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Using Age to Assess Retention Time of Ingested Plastic in Seabirds

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Northern Fulmar (allaboutbirds.com)

Using Age to Assess Retention Time of Ingested Plastic in Seabirds

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Cassin's Auklet (allaboutbirds.com)



Introduction

- Plastic pollution is a pervasive issue that has been the subject of seabird research for 35 years.
- Researchers use the amount and type of ingested plastic in birds as a bio-indicator of plastic in different areas and times.
- The retention time of plastic in digestive tracts of seabirds is poorly understood and is critical to the assessment of biological impacts of plastics on birds.
- Comparing size of plastic in the grinding stomachs of juveniles (with a known time to ingest/retain plastic) to adults will provide estimates of retention times.
- Denser (harder) plastic in adults indicates that harder pieces were retained by adults while less dense (softer) pieces have been ground down.

Goal

- Determine retention time of ingested plastic by comparing size and hardness of plastic in two seabird species, the Northern Fulmar (*Fulmarus glacialis*) and Cassin's Auklet (*Ptychoramphus aleuticus*).
- ❖ Plastic pieces of similar size and density in adults and juveniles indicates short retention times and no reduction in size from grinding in the stomach.
- ❖ Smaller and less dense plastic in adults indicates a longer retention time than juveniles due to grinding.

Methods

- We used archived plastic samples from the grinding stomach (ventriculus) of dead birds collected from WA/OR coasts (Slater Museum of Natural History).
- Density was determined by dropping plastic pieces into a succession of seawater and DI water-alcohol solutions of incrementally lower densities from 1.027 to 0.85 mg/mm³. Floating and sinking indicated that plastic was lower and higher density than the solution, respectively, with the midpoint used as density for individual pieces.
- Volume was calculated using measured mass and the determined density.

Results cont.

- Juvenile and adult fulmars had similar volumes of ingested plastic ($p = 0.053$), but density of pieces was greater in juveniles ($p < 0.001$).
- For auklets, adults had smaller volumes of plastic ($p = 0.002$) although density did not differ between age groups ($p = 0.207$).

Discussion

- Volume of plastic ingested by fulmars was similar between the two age groups, suggesting that plastic in adults is not retained for a long time to be ground down. The higher density of juvenile plastic was not predicted.
- Adult auklets had lower plastic volumes than juveniles, indicating they retain plastic longer and the plastic is being ground down in the stomach.
- This method of using known time periods that juveniles ingest and retain plastic provides a control of one variable critical to retention.
- These novel methods could be used in future research on plastic ingestion and/or the use of seabirds as bio-indicators of plastic contamination.

Results

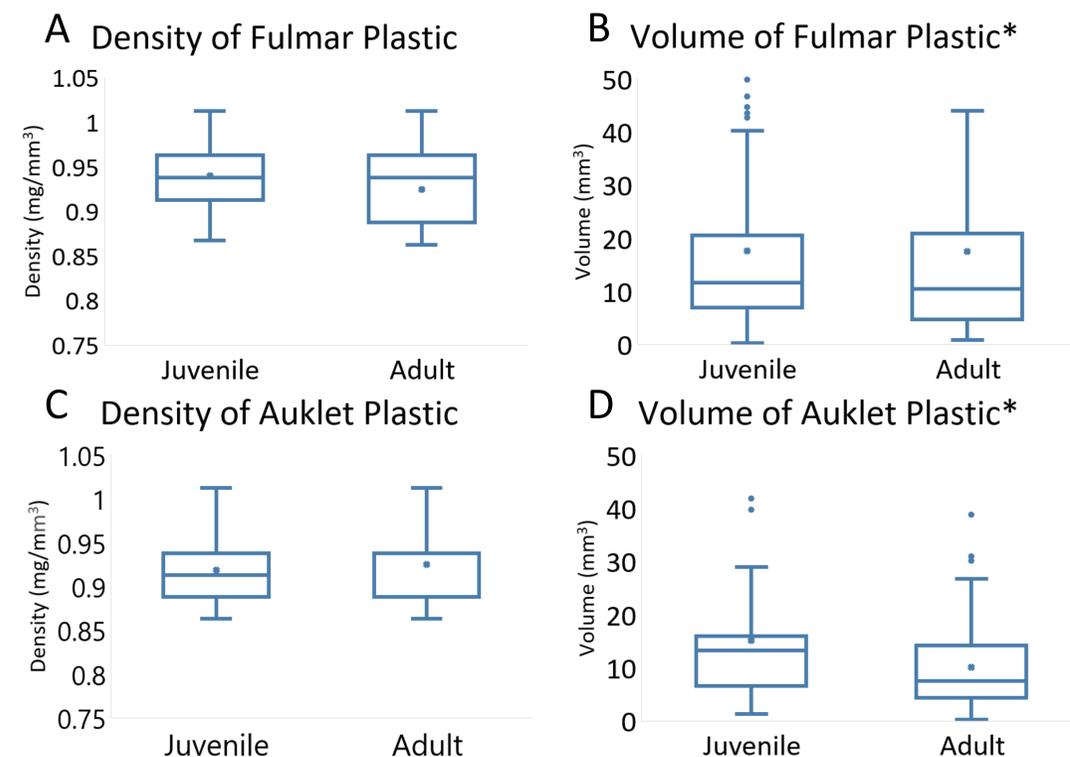


Figure 1. Measurements of individual pieces of plastic in both fulmar juveniles (n=361) and adults (n=189) and auklet juveniles (n=55) and adults (n=171). In fulmars, plastic was less dense in adults (Mann Whitney, $W=108230.00$, $p<0.001$; Figure 1A) but there was no difference in volume between age groups ($W=102884.50$, $p=0.053$; Figure 1B). In auklets, there was no difference in density between ages ($W=5709.50$, $p=0.207$; Figure 1C) but plastic volume was smaller in adults ($W=7533.00$, $p=0.002$; Figure 1D).

*Scale was adjusted to exclude outliers and make the figure clearer

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