California Sea Grant Delta Science Fellowship Spotlight:

Megan Sabal

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SEA GRANT FELLOW:	Megan Sabal
RESEARCH FOCUS:	Chinook Salmon
RESEARCH LOCATION:	Sacramento-San Joaquin Delta
CURRENT OCCUPATION:	2018 – 2020 Sea Grant Fellow
EDUCATION:	2010 Bachelor of Philosophy, Environmental Science, Miami University, Oxford, OH 2014 M.A. & Present Ph.D. in Ecology and Evolutionary Biology, University of California, Santa Cruz, CA

Sea Grant Fellow Q & A WITH MEGAN SABAL

I am a PhD student at the University of California Santa Cruz studying ecology and evolutionary biology. My dissertation focuses on predator effects on migrating prey behavior - both in juvenile salmon and more generally with a conceptual model and review that span migratory taxa. When I'm not scratching my head about science, I enjoy biking, scuba diving, and cheering on Chicago sports teams.

Q: Why did you choose to pursue a career path in science? A Sea Grant Fellowship?

A: I care strongly about protecting our world's amazing and diverse species and ecosystems.

I chose a career path in science because I get to explore nature, ask questions, and continually learn, with the goal that the more we understand about how nature works, the better we are able to protect the Earth.

Q: Can you briefly describe your research?

A: My research seeks to answer two questions: do predators change migrating salmon behavior, and if so, do changes in behavior matter to survival in future life stages?

Salmon are threatened by many things, one of which are predators in the river. Managers and scientists think a lot about how many salmon are eaten by predators. However, their predators may be hurting salmon populations another way. In fact, when prey feel threatened, they often change their behavior to feel safer. For example, prey may hide, fight, or flee. Each of these actions requires energy and losing energy can cause animals to die earlier in life or have fewer babies. Therefore, salmon populations may be declining because predators caused juvenile salmon to change their behavior during migration.

I use field experiments, mathematical models, and reviews to answer these questions. I try to understand how salmon decisions about what to do when they are afraid relate to the population trends of this important species.

Sea Grant Fellow Q & A WITH MEGAN SABAL

Q: What drew you to the study of chinook salmon? Why is this an important issue that needs to be researched further?

A: Chinook salmon are a very important and amazing species as they can travel thousands of miles as they migrate between rivers, the ocean, and back again, thereby connecting distant ecosystems.

Currently, chinook salmon populations are threatened. Salmon face many obstacles including altered habitat, stressful environments, and predators. There is probably not one sole reason for our salmon's struggles, but instead many reasons that act together to have a large effect.

I am inspired to learn how habitat, environmental conditions, and predators interact to affect salmon behavior, survival, and population trends. Only by understanding the complexities of these issues can we develop management strategies that best support conservation.

Q: What are some of the most interesting things you have learned from your research?

A: I have learned very interesting things about how predators cause salmon to change their behavior. I ran two experiments where I timed juvenile salmon swimming downstream through a flume in the river with and without a predator in their way. I wondered, will salmon change their speed when faced with a predator? Slow down to be cautious? Speed up to get past quickly? Not react at all?

I found that salmon changed their speed when faced with a predator, but what direction (speed up vs. slow down) and how much they changed speed was context-dependent.

Wild salmon slowed down in response to a plastic largemouth bass with odor cues, but hatchery salmon did not react at all. Hatchery salmon have never been exposed to predators, suggesting that learning experiences may improve antipredator behavior.

Habitat also influenced how salmon reacted to a predator. Salmon changed speed more in the shade compared to the sun—indicating salmon perceived shade to be less safe. This could be due to fish predators being more successful at capturing salmon in low light.

Q: How will this research help to inform our understanding of the Delta? Habitat restoration efforts and nonnative predators for juvenile chinook salmon?

A: My research will improve our understanding of the complex interactions between salmon, predators, and habitat in the Delta, and this understanding will help inform conservation efforts.

As hatchery salmon did not behaviorally react to a predator, this may make them more susceptible to predation. Predator conditioning activities in hatcheries could potentially improve naïve hatchery salmon survival.

Further, as shade influenced salmon antipredator behavior, plans for habitat restoration should consider how the light environment will change. Shade may provide cover for salmon to hide, but also may give predators an advantage—more research will need to evaluate these complex consequences.

My next steps will further evaluate applied consequences. I will link salmon behavior with predators, and other known biology using a mathematical model. I will use this model to see how small-scale salmon decisions affect large-scale population trends and what management scenarios might help salmon conservation.

Q: What are your plans after completing your fellowship?

A: The more I learn through my research and studies, the more questions I have about the natural world. For example, how do salmon swimming downstream know when predators are ahead—sight, smell, habitat? How does the presence of floodplains interact with predators to alter salmon behavior and survival?

After graduating with my PhD, I hope to pursue a career where I can continue to answer questions about how predators influence migrating fish behavior and survival. Both to improve our understanding of ecology and inform conservation and management.