

## MSA Question-Apr 26

Does lifting a black salmon out of the water to take a photo damage the fish's chance of survival? (from Greg Sprague)

Answer:

Short answer - yes - it is an added stress for the fish and can negatively affect a fish' probability of survival following release – whether a kelt (black salmon) or bright salmon.

Now, here's the long, more detailed, answer.

Most fish, including salmon, are not air-breathers. When taken out of the water, a salmon is incapable of effectively delivering oxygen to its tissues when needed such as during periods of stress. Stress occurs during the hooking and playing of a fish until release; the longer the angling duration, the more stress for the fish. Gaseous exchange (mostly oxygen and carbon dioxide) occurs in the gills. You need to visualize the gill structure to appreciate the effect of air exposure. The gills of a salmon are composed of 4 gill arches (the cartilaginous 'loops' behind the gill flap (operculum)). Gill filaments on the arches have numerous small, soft gill branchlets, or lamellae – this is where most of the oxygen exchange occurs, between water and blood. All those tiny branches provide an enormous amount of surface area for gaseous exchange. The buoyancy of water helps to support all those lamellae as water flows all around them. The problem occurs when a fish is removed from water; all that support disappears. The gill arches, filaments and lamellae collapse against one another significantly diminishing gill surface area. Very little oxygen gets into the blood and CO<sub>2</sub> stays in the blood unable to be eliminated – all this while the fish is exhausted. Not a good situation. Imagine you have just undergone some exhaustive exercise and you have been plunged underwater with only a small straw to breathe through!

So, how bad is air exposure in terms of survival? Canadian fish biologists have provided some of the best science on the effects of catch-and-release angling. Probably the most influential research has come from the lab of Dr. Bruce Tufts at Queen's University in Kingston, ON. His research, especially on air exposure, has influenced how fish are handled during angling tournaments throughout North America. A well-cited scientific publication of his from 1992, on rainbow trout, showed that trout exposed to air for only 30 sec and 60 sec after exhaustive exercise, experienced physiological stress and survival of only 62% and 28%, respectively, compared with a control group. Other studies, at different water temperatures and on different fish species, have also shown significant negative effects after only brief air exposure such that many conservation organizations promoting catch-and-release are advocating for no removal of a fish from water, whenever possible, and certainly not for more than 30 sec.

We might argue that the cold water in April and early May when salmon kelts are angled will lessen the impact, which may be true. There is also scientific evidence from research published in 1996 involving wild salmon in the Miramichi River that the physiological disturbance from angling was greater in bright salmon than kelts. But remember that recovery is also a function of fish condition and energy, and salmon kelts have just survived a long winter after having used up almost all their energy reserves, and they have only just resumed feeding. The scientific evidence is clear: air exposure, even for half a minute, will negatively affect fish physiology and decrease the probability for survival following release.

For more information on catch-and-release impacts, including the effects of air exposure, I recommend the following articles and papers:

Trout Unlimited has produced an excellent summary of the topic, called “ Fish Stress from Catch-And-Release Fishing”, available from their website.

Cooke, S.J. and C.D. Suski. 2005. Do we need species-specific guidelines for catch-and-release recreational angling to effectively conserve diverse fishery resources? *Biodiversity and Conservation* 14:1195-1209.

Cooke, S.J. and H.L. Schramm. 2007. Catch-and-release science and its application to conservation and management of recreational fisheries. *Fisheries Management and Ecology* 14:73-79.

Ferguson, R.A. and B.L. Tufts. 1992. Physiological effects of brief air exposure in exhaustively exercised rainbow trout (*Oncorhynchus mykiss*): implications for “catch and release” fisheries. *Canadian Journal of Fisheries and Aquatic Sciences* 49: 1157-1162.

Brobbel, M. A., M. P. Wilkie, K. Davidson, J. D. Kieffer, A. T. Bielak, & B. L. Tufts. 1996. Physiological effects of catch and release angling in Atlantic salmon (*Salmo salar*) at different stages of freshwater migration. *Canadian Journal Fisheries & Aquatic Sciences* 53: 2036-2043.