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**Indicators for Ecosystem-Based Fisheries Management: 20 years of research**

**Authors:**

1. Alida Bundy, Fisheries and Oceans Canada , Canada alida.bundy@dfo-mpo.gc.ca
2. Lynne Shannon, U. Cape Town , South Africa Lynne Shannon (lshannon4@yahoo.co.uk )
3. Ekin Akoglu, Middle East Technical University, Turkey, ekin@ims.metu.edu.tr
4. Daniela Banaru, Accueil Aix-Marseille Université, France, Daniela.BANARU@univ-amu.fr
5. Marta Coll, IRD , France marta.coll@ird.fr
6. Caihong Fu, Fisheries and Oceans Canada , Canada Caihong.Fu@dfo-mpo.gc.ca
7. Beth Fulton, CSIRO, Australia, Beth.Fulton@csiro.au
8. Arnaud Gruss, U. Miami , USA agruss@rsmas.miami.edu
9. Cecelie Hansen, IMR , Norway cecilie.hansen@imr.no
10. Ghassen Halouani, INAT , Tunisia ghassen.halouani@gmail.com
11. Sigrid Lehuta, IFREMER , France sigrid.lehuta@ifremer.fr
12. Ricardo Oliveros Ramos, Instituto del Mar del Perú, Peru
13. Morgane Travers-Trolet, IFREMER , France morgane.travers@ifremer.fr
14. Yunne Jae Shin , IRD, FRance yunne-jai.shin@ird.fr

**Abstract**

Ecosystem indicators are a key tool for the implementation of Ecosystem-Based Fisheries Management (EBFM). To progress towards effective EBFM, the scientific community has emphasized the development of indicator-based approaches, eg., Integrated ecosystem assessments, to track and evaluate the ecosystem effects of fishing and the effectiveness of management measures to maintain resources in a sustainable form. There is now a wealth of ecosystem and biodiversity indicators proposed by the scientific community and frameworks have been developed for the selection of indicators, mostly based on ecological theory and data availability. However, this is only a part of what is required to meeting the objectives of EBFM, the MSFD and other sustainability targets. Indicators need to track the state of the ecosystem and its components, and attributes that may be impacted by fishing, and there needs to be a clear understanding of the link between pressure (eg fishing) and state. In 2005, Simon Jennings wrote “There has been little formal evaluation of the properties of proposed indicators and when occasional screening exercises have been conducted, many proposed indicators have fared poorly.” In this review paper we ask how rigorously indicators are being assessed for these properties before they are used for management purposes. We evaluate the state of the art of indicator use for EBFM and IEA, with a particular focus on the assumptions made about indicator behavior, performance and reference points. Finally, we evaluate how we have progressed, and identify common challenges and future research recommendations.

**Keywords:** Indicators, performance, response, reference points, EBFM. IEA

**Contact author:** Alida Bundy, Fisheries and Oceans Canada, Bedford Institute of Oceanography, Nova Scotia, Canada . alida.bundy@dfo-mpo.gc.ca