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## ROLE OF OCEAN OBSERVATIONS IN THE WORLD OCEAN ASSESSMENT

Responding to changing and increasingly modified coastal and marine environments requires sufficient monitoring on relevant temporal and spatial scales, and an adaptive approach to management (Nicol et al., 2015; Constable et al., 2016). Adaptation of industries and activities to future environments and mitigation of possible impacts requires a capability to assess:

the dynamics of coastal and marine ecosystems in response to variability in the marine environment over

global scales (e.g., BOBLME, 2014; UNEP-NAIROBI Convention and WIOMSA, 2015; IOC-UNESCO and UNEP, 2016; Ministry for the Environment and Statistics New Zealand, 2016; Evans et al., 2017).

Prioritizing what, when and how components of the marine ecosystem are monitored is essential if scientific data are to support marine managers in the changing and increasingly complicated environment they find themselves in. Initiatives such as the Framework of Ocean Observing (FOO; UNESCO, 2012) are assisting this prioritization process through three Global Ocean Observing System (GOOS) panels (the Climate and Physical Oceanography panel, the Biogeochemistry panel and the Biology and Ecosystems panel). These panels have been tasked with identifying a number of environment and ecosystem focused Essential Ocean Variables toward which global monitoring efforts should be focused over sustained





- Covich, A. P., Austen, M. C., Bärlocher, F., Chauvet, E., Cardinale, B. J., Biles, C. L., et al. (2004). The role of biodiversity in the functioning of freshwater and marine benthic ecosystems. *BioScience* **54**, 767–775.
- Cury, P. M., and Christensen, V. (2005). Quantitative ecosystem indicators for fisheries management – introduction. *ICES J. Mar. Sci.* **62**, 307–310. doi: 10.1016/j.icesjms.2005.02.003

- Rey-Valette, H., Bodiguel, C., Cunningham, S., Degnbol, P., Hegland, T., Sverdrup-Jensen, S., et al. (2005). *DECO: Review of the Usage of Socio-Economic Indicators on the Environmental Impact of Fishing Activities*. London: IEEP.
- Smeets, E., and Weterings, R. (1999). *Environmental Indicators: Typology and Overview*. Report No. 25, European Environment Agency, Copenhagen.
- Stocklmayer, S. M., and Bryant, C. (2012). Science and the public—What should people know? *Int. J. Sci. Educ. B* 2, 81–101. doi: 10.1080/09500693.2010.543186
- Trouille, L., Lintott, C. J., and Fortson, L. F. (2019). Citizen science frontiers: efficiency, engagement, and serendipitous discovery with human-machine systems. *PNAS* 116, 1902–1909. doi: 10.1073/pnas.1807090116
- UNEP, and IOC-UNESCO (2009). *An Assessment of Assessments, Findings of the Group of Experts. Start-up phase of a Regular Process for Global Reporting and Assessment of the State of the Marine Environment including Socio-economic Aspects*. Nairobi: UNEP.
- UNEP-NAIROBI Convention, and WIOMSA (2015). *The Regional State of the Coast Report: Western Indian Ocean*. Nairobi: UNEP.
- UNESCO (2005). *Aspects of Literacy Assessment: Topics and ISSUES from the UNESCO Expert Meeting*. Paris: United Nations of Education Scientific and Cultural Organisation.
- UNESCO (2012). *A framework for Ocean Observing*. By the Task Team for an Integrated Framework for Sustained Ocean Observing. Paris: United Nations of Education Scientific and Cultural Organisation.
- UNESCO (2017). *Global Ocean Science Report: The current Status of Ocean Science Around the world*. Paris: UNESCO Publishing.
- United Nations [UN] (2016). *The First Global Integrated Marine Assessment*. World Ocean Assessment I. Cambridge: Cambridge University Press.
- Williams, M. J., Ausubel, J., Poiner, I., Garcia, S. M., Baker, D. J., Clark, M. R., et al. (2010). Making marine life count: a new baseline for policy. *PLoS Biol.* 8:e1000531. doi: 10.1371/journal.pbio.1000531
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