

Federal Activities to Support the Determination of Links between Environmental Conditions and the Health of Marine Organisms and Humans

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Marine animal health is affected by stressors including man-made pollution and disease. The National Institute of Standards and Technology (NIST) works closely with the National Oceanic and Atmospheric Administration (NOAA) in evaluating marine-life exposure to man-made toxicants and by archiving specimens for retrospective analysis. These activities allow for assessments of marine animal exposure to stressors that impact their health and provide the opportunity for retrospective analysis of marine mammal tissues. This work supports local, regional, and national-scale management of marine animal populations in U.S. waters near- and off-shore. The information provided by NIST enables informed decision making about which stressors lead to the greatest harm, and to what scale these factors exist and whether they can be alleviated. Methods for assessing contaminants and disease are continually improving. The availability of banked samples from marine species allows for assessment of past levels of contamination, disease, and physiological markers of health and potentially the examination of links to human health indicators. Resource management actions based on information provided by NIST will help to protect and conserve environmental resources now and well into the future.

Blood is progressively being used in health studies for exposure assessment as it can be collected less invasively than tissue biopsies. As such, NIST's most recent effort has focused on the development of methods for the determination of reliable measurements of trace elements and organic pollutants in marine animal blood. Methods have additionally been developed for the determination of "pollutants of emerging concern" in blood, including brominated flame retardants and perfluorinated substances. These have only recently been recognized as potentially toxic to marine life. NIST assists NOAA by developing standardized collection protocols for samples to be used for the assessment of marine animal health. These protocols are being used for assessing the health of bottlenose dolphins, beluga whales, and loggerhead sea turtles. Relationships of pollutant concentrations among various tissues of bottlenose dolphins and sea turtles have been examined to determine if non-lethally collected samples can be used for exposure assessment. Other studies have examined the physiological pathways leading to poor cardiac health in pygmy sperm whales and toxic mechanisms of perfluorinated compounds in northern fur seals and California sea lions.

NIST is also developing NMR-based metabolomics for use as an advanced tool for environmental modeling and risk assessment. A recent example of this work is the examination of metabolites that increase in quantity in the Atlantic blue crab, *Callinectes sapidus*, when under environmental stress such as exposure to a pathogen or pollutant. This work allows for the ecosystem-scale examination and discovery of metabolism-related compounds that correlate with different biological conditions. Understanding these correlations is necessary to reach a more comprehensive understanding of the impacts of pollution or physical environmental change on marine, environmental and human health.

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