

Group-navigating species may be vulnerable to collapse

July 18 2016



Credit: Santa Fe Institute

Migrating birds flock together and salmon swim upstream in schools because there's a navigational advantage: By traveling in groups, individuals are more likely to get to their destinations – or so a growing body of research suggests.

But the advantages of group navigation often come with strings attached, according to new research by SFI Omidyar Fellow Andrew Berdahl and collaborators: Populations relying on group navigation could be vulnerable to sudden collapse.

Studies of migrating animals such as cranes only recently confirmed the benefits of collective animal navigation; whether group navigation has other consequences isn't yet well understood.



To start to explore the question, Berdahl, SFI Science Board member Simon Levin, and two others developed models aimed at understanding how group migration affects species' population sizes and structures.

Perhaps their most striking finding is that migratory populations are bistable – that is, group navigation can drive a population to greater size or nearly to extinction, depending on context.

As an example, suppose overfishing is driving down the sizes of Pacific salmon runs. Fisheries managers using traditional, standard models could be blindsided by a collapse because their models don't account for the nonlinearities introduced by social navigation effects. If a population size gets too low, individuals might no longer successfully coordinate their travels, leaving the remaining population vulnerable to collapse. It's an outcome that wouldn't happen, Berdahl says, if the animals navigated individually.

The effect could hit populations adapted to local conditions in a more subtle way, too, Berdahl says. If salmon numbers are reduced, they'll disperse more readily, and the consequent mixing of fish between streams would result in homogenization of <u>fish populations</u>. If these local populations survive, they might comprise fish that are less well adapted to local conditions and more sensitive to environmental challenges.

Worse, wildlife managers might not see those effects coming – and if they don't, Berdahl says, they might not make the right choices to sustain already fragile migratory populations.

More information: Andrew Berdahl et al. Collective behavior as a driver of critical transitions in migratory populations, *Movement Ecology* (2016). DOI: 10.1186/s40462-016-0083-8



Provided by Santa Fe Institute

Citation: Group-navigating species may be vulnerable to collapse (2016, July 18) retrieved 5 May 2024 from <u>https://phys.org/news/2016-07-group-navigating-species-vulnerable-collapse.html</u>

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