Breaching the line: Persistent organic pollutant concentrations exceeding thresholds in endangered Hawaiian false killer whales (*Pseudorca crassidens*)

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Why is this important?

False killer whales are highly social, long-lived apex predators found in the tropics and sub-tropics. The resident main Hawaiian Islands population is small (~167) and subdivided into 4 or 5 social clusters.

This population was listed as “endangered” under the Endangered Species Act in 2012. Among threats to their population is exposure to persistent organic pollutants (POPs). POPs are toxic industrial chemicals and pesticides that contaminate marine environments. They are lipophilic, highly resistant to degradation, and readily bioaccumulate.

POP exposure has been linked to (1) immunosuppression; (2) reproductive disruption/impairment; and (3) thyroid disruption in aquatic mammals²,³

We examine variance in POP concentrations in blubber and assess the risk of exposure to individuals based on:

- **Age class**
- **Sex**
- **Reproductive status**
- **Mother/offspring relationships (e.g., birth order)**
- **Social cluster**

What we did

We took blubber biopsies from false killer whales using a Barnett crossbow and biopsy dart⁴ and analyzed them for several contaminants⁵:

- Total polychlorinated biphenyls (PCBs) – flame retardant
- Total DDTs – pesticide
- Total polychlorinated diphenyl ethers (PBDEs) – industrial uses
- Total Hexachlorocyclohexanes (HCHs) – insecticides/pesticides
- Hexachlorobenzene (HCB) – pesticide
- Dieldrin – pesticide
- Mirex – pesticide, was used in pineapple plantations

We identified whales using a long-term photo ID catalog⁶ that includes information on sex, age class, reproductive status, and social cluster assignment.

We used principal components analysis (PCA) to summarize variance among POP concentrations into factors.

Linear mixed effects models were used to examine how life history factors and social cluster explain the variance described by each retained principal component (PC).

Key findings

- **Age/sex class, reproductive status, and birth order influence POP levels** - adult males accumulate POPs throughout their lives whereas adult females offload POPs to offspring via lactation and gestation.

- **Sub-adults/juveniles are at greater risk of health effects from POPs** - they’re born with high levels from maternal offloading and have higher levels of PBDEs, which are known to have neurobehavioral effects⁷.

- **POP concentrations vary among social clusters likely due to differences in spatial use** (i.e., primary foraging areas).

- **POP exposure poses a considerable risk to this population’s long-term viability.** Continued monitoring of POP levels is essential in evaluating persistent threats to this endangered population.