



world ocean review 
Living with the oceans. 2010

Published by
maribus in cooperation with



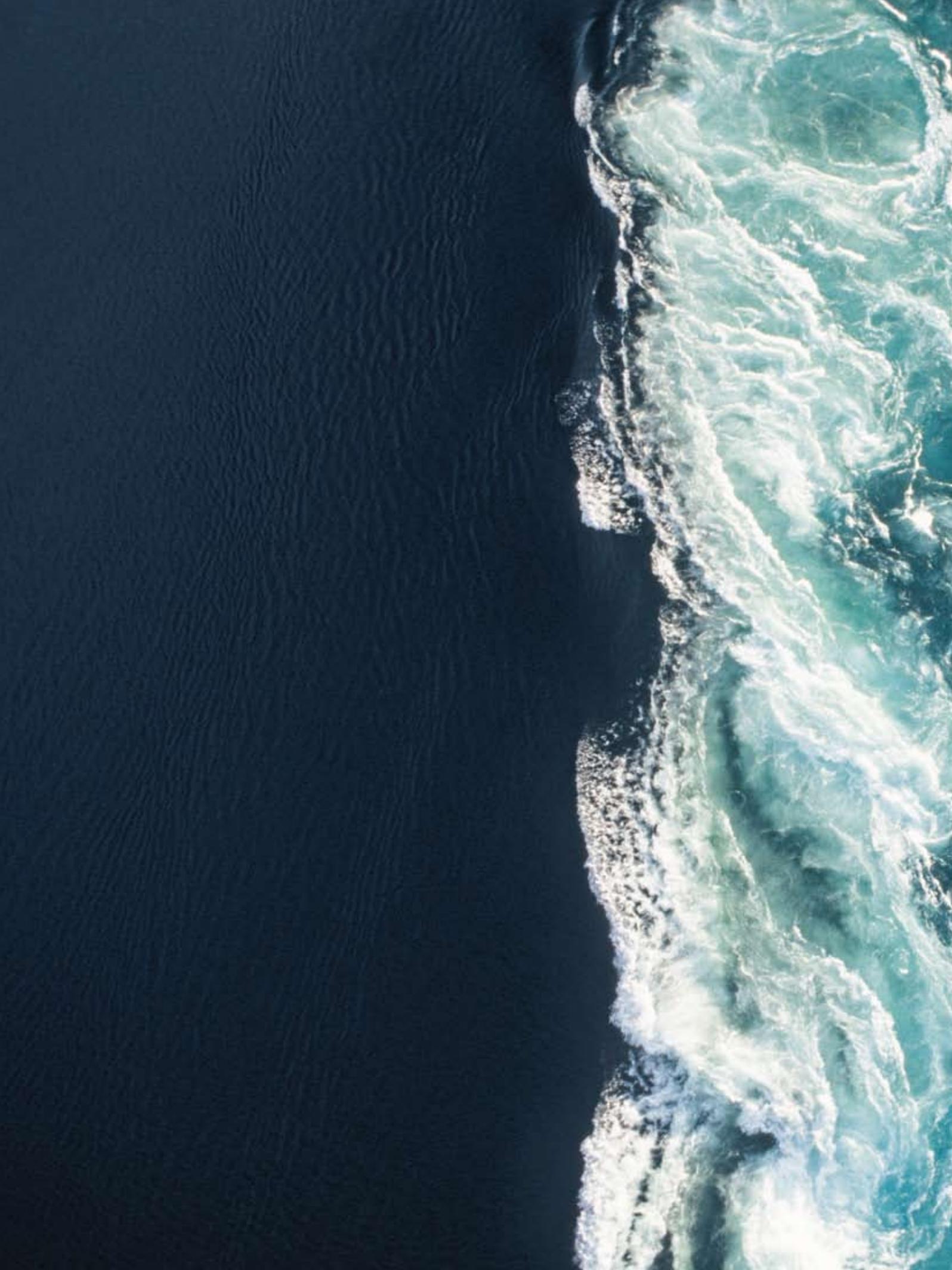
future ocean
KIEL MARINE SCIENCES



mare

1

world ocean review 
Living with the oceans. 2010



Authors:

Moritz Bollmann, Thomas Bosch, Franciscus Colijn,
Ralf Ebinghaus, Rainer Froese, Kerstin Güssow,
Setareh Khalilian, Sebastian Krastel, Arne Körtzinger,
Martina Langenbuch, Mojib Latif, Birte Matthiessen,
Frank Melzner, Andreas Oschlies, Sven Petersen,
Alexander Proelß, Martin Quaas, Johanna Reichenbach,
Till Requate, Thorsten Reusch, Philip Rosenstiel,
Jörn O. Schmidt, Kerstin Schrottke, Henning Sichelschmidt,
Ursula Siebert, Rüdiger Soltwedel, Ulrich Sommer,
Karl Stattegger, Horst Sterr, Renate Sturm, Tina Treude,
Athanasios Vafeidis, Carlo van Bernem,
Justus van Beusekom, Rüdiger Voss, Martin Visbeck,
Martin Wahl, Klaus Wallmann, Florian Weinberger

Preface

Our environmental awareness is steadily increasing, albeit very slowly. This process began when we started to address obvious and visible problems. As a result, our streets, beaches, fields and forests became cleaner, industrial emissions decreased, and our chimneys produced less and less air pollution. When we see that there is a problem and there is scope for advocacy, we take action.

The oceans, however, are vast and largely inaccessible, and our awareness and understanding of them are correspondingly small. What's more, they have hardly any advocates or lobby to represent their interests. This is especially remarkable when we consider that the seas crucially influence our climate and are an increasingly important source of food.

The Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) in 2007 and the Stern Review, published in 2006, created an unprecedented level of awareness worldwide of the problems and impacts of climate change. This sparked the idea of producing a similar type of report for the oceans, which cover three-quarters of the Earth's surface, thus focusing attention on some of the most urgent issues facing us today.

To that end, the publishing house *mareverlag* in Hamburg set up the non-profit company *maribus* two years ago. This was motivated not by commercial interest but by the desire to focus maximum possible attention on the state of the world's oceans. Partners were sought to support the pursuit of this objective, and the International Ocean Institute (IOI) and the non-profit Ocean Science and Research Foundation (OSRF) – both founded by Elisabeth Mann Borgese – joined the project. The IOI provides logistical support, its close association with the work of the United Nations playing an important role in this context. The OSRF provides financial backing for the project.

The key scientific partner is the Cluster of Excellence "The Future Ocean" – a research group made up of more than 250 scientists investigating climate and ocean change at a number of research institutions in Kiel. Drawing on their outstanding expertise and applying an interdisciplinary approach, more than 40 scientists within the Cluster have authored this first *World Ocean Review* (WOR).

The primary purpose of this first review is not to focus on spectacular new findings or launch high-profile appeals. Rather, with its judicious combination of well-researched and substantive content presented in a clear and accessible style – thanks to the cooperation with *mareverlag* – the *World Ocean Review* aims to paint a clear and compelling picture of the complex state of the world's oceans and underline the urgent need for action.

It is up to us to act on this knowledge. We hope that as we look to the future, the *World Ocean Review* will inspire advocacy to protect and preserve our blue planet.



Nikolaus Gelpke
Managing Director of *maribus gGmbH* and *mareverlag* publisher

The scientists in the Cluster of Excellence “The Future Ocean” undertake research in a range of disciplines, evaluating the complex interactions between the oceans and global change and assessing opportunities and risks. But how much do we really know about the state of the oceans today? What do we know about the many influences that come into play in relation to the increasing overexploitation of the seas or climate change, both of which have a direct and indirect impact on the marine environment? What are the limits to our understanding? And can sustainable solutions be devised for the future use of the seas?

Journalists, teachers and interested members of the public often ask us, the scientists, these questions, but they are difficult for individual marine researchers to answer comprehensively. The Kiel-based Cluster of Excellence “The Future Ocean” therefore brings together researchers from many different disciplines – marine scientists, earth scientists, biologists and chemists, as well as mathematicians, economists, lawyers and medical scientists – to engage in joint interdisciplinary research on the marine environment. How can unresolved questions be investigated and reliable answers provided? The diversity of disciplines and research institutions involved in the Cluster of Excellence comes into play here and helps to provide a comprehensive overview of the state of the world’s oceans.

The *World Ocean Review* is our attempt to present as realistic a picture as possible of the current state of the oceans. The aim is to draw together findings from the various disciplines and share our knowledge with the general public. We began by identifying the major issues of relevance to the state of the oceans. We asked scientists within the Cluster of Excellence to write about the current situation and topical issues from a variety of perspectives. Professional journalists were on hand to guide the experts with helpful advice on style and the choice of photographs and illustrations.

Readers will observe that many of the topics covered in the various chapters focus on humankind’s use and overexploitation of the marine environment. This apparently infinite resource has become finite. As the *World Ocean Review* makes clear, the state of the oceans, as depicted here, gives frequent cause for concern. The outlook on possible developments and consequences of further overexploitation and pollution of the marine environment sadly only reinforces our concern and highlights the important role that preventive research in the field of marine sciences has to play for the future of humankind. The scientists in Kiel wish to make a contribution here.

We wish all the users of this first *World Ocean Review* an interesting and informative read.

A handwritten signature in black ink, reading "Martin Visbeck". The signature is written in a cursive, slightly slanted style.

Prof. Dr. Martin Visbeck
Chairman, Cluster of Excellence “The Future Ocean”



Preface	4
The world oceans, global climate drivers	chapter 1
Earth's climate system – a complex framework	10
The great ocean currents – the climate engine	16
CONCLUSION: Time to act	25
How climate change alters ocean chemistry	chapter 2
The oceans – the largest CO ₂ -reservoir	28
The consequences of ocean acidification	36
Oxygen in the ocean	44
Climate change impacts on methane hydrates	48
CONCLUSION: Material fluxes – getting the full picture	53
The uncertain future of the coasts	chapter 3
Sea-level rise – an unavoidable threat	56
How nature and humankind alter the coasts	60
The battle for the coast	68
CONCLUSION: The future of the coast – defence or orderly retreat?	73
Last stop: The ocean – polluting the seas	chapter 4
Over-fertilization of the seas	76
Organic pollutants in the marine environment	82
Litter – pervading the ocean	86
Oil pollution of marine habitats	92

预览已结束，完整报告链接和二维码如下：

https://www.yunbaogao.cn/report/index/report?reportId=5_10091

