October 2010

# Marine Science Review – 392

## Human health and security

SeaWeb
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**In this review:**



O / A **denotes an open access article or journal**

## A. Recent articles – no abstract

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Vijver, M.G., Peijnenburg, W.J.G.M., and DeSnoo, G.R. Toxicological mixture models are based on inadequate assumptions. *Environmental Science and Technology* 44(13): 4841-4842, 2010. O / A

## B. Recent articles with abstracts

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Levy, J.K. and Gopalakrishnan, C. Promoting ecological sustainability and community resilience in the US Gulf Coast after the 2010 *Deepwater Horizon* oil spill. *Journal of Natural Resources Policy Research* 2(3): 297-315, 2010.

Notes: On 20 April 2010, the 5000-foot-deep Macondo Mississippi Canyon Block 252 (MC252) well erupted after a blowout caused a catastrophic explosion and fire aboard the BP PLC-leased *Deepwater Horizon* offshore oil drilling platform (owned by Transocean Ltd.) about 40 miles (64 km) southeast of the Louisiana coast. The 2010 *Deepwater Horizon* Gulf Coast oil spill now imperils ecologically sensitive lands, affects the livelihoods of thousands of workers, and threatens a way of life that has been passed down for generations. An oil spill management Decision Support System (DSS) architecture is put forth that integrates the latest advances in MCDA and geomatics engineering in order to cope with the worst environmental disaster in US history. It is shown that policy-makers should improve the sustainability and resilience of Gulf Coast ecosystems and communities so that they are healthier and more robust than before the oil spill. Policy recommendations with respect to the 2010 *Deepwater Horizon* spill are put forth. We discuss how to best assist disrupted businesses, rehabilitate polluted ecosystems, and improve regulatory oversight of the oil and gas industry in order to prevent future oil spill disasters.

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Webler, T. and Lord, F. Planning for the human dimensions of oil spills and spill response. *Environmental Management* 45(4): 723-738, 2010. O / A

Notes: Oil spill contingency planners need an improved approach to understanding and planning for the human dimensions of oil spills. Drawing on existing literature in social impact assessment, natural hazards, human ecology, adaptive management, global change and sustainability, we develop an integrative approach to understanding and portraying the human dimensions impacts of stressors associated with oil spill events. Our approach is based on three fundamental conclusions that are drawn from this literature review. First, it is productive to acknowledge that, while stressors can produce human impacts directly, they mainly affect intermediary processes and changes to these processes produce human impacts. Second, causal chain modeling taken from hazard management literature provides a means to document how oil spill stressors change processes and produce human impacts. Third, concepts from the global change literature on vulnerability enrich causal models in ways that make more obvious how management interventions lessen hazards and mitigate associated harm. Using examples from recent spill events, we illustrate how these conclusions can be used to diagrammatically portray the human dimensions of oil spills.

Svendsen, E.R., Whittle, N.C., Sanders, L., McKeown, R.E., Sprayberry, K., Heim, M., Caldwell, R., Gibson, J.J., and Vena, J.E. GRACE: Public health recovery methods following an environmental disaster. *Archives of Environmental and Occupational Health* 65(2): 77-85, 2010.

Notes: Different approaches are necessary when community-based participatory research (CBPR) of environmental illness is initiated after an environmental disaster within a community. Often such events are viewed as golden scientific opportunities to do epidemiological studies. However the authors believe that in such circumstances, community engagement and empowerment needs to be integrated into the public health service efforts in order for both those and any science to be successful, with special care being taken to address the immediate health needs of the community first, rather than the pressing needs to answer important scientific questions. The authors will demonstrate how they have simultaneously provided valuable public health service, embedded generalizable scientific knowledge, and built a successful foundation for supplemental CBPR through their on-going recovery work after the chlorine gas disaster in Graniteville, South Carolina.

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Bollati, V. and Baccarelli, A. Environmental epigenetics. *Heredity* 105(1): 105-112, 2010.

Notes: Epigenetics investigates heritable changes in gene expression that occur without changes in DNA sequence. Several epigenetic mechanisms, including DNA methylation and histone modifications, can change genome function under exogenous influence. We review current evidence indicating that epigenetic alterations mediate effects caused by exposure to environmental toxicants. Results obtained from animal models indicate that in utero or early-life environmental exposures produce effects that can be inherited transgenerationally and are accompanied by epigenetic alterations. The search for human equivalents of the epigenetic mechanisms identified in animal models is under way. Recent investigations have identified a number of environmental toxicants that cause altered methylation of human repetitive elements or genes. Some exposures can alter epigenetic states and the same and/or similar epigenetic alterations can be found in patients with the disease of concern. On the basis of current evidence, we propose possible models for the interplay between environmental exposures and the human epigenome. Several investigations have examined the relationship between exposure to environmental chemicals and epigenetics, and have identified toxicants that modify epigenetic states. Whether environmental exposures have transgenerational epigenetic effects in humans remains to be elucidated. In spite of the current limitations, available evidence supports the concept that epigenetics holds substantial potential for furthering our understanding of the molecular mechanisms of environmental toxicants, as well as for predicting health-related risks due to conditions of environmental exposure and individual susceptibility.

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Rice, G.E., Hammitt, J.K., and Evans, J.S. A probabilistic characterization of the health benefits of reducing methyl mercury intake in the United States. *Environmental Science and Technology* 44(13): 5216-5224, 2010.

Notes: We developed a probabilistic model to characterize the plausible distribution of health and economic benefits that would accrue to the U.S. population following reduction of methyl mercury (MeHg) exposure. MeHg, a known human developmental neurotoxicant, may increase fatal heart attack risks. Model parameters reflect current understanding of the relationships between MeHg intake, health risks, and societal valuation of these risks. The expected monetary value of the annual health benefits generated by a 10% reduction in U.S. population exposure to MeHg for one year is $460 million; 80% of this is associated with reductions in fatal heart attacks and the remainder with IQ gains. The plausible distribution of the benefits is quite broad with 5th and 95th percentile estimates of approximately $50 million and $3.5 billion, respectively. The largest source of uncertainty is whether epidemiological associations between MeHg exposure and fatal heart attacks reflect causality. The next largest sources of uncertainty concern the slope of the relationship between maternal MeHg exposure and reduced intelligence among children and whether this relationship exhibits a threshold. Our analysis suggests that the possible causal relationship between MeHg exposure and fatal heart attacks should be better characterized, using additional epidemiological studies and formally elicited expert judgment.

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Soto-Jimenez, M.F., Amezcua, F., and Gonzalez-Ledesma, R. Nonessential metals in striped marlin and Indo-Pacific sailfish in the southeast Gulf of California, Mexico: Concentration and assessment of human health risk. *Archives of Environmental Contamination and Toxicology* 58(3): 810-818, 2010.

Notes: Seventeen sailfish (*Istiophorus platypterus*; 166-246 cm long) and 13 striped marlin (*Tetrapturus audax*; 159-254 cm long) specimens from the southern Gulf of California were analyzed for As, Cd, Hg, and Pb concentrations. More than 20% of the As and Cd levels exceeded the guideline levels of the World Health Organization (WHO), the U.S. Food and Drug Administration, and the European Union. About 65-90% of the specimens exceeded the limit value for Hg. Pb levels in billfish were significantly lower than guideline values. The intakes of As and Cd through billfish consumption by the population represented 20-40% of the provisional tolerable weekly intake (PTWI) values as recommended by the WHO. Levels of Hg exceeded the PTWI value. Pb intake represented <5% of the PTWI through these species in all age and gender groups. The target hazard quotients (THQs) for Cd and Pb were <1 in each group of interest. In contrast, THQ values based on As and Hg showed large variations, with the highest values for children, then pregnant women, and, finally, adults. Values of THQ >1 indicate risk for As and Hg; the risk from As was estimated assuming that 20% of the total As was inorganic. These metals can affect the nervous system and intellectual and physical development of unborn children and infants. A national moratorium on billfish consumption in Mexico is recommended for children (0-6 years old), pregnant women, and women planning pregnancy.

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Stone, A. and Delistraty, D. Sources of toxicity and exposure information for identifying chemicals of high concern to children. *Environmental Impact Assessment Review* 30(6): 380-387, 2010.

Notes: Due to the large number of chemicals in commerce without adequate toxicity characterization data, coupled with an ineffective federal policy for chemical management in the United States, many states are grappling with the challenge to identify toxic chemicals that may pose a risk to human health and the environment. Specific populations (e.g., children, elderly) are particularly sensitive to these toxic chemicals. In 2008, the Children's Safe Product Act (CSPA) was passed in Washington State. The CSPA included specific requirements to identify High Priority Chemicals (HPCs) and Chemicals of High Concern to Children (CHCCs). To implement this legislation, a methodology was developed to identify HPCs from authoritative scientific and regulatory sources on the basis of toxicity criteria. Another set of chemicals of concern was then identified from authoritative sources, based on their potential exposure to children. Exposure potential was evaluated by identifying chemicals detected in biomonitoring studies (i.e., human tissues), as well as those present in residential exposure media (e.g., indoor air, house dust, drinking water, consumer products). Accordingly, CHCCs were defined as HPCs that also appear in biomonitoring studies or relevant exposure media. For chemicals with unique Chemical Abstracts Service (CAS) numbers, we identified 2044 HPCs and 2219 chemicals with potential exposure to children, resulting in 476 CHCCs. The process of chemical identification is dynamic, so that chemicals may be added or subtracted as new information becomes available. Although beyond the scope of this paper, the 476 CHCCs will be prioritized in a more detailed assessment, based on the strength and weight of evidence of toxicity and exposure data. Our approach was developed to be flexible which allows the addition or removal of specific sources of toxicity or exposure information, as well as transparent to allow clear identification of inputs. Although the methodology was constrained by specific requirements in the CSPA, the intent of this work was to identify HPCs and CHCCs that might guide future regulatory actions and inform chemical management policies, aimed at protecting children's health.

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Ashley, J.T.F., Ward, J.S., Schafer, M.W., Stapleton, H.M., and Velinsky, D.J. Evaluating daily exposure to polychlorinated biphenyls and polybrominated diphenyl ethers in fish oil supplements. *Food Additives and Contaminants: Part A* 27(8): 1177-1185, 2010.

Notes: Fish oil supplements have become a popular means of increasing one's dietary intake of essential polyunsaturated fatty acids. However, there is growing concern that the levels and potential health effects of lipophilic organic contaminants such as polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) may diminish some of the health benefits associated with the daily consumption of fish oil supplements. In this study, ten over-the-counter fish oil supplements available in the United States were analysed for PCBs and PBDEs and daily exposures calculated. Based on manufacturers'

recommended dosages, daily intakes of PCBs and PBDEs ranged from 5 to 686 ng $day^{-1}$ and from 1 to 13 ng $day^{-1}$, respectively. Daily consumption of fish oil supplements expose consumers to PCBs and PBDEs. However, in comparison with fish ingestion, fish supplements may decrease daily PCB exposure and provide a safer pathway for individuals seeking to maintain daily recommended levels of polyunsaturated fatty acids.

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Blackburn, J.K., Mitchell, M.A., Blackburn, M.C.H., Curtis, A., and Thompson, B.A. Evidence of antibiotic resistance in free-swimming, top-level marine predatory fishes. *Journal of Zoo and Wildlife Medicine* 41(1): 7-16, 2010.

Notes: Antibiotic resistance in bacteria is a growing problem in both human and veterinary medicine. Several studies documented the presence of resistant bacteria in humans, livestock, and domestic animals; however, limited research is available on the presence of antibiotic drug resistance in wildlife species. A cross-sectional study was conducted to estimate the prevalence of resistant bacteria collected from wild-caught, marine predatory fishes. Seven species of sharks and a single teleost species were opportunistically sampled from six different study sites in coastal Belize, coastal and nearshore waters of Louisiana, the Florida Keys, and Martha's Vineyard, Massachusetts. A total of 134 viable bacteria samples were isolated from the cloacal swabs of predatory fishes. Isolates were characterized by Gram-stain morphology and tested for resistance by using the Kirby-Bauer disc diffusion method. Thirteen drugs (penicillin G, piperacillin, ticarcillin, cefotaxime, ceftazidime, ceftiofur, amikacin, gentamicin, ciprofloxacin, enrofloxacin, doxycycline, chloramphenicol, and sulfamethoxazole) were selected for this study. Prevalence was calculated as the total number of isolates resistant to one or more drugs against the total number of samples in that study area or fish population. Sharks sampled in the Florida Keys exhibited the greatest resistance to a wide selection of drugs. Resistance to at least one drug was found in each of the six study sites and in all of the fish species sampled. Multidrug resistance was also documented in most of the study sites. Interspecific comparisons between redfish, *Sciaenops ocellaia*, and sharks from Louisiana offshore waters (which represent species of the *Carcharhinus* genus) demonstrated a significantly higher prevalence in redfish, which may be because of the older age of the population. The findings of this study confirmed the presence of antibiotic-resistant bacteria in marine predatory fishes from multiple taxa and multiple geographic locations.

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Touzet, N., Davidson, K., Pete, R., Flanagan, K., McCoy, G.R., Amzil, Z., Maher, M., Chapelle, A., and Raine, R. Co-occurrence of the West European (Gr.III) and North American (Gr.I) ribotypes of *Alexandrium tamarense* (Dinophyceae) in Shetland, Scotland. *Protist* 161(3): 370-384, 2010.

Notes: An investigation into the diversity of the dinoflagellate *Alexandrium* was carried out during August 2007 within two fjordic sea lochs in the Shetland Isles, Scotland. The co-occurrence in the water column of the non-toxic West European (W.E. or Gr.III) and the neurotoxic North American (N.A. or Gr.I) ribotypes of *A. tamarense* was demonstrated using fluorescent in situ hybridisation. A patch of *A. tamarense* (W.E.) localised at similar to 10 m depth and extending over 6 km was detected in 'Clift Sound' with concentrations locally reaching ~1 x $10^4$ cells $l^{-1}$. *A. tamarense* (N.A.) was also observed there but despite the presence of toxins in net haul samples collected locally, concentrations were low and near limits of detection. *Alexandrium* concentrations were ~1.5 x $10^3$ cells $l^{-1}$ in 'Vaila Sound', where both W.E. and N.A. ribotypes were detected with equal relative abundances in some samples. Given the patchiness of *A. tamarense* populations and their possible organisation in thin layer structures, better vertical resolution through fine-scale sampling will be necessary for population dynamic studies. Implications for the shellfish industry are substantial since harmful microalgae patches may not be detected during routine monitoring. Moreover, the co-occurrence of morphologically indistinct toxic and non-toxic ribotypes will necessitate implementing molecular methods for their discrimination.

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Mazzillo, F.F.M., Pomeroy, C., Kuo, J., Ramondi, P.T., Prado, R., and Silver, M.W. Angler exposure to domoic acid via consumption of contaminated fishes. *Aquatic Biology* 9(1): 1-12, 2010. O / A

Notes: Domoic acid (DA) is a neurotoxin that causes amnesic shellfish poisoning, and fish are recognized vectors of DA to marine fauna. However, the exposure of anglers through consumption of DA-contaminated fish is unknown. We measured DA in 11 fish species targeted by Santa Cruz Wharf (SCW) anglers in Monterey Bay, California, USA, and surveyed anglers regarding their fish consumption patterns. In addition, we used California mussel *Mytilus californianus* DA data provided by the

state of California and our measurements of DA in seawater to examine the associations between DA in fish viscera versus in mussels and seawater. DA was detected in the viscera of 7 fish species commonly consumed by anglers, and toxin uptake in fishes varied according to their diet. DA was almost entirely in the viscera, with low DA concentrations detected in muscle tissue. The majority of anglers (58% of 565) reported consuming their catch, with a small fraction ingesting the viscera. Total DA concentrations in fish decreased significantly after 11 mo storage at -20 ºC. DA concentration in seawater and California mussels was correlated with DA in the viscera of some but not all fish groups. We conclude that SCW anglers who consume their catch are exposed to asymptomatic DA doses, and that exposure is a function of the species and parts consumed, as well as storage methods and DA levels in the seawater when the fish are caught.

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Sinigalliano, C.D. *et al.* Traditional and molecular analyses for fecal indicator bacteria in non-point source subtropical recreational marine waters. *Water Research* 44(13): 3763-3772, 2010.

Notes: The use of enterococci as the primary fecal indicator bacteria (FIB) for the determination of recreational water safety has been questioned, particularly in sub/tropical marine waters without known point sources of sewage. Alternative FIB (such as the Bacteroidales group) and alternative measurement methods (such as rapid molecular testing) have been proposed to supplement or replace current marine water quality testing methods which require culturing enterococci. Moreover, environmental parameters have also been proposed to supplement current monitoring programs. The objective of this study was to evaluate the health risks to humans from exposure to subtropical recreational marine waters with no known point source. The study reported symptoms between one set of human subjects randomly assigned to marine water exposure with intensive environmental monitoring compared with other subjects who did not have exposure. In addition, illness outcomes among the exposed bathers were compared to levels of traditional and alternative FIB (as measured by culture-based and molecular-based methods), and compared to easily measured environmental parameters. Results demonstrated an increase in self-reported gastrointestinal, respiratory and skin illnesses among bathers vs. non-bathers. Among the bathers, a dose response relationship by logistic regression modeling was observed for skin illness, where illness was positively related to enterococci enumeration by membrane filtration (odds ratio = 1.46 [95% confidence interval = 0.97-2.21] per increasing log10 unit of enterococci exposure) and positively related to 24 h antecedent rain fall (1.04 [1.01-1.07] per increasing millimeters of rain). Acute febrile respiratory illness was inversely related to water temperature (0.74 [0.56-0.98] per increasing degree of water temperature). There were no significant dose response relationships between report of human illness and any of the other FIB or environmental measures. Therefore, for non-point source subtropical recreational marine waters, this study suggests that humans may be at increased risk of reported illness, and that the currently recommended and investigational FIB may not track gastrointestinal illness under these conditions; the relationship between other human illness and environmental measures is less clear.

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Heinrichs, S.C. Dietary omega-3 fatty acid supplementation for optimizing neuronal structure and function. *Molecular Nutrition and Food Research* 54(4): 447-456, 2010.

Notes: Direct actions of omega-3 polyunsaturated fatty acids (PUFAs) on neuronal composition, neurochemical signaling and cognitive function constitute a multidisciplinary rationale for classification of dietary lipids as "brain foods." The validity of this conclusion rests upon accumulated mechanistic evidence that omega-3 fatty acids actually regulate neurotransmission in the normal nervous system, principally by modulating membrane biophysical properties and presynaptic vesicular release of classical amino acid and amine neurotransmitters. The functional correlate of this hypothesis, that certain information processing and affective coping responses of the central nervous system are facilitated by bioavailability of omega-3 fatty acids, is tentatively supported by developmental and epidemiological evidence that dietary deficiency of omega-3 fatty acids results in diminished synaptic plasticity and impaired learning, memory and emotional coping performance later in life. The present review critically examines available evidence for the promotion in modern society of omega-3 fatty acids as adaptive neuromodulators capable of efficacy as dietary supplements and as potential prophylactic nutraceuticals for neurological and neuropsychiatric disorders.

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Shahid, S. Probable impacts of climate change on public health in Bangladesh. *Asia-Pacific Journal of Public Health* 22(3): 310-319, 2010.

Notes: The recent report of the Intergovernmental Panel on Climate Change confirmed that there is overwhelming evidence that the global climate will severely affect human health. Climate change might have severe consequences on public health in Bangladesh, especially in light of the poor state of the country's public health infrastructure. A number of possible direct and indirect impacts of climate change on public health in Bangladesh have been identified in this article. Adaptive measures that should be taken to reduce the negative consequences of climate change on public health have also been discussed.

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Akerlof, K., DeBono, R., Berry, P., Leiserowitz, A., Roser-Renouf, C., Clarke, K.L., Rogaeva, A., Nisbet, M.C., Weathers, M.R., and Maibach, E.W. Public perceptions of climate change as a human health risk: Surveys of the United States, Canada and Malta. *International Journal of Environmental Research and Public Health* 7(6): 2559-2606, 2010. O / A

Notes: We used data from nationally representative surveys conducted in the United States, Canada and Malta between 2008 and 2009 to answer three questions: Does the public believe that climate change poses human health risks, and if so, are they seen as current or future risks? Whose health does the public think will be harmed? In what specific ways does the public believe climate change will harm human health? When asked directly about the potential impacts of climate change on health and well-being, a majority of people in all three nations said that it poses significant risks; moreover, about one third of Americans, one half of Canadians, and two-thirds of Maltese said that people are already being harmed. About a third or more of people in the United States and Canada saw themselves (United States, 32%; Canada, 67%), their family (United States, 35%; Canada, 46%), and people in their community (United States, 39%; Canada, 76%) as being vulnerable to at least moderate harm from climate change. About one third of Maltese (31%) said they were most concerned about the risk to themselves and their families. Many Canadians said that the elderly (45%) and children (33%) are at heightened risk of harm, while Americans were more likely to see people in developing countries as being at risk than people in their own nation. When prompted, large numbers of Canadians and Maltese said that climate change can cause respiratory problems (78-91%), heat-related problems (75-84%), cancer (61-90%), and infectious diseases (49-62%). Canadians also named sunburn (79%) and injuries from extreme weather events (73%), and Maltese cited allergies (84%). However, climate change appears to lack salience as a health issue in all three countries: relatively few people answered open-ended questions in a manner that indicated clear top-of-mind associations between climate change and human health risks. We recommend mounting public health communication initiatives that increase the salience of the human health consequences associated with climate change.

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Hussain, S.A. and Badola, R. Valuing mangrove benefits: contribution of mangrove forests to local livelihoods in Bhitarkanika Conservation Area, East Coast of India. *Wetlands Ecology and Management* 18(3): 321-331, 2010.

Notes: The consumptive benefits of mangrove forests to subsistence economy receive little recognition. This paper quantifies the value of provisioning services of mangrove forests to local livelihoods in terms of forestry and fishery products. To examine the use of mangrove products, 324 households from 36 villages in the Bhitarkanika Conservation Area located in East Coast of India were surveyed using structured questionnaires. For estimating the contribution of mangrove forests to fish productivity, fish production was evaluated in three stages -inshore fishery, offshore fishery and the role of mangrove forests as nursery ground for fish and shellfish. The findings revealed that 14.2% of the fuel need of each household was being met by the forests. Other forestry products used were timber, honey and thatch grass. During the study, 14 species of fish and three of shellfish were recorded. The total catch for inshore fishery was estimated as 3.77 kg $h^{-1}$ having market price of US$ 2.25. In offshore fishery the number of species caught as well as income from the catch was higher in areas with mangroves (US$ 44.61 $h^{-1}$) than in those without mangroves (US$ 2.62 $h^{-1}$). The market price of the forestry and fishery products used by the people was estimated as US$ 107 $household^{-1}$ $annum^{-1}$. The resources extracted from mangrove forests contributed to more than 14.5% of the total income of the household. This was around 30% for the households residing in the immediate vicinity of the forests. This study suggests that provisioning services provided by the mangrove forests are of significant importance to the coastal communities as they increase the resilience and sustainability of the local economy.

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Tschakert, P. and Dietrich, K.A. Anticipatory learning for climate change adaptation and resilience. *Ecology and Society* 15(2): art. 11, 2010. O / A

Notes: This paper is a methodological contribution to emerging debates on the role of learning, particularly forward-looking (anticipatory) learning, as a key element for adaptation and resilience in the context of climate change. First, we describe two major challenges: understanding adaptation as a process and recognizing the inadequacy of existing learning tools, with a specific focus on high poverty contexts and complex livelihood-vulnerability risks. Then, the article examines learning processes from a dynamic systems perspective, comparing theoretical aspects and conceptual advances in resilience thinking and action research / learning (AR / AL). Particular attention is paid to learning loops (cycles), critical reflection, spaces for learning, and power. Finally, we outline a methodological framework to facilitate iterative learning processes and adaptive decision making in practice. We stress memory, monitoring of key drivers of change, scenario planning, and measuring anticipatory capacity as crucial ingredients. Our aim is to identify opportunities and obstacles for forward-looking learning processes at the intersection of climatic uncertainty and development challenges in Africa, with the overarching objective to enhance adaptation and resilient livelihood pathways, rather than learning by shock.

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Gunderson, L. Ecological and human community resilience in response to natural disasters. *Ecology and Society* 15(2): art. 18, 2010. O / A

Notes: Ecological resilience, adaptive cycles, and panarchy are all concepts that have been developed to explain abrupt and often surprising changes in complex socio-ecological systems that are prone to disturbances. These types of changes involve qualitative and quantitative alterations in systems' structures and processes. This paper uses the concepts of ecological resilience, adaptive cycles, and panarchies to compare ecological and human community systems. At least five important findings emerge from this comparison. 1) Both systems demonstrate the multiple meanings of resilience – both in terms of recovery time from disturbances and the capacity to absorb them. 2) Both systems recognize the role of diversity in contributing to resilience. 3) The comparison highlights the role of different forms of capital and 4) the importance of cross-scale interactions. 5) The comparison reveals the need for experimentation and learning to build adaptive capacities. All of these ideas have broad implications for attempting to manage complex systems with human and ecological components in the face of recurring natural disasters.

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Leach, M., Scoones, I., and Stirling, A. Governing epidemics in an age of complexity: Narratives, politics and pathways to sustainability. *Global Environmental Change* 20(3): 369-377, 2010.

Notes: This paper elaborates a 'pathways approach' to addressing the governance challenges posed by the dynamics of complex, coupled, multi-scale systems, while incorporating explicit concern for equity, social justice and the wellbeing of poor and marginalised groups. It illustrates the approach in relation to current policy challenges of dealing with epidemics and so-called 'emerging infectious diseases' such as avian influenza and haemorrhagic fevers, which involve highly dynamic, cross-scale, often-surprising viral-social-political-ecological interactions. Amidst complexity, we show how different actors in the epidemics field produce particular narratives which frame systems and their dynamics in different ways, promote particular goals and values, and justify particular pathways of disease response. These range from 'outbreak narratives' emphasising threat to global populations, to alternative but often marginalised narratives variously emphasising long-term structural, land use and environmental change, local knowledge and livelihood goals. We highlight tendencies – supported by cognitive, institutional and political pressures – for powerful actors and institutions to 'close down' around narratives that emphasise stability, underplaying longer term, less controllable dynamics. Arguing that governance approaches need to 'open up' to embrace strategies for resilience and robustness in relation to epidemics, we outline what some of the routes towards this might involve, and what the resulting governance models might look like. Key are practices and arrangements that involve flexibility, diversity, adaptation, learning and reflexivity, as well as highlighting and supporting alternative pathways within a progressive politics of sustainability.

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Few, R. and Pham, G.T. Climatic hazards, health risk and response in Vietnam: Case studies on social dimensions of vulnerability. *Global Environmental Change* 20(3): 529-538, 2010.

Notes: Vietnam is highly prone to climatic hazards, including extreme weather events and marked seasonal changes. Climatic hazards have wide-ranging implications for human health, but in most hazard-prone countries there has been little household level research on health risks. Drawing on the results of exploratory research in low-income communities in the Central Provinces and the Mekong Delta, this paper uses a qualitative approach to examine how the social dimensions of vulnerability can come into play in the generation of health outcomes associated with hazards. It explores particularly how aspects of economic livelihood, physical location, education and protective behaviour combined to influence the exposure and susceptibility of households, as well as to shape their capability to avoid adverse health impacts. These aspects were closely linked with, but not solely determined by, income-poverty: underlining the argument that understanding of risks to health in low-income settings requires careful analysis of this complex shaping of vulnerability. It also requires recognition that health protection for the poor may be articulated more in terms of protection of wider livelihood assets than preventive health actions *per se*.

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DePaola, A., Jones, J.L., Woods, J., Burkhardt, W., Calci, K.R., Krantz, J.A., Bowers, J.C., Kasturi, K., Byars, R.H., Jacobs, E., Williams-Hill, D., and Nabe, K. Bacterial and viral pathogens in live oysters: 2007 United States market survey. *Applied and Environmental Microbiology* 76(9): 2754-2768, 2010.

Notes: Two samples of market oysters, primarily from retail establishments, were collected twice each month in each of nine states during 2007. Samples were shipped refrigerated overnight to five U.S. Food and Drug Administration laboratories on a rotating basis and analyzed by most probable number (MPN) for total and pathogenic *Vibrio parahaemolyticus* and *V. vulnificus* numbers and for the presence of toxigenic *V. cholerae*, *Salmonella* spp., norovirus (NoV), and hepatitis A virus (HAV). Levels of indicator organisms, including fecal coliforms (MPN), *Escherichia coli* (MPN), male-specific bacteriophage, and aerobic plate counts, were also determined. *V. parahaemolyticus* and *V. vulnificus* levels were distributed seasonally and geographically by harvest region and were similar to levels observed in a previous study conducted in 1998-1999. Levels of pathogenic *V. parahaemolyticus* were typically several logs lower than total *V. parahaemolyticus* levels regardless of season or region. Pathogenic *V. parahaemolyticus* levels in the Gulf and Mid-Atlantic regions were about two logs greater than the levels observed in the Pacific and North Atlantic regions. Pathogens generally associated with fecal pollution were detected sporadically or not at all (toxigenic *V. cholerae*, 0%; *Salmonella*, 1.5%; NoV, 3.9%; HAV, 4.4%). While seasonal prevalences of NoV and HAV were generally greater in oysters harvested from December to March, the low detection frequency obscured any apparent seasonal effects. Overall, there was no relationship between the levels of indicator microorganisms and the presence of enteric viruses. These data provide a baseline that can be used to further validate risk assessment predictions, determine the effectiveness of new control measures, and compare the level of protection provided by the U.S. shellfish sanitation system to those in other countries.

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Miya, S., Takahashi, H., Ishikawa, T., Fujii, T., and Kimura, B. Risk of *Listeria monocytogenes* contamination of raw ready-to-eat seafood products available at retail outlets in Japan. *Applied and Environmental Microbiology* 76(10): 3383-3386, 2010.

Notes: Examination of *Listeria monocytogenes* prevalence among ready-to-eat foods in Japan revealed frequent (5.7 to 12.1%) contamination of minced tuna and fish roe products, and the isolates had the same virulence levels as clinical isolates in terms of invasion efficiency and infectivity in cell cultures and a murine infection model, respectively. Premature stop codons in *inlA* were infrequent (1 out of 39 isolates). Cell numbers of *L. monocytogenes* in minced tuna and salmon roe increased rapidly under inappropriate storage temperatures (from a most probable number [MPN] of $10^0$ to $10^1$/g to an MPN of $10^3$ to $10^4$/g over the course of 2 days at 10 ºC). Thus, regulatory guidelines are needed for acceptable levels of *L. monocytogenes* in these foods.

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Sim, M.S., Jo, I.J., and Song, H.G. Acute health problems related to the operation mounted to clean the *Hebei Spirit* oil spill in Taean, Korea. *Marine Pollution Bulletin* 60(1): 51-57, 2010. O/A

Notes: The authors investigated acute health problems in people engaged in the operation mounted to clear the *Hebei Spirit* oil spill which occurred in December 2007 in Taean County, South Korea, and identified the risk factors associated with the development of symptoms. Eight hundred forty-six people engaged in the clean up operation for periods between 7 and 14 days were examined. Demographic information and risk factors were obtained using a questionnaire. Symptoms were classified into six categories: back pain, skin lesions, headache, and eye, neurovestibular, and respiratory symptoms. Residents and volunteers engaged in the *Hebei Spirit* oil spill clean up operation experienced acute health problems. Risk analyses revealed that more frequent and greater exposure was strongly associated with a higher occurrence of symptoms.

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Griffith, J.F., Schiff, K.C., Lyon, G.S., and Fuhrman, J.A. Microbiological water quality at non-human influenced reference beaches in southern California during wet weather. *Marine Pollution Bulletin* 60(4): 500-508, 2010.

Notes: Although urban wet weather discharges may have elevated concentrations of fecal indicator bacteria impacting water quality at swimming beaches, not all of these bacteria may arise from human sources. In this study, the contribution of non-human fecal indicator bacteria was quantified by sampling coastal reference beaches in southern California. Samples were collected at beaches near stormwater discharges from undeveloped watersheds and analyzed for total coliform, *Escherichia coli*, and enterococci. Surfzone samples exceeded water quality thresholds >10 times more frequently during wet weather than dry weather. Exceedences were greatest <24 h following rainfall, then steadily declined on successive days. Early season storms exceeded thresholds more frequently, and by greater magnitude, compared to late season storms. Large storms exceeded thresholds more frequently than smaller-sized storms, partly due to the breaching of sand berms. When discharges did reach the surf zone, bacterial concentrations in the wave wash were correlated with watershed bacterial flux.

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Mansilha, C.R., Coelho, C.A., Reinas, A., Moutinho, A., Ferreira, S., Pizarro, C., and Tavares, A. *Salmonella*: The forgotten pathogen: Health hazards of compliance with European Bathing Water Legislation. *Marine Pollution Bulletin* 60(6): 819-826, 2010.

Notes: The increasing demands on recreational waters have made microbial contamination a matter of public and scientific concern. This study aimed to search for *Salmonella* spp. in waters classified according EU Directive 2006/7/EC, in order to assess associations between its prevalence and the concentration of the non-pathogenic new faecal indicators: *Escherichia coli* and intestinal enterococci. Although a statistically significant association was observed *Salmonella* was detected on beaches classified as "Good" (9.3%) and "Excellent" (14.4%) which compromises the idea that faecal indicators can be predictors of pathogens. Attending the high prevalence of *Salmonella* found (23.1%) it seemed important to improve the efficiency of the conventional analytical method (ISO 6340:1995), comparing its draft with SML-VIDAS *Salmonella* and two new chromogenic media: AES *Salmonella* Agar Plate (ASAP) and Simple Method *Salmonella* (SMS). ASAP showed the higher efficiency and can be recommended for a faster detection and presumptive identification of salmonellae in bathing waters.

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Costa, L.G., Giordano, G., and Faustman, E.M. Domoic acid as a developmental neurotoxin. *NeuroToxicology* 31(5): 409-423, 2010.

Notes: Domoic acid (DomA) is an excitatory amino acid which can accumulate in shellfish and finfish under certain environmental conditions. DomA is a potent neurotoxin. In humans and in non-human primates, oral exposure to a few mg/kg DomA elicits gastrointestinal effects, while slightly higher doses cause neurological symptoms, seizures, memory impairment, and limbic system degeneration. In rodents, which appear to be less sensitive than humans or non-human primates, oral doses cause behavioral abnormalities (e.g. hindlimb scratching), followed by seizures and hippocampal degeneration. Similar effects are also seen in other species (from sea lions to zebrafish), indicating that DomA exerts similar neurotoxic effects across species. The neurotoxicity of DomA is ascribed to its ability to interact and activate the AMPA/KA receptors, a subfamily of receptors for the neuroexcitatory neurotransmitter glutamate. Studies exploring the neurotoxic

effects of DomA on the developing nervous system indicate that DomA elicits similar behavioral, biochemical and morphological effects as in adult animals. However, most importantly, developmental neurotoxicity is seen at doses of DomA that are one to two orders of magnitude lower than those exerting neurotoxicity in adults. This difference may be due to toxicokinetic and/or toxicodynamic differences. Estimated safe doses may be exceeded in adults by high consumption of shellfish contaminated with DomA at the current limit of 20 μg/g. Given the potential higher susceptibility of the young to DomA neurotoxicity, additional studies investigating exposure to, and effects of this neurotoxin during brain development are warranted.

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Verner, M.A., Plusquellec, P., Muckle, G., Ayotte, P., Dewailly, E., Jacobson, S.W., Jacobson, J.L., Charbonneau, M., and Haddad, S. Alteration of infant attention and activity by poly-chlorinated biphenyls: Unravelling critical windows of susceptibility using physiologically based pharmacokinetic modeling. *NeuroToxicology* 31(5): 424-431, 2010.

Notes: Pre- and postnatal exposure to polychlorinated biphenyls (PCBs) can impair behavioural function in animal models at doses within the range at which humans are commonly exposed. Yet, epidemiologic studies conducted in the US and Europe are inconsistent with regard to the developmental effects of lactational exposure to these chemicals. This inconsistency may be due to limitations in the current methodological approaches for assessing postnatal exposure to PCBs. Our study used a physiologically based pharmacokinetic (PBPK) model to simulate blood PCB levels during specific pre- and postnatal periods and to evaluate the relation of those levels to infant behaviour. A previously validated PBPK model was used to simulate infant blood PCB-153 levels at delivery and on a month-by-month basis during the first year of life for Inuit infants enrolled in a longitudinal birth cohort. Infant behaviour was assessed using the Behaviour Rating Scales (BRS) of the Bayley Scales of Infant Development (BSID-II) at 11 months of age and video coding of inattention and activity measured during the administration of the mental development subscale of the BSID-II. The estimated pre- and postnatal PCB exposure measures predicted significant increases in inattention and activity at 11 months. Whereas inattention was related to prenatal exposure, activity level, measured by non-elicited activity, was best predicted by postnatal exposure, with the strongest association obtained for simulated PCB levels during the 4th month of life. These findings are consistent with previous reports indicating PCB-induced behavioural alteration in attention and activity level. Simulated infant toxicokinetic profiles for the first year of life revealed windows of susceptibility during which PCBs may impair infant attention and activity.

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Davidson, P.W. *et al.* Fish consumption, mercury exposure, and their associations with scholastic achievement in the Seychelles Child Development Study. *NeuroToxicology* 31(5): 439-447, 2010.

Notes: Studies of neurodevelopmental outcomes in offspring exposed to MeHg from maternal consumption of fish have primarily measured cognitive abilities. Reported associations have been subtle and in both adverse and beneficial directions. Changes in functional outcomes such as school achievement and behavior in exposed children and adolescents have not been examined. We undertook an assessment of school success of children in the Seychelles Child Development Study (SCDS) main cohort to determine if there were any associations with either prenatal or recent postnatal MeHg exposure. The primary endpoints were Seychelles nationally standardized end-of-year examinations given when the cohort children were 9 and 17 years of age. A subgroup ($n$ = 215) from the main cohort was also examined at 9 years of age using a regional achievement test called SACMEQ. Prenatal MeHg exposure was 6.8 ppm in maternal hair; recent postnatal exposure was 6.09 ppm at 9 years and 8.0 ppm at 17 years, measured in child hair. Multiple linear regression analyses showed no pattern of associations between prenatal or postnatal exposure, and either the 9- or 17-year end-of-year examination scores. For the subgroup of 215 subjects who participated in the SACMEQ test, there were significant adverse associations between examination scores and postnatal exposure, but only for males. The average postnatal exposure level in child hair for this subgroup was significantly higher than for the overall cohort. These results are consistent with our earlier studies and support the interpretation that prenatal MeHg exposure at dosages achieved by mothers consuming a diet high in fish are not associated with adverse educational measures of scholastic achievement. The adverse association of educational measures with postnatal exposure in males is intriguing, but will need to be confirmed by further studies examining factors that influence scholastic achievement.