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In This Issue

MERCURY SPECIAL FEATURE

Mercury is a well-known environmental toxicant, particularly in its organic form, methylmercury. Exposure to mercury or its compounds has been associated with a range of toxic effects in fish, birds, and mammals, including neurological impairment and behavioral, hormonal, and reproductive changes. Consumption of fish and shellfish that contain methylmercury is a dominant source of mercury exposure in humans and piscivorous wildlife. Six articles in this issue of *EcoHealth* contribute to a special feature describing current knowledge of mercury fates and effects in marine ecosystems. Four of these articles also discuss the relationship between mercury and selenium levels, and the importance of considering both in assessing the harmful effects of mercury.

Berry and Ralston describe how mercury distributes from geological sources into the atmosphere, and then into hydrological systems and food webs. They present the importance of coal-burning power plants as a key source of mercury release into the atmosphere from human activity. In this overview, the authors also detail some of the physiological selenium-dependant processes affected by mercury exposure and how increased selenium intake can act protectively to prevent oxidative tissue injury. They conclude that assessments of mercury exposure and tissue levels need to consider selenium intakes and tissue distributions in order to provide meaningful risk evaluations.

Ralston et al. describe the importance of considering the molar relationships between mercury and selenium when investigating neurodevelopmental outcomes of maternal mercury exposure during pregnancy. The ability of selenium compounds to decrease the toxicity of mercury has been established in all species of mammals, birds, and fish investigated. Since free-ranging marine fish are rich sources of selenium in substantial molar excess of mercury, this may explain why the largest and most recent studies of seafood consumption are finding substantial benefits instead of harm.

Considerable efforts are underway to monitor mercury levels in the U.S., with the strongest focus on terrestrial and freshwater environs. **Evers et al.** describe a coordinated and expanded coastal marine ecosystem monitoring program to evaluate the deposition and transport of mercury, methylmercury formation and bioaccumulation, wildlife populations at risk, and human exposure. This program focuses on the Atlantic coast from the Chesapeake Bay to the Gulf of Maine, covering four major habitat types from estuarine to pelagic, and five categories of indicators: abiotic measurements, invertebrates, fish, birds, and mammals. This study recognizes the importance of sampling strategies that also take into consideration how selenium interacts with methylmercury.

Chen et al. investigate the spatial patterns and mechanistic processes of methylmercury production, bioaccumulation, and biomagnification in various ocean regions, from estuarine to coastal to open ocean, among different latitudes and in various trophic levels. They include consideration of mercury bioaccumulation from phytoplankton at the base of the food web, on up through benthic species, and on to pelagic species in the open ocean. At the global scale, they reflect on disparities in our knowledge about where we know methylmercury to be produced and where it is found in marine fish harvested for human consumption.

Goodale et al. present their research on mercury levels in marine foraging birds in the Gulf of Maine. The main goals of this study were to determine the relationship and patterns of mercury levels in seabirds in this region, and to identify species that are the most effective bioindicators of

mercury availability in the marine system. Through sampling eggs and blood from chicks and adults, they reveal that eggs and adult blood are the best indicators. Their study also found that piscivorous birds had higher mercury levels than insectivorous birds.

Towards Healthy Coastal Ecosystems, and Healthy Aquaculture

Coastal ecosystems around the world are changing in response to a range of anthropogenic pressures, including impacts from growing human populations, conversion of native forest and shoreline habitat to urban development, toxic contamination of sediments and species, and overharvesting of resources. Efforts at ecosystem restoration generally look backward in time, and may be based on prior conditions that have changed, might never reoccur, or could be impossible to recreate. In the absence of a successful model for restoring changed estuarine or marine ecosystems, **Gaydos et al.** present 10 principles for forward-planning of coastal zones in a process they describe as ''designing healthy coastal ecosystems.'' They start with a broad resilience-based definition of what comprises a healthy marine ecosystem, then suggest what is required to design such a future system that reflects current societal values, using ecological principles for guidance. As their case in point, they discuss some of the problems and potential ways to protect the Salish Sea, the inland sea that bridges the international border of Washington State (U.S.A.) and British Columbia (Canada).

Stephen et al. investigate whether or not salmon farm health regulatory strategies in British Columbia (Canada) do, or could, support sustainability goals. This multifaceted coastal environmental management issue affects the Salish Sea and surrounding areas, and is considered at a time of dwindling wild fish stocks, increased demand for aquaculture, industry growth, and public concern about the ecological and social effects of salmon farming. Their review identifies the main obstacles to sustainability-based management systems and suggests future approaches. Many key issues are traced back to fundamental differences of opinion among key stakeholders (the salmon farming industry, those involved in recreational wild salmon fishing, and coastal communities) on the appropriate model to manage sustainable salmon farming, namely, a sustainable agriculture versus a sustainable natural resource model. They suggest development of a process to effectively integrate the ecological, sociological, and economic evidence needed to shift fish health management from reactive disease control to proactive sustainable health management, in effect, designing a healthy, and thereby sustainable, salmon-farming coastal ecosystem and the policy required to achieve this.

Transdisciplinarity: Achieving it in the Field

Transdisciplinary research aims to comprehend the complexity of problems and socially contextualize them so their resolution may contribute to sustainable development. Active and constructive engagement of stakeholders is one of its principle characteristics. **Orozco et al.** assess transdisciplinary learning among undergraduate students from different disciplines collaborating with an Ecuadorian sustainability-for-health research project. They identify factors that both facilitate and inhibit transdisciplinary learning, and their findings are readily applicable for those planning to develop transdisciplinary research training initiatives in similar environments of limited research and human resources.

Conservation Medicine

Conservation medicine is the study of health relationships occurring at the interface of humans, animals, and ecosystems. As a discipline, it is in an early stage of development, and shares a similar philosophy with EcoHealth, One Health, and Global Health, all of which recognize the clear relationship between human and animal health. Conservation medicine focuses specifically on the importance of ecosystem functionality in the context of health, and it draws on the principles of both ecology and applied medicine as an approach to human and animal disease issues.

As new diseases and other health threats continue to emerge, we are now realizing the need for a cadre of well-trained conservation medicine professionals equipped with the right tools to confront unprecedented challenges to human, animal, and ecosystem health. **Kaufman et al.** present examples of the application of conservation medicine, review existing academic programs, and provide examples of where opportunities exist for those interested in pursuing a career in conservation medicine. They then

suggest a core set of skills needed by the conservation medicine practitioner, and recommend key considerations for designing new conservation medicine training programs.

Nava et al. present a conservation medicine study that investigates disease spill-over at the interface of agricultural and natural ecosystems in Brazil. They report the first evidence of Canine Distemper Virus (CDV) exposure in Brazilian free-ranging felids, a disease previously associated with high mortality in captive and wild felid populations. Six jaguars and one puma captured in Ivinhema State Park were found to be seropositive to CDV. All dogs sampled from farming communities around this park were found to be seropositive to CDV. None of 13 free-ranging felids sampled from a second State Park (Morro do Diabo) were found to be seropositive, and a much lower estimated prevalence was found among dogs sampled from surrounding farms. The authors explain their results through providing insight into differences in forestry management, habitat disturbance, local farming practices, and dog vaccination programs between and around the two State Parks.

In 1977, at an American Legion convention in Philadelphia, a novel disease was identified and subsequently given the epithet of Legionellosis derived from the eponymous bacteria. **Ng et al.** endeavor to detail what environmental factors may influence outbreaks of this naturally occurring bacterium by examining all outbreaks over the past 28 years in Toronto. They conclude that local watershed may directly influence Legionellosis risk, but the exact mechanism of introduction remains unknown.

Health versus Emissions: Costs and Benefits of Domestic Travel

Road transport emissions are a major contributor to the rising rate of CO_2-equivalent emissions worldwide. **Greenaway et al.** investigate a highly significant but rarely studied aspect of the spectrum of travel that contributes to household CO_2 production. They explore the purpose, importance, and meaning of social and recreational travel for a diverse group of residents from Auckland, New Zealand's largest city. Such domestic trips, other than work-related trips, have been likened to discretionary expenditure, but this study demonstrates the range of important reasons for these trips, including maintaining relationships and providing opportunities for participating in physical activity. This leads to a discussion of the need to balance the ecological imperative to reduce CO_2 emissions and the equally important requirement to foster social cohesion, improve public health, and reduce inequalities. The findings could inform the development of strategies to mitigate adverse social impacts of CO_2 emissions reduction measures.

Reciprocal Book Reviews

Biologists define ''Ecology'' as a theoretically based, experimentally driven approach to understanding the interactions of organisms with each other and their environments, and how these interactions determine their distribution and abundance. Social scientists and many environmentalists see ''Ecology'' as analysis of the relationship of human society to our environment and the sustainability of that relationship. Epidemiologists have traditionally used the term ''Ecology'' to refer to statistical associations between health events and one or more variables at the aggregated population level, especially when we lack mechanistic explanations for the associations.

EcoHealth bridges all three of these communities, among others, and is challenged to provide a common platform for exchange of ideas. In this issue, we present an unusual experiment in this ongoing exchange—reciprocal book reviews of two high quality and recent books on the Ecology of Disease. One of these books comes from the Biological Ecology community and the other from the Epidemiological and Social Science community, with a strong medical influence. They are ''reciprocal reviews'' in that we have asked the editors of each book to review and describe the other book. We hope you find this experiment useful and thought provoking.

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