Journal Club

Fishy behaviour

To manage harvested populations in a rational way, we need to monitor their development in time, and to implement effective regulations when we discover signs of overexploitation. In the best of all possible worlds, we would build our assessment on accurate data, and people would actually comply with our recommendations. Unfortunately, basic human behaviour seems to be one of the major obstacles to us succeeding in our task. Let's take fishery management as an example. Fishermen are allegedly prone to improve on reality, and this could cause a bias in any monitoring schemes relying on fishermen reports. Not too bad, you might think – if the rate of lying is constant, reported figures will still be proportional to the real state of the fish stock. But when we discover a decline and impose regulations to counter it, fishermen are still likely to catch some illegal fish. Well, if fishermen always cheated at a constant rate, could we not simply adjust our bag rates accordingly?

Unfortunately, things are not that simple. In two new papers, Michael Sullivan reports on the real behaviour of fishermen in Western Canada [1,2]. By comparing the sizes of fish reported by fishermen to those observed in test fisheries, he was able to tease apart the facts from the fiction. Exaggeration by fishermen was not constant, but increased exponentially with decreasing catch rate [1]. Hence, the less fish you catch, the worse you lie about the ones you released. What is perhaps even worse, when catch rates get low enough and we try to ban fishing of particular size classes, anglers still tend to be more dishonest the less that they catch. With a decreasing catch rate, anglers tend to keep a larger proportion of the protected-length fish that they land [2].

These patterns have some profound implications for fisheries management. If fishermen tend to exaggerate their catches all the more as a fish stock declines, we might receive little warning before it completely collapses. And if subsequent regulations tend to be less efficient the more badly needed they are, then 'protected' populations will probably fail to recover. Human behaviour might therefore create a strong depensatory response to a fishery decline: once things turn bad, one accident follows another. If we are ever to manage resources in an effective way, we must take such patterns into account. No matter how irrational human behaviour might seem to us, managers must try to uncover the conditions that cause unwanted reactions and invent strategies to avoid them.

1 Sullivan, M. Exaggeration of walleye catches by anglers in Alberta and perceived hyperstability in reported catch rates. *N. Am. J. Fish. Manage.* (in press)
2 Sullivan, M. (2002) Illegal angling harvest of walleyes protected by length limits in Alberta. *N. Am. J. Fish. Manage.* 22, 1053–1063

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Is it dangerous to grow fast and become large?

Large animals generally live much longer than do small ones, and there is also a strong positive correlation between size (weight) and longevity, both in invertebrates and vertebrates. However, some studies have reported the reverse when populations or individuals within the same mammal species are compared. Rollo [1] has now reanalyzed a large set of rodent studies and has also found a negative relationship between maximum body size and maximum longevity. He explains this result by assuming that a large size requires both a fast growth rate and a high metabolic rate. This in turn leads to high oxidative damage of DNA and other metabolic damage, which results in reduced longevity. For data points that Rollo discusses explicitly, small size was induced experimentally either by a calorie-restricted diet or by mutations resulting in a low growth rate. In another recent study, Ricklefs and Scheuerlein [2] compared age-related mortality among mammals and found that postnatal growth rate had a positive effect on mortality rates, thus supporting Rollo's explanation for the pattern that he observed.

Under natural circumstances, however, a large size might also be the result of a protracted growth period rather than of a fast growth rate, which Rollo suggested as an explanation for the discrepancy between interspecific and intraspecific relationships between size and longevity. It is unclear to what extent this explanation contributes to the pattern found among different rodent populations. Another possible explanation is that the positive correlation found among mammals is the result of long-term selection, whereas a negative correlation among populations of the same species can be caused by physiological constraints associated with a large size that need more time to become mollified. The same negative relationship between size and longevity is also found in a comparison of many dog breeds [3], although this might be affected by the relatively recent selection for large body sizes in some breeds and by inbreeding depression in such breeds. Surprisingly, Patronek [3] also mentions that size differences among dog breeds are often explained by differences in maturation period (there might even be selection for delayed maturation via a human preference for protracted 'puppiness'). This is in contrast to the explanation for the rodent pattern. Even though a negative relationship between size and longevity is not commonly found, there already seem to be alternative explanations when it is. Should the larger or heavier individuals among us start worrying? We think not. Although the evidence for the effects of reducing high growth rates on longevity seems convincing, much less so is the strength of the link between growth rate and adult body size.

1 Rollo, C.D. (2002) Growth negatively impacts the life span of animals. *Evol. Dev.* 4, 55–61
2 Ricklefs, R.E. and Scheuerlein, A. (2001) Comparison of aging-related mortality among birds and mammals. *Exp. Gerontol.* 36, 845-857
3 Patronek, G.J. *et al.* (1997) Comparative longevity of pet dogs and humans: Implications for gerontology research. *J. Gerontol. Biol. Sci.* 52A, B171-B178

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