Ecologist overthrows generally accepted principles in ecology

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(Phys.org) —Contemporary ecological theory assumes that differently sized individuals in a population are equally efficient in their use of food resources. Still this is only true in a very exceptional case. It is much more common that ecological patterns occur in nature that are in conflict with these generally accepted rules. This is shown by Lennart Persson at Umeå university together with André De Roos at the University of Amsterdam.

Ecological research is based on a number of generally accepted principles, for example that a predator through its consumption of prey decreases the amount of prey, that predators that feed on the same prey species affect each other negatively and that increased productivity of the resource of the prey always will benefit the predator.

In a recently published paper in the journal *Ecology*, Lennart Persson at Umeå university and André De Roos at the University of Amsterdam presents a new ecological theory. This theory shows that the generally accepted principles in ecology only holds in the exceptional case when differently sized individuals in the population are equally efficient in using their resources.

"Simply stated an individual's efficiency in resource use is a result of two processes: how efficient it is in gaining food and how high its cost for metabolic demands is," says Lennart Persson. "We show that the generally accepted principles in ecology are only true in the case when food intake and metabolic demands increase at the same rate with body

size."

The scientists show that in all other cases that are much more common new ecological patterns not covered by contemporary ecological theory develop. One example is a predator that feeds on small stages of a prey population, such as small juvenile fish, by its consumption of these small stages will cause an increase in their numbers.

Another example is that predator species that feed on different stages of the same prey population may promote each other's existence.

A third example is that increased production of the resource of the predator's prey may lead to the extinction of the predator.

That predators may paradoxically increase the amount of the prey it consumes was shown in a lake in northern Norway. In this lake, the consumption by the main predatory fish - brown trout - of small Arctic char led to an increase in the numbers of these small Arctic char. This was because the consumption by brown trout thinned out the slowly growing Arctic char individuals that produced few offspring. The thinning resulted in an increase in the growth of the remaining Arctic char individuals that, in turn, produced a lot of offspring and an increase in the number of Arctic char size classes that brown trout preferently fed on.

"One conclusion one can draw from the above is that harvesting the prey fish may actually promote the recovery of predatory fish in overexploited fish stocks," says Lennart Persson. "This method has also been discussed with regard to the cod in the Baltic Sea."

Different efficiencies in capacity to use resources among differently sized individuals in a population also lead to new types of population cycles that are not present in classical ecological theory according to the

scientists. These types of cycles are also more common in nature than classical predator-prey cycles like vole cycles. For example, cycles observed in many fish populations like populations of cisco, are caused by differences in the efficiency by which differently sized individuals use the resources.

"We expect that our new findings will have major consequences for both basic ecological research as well as for applications, for example management of fish populations," concludes Lennart Persson.

More information: Persson, L. and De Roos, A. 2013. Symmetry breaking in ecological systems through different energy efficiencies of juveniles and adults. *Ecology* 94:1487–1498. dx.doi.org/10.1890/12-1883.1

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