My contacts at NOAA gave me some info and links to the subject of Endocrine Disruptors. I have listed 9 of them below. #s 1 and 2 describe some ongoing research that may be complete but not yet reproted. You may already be aware of or have some of this. The work in the Great Lakes was mostly with birds/eagles (see #9) but obviously, being at the top of the food-chain, they are picking up the contaminants from fish. I also attached some PDFs for you to look at as well. Hope yesterday was a success. Looking forward to your talk. Marty

1) Project to Develop Screening Assays for Endocrine Disrupting Compounds in Marine Invertebrates (2008)

Project Description: The risks associated with endocrine disrupting compounds in the marine/estuarine environment have not been well characterized. One important area of research requires the development of assays to identify the effects of endocrine disrupting in estuarine/marine invertebrates. In collaboration with the US EPA we will be conducting research to develop endocrine disruptor screening assays for two invertebrate species, the mysid (Americamysis bahia) and the copepod (Amphiascus tenuiremis).

Expected Outcome:
This work will lead to the development of assays to identify and characterize the effects of endocrine disrupting compounds in estuarine/ marine invertebrates. This will enhance the ability of coastal managers to understand the potential impacts of endocrine disrupting chemicals in estuaries.

PI: Fulton, Mike -NOAA/NOS/National Centers for Coastal Ocean Science
(link - http://www8.nos.noaa.gov/nccos/npe/projectdetail.aspx?id=684&fy=2008)

2) Marine fish health and Endocrine Disruptors
Problem Statement:
Chemicals that cause cancer, reduce disease resistance, disrupt the endocrine system, and alter growth and reproduction threaten marine fish populations and, potentially, the health of anyone who eats marine fish.

Critical Factors:
Many common marine pollutants, including aromatic hydrocarbons derived from fossil fuels, pesticides, surfactants present in detergents, phthalates present in plastics, DDT, PCBs, and even food preservatives can impair growth, reproduction, and disease resistance and increase cancer risk. Many of these compounds exert their effects by disrupting the endocrine system, a network of glands and organs that regulates many bodily functions, including growth, metabolism, reproduction, and immune function. Some endocrine-disrupting compounds mimic the effect of estrogens. These types of chemicals contaminate Puget Sound's urban bays and similar sites all along the West Coast.
Some of these chemicals (e.g., PAHs, PCBs) clearly affect the health of marine fish. Northwest Fisheries Science Center (NWFSC) scientists have found that English sole from contaminated sites in Puget Sound exhibit depressed sex hormone levels, altered or inhibited reproductive development, reduced egg and larva viability, and a high prevalence of liver disease. These chemicals may also affect the health of anadromous fish. NWFSC scientists have found that contaminants present in urban estuaries reduce the growth rates and suppress the immune functions of juvenile salmon. Little is known about the impact on marine fish of other potentially toxic or endocrine-disrupting chemicals such as alkylphenols, phthalates, pharmaceuticals, and biotoxins for which tests are seldom performed. There is no quick and accurate way to gauge the health risk posed by seafood contaminated with these contaminants. Current regulations may not protect trust resources or threatened or endangered marine species against the sublethal impacts of these contaminants.

Status of Research:
Pathology of rock sole for reproductive study:
The NWFSC is investigating the effects of chemical contaminants on the development, growth, reproduction, and survival of marine species. Center scientists have developed a substantial body of information about the effects of some contaminants on the cancer risk and reproductive function in English sole and other bottomfish. They are currently studying ways in which these contaminants affect growth, development, and stress response. Such studies have formed major parts of recent damage assessment investigations, including the Hylebos fish injury studies. (Because growth rates and reproductive success help to determine the productivity and population dynamics of fish stocks, they are crucial indicators of resource damage.) NWFSC scientists are also developing molecular biology-based assays to screen fish for exposure to endocrine-disrupting chemicals. One of their major objectives is to apply this knowledge to the development of adequate sediment and water quality standards to protect marine species against the impacts of chemical contaminants. As part of this effort, they are developing a bioassay system using zebrafish, a model organism with a short life cycle, to rapidly screen chemical contaminants for lethal and sublethal effects on development, growth, reproduction, and other critical life processes.
Future Considerations:
Quick, reliable tests for the presence of currently-used and poorly-regulated compounds (e.g., certain endocrine disruptors like surfactants and synthetic hormones) in the nation's seafood and endocrine-disrupting compounds in marine fish populations must be developed. An understanding of the ways in which these compounds affect declining marine species and the manner in which their impact on individual marine organisms, in turn, affects fisheries productivity must also be gained. Lastly, adequate guidance for resource managers must be accrued, enabling them to protect marine species from the adverse effects of these compounds, especially for those listed or being considered for listing under the Endangered Species Act (ESA).

NOOA Contact: Dr. Tracy Collier, Director, Environmental Conservation (EC) Division, NWFSC (206/860-3312)

3) Sea Grant science on Jamaica Bay featured in Newsday
Scientists are suggesting a common cause for two seemingly unrelated events: the feminization of fish in Jamaica Bay, where the former 50-50 male-to-female ratio has all but disappeared, and enlarged breasts in young boys. The common factor is endocrine disruptors (found in detergents, cosmetics and other products) that scientists now believe play havoc with normal hormone activity. Sea Grant researcher Anne McElroy's data shows gender change in Jamaica Bay's flounder due to chemical residues (the endocrine disruptors) that find their way into Jamaica Bay where the fish live. These residues mimic the female hormone estrogen, which may explain the three cases of enlarged breasts in young boys. The three cases prompted the National Institutes of Health to advise doctors to suspect the use of cosmetics that act as endocrine disruptors.

4) Project on Collaboration with Korean Scientists to Understand Ecological Impacts of Endocrine Disruptors:
Scientists from South Korea's National Fisheries Research and Development Institute are participating in joint research and an interagency project on endocrine disruption in fish, to aid understanding of ecological impacts. The Korean scientists are in the U.S. working with scientists from the National Centers for Coastal Ocean Science, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service to assess endocrine disruption in fish in the Potomac River and several other rivers in the Chesapeake watershed. Endocrine disruptors are chemicals that can mimic or inhibit natural hormones in the body, and can impact vital life

processes, including development, growth, metabolism, and reproduction. This is part of an ongoing NOAA bilateral agreement with the Korean Ministry of Maritime Affairs and Fisheries, administered by NOS's International Programs Office, to collaborate on integrated coastal and ocean resources management joint projects. For more information, contact Tony.Pait@noaa.gov or Lynne.Mersfelder@noaa.gov.

5) Author Analytic: Wirth; Edward F.; Michael H. Fulton; Geoffrey I. Scott, Center: CCEHBR
Title Analytic: Reproductive alterations in the grass shrimp (Palaemonetes pugio) following pesticide exposure
Place of Publication: Research Triangle Park, NC
Date of Publication: 2002
Availability: Ed.Wirth@noaa.gov
Type: Presentation
Proceedings Title: Endocrine disruptors workshop: Program review of extramural and intermural research. EPA Workshop on Estuarine Disruption
Paper Title: Reproductive alterations in the grass shrimp (Palaemonetes pugio) following pesticide exposure

6)Effects of Contaminants on Winter Flounder Living
in a Sewage-Impacted Estuary-Jamaica Bay, NY

(Lourdes Mena1, Lucia Cepriano2, Nancy Denslow3, Martin Schreibman4, and Anne E. McElroy1 - Stony Brook University/MSRC, Stony Brook, NY 11794, State University of New York, Farmingdale, NY 11735, University of Florida, Gainesville, FLA 3261, Aquatic Research & Environmental Assessment Center, Brooklyn, NY 11210)

Jamaica Bay, NY is an urban estuary that receives millions of gallons of sewage effluent daily making sewage effluent its primary source of freshwater. Extremely high levels environmental estrogen mimics (e.g., nonylphenol, estradiol, estrone) observed in sediments led us to postulate that benthic fish residing in Jamaica Bay, NY are likely targets for endocrine disruption and, potentially, reproductive impairment. We collected adult, juvenile and young-of-the-year winter flounder, Pseudopleuronectes americanus, from multiple sites in Jamaica Bay and a reference site off the east coast of Long Island, Shinnecock Bay, in the spring of 2002 and 2003. Very few male fish were found at the site with the highest levels of endocrine disruptors. Levels of circulating 17 beta-estradiol (E2), vitellogenin (VTG) and 11-Ketotestosterone (11-KT) showed unusual patterns of endocrine disruption in this species. Females from the most contaminated site showed significantly higher levels of VTG and males only showed decreased levels of E2 and 11-KT as compared to reference fish. Histological analysis of liver and gonad tissue are also ongoing.

8) Reproductive impairment and endocrine disruption in an estuarine fish population exposed to seasonal hypoxia

Dr. Peter Thomas, Research Assistant Professor, Marine Science Institute, Department of Marine Science and Section of Intergrative Biology , University
Abstract:
The long term effects of the recent dramatic increase worldwide in the incidence of coastal hypoxia on marine ecosystems are unknown. Here we show that chronic environmental exposure of Atlantic croaker to hypoxia in a Florida estuary in 2003 caused marked suppression of ovarian and testicular growth. The suppression of ovarian growth and egg development in female croaker was associated with lower levels of circulating estrogens, hepatic estrogen receptor mRNA expression and plasma vitellogenin, indicating an

impairment of estrogen signaling after hypoxia exposure. Similarly, inhibition of testicular growth and sperm production in males from the hypoxic sites was accompanied by lower plasma androgen levels. Laboratory hypoxia studies showed that the endocrine disruption was associated with impairment of reproductive neuroendocrine function and decreases in hypothalamic serotonin content and the activity of the serotonin biosynthetic enzyme, tryptophan hydroxylase. Pharmacological restoration of hypothalamic serotonin levels also restored neuroendocrine function, indicating that the stimulatory serotinergic neuroendocrine pathway is a major site of hypoxia-induced inhibition. Down-regulation of reproductive activity through inhibition of tryptophan hydroxylase activity could have evolved as an adaptive mechanism to survive periodic hypoxia, but in view of the recent increased incidence of coastal hypoxia could potentially affect fish population abundance and threaten valuable fishery resources.
Contact Person(s): Diane Tierney
206-860-3380

9)Assessment of environmental endocrine disruptors in bald eagles of the Great Lakes

W. W. Bowerman, , a, D. A. Bestb, T. G. Grubbc, J. G. Sikarskied and J. P. Giesye
a Department of Environmental Toxicology, Clemson University, P.O. Box 709, Pendleton, SC 29670, USA
b U.S. Fish and Wildlife Service, East Lansing Field Office, 2651 Coolidge Road, East Lansing, MI 48823, USA
c U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, 2500 S. Pine Knoll Drive, Flagstaff, AZ 86001, USA
d Department of Small Animal Clinical Sciences, College of Veterinary Medecine, Michigan State University, East Lansing, MI 48824, USA
e Department of Zoology, National Food Safety and Toxicology Center, Institute of Environmental Toxicology, Michigan State University, East Lansing, MI 48824, USA
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Abstract
Environmental endocrine disruption in wildlife has primarily focused on estrogenic/androgenic end points and their antagonists. We describe here the work that has occurred within the Great Lakes of North America that has used the bald eagle (Haliaeetus leucocephalus) as a sentinel species of the effects of environmental toxicants, including endocrine disruption. Our data suggests that population level effects of hormone disrupting chemicals, not necessarily estrogen/androgen mimics and their antagonists, have been associated with reproductive and teratogenic effects observed in the bald eagle population within the Great Lakes Basin. Additional laboratory and field studies are necessary to further clarify the role of environmental endocrine disruptors on reproduction in avian populations. The use of sea eagles (Haliaeetus spp.) as biosentinels of pollution in other regions of the world is also discussed.

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