

CURRICULUM VITAE

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

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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 Administration
- 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

Brumley, DR, F Carrara, **AM Hein**, Y Yuwata, SA Levin, R Stocker. *In Review*. Bacteria push the limits of sensory precision to navigate dynamic gradients. *Proc. Natl. Acad. Sci. USA*.

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*. Published online early edition.

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 \$2.5 million in total funding (only major awards/proposals listed)

- National Science Foundation, IOS Behavioral Systems Cluster (In Review)
- California Dept. Fish & Wildlife, Proposition 1 Grant program (\$1.73 million over 3 years)
- Simons Foundation, Mathematical Modeling of Living Systems (Simon Levin PI, \$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, Radolfzell, 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