Graduate students explore relationship of salmonids with estuary

Interest in restoring fish habitat in coastal watersheds throughout the Pacific Northwest has increased markedly in the face of declining Pacific salmon runs. Because many salmonid populations live in estuaries for an extended period before migrating to sea and use estuarine marsh channels as nursery habitats, there is interest in restoring salt marshes to promote salmon recovery.

The Sea Grant-funded Salmon River project was designed in part to answer important questions about landscape and habitat factors in estuaries. Researchers are also evaluating whether results from the project can be applied broadly to the diversity of estuaries and wetland-habitat conditions found along the Oregon coast. Among those researchers are graduate students Lisa Krentz and Dave Hering.

Krentz and Hering, two of several dozen Oregon Sea Grant-funded graduate students and fellows, are studying behavior and habitat use by different salmonid species in the Salmon River estuary. Hering studies the commercially important chinook salmon, while Krentz's primary focus is on a prized recreational fish, sea-run cutthroat trout. The two researchers track the movements of their respective species throughout the estuary, in an effort to discern behavioral patterns that might lead to a better understanding of how salmonids use the estuary.

PIT tag used to track salmonids in the Oregon Sea Grant-funded Salmon River estuary project.

Inserting the PIT tag into a juvenile salmon..

They track the fish with the help of two high-tech devices—a PIT (passive integrated transponder) tag and an acoustic tag. The PIT tag, which is about the size of a grain of rice, allows the identification of individual fish when they are recaptured or passed through a detection antenna. The acoustic tag, which Krentz surgically implants in cutthroat trout, contains a battery-powered acoustic transmitter that emits a signal, which is picked up by receivers placed throughout the estuary. The PIT and acoustic tags help Krentz and Hering determine when, and how long, each fish uses the estuary and whether the estuary is, indeed, a critical habitat. If so, it's another argument in favor of restoring estuaries.

"I'm interested in the conservation of fish and their habitat," Hering said, "and estuaries are a place that until recently were kind of ignored." He said a significant amount of work was being done to restore streams—for example, by adding large wood to them—while many estuary habitats remained diked, so that fish couldn't get into them. "For the last few years, it's been popular to

remove these dikes from estuary marshes, and it's looking like they might be an important habitat for salmon as they go downstream."

Chinook salmon and sea-run cutthroat trout are both anadromous fish, which means they are born in freshwater, swim downstream to the ocean, and return to freshwater to spawn.

"It really wasn't known," Krentz said, "what they do after they leave freshwater—how long they spend in the ocean or the estuary." She said her studies have helped identify three different life history strategies for anadromous cutthroat trout: the "ocean migrant," a fish that goes downstream from its place of birth, through the estuary, and out to the ocean; the "estuarine summer resident," a fish that travels down to the estuary, stays there for six to nine months, and returns upstream to spawn; and the occasional fish that comes down to the estuary in the spring and remains there for a year before returning to spawn.

"That's new information," Krentz said, "and it's important because the estuary I'm working in is relatively intact. It's been restored, it's productive, and it has really great habitat." To determine whether fish exhibit different behaviors in unrestored habitats, Krentz and her colleagues are doing comparative work in the Columbia River system, which is "highly impacted," said Krentz.

Hering also finds the variability of life-history strategies fascinating. "Within a population of chinook salmon or cutthroat trout, for example, individual fish can achieve reproductive success through a variety of migratory and maturation strategies. I'm interested in the forces that maintain this sort of diversity in nature. Although life history diversity isn't unique to fish, the fact that we manage fish populations so intensely makes fish particularly important animals in which to understand natural variability." He believes that estuaries may be as important to the production of anadromous fish as are freshwater or marine habitats. "Often our tendency is to consider these different habitats as separate and independent of one another, but I think it's appropriate to treat these different areas as integral components of a whole system that supports salmonid life history."

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Why is all this important to humans?

Hering said that the diversity we see in natural populations of fish results from thousands of years of evolution in variable environments, and conservation efforts should strive to maintain this natural diversity. "It isn't enough to conserve fish species in unnaturally homogenous populations such as those you might find in a hatchery," he said. "I would like people to recognize the variability that exists within wild fish populations and to understand that this variability is important."

Krentz concurs. "Knowledge and understanding of something often results in compassion for it. I'd be thrilled if people were able to understand that estuaries are critical habitat for many species and there is a need to protect these areas for the future."

Kim Jones, a principal investigator on the Salmon River estuary project and a fish biologist with the Oregon Department of Fish and Wildlife, believes that Krentz and Hering have made "significant contributions to the scientific knowledge of the ecological relationships of fish in estuaries." He cited their use of new technology to answer ecological questions "rather than letting technology drive the research."

Principal investigator Dan Bottom, a researcher with the National Marine Fisheries Service, added that Hering and Krentz have "balanced the work on their respective theses with contributions to each other's and the overall Salmon River research."

Krentz and Hering both feel their projects have been successful so far, but that there is more work to be done.

"I want to stay on the research end of things," Krentz said. "I find the work gripping and fun. There are so many questions yet to answer and they're always in my head."

"Studying fish has become my life's work," Hering said. "I plan to continue to do fisheries research here in the Pacific Northwest, and I hope that in some way my work contributes to the conservation of wild fish and aquatic ecosystems."

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