

Research, continued

(Trail of Dust continued from page 5)

Caribbean), and the U.S. Virgin Islands (in the northeastern Caribbean). She has also established a station in Hawai'i (for studying dust from Asia).

Although setting up collaborations takes a great deal of time, there always has been significant interest at each location. For one thing, many local citizens and departments of health are concerned about air

quality and its effects on human health. Many locals recognize the relation between dust storms and observed increases in human health problems. They want to see whether something in the air triggers asthma and other illnesses. Similarly, **Garrison** is interested in how dust-carrying air masses may affect coral-reef organisms in dust-impacted locations.

Collaborators want to share this work with others. UWI invited **Garrison** to be the featured speaker in their annual Research Days, held April 5-7, 2006, during which the university highlighted ongoing research and facilities. The theme of this year's event was "Your Wealth, Your Health, Your Safety, Your Future" (see URL <http://sta.uwi.edu/researchday/>). ☼

Water Temperature Appears to Restrict Distribution of Juvenile Coho Salmon in Redwood Creek, California

By Mary Ann Madej

The distribution of juvenile coho salmon in Redwood Creek, Calif., appears to be restricted to the lower reach of the river by water temperature, according to a recent publication by U.S. Geological Survey (USGS) and National Park Service (NPS) scientists.

Water temperature is an important physical factor influencing salmonid egg development, juvenile appetite and growth, and fish distribution. Juvenile coho salmon, like most salmonids, require cool water to survive and grow and are susceptible to increased summer water temperatures because they rear in freshwater for at least a year. Historically, coho salmon occurred throughout most of the 108-km-long mainstem of Redwood Creek in Humboldt County, northern coastal California; however, juvenile coho salmon distribution is

currently limited to the downstream-most 20 km of Redwood Creek and tributaries entering that reach.

Redwood Creek is currently listed as temperature and sediment impaired (with warmer and muddier water than normal) under the Clean Water Act because of past timber harvest, removal of riparian vegetation, widespread streamside landsliding, and buildup of sediment in the channel. The upstream reach of the creek is beginning to recover from past damage, with an increased frequency of deep pools, extensive shading from alders, a moderate (0.5 percent) channel gradient, and gravel size adequate for spawning; nevertheless, juvenile coho salmon are absent. In the June issue of the *Canadian Journal of Fisheries and Aquatic Sciences*, USGS scientists **Mary Ann Madej**, **Christopher Currents**, and **Julie Yee**, along with NPS colleagues **Vicki Ozaki** and **David Anderson**, hypothesize that elevated stream temperatures in the middle river reach constitute a thermal restriction for juvenile coho rearing. The scientists used 7 years of in-stream temperature monitoring in conjunction



Adult coho salmon, held by **Mike Sparkman**, California Department of Fish and Game. Photograph from the California Department of Fish and Game.

with thermal-infrared data collected during a July 2003 helicopter survey to identify warm reaches of Redwood Creek and to compare temperature regimes in coho-bearing river reaches with those in non-coho-bearing reaches. Their report presents detailed discussions of the trends in maximum and minimum stream temperature and the duration of high temperatures along the length of Redwood Creek.

Among the authors' conclusions are the following: Redwood Creek, unlike many rivers reported in the literature, reaches its maximum temperature in the middle basin



Juvenile coho salmon from the Redwood Creek watershed. Photograph from the Redwood National Park collection.

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Research, continued

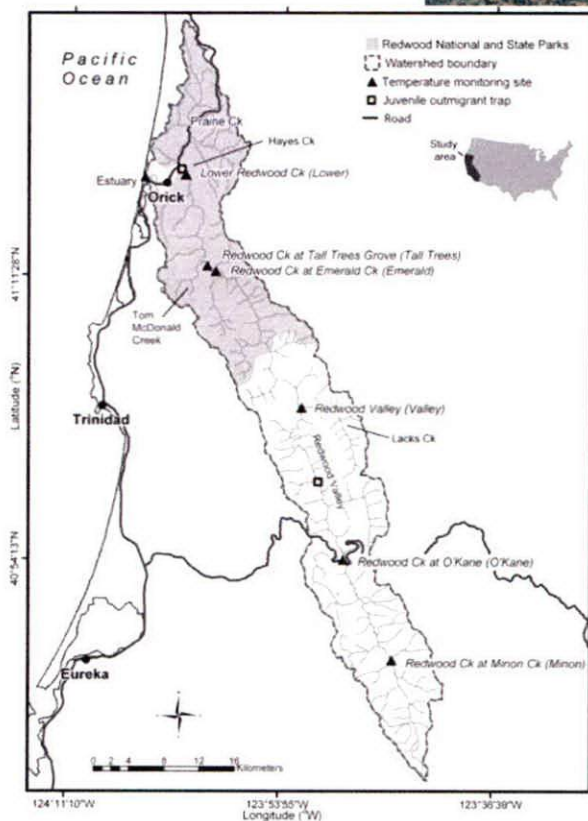
(Coho Salmon continued from page 6)

and becomes cooler farther downstream. Coastal fog and old-growth redwood trees in the riparian zone of the lower basin contribute to the cooling trend there. In the upper part of the creek, the thermal regime has largely recovered from past hot temperatures, and the temperature regime in this non-coho-bearing reach is similar to that in the downstream coho-bearing reach. In the intervening 50-km-long middle reach, however, summer water temperatures remain significantly warmer than the temperatures recommended for coho salmon.

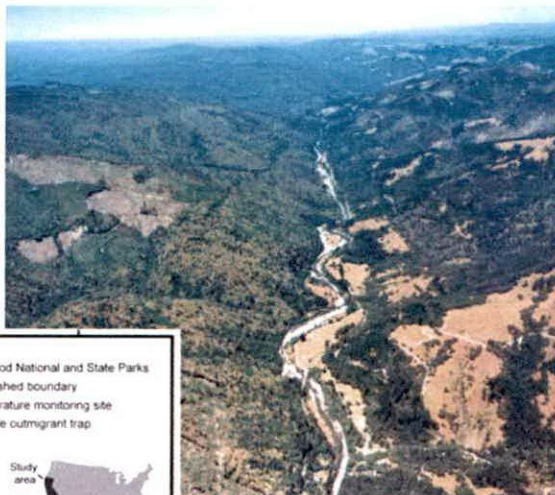
Management implications of the study are as follows:

- Although much upslope road-restoration work has been accomplished in the Redwood Creek basin, current riparian conditions along much of the creek are still degraded and do not provide adequate shading (and thus cooler temperatures) for the stream.
- The absence of large riparian conifers reduces the availability of inchannel wood to scour pools and provide cover and channel complexity, possibly also contributing to the limited upstream distribution of coho salmon.

- Besides efforts to control erosion in this watershed, active riparian restoration may be needed to restore the cool thermal regime along warm stretches of Redwood Creek.



Redwood Creek watershed in northern California.



The hot reach of Redwood Creek, looking downstream. Few trees shade the river in this area. As the creek flows to the ocean (in the background), it becomes cooler. Photograph from the Redwood National Park collection.

The full reference for the recent paper is:

Madej, M.A., Currens, C., Ozaki, V., Yee, J., and Anderson, D.G., 2006, Assessing possible thermal rearing restrictions for juvenile coho salmon (*Oncorhynchus kisutch*) through thermal infrared imaging and in-stream monitoring, Redwood Creek, California: Canadian Journal of Fisheries and Aquatic Sciences, v. 63, p. 1384-1396 [URL http://pubs.nrc-cnrc.gc.ca/cgi-bin/rp/rp2_abst_e?cfas_f06-043_63_ns_nf_cjfas6-06].

Outreach

Coastal and Marine Exhibits Are Wet and Wild at USGS Open House in Menlo Park, California

By Helen Gibbons

Coastal and marine exhibitors made a splash—many splashes, in fact—at the U.S. Geological Survey (USGS)'s 8th triennial Open House in Menlo Park, Calif., June 2-4, 2006. During the 3-day event, an estimated 10,000 people visited the USGS campus, where they could choose

from more than 130 displays and hands-on activities.

A large tent pitched over a parking lot was an excellent venue for some water-based exhibits. **Carissa Carter** set up a flume to show how water flowing over a sand bed forms ripples and cross-beds.

Kurt Rosenberger installed a current meter in a tank to demonstrate real-time measurements of current velocities and to explain how such measurements enabled scientists to detect turbidity flows tumbling down Monterey Submarine Canyon.

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