oceanographers and the cold war

DISCIPLES OF MARINE SCIENCE

JACOB DARWIN HAMBLIN

OCEANOGRAPHERS AND THE COLD WAR

OCEANOGRAPHERS AND THE COLD WAR

DISCIPLES OF MARINE SCIENCE

JACOB DARWIN HAMBLIN

UNIVERSITY OF WASHINGTON PRESS

SEATTLE AND LONDON

This book is published in memory of
MARSHA L. LANDOLT (1948–2004),
Dean of the Graduate School and Vice Provost,
University of Washington, with the support of
the University of Washington Press Endowment.

Printed in the United States of America
Designed by Pamela Canell
12 11 10 09 08 07 06 05 5 4 3 2 1

University of Washington Press
P.O. Box 50096, Seattle, WA 98145
www.washington.edu/uwpress

Library of Congress Cataloging-in-Publication Data
Hamblin, Jacob Darwin.
Oceanographers and the cold war : disciples of marine science / Jacob Darwin Hamblin. — 1st ed.
p. cm.
Includes bibliographical references and index.
ISBN 0-295-98482-1 (hardback : alk. paper)
1. Oceanographers—United States—Biography.
2. Oceanography—History—20th century. I. Title.
GC30.A1H36 2005 551.46'0973'09045—dc22
2004021922

The paper used in this publication is acid-free and 90 percent recycled from at least 50 percent post-consumer waste. It meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48–1984.♾♻

FOR MY WIFE, SARA

CONTENTS

PREFACE

In browsing these pages, the reader will notice a very loose usage of the term "oceanography." The book's subtitle reflects an even more vague term: marine science. The coverage here is not limited to any particular branch of marine science, though often some fields dominated at the expense of others. Because the book is about politics, patronage, and communities in many different branches of science pertaining to the sea, I did not wish to splinter the discussion by needlessly separating the scientists as they might have done themselves. Thus the book runs the risk of painting a picture with rather broad brushstrokes; however, I have made an effort to be consistent with one of the themes of the book, which is the effort of international organizations and leading scientists to define the field broadly. Although some may take oceanography to mean simply the study of the chemical composition and physical dynamics of the sea, this book does not conform to that narrow definition. This raises another issue: in discussing the subject, should we use "oceanology," "oceanography," "hydrography," or some other term? The reader will discover that oceanographers in the Soviet Union were typically called oceanologists, for reasons that are discussed in the text. I have kept this usage on occasion, but generally I use the term "oceanographer" to describe them all.

There are a few other points of usage. I tend to use "Soviet" rather than "Russian," but the reader should be aware that this is inconsistent with what most scientists used in the documents I examined for this study. Readers outside the United States may object to my using "Americans" to describe only the citizens of the United States of America, not all the people on the two American continents; I do so for convenience, as there is no easy alternative for myself or the reader. I also use the terms "East" and "West." These are terms of convenience with geopolitical connotations and do not have any real geographic meaning. In my discussion, the East refers to the Soviet

Union and its political allies, and the West refers to the United States and its political allies (which puts Japan, rather counterintuitively, into the Western category). I discuss the characteristics of oceanography in East and West in some detail. I do not use "North" and "South" very often, but prefer to speak of industrialized countries and those of the developing world. These terms follow the usage of the people described in this book. Another term loosely employed is "military," which most accurately would mean land forces, while "naval" would describe sea forces. Sticklers will be disappointed to find that I use the term more generally, as most Americans do, to describe all kinds of armed forces; for example, I treat funding by the U.S. Navy as a kind of military patronage.

Unfortunately, this story is extraordinarily acronym-rich. When possible, I have made an effort to ease the reader's suffering by using real words instead of acronyms. Thus I use "Scripps," instead of SIO (and instead of a worse alternative, spelling out each time Scripps Institution of Oceanography), and "Woods Hole," instead of WHOI. Also, UNESCO has been changed to Unesco, purely as a matter of style; I am not breaking new ground here, as this form has appeared occasionally even in official publications. Occasionally I use full names when I might have left the acronym, as in the case of the National Academy of Sciences or the National Science Foundation. In all cases I have done things that sacrifice consistency for the greater good of ease of reading. Acronyms tend to collide with each other on the page, standing out and diminishing the flow. They also confuse, as in the case of the IOC and the ICO, which were very different bodies but were involved in very similar things and occasionally are mentioned on the same pages of this book. The reader is in good company if confused; I found documents that had been filed incorrectly in major archives because of the closeness of these two acronyms. With ship names, typically I have eliminated words such as "HMS," "USS," "R/V," or other designations beyond the name itself. With individuals, I tend to avoid professional or honorific designations such as "Dr.," "Academician," "Sir," "Lord," and so on, except in cases where a title enhances the reader's ability to understand who the person is (i.e., government and military titles and ranks). This is all a bit informal, but I suspect the reader can get used to it.

This book has been made possible through the help of colleagues, patrons, family, and friends, not necessarily in that order. It began as a dissertation at the University of California, Santa Barbara. I thank my dissertation committee: Lawrence Badash, Michael A. Osborne, and Fredrik Logevall, for their guidance in that process. I thank them and all the faculty

and graduate students who advised me and critiqued my work during the early stages, especially participants in the History of Science Colloquium and the Cold War History Group (now the Center for Cold War Studies). I must also thank the Institute on Global Conflict and Cooperation for a major dissertation fellowship, which allowed me to conduct research in England, France, and (less glamorously) Massachusetts. I am indebted to the Center for History of Physics at the American Institute of Physics, for its Grant-in-Aid for History of Physics and Allied Sciences. I also thank my colleagues at the Centre Alexandre Koyré, who kindly hosted me in Paris as a postdoctoral fellow while I continued my research at Unesco and rewrote the entire manuscript. Special thanks go to Jacqueline Ettinger at the University of Washington Press for taking an interest in the manuscript and seeing it through.

I also would like to thank the many people who have commented upon or critiqued my work as it appeared in published or draft form, or otherwise encouraged the writing of this book. They include Lawrence Badash, Michael A. Osborne, Fredrik Logevall, Benjamin C. Zulueta, Zuoyue Wang, Peter Neushul, Ronald Rainger, Ronald E. Doel, Roy Macleod, Naomi Oreskes, David van Keuren, Helen Rozwadowski, Kurk Dorsey, Dominique Pestre, Amy Dahan Dalmedico, Margaret Rossiter, Walter Lenz, Harry N. Scheiber, Dean C. Allard, Roger Stuewer, David C. Engerman, and a number of very helpful anonymous referees. I wish to extend my gratitude to several people connected to the Intergovernmental Oceanographic Commission in Paris: Gary Wright for his continuous enthusiasm for my project; Alexei Suzyumov for discussing with me aspects of Soviet oceanography; Ray Griffiths for his reminiscences and his family's hospitality in lovely Saint Cloud; and Warren Wooster for kindly letting me interview him on his birthday. I owe a special debt to Warren Wooster and Ray Griffiths, who provided detailed comments on the entire manuscript.

I am grateful to the staffs at all the archives visited. In particular, a few individuals made my work much easier and more pleasant: Jens Boel and Mahmoud Ghander at the archives of Unesco; Janice Goldblum and Daniel Barbiero at the National Academies Archives; Deborah Day at the Scripps Institution of Oceanography; and Melissa Lamont at the archives of the Woods Hole Oceanographic Institution. In addition, I especially thank historian Margaret Deacon for her assistance with her father's papers at the Southampton Oceanography Centre and for her family's hospitality during a very rainy English November.

Naturally, I would like to thank my family, especially Les, Sharon, and

Sara Hamblin, and Paul and Cathy Goldberg. The love and support of friends from our Santa Barbara and Paris days have been much appreciated. I also thank the late John Coleman, whose encouragement was always heartening, and whose tenacious refusal to call anything but five-card draw (no wilds) inspired both ire and admiration. Rest in peace.

Most of all, I thank my wife, Sara Goldberg-Hamblin.

ABBREVIATIONS

AAAS	American Association for the Advancement of Science
AMSOC	American Miscellaneous Society
CICAR	Cooperative Investigations of the Caribbean and Adjacent Regions
CIM	Cooperative Investigations in the Mediterranean
CINECA	Cooperative Investigations of the Northern Part of the Eastern Central Atlantic
CNO	Chief of Naval Operations (United States)
CNRS	Centre National de la Recherche Scientifique (France)
COMSER	Commission on Marine Science, Engineering, and Resources (United States)
COSPAR	Committee of Space Research
CSAGI	Scientific Committee for the International Geophysical Year (Comité Speciale de l'Année Géophysique Internationale)
CSK	Cooperative Study of the Kuroshio and Adjacent Regions
EAMFRO	East African Marine Fisheries Research Organisation (United Kingdom)
ECOSOC	Economic and Social Council (United Nations)
FAO	Food and Agriculture Organization
FCST	Federal Council for Science and Technology (United States)
FOA	Foreign Operations Administration (United States)
GEBCO	General Bathymetric Chart of the Oceans
GEOSECS	Geochemical Ocean Sections Study
IACOMS	International Advisory Committee on Marine Science
IAPO	International Association of Physical Oceanography
ICA	International Cooperation Administration (United States)

ICES	International Council for the Exploration of the Sea
ICITA	International Cooperative Investigations of the Tropical Atlantic
ICNAF	International Commission for Northwest Atlantic Fisheries
ICO	Interagency Committee on Oceanography (United States)
ICSU	International Council of Scientific Unions
IDAB	International Development Advisory Board
IDOE	International Decade of Ocean Exploration
IGC	International Geophysical Cooperation (1959)
IGOSS	Integrated Global Ocean Station System
IGY	International Geophysical Year (1957–58)
IHB	International Hydrographic Bureau
IIOE	International Indian Ocean Expedition (1959–65)
IOBC	Indian Ocean Biological Centre (Cochin, India)
IOC	Intergovernmental Oceanographic Commission
IUGG	International Union of Geodesy and Geophysics
LEPOR	Long-Term and Expanded Programme of Oceanic Exploration and Research
LOFAR	Low Frequency Analysis and Recording
MATS	Military Air Transportation Service
NAS	National Academy of Sciences (United States)
NASCO	National Academy of Sciences Committee on Oceanography (United States)
NATO	North Atlantic Treaty Organization
NEL	Naval Electronics Laboratory (United States)
NIO	National Institute of Oceanography (United Kingdom)
NOAA	National Oceanic and Atmospheric Administration (United States)
NORPAX	North Pacific Experiment
NRC	National Research Council (United States)
NSF	National Science Foundation (United States)
ONR	Office of Naval Research (United States)
OST	Office of Science and Technology (United States)
PIPICO	Panel on International Programs, ICO (see above)
POG	Pacific Oceanographic Group
PSA	Pacific Science Association
PSAC	President's Science Advisory Committee (United States)
SCAR	Scientific Committee on Antarctic Research

SCOR	Scientific Committee on Oceanic Research
SEATO	Southeast Asian Treaty Organization
SOC	International Coordination Group for the Southern Oceans
SOFAR	Sound Fixing and Ranging
SOSUS	Sound Surveillance System
TENOC	Ten Years in Oceanography (report by the United States Navy)
TPO	Technical Panel on Oceanography for the IGY (United States) (see above)
UMC	Upper Mantle Committee
UMP	Upper Mantle Project
Unesco	United Nations Educational, Scientific, and Cultural Organization
USNC-IGY	United States National Committee for the International Geophysical Year

INTRODUCTION

In late 1963, not long after replacing his assassinated predecessor, President Lyndon Baines Johnson addressed the United Nations with an unorthodox plan for world peace. Rather than focusing on nuclear disarmament, containment of communism, or turning away from superpower posturing, he made an unexpected suggestion. He pointed to the long tradition of moral codes at sea, where people worked together for common objectives regardless of political boundaries. Scientists in particular, he said, were engaged in cooperative ventures that promised to break down animosities and ease global tensions. "Because of this tradition," Johnson asserted, "it appears that positive actions to bring about a peaceful world would be effective if based on scientific activities related to the world's ocean areas."[1] Like presidents before him, Johnson looked to science as a way to ease the tensions of the Cold War and to solve mankind's pressing problems. Yet he singled out oceanography, not nuclear physics or space technology, subjects that thus far had monopolized the public's imagination.

The new president's remarks baffled government-sponsored think tanks, because they knew that most oceanographic scientific work since 1945 was funded through the nation's defense expenditures. They wondered: what boundaries were transcended, what tensions eased, what problems addressed during almost two decades of research on undersea warfare? American oceanography, one of these think tanks insisted, "has never been conceived as an opportunity to lessen international tensions and attain President Johnson's objective to end the cold war."[2] Quite the contrary, oceanic science dealt with problems such as submarine acoustics, fleet operations, and sea-launched nuclear missiles. Of all the guiding principles at their disposal, Johnson and his speechwriters had chosen a scientific activity that was unsurpassed in its interconnections with the American military-industrial complex.

Despite the apparent contradiction, Johnson's words on the tradition of internationalism in oceanography were not entirely misplaced. In addition to military projects, scientists also had undertaken large-scale international ventures such as the International Geophysical Year, the International Indian Ocean Expedition, and numerous data exchange programs with political allies and with the Soviet Union. This was one of the great paradoxes of oceanography during the first two decades after World War II. Support for research was based on its usefulness for making war on other nations. At the same time, oceanography retained an identity that tied it closely to international cooperation.[3] That contradiction invites an exploration of the international context of oceanography during the Cold War. The science was young, having matured hastily from intense funding during the 1950s and 1960s, as the United States looked increasingly to science and technology as a cornerstone of power in the world. Oceanography's accelerated adolescence through military funding is one reason that historian of science Eric L. Mills has written that its history provides "a virtually unexploited opportunity to link the advance of knowledge with an understanding of how and why science is done by people, with human motives, with human aims."[4] Recent studies by scholars in the United States agree; they point out the personal and institutional links formed in the early postwar period and demonstrate the consequences for the military, American universities, and for scientists themselves.[5] The growth of oceanography under the care of military establishments in the quarter century after World War II is only now receiving due attention from historians.

How does international cooperation fit into a military framework? Oceanography was a Cold War science, tied to geopolitics as much as any other scientific field. Its most crucial component was international cooperation, which was not merely the domain of a few pious souls who wished naïvely to see everyone work together. The major figures in international oceanography were also the leaders of national institutions; the people who attended international congresses often were the same people who attended top secret military and foreign policy briefings. This is the first study to examine the parallel trajectories both of oceanography's "Cold War" side and of oceanographers' international focus, taking into account the role of the Navy, United States foreign policy, and the activities of scientists all over the world, including developing countries. Despite the seemingly isolated strength of American science, the most ambitious efforts in oceanography during the 1950s and 1960s were international; consequently, American oceanography

cannot be understood without taking into account its role in conflict and in cooperation with the other nations of the world.

OCEANOGRAPHY AND INTERNATIONAL COOPERATION

The lack of national borders at sea, the indiscriminately hostile environmental conditions, and the global scope of observations have long lent oceanography the reputation of being an inherently international endeavor. Just as often history reveals the ocean as a conduit of power, a "terrain" as fiercely contested as any other. Mastery of sea-lanes, coastal areas, and long-range trade routes have shaped, or even defined, the power structures of entire civilizations. The study of the sea has long contributed to national, often military or propagandistic, enterprises. Around 1768, for example, Benjamin Franklin and Timothy Folger developed the first chart of the Gulf Stream because merchants spent weeks longer traveling toward the colonies than they did sailing back to England. French ships used such charts to expedite shipments of arms and supplies from Europe during the American Revolution.[6] The famous *Challenger* expedition of 1872–76, in which British scientists circumnavigated the globe and collected biological specimens and hydrographic data, initially met with universal praise from scientists in other countries. But when some of the results were first published in an American journal, British scientists were furious, feeling that they had a natural claim to work on the collection first. To compete for prestige, Norway, Germany, France, Austria, and Russia all funded oceanographic cruises in the wake of the *Challenger*'s.[7] The use of such cruises to demonstrate power and prestige extended into the twentieth century, as in the case of the *Meteor* expedition. Forbidden by the Treaty of Versailles to send naval vessels to foreign ports, the German Admiralty in 1919 decided to outfit a scientific vessel to show a German presence in foreign countries. The scientific leader of the 1925–27 expedition, Alfred Merz, felt that Germany's destiny could be achieved by scientific greatness.[8]

Despite nationalistic tendencies, there were also numerous examples of cooperation during the era prior to World War II. These often were practical in nature. Countries with common economic interests in the North Atlantic recognized the need for cooperation in the early twentieth century, establishing the International Council for the Exploration of the Sea (ICES) in 1902. Its purpose was to encourage and coordinate oceanographic activities, particularly those related to fisheries. Also, nations wishing to stan-

dardize surveying methods and establish universal symbols in nautical charts formed the International Hydrographic Bureau (IHB) in 1921.[9] In the aftermath of the *Titanic*'s tragic sinking in 1912, the United States Coast Guard established the International Ice Patrol to keep track of the icebergs that appeared in the North Atlantic each spring. Although the Ice Patrol halted its activities during World War I, it carried on during the interwar period, putting into practice the latest methods of dynamic oceanography to track icebergs along the currents of the North Atlantic.[10]

During and after World War II, scientists in the United States and elsewhere forged strong bonds with government patrons. One effect of military patronage was the primacy of a few fields closely related to naval questions. Although scientists had explored physical oceanography and the relatively new fields of marine acoustics and marine geophysics during the interwar period, none of this work attracted significant funding from the U.S. Navy. The situation changed during the course of World War II, and by the late 1940s oceanography became one of the beneficiaries of the explosion of funding opportunities for science under the auspices of the Office of Naval Research, founded in 1946. The Navy played a critical part not only in supporting research with money but also in logistical support for major expeditions. Oceanographers and the Navy came to rely on each other, particularly because of the Navy's own competition with other armed services. Facing strategic obsolescence, it cast its lot with scientists, who assured the Navy that it could renew its relevance by focusing on the submarine threat and by developing an alternative nuclear deterrent at sea. Navy leaders learned the importance of a continuous flow of environmental data, to ensure the efficient use of its military technology. In addition, the Navy accepted international cooperation as a part of its mission to expand its sources of data.

The first major effort to put cooperation into practice on a large scale, with participation transcending Cold War boundaries, would be the International Geophysical Year (IGY) of 1957–58. It did not begin as an oceanographic enterprise, but oceanographers played a part, and their projects were the most ambitious they had ever attempted. To justify projects such as the IGY, the National Science Foundation emphasized nonsecrecy and data sharing with all nations. It reasoned, perhaps foolishly, that although such openness would benefit all nations, the United States was in the best position to translate shared data into innovative technology. As part of its own IGY program, the Soviet Union issued a timely challenge to that assumption by launching the first artificial satellite, *Sputnik.* Soviet scientists also stepped

up their work in other domains, especially oceanography, making *Sputnik* a symbol of scientific and technological competition across disciplines.

The Soviet challenge during the IGY split the American oceanographic community into two camps. Some thought cooperation ought to continue but shifted their focus away from "easing tensions" and latched onto another goal, namely, promoting marine science in poorer countries. The late 1950s and early 1960s saw the birth of a new project even more ambitious than the IGY: the International Indian Ocean Expedition (IIOE). New bodies, such as the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC), adopted a pragmatic vision for science, hoping to use science to address the world's problems, particularly its food shortages. The IOC brought more nations into oceanographic work, soliciting the participation of developing countries.

Others were more reluctant to promote international cooperation after the launch of *Sputnik.* Troubled by the geopolitical challenge posed by the Soviet Union, and reluctant to accept the new development-oriented outlook of international oceanography, these scientists retreated into national projects and tried to turn the international community against projects designed by the Soviets. Oceanographers routinely used the threat of Soviet leadership in science to attain congressional support for national programs in oceanography. This pursuit of scientific leadership often was self-defeating, as when Americans abandoned initiative in the Upper Mantle Project to pursue national projects. The Americans eventually chastised themselves when they realized that their insistence on a "first"—in this case their attempt to drill into the mantle during the failed Project Mohole—forced them to abandon their leadership position in international projects.

Many Western scientists felt increasingly disillusioned with cooperation by the late 1960s. They were squeezed between two forces: the agenda of the Soviet Union and the needs of the developing world. Their frustrations culminated in the North Atlantic Treaty Organization (NATO) Science Committee, a body that was partly international, but excluded the Soviet Union, and did not have to sell its research on the grounds of economic development. The Subcommittee on Oceanography was among its most successful activities. The Soviets, meanwhile, wanted a tougher IOC that could compel scientists to do certain projects. Against the official Soviet position were the scientists who wanted a free hand, claiming that intellectual autonomy and problem-solving were more important than endlessly recording more and more data. Attitudes toward Soviet science, usually informed by Cold War prejudices, turned increasingly negative in the face of its unin-

spired research programs, its wish to compel extensive surveys, and, perhaps more important, the fact that Soviet scientists were out of step, conceptually, with many of the new ideas about the oceans that appeared toward the end of the 1960s.

To the dismay of many American oceanographers, international programs by the late 1960s catered to the world's economic needs. This was due partly to the efforts of Unesco and its IOC. But in addition, attitudes toward oceanography were changing in the United States. Through the active support of President Johnson, American oceanography had achieved what many had been wanting since the launch of *Sputnik:* a Marine Sciences Council, to focus all American efforts into a single government advisory body that answered to the president of the United States. As they had when courting the Navy, scientists had gained a powerful ally, and they hoped to use international cooperation as a way to ensure that the recommendations of an international scientific body should decide the agendas of large-scale projects. But the council, which saw its zenith of influence under President Johnson, adopted "marine affairs" as its primary subject, abandoning science for its own sake. The 1970s were dubbed the International Decade of Ocean Exploration, and the Marine Sciences Council won the argument for marine science by focusing on economic development. But it remained to be seen if this would be at the expense of science itself.

By the end of the 1960s, cooperation had become an inextricable component of oceanography, for better or for worse. Scientists had convinced their patrons, first the Navy and then many other branches of the government, that cooperation could address their needs while keeping scientists happy by not subjecting cooperative work to security classification. But with expanding support for international cooperation, the price was high: Americans had to fight for control of their projects against world politics, they were held accountable to claims that science benefited the economy, and perhaps worst of all, they had to confront the falsehood of their own belief in the universality of science, as Cold War tensions divided oceanographers not only politically but also scientifically.

The inclusion of the term "Cold War" in the title of this book is intended to signal the importance of geopolitical considerations in the development of marine science after World War II. It is intended to enhance the argument of the book, not to define the years "covered" by it; the book itself ends in the early 1970s. International marine science was shaped by a confluence of scientific, military, and diplomatic efforts in the heyday of international cooperation in the 1950s and 1960s. The subsequent era, beginning

in the 1970s, differed in a number of ways. To name a few: expeditions declined in importance in favor of unmanned stations; plate tectonics became the dominant paradigm in Western marine geophysics, while Soviet scientists were prevented from publishing on the subject; both the President's Science Advisory Committee and the Marine Sciences Council were dismantled, eliminating the key liaison offices between scientists and the government and replacing them with weaker bodies. The zenith of oceanographers' influence in government had come and gone. In addition, my analysis ends in the early 1970s because one of the overriding themes of the subsequent period is far better known and might obscure the analysis of the earlier period. To be specific: the most significant change in international marine science in the 1970s was the importance placed upon environmental issues, sparked by devastating oil spills in the late 1960s and controversies over marine pollution of various kinds. Environmental controversy played a much smaller role during the earlier period; any book about international marine science in the 1970s and beyond will inevitably (and justifiably) showcase the rise of environmental consciousness at the expense of other themes. Although such a book would be fascinating, the present book tells a very different, and no less fascinating, story.

DISCIPLES OF MARINE SCIENCE

The premise of this book is that oceanographers in North America and northern Europe made international cooperation the common denominator for a host of activities that otherwise might have appeared incongruous or even conflicting. They sought support where they could find it, altering their purpose to appeal to whoever was listening, creating "disciples of marine science" wherever possible. Their strategy for doing this was to expand the definition of oceanography, or to embrace preexisting broad understandings of it, to include an endless number of scientific disciplines, to gather traditional support constituencies under one roof, and to extend the community of marine science to every country of the world. American scientists understood that oceanography was a collaborative enterprise not only between nations but also between disciplines and that its interdisciplinary character could provide a broad base of support both at home and abroad. Consider the term itself, "oceanography," which implies an emphasis on the measurement of the sea, not the scientific study of it, as "oceanology" might. For years, scientists in many other nations (such as the Soviet Union) called their subject "oceanology," leaving "graphy" work to a dif-

ferent set of specialists. Americans, while often admitting that "oceanology" was more proper, kept the term "oceanography," not only from the inertia of common usage, but also because its broad definition helped to attract funds from a wide range of sources. Particularly when money was so forthcoming from the U.S. Navy for oceanography in the 1950s, American scientists had little incentive to insist on explicit boundaries between disciplines.

Even prior to the period covered in this book, Americans had begun to adopt a broad definition of oceanography. By World War II there were two major institutions for oceanography in the United States, one on the Pacific Coast and one on the Atlantic. In 1903, a group of marine biologists formed a research institution near San Diego, on a tight budget provided by a few philanthropic individuals, and in 1924 it became the Scripps Institution of Oceanography. The Woods Hole Oceanographic Institution in Woods Hole, Massachusetts, owed its beginning in 1930 to several grants from the Rockefeller Foundation.[11] Neither of these institutions confined itself to oceanography as a narrow discipline. Their leading researchers barely considered themselves oceanographers at all; their doctoral degrees were in biology, chemistry, geology, and physics. They studied subjects as diverse as sea life, oceanic chemical processes, seafloor topography, meteorology, and the transmission of sound under the sea. Henry B. Bigelow, Woods Hole's first director and one of the founders of modern oceanography in the United States, claimed that oceanography could only be defined "as the study of the world below the surface of the sea." But then he added, broadening the definition further, that it also included the relationship of the sea with the atmosphere. Expeditions prior to World War II often focused on biological oceanography, gathering data on sea life, or on marine chemistry and physics, observing the ocean's temperature and salinity with a view to understanding the sea's dynamics.[12] But after World War II, many different fields turned to the sea to solve their pressing problems. This was particularly so for marine geology and geophysics, the latter owing its growth largely to the marine investigations begun in the 1930s and funded by the Navy during and after World War II.[13] In 1942 three prominent scientists of the sea, Harald Sverdrup, Martin W. Johnson, and Richard Fleming, published an influential book, *The Oceans,* which included more than just current patterns and ocean dynamics. This work, which described oceanography as a broad field embracing an array of subjects, represented a new standard of inquiry in the United States.[14] America's oceanographic institutions defined their field broadly and viewed their subject itself as spanning the entire globe. The need for collaboration, across both disci-

Four directors of Woods Hole Oceanographic Institution, 1960. From left: *Paul Fye, Henry Bigelow, Columbus Iselin, and Edward Smith. Courtesy Woods Hole Oceanographic Institution Archives*

plinary and national lines, was an integral part of this vision of oceanography.

Cooperation, American scientists learned, was also politically attractive. The question of "easing tensions," a phrase widely used during the IGY (1957–58) to advertise the benefits of international cooperation in science, provided the initial motivation for this study.[15] By building personal relationships with colleagues in the Eastern bloc, speaking a common intellectual language that rose above politics, some Americans claimed to be easing the tensions of the Cold War. At the same time, they were pursuing a scientific tradition that emerged strongly after World War II, namely, the social responsibility of science.[16] But closer examination yields a different picture, one of American scientists using "easing tensions" to advertise the project to the public while at the same time promoting various goals to their spon-

sors, some scientific, some not, some peaceful, some not, some drawing scientists together, some driving them apart along Cold War lines. The character and goals of their projects depended on who was listening.

Over the next decade or so, to about 1970, oceanographers constructed permanent international scientific bodies amid developments that seemed to indicate a trend, not toward peaceful cooperation, but toward complementing American military and foreign policy activities. Developments that seemed to indicate the importance of these military or foreign policy links included: (a) the massive support for "basic" scientific research by the U.S. Navy during the late 1940s and 1950s; (b) the role of scientists in the crisis of strategic roles within the armed services; (c) the growth of oceanography in the United States and the dominance of it by acoustics, ocean dynamics, and geophysics; (d) the pervasive recognition of an important relationship between science policy and foreign policy; (e) the development of a federal policy connecting international cooperation to American scientific and technological superiority; and (f) the Soviet Union's express challenge to American scientific and technological leadership not only in space but also at sea. Yet during the same period, scientists laid the foundations of international and intergovernmental machinery for coordinating oceanographic research, enlisting the participation of developing countries, gaining the endorsement of the American government at the highest level, securing the financial backing of the Navy, and rallying the support of scientists around the world for American-backed plans.

What were scientists' motivations for cooperation? One was the redemptive value of being part of an international community. Historians of science (and scientists) are well attuned to pleas for support of "basic" science, or its moral equivalents, "pure" science, "fundamental" science, and "unfettered" research. In addition to providing the "capital" for future technology, as leading science policymaker Vannevar Bush once wrote, basic research was something that scientists did to maintain their integrity as scholars and their reputations as scientists rather than engineers. The idea of an international community helped to preserve these notions for scientists working under military patronage. Oceanographers in the 1950s and 1960s conducted work that became known to scientists worldwide, had foreign colleagues with whom they interacted, and complained at restrictions that constrained the free flow of knowledge from one country to another. This was especially clear in regard to classification policies of the U.S. Navy; scientists did not feel that their connection to the military violated their freedom of inquiry as long as the Navy allowed them to pursue their own ideas

and *to permit research to be known outside the United States.* When it refused the latter, marine scientists complained bitterly, more than they ever did when the Navy tried to "direct" their research toward specific applications. In the 1960s, this situation remained virtually unchanged. As the implementation phase of the *Polaris* missile and its successors promised to provide long-term support for oceanography, Henry Stommel appealed to Woods Hole director Paul Fye not to transform the institution to a purely military enterprise under a veil of secrecy; the scientists, he wrote, had international reputations to maintain.[17]

International cooperation also gave scientists opportunities to solicit funding from a broad range of sponsors while promoting their own scientific goals. When such goals were validated by international scientific bodies, they were more defensible against interference by sponsors. As scientists sought patronage beyond the military, international scientific bodies became useful sources of authority to justify scientific work whose applications or utility were not readily apparent to sponsors.

Oceanographers adopted "development" as a rhetorical strategy after the IGY, because the old justification, "easing tensions," had lost its credibility as a selling point: what tensions were eased with the launch of *Sputnik* under the auspices of the IGY? Soviet and American activities in Antarctica and renewed efforts by American scientists to open congressional purse strings by fomenting anxiety over Soviet oceanographic activities, both at the close of the IGY, did little to reinforce the notion that the project had eased tensions. Development, however, had potential. If developing countries, and international organizations such as Unesco, could be convinced to participate, scientists could widen the scope of their observations and create even larger projects than the IGY, all under the vague promise of helping to understand the practical problems of the oceans that affected all humanity. This certainly helped to acquire funding, but addressing such problems also obscured the difference between basic and applied research, a difference that had served scientists so well in dealing with the Navy. Selling science in this way opened up a host of new problems: conflicts with more genuine fisheries organizations, conflicts between fields of marine science fighting for dominance (biologists seemed to think their work was relevant to fish, too), and the constant headache of governments expecting scientists to make good on their promises of practical results.

Motivations for oceanographic cooperation were many, and they were not limited to science. Some were based upon defeating communism, gaining strategic advantages, or defending a garrison state; others were based

upon the spread of scientific inquiry to other nations, or upon using science to help solve humanity's most pressing problems. Often, one person could embrace all these goals, even when they seemed to contradict one another. Scientists often adapted to new selling points with genuine zeal; some oceanographers took pride in working for the Navy, just as others hoped to see their work contribute to ending world hunger. American oceanography and the beginnings of marine science in many countries were born into this paradox. There was no single underlying motivation. This book does not attempt to define a meta-motivation for cooperation, because it would never stand up to historical criticism. However, this book does endeavor to demonstrate how scientists used international cooperation to appeal to diverse interests and gain supporters and advocates. Or, as the title of this book suggests, they used international cooperation to cultivate "disciples" of marine science. The strategy they most often used was to adopt a broad, inclusive definition of oceanography, often employing the term "marine science," with its broad applicability and potentially wide appeal.

The subtitle of this book is taken from the reflections of a British scientist discussing the merits of a Unesco training course; he said that the purpose of cooperation was not necessarily to discover new theories or to create new Ph.D.'s, but rather it was to generate "interested young men and women who will be disciples of the marine sciences in their own countries."[18] Many countries of the developing world, heretofore relatively disinterested in oceanography, were counted among the disciples, with scientific communities and government sponsors that began to look to the ocean as a significant component of scientific health and economic well-being. Other disciples were the governments that took on major financial commitments to participate in international cooperative projects. These governments began to appreciate the sea as a source of food, of minerals, and even as a future area in which to claim national sovereignty. In the United States, President Johnson was not the first disciple in government, but he certainly was the first president to insist that, if scientists were making promises of economic benefits, they ought to deliver on them. Perhaps the most problematic disciples were the scientists themselves who, despite the all-inclusive appellation "marine science," rarely acted as a unit and even more rarely were comfortable with sharing responsibilities, money, and research priorities. At the same time, even the greatest skeptics of large-scale international cooperation, such as British physical oceanographer George Deacon, admitted that defining marine science broadly was probably the best means to achieve financial support and endorsement by various sectors of government. But

Deacon, like so many others, bitterly fought the readjustments in relative power between physical oceanography, marine geophysics, and the ever-threatening biological sciences. Oceanographers adopted strategies ensuring support for their work and used international cooperation to do so in ways coinciding with their own interests, whether those be muting the problems of military patronage with free data exchange, finding global social problems to justify research trajectories, or ensuring their autonomy at home by pointing to the activities and recommendations of an international scientific community. This book tells the extraordinary story of how this was accomplished amid the dangerous backdrop of the Cold War.

OCEANOGRAPHERS AND THE COLD WAR

1 BEGINNINGS OF POSTWAR MARINE SCIENCE AND COOPERATION

While on a fellowship in Japan in 1953, marine geologist Robert S. Dietz observed, "The time has come when a 'showing of the flag' can be more effectively done in many parts of the world by a vessel engaged in scientific pursuits than by a man o' war."[1] He was writing to scientists at the Scripps Institution of Oceanography in San Diego, California, who were planning an expedition to cross the Pacific Ocean and visit ports in Japan. Dietz did not specify precisely how he thought marine science could influence relations between the United States and Japan, but he believed that science could accomplish something that traditional diplomacy and military power could not. Perhaps he sensed, as many Americans did, that the status gained by science since the war gave it a unique role in international affairs and that scientists could serve in roles as diverse as military advisors, espionage agents, atomic diplomats, and harbingers of world government. International scientific cooperation seemed poised to play an important role in extending military power, pursuing foreign policy, and building contacts between scientists.[2]

Given the long-standing needs of science to coordinate the collection and interpretation of environmental data, studies of the ocean traditionally invited international cooperation; at the same time, they were heavily dependent upon military funding, implicitly challenging the premise that the research was truly "international."[3] This chapter traces a couple of basic changes that established the trajectory of scientific cooperation in marine science after World War II. One change was an emphasis on physical oceanography and marine geophysics, both in ascendancy in the Cold War era but having their roots in the 1930s. The other was in the patronage for oceanography, which shifted from private and philanthropic enterprises to military organizations, particularly the U.S. Navy. Both of these trends fed off of each other, allowing oceanographers to conduct ambitious interdisciplinary

expeditions in the early 1950s and helping to shift the focus of scientific activity from northern Europe to two institutions in the United States. However, American oceanographers did not simply retreat into military patronage under a veil of secrecy. They pressed for wider participation by other countries, to experiment with synoptic investigations and to share data, expanding the scope of a vaguely defined field infused with money in the early years of the Cold War.

NEW DIRECTIONS IN COOPERATION AND RESEARCH BEFORE WORLD WAR II

After World War II, cynics saw science taking a turn for the worse, seduced by military patronage and deprived of its democratic, international image. Cooperation tempered science's militaristic image and tied scientists to loftier goals, such as the advancement of science and the amelioration of global political pressures. This conception of science would later become a major focal point of the International Geophysical Year, which was trumpeted as a means to use science's international, nonpolitical character to "ease the tensions" of the Cold War through cooperation. In a well-known 1962 article, Michael Polanyi outlined some characteristics of the global mentality in what he termed the "republic of science." To be part of it, scientists not only had to exercise freedom of inquiry but also needed to participate in a community as large as the total number of scientists. Autonomous activity and coordination were the soul of Polanyi's republic, because "scientists, freely making their own choice of problems and pursuing them in the light of their own personal judgment are in fact cooperating as members of a closely knit organization."[4] Combining individuality and universal interdependence, Polanyi's "republic of science" was based on freedom of personal inquiry and close coordination with everyone else. Adherents to the view embodied by Polanyi's article embraced the notion of a scientific community transcending national borders. Scholars of science and colonialism have pointed out some of the flaws in this vision, particularly when scientists felt on the periphery because of their distance from cores of scientific activity in Europe and North America. Many felt that the "tyranny of distance" from the dominant centers of intellectual activity made their communities weak, subordinate to the leadership of Europe or the United States. Lack of access to institutions, to funding, and to data undercut many scientific communities' efforts to participate as equals. As historian George Basalla once noted, "colonial science" persisted even in the absence of for-

mal colonial relationships.[5] None of these limitations, however, seemed to extinguish scientists' faith that such an ideal could and should exist.

Before World War II, oceanographers tried to approximate the "republic of science" ideal in the Pacific region through the first four Pacific Science Congresses. In the 1920s, these congresses brought together scientists from countries bordering on the Pacific Ocean to coordinate research and, more important, to appeal collectively to home governments for funding. They reasoned that governments might be more sympathetic if local scientists could demonstrate the international significance of such patronage. The first congress passed dozens of resolutions calling upon governments to support surveys both at sea and on land. Only by working together, they reasoned, could they tackle the most important scientific problems of the Pacific. Oceanography was a major component, and at the second congress, in Melbourne and Sydney, Australian scientists organized a committee on the physical and chemical oceanography of the Pacific, consisting of representatives of each country. Coordinating research, outlining future areas of critical importance, and preventing duplication of effort all would remain hallmarks of international oceanography for years to come.[6]

Some scientists also believed that these meetings served the interests of world peace. Members of the Pacific Science Association (PSA) wanted to cross the threshold of political divisions between Europeans, Americans, and Asians.[7] Scientific advance would not be their only goal. Perhaps by the act of cooperation, they could attempt to promote positive international relations. In the words of Yale geologist Herbert E. Gregory, the 1923 congress in Melbourne demonstrated that "friendship and science held equal place." In 1926, the president of the National Research Council of Japan, Prince Joji Sakurai, noted that the most remarkable thing about the congress in Tokyo was the "genuine warmth of feeling which pervades it." Several scientists echoed these sentiments and hoped that the meetings would foster not only science but also understanding.[8] In this respect, scientists consciously took up politics to promote a consciousness that was global in scope.

The congresses never matched the idyllic model of Polanyi's "republic." The Americans who dominated them were disappointed with the scientific efforts of their foreign colleagues. Thomas Wayland Vaughan, director of Scripps, chaired the first standing committee on oceanography and set the standard for the papers presented. Only the Japanese and the Canadians compared well, while most others failed to impress in thoughtfulness or rigor. American marine biologist Carl L. Hubbs scorned the Dutch working

"day" that lasted from nine until one. He wrote to his wife after the 1929 meeting in Java that "the Dutch certainly fall down on details of administration, the natives are exasperatingly stupid and lazy, and neither have any real sense of time." He felt that only the Americans made a strong showing and that some papers, notably those of the Soviets, were so bad that they should be struck from the congress's printed volume.[9] But these Americans nonetheless viewed the congresses positively: they were a step in the right direction, toward creating high international standards and establishing interdependent relations between scientific communities in the Pacific.

Because most of the Asian participants were colonial Europeans, whose scientific communities had strong ties to those in their home countries, the sense of an international scientific community in the Pacific Ocean region may come as no surprise.[10] With indigenous peoples, Western scientists had rather different relationships, usually lacking the basic element of trust in the science itself. An important exception to this rule was Japan, whose tradition of biological research already had entered a period of flourishing.[11] Hubbs was impressed by the quality of the Japanese papers delivered at the 1929 Java congress, and it was clear that scientists from Japan prioritized the congresses, often sending more delegates than the Americans did. When Hubbs visited Japan just after the Java congress, he was charmed by the enthusiasm of the scientists he met and by their desire to establish reciprocal arrangements for sharing literature and specimens.[12] The Japanese seemed to make promising partners in scientific cooperation. Scientists had high hopes for the Pacific community, linked by an international scientific body that attempted, formally and informally, to create lasting cooperative bonds between scientists.

International scientific cooperation in the Pacific in the 1930s failed to meet the aspirations of the 1920s. Many intellectuals tried to forge closer relations between the interests of science and the needs of society, concluding that the "internal" (science) and the "external" (society) could not easily be separated.[13] But such insights, when pitted against the economic and political strains of the 1930s, failed to provide effective tools by which internationally minded scientists could shape the world around them. The Great Depression had a devastating effect on international cooperation. Scientific conferences were an expensive luxury for scientists with falling salaries and limited research grants. In the Pacific region, Japan's militarism in Asia put severe strains on the spirit of cooperation. Participation in the congresses declined dramatically during this period, and the only ones held during the 1930s were in Canada and the United States, in which scientists from North

America made up the vast majority of participants. The realization of their helplessness in the face of international strains actually prompted the PSA to add a new emphasis on the social sciences, to promote the application of brainpower to practical human relations.[14] Still, the PSA's desire to use scientific cooperation as a means to ease international tensions, and even to apply scientific methods to social problems, established among oceanic scientists not only an ideal of social responsibility but also a feeling that science might be able to contribute to international peace.

These cooperative sentiments, ambitious as they were, inspired only a small portion of oceanography before World War II. Oceanographic endeavors generally were not cooperative, and coordination of expeditions was rare. This is not to say that they were all purely nationalistic enterprises, but simply that they were funded and executed by individual countries, often with support by navies. In the 1920s and 1930s, the British sent the *Discovery* and *Discovery II* to the Antarctic, Denmark sent the *Dana* to the Indian and Pacific oceans, and Germany sent the *Meteor* on voyages in the Atlantic. The *Meteor* was supported by the German Admiralty, which reasoned that the vessel could serve as a symbol of peacetime German power and prestige in foreign ports.[15] This may appear to be a naïve expectation or at least a tall order for a small research vessel, but in light of Robert Dietz's later feeling that American scientific vessels could accomplish similar purposes as warships without the negative feelings that went with ostentatious displays of military power, Germany's interwar strategy does not seem out of the ordinary.

It should come as no surprise that governments were at least somewhat receptive to scientists' appeals to support work in oceanography and related sciences. After all, scientists already had proven their worth in assessing national resources. During and after the First World War, American (and European) general staffs relied upon geological advice for military planning, particularly in regard to trench and tunnel construction, and at Versailles geologists were called in to remap Europe according to its natural borders and mineral wealth.[16] In 1929, the United States Navy invited the Dutch geodesist Felix Andries Vening Meinesz to conduct gravity experiments aboard an American submarine. The Navy believed that Vening Meinesz's work on gravitational compensation on the ocean floor (studies in isostasy) might aid in the discovery and exploitation of fuel resources, which the Navy wanted in order to avoid dependence upon imports during wartime.[17] The resulting "S-21 expedition" revealed the complexities of gravity anomalies beneath the seafloor and gave Vening Meinesz's work