Diverse habitats are required for river fish biodiversity restoration

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Floodplains must contain a variety of fish habitats, among other things, to restore river fish biodiversity. This is the result of a large-scale study conducted by Wageningen University & Research (WUR) in collaboration with Rijkswaterstaat, which is published in *Science of the*

Total Environment (STOTEN). Additionally, the extent to which the restored floodplain is connected to the river determines its success as a nursery.

Between 2017 and 2020, Ph.D. candidate Twan Stoffers studied the species diversity and abundance of typical river fish in 46 restored floodplains along the major rivers in the Netherlands. "Floodplains are spawning and nursery grounds for river fish," explains Stoffers. "As a result, optimizing these nurseries is critical for the restoration of biodiversity in our rivers. The degree of connectivity with the river determines whether a floodplain is successful as a nursery. When a floodplain is connected all year, you'll observe high biodiversity and a lot of fishes."

Habitat mosaic

Another important feature of restored floodplains for recovering biodiversity is the presence of a diverse variety of fish habitats. This might range from stagnant water with aquatic plants and overhanging willows to oxygenated fast-flowing water with cobbles and boulders. River fish species have different requirements for the environment in which they grow. The highest species diversity, up to 22 unique species per floodplain, is found in places with a mosaic of habitats.

Such a diverse habitat, on the other hand, is less favorable for some struggling species in Dutch rivers, such as the nase, dace, and barbel. "These species require a very specific nursery habitat, which consists of shallow, flowing water with a coarse bottom," says Stoffers. "They will feel comfortable if these habitat features are present."

With this large-scale evaluation, the researchers discovered that while natural restoration along major rivers is undoubtedly beneficial to the river fish community, there are still points for attention. The researchers

observed that many floodplains lose their connection to the river, especially at lower water levels later in the growing season. "This could represent a bottleneck in the growing process," explains associate professor Leo Nagelkerke. "This connection must be present when the juvenile fish are large and strong enough to migrate to the river. Otherwise, you'll undo all of your hard work to restore these nursery areas."

Restoring fish nurseries

Large floodplain rivers, in their natural form, constantly generate a variety of distinct habitats, for example, through flooding. These habitats also disappear after a while as they silt up or dry out. This dynamic environment is ideal for the growth of a diverse range of juvenile (rheophilic) river fishes.

Our rivers are now regulated for safety and shipping purposes, and this dynamic landscape has largely disappeared. This could explain why these animals' populations stay so small. It is therefore needed to construct and maintain various kinds of nursery habitats in order to allow specialized and critical river fish to recover.

More information: T. Stoffers et al, Freshwater fish biodiversity restoration in floodplain rivers requires connectivity and habitat heterogeneity at multiple spatial scales, *Science of The Total Environment* (2022). DOI: 10.1016/j.scitotenv.2022.156509

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