

A blue albatross is shown in flight, soaring over a vast expanse of deep blue ocean. The bird's wings are fully extended, and its long, hooked beak is visible. The water's surface is textured with small waves and reflects the sunlight, creating a shimmering effect. The overall scene is serene and captures the natural beauty of the ocean.

OCEAN

THE BASICS

WOLF BERGER

OCEAN – THE BASICS

**OUTLINE OF AN INTRODUCTORY COURSE IN OCEANOGRAPHY
FOR MIDDLE SCHOOL, HIGH SCHOOL AND COLLEGE,
WITH MATERIAL FOR COMPLEMENTING EXISTING COURSES**

by

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OCEAN THE BASICS

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[Excerpts from a book manuscript to be submitted to UC Press, celebrating a century of ocean research at Scripps and elsewhere, with additions]

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Introduction

Coping with a Sea of Change

What ocean scientists do has changed drastically in recent years. Not only are we using tools undreamt of a few decades ago, tools that produce immense data floods of entirely new types of observations, but also now the very objects of study have become moving targets. The various ecosystems of the ocean environment are changing rapidly in unforeseen and practically unpredictable ways. Today's graduate students and their mentors deal with a sea that is quite different from the one we studied even three decades ago.

It is a good time to take stock of what we have learned about the sea, as we enter an age where human impacts on the ocean environment – overfishing, coastal pollution, global warming – begin to exceed all other factors driving long-term change. This new age puts the stamp of “history” on what was, until yesteryear, a more or less familiar part of the planet's workings. The climate system, which governs the ocean's motions and thereby the life cycles of its inhabitants, is changing before our eyes, as the ocean warms and the winds and currents respond.

To ease the troubled mind, beyond the fleeting images of rapid change there are the underlying patterns of behavior of the ocean and its ecosystems, rules and concepts that emerged from the studies in the past century. Of all these studies, those concerned with the history of the ocean are likely to remain highly relevant. Today's changes cannot change history. In fact, the significance of today's changes can only be measured against the range of changes of the past. To define what is “unusual” implies knowledge of history, and the definition of change itself presupposes a comparison with expectations, derived from both experience and theory.



Fig. I.01. Digging up the history of the sea. The drilling vessel *JOIDES Resolution*.

The great body of basic ocean knowledge that has accumulated in the past century is an invaluable resource in dealing with the changes now afoot. We need to look to these basics when attempting to understand the direction things are going. Essential portions of basic ocean science were generated at Scripps Institution of Oceanography, where research on upwelling started early in the 20th century, followed by systematic surveys of the sea off California and the life within it and along its shores. During the war years, acoustic exploration of the deep ocean, using sound waves to “see” in the vast dark realm below the sunlit surface waters, served the Navy’s needs. Fisheries and a desire for general discovery of a poorly known ocean world provided impetus for research after WW II. Deep Sea Drilling, managed by Scripps for a consortium of oceanographic institutions, started in the 1960s, with the *Glomar Challenger*, later replaced by the much larger *JOIDES Resolution*. All through the second half of the 20th century, the vessels of the Scripps fleet criss-crossed the ocean, gathering vital data. From the 1980s satellite surveys yielded much additional information, on large scales that allowed the generalization of the findings along ship tracks.



Figure I.02. Reaching out beyond the breakers: the pier of Scripps Institution of Oceanography in La Jolla, California. Upper right: the Birch Aquarium at Scripps, SIO’s center for public education. SIO is a part of the University of California, San Diego campus.

Figure sources: I.01, *JOIDES Resolution* in seas stirred by trade winds, Ocean Drilling Program; I.02, Scripps Pier, air photo by the author. All figures modified using image processing (here and throughout).