

COMMITTEE ON NATURAL RESOURCES
115th Congress Disclosure Form
As required by and provided for in House Rule XI, clause 2(g)(5)

Examining the Creation and Management of Marine Monuments and Sanctuaries
Wednesday, March 15, 2017

For Individuals:

Name: John Bruno

Address: [REDACTED]

Email Address: [REDACTED]

Phone Number: [REDACTED]

* * * * *

For Witnesses Representing Organizations:

Name:

Name of Organization(s) You are Representing at the Hearing:

Business Address:

Business Email Address:

Business Phone Number:

* * * * *

For Nongovernment Witnesses ONLY:

1. Please attach/include current curriculum vitae or resume.
2. Please list any federal grants or contracts (including subgrants or subcontracts) related to the subject matter of the hearing that were received in the current year and previous two calendar years by you or the organization(s) you represent at this hearing, including the source and amount of each grant or contract.

National Science Foundation: Geomorphology

The role of ecomorphodynamic feedbacks in barrier island response to climate change (2013-2016) 478,177 (co-PI with Laura Moore, UNC Geology)

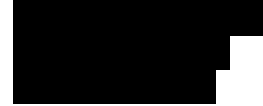
3. Please list any contracts or payments originating with a foreign government related to the subject matter of the hearing that were received in the current year and previous two calendar years by you or the organization(s) you represent at this hearing, including the amount and country of origin of each contract or payment.

None

JOHN F. BRUNO

Curriculum Vitae

Professor
Department of Biology
The University of North Carolina at Chapel Hill
Chapel Hill, NC 27500-3280



EDUCATION

PhD, Department of Ecology and Evolutionary Biology, Brown University, 2000
MS, Department of Biology, California State University, Northridge, 1995
BS, Department of Biology, Northeastern University, Boston, MA, 1991
East/West Marine Biology Program, Northeastern University, 1990

PROFESSIONAL APPOINTMENTS

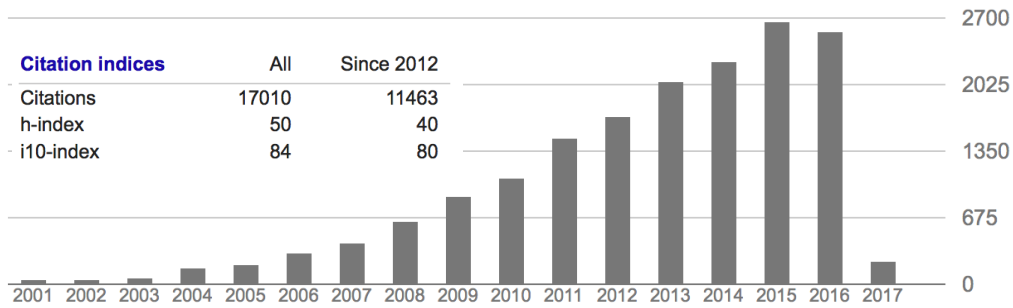
Professor, Department of Biology, The University of North Carolina at Chapel Hill, 2012-
Distinguished Visiting Scientist, Global Change Institute, University of Queensland and CSIRO
Climate Adaptation Flagship, Brisbane Australia, 2010
Associate Professor, Department of Marine Sciences & Department of Biology, The University
of North Carolina at Chapel Hill, 2007-2012
Assistant Professor, Department of Marine Sciences, The University of North Carolina at
Chapel Hill, 2001-2007
Instructor, East-West Marine Biology Program in Jamaica and Moorea, 2002-2005
Summer Instructor, Cornell University/Shoals Marine Laboratory, 2000-2002
Postdoctoral Research Associate, Section of Ecology and Evolutionary Biology, Cornell
University, 2000

HONORS

Invited Student Symposium Speaker: Western Society of Naturalists annual meeting, 2012
“Tar Heel of the Week” Raleigh News and Observer, July 2010 [Link](#)
Pew Marine Conservation Fellowship Nominee, 2010
Pogue Competitive Research Leave: UNC Vice Chancellors Office, 2010
Invited Plenary Speaker: Annual Meeting of the Ecological Society of Australia, 2008
Packard Foundation Fellowship for Science and Engineering UNC-CH nominee, 2001
Joukowsky Family Foundation Outstanding Dissertation Award, 2000
Western Society of Naturalists, Best Student Paper Award, 1998
California State University, Schiffman Award for Excellence in Scientific Research, 1995

REFEREED PUBLICATIONS

Citations per year



*graduate student co-author, †undergraduate student co-author

Valdivia, A., C.E. Cox and J.F. Bruno. Predatory fish depletion and recovery potential on Caribbean reefs. In press at Science Advances

Cox, C.E. *, A. Valdivia*, and M. McField, K. Castillo, and J.F. Bruno. 2017. Establishment of marine protected areas alone has not restored coral reef communities in Belize. *Marine Ecology Progress Series* 563: 65-79 doi.org/10.3354/meps11984

Bruno, J.F. and A. Valdivia*. 2016. Coral reef degradation is not associated with local human population density. *Nature Scientific Reports* doi.org/10.1038/srep29778

Anton, A. *, K. Cure, C.A. Layman, R. Puntilla, M.S. Simpson†, and J.F. Bruno. 2016. Prey naiveté to invasive lionfish (*Pterois volitans*). *Marine Ecology Progress Series* 544:257-269 doi.org/10.3354/meps11553

Bulleri, F, J.F. Bruno, B.R. Silliman, J.J Stachowicz. 2016. Facilitation and the niche: implications for coexistence, range shifts and functioning in marine ecosystems. *Functional Ecology* 30:70-78 doi.org/10.1111/1365-2435.12528

Bruno, J.F., L.A. Carr*, and M.I. O'Connor. 2015. Marine Metabolic Ecology: Exploring the role of temperature in the ocean through metabolic scaling. *Ecology* 96:3126-3140 doi.org/10.1890/14-1954.1

Gittman, R.K. *, C.H. Peterson, C. Currin, F.J. Fodrie, M.F. Piehler, and J.F. Bruno. 2015. Living shorelines can enhance the nursery role of estuarine habitats. *Ecological Applications* doi.org/10.1890/14-0716.1

Gittman, R.K. *, A.M. Popowich, D.A. Keller, J.F. Bruno, C.A. Currin, C.H. Peterson, M.F. Piehler. 2015. Engineering away our natural defenses: An analysis of shoreline hardening in the United States. *Frontier in Ecology and the Environment* 13: 301-306 doi.org/10.1890/150065

Bruno, J.F. 2015. The coral disease triangle. *Nature Climate Change* 5:302–303
doi.org/10.1038/nclimate2571

Cooper, J. M.* Spencer, and J.F. Bruno. 2015. Stochastic dynamics of a warmer Great Barrier Reef. *Ecology* 96(7):1802-1811 <http://dx.doi.org/10.1890/14-0112.1>

Castillo, K.D., J. B. Ries, J.F. Bruno, I.T. Westfield*. 2014. The reef-building coral *Siderastrea siderea* exhibits parabolic responses to ocean acidification and warming. *Proceedings Roy Acad B* 281: 20141856 doi.org/10.1098/rspb.2014.1856

Gittman, R.K.,* A.M. Popowich, J.F. Bruno, and C.H. Peterson. 2014. Marshes with and without sills protect estuarine shorelines from erosion better than bulkheads during a Category 1 Hurricane. *Ocean & Coastal Management* 102:94e102
doi.org/10.1016/j.ocecoaman.2014.09.016

O'Connor, M. I., J. M. Holding, C. V. Kappel, C. M. Duarte, K. Brander, C. J. Brown, J. F. Bruno, L. Buckley, M. T. Burrows, B. S. Halpern, W. Kiessling, P. Moore, J. M. Pandolfi, C. Parmesan, E. S. Poloczanska, D. S. Schoeman, W. J. Sydeman, and A. J. Richardson. 2014. Strengthening confidence in climate change impact science. *Global Ecology and Biogeography* 102: doi.org/10.1111/geb.12218

Bruno, J.F. 2014. How do coral reefs recover? *Science* 6119:879-880
doi.org/10.1126/science.1258556

He, Qiang, M.D. Bertness, J.F. Bruno, B. Li, G. Chen, T.C. Coverdale†, A.H. Altieri, J. Bai, T. Sun, S.C. Pennings, J. Liu, P.R. Ehrlich, B. Cui. 2014. Economic development and coastal ecosystem change in China. *Nature Scientific Reports* 4: 5995
doi.org/10.1038/srep05995

DelVecchia, A.G.†, J.F. Bruno, L. Benninger, M. Alperin, O. Banerjee†, J. de Dios Morales†. 2014. Organic carbon inventories in natural and restored Ecuadorian mangrove forests. [PeerJ](https://doi.org/10.1002/pea.2014.1856) 2:e388

Valdivia A.*, Bruno J.F., Cox C.E.*, Hackerott S.*, Green S.J.* 2014. Re-examining the relationship between invasive lionfish and native grouper in the Caribbean. [PeerJ](https://doi.org/10.1002/pea.2014.1856) 2:e348

Zhang, S.Y.†, K.E. Speare†, Z.T. Long, K.A. McKeever†, M. Gyoerkoe†, A.P. Ramus†, Z. Mohorn†, K.L. Akins†, S.M. Hambridge†, N.A.J. Graham, K.L. Nash†, E.R. Selig, J.F. Bruno. 2014. Relationships between richness and stability in coral reef communities. [PeerJ](https://doi.org/10.1002/pea.2014.1856) 2:e308

Thomsen, M.S., T. Wernberg, J.D. Olden J.E. Byers, J.F. Bruno, B.R. Silliman, D.R. Schiel. 2014. Forty years of experiments on aquatic invasive species: are study biases limiting our understanding of impacts? *NeoBiota* 22:1-22 doi.org/10.3897/neobiota.22.6224

Burrows, M. T., D. S. Schoeman, A. J. Richardson, J. G. Molinos, A. Hoffmann, L. B. Buckley, P. J. Moore, C. J. Brown, J. F. Bruno, C. M. Duarte, B. S. Halpern, O. Hoegh-Guldberg, C. V.

Kappel, W. Kiessling, M. I. O'Connor, J. M. Pandolfi, C. Parmesan, W. J. Sydeman, S. Ferrier, K. J. Williams, and E. S. Poloczanska. 2014. Geographical limits to species-range shifts are suggested by climate velocity. *Nature* 507: 492-495 <http://doi.org/10.1038/nature12976>

Bruno, J.F., W.F. Precht, P.S. Vroom and R.B. Aronson. 2014. Coral reef baselines: how much macroalgae is natural? *Marine Pollution Bulletin* 80:24-29
doi.org/10.1016/j.marpolbul.2014.01.010

Lee, S.C.* and J.F. Bruno. 2014. Propagule supply limits grazer richness equally across a resource gradient. *Ecosphere* 1:8 doi.org/10.1890/ES13-00152.1

Thomsen, M.S., J.E. Byers, D.R. Schiel, J.F. Bruno, J.D. Olden, T. Wernberg, and B.R. Silliman. 2013. Impacts of marine invaders on biodiversity depend on trophic position and functional similarity. *Marine Ecology Progress Series* 495: 39–47 doi.org/10.3354/meps10566

Poloczanska, E.S., C.J. Brown, W.J. Sydeman, W. Kiessling, D.S. Schoeman, P.J. Moore, K. Brander, J.F. Bruno, L.B. Buckley, M.T. Burrows, C.M. Duarte, B.S. Halpern, J. Holding, C.V. Kappel, M.I. O'Connor, J.M. Pandolfi, C. Parmesan, F. Schwing, S.A. Thompson, and A.J. Richardson. 2013. Global imprint of climate change on marine life. *Nature Climate Change*
doi.org/10.1038/nclimate1958

Bruno, J.F. 2013. Building a better crystal ball. *Current Biology*
doi.org/10.1016/j.cub.2013.04.042

Carr, L.A.* and J.F. Bruno. 2013. Warming increases the top-down effects and metabolism of a subtidal herbivore. *PeerJ* 1:e109 doi.org/10.7717/peerj.109

Hackerott, S.†, A. Valdivia*, S.J. Green*, I.M. Côté, C.E. Cox*, L. Akins, C.A. Layman, W.F. Precht, and J.F. Bruno. 2013. Native predators do not influence invasion success of Pacific lionfish on Caribbean reefs. *PLoS One* 8(7): e68259 doi.org/10.1371/journal.pone.0068259

Stat, M., X. Pochon, E. Franklin, J Bruno, K. Casey, L. Selig, R. Gates. 2013. Symbiodinium clade D correlates with a high cumulative frequency of thermal stress in *Montipora* but not *Porites* in Hawaii. *Ecology and Evolution* doi.org/10.1002/ece3.556

Reynolds, P.L.* and J.F. Bruno. 2013. Multiple predator species alter prey behavior, population growth and a trophic cascade in a model estuarine food web. *Ecological Monographs* 83: 119-132

Carr, L.A.*, A.C. Stier*, K. Fietz†, I. Montero†, A.J. Gallagher* and J.F. Bruno. 2013. Illegal shark fishing in the Galapagos marine reserve. *Marine Policy* 39: 317-321
doi.org/10.1016/j.marpol.2012.12.005

Cox, C.E.*, C.D. Jones, J.P. Wares, K.D. Castillo, and J.F. Bruno. 2012. Fish mislabeling in Belize: Implications for coral reef conservation. *Conservation Letters* doi.org/10.1111/j.1755-263X.2012.00286.x

Heard, M.J.* , D.F. Sax and J.F. Bruno. 2012. Dominance of non-native species increases over time in a historically invaded strandline community. *Diversity and Distributions* 18(12): 1232-1242

Pryzant L.K.† and J.F. Bruno. 2012. What to do when the oceans rise. *PLoS Biology* [10\(9\): e1001387](#) (Book review)

Reynolds, P.L.* and J.F. Bruno. 2012. Effects of trophic skewing of species richness on ecosystem functioning in a diverse marine community. *PLoS One* 7:5 e36196

Long, Z.T., M.I. O'Connor* and J.F. Bruno. 2012. Effects of predation and intraspecific aggregation on prey diversity at multiple spatial scales. *J. Exp. Mar. Biol. Ecol.* 416: 115-120

Selig, E.R.* , K.S. Casey and J.F. Bruno. 2012. Temperature-driven coral decline: the role of marine protected areas. *Global Change Biology* 18:5 1561-1570

Żychaluk, K, J.F. Bruno, D. Clancy, T.R. McClanahan and M. Spencer. 2012. Modeling regional coral-reef dynamics without mechanistic assumptions. *Ecology Letters* 15:151–158

Burrows, M.T., D.S. Schoeman, L.B. Buckley, P. Moore, E.S. Poloczanska, K.M. Brander, C. Brown, J.F. Bruno, C.M. Duarte, B.S. Halpern, J. Holding, C.V. Kappel, W. Kiessling, M.I. O'Connor, J.M. Pandolfi, C. Parmesan, F.B. Schwing, W.J. Sydeman and A.J. Richardson. 2011. The pace of shifting climate in marine and terrestrial ecosystems. *Science* 334:652-655

Lowe, P.K.†, J.F. Bruno, E.R. Selig and M. Spencer. 2011. Empirical models of transitions between coral reef states: effects of regions, marine protected areas, and environmental change scenarios. *PLoS One* 6(11) e26339

Hughes, T.P., D.R. Bellwood, A.H. Baird, J. Brodie, J.F. Bruno, J.M. Pandolfi. 2011. Shifting baselines, declining coral cover, and the erosion of reef resilience: comment on Sweatman et al. (2011). *Coral Reefs* 30: 653-660

Brander, K., J. Bruno, A. Hobday and D. Schoeman. 2011. The value of attribution. *Nature Climate Change*. 1: 70-71

Long, Z.T., J.F. Bruno and J.E. Duffy. 2011. Food chain length and omnivory determine the stability of a marine subtidal food web. *J. Animal Ecology* 80: 586-594

Bruno J.F., S.P. Ellner, I. Vu†, K. Kim, and C.D. Harvell. 2011. Impacts of aspergillosis on sea fan coral demography: modeling a moving target. *Ecological Monographs* 81: 123-139

Kiers, T.E., T.M. Palmer, A R. Ives, J.F. Bruno, and J.L. Bronstein. 2010. Mutualisms in a changing world: an evolutionary perspective. *Ecology Letters* 13: 1459-1474

Dudgeon, S.R., R.B. Aronson, J.F. Bruno and W.F. Precht. 2010. Phase shifts and stable states on coral reefs. *Marine Ecology Progress Series* 413: 201-216

McLeod E., R. Moffitt, A. Timmermann, R. Salm, L. Menviel, M.J. Palmer, E.R. Selig, K.S. Casey and J.F. Bruno 2010. Warming seas in the coral triangle: coral reef vulnerability and management implications. *Coastal Management* 38: 518-539

Moran, E. R. †, P.L. Reynolds*, L.M. Ladwig, M.I. O'Connor*, Z.T. Long, and J.F. Bruno. 2010. Predation intensity is negatively related to plant species richness in a benthic marine community. *Marine Ecology Progress Series* 400:277-282

Hoegh-Guldberg, O. and J.F. Bruno. 2010. Impacts of climate change on the world's marine ecosystems. *Science* 328:1523-1528

Butchart, S.H.M., M. Walpole, R. Almond, B. Bombard, J.F. Bruno, et al. 2010. Global biodiversity: indicators of recent declines. *Science* 238:1164-1168

Selig, E.R. *, K.S. Casey, and J.F. Bruno. 2010. New insights into global patterns of ocean temperature anomalies: implications for coral reef health and management. *Global Ecology and Biogeography* 19:397-411

Schutte, V.G.W. †, E.R. Selig* and J.F. Bruno. 2010. Regional spatio-temporal trends in Caribbean coral reef benthic communities. *Marine Ecology Progress Series* 402: 115-122

Selig, E.R.* and J.F. Bruno. 2010. A global analysis of the effects of marine protected areas on coral loss. *PLoS One* 5:e9278

O'Connor, M.I., M.F. Piehler, D. Leech, A. Anton and J.F. Bruno. 2009. Warming and resource availability shift food web structure and metabolism. *PLoS Biology* 7:e1000178

Bruno, J.F., H. Sweatman, W.F. Precht, E.R. Selig* and V.G.W. Schutte†. 2009. Assessing evidence of phase shifts from coral to macroalgal dominance on coral reefs. *Ecology* 90:1478-1484

O'Connor, M.I.* and J.F. Bruno. 2009. Predator richness has no effect in a diverse marine food web. *J. Animal Ecology* 78:732-740

Boyer, K.E., J.S. Kertesz* and J.F. Bruno. 2009. Environmental context influences the effects of species richness on productivity but not stability of marine macroalgal communities. *Oikos* 118: 1062-1072

Lee, S.C.* and J.F. Bruno. 2009. Propagule supply controls grazer community structure and primary production in a benthic marine ecosystem. *Proceedings of the National Academy of Sciences, USA* 106: 7052–7057

Selkoe, K.A., B.H. Halpern, C. Ebert, E. Franklin, E. Selig*, K. Casey, J. Bruno, and R.J. Toonen. 2009. A map of cumulative impacts to a “pristine” coral reef ecosystem, the Papahānaumokuākea Marine National Monument. *Coral Reefs* 28:635–650

Vu, I†., G. Smelick, S†. Harris†, S.C. Lee*, E. Weil, R.F. Whitehead and J.F. Bruno. 2009. Macroalgae has no effect on the severity and dynamics of Caribbean yellow band disease. PLoS One 4(2): e4514

Bruno, J.F., and B.J. Cardinale. 2008. Cascading effects of predator richness. *Frontiers in Ecology and the Environment* 6:539-546

Bruno, J.F., K.E. Boyer, J.E. Duffy and S.C. Lee*. 2008. Relative and interactive effects of plant and grazer richness in a benthic marine community. *Ecology* 89:2518-2528

Halpern, B.S., C.V. Kappel, F. Micheli, Selkoe, K.A., C. D'Agrosa, J.F. Bruno, K.S. Casey, C. Ebert, H.E. Fox, R. Fujita, D. Heinemann, H.S. Lenihan, E.M.P. Madin, M. Perry, E.R. Selig*, M. Spalding, R. Steneck, S. Walbridge, R. Watson. 2008. Response to "Southern ocean not so pristine" and "Diminishing sea ice" *Science* 321:1444-1445 (Letter to the editor)

Selkoe, K.A., C.V. Kappel, B.S. Halpern, F. Micheli, C. D'Agrosa, J.F. Bruno, K.S. Casey, C. Ebert, H.E. Fox, R. Fujita, D. Heinemann, H.S. Lenihan, E.M.P. Madin, M. Perry, E.R. Selig*, M. Spalding, R. Steneck, S. Walbridge, R. Watson. 2008. Response to comment on "A global map of human impact on marine ecosystems" *Science* 321:1446c (Technical comment)

Bulleri, F., J.F. Bruno, and L. Benedetti-Cecchi. 2008. Beyond competition: incorporating positive interactions between species to predict ecosystem invasibility. *PLoS Biology* 6: e162

Douglas, J.G.*, J.E. Duffy and J.F. Bruno. 2008. Herbivore and predator diversity interactively affect ecosystem properties in experimental marine communities. *Ecology Letters* 11: 598-608

Halpern, B.S., S. Walbridge, K.A. Selkoe, C.V. Kappel, F. Micheli, C. D'Agrosa, J.F. Bruno, K.S. Casey, C. Ebert, H.E. Fox, R. Fujita, D. Heinemann, H.S. Lenihan, E.M.P. Madin, M. Perry, E.R. Selig*, M. Spalding, R. Steneck, R. Watson. 2008. Assessing and mapping the global impact of human activities on marine ecosystems. *Science* 319:948-952

O'Connor, N.E., J.H. Grabowski, L.M. Ladwig, and J.F. Bruno. 2008. Simulated predator extinctions: predator identity affects the survival and settlement of oysters. *Ecology* 89:428-438

O'Connor, N.E. and J.F. Bruno. 2007. Identity of predator functional groups affects the structure and functioning of a model marine food web. *Oikos* 116:2027-2038

Long, Z.T., J.F. Bruno and J.E. Duffy. 2007. Biodiversity mediates functioning through different mechanisms at adjacent trophic levels. *Ecology* 88:2821-2829

Stachowicz, J.J., J.F. Bruno, and J.E. Duffy. 2007. Understanding the effects of marine biodiversity on communities and ecosystems. *Annual Review of Ecology, Evolution, and Systematics* 38:739-766

Sax, D. F., J.J. Stachowicz, J.H. Brown, J.F. Bruno, M.N. Dawson, S.D. Gaines, R.K. Grosberg, A. Hastings, R.D. Holt, M.M. Mayfield, M.I. O'Connor*, and W.R. Rice. 2007. Ecological and evolutionary insights from species invasions. *Trends in Ecology and Evolution* 22:465-471

Bruno, J.F., and E.R. Selig*. 2007. Regional decline of coral cover in the Indo-Pacific: timing, extent, and subregional comparisons. *PLoS One* 8:e711

Bruno, J.F., E.R. Selig*, K.S. Casey, C.A. Page*, B.L. Willis, C.D. Harvell, H. Sweatman, and A.M. Melendy. 2007. Thermal stress and coral cover as drivers of coral disease outbreaks. *PLoS Biology* 5:e124

Halpern, B.S., B.R. Silliman, J.D. Olden, J.F. Bruno, and M.D. Bertness. 2007. Incorporating positive interactions in aquatic restoration and conservation. *Frontiers in Ecology and the Environment* 5:153-160

O'Connor, M.I.* , J.F. Bruno, S.D. Gaines, B.S. Halpern, S.E. Lester*, B.P. Kinlan*, and J.M. Weiss. 2007. Temperature control of larval dispersal and the implications for marine ecology, evolution and conservation. *Proceedings of the National Academy of Sciences, USA* 104:1266-1271

Bruno, J.F., S.C. Lee*, J.S. Kertesz†, R.C. Carpenter, Z.T. Long, and J.E. Duffy. 2006. Partitioning the effects of algal species identity and richness on benthic marine primary production. *Oikos* 115:170-178

Idjadi, J.A.* , S.C. Lee*, J.F. Bruno, W.F. Precht, L. Allen-Requa*, and P.J. Edmunds. 2006. Rapid phase-shift reversal on a Jamaican coral reef. *Coral Reefs* 25:209-211

Ward, J.R.* , K.L. Rypien*, J.F. Bruno, C.D. Harvell, E. Jordán-Dahlgren, K.M. Mullen, R.E. Rodríguez-Martínez, J. Sánchez, and G. Smith. 2006. Coral diversity and disease in Mexico. *Diseases of Aquatic Organisms* 69:23-31

van de Koppel, J., A.H. Altieri*, B.R. Silliman, J.F. Bruno, and M.D. Bertness. 2006. Scale-dependent interactions and community structure on cobble beaches. *Ecology Letters* 9:45-50

Bruno, J.F., K.E. Boyer, J.E. Duffy, S.C. Lee*, and J.S. Kertesz†. 2005. Effects of species identity and richness on primary production in benthic marine communities. *Ecology Letters* 8:1165-1174

Bruno, J.F., and M.I. O'Connor*. 2005. Cascading effects of predator diversity and omnivory in a marine food web. *Ecology Letters* 8:1048-1056

Precht, W.F., S.L. Miller, R.B. Aronson, J.F. Bruno, and L. Kaufman. 2005. Reassessing U.S. coral reefs. *Science* 308: 1741 (Letter to the editor)

LaJeunesse, T.C., S. Lee*, S. Bush†, and J.F. Bruno. 2004. Persistence of non-Caribbean algal symbionts in Indo-Pacific mushroom corals released to Jamaica 35 years ago. *Coral Reefs* 24:157-159

Edmunds, P.J., J.F. Bruno, and D.B. Carlton. 2004. Effects of depth and microhabitat on growth and survivorship of juvenile corals in the Florida Keys. *Marine Ecology Progress Series* 278: 115-124

Fridley, J.D., R.L. Brown*, and J.F. Bruno. 2004. Null models of exotic invasions and scale-dependent patterns of native and exotic species richness. *Ecology* 85: 3215-3222

Bush, S. †, W.F. Precht, J.D. Woodley, and J.F. Bruno. 2004. Indo-Pacific mushroom corals found on Jamaican reefs. *Coral Reefs* 23: 234

Bruno, J.F., C.W. Kennedy†, T.A. Rand, and M.B. Grant†. 2004. Exotic invasion of a marine plant community: A landscape-scale test of some key predictions and paradigms of invasion biology. *Oikos* 107: 531-540

Bruno, J.F., L. Petes†, C.D. Harvell, and A. Hettinger†. 2003. Nutrient enrichment can increase the severity of two Caribbean coral diseases. *Ecology Letters* 6:1056-1061

Aronson, R.B., J.F. Bruno, W.F. Precht, P.W. Glynn, C.D. Harvell, L.S. Kaufman, C.S. Rogers, E.A. Shinn, and J.F. Valentine. 2003. Causes of coral reef degradation. *Science* 302: 1502 (Letter to the editor)

Bruno, J.F., J.J. Stachowicz, and M.D. Bertness. 2003. Inclusion of facilitation into ecological theory. *Trends in Ecology and Evolution* 18:119-125 (reviewed in Shouse, B. 2003. Conflict Over Cooperation. *Science* 299: 644-646)

Witman, J.D., S.J. Genovese, J.F. Bruno, J.W. McLaughlin, and B.I. Pavlin†. 2003. Massive prey recruitment and the control of subtidal communities on regional spatial scales. *Ecological Monographs* 73:441-462

Bruno, J.F. 2002. Causes of nested species distributions and landscape-scale rarity in cobble beach plant communities. *Ecology* 83:2304-2314

Bruno, J.F., C.E. Siddon, J.D. Witman, and P.L. Colin. 2001. El Niño-related coral bleaching in Palau, Western Caroline Islands. *Coral Reefs* 20:127-136

Bruno, J.F. 2000. Facilitation of cobble beach plant communities through habitat modification by *Spartina alterniflora*. *Ecology* 81:1179-1192

Bruno, J.F., and C.W. Kennedy. 2000. Patch-size dependent habitat modification and facilitation on New England cobble beaches by *Spartina alterniflora*. *Oecologia* 122:98-108

Kennedy, C.W., and J.F. Bruno. 2000. Restriction of the upper distribution of New England cobble beach plants by wave-related disturbance. *J. Ecology* 88:856-868

Bertness, M.D., G.H. Leonard, J.M. Levine, and J.F. Bruno. 1999. Climate-driven interactions among rocky intertidal organisms caught between a rock and a hot place. *Oecologia* 120:446-450

Bruno, J.F. 1998. Fragmentation in *Madracis mirabilis* (Duchassaing and Michelotti): How common is size-specific fragment survivorship in corals? *J. Exp. Mar. Biol. Ecol.* 230:169-181

Bruno, J.F., and P.J. Edmunds. 1998. Metabolic consequences of phenotypic plasticity in the coral *Madracis mirabilis* (Duchassaing and Michelotti): the effect of morphology and water flow on aggregate respiration. *J. Exp. Mar. Biol. Ecol.* 229:187-195

Bruno, J.F., and P.J. Edmunds. 1997. Clonal variation for phenotypic plasticity in the coral *Madracis mirabilis*. *Ecology* 78:2177-2190

Bruno, J.F., and J.D. Witman. 1996. Defense mechanisms of scleractinian cup corals against overgrowth by colonial invertebrates. *Marine Ecology Progress Series* 143:165-171

MANUSCRIPTS IN REVIEW

Cox, C., N. Truelove, J. Wares, L. Garavelli, L. Cherubin, J. Bruno, S. Box. The role of population connectivity in coral reef management. In review at *Ecological Applications*

Carr, L.A., R.K. Gittman, and J.F. Bruno. Temperature influences herbivory across an upwelling gradient in the Galápagos Islands, Ecuador. In review at *J. Ecology*

Hackerott, S., A. Valdivia, C.E. Cox, and J.F. Bruno. Invasive lionfish have not affected fish community structure on the Mesoamerican Barrier Reef, Belize. In review at *PeerJ*

BOOKS AND BOOK CHAPTERS

Côté I. M. and J. F. Bruno. Impacts of invasive species on coral reef fishes. 2015. In: Mora, C. (ed.) *Ecology and Conservation of fishes on coral reefs: The functioning of an ecosystem in a changing world*. University of Hawaii Press, Manoa, United States.

Bertness, M.D., B.R. Silliman, J.F. Bruno and J.J. Stachowicz 2013. *Marine community ecology and conservation*. Sinauer, Sunderland, MA

Bertness, M.D., B.R. Silliman, J.J. Stachowicz, and J.F. Bruno. 2013. A history of marine community ecology. In: Bertness, M.D., B.R. Silliman, J.F. Bruno and J.J. Stachowicz (eds.) *Marine community ecology and conservation*. Sinauer, Sunderland, MA

Bruno, J.F., C.D.G. Harley, and M.T. Burrows. 2013. Climate change and marine communities. In: Bertness, M.D., B.R. Silliman, J.F. Bruno and J.J. Stachowicz (eds.) *Marine community ecology and conservation*. Sinauer, Sunderland, MA

Duffy J.E., J.J. Stachowicz and J.F. Bruno. 2012. Multitrophic biodiversity and the responses of marine ecosystems to global change. In: Paterson et al. (eds.) *Marine biodiversity futures and ecosystem functioning: Frameworks, methodologies and integration*. Oxford University Press, Oxford

O'Connor, M.I. and J.F. Bruno. 2012. Marine Invertebrates. In: Brown J.H., R. Sibley and A. Kodric-Brown (eds.) *Metabolic Ecology: A Scaling Approach*. Wiley and Sons, London

Selig, E.R. *, C.D. Harvell, J.F. Bruno, B.L. Willis, C.A. Page, K.S. Casey and H. Sweatman. 2006. Analyzing the relationship between ocean temperature anomalies and coral disease outbreaks at broad spatial scales. In: J.T. Phinney, O. Hoegh-Guldberg, J. Kleypas, W. Skirving, and A. Strong (eds.) *Coral reefs and climate change: science and management*. American Geophysical Union, Washington, DC, Pages 111-128

Bruno, J.F., J.D. Fridley*, K. Bromberg† and M.D. Bertness. 2005. Insights into biotic interactions from studies of species invasions. In: Sax, D.F., S.D. Gaines, and J.J. Stachowicz (eds.) *Species Invasions: Insights into Ecology, Evolution and Biogeography*. Sinauer, Sunderland, MA, Pages 13-40

Bruno, J.F. and M.D. Bertness. 2001. Habitat modification and facilitation in benthic marine communities. In: Bertness M.D., M.E. Hay and S.D. Gaines (eds.) *Marine Community Ecology*. Sinauer, Sunderland, MA pages 201-218

SELECTED UNREFEREED ARTICLES AND ESSAYS

Bruno, J.F., A. Valdivia, S. Hackerott, C.E. Cox, S.J. Green, I.M. Côté, L. Akins, C.A. Layman, W.F. Precht. Testing the grouper biocontrol hypothesis: A response to Mumby et al. 2013. PeerJ PrePrints 1:e139v1 [link](#)

Bruno, J.F. 2013. A critique of Mumby et al. 2011 “Grouper as a natural biocontrol of invasive lionfish” PeerJ PrePrints 1:e141v2 [link](#)

Bruno, J.F. 2013. Coral reef baselines survey: what do we think is natural? FigShare [Link](#)

Bruno, J.F. 2012. The decay of the Great Barrier Reef calls for a reckoning. The Conversation [link](#)

Bruno, J.F. 2011. Fact checking the 60 Minutes segment on Gardens of the Queen. Huffington Post [link](#)

Bruno, J.F. 2011. Let us eat (other people's) fish. SeaMonser [link](#)

Bruno, J.F. 2010. The impact of climate change on the world's marine ecosystems. Huffington Post [link](#)

Bruno, J.F. 2010. Biodiversity loss continues unabated despite international efforts. Huffington Post [link](#)

Bruno, J.F. 2010. A down under journalistic wipeout in covering risks to the great barrier reef. Yale Forum on Climate Change and the Media link [link](#)

Bruno, J.F. and M. Sorensen. 2009. Warming is fact; denial is harmful. News & Observer op-ed [link](#)

Bruno, J.F. 2008. Origins of sea fan aspergillosis. ClimateShifts.org [link](#)

Bruno, J.F. 2008. Coral reefs and climate change. Encyclopedia of Earth/Earth Portal [link](#)

Bruno, J.F. 2007. Professor makes personal appeal for coral. msnbc.com [link](#)

Bruno, J.F. 2007. Indo-Pacific coral reefs are disappearing more rapidly than expected. Scitizen [link](#)

Bruno, J.F. 2007. Rising ocean temperature leads to coral disease outbreaks. Scitizen [link](#)

POST DOCS

Kathryn Boyer (2003-2004, now an Associate Professor at San Francisco State U); Nessa O'Connor (2005, now a Lecturer at Queens U Belfast); Zachary Long (2005-2007, now an Associate Professor at UNCW); Karl Castillo (2008-2012, now an Assistant Professor at UNC-CH in Marine Sciences); Emily Darling (2013-2015 now a research scientist at the Wildlife Conservation Society / the University of Toronto)

PAST GRADUATE STUDENTS

Elizabeth R. Selig, PhD in 2008, now a senior scientist at the Norwegian Institute for Water Research. Dissertation title: *Effects of changing temperatures on coral reef health: implications for management*

Sarah C. Lee, PhD in 2008, now an Assistant Professor at DePauw University. Dissertation title: *Open systems in community ecology: dispersal, diversity, and ecosystem properties*

Mary O'Connor, PhD in 2009, now an Associate Professor at the University of British Columbia, Vancouver. Dissertation title: *Linking physiological rates and community ecology: effects of ocean temperature on dispersal and species interactions*

Pamela Reynolds, PhD in 2011, now a post doc at UC Davis. Dissertation title: *The ecology of fear in estuarine communities: cascading effects of multiple predators*

Rachel Gittman, PhD in 2014, now a post doc at Northeastern University. Dissertation title: *The living shoreline approach as an alternative to shoreline hardening: implications for the ecology and ecosystem service delivery of salt marshes*

Courtney Cox, PhD in 2014, now a post doc at the Smithsonian Institution, Washington DC.
Dissertation title: *Evaluating strategies for restoring parrotfish populations in Belize*

Serena Hackerott, MS in 2014, now a visiting lecturer at the University of the Marshall Islands.
Thesis title: *The effect of invasive lionfish on reef fish community structure along the Mesoamerican Barrier Reef*

Abel Valdivia, PhD in 2014, now a research scientist with the Center for Biological Diversity.
Dissertation title: *The lost role of predatory reef fishes in Caribbean coral reefs*

Lindsey Carr, PhD in 2015. Dissertation title: *Effects of spatiotemporal temperature variation on benthic community dynamics in the Galápagos Islands*

CURRENT GRADUATE STUDENTS

Laura Mudge (PhD, Biology) and Catherine Alves (MS, CEE)

UNDERGRADUATE STUDENT RESEARCH (last 5 years)

Rachel Snider (current) *Can local management improve reef resilience to climate change?*

Allison McGuire (current) *Investigation of the impact of overfishing on marine biodiversity*

Caroline Jasperse (current) *Prevalence and implications of seafood mislabeling in global seafood markets*

Logan Gin (current) *Effectiveness of CUREs in achieving student learning outcomes*

Zac Locklear (current) *Changes in the community composition of corals across the Belizean Barrier Reef: 1996-2016*

Hope Gattis (North Carolina School of Science and Mathematics, current) *Effect of the recovery of the herbivorous sea urchin Diadema antillarum on macroalgae and coral recruitment*

Brittany Cooper (2016) *Frequency of mislabeling of North Carolina shrimp*

Carson Clough (2016) *Prevalence and consequences of seafood mislabeling in the United States and Canada*

Jenny Hughes (2015-2016) *Long term community dynamics of the Belizean Barrier Reef*

Sophia Schermerhorn (2015) *Spatial variation in herbivory among Cuban reefs*

Amanda DelVecchia, Ovik Banerjee, and Juan de Dios Morales (2011-2012) *Organic carbon inventories in natural and restored Ecuadorian mangrove forests* [PeerJ 2:e388](#)

Kim McKeever and Cort Smith (2012) *A quantitative analysis of shark and billfish tournaments in the United States*

Stacy Zhang and Kelly Speare (2013) *Relationships between richness and stability in coral reef communities* [PeerJ 2:e308](#)

Serena Hackerott (2012) *Native predators do not influence invasion success of Pacific lionfish on Caribbean reefs.* [PLoS One 8\(7\): e68259](#)

Lauren Pryzant (2012) *What to do when the oceans rise.* [PLoS Biology 10\(9\): e1001387](#)

Phillip Lowe (2011) *Empirical models of transitions between coral reef states: effects of regions, marine protected areas, and environmental change scenarios.* [PLoS One 6\(11\) e26339](#)

EXTERNAL FUNDING

Waite Foundation: Zombie reefs of the Caribbean (PI, 2015) \$10,000

Christopher Reynolds Foundation: Cuban-American coral reef management (PI, 2015) \$3,000

National Science Foundation: Geomorphology

The role of ecomorphodynamic feedbacks in barrier island response to climate change (2013-2016) 478,177 (co-PI with Laura Moore, UNC Geology)

North Carolina Division of Marine Fisheries

Investigating salinity fluxes on natural and restored shell bottom habitat to better predict disturbance effects driven by climate change (2013-2015) \$225,963 (co-PI with J. Fodrie)

Rufford Foundation

Effectiveness of new fisheries regulations in Belize on restoring grazer populations and coral reef resilience (2010-2013) \$60,000 (co-PI with C. Cox)

National Science Foundation: Division of Integrative Organismal Systems

Collaborative Research: Assessing the effect of environmental stressors on invertebrate innate immunity using a coral pathosystem (2010-2013) \$683,861 (co-PI with L. Mydlarz and E. Weil)

CSIRO Distinguished Visiting Scientist Fellowship

Forecasting the effects of climate change on coral reefs ecosystems (2010) \$15,000

North Carolina Division of Coastal Management CRFL grant program

Fisheries habitat impacts of marsh sills (living shorelines) as a stabilization/restoration alternative to bulkheads (2010-2011) \$212,547 (co-PI with C. Peterson and R. Gittman)

The World Bank: Environment Program

Mapping the vulnerability of coastal marine ecosystems to anthropogenic climate change (PI, 2009) \$80,000

National Science Foundation: Biological Oceanography Panel

Lionfish invasion of the Mesoamerican reef: community invasibility and the evolutionary response of prey avoidance behavior to a novel predator (PI, 2009-2010) \$133,052

National Geographic Society

The efficacy of marine reserves on the Mesoamerican Reef in conserving reef-building corals (PI, 2008-2009) \$13,378

National Science Foundation: Biological Oceanography Panel

Cascading effects of predator diversity in a marine food web (PI, 2006-2009) \$349,927

NOAA Coral Reef Conservation Program

Improving the effectiveness of coral MPAs through the analysis and synthesis of global coral thermal stress and decline (2006-2008) \$60,000 (PI, with K. Casey)

North Carolina Sea Grant

Linking biodiversity to the survival of native oyster beds and their associated faunal assemblages (co-PI with Nessa O'Connor, 2005) \$4,645

National Science Foundation: Biological Oceanography Panel

Biodiversity and ecosystem functioning in plant-grazer systems: Experimental tests in a marine benthic community (2003-2006) \$470,000 (PI, with J.E. Duffy)

National Science Foundation: Ecology of Infectious Disease Panel

Origins and spread of the *Aspergillus*-Gorgonian coral epizootic: Role of climate and environmental facilitators (2003-2006) \$1,728,000 (co-PI with C.D. Harvell, S. Ellner, and G. Smith)

PADI Foundation

Environmental control and demographic effects of coral disease epidemics (PI, 2002-2003) \$2,400

National Science Foundation: Population Biology Panel

Metapopulation dynamics of the New England cobble beach plant community (PI, 2001-2004) \$138,000

NOAA, Sanctuaries and Reserves Division, Fellowship Award

The ecology of New England cobble beach plant communities: An investigation of the factors dictating community distribution (1998-2000) \$50,000

National Science Foundation Dissertation Improvement Award

Mechanisms of community facilitation and metapopulation dynamics of New England cobble beach plants (1998-2000) \$4,500

PROFESSIONAL SERVICE TO THE DISCIPLINE

Editor for Ecology, Ecological Monographs (since 2005)

Founding editor for [PeerJ](#)

Ad-hoc Editor for PLoS Biology, Trends in Ecology and Evolution, and Current Biology

Co-creator and editor of [SeaMonster](#) (a blog about ocean science)

Outreach fellow for Polar Bears International (November 2011)

Board member, [Climate Law Institute](#) at the Center for Biological Diversity (since 2011)

Co-developer of the Coral reef Temperature Anomaly Database, AKA [CorTAD](#)

Coordinator and speaker, special session at the 2011 National Council for Science and the Environment “Our Changing Oceans” meeting titled “Impacts of Climate Change on Ocean Ecosystems in the 21st century”

NOAA Ocean Acidification panel (March 2012)

Reviewer for NSF, NOAA, Ecology Letters, Ecology, Canadian Journal of Botany, Marine Ecology Progress Series, Journal of Experimental Marine Biology and Ecology, Oikos, Oecologia, Trends in Ecology and Evolution, Diversity and Distributions, Marine Biology, Coral Reefs, PNAS, Science, and Nature

Editor for PLoS One (2009-2010)

Member of the Three Seas Marine Biology Program’s Advisory Board (2003-2007)

Director and Lead Instructor of Cornell University’s Tropical Marine Science Program, Akumal, Mexico (2000-2002)

National Science Foundation Panel (2005, 2013, 2016)

Participant in NCEAS working group on “Insights from exotic species” (2004-2007)

Leader of NCEAS working group on “Community Saturation” (September 2007)

Participant in NCEAS working group on “Marine Climate Change Impacts” (2009-2012)

SELECTED CONFERENCE AND SEMINAR ABSTRACT TITLES

*invited talk, **invited by grad students

****Bruno, J.F.** Drivers of coral reef decline: what are the management options?
Pennsylvania State University, November 2016

***Bruno, J.F.** The human impact of climate change on the oceans. Plenary Speaker,
World View Community College Symposium, November 2016

***Bruno, J.F.** Exploring the role of temperature in the ocean through metabolic scaling.
University of Mexico (UNAM), Puerto Morelos Marine Laboratory, Mexico, May 2016

***Bruno, J.F.** The human impact of climate change on the oceans. Plenary Speaker,
World View Symposium, November 2015

****Bruno, J.F.** Exploring the role of temperature in the ocean through metabolic scaling.
North Carolina State University, September 2015

****Bruno, J.F.** Exploring the role of temperature in the ocean through metabolic scaling.
Duke University Marine Lab, Graduate Students Research Symposium Plenary Speaker,
April 2015

Bruno, J.F. C.E. Cox, A. Valdivia, C. Fieseler. How effective are Caribbean MPAs?
International Marine Conservation Congress Meeting, Glasgow, Scotland, August 2014

***Bruno, J.F.** Patterns and drivers of change on Caribbean reefs. University of Havana,
Department of Oceanography, Cuba, June 2014

***Bruno, J.F.** The role of temperature in structuring marine communities. The University of Pisa,
Italy, May 2014

****Bruno, J.F.** Tracking changes in biodiversity is really hard: a coral reef example. Florida
International University, April 2014

****Bruno, J.F.** What really works in marine conservation. Florida State University. February,
2014

***Bruno, J.F.** Coral Reef Macroecology. The University of California at Santa Barbara. March
2013

****Bruno, J.F.** The use and misuse of ecological theory in coral reef management. Western
Society of Naturalists (WSN) meeting, Student Symposium Invited Speaker, November 2012

***Bruno, J.F.** What is the role of scientists in marine conservation? Duke University Marine
Laboratory, April 2012

Bruno, J.F. Coral reef MPAs; what are they really good for? Benthic Ecology Meeting
March 2012

***Bruno, J.F.** State of the Oceans 2012. Great decisions lecture series, UNC Chapel Hill, March 2012

****Bruno, J.F.** Forget Columbus: Changes in Caribbean coral reefs since 1980, VIMS, February 2012

***Bruno, J.F.** Threats to marine ecosystems in the Inter-American seas. Plenary Speaker, Inter-American Seas Symposium, Florida State University, December 2011

****Bruno, J.F.** Changes in Caribbean reef communities: patterns, causes and mitigation. Plenary speaker for the Student Research Colloquium, College of Charleston, September 2011, Charleston SC

Bruno, J.F. Impacts of climate change on ocean ecosystems in the 21st century. National Council for Science and the Environment Annual Meeting, January 2011, Washington DC

***Bruno, J.F.** Impacts of climate change on ocean ecosystems. RTI International, October 2010, Durham, NC

***Bruno, J.F.** The future of coral reefs. CSIRO Climate Change Flagship, May 2010, Brisbane Australia

****Bruno, J.F.** Florida's coral reefs: threats, decline, management, and signs of hope. Newell Seminar Speaker, FSU and FSU Coastal and Marine Laboratory, February 2009, Tallahassee, FL and St. Teresa, FL

***Bruno, J.F.** Climate change and coral reef resilience: are we expecting too much from marine reserves? Annual graduate student seminar speaker FIU, February 2009, Miami FL

***Bruno, J.F.** Linking global change and coral epizootics. Sigma Xi, December 2008, Durham, NC

***Bruno, J.F.** Effects of fishing and macroalgae on coral disease dynamics. International Coral Reef Symposium, July 2008, Fort Lauderdale, Florida

***Bruno, J.F.** Climate change and coral reef resilience: are we expecting too much from marine reserves? Invited Plenary Speaker: Annual Meeting of the Ecological Society of Australia, 2008, Sydney Australia

***Bruno, J.F.** Environmental drivers of coral epizootics and global patterns of coral reef decline. Invited seminar speaker UCLA, November 2007, Los Angeles CA

***Bruno, J.F.** Global coral decline: regional baselines, timing, and variation. 2nd Annual Coral Reef Conservation and Management Conference, November 2006, Miami, FL

***Bruno, J.F.** and S.C. Lee. The role of species saturation and propagule limitation in structuring benthic marine communities. Annual Meeting of the Ecological Society of America, August 2006, Memphis, TN

Long, Z.T., **J.F. Bruno**, and J.E. Duffy. Biodiversity mediates productivity through different mechanisms at adjacent trophic levels. Annual Meeting of the Ecological Society of America, August 2006, Memphis, TN

***Bruno, J.F.** What are the cascading effects of predator diversity in marine food webs? International Temperate Reef Symposium, June 2006, Santa Barbara, CA

O'Connor, N.E., J.H. Grabowski and **J.F. Bruno**. Species loss and ecosystem functioning: Effects of simulated predator extinctions on an ecosystem engineer. International Temperate Reef Symposium, June 2006, Santa Barbara, CA

Casey, K.S., E.R. Selig, and **J.F. Bruno**. Use of satellite-based pathfinder sea surface temperatures for understanding coral disease dynamics. ASLO, July 2006, Victoria, British Columbia, Canada

*Fridley, J, **J.F. Bruno** and B. Brown. Scale-dependent invasion patterns and null models of community assembly. Annual Meeting of the Ecological Society of America, August 2005, Montreal, Canada

***Bruno, J.F.** Biodiversity in marine ecosystems. Duke University Marine Laboratory, April 2005, Beaufort, NC

***Bruno, J.F.**, J.E. Duffy and Z. Long. Decomposing the net effects of plant diversity in marine ecosystems: selection versus complementarity. Benthic Ecology Meeting, March 2005, Williamsburg, VA

O'Connor, M.I. and **J.F. Bruno**. Cascading predator diversity effects dominated by the inclusion of omnivores. Benthic Ecology Meeting, March 2005, Williamsburg, VA

***Bruno, J.F.** Macroecology of the cobble beach plant community. Duke University, March 2005

Bruno, J.F., S.C. Lee, J. Kertesz, R. Carpenter, K. Boyer, J.E. Duffy. Is algal species identity or diversity related to primary production in benthic marine communities? Annual Meeting of the Ecological Society of America, August 2004, Portland, OR

Bruno, J.F., S.C. Lee, J. Kertesz, R. Carpenter, K. Boyer, J.E. Duffy. Biodiversity and ecosystem functioning in benthic marine communities. Benthic Ecology Meeting, March 2004, Mobile AL

***Bruno, J.F.**, K. Boyer, S.C. Lee, J.E. Duffy. Biodiversity and ecosystem functioning in multi-trophic systems: experimental tests in a benthic marine community. Annual meeting of the American Society of Limnology and Oceanography, February 2004, Honolulu, HI

***Bruno, J.F.** Macroecology of the cobble beach plant community. Appalachian State University, November 2003, Boone, NC