

No. LXIV, MARTIUS MMXXII

ISSN: 2001-9734
ISBN: 978-91-89331-40-2

ACTA ACADEMIAE STROMSTADIENSIS

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**Ocean Science and International Cooperation; Historical
and Personal Recollections, extended abstract**

Ocean Science and International Cooperation; Historical and Personal Recollections

by Gunnar Kullenberg, (IOC/UNESCO, Paris 2021)

(Extended) Abstract

Cooperation is fundamental for pursuit of knowledge. The aim of the present book is to highlight the role of international cooperation, together with social and environmental developments and needs, in our efforts to understand the most important realm of our planet: the ocean. The content presents the development and role of cooperation in ocean exploration and science, coupled with new technology, over more than two centuries. Regional divisions and motivations for specific actions, including social needs and environmental concerns, are examined to demonstrate this development. The reflections are also linked to the creation, development and strengthening of the Intergovernmental Oceanographic Commission of UNESCO and its role in facilitating cooperation. Since the mid-nineteenth century, the development of oceanography through exploration and scientific observation has been coupled with industrialization and is indivisible from scientific, technological and social change. It has been driven by revolutions and wars as well as globalizations, reflecting developments in trade, transportation and economic growth. All have increased the need for governments and industry for greater knowledge of the ocean conditions and resources. Results of the research have provided the basis for an integrated interpretation in a number of assessments with respect to the conditions in the ocean and shelf seas. These have demonstrated the necessity for proper governance and management of the ocean as a whole including the marine resources.

The content in 30 chapters, with my personal experiences given in 8 separate boxes, initially includes overviews of cooperative data collections through systematic, agreed regular observations from ships with data exchange which was initiated in the mid 1800's; of some earlier explorations with collection of samples of material and data involving several nations and scientists; several subsequent chapters for the period up until WW II consider the mounting of global and regional ocean science expeditions in light of major infrastructure and industrial developments, with the Challenger Expedition 1872-76 as a leading example. The discussion also includes considerations of concerns for limitations of fisheries resources on a regional level, resulting in the creation of the International Council for the Exploration of the Sea, ICES, in 1902 (chapters 1-8).

Directly after WW II, scientific cooperation was motivated by the desire to bring technologies developed during the war into ocean science and observation, and attract leading scientists from other disciplines. This was combined with new ideas not so far fully tested and technological developments. The section illustrates the process by highlighting two global expeditions by Sweden in the Albatross 1947-48 and by Denmark in the Galathea 1950-52, and by several new technologies for ocean observations such as recording current meters, satellite navigation and observations, and diving technology (chapters 9, 10, 11).

The next section identifies the need for ocean governance and management in cooperation, brought out by extensions of national jurisdictions together with discoveries of many resources on and in the ocean floor. This development triggered the UN Conferences on the Law of the Sea, with the third one 1973-82 resulting in the current UN Convention on the Law of the Sea, UNCLOS, which entered into force in November 1994. This also stimulated the development of the International Decade of Ocean Exploration 1971-80, that enabled and stimulated increasing ocean scientific

cooperation at global, regional and sub-regional levels with inclusion of several additional countries (chapters 12, 13). The subsequent section considers the increasing concerns regarding the degradation of the marine environment, overfishing, coastal erosion, levels of waste disposal and pollution, global changes in demography, nutrition and political tensions. The whole development relates to the Stockholm Conference on the Human Environment 1972 with the creation of UNEP, the UN Conference on Environment and Development 1992, and increasing applications of agreed cooperative management processes together with creation of regional conventions (chapters 14-22).

The following section traces the notion of the sustainable development paradigm, climate change and multi-stressor issues, including ocean acidification, warming and decreasing oxygen content, plastic pollution, sea level change and decreasing organic production. All of this triggers the idea of the Ocean Science Decade for Sustainable Development 2021-2030, as an element of the UN Agenda 2030 (chapters 23, 24, 25).

The final section examines the developments up to about 2015, including modalities of interdisciplinary cooperation, increasing need for integration with involvement of social and economic sciences, for instance in relation to the strong, competitive development of ocean (blue) economy. Trends in ocean research and industrial applications are elucidated, together with some results of the cooperative research efforts, being gradually applied in services of society.

The executive summary is given in the form of five Executive messages highlighting: the ocean imperative-without the ocean we would not be here; the need for ocean governance; the need for knowledge, understanding and cooperation; the funding requirements; and the institutional development needs.