

Interactive comment on “Foraging segregation of two congeneric diving seabird species (common and thick-billed murres) breeding on St. George Island, Bering Sea” by N. Kokubun et al.

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Received and published: 2 December 2015

2015 11 30 G. Hunt Review of Kokubun et al murre diving for Biogeosciences Discuss
Kokubun et al examine ecological segregation of two closely related seabirds by providing a thorough analysis of their diving behavior. They find that the common murre, with smaller wings, was more agile underwater and brought larger fish to its young than the thick-billed murre, with larger wings and a heavier body. Prey choice resulted in common murres foraging at a higher trophic level than thick-billed murres. They suggest that the greater underwater agility of common murres allows them to be more flexible in the marine habitats that they inhabit. The paper has two themes, neither of which

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is developed in much depth. On the one hand is ecological segregation, a concept that two species cannot inhabit the same ecological niche. The second theme is that climate change will challenge species to be flexible in their behaviors as new opportunities emerge and old resources decline. The first theme is investigated thoroughly using recording devices that document the details of underwater behavior of the birds, and stable isotope analyses to document differences in trophic levels. The methods used here are state of the art, and the results are compelling. Fig. 2 is particularly effective in showing the diving behavior over the daily cycle, whereas Fig. 3 shows how the dives of the two species differed. In the diet analyses, it was good to have observations of foods brought to chicks as well stable isotope analyses of red blood cells from adult birds that provide an indication of foods used by the adults. That said, they do not place their results in the broader context of where this field has gone. The discussion of the relevance of the differences in foraging behavior to adaptability to climate change seemed to be an afterthought tacked on at the end. This theme of the paper is probably of more general interest than the ecological segregation analysis, as many people are interested in predicting which species will be winners or losers in a world with a warming climate. I would have liked to see this theme developed in the Introduction, with the aim of exploring the characteristics that might improve adaptability and then asking if one of the two murre species was likely to thrive more than the other. For advancing this theme, it would have been valuable to: 1) describe the observation that common murres cope with environmental variability better than thick-billed murres; 2) evaluate how the eastern Bering Sea ecosystem responds to years with late ice retreat and warm water temperatures and how the prey field likely available to the murres would change; and 3) hypothesize that the common murres are more flexible in their foraging because they can dive deeper, turn faster, and take a wider size range of fish.

Smaller stuff: Abstract- There is a big jump from the first sentence on environmental change to the second on what you did to look at murre foraging behavior. Do you have ideas about what changes are expected and what impacts they might have on predators? Page 18153, line 22-24: What are the differences in the responses of these

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two species to long term changes, or do you mean predict how they might respond? I think that you can do a better job of setting up the question and/or hypotheses up front, and then telling us what to do and what you found. It would then be good to finish off with your take on why this research is important and/or your predictions. Page 18154, line 2: There are more recent USFWS reports. Page 18154, line 6: Add Hunt et al., 2011 Page 18154, line 14: Is this driven by ocean temperature directly, or by something that ocean temperature affects? Page 18154, lines around line 25: There are several Hunt group papers that deal with prey difference in the two murres at St. Paul and St. George Islands. Also, the nest sites preferred by the two murre species are quite different. Page 18155, line 7: Again, cite papers on murre prey use at the Pribilof Islands. Page 18155, line 25 - 27: Can you propose this as a hypothesis? Page 18157, line 14: ? should this be m^{-2} ? I am not sure. Page 18158, lines 4-7: Why put mention of the GPS data in if it was not the focus? Page 18159, line 21: delete “following” Page 18160, lines 19-23: In thinking about enrichment values, ^{13}C values vary on and off the shelf, and with rates of primary production. Also, in summer, micro-zooplankton play a very important trophic role and can bounce ^{15}N values up by a trophic level. If all of your murre samples were collected in the same year and at about the same date, this should not be a problem, but it is something to think about in evaluating your enrichment results. Page 18163, line 13 - 23: Did you expect to find differences, and if so, why? Page 18164, line 2: fewer rather than “less” Page 18164, line 14: Did you expect to find differences? This would make a difference between a one-tailed and a two-tailed test. What about using AIC methods to identify the dive characteristics that may differ most between species? Page 18165, line 13: When murres are bringing back meso-zooplankton (and maybe squid), higher quality prey may be scarce. Historical data might show whether, in years when squid were common in murre diets, growth rates of young were lower. Page 19165, line 21: Because of, not “according to” Page 18166, lines 5 – 11: why look at CORT? Did you expect one of the murres to be working harder to feed its young? I do not recall you mentioning stress or CORT in either the Abstract or the Introduction Page 18166, line

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14 – 16: Why do you conclude that they use similar foraging areas? One could be going off the shelf and the other toward the middle shelf. Page 18166, line 19: How did you determine their ages? Page 18166, line 24: Why? I am a bit confused by this whole sentence. Could thick-billed murres be switching more to fish when in the chick-rearing period? What do you mean by isotopic distance? Between what and what? Page 18167, line 6: Can you test this with your data? Page 18168, line 10-13: There is an old Hunt et al. paper that discusses the impact of living in a larger colony. Page 18169, lines 18- 29 and top page 18170: This is really the first that you have brought this up. If prey niche breadth and foraging behavior breadth are tied to better performance in a variable climate or a poor one, then highlight this in the Introduction as an hypothesis. Fig 2: Do you have any idea as to the depth at which light is sufficient for vzial predators? Are prey bioluminescent? Fig. 3. Are there differences in wing stroke characteristics in the upper water column in day and night? Do the murres work as hard or harder at night?

Interactive comment on Biogeosciences Discuss., 12, 18151, 2015.

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