

## *In This Issue*

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#### **ILLEGAL INTERNATIONAL WILDLIFE TRADE: THE EVIDENCE IS IN!**

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The global trade in illegal wildlife is a multi-billion dollar industry that threatens biodiversity and acts as a potential avenue for invasive species and disease spread. Despite the broad-sweeping implications of illegal wildlife sales, scientists have yet to describe the scope and scale of the trade. In this issue, Rosen and Smith provide the most thorough and current description of the illegal wildlife trade using 12 years of seizure records compiled by TRAFFIC, the wildlife trade monitoring network. These records comprise 967 seizures, including massive quantities of ivory, tiger skins, live reptiles, and other endangered wildlife and wildlife products.

#### **DISEASE AT THE CATTLE-HUMAN INTERFACE**

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Waste from cattle production contains protozoa, which can be transmitted to humans. People residing in areas of high cattle density may be at increased risk for protozoan infections. This study by Jagai et al. assessed spatial and temporal associations between cattle density and hospitalizations for protozoan infections in the U.S. elderly. Cryptosporidiosis demonstrated increasing annual rates related to increased potential exposure to cattle. Counties with low human population density (regardless of cattle density) had the highest rate of all protozoan infections, peaking in the summer. These results demonstrate the elderly population is at increased risk of protozoan infections in areas of high cattle density.

#### **LYME DISEASE: WHEN TICKS INVADE**

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Biological invasions are occurring at unprecedented rates. When the invaders are species of medical importance—

vectors and pathogens—significant disease may result. Hamer et al. report a 5-year invasion of the blacklegged tick and the Lyme disease pathogen—together responsible for the most significant arthropod-borne human disease in the United States—in an area of the Midwestern United States where these species previously did not occur. The Lyme disease pathogen furthermore was found infecting the wildlife community ahead of the blacklegged tick invasion front, suggesting a system of cryptic pathogen maintenance, which may reduce the time lag between blacklegged tick invasion and build up of high pathogen prevalence. These results demonstrate the complex ecology of an invading disease system in which wildlife provide an early warning of disease emergence.

#### **UNDERSTANDING DENGUE ECOLOGY**

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Dengue is the most important arthropod-borne virus, and its primary vector, *Aedes aegypti*, is an anthropophilic species that thrives in human-modified landscapes, in and around human dwellings. This habit, along with the expansion of global human transport systems facilitating its dispersal, has contributed to *A. aegypti*'s range expansion. However, the abrupt decrease in dengue transmission along the Mexico–U.S. border likely reflects differing human-driven ecological factors. Hayden et al. examine the characteristically different attributes of the landscape that may present less favorable conditions for dengue transmission on the U.S. side of the border in Arizona despite the presence of *A. aegypti*. In Colombia, Padmanabha et al. take a look at the ecological links between water storage and *A. aegypti* production. Their results show that *A. aegypti* production and human behaviors are coupled in a temperature-dependent manner. Other factors may compound the issue, such as climate change. The authors

suggest that vector control programs account for the geographic variation in temperature and the water-usage behaviors when designing targeted interventions. These two studies demonstrate that dengue ecology is not separate from human ecology and should not be treated as such.

## CLIMATE CHANGE

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In the sub-Arctic region of Fennoscandia, the mosquito-borne filarioid nematode *Setaria tundra* is now associated with emerging epidemic disease resulting in substantial morbidity and mortality for reindeer and moose. We describe a host-parasite system involving reindeer, arthropods, and nematodes that may contribute as a factor to ongoing declines documented for this ungulate species across northern ecosystems. Laaksonen et al. demonstrate that mean summer temperatures exceeding 14°C drive the emergence of disease due to *S. tundra*. An association between climate and emergence of filarioid parasites is a challenge to ecosystem services with direct effects on public health, sustainability of free-ranging and domestic ungulates, and ultimately food security for subsistence cultures at high latitudes. The paper by Jacups discusses global climate change influencing the arrival and extension of the present *Chironex fleckeri* stinger season in Darwin, Northern Territory, which also is a worthwhile addition to the literature and of tropical health importance.

## WATER AND DISEASE

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Assessments of ecological integrity are commonly used for conservation planning, but are they also relevant for understanding public health and disease? In this study, Hitt and Hendryx answer this question in the affirmative, demonstrating that the ecological integrity of stream benthic macroinvertebrate communities is related to human cancer mortality in West Virginia, USA. The authors concluded that, although the macroinvertebrate data analyzed in their study were collected to assess the quality of aquatic life, such ecological assessments offer valuable insights for public health. In their research in Hawaii, Ragosta et al. examined associations between riparian canopy cover, presence or absence of cattle, rainfall, solar radiation, month of year, dissolved oxygen, turbidity, salinity, and *Enterococcus* concentrations in riparian surface soils with *Enterococcus* geometric mean in-stream water concentra-

tions at Waipā watershed on the North Side of the Hawaiian island Kaua'i. The authors found that each percent decrease in riparian canopy cover was associated with an increase of the geometric mean of *Enterococcus* in stream water. This finding has important implications for health and conservation issues because it suggests that a loss in riparian vegetation could increase fecal bacteria surface runoff. In India, millions people living there are at risk by consuming arsenic-contaminated groundwater. In the near future, arsenic-related cancer might be a leading cause of death in the region. However, due to segmental approaches, the current mitigation strategy has failed to stop suffering of the affected population. Sarkar found that overexploitation of groundwater for agriculture was responsible for arsenic contamination of aquifers and ecological damage. Disparity, inequality, and lack of services resulted in more suffering among the poor. The author has provided a valuable integrated model to address the multidimensional perspective of the arsenic contamination and a sustainable development strategy.

## AMPHIBIANS IN CHINA

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Ranaviruses have been associated with die-offs in cultured amphibians in China, but their presence in wild amphibians has not yet been assessed. Data collection over the free-ranging *Rana dybowskii* at seven sites throughout Heilongjiang Province revealed an overall infection prevalence of 5.7% (18/315) for adults and 42.5% (51/120) for tadpoles by polymerase chain reaction (PCR). PCR amplified product showed a high degree of homology with members of the genus *Ranavirus* in the Iridoviridae. Wei et al. indicate that ranaviruses are broadly distributed throughout Heilongjiang Province and could have important implications for the health of both native wildlife and those in northeast Asia. Chytridiomycosis, caused by the fungus *Batrachochytrium dendrobatidis* (Bd), is an emerging infectious disease of amphibians. It has caused population declines on several continents around the world, although there have been no reports on the occurrence of Bd infection in China. In this study, Bai et al. investigate the presence of Bd in introduced bullfrogs and four native amphibian species in bullfrog-invaded areas in China. Thirty-nine of 259 samples were detected to be positive, and 4 Bd-positive samples were from adult bullfrogs sold on the market. The result suggested that the breeding and trade of bullfrogs may contribute to the spread of Bd.

## MONITORING GREEN TURTLES

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Marine turtles are proposed sentinel indicators of environmental health, yet their status is threatened, raising question on the health of our environment. This investigation by Flint et al. examined 100 green turtles over 4 years in Queensland to determine the causes of morbidity

and mortality. Diseases are an important contributor to mortality, but different diseases occur at different locations. In Queensland, the authors show that spirorchiidiasis is prevalent and may be increasing in pathogenicity with time. Season and turtle age influence the impact of this disease and infection rates are independent of body organ.