

# *CURRICULUM VITAE*

## **Edith A. Widder**

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President and Senior Scientist  
Ocean Research & Conservation Association  
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### **AREAS OF EXPERTISE:**

Photophysiology and photoecology of marine organisms with emphasis on bioluminescence and vision. Instrumentation development and utilization of research submersibles for oceanic *in situ* light measurements. Development of bioluminescence measurements as a tool for mapping organism distribution patterns. Radiometric calibration. Certified research pilot for single-person submersibles: *Wasp*, *Deep Rover*, and *Deep Worker*.

### **EDUCATION:**

- 1973 B.S. - *Magna cum laude* - Biology, Tufts University, Medford, Massachusetts
- 1977 M.S. - Biochemistry, University of California, Santa Barbara
- 1979 Experimental Neurobiology, Catalina Marine Science Center (Summer Program)
- 1982 Ph.D.- Neurobiology, University of California, Santa Barbara
- 1984 Certification: Scientific Research Pilot for Atmospheric Diving System Submersibles

### **ACADEMIC POSITIONS:**

- President and senior scientist, **Ocean Research & Conservation Assoc.** (2005-present)
- Senior scientist and principal investigator, **Harbor Branch Oceanogr. Inst.** (1993-2005)
- Adjunct Senior Research Scientist, **Bigelow Laboratory for Ocean Sciences** (2005-present)
- Adjunct Research Professor, Earth and Planetary Sciences Dept, **Johns Hopkins Univ.** (2000-present)
- Distinguished Scientist Adjunct, **Monterey Bay Aquarium Research Institute** (1998-present)
- Professor of Biological Sciences, **Florida Institute of Technology** (1991-present)
- Affiliate Professor, Dept of Biological Science, **Florida Atlantic University** (2000-present)
- Acting Division Director, **Harbor Branch Oceanogr. Inst.** (1993-1994)
- Associate scientist and principal investigator, **Harbor Branch Oceanogr. Inst.** (1991-93)
- Assistant scientist and principal investigator, **Harbor Branch Oceanogr. Inst.** (1989-91)
- Scientific consultant for **Dynamics Technology, Inc.**, Los Angeles (1987-89)
- Assistant research biologist and co-principal investigator, **UC Santa Barbara**, Marine Science Inst. and Neuroscience Research Inst. (1985-89)
- Postdoctoral research biologist, ONR bioluminescence program. **UC Santa Barbara** (1983-85)
- Associate researcher, ONR bioluminescence program, **UC Santa Barbara** (1977-83)
- Ph.D. dissertation research, **UC Santa Barbara** (1977-82)
- Research associate NIH resource lab in electron probe microanalysis. **Harvard Medical School.** (1973-75)
- Laboratory assistant in phycology. Field Station of Environmental Sciences of the **University of Massachusetts.** (1968-69)

### **AWARDS SUMMARY:**

Since 1984 over \$12,000,000 in externally funded support including over **\$7,000,000 from U.S. Navy agencies** (ONR, NORDA, NOARL, NRL), over **\$3,000,000 from the National Science Foundation** and over **\$1,000,000 from the National Oceanographic and Atmospheric Administration**.

### **PROFESSIONAL SOCIETIES:**

American Academy of Underwater Sciences  
American Association for the Advancement of Science  
American Society of Limnology and Oceanography  
Society of Photo-Optical and Instrumentation Engineers  
International Society for Bioluminescence and Chemiluminescence, Councilor  
Marine Technology Society, Editorial Board Member  
Explorers Club

### **RESEARCH EXPEDITIONS :**

59 research expeditions, 22 as chief scientist and 13 as co-chief scientist, including to the Gulf of Mexico, Bahamas, Gulf of Maine, western Mediterranean, Canary Islands and off the NW coast of Africa, as part of the first US oceanographic expedition into Cuban waters since Castro took power, to the Sea of Cortez, trans-Atlantic, trans-Pacific and off California. Over 250 dives in deep-diving submersibles.

### **PUBLICATIONS:**

- Suntsov, A.V., E.A. Widder and T.T. Sutton (in review) Bioluminescence in larval fishes. In: **Fish Larval Physiology**. Eds R.N. Finn and B.G. Kapoor. Sciences Publishers Inc. Enfield, N.H.
- Widder, E.A. (2006) A look back at quantifying oceanic bioluminescence: Seeing the light, flashes of insight and other bad puns. **Mar Tech Soc J.** 40(2):136-137.
- Johnsen, S., Kelber, A., Warrant, E., Sweeney, A.M., Widder, E.A., Lee, Jr., R.L. and Hernández-Andrés, J. (2006) Crepuscular and nocturnal illumination and its effects on color perception in the nocturnal hawkmoth *Deilephila elpenor*. **J. Exp. Biol.** 209:789-800
- Malkiel, E., Abras, J. N., Widder, E. and Katz, J. (2006) On the spatial distribution and NND between particles in the water column determined from in situ holographic measurements. **J. Plank. Res.** 28(2):149-170.
- Davis, J.W., Thosteson, E.D., Widder, E.A., & C.L. Frey (2005). Examination of Bioluminescent Excitation Response using Empirical Orthogonal Function Analysis. **MTS/IEEE Oceans 2005**
- Widder, E.A., B.H. Robison, K.R. Reisenbichler, and S.H.D. Haddock (2005) Using red light for *in situ* observations of deep-sea fishes. **Deep-Sea Res.** 52:2077-2085
- Myslinski TJ, Frank TM, Widder, EA (2005) Correlation between photosensitivity and downwelling irradiance in mesopelagic crustaceans. **Mar. Biol.** 147: 619–629

- Widder, E.A., C.L. Frey and J.R. Bowers (2005) Improved bioluminescence measurement instrument. **Sea Technology** 46(2): 10-16
- Herring, P.J. and E.A. Widder (2004) Bioluminescence of coronate medusae. **Mar. Biol.** 146:39-51
- Johnsen, S., E.A. Widder, and C.D. Mobley (2004) Propagation and perception of bioluminescence: Factors affecting counterillumination as a cryptic strategy **Biol. Bull.** 207:1-16
- Shagin, D.A., E.V. Barsova, Y.G. Yanushevich, A.F. Fradkov, K.A. Lukyanov, Y.A. Labas, T.N. Semenova, J.A. Ugalde, A. Meyer, J.M. Nunes, E.A. Widder, S.A. Lukyanov and M.V. Matz (2004) GFP-like proteins as ubiquitous Metazoan superfamily: Evolution of functional features and structural complexity. **Mol. Biol. Evol.** 21(5):841-850
- Widder, E.A., C.L. Frey and L.J. Borne (2003) HIDE X Generation II: A New and Improved Instrument for Measuring Marine Bioluminescence. **Marine Technology Society of the IEEE, Oceans** 4:2214-2221
- Vecchione, M., C.F.E. Roper, E.A. Widder, and T.M. Frank (2003) In-situ observations of three species of large-finned deep-sea squids. **Bull. Mar. Sci.** 71(2):893-902
- Widder, E.A. (2002) SPLAT CAM: Mapping plankton distributions with bioluminescent road-kill. **Marine Technology Society of the IEEE, Oceans** 3:1711-1715
- Frank, T.M. and E.A. Widder (2002) Effects of a decrease in downwelling irradiance on the daytime vertical distribution patterns of zooplankton and micronekton. **Mar. Biol.** 140 (6):1181-1194
- Widder, E.A. (2002) Bioluminescence and the pelagic visual environment. **Mar. Fresh. Behav. Physiol.** 35 (1-2): 1-26. Invited review.
- Widder, E.A. (2001) Bioluminescence. **Bioscience Explained** <http://www.bioscience-explained.org/EN1.1/features.html> Invited review.
- Johnsen, S. and E.A. Widder (2001) Ultraviolet absorption in transparent zooplankton and its implications for depth distribution and visual predation. **Mar. Biol.** 138:717-730.
- Widder, E.A. and T.M. Frank (2001) The Speed of an Isolume: A Shrimp's Eye View. **Mar. Biol.** 138:669-677
- Herring, P.J. and E.A. Widder (2001) Bioluminescence in plankton and nekton. In: Steele, J.H., Thorpe, S.A. and Turekian, K.K. editors, **Encyclopedia of Ocean Science**, Vol. 1, 308-317. Academic Press, San Diego.
- Widder, E.A. (2000) Bioluminescence in octopods. **Yearbook of Science and Technology**. McGraw-Hill 2001: 52-55.
- Widder, E.A. and S. Johnsen (2000) 3D spatial point patterns of bioluminescent plankton: A map of the "minefield" **J. Plank. Res.** 22(3): 409-420.

Widder, E.A. (1999) Bioluminescence. In: “**Adaptive Mechanisms in the Ecology of Vision.**” Edited by: S.N. Archer, M.B.A. Djamgoz, E. Loew, J.C. Partridge & S. Vallergera. Kluwer Academic Publishers, Dordrecht, the Netherlands. Pp 555-581.

Frank, T.M. and E.A. Widder. (1999) A comparative study of the spectral sensitivities of mesopelagic crustaceans. **J. Comp. Physiol.** 185(3): 255-265.

Johnsen, S. and E.A. Widder. (1999) The physical basis of transparency in biological tissue: Ultrastructure and the minimization of light scattering. **J. Theor. Biol.** 199: 181-198

Kocak, D.M., N.D.V. Lobo, and E.A. Widder. (1999) Computer vision techniques for quantifying, tracking and identifying Bioluminescent plankton. **IEEE J. Oceanic Engineering** 24(1):81-95.

Widder, E.A., S. Johnsen, S. A. Bernstein, J. F. Case, D. J. Neilson. (1999) Thin layers of bioluminescent copepods found at density discontinuities in the water column. **Mar. Biol.** 134: 429-437.

Johnsen, S., E.J. Balsler and E.A. Widder. (1999) Modified suckers as light organs in a deep-sea octopod. **Nature** 398:113-114.



Johnsen, S., E.J. Balsler, E.C. Fisher, and E.A. Widder (1999) Bioluminescence in the deep-sea cirrate octopod *Stauroteuthis syrtensis* Verrill (Mollusca: Cephalopoda) **Biol. Bull.** 197: 26-39

Haddock, S.H.D. Neilson, D.J. Widder, E.A. and Case, J.F. (1998) Feasibility of using in situ measurements of bioluminescence spectra to determine the vertical distribution of plankton. In: **Pelagic Biogeography IcoPB II Proceedings of the 2<sup>nd</sup> International Conference Workshop Report** 142:137-142.

Widder, E.A. (1998) A predatory use of counterillumination by the squaloid shark, *Isistius brasiliensis*. **Env. Biol. Fishes** 53:267-273.

Johnsen, S. and E.A. Widder. (1998) Measurements of the transparency of mesopelagic gelatinous zooplankton from the North Western Atlantic. **Biol. Bull.** 195:337-348.



Widder, E.A. and S. Johnsen. (1998) Optical imaging, identification and 3D analysis of spatial distribution patterns of bioluminescent plankton. **SPIE Ocean Optics XIV.**

Johnsen, S. and E.A. Widder. (1998) The transparency and visibility of gelatinous zooplankton. **SPIE Ocean Optics XIV.**

Widder, E.A. (1997) Bioluminescence - Shedding some light on plankton distribution patterns. **Sea Technology** March 1997:33-39.

Widder, E.A. (1997) *In situ* video recordings of bioluminescence in the ostracod, *Conchoecia elegans*, and co-occurring bioluminescent zooplankton in the Gulf of Maine.

- In: *Bioluminescence and chemiluminescence: molecular reporting with photons*. (eds J.W.Hastings, L.J.Kricka, & P.E.Stanley), pp. 159-164. John Wiley: Chichester
- Makemson, J.C., N.R. Fulayfil, W.L. Landry, L.M. Van Ert, C.F. Wimpee, E.A. Widder and J.F. Case (1997) *Shewanella woodyi* sp. nov., an exclusively respiratory luminous bacterium isolated from the Alboran Sea. **International Journal of Systematic Bacteriology** 47 (4): 1034-1039.
- Frank, T.M. and E.A. Widder (1997) The correlation of downwelling irradiance and staggered vertical migration patterns of zooplankton in Wilkinson Basin, Gulf of Maine. **J. Plankton Research** 19 (12): 1975-1991.
- Frank, T.M. and E.A. Widder. (1996) UV light in the deep-sea: In situ measurements of downwelling irradiance in relation to the visual threshold sensitivity of UV-sensitive crustaceans. **Mar. Fresh. Behav. Physiol.** 27 (2-3): 189-197.
- Kocak, D.M., N.da V. Lobo, E.A. Widder (1996) Tracking and mapping underwater bioluminescent displays using snakes. **Marine Technology Society of the IEEE, OCEANS '96** 3:1220-1226.
- Frank, T.M. and E.A. Widder. (1994) Evidence for behavioral sensitivity to near-UV light in the deep-sea crustacean, *Systellaspis debilis*. **Mar. Biol.** 118: 279-284.
- Frank, T.M. and E.A. Widder. (1994) Comparative study of behavioral sensitivity thresholds to near-UV and blue-green light in deep-sea crustaceans. **Mar. Biol.** 121: 229-235.
- Widder, E.A., J.F. Case, S.A. Bernstein, S. MacIntyre, M.R. Lowenstine, M.R. Bowlby, and D.P. Cook. (1993) A new large volume bioluminescence bathyphotometer with defined turbulence excitation. **Deep-Sea Res.** 40(3): 607-627.
- Herring, P.J., M.I. Latz, N.J. Bannister and E.A. Widder. (1993) Bioluminescence of the poecilostomatoid copepod *Oncaea conifera*. **MEPS** 94:297-309.
- Case, J.F., E.A. Widder, S.A. Bernstein, K. Ferer, D. Young, M. Latz, M. Geiger, and D. Lapota. (1993) Assessment of Marine Bioluminescence. **Naval Research Reviews** XLV:31-41.
- Widder, E.A. (1993) 3-D bioluminescence mapping. **U.S. GLOBEC News** No. 4 August 1993:6.
- Herring, P.J., E.A. Widder and S. Haddock. (1992) Correlation of bioluminescence emissions with ventral photophores in the mesopelagic squid *Abralia veranyi*. **Mar. Biol.** 112:293-298.
- Widder, E.A. (1992) Mixed light imaging system for recording bioluminescence behaviors. **J. Mar. Biol. Assoc. U.K.** 72:131-138.
- Greene, C.H., E.A. Widder, M.J. Youngbluth, A. Tamso, and G.E. Johnson. (1992) The migration behavior, fine structure, and bioluminescent activity of krill sound-scattering layers. **Limnol. Oceanogr.** 37:650-658.

- Widder, E.A., C.H. Greene and M.J. Youngbluth. (1992) Bioluminescence of sound-scattering layers in the Gulf of Maine. **J. Plank. Res.** 14(11): 1607-1624.
- Spinrad, R.W. and E.A. Widder. (1992) Ship shadow measurements obtained from a manned submersible. **SPIE Proceedings** Vol. 1750: 372-383.
- Widder, E. A., Caimi, F. M., Taylor, L. D. and Tusting, R. F. (1992) Design and development of an autocalibrating radiometer for deep sea biooptical studies. **Oceanic Engineering Society of the IEEE, OCEANS '92**, Mastering the Oceans through technology. 1:525-530. New York.
- Bowlby, M.R., E.A. Widder, and J.F. Case. (1991) Disparate forms of bioluminescence from the amphipods *Cyphocaris faurei*, *Scina crassicornis* and *S. borealis*. **Mar. Biol.** 108:247-253.
- Widder, E.A., (1991) Midwater bioluminescence assessment in the West Alboran Gyre (Mediterranean Sea). **HBOI MP #126**.
- Hollman, R., D.M. Lavoie, and E.A. Widder. (1991) Executive Summary Western Alboran Sea Assessments: April 1991. **Naval Oceanographic and Atmospheric Research Laboratory. Technical Note 270**.
- Bowlby, M.R., E.A. Widder, and J.F. Case. (1990) Patterns of stimulated bioluminescence in two Pyrosomes (Tunicata: Pyrosomatidae). **Biol. Bull.** 179: 340-350.
- Huber, M.E., A.C. Arneson and E.A. Widder. (1989) Extremely blue bioluminescence in the polychaete *Polycirrus* (Terebellidae). **Bull. of Mar. Science** 44:1236-1239.
- Widder, E.A., S.A. Bernstein, D.F. Bracher, J.F. Case, K.R. Reisenbichler, J.J. Torres and B.H. Robison. (1989) Bioluminescence in Monterey Submarine Canyon: image analysis of video recordings from a midwater submersible. **Mar. Biol.** 100:541-551.
- Hiller-Adams, P., E.A. Widder, and J.F. Case. (1988) The visual pigments of four deep-sea crustacean species. **J. Comp. Physiol. A.** 163:63-72.
- Widder, E.A., P. Hiller-Adams and J.F. Case. (1987) A multichannel microspectrophotometer for visual pigment investigations. **Vision Research** 27(7):1047-1055.
- Latz, M.I., T.M. Frank, M.R. Bowlby, E.A. Widder and J.F. Case. (1987) Variability in flash characteristics of a bioluminescent copepod. **Biol. Bull.** 173:489-503.
- Widder, E.A., M.I. Latz, and P.J. Herring. (1986) Temporal shifts in bioluminescence emission spectra from the deep-sea fish, *Searsia koefoedi*. **Photochem. Photobiol.** 44:97-101.
- Denton, E.J., P.J. Herring, E.A. Widder, M.I. Latz and J.F. Case. (1985) The roles of filters in the photophores of oceanic animals and their relation to vision in the oceanic environment. **Proc. R. Soc. Lond. B** 225:63-97.

- Widder, E.A., M.I. Latz, P.J. Herring, and J.F. Case. (1984) Far red bioluminescence from two deep-sea fishes. **Science** 225:512-514.
- Frank, T.M., E.A. Widder, M.I. Latz and J.F. Case. (1984) Dietary maintenance of bioluminescence in a deep-sea mysid. **J. Exp. Biol.** 109:385-389.
- Widder, E.A., M.I. Latz and J.F. Case. (1983) Marine bioluminescence spectra measured with an optical multichannel detection system. **Biol. Bull.** 165:791-810.
- Widder, E.A. and J.F. Case. (1982) Distribution of subcellular bioluminescent sources in a dinoflagellate, *Pyrocystis fusiformis*. **Biol. Bull.** 162:423-448.
- Widder, E.A. and J.F. Case. (1982) Luminescent microsource activity in bioluminescence of the dinoflagellate, *Pyrocystis fusiformis*. **J. Comp. Physiol.** 145:517-527.
- Widder, E.A. (1982) Effector control in the bioluminescent dinoflagellate, *Pyrocystis fusiformis* (Murray) **Ph.D. Dissertation**, University of California, Santa Barbara.
- Widder, E.A. and J.F. Case. (1981) Two flash forms in the bioluminescent dinoflagellate, *Pyrocystis fusiformis*. **J. Comp. Physiol.** 143:43-52.
- Widder, E.A. and J.F. Case. (1980) Bioluminescence excitation in a dinoflagellate. IN **Bioluminescence: Current Perspectives** (K.H. Neilson, ed.) Burgess Publishing Company, Minneapolis, pp. 125-132.

#### **PATENTS HELD:**

Co-holder of U.S. Patent # 5264906, awarded in 1993 for the HIDEX-BP (High Intake Defined Excitation Bathypotometer) which is the standard in the U.S. Navy for the measurement of bioluminescence in the oceans.

#### ***Students and Postdocs Advised and Co-Advised:***

##### Graduate Students:

Maura Jess, M.S. University of California Santa Barbara  
Mark Bowlby, Ph.D. University of California Santa Barbara  
Kathy Daumer, M.S. Florida Institute of Technology  
Trevor Myslinski, M.S. Florida Institute of Technology  
Jessie W. Davis, M.S. Florida Institute of Technology  
Nicole McMullen, M.S. Florida Atlantic University  
Erika Raymond, Ph.D. Candidate Johns Hopkins University  
Karen Breitlow, M.S. Candidate Florida Atlantic University  
Miranda Hoover, Ph.D. Candidate Florida Atlantic University

##### Post-docs:

Tamara Frank, HBOI Post Doc  
Sönke Johnsen, HBOI Post Doc

#### **EDUCATIONAL PRODUCTIONS:**

1997 Educational web site on bioluminescence [www.biolum.org](http://www.biolum.org) produced in 1997. Winner of the National Science Teachers Association sciLINKS award in 2001.

1998 Author of The Bioluminescence Coloring Book. Harbor Branch Oceanographic Institution, Fort Pierce, Florida. Over 6000 sold.

2000 Wrote and produced Marine bioluminescence: Secret Lights in the Sea. 26 min educational video. Harbor Branch Oceanographic Institution, Fort Pierce, Florida. Winner of the 2001 Silver Reel Award in Media Excellence and the 2002 Silver CINDY (Cinema In Industry) Award from the International Association of Audio-Visual Communicators.



2003 National Geographic Virtual Teacher Workshop May 5 - 9, 2003: "Living Light in the Ocean" <http://www.coexploration.org/ceo/> Over 3000 registrants (K-12 teachers).

2003-2008 Curator of 5000 sq ft traveling museum exhibit on bioluminescence. Glow: Living Lights is scheduled for a 5 year North American tour and will be seen by over 5 million viewers. <http://www.glowexhibit.com/> Much of the imagery in this exhibit is from my library of stills and videos collected over the course of my career.

2004 Operation Deep Scope posted on NOAA's Ocean Explorer Explorations web page <http://oceanexplorer.noaa.gov/explorations/04deepscope/welcome.html>

2005 OceanAGE profile posted on NOAA website for web chat with video interview <http://oceanexplorer.noaa.gov/edu/oceanage/welcome.html>

2005 Operation Deep Scope II posted on NOAA's Ocean Explorer Explorations web page <http://oceanexplorer.noaa.gov/explorations/05deepscope/welcome.html>

Lucinda's Lamps: A Mermaid's Guide to Lights in the Sea (in development). Educational picture book: Ages 5-9. Written by Edith A. Widder.

