17 Dec 2008

Response to questions by M. Michel Germain, President of the BAPE at Havre-St-Pierre on 4 Dec 2008

Alliance Romaine

Alliance Romaine, un groupe environnemental fondé en janvier 2008 pour opposer le projet d'Hydro-Québec de construction de 4 barrages sur la rivière Romaine, représente plus de 100 membres à travers le Québec, le Canada et les États-Unis, parmi lesquels on retrouve des scientifiques, des académiciens, des éducateurs pleinairistes et des citoyens concernés. Alliance Romaine s'est dévoué à la rivière cet été et a mené une expédition de canot de 48 jours. Les membres sont principalement des jeunes engagés qui veulent s'impliquer dans l'édification d'un monde meilleur, ce monde dans lequel ils vont continuer de vivre. Alliance Romaine a participé activement aux procédures publiques jusqu'à présent, soit dans le contexte de l'Agence canadienne d'évaluation environnementale et du BAPE.

Intérêts

Nos intérêts principaux dans ce projet sont ceux de citoyens concernés par l'environnement que nous laisserons aux générations futures et concernés par un besoin de voir nos autorités politiques mettre en place un plan énergétique ambitieux axé sur la conservation de l'énergie plutot que la surconsommation de ressources et investissant de manière transparente dans les énergies propres et renouvelables. En tant que contribuables, nous ne voulons pas devoir payer pour les pertes dues au fait qu'Hydro-Quebec vend son hydroélectricité moins cher à certains acheteurs tels Alcoa et nous ne voulons pas passer les prochains 50 ans de nos vies à absorber les couts de barrages rendus désuets ou qui auraient pu être évités.

1. Questions 815-825 relating to the cumulative impacts of other hydro- electric projects such as the Churchill River- Smallwood Reservoir complex in adjacent Labrador, and questions 875-880 relating to cumulative impacts of existing hydro-electric projects such on the Ottawa, Ste. Marguarite, Manicougan, Outardes, Betsiamites and Saguenay rivers etc.

References:

Rosenburg D. et al. (1997). Large Scale Impacts of Hydro-electric Development. Environmental Reviews 5: 27-54. http://article.pubs.nrc-cnrc.gc.ca/RPAS/rpv?hm=HInit&afpf=a97-001.pdf&journal=er&volume=5

Rosenburg D. et al. (2000) Global-Scale Environmental Effects of Hydrological Alterations: Introduction. Bioscience: 50:746-750. http://www.bioone.org/perlserv/?request=get-document&doi=10.1641%2F0006-3568(2000)050%5B0746%3AGSEEOH%5D2.0.CO%3B2&ct=1

Gibson R. J. (2006) The myth of hydroelectricity as "green" energy. (Review prepared on behalf of the Natural History Society of Newfoundland and Labrador.) http://www.nr.gov.nl.ca/energyplan/submissions/pdf/DOC1521.pdf

Anderson M.R. et al. (1995). Mercury in fish in the Smallwood Reservoir Labrador, twenty one years after impoundment. Water Air and Soil Pollution 80: 927-930 http://www.springerlink.com/content/r157p2627828g423/fulltext.pdf

Higgins J and Shalev G. (2007) Churchill Falls Impacts. Newfoundland and Labrador Heritage [http://www.heritage.nf.ca/law/cfimpacts.html]

Gagnon. M. 1998. Regional Assessment: North Shore -Anticosti Priority Intervention Zone 19. Environment Canada-Quebec Region, Environmental Conservation, St. Lawrence Centre. 78 pages.

Examples of potential cumulative impacts are as follows:

Cumulative impacts (from wide scale hydro-electric development) result from loss and fragmentation of animal, bird, fish and plant habitat. Impacts are caused by inundation, road construction, irregular fluctuations in reservoir levels (draw down), transmission lines and corridors, deforestation (logging), encroachment, mineral extraction etc.

For example the Woodland Caribou populations (protected status) that frequent the upper Romaine watershed (in critical decline throughout their range) have already been impacted by loss and fragmentation of habitat caused by flooding of much of the Labrador plateau to create the massive Smallwood Reservoir. The Romaine and Churchill River water sheds share an inter-connected and fragile ecosystem.

What will be the cumulative impacts on Woodland Caribou populations of further habitat loss and fragmentation if the Romaine and Lower Churchill megaprojects are realized? What will be the cumulative impacts on other animal species, particularly those with large ranges, and on bird species?

The cumulative effects of large scale hydro-electric development may be manifested at community, species and genotype within species, levels. The cumulative impacts of loss, simplification and/or alterations to natural habitats create the main effects.

For example, dams convert rivers into lacustrine environments (habitat simplification). Dams fragment the continuity of a river and may isolate fish populations preventing their upstream or downstream movement in search of food or suitable spawning sites. Fish species uniquely adapted to specific riverine conditions are often displaced (e.g., Brook Trout) and replaced by those species that can tolerate the newly created lacustrine conditions (e.g. Pike). The frequently practiced introduction of "exotic" strains of native fish species to compensate for habitat loss may alter gene pools.

Irregular fluctuations in water levels (drawdown) tends to destroy the productive littoral region. Fish species that spawn in shallow water near the shore are either significantly reduced or eliminated from hydro-electric reservoirs. The fluctuations also cause erosion /slumping of shoreline; in winter erosion is caused by ice. Nesting birds and some mammals (e.g. beaver) that depend on the littoral zone may be eliminated. Thus, reservoir creation may cause a reduction in biodiversity.

Many of the impacts on the river downstream of dams are the reverse of those on the reservoir/s that were created above. What is retained in the reservoirs (heat, sediments, inorganic and organic nutrients) is lost to the river and coastal areas. These perturbations as well as regulated river flows can adversely affect downstream fish communities, as well as plants, birds and animals due to erosion, lowering of the water table, and loss or deterioration of riparian habitat.

We reiterate: What are the cumulative impacts on plant and animal species, communities and on biodiversity in general, of wide scale hydro-electric development in the region e.g. Ste. Marguarite, Manicougan, Outardes, Betsiamites , Saguenay and Churchill Rivers (Smallwood Reservoir)?

Other cumulative impacts include greenhouse gas emissions (Co2 and methane) from reservoir surfaces, turbines, spillways etc. and indirect emissions accruing from deforestation, use of petroleum fuels during construction, aluminum smelting etc.

As far as we know, there is no comprehensive or cumulative inventory of direct and indirect GHG emissions from hydro-electric reservoirs either for Quebec or for Canada.

Mercury contamination of the food chain represents a cumulative impact on both temporal and spatial scales. Elevated levels of mercury found in fish flesh after impoundment of a reservoir are predicted to decline as the reservoir ages. Predictions for predatory fish range from 20 to 30 years to return to background levels. However, Anderson et al (1995) found that mercury levels in flesh of piscivores such as Pike resident in the Smallwood reservoir in adjacent Labrador, remained elevated even after 21 years following impoundment. Anderson et al. (1995) conclude : " *models predicting*

decline in mercury levels in piscivorous fish in reservoirs must be re-evaluated in light of this extended data set".

During the summer of 2008, Alliance Romaine observed numerous signs posted on waterways in Labrador (in the vicinity of the Smallwood Reservoir and head water region of the Romaine River) warning against fish consumption because of mercury contamination. The Smallwood reservoir complex was completed during the 70s. It appears that mercury contamination is still an important health issue more than 30 years after impoundment of the Smallwood reservoir.

What are the cumulative impacts on human health, psychology, and traditional way of life of Aboriginal communities, of pervasive mercury contamination caused by wide scale hydroelectric development in the region? What are the cumulative impacts of pervasive mercury contamination of the food chain on animal and bird populations in the region?

The large scale hydrological alterations in the St Lawrence watershed (e.g., Ottawa, Ste. Marguarite, Manicougan, Outardes, Betsiamites and Saguenay rivers etc.) has undoubtedly had cumulative repercussions with respect to the delivery of freshwater inputs, sediments, organic and inorganic nutrients to the Gulf. This in turn has potential long term cumulative impacts on the productivity of the marine ecosystem particularly with regard to Fisheries, populations of marine birds and animals.

Northern rivers typically have high flows in the spring and low flows in winter. Hydro-electric developments, on the other hand, usually trap the high spring flows for storage in reservoirs and release higher than normal flows in the winter when power is most needed. This transfers runoff from the biologically active period (spring) to the biologically inactive (winter). The large scale construction of hydro-electric dams in the St Lawrence drainage basin has greatly reduced freshwater flow to the Gulf during the natural flood period (June) but raised it in winter. The cumulative impact of these hydrological alterations on the marine environment is unknown (Gagnon, 1995).

Rosenberg et al. (1997), in a review of research done on the large scale impacts of hydroelectric development, refers to two research papers published in the 80s (Table 5, p 38). These papers indicate that large scale hydro-electric development in the St. Lawrence watershed, had up until that time, caused >8000 m^3/s of spring freshwater discharge to be withheld, as well as a 20-30% reduction in the normal spring quantity of nutrients. The authors of these two research articles attempt to relate freshwater and nutrient inputs to levels of fish catches in the interval between the late 60s and mid 70s (Note: this is speculative, because of many variables involved).

Any assessment of cumulative impacts of wide-scale hydro-electric development in the region is hampered by the paucity of data on pre dam conditions. This is because many of the dams in the St Lawrence watershed were constructed in the late 60s and early 70s, before many of the environmental impacts of dams were known.

A general account of historical impacts associated with the damming of the upper Churchill River (in the 70s) to create the Smallwood Reservoir in Labrador is provided by Higgins and Shalev (2007).

We would like to conclude by quoting from Rosenburg et al. (2000):

"The whole story has not yet been told, but the authors in the series [of research papers] *have served notice that human interference with the hydrological cycle is producing environmental effects detectable at very large – even global –scales"*.

2. Questions 920-925 and 940-950 requesting more information on impacts of silicate limitation in the Gulf of St. Lawrence.

References :

Ragueneau, O., D.J. Conley, A. Leynaert, S. Ni Longphuirt and C.P. Slomp 2006. Responses of coastal ecosystems to anthropogenic perturbations of silicon cycling. In: Ittekot V., D. Unger, C. Humborg, N.T. An. (eds.) *The Silicon Cycle. Human Perturbations and Impacts on Aquatic Systems*, Scope 66, Island Press, pp197-213.

[http://books.google.com/books?hl=en&lr=&id=bced7WY0IncC&oi=fnd&pg=PR9&dq=The+Silicon+Cycle+Human+Perturbations+and+Impacts+on+Aquatic+Systems+Scope+66+:197+-213&ots=kfu3cJ9sks&sig=XOcEBxHcEmb6PyCIkj_TQSJIYiI#PPP1,M1]

Humborg C, Conley D J, Rahm L, Wulff F, Cociasu A, et al. 2000. Silicon Retention in River Basins: Far-reaching Effects on Biogeochemistry and Aquatic Food Webs in Coastal Marine Environments. AMBIO: A Journal of the Human Environment: Vol. 29: 45–50. http://ambio.allenpress.com/perlserv/?request=get-document&doi=10.1639%2F0044-7447(2000)029%5B0045%3ASRIRBF%5D2.0.CO%3B2

Ittekkot, V. et al. 2000. Hydrological alterations and marine biogeochemistry: A silicate issue? Bioscience 50:776-782.

Freidl, G and Wuest, A. 2002. Disrupting Biogeochemical cycles - Consequences of Damming. Aquatic Science 64: 55-65

Hutchins D.A, and Bruland K.W. 1998. Iron limited diatom growth and Si:N uptake ratios in coastal upwelling. Nature 393:561-564.

In our Brief we cite a number of Scientific Review Articles (some of which are listed above) that describe how nutrient delivery, especially of silicates, is disrupted by river damming with implications for the composition of phytoplankton communities (aquatic food web) and for the overall productivity of offshore marine areas (Fisheries etc.). The authors of these research articles also implicate reduced silicate inputs from dammed rivers as a potential factor contributing to the development of toxic algal blooms in coastal areas.

It should be noted that the St Lawrence estuary is a semi-enclosed marine ecosystem and therefore may be more susceptible to reduced river inputs of nutrients than open ocean systems.

The research reviews that we cite in our Brief represent a synthesis of about two decades of research on a number of world rivers that have been subjected to large scale hydrological alterations.

With regard to the St Lawrence, we are not aware of any published research articles specifically relating to the impacts of reduced river inputs of silicates on the composition of phytoplankton populations (i.e., diatoms relative to non siliceous algae). However a number of publications exist that consider aspects of nutrient availability (including Si) on phytoplankton productivity.

Fisheries and Oceans Canada conduct research on phytoplankton populations in the St. Lawrence as well as monitor nutrient levels (Si, P, N) in the water column on a regular basis: http://www.osl.gc.ca/sl_monitore/en/variables/sels.html. We recommend contacting DFO for further information on the potential impacts of reduced riverine silicate inputs on the marine environment of the St Lawrence.