreline Protection Measures Along the Central California Coast (Griggs 1982-84)
- R/F-92 Assessment of the Impact of the California Sea Lion and Elephant Seal on Commercial Fisheries (Costa, 1983-86)
- R/MP-33 Marine Chemistry and Pharmacology Program, Phase II: Natural Products from Toxic Marine Organisms (Crews, 1983-86)
- R/F-108 Schooling Behavior of Anchovies (Norris, 1985-87)
- R/MP-41 Marine Natural Products in Pharmacology: Development of Leads from Marine Animals (Crews, 1986-89)

SAN LUIS OBISPO/SANTA BARBARA REGION

University of California, Santa Barbara

- R/A-43 Biochemical Engineering for Improved Production of Commercially Valuable Marine Shellfish (Morse, 1980-83)
- R/F-67 Improving Efficiency of Commercial Shellfishing by Analysis of Bait and Trap Functions (Case, 1980-83)
- R/MP-21 Marine Chemistry and Pharmacology Program: Pharmacological Screening and Evaluation (Jacobs, 1980-83)
- R/F-75 Effect of Nemertean Egg Predators on the Dungeness Crab Fishery (Kuris, 1981-84)
- R/NP-1-11H Exploring Conflicts Between Offshore Oil Development and Commercial Fishing in California (Mann, 1982-83)
- R/A-54 Vegetative Propagation of Commercially Important Benthic Algae (Gibor, 1982-84)
- R/MA-18 United States-Mexico Relations on Fishery Policy: Focus on Pacific Coast Fisheries (Cicin-Sain, 1982-84)
- R/CZ-64 Phytoplankton Dynamics in Eutrophic Coastal Waters (Smith, 1982-85)
- R/A-51 Genetic Engineering: Modern Technology Applied to Improvements in Molluscan Aquaculture (Morse, 1982-85)
- R/NP-1-12M Chemoreceptive Behavior and Physiology in the California Spiny Lobster, *Panulirus interruptus* (Case, 1983)
- R/NP-1-13F Mariculture of Red Algae: Heterotrophy? (Hansen/Arnold, 1983-84)
- R/NP-1-12N Biological Control of Nuisance Algae and Enhancement of Aquacultural Productivity (Holmes, 1982-84)

- R/NP-1-12J Radioactivity at Sea: Marine Science and the Development of Pollution Abatement Policy: A Study in U.S. History of Science, 1946-1972 (Badash, 1983-84)
- R/OT-10 The Geology and Structure of the Southern Hosgri Fault Zone Offshore California: A 3-D View Using Computer Color Graphics (Luyendyk, 1983-85)
- R/MP-31 Marine Chemistry and Pharmacology Program, Phase II: Pharmacological Screening and Evaluation (Jacobs, 1983-86)
- R/NP-1-14A Domestication and Genetic Improvements of *Sargassum* Species (Gibor, 1984-85)
- R/NP-1-14C Capsizing of Semi-Submersible Platforms (Armand, 1984-85)
- R/NP-1-14F New Challenges Ahead in Managing Santa Barbara Channel Resources (Cicin-Sain, 1984-85)
- R/MA-23 Containerization in the California Maritime Transportation Industry: 1958-1980 (Pursell, 1984-86)
- R/F-AL Brood Mortality and Egg Predation in King Crab Fisheries (Wickham/Kuris, 1984-85)
- R/OT-15 Structure of the Hosgri Fault Zone at Depth: A High Resolution View and Computer Graphics Models (Luyendyk, 1985-86)
- R/OT-12 Capsizing of Semi-Submersible Platforms (Armand, 1984-87)
- R/OT-14 Time-Domain Analysis of Large Motions of Offshore Platforms (Webster/Paulling, 1985-87)
- R/MP-37 GABA-Mimetic Peptides from Marine Algae and Bacteria: A New Class of Potential Diagnostic and Therapeutic Agents (Morse, 1985-88)
- R/MP-38 Marine Chemistry and Pharmacology: Pharmacological Screening and Evaluation (Jacobs, 1986-89)

LOS ANGELES REGION

California State University, Long Beach

- R/A-56 *In Vitro* Cultivation of Marine Crustacean and Molluscan Cells (Kingsford, 1983-85)

University of California, Irvine

- R/A-48 Culture of Marine Bivalves: Nutritional Role of Dissolved Organic Solutes (Stephens, 1981-84)
- R/A-60 Culture of Marine Bivalves: Utilization of Dissolved Amino Acids (Stephens, 1984-87)

University of California, Los Angeles

- R/A-57 Nutrient Uptake by Fish Intestine (Diamond, 1983-85)
- R/A-63 Absorption of Nutrients by Fish (Diamond, 1985-87)

University of California, Riverside

- R/A-46 Development of Procedures for Artificial Insemination and Sperm Storage in Lobsters (Talbot, 1981-84)
- R/A-59 Control of Reproduction in Crustaceans (Talbot, 1984-87)

University of Southern California

- R/MA-14 Legal Analysis of Multispecies Fishery Management: The Pacific Groundfish Plan (Smith, 1982-83)
- R/EQ-24 Nitrogen Transformations Associated with the Discharge of the Terminal Island Treatment Plant (Dugdale/Kiefer/Dugdale, 1980-83)
- R/EQ-28 Microbially Mediated Entry of Pollutants into Marine Food Webs (Sullivan/Taylor/Iturriaga/Manahan, 1981-84)
- R/RD-14 Aspects of the Biology of the Sea Cucumber *Parastichopus parvimensis* (Kastendiek/Muscat, 1981-83)
- R/CE-7 Wave Uplift Pressures on Horizontal Platforms (Lee/Wellford, 1981-83)
- R/RD-13 Factors Affecting the Survival of Nearshore Larval Fishes (Brewer/Kleppel, 1981-84)
- R/CM-20 Capital Development Decision-Making by Ports . . . the Rediscovery of Coal (Price, 1982-83)

- R/RD-16 Food Availability, Feeding, and the Potential Competition for Food Between Larval Northern Anchovies and Adult Copepods (Pieper/Kleppel, 1982-83)
- R/CM-22 Scientific Information and the Valuation of Ecological Resources in Coastal Wetlands (Wingo, 1982-84)
- R/EQ-31 Problems of Paralytic Shellfish Poisoning (Abbott/Ross/Siger, 1982-85)
- R/RD-19 A Time Series of Satellite Thermal Imagery and Its Use (Kleppel, 1983-84)
- R/RD-20 Economic Analysis for Management of the California Northern Anchovy Fishery (Spulber, 1983-84)
- R/CM-26 Fees for Service at Seaports: Pricing Approaches, Federal User Fees, and Public Policy Issues (Price/Kenyon/Bryan, 1983-84)
- R/CM-27 California's Coastal Population: Transition and Development (Van Arsdol, 1983-84)
- R/CE-8 Corrosion Fatigue of Weldments in Offshore Structures (Todd, 1983-86)
- R/RD-26 Origin and Distribution of Enigmatic Upper Slope Depressions (Gorsline/Douglas, 1984-85)
- R/CM-29 Population Policies in California's Coastal Zone (Van Arsdol/Koss, 1984-85)
- R/CM-30 Smaller Seaports: An Examination of Selected Attributes and Trends (Price, 1984-85)
- R/RD-27 Nutritional Implications of Dissolved Organic Material for Culturing Oysters (Manahan, 1984-87)
- R/EQ-40 Physical and Chemical Oceanographic Variability in the Region Near White's Point Outfall (Jones/Bratkovich/Dickey/Kleppel/Iturriaga, 1984-87)
- R/CM-38 Determinants of Seaport Viability in the Local Economy (Price/Gordon/West, 1985-86)
- R/CM-34 Shallow-Water Diving Accidents at Southern California Beaches (Osborne/Ward/Orphan/Porterfield, 1985-87)
- R/RD-29 Optimizing Mercuric Iodide Detector Systems for Oceanographic Research (Warburton/Singh/Dabrowski, 1985-88)
- R/RD-30 Growth and Chemical Composition of Ecotypes of the Giant Kelp (Kremer/Zimmerman, 1985-88)
- R/RD-34 Electrochemical Studies of Cathodically Protected Marine Structures (Todd/Mansfeld, 1986-87)
- R/RD-31 Diet, Reproduction, and the Contribution of the Copepod *Acartia tonsa* to the Coastal Marine Foodweb (Kleppel, 1986-88)

SAN DIEGO REGION

San Diego State University

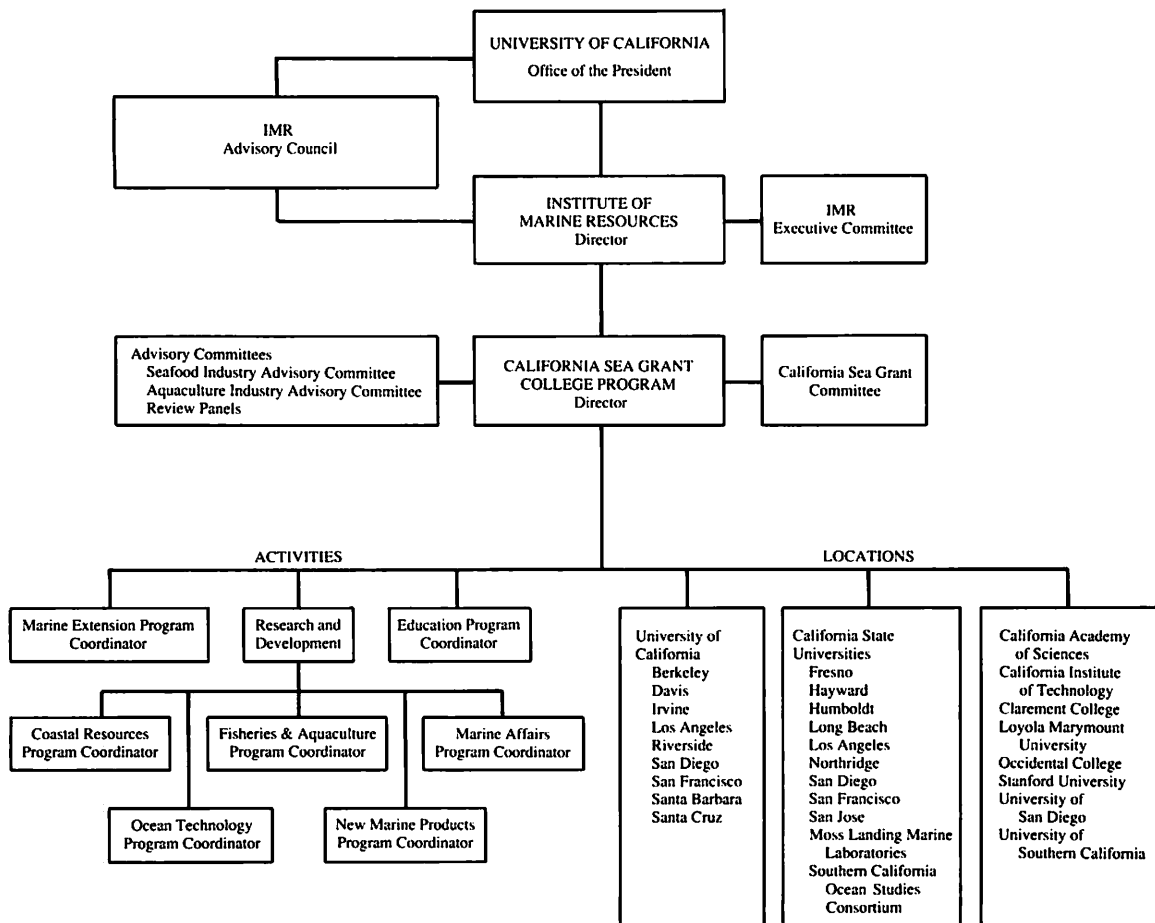
- R/CZ-65 Study of Feasibility of Using Geofibers and Geofabrics in Coastal and Offshore Fills (Noorany, 1982-83)
- R/NP-1-12B The Economic Impact of California's Ports and Harbors: A Preliminary Input-Output Analysis (King, 1982-83)
- R/MA-17 Revision and Development of Update Procedure for the 1980 California Interindustry Fishery Model (King, 1982-83)
- R/A-52 Particle Size Limitations in Osmotic Infiltration Techniques for Immunization of Shrimp (Steenbergen, 1982-84)
- R/NP-1-11J Vitamin and Mineral Methods Development and Standardization for Assessing the Nutritional Value of Cooked Fish (Josephson/Spindler 1982-84)
- R/NP-1-13B The Impact of Hydrological Modifications on Estuarine Ecosystems (Zedler, 1983-84)
- R/F-93 Enzymatic Degradation of Material from Shellfish Processing (Zyskind, 1983-86)
- R/CZ-72 Liquefaction Susceptibility of Fiber-Reinforced Coastal and Offshore Fills (Noorany 1984-85)
- R/NP-1-14G The Economic Consequences of Lost Commercial Fisheries: A Case Study of the U.S. Tuna Industry (King, 1984-85)
- R/MA-24 Benefit/Cost Valuations in a Multispecies Ecosystem: Implications for Management of the Southern Sea Otter (Hageman, 1984-85)
- R/CZ-73 Modified Watershed Hydrology: Effects on Estuarine Ecosystems (Zedler, 1984-87)
- R/CZ-79 Maintenance of Entrance Channels of Coastal Lagoons and River Mouths (Chang/Stow, 1986-89)

University of California, San Diego

- R/MP-22 Marine Chemistry and Pharmacology Program: Chemical Studies of Tropical Marine Algae and Coelenterates (Fenical, 1980-83)
- R/MP-23 Marine Chemistry and Pharmacology Program: Chemistry of Sponges and Opisthobranch Molluscs (Faulkner, 1980-83)
- R/CZ-59 Kelp Bed Physical Oceanography (Jackson/Winant, 1980-83)
- R/MA-2 Management of Multispecies Systems: The Pacific Whiting Example (Goodman, 1980-83)
- R/F-73 Evaluation of the Experimental Abalone Enhancement Program (Tegner, 1981-83)
- R/OT-6 Design of a Seafloor Work System (Anderson, 1981-84)
- R/OT-8 Design of a Towed Electromagnetic Prospecting System (Cox/Chave, 1982-83)
- R/NP-1-12F El Niño Effects on Kelp Forest Communities (Tegner, 1982-83)
- R/NP-1-12G A Study of the Effect of the 1983 El Niño on the California Current (McGowan, 1982-83)
- R/MP-28 Natural Marine Products that Regulate Mineral and Bone Metabolism (Deftos, 1982-85)
- A/S-1 Scientific Liaison, Joint Research Planning, and Information Exchange Among Alta California, Baja California, and Gulf of California Marine Scientists (Hemingway, 1983-85)
- R/F-86 The Effects of Climate and Weather on Albacore Migration and Distribution in the Northeastern Pacific (Lasker, 1983-86)
- R/MP-30 Marine Chemistry and Pharmacology Program, Phase II: Metabolites from Marine Invertebrates (Faulkner, 1983-86)
- R/MP-32 Marine Chemistry and Pharmacology Program, Phase II: Chemical Studies of Tropical Marine Algae and Coelenterates (Fenical, 1983-86)
- R/CZ-69 Coastal Engineering Implications of Trends and Fluctuations in California Coastal Sea Level (Flick, 1984-85)
- R/NP-1-14E Nearshore Sediment Transport Monograph (Seymour, 1984-85)
- R/F-102 Biochemical Indices of Activity in the Northern Anchovy, *Engraulis mordax* (Somero, 1984-87)
- R/NP-1-15C Aging in Fishes: A New Technique Based on Age Pigments (Lipofuscin) (Vetter, 1985-86)
- R/NP-1-15D Abalone Larval Transplants as an Approach to Stock Enhancement (Tegner, 1985-86)
- R/CZ-74 Prediction of Coastal Stratus and Fog (Vallis, 1985-86)
- R/F-106 Larval Feeding and Year-Class Strength of the Northern Anchovy, *Engraulis mordax* (Huntley/Lasker, 1985-87)
- R/F-107 Estimation of Larval Fish Starvation Rates in the Sea with Application to Northern Anchovy Larvae (Benson, 1985-87)
- R/NP-1-16A Symposium on Biological Treatment of Wastewater (Huntley, 1986-87)
- R/NP-1-16B Ocean Policy Program (Revelle, 1986-87)
- R/CZ-76 Study of Extreme Coastal Sea Level (Cayan/Flick, 1986-88)
- R/OE-3 Numerical Bathymetry in Shallow Water (Seymour, 1986-88)
- R/OE-4 Acoustic Doppler System for Directional Wave Measurements (Lowe/Guza, 1986-88)
- R/F-111 Correlation Between the Whiting Fishery and the Biomass of Whiting Food (Mullin, 1986-88)
- R/MP-39 Marine Chemistry and Pharmacology Program: Development of New Drug Leads from Marine Plants and Gorgonian Corals (Fenical, 1986-89)
- R/MP-40 Marine Chemistry and Pharmacology Program: Development of New Pharmaceutical Agents from Marine Invertebrates (Faulkner, 1986-89)
- R/CZ-77 Prediction of Nearshore Sediment Transport Using a Model for Fluid-Sediment Coupling (Inman, 1986-89)

California Sea Grant College Program

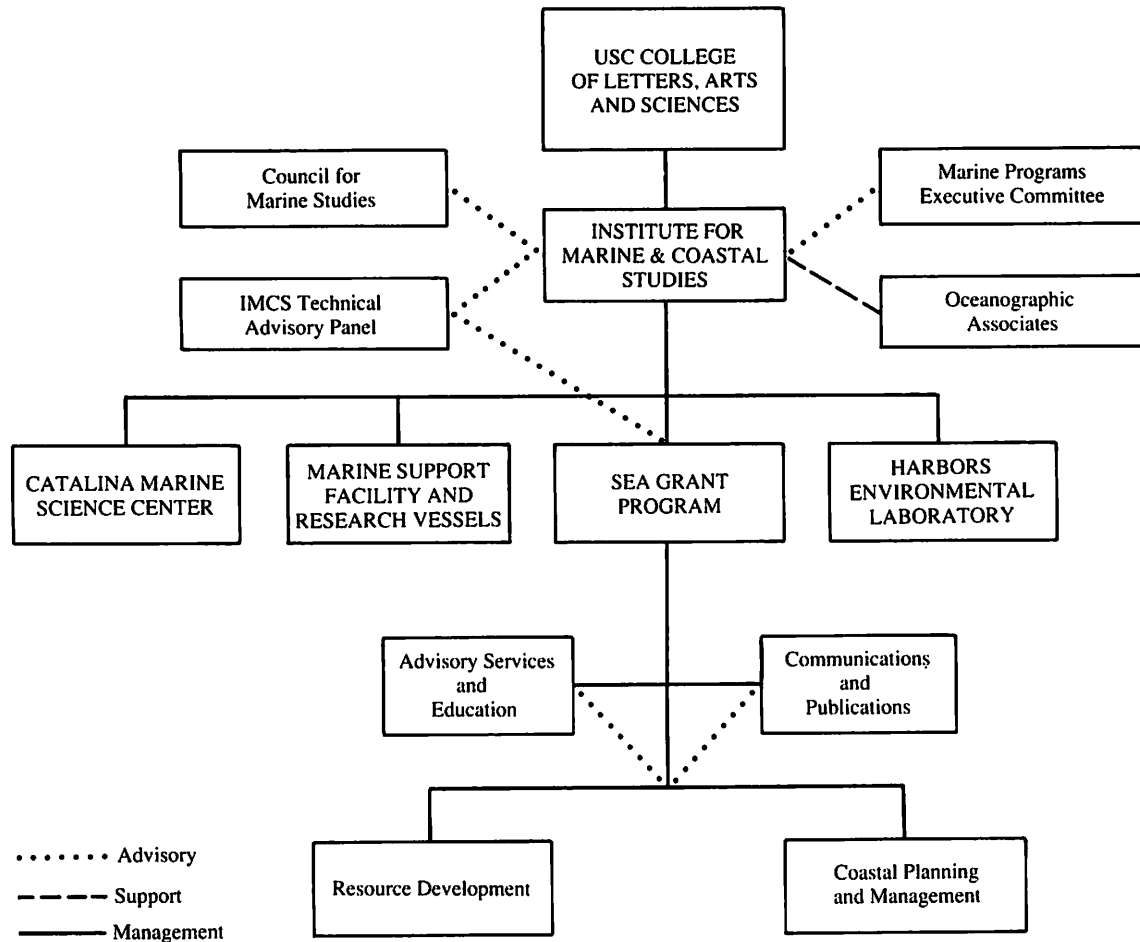
The California Sea Grant College Program is administratively housed in the University of California's Institute of Marine Resources (IMR). The IMR Advisory Council, appointed by the President of the University of California, provides policy guidance to the program. The California Sea Grant Committee, composed of seven members from the University of California, three from the State University and College System, and one from the University of Southern California, advises the program's director on administrative matters and acts as the review committee for the program subject areas. To aid the committee in its policy-making task, a seafood industry advisory committee and an aquaculture industry advisory committee have been established. California Sea Grant's Marine Extension Program is administered through University of California Cooperative Extension.



USC Sea Grant Institutional Program

At the University of Southern California, the Sea Grant Institutional Program is a major component of the Institute for Marine and Coastal Studies (IMCS). The director of IMCS reports to a senior vice president at the university.

USC Sea Grant's interuniversity coordination and review is complemented by a technical advisory panel of representatives from a range of marine perspectives, including related industries, local governments, and universities in the area. The members are a vital link in the project review process. The advisory panel also provides guidance to IMCS management.



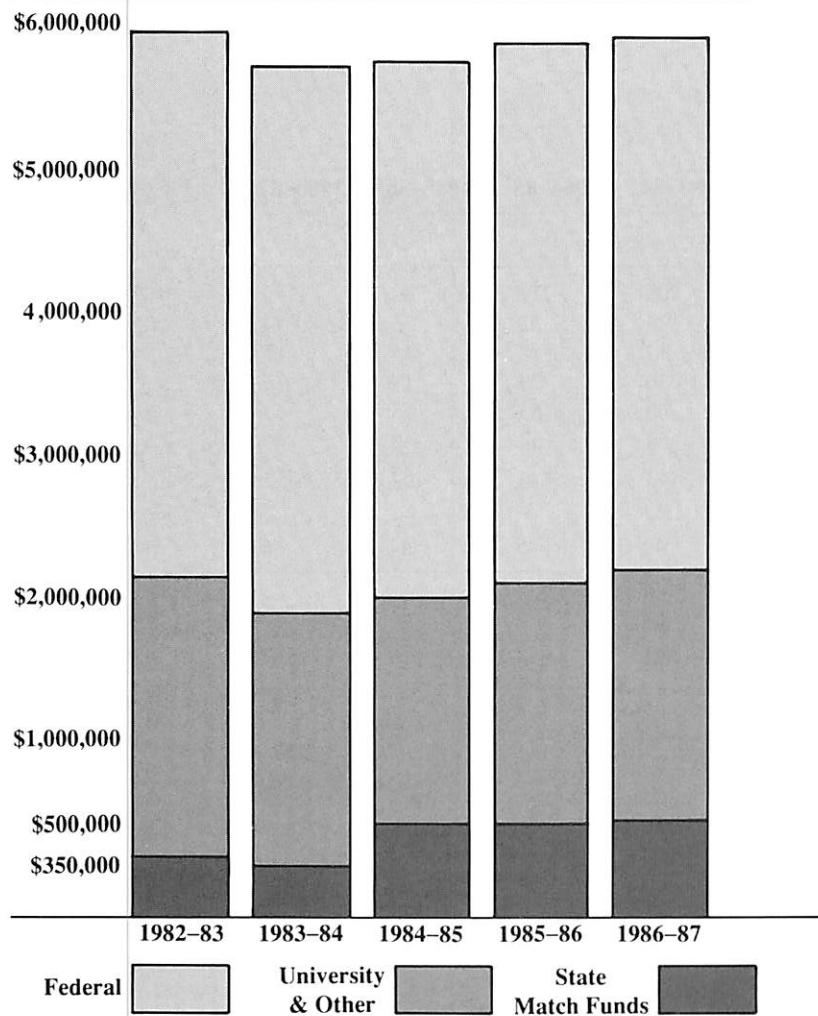
Federal Funds and State Matching Funds.*

| Year | Federal Funds | State Matching Funds |
|---------|---------------|----------------------|
| 1982-83 | \$ 3,766,667 | \$ 387,464 |
| 1983-84 | 3,746,000 | 350,000 |
| 1984-85 | 3,700,000 | 500,000 |
| 1985-86 | 3,809,000 | 500,000 |
| 1986-87 | 3,752,200 | 514,009 |

*California Sea Grant College Program and USC Institutional Sea Grant Program.

Federal, State, Other Match Funding.*

Funding



*These figures have not been adjusted to show the effects of inflation over the period October 1, 1982 to September 30, 1987, nor do they indicate increases in overhead rates, academic salaries, and other items.

Sources of Matching Funds*

| Sources | 1982-83 | 1983-84 | 1984-85 | 1985-86 | 1986-87 | Totals |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Universities and Colleges | \$ 1,432,832 | \$ 1,369,857 | \$ 1,194,704 | \$ 1,198,537 | \$ 1,273,247 | \$ 6,469,177 |
| State Government Departments and Agencies | 136,201 | 45,122 | 43,076 | 90,100 | 58,594 | 373,093 |
| Stull Funds | 387,464 | 350,000 | 500,000 | 500,000 | 514,009 | 2,237,464 |
| Private Industries | 136,400 | 111,799 | 154,015 | 187,298 | 213,904 | 803,416 |
| Public Organizations, Foundations, etc. | 29,560 | 17,150 | 41,017 | 37,246 | 38,220 | 163,193 |
| Totals | \$ 2,122,457 | \$ 1,893,928 | \$ 1,932,812 | \$ 2,013,181 | \$ 2,097,974 | \$10,046,343 |

*California Sea Grant College Program and USC Institutional Sea Grant Program.

Projects and Associated Personnel.*

| | 1982-83 | 1983-84 | 1984-85 | 1985-86 | 1986-87 |
|---------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Individuals | | | | | |
| Faculty & Professional | 166 | 209 | 211 | 202 | 170 |
| Graduate Students | 90 | 73 | 72 | 75 | 74 |
| Undergraduates | 19 | 17 | 18 | 15 | 11 |
| Technicians | 40 | 30 | 23 | 19 | 16 |
| Clerical | 65 | 60 | 55 | 53 | 44 |
| Other | 45 | 54 | 54 | 40 | 40 |
| Total | 425 | 443 | 433 | 404 | 352 |
| Research Projects (No.) | 51 | 46 | 45 | 47 | 46 |
| Research Projects (Av. Size)** | \$39,750 | \$38,691 | \$38,074 | \$35,910 | \$37,167 |

* California Sea Grant College Program and USC Institutional Sea Grant Program.

**Extramural funds.

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For information on these publications or to obtain a complete listing of publications from the California Sea Grant College Program contact: California Sea Grant College Program, A-032, University of California, San Diego, La Jolla, California 92093-0232, (619) 534-4446.

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- Amidei, Rosemary, Editor. 1987. *Educating Fisheries Managers*. No. T-CSGCP-016.
- Amidei, Rosemary, Editor. 1986. *Rockfish: A Focus for Research?* Proceedings of a California Sea Grant Workshop, April 4, 1986, University of California, Davis. No. T-CSGCP-015.
- Hedgecock, Dennis, Editor. 1986. *Identifying Fish Subpopulations*. Proceedings of a California Sea Grant Workshop held January 27, 1984 at Scripps Institution of Oceanography, University of California, San Diego. No. T-CSGCP-013.
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- Anderson, Kelly, Editor. 1985. *Advances in Aquaculture and Fisheries Research*. Report of a California Sea Grant Symposium, May 18-20, 1983. T-CSGCP-010.
- Abbott, Isabella A. and James N. Norris, Editors. 1985. *Taxonomy of Economic Seaweeds, with Reference to Some Pacific and Caribbean Species*. Results of an international workshop sponsored by the California Sea Grant College Program in cooperation with the Pacific Sea Grant College Programs of Alaska, Hawaii, Oregon, and Washington and hosted by the University of Guam, U.S.A., June 15-20, 1984. T-CSGCP-011.
- Amidei, Rosemary, Editor. 1985. *Applications of Remote Sensing to Fisheries and Coastal Resources*. Report of a California Sea Grant Workshop held November 30, 1983 at Scripps Institution of Oceanography, University of California, San Diego. No. T-CSGCP-012.
- Zedler, Joy B. 1984. *Salt Marsh Restoration: A Guidebook for Southern California*. No. T-CSGCP-009.
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- Anderson, Kelly E., Editor. 1983. *California Sea Grant College Program Summary 1981-82*. No. R-012.

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Marine Extension Program

Seafood Processing

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Sanitizers for Food Processing, by Robert Price. 1986. UCSGEP86-12.

Seafood Retailing Manual, Third Edition, by Robert Price. 1985. UCSGMAP85-6

Fisheries

California Squid Fishery, by Christopher Dewees and Robert Price. 1983.

The Fishing Industry and Pacific Coastal Communities: Understanding the Assessment of Economic Impacts, by Hans Radtke, Christopher Dewees, and Frederick Smith. 1987. Produced in cooperation with the Pacific Sea Grant College Program. UCSGMAP-87-1. PSGCP-15.

A Guide to the Commercial Fisheries of Humboldt County by Christopher Toole. 1986.

Marine Electronics Curriculum for Vietnamese Fishermen, by Ed Melvin. 1985.

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Production and Market Development of Pacific Whiting, by Bruce Wyatt, Robert J. Price, and Elizabeth Strange. 1985. UCSGMAP-85-1.

Recommended Procedures for Handling Troll-Caught Salmon, by Edward Melvin, Bruce Wyatt, and Robert Price. 1983.

Safety and Survival at Sea: An Educational Tape for Vietnamese Fishermen, by Constance Ryan, Edward Melvin, and N. Duc. 1987.

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and Vietnamese) (Produced Jointly with the California Department of Fish and Game.) UCSGMAP-2.

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Marine Education

Gyotaku—Japanese Fish Printing, by Christopher Dewees. 1986. UCSGMAP-86-8.

Marine Mammals of California, Third Edition. 1985. By Anita E. Daugherty. (Produced Jointly with the California Department of Fish and Game.) UCSGMAP85-3.

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San Francisco Bay Recreational Opportunities and Climate, Third Edition, by Christopher Dewees, Constance Ryan, and Michael Lau. 1986. UCSGMAP 86-2.

Consumer Information

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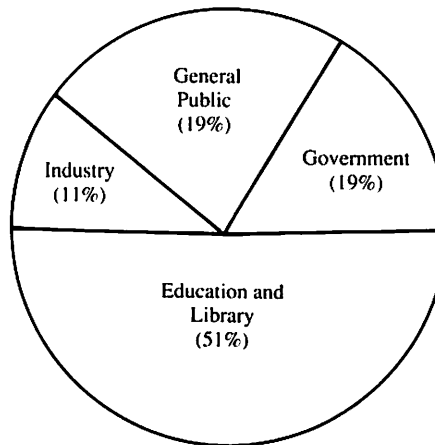
Publication Titles by Subject Area.*

| Subject Areas | Sea Grant Series | Journal Articles | Conference Papers | Theses | Reports | Abstracts | Misc. | Extension Pubs. | Total | Percent |
|---------------------|------------------|------------------|-------------------|-----------|-----------|-----------|-----------|-----------------|------------|-------------|
| Education/Reference | 17 | | | | 1 | | 6 | 4 | 38 | 7% |
| Consumer/Industry | | | | 1 | | | | 15 | 6 | 1% |
| Aquaculture | 2 | 115 | 15 | 7 | 1 | 9 | 2 | | 151 | 27% |
| Coastal Resources | 6 | 36 | 9 | 5 | | 4 | 6 | 1 | 67 | 12% |
| Fisheries | 3 | 118 | 15 | 12 | 6 | 9 | 3 | 15 | 181 | 32% |
| New Marine Products | | 65 | 3 | 3 | | | | | 71 | 13% |
| Ocean Engineering | | 7 | 4 | 6 | 3 | 1 | | | 21 | 4% |
| Marine Affairs | 5 | 8 | 3 | 2 | 3 | | 3 | 1 | 25 | 4% |
| Total | 33 | 349 | 49 | 36 | 14 | 23 | 20 | 36 | 560 | — |
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*California Sea Grant College Program, 1982-87.

Publications Distributed by Audience.*

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*California Sea Grant College Program, 1986-87.

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For information on these publications or to obtain a complete listing of USC Sea Grant publications contact: USC Sea Grant, University Park, Los Angeles, CA 90089-1231, (213) 743-6068.

Annual Reports

Project Directory 1986-87. USCSG-SR-02-86.

Trainee Annual Report 1986-87. USCSG-SR-04-87.

Trainee Annual Report 1985-86. USCSG-SR-03-86.

Annual Report 1985-86. USCSG-SR-03-87.

Annual Report 1984-85. USCSG-SR-01-86.

Marine Advisory Services

Charest, Karen and James Fawcett. 1986. *Pocket Guide to Los Angeles Area Beaches.* No. USCSG-AS-01-86.

Weather to Go Boating: Hints on Coastal Boating in Southern California, Third Edition. USCSG-AS-01-83. (Published in cooperation with the Southern California Boating Safety Advisory Group, National Weather Service, U.S. Coast Guard, and the California Department of Boating and Waterways.)

Marine Education

Wet and Wild: Six Bilingual Supplementary Marine Education Curriculum Guides for Teachers, Grades K-6. 1983. USCSG-ME-01 through 06.

Technical Reports

Osborne, Robert H., Editor. *Shallow-Water Diving Accidents at Southern California Ocean Beaches.*

1987. USCSG-TR-01-87.

Fawcett, James A. and Michael Liffman, Editors.

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Smaller Maritime Ports: A Research Agenda. 1984. Willard T. Price, Robert L. Friedheim and Stuart A. Ross, Editors. Proceedings of a national workshop, Port of Sacramento. USCSG-TR-04-84.

Osborne, Robert H., et al. 1983. *Report of Potential Offshore Sand and Gravel Resources of the Inner Continental Shelf off Southern California.* USCSG-TR-03-84. (Prepared for the Department of Boating and Waterways.)

A Research Agenda For Seaport Management and Related Marine Transportation Issues. 1983. Willard T. Price, Robert L. Friedheim and Stuart Ross, Editors. Proceedings of a national workshop, Port of Los Angeles. USCSG-TR-02-83.



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Conferences and Symposia*

| Meeting | Location |
|--|---------------------------|
| 1982–83 | |
| Pathogens in the Marine Environment, CSGCP* workshop | Washington, D.C. |
| Recent Innovations in Cultivation of Pacific Molluscs, CSGCP symposium | La Jolla, California |
| The Effects of Waste Disposal on Kelp Communities, symposium, CSGCP cosponsor | La Jolla, California |
| Advances in Aquaculture and Fisheries Research, CSGCP symposium | Davis, California |
| International Symposium on Salmonid Reproduction, CSGCP cosponsor | Seattle, Washington |
| Trust Territories of the Pacific Islands Marine Studies, CSGCP workshop | Majuro |
| 1983–84 | |
| Biological Interaction Among Marine Mammals and Commercial Fisheries, CSGCP cosponsor | Anchorage, Alaska |
| Small Boat Fisheries Conference, seminar at Fish Expo '83, CSGCP cosponsor | Seattle, Washington |
| Applications of Remote Sensing to Fisheries and Coastal Resources, CSGCP workshop | La Jolla, California |
| Identifying Fish Sub-Populations, CSGCP workshop | La Jolla, California |
| Blue Water Diving Workshop, CSGCP cosponsor | Moss Landing, California |
| Gordon Research Conference on Marine Natural Products, CSGCP cosponsor | Santa Barbara, California |
| Large Maritime Ports, USC Sea Grant conference | Los Angeles, California |
| Ocean Education for the Public, CSGCP workshop | La Jolla, California |
| Marine Affairs subject area meeting, CSGCP workshop | Berkeley, California |
| Fisheries and Aquaculture subject area meeting, CSGCP workshop | Davis, California |
| Coastal Resources subject area meeting, CSGCP workshop | La Jolla, California |
| Smaller Maritime Ports: A Research Agenda, USC Sea Grant | Sacramento, California |
| Plant Aquaculture subject area meeting, CSGCP workshop | Santa Cruz, California |
| Taxonomy of Economic Seaweeds, CSGCP international workshop | Guam |
| International Symposium on Fertilization, CSGCP cosponsor | Davis, California |
| Trust Territories of the Pacific Islands Marine Studies, CSGCP workshop | Yap |
| 1984–85 | |
| Dungeness Crab Biology and Management Symposium, CSGCP cosponsor | Anchorage, Alaska |
| Ocean Technology subject area meeting, CSGCP workshop | La Jolla, California |
| Conference on Fisheries Management: Issues and Options, CSGCP cosponsor | Anchorage, Alaska |
| Fate and Impact of Marine Debris workshop, CSGCP cosponsor | Honolulu, Hawaii |
| Training workshop for Pacific Sea Grant College Program marine advisors, specialists and communicators, CSGCP and USC Sea Grant cosponsors | Honolulu, Hawaii |

*California Sea Grant College Program (CSGCP) and USC Sea Grant Institutional Program. For reasons of space, the workshops and conferences sponsored by the California Sea Grant Marine Extension Program have not been included; a complete list is available on request.

| Meeting | Location |
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| International King Crab Symposium, CSGCP cosponsor | Anchorage, Alaska |
| Education Needs Assessment meeting, CSGCP workshop | La Jolla, California |
| Aquaculture and Fisheries subject area meeting, CSGCP workshop | Davis, California |
| Offshore Platform Safety, Ocean Technology subject area meeting, CSGCP workshop | Berkeley, California |
| Non-Maritime Port Activities: A Research Agenda, USC Sea Grant cosponsor | Baton Rouge, Louisiana |
| Second International Symposium on Genetics in Aquaculture, CSGCP cosponsor | Davis, California |
| 1985–86 | |
| Sharks: An Inquiry into Biology, Behavior, Fisheries and Use, CSGCP cosponsor | Portland, Oregon |
| Prospects for Domestication and Breeding of Marine Shrimp, CSGCP cosponsor | La Jolla, California |
| Community Impact Analysis Workshop, CSGCP cosponsor | Portland, Oregon |
| Western Groundfish Conference, CSGCP cosponsor | Anchorage, Alaska |
| Options for Marketing and Market Development for Pacific Mackerel meeting, CSGCP cosponsor | San Pedro, California |
| Workshop on Measures to Address Marine Mammal/Fisheries Interactions in California, CSGCP cosponsor | San Francisco, California |
| Educating Fisheries Managers/Rockfish: A Focus for Research? CSGCP workshops | Davis, California |
| Engineering in the Ocean Environment, CSGCP workshop | La Jolla, California |
| Role of Oceans in Our Economy, CSGCP workshop | La Jolla, California |
| Pacific Sea Grant College Program regional meeting, CSGCP cosponsor | La Jolla, California |
| Cadet Hand Lecture, CSGCP cosponsor | Irvine, California |
| Second International Workshop on the Taxonomy of Economic Seaweeds, CSGCP workshop | Qingdao, China |
| 1986–87 | |
| International Rockfish Symposium, CSGCP cosponsor | Anchorage, Alaska |
| International Symposium on Seafood Quality Determination, CSGCP cosponsor | Anchorage, Alaska |
| National Workshop on Fishing Vessel Insurance and Safety, CSGCP cosponsor | Washington, D.C. |
| Western Regional Conference on Comparative Endocrinology, CSGCP cosponsor | Hayward, California |
| Aquaculture and Fisheries subject area meeting, CSGCP workshop | Berkeley, California |
| Ocean Engineering subject area meeting, CSGCP workshop | Berkeley, California |
| Seafood Industry Advisory Committee meeting | La Jolla, California |
| West Coast Mollusc Workshop, CSGCP workshop | Berkeley, California |
| Symposium on Biological Treatment of Wastewater, CSGCP cosponsor | La Jolla, California |
| Sea Grant Caucus at the Law of the Sea Institute, CSGCP cosponsor | Honolulu, Hawaii |
| Aquaculture Industry Advisory Committee, CSGCP meeting | La Jolla, California |
| Pacific Trade Growth and the Ports: Gauging Southern California Business Needs to the Year 2020, USC Sea Grant conference | Los Angeles, California |

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 Eureka Kiwanis Club
 Eureka Seafood Market
Eureka Times-Standard
 European Aquaculture Society
 Evergreen Marine Corporation
 FMC Corporation
 FMC, Inc., Marine Colloids Division, Rockland, Maine
 Federal Maritime Commission
 Finley, Kumble, Wagner, Heine, Underberg and Manley
F/V Abrigo
F/V Ann
F/V Anna Louise

F/V *Anna W.*
 F/V *Apollo*
 F/V *Arnie P.*
 F/V *Blue Pacific*
 F/V *Callistratus*
 F/V *Cat Special*
 F/V *Colentino Rose II*
 F/V *Donna Mae*
 F/V *Gus D.*
 F/V *Janus*
 F/V *Kelly Ann*
 F/V *Marion W.*
 F/V *Miss Rickie*
 F/V *Peggy L.*
 F/V *Prowler*
 F/V *Sally Kay*
 F/V *Salty Lady*
 Fish Breeders
 The Fish Tail Market
 Fisheries and Oceans Biological Station, St. Andrews,
 New Brunswick, Canada
 Fisheries and Oil Industries Joint Committee
 Fisheries and Oil Industries Liaison Office
 Fisheries/Offshore Oil Liaison Office for South-Central
 California
 Fisheries Protection Institute
 Fisheries Research Board of Canada
 The Fisherman
 Fisherman's Wharf Seafoods
 Fishermen's Cooperative Association
 Fishermen's Landing
 Fishermen's Marketing Association, Inc.
 Fishermen's Protection Institute
 Fishermen's Union--I.C.W.U. Local 33
 The Fishery
 The Fishery of Sacramento
Fishing World Magazine
 The Fishmarket
Five-Cities-Times-Press Recorder
 Fleischmann Foundation
 Foster Farms
 France, Government of
 Friends of Del Norte
 Friends of the Sea Otter
 Galway Mariculture Laboratory, Ireland
 Gas Research Institute
 General Fisherman's Service
 Genentech, Inc.
 Ghio Seafood Products
 Gilroy Flycasters
 Golden Gate Fishermen's Association
 Golden Gate National Recreation Area
 Governor of California's Office of Planning and
 Research
 Great American Oyster Company
 Greater Los Angeles Council of Divers
 Griffith Laboratories
 H. J. Baker, Inc., New York
 H & N Fish Company
 Halifax Fisheries Research Laboratory, Canada
 Half Moon Bay Fishermen's Association
 Half Moon Bay Public Library
 Harvard University
 Hawaii Department of Fish and Game
 Hawaii State Archives
 Hawaii State Library
 Hawaiian International Billfish Association
 Hawkwing Enterprises
 Heart of the City Farmer's Market
 Henkel Corporation, Analytical Chemistry Division,
 Minneapolis
 Hog Island Oyster Company
 Hog Island Shellfish Company, Pt. Reyes Station
 Hoover Institution, Stanford
 Hopkins Marine Station
 Howorth & Associates, Santa Barbara
 Hubbs-Sea World Research Institute
 Humboldt Bay Harbor, Recreation, and Conservation
 District
 Humboldt Bay Herring Company
 Humboldt Bay Symposium Committee
 Humboldt County Board of Education
 Humboldt County Board of Supervisors
 Humboldt County Department of Education
 Humboldt County Health Department
 Humboldt, County of
 Humboldt County Parks Department
 Humboldt County Planning Department
 Humboldt County Public Works Department
 Humboldt County Schools
 Humboldt County Zoo
 Humboldt Fish Action Council
 Humboldt Fishermen's Marketing Association

Humboldt State University
 Humboldt State University Alumni
 Humboldt State University, Center for Community Development
 Humboldt State University, Department of Biology
 Humboldt State University, Fisheries Cooperative Unit
 Humboldt State University, Home Economics Department
 Humboldt State University, School of Natural Resources
 Hydro Products
 Hy-C-Tanc
 Idaho Department of Fish and Game
 Industrial Components, Inc., Seattle
 International Boundary and Water Commission
 International Institute for Transportation and Ocean Policy Studies
 Institute of Food Technologists
 Institute for Environmental Mediation
 Instituto Nacional de Pesca (INP) of Mexico, Centro de Investigaciones Pesqueras, Guaymas
 International Longshoremen and Warehousemen's Union, Library
 International Paint Company
 International Women's Fishing Association Scholarship Fund
 Island Packers
 Iwate Prefectural Fish Farming Center, Japan
 J.A.C. Creative Foods
 J.J. Camillo Seafood Company
 Jankovich Shell
 Jet Propulsion Lab
 Johns Hopkins University
 Johnson Oyster Company
 Joint State GSI Coordinating Committee
 KABC
 KCET-TV
 KNX
 KCOP-TV
 KIEM-TV
 KNX Radio
 KVIQ-TV
 Kamilche Sea Farms, Washington
 Kerckhoff Marine Laboratory
 King Harbor, City of Redondo Beach
 Kodiak Community College
 Kraft, Inc., Glenview, Illinois
 Kyoto University, Japan
 Lawrence Livermore Laboratory
 Lilly Research Laboratories
 Little Skookum Shellfish Growers, Washington
 Lockheed Missiles and Space Company
The Log
 Long Marine Laboratory
 Long Marine Laboratory, Bioacoustics Services Laboratory
 Los Angeles Chamber of Commerce, Maritime Affairs Committee
 Los Angeles City School System Marine Occupation Center
 Los Angeles County Board of Education
 Los Angeles County Department of Beaches and Harbors
 Los Angeles County Department of Parks and Recreation
 Los Angeles County Museum of Natural History
 Los Angeles County Regional Planning Commission
 Los Angeles County Sanitation District
 Los Angeles County Superintendent of Schools
 Los Angeles County Water and Power Department
 Los Angeles Department of Parks and Recreation
 Los Angeles Department of Planning
 Los Angeles Harbor Department
 Los Angeles Department of Public Works (Sanitation District)
 Los Angeles Unified School District
Los Angeles Times
 Los Peñasquitos Lagoon Foundation
 Louisiana Crayfish Farmer's Association
 Louisiana State University, Baton Rouge
 Louisiana State University, Department of Food Science
 MALABAR Fisheries
 MCTV
 MacArthur Foundation
 Mad River Community Hospital, Pathology Section, Arcata
 Malibu Chamber of Commerce
 Malaspina College, British Columbia
 Mad River Community Hospital, Pathology Section, Arcata
 Management Authority, Tijuana River National Estuarine Research Reserve
 Marin, City of
 Marin County Department of Parks and Recreation
 Marin Fish and Game Advisory Committee

Marina City Club
 Marine City Club
 The Marina Foundation
 Marine Biological Consultants
 Marine Ecological Institute
 Marine Fish and Game Advisory Committee
 Marine Associations Council of California
 Marine Mammal Commission
 Marine Technical Society
 Marineland of the Pacific
 Marinelli Shellfish Company
 Mark Anthony Computers, Inc.
 Mars Microencapsulation Research Group
 Massachusetts Institute of Technology
 Massachusetts State Lobster Hatchery and Research Station, Vineyard Haven
 Matson Navigation Company
 Max Machinery Company
 McDowell Valley Vineyards
 McNaughton Scholarship Fund
 Mediation Institute
 Medical School of Charleston, South Carolina
 Mendocino Fish Advisory Committee
 Meredith Fish Company
 Metropolitan Yacht Club
 Mexican Naval Oceanographic Laboratory, Manzanillo
 Mexican Naval Vessel *Matamoros*
 Meyer Resources, Inc.
 Michael Brandman Associates
 Microbio Resources, Inc.
 Mid-Coast T.V.
 Miller-Rellim Timber Company
 Ministry of Agriculture, Fisheries, and Food, U.K.
 Mixner/Scott, Inc.
 Miyagi Prefectural Fish Farming Center, Japan
 Mobil Chemical
 Modesto Tallow Company
 Monsanto Corporation
 Monterey Bay Aquarium
 Monterey Bay Salmon and Trout Project
 Monterey City and County Schools
 Monterey County Head Start
 Monterey County Health Department
 Monterey County Office of Education
 Monterey County Planning Department
 Monterey County Public Works Department
 Monterey Harbor, City of Monterey
 Monterey Peninsula Flycasters
 Morro Bay Commercial Fishermen's Association
 Morro Bay Harbor Department
 Moss Landing Commercial Fishermen's Association
 Moss Landing Commercial Fishermen's Auxiliary
 Moss Landing Harbor District
 Moss Landing Marine Laboratory
 Moss Landing Marine Supply
 Moss Landing Women for Fisheries
 Mt. Lassen Trout Company
 Muh Seafood Company
 Mycogen, Inc., San Diego
 N.J. Russo Co., San Pedro
 NOYO Pride Fisheries
 NOYO Women for Fisheries
 NTH, Trondheim, Norway
 National Aeronautic and Space Agency, Goddard
 National Archives, Washington, D.C.
 National Association of Corrosion Engineers
 National Cancer Institute
 National Coalition for Marine Conservation, Pacific Region
 National Coastal Resources Institute
 National Environmental Satellite Data and Information Service
 National Fish Health Center
 National Fisheries Institute
National Fisherman Magazine
 National Institutes of Health
 National Marine Educators Association
 National Marine Fisheries Laboratory, Cook, Washington
 National Marine Fisheries Service
 National Marine Fisheries Science Laboratory, Duke Bay, Alaska
 National Marine Fisheries Service, Juneau, Alaska
 National Marine Fisheries Service, Manchester Laboratory
 National Marine Fisheries Service, National Marine Mammal Laboratory, Seattle
 National Marine Fisheries Service, National Seafood Inspection Laboratory, Pascagoula, Mississippi
 National Marine Fisheries Service, Northwest Fisheries Center, Seattle
 National Marine Fisheries Service, Pacific Environmental Group
 National Marine Fisheries Service, Seattle, Washington

National Marine Fisheries Service, Seattle Utilization Laboratory
 National Marine Fisheries Service, Southwest Fisheries Center
 National Marine Fisheries Service, Tiburon Laboratory
 National Marine Mammal Laboratory, Seattle
 National Marine Manufacturers Association
 National Oceanic and Atmospheric Administration, National Ocean Service
 National Oceanic and Atmospheric Administration, Office of Coastal Resource Management, Sanctuary Programs Division
 National Oceanic Society, Los Angeles Chapter
 National Oceanographic Data Center
 National Science Foundation
 National Science Teachers Association
 National Weather Service
 National Weather Service Forecasting Office, Los Angeles
 Native Plant Resource Institute
 Natural Bridges State Park
 Naval Ocean Systems
 The Nature Conservancy
 Nature Discovery Volunteers
 Nearshore Benthic Invertebrate Group, Long Beach
 Neushul Mariculture, Inc.
 New England Lobster Company, Sunset Beach
 New Growth Forestry Services
 New York Sea Grant College Program
 New Zealand Ministry of Agriculture and Fisheries
 Newhall Land and Livestock, Dixon
 Newport Beach Chamber of Commerce
 Newport First Investment Corporation
 Nor-Cal Seafoods
 Nor Cal Truck Specialties
 North Carolina State University, Computer Graphics Center
 Northcoast Commercial Fishermen's Association (Surfneters)
 Northern California Indian Development Council
 Northern California Marine Association
 Northwest Ocean Service Center
 Northwest Steelheaders (Chetco, Gold Beach, and Klamath Chapters)
 Nossaman, Krueger & Knox
 OREHP Project, King Harbor
 Oakland Public Library
 Ocean Fare Sales and Marketing
 Ocean Garden Products
 The Ocean Research Institute
 Oceanic Society
 Oceanside City Harbor District
 Oceanside, City of
 Oceanside Small Boat Harbor
 Office of Coastal Zone Management
 Ogle Petroleum, Inc.
 Oklahoma Department of Wildlife Conservation
 Old Dominion University, Norfolk, Virginia
 Olympia Oyster Company, Washington
 Orange County Department of Harbors
 Orange County Marine Institute
 Orange County School District
 Orange County Sheriff-Coroner Department
 Oregon Coastal Operators Association
 Oregon Department of Fish and Game
 Oregon Department of Fish and Wildlife
 Oregon Land Conservation and Development Commission
 Oregon Pacific Salmon Ranch
 Oregon State University
 Oregon State University, Department of Microbiology
 Oregon State University, Marine Science Center
 Oyster Research Institute, Tohoku, Japan
 PRC Harris, Inc.
 Pacific Aqua Farms
 Pacific Biological Station, Nanaimo, B.C., Canada
 Pacific Biological Station, Fisheries Research Board of Canada
 Pacific Coast Beach Fishermen (Surfneters)
 Pacific Coast Federation of Fishermen's Associations, Inc.
 Pacific Coast Fishermen's Wives Coalition
 Pacific Coast Oyster Growers Association
 Pacific Environmental Group Laboratories
 Pacific Fishery Management Council
Pacific Fishing Magazine
 Pacific Gamefish Foundation, Kailua-Kona, Hawaii
 Pacific Gas & Electric Company
 Pacific Lighting Service Company
 Pacific Marine Fisheries Commission
 Pacific Mariculture Inc.
 Pacific Merchant Shipping Association
Pacific News Service
 Pacific Seafood Industries
 Pacific Shellfish Company, Morro Bay

The Pacific Shipper, San Francisco
 Pacific Trawl Company
 Pacific Whiting Ltd.
 Pacifica, City of
 Pajaro School District Office of Education
 Paladini Fish Company
 Patrick's Point State Park
 Penn Cove Mussels
 Pennsylvania State University
 People-to-People Program
 Pfanstiehl Laboratories, Inc., Waukegan, Illinois
 Philip Williams and Associates
 Pigeon Point Aquaculture Center, Pescadero
 Pillar Point Harbor
 Pioneer Fish Company
 Pitchometer Propellers
 Point Loma Seafoods
 Point St. George Fisheries
 Port of Brookings
 Port of Gold Beach
 Port of Long Beach
 Port of Los Angeles
 Port of Oakland
 Port of Richmond
 Port of San Cyprion, Spain, Port Engineers
 Port of San Diego
 Port of San Francisco
 Port of Sines, Portugal, Port Engineers
 Port San Luis Commercial Fishermen and Boat Owners Association
 Port San Luis Fishermen's Auxiliary
 Port San Luis Harbor District
 Portsmouth Polytechnic Institute, U.K.
 Poway, City of
 Prairie Creek Fish Hatchery
 Princeton University, Manuscript Collection
 Primate Research Center, Holloman Air Force Base, New Mexico
 Producers Seafoods
 Quality Refrigeration, Wilmington
 Qualman Oyster Farm
 Quinault Indian Tribe, Washington State
 Race Lagoon Mussels, Washington
 Radio KATA
 Radio KCRE
 Radio KEKA
 Radio KFLY
 Radio KPOD
 Radio KPRL
 Radio KUKI
 Radio KURY
 Radio KXGO
 Radtke, Hans
 Rangen Fish Lab, Idaho
 Rangen, Inc.
 Ralph's Supermarket, Riverside
 Redwood Community Action Agency
 Redwood National Park
R/V David Starr Jordan
 Resource Development Associates, Oman
 Rhode Island Sea Grant College Program
 Riceland Foods, Stuttgart, Alaska
 Rockport Apprenticeshop
 Rockwell International
 Rohm & Haas
 Rowdy Creek Fish Hatchery
 Russian River Committee
 Rutgers University
 Rural Human Services
 SAFCOL Holdings Ltd.
 SOHIO
 Safer Chemical Corporation
 Salmon Unlimited
 Salty Lady Sportfishing
 San Benito County Schools
 San Diego Association of Governments
 San Diego, City of
 San Diego City Schools
 San Diego City Water Utilities Division
 San Diego County Department of Education
 San Diego County Department of Health Services
 San Diego, County of
 San Diego County Planning Department
 San Diego County Public Health Department
 San Diego County Schools
 San Diego Department of Education
 San Diego Gas & Electric Company
San Diego Log
 San Diego Oceans Foundation
 San Deigo School District
 San Diego Sportfishing Association
 San Diego State University

San Diego State University Foundation
 San Diego State University, Library
 San Diego Unified Port District
San Diego Union
 San Francisco Bay Conservation and Development
 Commission
 San Francisco Bay Fishermen's Association
 San Francisco Bay National Wildlife Area
 San Francisco Bay National Wildlife Refuge
 San Francisco Police Activities League
 San Jose City Schools
 San Jose State University
 San Lorenzo River Steelheaders
 San Luis Obispo, City of
 San Luis Obispo County Board of Supervisors
 San Luis Obispo County Planning Department
 San Marcos Unified School District
 San Mateo City Schools
 San Mateo Legal Aid Society
 San Pedro Fish Market
 San Luis Obispo County Planning Department
 Sandoz Pharmaceuticals
 Santa Barbara City Community Development
 Department
 Santa Barbara City and County Schools
 Santa Barbara City Planning Department
 Santa Barbara Commercial Fishermen
 Santa Barbara Commercial Fishermen's Association
 Santa Barbara County Board of Supervisors
 Santa Barbara County Citizens Planning Association
 Santa Barbara County, Energy Division
 Santa Barbara County Fish and Game Commission
 Santa Barbara County Resource Management
 Department
 Santa Barbara Harbor Department
 Santa Barbara Museum of Natural History
Santa Barbara News Press
 Santa Barbara Recreation Department
 Santa Cruz, City of
 Santa Cruz City and County Schools
 Santa Cruz City Museum
 Santa Cruz Commercial Fishermen's Association
 Santa Cruz County Community Resource Program
 Santa Cruz County Health Department
 Santa Cruz County Planning Department
 Santa Cruz, County of
 Santa Cruz County Office of Education
 Santa Cruz Public Library System
 Santa Cruz Port District
 School of Natural Resources
 Scotia-Rio Dell Community Services Club
 Sea Farms West
 Sea Ventures
 Sea World, Inc.
 Sea World, San Diego
 SeaPharm
 Secretaría de Marina, Mexico
 Seafood Specialties, Inc.
 Seafood West, Inc.
 Secretaría de Pesca, Mexico
 Secretaría de Relaciones Exteriores, Mexico
 Senior Resources Center, Humboldt County
 Shanghai Jiao Tong University, Department of Naval
 Architecture and Ocean Engineering
 Shell Development
 Shellfish Institute of North America
 Sho Sato Fund for Japanese-American Legal Research
 Shoreline Marketing Associates
 Six Rivers National Forest
 Smith River Anglers Association
 Smith Kline & French Laboratories
 Socio Economic Systems
 Soil International
 Sona Tech, Inc.
 Sonoma County Grape Growers
 South Carolina Department of Natural Resources
 South Pacific Commission, New Caledonia
 Southern California Answering Network
 Southern California Association of Governments
 Southern California Coastal Water Research Project
 Southern California Gas Company
 Southern California Edison
 Southern California Lobstermen's Association
 Southern California Marina Association
 Southern California Marine Association
 Southland Farmer's Association
 Southland Farmer's Market Association
 Sportfishing Association of California
 Sportfishing Association of America
 Sport Fishing Institute
 Sportsman Seafoods
 The Squid Machine Corporation
 Standard Fisheries

Stanford University
 Stanford University Library
 Star Milling Company
 Star-Kist Foods
 State Fish Company
 Steinhart Aquarium
Sun Bulletin
Sunset Magazine
 Suntory Institute for Bio-organic Research, Osaka,
 Japan
 Supreme Seafoods
 Swedlow, Inc.
 Syntex Corporation
 Syntex Laboratories, Palo Alto
 TRW
 TV Station KOVR
 TV Station KEET
 Taiyo Fish Company
 Tarantino Fish Company
 Tasmanian Fisheries Development Authority, Australia
 Taylor University (Washington)
 Telegraph Hill Neighborhood Center
 Telonicher Marine Lab
 Texas A&M University
 Texas A&M University, Food Protein Research and
 Development Center
 Texas A&M University Sea Grant College Program
 Tideland Shellfish Company
 Tijuana River National Estuarine Sanctuary
 Management Authority
 Tinker Foundation
 Tokai Regional Fisheries Research Laboratories, Japan
 Tokyo Institute of Technology
 Tokyo University, Department of International
 Relations
 Tom Lazio Fish Company
 Trinidad Fishermen's Marketing Association
 Trinity Hatchery
 Umpqua Aquaculture, Inc., Oregon
 United Anglers of California
 United Anglers, Inc.
 United Fishermen's Organization
 U.S. Army, Ft. Baker
 U.S. Army Corps of Engineers
 U.S. Bureau of Land Management
 U.S. Bureau of Reclamation
 U.S. Bureau of Labor Statistics
 U.S. Coast Guard
 U.S. Coast Guard Auxiliary
 U.S. Department of Agriculture
 U.S. Department of Commerce, Economic Analysis
 Division
 U.S. Department of Energy, Historical Office
 U.S. Department of Energy, Office of Energy Research,
 Ecological Research Division
 U.S. Department of Interior
 U.S. Department of Interior, Minerals Management
 Service
 U.S. Department of Interior, Bureau of Indian Affairs
 U.S. Department of State
 U.S. Department of Transportation, Library
 U.S. Environmental Protection Agency
 U.S. Environmental Protection Agency, Office of
 Radiation Programs, Division of Waste Management
 U.S. Fish and Wildlife Service
 U.S. Food and Drug Administration
 U.S. Forest Service
 U.S. General Accounting Office
 U.S. Geological Survey, Menlo Park
 U.S. House of Representatives, Committee on
 Merchant Marine and Fisheries
 U.S. House of Representatives, Committee on
 Merchant Marine and Fisheries, Subcommittee on
 Oceanography
 U.S. Interstate Commerce Commission, Library
 U.S. Maritime Administration
 U.S. NARS, San Bruno Center
 U.S. Naval Postgraduate School
 U.S. Navy
 U.S. Nuclear Regulatory Commission, Historical Office
 U.S. Office of Naval Research
 U.S. Small Business Administration
 U.S. Soil Conservation Service
 U.S. Tuna Foundation
 U.S. Trout Farmers Association
 United Way
 U.S. Fish and Wildlife Service
 U.S. Fish and Wildlife Service, Arcata Field Station
 U.S. Food and Drug Administration
 U.S. Forest Service
 U.S. General Accounting Office
 U.S. Geological Survey, Menlo Park
 U.S. House of Representatives, Committee on
 Merchant Marine and Fisheries
 U.S. House of Representatives, Committee on

Merchant Marine and Fisheries, Subcommittee on
 Oceanography
 U.S. Interstate Commerce Commission, Library
 U.S. Maritime Administration
 U.S. NARS, San Bruno Center
 U.S. Naval Postgraduate School
 U.S. Navy
 U.S. Nuclear Regulatory Commission, Historical Office
 U.S. Office of Naval Research
 U.S. Small Business Administration
 U.S. Soil Conservation Service
 U.S. Tuna Foundation
 U.S. Trout Farmers Association
 United Way
 Universidad Autónoma de Baja California, Escuela
 Superior de Ciencias Marinas
 Universidad Nacional Autónoma, Instituto de
 Investigaciones Jurídicas
 Universidad Autónoma de Baja California, Instituto de
 Investigaciones Oceanológicas
 Universidad Autónoma de Baja California Sur, Area de
 Ciencias Marinas La Paz, B.C.S.
 Universidad del Occidente, Los Mochis, Sinaloa
 Universidad Nacional Autónoma de México, Instituto
 de Ciencias del Mar y Limnología, Estación
 Mazatlán
 University Hilton Hotel
 University of Alaska Marine Laboratory, Seward,
 Alaska
 University of Arizona
 University of Arizona, Environmental Research
 laboratory, Tucson
 University of British Columbia
 University of California, Berkeley, Department of
 Naval Architecture and Offshore Engineering
 University of California, Berkeley, Department of
 Zoology
 University of California, Berkeley, Lawrence Berkeley
 Laboratory
 University of California, Berkeley, Library
 University of California, Berkeley, Research
 Expeditions Program
 University of California Board of Patents
 University of California, Bodega Marine Laboratory
 University of California Cooperative Extension
 University of California, Davis, Aquaculture and
 Fisheries Program
 University of California, Davis, Department of Food
 Science and Technology
 University of California, Davis, Experiment Station
 University of California, Davis, Library
 University of California, Davis, Sturgeon Facility
 University of California, Experiment Station
 University of California, Los Angeles, Department of
 Biology
 University of California, San Diego, Extension
 University of California, San Diego, Library
 University of California, San Diego, Scripps Institution
 of Oceanography
 University of California, San Diego, Scripps Institution
 of Oceanography, Aquarium-Museum
 University of California, San Diego, Scripps Institution
 of Oceanography, Archives
 University of California, San Diego, Scripps Institution
 of Oceanography, Marine Life Research Group
 University of California, San Diego, Scripps Institution
 of Oceanography, Visibility Laboratory
 University of California, Santa Barbara, Computer
 Systems Laboratory
 University of California, Santa Barbara, Extension
 University of California, Santa Barbara, Foundation of
 University of California, Santa Barbara, Geography
 Department
 University of California, Santa Barbara, Marine
 Science Institute
 University of California, Santa Cruz, Center for Coastal
 Studies
 University of California, Santa Cruz, Institute of
 Marine Sciences
 University of California, Santa Cruz, Long Marine Lab
 University of California Toxic Substances Program
 University of Colima
 University of Connecticut
 University of Florida
 University of Goeteborg, Sweden
 University of Guadalajara
 University of Guadalajara, Laboratory at Barra
 Navidad
 University of Guelph, Department of Nutrition
 University of Hawaii, Department of Biology
 University of Hawaii, H.I.M.B.
 University of Hawaii, Honolulu
 University of Hawaii, Honolulu, Library
 University of Illinois
 University of Maine
 University of Michigan
 University of Nebraska
 University of Oklahoma

University of Oregon, Institute of Marine Biology
University of Osaka, Japan
University of Osaka, Japan, Department of Naval Architecture
University of Sonora
University of Sonora, Laboratory at Puerto Peñasco
University of Southern California
University of Southern California Sea Grant Institutional Program
University of Tokyo, Department of International Relations
University of Toronto
University of Washington
University of Washington, Archives and Library
University of Washington, Manchester Laboratory
University of Washington, Seattle
University of Washington, Seattle, Library
University of Wisconsin
University of Wisconsin, Center for Great Lakes Studies
Upwellings Magazine
Urban Outdoor Adventure Center
Ventura County Department of Harbors
Ventura County School District
Ventura Harbor District
Vestar, Inc., Pasadena
Vietnamese Fishermen's Association of America
Vietnamese Pacific Fishermen's Association
VinMar R&D
W. R. Grace & Company, Cryovac Division
W. R. Merry Seafood Company
Washington Aquaculture Council
Washington Department of Ecology
Washington Department of Fisheries
Washington Department of Natural Resources
Washington Division of Fish and Wildlife
Washington State University Cooperative Extension
Water Quality Control Board
Wayman Fish Company
Wescott Bay Gourmet Shellfish
West Coast Aquaculture Foundation
West Coast Crab
West Coast Fisheries Development Foundation
Western Association for the Valuation of Ecosystems (WAVE)
Western Fishboat Owners Association
Western Oil and Gas Association

Western Sea Treat
Whiskey Creek Oyster Farm, Oregon
Whitewater Trout Company
Widman Fish Farm
Wiegandt Brothers Oyster Company
Winkleman Bros. Meat Company
Wisconsin Department of Natural Resources
Woodward-Clyde, Inc.
Women's Fisheries Network
World Mariculture Society
Wrather Corporation
Youth Conservation Corps
Zoecon Corporation
Zoecon Research Institute, Palo Alto



Los Angeles Times photo

Resources Agency Sea Grant Advisory Panel

The National Sea Grant College Program requires that at least one-third of the total federal funds received by each program be matched with local (nonfederal) funds.

In 1973 the California legislature created the Resources Agency Sea Grant Advisory Panel (RASGAP) by Section 6217 of the California Public Resource Code. The legislation currently appropriates \$525,000 annually to the State's Resources Agency "for distribution for public and private higher education for use as up to two-thirds of the local matching share for projects under the National Sea Grant College and Program Act of 1966" The 11-member panel was expanded to 13 members in 1983 and to 15 members in 1986 when Section 6217 was amended.

This and subsequent legislation also provided for the establishment of a Resources Agency Sea Grant Advisory Panel (RASGAP) to advise the Secretary of the Resources Agency with regard to the use of these funds. More specifically, under the provisions of Section 6217, the Sea Grant Advisory Panel is charged with the responsibility to:

1. Identify state needs that might be met through Sea Grant research projects (including but not limited to such fields as living marine resources, aquaculture, ocean engineering, marine minerals, public recreation, coastal physical processes and coastal and ocean resources, planning and management, and marine data acquisition and dissemination, establish priorities for those needs, and transmit those needs and priorities to the state legislature no later than January 1 of each year and include them in all announcements of proposals for grants in the following fiscal year.
2. Review all applications for funding and make recommendations based upon the priorities it establishes.
3. Periodically review progress on Sea Grant research projects subsequent to their approval and funding.
4. Make recommendations to the Secretary for the Resources Agency with respect to the implementation of this program.

In addition, Section 6217 provides that the goal of the Resources Agency Sea Grant Advisory Panel is to select those projects for state support which have a clearly defined benefit to the people of the State of California and which meet needs that can be clearly identified.

California Public Resources Code

Section 6217

Amended August 17, 1983

To the Resources Agency, the amount of five hundred thousand dollars (\$500,000) for each of the fiscal years 1984-85, 1985-86, 1986-87, 1987-88, and 1988-89 for distribution for public and private higher education for use as up to two-thirds of the local matching share for projects under the National Sea Grant College and Program Act of 1966 (P.L. 89-688) approved, upon the recommendation of the advisory panel appointed pursuant to this section, by the Secretary of the Resources Agency or his or her designee. During the 1988-89 fiscal year, the Legislature shall consider recommendations from the Secretary of the Resources Agency and other interested parties on the benefits to the people of the State of California derived from this program and shall determine whether or not to continue similar appropriations for subsequent fiscal years.

There shall be an advisory panel to the Secretary of the Resources Agency consisting of 13 members, which shall do all of the following:

(1) Identify state needs which might be met through Sea Grant research projects, including, but not limited to, such fields as living marine resources, aquaculture, ocean engineering, marine minerals, public recreation, coastal physical processes and coastal and ocean resources planning and management, and marine data acquisition and dissemination, establish priorities for those needs, and transmit those needs and priorities to the Legislature not later than January 1 of each year and include them in all announcements of proposals for grants in the following fiscal year.

(2) Review all applications for funding under this section and make recommendations based upon the priorities it establishes.

(3) Periodically review progress on Sea Grant research projects subsequent to their approval and funding under this section.

(4) Make recommendations to the Secretary of the Resources Agency with respect to the implementation of this section.

The Secretary of the Resources Agency shall appoint the following members of the advisory panel, who shall serve at the pleasure of the secretary:

- (1) A representative of the Department of Boating and Waterways.*
- (2) A representative of the Department of Conservation.*
- (3) A representative of the Department of Fish and Game.*

- (4) *The executive director of the California Coastal Commission or his or her designee.*
- (5) *A representative of the fish industry.*
- (6) *A representative of the aquaculture industry.*
- (7) *A representative of the ocean engineering industry.*
- (8) *A representative of the University of California.*
- (9) *A representative of the California State University.*
- (10) *A representative of a private California institution of higher education which is participating in the National Sea Grant Program.*
- (11) *A representative of the State Lands Commission.*

The Senate Committee on Rules shall appoint one Member of the Senate to the panel, who shall serve at the pleasure of the Senate Committee on Rules.

The Speaker of the Assembly shall appoint one Member of the Assembly to the panel, who shall serve at the pleasure of the Speaker. This member shall not be of the same political party as the member appointed by the Senate Committee on Rules.

The Secretary of the Resources Agency shall designate one member of the panel to serve as its chairman. Panel members shall serve without compensation.

The Sea Grant research projects selected for state support under this section shall have a clearly defined benefit to the people of the State of California. The Legislature hereby finds and declares that the funding provided by this section is needed to stimulate the development and utilization of ocean and coastal resources by working constructively with private sector firms and individuals. Nothing in this section shall be construed to preclude the application for funding of any project which would be eligible for funding under the terms of the National Sea Grant College and Program Act of 1966.

1986 Amendment

An act to add Division 20.5 to, and to add and repeal Section 6217.4 of the Public Resources Code approved by the Governor, September 23, 1986.

The Legislature hereby finds and declares that the problems of the fishery and fishery-related industries and people of San Diego, San Pedro, Los Angeles, Santa Barbara, Monterey, San Francisco, Bodega Bay, Eureka, and Crescent City, together with creation of the Exclusive Economic Zone—about 250,000 square miles off of California's shore—which contains valuable oceanic resources and the capacity for and impact of the increasing seaborne traffic between the nations of the Pacific and California on our coastal communities, raises new and major economic, environmental, and social issues of the highest importance to the people of California. The Legislature accordingly recognizes the urgent need for a comprehensive and coordinated approach to ocean use planning and policy for the state.

SEC. 2. Section 6217.4 is added to the Public Resources Code, to read:

6217.4 (a) Notwithstanding paragraph (1) of subdivision (d) of Section 6217, the amount of five hundred twenty-five thousand dollars (\$525,000) shall be transferred to the Resources Agency for each of the 1986-87, 1987-88, and 1988-89 fiscal years.

(b) In addition to the persons designated in paragraph (4) of subdivision (d) of Section 6217, the Secretary of the Resources Agency shall appoint the following additional members of the advisory panel, who shall serve at the discretion of the secretary:

- (1) A representative of the State Department of Health Services.*
- (2) A representative of the State Water Resources Control Board.*

(c) This section shall remain in effect only until January 1, 1989, and as of that date is repealed, unless a later enacted statute, which is enacted before January 1, 1989, deletes or extends that date.

SEC. 3. Division 20.5 (commencing with Section 30950) is added to the Public Resources Code, to read:

Division 20.5. Ocean Use Planning

30950. The Secretary of the Resources Agency shall initiate a comprehensive long-range planning process for the use of ocean waters offshore of California, may use the advisory panel appointed pursuant to paragraphs (4) of subdivision (d) of Section 6217 as the planning committee, and may use the California Sea Grant Program to promote sound scientific data analysis and assessment in this planning process.

Present Representatives

Gordon Van Vleck
Secretary of Resources
Resources Agency
State of California
Sacramento, California

Chairperson, representing the
Resources Agency

Pete Bontadelli
Director
California Department of Fish and Game
Sacramento, California

Member, representing the Department of
Fish and Game

Peter Douglas
Executive Director
California Coastal Commission
San Francisco, California

Member, representing the California
Coastal Commission

William Ivers
Department of Boating and Waterways
Sacramento, California
Reinhard Flick (alternate)

Member, representing the Department
of Boating and Waterways

Donald L. Keach
Director
USC Institute for Marine and
Coastal Studies
University of Southern California
Los Angeles, California

Member, representing the private
institutions participating in the
National Sea Grant College Program

Senator Barry Keene
State Capitol
Sacramento, California

Member, representing the California
State Senate

Assemblywoman Sunny Mojonier
State Capitol
Sacramento, California

Member, representing the California
State Assembly

Gerald A. Pollock
Hazard Evaluation Section
Department of Health Services
Sacramento, California

Member, representing the Department of
Health Services

Richard Ridenhour
College of Natural Resources
Humboldt State University
Arcata, California 95521

Member, representing the California
State Universities and Colleges

Robert E. Ross
Associate Director of Legislative Relations
California Seafood Institute
Sacramento, California

Member, representing the fish industry

Theodore C. Smith
Technical Planning Officer
Division of Mines and Geology
Sacramento, California

Member, representing the Department
of Conservation

F.N. Spiess
Director
Institute of Marine Resources
University of California
La Jolla, California

R. Robert Studdert
Johnson Oyster Company
San Rafael, California

Wilbur M. Thompson
State Lands Commission
Long Beach, California

Daniel Walsh
State Water Resources Control Board
Sacramento, California

Elmer P. Wheaton
Portola Valley, California

Member, representing the University
of California

Member, representing the aquaculture
industry

Member, representing the State
Lands Commission

Member, representing the State
Water Resources Board

Member, representing the ocean
engineering industry



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California's Sea Grant Institutions

Bodega Marine Laboratory
California Academy of Sciences
California Institute of Technology
California Maritime Academy
California Polytechnic University
California State University, Fresno
California State University, Hayward
California State University, Long Beach
California State University, Los Angeles
California State University, Northridge
Cerritos Community College
Claremont College
Coker College
El Camino Junior College
Foremost Research Center
Fullerton Community College
Humboldt State University
Immaculate Heart College
Loyola Marymount University
Monterey Bay Aquarium
Moss Landing Marine Laboratories
Occidental College
Oceanic Society
Point Loma College
San Diego State University
San Francisco State University
San Jose State University
Santa Barbara Community College
Southern California Ocean Studies Consortium
Stanford University
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, Riverside
University of California, San Diego
University of California, San Francisco
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