

**SOCIETY OF MARINE MAMMALOLOGY 21ST BIENNIAL CONFERENCE ON THE
BIOLOGY OF MARINE MAMMALS – Dec 13-18, 2015**

<https://www.marinemammalscience.org/conference/>

No Contaminant Left Behind: Enhanced Cataloguing Of Bioaccumulative Organic Pollutants in Five Southern California Marine Mammal Species Using a Non-Targeted Analytical Approach

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Abstract

Apex marine predators of the Southern California Bight (SCB) face a complex combination of environmental stressors including exposure to anthropogenic toxicants and biotoxins produced by harmful algal blooms. Marine mammals serve as effective indicators of marine pollution due to their high trophic position, longevity, and large blubber stores. These factors lead to substantial body burdens of persistent, bioaccumulative compounds suspected to result in immunosuppression and increased vulnerability to disease. Pseudo-nitzschia algal species can produce high concentrations of domoic acid (DA), a potent neurotoxin to which fatal stranding incidents of long-beaked common dolphins (*Delphinus capensis*), short-beaked common dolphins (*Delphinus delphis*), and California sea lions (*Zalophus californianus*) have been attributed. Other species including Risso's dolphins (*Grampus griseus*) and harbor seals (*Phoca vitulina*) have not been documented to experience mass mortality events following DA exposure. An innovative, non-targeted analytical method using comprehensive two-dimensional gas chromatography coupled to time-of-flight mass spectrometry (GCxGC TOF-MS) has been implemented to generate a full inventory of halogenated organic compounds from archived blubber samples of these five sentinel species. The non-targeted analysis characterizes thousands of known and unknown anthropogenic and natural compounds often missed by traditional targeted screening methods. Chemicals that exhibit exposure based on abundance and frequency of occurrence will be catalogued and contaminant profiles will be created for each species. The relationship between chronic exposure to bioaccumulative compounds and susceptibility to DA toxicosis will be investigated and the best sentinel species for future environmental monitoring will be identified based upon magnitude and multitude of accumulated compounds. This project ultimately aims to develop a streamlined and comprehensive approach for discovery of emerging contaminants, investigate associations with health outcomes, and reinforce the importance of non-targeted analytical methods in informing environmental monitoring and assessment.