

### Assessing Gravel Bars' Habitat Complexity and Ecological Functions

*Determining how restored gravel bars affect the aquatic ecosystem in the Trinity River, California*

#### Bottom Line

This scoping study determined that gravel bars do provide habitat, and that future evaluations could greatly improve the conditions in the Trinity River.

#### Better, Faster, Cheaper

Channel rehabilitation projects can use this information to determine the best location and methods for building gravel bars. Dynamic construction (creating bars with flowing water rather than heavy equipment) may save costs and create better habitat.

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#### Collaborators

- Trinity River Restoration Program (TRRP)
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#### Future Plans

These and other pilot results will be expanded upon in fiscal year 2013, as we continue our investigations into the ecological function of gravel bars with support from the Science and Technology Program and collaboration with TRRP.

#### Problem

Sediment may be held back by dams resulting in losses of habitat for fish and other aquatic wildlife, such as riffle-pool sequences and gravel bars. Restoring gravel bars downstream from dams is an important way to improve physiological, ecological, and thermal diversity in these river reaches. Having these diverse rivers is important for fish, such as salmon, which require different types of habitat during various life stages. Gravel bars are also believed to function as 'natural filters' for particulate organic matter, nutrients, and plankton. Retaining this organic matter helps purify the river and provide primary energy resources to the river ecosystem.

The Trinity River Restoration Program (TRRP) has been at the forefront of efforts to restore coarse sediment supply and transport in regulated rivers, with the goal of re-creating the instream geomorphological features lost due to sediment starvation by upstream dams. Part of this restoration effort is to create new gravel bars, either by augmenting sediment for natural deposition downstream or rehabilitating channels to construct bars.

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Gravel bar in the Trinity River, California.



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TRRP is documenting and evaluating the physical processes involved in these changes (creating gravel bars, augmenting coarse sediment, and rehabilitating fossilized channels) and the resulting channel changes. Direct measurements of salmon-spawning habitat have been taken; however, the ecological roles of these newly formed gravel bars still need to be assessed from the critical perspectives of habitat diversity and material exchange interactions.

We need to improve our current understanding of the ecological role of gravel bars to determine the most effective ways to design gravel bars, rehabilitate the river, and restore the fishery.

## Solution

This Science and Technology Program research pilot project evaluated the ecological function of restored gravel bars downstream from dams in the Trinity River, downstream from Lewiston Dam, California.

Four gravel bars or islands, each constructed differently (i.e., a side channel dug to form a bar on the shore, construction in the river, gravel injection to deposit a gravel bar, and a naturally deposited bar), were selected. We assessed the ecological function of the features of each of these gravel bars using a number of ecologically significant parameters at more than 20 locations, including the concentration of suspended particulate organic matter, water temperature, dissolved oxygen, conductivity, pH, flow velocity, hydraulic head, and macroinvertebrate samples. All field work was performed during the summer of 2012 under summer base flow conditions.

## Findings

Gravel bars are needed to provide slow, shallow water habitats to rear juvenile salmonids, which require cooler temperatures. All of the gravel bars, both constructed and naturally occurring, did provide the temperatures and habitat diversity needed for salmonid rearing, presumably due to water flows in the hyporheic zone (beneath and alongside a streambed, where shallow ground water and surface water mix). Further research to determine the nature and timing of these flows would provide insights into gravel bar construction and fishery management.

The shape and height of the bar is important for determining how well the bar retains organic matter and provides diverse habitat. A more complex shape with alcoves and more shoreline could provide additional habitat value, but further research is needed to determine the most effective configurations. All four bar types retained the organic matter. The naturally occurring bar was the most efficient in retaining this matter, possibly because these bars have more sand and smaller particles. The reasons for this finding could be a topic for further analysis.

Naturally formed gravel bars may be more effective; however, all of the gravel bars did increase habitat diversity and provided better habitat. Further research to fully understand the ecological role of gravel bars could yield insights to improve gravel bar design, environmental management, and fisheries within complex river systems such as the Trinity River.



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Reclamation. 2000.  
TRRP Record of Decision.

## More Information

Ock, Giyoung and G. Mathias Kondolf. *“Assessment of Ecological Roles of Gravel Bar Features Restored by Gravel Augmentation and Channel Rehabilitation Activities Below Lewiston Dam.”* Cooperative Ecosystem Studies Unit (CESU) Scoping Report, November 2012.

Science and Technology Program  
Research Project:

[www.usbr.gov/research/projects/detail.cfm?id=5907](http://www.usbr.gov/research/projects/detail.cfm?id=5907)



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