

Fish born in larger groups develop more social skills and a different brain 'architecture'

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Neolamprologus pulcher (*N. pulcher*) is the breed of cichlid used in the study.
Credit: Dario Josi

A new study shows that cichlid fish reared in larger social groups from birth display a greater and more extensive range of social interactions, which continues into the later life of the fish. Researchers say this indicates the fish develop more attuned social behaviour as a result of early environments.

The researchers also found that those fish raised in a more complex [social environment](#) have a different brain structure to those who experienced fewer group members in early life. If fish experienced the complex social environment for 2 month they had a larger hypothalamus: the area that contains most of the brain nodes of the 'social behaviour network'. They also had a larger 'optic tectum', which processes visual stimuli and could be related to the need to process more visual stimuli in larger groups, say researchers.

The brains of fish with enhanced social skills were not bigger overall than those reared in small groups; however, the 'architecture' within the brain was different.

"Our data suggests that, during development, relative brain parts change their size in response to environmental cues without affecting overall brain size: increasing certain parts forces others to decrease concurrently. These 'plastic' adjustments of brain architecture were still present long after the early stages of [social interaction](#)," said study author Dr Stefan Fischer, from Cambridge University's Department of Zoology.

"Social animals need to develop social skills, which regulate social interactions, aggression and hierarchy formations within groups. Such skills are difficult and costly to develop, and only beneficial if the early social environment predicts a high number of social interactions continues to be critically important later in life," he said.

For the study, published this week in the journal *American Naturalist*, researchers used the *Neolamprologus pulcher* (N. Pulcher) breed of cichlid, primarily found in Lake Tanganyika - the great African freshwater lake that feeds into the Congo River.

N. Pulcher lives in family groups with up to 25 individuals, with one breeder pair and several helpers participating in territory defence and raising of offspring - known as 'cooperative breeding'. To test for social skills, the researchers reared juvenile fish over two months with either three or nine adult group members, and observed all social behaviours at key experimental points.

These interactions included 'lateral display' - when one fish interrupts another by displaying their body side-on, sometimes as a mating ritual - as well as ramming, tail quivering, and 'mouth fighting': a social display in which fish lock mouths to challenge each other over everything from food to mates.

Six month after this test phase, individual fish brains were measured to investigate the long term consequences of early group size on brain morphology, revealing differences in brain architecture.

The researchers say that one of the effects on social behaviour in larger groups might be the perception of environmental risk. "In the wild, larger social groups of N. Pulcher represent a low-risk environment with enhanced juvenile survival. Being part of a larger, safer group may increase the motivation of juveniles to interact socially with siblings,

enhancing the opportunities to acquire social skills," said Fischer.

As perhaps with any social creature, Fischer points out that higher social competence and the ability to conform to social hierarchies may well stand the cichlids in good stead in later life:

"Group size for these fish stays relatively stable across the years, they have delayed dispersal. Remaining in a larger group means a better chance of survival. Fish reared in large groups showed more submissive and less aggressive behaviour to big fish in the [group, social behaviour](#) which greatly enhances the survival chances of smaller [fish](#)."

Fischer added: "In highly [social animals](#), such as cooperative breeders, almost all activities involve social interactions, where individuals need to adequately respond to social partners. In larger groups, these interactions are more common and individuals developing sophisticated [social skills](#) during childhood might highly benefit from them later in life."

More information: *American Naturalist*,
www.jstor.org/stable/info/10.1086/681636

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