PETRA HOEPCKE LENZ

Békésy Laboratory of Neurobiology
Pacific Biosciences Research Center, School of Ocean and Earth Science and Technology
Univ. of Hawai‘i at Mānoa
1993 East-West Road, Honolulu, HI 96822
E-mail: petra@hawaii.edu Web: www.pbrc.hawaii.edu/~petra

Dual Citizenship – U.S. and Brazil

Education

U. California, San Diego, CA, B.A. in Biology, 1976
U. California, Santa Barbara, CA, M.A. (1980), Ph.D. (1983) in Biology (J. Melack, advisor)
U. California, Santa Barbara, CA, Post-Doc in Limnology, 1/83-7/84 (J. Melack, advisor)
U. Hawai‘i, Mānoa, HI, Post-Doc in Biological Oceanography, 1/88-4/90 (R. Radtke, advisor)
Smith College, New England BioLabs Workshop in Molecular Biology, 6/03

Professional Positions and Experience

Researcher, PBRC, Univ. Hawai‘i, Mānoa, 8/11 to present
Interim Associate Director, PBRC, 7/23 to present
Interim Director, Biological Electron Microscope Facility, 12/21 – 9/22
Program Director, rotator, National Science Foundation, Geosciences, Ocean Sciences, 11/19 to 11/21
Associate Researcher, PBRC, Univ. Hawai‘i, Mānoa, 8/00 to 7/11
Assistant Researcher, PBRC, Univ. Hawai‘i, Mānoa, 7/90 to 7/00
Lecturer, University of Hawai‘i at Mānoa and Kapiolani Community College, 8/84 to 5/85, 1/87 to 5/88
Research Affiliate, Hawai‘i Inst. of Marine Biology, Univ. Hawai‘i, Manoa, 1/84 to 6/88

Research Interests

Zooplankton ecology and physiology, life-history strategies, diapause and dormancy, predator-prey interactions, behavioral performance, sensory systems, organism-environment interactions, population dynamics, ‘omics, and biological oceanography. With a special interest in high latitude marine environments, recent work has focused on lipid-rich copepods in sub-arctic environments.

Administrative Experience

Pacific Biosciences Research Center, Interim Associate Director (2023-)
Biological Electron Microscope Facility, Interim Director (2022)
National Science Foundation, Directorate of Geosciences, Program Director (2019-2021)
UH Mānoa and National Science Foundation, Advisory Search Committee member/chair (2013, 2014-2016, 2020, 2021, 2021-2022)
UH Mānoa, Faculty Senate, Senator, member of the Committee on Research and Graduate Education, 2013-2015

UH Mānoa, Maximizing Access to Research Careers (MARC, NIH funded), co-Director (2010-2015)
UH Mānoa Honors Program, Honors Council, member (2012-2016)

Membership in Professional Societies

American Geophysical Union
Association for the Sciences of Limnology and Oceanography
Society for Integrative and Comparative Biology
Sigma Xi Full Member
Mount Desert Island Biological Laboratory, Life Member
SACNAS – Advancing Chicanos/Hispanics and Native Americans in the Sciences, Life Member

Field Expeditions

Antarctic Peninsula, Explorers Club Flag Expedition – February to March, 2024
Gulf of Alaska Seamounts 2019, NOAA Ocean Exploration – July to August, 2019
Gulf of Alaska, Long-term Ecological Research Program – multiple spring and fall cruises, May, 2015 to Spring, 2019

Publications - Peer-reviewed Journals

2025

Hartline, D. K. and Lenz, P. H. (2025) Adaptations of calanoid copepods for escaping predatory attacks. *Journal of Plankton Research*, 47(2), p.fbae050.

Lenz, P. H., Block, L. N., Cieslak, M. C., Suitos, J., Roncalli, V., Castelfranco, A. M., and Hartline, D. K. (2025) Genetic divergence in a marine copepod associated with marginal habitats across the subarctic Pacific. *Marine Ecology Progress Series*, in press

2023

Hansen, B. H., Tarrant, A. M., Lenz, P. H., Roncalli, V., Almeda, R., Broch, O. J., Altin, D. and Tollefsen, K. E., (2023) Effects of petrogenic pollutants on North Atlantic and Arctic *Calanus* copepods: From molecular mechanisms to population impacts. *Aquatic Toxicology*, p.106825.

Hartline, D. K., Cieslak, M. C., Castelfranco, A. M., Lieberman, B., Roncalli, V., and Lenz, P. H. (2023) *De novo* transcriptomes of six calanoid copepods (Crustacea): a resource for the discovery of novel genes. *Scientific Data* **10(1)**: 242. Doi: 10.1038/s41597-023-02130-1

Monell, K. M., Roncalli, V., Hopcroft, R. R., Hartline, D. K., and Lenz, P. H. (2023) Post-diapause DNA replication during oogenesis in a capital-breeding copepod. *Integrative Organismal Biology*, **5(1)**: obad020. Doi: 10.1093/iob/obad020

Roncalli, V., Block, L. N., Niestroy, J. L., Cieslak, M. C., Castelfranco, A. M., Hartline, D. K., and Lenz, P. H. (2023) Experimental analysis of development, lipid accumulation and gene expression in a high-latitude marine copepod. *Journal of Plankton Research*, **45(6)**: 885-898.

2022

Chang, I., Hartline, D. K., Lenz, P. H., and Takagi, D. (2022) Larval fish counteract ram and suction to capture evasive prey. *Royal Society Open Science*, **9(11)**: 220714.

Jungbluth, M. J., Hanson, K. M., Lenz, P. H., Robinson, E., and Goetze, E. (2022) Species-specific biomass estimation from gene copy number in metazoan plankton. *Limnology and Oceanography: Methods*, **20(6)**: 305-319. Doi: 10.1002/lom3.10487

Roncalli, V., Cieslak, M. C., Castelfranco, A. M., Hartline, D. K., and Lenz, P. H. (2022) Postponing development: dormancy in the earliest developmental stages of a high-latitude calanoid copepod. *Journal of Plankton Research,* **44(6)**: 923-935.

Roncalli, V., Niestroy, J., Cieslak, M. C., Castelfranco, A. M., Hopcroft, R. R., and Lenz, P. H. (2022) Physiological acclimatization in high-latitude zooplankton. *Molecular Ecology*, **31(6)**: 1753-1765.

2021

Lenz, P. H., Lieberman, B., Cieslak, M. C., Roncalli, V., and Hartline, D. K. (2021) Transcriptomics and metatranscriptomics in zooplankton: Wave of the Future? *Journal of Plankton Research,* **43(1)**: 3–9.

Lenz, P. H., Roncalli, V., Cieslak, M. C., Tarrant, A. M., Castelfranco, A. M., & Hartline, D. K. (2021) Diapause vs. reproductive programs: transcriptional phenotypes in a keystone copepod. *Communications Biology,* **4(1)**: 1-13.

Roncalli, V., Cieslak, M. C., Castelfranco, A. M., Hopcroft, R. R., Hartline, D. K. & Lenz, P. H. (2021). Post-diapause transcriptomic restarts: Insight from a high-latitude copepod. *BMC Genomics*, **22(1)**: 1-17. Doi: 10.1186/s12864-021-07557-7.

2020

Cieslak, M. C., Castelfranco, A. M., Roncalli, V., Lenz, P. H & Hartline, D. K. (2020) t-Distributed Stochastic Neighbor Embedding (t-SNE): A tool for eco-physiological transcriptomic analysis. *Marine Genomics*, **51**: 100723.

Niimoto, K., Kuball, K. J., Block, L. N., Lenz, P. H. & Takagi, D. (2020). Rotational maneuvers of copepod nauplii at low Reynolds number. *Fluids*, **5**: 78. *(Editor's Choice Article)*

Roncalli, V., Cieslak, M. C., Hopcroft, R. R. & Lenz, P. H. (2020). Capital breeding in a diapausing copepod: a transcriptomics analysis. *Frontiers in Marine Science*, **7**: 56.

2019

Fashingbauer, M. C., Tuttle, L. J., Robinson, H. E., Strickler, J. R., Hartline, D. K., & Lenz, P. H. (2019). Predatory posture and performance in a precocious larval fish targeting evasive copepods. *Journal of Experimental Biology*, **222(9)**: jeb191411. Doi: 10.1242/jeb.191411.

Lenz, P. H. & Roncalli, V. (2019). Diapause within the context of life-history strategies in calanid copepods (Calanoida: Crustacea). *Biological Bulletin*, **237**: 170-179.

Robinson, H. E., Strickler, J. R., Henderson, M. J., Hartline, D. K. & Lenz, P. H. (2019). Predation strategies of larval clownfish capturing evasive copepod prey. *Marine Ecology Progress Series*, **614**: 125-146.

Roncalli, V., Cieslak, M. C., Germano, M., Hopcroft, R. R., & Lenz, P. H. (2019). Regional heterogeneity impacts gene expression in the subarctic zooplankter *Neocalanus flemingeri* in the northern Gulf of Alaska. *Communications Biology*, **2(1)**: 1-13. Doi: 10.1038/s42003-019-0565-5 COMMSBIO-18-1375

Tuttle, L. J., Robinson, H. E., Takagi, D., Strickler, J. R., Lenz, P. H. & Hartline, D. K. (2019). Going with the flow: hydrodynamic cues trigger directed escapes from a stalking predator. *Journal of the Royal Society Interface*, **16(151)**: 20180776.

2018

Christie, A. E., Cieslak, M. C., Roncalli, V., Lenz, P. H., Major, K. M., & Poynton, H. C. (2018) Prediction of a peptidome for the ecotoxicological model *Hyalella azteca* (Crustacea; Amphipoda) using a *de novo* assembled transcriptome. *Marine Genomics*, **38**: 67-88 Doi: 10.1016/j.margen.2017.12.003.

Lenz, P. H., and D. K. Hartline. 2018. The biology of myelin in calanoid copepods. In: Trends in Copepod Studies - Distribution, Biology and Ecology, edited by M. Uttieri, 219-240. New York: Nova Science Publishers, Inc.

Mathews, L., Faithfull, C. L., Lenz, P. H. and Nelson, C. E. (2018) The effects of food stoichiometry and temperature on copepods are mediated by ontogeny. *Oecologia*, **188**: 75-84. Doi: 10.1007/s00442-018-4183-6.

Roncalli, V., Cieslak, M. C., Sommer, S. A., Hopcroft, R. R., & Lenz, P. H. (2018) *De novo* transcriptome assembly of the calanoid copepod *Neocalanus flemingeri*: a new resource for emergence from diapause. *Marine Genomics*, **37**: 114-119. Doi: 10.1016/j.margen.2017.09.002.

Roncalli, V., Sommer, S. A., Cieslak, M. C., Clarke, C., Hopcroft, R. R., & Lenz, P. H. (2018) Physiological transitions during emergence from diapause: a transcriptomic approach. *Scientific Reports,* **8(1)**: 12577.

Selph, K. E., Goetze, E., Jungbluth, M. J., Lenz, P. H., & Kolker, G. (2018) Microbial food web connections and rates in a subtropical embayment. *Marine Ecology Progress Series*, **590**: 19-34. Doi: 10.3354/meps12432.

2017

Buskey, E. J., Strickler, J. R., Bradley, C. J., Hartline, D. K., & Lenz, P. H. (2017). Escapes in copepods: comparison between myelinate and amyelinate species. *Journal of Experimental Biology* **220**: 754-758. Doi: 10.1242/jeb.148304

Jungbluth, M. J., Selph, K. E., Lenz, P. H. & Goetze, E. (2017). Incubation duration effects on copepod naupliar grazing estimates. *Journal of Experimental Marine Biology and Ecology* **494**: 54-62.

Jungbluth, M. J., Selph, K. E., Lenz, P. H., & Goetze, E. (2017). Species-specific grazing and significant trophic impacts by two species of copepod nauplii, *Parvocalanus crassirostris* and *Bestiolina similis*. *Marine Ecology Progress Series* **572**: 57-76.

Porter, M. L., Steck, M., Roncalli, V., & Lenz, P. H. (2017) Molecular characterization of copepod photoreception. *Biological Bulletin*, **233**: 96-110. Doi: 10.1086/694564.

Roncalli, V., Lenz, P. H., Cieslak, M. C., & Hartline, D. K. (2017) Complementary mechanisms for neurotoxin resistance in a copepod. *Scientific Reports*, **7**: 14201. Doi: 10.1038/s41598-017-14545-z.

Roncalli, V., Christie, A. E., Sommer, S. A., Cieslak, M. C., Hartline, D. K. & Lenz, P. H. (2017) A deep transcriptomic resource for the copepod crustacean *Labidocera madurae*: a potential indicator species for assessing near shore ecosystem health. *PloS One*, **12(10)**: e0186794. Doi: 10.1371/journal.pone.0186794.

Sommer, S. A., Van Woudenberg, L., Lenz, P. H., Cepeda, G., & Goetze, E. (2017) Vertical gradients in species richness and community composition across the twilight zone in the North Pacific Subtropical Gyre. *Molecular Ecology*, **26**: 6136-6156. Doi: 10.1111/mec.14286.

2016

Jackson, J. M. and Lenz, P. H. (2016). Predator-prey interactions in the plankton: larval fish feeding on evasive copepods. *Scientific Reports* **6**: 33585; Doi: 10.1038/srep33585 (2016).

Christie, A. E., Roncalli, V., & Lenz, P. H. (2016). Diversity of insulin-like peptide signaling system proteins in *Calanus finmarchicus* (Crustacea; Copepoda) – Possible contributors to seasonal pre-adult diapause. *General and Comparative Endocrinology* **236**: 157-173.

Roncalli, V., Jungbluth, M. J., & Lenz, P. H. (2016). Glutathione S-transferase regulation in *Calanus finmarchicus* feeding on the toxic dinoflagellate *Alexandrium fundyense*. *PloS One* **11(7)**: e0159563.

Roncalli, V., Cieslak, M. C., & Lenz, P. H. (2016). Transcriptomic responses of the calanoid copepod *Calanus finmarchicus* to the saxitoxin producing dinoflagellate *Alexandrium fundyense*. *Scientific Reports*, **6**: 25708; Doi:10.1038/srep25708.

Roncalli, V., Turner, J. T., Kulis, D., Anderson, D. M., & Lenz, P. H. (2016). The effect of the toxic dinoflagellate *Alexandrium fundyense* on the fitness of the calanoid copepod *Calanus finmarchicus*. *Harmful Algae*, **51**: 56-66.

2015

Roncalli, V., Cieslak, M. C., Passamaneck, Y., Christie, A. E., & Lenz, P. H. (2015). Glutathione S-Transferase (GST) Gene diversity in the crustacean *Calanus finmarchicus*–contributors to cellular detoxification. *PloS One*, **10(5)**: e0123322.

Lenz, P. H., Takagi, D., & Hartline, D. K. (2015). Choreographed swimming of copepod nauplii. *Journal of The Royal Society Interface*, **12(112)**: 20150776.

2014

Christie, A. E., Fontanilla, T. M., Roncalli, V., Cieslak, M. C., & Lenz, P. H. (2014). Diffusible gas transmitter signaling in the copepod crustacean *Calanus finmarchicus*: Identification of the biosynthetic enzymes of nitric oxide (NO), carbon monoxide (CO) and hydrogen sulfide (H_2S) using a *de novo* assembled transcriptome. *General and Comparative Endocrinology*, **202**: 76-86.

Lenz, P. H., Roncalli, V., Hassett, R. P., Wu, L. S., Cieslak, M. C., Hartline, D. K., & Christie, A. E. (2014). *De novo* assembly of a transcriptome for *Calanus finmarchicus* (Crustacea, Copepoda) – the dominant zooplankter of the North Atlantic Ocean. *PloS One*, **9(2)**: e88589.

Christie, A.E., Fontanilla, T.M., Roncalli, V., Cieslak, M.C. and Lenz, P.H. (2014). Identification and developmental expression of the enzymes responsible for dopamine, histamine, octopamine and serotonin biosynthesis in the copepod crustacean *Calanus finmarchicus. General and Comparative Endocrinology*, **195**: 28-39.

2013

Jungbluth, M. J., Goetze, E., Lenz, P. H. (2013). Measuring copepod naupliar abundance in a subtropical bay using quantitative PCR. *Marine Biology*, **160**:3125-3141.

Unal, E., Bucklin, A., Lenz, P. H. and Towle, D. W. (2013). Gene expression of the marine copepod *Calanus finmarchicus*: Responses to small-scale environmental variation in the Gulf of Maine (NW Atlantic Ocean). *Journal of Experimental and Marine Biology and Ecology*, **446**: 76-85.

Christie, A. E., Fontanilla, T. M., Nesbit, K. T. and Lenz, P. H. (2013). Prediction of the protein components of a putative *Calanus finmarchicus* (Crustacea, Copepoda) circadian signaling system using a de novo assembled transcriptome. *Comparative Biochemistry and Physiology Part D*, *Genomics & Proteomics*, **8**:165-193.

Christie, A. E., Roncalli, V., Wu, L.-S., Garrote, C.L., Doak, T. and Lenz, P.H. (2013). Peptidergic signaling in *Calanus finmarchicus* (Crustacea: Copepoda): *in silico* identification of putative

peptide hormones and their receptors using a *de novo* assembled transcriptome. *General and Comparative Endocrinology*, **187**:117-135.

Jungbluth, M. J. and Lenz, P. H. (2013). Copepod diversity in a subtropical bay based on a fragment of the mitochondrial COI gene. *Journal of Plankton Research*, **35**:630-643.

Bradley, C. J., Strickler, J. R., Buskey, E. J. and Lenz, P. H. (2013). Swimming and escape behavior in two species of calanoid copepods from nauplius to adult. *Journal of Plankton Research*, **35**:49-65.

Christie, A. E., Roncalli, V., Batta Lona, P., McCoole, M. D., King, B. L., Bucklin, A., Hartline, D. K. and Lenz, P. H. (2013). *In silico* characterization of the insect diapause-associated protein couch potato (CPO) in *Calanus finmarchicus* (Crustacea: Copepoda). *Comparative Biochemistry and Physiology. Part D, Genomics & Proteomics*, **8**:45-57.

2012

Buskey, E. J., Lenz, P. H. and Hartline, D. K. (2012) Sensory perception, neurobiology, and behavioral adaptations for predator avoidance in planktonic copepods. *Adaptive Behavior,* **20:**57-66

Lenz, P. H. (2012) The biogeography and ecology of myelin in marine copepods. *Journal of Plankton Research*, 34:575-589 (journal cover, featured article)

Lenz, P. H., Unal, E., Hassett, R. P., Smith, C. M., Bucklin, A., Christie, A. E. and Towle, D. W. (2012) Functional genomics resources for the North Atlantic copepod, *Calanus finmarchicus*: EST database and physiological microarray. *Comparative Biochemistry Physiology Part D, Genomics & Proteomics,* **7:**110-123

2011

Christie, A. E., McCoole, M. D., Harmon, S. M., Baer, K. N. and Lenz, P. H. (2011) Genomic analysis of the *Daphnia pulex* peptidome. *General and Comparative Endocrinology*, **171**:131-150

Christie, A. E., Chapline, M. C., Jackson, J. M., Dowda, J. K., Hartline, N., Malecha, S. R. and Lenz, P. H. (2011) Identification, tissue distribution and orexigenic activity of neuropeptide F (NPF) in penaeid shrimp. *Journal of Experimental Biology*, **214**:1386-1396

Christie, A. E., Nolan, D. H., Garcia, Z. A., McCoole, M. D., Harmon, S. M., Congdon-Jones, B., Ohno, P., Hartline, N., Congdon, C. B., Baer, K. N. and Lenz, P. H. (2011) Bioinformatic prediction of arthropod/nematode-like peptides in non-arthropod, non-nematode members of the Ecdysozoa. *General and Comparative Endocrinology*, **170**:480-486

Christie, A. E., Nolan, D. H. Ohno, P., Hartline, N. and Lenz, P. H. (2011) Identification of chelicerate neuropeptides using bioinformatics of publicly accessible expressed sequence tags. *General and Comparative Endocrinology*, **170**:144-155

2010 and earlier

Christie, A. E., Durkin, C. S., Hartline, N., Ohno, P. and Lenz, P. H. (2010) Bioinformatic analyses of the publicly accessible crustacean expressed sequence tags (ESTs) reveal numerous novel neuropeptide-encoding precursor proteins, including ones from members of several little studied taxa. *General and Comparative Endocrinology*, **167**:164-178

Ma, M., Xiang, X., Wang, J., Davoodian, N., Gard, A. L., Lenz, P. H., Malecha, S. R., Christie, A. E. and Li, L. (2010) Combining *in silico* transcriptome mining and biological mass spectrometry for neuropeptide discovery in the Pacific white shrimp *Litopenaeus vannamei*. *Peptides,* **31**:27-43

Gard, A. L., Lenz, P. H., Shaw, J. R., and Christie, A. E. (2009) Identification of putative peptide paracrines/hormones in the water flea *Daphnia pulex* (Crustacea; Branchiopoda; Cladocera) using transcriptomics and immunohistochemistry. *General and Comparative Endocrinology*, **160**: 271-287

VanderLugt, K., Cooney, M. J., Lechner, A., and Lenz, P. H. (2009) Cultivation of the paracalanid copepod, *Bestiolina similis* (Calanoida: Crustacea). *Journal of the World Aquaculture Society* **40:** 616-628

Sousa, G. L., Lenz, P. H., Hartline, D. K., and Christie, A. E. (2008) Distribution of pigment dispersing hormone- and tachykinin-related peptides in the central nervous system of the copepod crustacean *Calanus finmarchicus*. *Comparative and General Endocrinology* 156: 454-459

VanderLugt, K. and P. H. Lenz. (2008) Management of nauplius production in the paracalanid, *Bestiolina similis* (Crustacea: Copepoda): Effects of stocking densities and culture dilution. *Aquaculture* **276**: 69-77

Burdick, D. S., Hartline, D. K., and Lenz, P. H. (2007) Escape strategies in co-occurring calanoid copepods. *Limnology and Oceanography* **52**: 2373-2385

Lenz, P. H., Hower, A. E., and Hartline, D. K. (2005) Temperature compensation in the escape response of a marine copepod, *Calanus finmarchicus* (Crustacea). *Biological Bulletin* **209**: 75-85

Lenz, P. H., Hower, A. E., and Hartline, D. K. (2004) Force production during pereiopod power strokes in *Calanus finmarchicus*. *Journal of Marine Systems* **49:** 133-144

Voznesensky, M., Lenz, P. H., Spanings-Pierrot, C., and Towle, D. W. (2004) Genomic approaches to detecting thermal stress in *Calanus finmarchicus* (Copepoda: Calanoida). *Journal of Experimental Marine Biology and Ecology* **311:** 37-46

Buskey, E. J., Lenz, P. H., and Hartline, D. K. (2002) Escape behavior of planktonic copepods to hydrodynamic disturbances: high-speed video analysis. *Marine Ecology Progress Series* **235:** 135-146

Marine Zooplankton Colloquium 2 (2001) Future marine zooplankton research – a perspective. *Marine Ecology Progress Series* **222:** 297-308 (contributing author)

Weatherby, T. M. and Lenz, P. H. (2000) Mechanoreceptors in calanoid copepods: designed for high sensitivity. *Arthropod Structure and Development* **29**: 275-288

Lenz, P. H., Hartline, D. K., and Davis, A. D. (2000) The need for speed. I. Fast reactions and myelinated axons in copepods. *Journal of Comparative Physiology A* **186**: 337-345

Weatherby, T. M., Davis, A. D., Hartline, D. K., and Lenz, P. H. (2000) The need for speed. II. Myelin in calanoid copepods. *Journal of Comparative Physiology A* **186**: 347-357

Davis, A. D., Weatherby, T. M., Hartline, D. K., and Lenz, P. H. (1999) Myelin-like sheaths in copepod axons. *Nature* **398**: 571

Hartline, D. K., Buskey, E. J., and Lenz, P. H. (1999) Rapid jumps and bioluminescence elicited by controlled hydrodynamic stimuli in a mesopelagic copepod, *Pleuromamma xiphias*. *Biological Bulletin* **197**: 132-143

Lenz, P. H. and Hartline, D. K. (1999) Reaction times and force production during escape behavior of a calanoid copepod, *Undinula vulgaris*. *Marine Biology* **133**: 249-258

Hartline, D. K., Lenz, P. H. and Herren, C. M. (1996) Physiological and behavioral studies of escape responses in calanoid copepods. *Marine Freshwater Behavior and Physiology* **27**: 199-212

Lenz, P. H., Weatherby, T. M., Weber, W. and Wong, K. K. (1996) Sensory specialization along the first antenna of a calanoid copepod, *Pleuromamma xiphias* (Crustacea). *Marine Freshwater Behavior and Physiology* **27**: 213-221

Radtke, R. L., Showers, W., Mokness, E. and Lenz, P. H. (1996) Environmental information stored in otoliths: insights from stable isotopes. *Marine Biology* **127**: 161-170

Weatherby, T. M., Wong, K. K. and Lenz, P. H. (1994) Fine structure of the distal sensory setae on the first antennae of *Pleuromamma xiphias* Giesbrecht (Crustacea: Copepoda). *Journal of Crustacean Biology* **14**: 670-685

Lenz, P. H. and Yen, J. (1993) Distal setal mechanoreceptors of the first antennae of marine copepods. *Bulletin of Marine Science* **53**: 170-179

Linkowski, T. B., Radtke, R. L. and Lenz, P. H. (1993) Otolith microstructure, age and growth of two species of *Ceratoscopelus* (Osteichthyes: Myctophidae) from the Eastern North Atlantic. *Journal of Experimental Marine Biology and Ecology.* **167**: 237-260

Radtke, R. L., Hubold, G., Folsom, S. D. and Lenz P. H. (1993) Otolith structural and chemical analyses: the key to resolving age and growth of the Antarctic silverfish, *Pleurogramma antarcticum*. *Antarctic Science* **5**: 51-62

Gassie, D. V., Lenz, P. H., Yen, J., and Hartline, D. K. (1993) Mechanoreception in zooplankton first antennae: Electrophysiological techniques. *Bulletin of Marine Science* **53**: 96-105

Yen, J., Lenz, P. H., Gassie, D. V. and Hartline, D. K. (1992) Mechanoreception in marine copepods: electrophysiological studies on the first antennae. *Journal of Plankton Research* **14**: 495-512

Lenz, P. H., Melack, J. M., Robertson, B., and Hardy, E. (1986) Ammonium and phosphate regeneration by zooplankton in an Amazon floodplain lake. *Freshwater Biology* **16**: 821-830

Lenz, P. H., Cooper, S. D., Melack, J. M., and Winkler, D. W. (1986) Spatial and temporal distribution patterns of three trophic levels in a saline lake. *J. Plankton Res*. **8**: 1051-1064

Dana, G. L. and Lenz, P. H. (1986) Effects of increasing salinity on an *Artemia* population from Mono Lake, California. *Oecologia* **68**: 428-436

Cooper, S. D., Winkler, D. W., and Lenz, P. H. (1984) The effect of grebe predation on a brine shrimp population. *J. Anim. Ecol.* **53**: 51-64

Lenz, P. H. (1984) Life-history analysis of an *Artemia* population in a changing environment. *J. Plankton Res*. **6**: 967-983

Published Datasets

Block, L. N., Lenz, P. H. (2025) CTD (temperature, salinity and fluorescence) from bi-weekly vertical profiles in Resurrection Bay, AK from January to March of 2023. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-02-21. doi:10.26008/1912/bco-dmo.954156.1

Block, L. N., Lenz, P. H. (2025) Chlorophyll a and flow cytometry data from bi-weekly vertical profiles in Resurrection Bay, AK from January to March of 2023 from bi-weekly vertical profiles in Resurrection Bay, AK from January to March of 2023. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-02-21. doi:10.26008/1912/bco-dmo.954173.1

Block, L. N., Lenz, P. H. (2025) Microplankton microscopy and biovolume analysis from Lugol's samples collected in Resurrection Bay, AK from January to March of 2023. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-02-21. doi:10.26008/1912/bco-dmo.954189.1

Lenz, P. H., Cieslak, M. C., Roncalli, V., Hartline, D. K. (2025) Molecular identification of genetic variants of *Neocalanus flemingeri* in the Gulf of Alaska from samples collected from 2015 to 2023. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-02-21. doi:10.26008/1912/bco-dmo.954181.1

Hartline, D. K., Lenz, P. H., Hopcroft, R. R., Roncalli, V., Cieslak, M. C. (2025) RNA-Seq sample information and accessions numbers for the copepods *Neocalanus flemingeri* (Prince William Sound, Gulf of Alaska)(2015-2017) and *Labidocera madurae* (Kane'ohe Bay, Oahu, Hawaii)(2017). Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2) Version Date 2020-12-11. doi:10.26008/1912/bco-dmo.821289.2

Hartline, D. K., Lenz, P. H., Cieslak, M. C. (2024) Annotated de novo transcriptomes generated from six co-occurring species of calanoid copepods from the R/V Tiglax TXF18, TXS19, TXF15, TXF17 in the Gulf of Alaska from 2015-2019. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-07-02. doi:10.26008/1912/bco-dmo.908689.1

Hopcroft, R. R., Lenz, P. H. (2024) *Neocalanus* distribution, mean length, mean weight, abundance and biomass from the Gulf of Alaska , Fall 2015, 2016 and 2017. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-05-10. doi:10.26008/1912/bco-dmo.852896.1

Lenz, P. H., Hartline, D. K., Monell, K. J. (2024) Post-diapause *Neocalanus flemingeri* females morphometric measurements and calculations of lipid fullness and lipid volume taken from the R/V Sikuliaq and the R/V Tiglax in the Northern Gulf of Alaska from 2019-06-30 to 2019-09-13. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-06-12. doi:10.26008/1912/bco-dmo.907880.1

Lenz, P. H., Hartline, D. K., Monell, K. J. (2024) Oocytes formation in post-diapause *Neocalanus flemingeri* females from the R/V Sikuliaq and the R/V Tiglax in the Northern Gulf of Alaska from 2019-06-30 to 2019-09-13. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-06-12. doi:10.26008/1912/bco-dmo.908514.1

Lenz, P. H., Roncalli, V., Cieslak, M. C. (2024) Multiyear RNA-Seq of *Neocalanus flemingeri* stages CV and adult female from the R/V Tiglax and R/V Sikuliaq in the Northern Gulf of Alaska from 2015-2022. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-07-26. doi:10.26008/1912/bco-dmo.922330.1

Lenz, P. H., Hartline, D. K., Roncalli, V., Block, L. N., Niestroy, J. L., Cieslak, M. C. (2024) Gene expression profiles for *Neocalanus flemingeri* pre adults (CV) exposed to four different experimental food conditions collected from the M/V Dora in the Gulf of Alaska at station GAK1 from April 2019. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-05-30. doi:10.26008/1912/bco-dmo.914459.1

Goetze, E., Lenz, P., Selph, K. E. (2022) Measurements of mixed field samples used for qPCR estimates and estimating biomass of DNA copy number in bulk samples. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-02-03. doi:10.26008/1912/bco-dmo.869225.1

Goetze, E., Lenz, P., Selph, K. E. (2022) Measurements of individual body size and qPCR estimates of DNA copy number per individual from the development of four assays to quantify copeod naupliar biomass in Kaneohe Bay, Hawaii. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-02-02. doi:10.26008/1912/bco-dmo.869085.1

Goetze, E., Lenz, P., Selph, K. E. (2022) Data resulting from testing dilution experiments conducted in the development of four assays to quantify copeod naupliar biomass in Kaneohe Bay, Hawaii. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-02-01. doi:10.26008/1912/bco-dmo.869011.1

Goetze, E., Lenz, P., Selph, K. E. (2021) Metadata for field dilution experiments to measure community microzooplankton grazing rates in Kaneohe Bay, HI from 2012-2013 (EAGER:

Copepod nauplii project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2016-02-04. doi:10.26008/1912/bco-dmo.637670.1
Goetze, E., Lenz, P., Selph, K. E. (2021) Field conditions during grazing experiments in Kaneohe Bay, HI during 2012-2013 (EAGER: Copepod nauplii project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2016-02-02. doi:10.26008/1912/bco-dmo.637695.1
Goetze, E., Lenz, P., Selph, K. E. (2021) Flow cytometry results for naupliar grazing laboratory experiments conducted from 2012-2013 (EAGER: Copepod nauplii project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2016-02-04. doi:10.26008/1912/bco-dmo.637720.1
Hopcroft, R. R., Lenz, P. (2021) *Neocalanus* copepod egg production is described from the Northern Gulf of Alaska for Fall 2015, 2016, 2017. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-11-08. doi:10.26008/1912/bco-dmo.852869.1
Lenz, P., Hartline, D. (2018) Quantification of a previously undescribed fast-start of larval clownfish targeting copepod prey: predatory posture, speed and acceleration from high-speed video, July 2015. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2018-11-28. doi:10.1575/1912/bco-dmo.750328.1
Lenz, P. H., & Hartline D. K. (2018) High-speed videos of larval clownfish, *Amphiprion ocellaris*, predators and copepod prey. Biological and Chemical Oceanography Data Management Office (BCO-DMO) 801215–227. http://lod.bco-dmo.org/id/dataset/747926
Lenz, P. H., Christie, A. E. (2017) Links to a microarray and transcriptome for *C. finmarchicus* in the Gulf of Maine from 2008-2011 (CFINTRANSCRIPT project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). Version Date 2017-12-06. http://lod.bco-dmo.org/id/dataset/528312
Lenz, P. H., Hartline, D. K. (2017) Growth of larval clownfish, *Amphiprion ocellaris* used in predator-prey experiment (PreyEscape project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). Version Date 2017-04-04. http://lod.bco-dmo.org/id/dataset/686893
Lenz, P. H., Hartline, D. K. (2017) Larval clownfish (*Amphiprion ocellaris*) predatory success during first 14 days post-hatch from Lenz lab in the University of Hawai‘i at Mānoa lab from 2012-2015 (PreyEscape project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). Version Date 2017-04-04. http://lod.bco-dmo.org/id/dataset/686907
Lenz, P. H., Hartline, D. K. (2017) Experimental results on the direction of escape for five species of calanoid copepod and multiple developmental stages in response to artificial hydrodynamic stimuli (PreyEscape project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). Version Date 2017-04-04. http://lod.bco-dmo.org/id/dataset/686922
Lenz, P. H., Hartline, D. K. (2017) Experimental results on the speed of escape for five species of calanoid copepod and multiple developmental stages in response to artificial hydrodynamic stimuli (PreyEscape project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). Version Date 2017-04-12. http://lod.bco-dmo.org/id/dataset/686940
Roncalli, V., Cieslak, M. C., & Lenz, P. H. (2016) Data from: Transcriptomic responses of the calanoid copepod *Calanus finmarchicus* to the saxitoxin producing dinoflagellate *Alexandrium fundyense*. Dryad Digital Repository. http://dx.Doi.org/10.5061/dryad.11978
Lenz, P. H., Hartline, D. K. (2015) Copepod nauplius appendage measurements collected during escape response University of Hawai‘i at Mānoa in 2015 (PreyEscape project). Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2015-12-15) Version Date 2015-12-15. http://lod.bco-dmo.org/id/dataset/627968

Invited contributions and reviews

Lopes, R. M., Costello, J. H., Buskey, E. J. and Lenz, P. H. (2025) Introduction to the themed section "Unravelling plankton behaviour: a tribute to Rudi Strickler's legacy and innovations". *Journal of Plankton Research*, 47(2), p.fbae080.

Lenz, P. H., and D. K. Hartline (2018) The biology of myelin in calanoid copepods. In: Uttieri, M. (ed) *Trends in Copepod Studies - Distribution, Biology and Ecology*. New York: Nova Science Publishers, Inc, pp. 219-240 (*peer reviewed*)

Lenz, P. H. and Hartline, D. K. (2014) Mechanoreception in Crustaceans of the Pelagic Realm. In: Derby, C. Thiel, M. (eds), *Nervous Systems and the Control of Behavior. The Natural History of the Crustacea*, pp. 295-320 (*peer reviewed*)

Lenz, P. H. (1993) Vibration sensitivity in marine copepods Pp. 423-430. In *Sensory Systems and Communication in Arthropods II*, Wiese, K., Gribakin, F.G., Popov, A.V. and Renninger, G.H. (eds.), Birkhäuser, Basel, Switzerland. 682 pp.

Lenz, P. H. and Browne, R. A. (1991) Ecology of *Artemia*, pp. 237-253. In R.A. Browne, P. Sorgeloos and C.N.A. Trotman (eds), *Artemia* Biology, CRC Press, Boca Raton

Lenz, P. H. and Dana, G. L. (1987) Life-cycle studies in *Artemia*: a comparison between a sub-tropical and a temperate population. Pp. 89-100. Sorgeloos, P., Bengston, D.A., Decleir, W., and Jaspers, E. (eds.), *Artemia Research and its Applications. Vol. 3. Ecology, Culturing, Use in Aquaculture*. Universa Press, Wetteren, Belgium

Lenz, P. H. (1987) Ecological studies on *Artemia*: a review. Pp. 5-18. Sorgeloos, P., Bengston, D.A., Decleir, W., and Jaspers, E. (eds.), *Artemia Research and its Applications. Vol. 3. Ecology, Culturing, Use in Aquaculture*. Universa Press, Wetteren, Belgium

Melack, J. M., Lenz, P. H., and Cooper, S.D. (1985) The ecology of Mono Lake. *National Geographic Soc. Res. Repts.* 20: 461-470

Books & Special collections

Lopes, R. M., Costello, J. H., Buskey, E. J. and Lenz, P. H. (2025) Unravelling plankton behaviour: a tribute to Rudi Strickler's legacy and innovations. *Journal of Plankton Research*, 47(2), p.fbae080.

Lenz, P. H., Hartline, D. K., Purcell, J. E. and Macmillan, D. L. (eds) (1996) *Zooplankton: sensory ecology and physiology*. Gordon and Breach Publishers, Amsterdam. 590 pp.

Recent Research Awards (last 10 years)

"Scanning electron microscope for research in materials development, energy, and microbiology in extreme environments." (Lenz, co-P.I., Culley, P.I), U.S. Army Contracting Command; award amount: $868,790; 08/01/2023 – 07/31/2024.

"Visualizing microbial communities and their interaction with wild viruses." (Lenz, co-P.I., Culley, P.I), U.S. Army Contracting Command, Program: W911NF-22-S-0010, Proposal #: 81455-BB-REP, award amount: $791,237, 06/01/2023 – 05/31/2027.

"Collaborative Research: Zooplankton restarts in a high-latitude marine ecosystem: species-specific recruitment and development in early spring." UHM Lead Institution: Lenz (P.I.), Hartline, Castelfranco (co-PIs) (UHM), Jungbluth (San Francisco State U.) & Hopcroft (U. Alaska Fairbanks). Total project award: $1,201,141. UHM award amount: $514,353 + INTERN supplement: $24,535 (NSF OPP 2222376), 10/01/2022 – 09/30/2025.

"Collaborative Research: Molecular profiling of the ecophysiology of diapause induction in calanid copepods of the Northern Gulf of Alaska LTER site." UHM Lead Institution: Lenz (former P.I.), Hartline (current PI) (UHM) & Hopcroft (U. Alaska Fairbanks). Total: $1,117,513; UHM: $676,391 (NSF OCE 1756767), 03/01/2018 – 02/28/2022 (no cost extension to 8/31/2023).

"Collaborative Research: Optimizing recruitment of *Neocalanus* copepods through strategic timing of reproduction and growth in the Gulf of Alaska", UHM Lead Institution: Lenz (P.I.), Christie & Hopcroft (U. Alaska Fairbanks). Total: $1,039,953; UHM: $624,992 (NSF OCE 1459235), 03/01/2015 – 02/28/2019, no-cost-extension to 08/31/2020

"Interannual and spatial variability in the physiological ecology of a key forage species, the copepod *Neocalanus flemingeri* during the spring growth phase", NPRB 1709 (North Pacific Research Board), 09/01/2017 – 08/31/2019, $51,270 (P.I.)

"The drive to survive: copepods vs. ichthyoplankton", NSF OCE 1235549, 09/15/2012 – 08/31/2016 (no-cost extension to: 08/31/2018), $542,383 (P.I., D.K. Hartline, co-P.I.)

"Eager: New molecular methods for studying copepod nauplii in the field", NSF OCE 1255697, 01/01/2013 – 12/31/2015 (no cost extension to 12/31/2016), $298,507 (co-P.I., E. Goetze, P.I., K. Selph, co-P.I.)

"Maximizing Access to Research Careers." NIH 2T34GM007684-29A1, 06/01/2010 – 05/31/2015, ~ $1,800,000 (co-Director with Pat Couvillon)

Graduate Students (Committee chair)

Megan Smith, Marine Biology Graduate Program, Univ. Hawai'i Mānoa, M.S. program (current)
Lauren Block, Biological Oceanography, Univ. Hawai'i Mānoa, M.S. program (8/2024)
Kira Monell, Marine Biology Graduate Program, Univ. Hawai'i Mānoa, M.S. program (12/2020)
Christina Bradley, Dept. Oceanography, Univ. Hawai'i Mānoa, M.S. (5/2009)
Kyle VanderLugt, Dept. Animal Sciences, Univ. Hawai'i Mānoa, M.S. (5/2007)

Graduate Students (Committee member)

Jennifer P. Staat, Marine Biology and Biological Oceanography, San Francisco State Univ., M.S. (current)
Noah Doeden, Zoology Graduate Program, Univ. Hawai'i Mānoa, Ph.D. (current)
Marisa McDonald, Marine Biology Graduate Program, Univ. Hawai'i Mānoa, Ph.D. (2022)
Mireille Steck, Marine Biology Graduate Program, Univ. Hawai'i Mānoa, M.S. (2016)
Michelle Jungbluth, Department of Oceanography, Univ. Hawai'i Mānoa, M.S (2012), Ph.D. (2016)
Vittoria Roncalli, Department of Zoology, Univ. Hawai'i Mānoa, Ph.D. (2015)
James Jackson, Department of Zoology, Univ. Hawai'i Mānoa, M.S. (2011)
Brad Gemmell, Marine Science, Univ. Texas at Austin, Ph.D. (2011)
Cecelia Sheridan Hannides, Biological Oceanography, Univ. Hawai'i Mānoa, Ph.D. (2007)
Kevin Funk, Department of Zoology, Univ. Hawai'i Mānoa, M.S. (2005)
Rebecca Waggett, Marine Science, Univ. Texas at Austin, Ph.D. (2005)

Teaching and Course Development

MBIO725 – Topics in Marine Physiology, Behavior and Organismal Biology. Specific topic: Transcriptomics of non-model eukaryotes (2 credits, Fall 2015), new course.

Creationism, Evolution and Intelligent Design – Honors Seminar (Honors 491): upper division seminar to introduce students to the interaction between science, religion, law and politics. Co-instructor with Helen Baroni, Religion Dept.); Spring 2009, new course.

Plankton bloom dynamics – new insights from molecular and genomic tools. Marine Genomics Europe, summer course: Instructor of Zooplankton Module (co-instructor: Ann Bucklin); June 18-19, 2008, new course.

Research Methods (Honors 495): Upper division course designed to prepare students for completing an Honors thesis. Univ. Hawai'i at Manoa, Spring 2001, 2002, 2003, 2004, 2005, 2006, 2008 (contribution praised by Program Director)

Oceanography (201): General introductory course providing a survey of the biology, chemistry, physics and geology of the oceans. Kapiolani Community College, U. Hawai'i System, Fall and Spring, 1984-1985; 1987-1988

General Science (187L): Introductory laboratory course on the principles of science with special emphasis on the ecology of the Hawai'ian Islands. Univ. Hawai'i at Manoa, Spring, 1987

Service

Editorial Boards

Journal of Plankton Research (Member)
Ocean and Coastal Research (Associate Editor)
Integrative and Comparative Biology (Assistant Editor) (2018-2022)

Peer-reviewer

National Science Foundation (Panelist, Ad Hoc)
Deutsche Forschungsgemeinschaft (Ad Hoc)
PNAS, *PLoS One*, *Invertebrate Neuroscience*, *Journal of Experimental Biology*, *Comparative Physiology and Biochemistry*, *Marine Ecology Progress Series, Philosophical Transactions of the Royal Society, London, Biological Bulletin, Science of the Total Environment, General and Comparative Endocrinology*, *Progress in Oceanography*, *Journal of Plankton Research, Integrative and Comparative Biology, Marine Genomics*, *Biochemie, Molecular Ecology, Molecular Ecology Resources*, *Royal Society Open*, *Integrated Organismal Biology*, *Royal Society Open Science*

Scientific Advisor – *CO2 Foundation*

Search Committees

Advisory Search Committee, Research Faculty, PBRC, U. Hawai'i Manoa (2021-2022 [co-chair], 2023-2024 [chair])
Program Director, NSF, Office of Polar Programs (2020)
Advisory Search Committee, Faculty Search, PBRC, U. Hawai'i Manoa (2014-2015, 2015-2016 [chair])
Honor's Program Director, U. Hawai'i Manoa (2013)

Other Committees

Graduate Instructional Committee, Zoology Graduate Program (2022-
Diversity, Equity and Inclusion, NSF, Ocean Section (2019-2021)
Ocean Observing Initiative, NSF (2019-2021)
Faculty Mentoring, PBRC, U. Hawai'i Manoa (2016-2019)
Research Council, SOEST, U. Hawai'i Manoa (2019, 2025)
Director's Advisory, Mt. Desert Island Biological Laboratory (2009-2011)
Environmental Sciences, Mt. Desert Island Biological Laboratory (2009-2011)
Helen Cserr Lecture, Mt. Desert Island Biological Laboratory (2005-2011)

Education, Mt. Desert Island Biological Laboratory (2003-2010)

Affiliate Graduate Faculty (U. Hawai'i Manoa)

Zoology (CNS)
Food and Animal Sciences and Human Nutrition (CTAHR)
Oceanography (SOEST)
Marine Biology Graduate Program (SOEST & CNS)

Current Collaborators

Russell Hopcroft (Univ. Alaska Fairbanks), *Vittoria Roncalli* (Stazione Zoologica Anton Dohrn, Naples, Italy), *Michelle Jungbluth* (San Francisco State University), *Ann Castelfranco* and *Dan Hartline* (PBRC) on the application of transcriptomics to investigate ecological physiology of zooplankton

Russell Hopcroft (Univ. Alaska Fairbanks), *Seth Danielson* (Univ. Alaska Fairbanks), *Ana Aguilar-Islas* (Univ. Alaska Fairbanks), *Jerome Fiechter* (Univ. California, Santa Cruz), *Suzanne Strom* (Western Washington Univ.) on Northern Gulf of Alaska Longterm Ecological Research Program (NGA LTER)

Angel Yanagihara (PBRC), *Vittoria Roncalli* (Stazione Zoologica Anton Dohrn, Naples, Italy) Polar plankton research (Explorers Club Flag Expedition).

Alexander Culley (PBRC) on procuring financial support and new instrumentation for BEMF

Janet Bradford-Grieve (NIWA, New Zealand), *Grace Wyngaard* (James Madison University) on chapters on the Copepoda and Calanoida for the *Treatise on Zoology* (Carel von Vaupel Klein, editor)

J. Rudi Strickler (Univ. Wisconsin Milwaukee), *Daisuke Takagi* (Mathematics, UHM) and *Dan Hartline* (PBRC) on copepod neuroethology and predator-prey interactions