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PERSONAL VIEW

Managing environmental risks: the benefits of a place-based approach

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ABSTRACT

Context: Effective management of environmental risks such as food and water contamination requires both high quality scientific information and effective, informed social policy. Not only must health practitioners and policy-makers recognize the complexities of human health as a social phenomenon, they must also negotiate the vagaries of uncertainty, precaution, and ethics in their implementation of public health guidelines and advisories. For example, some health practitioners in Alaska have argued against implementation of US Environmental Protection Agency and World Health Organization's standardized consumption advisories for methylmercury (MeHg) in fish, in favor of place-based approaches to evaluating and communicating risk. They stress the importance of traditional subsistence foods and lifestyles, along with other local environmental, economic, and cultural drivers and determinants of environmental health. Such place-based approaches have been successful in improving health outcomes in Alaska and elsewhere.

Issue: Nevertheless, debate continues regarding the validity and ethics of place-based approaches to developing and communicating standards and advice for managing environmental risks. Recent critiques suggest that place-based approaches to environmental health represent an undesirable kind of regional 'exceptionalism': the implication of which is that precaution, in respect to acting on the best available objective science, is undermined by attention to subjective local values. In this article we comment on this debate, a debate rooted in concerns regarding the delineation between science-based and policy-based decision-making.

Lessons Learned: Our experience with the social and ecological dimensions of MeHg contamination of fish and game in Alaska and elsewhere offers three considerations regarding the potential benefits available through place-based approaches: (1) they can contribute to the accuracy and systematic characterization of risks and their relationship to multiple direct and indirect health outcomes; (2) they are more likely to inform actual changes in behavior; and (3) they afford greater transparency to the risk

management process and therefore facilitate environmental justice. We stress that standardized risk assessments and advisories remain important for providing a precautionary baseline that can inform the management and enforcement of industrial and other polluting activities at the state level. However, the management of environmental health at the regional and local level requires an approach that is cognizant of local circumstances and needs, and addresses health in a systemic and integrative fashion capable of incorporating qualitative social, cultural, and economic drivers and determinants. Thus, we recommend a two-tiered approach that blends state-based and place-based environmental risk management.

Key words: Alaska, contaminants, food safety, methylmercury, precautionary principle, risk advisories, vulnerability.

Context

Promotion of individual and community health, through dietary and lifestyle interventions and through the effective management of environmental risks from hazards such as food and water contamination, requires both high quality scientific information and effective, informed social policy[1,2]. Health practitioners and policy-makers must account for the complexities of human health as a social and place-based phenomenon, incorporating with biomedical considerations many hard to quantify and poorly understood drivers and determinants of health, from socioeconomic status to local definitions of wellness. They must also negotiate the vagaries of ethics, uncertainty, and precaution in their implementation of public health guidelines and advisories. Place-based approaches to health and risk management have emerged as a way to better account for the social dimensions of health and minimize issues of environmental justice. A tension remains, however, regarding the role of qualitative and perhaps even subjective information in the assessment and management of environmental risks.

The challenge of effectively managing methylmercury (MeHg) exposure through the consumption of fish and marine mammals provides an informative example[3]. Methylmercury exposure through food webs, with sources including anthropogenic point source pollution, climate change, and atmospheric transport and deposition into snowpack, lakes, and the Arctic Ocean, is associated with a wide variety of negative health impacts. These include: significantly increased rates of coronary heart disease (CHD), endocrine disruption, and neurological and neurobehavioral impacts, especially on children, including developmental delays and other impacts in the children of exposed mothers[4,5].

State, federal, and non-governmental agencies including the US Environmental Protection Agency (EPA) have for years provided consumption advisories intended to minimize chronic exposure to MeHg[6]. There is debate, however, regarding the implementation of these recommendations; some argue that a consistent message is essential for both the effective management of risk and the assurance of environmental justice[7]. Others, including health practitioners in Alaska, argue in favor of more regionally and culturally specific approaches to MeHg contamination, weighing the risks against the benefits of fish consumption[8,9], including the benefits of omega-3 (n-3) fatty acids (FAs), as well as the positive psychological, social, and cultural influences on health of fish as a valued traditional food (Fig1)[10].

The impetus for incorporating such considerations into environmental risk management is informed by a trend in environmental health research away from strict reliance on biomedical models of human health, and toward integrative and place-based approaches to understanding and treating health problems[10,11]. Ranco (2001) also argues that place-based approaches to environmental risk management are more likely than state-based programs to ensure environmental justice for historically marginalized populations[12]. Improvements in health outcomes, including infant mortality rates and psychosocial illnesses, have indeed been achieved in Alaska and elsewhere through place-based interventions[13-15].

Figure 1: Wild fish and game are especially important components of food security in rural Alaska. This sign is posted at the boat launch at Minto, Alaska. Many locals fish for Northern Pike, a fish notoriously high in methylmercury.

In this article we discuss the value of place-based approaches to environmental risk management – a process that the US EPA describes as involving three steps: risk assessment, risk characterization, and management response[16]. We suggest that place-based approaches can contribute to more accurate risk characterizations, and to the likelihood of promoting greater overall precaution, transparency, and environmental justice through the risk management process. Our intent is not to elevate local over state approaches, but to create space for a two-tiered and mutually supportive approach. We believe that effective management of environmental risks requires both place-based and state-based mechanisms; the challenge remains in how to marry the two into a process that is complementary and supportive of ethical outcomes.

Issue

In Alaska, where wild fish and marine mammals make up a significant portion of diet, especially for Alaska Natives, the problem of MeHg contamination is significant yet contested. The Alaska Department of Health and Social Services Division of Public Health (ADPH) has suggested an average daily intake (ADI) of MeHg nearly four times higher than the reference dose (RfD) recommended by the EPA[17]. Some local health practitioners have argued for even less concern regarding MeHg contamination[18]. These recommendations have been controversial[19], and their validity has faced repeated challenges from outside observers. Cassady, in the most recent example, argues that the ADPH's approach represents a kind of regional 'exceptionalism' by promoting 'lenient' consumption advisories that (p.452)[7]:

> *…[do] nothing to mitigate against neurologic damage from methylmercury exposure, or from the multitude of other toxins, [and] …may actually undermine the very lifeways and traditions that it presumes to preserve.*

This critique was noted previously by Betancourt (p.953)[20], and variants are also found in arguments made by Knobeloch and Anderson[19] and Howard and Widdowson[21], among others. In our view, this critique reflects a skepticism regarding the importance of place, of community participation and local knowledge and values, in understanding and supporting individual and community health[13,22]. This skepticism seems blind to the repeated failure of state-based approaches to environmental risk management to effect outcomes that pass the test of environmental justice[12,23]. Here, environmental justice is used to describe a goal of redressing inequities in the distribution of risks, impacts, and benefits of environmental development, management, and policies, which are often affected by race, ethnicity, culture, or socioeconomic status or station[24,25]. While it is true that place-based approaches require attention to quality control and assurance, cross-cultural dynamics, and issues of power[26], this is not any more or less true for any kind of science, regardless of the training or station of the practitioner[27]. Only the indigenous or place-based methodologies, however, are those that have to justify their validity, while the positions and recommendations of federal or other cultural majorities are implemented without question.

Lessons learned

Contours of a contentious issue aside, the case of MeHg contamination in Alaska suggest that place-based approaches can contribute:

1. More *accurate* and systematic characterizations of risks and their relationship to multiple direct and indirect health outcomes.
2. More *precaution* in respect to risk-aversion, risk-acceptance behavior.
3. Greater likelihood of serving *environmental justice* because of *transparency* in respect to the integrity of the risk management process.

Accuracy

Characterization of risk involves the integration of information available for a hazard, including exposure and dose-response relationships, with the goal of providing an estimate of the likelihood of adverse health effects that can inform effective response[16]. State-based environmental risk management approaches tend to be precautionary in nature, based on RfDs for a single health risk, and developed with the most sensitive demographic subgroups in mind. They are also precise, in that they communicate a standardized and unchanging picture of risk. They cannot, however, provide the accuracy of a locally scaled approach.

Loring and colleagues, for example, performed risk-benefit analyses for a selection of common food fish species in Alaska, using established dose-response relationships to weigh the negative impacts of MeHg exposure against the benefits of consumption of foods rich in n-3 FAs, in respect to two health end points (CHD and infant visual recognition memory)[28,29]. Their study found that the cumulative risk-benefit tradeoffs for species with moderate to high MeHg loads such as Pacific halibut, arctic grayling, and northern pike, are far more nuanced than can be accounted for by generic advisories (Figure 2)[29]. Their study highlights the degree of uncertainty and regional variation in existing data for MeHg in wild fish, and also the importance of taking a systematic approach to evaluating impacts. The implication of this study is that consumption advisories for MeHg need to include a variety of interacting and intervening factors, including fish age/size and the intervening effects of food pairings, physical activity, and individual health status[30-32].

When one considers the extensive regional variation in MeHg for species of wild food fish in Alaska[29] alongside the paucity of healthful food alternatives in most remote rural Alaskan communities[33] and the numerous nutritional benefits offered by traditional Alaska Native foods[34], the rationale for assessing the risk of fish consumption at the local scale is clear. Locally scaled risk characterizations can incorporate a variety of important data relevant to the evaluation of sensitivity and response, including ethnographic data on

health and dietary habits, even considerations regarding the availability of healthful food alternatives. While this may produce a less precise approach in the strictest sense, in that broadly consistent information is not the goal, locally scaled risk characterizations have the potential to be more accurate, reflecting a systematic, rather than single, variable picture of risk.

Precautionary behavior

The appeal of offering standardized consumption advisories lies in the notion that a unified message will maximize precautionary behavior[35]. With all else being equal, if everybody were to follow EPA consumption guidelines, the risk of negative health impacts would indeed be minimized. However, there are two caveats to this logic; the first is that while standardized consumption advice regarding MeHg *seems* precautionary, without accounting for the potential health impacts of alternative foods, positive outcomes from risk avoidance behavior are not guaranteed. Methylmercury exposure may indeed be minimized, but people may alter their eating habits in ways that create even greater risks for their long-term health status, for example, replacing fish that are high in MeHg but also with n-3 FAs with red meat that is high in saturated fats, or processed foods that are high in refined sugars. It is also possible that risk will be overstated, and the perception of contamination will influence people to avoid fish that are safe, an outcome already being reported in Alaska[36]. A similar consideration in Alaska involves the more nuanced psychosocial and cultural impacts on individual and community health that might result from a decline in fishing; beyond simple calories and nutrition, food and foodways play many roles in supporting individual and community health, especially for Alaska Native communities[8]. Only when all of these considerations have been taken into account through a systematic and place-based characterization of risks, can behavior be recommended that not only minimizes risk but also maximizes health.

A second caveat to the precautionary rationale for state-based risk management is that people are often skeptical of the 'outside expert' who offers advice regarding diet and lifestyle. Just as risk itself is influenced by a variety of local factors, *perceptions* of risks are likewise easily influenced by sociological factors such as gender, race, and power[37]. Collaborative and place-based approaches to risk management can increase local trust and buy-in, however, because the assessment process is more proximate and can be made more inclusive[20]. People are more likely to trust knowledge if they know how it was constructed, and especially so if they participated in its construction[38,39]. Likewise, they are also more likely to feel that the new information has personal meaning or relevance, which improves the likelihood that they will incorporate that information into their behavior[6,40].

Transparency and Environmental Justice

What follows from the issue of trust is the importance of transparency to the environmental risk management process. Risk has become something of a tradable commodity in contemporary society[23], and those with sufficient financial and/or political capital are often in a position of power to apportion that risk as they see fit, with disadvantaged demographic groups often among those least able to control their exposure[41]. The public tends to be skeptical of the influence of special interests in science and the science-policy enterprise, and the controversy in the public discourse over climate change provides a ready example of this problem. But these are concerns that participatory approaches to risk management can assuage. There is usually little opportunity for a member of the general public to ascertain whether and how recommendations given by federal and state agencies were influenced by political and corporate agendas; one need only look to the contemporary debate regarding Intergovernmental Panel on Climate Change (IPCC) reports, or to the EPA's attempted regulation of greenhouse gasses, for evidence of the multiple possible ways that special interests can confound the establishment of consensus around scientifically valid standards.

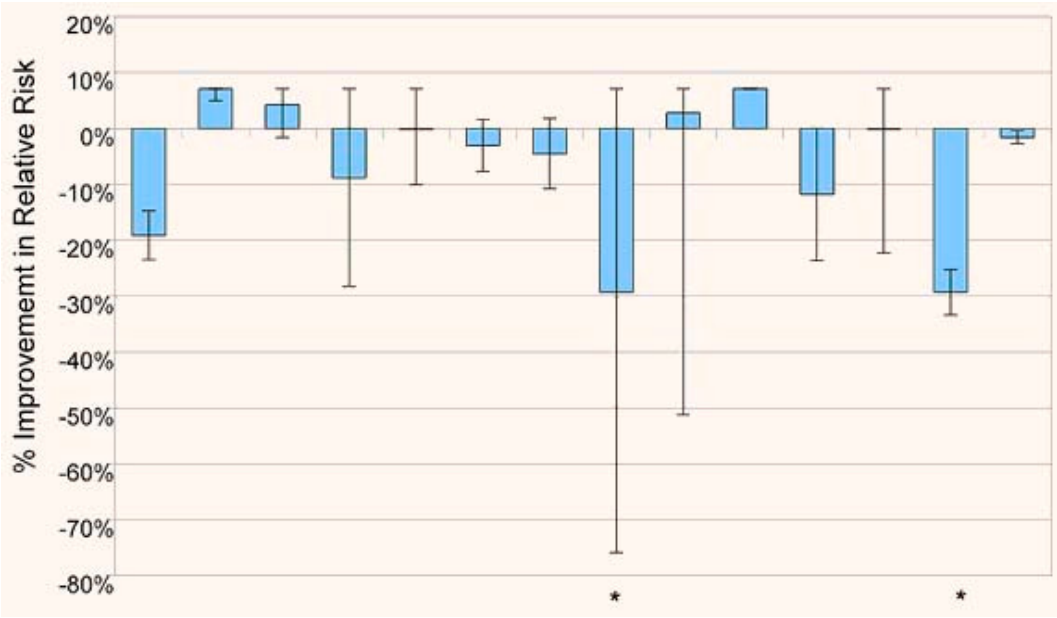

Figure 2: Risk-benefit analysis for arctic grayling in Alaska. Using a method developed by Ginsberg and Toal[29], the relative risk of consuming one serving per week of arctic grayling is shown in relation to coronary heart disease, based on methylmercury (MeHg) data from 14 studies from different regions of Alaska. The majority of study means (μ) for grayling show a net-risk at this consumption level. Like other fish types evaluated in their study, however, several show a possibility of either net-benefit or net-risk within the μ ± 1σ range (error bars). *μ Tissue MeHg value is higher than Environmental Protection Agency action level of 0.30 ppm.

We do not argue that transparency is guaranteed by place-based approaches, or that concerns regarding the influence of special interests disappear. With the appropriate due diligence, however, which include bringing multiple sets of stakeholders to the table and fostering an inclusive and multicultural research environment, participatory approaches can strip special interests of much of their power, simply by not allowing space for agendas to be hidden. A final caveat is that in order for participatory approaches to effectively undercut special interests with transparency, the legitimacy (i.e., power) of such approaches must be recognized and assured at the state level[42].

Toward a two-tiered approach

The successful assessment, characterization, and management of environmental risks are as much matters of public health as they are of community self-reliance, sustainability, and environmental justice[43,44]. In addition to this specific case from the USA described above, a two-tiered system that includes local knowledge is relevant for furthering environmental justice in multiple settings throughout the world, for instance in Canada[45] and the former Soviet Union[46]. Chief Bernard Ominayak of the Lubicon Lake peoples, for example, points out that all decisions regarding resource exploitation in their traditional territory are made elsewhere and by outsiders, without local involvement. Yet, the Lubicon people feel the full impacts of these decisions. Julian Agyelan and Yelena Ogneva-Himmelberger, likewise, give many examples where outside decisions impact local health in inconsistent and often unexpected ways.

Practitioners from both environmental health and environmental sustainability research programs have done much to improve the quality of environmental assessments, and the coping range of impacted peoples, through place-based research and research partnerships. Surely, consistent and broadly applicable environmental standards continue to be important for state-based regulation and management of point source contaminants, for example industrial emissions[7]. But when it comes to the effective management of inherently place-based phenomena such as risk and health, an eye toward the 'exceptionalism' of local circumstances is warranted. Locally held values regarding health and environmental security may often compete with agendas and mandates set regionally or nationally, as culture and social environment play a large role in shaping health-related values, beliefs, and behavior[18]. Unfortunately, how and whether these values track with generally accepted practice for supporting public health is not always clear. This leaves us with the ongoing need to learn how to better align and integrate place-based values with state-based agendas and mandates, such that positive and equitable environmental health outcomes can be the norm.

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References

1. Clark N. Population health and the environment. In: *The future of environmental health research: a tribute to Dr Kenneth Olden*. Research Triangle Park, NC: Environmental Health Perspectives and the National Institute of Environmental Health Sciences, 2005; 138-147.

2. House J. Understanding social factors and inequalities in health: 20th Century progress and 21st Century prospects. *Journal of Health and Social Behavior* 2001; **43(2):** 125-142.

3. Mergler D, Anderson HA, Chan LHM, Mahaffey KR, Murray M, Sakamoto M et al. Methylmercury exposure and health effects in humans: a worldwide concern. *AMBIO: A Journal of the Human Environment* 2007; **36(1):** 3-11.

4. Stern AH. A review of the studies of the cardiovascular health effects of methylmercury with consideration of their suitability for risk assessment. *Environmental Research* 2005; **98(1):**133-142.

5. Jewett S, Duffy L. Mercury in fishes of Alaska, with emphasis on subsistence species. *Science of the Total Environment* 2007; **387:** 3-27.

6. Environmental Protection Agency. *One fish, two fish.* (Online) 2006. Available: http://www.epa.gov/waterscience/fish/images/one-fish-original.jpg (Accessed 8 September 2011).

7. Cassady J. State calculations of cultural survival in environmental risk assessment: consequences for Alaska Natives. *Medical Anthropology Quarterly* 2010; **24(4):** 451-471.

8. Arquette M, Cole M, Cook K, LaFrance B, Peters M, Ransom J et al. Holistic risk-based environmental decision making: a Native perspective. *Environmental Health Perspectives* 2002; **110(suppl2):** 259-264.

9. Egeland GM, Middaugh JP. Balancing Fish Consumption Benefits with Mercury Exposure. *Science* 1997; **278(5345):** 1904-1905.

10. Loring P, Gerlach S. Food, Culture, and Human Health in Alaska: An integrative health approach to food security. *Environmental Science and Policy* 2009; **12(4):** 466-478.

11. Kleinman A, Eisenberg L, Good B. Culture, illness, and care: clinical lessons from anthropologic and cross-cultural research. *Focus* 2006; **4:** 140-149.

12. Ranco D. Environment Risk, Fish consumption, and American Indians: exploring the logic of genocide. *Bad Subjects* 2001; **55(1):** 9-12.

13. Hassel C. Woodlands Wisdom: a nutrition program interfacing indigenous and biomedical epistemologies. *Journal of Nutrition Education and Behavior* 2006; **38(2):** 114-120.

14. ADHSS. *Healthy Alaskans* 2010. Juneau, AK: Alaska Department of Health and Social Services, 2000.

15. Saylor B, Graves K, Cochran P. A resilience-based approach to improving community health. *Northwest Public Health* 2006; **23(1):** 4.

16. US Environmental Protection Agency. *Integrated Risk Information System (IRIS) gossary*. (Online) 2011. Available: http://www.epa.gov/iris/help_gloss.htm (Accessed 1 May 2011).

17. Verbrugge LA. Fish consumption advice for Alaskans: a risk management strategy to optimize the public's health. *State of Alaska Epidemiology Bulletin* 2007; **11(4):** 1-39.

18. Klejka J. Studies show little risk in eating Alaska fish. *YKHC Messenger* 2001; **VI(5):** 1.

19. Knobeloch L, Anderson HA. Human biomonitoring to optimize fish consumption advice. *American Journal of Public Health* 2005; **95(8):** 1304.

20. Betancourt JR. Cultural competence — marginal or mainstream movement? *New England Journal of Medicine* 2004; **351(10):** 953-955.

21. Howard A, Widdowson F. Traditional knowledge threatens environmental assesment. *Policy Options* 1997; **17(9):** 34-36.

22. Minkler M, Wallerstein N. *Community based participatory research for health*. Jossey-Bass, 2003.

23. Checker M. "But I know it's true:" environmental risk assessment, justice, and anthropology. *Human Organization* 2007; **66(2):** 112-124.

24. Schlosberg D. *Defining environmental justice: theories, movements, and nature*. Oxford : Oxford University Press, 2009.

25. Beck U. *Risk society: towards a new modernity*. Thousand Oaks, CA: Sage, 1992.

26. Nadasdy P. The Politics of TEK: Power and the "integration" of knowledge. *Arctic Anthropology* 1999; **36(1-2):** 1-18.

27. Nader L. *Naked science: anthropological inquiry into boundaries, power, and knowledge*. New York: Routledge, 1996.

28. Loring PA, Duffy LK, Murray MS. A risk-benefit analysis of wild fish consumption for various species in Alaska reveals shortcomings in data and monitoring needs. *Science of The Total Environment* 2010; **408(20):** 4532-4541.

29. Ginsberg G, Toal B. Quantitative approach for incorporating methylmercury risks and omega-3 fatty acid benefits in developing species-specific fish consumption advice. *Environmental Health Perspectives* 2009; **117(2):** 267-275.

30. Tribble D, Frank E. Dietary antioxidants, cancer, and atherosclerotic heart disease. *Western Journal of Medicine* 1994; **161(6):** 605-612.

31. Guallar E, Sanz-Gallardo MI, Veer PV, Bode P, Aro A, Gomez-Aracena J et al. Mercury, Fish Oils, and the Risk of Myocardial Infarction. *New England Journal of Medicine* 2002; **347(22):** 1747-1754.

32. Dubos R, Savage D, Shaedler R. Biological Freudianism: lasting effects of early environmental influences. *International Journal of Epidemiology* 2005; **34:** 5-12.

33. Bersamin A, Luick B, Ruppert E, Stern J, Sidenberg-Cherr S. Diet quality among Yup'ik Eskimos living in rural communities is low: The Center for Alaska Native Health Research Pilot Study. *Journal of the American Dietetic Association* 2007; **106(7):** 1055-1063.

34. Bersamin A, Sidenberg-Cherr S, Stern J, Luick B. Nutrient intakes are associated with adherence to a traditional diet among Yup'ik Eskimos living in remote Alaska Native communities: the CANHR Study. *International Journal of Circumpolar Health* 2007; **66(1):** 62-70.

35. Ginsberg GL, Toal BF. Development of a single-meal fish consumption advisory for methyl mercury. *Risk Analysis* 2000; **20(1):** 41-48.

36. Trainor S, Godduhn A, Duffy L, Chapin III F, Natcher D, Kofinas G et al. Environmental injustice in the Canadian Far North: persistent organic pollutants and Arctic climate impacts. In: J Agyeman, R Haluza-DeLay, P Cole, P O'Riley (Eds). *Speaking for ourselves: environmental justice in Canada*. Vancouver: University of British Columbia Press, 2009.

37. Norgaard KM. The politics of invasive weed management: gender, race, and risk perception in rural California. *Rural Sociology* 2007; **72(3):** 450-477.

38. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W et al. Lost in knowledge translation: Time for a map? *Journal of Continuing Education for Health Professionals* 2006; **26(1):** 13-24.

39. Kaplan S. Beyond rationality: clarity-based decision-making. In: *Environment, cognition, and action: an integrated approach*. New York, NY: Oxford University Press, 1991; 171-190.

40. Bridges J. Human health and environmental risk assessment: the need for a more harmonised and integrated approach. *Chemosphere* 2003; **52(9):** 1347-1351.

41. O'Neill CA. Risk avoidance, cultural discrimination, and environmental justice for indigenous peoples. *Ecology Law Quarterly* 2003; **30(1):** 1.

42. Turner N, Gregory R, Brooks C, Failing L, Satterfield T. From invisibility to transparency: identifying the implications. *Ecology and Society* 2008; **13(2):** 7.

43. Bhatia, Wernham A. Integrating human health into environmental impact assessment: an unrealized opportunity for environmental health and justice. *Environmental Health Perspectives* 2008; **116(8):** 991-1000.

44. Loring P, Gerlach S. Food security and conservation of Yukon River Salmon: are we asking too much of the Yukon River? *Sustainability* 2010; **2(9):** 2965-2987.

45. Ominayak B, Thomas K. These are Lubicon lands: a first nation forced to step in to the regulatory gap. In: J Agyeman, R Haluza-DeLay, P O'Riley (Eds). *Speaking for ourselves: environmental justice in Canada*. Vancouver, BC: University of British Columbia Press, 2009; 111-122.

46. Agyeman J, Ogeva-Himmelberger Y (Eds). *Environmental justice and sustainability in the former Soviet Union*. Cambridge, MA: Massachusetts Institute of Technology, 2009.

