

# LISTS OF PROPOSED WRITING TEAMS SECOND WORLD OCEAN ASSESSMENT

## PART 1: SUMMARY

### CHAPTER 1: OVERALL SUMMARY

This chapter will be prepared collectively by the Group of Experts of the Regular Process

## PART 2: INTRODUCTION

### CHAPTER 2: APPROACH TO THE ASSESSMENT

This chapter will be produced by a sub-group of the Group of Experts, with the help of the secretariat.

## PART 3: DRIVERS OF CHANGES IN THE MARINE ENVIRONMENT

### Writing team for Chapter 3

CHAPTER 3	SCIENTIFIC UNDERSTANDING		
	The importance of marine scientific research, and recent step-change improvements in understanding the ocean.		
NAME	STATE <sup>1</sup>	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Renison Ruwa	Kenya	Deputy Director, Kenya Marine and Fisheries Research Institute.	Contributor to Chapters 32 and 53 (Capacity-building), 36E (Indian Ocean biodiversity) and 48 (Mangroves) of WOA I. PhD, University of Florence, Italy. Published on influence of seasonality and bathymetry on crustacea, mangroves, etc.
<b>CO-LEAD MEMBERS</b>			
Sanae Chiba	Japan	Senior Scientist, Japan Agency for Marine-Earth Science and Technology, Tokyo	Ph.D. in aquatic bioscience, Tokyo University of Fisheries, Japan. Published on long-term marine ecosystem change, plankton, etc.
Carlos Garcia-Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
Tymon Zielinski	Poland	Professor, Institute of Oceanology, Polish Academy of Science, Sopot, Poland	PhD in oceanography, University of Gdańsk, Poland. Published on air/sea interchange, marine boundary layer, etc.

<sup>1</sup> In this and the other tables "STATE" generally refers to the State that nominated the expert. Where it is known that the State suggesting the expert is not the State of the expert's nationality, that nationality is also indicated. Where an intergovernmental organization has recommended an expert, the State specified is the State that has accepted the suggestion.

<b>CONVENOR</b>			
Bing Qiao	China	Vice-director of Academic Committee and Professor, China Waterborne Transport Research Institute	Registered Environmental Impact Assessment (EIA) Engineer in China, Expert group member of Chinese scientific project of Marine Environmental Safety (ENSURE).
<b>MEMBERS</b>			
Mohammad Zahedur Rahman Chowdhury	Bangladesh	Director and Associate Professor, Institute of Marine Sciences and Fisheries, University of Chittagong Chittagong, Bangladesh	PhD. in fisheries oceanography, University of Chittagong. Published on sea surface temperature in the Bay of Bengal, and on fisheries resilience, etc.
Kedong Yin	China	Professor, School of Marine Sciences Sun Yat-Sen (Zhongshan) University, Guangzhou	PhD, University of British Columbia, Canada. Published on dynamics of nutrients, phytoplankton biomass, etc.
Antonio di Natale	Italy	Secretary General of the Genoa Aquarium Foundation, Italy	PhD, University of Messina, Italy. Published on tuna and swordfish, etc.
Chang Zhang	Republic of Korea	Professor, Pukyong National University, Busan, Korea	PhD, University of Washington, WA, USA. Published on fish stock propagation, impact of climate change on fisheries.
Colin Moffat	United Kingdom	Chief Scientific Advisor Marine, Marine Scotland, Scottish Government, Scotland	PhD, University of Aberdeen, Scotland. Published on pilot whales, agricultural chemicals and the marine environment, trophic transfer through food webs, oil spills, etc.
Paulo Antunes Horta Junior	Brazil	Associate Professor Laboratório de Ficologia, Departamento de Botânica, Centro de Ciências Biológicas Universidade Federal de Santa Catarina, Brasil	PhD, São Paulo University. Published on the role of Ecological/Oceanographic Processes and Implications to Marine Forest Conservation, Structural and physiological responses of Halodule wrightii to ocean acidification, and on Antarctic Circumpolar Current
Enrique Marschoff	Argentina	Member of the Instituto Antártico Argentino, Buenos Aires, Argentina	Contributor to Chapters 11 (Capture fisheries), 15 (Social and economic aspects of fisheries), 36B (South Atlantic biodiversity), 36H (Southern Ocean biodiversity) 46 (High-latitude ice), 54 (Overall human impact) and 55 (Overall value) of WOA I. Doctorate in biological sciences, University of Buenos Aires, Argentina. Published on Southern Ocean fisheries, Southern elephant-seal, etc.
Hoinsoude Segniagbeto	Togo	Associate Professor at the Department of Zoology and Animal Biology,	PhD in zoological systematic, University of Lomé, Togo.

		Faculty of Sciences, University of Lomé	
Bi Tra Boniface Nene	Cote d'Ivoire	Head of the Mapping and Offshore Environment Department at Ministry of Petroleum, Energy and Renewable Energies	Master in Geographic Information System (GIS), Institut des Sciences et Industries du Vivant et de l'Environnement, Paris. Petroleum Engineer, Institut National Polytechnique Félix Houphouet Boigny, Yamoussoukro, Côte d'Ivoire
Jocelyne Mpemba Kazadi	Democratic Republic of Congo	Head Officer in the Water Resource Directorate, Ministry of Environment and Sustainable Development, Kinshasa	Recent publications include on Integrating Biosecurity for a Successful Shift from Subsistence to Sustainable aquaculture, National Action Plan for DR Congo Coastal Area. Also an active member of the team who developed the Congolese coastal area assessment for the 2010 Coastal National Action Plan.
Carlos Francisco Andrade	Brazil	Adjunct Professor at Universidade Federal do Rio Grande, Brazil	PhD in physical, chemical and geological oceanography, Universidade Federal do Rio Grande, Brazil. Published on groundwater discharge, trace elements in seaweed, etc.
Sekou Tidiane Bangoura	Guinea	Head of Sea Physic Laboratory, Conakry, Guinea	Master of Engineering Degree in Environmental Science, China University of Geosciences (Wuhan), China; Master of Science in Molecular Chemistry, university of Conakry, Guinea. Specialized in Physical oceanography, and GIS technology and method to assess environmental problems from land use/cover changes.

## Writing team for Chapter 4

CHAPTER 4	<b>DRIVERS</b>		
	Developments in human population (especially populations in coastal areas); development aspirations: food security and food safety; resource use (including demand for metals and hydrocarbons and the use of marine genetic resources); energy, transport; leisure and recreation.		
NAME	STATE	AFFILIATION	OTHER RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Renison Ruwa	Kenya	Deputy Director, Kenya Marine and Fisheries Research Institute.	Contributor to Chapters 32 and 53 (Capacity-building), 36E (Indian Ocean biodiversity) and 48 (Mangroves) of WOA I. PhD, University of Florence, Italy. Published on influence of seasonality and bathymetry on crustacea, mangroves, etc.
<b>CO-LEAD MEMBERS</b>			
Osman Keh Kamara	Sierra Leone	Sierra Leone Ambassador to Ethiopia and Permanent Representative to the African Union	Contributor to Chapters 17 (Shipping) and 32 and 53 (Capacity Building) of WOA I. Graduate of University of Sierra Leone and Columbia University, New York, Post-Graduate Diploma (Rhodes Academy of Ocean Law and Policy, Greece).
<b>CONVENOR</b>			
Chang Ik Zhang	Republic of Korea	Professor, Pukyong National University, Busan, Korea	PhD, University of Washington, WA, USA. Published on fish stock propagation, impact of climate change on fisheries.
<b>MEMBERS</b>			
Andrew Johnson	United Kingdom	Scripps Institution of Oceanography, California, USA, and Marfisheco consultancy	PhD, Bangor University, UK. Published on small-scale fisheries, effects of bottom trawling, etc.
Thomas Therriault	Canada	Pacific Biological Station, Department of Fisheries and Oceans Canada, British Columbia	Convenor of the writing team for Chapter 36C (North Pacific Biodiversity), WOA I. Published on invasive species, etc.
Ben S. Malayang III	Philippines	Institute of Environmental and Marine Sciences, Silliman University	PhD (Wildland Resource Science), Department of Forestry and Environmental Management, University of California at Berkeley. Published on Environmental Science, Ecosystem Assessments and Valuation

## PART 4: CURRENT STATE OF THE MARINE ENVIRONMENT AND ITS TRENDS

### Writing team for Chapter 5

CHAPTER 5	<b>OCEAN PHYSICAL AND CHEMICAL STATE</b> (a)Sea temperature; (b)Sea level; (c)Salinity; (d)Ocean circulation; (e)Sea ice; (f)Ocean chemistry; (g)Dissolved oxygen.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Carlos Garcia-Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
<b>CO-LEAD MEMBERS</b>			
Tymon Zielinski	Poland	Professor, Institute of Oceanology, Polish Academy of Science, Sopot, Poland	PhD in oceanography, University of Gdańsk, Poland. Published on air/sea interchange, marine boundary layer, etc.
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
<b>CONVENOR</b>			
Carlos Garcia-Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
<b>MEMBERS</b>			
Lijing Cheng (Sea Temperature)	China	International Center for Climate and Environment Sciences, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China	PhD, Institute of Atmospheric Physics, Chinese Academy of Sciences. Author in IPCC Report on Oceans and Cryosphere.
Anny Cazenave (Sea Level)	France	Director Laboratoire d'Etudes en Géophysique et Oceanographie Spatiales (LEGOS)	PhD in Geophysics (Rotation of the Earth), University of Toulouse. Cited in IPCC Special Report on Oceans and Cryosphere.
Levke Caesar (Ocean Circulation)	Germany	Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany	Master of Science (Physics), University of Potsdam, Germany. Published on North Atlantic meridional overturning circulation, European rainfall and temperature, etc. Cited in IPCC Special Report on Oceans and Cryosphere.

Libby Jewett (Ocean Chemistry)	United States	Founding Director of the Ocean Acidification Program, National Oceanic and Atmospheric Administration, USA	PhD in marine biology, University of Maryland, USA. Co-Chair of the Global Ocean Acidification Observing Network. Coordinating Lead Author for Oceans Chapter, Fourth USA National Climate Assessment.
Sunke Schmidtke (Dissolved oxygen)	Germany	GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany	Doctorate, University of Kiel, Germany. Cited in IPCC Report on Oceans and Cryosphere.
David Halpern (General aspects)	United States	Jet Propulsion Laboratory, California Institute of Technology/National Aeronautics and Space Administration, Pasadena, California, United States	PhD, Physical Oceanography, Massachusetts Institute of Technology, USA. Published on upwelling dynamics in the southeast Pacific Ocean and along the equator, large-scale ocean-atmosphere interactions in the southeast Pacific Ocean, etc.
Matthew Collins	United Kingdom	Joint Met Office Chair in Climate Change, College of Engineering, Mathematics and Physical Sciences (CEMPS), University of Exeter, United Kingdom.	PhD Meteorology, University of Reading, United Kingdom.

### Writing teams for Chapter 6

<b>CHAPTER 6</b>	<b>BIOTA DIVERSITY</b>		
	Trends in the biodiversity of main taxa of marine biota. Biodiversity of taxa will be described in terms of abundance, distribution, productivity and diversity within the taxon.		
<b>NAME</b>	<b>STATE</b>	<b>AFFILIATION</b>	<b>RELEVANT EXPERIENCE</b>
<b>LEAD MEMBER</b>			
Chul Park	Korea (Republic of)	Chair of the North Pacific Marine Science Organisation (PICES), Professor of Oceanography and Ocean Environmental Sciences, Chungnam National University, Daejeon, Republic of Korea	Contributor to Chapters 6 (Primary production and plankton), 36C (North Pacific biodiversity) of WOA I. PhD in Oceanography, Texas A&M University, USA. Published on zooplankton distribution, phytoplankton dynamics, etc.
<b>CO-LEAD MEMBERS</b>			
Hilconida Calumpong	Philippines	Director, Institute of Environmental and Marine Sciences, Silliman University, Philippines	Contributor to Chapters 6 (Primary production and plankton), 14 (Seaweeds), 47 (Kelp forests and seagrasses), and 48 (Mangroves) of WOA I. PhD (major in Botany), University of California, Berkeley. Published on mangroves, seagrasses, algae, invertebrates, coastal resource management, etc.

Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
Henn Ojaveer (especially Chapter 6C)	Estonia	Research Professor in Marine Ecosystems, University of Tartu, Estonia.	PhD in ichthyology and fisheries, University of Tartu, Estonia. Published on invasive species, biodiversity status of the Baltic, etc.
<b>CHAPTER 6A</b>	<b>PLANKTON</b>		
<b>CONVENOR</b>			
Thomas Malone	United States	Professor Emeritus, Horn Point Laboratory, Center for Environmental Science, University of Maryland	Convenor of writing team for Chapter 6 (Primary production and plankton), WOA I.
<b>MEMBERS</b>			
Maurizio Azzaro	Italy	Research scientist CNR - Institute for Coastal Marine Environment	Contributor to Chapters 6 (Primary production and plankton) and 36H (Southern Ocean), WOA I. Published on Arctic and Antarctic marine microbes, etc.
Russell Hopcroft	Canada	Professor, Institute of Marine Science, University of Alaska, Fairbanks, AK, United States	PhD, University of Guelph, Canada. Contributor to Chapters 34 (Global Patterns of Marine Biodiversity) and 35 (Extent of Assessment) of WOA I. Published on arctic zooplankton, etc.
Kazuaki Tadokoro	Japan	Research scientist, Tohoku National Fisheries Research Institute	PhD, University of Tokyo. Published on phosphate variation in North Pacific, etc.
Michael Thorndyke	Sweden	Professor, Department of Biological and Environmental Sciences, University of Gothenburg	Contributor to Chapters 3 (Scientific understanding) and 6 (Primary production and plankton), WOA I. Published on impact of acidification on marine organisms, etc.
Sinjaee Yoo	Korea	Research scientist Korea Institute of Ocean Science and Technology	PhD, State University of New York. Published on primary productivity of North-West Pacific Large Marine Ecosystems, remote sensing, etc.
<b>CHAPTER 6B</b>	<b>MARINE INVERTEBRATES</b>		
<b>CONVENOR</b>			
Lis Lindal Jørgensen	Norway	Senior Scientist, Research Group of Ecosystem Processes, Institute of Marine Research in Norway	DSc on benthic fauna, University of Bergen. Published on Arctic macrobenthos, etc.
<b>MEMBERS</b>			
Rachel Przelawski	Australia	Senior Benthic Ecologist, Geoscience	PhD, University of Wollongong. Published on marine seismic

		Australia	surveys and sponge biodiversity, etc.
Jake Rice	Canada	Chief Scientist Emeritus, Department of Fisheries and Oceans, Canada	Editor of Part VI (Biodiversity) of WOA I.
Christos Arvanitidis	Greece	Institute of Marine Biology, Biotechnology and Aquaculture Thalassokosmos, Heraklion, Greece	PhD, University of Thessaloniki on Aegean polychaeta. Published on effects of tourism on benthos, marine leeches, etc.
Alan Deidun	Malta	University of Malta; International Ocean Institute, Malta	PhD, University of Malta. Published on invasive species, jellyfish, beached litter, etc.
Malcolm Ross Clark	New Zealand	Principal Scientist (Fisheries), National Institute of Water & Atmospheric Research, New Zealand	PhD, University of Wellington. Contributor to Chapters 34 (Global patterns of biodiversity), 35 (Extent of biodiversity assessment) and 36F (Open Ocean Deep Sea) of WOA I. Member of Technical Committee of International Seabed Authority. Published on deep-sea mining, seamounts, etc.
Ana Cristina Martins de Jesus	Portugal	Marine Evidence Manager, Joint Nature Conservation Committee, Peterborough, England	MSc in Marine Biology, University of the Algarve. Published on marine benthic monitoring, etc.
Silvana N. R. Birchenough	United Kingdom	Centre for Environmental, Fisheries and Aquatic Science, Lowestoft, United Kingdom	Chair of the ICES Benthic Ecology Working Group.
Carmen Mifsud	Malta	Environment and Resources Authority, Malta	Co-Chair of the Regular Process regional Workshop, Valetta, August 2018. MSc in marine biology, University of Malta. Published on marine turtles, Mediterranean marine ecology, etc.
Marina Cunha	Portugal	Assistant Professor, Centro de Estudos do Ambiente e do Mar, University of Aveiro, Portugal	PhD, University of Aveiro. Published on hydrothermal vents and hydrocarbon seeps, etc.
Paul Snelgrove	Canada	Professor, Department of Ocean Sciences and Biology Department Memorial University of Newfoundland, St. John's, Canada	PhD in Biological Oceanography, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution (MIT/WHOI) Joint Program in Oceanography.
Judith Gobin	Trinidad and Tobago	Marine Biologist, University of the West Indies,	PhD in Marine Biology with environmental and ecological experience in the marine and



		St. Augustine, Trinidad and Tobago	coastal areas of Trinidad and Tobago. Researcher and co-author in the first Global Census of Marine Life with the NAGISA (rocky shore) Caribbean project
Md. M. Maruf Hossain	Bangladesh	Professor, Institute of Marine Sciences and Fisheries, University of Chittagong, Bangladesh	PhD in Benthic Ecology; Marine Invasive species; Marine and Coastal Ecosystem Based Management.
Nguyen Khac Bat	Viet Nam	Director, Research Institute for Marine Fisheries, Ministry of Agriculture and Rural Development	PhD in Marine Science, Tokyo University of Marine Science and Technology. Published on fish stock assessment, squid, bycatch, etc
Igor Cristino Silva Cruz	Brazil	Assistant professor of biological oceanography at Oceanography Department on Federal University of Bahia, Rua Barão de Jeremoabo, Brazil	PhD in benthic ecology, University of Rio de Janeiro State, Sea area: The South Atlantic Ocean and the Wider Caribbean.
Natalia Strelkova	Russia	Deputy head of laboratory, Polar Research Institute of Marine Fisheries and Oceanography, Murmansk, Russian Federation	PhD in arctic benthic ecology, biology and taxonomy. Published on large scale patterns and trends in Barents Sea benthos.
Leen Vandepitte	Belgium	Senior scientist and project leader, Data Centre Division Flanders Marine Institute (VLIZ), Oostende Belgium	Project manager at the Flanders Marine Institute (VLIZ); Data manager of the European Ocean Biogeographic Information System (EurOBIS); Data manager of the World Register of Marine Species (WoRMS)
<b>CHAPTER 6C</b>	<b>FISH</b>		
<b>CONVENOR</b>			
Thomas J. Webb	United Kingdom	Lecturer, Animal and Plant Sciences, University of Sheffield	Published on large-scale patterns and trends in marine biodiversity, climate-change impact on fisheries, etc.
<b>MEMBERS</b>			
Bat, Nguyen Khac	Viet Nam	Director of the Research Institute for Marine Fisheries, Marine Research Institute	Doctorate in Marine Science, Tokyo University of Marine Science and Technology. Published on fish stock assessment, squid, bycatch, etc
Burcu Bilgin Topcu	Turkey	European Union Expert, Ministry of Food, Agriculture and Livestock, General Directorate of	PhD in fisheries, Ankara University. Published on management of tuna and swordfish, fisheries discards, etc.

		Fisheries and Aquaculture	
Fernanda De Oliveira Lana	Brazil	Post-Doctoral Student in Marine Biology and Coastal Environments, Federal Fluminense University, Rio de Janeiro, Brazil	PhD in fisheries, Federal Rural University of Pernambuco. Published on sharks and other elasmobranchs, etc.
Hazel Oxenford	Barbados	Professor, Centre for Resource Management and Environmental Studies, The University of the West Indies at Cave Hill, Barbados	PhD on dolphinfish, University of West Indies. Contributor to Chapter 36A (North Atlantic biodiversity) of WOA I. Published on climate-change impacts on fish, fisheries impacts on reef fish, etc.
Maria Jose Juan-Jordá	Spain	Postdoctoral Researcher, AZTI Innovation Centre for marine and food technology, Basque Country, Spain	PhD in marine biology, University of A Coruna, Spain. Published on fisheries impact on biodiversity, etc. Contributor to Chapter 41 (Tuna and billfish) in WOA I.
Michael Thorndyke	Sweden	Professor Emeritus, The Linnaeus Centre for Marine Evolutionary Biology, University of Gothenburg	Contributor to Chapters 3 (Scientific understanding) and 6 (Primary production and plankton), WOA I. Published on impact of acidification on marine organisms, etc. Holds Linnaeus Gold Medal from the Royal Swedish Academy of Science.
Mudjekeewis D. Santos	Philippines	Scientist, National Fisheries Research and Development Institute, Philippines	PhD in Applied Marine Biosciences, Tokyo University of Marine Science and Technology. Published on fisheries resources, tuna, giant clams, etc.
Tracey T. Sutton	United States	Associate Professor, Department of Marine and Environmental Sciences, Nova Southeastern University, Fort Lauderdale, Florida, United States	PhD, University of South Florida. Contributor to Chapter 36F (Open Ocean Deep Sea) of WOA I. Published on deep-sea ecology, mesopelagic zone, etc.
V.N. Sanjeevan	India	Centre for Marine Living Resources and Ecology, Kochi, Kerala, India	Contributor to Chapter 13 (Fish stock propagation) in WOA I. Published on Indian Ocean fish, echinoderms, etc.
Francisco Navarrete-Mier	Ecuador	Professor, Marine Sciences Faculty, University Laica Eloy Alfaro de Manabí, Manta, Ecuador	PhD, University of Murcia, Spain. Published on ocean acidification and fisheries, impacts of aquaculture, etc.

<b>CHAPTER 6D</b>		<b>MARINE MAMMALS</b>	
<b>CONVENOR</b>			
David Lusseau	France	University of Aberdeen, Scotland, United Kingdom	PhD, University of Otago, New Zealand. Published on marine mammal tourism, disturbance to marine mammals, etc.
<b>MEMBERS</b>			
Iryna Makarenko	Ukraine	Black Sea Commission Secretariat, Istanbul, Turkey	MSc, Catholic University of Leuven, Belgium. Published on assessment of Black Sea marine living resources, etc.
Luciano Dalla Rosa	Brazil	Institute of Oceanography, Universidade Federal do Rio Grande, Brazil	PhD, University of British Columbia, Canada. Published on marine mammal spatial ecology and movements.
Marta Soeffker	United Kingdom (Germany)	Centre for Environmental, Fisheries and Aquatic Science, Lowestoft, and University of East Anglia, Norwich, United Kingdom	PhD, University of Exeter, United Kingdom. Published on interactions between fisheries and marine mammals.
Mette Skern-Mauritzen	Norway	Institute of Marine Research, Bergen, Norway	PhD, University of Oslo, Norway. Published on distribution of marine mammals particularly in relation to trophodynamics.
Andre Silva Barreto	Brazil	Universidade do Vale do Itajai, Santa Catarina, Brazil	PhD, Federal University of Rio Grande, Brazil. Published on taxonomy and distribution of marine mammals.
<b>CHAPTER 6E</b>		<b>MARINE REPTILES</b>	
<b>CONVENOR</b>			
Qamar Schuyler	Australia	Commonwealth Scientific and Industrial Research Organization Oceans and Atmosphere, Australia	PhD, University of Queensland, Australia. Published on impacts of marine debris on sea turtles.
<b>MEMBERS</b>			
Andre Silva Barreto	Brazil	Universidade do Vale do Itajai, Itajai, Brazil	PhD, Federal University of Rio Grande, Brazil. Coordinates sea turtle stranding network.
Gabriel Hoinsoude Segniagbeto	Togo	University of Lome, Lome, Togo	PhD, Musée National d'Histoire naturelle, France. Published on distribution and ecology of sea turtles and trade in live reptiles.
Carmen Mifsud	Malta	Environment Protection Directorate Mepa, Floriana, Malta	MSc, University of Malta, Malta. Member of IUCN Marine Turtle Specialist Group.
Vinay Udyawer	Australia	Australian Institute of Marine Science, Darwin, Australia	PhD, James Cook University, Australia. Published on distribution, movements and reproductive ecology of sea snakes.

<b>CHAPTER 6F</b>		<b>SEABIRDS</b>	
<b>CONVENOR</b>			
Martin Cryer	New Zealand	Ministry for Primary Industries, Wellington, New Zealand	PhD, University of East Anglia, United Kingdom. Published on seabird interactions with fisheries.
<b>MEMBER</b>			
Ross McLeod Wanless	South Africa	Birdlife International, Johannesburg, South Africa	PhD, University of Cape Town, South Africa. Published on contaminants in seabirds, seabird ecology and seabird bycatch.
Maria Dias	Portugal	Senior Marine Science Officer, BirdLife International	PhD in Ecology; University of Lisbon, Portugal. Main scientific areas: Ornithology; Conservation Biology; Marine Ecology; Animal Migration; Estuarine Ecology; Geographic Information Systems.
Cleo Small	United Kingdom	Head of BirdLife International Marine Programme	PhD in Biology on spatial distribution of breeding wading birds in relation to agriculture, Lancaster University, United Kingdom.
<b>CHAPTER 6G</b>		<b>MARINE PLANTS</b>	
<b>CONVENOR</b>			
Hugh Kirkman	Australia	Professor, University of Western Australia, Perth, Australia	PhD, University of Western Australia. Published on mangroves, seagrasses, coastal biodiversity, etc.
<b>MEMBERS</b>			
Nahid Abdel Rahim Osman	Sudan	Associate Professor of Phycology Faculty of Marine Science and Fisheries, Red Sea University	PhD in phycology, Khartoum University. Published on mangroves, Red Sea seaweeds, etc.
Phillip Da Silva	Guyana	University of Guyana, and Environmental Management Consultants, Demarara, Guyana.	MSc in coastal management, University of the West Indies. Published on mangroves and coastal zone management.
Franciane Pellizzari	Brazil	Professor, College of Biological Science, State University of Paraná, Brazil	PhD in plant ecology, University of Sao Paulo. Published on Antarctic seaweeds, Brazilian marine algae, etc.
Mario Soares	Brazil	State University of Rio de Janeiro, Brazil	Contributor to Chapter 48 (Mangroves) of WOA I. Published on mangroves, etc.
Carmen Mifsud	Malta	Environment and Resources Authority, Malta	Co-Chair of the Regular Process regional Workshop, Valetta, August 2018. MSc in marine biology, University of Malta. Published on marine turtles, Mediterranean marine ecology, etc.

<b>CHAPTER 6H</b>	<b>MACROALGAE</b>		
<b>JOINT CONVENORS</b>			
Hilconida Calumpong	Philippines	Director, Institute of Environmental and Marine Sciences, Silliman University, Philippines.	Contributor to Chapters 6 (Primary production and plankton), 14 (Seaweeds), 47 (Kelp forests and seagrasses), and 48 (Mangroves) of WOA I. PhD (major in Botany), University of California, Berkeley. Published on mangroves, seagrasses, algae, invertebrates, coastal resource management, etc.
Nair Sumie Yokoya	Brazil	Instituto de Botânica University of São Paulo, Brazil	DSc, University of Sao Paulo. Published on seaweed farming, Antarctic seaweeds, etc.
<b>MEMBERS</b>			
Nahid Abdel Rahim Osman	Sudan	Associate Professor of Phycology Faculty of Marine Science and Fisheries, Red Sea University	PhD in phycology, Khartoum University. Published on mangroves, Red Sea seaweeds, etc.
John A. West	Australia	Professorial Fellow, School of Biosciences 2 University of Melbourne Australia	Main contributor to Chapter 14 (Seaweeds) of WOA I. Published on (reproductive biology and molecular (DNA) biology of marine algae, etc.
Paula Bontempi	United States	Manager, Ocean Biology and Biogeochemistry Program, National Aeronautics and Space Administration, United States	PhD, University of Rhode Island. Published on remote sensing of chlorophyll, red tides, etc.
Carmen Mifsud	Malta	Environment and Resources Authority, Malta	Co-Chair of the Regular Process regional Workshop, Valetta, August 2018. MSc in marine biology, University of Malta. Published on marine turtles, Mediterranean marine ecology, etc.

## Writing Team of Chapter 7

CHAPTER 7	HABITAT DIVERSITY		
	Trends in the state of biodiversity in marine habitats		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Hilconida Calumpong	Philippines	Director, Institute of Environmental and Marine Sciences, Silliman University, Philippines.	Contributor to Chapters 6 (Primary production and plankton), 14 (Seaweeds), 47 (Kelp forests and seagrasses), and 48 (Mangroves) of WOA I. PhD (major in Botany), University of California, Berkeley. Published on mangroves, seagrasses, algae, invertebrates, coastal resource management, etc.
<b>CO-LEAD MEMBERS</b>			
Sanae Chiba (especially for Chapter 7R)	Japan	Senior Scientist, Japan Agency for Marine-Earth Science and Technology, Tokyo	Ph.D. in aquatic bioscience, Tokyo University of Fisheries, Japan. Published on long-term marine ecosystem change, plankton, etc.
Karen Evans (especially for Chapters 7E, 7F and 7M)	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
Osman Keh Kamara (especially for Chapter 7P)	Sierra Leone	Sierra Leone Ambassador to Ethiopia and Permanent Representative to the African Union	Contributor to Chapters 17 (Shipping) and 32 and 53 (Capacity Building) of WOA I. Graduate of University of Sierra Leone and Columbia University, New York, Post-Graduate Diploma (Rhodes Academy of Ocean Law and Policy, Greece).
Enrique Marschoff (especially for Chapter 7M)	Argentina	Member of the Instituto Antártico Argentino, Buenos Aires, Argentina	Contributor to Chapters 11 (Capture fisheries), 15 (Social and economic aspects of fisheries), 36B (South Atlantic biodiversity), 36H (Southern Ocean biodiversity) 46 (High-latitude ice), 54 (Overall human impact) and 55 (Overall value) of WOA I. Doctorate in biological sciences, University of Buenos Aires, Argentina. Published on Southern Ocean fisheries, Southern elephant-seal, etc.
Renison Ruwa (especially for Chapter 7J)	Kenya	Deputy Director, Kenya Marine and Fisheries Research Institute.	Contributor to Chapters 32 and 53 (Capacity-building), 36E (Indian Ocean biodiversity) and 48 (Mangroves) of WOA I. PhD, University of Florence, Italy. Published on influence of seasonality and bathymetry on crustacea, mangroves, etc.

Joshua T. Tuhumwire (especially for Chapter 7B and 7N)	Uganda	Chief Executive Officer of Gondwana Geoscience Consulting Ltd.; Director/Chairman of Sipa Exploration Resources (Uganda) Ltd; Commissioner, Uganda Department of Geological Survey and Mines (2001 to 2010). Consultant to several mineral exploration projects in Uganda. Member, Legal & Technical Commission, International Seabed Authority	Contributor to Chapters 1 (Planet, Ocean and Life) 23 (Offshore mining), and 26 (Land/Sea interaction) of WOA I. B.Sc. (Hons.) in chemistry and geology, Makerere University, Uganda; M.Sc. in geology, Vrije Universiteit Brussel, Belgium. Several unpublished geological reports during 30 years' career at Uganda's Geological Survey & Mines.
<b>CHAPTER 7A</b>	<b>SAND AND MUD SUBSTRATES (SOFT BOTTOM)</b>		
<b>CONVENOR</b>			
Judith Gobin	Trinidad and Tobago	Head and Senior Lecturer, Department of Zoology, University of the West Indies, St. Augustine Campus, Trinidad.	PhD, University of Exeter, England. Contributor to Chapter 35 (Extent of Biodiversity Assessment) in WOA I. Published on methane and oil seeps, intertidal zones, etc.
<b>MEMBERS</b>			
José Souto Rosa Filho	Brazil	Professor, Benthic Laboratory, Department of Oceanography, Federal University of Pernambuco, Brazil	PhD, Federal University of Rio Grande. Published on estuaries, Brazilian sandy beaches, etc.
Fahad Ibrahim	Qatar	Director, Aquaculture Centre, Directorate General of Fisheries Research, Ministry of Municipality and Environment, Doha, Qatar	Published on fish reproduction, etc.
Mohammed Abdallah	Qatar	Professor, Fish Wealth Department, Ministry of Municipality and Environment, Doha, Qatar	Published on fish stock assessment and management, reef fish, etc.
<b>CHAPTER 7B</b>	<b>ROCKY SUBSTRATES AND REEFS</b>		
<b>CONVENOR</b>			
Ronaldo Adriano Christofolletti	Brazil	Departamento de Ciências do Mar Universidade Federal de São Paulo, Santos, Province of São Paulo, Brazil	PhD, Universidade Estadual Paulista Julio de Mesquita Filho. Published on south-west Atlantic rocky shores, estuarine benthos, etc.

<b>MEMBERS</b>			
Judith Gobin	Trinidad and Tobago	Head and Senior Lecturer, Department of Zoology, The University of The West Indies, St. Augustine, Trinidad.	PhD, University of Exeter, England. Contributor to Chapter 35 (Extent of Biodiversity Assessment) in WOA I. Published on methane and oil seeps, intertidal zones, etc.
Anna Metaxas	Canada	Professor, Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada	PhD on phytoplankton, Dalhousie University. Contributor to Chapter 34 (Global patterns of Marine Biodiversity) in WOA I. Published on epibenthic megafauna, hydrothermal vents, rocky substrates, etc.
Frederic Guichard	Canada	Professor, Department of Biology McGill University, Montreal, Canada	PhD, Laval University. Published on marine dynamic connectivity, species distribution of marine benthic invertebrates, etc.
Nicole Webster	Australia	Principal Research Scientist, Australian Institute of Marine Science, Townsville, Queensland, Australia	PhD, James Cook University, Australia. Published on sponges, coral-reef viruses, etc.
Julia Sigwart	United States	Marine Laboratory, Queen's University Belfast, United Kingdom	PhD, Queen's University, Belfast, Northern Ireland. Published on species theory, hydrothermal vents, etc.
Fahad Ibrahim	Qatar	Director, Aquaculture Centre, Directorate General of Fisheries Research, Ministry of Municipality and Environment, Doha, Qatar	Published on fish reproduction, etc.
<b>CHAPTER 7C</b>	<b>INTERTIDAL ZONE</b>		
<b>CONVENOR</b>			
Julia Sigwart	United States	Marine Laboratory, Queen's University Belfast, United Kingdom	PhD, Queen's University, Belfast, Northern Ireland. Published on species theory, hydrothermal vents, etc.
<b>MEMBERS</b>			
Anna Metaxas	Canada	Professor, Department of Oceanography Dalhousie University Halifax, Nova Scotia, Canada	PhD on phytoplankton, Dalhousie University. Contributor to Chapter 34 (Global patterns of Marine Biodiversity) in WOAI. Published on epibenthic megafauna, hydrothermal vents, rocky substrates, etc.
Ronaldo Adriano Christofolletti	Brazil	Departamento de Ciências do Mar Universidade Federal de São Paulo, Santos, Province of São Paulo, Brazil	PhD, Universidade Estadual Paulista Julio de Mesquita Filho. Benthic ecology. Published on south-west Atlantic rocky shores, estuarine benthos, etc.
Judith Gobin	Trinidad and	Head and Senior	PhD, University of Exeter, England.



	Tobago	Lecturer, Department of Zoology, The University of The West Indies, St. Augustine, Trinidad	Contributor to Chapter 35 (Extent of Biodiversity Assessment) in WOAI. Published on methane and oil seeps, intertidal zones, etc.
<b>CHAPTER 7D</b>	<b>ATOLL AND ISLAND LAGOONS</b>		
<b>CONVENOR</b>			
Colin Woodroffe	Australia	Professor, School of Earth and Environmental Sciences, University of Wollongong, New South Wales, Australia	DSc, Cambridge University. Convenor of the writing team for Chapter 7 (Carbonate Production) of WOAI. Published on coral reefs and sea-level change, fringing reefs and mangroves.
<b>*The members for this writing team will be posted once approved by the Bureau.</b>			
<b>CHAPTER 7E</b>	<b>TROPICAL AND SUBTROPICAL CORAL REEFS</b>		
<b>CONVENOR</b>			
Ian Butler	Australia	Australian Fisheries Management Authority and CoraLogic Environmental Consulting, Canberra, Australia	PhD, University of Queensland, Australia. Published on water quality impacts on coral reefs and conservation management of coral reefs.
<b>MEMBERS</b>			
Alex Rogers	United Kingdom	University of Oxford, Oxford, United Kingdom	PhD, University of Liverpool, United Kingdom, Published on mesophotic coral reefs and modelling of coral dispersal and connectivity.
Raquel Silva Peixoto	Brazil	Federal University of Rio de Janeiro/Rio de Janeiro Marine Aquarium, Rio de Janeiro, Brazil	PhD, Federal University of Rio de Janeiro, Brazil. Published on symbiotic relationships and the health of corals, impacts on coral reefs.
Hazel Oxenford	Barbados	Centre for Resource Management and Environmental Studies, The University of the West Indies, Cave Hill, Barbados	PhD, University of West Indies, Barbados. Published on climate-change impacts on coral reefs and reef resilience.
Kemraj Parsram	Guyana	Environmental Protection Agency, Georgetown, Guyana	PhD, University of the West Indies, Barbados. Published on ecosystem-based management of coral reef and coastal areas.
Hiroya Yamano	Japan	Center for Environmental Biology and Ecosystem Studies, National Institute for Environmental Studies, Japan	DSc, University of Tokyo, Japan. Published on thermal thresholds and changes in the distribution of coral reefs.

<b>CHAPTER 7F</b>		<b>COLD-WATER CORALS</b>	
<b>CONVENOR</b>			
Erik Cordes	United States	Department of Biology, Temple University, Philadelphia, United States of America	PhD, Pennsylvania State University, United States of America. Published on deep-water coral/canyon/cold seep habitats.
<b>MEMBERS</b>			
Georgios Kazanidis	Greece	University of Edinburgh, Edinburgh, United Kingdom	PhD, Aberdeen University, United Kingdom. Published on impacts of oil and ecology of deep sea sponges.
Sebastian Hennige	United Kingdom	University of Edinburgh, Edinburgh, United Kingdom	PhD, University of Essex, United Kingdom. Published on spatial distribution and ecology of cold-water corals.
Malcolm Ross Clark	New Zealand	National Institute of Water & Atmospheric Research, Wellington, New Zealand	PhD, University of Wellington, New Zealand. Published on ecology and biodiversity of deep sea corals.
<b>CHAPTER 7G</b>		<b>ESTUARIES AND DELTAS</b>	
<b>CONVENOR</b>			
Colin Woodroffe	Australia	Professor, School of Earth and Environmental Sciences, University of Wollongong, New South Wales, Australia	DSc, Cambridge University. Convenor of the writing team for Chapter 7 (Carbonate Production) of WOA I. Published on coral reefs and sea-level change, fringing reefs and mangroves.
<b>MEMBERS</b>			
Moriaki Yasuhara	Japan	Associate Professor, School of Biological Sciences, University of Hong Kong, China	PhD, Osaka City University. Published on deep-sea species, cold seeps, etc.
José H. Muelbert	Brazil	Professor, Instituto de Oceanografia, Federal University of Rio Grande, Rio Grande do Sul, Brazil and Adjunct Researcher, Institute for Marine and Antarctic Studies, University of Tasmania, Australia	PhD, Dalhousie University, Canada. Published on estuary fish, zooplankton, climate change and fish larvae.
Ronaldo Adriano Christofletti	Brazil	Departamento de Ciências do Mar Universidade Federal de São Paulo, Santos, Province of São Paulo, Brazil	PhD, Universidade Estadual Paulista Julio de Mesquita Filho. Benthic ecology. Published on south-west Atlantic rocky shores, estuarine benthos, etc.
Pablo Muniz Maciel	Uruguay	Professor, Oceanografía & Ecología Marina Instituto de Ecología y Ciencias Ambientales,	PhD, University of Sao Paulo. Contributor to Chapter 44 (Estuaries and deltas) of WOA I. Published on estuarine sediments, coastal pollution, benthic estuarine

		University of the Republic, Uruguay	communities, etc.
Dana Hunt	United States	Assistant Professor of Microbial Ecology Duke University Marine Laboratory, North Carolina	PhD, Environmental Engineering, Massachusetts Institute of Technology. Published on marine bacteria, impacts of silver nanoparticles, etc.
Judith Weis	United States	Rutgers University, New Jersey, United States	PhD, New York University. Contributor Chapter 49 (Salt marshes) of WOA I. Published on salt marshes, marine pollution, invasive species, etc.
Bing Qiao	China	Vice-director of Academic Committee and Professor, China Waterborne Transport Research Institute	Environmental Science Registered EIA Engineer of China Expert group member of Chinese scientific project of Marine Environmental Safety (Ensure)
<b>CHAPTER 7H</b>	<b>KELP FORESTS AND ALGAL BEDS</b>		
<b>CONVENOR</b>			
Jason Hall-Spencer	United Kingdom	Professor of Marine Biology, University of Plymouth	PhD, University of London. Published on ocean acidification, North-East Atlantic benthic flora, etc.
<b>MEMBERS</b>			
John A. West	Australia	Professorial Fellow, School of Biosciences, University of Melbourne, Australia	Main contributor to Chapter 14 (Seaweeds) of WOA I. Published on (reproductive biology and molecular (DNA) biology of marine algae, etc.
Robin Anderson	Canada	Marine Habitat Research Scientist, Science Branch, Fisheries and Oceans Canada	PhD, McGill University. Published on integrated marine ecosystem assessment and management, mercury pollution.
Isabel Sousa Pinto	Portugal	Professor at the Department of Biology, University of Porto and Director of the Coastal Biodiversity Laboratory	PhD, University of California, Santa Barbara. Published on kelp and kelp forests, including relationship with fish species, etc.
Honghui Huang	China	Director, South China Sea Fisheries Research Institute, Guangzhou, China	Published on macroalgae, sargassum, marine bivalves and seaweed as carbon sink, etc.
<b>CHAPTER 7I</b>	<b>SEAGRASS MEADOWS</b>		
<b>CONVENOR</b>			
Hugh Kirkman	Australia	Professor, University of Western Australia, Perth, Australia	PhD, University of Western Australia. Published on mangroves, coastal biodiversity, etc.
<b>*The members for this writing team will be posted once approved by the Bureau.</b>			
<b>CHAPTER 7J</b>	<b>MANGROVES</b>		
<b>CONVENOR</b>			
José Souto Rosa Filho	Brazil	Professor, Benthic Laboratory,	PhD, Federal University of Rio Grande. Published on estuaries,

		Department of Oceanography, Federal University of Pernambuco, Brazil	Brazilian sandy beaches, etc.
<b>MEMBERS</b>			
Phillip da Silva	Guyana	University of Guyana, and Environmental Management Consultants, Demarara, Guyana.	MSc in coastal management, University of the West Indies. Published on mangroves and coastal zone management.
Seon Hamer	Guyana	Assistant Dean, Faculty of Earth and Environmental Sciences, University of Guyana	MSc, University of the West Indies. Published on mercury pollution, microalgae, etc.
Colin Woodroffe	Australia	Professor, School of Earth and Environmental Sciences, University of Wollongong, New South Wales, Australia	DSc, Cambridge University. Convenor of the writing team for Chapter 7 (Carbonate Production) of WOA I. Published on coral reefs and sea-level change, fringing reefs and mangroves.
Mario Soares	Brazil	State University of Rio de Janeiro, Brazil	Contributor to Chapter 48 (Mangroves) of WOA I. Published on mangroves, etc.
Mohammad Zahedur Rahman Chowdhury	Bangladesh	Director and Associate Professor, Institute of Marine Sciences and Fisheries, University of Chittagong, Bangladesh	PhD in fisheries oceanography, University of Chittagong. Published on sea surface temperature in the Bay of Bengal, and on fisheries resilience, etc.
<b>CHAPTER 7K</b>	<b>SALT MARSHES</b>		
<b>CONVENOR</b>			
Judith Weis	United States	Rutgers University, New Jersey, United States	PhD, New York University. Contributor Chapter 49 (Salt marshes) of WOA I. Published on salt marshes, marine pollution, invasive species, etc.
<b>*The members for this writing team will be posted once approved by the Bureau.</b>			
<b>CHAPTER 7L</b>	<b>CONTINENTAL SLOPES AND SUBMARINE CANYONS</b>		
<b>CONVENOR</b>			
Lisa A. Levin	United States	Center for Marine Biodiversity and Conservation, Scripps Institution of Oceanography, California, United States	PhD, University of California, San Diego. Published on deep ocean ecology, ocean deoxygenation, hydrothermal vents, etc.
<b>MEMBERS</b>			
Bhavani Narayanaswamy	United Kingdom	Senior Lecturer in Deep Sea Ecosystems & Head of Graduate School, Scottish Association for Marine	PhD, University of Southampton. Published on impact of microplastics, habitat mapping, seamounts, etc

		Science, Oban, Argyll	
Jeroen Ingels	Belgium	Research Faculty, Florida State University Coastal and Marine Laboratory, St Teresa, Florida, United States	PhD, Ghent University. Convenor of the writing team for Chapter 36F (Open ocean deep sea) of WOA I. Published on Atlantic canyons, deep-sea ecology, etc.
Jason Hall-Spencer	United Kingdom	Professor of Marine Biology, University of Plymouth, England	PhD, University of London. Published on ocean acidification, North-East Atlantic benthic flora, etc.
Malcolm Ross Clark	New Zealand	Principal Scientist (Fisheries), National Institute of Water & Atmospheric Research, New Zealand	PhD, University of Wellington Contributor to Chapters 34 (Global patterns of biodiversity), 35 (Extent of biodiversity assessment) and 36F (Open Ocean Deep Sea) of WOA I. Member of Technical Committee of International Seabed Authority. Published on deep-sea mining, seamounts, etc.
Anna Metaxas	Canada	Department of Oceanography, Dalhousie University, Halifax, Nova Scotia Canada	PhD on phytoplankton, Dalhousie University. Contributor to Chapter 34 (Global patterns of Marine Biodiversity) in WOA I. Published on epibenthic megafauna, hydrothermal vents, rocky substrates, etc.
J. Murray Roberts	United Kingdom	Professor, School of GeoSciences, University of Edinburgh, Scotland	PhD, Glasgow University. Contributor to Chapters 42(Cold- water Corals) and 51 (Seamounts, etc) of WOA I. Published on cold- water corals, ocean acidification, etc.
Russel Hopcroft	United States	Professor, Biological Oceanography, University of Alaska, United States	PhD, University of Guelph, Canada. Contributor to Chapters 34 (Global Patterns of Marine Biodiversity) and 35 (Extent of Assessment) of WOA I. Published on arctic zooplankton, etc
Peter Auster	United States	Research Professor Emeritus, Department of Marine Sciences University of Connecticut, Senior Research Scientist, Mystic Aquarium, United States	PhD, National University of Ireland (Galway). Published on underwater habitats and ecosystems in North Atlantic and North Pacific, etc. Contributor to Chapter 51 (Seamounts, etc.) of WOA I
Moriaki Yasuhara	Japan	Associate Professor, School of Biological Sciences, University of Hong Kong, China	PhD, Osaka City University. Published on deep-sea species, cold seeps, etc.

<b>CHAPTER 7M</b>	<b>HIGH LATITUDE ICE</b> (including that over the open ocean)		
<b>CONVENOR</b>			
Grant Bigg	United Kingdom	Department of Geography, University of Sheffield, Sheffield, United Kingdom	PhD, University of Adelaide, Australia. Published on modelling of ice sheet dynamics and productivity associated with icebergs.
<b>MEMBERS</b>			
Maurizio Azzaro	Italy	Institute for Coastal Marine Environment, Italian National Research Centre, Rome, Italy	Published on microbial communities in ice habitats.
Huw Griffiths	United Kingdom	British Antarctic Survey, Cambridge, United Kingdom	PhD, Open University, United Kingdom. Chair of the State of the Antarctic Ecosystem research programme, Scientific Committee on Antarctic Research. Published on climate and marine debris impacts on Antarctic marine systems.
Moriaki Yasuhara	Japan	Associate Professor, School of Biological Sciences, University of Hong Kong, China	PhD, Osaka City University. Published on deep-sea species, cold seeps, etc.
<b>CHAPTER 7N</b>	<b>SEAMOUNTS AND PINNACLES</b>		
<b>CONVENOR</b>			
Malcolm Ross Clark	New Zealand	Principal Scientist (Fisheries), National Institute of Water & Atmospheric Research, New Zealand	PhD, University of Wellington. Contributor to Chapters 34 (Global patterns of biodiversity), 35 (Extent of biodiversity assessment) and 36F (Open Ocean Deep Sea) of WOA I. Member of Technical Committee of International Seabed Authority. Published on deep-sea mining, seamounts, etc.
<b>MEMBERS</b>			
Jason Hall-Spencer	United Kingdom	Professor of Marine Biology, University of Plymouth, England	PhD, University of London. Published on ocean acidification, North-East Atlantic benthic flora, etc.
J. Murray Roberts	United Kingdom	Professor, School of GeoSciences, University of Edinburgh, Scotland	PhD, Glasgow University. Contributor to Chapters 42(Cold-water Corals) and 51 (Seamounts, etc) of WOA I. Published on cold-water corals, ocean acidification, etc.
Bhavani Narayanaswamy	United Kingdom	Senior Lecturer in Deep Sea Ecosystems & Head of Graduate School, Scottish Association for Marine Science, Oban, Argyll, Scotland	PhD, University of Southampton. Published on impact of microplastics, habitat mapping, seamounts, etc.

Paul Snelgrove	Canada	Professor, Department of Ocean Sciences and Biology, Memorial University of Newfoundland, Canada	PhD Massachusetts Institute of Technology and Biology Department at Woods Hole Oceanographic Institution. Deep sea ecology.
Angelo Fraga Bernardino	Brazil	Professor of Oceanography, Universidade Federal do Espirito Santo, Brazil	PhD, University of Sao Paulo. Published on ecosystem impacts of offshore oil installations, tropical storms and mangroves, etc.
<b>CHAPTER 70</b>	<b>ABYSSAL PLAINS</b>		
<b>CONVENOR</b>			
Jeroen Ingels	Belgium	Research Faculty, Florida State University Coastal and Marine Laboratory, St Teresa, Florida, United States	PhD, Ghent University. Convenor of the writing team for Chapter 36F (Open ocean deep sea) of WOAI. Published on Atlantic canyons, deep-sea ecology, etc.
<b>MEMBERS</b>			
Fuji Toyonobu	Japan	University of Aberdeen Oceanlab, United Kingdom	Deep sea (abyssal and hadal)
Thomas Dahlgren	Sweden	University of Gothenburg, Sweden	PhD, University of Gothenburg. Published on impacts of offshore wind-farms, sponges, etc.
Moriaki Yasuhara	Japan	Associate Professor, School of Biological Sciences, University of Hong Kong, China	PhD, Osaka City University. Published on deep-sea species, cold seeps, etc.
Malcolm Ross Clark	New Zealand	Principal Scientist (Fisheries), National Institute of Water & Atmospheric Research, New Zealand	PhD, University of Wellington. Contributor to Chapters 34 (Global patterns of biodiversity), 35 (Extent of biodiversity assessment) and 36F (Open Ocean Deep Sea) of WOAI. Member of Technical Committee of International Seabed Authority. Published on deep-sea mining, seamounts, etc.
Paul Snelgrove	Canada	Professor, Department of Ocean Sciences and Biology, Memorial University of Newfoundland, Canada	PhD, Massachusetts Institute of Technology and Biology Department at Woods Hole Oceanographic Institution. Deep sea ecology.
Angelo Fraga Bernardino	Brazil	Professor of Oceanography, Universidade Federal do Espirito Santo, Brazil	PhD, University of Sao Paulo. Published on ecosystem impacts of offshore oil installations, tropical storms and mangroves, etc.
Craig McClain	United States	Executive Director at LUMCON, United States	PhD, University of Massachusetts, Boston, Environmental Biology, - Deconstructing Patterns of Species Diversity and Body Size in the Deep Sea.

Clifton Nunnally	United States	Research Scientist Louisiana Universities Marine Consortium, United States	PhD, Texas A&M University, Biological Oceanography - Benthic Function and Structure in the Northern Gulf of Mexico Hypoxic Zone: Sediment Biogeochemistry and Macrobenthic Community Dynamics in the Dead Zone.
Holly Bik	United States	Assistant Professor, Department of Nematology, University of California, United States	PhD in Molecular Phylogenetics, University of Southampton, United Kingdom.
Tomo Kitahashi	Japan	Project Engineer, Research Institute for Global Change, Marine Biodiversity and Environmental Assessment Research Center, Marine Plastics Research Group, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan	PhD in Environment, University of Tokyo, Japan. Specialized in the relationship between meiofaunal assemblages and environmental variables at deep seafloor. Also in the change of deep-sea biodiversity due to climate change and anthropogenic impacts.
Daniel Jones	United Kingdom	Principal Scientist National, Oceanography Centre European Way Southampton, United Kingdom	PhD in Marine Ecology, University of Southampton, United Kingdom. Specialized on the impacts on marine ecosystems, particularly those caused by industrial activities. Scientific research in the fields of macroecology, community ecology and environmental impact assessment from oil and gas and mining activities.
Punyasloke Bhadury	India	Professor, Department of Biological Sciences, & Head, Centre for Climate and Environmental Studies, Indian Institute of Science Education and Research Kolkata Mohanpur, West Bengal, India	PhD in Biological Sciences, Plymouth Marine Laboratory and University of Plymouth, United Kingdom. Specialized in Biocomplexity in coastal ecosystems; Functional biodiversity of benthic faunal communities from coast to deep-sea environments; Biogeochemical cycling of carbon and nitrogen; Carbonate chemistry and coastal ocean acidification
<b>CHAPTER 7P</b>	<b>OPEN OCEAN</b>		
<b>CONVENOR</b>			
Peter Croot	New Zealand	Professor of Earth and Ocean Sciences, National University of Ireland, Galway, Ireland	PhD, University of Otago, New Zealand. Published on microplastics in mesopelagic fish, copper in marine species, ocean fertilisation, etc.
<b>MEMBERS</b>			



Michael Vecchione	United States	National Marine Fisheries Service's National Systematics Laboratory, Smithsonian Institution Washington, DC, United States	Contributor to Chapter 36F (Deep Sea Open Ocean) in WOA I. PhD, College of William and Mary, VA, USA. Published on cephalopods, sea-mount biodiversity, etc.
Tracey T Sutton	United States	Associate Professor, Department of Marine and Environmental Sciences, Nova Southeastern University, Fort Lauderdale, Florida, United States.	Contributor to Chapter 36F (Open Ocean Deep Sea) of WOA I. PhD, University of South Florida. Published on deep-sea ecology, mesopelagic zone, etc.
Silvia I. Romero	Argentina	Naval Hydrographic Service, Argentina	Physical oceanography Marine protected areas Sea area: the Global Ocean as a whole.
Fernanda De Oliveira Lana	Brazil	Post-Doctoral Student in Marine Biology and Coastal Environments, Federal Fluminense University, Rio de Janeiro, Brazil	PhD in fisheries, Federal Rural University of Pernambuco. Published on sharks and other elasmobranchs, etc.
Joseph Montoya	United States	Professor, School of Biological Sciences, Georgia Institute of Technology	Invertebrate biology, Plankton biology, Fate of hydrocarbons in the marine environment, inputs of nutrients to the marine environment. Sea area: The Global Ocean as a whole, The North Atlantic Ocean (esp. Gulf of Mexico), the North Pacific Ocean (esp. South China Sea).
<b>CHAPTER 7Q</b>	<b>RIDGES, PLATEAUS AND TRENCHES</b>		
<b>CONVENOR</b>			
Ana Colaco	Portugal	Institute of Marine Research and Marine and Environmental Sciences Centre, University of the Azores, Portugal	PhD, University of Lisbon. Published on seamounts, resilience of deep-sea fauna, etc.
<b>MEMBERS</b>			
Bhavani Narayanaswamy	United Kingdom	Senior Lecturer in Deep Sea Ecosystems & Head of Graduate School, Scottish Association for Marine Science, Oban, Argyll	PhD, University of Southampton. Published on impact of microplastics, habitat mapping, seamounts, etc.
Michael Vecchione	United States	National Marine Fisheries Service's National Systematics Laboratory, Smithsonian Institution	PhD, College of William and Mary, VA, USA. Contributor to Chapter 36F (Deep Sea Open Ocean) in WOA I. Published on cephalopods, sea-mount biodiversity, etc.

		Washington, DC, United States	
Hiroimi Watanabe	Japan	Japan Agency for Marine Science and Technology, Yokosuka, Japan	PhD, University of Tokyo. Published on hydrothermal-vent and trench barnacles and gastropods, impacts of deep-sea mining, etc.
Nuno Lourenço	Portugal	Director, Instituto Português do Mar e da Atmosfera	Contributor to Chapter 21 (Offshore Hydrocarbon Industries) of WOAI.
Ashley Rowden	New Zealand	Principal Scientist, Coasts and Oceans Marine Ecology, National Institute of Water and Atmospheric, New Zealand	Habitat heterogeneity, productivity and disturbance, and the biodiversity of seafloor fauna.
Ana Hilario	Portugal	Researcher, Department of Biology Marine and Estuarine Ecology	Connectivity.
Imants George Priede	Belgium	Professor Emeritus, OceanLab University of Aberdeen, Scotland	Founding Director of OceanLab. Editor-in-Chief, Deep-Sea Research. Published on deep-sea fish, fish anatomy, etc.
Tomo Kitahashi	Japan	Project Engineer, Research Institute for Global Change, Marine Biodiversity and Environmental Assessment Research Center, Marine Plastics Research Group, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan	PhD in Environment, University of Tokyo, Japan. Specialized in the relationship between meiofaunal assemblages and environmental variables at deep seafloor. Also in the change of deep-sea biodiversity due to climate change and anthropogenic impacts.
Angelika Brandt	Germany	Research Institute, Department of Marine Zoology, Frankfurt, Germany	PhD, University of Oldenburg. Specialized on deep-sea benthic organisms, their evolution, biodiversity, biogeography and ecology.
<b>CHAPTER 7R</b>	<b>HYDROTHERMAL VENTS AND COLD SEEPS</b>		
<b>CONVENOR</b>			
Nadine Le Bris	France	Full Professor at University Pierre and Marie Curie, Paris and Director of Ecogeochemistry at the Benthic Environment Laboratory	Convenor of writing team for Chapter 45 (Hydrothermal vents and cold seeps) in WOA I. Doctorate in pollution chemistry, University of Paris 7. Publications on hydrothermal vents, bacteria of wood-falls, sulphide monitoring, etc.

<b>MEMBERS</b>			
Elva Escobar	Mexico	Institute of Marine Sciences and Limnology, Universidad Nacional Autónoma de México	Contributor to Chapters 29 (Marine genetic resources) and 35 (Extent of biodiversity assessment) of WOA I. PhD, National University of Mexico. Published on food-webs of hydrothermal vents, methane/oil seeps, etc.
Verena Tunnicliffe	Canada	Professor, Canada Research Chair, Biology and Earth/Ocean Sciences University of Victoria, British Columbia, Canada	Contributor to Chapters 34 (Global patterns of marine biodiversity) and 35 (Extent of assessment) of WOA I. PhD, Victoria University, Canada. Published on hydrothermal-vent fauna, seamounts, etc.
Nomikou Paraskevi	Greece	Assistant Professor, Dept of Geology and Geoenvironment, National and Kapodistrian University of Athens, Greece	PhD in geology, University of Athens. Published on submarine volcanoes, Mid-Atlantic ridge, etc.
Ana Colaco	Portugal	Institute of Marine Research and Marine and Environmental Sciences Centre, University of the Azores, Portugal	PhD, University of Lisbon. Published on seamounts, resilience of deep-sea fauna, etc.
Julia Sigwart	United States	Queen's University Belfast, Marine Laboratory, United Kingdom	PhD, Queen's University, Belfast, Northern Ireland. Published on species theory, hydrothermal vents, etc.
Hiroimi Watanabe	Japan	Japan Agency for Marine Science and Technology	PhD, University of Tokyo. Published on hydrothermal-vent and trench barnacles and gastropods, impacts of deep-sea mining, etc.
Anna Metaxas	Canada	Professor, Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada	PhD on phytoplankton, Dalhousie University. Contributor to Chapter 34 (Global patterns of Marine Biodiversity) in WOAI. Published on epibenthic megafauna, hydrothermal vents, rocky substrates, etc.
<b>CHAPTER 7S</b>	<b>SARGASSO SEA</b>		
<b>CONVENOR</b>			
Howard Stanley James Roe	United Kingdom	Emeritus Professor at the University of Southampton and	Chair of the Sargasso Sea Alliance's (SSA) Senior Science Advisory Committee and member of the SSA Executive Committee; was Director of the Southampton Oceanography Centre from 1999-2005; has vast experience in marine ecology, taxonomy, gear and technology developments; authored over 100

			books, papers and reports.
<b>MEMBERS</b>			
Michael Vecchione	United States	National Marine Fisheries Service's National Systematics Laboratory, Smithsonian Institution Washington, DC, United States	PhD, College of William and Mary, VA, USA. Contributor to Chapter 36F (Deep Sea Open Ocean) in WOA I. Published on cephalopods, sea-mount biodiversity, etc.
Tracey T. Sutton	United States	Associate Professor, Department of Marine and Environmental Sciences, Nova Southeastern University, Fort Lauderdale, Florida, United States.	Contributor to Chapter 36F (Open Ocean Deep Sea) of WOA I. PhD, University of South Florida. Published on deep-sea ecology, mesopelagic zone, etc.
David Freestone	United Kingdom	Executive Secretary Sargasso Sea Commission, Washington DC, United States	Convenor of writing team for Chapter 50 (Sargasso Sea) of WOA I. Former Deputy General Counsel (International and Environmental Law), World Bank. Editor-in-Chief of the International Journal of Marine and Coastal Law.
Tammy Warren	United Kingdom	Senior Marine Resources Officer for the Department of Environment and Natural Resources, Hamilton, Bermuda	PhD, University of Liverpool, England. Acting Chair, Sargasso Sea Commission.
Joseph Montoya	United States	Professor, School of Biological Sciences, Georgia Institute of Technology	Invertebrate biology, Plankton biology, Fate of hydrocarbons in the marine environment, inputs of nutrients to the marine environment. Sea area: The Global Ocean as a whole, The North Atlantic Ocean (esp. Gulf of Mexico), the North Pacific Ocean (esp. South China Sea).

## Writing team for Chapter 8

CHAPTER 8	HUMAN SOCIETY		
	Trends in the state of human society in relation to the ocean		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CO-LEAD MEMBERS</b>			
Anastasia Strati	Greece	Expert Minister Counsellor, Law of the Sea, Permanent Mission of Greece to the United Nations	MSc in Marine Law and Policy; PhD in Law of the Sea, University of Wales, United Kingdom. Published on underwater cultural heritage, fisheries, marine pollution, offshore energy, maritime delimitation, dispute settlement, etc.
Osman Keh Kamara	Sierra Leone	Sierra Leone Ambassador to Ethiopia and Permanent Representative to the African Union	Contributor to Chapters 17 (Shipping) and 32 and 53 (Capacity Building) of WOA I. Graduate of University of Sierra Leone and Columbia University, New York, Post-Graduate Diploma (Rhodes Academy of Ocean Law and Policy, Greece).
Essam Yassin Mohammed	Eritrea	Head of blue economy, International Institute for Environment and Development, London, England	PhD in international development, University of Nagoya, Japan. Published on small scale fisheries, connection between areas beyond national jurisdiction and areas under national jurisdiction, etc.
<b>CHAPTER 8A Coastal communities</b> , including the coastal population, the size of coastal communities, their wealth/income, their vulnerability, adaptability, and dependency on the ocean (including dependence on, and engagement, with marine resources)			
Under construction			
<b>CHAPTER 8B - Human health as affected by the ocean</b> , including the health of coastal communities relative to inland communities, the effects of exposure to contaminated seawater, the scale of beach closures for health reasons, and the extent to which food resources available from the sea create health problems through their content of hazardous substances (including metals, microplastics and nanoparticles) and pathogens.			
Under construction			
<b>CHAPTER 8C - Maritime industries</b> , including their economic performance, the role of freight transport in international trade, the role of ferries and coastwise shipping in internal transport; recruitment of workers, the proportion of their workers who are women, the rates of death of, and injury to, those working in them, the protection of their working conditions, their levels of pay, maritime security, human trafficking, slavery and smuggling, access to markets and handling facilities for fisheries produce and the			

proportion of fisheries which are artisanal, culture-related or conducted by indigenous peoples.
Under construction
<b>CHAPTER 8D - Maritime cultural services</b> , including the extent to which marine cultural resources are conserved, support for cultural activities linked to the sea, and the scale of use of objects from the sea valued for cultural reasons.
<b>*The members for this writing team will be posted once approved by the Bureau.</b>

## PART 5: TRENDS IN PRESSURES ON THE MARINE ENVIRONMENT

### Writing team for Chapter 9

CHAPTER 9	CLIMATE PRESSURES		
	Pressures from changes in climate and atmosphere (a) Physical properties of the ocean; (b) Ocean chemistry; (c) Extreme climate events.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Carlos Garcia-Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
<b>CO-LEAD MEMBERS</b>			
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
Sanae Chiba (especially for Chapter 9C)	Japan	Senior Scientist, Japan Agency for Marine-Earth Science and Technology, Tokyo	Ph.D. in aquatic bioscience, Tokyo University of Fisheries, Japan. Published on long-term marine ecosystem change, plankton, etc.
Ca Thanh Vu (especially for Chapters 9A and 9C)	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
<b>CONVENOR</b>			
Carlos Garcia-Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
<b>MEMBER</b>			
Karen Hunter	Canada	Project Leader, Aquatic Climate Change, Department of Fisheries and Oceans, Canada	MSc, Trent University, Canada. Published on Pacific climate change, etc.
Jason Hall-Spencer	United Kingdom	Professor of Marine Biology, University of Plymouth	PhD, University of London. Published on ocean acidification, North-East Atlantic benthic flora, etc.
Denise Breitburg	United States	Senior Scientist (transitioning to	PhD in Biology, University of California, Santa Barbara

		Scientist Emerita on 28 April), Smithsonian Environmental Research Center	
Patricia Castillo-Briceno	Ecuador	Research professor, Faculty of Marine Sciences, ULEAM University, Ecuador	PhD in Animal Biomedicine, European Mention, University of Murcia
David Halpern (General aspects)	United States	Jet Propulsion Laboratory, California Institute of Technology/National Aeronautics and Space Administration, Pasadena, California, United States	PhD, Physical Oceanography, Massachusetts Institute of Technology, USA. Published on upwelling dynamics in the southeast Pacific Ocean and along the equator, large-scale ocean-atmosphere interactions in the southeast Pacific Ocean, etc.
Matthew Collins	United Kingdom	Joint Met Office Chair in Climate Change, College of Engineering, Mathematics and Physical Sciences (CEMPS), University of Exeter, United Kingdom.	PhD Meteorology, University of Reading, United Kingdom.
Bess Ward	United States	Professor and Chair of Department of Geosciences, Princeton University, United States	PhD in Biological Oceanography, University of Washington, Seattle, United States. Specialized in Marine and global nitrogen cycle, molecular analyses to link marine phytoplankton, bacteria and microbial processes (especially nitrification and denitrification), oxygen minimum zones, phytoplankton nitrogen dynamics, microbial genomics.

### Writing team for Chapter 10

<b>CHAPTER 10</b>	<b>NUTRIENT POLLUTION</b>		
	Changes in inputs to the marine environment of nutrients, from land, from ships and offshore installations, and consequent levels of eutrophication problems in the marine environment, including harmful algal blooms.		
<b>NAME</b>	<b>STATE</b>	<b>AFFILIATION</b>	<b>RELEVANT EXPERIENCE</b>
<b>LEAD MEMBER</b>			
Juying Wang	China	Head of Marine Chemistry Division, National Marine Environment Monitoring Centre, Dalian, China	Contributor to Chapters 20 (Land-based inputs), 24 (Solid waste) and 25 (Marine debris) of WOA I. PhD in marine chemistry, Ocean University of China, Chingdao, China. Published on microplastics, aragonite saturation, etc.
<b>CO-LEAD MEMBERS</b>			
Maria Bebianno	Portugal	Director, Centre for Marine and Environmental Research	PhD in ecotoxicology, University of Reading, England. Published on mine tailings, effects of metals,



		(CIMA), University of the Algarve, Portugal	persistent organic compounds, microplastics nanoparticles and personal care products, ecotoxicological protocol for deep-sea fauna, etc.
<b>CONVENOR</b>			
Thomas C. Malone	United States	Professor Emeritus, Horn Point Laboratory, University of Maryland Center for Environmental Science	Convenor of writing team for Chapter 6 (Primary production and plankton), WOA I.
<b>MEMBERS</b>			
Alice Newton	Portugal	Professor, Centre for Marine and Environmental Research, University of Algarve, Portugal	PhD, University of Wales. Published on lagoons, marine socio-economics, ecosystem-based management.
Georgios Sylaios	Greece	Professor, Director, Lab of Ecological Engineering & Technology, Democritus University of Thrace, Greece	PhD, University of Southampton, England. Published on shoreline change, Aegean hydrodynamics, etc.
Harri Kuosa	Finland	Group Leader, Marine Research Centre, Finnish Environment Institute	PhD in hydrobiology, University of Helsinki. Published on harmful algal blooms, Baltic hypoxia, etc.
João Sarkis Yunes	Brazil	Professor, Instituto de Oceanografia, Universidade Federal de Rio Grande	Published on toxic algal blooms, cyanobacteria, etc.
Lars Sonesten	Sweden	Deputy Head, Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences	PhD in limnology, Uppsala University. Published on nutrients and pollution in the Baltic, etc.
Michael Krom	United Kingdom	Professor Emeritus, School of Earth and Environment, University of Leeds, England	PhD, University of Edinburgh, Scotland. Published on nutrient cycling in the Mediterranean, effect of atmospheric processing on nutrient supply to the ocean, phosphorus cycling in aquatic systems, etc.
Paula Bontempi	United States	Manager, Ocean Biology and Biogeochemistry Program, Headquarters of the National Aeronautic and Space Administration, United States	PhD, University of Rhode Island. Published on remote sensing of chlorophyll, red tides, etc.
Walker Smith	United States	Virginia Institute of Marine Science and Professor of Marine Science, College of	PhD, Duke University, NC, USA. Contributor to Chapter 36G (Arctic Ocean) of WOA I. Published on Southern Ocean

		William and Mary, Virginia, United States	phytoplankton blooms and nutrients, etc.
Ossey Bernard Yapo	Côte d'Ivoire	Professor, Université Nangui Abrogoua, Abidjan, Côte d'Ivoire	Published on eutrophication, status of coastal waters of Cote d'Ivoire, etc.
Kedong Yin	China	Professor, Sun Yat-Sen University, Guangzhou, China	PhD, University of British Columbia, Canada. Published on dynamics of nutrients, phytoplankton biomass, etc.
Archis Ambulkar	United States	Environmental Engineer, Brinjac Engineering, Inc., Harrisburg, Pennsylvania, United States	M.S. in Environmental Engineering – Bucknell University, USA and B.S. in Chemical Engineering – Nagpur University, India. Certified Environmental Specialist & Certified Environmental Consultant, Small Water Treatment System Operator, Laboratory Analyst-in-training.
Joseph Montoya	United States	Professor, School of Biological Sciences, Georgia Institute of Technology	Invertebrate biology, Plankton biology, Fate of hydrocarbons in the marine environment, inputs of nutrients to the marine environment. Sea area: The Global Ocean as a whole, The North Atlantic Ocean (esp. Gulf of Mexico), the North Pacific Ocean (esp. South China Sea).

### Writing team for Chapter 11

<b>CHAPTER 11</b>	<b>INPUTS FROM LAND, SHIPS AND OFFSHORE INSTALLATIONS</b> Changes in liquid and atmospheric inputs to the marine environment from land (including through groundwater), ships and offshore installations; persistent organic pollutants (including run-off from the use of agricultural pesticides); metals; radioactive substances (including naturally occurring radioactive material (NORM); personal care products, pharmaceuticals and nutraceuticals; atmospheric pollutants (NO <sub>x</sub> (but not in its role as a nutrient) and SO <sub>x</sub> ); hydrocarbons from terrestrial sources, ships and offshore installations (including arrangements for response to spills and discharges); other substances used on, and discharged from, offshore installations; distribution of, and trends in, contaminant concentrations.		
<b>NAME</b>	<b>STATE</b>	<b>AFFILIATION</b>	<b>RELEVANT EXPERIENCE</b>
<b>LEAD MEMBER</b>			
Maria Bebianno	Portugal	Director, Centre for Marine and Environmental Research (CIMA), University of the Algarve, Portugal	PhD in ecotoxicology, University of Reading, England. Published on mine tailings, effects of metals, persistent organic compounds, microplastics nanoparticles and personel careproducts, ecotoxicological protocol for deep-sea fauna, etc.
<b>CO-LEAD MEMBERS</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006),	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping),

		OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
Joshua T. Tuhumwire	Uganda	Chief Executive Officer of Gondwana Geoscience Consulting Ltd.; Director/Chairman of Sipa Exploration Resources (Uganda) Ltd; Commissioner, Uganda Department of Geological Survey and Mines (2001 to 2010). Consultant to several mineral exploration projects in Uganda. Member, Legal & Technical Commission, International Seabed Authority	Contributor to Chapters 1 (Planet, Ocean and Life) 23 (Offshore mining), and 26 (Land/Sea interaction) of WOA I. B.Sc. (Hons.) in chemistry and geology, Makerere University, Uganda; M.Sc. in geology, Vrije Universiteit Brussel, Belgium. Several unpublished geological reports during 30 years' career at Uganda's Geological Survey & Mines.
<b>JOINT CONVENORS</b>			
Colin Moffat (Persistent organic pollutant)	United Kingdom	Chief Scientific Advisor Marine, Marine Scotland, Scottish Government, Scotland	PhD, University of Aberdeen, Scotland. Published on pilot whales, agricultural chemicals and the marine environment, trophic transfer through food webs, oil spills, etc.
Penny (Epapandi) Vlahos (Metals)	United States	Associate Professor Departments of Marine Sciences & Environmental Engineering, University of Connecticut, United States	PhD, in environmental, coastal and ocean sciences, University of Massachusetts, USA. Published on carbon budgets, air/sea gas exchange, perfluorinated chemicals in the Arctic atmosphere, etc.
Alan Simcock (Radioactive substances)	United Kingdom	Joint Coordinator of the Group of Experts	Marine social and economic policy.
Ralf Ebinghaus (PCPs, Pharmaceuticals and nutraceuticals)	Germany	Head of Department for Environmental Chemistry Institute of Coastal Research, Hamburg, Germany	PhD, University of Hamburg. Contributor to Chapter 20 (Land-based inputs) of WOAI. Published on atmospheric chemistry, persistent pollutants, etc.
Bjorn Einar Grøsvik (Hydrocarbons)	Norway	Institute of Marine Research, Bergen, Norway	Dr Scient, Bergen University. Contributor to Chapter 21 (Offshore hydrocarbons) of WOAI. Published on marine debris, oil in the Arctic food web, oil spills.
Ida-Maja Hassellöv (Other)	Sweden	Associate professor,	PhD in marine chemistry,

substances used on, and discharged from ships and offshore installations)		Maritime Environmental Science, Chalmers University of Technology, Gothenburg, Sweden	University of Gothenburg, Sweden. Published on effects of anthropogenic impact, especially from shipping and shipwrecks, on the marine environment.
<b>MEMBERS</b>			
Bi Tra Boniface Nene	Cote d'Ivoire	Head of the Mapping and Offshore Environment Department at Ministry of Petroleum, Energy and Renewable Energies	Master in Geographic Information System (GIS), Institut des Sciences et Industries du Vivant et de l'Environnement, Paris. Petroleum Engineer, Institut National Polytechnique Félix Houphouet Boigny, Yamoussoukro, Côte d'Ivoire
Kida Rose Ninsemon	Cote d'Ivoire	Marine and Lagoon Environment Manager, Directorate General of Maritime and Port Affairs, Cote d'Ivoire	Diploma in port affairs, National School of Administration, Coted'Ivoire. Master's in risk management, Mines Paris Tech.
Arsonina Bera	Madagascar	Regional Director of Environment, Ecology and Forest, Sava Region, Madagascar	Diplomas, Dresden University, Germany, and Antananarivo University, Madagascar. Contributor to Chapters 20 (Land-based inputs), 21 (Offshore hydrocarbons), 25 (Marine debris) and 26 (Land/sea interaction) of WOA I.
Babajide Ibitayo Alo	Nigeria	Distinguished Professor of Chemistry & Director, Centre for Environmental Human Resources Development, University of Lagos.	PhD, University of Bristol, England. Contributor to Chapter 21 (Offshore Hydrocarbon Industries) WOA I. Published on polycyclic aromatic hydrocarbons, polychlorinated biphenyls, waste management and sustainability, etc.
Kissao Gnandi	Togo	Associate Professor, University of Lomé, Togo	PhD, University of Erlangen, Germany. Published on lead, cadmium, pesticide residues, etc.
Bing Qiao	China	Vice-director of Academic Committee and Professor, China Waterborne Transport Research Institute	Registered Environmental Impact Assessment (EIA) Engineer of China Expert group member of Chinese scientific project of Marine Environmental Safety (Ensure).
Carlos Francisco Andrade	Brazil	Adjunct Professor at Universidade Federal do Rio Grande, Brazil	PhD in physical, chemical and geological oceanography, Universidade Federal do Rio Grande, Brazil. Published on groundwater discharge, trace elements in seaweed, etc.
Isabel Natalia Garcia Arevalo	Ecuador	Hydrographer, Continental Shelf and Deep-Sea division, Oceanographic Institute of the Ecuadorian	MSc in environmental sanitation, University of Ghent, Belgium. Engineer in environmental management, Universidad de

		Navy	Espiritu Santo, Ecuador. Published on rainfall and sea-surface temperature, toxicology of Pacific species, etc.
Jae Ryoung Oh	Republic of Korea	Research Counselor, Korea Institute of Ocean Science & Technology	PhD in environmental dynamics and management, Hiroshima University, Japan. Published on organochlorine pollutants, dioxins, furans, etc.
Julio Esteban Guerra Massón	Ecuador	M.Sc. Nanotechnology and Microsystems	MSc in nanotechnology and microsystems engineering, Southwest State University of Kursk, Russia. Published on waste-water treatment, adsorption by micro-organisms, etc.
Robin Anderson	Canada	Marine Habitat Research Scientist, Science Branch, Fisheries and Oceans Canada	PhD, McGill University. Published on integrated marine ecosystem assessment and management, mercury pollution.
Andrea Weiss	Germany	Scientist, German Environment Agency, Dessau, Germany. Formerly, Deputy Secretary of the OSPAR Commission	First and Second State Examinations in Law, University of Passau and Kammergericht Berlin, Germany. Published on European Union Marine Strategy Framework Directive, marine assessments.
Ralf Ebinghaus	Germany	Head of Department for Environmental Chemistry Institute of Coastal Research, Hamburg, Germany	PhD, University of Hamburg. Contributor to Chapter 20 (Land-based inputs) of WOA I. Published on atmospheric chemistry, persistent pollutants, etc.
Michael Angelidis	Greece	Professor of Environmental Chemistry University of the Aegean, Greece	PhD in chemistry, University of Patras, Greece. Published on marine pollution monitoring and assessment, with particular focus on the Mediterranean Sea.
Eric Pieter Achterberg	Netherlands	Professor of Ocean Chemistry, Helmholtz Center for Ocean Research Kiel, Germany	MSc, University of Wageningen, Netherlands; PhD, University of Liverpool, UK. Published on trace metals in deep ocean, nanoparticles and mining pollution, ecological impact of dumped munitions.
Bjorn Einar Grøsvik	Norway	Institute of Marine Research, Bergen, Norway	Dr Scient, Bergen University. Contributor to Chapter 21 (Offshore hydrocarbons) of WOA I. Published on marine debris, oil in the Arctic food web, oil spills.
Ida-Maja Hassellöv	Sweden	Associate professor, Maritime Environmental Science, Chalmers University of Technology, Gothenburg, Sweden	PhD in marine chemistry, University of Gothenburg, Sweden. Published on effects of anthropogenic impact, especially from shipping and shipwrecks, on the marine environment.

Colin Moffat	United Kingdom	Chief Scientific Advisor Marine, Marine Scotland, Scottish Government, Scotland	PhD, University of Aberdeen, Scotland. Published on pilot whales, agricultural chemicals and the marine environment, trophic transfer through food webs, oil spills, etc.
Judith Weis	United States	Rutgers University, New Jersey, USA	PhD, New York University. Contributor Chapter 49 (Salt marshes) of WOA I. Published on salt marshes, marine pollution, invasive species, etc.
Penny (Epapandi) Vlahos	United States	Associate Professor Departments of Marine Sciences & Environmental Engineering, University of Connecticut, USA	PhD, in environmental, coastal and ocean sciences, University of Massachusetts, USA. Published on carbon budgets, air/sea gas exchange, perfluorinated chemicals in the Arctic atmosphere, etc.
Rainer Lohmann	United States	Professor of Oceanography, University of Rhode Island, United States	PhD in environmental chemistry, Lancaster University, England. Published on pesticides, mercury, polychlorinated biphenyls (PCBs), flame retardants, emerging contaminants, especially in the Arctic, etc.
Miguel Caetano	Portugal	Head of the Division of Environmental Oceanography and Bioprospection, Instituto Português do Mar e da Atmosfera, Av. Alfredo magalhães Ramalho	PhD in marine science, University of Algarve - Portugal. Published on sources of Pb contamination in a sediment core of the Southwestern Iberian Atlantic Shelf, concentrations in marine fish species over a decade as response to reduction of anthropogenic inputs. Research focuses in biogeochemistry, marine science and chemical oceanography
Lars Sonesten	Sweden	Head, Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences	PhD in limnology, Uppsala University. Published on nutrients and pollution in the Baltic, etc.

## Writing team for Chapter 12

CHAPTER 12	SOLID WASTE		
	Changes in inputs and distribution of solid waste in the marine environment (other than dredged material): dumping at sea (including garbage from ships and sewage sludge); activities resulting in marine debris, including plastics, abandoned fishing gear, microparticles and nanoparticles and estimates of the sources both from land, ships and offshore installations.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Maria Bebianno	Portugal	Director, Centre for Marine and Environmental Research (CIMA), University of the Algarve, Portugal	PhD in ecotoxicology, University of Reading, England. Published on mine tailings, effects of metals, persistent organic compounds, microplastics nanoparticles and personal careproducts, ecotoxicological protocol for deep-sea fauna, etc.
<b>CO-LEAD MEMBERS</b>			
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
Juying Wang	China	Head of Marine Chemistry Division, National Marine Environment Monitoring Centre, Dalian, China	Contributor to Chapters 20 (Land-based inputs), 24 (Solid waste) and 25 (Marine debris) of WOA I. PhD in marine chemistry, Ocean University of China, Chingdao, China. Published on microplastics, aragonite saturation, etc.
Joshua T. Tuhumwire	Uganda	Chief Executive Officer of Gondwana Geoscience Consulting Ltd.; Director/Chairman of Sipa Exploration Resources (Uganda) Ltd; Commissioner, Uganda Department of Geological Survey and Mines (2001 to 2010). Consultant to several mineral exploration projects in Uganda. Member, Legal & Technical Commission, International Seabed Authority	Contributor to Chapters 1 (Planet, Ocean and Life) 23 (Offshore mining), and 26 (Land/Sea interaction) of WOA I. B.Sc. (Hons.) in chemistry and geology, Makerere University, Uganda; M.Sc. in geology, Vrije Universiteit Brussel, Belgium. Several unpublished geological reports during 30 years' career at Uganda's Geological Survey & Mines.
<b>JOINT CONVENORS</b>			
François Galgani	France	Senior Researcher at IFREMER, Laboratoire LER/PAC, Bastia, France	Ecotoxicology, Chemistry and Marine Litter. Chair of the European Commission/DG ENV/MSCG technical group on marine litter, Chair of the MEDPOL expert group on Marine Litter and CIESM Committee chair

			(Biogeochemistry and ecotoxicology)
Aleke Stöfen-O'Brien	Germany	WMU-Sasakawa Global Ocean Institute, World Maritime University, Sweden	PhD in law, University of Trier, Germany. Published on sewage and waste management, marine debris, etc.
<b>MEMBERS</b>			
Arsonina Bera	Madagascar	Regional Director of Environment, Ecology and Forest, Sava Region, Madagascar	Diplomas, Dresden University, Germany, and Antananarivo University, Madagascar. Contributor to Chapters 20 (Land-based inputs), 21 (Offshore hydrocarbons), 25 (Marine debris) and 26 (Land/sea interaction) of WOA I.
Iryna Makarenko	Ukraine	Black Sea Commission Secretariat	LLM in international environmental and energy law. Published on assessment of Black Sea marine living resources, etc.
Maurizio Azzaro	Italy	Marine Microbiologist, Institute for Coastal and Marine Environment, Messina, Italy	Contributor to Chapters 6 (Primary production and plankton) and 36H (Southern Ocean), WOA I. Published on Arctic and Antarctic marine microbes, etc.
Alan Deidun	Malta	International Ocean Institute (IOI), Valletta, Malta	PhD, University of Malta. Published on invasive species, jellyfish, beached litter, etc.
Dick Vethaak	Netherlands	Professor of Marine Ecotoxicology / Water Quality and Health, VU University, Amsterdam and Deltares, Delft, Netherlands	PhD, EU-registered toxicologist. Published on effect and risk assessment, emerging contaminants, endocrine disrupters, plastic litter and microplastics, etc.
Bjørn Einar Grøsvik	Norway	Institute of Marine Research, Bergen, Norway	Dr Scient, Bergen University. Contributor to Chapter 21 (Offshore hydrocarbons) of WOA I. Published on marine debris, oil in the Arctic food web, oil spills.
Martin Hassellöv	Sweden	Professor, Analytical Environmental Chemistry, University of Gothenburg	PhD in marine chemistry, University of Gothenburg. Published on microplastics in the Arctic and in relation to small island developing states, etc.
Huw Griffiths	United Kingdom	British Antarctic Survey, Cambridge, England	PhD, Open University, England. Chair of the State of the Antarctic Ecosystem research programme under the Scientific Committee on Antarctic Research. Published on



			Southern Ocean cephalopods, Southern Ocean seafloor warming, etc.
Chelsea Rochman	United States	Assistant Professor, University of Toronto, Canada	PhD, University of California, Davis. Published on microplastics, marine debris, etc.
Jenna Jambeck	United States	Associate Professor, College of Engineering, University of Georgia, United States	PhD, University of Florida. Published on plastic waste, marine debris, etc.
Joan Bondareff	United States	Lawyer, Blank Rome LLP, Washington DC, United States	JD, George Washington University, DC, USA. Published on offshore wind energy, etc. 2018 Award winner for Marine Environment Protection, North American Marine Environment Protection Association.
Judith Weis	United States	Rutgers University, New Jersey, United States	PhD, New York University. Contributor Chapter 49 (Salt marshes) of WOA I. Published on salt marshes, marine pollution, invasive species, etc.
Paula Keener	United States	National Aeronautics and Space Administration, Charleston, South Carolina, United States	MSc in marine biology, University of Charleston. Published on work of the National Oceanic and Atmospheric Administration, etc. Lead Reviewer, USA, of WOA I.
Alexander Turra	Brazil	Professor, Oceanographic Institute, University of Sao Paulo, Brazil	PhD, Campinas University, Brazil. Published on beach ecology, marine debris, crabs, clams, etc.
Paula Sobral	Portugal	Associate Professor, New University of Lisbon, Portugal	PhD, New University of Lisbon. Published on microplastics and marine debris.
Ahmed Md. Kawser	Bangladesh	Professor University of Dhaka; Director of the International Centre for Ocean Governance	Contributor to Chapters 29 (Marine genetic resources) and 44 (Estuaries and deltas) of WOA I. Published on arsenic, PAHs and PCBs in food, contamination of sediments, etc.
Aleka Stöfen-O'Brien	Germany	Scientific Officer, Marine Environment Protection Unit, German Environment Agency	Dr Jur, University of Trier, Germany. Published on sewage and waste management, marine debris, etc.
Archis Ambulkar	United States	Environmental Engineer, Brinjac Engineering, Inc., Harrisburg, Pennsylvania, United States	M.S. in Environmental Engineering – Bucknell University, USA and B.S. in Chemical Engineering – Nagpur University, India. Certified Environmental Specialist & Certified Environmental Consultant, Small

			Water Treatment System Operator, Laboratory Analyst-in-training
Christos Ioakeimidis	Greece	UN Environment / Mediterranean Action Plan Coordinating Unit Barcelona Convention Secretaria	Marine Litter, Expert in the Project Management and Implementation, Expert in the Mediterranean Pollution Assessment and Control Programme (MED POL)
Konstantinos Topouzelis	Greece	Assistant Professor in Marine Remote Sensing, Department of Marine Sciences, University of the Aegean, Lesbos, Greece	PhD, National Technical University, Athens. Published on remote sensing, seagrasses, marine debris, etc.
Fernanda De Oliveira Lana	Brazil	Post-Doctoral Student in Marine Biology and Coastal Environments, Federal Fluminense University, Rio de Janeiro, Brazil	PhD in fisheries, Federal Rural University of Pernambuco. Published on sharks and other elasmobranchs, etc.
Penny (Epanandi) Vlahos	United States	Associate Professor Departments of Marine Sciences & Environmental Engineering, University of Connecticut, United States	PhD, in environmental, coastal and ocean sciences, University of Massachusetts, USA. Published on carbon budgets, air/sea gas exchange, perfluorinated chemicals in the Arctic atmosphere, etc.
Qamar Schulyer	Australia	Commonwealth Scientific and Industrial Research Organization Oceans and Atmosphere, Australia	PhD, University of Queensland, Australia. Published on impacts of marine debris on sea turtles.

## Writing team for Chapter 13

CHAPTER 13	<b>EROSION AND SEDIMENTATION</b>		
	Changes in erosion and sedimentation: changes in river management (including dams) affecting the amount of sediment and water delivered to the ocean, and coastal erosion; changes in land use resulting in changes in erosion patterns; beach nourishment		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
<b>CO-LEAD MEMBERS</b>			
Joshua T. Tuhumwire	Uganda	Chief Executive Officer of Gondwana Geoscience Consulting Ltd.; Director/Chairman of Sipa Exploration Resources (Uganda) Ltd; Commissioner, Uganda Department of Geological Survey and Mines (2001 to 2010). Consultant to several mineral exploration projects in Uganda. Member, Legal & Technical Commission, International Seabed Authority	Contributor to Chapters 1 (Planet, Ocean and Life) 23 (Offshore mining), and 26 (Land/Sea interaction) of WOA I. B.Sc. (Hons.) in chemistry and geology, Makerere University, Uganda; M.Sc. in geology, Vrije Universiteit Brussel, Belgium. Several unpublished geological reports during 30 years' career at Uganda's Geological Survey & Mines.
<b>CONVENOR</b>			
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
<b>MEMBERS</b>			
Paulette Bynoe	Guyana	Senior Lecturer, Faculty of Earth and Environmental Sciences of the University of Guyana	PhD in development geography, University of Sussex. Published on ecotourism, watershed management, etc.
Matt Eliot	Australia	Director (Coastal Engineering) Damara WA Pty Ltd;	PhD, University of Western Australia. Published on coastal sediments, sea levels, coastal flooding.
Jarbas Bonetti	Brazil	Associate Professor, Department of Oceanography, Federal University of Santa Catarina, Brazil	PhD, in Physical Geography, University of Sao Paulo. Published on coastal erosion, flooding risks, climate-change impacts on coasts.
Frank R. Hall	United States	Dean, College of Science, Engineering & Technology. Saginaw Valley State University, Michigan, United States	PhD in geological oceanography, University of Rhode Island. Contributor to Chapters 7 (Carbonate production) and 26 (Land/Sea interaction) of WOA I.

			Published on sediment transport into the deep ocean, etc.
Rosh Ranasinghe	The Netherlands	Professor of Climate Change Impacts and Coastal Risk, Delft Institute for Water Education; Professor University of Twente, Netherlands	PhD in coastal engineering and oceanography, University of Western Australia. Published on sand movement, climate-change impact on coasts, etc.
Sylvain Monde	Cote d'Ivoire	Professor of marine geology, University F Houphouet-Boigny (Abidjan), Cote d'Ivoire	Doctorates from Universities of Cocody, Cote d'Ivoire, and La Rochelle, France. Published on coastal pollution, estuarial sediments, etc.
Tuan Le Nguyen	Vietnam	Director of Vietnam Institute of Seas and Islands, Hanoi	Doctorate in Engineering. Published on environmental-risk zoning, watershed management, marine spatial planning.

## Writing Team of Chapter 14

CHAPTER 14	MARITIME INFRASTRUCTURE		
	Amounts of land reclaimed from the sea; extent of new land defences against the sea, and extent of sea defences abandoned; extent of coastal development, including development for tourism; other adaptations affecting coastal populations as a result of sea-level rise; changes in port installations and their management, including dredging; changes in submarine cables and submarine pipelines.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
<b>CO-LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CONVENOR</b>			
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
<b>MEMBERS</b>			
Matchonnawe Hubert Bakai	Togo	Chef de Cabinet, National Organization for State Action in the Sea, Togo	Diploma, United Nations Institute for Training and Research.
Samuel Jackson Bentley, Senior	United States	Professor and Associate Dean for Research, Louisiana State University, Louisiana, United States	PhD, Stony Brook University, New York, USA. Published on the Mississippi and its management, river deltas, etc
Bi Tra Boniface Nene	Cote d'Ivoire	Head of the Mapping and Offshore Environment Department at Ministry of Petroleum, Energy and Renewable Energies	Master in Geographic Information System (GIS), Institut des Sciences et Industries du Vivant et de l'Environnement, Paris. Petroleum Engineer, Institut National Polytechnique Félix Houphouet Boigny, Yamoussoukro, Côte d'Ivoire

Lionel Carter	New Zealand	Professor of Marine Geology, Victoria University of Wellington, New Zealand	PhD, University of British Columbia, Canada. Published on submarine cables, including geophysical hazards, etc.
Catherine Creese	United States	Director, Naval Seafloor Cable Protection Office, United States	Degree, US Coastguard Academy. Twenty years' experience in the undersea cable industry.
Victor Hugo Masson Fiallos	Ecuador	Advisor on maritime affairs, Ministry of Foreign Affairs, Ecuador	Master's in management, Loja University, Ecuador. Degree in physical oceanography, ENAP University, Cartagena, Colombia.
Regina Folorunsho	Nigeria	Assistant Director of Research, Nigerian Institute for Oceanography and Marine Research	PhD, oceanography and meteorology, University of Lagos. Published on oil spill response, climate change and cities, etc.
Gheorghe Ftadeev-Brat	Romania	Chief of Safety, Navigation and Pollution Prevention and Port State Control Officer, Romanian Naval Authority, Tulcea, Romania	Engineering diploma, Nautical Institute, Constanța; economic management diploma, University of Galați, Master in maritime safety, Maritime University of Constanța, Romania. Published on the prevention of pollution from ships, the "green ship" concept, etc.
Koffi Robert Dapa	Cote d'Ivoire	Head of Production and Operations Service of the National Oil Company of Côte d'Ivoire	Diploma from the Institut Polytechnique Felix Houphouët-Boigny, Cote d'Ivoire; Master of Project Management and Engineering, CentralesSupélec (high-level public training centre in France). Mining and petroleum engineer.
Alix Willemez	France	Independent consultant, Jouy-lès-Tours, France	PhD in the law of the sea, University of Paris I (Panthéon-Sorbonne). Published for UNIDO on the exploitation of natural resources in the Pacific, etc.

## Writing team for Chapter 15

<b>CHAPTER 15</b>	<b>CAPTURE FISHERIES</b>		
	<p>Changes in capture fisheries and harvesting of wild marine invertebrates: levels of catches of fish, after allowing for the effects of management measures (including the effects of estimated levels of fisheries subsidies (both capacity-enhancing and beneficial subsidies)) - within national jurisdiction (by commercial fisheries, by artisanal (otherwise called small-scale) and subsistence fisheries), and beyond national jurisdiction (including the effects of fisheries beyond national jurisdiction as a result of the exhaustion of fisheries within national jurisdiction); levels of harvesting of marine invertebrates (including shellfish); levels of by-catch and other impacts on vulnerable marine ecosystems and benthic ecosystems; levels of post-harvest loss; levels of fish-stock propagation; use of marine protein in agriculture and aquaculture; estimated levels of illegal, unregulated and unreported (IUU) fisheries.</p>		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Enrique Marschoff	Argentina	Member of the Instituto Antártico Argentino, Buenos Aires, Argentina	Contributor to Chapters 11 (Capture fisheries), 15 (Social and economic aspects of fisheries), 36B (South Atlantic biodiversity), 36H (Southern Ocean biodiversity) 46 (High-latitude ice), 54 (Overall human impact) and 55 (Overall value) of WOA I. Doctorate in biological sciences, University of Buenos Aires, Argentina. Published on Southern Ocean fisheries, Southern elephant-seal, etc.
<b>CO-LEAD MEMBERS</b>			
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
Essam Yassin Mohammed	Eritrea	Head of blue economy, International Institute for Environment and Development, London, England	PhD in international development, University of Nagoya, Japan. Published on small scale fisheries, connection between areas beyond national jurisdiction and areas under national jurisdiction, etc.
Ylenia Randrianisoa	Madagascar	Professor, University of Toamasina, Madagascar	Diploma in applied oceanography, and PhD in fishery management, Fisheries and Marine Science Institute (IHSM) Tuléar, Madagascar. Published on fisheries management, etc.
<b>CONVENOR</b>			
Porter Hoagland	United States	Senior Research Specialist, Marine Policy Center, Woods Hole Oceanographic Institution, Massachusetts, United States	PhD in marine policy, University of Delaware. Published on effects of red tides, implementing ecosystem-based fisheries management, consequences of siting of wind-

			farms, etc.
<b>MEMBERS</b>			
Alida Bundy	Canada	Research Scientist, Fisheries and Oceans Canada, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada.	PhD in resource management, University of British Columbia, Canada. Published on ecosystem-based management, trophic-level indicators of fisheries impact, etc.
Andrew Frederick Johnson	United Kingdom	Postdoctoral Scholar, Scripps Institution of Oceanography at University of California (San Diego), United States	PhD, Bangor University, UK. Published on small-scale fisheries, effects of bottom trawling, etc.
Chang-Ik Zhang	Republic of Korea	Head of Faculty, Division of Marine Production System Management, Pukyong National University	PhD, University of Washington, WA, USA. Published on fish stock propagation, impact of climate change on fisheries, etc.
Franklin Isaac Ormazá-González	Ecuador	Professor, Facultad de Ingeniería Marítima, Ciencias Biológicas Oceanicas y Recursos Naturales, University of Ecuador	PhD in oceanography, University of Southampton, England. Published on fisheries management, tuna, oceanographic fluctuations and fish stocks, etc.
Hector Lozano-Montes	Australia	Research Scientist, Commonwealth Scientific and Industrial Research Organisation, Crawley, Western Australia	PhD in fisheries, University of British Columbia, Canada. Published on variations in trophic flows, recruitment, fishing effort and ecosystem variations on fish stocks, etc.
Imants George Priede	Belgium	Emeritus Professor, OceanLab, University of Aberdeen, Scotland	Founding Director of OceanLab. Editor-in-Chief, Deep-Sea Research. Published on deep-sea fish, fish anatomy, etc.
Zacharie Sohou	Benin	Research Oceanographer, Institut de Recherches Halieutiques et Océanologiques du Bénin	Contributor to Chapter 13 (Fish stock propagation) of WOA I. Published on West African cetaceans, fish stocks of the Gulf of Guinea, etc.
Burcu Bilgin Topçu	Turkey	Senior Fisheries Officer, Ministry of Agriculture and Forestry, Turkey	PhD in fisheries, Ankara University. Published on management of tuna and swordfish, fisheries discards, etc.
Fernanda De Oliveira Lana	Brazil	Post-Doctoral Student in Marine Biology and Coastal Environments, Federal Fluminense University, Rio de Janeiro, Brazil	PhD in fisheries, Federal Rural University of Pernambuco. Published on sharks and other elasmobranchs, etc.
Manuel Hidalgo	Spain	Balearic Oceanographic Centre, Spanish Institute of Oceanography, Palma de Mallorca, Spain	PhD in Marine Sciences, University of Vigo, Spain. Published on ocean connectivity, ecological function and management,



			cephalopods, resilience mechanisms of fish communities, etc.
Lynn Waterhouse	United States	Research biologist, Shedd Aquarium, Chicago, United States	PhD in Biological Oceanography, Scripps Institution of Oceanography, University of California San Diego, United States
Lena Bergstrom	Sweden	Project coordinator at HELCOM. Baltic Marine Environment Protection Commission	Assessment and management of fish stocks, Maritime spatial planning, Marine and coastal ecosystem-based management.
Megan Bailey	Canada	Assistant Professor, Marine Affairs Program, Dalhousie University Canada Research Chair: Integrated Ocean and Coastal Governance	PhD in Resource Management and Environmental Studies: Improving the management of regional and global tuna fisheries, University of British Columbia, Vancouver, Canada

### Writing team for Chapter 16

<b>CHAPTER 16</b>	<b>AQUACULTURE</b>		
	Changes in aquaculture: changes in the areas of the sea-bed covered with aquaculture installations; changes in the quantities produced by marine aquaculture of –fish, invertebrates (including shellfish); changes in the management of marine aquaculture, including effects on wild fish populations, in the proportions of fish meal and vegetable feed used, and the quantities of pesticides used.		
<b>NAME</b>	<b>STATE</b>	<b>AFFILIATION</b>	<b>RELEVANT EXPERIENCE</b>
<b>LEAD MEMBER</b>			
Enrique Marschoff	Argentina	Member of the Instituto Antártico Argentino, Buenos Aires, Argentina	Contributor to Chapters 11 (Capture fisheries), 15 (Social and economic aspects of fisheries), 36B (South Atlantic biodiversity), 36H (Southern Ocean biodiversity) 46 (High-latitude ice), 54 (Overall human impact) and 55 (Overall value) of WOA I. Doctorate in biological sciences, University of Buenos Aires, Argentina. Published on Southern Ocean fisheries, Southern elephant-seal, etc.
<b>CO-LEAD MEMBER</b>			
Renison Ruwa	Kenya	Deputy Director, Kenya Marine and Fisheries Research Institute.	Contributor to Chapters 32 and 53 (Capacity-building), 36E (Indian Ocean biodiversity) and 48 (Mangroves) of WOA I. PhD, University of Florence, Italy. Published on influence of seasonality and bathymetry on crustacea, mangroves, etc.

<b>CONVENOR</b>			
Rohana Subasinghe	Sri Lanka	Consultant, FutureFish Foundation, Victoria Australia. Formerly, Chief, Aquaculture Branch, Food and Agricultural Organization (FAO)	PhD, University of Stirling, Scotland. Published on Asia-Pacific aquaculture, Global aquaculture and its role in sustainable development.
<b>MEMBERS</b>			
Pedro Baron	Argentina	Director of the Center for the Study of Marine Systems, and of the Sci-Tech Centre, Patagonia, Argentina	Doctorate in biology, National University of Comahue (Argentina). Director of studies on aquaculture technology foresight (2014-2017). Published on crab population biology and fishing, bivalves, zooplankton and ocean conditions, etc.
Malcolm Beveridge	United Kingdom	Consultant, formerly with Food and Agriculture Organization of the United Nations, Rome, Italy	PhD, University of Glasgow. Co-Author of FAO Technical Paper “Impacts of Climate Change on Fisheries and Aquaculture”. Published on aquaculture and food security, etc.
Doris Oliva	Chile	Head, Institute of Biology, Centre for Research and Management of Natural Resources (CIGREN), University of Valparaíso, Chile	Contributor to Chapter 12 (Aquaculture of WOA I). Licentiate in Sciences, University of Valparaiso. Published on shellfish, interaction of marine mammals and fisheries, etc.

## Writing team for Chapter 17

CHAPTER 17	SEAWEED HARVESTING		
	Changes in seaweed harvesting and use: changes in the level of wild seaweed harvesting; changes in the level of seaweed cultivation; developments in uses of seaweed.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Hilconida Calumpong	Philippines	Director, Institute of Environmental and Marine Sciences, Silliman University, Philippines	Contributor to Chapters 6 (Primary production and plankton), 14 (Seaweeds), 47 (Kelp forests and seagrasses), and 48 (Mangroves) of WOA I. PhD (major in Botany), University of California, Berkeley. Published on mangroves, seagrasses, algae, invertebrates, coastal resource management, etc.
<b>CO-LEAD MEMBER</b>			
Renison Ruwa	Kenya	Deputy Director, Kenya Marine and Fisheries Research Institute	Contributor to Chapters 32 and 53 (Capacity-building), 36E (Indian Ocean biodiversity) and 48 (Mangroves) of WOA I. PhD, University of Florence, Italy. Published on influence of seasonality and bathymetry on crustacea, mangroves, etc.
<b>CONVENOR</b>			
Isabel Sousa Pinto	Portugal	Professor, Department of Biology, University of Porto and Director of the Coastal Biodiversity Laboratory, Portugal	PhD, University of California, Santa Barbara. Published on kelp and kelp forests, including relationship with fish species, etc.
<b>MEMBERS</b>			
Adam Hughes	United Kingdom	Senior Lecturer in Sustainable Aquaculture, Scottish Association for Marine Science, University of the Highlands and Islands, Oban Scotland	PhD on sea urchins, Open University, England. Published on climate-change and aquaculture, biogas from algae, aquaculture and marine protected areas, etc.
Paula Bontempi	United States	Manager, Ocean Biology and Biogeochemistry Program, Headquarters of the National Aeronautic and Space Administration, United States	PhD, University of Rhode Island. Published on remote sensing of chlorophyll, red tides, etc.
Franciane Maria Pellizzari	Brazil	Professor, College of Biological Science, State University of Paraná, Brazil	PhD in plant ecology, University of Sao Paulo. Published on Antarctic seaweeds, Brazilian marine algae, etc.
Noemí Andrea Solar Bacho	Chile	Marine biologist, Empresa de Alimentación Sustentable, Chile	Specialization in Marine Aquaculture

## Writing team for Chapter 18

CHAPTER 18	SALT		
	Changes in desalinization and in the production of sea salt		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CO-LEAD MEMBER</b>			
Carlos Garcia Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
<b>*The members of this writing team will be posted once approved by the Bureau.</b>			

## Writing team for Chapter 19

CHAPTER 19	SEABED MINING		
	Changes in seabed mining: effects of technological improvements; mining within national jurisdiction: for metals, for sand and aggregates, for other substances (for example, diamonds); mining beyond national jurisdiction.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Joshua T. Tuhumwire	Uganda	Chief Executive Officer of Gondwana Geoscience Consulting Ltd.; Director/Chairman of Sipa Exploration Resources (Uganda) Ltd; Commissioner, Uganda Department of Geological Survey and Mines (2001 to 2010). Consultant to several mineral exploration projects in Uganda. Member, Legal & Technical Commission, International Seabed Authority	Contributor to Chapters 1 (Planet, Ocean and Life) 23 (Offshore mining), and 26 (Land/Sea interaction) of WOA I. B.Sc. (Hons.) in chemistry and geology, Makerere University, Uganda; M.Sc. in geology, Vrije Universiteit Brussel, Belgium. Several unpublished geological reports during 30 years' career at Uganda's Geological Survey & Mines.

<b>CO-LEAD MEMBERS</b>			
Maria Bebianno	Portugal	Director, Centre for Marine and Environmental Research (CIMA), University of the Algarve, Portugal	PhD in ecotoxicology, University of Reading, England. Published on mine tailings, effects of metals, persistent organic compounds, microplastics nanoparticles and personal careproducts, ecotoxicological protocol for deep-sea fauna, etc.
Anastasia Strati	Greece	Expert Minister Counsellor, Law of the Sea, Permanent Mission of Greece to the United Nations	MSc in Marine Law and Policy; PhD in Law of the Sea, University of Wales, United Kingdom. Published on underwater cultural heritage, fisheries, marine pollution, offshore energy, maritime delimitation, dispute settlement, etc.
<b>JOINT CONVENORS</b>			
James R. Hein	United States	United States. Geological Survey, Senior Scientist, Head of Marine Minerals Program, Santa Cruz, California, United States	PhD, University of California, Santa Cruz. Published on Arctic ferromanganese-oxide deposits, Pacific manganese nodules, etc.
Pedro Madureira	Portugal	Associate Professor, Evora University, Portugal	PhD, University of Evora. Member of the Legal and Technical Commission of the International Seabed Authority. Published on submarine eruptions, polymetallic nodules in the Area, etc.
<b>MEMBERS</b>			
Luis Menezes Pinheiro	Portugal	Associate Professor in Marine Geology and Geophysics, University of Aveiro, Portugal	PhD, Imperial College, London. Published on submarine seismology, submarine mud volcanoes, methane-derived carbonates, etc. Coordinator of the Sea Technology Platform, University of Aveiro.
Giorgio de la Torre	Ecuador	Department Head, Oceanographic Institute of the Ecuadorian Navy	Master of Science, Texas A&M University, United States. Former chair of the Pacific Tsunami Warning and Mitigation System. Head of team for the outer limits of the Ecuadorian continental shelf.
Nomikou Paraskevi	Greece	Assistant Professor in Geological Oceanography, University of Athens, Greece	PhD in geology, University of Athens. Published on submarine volcanoes, Mid-Atlantic ridge, etc. Marine Geologist at the Hellenic Centre for Marine Research.
Ana Colaco	Portugal	Institute of Marine Research and Marine and	PhD, University of Lisbon. Published on seamounts,

		Environmental Sciences Centre, University of the Azores, Portugal	resilience of deep-sea fauna, etc.
Richard Roth	United States	Research Associate Director, Materials Systems Laboratory Massachusetts Institute of Technology, United States	PhD in Materials Science & Engineering, Massachusetts Institute of Technology, United States. Published on modelling the economics of seabed mining.

### Writing team for Chapter 20

CHAPTER 20	<b>OFFSHORE HYDROCARBONS</b>		
	Changes in hydrocarbon exploration and extraction: including coverage of new exploration zones and new fields, but not including noise effects (see chapter 21) and, not including discharges and emissions (see chapter 11); decommissioning of offshore installations.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Joshua T. Tuhumwire	Uganda	Chief Executive Officer of Gondwana Geoscience Consulting Ltd.; Director/Chairman of Sipa Exploration Resources (Uganda) Ltd; Commissioner, Uganda Department of Geological Survey and Mines (2001 to 2010). Consultant to several mineral exploration projects in Uganda. Member, Legal & Technical Commission, International Seabed Authority	Contributor to Chapters 1 (Planet, Ocean and Life) 23 (Offshore mining), and 26 (Land/Sea interaction) of WOA I. B.Sc. (Hons.) in chemistry and geology, Makerere University, Uganda; M.Sc. in geology, Vrije Universiteit Brussel, Belgium. Several unpublished geological reports during 30 years' career at Uganda's Geological Survey & Mines.
<b>CO-LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CONVENOR</b>			
Amardeep Dhanju	United States	Senior Policy Analyst, Contractor, LCH Consulting, in support of Bureau of Ocean Energy Management, USA Department of Interior	PhD in Marine Policy, University of Delaware. Contributor to Chapter 22 (Other Marine-Based Energy Industries) of WOA I. Coordinator of the USA

			National Ocean Policy initiative, and co-chair of the Marine Planning Implementation subgroup of the United States National Ocean Council.
<b>MEMBERS</b>			
Koffi Robert Dapa	Cote d'Ivoire	Head of Production and Operations Service of the National Oil Company of Côte d'Ivoire	Mining and petroleum engineer diploma from the Institut Polytechnique Felix Houphouët-Boigny, Cote d'Ivoire; Master of Project Management and Engineering, Centrales Supélec (high-level public training centre in France).
Yeboue Kacou Seraphin	Cote d'Ivoire	Head of Drilling and Environment Department, Ministry of Petroleum, Energy and Renewable Energies, Côte d'Ivoire	Diploma as Mining Engineer, Institut National Polytechnique Houphouet Boigny, Cote d'Ivoire; Master's in environmental and industrial engineering, University of Paris.
Arsonina Bera	Madagascar	Regional Director of Environment, Ecology and Forests, Ministry of Environment, Ecology and Forests, Sava Region Madagascar	Diplomas, Dresden University, Germany, and Antananarivo University, Madagascar. Contributor to Chapters 20 (Land-based inputs) and 21 (Offshore hydrocarbons) of WOA I.
Hans-Peter Damian	Germany	Senior Scientific Officer, Federal Environment Agency, Germany	Degree in biology, University of Bielefeld. Published on environmental regulation of offshore hydrocarbon extraction, use of dispersants at sea, etc.
Giorgio de la Torre	Ecuador	Department Head, Oceanographic Institute of the Ecuadorian Navy	Master of Science, Texas A&M University, USA. Former chair of the Pacific Tsunami Warning and Mitigation System. Head of team for the outer limits of the Ecuadorian continental shelf.

## Writing team for Chapter 21

CHAPTER 21	MARINE NOISE		
	Trends in inputs of anthropogenic noise to the marine environment (including improved understanding of its effects across all species).		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
<b>CO-LEAD MEMBER</b>			
Carlos Garcia-Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
<b>CONVENOR</b>			
Ana Širović	United States	Texas A&M University, Galveston, Texas, United States.	PhD, University of California, United States of America. Published on ocean ambient noise, marine mammal acoustics, noise impacts on fish.
<b>MEMBERS</b>			
James H. Miller	United States	University of Rhode Island, Kingston, Rhode Island, United States	DSc, Massachusetts Institute of Technology, United States of America. Published on ocean noise budgets and modelling, impacts of noise on marine animals.
John Hildebrand	United States	Scripps Institute of Oceanography, and University of California (San Diego), United States	PhD, Stanford University, United States of America. Published on acoustic monitoring of whales, seismic and sonar impacts on marine mammals.
Sergio de Jesus	Portugal	Signal Processing Laboratory, University of Algarve, Algarve, Portugal	PhD, University of Nice, France. Published on noise detection and transmission of sound in water.



## Writing team for Chapter 22

CHAPTER 22	<b>RENEWABLE ENERGY</b>		
	Developments in renewable energy sources, including offshore geothermal energy, solar energy, tidal energy, wave energy wind energy.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Anastasia Strati	Greece	Expert Minister Counsellor, Law of the Sea, Permanent Mission of Greece to the United Nations	MSc in Marine Law and Policy; PhD in Law of the Sea, University of Wales, United Kingdom. Published on underwater cultural heritage, fisheries, marine pollution, offshore energy, maritime delimitation, dispute settlement, etc.
<b>CO-LEAD MEMBERS</b>			
Carlos Garcia-Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
Osman Keh Kamara	Sierra Leone	Sierra Leone Ambassador to Ethiopia and Permanent Representative to the African Union	Contributor to Chapters 17 (Shipping) and 32 and 53 (Capacity Building) of WOA I. Graduate of University of Sierra Leone and Columbia University, New York, Post-Graduate Diploma (Rhodes Academy of Ocean Law and Policy, Greece).
<b>CONVENOR</b>			
Takvor Soukissian	Greece	Research Director, Institute of Oceanography, Hellenic Center for Marine Research, Athens, Greece	PhD in ocean hydrodynamics, National Technical University of Athens. Published on offshore wave potential and in general marine renewable energy in the Mediterranean, water-column device for wave energy absorption, etc.
<b>MEMBERS</b>			
Amardeep Dhanju	United States	Senior Policy Analyst, Contractor, LCH Consulting, in support of Bureau of Ocean Energy Management (BOEM), United States Department of the Interior, United States	PhD in Marine Policy, University of Delaware. Contributor to Chapter 22 (Other Marine-Based Energy Industries) of WOA I. Coordinator of the USA National Ocean Policy initiative, and co-chair of the Marine Planning Implementation subgroup of the USA National Ocean Council.
Lars Golmen	Norway	Senior Research Scientist, Norwegian	Contributor to Chapter 22 (Other Marine-Based Energy

		Institute for Water Research (NIVA) and, Runde Environmental Centre (REC), Norway. Adj. Professor, Tokyo University of Marine Science and Technology, TUMSAT, Tokyo, Japan.	Industries) of WOA I. Msc in deep ocean water information. Published on ocean optics, acoustics and observing systems interoperability, design of multi-purpose offshore platforms, etc.
Jimmy Murphy	Ireland	Marine and Renewable Energy Ireland Centre, Environmental Research Institute, University College Cork, Ireland	PhD, University College, Cork, Ireland. Published on economic and environmental impact appraisal of commercial-scale offshore renewable energy installations, energy and resource assessment of waves, etc.
Georgios Vougioukalakis	Greece	Researcher Volcanologist, Head of Department of Geothermy and Thermal Waters, Greek Institute of Geology and Mineral Exploration, Athens, Greece	PhD in volcanology and geothermy, Aristotle University of Thessaloniki, Greece. Published on the Santorini volcanic field, mercury emissions from volcanic soils and fumaroles, etc.
Joan Bondareff	United States	Lawyer, Blank Rome LLP, Washington DC, United States	BA George Washington University, DC, USA. JD, American University, WCL. Published on offshore wind energy, etc. 2018 Award winner for Marine Environment Protection, North American Marine Environment Protection Association
Eric Mwangi Njoroge	Kenya	CEO and Director, Operations and Facilities, WIO Marine Limited, Sarit Centre, Nairobi, Kenya	Experience in ensuring effective implementation of administrative policies to achieve ecologically viable renewable energy and linear infrastructure development on both public and private lands; and in coordinating engagement on linear infrastructure development as well as renewable energy and wildlife conservation issues;
Valerie Ann Cummins	Ireland	Senior Lecturer, School of Biological, Earth and Environmental Sciences, University College Cork	PhD in Geography, University College Cork; MSc University College Cork; BSc Cardiff University. Published on Governance challenges of marine renewable energy developments in the U.S.A, and on Governance Barriers to sustainable Energy Transitions

## Writing team for Chapter 23

CHAPTER 23	SHIPPING		
	Developments in marine transportation: ferries, other coastwise shipping, international freight transport, including effects of containerization, cruising, ship-breaking, bunkers, (but discharges and emissions from ships, garbage, sewage and transport of invasive species are covered in the chapters dealing with those subjects).		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CO-LEAD MEMBER</b>			
Osman Keh Kamara	Sierra Leone	Sierra Leone Ambassador to Ethiopia and Permanent Representative to the African Union	Contributor to Chapters 17 (Shipping) and 32 and 53 (Capacity Building) of WOA I. Graduate of University of Sierra Leone and Columbia University, New York, Post-Graduate Diploma (Rhodes Academy of Ocean Law and Policy, Greece).
<b>MEMBERS</b>			
Joan Bondareff	United States	Lawyer, Blank Rome LLP, Washington DC, United States	JD, George Washington University, DC, USA. Published on offshore wind energy, etc. 2018 Award winner for Marine Environment Protection, North American Marine Environment Protection Association
<b>*The members of this writing team will be posted once approved by the Bureau.</b>			

## Writing team for Chapter 24

CHAPTER 24	TOURISM		
	Developments in tourism and recreational activities.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CO-LEAD MEMBER</b>			
Anastasia Strati	Greece	Expert Minister Counsellor, Law of the Sea, Permanent Mission of Greece to the United Nations	MSc in Marine Law and Policy; PhD in Law of the Sea, University of Wales, United Kingdom. Published on underwater cultural heritage, fisheries, marine pollution, offshore energy, maritime delimitation, dispute settlement, etc.
<b>*The members of this writing team will be posted once approved by the Bureau.</b>			

## Writing team for Chapter 25

CHAPTER 25	INVASIVE SPECIES		
	Including transport in ballast water and on ships' hulls.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Chul Park	Korea (Republic of)	Chair of the North Pacific Marine Science Organisation (PICES), Professor of Oceanography and Ocean Environmental Sciences, Chungnam National University, Daejon, Republic of Korea.	Contributor to Chapters 6 (Primary production and plankton), 36C (North Pacific biodiversity) of WOA I. PhD in Oceanography, Texas A&M University, USA. Published on zooplankton distribution, phytoplankton dynamics, etc.
<b>CO-LEAD MEMBERS</b>			
Henn Ojaveer	Estonia	Research Professor in Marine Ecosystems, University of Tartu, Estonia.	PhD in ichthyology and fisheries, University of Tartu, Estonia. Published on invasive species, biodiversity status of the Baltic, etc.
Renison Ruwa	Kenya	Deputy Director, Kenya Marine and Fisheries Research Institute.	Contributor to Chapters 32 and 53 (Capacity-building), 36E (Indian Ocean biodiversity) and 48 (Mangroves) of

			WOA I. PhD, University of Florence, Italy. Published on influence of seasonality and bathymetry on crustacea, mangroves, etc.
<b>CONVENOR</b>			
Thomas Therriault	Canada	Research Scientist, Pacific Biological Station, Fisheries and Oceans, Canada	Convenor of the writing team for Chapter 36C (North Pacific Biodiversity), WOA I. Published on invasive species, etc.
<b>MEMBERS</b>			
Alan Deidun	Malta	Professor, Department of Geosciences University of Malta	PhD, University of Malta. Published on invasive species, jellyfish, beached litter, etc.
Evangelina Schwindt	Argentina	Research Scientist, Instituto de Biología de Organismos Marinos, Puerto Madryn, Argentina	PhD, in biological sciences, National University of Mar del Plata, Argentina. Published on marine fouling invasions in Patagonian ports, etc.
Bing Qiao	China	Vice-director of Academic Committee and Professor, China Waterborne Transport Research Institute	Registered Environmental Impact Assessment (EIA) Engineer of China Expert group member of Chinese scientific project of Marine Environmental Safety (Ensure).
Graeme Inglis	New Zealand	Principal Scientist (Marine Ecology) and Group Leader, Marine Biosecurity, National Institute for Water and Atmospheric Research, New Zealand	PhD, University of Sydney. Published on economic impacts of biofouling invaders on aquaculture, early detection of marine invaders, etc.
Sarah Bella Galil	Israel	Curator, Steinhardt Museum of Natural History, Tel Aviv University, Israel	PhD in marine biology, Tel-Aviv University. Published on invasive biota in the deep-sea Mediterranean, molecular genetic tools to assess and manage marine biological invasions, etc.
Chad Hewitt	Australia	Professor and Director of the Centre for Biosecurity Research, Murdoch University, Western Australia, Australia	PhD in marine biology, University of Oregon, United States. Published on marine biosecurity crisis decision-making, marine debris and transfer of non-indigenous species, etc.
Marnie Campbell	Australia	Professor of Biosecurity and Environmental Science, Harry Butler Institute, Murdoch University, Western Australia	Published on the human health impact of anthropogenic beach litter, values affected by non-native marine species, etc.

## Writing team for Chapter 26

CHAPTER 26	MARINE GENETIC RESOURCES		
	Developments in exploration and use of marine genetic resources		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Sanae Chiba	Japan	Senior Scientist, Japan Agency for Marine-Earth Science and Technology, Tokyo	Ph.D. in aquatic bioscience, Tokyo University of Fisheries, Japan. Published on long-term marine ecosystem change, plankton, etc.
<b>CO-LEAD MEMBER</b>			
Hilconida Calumpong	Philippines	Director, Institute of Environmental and Marine Sciences, Silliman University, Philippines	Contributor to Chapters 6 (Primary production and plankton), 14 (Seaweeds), 47 (Kelp forests and seagrasses), and 48 (Mangroves) of WOA I. PhD (major in Botany), University of California, Berkeley. Published on mangroves, seagrasses, algae, invertebrates, coastal resource management, etc.
<b>JOINT CONVENORS</b>			
Ellen Kenchington	Canada	Department of Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, Nova Scotia Canada	PhD, University of Tasmania. Benthic ecology Contributor to Chapter 29 (Marine genetic resources) of WOA I. Published on sponges, relationship between seabed, benthos and fish, molluscs, etc.
Robert Blasiak	United States	Post-doctoral researcher, Stockholm Resilience Centre, University of Stockholm, Sweden	PhD, University of Tokyo, Japan. Published on corporate control and global governance of marine genetic resources, an international agreement on marine biodiversity beyond areas of national jurisdiction, etc.
<b>MEMBERS</b>			
Changwei Shao	China	Yellow Sea Fisheries Research Institute, Qiongdao, China	PhD, Yellow Sea Fisheries Research Institute. Published on genomes of flatfish, epigenetic modification and inheritance in sexual reversal of fish, etc.
Hebe Dionisi	Argentina	Instituto de Biología de Organismos Marinos, Puerto Madryn, Argentina	PhD in biology, National University of Rosario, Argentina. Published on Prospecting biotechnologically-relevant monooxygenases from cold sediment metagenomes, bacterial community structure of hydrocarbon-polluted marine environments, etc.

Jorge Rafael Bermúdez-Monsalve	Ecuador	Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador	PhD in Natural Sciences, Kiel University, Germany. Published on ocean acidification and plankton, etc.
Helena Vieira	Portugal	Associate Professor, Faculty of Sciences, University of Lisbon, Portugal; Executive Director of BLUEBIO-ALLIANCE (a national association for marine bioresources), Cascais, Portugal	PhD in Biosciences and MPhil in Molecular Biology, Imperial College of London. Published on marketing marine natural products for pharmaceutical, cosmetics & nutraceutical markets, biotechnological potential of marine microbes, etc.
Jesús M. Arrieta	Spain	Spanish Institute of Oceanography, Santa Cruz de Tenerife, Spain	PhD in Natural Sciences. University of Groningen. The Netherlands. Published on marine biodiversity and gene patents, response of bacterioplankton to iron fertilization in the Southern Ocean, etc.
Boris Wawrik	United States	Programme Director, Division of Ocean Science, National Science Foundation, Washington DC, United States	PhD in marine science, University of South Florida, USA. Published on the functional diversity of ocean life shown through transcriptome sequencing, anaerobic alkane oxidation, etc.

## Writing team for Chapter 27

CHAPTER 27	MARINE HYDRATES		
	A potentially emerging issue		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CO-LEAD MEMBER</b>			
Carlos Garcia Soto	Spain	Director of International Relations, Senior Scientist, Spanish Institute of Oceanography, Spain	Contributor to Chapter 4 (Hydrological cycle) of WOA I. PhD in oceanography, University of Southampton, England. Published on ocean remote sensing, North Atlantic Oscillation and plankton blooms, etc.
Joshua T. Tuhumwire	Uganda	Chief Executive Officer of Gondwana Geoscience Consulting Ltd.; Director/Chairman of Sipa Exploration Resources (Uganda) Ltd; Commissioner, Uganda Department of Geological Survey and Mines (2001 to 2010). Consultant to several mineral exploration projects in Uganda. Member, Legal & Technical Commission, International Seabed Authority	Contributor to Chapters 1 (Planet, Ocean and Life) 23 (Offshore mining), and 26 (Land/Sea interaction) of WOA I. B.Sc. (Hons.) in chemistry and geology, Makerere University, Uganda; M.Sc. in geology, Vrije Universiteit Brussel, Belgium. Several unpublished geological reports during 30 years' career at Uganda's Geological Survey & Mines.
<b>*The members of this writing team will be posted once approved by the Bureau.</b>			



## Writing team for Chapter 28

CHAPTER 28	CUMULATIVE IMPACTS		
	Current approaches to the identification and assessment of cumulative impacts on marine environments		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
<b>CO-LEAD MEMBERS</b>			
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
Essam Yassin Mohammed	Eritrea	Head of blue economy, International Institute for Environment and Development, London, England	PhD in international development, University of Nagoya, Japan. Published on small scale fisheries, connection between areas beyond national jurisdiction and areas under national jurisdiction, etc.
Alan Simcock	United Kingdom		Marine social and economic policy. Sea area: Global Ocean as a whole, but especially the North Atlantic Ocean, the Baltic Sea, the Black Sea, the Mediterranean and the North Sea.
Jörn Schmidt	Germany	Christian-Albrechts-Universität zu Kiel Kiel, Germany	PhD, Helmholtz Centre for Ocean Research Kiel Germany. Published on socio-ecological trade-offs in fisheries, integrated ecosystem assessments.
<b>CONVENOR</b>			
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
<b>MEMBERS</b>			
Beth Fulton	Australia	Commonwealth Scientific and Industrial Research Organization Oceans and Atmosphere, Hobart, Tasmania, Australia	PhD, University of Tasmania, Australia. Published on evaluation of interactions of environmental change and human impacts on marine ecosystems sustainability challenges and trade-offs among marine and coastal industries, socio-ecological

			modelling of marine systems
Piers Dunstan	Australia	Commonwealth Scientific and Industrial Research Organization, Oceans and Atmosphere, Hobart, Tasmania, Australia	PhD, University of Tasmania, Australia. Published on climate impacts on sustainability, cumulative impacts of fishing.
Vanessa Stelzenmüller	Germany	Research group leader Marine Spatial Management, Thünen Institute of Sea Fisheries, Germany	PhD in natural sciences, Carl von Ossietzky Universität Oldenburg, Germany
Roland Cormier	Canada	Guest Scientist, Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Max-Planck, Germany	PhD candidate in marine risk management, University of Hull, United Kingdom. Specialized in risk management approaches to environmental legislative and regulatory frameworks.

## PART 6: TRENDS IN MANAGEMENT APPROACHES TO THE MARINE ENVIRONMENT

### Writing team for Chapter 29

<b>CHAPTER 29</b>	<b>MARINE SPATIAL PLANNING</b>		
<b>NAME</b>	<b>STATE</b>	<b>AFFILIATION</b>	<b>RELEVANT EXPERIENCE</b>
<b>LEAD MEMBER</b>			
Alan Simcock	United Kingdom	Formerly Chairman (1996 – 2000) and Executive Secretary (2001 – 2006), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, and Co-Chair (2000-2002) United Nations Informal Consultative Process on the Ocean and Law of the Sea.	Joint Coordinator, and contributor to, among others, Chapters 8 (Cultural aspects), 17 (Shipping), 19 (Submarine cable and pipelines), 20 (Land-based inputs), 21 (Offshore hydrocarbons), 24 (Solid waste), 27 (Tourism) and 28 (Desalinisation), of WOA I. Published on science/policy interface. Author of OSPAR reports on marine spatial planning, radioactivity discharges, etc
<b>CO-LEAD MEMBERS</b>			
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
<b>* The members of this writing team will be posted once approved by the Bureau</b>			

## Writing team for Chapter 30

CHAPTER 30	MANAGEMENT APPROACHES		
<p>Developments in management approaches: ecosystem-based management approaches, culturally-based management approaches, community-based management approaches, area-based management tools, including marine protected areas and special areas (such as special areas under the International Convention for the Prevention of Pollution from Ships (MARPOL) and Particularly Sensitive Sea Areas); adaptation to climate change and resilience building.</p>			
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Anastasia Strati	Greece	Expert Minister Counsellor, Law of the Sea, Permanent Mission of Greece to the United Nations	MSc in Marine Law and Policy; PhD in Law of the Sea, University of Wales, United Kingdom. Published on underwater cultural heritage, fisheries, marine pollution, offshore energy, maritime delimitation, dispute settlement, etc.
<b>CO-LEAD MEMBERS</b>			
Hilconida Calumpong	Philippines	Director, Institute of Environmental and Marine Sciences, Silliman University, Philippines.	Contributor to Chapters 6 (Primary production and plankton), 14 (Seaweeds), 47 (Kelp forests and seagrasses), and 48 (Mangroves) of WOA I. PhD (major in Botany), University of California, Berkeley. Published on mangroves, seagrasses, algae, invertebrates, coastal resource management, etc.
Karen Evans	Australia	Principal Research Scientist and Team Leader, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD, University of Tasmania, Australia. Published on marine top predators (mammals, birds, fish), climate impacts and large scale biodiversity assessments.
Essam Yassin Mohammed	Eritrea	Head of blue economy, International Institute for Environment and Development, London, England	PhD in international development, University of Nagoya, Japan. Published on small scale fisheries, connection between areas beyond national jurisdiction and areas under national jurisdiction, etc.
Ca Thanh Vu	Viet Nam	Principal Lecturer, Ha Noi University of Natural Resources and Environment	PhD in Biological and Environmental Science, Saitama University, Japan. Published on integrated coastal zone management, tsunami risks, etc.
<b>CONVENOR</b>			
Piers Dunstan	Australia	Team Leader, Marine and Atmospheric Research Department, Commonwealth Scientific and Industrial Research Organization	PhD, University of Tasmania. Published on marine ecological indicators for fishing and environmental change, sustainability challenges and trade-offs among fisheries,

			aquaculture and agriculture, etc.
<b>MEMBERS</b>			
Louis Celliers	South Africa	Project Manager, Climate Service Center Germany (part of the Helmholtz Zentrum Geesthacht), Hamburg, Germany	PhD in marine ecology, University of Natal, South Africa. Published on coral reefs of Western Indian Ocean, ocean and coastal governance, climate change and coasts, etc.
Valerie Anne Cummins	Ireland	Senior Lecturer, School of Biological, Earth and Environmental Studies, University College Cork, Ireland	PhD, University College, Cork, Ireland. Published on integrated coastal zone management as a framework for climate-change adaptation action, the experience of implementing integrated coastal zone management in northwest Europe, etc.
Mike Elliott	United Kingdom	Research Professor, Institute of Estuarine & Coastal Studies University of Hull, England	PhD in estuarine ecology and management, Stirling University, Scotland. Published on the science/policy interface on managing human impacts on the ocean, frameworks for marine environmental management, environmental economics and ecosystem services, etc.
Antony Firth	United Kingdom	Director, Fjodr Ltd. Formerly head of coastal and marine archaeology at Wessex Archaeology.	PhD in management of underwater archaeology, Southampton University. Published on managing shipwrecks, and economic benefits of marine and maritime cultural heritage, etc.
Frederic Guichard	Canada	Professor, Department of Biology, McGill University	PhD, Laval University. Published on marine dynamic connectivity, species distribution of marine benthic invertebrates, etc.
Quentin Hanich	Australia	Associate Professor and Fisheries Governance Program Leader, Australian National Centre for Ocean Resources and Security, University of Wollongong, Australia	PhD in international fisheries, University of Wollongong. Published on fisheries management, especially in the Pacific, etc.
Ana Cristina Martins de Jesus	Portugal	Integrated Environmental Assessment expert, European Environment Agency	MSc in Marine Biology, University of the Algarve. Published on marine benthic monitoring, etc.
Manuel Hidalgo	Spain	Balearic Oceanographic Centre, Spanish Institute	PhD in Marine Sciences, University of Vigo, Spain.

		of Oceanography, Palma de Mallorca, Spain	Published on ocean connectivity, ecological function and management, cephalopods, resilience mechanisms of fish communities, etc.
Hector Lozano-Montes	Australia	Marine Scientist, Commonwealth Scientific and Industrial Research Organisation, Australia	PhD in fisheries, University of British Columbia, Canada. Published on variations in trophic flows, recruitment, fishing effort and ecosystem variations on fish stocks, etc.
Chanda L. Meek	United States	Associate Professor, Department of Political Science, University of Alaska, United States	PhD in natural resources and sustainability, University of Alaska, Fairbanks. Published on forms of collaboration and social fit in wildlife management, principles for enhancing the resilience of ecosystem services, etc.
Marcus Polette	Brazil	Professor and Director of the School of Sea, Science and Technology, University of Vale do Itajai, Santa Catarina, Brazil	Contributor to Chapter 20 (Land-based inputs) of WOA I. PhD in Coastal Zone Management and Governance. Published on the management of urban beaches, Urban and Regional Planning, Sustainable Development Goals – SDG Indicators, etc.
Jemma Purandare	Australia	Coastal and Marine Scientist, Center for Coastal Management, Griffith University, Queensland, Australia	MSc in coastal zone management, University of Ulster, Northern Ireland. Published on sustainable resort development in sensitive environments, ecosystem restoration and related ecosystem services, etc.
Anita Smith	Australia	Senior Lecturer in Archaeology and Heritage, La Trobe University, Melbourne, Australia	PhD in archaeology, La Trobe University, Australia. Published on heritage and indigenous knowledge systems in the Pacific islands, assessing the World Heritage aesthetic values of the Great Barrier Reef, etc.

## Writing team for Chapter 31

CHAPTER 31	OVERALL BENEFITS		
	Developments in the understanding of overall benefits from the ocean to humans, including the distribution of those benefits, and the role in safeguarding those benefits of improved implementation of international law as reflected in the United Nations Convention on the Law of the Sea.		
NAME	STATE	AFFILIATION	RELEVANT EXPERIENCE
<b>LEAD MEMBER</b>			
Essam Mohammed	Eritrea	Head of blue economy, International Institute for Environment and Development, London, England	PhD in international development, University of Nagoya, Japan. Published on small scale fisheries, connection between areas beyond national jurisdiction and areas under national jurisdiction, etc.
<b>CO-LEAD MEMBERS</b>			
Osman Keh Kamara	Sierra Leone	Sierra Leone Ambassador to Ethiopia and Permanent Representative to the African Union	Contributor to Chapters 17 (Shipping) and 32 and 53 (Capacity Building) of WOA I. Graduate of University of Sierra Leone and Columbia University, New York, Post-Graduate Diploma (Rhodes Academy of Ocean Law and Policy, Greece).
Anastasia Strati	Greece	Expert Minister Counsellor, Law of the Sea, Permanent Mission of Greece to the United Nations	MSc in Marine Law and Policy; PhD in Law of the Sea, University of Wales, United Kingdom. Published on underwater cultural heritage, fisheries, marine pollution, offshore energy, maritime delimitation, dispute settlement, etc.
<b>CONVENOR</b>			
Luciano Hermanns	Brazil	Vice-President of the Brazilian Association of Oceanography (AOCEANO), associated to Acquaplan Tecnologia e Consultoria Ambiental.	PhD in Geosciences. Federal University of Rio Grande do Sul, UFRGS, Brazil. Contributor at the Institute of Geosciences of UFRGS.
<b>MEMBERS</b>			

Stale Navrud	Norway	Professor of Environmental and Resource Economics, School of Economics and Business, Norwegian University of Life Sciences, Norway	PhD in environmental and resource economics, Norwegian University of Life Sciences. Visiting Fulbright Scholar at University of California (UC) - Berkeley and UC-San Diego. Published and worked in economic valuation and benefit transfer of marine and coastal ecosystem services for policy in cost-benefit analysis of e.g. protection of marine species (cold water corals), and measures to reduce the risk of marine oil spills from ships, measure to clean up marine waste, measures to clean up contaminated marine sediments; and the economic value of whale watching tourism and marine recreational fishing.
Robert Blasiak	United States	Researcher, Stockholm Resilience Centre, Stockholm University	PhD, Graduate School of Agricultural and Life Sciences Research, focus on international cooperation for the conservation and sustainable use of marine resources. Particular emphasis on equity surrounding transboundary issues, including marine genetic resources and the ongoing negotiations on biodiversity in areas beyond national jurisdiction.
Marinez Eymael Garcia Scherer	Brazil	Coordinator of the Integrated Coastal and Marine Management Laboratory at Federal University of Santa Catarina	PhD in Marine Sciences and Coastal Management. Experienced in teaching and technical consultancy on these topics, including advice to local, regional and national governments. Main publications are on coastal and marine management, marine protected areas, marines spatial planning and coastal and marine governance.
Rashid Sumaila	Canada	Director, Fisheries Economics Research Unit and Ocean Canada Partnership, the University of British Columbia, Canada	PhD in Economics, University of Bergen, Norway. Published extensively on the economics of oceans and fisheries.
Denis Worlanyo Aheto	Ghana	Director and Associate Professor, World Bank Africa Centre of Excellence in Coastal Resilience (ACECoR) at the University of Cape Coast	PhD in Environmental Science, University of Bremen, Germany. Published on coastal ecology, small-scale fisheries management, coastal management, ocean and coastal conservation, etc.
Wenhai Lu	China	Director of Ecological Department,	Ph.D. in Geographic



		National Marine Data and Service, Tianjin, China	Information Systems, working on marine spatial planning, ecosystem assessment, etc.
Iryna Makarenko	Ukraine	Pollution Monitoring and Assessment Officer, Permanent Secretariat of the Commission on the Protection of the Black Sea Against Pollution (Bucharest Convention), Istanbul, Turkey	LLM in Environmental and Energy Law (Leuven, Belgium). Publications on Environmental Impact Assessment in Transboundary Context, Legal aspects of functioning of Regional Sea Conventions, etc. Editing of the Report on the State of the Black Sea Environment 2009-2014, proposing and organizing common monitoring programmes, exchange of information and scientific data on the implementation of Bucharest Convention‘ provisions; maintaining close collaboration with the relevant international organizations and bodies; legal support of the activities of the Black Sea Commission; follow up the legal aspects of relations with projects, observers and partners to Commission (UNEP, IMO, EC, ACCOBAMS, IAEA, UNEP/MAP etc.); contributing the preparation of the relevant documents and assisting in organization of activities; public relations with governmental and non-governmental organizations, private companies and individuals.
Wojciech Wawrzynski	Poland	Head of Science Support at the International Council for the Exploration of the Sea (ICES) in Copenhagen, Denmark	PhD in political economics, University of Gdansk, Poland. Science diplomat, Chair of the LME-LEARN Working Group on Ocean Governance Mechanisms; serving also as lead support to the Atlantic Ocean Research Alliance Trilateral Aquaculture Working Group. Experience in sustainable development, macroeconomics, maritime economics, ecosystem services. Published on ocean governance, research cooperation and programming.
Cecile Brugere	France	Director of Soulfish Research and Consultancy (aquaculture/fisheries	PhD in Agricultural Economics, University of Newcastle, UK,

		economics, gender and sustainable development) <a href="http://www.cecilebrugere.com/">http://www.cecilebrugere.com/</a>	MSc in Ecological Economics, University of Edinburgh, UK. Formerly Fishery Planning/Aquaculture Officer of the Food and Agriculture Organization (FAO) of the UN. Advisory role to governments on aquaculture development planning and policy formulation, and guidance on climate change adaptation planning in fisheries and aquaculture. Published on gender in fisheries and aquaculture, economic and institutional aspects of aquaculture development, including value chain analyses.
Adem Bilgin	Turkey	Head of Research Division, National Focal Point of Turkey to UNCBD and IPBES. General Directorate of Nature Conservation and National Parks, Ministry of Agriculture and Forestry of Republic of Turkey	Chief negotiator of Turkey in various platforms such as UNCBD, IPBES, ECO and in particular including marine biodiversity negotiations, writer of many books and articles on ecological economics and environmental diplomacy. Various international positions in international organizations and MEAs
Utkina Kateryna	Ukraine	Deputy Dean on Scientific Work – School of Ecology, Associate Professor of Department of Ecological Safety and Environmental Education, School of Ecology, V. N. Karazin Kharkiv National University Kharkiv, Ukraine	PhD in Geography, V. I. Vernadskiy Taurida National University, Ukraine. Scientific interests: integrated coastal zone management, assessment and ranking of anthropogenic pressure from land-based pollution sources, socio-economic issues, etc.
Deborah Greaves	United Kingdom	Director of the Supergen ORE Hub, Head of School, University of Plymouth, United Kingdom	Research track record in Marine and Offshore Renewable Energy.