Biogeosciences Discuss., 8, C2368–C2371, 2011
www.biogeosciences-discuss.net/8/C2368/2011/

Biogeosciences Discussions

Interactive comment on "Effect of ocean acidification on early life stages of Atlantic herring (Clupea harengus L.)" *by* A. Franke and C. Clemmesen

A. Franke and C. Clemmesen

afranke@ifm-geomar.de

Received and published: 8 August 2011

First of all we would like to thank you for your helpful comments!

Comment Anonymous Referee #1:

1. Seawater was acidified with strong acid (HCl) in a closed system. Although this replicates the pCO2 environment expected for a given pH, it causes a decline in total alkalinity (TA) that does not occur with CO2-acidification. This decline in TA is evident in Table 1. Although the decline in TA is unlikely to have had any effect on the life history traits measured, because the physiological processes of the fish are responding to rising pCO2, not TA, I think it is important that the authors explicitly mention this issue

in the methods, especially for readers who are not expert in the chemistry of ocean acidification manipulations.

Authors′ reply:

Thank you for the suggestion. The issue will be clarified in "Material and methods".

Comment Anonymous Referee #1:

2. I assume from Table 1 that bicarbonate and/or carbonate additions were not used to correct TA in the experiment. Although not important to the life history traits measured, this might have some relevance to the otolith analysis. The reduced bicarbonate and carbonate concentrations in the acid-treated water, compared with that predicted for CO2-treated water, could conceivably influence the concentrations of these ions in the plasma and otolith endolymph. Although any effects are likely to be trivial, because the concentration of bicarbonate in seawater remains high and should not affect the ability of fish to transport bicarbonate from the ocean to plasma for acid-base regulation (the major mechanisms that fish use to compensate for acidosis). This limitation in the experimental methods should at least be mentioned in the discussion.

Authors′ reply:

Thank you for the comments. Bicarbonate and/or carbonate additions were not used to correct TA in the experiment. The difference in bicarbonate/carbonate concentrations between acid-treated water and CO2-treated water will be discussed in the revised version.

Comment Anonymous Referee #1:

3. In the abstract, and to a lesser extent in the discussion, the authors make claims about how reduced RNA levels could affect somatic growth and survival of larvae that are not supported by the results. They even extrapolate out to ecosystem and fisheries impacts without support from their own data. I feel this inaccurate interpretation must be corrected. Yes, the RNA/DNA ratio was different in fish reared in acidified water

compared with controls, but there were absolutely no differences in the key life history traits measures, including length weight and yolk area. Therefore, there is no evidence of a link between RNA levels and early life history growth rates in this species. Variation in RNA/DNA ratios often do not correspond with variation in life history traits and the predictive power of these ratios in an ecological context is highly questionable. I urge greater caution here.

Authors′ reply:

Elevated pCO2 did not affect any of the examined morphometric traits (total length, dry weight and yolk sac area) of newly hatched Atlantic herring larvae. However, the RNA/DNA ratio was negatively affected by acidification.

The RNA/DNA ratio is used as an indicator of protein biosynthesis and has been shown to be correlated to growth rate (e.g. Bulow, 1970; Buckley et al., 1984; Bergeron, 1997). Since no RNA/DNA measurements of later larval stages could be performed in our study, the question remains whether or not the growth rate would have been affected. However, the authors did not conclude that a reduced RNA/DNA ratio will result in a lowered growth rate. We merely wanted to point out that it might be a possible effect according to the literature (e.g. Malloy and Targett, 1994; Clemmesen et al., 2003; Buckley et al., 2008).

Furthermore, we mentioned the possible consequences of reduction in growth (Page 7109, line 11-18). This might have caused misunderstandings. We are not drawing the conclusion that the observed lowered RNA/DNA ratio will definitely lead to lower survival, reduction in population size and will impact the ecosystem and fisheries negatively. Our aim was to mention the effects of growth reduction that are discussed in various publications, since growth reduction might be a consequence of the observed lowered RNA/DNA ratio. However, the authors are thankful for the advice. In the revised version it will be clarified that a reduce growth rate was not observed.

Additionally, we would like to thank you for your “Technical corrections”. They will be

considered in our revised version.

References:

Bergeron, J. P.: Nucleic acids in ichthyoplankton ecology: a review, with emphasis of recent advances for new perspectives, J. Fish Biol., 51, 284-302, 1997.

Buckley, L. J.: RNA-DNA ratio: an index of larval fish growth in the sea, Mar. Biol., 80, 291-298, 1984.

Buckley, L. J., Caldarone, E. M., and Clemmesen, C.: Multi-species larval fish growth model based on temperature and fluorometrically derived RNA/DNA ratios: results from a meta-analysis, Mar. Ecol. Prog. Ser., 371, 221-232, 2008.

Bulow, F. J.: RNA–DNA ratios as indicators of recent growth rates of a fish, J. Fish. Res. Bd. Can., 27, 2343-2349, 1970.

Clemmesen, C., Bühler, V., Carvallo, G., Case, R., Evans, G., Hauser, L., Hutchinson, W. F., Kjesbu, O. S., Mempel, H., Moksness, E., Otteraa, H., Paulsen, H., Thorsen, H., and Svaasand, T.: Variability in condition and growth of Atlantic cod larvae and juveniles reared in mesocosms: environmental and maternal effects, J. Fish. Biol., 62, 706-723, 2003.

Malloy, K. D. and Targett, T. E.: The use of RNA:DNA ratios to predict growth limitation of juvenile summer flounder (Paralichthys dentatus) from Delaware and North Carolina estuaries, Mar. Biol., 118, 367-375, 1994.

Interactive comment on Biogeosciences Discuss., 8, 7097, 2011.