NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
US DEPARTMENT OF COMMERCE

A Bibliometric Analysis of Articles Sponsored 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 research 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 22 October 2013. 67 articles known to have resulted from OER-funded research 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-sponsored research from peer-reviewed journals outside of Web of Science 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 Chris.Belter@noaa.gov.

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SUMMARY METRICS

Bibliometric Indicator	Value
Number of Publications (p)	500
Total Number of Citations Received (c)	6,600
Average Number of Citations per Paper (c/p)	13.2
H- Index	37
Percentage of Publications in the Top 10% for Citation Counts	≈20%

Table 1: Common bibliometric indicators calculated for publications supported by OER. An H-Index of 37 means that this group of 500 publications includes 37 articles that have received 37 or more citations each. For more details on the H-Index, see Hirsch (2005).

PUBLICATION ANALYSIS

The following figures analyze the number of publications produced as a result of OER-sponsored research. 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.

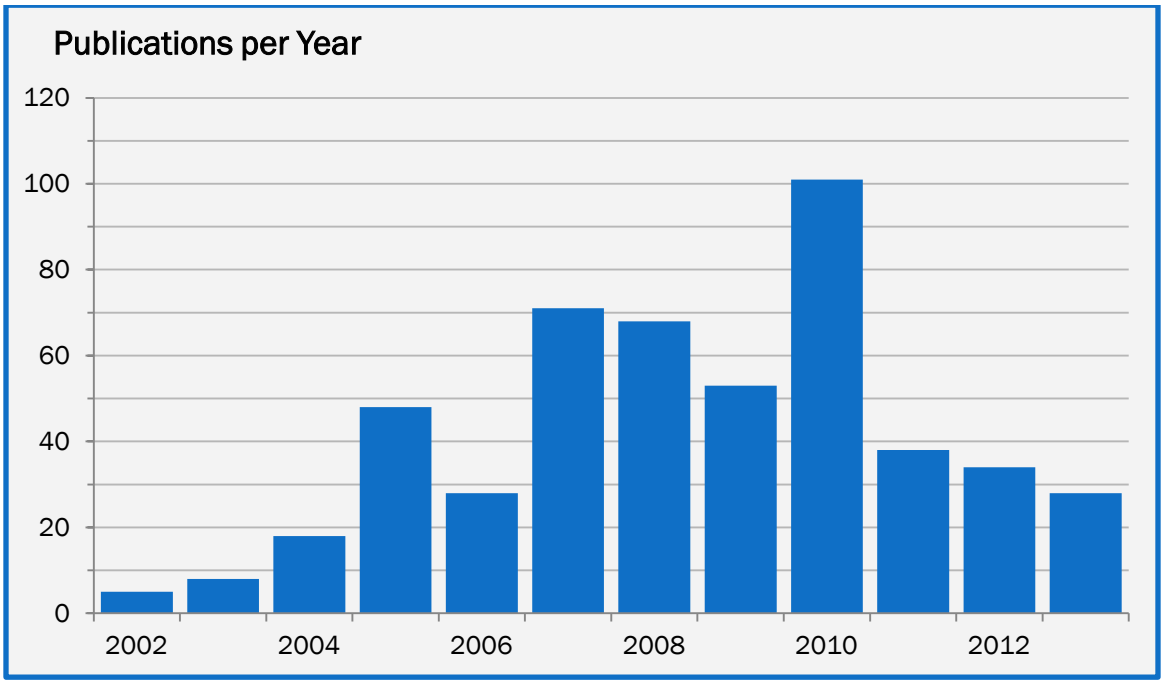

Figure 1: Non-cumulative number of OER-sponsored publications produced per year.

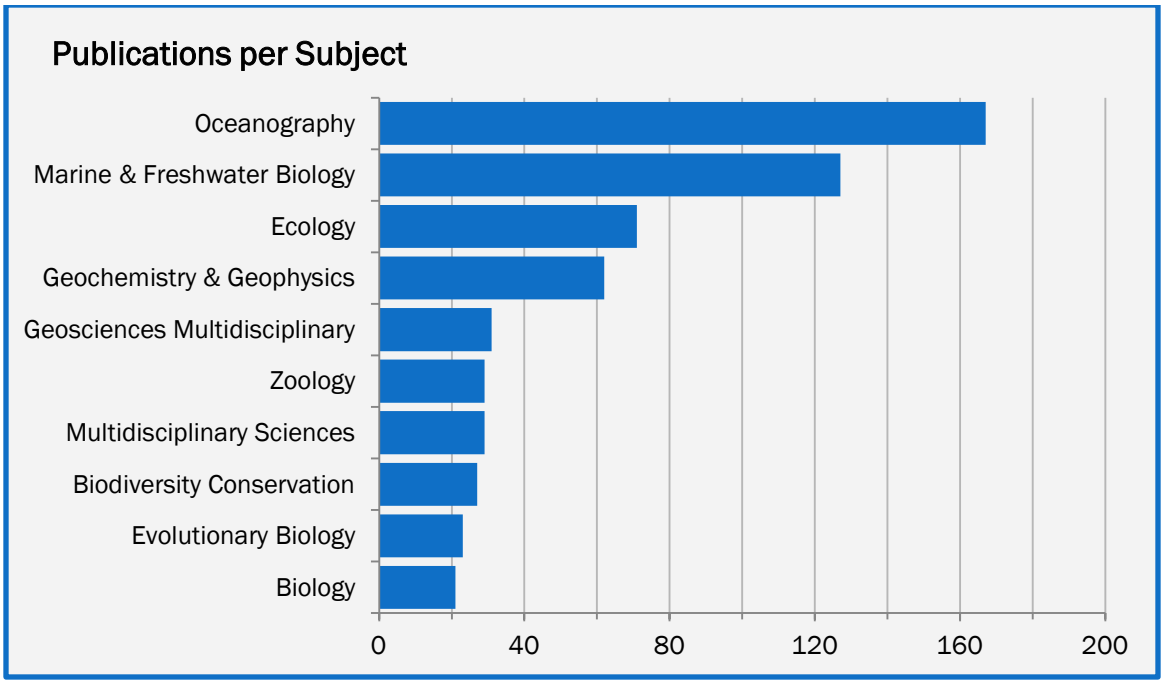

Figure 2: Number of OER-sponsored publications assigned to subject categories by WoS based on the journal in which the publication appeared. These subject categories are not mutually exclusive.

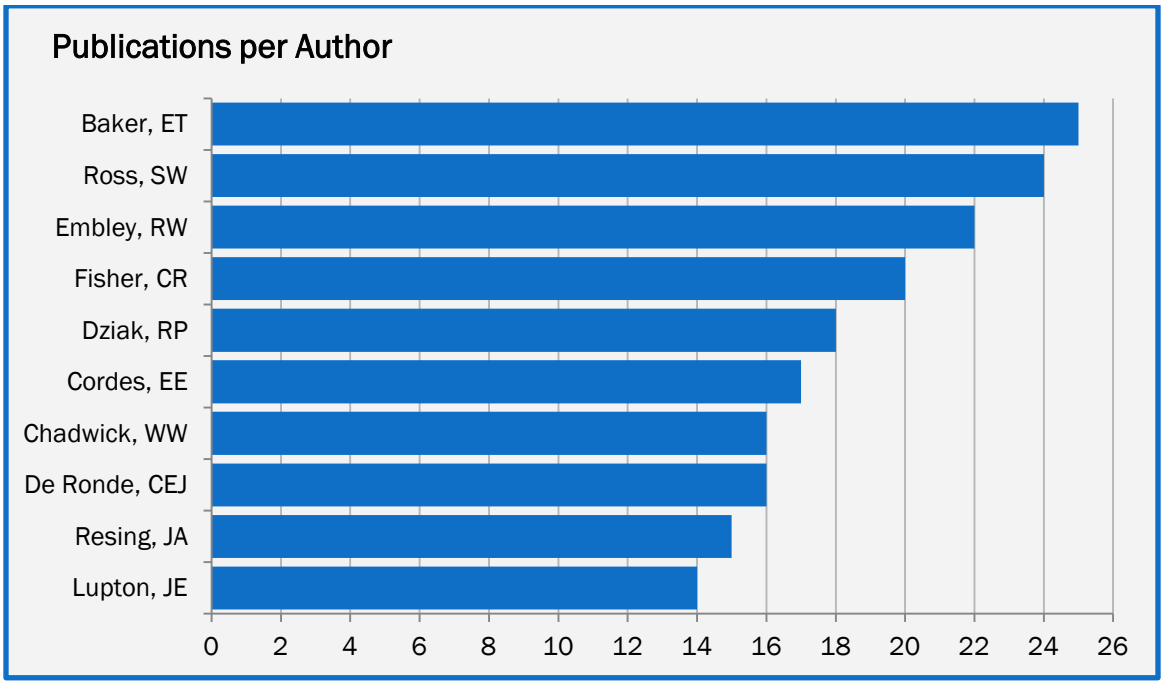

Figure 3: Number of OER-sponsored publications produced per author.

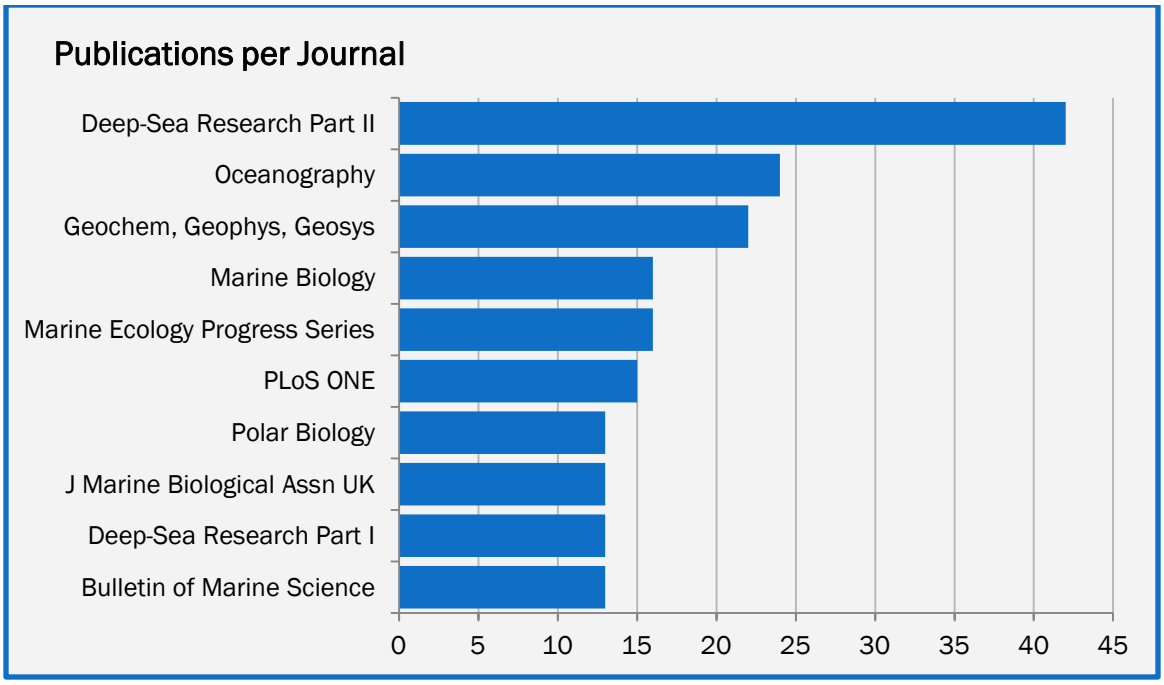

Figure 4: Number of OER-sponsored publications per journal. Journal special issues dedicated to OER research explorations include: Deep-Sea Research Part II 57(1-2), 57(21-23), and 57(24-26); Journal of Geophysical Research – Solid Earth 113 (B8); Oceanography 20(4) and 25(S1); and Polar Biology 28(3).

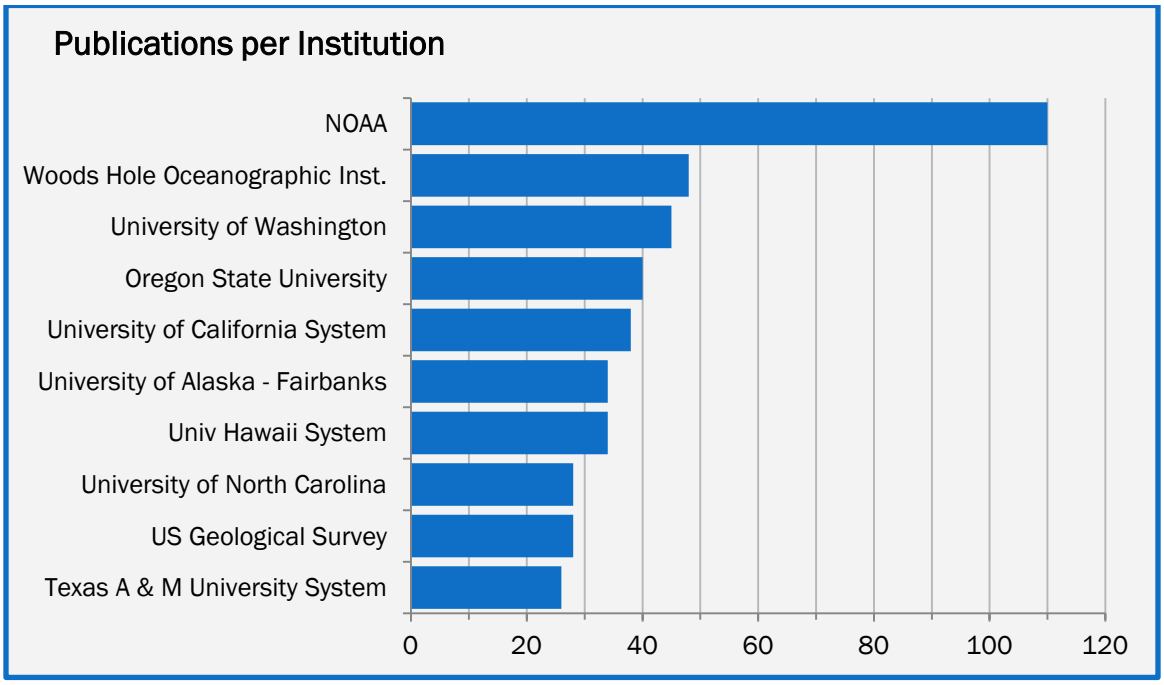

Figure 5: Number of OER-sponsored publications per institution. Publications are counted for an institution if at least one of the publication's authors lists that institution as his/her affiliation.

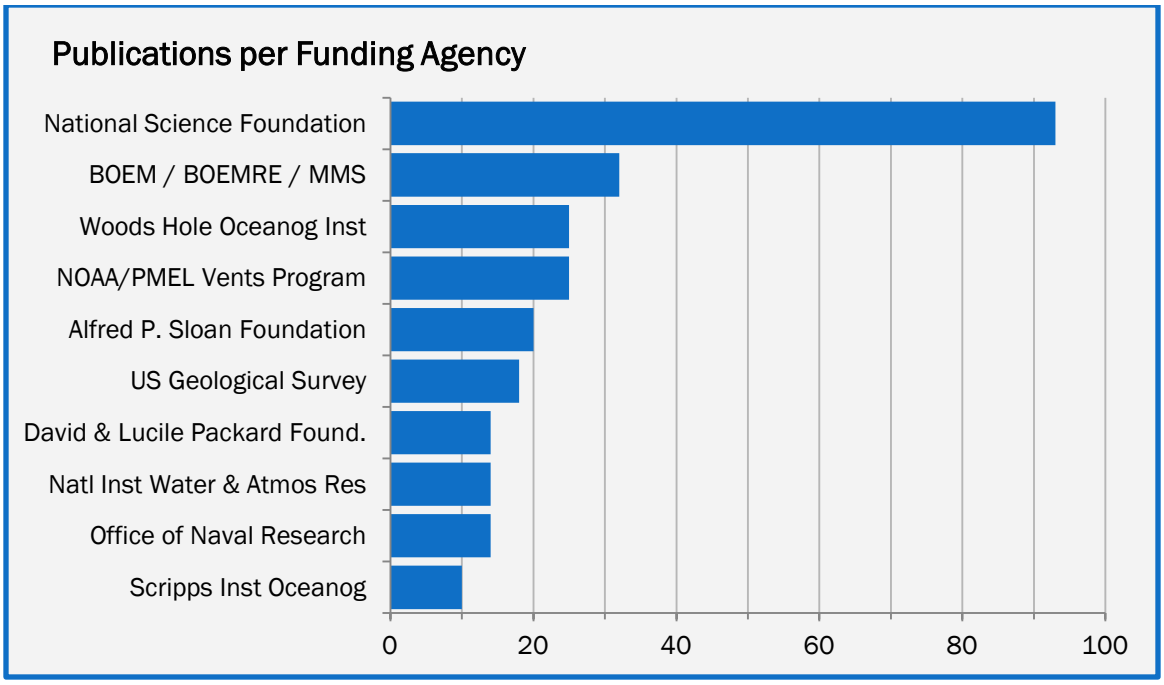

Figure 6: Number of publications co-funded by OER and other agencies and foundations. Data for this figure were derived from an analysis of the 'Acknowledgements' texts of 260 articles published 2008-present for which this information is available.

CITATION COUNT ANALYSIS

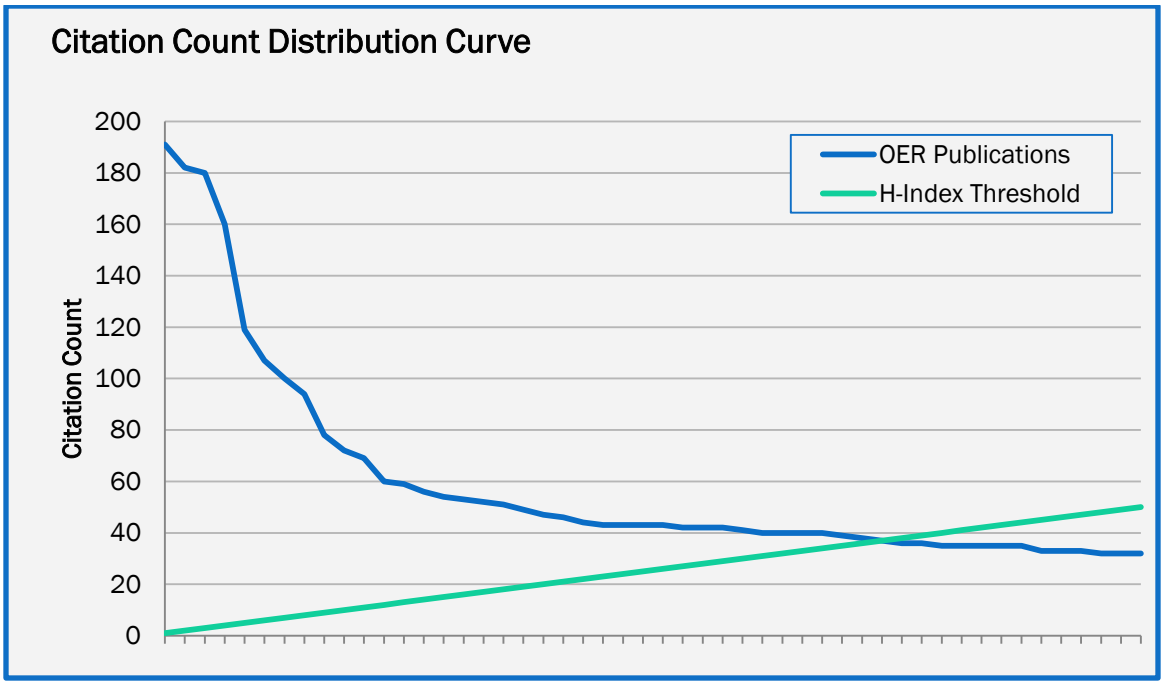

Figure 7: Distribution curve showing the citation counts of the 50 most highly cited publications supported by OER. The straight line indicates the H-Index threshold (slope: y = x). The intersect point of the two curves (y = 37) is the H-Index of OER articles.

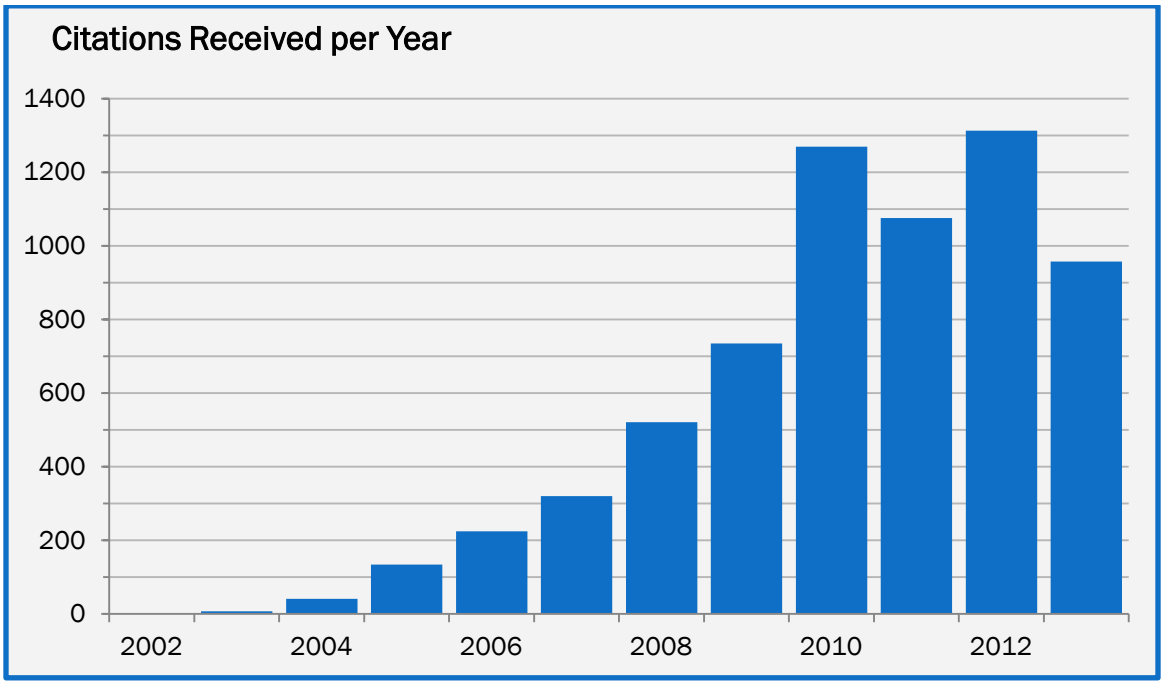

Figure 8: Non-cumulative number of citations received by all 500 OER-supported articles per year.

CITING ARTICLE ANALYSIS

The following tables analyze the 6,600 publications that have cited OER publications in an attempt to indicate how OER 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.

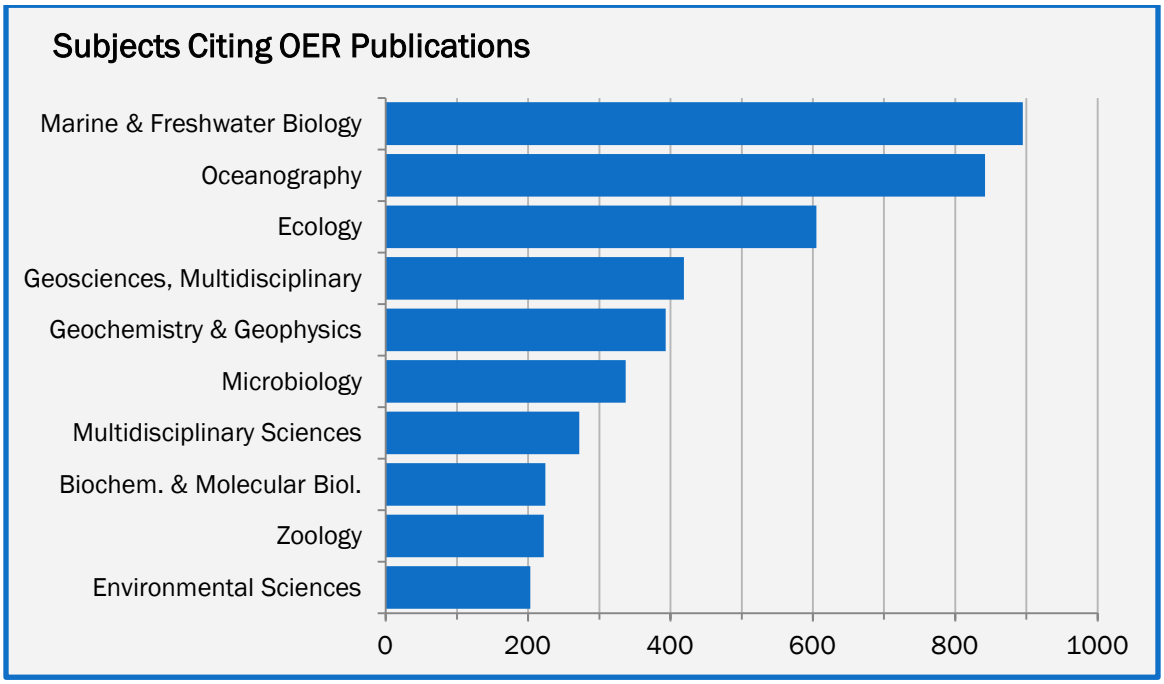

Figure 9: Number of publications per WoS-defined subject category for all publications citing OER-sponsored publications.

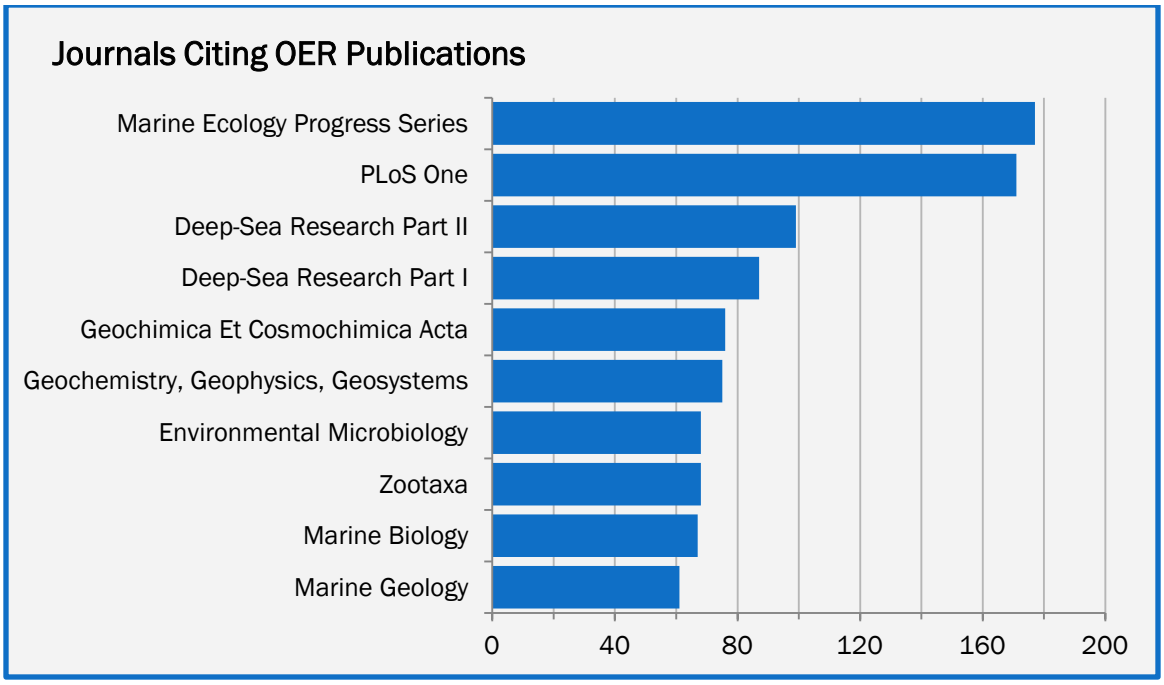

Figure 10: Number of publications per journal for all publications citing OER-sponsored publications.

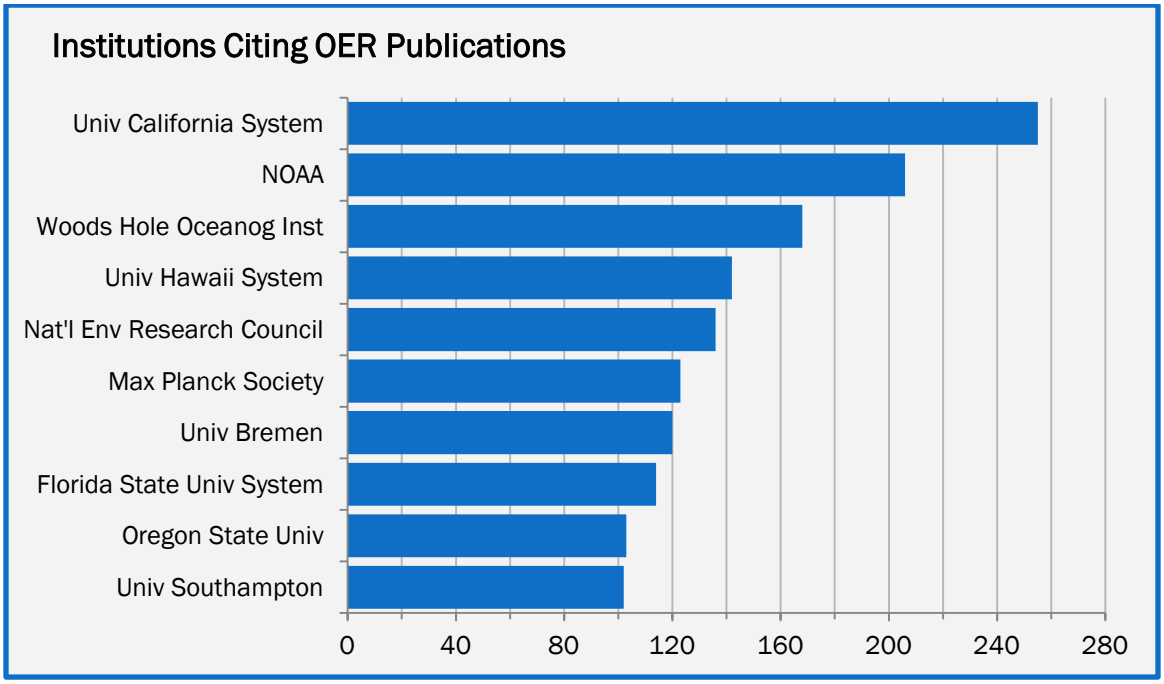

Figure 11: Number of publications per institution for all publications citing OER-sponsored publications. Publications are counted for an institution if at least one of the publication's authors lists that institution as their affiliation.

INTERNATIONAL COLLABORATION

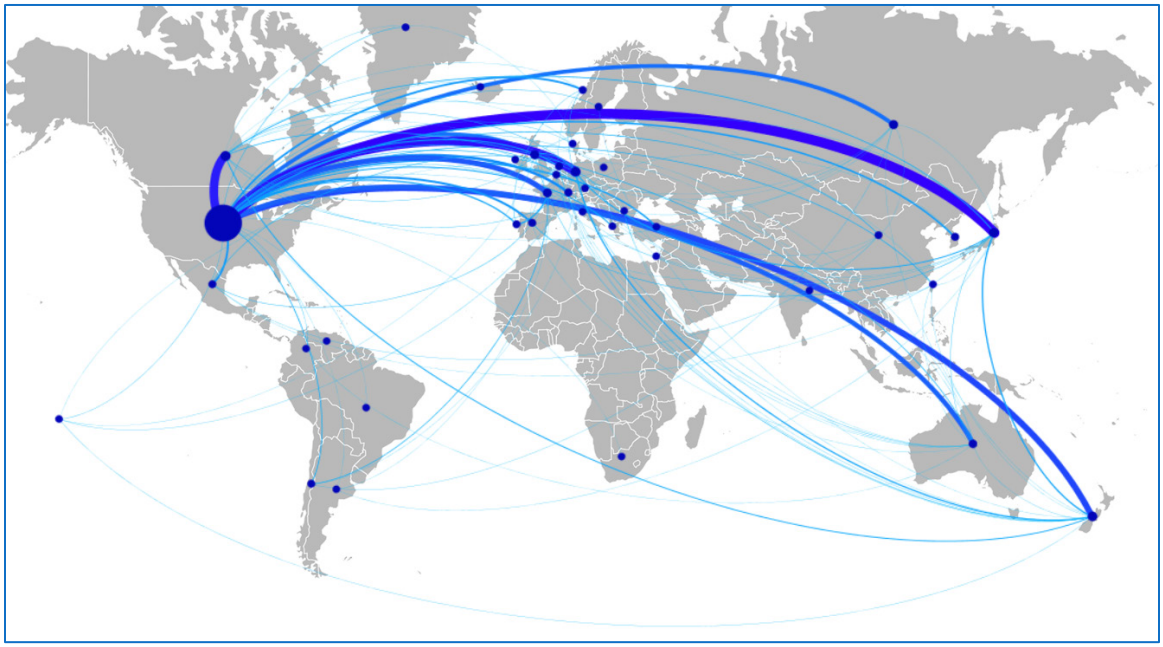

Figure 12: Map depicting the international collaboration network of OER-supported publications. Circles indicate the countries with which authors of OER-supported publications are affiliated, with larger circles representing larger numbers of publications by authors affiliated with each country. Lines connecting countries represent co-authored publications between authors from the connected countries, with larger and darker lines indicating larger numbers of co-authored publications.

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 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

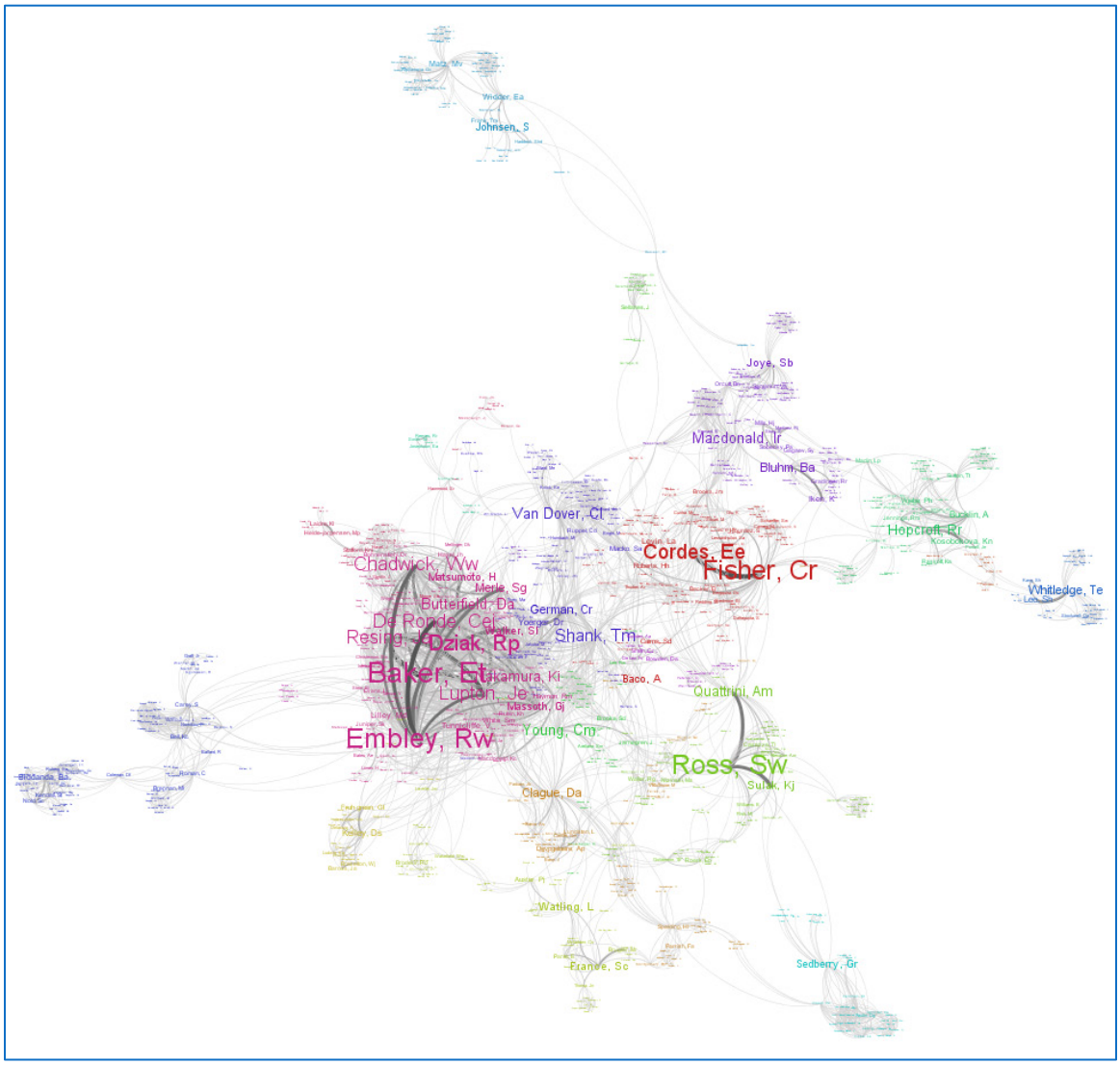

Figure 13: Bibliometric map of the largest connected co-authorship network of authors of OER-supported research. Author names were manually standardized to eliminate misspellings and name variants (e.g. Cordes E and Cordes Ee) were merged prior to creating this network. In this map, name size indicates the number of OER-supported publications by that author; values range from 1 to 25 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 15. This map depicts 4,981 co-author relationships between 991 authors of OER-supported articles.

Article Bibliographic Coupling Network

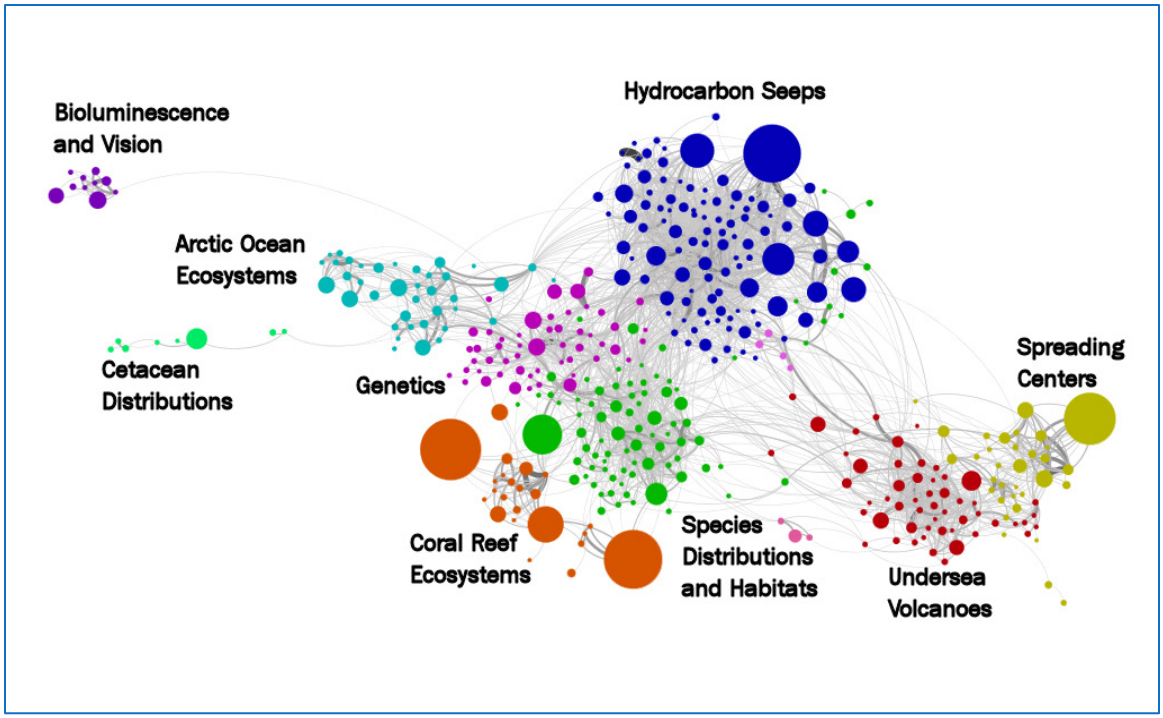

Figure 14: Bibliometric map depicting the bibliographic coupling network of 413 (83%) of the 500 articles analyzed here. Bibliographic coupling (Kessler 1963) is a method of grouping papers into topical clusters based on the number of cited references they share. The larger the number of common references between two articles, the higher the probability that they are about the same topic. The 413 articles depicted on this map are representative of the major topics covered by OER-sponsored journal articles. In this map, circles represent articles and lines represent bibliographic coupling links. Circle size is proportional to the article's citation count; paper citation counts range from 0 to 191 citations. Circle colors represent paper communities, or research topics, identified by the community detection algorithm developed by Blondel and others (2008). Labels indicating the major topic areas on the map have been added based on a review of the articles grouped in each community. Line size and darkness indicates the number of shared references between the connected articles; the number of shared references depicted ranges from 2 to 41. For clarity, lines with a weight of less than 2 were removed and only the largest connected component of the network is shown.

Word Co-Occurrence Network

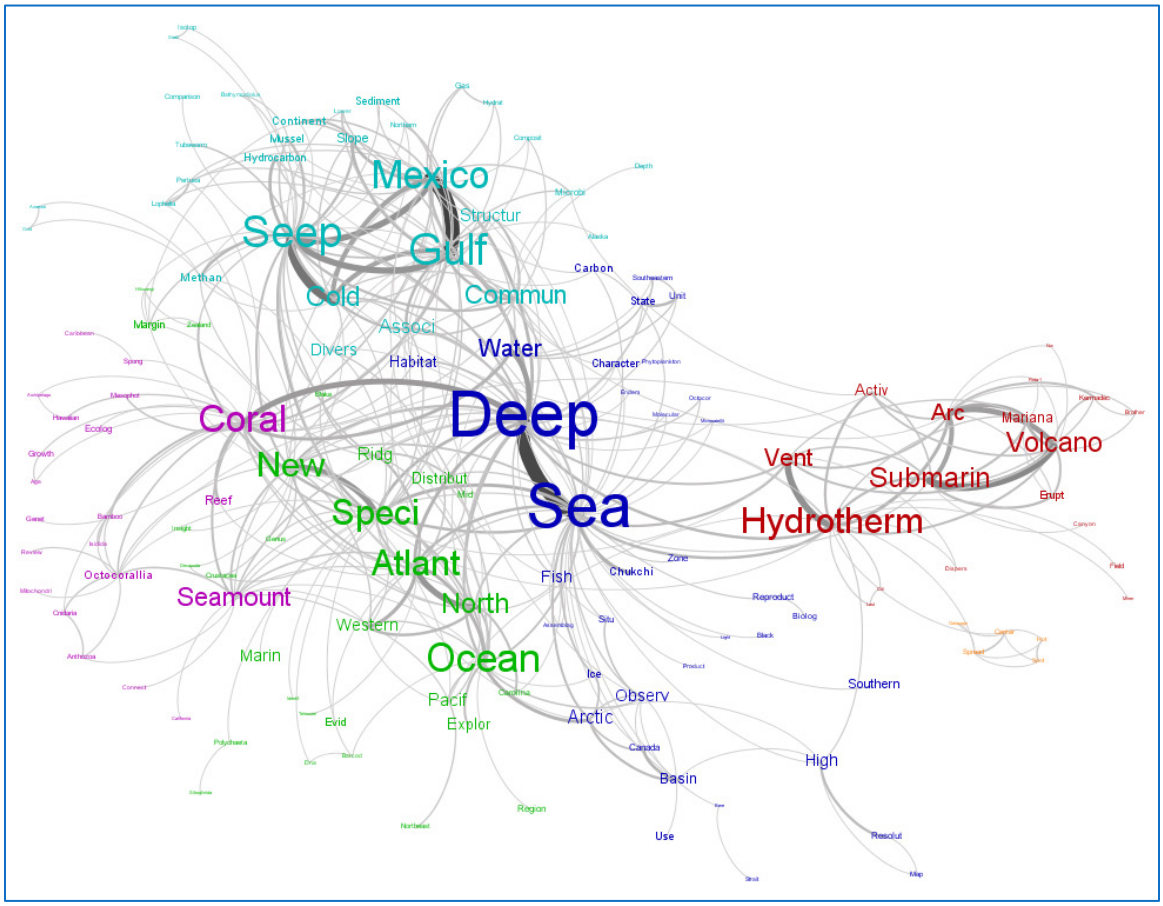

Figure 15: Word co-occurrence network map of the 141 words most commonly co-occurring in the titles of OER-sponsored journal articles. Words were truncated (i.e. word endings like '-es', '-al', and '-ity' were removed) to increase word matching accuracy and stopwords (words that carry little meaning 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 90 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. These values range from 4 articles to 54 articles.

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).

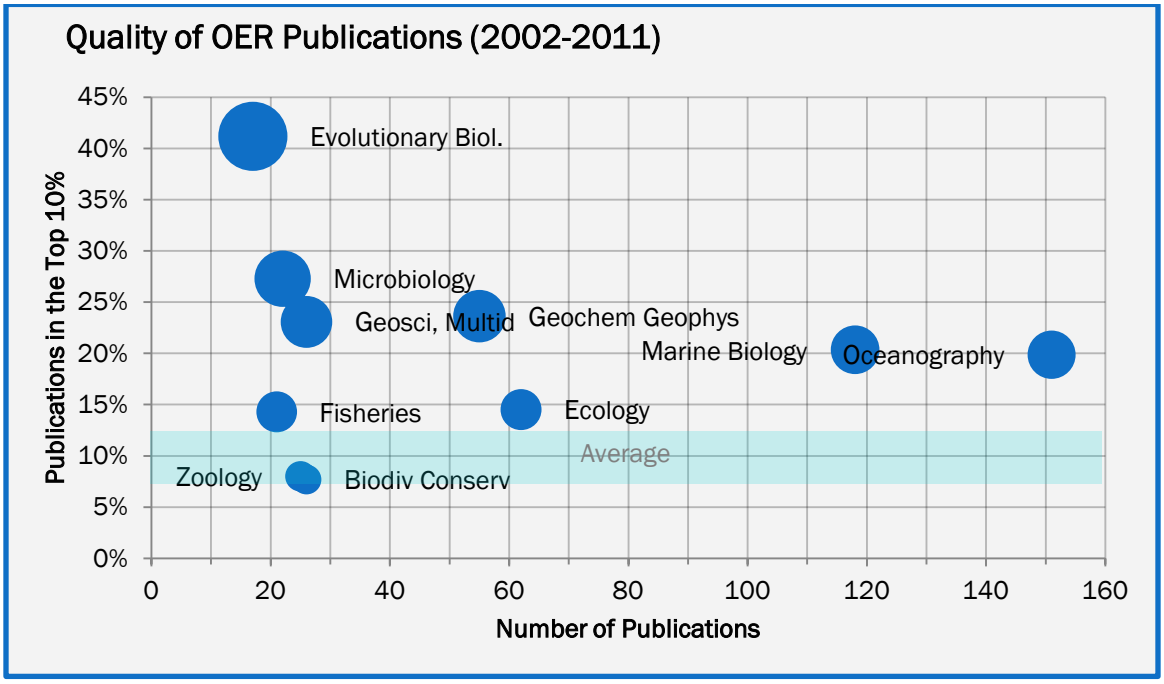

Figure 16: Bubble chart showing the percentage of OER publications in ten subject categories that had citation counts ranking in the top 10% of all publications in WoS that were published in the same categories during the same years (2002-2011). Bubble size indicates the percentage of OER-supported publications 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 research was most often published (from Figure 2). 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-sponsored 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 disciplines. 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), I only list articles published in 2011 or 2010.

2011

Auster PJ, Gjerde K, Heupel E, Watling L, Grehan A, Rogers AD. 2011. Definition and detection of vulnerable marine ecosystems on the high seas: problems with the "move-on" rule. ICES Journal of Marine Science 68(2):254-264. doi:10.1093/icesjms/fsq074

de Ronde CEJ, Massoth GJ, Butterfield DA, Christenson BW, Ishibashi J, Ditchburn RG, Hannington MD, Brathwaite RL, Lupton JE, Kamenetsky VS et al. . 2011. Submarine hydrothermal activity and gold-rich mineralization at Brothers Volcano, Kermadec Arc, New Zealand. Mineralium Deposita 46(5-6):541-584. doi:10.1007/s00126-011-0345-8

Johnsen S, Marshall NJ, Widder EA. 2011. Polarization sensitivity as a contrast enhancer in pelagic predators: lessons from in situ polarization imaging of transparent zooplankton. Philosophical Transactions of the Royal Society B-Biological Sciences 366(1565):655-670. doi:10.1098/rstb.2010.0193

Lesser MP, Slattery M. 2011. Phase shift to algal dominated communities at mesophotic depths associated with lionfish (Pterois volitans) invasion on a Bahamian coral reef. Biological Invasions 13(8):1855-1868. doi:10.1007/s10530-011-0005-z

Ludwig KA, Shen CC, Kelley DS, Cheng H, Edwards RL. 2011. U-Th systematics and Th-230 ages of carbonate chimneys at the Lost City Hydrothermal Field. Geochimica et Cosmochimica Acta 75(7):1869-1888. doi:10.1016/j.gca.2011.01.008

McFadden CS, Benayahu Y, Pante E, Thoma JN, Nevarez PA, France SC. 2011. Limitations of mitochondrial gene barcoding in Octocorallia. Molecular Ecology Resources 11(1):19-31. doi:10.1111/j.1755-0998.2010.02875.x

Resing JA, Rubin KH, Embley RW, Lupton JE, Baker ET, Dziak RP, Baumberger T, Lilley MD, Huber JA, Shank TM et al. . 2011. Active submarine eruption of boninite in the northeastern Lau Basin. Nature Geoscience 4(11):799-806. doi:10.1038/ngeo1275

2010

Baco AR, Rowden AA, Levin LA, Smith CR, Bowden DA. 2010. Initial characterization of cold seep faunal communities on the New Zealand Hikurangi margin. Marine Geology 272(1-4):251-259. doi:10.1016/j.margeo.2009.06.015

Brazelton WJ, Ludwig KA, Sogin ML, Andreishcheva EN, Kelley DS, Shen CC, Edwards RL, Baross JA. 2010. Archaea and bacteria with surprising microdiversity show shifts in dominance over 1,000-year time scales in hydrothermal chimneys. Proceedings of the National Academy of Sciences of the United States of America 107(4):1612-1617. doi:10.1073/pnas.0905369107

Bucklin A, Hopcroft RR, Kosobokova KN, Nigro LM, Ortman BD, Jennings RM, Sweetman CJ. 2010. DNA barcoding of Arctic Ocean holozooplankton for species identification and recognition. Deep-Sea Research Part II-Topical Studies in Oceanography 57(1-2):40-48. doi:10.1016/j.dsr2.2009.08.005

Bucklin A, Ortman BD, Jennings RM, Nigro LM, Sweetman CJ, Copley NJ, Sutton T, Wiebe PH. 2010. A "Rosetta Stone" for metazoan zooplankton: DNA barcode analysis of species diversity of the Sargasso Sea (Northwest Atlantic Ocean). Deep-Sea Research Part II-Topical Studies in Oceanography 57(24-26):2234-2247. doi:10.1016/j.dsr2.2010.09.025

Burki F, Kudryavtsev A, Matz M, Aglyamova G, Bulman S, Fiers M, Keeling P, Pawlowski J. 2010. Evolution of Rhizaria: new insights from phylogenomic analysis of uncultivated protists. BMC Evolutionary Biology 10(1):377. doi:10.1186/1471-2148-10-377

Cho W, Shank TM. 2010. Incongruent patterns of genetic connectivity among four ophiuroid species with differing coral host specificity on North Atlantic seamounts. Marine Ecology: An Evolutionary Perspective 31:121-143. doi:10.1111/j.1439-0485.2010.00395.x

Cordes EE, Becker EL, Hourdez S, Fisher CR. 2010. Influence of foundation species, depth, and location on diversity and community composition at Gulf of Mexico lower-slope cold seeps. Deep-Sea Research Part II-Topical Studies in Oceanography 57(21-23):1870-1881. doi:10.1016/j.dsr2.2010.05.010

Cordes EE, Cunha MR, Galeron J, Mora C, Olu-Le Roy K, Sibuet M, Van Gaever S, Vanreusel A, Levin LA. 2010. The influence of geological, geochemical, and biogenic habitat heterogeneity on seep biodiversity. Marine Ecology: An Evolutionary Perspective 31(1):51-65. doi:10.1111/j.1439-0485.2009.00334.x

Crutchley GJ, Pecher IA, Gorman AR, Henrys SA, Greinert J. 2010. Seismic imaging of gas conduits beneath seafloor seep sites in a shallow marine gas hydrate province, Hikurangi Margin, New Zealand. Marine Geology 272(1-4):114-126. doi:10.1016/j.margeo.2009.03.007

Davies AJ, Duineveld GCA, van Weering TCE, Mienis F, Quattrini AM, Seim HE, Bane JM, Ross SW. 2010. Short-term environmental variability in cold-water coral habitat at Viosca Knoll, Gulf of Mexico. Deep-Sea Research Part I-Oceanographic Research Papers 57(2):199-212. doi:10.1016/j.dsr.2009.10.012

De Leo FC, Smith CR, Rowden AA, Bowden DA, Clark MR. 2010. Submarine canyons: hotspots of benthic biomass and productivity in the deep sea. Proceedings of the Royal Society B-Biological Sciences 277(1695):2783-2792. doi:10.1098/rspb.2010.0462

Fiore CL, Jarett JK, Olson ND, Lesser MP. 2010. Nitrogen fixation and nitrogen transformations in marine symbioses. Trends in Microbiology 18(10):455-463. doi:10.1016/j.tim.2010.07.001

Hinderstein LM, Marr JCA, Martinez FA, Dowgiallo MJ, Puglise KA, Pyle RL, Zawada DG, Appeldoorn R. 2010. Theme section on "Mesophotic Coral Ecosystems: Characterization, Ecology, and Management". Coral Reefs 29(2):247-251. doi:10.1007/s00338-010-0614-5

Hopcroft RR, Kosobokova KN, Pinchuk AI. 2010. Zooplankton community patterns in the Chukchi Sea during summer 2004. Deep-Sea Research Part II-Topical Studies in Oceanography 57(1-2):27-39. doi:10.1016/j.dsr2.2009.08.003

Iken K, Bluhm B, Dunton K. 2010. Benthic food-web structure under differing water mass properties in the southern Chukchi Sea. Deep-Sea Research Part II-Topical Studies in Oceanography 57(1-2):71-85. doi:10.1016/j.dsr2.2009.08.007

Joye SB, Bowles MW, Samarkin VA, Hunter KS, Niemann H. 2010. Biogeochemical signatures and microbial activity of different cold-seep habitats along the Gulf of Mexico deep slope. Deep-Sea Research Part II-Topical Studies in Oceanography 57(21-23):1990-2001. doi:10.1016/j.dsr2.2010.06.001

Klaucke I, Weinrebe W, Petersen CJ, Bowden D. 2010. Temporal variability of gas seeps offshore New Zealand: Multi-frequency geoacoustic imaging of the Wairarapa area, Hikurangi margin. Marine Geology 272(1-4):49-58. doi:10.1016/j.margeo.2009.02.009

Kosobokova KN, Hopcroft RR. 2010. Diversity and vertical distribution of mesozooplankton in the Arctic's Canada Basin. Deep-Sea Research Part II-Topical Studies in Oceanography 57(1-2):96-110. doi:10.1016/j.dsr2.2009.08.009

Lavelle JW, Mohn C. 2010. Motion, Commotion, and Biophysical Connections at Deep Ocean Seamounts. Oceanography 23(1):90-103. doi:10.5670/oceanog.2010.64

Lesser MP, Slattery M, Stat M, Ojimi M, Gates RD, Grottoli A. 2010. Photoacclimatization by the coral Montastraea cavernosa in the mesophotic zone: light, food, and genetics. Ecology 91(4):990-1003. doi:10.1890/09-0313.1

Levin LA, Mendoza GF, Gonzalez JP, Thurber AR, Cordes EE. 2010. Diversity of bathyal macrofauna on the northeastern Pacific margin: the influence of methane seeps and oxygen minimum zones. Marine Ecology: An Evolutionary Perspective 31(1):94-110. doi:10.1111/j.1439-0485.2009.00335.x

MacDonald IR, Bluhm BA, Iken K, Gagaev S, Strong S. 2010. Benthic macrofauna and megafauna assemblages in the Arctic deep-sea Canada Basin. Deep-Sea Research Part II-Topical Studies in Oceanography 57(1-2):136-152. doi:10.1016/j.dsr2.2009.08.012

Mah C, Nizinski M, Lundsten L. 2010. Phylogenetic revision of the Hippasterinae (Goniasteridae; Asteroidea): systematics of deep sea corallivores, including one new genus and three new species. Zoological Journal of the Linnean Society 160(2):266-301. doi:10.1111/j.1096-3642.2010.00638.x

Shank TM. 2010. Seamounts: Deep-Ocean Laboratories of Faunal Connectivity, Evolution, and Endemism. Oceanography 23(1):108-122. doi:10.5670/oceanog.2010.65

Thurber AR, Kroger K, Neira C, Wiklund H, Levin LA. 2010. Stable isotope signatures and methane use by New Zealand cold seep benthos. Marine Geology 272(1-4):260-269. doi:10.1016/j.margeo.2009.06.001

Vetter EW, Smith CR, De Leo FC. 2010. Hawaiian hotspots: enhanced megafaunal abundance and diversity in submarine canyons on the oceanic islands of Hawaii. Marine Ecology: An Evolutionary Perspective 31(1):183-199. doi:10.1111/j.1439-0485.2009.00351.x

Wankel SD, Joye SB, Samarkin VA, Shah SR, Friederich G, Melas-Kyriazi J, Girguis PR. 2010. New constraints on methane fluxes and rates of anaerobic methane oxidation in a Gulf of Mexico brine pool via in situ mass spectrometry. Deep-Sea Research Part II-Topical Studies in Oceanography 57(21-23):2022-2029. doi:10.1016/j.dsr2.2010.05.009

Widder EA. 2010. Bioluminescence in the Ocean: Origins of Biological, Chemical, and Ecological Diversity. Science 328(5979):704-708. doi:10.1126/science.1174269

WORKS CITED

Abramo G, D'Angelo CA, Cicero T. 2012. What is the appropriate length of the publication period over which to assess research performance? Scientometrics 93(3):1005-1017. doi:10.1007/s11192-012-0714-9

Blondel VD, Guillaume JL, Lambiotte R, Lefebvre E. 2008. Fast unfolding of communities in large networks. Journal of Statistical Mechanics-Theory and Experiment October 2008:P10008. doi:10.1088/1742-5468/2008/10/p10008

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

Bornmann L, de Moya Anegón F, Leydesdorff L. 2012. The new Excellence Indicator in the World Report of the SCImago Institutions Rankings 2011. Journal of Informetrics 6(2):333-335. doi:10.1016/j.joi.2011.11.006

Boyack KW, Klavans R. 2010. Co-Citation Analysis, Bibliographic Coupling, and Direct Citation: Which Citation Approach Represents the Research Front Most Accurately? Journal of the American Society for Information Science and Technology 61(12):2389-2404. doi:10.1002/asi.21419

Costas R, van Leeuwen TN, van Raan AF. 2011. The "Mendel syndrome" in science: durability of scientific literature and its effects on bibliometric analysis of individual scientists. Scientometrics 89(1):177-205. doi:10.1007/s11192-011-0436-4

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

Mane KK, Borner K. 2004. Mapping topics and topic bursts in PNAS. Proceedings of the National Academy of Sciences of the United States of America 101(S1):5287-5290. doi:10.1073/pnas.0307626100

National Science Board. 2012. Science and Engineering Indicators 2012. Arlington VA: National Science Foundation (NSB 12-01).

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

Sci2 Team. 2009. Science of Science (Sci2) Tool. Indiana University and SciTech Strategies.

Waltman L, Calero-Medina C, Kosten J, Noyons ECM, Tijssen RJW, van Eck NJ, van Leeuwen TN, van Raan AFJ, Visser MS, Wouters P. 2012. The Leiden ranking 2011/2012: Data collection, indicators, and interpretation. Journal of the American Society for Information Science and Technology 63(12):2419-2432. doi:10.1002/Asi.22708