NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
US DEPARTMENT OF COMMERCE

A Bibliometric Analysis of Articles Supported by NOAA's Office of Ocean Exploration and Research

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ABOUT THIS REPORT

This report presents a summary-level bibliometric analysis of the known peer-reviewed journal articles produced as a result of ocean exploration missions supported by NOAA's Office of Ocean Exploration and Research (OER). This report was produced using data retrieved from the Web of Science, Science Citation Index Expanded database on 11 July 2016. 47 articles known to have resulted from OER-supported explorations had to be omitted from this analysis, either because the articles are still in press or because Web of Science does not index the journals in which the articles were published. 15 of these omitted articles were produced with support from OER's underwater archaeology program.

The bibliometric indicators presented in this report are based on citations from the select group of peer-reviewed journal articles indexed by Web of Science and, as such, do not reflect citations to OER-supported expeditions from peer-reviewed journals not indexed by Web of Science (WoS) or from other sources such as book chapters, conference proceedings, or technical reports.

More information about the methodology used and a full listing of all of the articles evaluated in this report are available upon request to Sarah.Davis@noaa.gov.

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SUMMARY METRICS

Bibliometric Indicator	Value
Number of Publications (p)	634
Total Number of Citations Received (c)	11,900
Average Number of Citations per Paper (c/p)	18.77
H- Index	51
Percentage of Publications in the Top 10% for Citation Counts	≈19.2%

Table 1: Common bibliometric indicators calculated for publications supported by OER. An H-Index of 51 indicates that this group of 634 publications includes 51 articles that have each received 51 or more citations. For more details on the H-Index, see Hirsch (2005). For more details about the Percentage of Publications in the Top 10% for Citation Counts, see page 14.

PUBLICATION ANALYSIS

The following figures analyze the number of publications produced as a result of OER-supported expeditions. For clarity, the figures showing the number of publications per subject, author, journal, institution, and funding agency only list the top 10 results in each category.

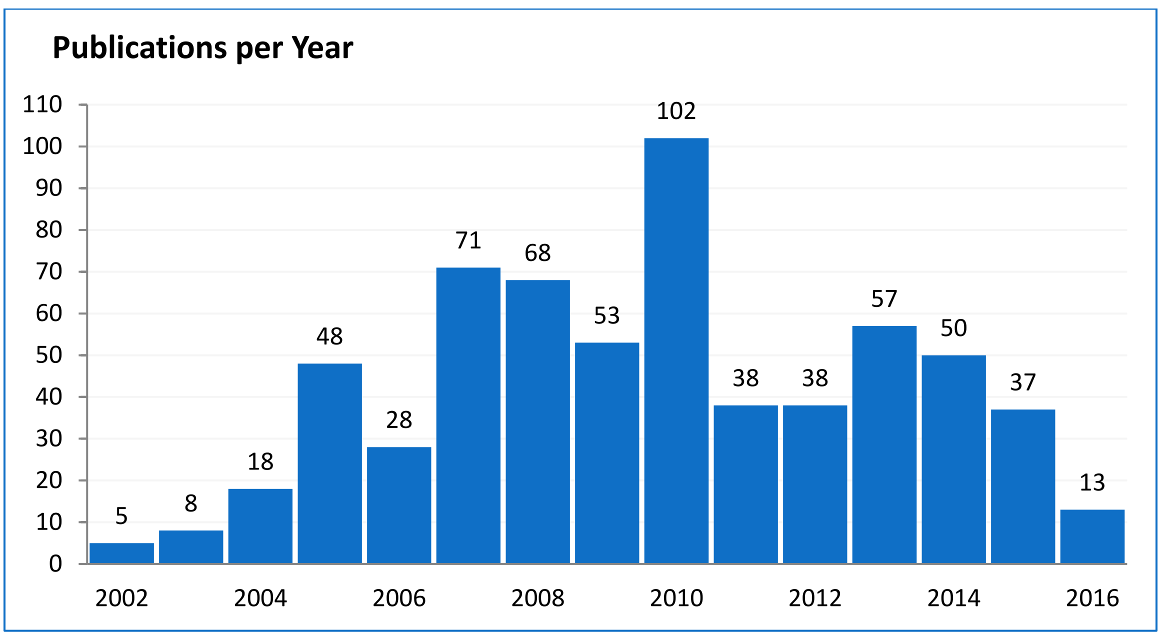

Figure 1: Non-cumulative number of OER-supported publications produced per year.

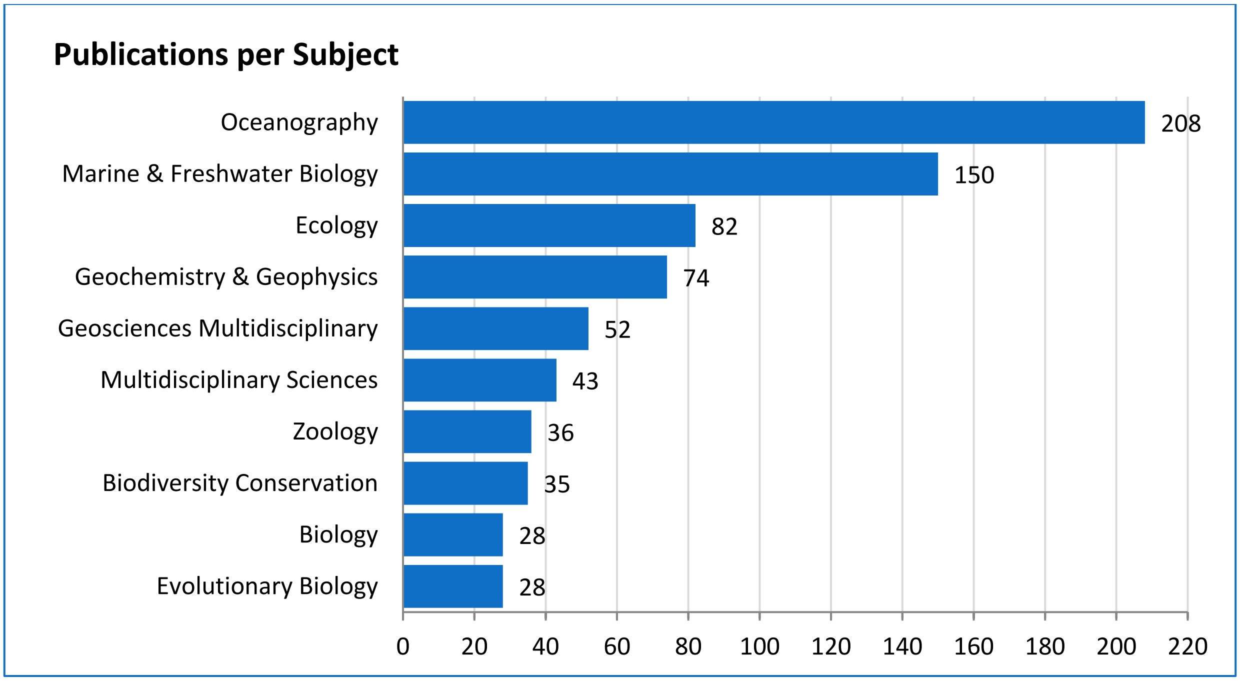

Figure 2: Number of OER-supported publications assigned to subject categories by WoS based on the journal in which the publication appeared. These subject categories are not mutually exclusive.

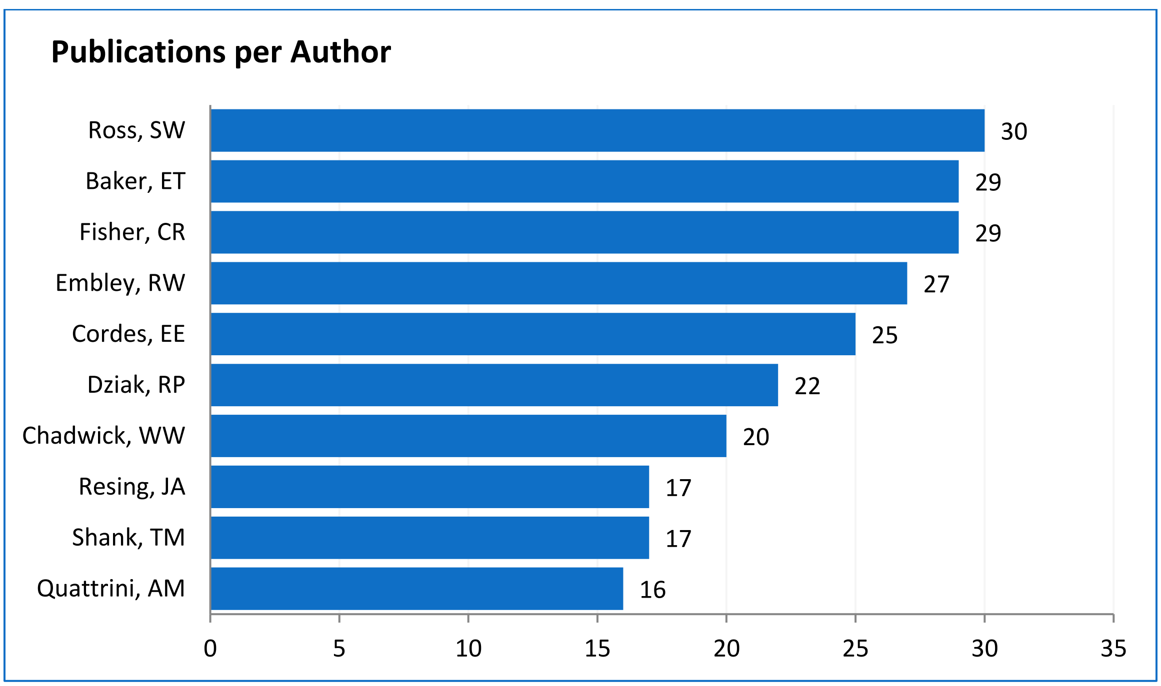

Figure 3: Number of OER-supported publications produced per author.

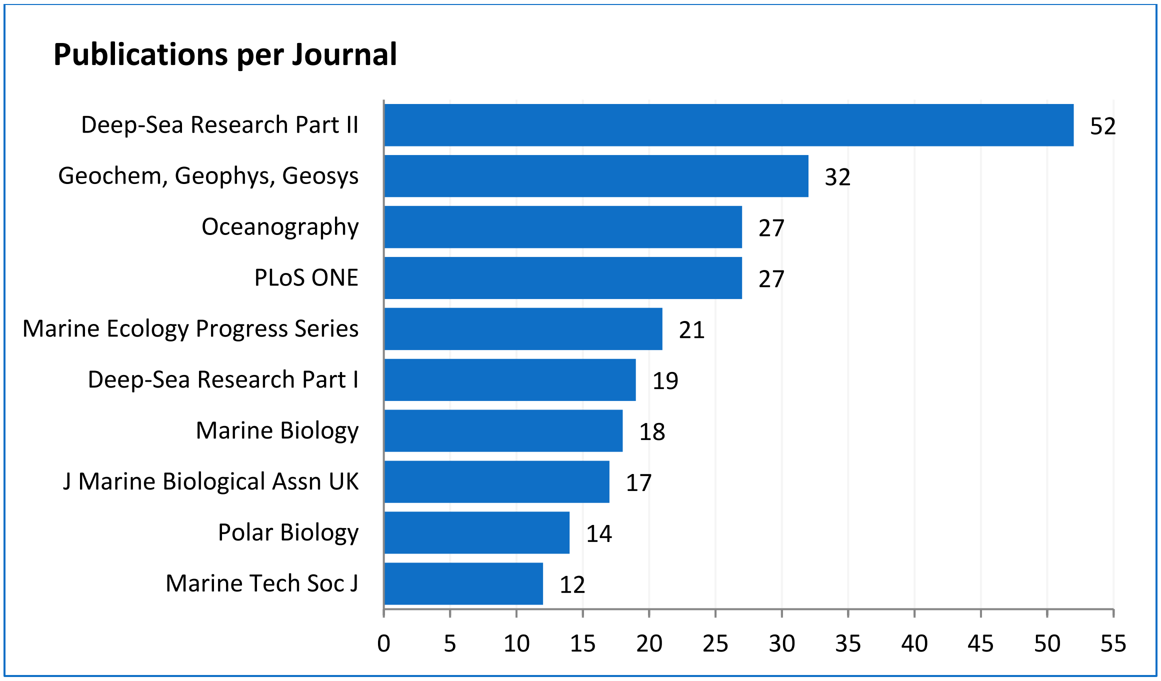

Figure 4: Number of OER-supported publications per journal. Journal special issues dedicated to OER- supported explorations include: Deep-Sea Research Part II 57(1-2), 57(21-23), and 57(24-26); Journal of Geophysical Research – Solid Earth 113 (B8); Oceanography 20(4), 25(S1), and 26(S1); and Polar Biology 28(3).

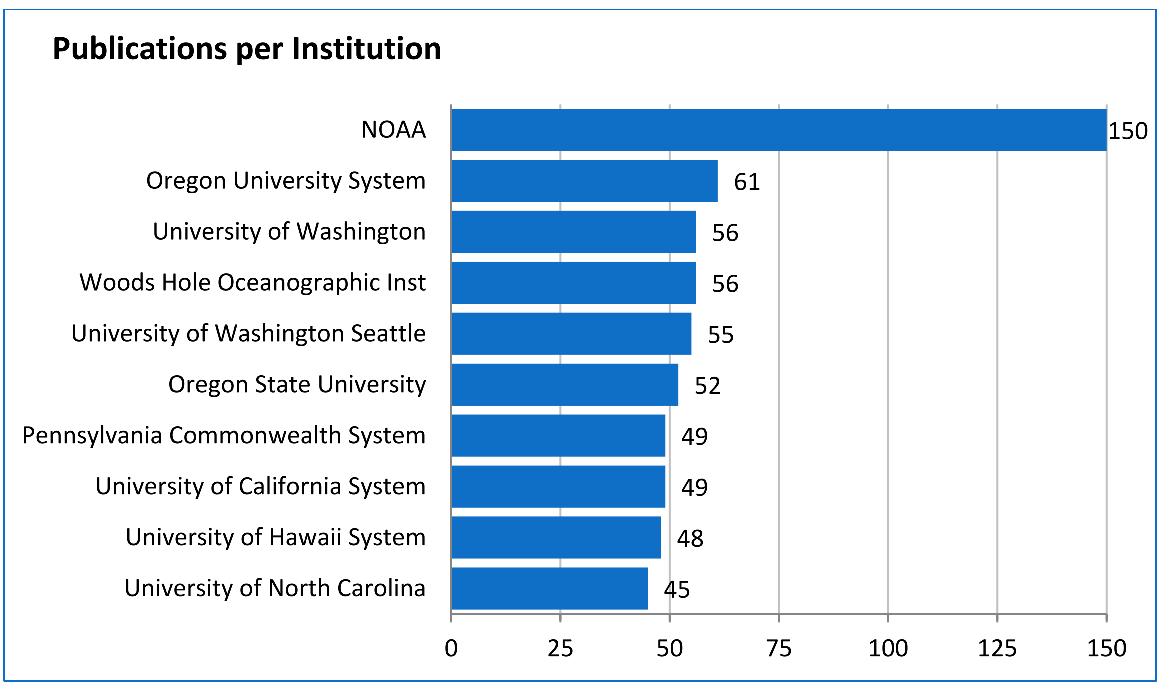

Figure 5: Number of OER-supported publications per institution. Publications are counted for an institution if at least one of the publication's authors lists that institution as his/her affiliation.

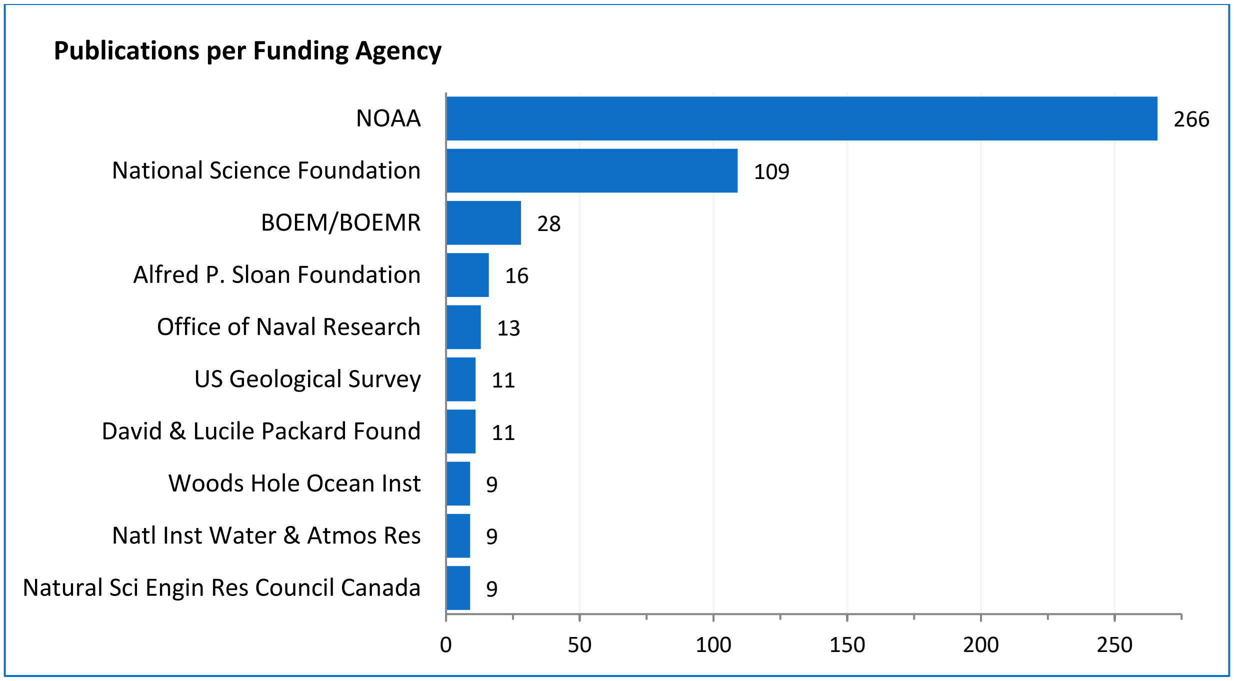

Figure 6: Number of publications co-funded by OER and other agencies and foundations. Data for this figure were derived from an analysis of the 'Acknowledgements' texts of 390 articles (62% of the 634 articles analyzed in this report) that were published from 2008 to the present for which this information is available.

CITATION COUNT ANALYSIS

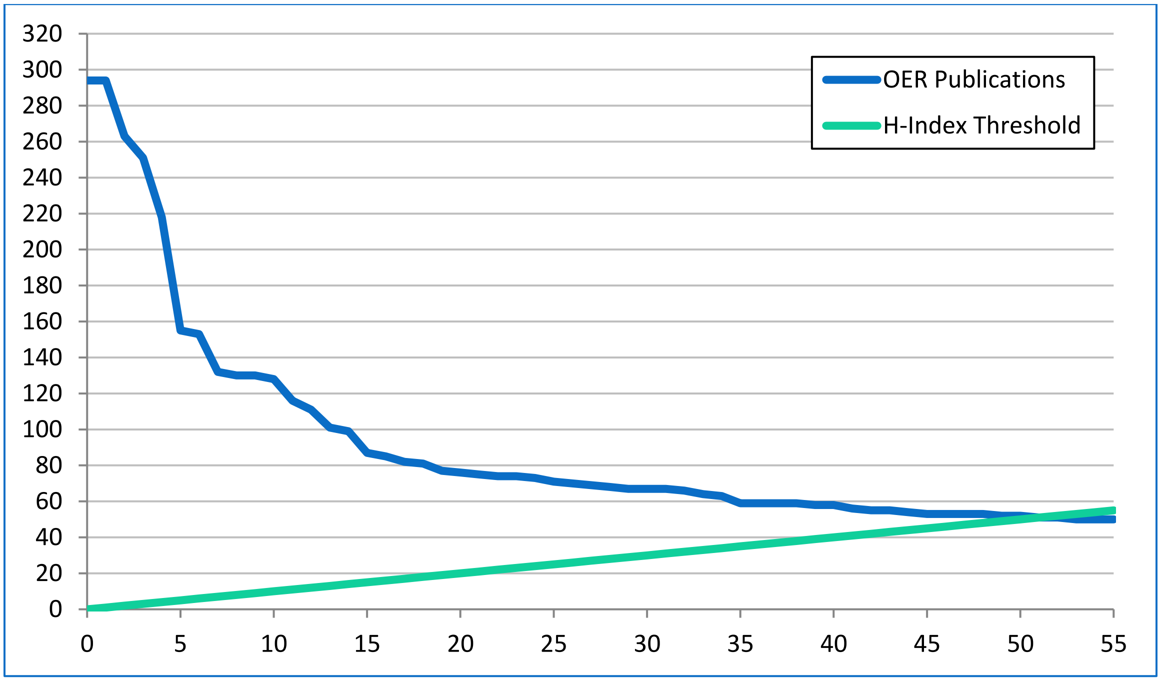

Figure 7: Distribution curve showing the citation counts of the 55 most highly cited publications supported by OER. The straight line indicates the H-Index threshold (slope: y = x). The intersect point of the two curves (x = 51) is the H-Index of OER articles.

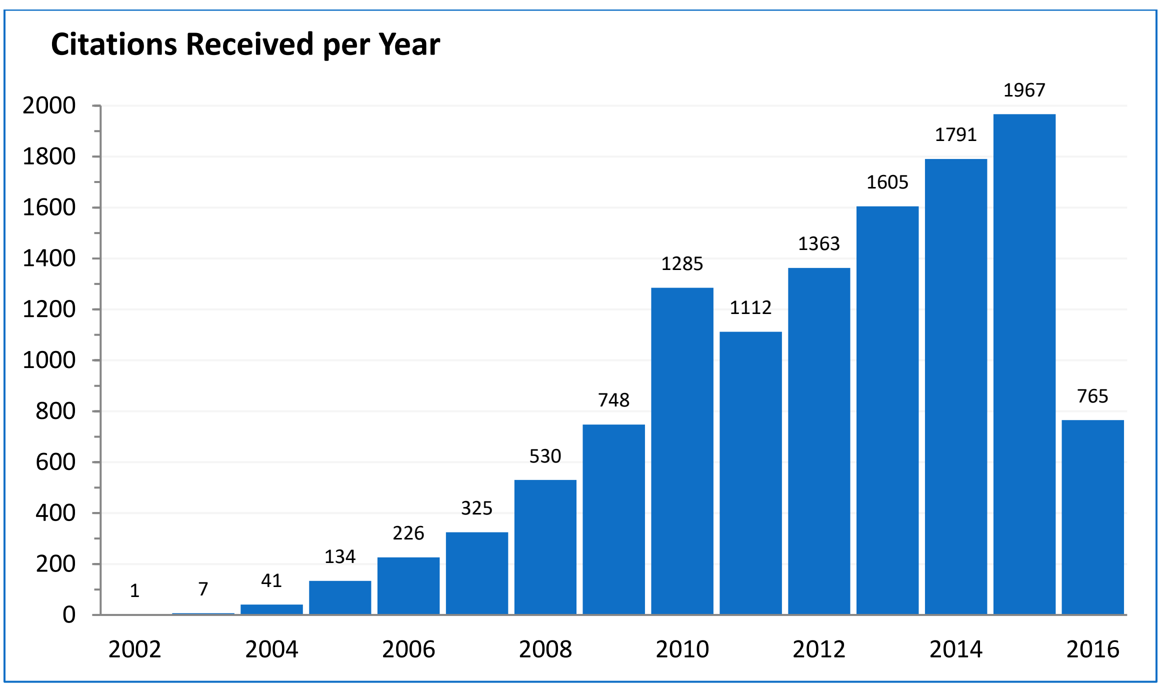

Figure 8: Non-cumulative number of citations received by all 634 OER-supported articles per year.

CITING ARTICLE ANALYSIS

The following tables analyze the 7,801 publications that have cited OER-supported publications in an attempt to indicate how these publications are used. These tables include self-citations (OER publications citing other OER publications). For brevity, each table only includes the top 10 results in each category.

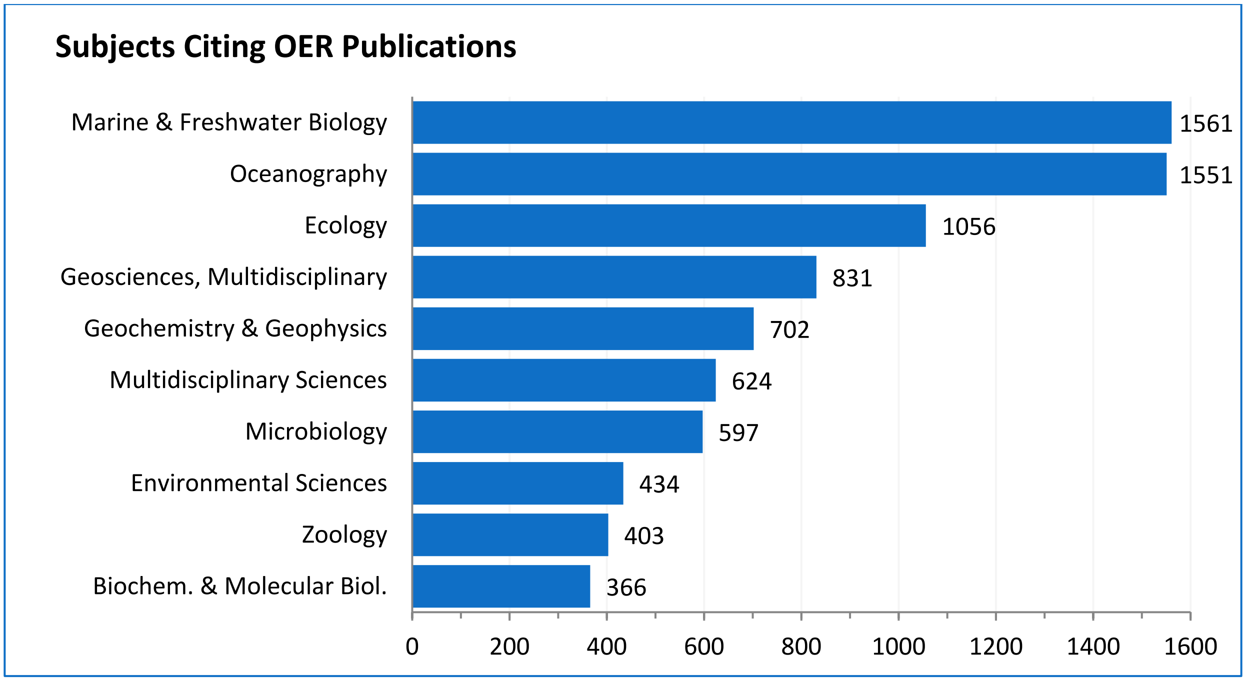

Figure 9: Number of publications per WoS-defined subject category for all publications citing OER-supported publications.

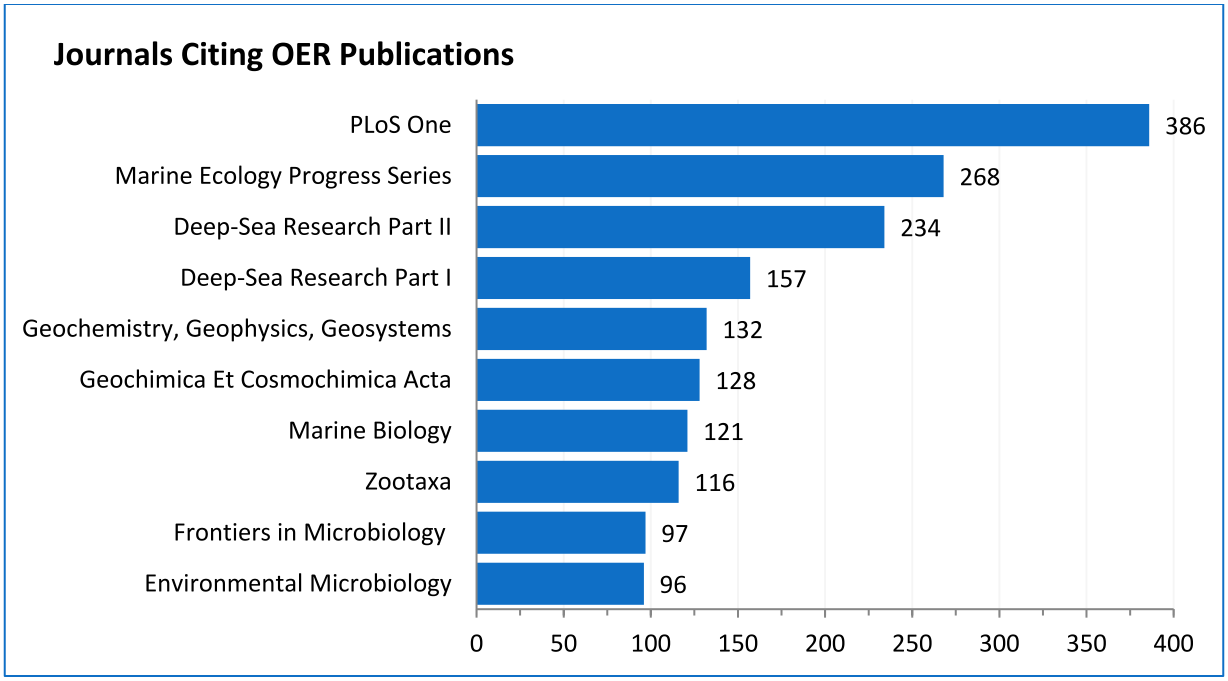

Figure 10: Number of publications per journal for all publications citing OER-supported publications.

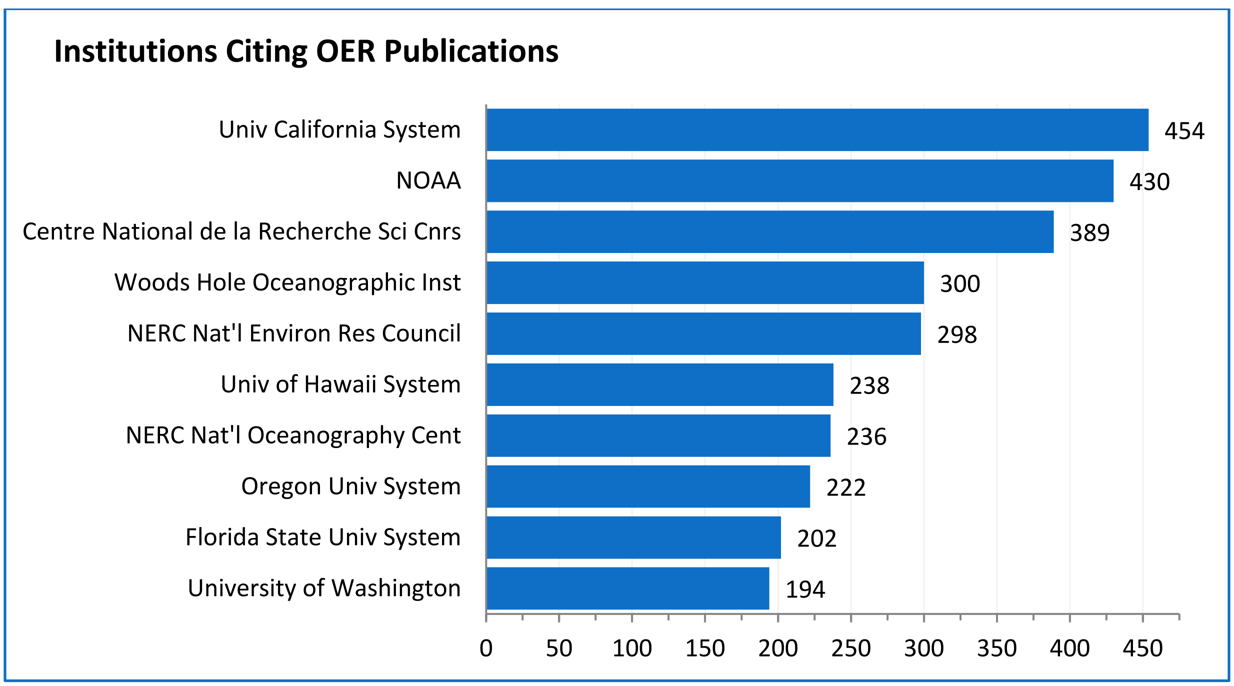

Figure 11: Number of publications per institution for all publications citing OER-supported publications. Publications are counted for an institution if at least one of the publication's authors lists that institution as their affiliation.

INTERNATIONAL PUBLICATION

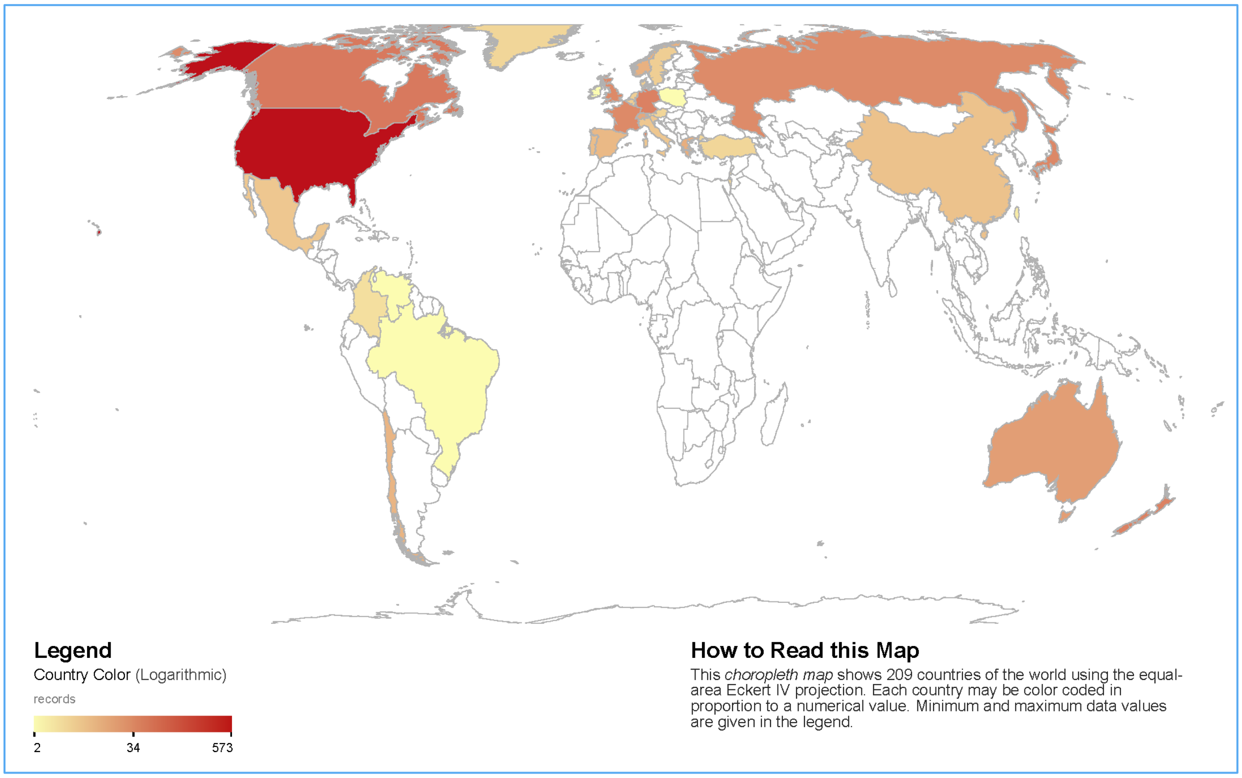

Figure 12: Map depicting the international publication of OER-supported articles. Countries are colored based on the number of OER-supported articles with at least one author from each country.

BIBLIOMETRIC MAPPING

Bibliometric maps attempt to create visual representations of the structure of scientific research by analyzing networks (Borner and others 2007) of scientific publications. Depending on the level of analysis, bibliometric maps attempt to show the relationships between different lines of research on a single topic, between sub-disciplines within a field, and between major disciplines. Such maps can be constructed depicting co-authorship networks (Newman 2001), article citation networks (Boyack and Klavans 2010), or article keyword networks (Mane and Borner 2004). For an extensive survey of the field, see Borner and others (2003).

The following maps depict co-authorship, paper citation, and word co-occurrence networks derived from OER-supported journal articles indexed in Web of Science. These maps were generated using the Science of Science Tool (Sci2 Team 2009). Higher resolution images of these maps are available upon request.

Co-Authorship Network

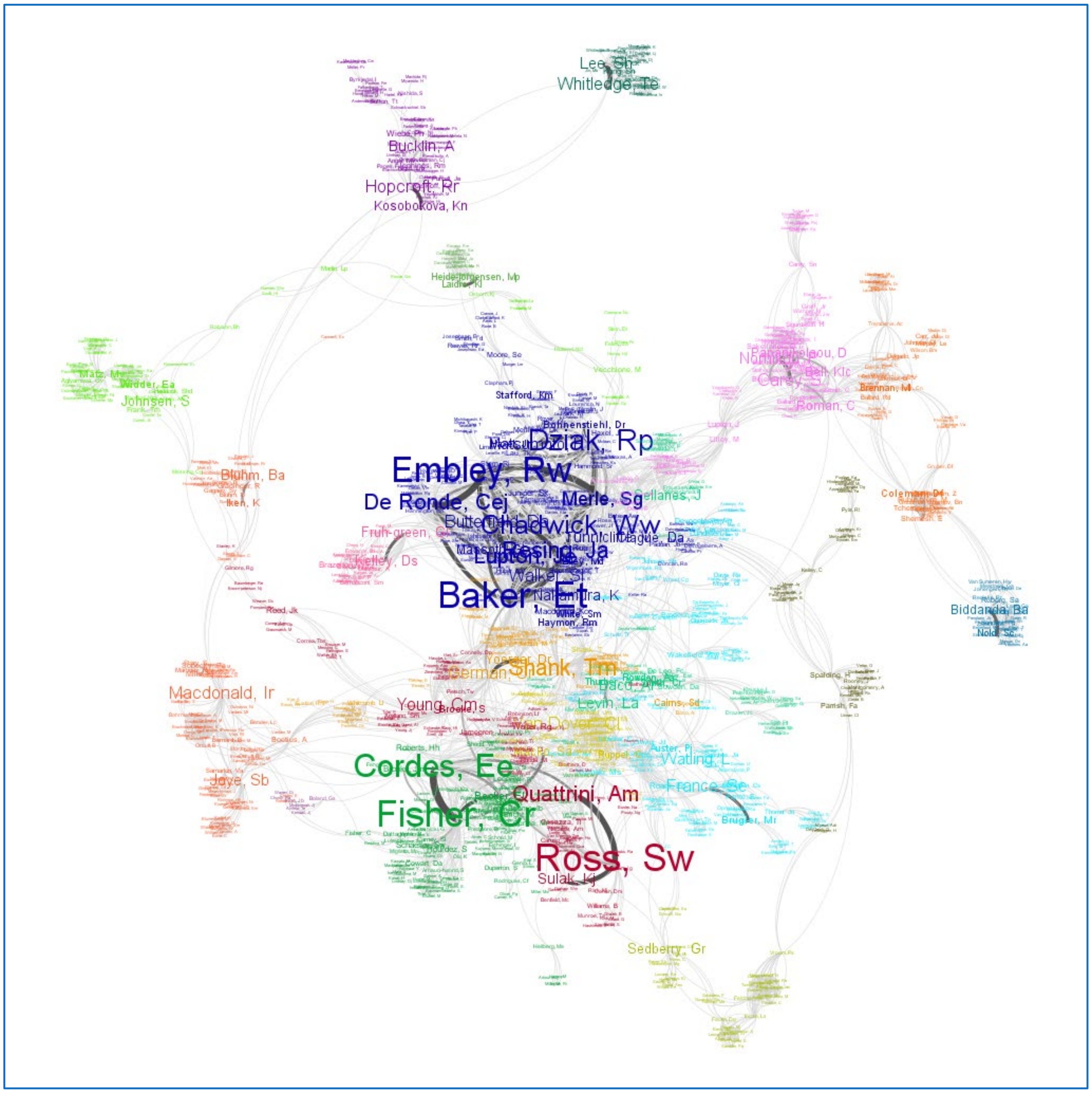

Figure 13: Bibliometric map of the largest connected co-authorship network of authors of OER-supported research. Author names were manually standardized to eliminate misspellings and name variants (e.g. Cordes E and Cordes Ee) were merged prior to creating this network. In this map, name size indicates the number of OER-supported publications by that author; values range from 1 to 30 publications. Name colors indicate communities of authors who tend to write articles together as identified by the community detection algorithm of Blondel and others (2008). Line size and darkness indicate the number of co-authored works between the connected authors; values range from 1 to 16. This map depicts 6,549 co-author relationships between 1,305 authors of OER-supported articles.

Word Co-Occurrence Network

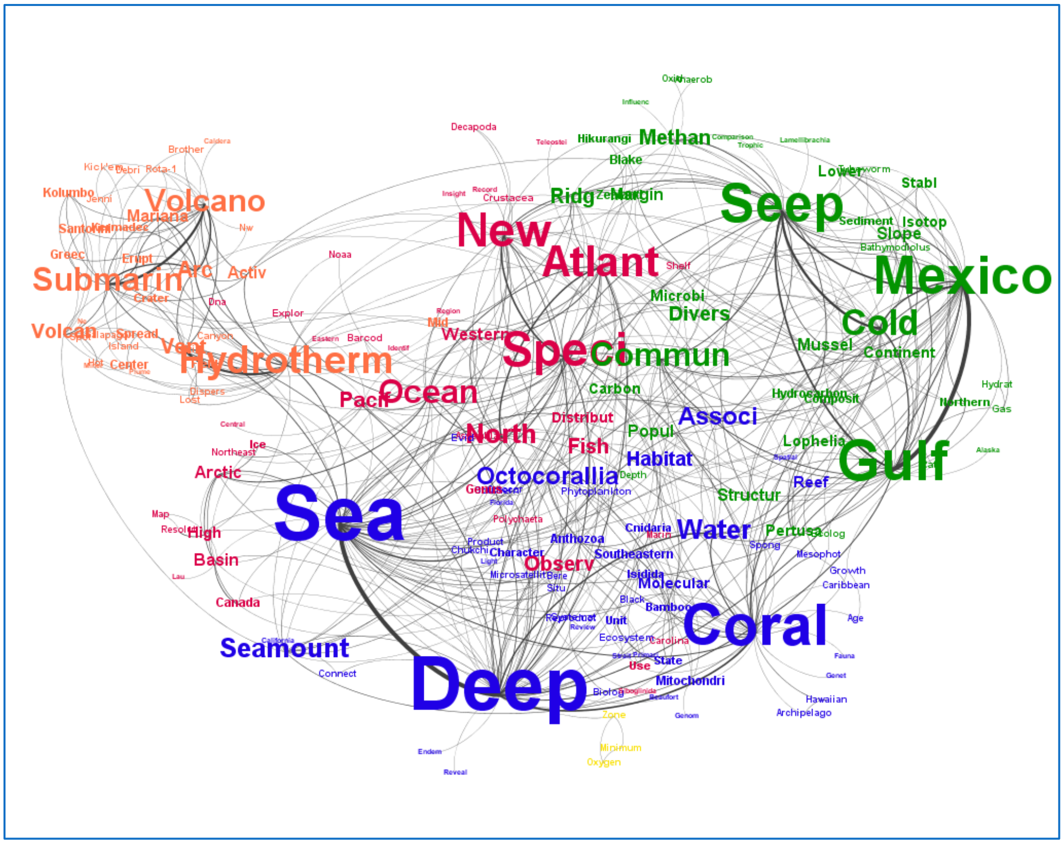

Figure 15: Word co-occurrence network map of the 175 words most commonly co-occurring in the titles of OER-supported journal articles. Words were truncated (i.e. word endings like '-es', '-al', and '-ity' were removed) to increase word matching accuracy and stop words (words that carry little meaning like "and", "the", and "if") were deleted prior to creating the network. In the map, word size indicates the number of article titles in which the word appears; these values range from 4 articles to 117 articles. Words are colored based on the results of the community detection algorithm of Blondel and others (2008) to indicate groups of words that tend to appear together in article titles. Lines represent article titles in which the connected words both appear, with line size and darkness indicating the number of articles in which the two connected words both occur. For clarity, lines with a weight of less than 4 were removed and only the largest connected component of the network is shown.

CITATION PERFORMANCE EVALUATION

Bibliometric researchers have recently agreed that paper citation counts ought to be evaluated using percentiles rather than averages. In this method, a paper is assigned a percentile rank (top 1%, top 10%, etc.) based on how its citation count compares to that of all other papers in a given set. Sets of papers, such as those by an author or by a research group, are evaluated by calculating the percentage of those papers that have citation counts that rank in a certain percentile (or set of percentiles) when compared to a similar set of papers. In practice, researchers have tended to focus on the percentage of papers in a set with citation counts ranking in the top 10% of all papers in the same database that were published in the same year and subject category. For more information about this approach, see (Bornmann and others 2012; Leydesdorff and others 2011; National Science Board 2012; Waltman and others 2012).

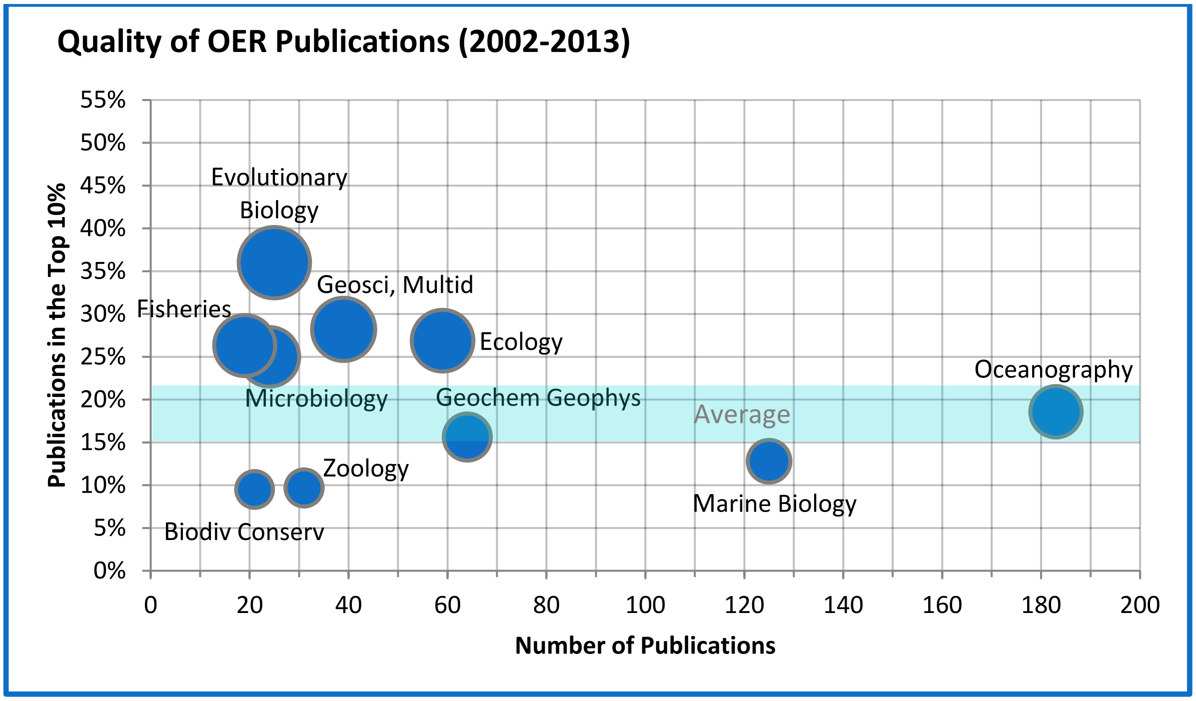

Figure 16: Bubble chart showing the percentage of OER-supported publications in ten subject categories that had citation counts ranking in the top 10% of all publications in WoS that were published in the same categories during the same years (2002-2015). Bubble size indicates the percentage of OER-supported publications in each subject area that had citation counts in the top 10% of all publications in that subject area and year of publication. The ten subject categories shown here are those in which OER-supported explorations were most often published (from Figure 2). Approximately 88% of the articles published during 2002-2016 that are analyzed in this report are included in one or more of these ten subject categories. The 'Multidisciplinary Sciences' subject category, which includes publications in Nature and Science, was omitted from this analysis because these articles could not be analyzed according to the same standards as the other subject categories.

RECENT HIGHLY CITED ARTICLES

The following lists highlight recently published OER-supported articles that have received enough citations for them to rank in the top 10% for citation counts out of all publications in WoS in their respective subject categories. Because articles typically require at least 2-3 years to accumulate enough citations for article-level bibliometric indicators to be reliable (Abramo and others 2012; Costas and others 2011), only articles published in 2014, 2013 or 2012 are listed.

2014

Brothers, D. S., Ruppel, C., Kluesner, J. W., ten Brink, U. S., Chaytor, J. D., Hill, J. C., . . . Flores, C. (2014). Seabed fluid expulsion along the upper slope and outer shelf of the U. S. Atlantic continental margin. *Geophysical Research Letters, 41*(1), 96-101. doi:10.1002/2013gl058048

De Leo, F. C., Vetter, E. W., Smith, C. R., Rowden, A. A., & McGranaghan, M. (2014). Spatial scale dependent habitat heterogeneity influences submarine canyon macrofaunal abundance and diversity off the Main and Northwest Hawaiian Islands. *Deep Sea Research Part II: Topical Studies in Oceanography, 104*, 267-290. doi:10.1016/j.dsr2.2013.06.015

Doughty, C. L., Quattrini, A. M., & Cordes, E. E. (2014). Insights into the population dynamics of the deep-sea coral genus Paramuricea in the Gulf of Mexico. *Deep-Sea Research Part II-Topical Studies in Oceanography, 99*, 71-82. doi:10.1016/j.dsr2.2013.05.023

Figueroa, D. F., & Baco, A. R. (2014). Complete mitochondrial genomes elucidate phylogenetic relationships of the deep-sea octocoral families Coralliidae and Paragorgiidae. *Deep-Sea Research Part II Topical Studies in Oceanography, 99*, 83-91. doi:10.1016/j.dsr2.2013.06.001

Micheli, F., Mumby, P. J., Brumbaugh, D. R., Broad, K., Dahlgren, C. P., Harborne, A. R., . . . Sanchirico, J. N. (2014). High vulnerability of ecosystem function and services to diversity loss in Caribbean coral reefs. *Biological Conservation, 171*, 186-194. doi:10.1016/j.biocon.2013.12.029

Nomikou, P., Carey, S., Bell, K. L. C., Papanikolaou, D., Bejelou, K., Cantner, K., . . . Perros, I. (2014). Tsunami hazard risk of a future volcanic eruption of Kolumbo submarine volcano, NE of Santorini Caldera, Greece. *Natural Hazards, 72*(3), 1375-1390. doi:10.1007/s11069-012-0405-0

Obelcz, J., Brothers, D., Chaytor, J., ten Brink, U., Ross, S. W., & Brooke, S. (2014). Geomorphic characterization of four shelf-sourced submarine canyons along the US Mid-Atlantic continental margin. *Deep Sea Research Part II: Topical Studies in Oceanography, 104*, 106-119. doi:10.1016/j.dsr2.2013.09.013

Skarke, A., Ruppel, C., Kodis, M., Brothers, D., & Lobecker, E. (2014). Widespread methane leakage from the sea floor on the northern US Atlantic margin. *Nature Geoscience, 7*(9), 657-661. doi:10.1038/ngeo2232

Tricas, T. C., & Boyle, K. S. (2014). Acoustic behaviors in Hawaiian coral reef fish communities. *Marine Ecology Progress Series, 511*, 1-16. doi:10.3354/meps10930

Weber, T. C., Mayer, L., Jerram, K., Beaudoin, J., Rzhanov, Y., & Lovalvo, D. (2014). Acoustic estimates of methane gas flux from the seabed in a 6000 km(2) region in the Northern Gulf of Mexico. *Geochemistry Geophysics Geosystems, 15*(5), 1911-1925. doi:10.1002/2014gc005271

Yun, M. S., Whitledge, T. E., Kong, M., & Lee, S. H. (2014). Low primary production in the Chukchi Sea shelf, 2009. *Continental Shelf Research, 76*, 1-11. doi:10.1016/j.csr.2014.01.001

2013

Brugler, M. R., Opresko, D. M., & France, S. C. (2013). The evolutionary history of the order Antipatharia (Cnidaria: Anthozoa: Hexacorallia) as inferred from mitochondrial and nuclear DNA: implications for black coral taxonomy and systematics. *Zoological Journal of the Linnean Society, 169*(2), 312-361. doi:10.1111/zoj.12060

Lunden, J. J., Georgian, S. E., & Cordes, E. E. (2013). Aragonite saturation states at cold-water coral reefs structured by Lophelia pertusa in the northern Gulf of Mexico. *Limnology and Oceanography, 58*(1), 354-362. doi:10.4319/lo.2013.58.1.0354

Quattrini, A. M., Georgian, S. E., Byrnes, L., Stevens, A., Falco, R., & Cordes, E. E. (2013). Niche divergence by deep-sea octocorals in the genus Callogorgia across the continental slope of the Gulf of Mexico. *Molecular Ecology, 22*(15), 4123-4140. doi:10.1111/mec.12370

Reitzel, A. M., Herrera, S., Layden, M. J., Martindale, M. Q., & Shank, T. M. (2013). Going where traditional markers have not gone before: utility of and promise for RAD sequencing in marine invertebrate phylogeography and population genomics. *Molecular Ecology, 22*(11), 2953-2970. doi:10.1111/mec.12228

2012

Goldstein, M. C., Rosenberg, M., & Cheng, L. (2012). Increased oceanic microplastic debris enhances oviposition in an endemic pelagic insect. *Biology Letters, 8*(5), 817-820. doi:10.1098/rsbl.2012.0298

Lee, S. H., Stockwell, D. A., Joo, H. M., Son, Y. B., Kang, C. K., & Whitledge, T. E. (2012). Phytoplankton production from melting ponds on Arctic sea ice. *Journal of Geophysical Research-Oceans, 117*, C04030. doi:10.1029/2011jc007717

Nomikou, P., Carey, S., Papanikolaou, D., Bell, K. C., Sakellariou, D., Alexandri, M., & Bejelou, K. (2012). Submarine volcanoes of the Kolumbo volcanic zone NE of Santorini Caldera, Greece. *Global and Planetary Change, 90-91*, 135-151. doi:10.1016/j.gloplacha.2012.01.001

Osborn, K. J., Kuhnz, L. A., Priede, I. G., Urata, M., Gebruk, A. V., & Holland, N. D. (2012). Diversification of acorn worms (Hemichordata, Enteropneusta) revealed in the deep sea. *Proceedings of the Royal Society B-Biological Sciences, 279*(1733), 1646-1654. doi:10.1098/rspb.2011.1916

Voorhies, A. A., Biddanda, B. A., Kendall, S. T., Jain, S., Marcus, D. N., Nold, S. C., . . . Dick, G. J. (2012). Cyanobacterial life at low O2: community genomics and function reveal metabolic versatility and extremely low diversity in a Great Lakes sinkhole mat. *Geobiology, 10*(3), 250-267. doi:10.1111/j.1472-4669.2012.00322.x

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Borner K, Chen CM, Boyack KW. 2003. Visualizing knowledge domains. Annual Review of Information Science and Technology 37:179-255. doi:10.1002/aris.1440370106

Borner K, Sanyal S, Vespignani A. 2007. Network science. Annual Review of Information Science and Technology 41:537-607. doi:10.1002/aris.2007.1440410119

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Hirsch JE. 2005. An index to quantify an individual's scientific research output. Proceedings of the National Academy of Sciences of the United States of America 102(46):16569-16572. doi:10.1073/pnas.0507655102

Kessler MM. 1963. Bibliographic coupling between scientific papers. American Documentation 14(1):10-25. doi:10.1002/asi.5090140103

Leydesdorff L, Bornmann L, Mutz R, Opthof T. 2011. Turning the tables on citation analysis one more time: Principles for comparing sets of documents. Journal of the American Society for Information Science and Technology 62(7):1370-1381. doi:10.1002/asi.21534

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Newman MEJ. 2001. The structure of scientific collaboration networks. Proceedings of the National Academy of Sciences of the United States of America 98(2):404-409. doi:10.1073/pnas.021544898

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