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**Subject:** Info for 316(b) Biological Evaluation  
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**Attachments:** [Patrick et al. 2013.pdf](#)

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Hello,

I apologize for this very late update to you, but the author of a recently published peer reviewed paper just sent us his work and we wanted to share with you.

The subject of the research is "advanced hatch" - the tendency of fish eggs exposed to elevated temperatures due to thermal discharge from cooling water intake systems to hatch earlier than would otherwise be expected. The timing of hatch, like the timing of migration and other key life events, can affect mortality rates and food availability at multiple trophic levels in an ecosystem. The paper quantifies advanced hatch in freshwater clupeiforms that are common through the Great Lakes and other northern US inland waters. But the advanced hatch phenomenon is an issue for other species as well. As the author wrote in a cover note to us, "Advanced hatch may be an issue for some species which have a longer incubation period such as Atlantic tomcod and winter flounder (marine examples), and whitefish (our paper as a freshwater example)."

Thanks, and sorry for such a late submission - I only just got it.

Edan

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