Marine heat wave increased variance and decreased productivity at Bering Strait during 2015-2016

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Abstract: Planktivorous auklets registered changes across two years of a marine heat wave (2015-2016). Colony attendance of crested auklets (*Aethia cristatella*) was reduced (35-50%) at Little Diomede I., AK in latter June 2016 compared to 2015. The pattern was similar for least auklets (*A. pusilla*). An anomalous marine distribution and anomalous consumption pattern were noted for crested auklets. A plot of $\delta^{15}N/\delta^{13}C$ spanned three times the range in 2016 vs. 2015. Crested auklet RBC's had lower $\delta^{13}C$ values and higher $\delta^{15}N$ in 2016. Least auklet growing primaries showed the same pattern. Advected production is important, but $\delta^{13}C$ enrichment may have occurred later in 2016. Julian Date of sampling was more strongly correlated with $\delta^{13}C$ of crested auklet RBCs in 2016 ($r = 0.47$, $p < 0.001$) than 2015 ($r=0.31$, $p=0.01$). Crested auklets had higher baseline corticosterone ($t_{0.05(2)27} = 2.56$, $p < 0.05$) and higher variances in 2016. The crested auklet's citrus-like odorant was less evident in 2016 and ceased earlier in the summer. Bill pigmentation was incomplete in 11% of crested auklets (n=82) in 2016. Planktivorous auklets are proxies for the marine ecosystem. Increased marine heat content may have imposed additive costs that decreased productivity of some top predators.

Keywords: marine heat wave; crested auklet; stable isotopes; corticosterone; foraging ecology

Results and Discussion

In 2016 there was reduced attendance at breeding colonies, delayed breeding, increased variances in consumption patterns, higher baseline corticosterone, and suppressed expression of secondary sexual traits. Stable isotopes analysis suggest that crested and least auklets foraged at a higher trophic level in 2016. Also crested aukets had lower $\delta^{13}C$ suggesting the food web had less upwelled carbon. The marked contrasts from 2015 to 2016 suggest additive costs from increased marine heat content that negatively impacted condition and productivity.

Conclusions

Increased marine heat content may have caused increased variances in the marine ecosystem. Productivity was probably reduced in 2016. Synchronized breeding reduces threats from predators and the usual breeding schedule takes advantage of abundant prey resources for chick rearing. As proxies for the marine ecosystem, auklets help to manifest changes that may affect other species.

The marine heat content in 2016 was the highest on record, but such events are forecasted to recur and become more common. Recurring heat waves could drastically alter species abundances.

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