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Education

Ph.D., Anthropology, Columbia University, 1999
M.A., Marine Affairs, University of Miami, 1992
B.A., Literature, University of California, Santa Barbara, 1989

Research Interests

Kenneth Broad, an ecological anthropologist, is interested in studying the interaction between humans and the environment. In the Bahamas Biocomplexity Project, he is focusing on identifying the potential consequences of marine protected areas (MPAs) on different groups, and in anticipating the reaction of these groups to restrictions on their traditional activities (including small scale, recreational and commercial fishing). Work includes ethnographic research at the settlement level, where fieldworkers have been living for periods of 1-3 months in order to gain a more detailed understanding of how local people perceive, participate, and respond to marine resource regulations, and how trends in settlement development (e.g., increased tourism, infrastructure changes, etc.) may influence the degree of acceptance of new restrictions. This qualitative fieldwork will complement a wider scale survey, participatory mapping, and focus group work.

Selected Publications

Broad, K. and J.N. Sanchirico. 2008. Local perspectives on marine reserve creation in the Bahamas. *Ocean & Coastal Management* 51(2008): 763-771.

Harborne, A.R., P.J. Mumby, C.V. Kappel, C.P. Dahlgren, F. Micheli, K.E. Holmes, J.N. Sanchirico, K. Broad, I.A. Elliott, and D.R. Brumbaugh. 2008. Reserve effects and natural variation in coral reef communities. *Journal of Applied Ecology* 45: 1010-1018.

Mumby P.J., K. Broad, D.R. Brumbaugh, C.P. Dahlgren, A.R. Harborne, A. Hastings, K.E.

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Mumby, P.J., F. Micheli, C.P. Dahlgren, S.Y. Litvin, A.B. Gill, D.R. Brumbaugh, K. Broad, J.N. Sanchirico, C.V. Kappel, A.R. Harborne, and K.E. Holmes. 2006. Marine parks need sharks? Response to letter. *Science* 312: 527-528.

Orlove, B., K. Broad and A. Petty. 2004. Factors that Influence the use of climate forecasts: Evidence from the 1997-98 El Niño event in Peru. *Bulletin of the American Meteorological Society* 85(11): 1735–1743.

Bakun, A. and K. Broad. 2003. Environmental 'loopholes' and fish population dynamics: comparative pattern recognition with focus on El Niño effects in the Pacific. *Fisheries Oceanography* 12(4/5): 458-473.

Sanchirico, J.N., R. Stoffle, K. Broad, and L. Talaue-McManus. 2003. Modeling marine protected areas. Letter. *Science* 301: 47-48.

Broad, K., A.P. Pfaff, and M.H. Glantz. 2002. Effective & equitable dissemination of seasonal-to interannual climate forecasts: Policy Implications from the Peruvian fishery during El Niño 1997-98. *Climatic Change* 54(4): 415-438.

Broad, K. 2003. Biological and societal impacts of climate variability: An example from Peruvian fisheries. In: T. Potter and B. Coleman (eds.), *Handbook of Weather, Climate and Water: Chemistry, Impacts, and Applications*. New York: John Wiley & Sons: 817-832.

Lutz, S., K. Broad, L Talaue-Mcmanus, J. Sanchirico, R. Stoffle. 2002. Human dimensions of marine reserve policy: Applications in Bimini. *Bahamas Journal of Science* 5(2):50-57.

Agrawala, S., K. Broad, and D.H. Guston. 2001. Integrating climate forecasts and societal decision making: Challenges to an emergent boundary organization. *Science, Technology, and Human Values* 26(4): 454-477.

Broad, K. and S. Agrawala. 2000. The Ethiopia food crisis: Uses and limits of climate forecasts. *Science* 289: 1693-1694.

Pfaff, A., K. Broad, and M.G. Glantz. 1999. Who benefits from climate forecasts? *Nature* 397: 645-646.

Broad, K., and B. Feinberg. 1995. Perceptions of ganja and cocaine in urban Jamaica. *Journal of Psychoactive Drugs* 27: 261-277.

Daniel R. Brumbaugh

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Education

Ph.D., Zoology, University of Washington, 1996
B.S., Biological Sciences, Stanford University, 1987
A.B., Art History, Stanford University, 1987

Research Interests

Dan Brumbaugh, a marine conservation scientist with a background primarily in the ecology and evolution of marine invertebrates, is the Principal Investigator and Coordinator for the Bahamas Biocomplexity Project. In addition to overseeing the general management of the project, he is involved in various degrees in many aspects of the research, though especially in the Habitat and Connectivity Working Groups. He also works to integrate the diverse research activities of the BBP's working groups with outreach and education in The Bahamas, the wider Caribbean, and the U.S.

Selected Publications

Naro-Maciel, E., B. Reid, K.E. Holmes, D.R. Brumbaugh, M. Martin, and R. DeSalle. 2011. Mitochondrial DNA sequence variation in spiny lobsters: Population expansion, panmixia, and divergence. *Marine Biology* 158(9): 2027-2041.

Mumby, P.J., A.R. Harborne, and D.R. Brumbaugh. 2011. Grouper as a natural biocontrol of invasive lionfish. *PLoS ONE* 6(6): e21510.

Kininmonth, S., M. Beger, M. Bode, E. Peterson, V.M. Adams, D. Dorfman, D.R. Brumbaugh, and H.P. Possingham. 2011. Dispersal connectivity and reserve selection for marine

conservation. *Ecological Modelling* 222(7): 1272-1282.

McCauley, D.J., F. Micheli, H.S. Young, D.P. Tittensor, D.R. Brumbaugh, E.M.P. Madin, K.E. Holmes, J.E. Smith, H.K. Lotze, P.A. DeSalles, S.N. Arnold, and B. Worm. 2010. Acute effects of removing large fish from a near-pristine coral reef. *Marine Biology* 157(12): 2739-2750.

Beger, M., H.S. Grantham, R.L. Pressey, K.A. Wilson, E.L. Peterson, D. Dorfman, P.J. Mumby, R. Lourival, D.R. Brumbaugh, and H.P. Possingham. 2010. Conservation planning for connectivity across marine, freshwater, and terrestrial realms. Biological Conservation 143(3): 565-575.

Botsford, L.W., D.R. Brumbaugh, C. Grimes, J.B. Kellner, J. Largier, M.R. O'Farrell, S. Ralston, E. Soulanille and V. Wespestad. 2009. Connectivity, sustainability, and yield: bridging the gap between conventional fisheries management and marine protected areas. *Reviews in Fish Biology and Fisheries*. 19: 69-95.

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Phillips, S.J., and D.R. Brumbaugh. 2008. Marine reserves and local fisheries: An interactive simulation, version 1.1. American Museum of Natural History, Center for Biodiversity and Conservation, New York, NY. http://ncep.amnh.org/marine_simulation/

Brumbaugh, D.R. 2008. Future directions in MPA site selection. *MPA News* 10(2): 4.

Harborne A.R., P.J. Mumby, C.V. Kappel, C.P. Dahlgren, F. Micheli, K.E. Holmes, and D.R. Brumbaugh. 2008. Tropical coastal habitats as surrogates of fish community structure, grazing, and fisheries value. *Ecological Applications* 18: 1689–1701.

Mumby P.J., K. Broad, D.R. Brumbaugh, C.P. Dahlgren, A.R. Harborne, A. Hastings, K.E. Holmes, C.V. Kappel, F. Micheli, and J.N. Sanchirico. 2008. Coral reef habitats as surrogates of species, ecological functions and ecosystem services. *Conservation Biology* 22(4): 941-951.

Harborne, A.R., P.J. Mumby, C.V. Kappel, C.P. Dahlgren, F. Micheli, K.E. Holmes, J.N. Sanchirico, K. Broad, I.A. Elliott, and D.R. Brumbaugh. 2008. Reserve effects and natural variation in coral reef communities. *Journal of Applied Ecology* 45: 1010-1018.

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Granek, E.F., D.R. Brumbaugh, S.A. Heppell, S.S. Heppell, D. Secord. 2005. A blueprint for our oceans: Implications of two national commission reports for conservation practitioners. *Conservation Biology* 19(4): 1008-1018.

Semmens, B.X., D.R. Brumbaugh, and J.A. Drew. 2005. Interpreting space use and behavior of blue tang, *Acanthurus coeruleus*, in the context of habitat, density, and intra-specific interactions. *Environmental Biology of Fishes* 74(1): 99-107.

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Education

Ph.D., Mathematics, University of Utah, 1981
B.Sc., Mathematics, Furman University, 1976

Research Interests

Stephen Cantrell, an applied mathematician/mathematical ecologist, is interested in the impact of spatial heterogeneity on population dynamics and the structure of ecological communities. He serves as part of the modeling group for The Bahamas Biocomplexity Project. The group is incorporating socio-economic aspects of fisheries into dynamical systems models for focal species in marine protected areas.

Selected Publications

Olson, D., C. Cosner, S. Cantrell, A. Hastings. 2005. Persistence of fish populations in time and space as a key to sustainable fisheries. *Bulletin of Marine Science* 76(2): 213-231.

Cantrell, R.S. and C. Cosner. 2003. Spatial Ecology via Reaction-Diffusion Equations. Series In: *Mathematical and Computational Biology*, John Wiley and Sons, Chichester, Sussex UK.

Cantrell, R.S. and C. Cosner. 2001. Effects of domain size on the persistence of populations in a diffusive food chain model with DeAngelis-Beddington functional response. *Natural Resource Modeling* 14: 335-367.

Cantrell, R.S. and C. Cosner. 1999. Diffusion models for population dynamics incorporating individual behavior at boundaries. *Theoretical Population Biology* 55: 189-207.

Fagan, W.F., R.S. Cantrell, and C. Cosner. 1999. How habitat edges change species interactions: a synthesis of data and theory. *The American Naturalist* 153: 165-182.

Cantrell, R.S., C. Cosner, and W.F. Fagan. 1998. Competitive reversals inside ecological preserves: the role of external habitat degradation. *J. Mathematical Biology* 37: 491-533.

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Education

Masters in Marine Management, Dalhousie University, Canada, 2009
B.S. Biology with honors, University of The West Indies, Barbados, 1994
A.A. General Science, College of The Bahamas, 1989

Research Interests

Jacklyn Chisholm's research interest with the Bahamas Biocomplexity Project lies in exploring the health and diversity of marine ecosystems of The Bahamas and communicating that knowledge to her students at the College of The Bahamas. Jacklyn has been involved in several projects in The Bahamas and the Caribbean including those dealing with monitoring and managing Caribbean marine ecosystems, promoting sustainable development through community participation, sustainability of tropical marine ecosystems and promoting sustainable tourism in the Bahamas. She has also served at Dalhousie University engaging in environmental education in support of sustainable development and the promotion of sustainable lifestyle.

Selected Publications

Chisholm, J., M. Jackson, L. Johnson, P. Johnson, K. Reddy, D. Samuels, and J. Vanderpool. 2005. The Bahamas State of The Environment Report, GEO Bahamas 2005. BEST Commission, UNEP.

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Education

Ph.D., Mathematics, University of California, Berkeley, 1977
M.A., Mathematics, University of California, Berkeley, 1975
B.A., Mathematics, University of California, San Diego, 1973

Research Interests

Chris Cosner, an applied mathematician, is interested in studying mathematical models for the the ways that organisms interact with each other, humans, and the environment, especially in their utilization of space. In the Bahamas Biocomplexity Project, he intends to focus on formulating and analyzing mathematical models for marine protected areas (MPAs). The models will incorporate population dynamics, the possible spatial arrangement of the MPAs, transport of organisms into, out of, and among the MPAs, and the economic benefits and effects on biological populations of fishing. Work includes collaboration with other theoreticians in the Project on developing and using mathematical models that can help compare the different costs and benefits, both ecological and economic, that can be expected to arise from different decisions about where MPAs are located and how they are regulated.

Selected Publications

Olson, D., C. Cosner, S. Cantrell, A. Hastings. 2005. Persistence of fish populations in time and space as a key to sustainable fisheries. *Bulletin of Marine Science* 76(2): 213-231.

Cosner, C. and R.S. Cantrell. 2002. Conditional persistence in logistic models via nonlinear diffusion. *Proceedings of the Royal Society of Edinburgh* 132A: 267-281.

Cosner, C. and R.S. Cantrell. 2001. Effects of domain size on the persistence of populations in a diffusive food chain model with DeAngelis-Beddington functional response. *Natural Resource Modeling* 14: 335-367.

Cosner, C. and R.S. Cantrell. 2001. On the dynamics of predator-prey models with the Beddinton-DeAngelis functional response. *Journal of Mathematical Analysis and Applications* 257: 206-222.

Cosner, C., D.L. DeAngelis, J.S. Ault, and D.B. Olson. 1999. Effects of spatial grouping on the functional response of predators. *Theoretical Population Biology* 56: 65-75.

W.F. Fagan, R.S. Cantrell, and C. Cosner. 1999. How habitat edges change species interactions: a synthesis of data and theory. *The American Naturalist* 153: 165-182.

Cosner, C., R.S. Cantrell, and W.F. Fagan. 1998. Competitive reversals inside ecological preserves: the role of external habitat degradation. *J. Mathematical Biology* 37: 491-533.

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Research Interests

Bob Cowen's research centers on the ecology and life history of fishes, in particular their early stages. He has worked extensively on the biological and physical oceanographic processes affecting the retention and transport of larval fishes in terms of examining larval dynamics, population replenishment, and population connectivity.

Education

Ph.D., Oceanography, Scripps Institution of Oceanography, UCSD, 1985M.S., Marine Biology, Moss Landing Marine Laboratories, California State University, Hayward, 1979B.A., Biology, University of California, Santa Barbara, 1975

Selected Publications

Paris C.B., L.M. Cherubin, A. Srinivasan, and R.K. Cowen. 2007. Surfing, spinning, or diving from reef to reef: How does it change population connectivity? *Marine Ecology Progress Series* 347: 285-300.

Cowen, R.K., C.B. Paris, and A. Srinivasan. 2006. Scaling Connectivity in Marine Populations. *Science* 311: 522-527.

Steneck, R., R.K. Cowen, C.B. Paris, and A. Srinivasan. 2006. Connectivity in Marine Protected Areas, Response to letter. *Science* 313: 44-45.

Cowen, R.K. 2002. Larval dispersal and retention and consequences for population connectivity. In: P.F. Sale (ed.), *Ecology of Coral Reef fishes: Recent Advances*. Academic Press: 149-170.

Paris, C.B., R.K. Cowen, K.M.M. Lwiza, D.-P. Wang, and D.B. Olson. 2002. Multivariate

objective analysis of the coastal circulation of Barbados, West Indies: Implication for larval transport. *Deep-Sea Research I* 49: 1363-1386.

Sponaugle, Su, R.K. Cowen, A. Shanks, S.G. Morgan, J.M. Leis, J. Pineda, G.W. Boehlert, M.J. Kingsford, K.C. Lindeman, C. Grimes, and J.L. Munro. 2002. Predicting self-recruitment in marine populations: Biophysical correlates and mechanisms. *Bulletin of Marine Science* 70(1) Suppl.: 341-375.

Warner, R.R. and R.K. Cowen. 2002. Local retention of production in marine populations: Evidence, mechanisms, and consequences. *Bulletin of Marine Science* 70(1) Suppl.: 245-249.

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Cowen, R.K. and S. Sponaugle. 1997. Relationship between early life history traits and recruitment in coral reef fishes. In: R.C. Chambers and E. Trippel (eds.), *Early life history and recruitment in fish populations*. Chapman and Hall, 423-449.

Schultz, E.T. and R.K. Cowen. 1994. The recruitment of coral-reef fishes to Bermuda: Local retention or long-distance transport. *Marine Ecology Progress Series* 109:15-28.

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Education

Ph.D., Marine Science, Biostatistics, North Carolina State University, 1998
M.Sc., Marine Biology, University of North Carolina at Wilmington, 1994
B.A., International Relations, College of William and Mary, 1991

Research Interests

Craig Dahlgren, a marine ecologist, is primarily interested in studying populations of important fishery species in the Caribbean and the community ecology of coral reef and lagoonal habitats of the Caribbean. Specifically, much of his research focuses on factors that influence populations of Nassau grouper, Caribbean spiny lobster, and other important fishery species, particularly their recruitment, and use of various coral reef and off-reef nursery habitats. He is interested in the design and effects of marine protected areas, especially no-take marine reserves, and how protected areas can be used to sustain fisheries and protect ecosystem function. Craig has been conducting research in The Bahamas and elsewhere in the Caribbean for over a decade.

Selected Publications

Harborne A.R., P.J. Mumby, C.V. Kappel, C.P. Dahlgren, F. Micheli, K.E. Holmes, and D.R. Brumbaugh. 2008. Tropical coastal habitats as surrogates of fish community structure, grazing, and fisheries value. *Ecological Applications* 18: 1689–1701.

Mumby P.J., K. Broad, D.R. Brumbaugh, C.P. Dahlgren, A.R. Harborne, A. Hastings, K.E. Holmes, C.V. Kappel, F. Micheli, and J.N. Sanchirico. 2008. Coral reef habitats as surrogates of species, ecological functions and ecosystem services. *Conservation Biology* 22(4): 941-951.

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Dahlgren, C.P., G.T. Kellison, A.J. Adams, B.M. Gillanders, M.S. Kendall, C.A. Layman, J.A. Ley, I. Nagelkerken, and J.E. Serafy. 2006. Marine nurseries and effective juvenile habitats: concepts and applications. *Marine Ecology Progress Series* 312: 291-295.

Layman, C.A., Dahlgren, C.P., G.T. Kellison, A.J. Adams, B.M Gillanders, M.S. Kendall, J.A. Ley, I. Nagelkerken, and J.E. Serafy. 2006. Marine nurseries and effective juvenile habitats. Reply comment. *Marine Ecology Progress Series* 318: 307-308.

Mumby, P.J., C.P. Dahlgren, A.R. Harborne, C.V. Kappel, F. Micheli, D.R. Brumbaugh, K.E. Holmes, J.M. Mendes, K. Broad, J.N. Sanchirico, K. Buch, S. Box, R.W. Stoffle, and A.B. Gill. 2006. Fishing, trophic cascades, and the process of grazing on coral reefs. *Science* 311: 98-101.

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Harborne, A.R., P.J. Mumby, F. Micheli, C.T. Perry, C.P. Dahlgren, K.E. Holmes, and D.R. Brumbaugh. 2006. The functional value of Caribbean coral reef, seagrass and mangrove habitats to ecosystem processes. *Advances in Marine Biology* 50: 57-190.

Dahlgren, C.P., and J. Marr. 2004. Back reef systems: important but overlooked components of tropical marine ecosystems. *Bulletin of Marine Science* 75: 145-152.

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Dahlgren, C.P. and D.B. Eggleston. 2000. Ecological processes underlying ontogenetic habitat shifts in a coral reef fish. *Ecology* 81(8): 2227-2240.

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Dahlgren, C.P. 1999. The biology, ecology and conservation of Nassau grouper, *Epinephelus striatus*, in the Bahamas. *Bahamas Journal of Science* 7: 6-12.

Dahlgren, C.P. 1999. Replenishing Marine Populations. *Science* 284: 49.

Stoner, A.W., M.A. Hixon, and C.P. Dahlgren. 1999. Scientific review of the marine reserve network proposed for the Commonwealth of the Bahamas by the Bahamas Department of Fisheries. *Report to the Bahamas Ministry of Agriculture and Fisheries*, 59 pp.

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Education

Ph.D., Biology, Washington University, 1984
B.A., Biology, University of Chicago, 1976

Research Interests

Rob DeSalle works on the genetics and phylogenetics in a wide range of organisms and contexts. While conservation genetics and insect systematics have been past interests, much of his lab is now focused on bacterial genomics and genomic bioinformatics. Within the Bahamas Biocomplexity Project, Rob is working with Kate Holmes, Genia Naro, and Dan Brumbaugh on examining the connectivity of spiny lobster, land crabs, and bonefish throughout the islands of The Bahamas.

Selected Publications

Roudier F, G. Schindelman, R. DeSalle, and P.N. Benfey. 2002. The COBRA family of putative GPI-anchored proteins in Arabidopsis. A new fellowship in expansion. *Plant Physiology* 130: 538-548.

DeSalle, R., G. Giribet, and W. Wheeler, 2002. Methods and Tools in Biosciences and Medicine: Techniques in Molecular Evolution and Systematics. Birkhauser-Verlag, New York.

Kao H.T., B. Porton, S. Hilfiker, G. Stefani, V.A. Pieribone, R. DeSalle, and P. Greengard. 1999. Molecular evolution of the synapsin gene family. *Journal of Experimental Zoology* 285(4): 360-377.

Planet, P.J., R. DeSalle, M. Siddall, T. Bael, I.N. Sarkar, and S.E. Stanley. 2001. Systematic analysis of DNA microarray data: ordering and interpreting patterns of gene expression. *Genome Research* 11: 1149-1155.

Lacombe B., D. Becker, R. Hedrich, R. DeSalle, M. Hollmann, J.M. Kwak, J.I. Schroeder, N. Le Novere, H.G. Nam, E.P. Spalding, M. Tester, F.J. Turano, J. Chiu, and G. Coruzzi. 2001. The identity of plant glutamate receptors. *Science* 292: 1486-1487.

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Education

Ph.D., Mathematical Ecology, University of York, UK, 2006
M.Res., Mathematics in the Living Environment, University of York, UK, 2002
B.Sc., Mathematics, University of York, UK, 2001

Research Interests

Helen Edwards is an ecological modeller whose primary interest is in the use of simple mathematical models and computer simulations for marine conservation. In particular, her research focuses on understanding the spatial dynamics of interacting populations, the development of tools for conservation planning, and exploring how incorporating differing levels of complexity can influence model outcomes. Helen is currently developing a new reserve-selection tool with the aim of integrating biodiversity and socio-economic perspectives into reserve-system design. Her work focuses on improving our understanding of how incorporating more information into the reserve-selection process can influence the optimal locations for reserves. The reserve-selection tool is currently being applied to select networks of marine reserves for the Belize Barrier Reef and in the future will be applied to the Bahamian archipelago as part of the Bahamas Biocomplexity Project. Helen is collaborating with members of the Habitat and Modelling Working Groups to model the interactions between corals, algae, groupers, snappers and parrotfish. These models will provide insight into how factors such as fishing pressure and the extent of mangroves may influence the resilience of coral reefs.

Selected Publications

Edwards, H.J., C. Dytham, J.W. Pitchford, and D. Righton. 2007. Prey selection, vertical migrations and the impacts of fishing upon the population dynamics of a predator-prey system. *Bulletin of Mathematical Biology*. In press.

Mumby, P.J., A. Hastings, and H.J. Edwards. 2007. Thresholds and the resilience of Caribbean coral reefs. *Nature* 450: 98-101.

Heather Galindo

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Education

Ph.D. Biological Sciences, Stanford University, 2008
B.S. Oceanography, University of Washington, 2000
B.A. English, University of Washington, 2000

Research Interests

Heather Galindo's research focused on developing new ways to use population genetics to measure the biological connections via larval dispersal among marine populations. By applying genetic tools in an ecological framework, it is possible to gain information that is useful for stakeholders, policy-makers, and scientists. As part of the Bahamas Biocomplexity Project, Heather collaborated with her Ph.D. advisor Stephen Palumbi and Don Olson to use information about ocean currents to predict genetic patterns in Caribbean corals. The coupling of oceanographic and population genetic simulation models allows for the prediction of broad-scale genetic patterns that can be easily compared against empirical datasets.

Selected Publications

Galindo, H.M., A.S. Pfeiffer-Herbert, M.A. McManus, Y. Chao, F. Chai, and S.R. Palumbi. 2010. Seascape genetics along a steep cline: Using genetic patterns to test predictions of marine larval dispersal. *Molecular Ecology* 19(17) SI: 3692-3707.

Galindo, H.M., D. B. Olson, and S.R. Palumbi. 2006. Seascape genetics: A coupled oceanographic-genetic model predicts population structure of Caribbean corals. *Current Biology* 16: 1622-1626.

Armbrust, E. V. and H. M. Galindo. 2001. Rapid evolution of a sexual reproduction gene in centric diatoms of the genus *Thalassiosira*. *Applied and Environmental Microbiology* 67: 3501-3513.

Felimon C. Gayanilo

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Education

M.Sc., Computer Science, University of the Philippines, Los Baños, 1993
B.Sc., Agricultural Engineering, University of the Philippines, Los Baños, 1982

Research Interests

Since 1982, Felimon Gayanilo (usually called Nonong) has designed and developed several scientific software packages, including the compendium of over 100 analytical models for tropical and multi-species fisheries stock assessment applications; these are now used by many learning and research institutions and organizations for fisheries assessment and management. Nonong has also developed Geographic Information Systems (GIS)-based tools for coastal management applications. These includes among others, the Data Navigator for South Florida (*DNav: South Florida*) and the *Bahamas Online Digital Map Atlas* as part of the Bahamas Biocomplexity Project. Nonong is the primary architect and developer of the Gulf of Mexico Coastal and Ocean Observing System (GCOOS) Data portal.

Selected Publications

Howard, M. K., S. Kobara, F. C. Gayanilo, S.K. Baum, C. Simoniello and A. E. Jochens. 2010. Regional Ocean Data Portal: Transforming Information to Knowledge. American Geophysical Union, Fall Meeting 2010.

Howard, M. K., F. C. Gayanilo and A. E. Jochens. 2009. Establishing the GCOOS Regional Association's Data Portal. Oceans 2009 MTS/IEEE, Biloxi, Mississippi.

Gayanilo, F. C. Jr., A. Hazra, J. Kool, and J. McManus. 2004. A GIS-based dynamic decision support system for Florida's coral reefs. Abstract and Oral Presentation. *10th International*

Coral Reef Symposium, 28 June – 2 July 2004.

Gayanilo, F.C. Jr., G. Silvestre, F. Valdez, and D. Pauly. 2001. *Fisheries Resources Information System (FiRST): User Manual*. WorldFish Center, Penang, Malaysia, 126 pp.

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Gayanilo, F.C., Jr., G. Silvestre, and D. Pauly. 1997. User's guide to B:RUN, a decision support system and teaching tool for managing the coastal resources of Brunei Darussalam. ICLARM Software 8, 22 pp.

Pauly, D., F.C. Gayanilo, Jr., R. Froese, and V. Christensen. 1995. Software tools for management of tropical aquatic resources, p. 90-102. In: G.T. Sakagawa (ed.), *Assessment methodologies and management. Proceedings of the World Fisheries Congress, Theme 5*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Ruttan, L., F.C. Gayanilo, Jr., U.R. Sumaila, and D. Pauly. 2000. Small versus large-scale fisheries: A multi-species, multi-fleet model for evaluating their interactions and potential benefits. In: D. Pauly, and Pitcher T. (eds.), *Methods for assessing the impact of fisheries on marine ecosystems of the North Atlantic*. The University of British Columbia, Vancouver, Canada. Fisheries Centre Research Report 8(2): 64-78.

Alastair Harbourne

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Education

Ph.D., Marine Ecology, University of Exeter, UK, 2007
B.Sc., Oceanography with Biology, Southampton University, UK, 1993

Research Interests

Alastair Harborne is a marine biologist interested in the spatial ecology and conservation of coral reefs. Following eight years of experience working with non-professional researchers in tropical marine survey techniques and the establishment of marine protected areas, he has joined the Bahamas Biocomplexity Project to work with Peter Mumby as part of the Habitat Working Group. Alastair's main research interests within the project are: (a) investigating patterns of benthic and fish biodiversity at a range of spatial scales and the appropriateness of habitats as surrogates of species biodiversity; (b) linking habitat maps to the underlying benthic and fish community structures in order to generate maps of beta-diversity and attempting to understand the resulting patterns; (c) deriving maps of reef functions from habitat maps and modeling the effects of perturbations on these functions and (d) investigating how patterns of species and beta-diversity can be incorporated in reserve selection algorithms.

Selected Publications

Harborne A.R., P.J. Mumby, C.V. Kappel, C.P. Dahlgren, F. Micheli, K.E. Holmes, and D.R. Brumbaugh. 2008. Tropical coastal habitats as surrogates of fish community structure, grazing,

and fisheries value. *Ecological Applications* 18: 1689–1701.

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Beger M., A.R. Harborne, T.P. Dacles, J-L. Solandt, and G.L. Ledesma. 2005. A framework of lessons learnt from community-based marine reserves and its effectiveness in guiding a new coastal management initiative in the Philippines. *Environmental Management* 34(6): 786-801.

Hedley J.D., A.R. Harborne, and P.J. Mumby. 2005. Simple and robust removal of sun glint for mapping shallow-water benthos. *International Journal of Remote Sensing* 26: 2107-2112.

Mumby P.J., A.J. Edwards, J.E. Arias-Gonzalez, K.C. Lindeman, P.G. Blackwell, A. Gall, M.I. Gorczynska, A.R. Harborne, C.L. Pescod, H. Renken, C.C.C. Wabnitz, and G. Llewellyn. 2004. Mangroves enhance the biomass of coral reef fish communities in the Caribbean. *Nature* 427:

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Harborne, A.R., D.C. Afzal, and M.J. Andrews. 2001. Honduras: Caribbean coast. *Marine Pollution Bulletin* 42: 1221-1235.

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Mumby, P.J., K.R. Clarke, and A.R. Harborne. 1996. Weighting species abundance estimates for marine resources assessment. *Aquatic Conservation: Marine and Freshwater Ecosystems* 6: 115-120.

Mumby, P.J., A.R. Harborne, P.S. Raines, and J.M. Ridley. 1995. A critical assessment of data derived from Coral Cay Conservation volunteers. *Bulletin of Marine Science* 56: 742-756.

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Education

Ph.D., Applied Mathematics, Cornell University, 1977
M.S., Applied Mathematics, Cornell University, 1975
B.S., Mathematics, Cornell University, 1973

Research Interests

Alan Hastings, an ecologist, is interested in using mathematical and quantitative approaches to understand the dynamics and interactions of populations, especially emphasizing the spatial component. In the Bahamas Biocomplexity Project, he is focusing on the development of models describing the dynamics inside and outside marine protected areas (MPAs), developing basic principles to help guide the selection of MPAs and determining conditions that will help guarantee species persistence. Planned work includes model formulation and solution, as well as the development of appropriate statistical approaches to help design monitoring schemes for MPAs.

Selected Publications

Kellner, J.B., J.N. Sanchirico, A. Hastings, and P.J. Mumby. 2011. Optimizing for multiple species and multiple values: Tradeoffs inherent in ecosystem-based fisheries management. *Conservation Letters* 4(1): 21-30.

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of species, ecological functions and ecosystem services. *Conservation Biology* 22(4): 941-951.

Malvadkar, U. and A. Hastings. 2008. Persistence of mobile species in marine protected areas. *Fisheries Research* 91: 69-78.

Mumby, P.J. and A. Hastings. 2008. The impact of ecosystem connectivity on coral reef resilience. *Journal of Applied Ecology* 45: 854-862.

Gaines, S.D., B. Gaylord, L.R. Gerber, A. Hastings, and B. Kinlan. 2007. Connecting places; the ecological consequences of dispersal in the sea. *Oceanography* 20(3): 90-99.

Mumby, P.J., A. Hastings, and H.J. Edwards. 2007. Thresholds and the resilience of Caribbean coral reefs. *Nature* 450: 98-101.

Hastings, A. and L.W. Botsford. 2006. A simple persistence condition for structured populations. *Ecology Letters* 9(7): 846-852.

Hastings, A. and L.W. Botsford. 2006. Persistence of spatial populations depends on returning home. *Proceedings of the National Academy of Sciences* 6067-6072.

Botsford, L.W. and A. Hastings. 2006. Conservation dynamics of marine metapopulations with dispersing larvae. In: J. Kritzer and P. Sale (eds.), *Marine Metapopulations*. Elsevier, New York: 411-429.

Sanchirico, J.N., U. Malvadkar, A. Hastings, and J.E. Wilen. 2006. When are no-take zones an economically optimal fishery management strategy? *Ecological Applications* 16(5): 1643-1659.

Olson, D., C. Cosner, S. Cantrell, and A. Hastings. 2005. Persistence of fish populations in time and space as a key to sustainable fisheries. *Bulletin of Marine Science* 76(2): 213-231.

Hastings, A. 2004. Transients: the key to long-term ecological understanding? *Trends in Ecology and Evolution* 19: 39-45.

Guichard, F., S.A. Levin, A. Hastings, and D. Siegel. 2004. Toward a dynamic metacommunity approach to marine reserve theory. *BioScience* 54(11): 1003-1011.

Gerber, L.R., L.W. Botsford, A. Hastings, H.P. Possingham, S.D. Gaines, S.R. Palumbi, and S.J. Andelman. 2003. Population models for marine reserve design: A retrospective and prospective synthesis. *Ecological Applications* 13(Supp.): 47-64.

McCann, K.S., L.W. Botsford, and A. Hastings. 2003. Differential response of marine populations to climate forcing. *Canadian Journal of Fisheries and Aquatic Science* 60: 971-985.

Hastings, A. 2003. Metapopulation persistence with age dependent disturbance or succession.

Science 301: 1525-1526.

Hastings, A. and L.W. Botsford. 2003. Comparing designs of marine reserves for fisheries and for biodiversity. *Ecological Applications* 13(Supp.): 65-70.

Botsford, L.W., F. Micheli, and A. Hastings. 2003. Principles for the design of marine reserves. *Ecological Applications* 13(Supp.): 25-31.

Lockwood, D.R., A. Hastings, and L.W. Botsford. 2002. The Effects of Dispersal Patterns on Marine Reserves: Does the Tail Wag the Dog? *Theoretical Population Biology* 61: 297-309.

Hastings, A. and L. Botsford. 1999. Equivalence in yield from marine reserves and traditional fisheries management. *Science* 284:1537-1538.

Hastings, A. 1977. Spatial heterogeneity and the stability of predator-prey systems. *Theoretical Population Biology* 12: 37-48.

Katherine Holmes

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Education

M.Sc., Biology, McGill University, 1996
B.Sc. (Hons.), Biology, Queen's University, Ontario, 1993

Research Interests

Kate Holmes is a Marine Conservation Specialist with the Wildlife Conservation Society's (WCS) and was the Director for the WCS Papua New Guinea (PNG) Marine Program. Along with Papua New Guinean staff and community members, Kate has been promoting marine conservation in priority seascapes in PNG and Melanesia through developing and implementing science-based, community-driven field conservation and capacity building programs. Kate also worked for the Marine Program at the Center for Biodiversity and Conservation of the American Museum of Natural History, where she started her involvement with the Bahamas Biocomplexity Project, a large scale, multi-disciplinary project investigating marine reserve network design in the Bahamas. She is also involved on collaborative research projects at Palmyra Atoll in the Central Pacific studying coral community dynamics and local sea turtle populations. She has contributed to the establishment of marine reserves in the Philippines; conducted marine research in Indonesia and Barbados focusing on reef bioerosion; and participated in ecological research in Ecuador and Canada.

Selected Publications

Naro-Maciel, E., B. Reid, K.E. Holmes, D.R. Brumbaugh, M. Martin, and R. DeSalle. 2011. Mitochondrial DNA sequence variation in spiny lobsters: Population expansion, panmixia, and divergence. *Marine Biology* 158(9): 2027-2041.

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Holmes, K.E. 2001. *Kastom Laef Blong Solwota: ol Woman i Save Lukaotem Rif mo ol Woman i Save Lukaotem ol Risos. (Custom Life of the Sea: Women as Guardians of their Resources.)* Duration 1hr 16 min. Copyright Vanuatu Cultural Centre.

Holmes, K.E. 2001. *Reef Survivors*. Duration 15 min. Copyright Vanuatu Cultural Centre.

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Education

Ph.D., Biological Sciences, Stanford University, 2006
B.Sc., Biology, Brown University, 1995

Research Interests

Carrie Kappel is a marine community ecologist who has just completed her Ph.D. in biological sciences with Dr. Fiorenza Micheli at Stanford University. She is interested in the application of community ecology to marine biodiversity conservation and conducted research with the Bahamas Biocomplexity Project as part of her dissertation. Carrie conducted her fieldwork, which involved quantitative video surveys of benthic habitats, as part of the Habitat Working Group, at all of the group's sites. She used the benthic and fish databases collected via this group effort as her main data sources. Her research with the BBP centered on spatial variation in abundance and diversity of coral and fish species across a range of scales and different habitat types. By focusing on less common members of the coral reef community, Carrie provided insight into the use of habitats as a proxy for underlying biodiversity in conservation planning. Her results show that remotely sensed benthic habitat classes are a good surrogate for communities of both common and low abundance fishes and corals at scales up to ~100 km, a scale which corresponds to individual islands and island systems within The Bahamas. This suggests that the island scale is

an appropriate one for conservation planning and that habitat maps can form an effective basis for marine reserve design for biodiversity conservation. In addition, Carrie's analysis of the factors that affect coral community structure demonstrated that depth, substrate rugosity, and grazing intensity by herbivorous parrotfishes contribute significantly to spatial variation in these communities. By measuring and incorporating such factors into habitat-based conservation planning activities, we may improve our ability to understand and predict the distribution of biodiversity across the archipelago.

Selected Publications

Harborne A.R., P.J. Mumby, C.V. Kappel, C.P. Dahlgren, F. Micheli, K.E. Holmes, and D.R. Brumbaugh. 2008. Tropical coastal habitats as surrogates of fish community structure, grazing, and fisheries value. *Ecological Applications* 18: 1689–1701.

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Kappel, C.V. 2006. Threats to marine biodiversity and considerations for its conservation: from species to seascapes. *Ph.D. dissertation*. Stanford University. 183 pp.

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Education

Postdoctoral Fellow, Department of Environmental Science and Policy, University of California, Davis
Ph.D., Ecology, Evolution and Marine Biology, University of California, Santa Barbara, 2004
Certificate in College and University Teaching, University of California, Santa Barbara, 2004
M.A., Biological Sciences, University of California, Santa Barbara, 2002
B.Sc., Biological Sciences, University of California, San Diego, 1996

Research Interests

Julie Kellner's primary research interest is the ecology and management of aquatic ecosystems. As a postdoctoral fellow with the Bahamas Biocomplexity Project, her current work focuses on the implications of spillover, density-dependence, and species interactions for marine reserve designation using spatially-explicit models. Connecting theoretical and empirical applications to tackle applied ecological questions has been an underlying theme throughout her research. Julie's previous projects using a multi-tiered approach have included studies on watershed restoration, intertidal runoff, aquaculture development and diesel contamination in a salt marsh. Integrating scientific research with coastal resource management is central to Julie's research, and as such she continues to build upon her experience as a Knauss marine policy fellow at NOAA through working groups and collaborative projects that bring together ecological and socioeconomic studies.

Selected Publications

J.B. Kellner, J.S. Sanchirico, A. Hastings, and P.J. Mumby. 2011. Optimizing for multiple species and multiple objectives: Tradeoffs inherent in ecosystem-based fisheries management. *Conservation Letters* 4(1): 21-30.

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Jensen, O., H. Carter, G. Ford, J.B. Kellner, and J. Christensen. 2005. Biogeography of Marine Birds. In: *A Biogeographic Assessment of the Channel Islands National Marine Sanctuary: A Review of Boundary Expansion Concepts for NOAA's National Marine Sanctuary Program*.

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Clark, R., C. Caldow, J. Christensen, and J.B. Kellner. 2005. Integration. In: *A Biogeographic Assessment of the Channel Islands National Marine Sanctuary: A Review of Boundary Expansion Concepts for NOAA's National Marine Sanctuary Program*. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 21: 199-210.

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Education

Ph.D., Marine Geology, University of Miami, 1996
B.Sc., Biology, University of California, San Diego, 1989

Research Interests

Phil Kramer's current research focuses on aspects of understanding how to quantify coral reef health and examining multi-scale patterns in reef ecology. He is involved with the Atlantic and Gulf Rapid Reef Assessment Program and maintains involvement in projects focusing on the Remote Sensing of Tropical Coral Reef environments, and design of Marine Protected Areas in tropical environments including the Bahamas Biocomplexity Project.

Selected Publications

Spalding, M. and P.A. Kramer. 2004. The Caribbean. In: L. Glover and S. Earl (eds.), *Defying Oceans End- An Agenda for Action*. Island Press, Washington, D.C.

Kramer, P.A. 2003. Synthesis of Atlantic and Gulf Rapid Reef Assessment results: 1997-2000. *Atoll Research Bulletin* 1-57.

Kramer, P.A., P.R. Kramer, and R.N. Ginsburg. 2003. Assessment of Andros Island Reef System, Bahamas (Part 1: stony corals and algae). *Atoll Research Bulletin* 76-99.

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Kramer, P.A., Kramer, P.R., and R. Ginsburg. 1999. Assessment of coral vitality, Andros Reef System, Bahamas. *National Geographic Society Report* 70 pp.

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Education

Ph.D., Oceanography, Rutgers, 2005
M.Sc., Ecology and Evolution, Rutgers, 1997
B.S., Biology, Pennsylvania State University, 1993

Research Interests

Steve Litvin is a marine ecologist interested in how ecological interactions affect the populations of specific species and the overall structure of aquatic foodwebs. As a postdoctoral fellow with the Bahamas Biocomplexity Project, his work focuses on understanding the ecological interactions driving differences in community structure across the Bahamian archipelago, how factors, such as fishing pressure and the extent of mangroves, will modify these interactions, and the implications for the management of marine protected areas. This work is conducted with Fiorenza Micheli and employs both statistical analysis of empirical data collected by the BBP and, in conjunction with Julie Kellner and Alan Hastings at the University of California at Davis, modeling approaches. Steve's previous research used naturally occurring stable isotopes of carbon, nitrogen, and sulfur and measures of biochemical condition along with bioenergetics models to address the role of natural and resorted estuarine habitats in the production of juvenile fish.

Selected Publications

Mumby, P.J., F. Micheli, C.P. Dahlgren, S.Y. Litvin, A.B. Gill, D.R. Brumbaugh, K. Broad, J.N.

Sanchirico, C.V. Kappel, A.R. Harborne, and K.E. Holmes. 2006. Marine parks need sharks? Response to letter. *Science* 312: 527-528.

Weinstein, M.P., S.Y. Litvin and V.G. Guida. 2005. Considerations of habitat linkages, estuary landscapes, and trophic spectrum in wetland restoration design. *Journal of Coastal Research* SI 40: 51-63.

Litvin, S.Y. and M.P. Weinstein. 2004. Multivariate analysis of stable isotope ratios to infer movements and utilization of estuarine organic matter by juvenile weakfish (*Cynoscion regalis*). *Canadian Journal of Fisheries and Aquatic Sciences* 61(10): 1851-1861.

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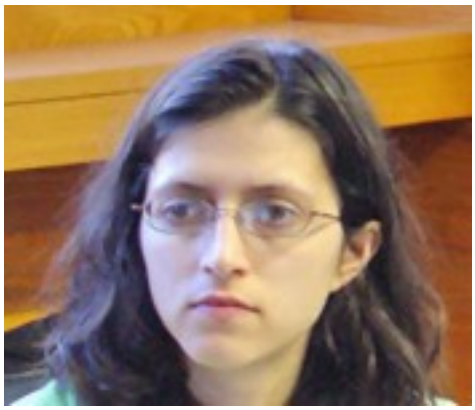

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Education

Ph.D., Applied and Computational Mathematics, Princeton University, 2002
B.Sc., Mathematics and Environmental Science, Vanderbilt University, 1997

Research Interests

For the Bahamas Biocomplexity Project, Urmila Malvadkar has been modeling the effects of marine reserves on the survival of species with different dispersal strategies and life histories. These models will also include humans' economic response to the creation of marine reserves.

Selected Publications

Malvadkar, U. and A. Hastings. 2008. Persistence of mobile species in marine protected areas. *Fisheries Research* 91: 69-78.

Sanchirico, J.N., U. Malvadkar, A. Hastings, and J.E. Wilen. 2006. When are no-take zones an economically optimal fishery management strategy? *Ecological Applications* 16(5): 1643-1659.

Boughton, D. and U. Malvadkar. 2002. Extinction risk in successional landscapes subject to catastrophic disturbances. *Conservation Ecology* 6(2): 2.

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Malvadkar, U. and S. Levin. In review. The evolution of diel vertical migration in zooplankton.

Malvadkar, U. In prep. Investigations of stochastic dynamics in ecosystems.

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Education
Ph.D., Oceanography, University of Rhode Island, 1985
M.Sc., Ecology, University of Connecticut, 1978
B.A., Biology, University of Connecticut, 1974

Research Interests

John McManus has worked on many aspects of coral reef science, with a focus on facilitating improved coral reef management through interdisciplinary research and modeling. In the Bahamas Biocomplexity Project, he chairs the GIS Working Group developing the Geographic Information System-based Spatio-temporal Simulation System. This is integrating models and data from the project's research efforts with existing information into a user-friendly decision support system to help guide the future development of the Bahamas system of Marine Protected Areas.

Selected Publications

McManus, J.W. and J.F. Polsenberg. 2004. Coral–algal phase shifts on coral reefs: ecological and environmental aspects. *Progress in Oceanography* 60: 263–279.

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Education

Ph.D., Marine Sciences, University of North Carolina at Chapel Hill, 1995
B.Sc., Natural Sciences, University of Florence, Italy, 1988

Research Interests

Fiorenza Micheli, a marine community ecologist, is interested in how species interactions and habitat-organism relationships shape marine communities, in investigating human impacts on coastal marine communities, and in incorporating this understanding in the management and conservation of marine ecosystems, particularly the design and evaluation of marine protected areas. With the Bahamas Biocomplexity Project, she is focusing on the feedbacks and interactions between different components of the Bahamanian archipelago marine ecosystem. Her particular research is focused on establishing links between habitat quality and the structure and diversity of benthic and fish assemblages, examining relationships among different functional groups of organisms, and developing dynamic models for reserve site selection. The work includes field surveys of marine habitat and benthic communities at multiple sites in order to describe patterns of diversity and community structure at varying spatial scales. In the last three years of the project, she will conduct modeling studies that incorporate different criteria and constraints in the design of networks of marine protected areas and examine possible effects of population dynamics of focal species, and variation in habitat quality and community structure. This work has been conducted in collaboration with Carrie Kappel, who was a doctoral student at Stanford University, and with Steven Litvin, a postdoctoral researcher also based at Stanford.

Selected Publications

McCauley, D.J., K.A. McLean, H.S. Young, J. Bauer, and F. Micheli. In press. Evaluating the performance of methods for estimating the abundance of rapidly declining coastal shark populations. *Ecological Applications.*

Micheli, F., and A. Guerry. *In press.* Ecosystem Services. Chapter for the *Encyclopedia of Theoretical Ecology* (A. Hastings and L. Gross, eds). University of California Press.

Claudet J., P. Guidetti, D. Mouillot, N.T. Shears, and F. Micheli. 2011. Ecological effects of marine protected areas: conservation, restoration and functioning. In: *Marine Protected Areas - A Multidisciplinary Approach.* Cambridge University Press. Cambridge, UK.

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Wood, C.L., K. Lafferty and F. Micheli. 2010. Fishing out marine parasites: Impacts of fishing on rates of parasitism in the ocean. *Ecology Letters* 13: 761-775.

Foley, M., B.S. Halpern, F. Micheli, M.H. Armsby, M.R. Caldwell, C.M. Crain, E. Prahler, N. Rohr, D. Sivas, M.W. Beck, M.H. Carr, L.B. Crowder, J.E. Duffy, S.D. Hacker, K. McLeod, C. H. Peterson, H.M. Regan, M.H. Ruckelshaus, P.A. Sandifer, R.S. Steneck. 2010. Guiding ecological principles for marine spatial planning. *Marine Policy* 34(5): 955-966.

Kellner, J.B., S.Y. Litvin, A. Hastings, F. Micheli, and P.J. Mumby. 2010. Disentangling trophic interactions inside a Caribbean marine reserve. *Ecological Applications* 20: 1979-1992.

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Brumbaugh. 2008. Tropical coastal habitats as surrogates of fish community structure, grazing, and fisheries value. *Ecological Applications* 18: 1689–1701.

Mumby P.J., K. Broad, D.R. Brumbaugh, C.P. Dahlgren, A.R. Harborne, A. Hastings, K.E. Holmes, C.V. Kappel, F. Micheli, and J.N. Sanchirico. 2008. Coral reef habitats as surrogates of species, ecological functions and ecosystem services. *Conservation Biology* 22(4): 941-951.

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Mumby, P.J., A.R. Harborne, J. Williams, C.V. Kappel, D.R. Brumbaugh, F. Micheli, K.E. Holmes, C.P. Dahlgren, C.B. Paris, and P.G. Blackwell. 2007. Trophic cascade facilitates coral recruitment in a marine reserve. *Proceedings of the National Academy of Sciences* 104(20): 8362-8367.

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Harborne, A.R., P.J. Mumby, F. Micheli, C.T. Perry, C.P. Dahlgren, K.E. Holmes, and D.R. Brumbaugh. 2006. The functional value of Caribbean coral reef, seagrass and mangrove habitats to ecosystem processes. *Advances in Marine Biology* 50: 57-190.

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Micheli, F., and B.S. Halpern. 2005. Low functional redundancy in coastal marine assemblages. *Ecology Letters* 8(4): 391-400.

Pandolfi, J. M., N. Baron, R. H. Bradbury, H. M. Guzmán, T. P. Hughes, C. V. Kappel, F. Micheli, J. C. Ogden, H. P. Possingham, E. Sala, and J. B. C. Jackson. 2005. Are US coral reefs on the slippery slope to slime? *Science* 307: 1725-1726.

Jackson, J.B.C., J.C. Ogden, J.M. Pandolfi, N. Baron, R.H. Bradbury, H.M. Guzman, T.P. Hughes, C.V. Kappel, F. Micheli, H. P. Possingham, and E. Sala. 2005. Reassessing US coral reefs - Response. *Science* 308: 1741-1742.

Palmer, M.A., E. Bernhardt, E. Chorneski, S.L. Collins, A. Dobson, C. Duke, B. Gold, R. Jacobson, S. Kingsland, R. Kranz, M. Mappin, M. L. Martinez, F. Micheli, J. Morse, M. Pace, M. Pascual, S. Palumbi, J. Reichman, A. L. Simons, A. Townsend, and M. Turner. 2004. Ecology for a Crowded Planet. *Science* 304: 1251-1252.

Micheli, F., B.S. Halpern, L.W. Botsford, and R.R. Warner. 2004. Trajectories and correlates of community change in no-take marine reserves. *Ecological Applications* 14: 1709-1723.

Micheli, F., A. Amarasekare, J. Bascompte, and L.R. Gerber. 2004. Including species interactions in the design and evaluation of marine reserves: some insights from a predator-prey model. *Bulletin of Marine Science*, Special issue on "Confronting Trade-offs in the Ecosystem Approach to Fisheries Management". 74(3): 653-669.

Botsford, L.W., F. Micheli, and A. Hastings. 2003. Principles for the design of marine reserves. *Ecological Applications* 13(Supp.): 25-31.

Micheli, F., G.A. Polis, P.D. Boersma, M.A. Hixon, E.A. Norse, P.V.R. Snelgrove, and M.E. Soulé. 2001. Human alteration of food webs: research priorities for conservation and management. In: M.E. Soulé and G.H. Orians (eds.), *Conservation Biology: Research Priorities for the Next Decade*. 2nd edition. Island Press, Washington, D.C.

Micheli, F. 1999. Eutrophication, fisheries, and consumer-resource dynamics in marine pelagic ecosystems. *Science* 285: 1396-1398.

Micheli, F. and C.H. Peterson. 1999. Estuarine vegetated habitats as corridors for predator movements. *Conservation Biology* 13: 869-881.

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Education

Ph.D., Marine Ecology , University of Sheffield, UK, 1997
B.Sc. (Hons.) Marine Biology, University of Liverpool, UK, 1992

Research Interests

Peter Mumby is interested in spatial aspects of reef ecology. A key focus of this research is how to make use of reef habitat maps made using satellite or airborne images and photographs. Habitat maps provide information on the connectivity of ecosystems (e.g. which reefs are nearest nursery grounds for grouper), the functions of reefs (why are some reefs only found in sheltered areas?) and patterns of biodiversity (why are some parts of the reef always richer in species than others?). Many of these issues are pertinent to the design of marine protected area (MPA) networks and the Habitat Working Group is investigating how habitat maps of The Bahamas help inform improved designs of MPAs. In particular, how do the placement of MPAs influence the amount of essential fish habitat and overall species diversity protected?

Selected Publications

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Education

Ph.D., Ecology, Evolution and Environmental Biology, Columbia University, 2006
Certificate in Environmental Policy, Ecology, Evolution and Environmental Biology, Columbia University, 2003
M.A., Ecology, Evolution and Environmental Biology, Columbia University, 1997
B.Sc., Environmental Biology, Yale University, 1994

Research Interests

Eugenia Naro-Maciel is a conservation biologist focusing on the genetics of marine organisms and marine conservation. As a postdoctoral fellow with the CBC, she researches the genetic connectivity of marine organisms in The Bahamas and surrounding areas, and implications for marine protected area planning with Dan Brumbaugh, Kate Holmes, and Steve Palumbi, among others. A suite of taxa is being studied, including spiny lobsters (*Panulirus argus*), bonefish (*Albula vulpes*), and black land crabs (*Gecarcinus lateralis*). Genia also researches the population genetics and evolutionary relationships of sea turtles, sea turtles of the Palmyra Atoll National Wildlife Refuge, and other marine issues. In addition, she has been collaborating on the development of undergraduate-level educational materials through the Network of Conservation Educators and Practitioners (NCEP). These have included the interactive simulation exercise “Marine Reserves and Local Fisheries” and two modules concerning Protected Areas and Biodiversity Conservation.

Selected Publications

Naro-Maciel, E., B. Reid, K.E. Holmes, D.R. Brumbaugh, M. Martin, and R. DeSalle. 2011.

Mitochondrial DNA sequence variation in spiny lobsters: Population expansion, panmixia, and divergence. *Marine Biology* 158(9): 2027-2041.

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Naro-Maciel, E. and A. Formia. 2006. Sea Turtle Subpopulations and the IUCN Red List: A complementary role for conservation genetics. *Marine Turtle Newsletter* 114: 6-8.

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Naro-Maciel, E. 1998. The Inter-American Convention for the Protection and Conservation of Sea Turtles: an historical overview. *Journal of International Wildlife Law & Policy* 1(1): 169-178.

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Education

Ph.D., Oceanography, Texas A&M, 1979
M.S. Oceanography , Texas A&M, 1976
B.Sc., Physics, University of Wyoming, 1974

Research Interests

Donald Olson, trained in fluid dynamics and physical oceanography, has a long standing in observational and theoretical aspects of the marine environment including both physical aspects of circulation, marine ecology, and applications of these to fisheries science. In the Bahamas Biocomplexity Project he chairs the Connectivity Working Group and is a member of the Modeling Working Group. His contribution to the connectivity work includes an analysis of the sources of the waters that surround the islands and estimates of flow through the island passages. The initial effort makes use of tracer techniques, drifters, and model simulations using the Miami Community Ocean Model (MICOM) North Atlantic runs. Later work will aim at understanding the exchange of fluid from the banks to the open ocean. On the modeling side, the initial analysis of a three component foodweb model is underway and plans include running these models on the results of the MICOM simulations. Discussions are underway to couple this model of fish stocks to an explicit model of the fisheries and their tie to the Bahamian economy.

Selected Publications

Olson, D.B. 2007. Lagrangian biophysical dynamics. In: A. Griffa, A.D. Kirwan, A.J. Mariano, T. Özgökmen, and T. Rossby (eds.), *Lagrangian Analysis and Prediction in Coastal and Ocean Dynamics*. Cambridge University Press: 275-348.

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Olson, D.B. 2001. Biophysical Dynamics of Western Transition Zones. *Fisheries Oceanography* 10: 133-150.

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Education

Ph.D. Coastal Oceanography, Marine Sciences Research Center, Stony Brook, 2001
M.Sc., Biology, RSMAS, University of Miami, 1987

Research Interests

One of the most significant challenges facing marine ecology today is to understand the spatial patterns of population structure and how changes in the environment may affect population persistence. Claire's primary research interests are in the biological-physical interactions that control marine population dynamics with an emphasis on the early life history stages (pelagic larvae). Theoretical studies suggest that the exchange of individuals among geographically-separated populations (population connectivity) plays a fundamental role in metapopulations dynamics, community structure, genetic diversity, and the resiliency of populations to human exploitation. To test these hypotheses, a modeling approach was developed integrating physical and biological processes, such as realistic renditions of ocean circulation, adult reproductive strategies, larval behavior and traits, and suitable habitat. The modeling system estimates the scales and strength of natural population networks (in the absence of pervasive human impacts). In the context of the Bahamas Biocomplexity Project, a significant application of this research is the optimization of spatial conservation strategies to maintain or restore natural levels of biodiversity and ecosystem function. Field data from the Habitat Working Group are now integrated to the seascape component of the larval tracking system to quantify the relative influence of ecological connectivity on the observed structure of the communities of coral and fish species. The biophysical model also serves to support population genetic studies by scaling gene flow between breeding populations.

Selected Publications

Foster, N., C.B. Paris, J.T. Kool, I.B. Baums, J.R. Stevens, J.A. Sanchez, C. Bastidas, C. Agudelo, P. Bush, O. Day, R. Ferrari, P. Gonzalez, S. Gore, R. Guppy, M.A. McCartney, C. McCoy, J. Mendes, A. Srinivasan, S. Steiner, M.J.A. Vermeij, E. Weil, and P.J. Mumby. 2012. Connectivity of Caribbean coral populations: Complementary insights from empirical and modelled gene flow. *Molecular Ecology* 21(5): 1143-1157. http://dx.doi.org/10.1111/j.1365-294X.2012.05455.x

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Werner, F.E., R.K. Cowen, and C.B. Paris. 2007. Coupled biophysical models: Present capabilities and necessary developments for future studies of population connectivity. *Oceanography* 20(3): 54-69.

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Education

Ph.D., Agricultural and Resource Economics, University of California, Davis, 1998
B.A., Economics and Mathematics, Boston University, 1991

Research Interests

Jim Sanchirico's main research focus is on the economic analysis of fishery policy design, implementation, and performance with a particular interest in analyzing the ecosystem impacts of polices such as individual transferable quotas (ITQs) and marine reserves. In the Bahamas Biocomplexity Project, he is focusing on modeling the bioeconomic effects of marine reserves, which depend critically on the responses by small-scale fishers, recreational and commercial fishing, and tourists. Planned work includes development of spatial and inter-temporal bioeconomic models that depict in a stylized way the complexity inherent in The Bahamas' ecological and socioeconomic system.

Selected Publications

Broad, K. and J.N. Sanchirico. 2008. Local perspectives on marine reserve creation in the Bahamas. *Ocean & Coastal Management* 51(2008): 763-771.

Mumby P.J., K. Broad, D.R. Brumbaugh, C.P. Dahlgren, A.R. Harborne, A. Hastings, K.E. Holmes, C.V. Kappel, F. Micheli, and J.N. Sanchirico. 2008. Coral reef habitats as surrogates of species, ecological functions and ecosystem services. *Conservation Biology* 22(4): 941-951.

Harborne, A.R., P.J. Mumby, C.V. Kappel, C.P. Dahlgren, F. Micheli, K.E. Holmes, J.N. Sanchirico, K. Broad, I.A. Elliott, and D.R. Brumbaugh. 2008. Reserve effects and natural

variation in coral reef communities. *Journal of Applied Ecology* 45: 1010-1018.

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Sanchirico, J.N. 2005. Additivity properties in metapopulation models: Implications for the assessment of marine reserves. *Journal of Environmental Economics and Management* 49(1): 1–25.

Holland, D., J.N. Sanchirico, R. Curtis, and R. L. Hicks. 2004. An Introduction to Spatial Modeling in Fisheries Economics, *Marine Resource Economics* 19(1): 1-6.

Sanchirico, J.N. 2004. Designing a cost-effective marine reserve network: A bioeconomic metapopulation analysis. *Marine Resource Economics* 19: 41-65.

Sanchirico, J.N. 2004. Marine Resources Foundation Designing a Cost-Effective Marine Reserve Network: A Bioeconomic Metapopulation Analysis. *Marine Resource Economics* 19: 41-65.

Sanchirico, J.N., R. Stoffle, K. Broad, and L. Talaue-McManus. 2003. Modeling Marine Protected Areas. Letter. *Science* 301: 47-48.

Lutz, S., K. Broad, L Talaue-Mcmanus, J. Sanchirico, R. Stoffle. 2002. Human Dimensions of Marine Reserve Policy: Applications in Bimini. *Bahamas Journal of Science* 5(2): 50-57.

Sanchirico, J.N. and J.E. Wilen. 2002. The impacts of marine reserves on limited-entry Fisheries. *Natural Resource Modeling* 15(3): 291-310.

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Sanchirico, J.N. and J.E. Wilen.1999. Bioeconomics of spatial exploitation in a patchy environment. *Journal of Environmental Economics and Management* 37: 129-150.

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Education

Ph.D., University of Kentucky, 1972
M.A., University of Kentucky, 1969
B.A., Univeristy of Colorado, 1965

Research Interests

Rich Stoffle has worked in the Caribbean since 1965 when he was a Peace Corps Volunteer in Barbados conducting surveys for the social welfare department. He consequently conducted research for both his MA thesis and his PhD dissertation in Barbados. Since then, he has continued to research fisheries, fishery sectors, and communities in the Caribbean as well as in the United States. He conducted on-going fisheries research in Lake Michigan for five years and served for on the Board of Technical Experts for the Great Lakes Fishery Commission. Rich's decade-long fisheries research in Antigua and the Dominican Republic resulted in eleven articles and book chapters. Rich's course on Ecological Anthropology draws heavily on the literature on fishing communities. He has conducted a series of seminars for two years on issues related to fishing communities, especially as they relate to marine protected areas (MPAs). In The Bahamas, Rich works alongside The College of the Bahamas' lecturer Jessica Minnis. Thus far, Rich and Jessica's team has focused on the people of the Exuma islands, exploring their cultural attachments to the sea.

Selected Publications

Stoffle, R.W., J. Minnis, A. Murphy, K. Van Vlack, N. O'Meara, T. Smith, and T. McDonald. 2010. Two-MPA model for siting a marine protected area: Bahamian case. *Coastal Management* 38(5): 501 - 517. http://dx.doi.org/10.1080/08920753.2010.507460

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Education

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Research Interests

Liana Talaue-McManus is interested in human-environment interactions in the coastal zone. Over a period of 15 years and while undertaking plankton research, she developed participatory tools to engage major stakeholders including central government and local coastal communities in a collective process of analyses and planning for their marine resources. In the Bahamas Biocomplexity Project, she is analyzing current institutional structures and functions that influence decisions regarding the design and implementation of marine protected areas (MPAs). As well as fishing and tourism uses of the marine environment using government-based indicators. To date, she has completed a study on marine food consumption by both residential and tourist populations as a proxy for harvest pressure, and another on the diving industry of the Bahamas. An ongoing study on the boating industry will be completed in 2004. Her studies will complement ethnographic work to be done at the settlement scale.

Selected Publications

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Education

Ph.D., Environmental Science, Duke University, 2006
M.S., Marine Biology, University of Charleston, 2000
B.S., Biology, University of Wisconsin-Superior, 1994

Research Interests

Eric Treml's primary interest is in the spatial ecology and conservation of tropical marine systems. In particular, addressing the question of how connectivity, via larval dispersal, impacts population and community structure at multiple spatiotemporal scales. Eric's current research combines empirical data (species abundance, population genetics) and biophysical models within a graph-theoretic framework to explore the role connectivity plays in shaping marine systems. He has worked in the geographic information sciences for over a decade and brings these tools and experiences to the Bahamas Biocomplexity Project.

Selected Publications

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