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Title:

DEVELOPING ECOSYSTEM METRICS OF PLASTIC INGESTION BY HAWAIIAN SEABIRDS

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Abstract:

Since 2008, we have studied plastic ingestion by Hawaiian seabirds following three approaches: (1) assessing community-wide patterns in breeding species; (2) comparing regional plastic pollution distributions using far-ranging species, and (3) developing standardized time series to track change over time. In Tern Island, we necropsied 362 specimens of 16 species and found plastic in 11 species, belonging to 7 families and 4 feeding guilds. We documented high plastic incidence (>50% adults, >90% chicks) in 4 surface-foraging tubenoses: Tristram storm-petrel, Bonin Petrel, Laysan Albatross (LAAL) and Black-footed Albatross (BFAL). The albatrosses, which provide coverage of the subtropical and temperate North Pacific, can be sampled via chick regurgitations at colonies and adult specimens bycaught in longline fisheries. Regional comparisons of LAAL and BFAL boluses from 3 colonies (Tern, Midway, Kure) highlighted the large plastic loads cast by chicks from Kure, with plastic accounting for 62.8% of the bolus mass. Regional comparisons of BFAL and LAAL incidentally killed in U.S. fisheries, involving adults in good body condition, are collected annually from NOAA Fisheries. We quantified plastic ingestion in BFAL (n=373) and LAAL (n=246) from Alaska and Hawaii-based fisheries during 2010-2017. Because we found no difference in frequency of plastic occurrence between sexes or fisheries, subsequent analyses combined these samples. For both species, the ventriculus (gizzard) had a two-fold higher plastic occurrence than the proventriculus (stomach), highlighting the need to sample both chambers. Overall, LAAL had higher (64%) plastic occurrence than BFAL (49%), and showed a significant positive temporal trend in plastic ingestion (2010-2017; n=15-53 per year). These findings underscore the value of seabirds as bioindicators of plastic pollution at regional (1000s km) scales. Standardized metrics of plastic occurrence and mass in chick boluses and bycaught specimens facilitate monitoring over time. Moreover, by coupling plastic ingestion with tracking and diet analyses, we are gaining a wider context for understanding the distribution and flow of plastic through North Pacific marine food webs.