

Stephanie L. Bush, Ph. D.

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CURRENT POSITION

Postdoctoral Fellow, Midwater Ecology Group, Monterey Bay Aquarium Research Institute & Tentacles Exhibit, Monterey Bay Aquarium.

Advisor: Dr. Bruce Robison, Research Chair & Senior Scientist
Research Collaborator, Smithsonian Institution, National Museum of Natural History

PREVIOUS POSITIONS

Postdoctoral Fellow, Smithsonian Institution, National Museum of Natural History

Advisor: Dr. Karen Osborn, Curator of Invertebrate Zoology
Postdoctoral Fellow, Department of Biological Sciences, University of Rhode Island
Advisor: Dr. Brad Seibel, Professor of Biological Sciences

EDUCATION

2004-2009, Ph. D. in Integrative Biology, University of California, Berkeley, CA

Dissertation title: Deep-sea squid defensive behaviors: ink release, body patterning, and arm autotomy

Major Advisor: Dr. Roy L. Caldwell, Professor of Integrative Biology

“Field-site”: MBARI/Monterey Bay Submarine Canyon, CA

On-site Advisor: Dr. Bruce Robison, Senior Scientist, MBARI

2002-2003, Three Seas Program, Northeastern University, Boston, MA

Intensive marine biology field- and course-work at 3 locations: The Marine Science Center, Nahant, Massachusetts; Discovery Bay Marine Laboratory, Discovery Bay, Jamaica; and Friday Harbor Laboratories, San Juan Island, Washington

1998-2002, B. S. in Biology, Illinois Wesleyan University, Bloomington, IL

Magna Cum Laude, May 2002

2000-2001, James Cook University, Townsville, Queensland, Australia

Study abroad concentrating on marine biology, animal behavior, and statistics coursework

PUBLICATIONS

Hoving, H.J.T., Zeidberg, L.D., Benfield, M.C., **Bush, S.L.**, Robison, B.H., & M.

Vecchione. 2013. First *in situ* observations of the deep-sea squid *Grimalditeuthis bonplandi* reveal unique use of tentacles. *Proceedings of the Royal Society B*. 280: 20131463

Bush, S.L. 2012. Economy of arm autotomy in the mesopelagic squid *Octopoteuthis deletron* Young 1972. *Marine Ecology Progress Series*. 458: 133-140.

Bush, S.L., Hoving, H.J.T., Huffard, C.L., Robison, B.R., & L.D. Zeidberg. 2012.

Brooding and sperm storage by the deep-sea squid *Bathyteuthis berryi* (Cephalopoda: Decapodiformes). *Journal of the Marine Biological Association of the United Kingdom*. 92(7):1629-1636.

Hoving, H.J.T., **Bush, S.L.**, & B.H. Robison. 2012. A shot in the dark: Same-sex sexual behavior in a deep-sea squid. *Biology Letters*. 8(2): 287-290.

PUBLICATIONS CONTINUED

- Sherlock, R.E., Reisenbichler, K.R., **Bush, S.L.**, Osborn, K.J., & B.H. Robison. 2010. Near-field zooplankton and ice-face biota of free-drifting Antarctic icebergs. *Deep Sea Research Part II: Topical Studies in Oceanography*. 58: 1457-1468.
- Bush, S.L.**, Robison, B.H., & R.L. Caldwell. 2009. Behaving in the dark: locomotor, chromatic, postural and bioluminescent behaviors of the deep-sea squid *Octopoteuthis deletron* Young 1972. *Biol. Bull.* 216:7-22.
- Bush, S.L.** & B.H. Robison. 2007. Ink utilization by mesopelagic squid. *Marine Biology*. 152(3):485-494.
- LaJeunesse, T.C., Lee, S., **Bush, S.L.**, & J.F. Bruno. 2004. Persistence of non-Caribbean algal symbionts in Indo-Pacific mushroom corals released to Jamaica 35 years ago. *Coral Reefs*. 24(1):157-159.
- Bush, S.L.**, Precht, W.L., Woodley, J.D., & J.F. Bruno. 2004. Indo-Pacific mushroom corals found on Jamaican reefs. *Coral Reefs*. 23(2):234.

MANUSCRIPTS IN PREPARATION

- Hoving, H.J.T., **Bush, S.L.** & B.H. Robison. Bathyal feasting: post-spawning squid as carrion for deep-sea benthic communities.
- Bush, S.L.**, Walz, K., Bolstad, K., Lindgren, A., Hoving, H.J.T., Strugnell, J., Allcock, L., Lindsay, D., & B.H. Robison. *Vampyroteuthis infernalis*: Two populations, one species
- Bush, S.L.**, Bitondo, A. Grasse, B., Payne, C., & Paul Clarkson. *Opisthoteuthis packardi* sp. nov. (Octopoda: Cirrata: Opisthoteuthidae), a new species of cirrate octopus in the Eastern Pacific.
- Bush, S.L.**, Bitondo, A. Grasse, B., Payne, C., & P. Clarkson. Egg-laying behavior and embryo development of two cirrate octopuses, *Opisthoteuthis* sp. and *Opisthoteuthis cf. californiana*
- Bush, S.L.** & K.J. Osborn. Population connectivity and species delimitations in an open ocean taxa, the Pteropoda (Mollusca: Gastropoda).

TEACHING EXPERIENCE

- Course Designer and Instructor** - Tropical Islands: How Did Paradise Become...Paradise?, Osher Lifelong Learning Institute, California State University, Monterey Bay, 2010
- Graduate Student Instructor** - Biology and Geomorphology of Tropical Islands, University of California, Berkeley, 2009
- Course Designer and Instructor** - Natural History and Human Interactions of Monterey Bay, Osher Lifelong Learning Institute, California State University, Monterey Bay, 2009
- Course Designer and Instructor** - The Deep Sea, Osher Lifelong Learning Institute, California State University, Monterey Bay, 2008
- Graduate Student Instructor** - Invertebrate Zoology, University of California, Berkeley, 2006
- Graduate Student Instructor** - Animal Biology: A Behavioral View, University of California, Berkeley, 2005
- Graduate Student Instructor** - General Biology, University of California, Berkeley, 2004, 2005
- Teaching Assistant** - Oceanography, Three Seas Program, Northeastern University, 2004
- Teaching Assistant** - Marine Conservation Biology, Three Seas Program, Northeastern University, 2004
- Teaching Assistant and Lab Instructor** - Marine Biology for Non-Science Majors, Harvard University, 2003

CONFERENCE TALKS AND INVITED LECTURES

“Using integrative taxonomy to reveal hidden biodiversity in the open ocean and deep sea”
Stanford University, Hopkins Marine Station, Fall Lecture Series, 2014

“Squids (and other cephalopods) around Saba”
Sea & Learn on Saba, Dutch Caribbean, Caribbean, 2014

“Deep-sea cephalopods of the Monterey Bay”
Staff Enrichment Program, Monterey Bay Aquarium, Monterey, CA, 2014

“Shape and color change, bioluminescence, and arm autotomy in a deep-sea squid”
Student Oceanography Club, Monterey Bay Aquarium, Monterey, CA, 2014

“The role of arm regeneration in the behavioral ecology of a deep-sea squid”
Cephalopods as Models for Tissue Regeneration, Stazione Zoologica, Naples, Italy, 2013

“Physiology of Deep-Sea Invertebrates: Predicting Responses to Climate Change”
National Museum of Natural History, Invertebrate Zoology Lecture Series, 2012

“A tale of two species: Polarization camouflage and climate change physiology in squids”
Graduate School of Oceanography, University of Rhode Island, 2011

“Lost limbs and flashing lights: defensive behaviors of deep-sea squids”
Department of Biological Sciences, University of Rhode Island, 2010

“Behavioral Ecology of Deep-sea Squids”,
NOAA Ocean Explorer Teacher Enrichment Workshop, San Diego, CA, 2010

“Squids Will Be Squids”
Biology and Geomorphology of Tropical Islands, University of California, Berkeley, 2009

“Deep-sea squid covert activities...”
TONMOCON III, 2009

“Deep sea squid: What are they inking?”
Science, Technology, Engineering, and Mathematics Colloquium, Hartnell College, 2009

“Hunting and hiding in the dark: Predator-prey interactions in the deep sea”,
Sea Creatures Rediscovered, Pacific Grove Natural History Museum, 2009

“How to survive as a squid in the deep sea”
NOAA Ocean Explorer Teacher Enrichment Workshop, San Diego, CA, 2009

“Deep sea research: Understanding animal adaptations”
California State University, Channel Islands, Resource Management Course, 2008

“Arm autotomy in a mesopelagic squid”
Micheli Lab, Hopkins Marine Station, Stanford University, 2008

“Deep sea research and squid defenses”
UC Berkeley Lawrence Hall of Science, MARE Summer Leadership Institute, 2008

CONFERENCE TALKS AND INVITED LECTURES CONTINUED

“Defensive behavior of a deep-sea squid”

American Society of Limnology & Oceanography Conference, 2007

“Posing in the dark: Behavioral components of the deep-sea squid *Octopoteuthis deletron*”

World Congress of Malacology, 2007

“Animal adaptations to the deep sea”

Camp SEA Lab, 2007

“Autotomy as a deep-sea squid defense”

Society of Integrative & Comparative Biology Conference, 2007

“Ink release by deep-sea squid”

11th International Deep-sea Biology Symposium, 2006

“Why do deep-sea squids release ink in the dark?”

American Malacological Society Conference, 2006

“How does a midwater squid avoid becoming a sperm whale (or ROV) meal?”

MBARI Summer Intern Symposium, 2006

“A day in the life of a squid”

Bermuda Biological Station for Research Scientific Photography Course Symposium, 2004

“It’s pitch-black down here: Why are the squids still inking?”

MBARI Summer Intern Symposium, 2003

UNDERGRADUATE MENTORING

Haley Oleynik, Colby College – Imaging and Documentation of Pteropod Molluscs

Nathaniel Coolidge, URI – Respiratory physiology of deep-sea Oplophoridae shrimp

Maria Zizka, UC Berkeley – Sea urchins distribution changes in Mo’orea, French Polynesia

Stosh Ozog, UC Berkeley – Color variation in relation to symbiosis in giant clams

Danielle Desmet, UC Berkeley – Distribution of large sponges on Mo’orea, French Polynesia

Connor Dibble, UC Berkeley – Intraspecific competition in a tropical bryozoan

Katie Hendrickson, UC Berkeley – Crustaceans defense of host corals by a corallivorous snail

Carolyn Kobervig, UC Berkeley – Plankton distribution and substrate preferences

Ian Will, UC Berkeley – Ecology of the ectoparasitic gastropods on sea cucumbers

Nick Fletcher, UC Berkeley – Freshwater runoff effects on microcommunities

Alexandria Pickard, UC Berkeley – Influence of coastal marae construction on coral populations

Alexandra Title, UC Berkeley – Study of coral diversity in Mo’orea, French Polynesia

Julia Hassen, UC Berkeley – The geomorphology of Motu Tihura with a focus on human impact

Ryan Wilson, UC Berkeley – Gastropod distribution on a motu in Mo’orea, French Polynesia

Christine Mansfield, UC Berkeley – Effects of density on intraspecific aggression in a fiddler crab

Chris Ahlgren, UC Berkeley – Life history of the plant *Sophora tomentosa* on reef islands

Trisha Borland, UC Berkeley – *Cordyline fruticosa*: the continuity of a sacred plant

Elliot Chan, UC Berkeley – Medicinally active secondary compounds in Leguminosae

Amanda Minnich, UC Berkeley – The effect of *Falcataria moluccana* on native plants

Annie Maguire, UC Berkeley – Courtship and time budgets of White-tailed Tropicbirds

Rebecca Wilcox, UC Berkeley – Seabird predation by swamp harriers (*Circus approximans*)

Irene Chen, UC Berkeley – Evaluation of fungus for biological control of an introduced plant

Danielle Peña, UC Berkeley – Jumping spider (Araneae: Salticidae) distribution and ecology

Vanessa Lovenburg, UC Berkeley – Terrestrial gastropod biodiversity on Mo’orea

EDUCATIONAL OUTREACH

Science Fair Judge, Marshall High School, Falls Church, VA

Author, Dumbo Octopus chapter, World Book Encyclopedia

Instructor, Kayaking & Snorkeling, Young Women in Science, Monterey Bay Aquarium, CA

Author, Squid Science: Field Notes from Stephanie Bush, University of California Museum of Paleontology (http://www.ucmp.berkeley.edu/science/profiles/bush_0704index.php)

Science Fair Judge, The Aptos Academy, Aptos, CA

Workshop Leader, 9th Annual University of California, Santa Cruz Expanding Your Horizons Conference in Science, Math and Engineering for 9th- 12th grade girls

RESEARCH AND FIELD EXPERIENCE

- 2012 – present **Researcher**, species delineations and population connectivity in pteropod molluscs Collaborator: Dr. Karen Osborn, SI-NMNH
- 2004-present **Researcher**, deep-sea squid defensive behaviors. Ink release, ink chemical composition, marine organism reaction to cephalopod ink, deep-sea squid body patterning, deep-sea squid arm autotomy. Collaborator: Dr. Bruce Robison, MBARI
- 2010 – 2012 **Researcher**, climate change physiology in deep-sea animals associated with oxygen minimum layers (OMLs) Collaborator: Dr. Brad Seibel, Univ. Rhode Island
- 2010 – 2012 **Researcher**, polarization camouflage in cephalopods, part of an Office of Naval Research MURI grant. PI: Molly Cummings, Univ. Texas, Austin
- 2007-2009 **Researcher**, liquid chromatography-mass spectroscopy of cephalopod ink. Collaborator: Dr. Ulla Anderson, University of California, Berkeley
- 2006 **Researcher**, animal camouflage. Sulawesi, Papua, and Ambon, Indonesia.
- 2006 **Assistant intern coordinator and researcher**, deep-sea squid arm autotomy. Advisor: Dr. George Matsumoto, Monterey Bay Aquarium Research Institute.
- 2005 **Researcher**, stomatopod reaction to squid ink. Hawaii Institute of Marine Biology, Coconut Island.
- 2003 **Intern**, deep-sea squid ink release. Advisor: Dr. Bruce Robison, Monterey Bay Aquarium Research Institute.
- 2003 **Researcher**, courtship behavior in the Caribbean Reef Squid. Bonaire, Netherlands Antilles. Collaborator: Jennifer Mather, University of Lethbridge.
- 2003 **Researcher**, heat shock response in anemones. Independent study, Three Seas Program. Advisor: Dr. Michael Lesser, University of New Hampshire.
- 2003 **Researcher**, heterotrophy in corals. Discovery Bay, Jamaica. Independent study, Three Seas Program. Advisor: Dr. Pete Edmunds, California State University, Northridge.
- 2002 **Researcher**, primary productivity. Friday Harbor Laboratories, WA. Independent study, Three Seas Program. Advisor: Dr. Jan Newton, University of Washington.
- 2002 **Researcher**, bryozoan natural products. Advisor: Dr. Elizabeth Balsler, Illinois Wesleyan University.
- 2001 **Researcher**, coral colonization. Orpheus Island Research Station, James Cook University, Australia. Advisor: Dr. Bette Willis, James Cook University.
- 2001 **Station and research assistant**. Orpheus Island Research Station, James Cook University, Australia.

RESEARCH CRUISES

R/V Rachel Carson, Monterey Bay. MBARI, 2013 – present, 6 cruises as chief scientist
R/V Pt. Lobos, Monterey Bay. MBARI, 2003-2010 (64 cruises, incl. those as chief scientist)
R/V Western Flyer, Monterey Bay; Oregon; Gulf of Ca. MBARI, 2003-present (18 cruises)
R/V Nathaniel B. Palmer, Antarctica. MBARI, 2008, 2009
R/V Derek M. Bayliss, Monterey Bay. MBARI, 2006
R/V New Horizon, Gulf of California, Mexico. University of Rhode Island, 2006, 2010, 2011
R/V Pt. Sur, Monterey Bay. Moss Landing Marine Labs, 2008
R/V Endeavor, Northwest Atlantic. University of Rhode Island, 2011
R/V Kilo Moana, Hawai'i. University of California, Santa Barbara, 2012
FSV Pisces, Northwest Atlantic. NOAA/NMFS, 2012
R/V New Horizon, Santa Barbara Basin. UNOLS Training Course, 2012

FELLOWSHIPS, SCHOLARSHIPS, AND HONORS

National Science Foundation, Graduate Research Fellowship, 2006-2009
Outstanding Graduate Student Instructor, UC Berkeley, 2007
UC Museum of Paleontology Remington-Kellogg Grant, 2008
Robert and Nancy Beim Field Research Fellowship, 2008
Society of Integrative and Comparative Biology, Student Support, 2007
Graduate Research Funds, UC Berkeley, 2007, 2008, 2009
Sigma Xi Grants-in-Aid of Research, 2006
Julius Thomas Hansen Travel Fellowship, UC Berkeley, 2006
Graduate Student Summer Fellowship, UC Berkeley, 2006, 2007, 2008
Ralph I. Smith Grant for Marine Research, UC Berkeley, 2005
Bermuda Biological Station for Research, Course Scholarship, 2005
Phi Beta Kappa, National Honor Society, inducted 2002
Beta Beta Beta, Biology Honors Society, inducted 2002
Dean's List, Illinois Wesleyan University, 1998-2000, 2001-2002
Golden Key International Honor Society, nominated 2001
Presidential Scholarship, Illinois Wesleyan University, 1998-2002

POSTERS

Bush, S. L., & B. A. Seibel. Measuring the anaerobic response of the deep-sea mysid *Gnathopausia ingens* to low oxygen: Implications for oxygen minimum zone expansion. 5th International Zooplankton Production Symposium. Pucon, Chile, 2011
Kaufmann, R. S., Garcia, D. N., Robison, B. R., Sherlock, R. E., Reisenbichler, K. R., **Bush, S. L.**, Smith, K. L. Jr., Osborn, K. J., & M. S. Lowery. Effects of Free-Drifting Icebergs on the Abundance and Composition of Macrozooplankton and Micronekton Communities in the Southern Ocean. ASLO Aquatic Sciences Meeting, Portland, OR, 2010
Robison, B. H., Sherlock, R. E., Reisenbichler, K. R. & **S. L. Bush**. In situ studies of the dark ocean: deep pelagic biology and ecology. ASLO Aquatic Sciences Meeting, Nice, France, 2009

PROFESSIONAL SERVICE AND DEVELOPMENT

Reviewer: Biology Letters, The Biological Bulletin, Marine Biology, Marine Biology Research, Journal of Experimental Marine Biology and Ecology, Oregon Sea Grant
Centers for Ocean Sciences Education Excellence (COSEE) - Ocean Systems and New England Ocean Science Education Collaborative (NEOSEC) "Strategies for Engaging in Broader Impact Programs" Workshop
Centers for Ocean Sciences Education Excellence (COSEE) - GEARS Workshop

WEBSITES

SI <http://invertebrates.si.edu/bush.htm>

UC BERKELEY UCMP: http://www.ucmp.berkeley.edu/science/profiles/bush_0704.php

PERSONAL: stephalopod.com

PUBLISHED PHOTOGRAPHS OF ORGANISMS

Deep-sea squid *H. heteropsis* – UC Berkeley, Dept. of Integrative Biology, newsletter cover

Deep-sea squid *G. phyllura* – UC Berkeley, Dept. of Integrative Biology, research pamphlet

Antarctic krill – ICEBERG II/Exploratorium Picture of the Day

Squat lobster larva– MBARI Board Meeting Proceedings, cover

Caribbean Reef Squid, *Sepioteuthis sepioidea* – Byrne et al. 2010, Ferrantia

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

American Academy of Underwater Sciences - Scientific Diver

American Malacological Society

American Society of Limnology and Oceanography

Animal Behavior Society

Sigma Xi, Associate Member

Society for Integrative and Comparative Biology

PRESS

Re: A shot in the dark: Same-sex sexual behavior in a deep-sea squid

<http://www.mbari.org/news/homepage/2011/squid-mating-behavior/squid-mating-behavior.html>

<http://www.nytimes.com/2011/09/21/science/21squid.html>

<http://www.bbc.co.uk/news/science-environment-14986769>

<http://news.sciencemag.org/sciencenow/2011/09/deep-sea-squid-mate-indiscrimina.html>

<http://www.guardian.co.uk/science/2011/sep/21/male-squid-mate-sex-dark>

<http://www.livescience.com/16146-sex-starved-bisexual-squid.html>

<http://blogs.discovermagazine.com/notrocketscience/2011/09/20/indiscriminate-squid-just-implantin-everyone-with-sperm/>

Re: Economy of autotomy in the mesopelagic squid *Octopoteuthis deletron*

<http://news.sciencemag.org/sciencenow/2012/07/disarming-deep-sea-tactics.html?ref=hp>

<http://news.sciencemag.org/sciencenow/2012/08/podcast-surviving-rabies-skin-ca.html?ref=hp>

<http://blogs.discovermagazine.com/notrocketscience/2012/08/01/deep-sea-squid-can-break-off-all-its-arms-onto-an-enemy/#more-7353>

<http://www.uri.edu/news/releases/?id=6335>

<http://www.ecori.org/press-releases/2012/8/3/uri-scientist-makes-squid-lose-its-arms.html>

http://www.msnbc.msn.com/id/48486657/ns/technology_and_science-science/#.UBxE4b_F5wE

<http://www.deathandtaxesmag.com/186641/watch-a-squid-disconnect-its-arm-to-survive-attack/>

<http://www.wired.co.uk/news/archive/2012-08/03/armless-squid>

<http://www.dailymail.co.uk/sciencetech/article-2181643/The-squid-simply-leaves-arms-flees.html>

<http://laughingsquid.com/deep-sea-squid-detach-arms-when-faced-with-predators-or-prey/>

http://www.huffingtonpost.com/2012/07/31/squid-detach-arms-octopoteuthis_n_1725772.html

http://www.sciencecodex.com/deepsea_squid_can_jettison_arms_as_defensive_tactic-95984

<http://phys.org/news/2012-08-kind-squid-jettison-arm-video.html>

<http://www.abc.es/20120802/ciencia/abci-calamar-amputa-brazos-201208021612.html>

http://www.khoahoc.com.vn/khampha/dai-duong-hoc/40945_Loai-duy-nhat-biet-tu-chat-tay-de-phong-ve.aspx

<http://kopalniawiedzy.pl/Octopoteuthis-deletron-kalamarnica-ramiona-autotomia-Stephanie-Bush,16351>