Popular science summary of the PhD thesis

PhD student	Alexander Rosén
Title of the PhD thesis	Growth and metabolic scaling of fish: Unravelling how variation in growth affects metabolic scaling
PhD school/Department	DTU Aqua

Science summary

Energy use (metabolic rate) in organisms does not increase proportionally with the mass of an organism. Instead, as organisms get bigger, they use relatively less energy. This means that an organism that is twice as big uses less than twice the amount of energy. The way this relationship scale depends on a number called the scaling exponent between metabolic rate and mass. We found that these scaling exponents depend on the growth rate of the fish. Fish that grow faster tend to have a higher scaling exponent. This means that if fish A and fish B both start at the same mass and have the same metabolic rate, then fish A will have a higher metabolic rate at mass x, if it grows faster than fish B to mass x. This was found only for the energy cost needed to stay alive (maintenance metabolic rate), while the scaling exponent for maximum metabolic rate remained the same. The difference between the maximum metabolic rate and the maintenance metabolic rate is an estimate for how much energy a fish can spend on essential activities such as growing, feeding or reproduction. Thus, it appears that there is a trade-off between growing faster and having less energy available for crucial activities. This is likely to have implications for how fish respond to human made changes and how we assess their impact. During experiments in the wild on coral fish, we found that growth rate was larger under light pollution, but it also seemed to increase the scaling exponent of metabolism. By just looking at the growth rate, the conclusion could be that light pollution increases the growth rate, which is probably good. However, by also looking at how it affects metabolism, we can see that there might be a trade-off, so light pollution leaves the fish with less energy, for instance, for reproduction. Getting a better understanding of how the metabolism scaling exponent is connected to growth rate is also important because fish sizes are changing, as many fish species are getting smaller due to anthropogenic activities. The knowledge gained through this thesis could therefore help estimate the energy use (and hence food requirement) of the fish population under human made change.