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Biogeosciences Discussions

Interactive comment on "Seasonal distribution of short-tailed shearwaters and their prey in the Bering and Chukchi Seas" *by* B. Nishizawa et al.

G. Hunt (Referee)

geohunt2@u.washington.edu

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2015 11 29 G Hunt Review of Nishizawa et al STSH in Chukchi Biogeosci.-discuss

Nishizawa et al document the distribution and abundance of short-tailed shearwaters in the southeastern Bering Sea and the Chukchi Sea in summer and fall. They also document the size and abundance of euphausiids available to the shearwaters. They find that the shearwaters are most abundant in the Bering in summer, but more abundant in the Chukchi in fall. They also find that euphausiid sizes in the Chukchi Sea were greater in fall than in summer. They conclude that shearwaters remain in the Bering in summer because the krill there are larger, and then only move to the Chukchi when the krill there have increased in size. The paper is potentially an important contribution,

but needs some substantial revision before publication.

I liked this paper in that it began with a hypothesis and then set about testing it. That said, the test is a bit less robust than it might have been. In their comparisons, they are forced to compare summer in the Bering in year 1 with summer or fall in the Chukchi in year 2 (except in 2013, when they looked at the summer in both the Bering and the Chukchi). There is now considerable evidence that krill recruitment was depressed from 2001- 2005, that an increasing biomass of pollock further depressed krill abundance until about 2008, after which krill abundance increased until about 2009, then declined (see Ressler et al., 2012, 2014; Hunt et al., In Press Deep-Sea res. II). As a result, there may be aliasing of the krill biomass by other factors that are unique to the different years. Thus, in the models of explanatory variables (Table 3), it would be good to include year. In Table 4, there is a spatial component (Bering vs Chukchi) as well as SST, Chl a, and slope. How much of the effects of slope or temperature is because of location? I do not think that this is a problem in tables 5, 6 and 7. What happens with krill size in fall in the Bering Sea (Table 2 suggests no fall samples in the Bering)?

You suggest that the increase of shearwaters in fall in the Chukchi is related to an increase in large krill there. Could it be due to a decrease in krill in the Bering? Could you have detected that?

You might be able to test whether there is a general pattern of decreasing numbers of shearwaters in the se Bering Sea by using the data available in the North Pacific Pelagic Seabird Database available at the USGS. Co-author Kuletz should be able to develop a nice set of figures from that.

Page 17723, line 1: Hunt 2011 would be better than Hunt 2002a Page 17724,lines 12-13: expand? Page 17724, lines 16-19: the lack of observations in both places in the same year or in the same place, summer and fall complicates the analysis, as there may be considerable interannual differences in both the availability of krill, and in the numbers of shearwaters in the Bering. Page 17724, lines 24 -26. These

were apparently continuous counts of flying birds, rather than snapshot counts. This can complicate comparisons if in some places you encountered large flock of flying shearwaters, but in others most shearwaters were feeding or on the water. Page 17725, lines 10 – 12; Good! Page 17725, lines 15 – 18: 20012 was a cold year with late ice retreat, 2013 was a warm year with early ice retreat. The timing of the spring bloom and the recruitment of krill in these two years were likely VERY different. Page 17726, lines 5-8: Why not use length weight relationships for the species of krill inb the SE Bering? They are available in several publications (see Hunt et al., In Press). There are considerable interspecific differences in mass and in lipid content, and presumably both wet and dry weights per unit length. Page 17726, line 17-18: Is there a way to test this assumption? Are there not some small-scale differences in where krill are found? Anadyr water versus Bering Shelf Water in the northern Bering Sea? Page 17727, line 3 -4: I do not think that you can assume that slope is a good proxy for upwelling, but it may be. Can you check this? Page 17729, lines 8 – 10. Here you are contrasting not only the Bering and the Chukchi seas, but also, 2012 (cold and early bloom, likely strong krill recruitment) and 2013, (Warm and late bloom, likely very poor krill recruitment). In 2013, many of the krill may have been adults rather than first year recruits (Bering Sea T. raschii live 3-4 years). Page 17729, lines 16 – 17: the effects of temperature are interesting. It is possible that the temperature difference were sufficient to affect growth rates of krill in the warmer waters. Page 17730, line 7: In view of no fall SE Bering Sea data, I think that “substantiate” is too strong. Perhaps “is in line with”? Page 17730, lines 10 – 20: This is a very good point about seasons vs months. Even months may be misleading. Late August is “fall” in the SE Bering, as most birds leave the colonies in August, and migrant phalaropes and other species appear. Perhaps fall also begins in August in the Chukchi? Page 17731, lines 3 – 7: You need to be a bit more explicit about the mechanisms for a temperature- driven impact on the availability of krill. Remember, T.raschii is apparently breeding until at least mid August in the SE Bering Sea and shearwaters are foraging at breeding swarms then (Hunt et al., 1996). The main bloom in the Bering Sea is done

in May or June. I am not certain that Yamamoto et al. (2015) put enough emphasis on the breeding chronology of T. raschii rather than on temperature. Page 17731 lines 10 – 14: What they are eating may depend, in part, on where they were collected. Also, amphipods (Thermisto libellula) may be important only after a series of very cold years (Pinchuk et al., 2013). Page 17731, line 27: size, and or abundance?? Page 17732, line 5 – 8: May depend where one is sampling- remember Hunt et al. (1996) had lots of adult T. raschii at the surface in mid-August near the Pribilofs. See also the paper by Vleitstra et al.2005, where shearwaters were taking adult T raschii just north and east of Unimak Pass. Page 17733, line 19: There are a number of papers specific to the SE Bering Sea summarizes in Coyle et al., 2011, Hunt et al. 2011, In Press).

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