August 2019

CURRICULUM VITAE

Andrew M. Hein – Research Scientist (NOAA), Assistant Researcher (UC Santa Cruz)

Institution Address:	National Oceanic and Atmospheric Administration (NOAA) Southwest Fisheries Science Center AND Institute of Marine Sciences University of California, Santa Cruz Santa Cruz, CA 95060
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RESEARCH INTERESTS:

1) Building quantitative, predictive models of ecological systems (pop. dynamics, nutrient cycling)
2) Integrating organismal movement and ecological dynamics
3) Search behavior and information processing in biological systems
4) Evolution of sensory and decision-making systems
5) Physics, biomechanics, and energetics of animal movement

EDUCATION AND PAST POSITIONS HELD:

2016-present **Research Scientist, Prinipal Investigator**
National Oceanic and Atmospheric Administation

2017-present **Assistant Researcher, Prinipal Investigator**
UC Santa Cruz, Institute of Marine Sciences

2014-2016 **James S. McDonnell Postdoctoral Fellow**
Department of Ecology and Evolutionary Biology, Princeton University
Princeton, NJ. Faculty Mentor: Simon Levin

2013-2014 **Postdoctoral Scholar**
Department of Ecology and Evolutionary Biology, Princeton University
Princeton, NJ. Faculty Mentors: Simon Levin and Iain Couzin

2007-2013 **PhD in Biology (awarded Aug, 2013)**
Department of Biology, University of Florida, Gainesville, FL. Advisors: James Gillooly (Biology), Scott McKinley (Mathematics)

2009-2013 **NSF IGERT Fellow** (PIs Craig Osenberg & Ben Bolker)

2009-2013 **NSF Pre-Doctoral Research Fellow**

2010 **Santa Fe Institute Complex Systems Summer School**
Santa Fe Institute, Santa Fe, NM

2002-2006 **B.S., Zoology**
Department of Biological Sciences**,** Auburn University (Summa Cum Laude, Honors)

REFEREED PUBLICATIONS:

[=]equal contribution
‡ undergraduate/graduate mentee

Hein, AM, BT Martin. *Accepted*. Information limitation and the dynamics of coupled ecological systems. *Nature Ecology & Evolution.*

Carrara, F, DR Brumley, **AM Hein**, Y Yawata, MM Salek, KS Lee, E Sliwerska, SA Levin, R Stocker. *In Review*. A method for generating controlled, dynamic chemical landscapes to study microbial behavior.

Sridharan, VK, **AM Hein**. *In Review*. Exact solution of the advection-dispersion boundary value processes in rivers and estuaries.

Brumley, DR, F Carrara, **AM Hein**, Y Yuwata, SA Levin, R Stocker. 2019. Bacteria push the limits of sensory precision to navigate dynamic gradients. *Proc. Natl. Acad. Sci. USA*. 116: 10792-10797.

Hein, A.M., Hil, M.A., Twomey, C.R., Couzin, I.D. & Levin, S.A. 2018*,* Simulated attacks on wild fish shoals reveal conserved rules of escape decision-making. *Proc. Natl. Acad. Sci. USA*. 115: 12224-12228.

Gil, M A, **A M Hein**, O Spiegel, M Baskett, and A Sih. 2018. Social information can link individual behavior to ecological dynamics. *Trends Ecol. Evol.* 33:535-548.

Martin, B T, S B Munch, and **A M Hein**. 2018. Reverse-engineering ecological theory from data. *Proc. Roy. Soc. B* 285:20180422.

Hughey, L, **A M Hein**, A Strandburg-Peshkin, and F Jensen. 2018. Challenges and solutions for studying collective animal behavior in the wild. *Phil. Trans. Roy. Soc. B*. 373: 20170005.

Gil[=,‡], M A and **A M Hein**[=]. 2017. Social interactions among grazing reef fish drive material flux in a coral reef ecosystem. *Proc. Natl. Acad. Sci. USA*. 114: 4703-4708.

Ache, B W, **A M Hein**, Y V Bobkov, J C Principe. 2016. Smelling time: a neural basis for olfactory scene analysis. *Trends in Neuroscience*.

Hein, A M, D. Brumley, F Carrara, R Stocker, and S A Levin. 2016. Natural search algorithms as a bridge between organisms, evolution, and ecology. *Proc. Natl. Acad. Sci. USA*. 113:9413-9420.

Hein, A M, D. Brumley, F Carrara, R Stocker, and S A Levin. 2016. Physical limits on bacterial navigation in dynamic environments. *J. Roy. Soc. Interface* 3: 20150844.

Park, I, **A M Hein**, Y V Bobkov, M A Reidenbach, B Ache, and J C Principe. 2016. Neurally encoding time for olfactory navigation. *PLoS Comput. Biol.* 12(1): e1004682.

Hein[=], A M, S B Rosenthal[=,‡], G I Hagstrom[=], A Berdahl, C J Torney, and I D Couzin. 2015. The evolution of distributed sensing and collective computation in animal populations. *eLife* 10.7554/eLife.10955

Gillooly, J F, R Damiani[‡], and **A M Hein**. 2015. Nuclear DNA Content Increases with Cell Size in Humans. *in* Size Control in Biology, from Organelles to Organisms Eds. R Heald, D Wake, & I Hariharan (Cold Spring Harbor Press).

Stier[=], A C, **A M Hein**[=], V Parravicini, and M Kulbicki. 2014. Larval dispersal drives trophic structure across Pacific coral reefs. *Nature Communications.* 5:5575.

Fahimipour[‡], A K and **A M Hein**. 2014. The dynamics of assembling food webs. *Ecology Letters.* 17:606-613. – ESA Frost award for outstanding graduate paper of 2014.

Hein, A M and S A McKinley. 2013. Sensory information and encounter rates of interacting species. *PLoS Comput. Biol.* 9:e1003178.

Hein, A M and S McKinley. 2012. Sensing and decision-making in random search. *Proc. Natl. Acad. Sci. USA.* 109:12070-12074.

Hein, A M, C Hou, and J F Gillooly. 2012. Energetic and biomechanical constraints on animal migration distance. *Ecology Letters.* 15:104-110.

Hein, A M and K J Keirsted‡. 2011. The rising cost of warming waters: Effects of temperature on the cost of swimming in fish. *Biology Letters.* 8:266-269 (doi: 10.1098/rsbl.2011.0885).

Hein, A M and J F Gillooly. 2011. Predators, prey, and transient states in the assembly of spatially structured communities. *Ecology.* 92:549-555.

Ray, J M , **A M Hein**, A Gonzalez, S Goetz, and M Miller. 2011. *Imantodes cenchoa* (Brown Blunt-Nosed Vine Snake) Diet. *Herpetological Review.* 42:100.

Ray, J.M., **A M Hein**, A Gonzalez, S Goetz, & M Miller. 2011. *Imantodes cenchoa* (Brown Blunt-Nosed Vine Snake) Maximum Size. *Herpetological Review.* 42:614-615.

Hein, A M, and C Guyer. 2009. Hibernaculum selection and overwintering body temperatures of Cottonmouth snakes (*Agkistrodon piscivorus*). *Journal of the Alabama Academy of Science.* 80:35-43.--AAS Carmichael award for outstanding paper of 2009.

FUNDING:

Over $3 million in total funding (only major awards listed)

- NOAA High Performance Computing Initiative ($129k over 1 year)
- National Science Foundation, IOS Behavioral Systems Cluster ($620k over 3 years)
- California Dept. Fish & Wildlife, Proposition 1 Grant program ($1.73 million over 3 years)
- Simons Foundation, Mathematical Modeling of Living Systems (with Simon Levin, $518k over 3 years)
- James S. McDonnell Foundation Post-Doctoral Fellowship ($200k over 2 years)
- NSF Quantitative Ecology, Evolution, and Environment IGERT Fellow ($30k over 1 year)
- NSF Graduate Research Fellowship ($120k over 3 years)

- University of Florida Alumni Fellowship ($68,000k over 4 years)
- Alabama Wildlife Federation Biologist of the Year Award (2005)

SELECTED INVITED TALKS:

Hein, A. M. (2018) The primacy of space: movement theory, past, present, and future. *Keynote lecture for Center for the Advancement of Population Assessment Methodology annual meeting.*

Hein, A. M. (2018) Sensing and decision-making in natural ecosystems. *Invited talk for UC Santa Barbara Kavli Institute for Theoretical Physics program on sensory navigation*

Hein, A. M. (2018) Movement, information, and material flux: measuring and modeling the flow of life's currencies. *Invited talk for Gordon Research Conference: Unifying Ecology Across Scales*

Hein, A M. (2017) What animal movement can teach us about ecological dynamics. *University of British Columbia. Host Dolph Schluter.*

Hein, A M. (2016) How animals integrate social and environmental data to make decisions. *UC Santa Barbara, Santa Barbara, CA, Host Jean Carlson.*

Hein, A M. (2016) Sensing, decision-making, and ecology in complex natural environments. *California Institute of Technology, Host Michael Dickinson.*

Hein, A M. (2016) Chemotaxis and the ecology of marine microbial food webs. *San Diego State University, Host Forest Rohwer.*

Hein, A M. (2015) Movement and ecological dynamics in a heterogeneous world. *Max Planck Institute for Ornithology, Radolfzel, Germany, Host Iain Couzin.*

Hein, A M. (2014) Predicting the pace of ecological interactions. *UCLA, Host Van Savage.*

Hein, A M. (2014) Fast times in animal movement research. *EEMB Seminar Series, UC Santa Barbara.*

Hein, A M. (2014) Spatial ecology and ecosystem dynamics: the long and short of it. *Annual NSF IGERT Symposium. University of Florida.*

Hein, A M. (2014) Lotka's dilemma, search strategies, and the pace of ecological interactions. *MIT, Cambridge, MA, host Roman Stocker.*

Hein, A M (2014) Exciting times in animal movement. *CSTAR UCSC, Santa Cruz, CA, host Marc Mangel.*

Hein, A M and S A McKinley. (2013) Encounter rates of interacting species. *Department of Systems Biology, Harvard University, host Johan Paulsson.*

Hein, A M (2011) Modeling animal movement: from migration to search behavior. *Princeton University EEB, October 7, 2011, Princeton, NJ.*

TEACHING EXPERIENCE

2018 Course Developer/co-Instructor – Machine Learning for Ecologists, UCSC/NOAA

2012 Course Developer/Instructor – Integrative Principles: Theoretical Biology Module, University of Florida

2010 Teaching assistant – quantitative spatial ecology, evolution and environment (instructor Craig Osenberg), University of Florida

2008 Teaching assistant–Evolution (instructor Charlie Baer), University of Florida

2007 Instructor–Ecology and Conservation in Tropical Forests (in Spanish), Association of Guides for Conservation, El Cope, Panama