Voluntary report for the in-depth review of implementation of the CBD program of work on the biological diversity of inland water ecosystems
DRAFT - FOR COMMENT

CANADA – March 2009

1. What is the overall situation regarding the status and trends of inland water ecosystems in your country?
a. steady, declining, declining fast, improving, improving rapidly?

In recent years, industrial emissions of sulphur dioxide have decreased in eastern Canada, and deposition of acidic sulphates on lakes and forests has decreased correspondingly. It was thought that by reducing industrial sulphur emissions, and thereby reducing acid rain, lakes and soils previously impacted by acidification would recover. However, lake-water calcium concentrations continue to decline in many boreal softwater lakes, even where pH levels are increasing. In a large proportion of lakes on the southeastern Canadian Shield, aqueous calcium concentrations are at or below thresholds of population fitness for calcium-rich crustacean zooplankton owing to continuing acidic deposition, reduction in atmospheric calcium inputs, and calcium removal in harvested forest biomass combined with calcium uptake in forest regrowth (Jeziorski et al. 2008). .

Last year, scientists from the United States, Canada and Mexico assessed imperiled freshwater and diadromous fish species in North America. They listed 700 fishes as imperilled – a 92% increase over the 364 listed in a previous assessment in 1989 (Jelks et al., 2008). Nearly 40 percent of fish species in North American streams, rivers and lakes are now in jeopardy. Researchers classified 230 fishes as vulnerable, 190 as threatened, and 280 as endangered. In addition, 61 fishes are presumed extinct. The scientists identified degradation and introduced species as the main threats, supporting findings of Chu et al. (2003) and Abell et al. (2000).

Other freshwater taxa appear to be showing similar rapid declines (Ricciardi and Rasmussen 1999). The Great Lakes are among the most intensively monitored freshwater ecosystems in North America, thanks to reports prepared jointly by Canada and the U.S at biennial State of the Lakes Ecosystem Conferences (SOLEC). According to SOLEC (2007), five amphibian species (American toad, bullfrog, chorus frog, green frog, and northern leopard frog) exhibited significant population declines from 1995 to 2005 while only one species (spring peeper) increased significantly in Great Lakes coastal wetlands. For this time period, 14 species of wetland-dependent birds exhibited significant population declines, while six species exhibited significantly increasing trends.

Migratory waterfowl, which have received much attention through the North American Waterfowl Management Program and other conservation efforts, are an exception to declining trends. Many waterfowl species have undergone significant increases in the past 40 years, a testament to coordinated conservation efforts in wetlands (Zimpfer et al.

2008). Status of duck populations and wetland habitats is intensively monitored on an annual basis in areas encompassed by the Waterfowl Breeding Population and Habitat Survey, done jointly by the U.S. Fish and Wildlife Service and Canadian Wildlife Service. Many species surveyed have been stable or increasing over the period from 1955-2008, although declining trends are evident in some species (canvasback, pintail and scaup). Canada geese have increased dramatically in North America – roughly 5-fold since 1970, and 2-fold since 1990 - reflecting a shift towards non-migratory populations of this species (Dolbeer and Seubert 2006).

b. how does this compare to other major biomes? (same, better than others and which ones, worse than others and which ones, the worst?)

Ricciardi and Rasmussen (1999) found that recent extinction rates for North American freshwater fauna are five times higher than those for terrestrial fauna. Data for the United States analyzed by NatureServe and reported by the Heinz Center (2008) show that 37% percent of native freshwater aquatic animal species are currently considered at risk for extinction, and of these 4% may already be extinct. These include mussels and small aquatic invertebrates as well as fish. High percentages of at-risk species are found in a wide range of animals that depend on freshwater habitat, including fishes, turtles, frogs, mussels and crayfish. In the 1999 analysis by Ricciardi and Rasmussen, at-risk species accounted for 49% of 262 freshwater mussel species, 33% of 336 crayfish species, 26% of 243 amphibian species, and 21% of 1021 fish species. As noted earlier, Jelks et al. (2008) now find that nearly 40% of freshwater fish species are at risk.

2. Which are the main direct drivers of loss of inland waters biodiversity (list the most important, or in order of importance if possible/necessary)?

Dudgeon et al. (2006) observed that freshwater biodiversity conservation is extremely challenging "because it is influenced by the upstream drainage network, the surrounding land, the riparian zone, and – in the case of migrating aquatic fauna – downstream reaches". These authors categorize threats to freshwater biodiversity under five headings: overexploitation; pollution; flow modification; destruction or degradation of habitat; and invasion by exotic species.

The significance of these main drivers of inland waters biodiversity loss varies across Canada depending on climate, existing water resources, economic development, settlement patterns and population. Reports from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Government of Canada 2008) suggest that the main threats to freshwater fish species at risk in Canada are habitat degradation/loss and invasive alien species. Siltation, dams/impoundment and urban, agricultural and industrial development are also significant factors.

Chu et al. (2003) compared stresses on freshwater fish biodiversity in different regions of Canada. Based on data from Statistics Canada, they identified density of dwellings, road density, farming, and forestry as dominant fish stressors in southern watersheds of Canada. They noted that watersheds in southern British Columbia and Ontario contained

the greatest fish diversity and were also under the most stress. Abell et al. (2000), using coarser-scale data such as measures as degree of land cover alteration, water-quality degradation, habitat fragmentation, impact of introductions, and exploitation, identified the same areas of southern Canada as priorities for freshwater biodiversity conservation. In contrast, both Chu et al. (2003) and Abell et al. (2000) classified fish populations in northern Canada as relatively stable and intact.

Climate change is placing additional stress on freshwater ecosystems, particularly in areas such as the prairies. Climate models suggest that a warmer, drier climate in the Prairie Pothole Region in the future would result in a reduction in, or elimination of, wetlands that provide waterfowl breeding habitat. This is one of North America's most ecologically valuable freshwater areas (CCSP, 2009). The Arctic is a particularly sensitive area with considerable freshwater resources (ACIA).

a. over use of water?

Canada is commonly perceived as having plentiful freshwater resources. However, this reflects Canada's immense land area and correspondingly large water resource . With 7% of the earth's land surface, Canada possesses just about 7% of the world's renewable freshwater (runoff/river flow). Many of Canada's major river systems flow northwards, away from the regions of highest population density. Increasing population in urban areas in the south has resulted in a mismatch between sources of freshwater and areas of highest demand. Canadians use about 1650 cubic metres of freshwater per capita each year, more than double the average European rate, and second highest among OECD nations. Freshwater availability in Canada should be seen, therefore, as a limited national resource, not always located in the right place and increasingly under stress from human and other influences (Environment Canada 2003).

Nationally, about 51 billion cubic metres of surface water are withdrawn annually by major users from Canada's rivers (Environment Canada 2005). Most of this water is returned to its source, although quality may be diminished, and temperature altered, with implications for biota in receiving waters. The thermal power generation sector dominates, extracting some 32 billion cubic metres per year. This has involved damming on many large river systems blocking fish migrations and altering hydrological regimes far downstream. Manufacturing accounts for around 15.3% of water withdrawals, municipal use 9.4% and agriculture 9.4%.

Overall, about 12% (6.1 billion m3) of water withdrawn is actually consumed (not returned to its source). Agriculture consumes 74% of the water it diverts, making it by far the greatest consumer. About 92.4% of agricultural withdrawals are used for irrigation (primarily in the West) and 5.4% is used for watering livestock. Water resources are fully allocated in some irrigation-dependent watersheds. Increasing amounts of water are also used for the extraction of oil and gas, including fluid make-up to maintain formation pressures for production of light crude oil, extraction of heavy crude from oil sands, and coalbed methane extraction. Much of this water is consumed

and cannot be reused. Natural Resources Canada is leading research efforts to develop technologies to reduce the water required by half in the oil sands development.

b. unsustainable land based practices (pollution, siltation, eutrophication)

Trends in water pollution show large regional variations in Canada. In the Great Lakes, over the last 30 years, there has been a marked reduction in the levels of toxic chemicals in air, water, biota, and sediments. Many remaining problems are associated with local regions. However, increasing levels of certain chemicals in fish are of emerging concern, including polybrominated diphenyl ethers (PBDEs) used as flame retardants, and perfluorinated chemicals. Levels of most contaminants in herring gull eggs continue to decrease throughout the Great Lakes, although concentration levels vary from good in Lake Superior, to mixed in Lake Michigan, Lake Erie and Lake Huron, to poor in Lake Ontario. While the frequency of gross effects of contamination on wildlife has subsided, subtle physiological and genetic effects not measured in earlier years of sampling are associated with chemicals such as PBDEs (SOLEC 2007)..

In Lake Winnipeg, nitrogen and phosphorus levels in the lake spiked in the early 70s and have contributed to algal blooms and declining health of the lake ever since. Despite recent improvements such as provincial bans on domestic fertilizer and phosphate free dish detergents, eutrophication remains a problem. Agricultural fertilizer use, an expanding hog industry, new invasive species and outdated rural waste water lagoons are linked to the lake's continuing decline. Satellite images over the last decade show a worsening trend, with blue-green algae at times covering more than half the lake surface area (http://www.ec.gc.ca/paae-apcw/default.asp?lang=En&n=61284017-1).

Phosphorus concentrations in the Great Lakes were a major concern in the 1960s and 1970s, but private and government actions have reduced phosphorus loadings, reducing phosphorus concentrations in open waters. High phosphorus concentrations are still measured in some nearshore areas, and blooms of the green alga *Cladophora* have reappeared along the shoreline (SOLEC 2007). Blue-green algal blooms are a growing problem in smaller lakes and water bodies in the Great Lakes – St. Lawrence basin of southern Ontario and Quebec. (http://www.qc.ec.gc.ca/csl/inf/inf073_e.html. The health of Lake Simcoe, a 744 square km lake north of Toronto, has been declining for many years owing to pollution from land-based rural and urban sources. Lake Simcoe's annual phosphorus inputs are two to three times the natural level. This is causing excessive algal growth and reduced oxygen levels, affecting the cold water fish community, wildlife and overall water quality. Eutrophication is likely to redevelop if investments in public treatment facilities do not keep ahead of population growth especially in the larger urban areas.

c. habitat (wetland) conversion?

Canada's extensive northern peatlands remain largely unaltered and continue to provide globally significant sinks and reservoirs of carbon. There is increasing concern that climate warming already evident in northern areas is starting to increase decomposition

and methane releases potentially accelerating climate warming further. Wetland conservation efforts in southern Canada, such as those supported by the North American Waterfowl Management Program, have achieved positive results, as shown by stable or increasing populations of most waterfowl species.

The Government of Canada adopted a Federal Policy on Wetland Conservation in 1991 (http://dsp-psd.communication.gc.ca/Collection/CW66-116-1991E.pdf). which recognizes wetlands as providing key ecosystem services (carbon sequestration, groundwater recharge, flood control, water purification, etc.). It contains a goal of no net loss of wetland functions on all federal lands and waters; however it has been difficult to provide trend data and track compliance. At the time the Policy was adopted, it was estimated that 20 million of Canada's 140 million hectares of wetlands had been converted to other land uses or submerged under reservoirs, nearly all in southern Canada.

d. over-exploitation of species?

Canada's freshwater commercial fisheries are controlled by each province or territory. The Great Lakes fishery is however controlled by the Government of Canada and the Government of the United States of America, but its direct management is coordinated by the province of Ontario and neighbouring U.S. states. Fisheries and fish are a federal responsibility with day-to-day management delegated to the provinces in many instances. Many accessible freshwater fisheries are already considered to be exploited close to or above sustainable levels.

Populations of Atlantic salmon have been under continuous threat throughout the range of this species, and have been designated as endangered, and extirpated mostly due to overexploitation and dam construction. Efforts to restock native Atlantic salmon and restore its habitat in the Great Lakes have failed owing to a number of factors including urbanization in the greater Toronto Area. The Pacific Coho salmon has experienced declines of more than 60%, also due to over-exploitation of the species; however there has been some stabilization of spawning numbers in some watersheds.

e. invasive alien species?

In the Great Lakes basin, introduction and spread of invasive alien species has been well documented as a dominant factor in biodiversity loss. The opening of the St. Lawrence Seaway in 1959 allowed ships to discharge ballast water from ports around the world, creating a major new pathway for introduction of highly damaging invasive species such as the zebra mussel (National Research Council 2008). The total number of aquatic invasive species in the Great Lakes is now more than 180, including algae, fish, invertebrates, and plants. Invasive species are the second most prevalent threat for Canadian fishes at risk, affecting 26 of 41 listed species (Dextrase and Mandrak 2006).

Within Canada, the National Code on Introduction and Transfers of Aquatic Organisms (http://www.dfo-mpo.gc.ca/Science/enviro/ais-eae/code-eng.htm) provides a mechanism

for assessing proposals to move aquatic organisms from one water body to another. The movement of the coho salmon (*Oncorhynchus kisutch)* and chinook salmon (*O. tshawytscha*) to the Great Lakes are examples of intentional introductions. These introductions of Pacific salmon have created economically important sport fisheries. However, high stocking rates have created large instabilities in forage fish populations in Lakes Ontario and Michigan. Continued reliance on the hatchery-based Pacific salmon fishery in the Great Lakes may have compromised managers' abilities to rehabilitate native top predators such as lake trout and Atlantic salmon.

f. other (dams/habitat degradation/fragmentation)

The most important threat for freshwater fish at risk in Canada is habitat alteration (Dextrase & Mandrak 2006). River redhorse and white sturgeon are examples of fish species at risk that are threatened by habitat degradation and fragmentation from dams and canal diversions. The black redhorse has been affected by raised sediment levels (a direct effect of damming) in addition to problems with high nutrient levels, altered flow regimes and physical habitat degradation. Habitat alteration can aggravate other threats: a study in the upper Midwest of the United States showed that non-indigenous species are 2.4 to 300 times more likely to occur in impoundments (Johnson et al. 2008).

Similarly, while the major cause of decline of freshwater mussels during the last century has been destruction of their habitat by siltation, dredging, channelization, the creation of impoundments, and pollution; the introduction of exotic zebra mussels has led to additional catastrophic declines in infested areas (Metcalfe-Smith et al. 1997).

.

3. Do you generally tend to try to manage inland water ecosystems as a functioning ecological unit?

a. are catchment/basin based approaches (or sub-catchments for larger systems) widely used?; i.e., is the land within the catchment generally considered and managed as part of the inland water ecosystem?

b. to what extent is the relevant estuary/coastal region considered as part of the “inland water” ecosystem (if applicable)?

Canada is gradually developing programs for integrated water resource management, or integrated watershed management, (Infrastructure Canada 2008). This is one of the best examples of use of an ecosystem approach in Canada. It recognizes the inter-dependence of Canada's fresh waters and coastal waters, water quality and water quantity, surface water resources and groundwater resources, land uses and water uses, and upstream and downstream uses.

Watershed boundaries remain stable over time and are easily recognized. They provide natural units for planning and managing social, economic, environmental, and institutional connections. Integrated watershed management generally involves a local advisory board with members from provincial/territorial and local municipal governments, Aboriginal peoples, industry, educational institutions, local stewardship

groups, development groups, wildlife groups, environmentalists, landowners, and the concerned public. In larger boundary or trans-boundary water basins federal government officials are also involved.

There are many examples of this type of governance underway in Canada. Environment Canada works with a broad spectrum of partners through "ecosystem initiatives" to address priority areas and issues of concern in the Atlantic Coastal region, St. Lawrence River Basin, Great Lakes, Fraser River/Georgia Basin and Northern region of the country. Work is being carried out under the Government of Canada's Action Plan for Clean Water to restore Lake Simcoe, Lake Winnipeg, and Areas of Concern in the Great Lakes. Ontario's Lake Simcoe Protection Act became law on December 10, 2008. The legislation enshrines watershed protection in law and requires the establishment of a protection plan for the lake and surrounding regions. The draft Lake Simcoe Protection Plan was available for public comment in March 2009".
http://www.ene.gov.on.ca/en/water/lakesimcoe/index.php

4. Does the POW have a significant influence on policies and management in your country?:
a. yes, no, difficult to assess?
b. do other policy and management frameworks result in outcomes relevant to the POW but these are not influenced directly the POW?; what are these (e.g., other regional frameworks; national measures/mechanisms but not directly influenced by the POW)?

The programme of work (POW) on inland waters biodiversity has had limited influence on water policy and management in Canada . Current water policy and management frameworks are however achieving outcomes relevant to the POW, chief among these frameworks is integrated watershed management. Its principles mirror those in the POW, including:

- Recognition of the values of water to environment, economy, and society;
- Stakeholder representation, support, and involvement; including involvement of local and First Nations communities;
- Reflection of relationship with land use, other environmental issues, and ecosystem linkages;
- Design and deployment of a mix of measures (voluntary, regulatory, and market-based instruments), and the right balance of actions for effective implementation;
- Clear focus and orientation towards results and evidence-based decision-making;
- Basis in scientific principles, sustainable management, and precautionary approaches;
- Monitoring, assessment, reporting, feedback system;
- Realistic performance evaluation and continuous improvement;
- Research, sound scientific and economic data and information; and

- Capacity building (including through education and public awareness, technology transfer, and funding)

Since watersheds rarely align neatly with jurisdictional boundaries, one of the primary strategies for integrated watershed management and planning activities in Canada is designing effective mechanisms for governance of water within and across jurisdictions. Many such mechanisms are in use. Domestic water boards, such as the Prairie Provinces Water Board, exist to promote regional cooperation in water management, ensure that interprovincial surface waters and groundwaters are shared equitably, and to prevent potential conflicts. Provinces use a variety of strategies to manage their water resources. Non-governmental watershed stewardship groups are active in many areas. In Ontario, under the Conservation Authorities Act (1946), different local authorities within a watershed can cost-share water management activities, including flood control, dam maintenance, floodplain management, soil erosion, reforestation, recreation, and education. There are 36 Conservation Authorities in all major populated watersheds in Ontario. The Ontario CAs have limited resources and limited ability to oppose local and regional development planning. Similar watershed councils exist or are being established in Alberta, Saskatchewan, Manitoba, and Quebec.

At the national level, the Canadian Council of Ministers of the Environment (CCME) and the Canadian Councils of Resource Ministers provide formal mechanisms for effective intergovernmental discussion and coordinated approaches to regional and national environmental issues, including water demand and use management, the regulation of municipal wastewater effluents, and water quality. The CCME's Water Quality Task Group is mandated to undertake technical work on water quality initiatives, including:

- developing water quality guidelines for the protection of aquatic life;
- developing water quality guidelines for the protection of agricultural water uses;
- developing sediment guidelines for the protection of aquatic life;
- developing tissue residue guidelines for the protection of wildlife consumers of aquatic biota; and,
- examining other water quality issues as required.

The federal and provincial/territorial governments also cooperate on the national collection of water quantity information through national hydrometric agreements.

Another significant example of federal-provincial cooperation is the October 2007 announcement of an agreement to establish the Lake Superior National Marine Conservation area. More than 10,000 square kilometres of Lake Superior, including the lakebed, islands and shorelands will be included, making this the largest freshwater protected area in the world. The announcement marked the culmination of a decade of planning and negotiations involving the federal, Ontario and local governments as well as First Nations in the region. National marine conservation areas are part of Parks Canada’s growing number of national heritage sites. They protect key elements of the ecosystem while preserving the livelihoods of local residents who work in marine industries such as commercial fishing, sport fishing and shipping.

The International Joint Commission, established under the 1909 *Boundary Waters Treaty*, is the key international governance mechanism in use between Canada and the United States that helps anticipate, prevent, and resolve water disputes over boundary and transboundary waters, particularly in the Great Lakes. The Commission serves as an independent and objective advisor to governments, addressing and recommending ways to resolve transboundary water issues through bilateral arrangements that often use existing mechanisms at the federal and provincial-state levels of the two countries. For specific water issues or watersheds, Canadian provinces and U.S. states are working together in various binational initiatives and forums. For instance, Ontario and Quebec are associate members of the Great Lakes Commission, an American organization created by joint legislative action of the eight Great Lakes states in 1955. The Lake Champlain Basin Program, involving the governments of Quebec, Vermont, and New York, is another example of such a province-state joint effort.

5. Has the POW had a significant impact on relevant water-related policies in your country?:
a. on water use policies – particularly water use by the sectors (agriculture including irrigation; hydropower; navigation; urban/industrial water supply and use etc.)?
b. on water quality?;
c. does this include adequate consideration of groundwater?; e.g., interactions between groundwater and surface water (e.g., how groundwater recharges other wetlands)? ; impacts of unsustainable groundwater use on terrestrial biodiversity (e.g., vegetation cover, forests)?

As noted above, the POW has had limited impact on water-related policy in Canada, but effective water governance mechanisms are already in place and are achieving equivalent results.

6. Are the linkages between inland water biodiversity and sustainable human development (and poverty reduction) adequately understood and considered in relevant policy making?:

A *Federal Sustainable Development Act* recently came into force (June 2008). Its purpose is to "provide the legal framework for developing and implementing a Federal Sustainable Development Strategy that will make environmental decision-making more transparent and accountable to Parliament. Under this new Act, "The Government accepts the basic principle that sustainable development is based on an ecologically efficient use of natural, social and economic resources and acknowledges the need to integrate environmental, economic and social factors in the making of all decisions by government."

Most Canadians appreciate the importance of freshwater for their well-being and livelihood. There is also a growing appreciation of the wider ecological goods and

services available and the well-being of freshwater biodiversity. Canada will continue to enhance and strengthen federal, provincial, territorial and international collaboration to address shared water priorities. One of these mechanisms to achieve collaboration is via the *Biodiversity Outcomes Framework for Canada.* The framework was developed jointly by federal, provincial and territorial governments, as a tool to manage, measure, and report on biodiversity conservation in Canada and to assist governments in more directly engaging Canadians in conservation planning, implementation and reporting. . http://www.cbin.ec.gc.ca/strategie-strategy/6.cfm?lang=eng

a. regarding the importance of the direct use of inland water fauna and flora (e.g., fisheries, medicinal uses etc.)?

The Canadian Council of Fisheries and Aquaculture Ministers, composed of federal, provincial and territorial ministers responsible for fisheries and aquaculture, plays an important national coordination role on issues involving use of aquatic species. Through cooperative agreements with provincial government agencies, Fisheries and Oceans Canada works toward conservation and protection of inland freshwater fisheries, such as in the Great Lakes and Lake Winnipeg. The federal mandate for aquatic fauna and flora is largely focused on the conservation and management of marine fisheries on the Atlantic, Pacific and Arctic coasts. This federal mandate affects species such as salmon that divide their lives between freshwater and the oceans. The federal mandate covers all fish habitat as specified in the Fisheries Act. The Department of Fisheries and Oceans has lead responsibility for aquatic species under the Species at Risk Act and Aquatic Invasive Species programs.

Environment Canada administers *The Migratory Bird Convention Act*, 1994 and *Migratory Bird Regulations,* which apply to waterfowl. Subsection 6(a) of the *Regulations* states that: "no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird except under authority of a permit therefore." Other (non-mandated) national committees and structures, such as the Canadian Wildlife Directors Committee, influence the development and implementation of policies related to sustainable use and conservation of inland water fauna.

b. regarding the role of inland water biodiversity (ecosystems/wetlands) in sustaining freshwater for human uses?

The 1991 Federal Policy on Wetland Conservation promotes wetland conservation throughout the full range of federal decisions and responsibilities. Among the wetland ecological functions recognized by the Policy is "water recharge, providing natural purification and storage of freshwater for humans and wildlife." The Policy is not a regulatory document, but the federal Cabinet directed that it should be applied to all policies, plans, programs, projects, and activities carried out by the federal government. A 1996 Implementation Guide for the Policy assists federal land managers in making

decisions that may affect wetlands, such as granting permits, constructing facilities, buying, selling or leasing land, or land use planning.

c. regarding the role of inland water ecosystems in the provision of other services (nutrient recycling, flood management, adaptation to extreme weather events)?

All provinces and territories have programs that aim to reduce vulnerability to current climate variability and extremes. Examples include Alberta's *Water for Life Strategy*, the *Water Conservation Plan* in Saskatchewan, the *Manitoba Crop Insurance Corporation Programs,* Ontario's *Emergency Management Act*, and the New Brunswick *Coastal Areas Protection Policy* (http://www.c-ciarn.ca/primer/page10_e.html).

Addressing high-impact weather and climate events is a priority science commitment for Environment Canada (http://www.ec.gc.ca/sd-dd_consult/DPR2004Table_e.html). This includes hydrological science initiatives such as the Drought Research Initiative and the improved parameterization, process and prediction initiative, which are both funded through Canadian Foundation for Climate and Atmospheric Sciences and involve universities from coast to coast. Several programs aim to improve hydrological land-surface modeling as part of the weather prediction infrastructure.

At the municipal level, the Greater Vancouver Regional District is developing Integrated Stormwater Management Plans that integrate climate change scenarios with watershed health, land-use planning, engineering, and community values (http://www.metrovancouver.org/planning/ClimateChange/ClimateChangeDocs/Forms/AllItems.aspx).

d. is the problem lack of awareness of these, and other, roles that inland water ecosystems play or lack of appreciation of their values (or both)?

Canadians see Canada as a water rich nation and may not fully appreciate the value of inland water ecosystems, but awareness of risks posed by climate change to freshwater supply is growing. In 2007, water supply was mentioned by only 4% of people surveyed as a major concern *(Ipsos Reid, Canada's Water Supply, March 2008).* In March 2008, Canadians indicated climate change (23%) and air pollution (20%) to be of highest concern, and 9% of those surveyed were concerned about long-term supply of freshwater.

Ducks Unlimited Canada is conducting research on the value of the ecological goods and services provided by wetlands, documenting their economic and societal roles such as carbon sequestration and water purification.

The National Round Table on the Environment and the Economy (NRTEE) is undertaking a new research program on Water and Canada's Natural Resource Sectors. It will engage industry sector leaders and other stakeholders in:

- identifying critical issues and opportunities associated with the water, natural resource and climate change interrelationship; and
- catalyzing the design and implementation of new policies, approaches and mechanisms through which water can be managed to foster both ecosystem health and economic sustainability of the sectors.

Canada has recently started work in water valuation in order to assist in water management decision making. So far, the data collected for water valuation is limited. Environment Canada hosts the Environmental Valuation Reference Inventory (EVRI) in partnership with other countries. The EVRI database contains around 700 published studies on environmental valuation. Of these, 70 are Canadian studies and 27 of these relate to water (http://www.evri.ca).

7. What is the level of awareness and attention to the importance of inland water biodiversity in relation to climate change?

a. are people adequately aware that the main impacts of climate change are on water, therefore, not only are inland water ecosystems particularly vulnerable to climate change but their functions play a key role in adaptation measures to deal with the impacts of climate change (for example, responding to the increasing frequency and severity of droughts and floods)?

It is well recognized that climate change threatens water supply in Canada. Asked if they believed that climate change will impact Canada's supply of clean freshwater, 75% of Canadians said "yes." (Ipsos Reid, Canada's Water Supply, March 2008). Numerous reports have identified Canadian water resources as one of the highest priority issues with respect to climate change impacts and adaptation (e.g., Cohen and Miller 2001). There is also some awareness that components of inland water biodiversity are vulnerable to climate change.

In contrast, there is much less awareness that conserving and restoring inland water ecosystems, particularly wetlands, is a highly effective means of mitigating potential negative impacts of climate change (e.g., floods, drought, and reduced water supply). Understanding of the ecological goods and services provided by inland water ecosystems, including groundwater recharge, flow regulation and flood control, and hydrologic recycling of water from land surfaces to the atmosphere, remains limited.

This is illustrated by the Government of Canada's report, *Climate Change Impacts and Adaptation: A Canadian Perspective*, which detailed the results of impacts and adaptation research between 1999 and 2004. It examines specific sectors (water resources, agriculture, forestry, fisheries, coastal zones, human health and well-being, transportation, etc.) within major Canadian biomes (http://adaptation.nrcan.gc.ca). For example, the report on the Prairies emphasizes risks posed by climate change to water resources, but gives minimal attention to ecosystem services provided by inland water ecosystems. The "tag line" for this report says that "increases in water scarcity represent

the most serious climate risk in the Prairies". However, in terms of mitigating these risks, the report merely states that

> Anecdotal evidence suggests that owners and managers of agricultural land are giving more thought to restoring natural storage and traditional practices, such as rainwater collection systems, and using the storage capacity of wetlands and riparian ecosystems. However, the large scale of modern farming is a barrier to the restoration of wetlands, as wetland restoration may result in greater inefficiency of operating large farm equipment and may require compensation for flooded cropland.

b. and therefore, is there adequate attention to the fact that climate change significantly increases the importance of the POW in relation to sustainable human development?

Inadequate attention is being given to the role of inland water ecosystems - particularly wetlands - in enabling sustainable development to proceed in the face of climate change.

The POW, while containing several references to ecosystem services provided by wetlands, makes no connection between ecosystem services and climate change apart from a reference to carbon sequestration and peatlands in activity 1.1.10(c). Also, there is only one specific reference to hydrologic services in the POW (in activity 2.2.2).

8. Is there adequate awareness at policy and planning level of the need to consider managing the "ecosystem services" provided by inland water ecosystems?:
a. do relevant policy makers (including in all relevant sectors) understand the concept of "ecosystem services" (even if using similar but alternative terminology) and do they use this as a framework for planning? For example, this approach would involve some level of trade off decision making in order to balance the services that are provided.
b. alternatively - do policy makers and planners still manage water on a sector basis (and relatively independently of each other) and by looking at tangible products such as food produced, or water extracted for direct human use, e.g., urban water supplies), largely disregarding other services? This approach would tend to give less attention to trade off decision making.
c. is there adequate awareness of the importance and value of the many other services provided (particularly those which currently have no "formal economic value" – such as climate regulation, freshwater regulation, nutrient recycling, mitigating the impacts of extreme weather etc.)?
d. is the problem the decision making process in terms of infrastructure/governance/dialogue, or lack of awareness of values of services?

Water is an essential resource for important areas of Canada's economy such as agriculture, pulp and paper, oil and gas, electric power generation and transportation, as well as tourism and other recreational uses. Policy makers at all levels of government recognize the value of Canada's freshwater resources and work to restore, conserve and enhance Canada's aquatic natural capital by ensuring that Canada's water is clean, safe and secure and that aquatic ecosystems are conserved and protected.

That being said, the concept of "ecosystem services" is just beginning to be used in planning frameworks and in decision-making trade-offs.

Environment Canada, which has the lead for water at the federal level, works in collaboration with other federal departments, provinces and territories (individually as well as through the Canadian Council of Ministers of the Environment), through science networks related to work on the environment, and with the public (including non-governmental organizations, academia and municipalities). This collaborative work allows Environment Canada to share information; determine priorities for monitoring and research; provide timely and integrated scientific information and advice to decision-makers; build best management practices; and promote sustainable water management in Canada for the efficient use of Canada's water.

Provinces are the primary managers of water and are responsible for much of the environmental regulation and policy making that affects water issues. Each province has a comprehensive water management policy with supporting legislative frameworks, and most have developed and are implementing integrated water resource management strategies. Examples include:

- Water for Life: Alberta's Strategy for Sustainability (www.waterforlife.alberta.ca/)
- Living Water Smart: BC's Water Plan (www.livingwatersmart.ca)
- Manitoba Water Strategy (www.gov.mb.ca/waterstewardship/waterstrategy/index.html)
- Quebec Water Policy (www.mddep.gouv.qc.ca/eau/politique/index-en.htm)
- Nova Scotia's Water Resources Management Strategy (www.gov.ns.ca/nse/water/WaterStrategy.asp)

Canada's new ***Growing Forward*** agricultural policy framework, signed in July 2008, illustrates how the ecosystem services concept is becoming mainstreamed. This federal-provincial-territorial initiative aims at supporting a profitable and innovative agriculture and agri-food sector in Canada. It recognizes that governments and industry each have a role to play in good stewardship of land, water and resources. The parties to this framework agree to work toward specific policy outcomes, including "the capacity to meet the need for strong environmental stewardship and to deliver ecological goods and services". Specific components include watershed evaluation of beneficial management practices; on-farm agri-environmental risk assessments that that cover risks and benefits associated with air, water soil and biodiversity; and funding to help producers improve

riparian area management, grassland management, protect water quality and reduce greenhouse gas emissions (http://www.agr.gc.ca/index_e.php).

Greater awareness of the values of ecosystem services and the costs of damages (e.g., Dodds et al. 2009) will improve decision-making and inform trade-offs.

9. Which convention has the most influence on relevant inland water related policies and policies in areas which impact water (e.g., agriculture) in your country?
a. CBD?, Ramsar?, CBD and Ramsar jointly?, or none? (if other more influential regional conventions/agreements are applicable please specify)
b. If you are not a Party to Ramsar – is Ramsar guidance still used as a means to guide relevant policies and activities?

Neither the CBD nor the Ramsar Convention on Wetlands is having a significant impact on Canada's inland water related domestic policies. Ramsar is seen largely as a protected areas convention by virtue of its List of Wetlands of International Importance.

Conversely , the benefits of ensuring that global agreements reflect integrated approaches is well recognized.

10. The CBD has many other programmes of work, the majority of which also influence the status and trends of inland water ecosystems:
a. is there adequate attention to the objectives and activities of the POW on inland waters in these other POWs (e.g., agricultural biodiversity; marine and coastal; mountains; dry and sub-humid lands; forests)?

Inland waters biodiversity receives far less policy attention than other CBD programmes of work. For example, there is still very little appreciation that peatlands are far more important than forests as global carbon sinks.

11. Has your country shifted policies (within the past 10 years or so) towards the rehabilitation and/or restoration of the functions inland water ecosystems? If so – what was the *main* driver of (reason for) this shift in policies?
a. "economic" reasons, for example - based on financial cost-benefit considerations (which ones? e.g., more cost effective water management – including flood regulation?, more cost effective water supplies for human uses? etc.)
b. to rehabilitate rural livelihoods among the poor (e.g., rehabilitating food supply from fisheries, to rehabilitate drinking water supplies etc.)?
c. recreation/tourism/cultural reasons (including recreational fisheries)?

d. “nature conservation” in its own right (e.g., endangered species protection)

Previous efforts towards the rehabilitation and/or restoration of inland water ecosystems were based on pollution control. For example, the 1987 Canada-U.S. Great Lakes Water Quality Agreement where Canada committed to remediation 17 Areas of Concern (12 domestic and five shared with the US). The updated GLWQA and other recent agreements addresses ecosystem, economic and social threats and includes a model of governance that is more ecosystem-based.

Canada has committed to its Action Plan for Clean Water to help clean up Canada's major lakes and oceans and improve access to safe drinking water for First Nations. The plan focuses on improving the quality of drinking water, cleaning up polluted waters, better understanding and predicting changes in water levels in basins such as the Great Lakes, and protecting key ecosystems. So far, investments have been made in the Great Lakes and in lakes Simcoe and Winnipeg.

Throughout these activities a comprehensive, outcomes-based approach will be used, focusing on the following: healthy and diverse ecosystems, viable populations of species, access to genetic resources and sustainable use of biological resources. (http://www.tbs-sct.gc.ca/rpp/2008-2009/inst/doe/doe01-eng.asp)

Restoration and conservation of inland water ecosystems particularly wetlands- has long been a priority of government agencies and non-government organizations concerned with wildlife, such as the Canadian Wildlife Service and Ducks Unlimited Canada. Interest in this topic has broadened in the past decade to include a range of government agencies and non-government organizations concerned with agriculture and municipal planning, as seen in new initiatives related to “ecological goods and services”. Canada’s Biodiversity Outcomes Framework, approved by Ministers responsible for Environment, Forests, Parks, Fisheries and Aquaculture, and Wildlife in October 2006, calls for “reducing human impacts”, “restoring damaged ecosystems” and preserving “goods and services essential to our well-being”.

Locally-based integrated watershed management bodies and an economic perspective regarding cost-effective water management are helping drive this shift. Climate change considerations such as carbon sequestration in wetland soils are also starting to have some policy influence.

However, older agricultural policies, legislation and programs that promote wetland drainage and conversion remain in effect, contributing to lack of policy coherence and weakening the implementation of new policies.

12. What is the level of importance (balance) placed on this programme of work/subject in appropriate biodiversity related policy arenas in relation to other POWs/subject areas?:

a. in relation to the conservation of threatened species? (high, medium, low)
Low
b. in relation to importance for human development (and development targets)? (high, medium, low)
Low
c. should the *relative* importance of this subject area be higher or lower?
Higher
d. if this subject area needs a higher profile – what are best grounds (basis/arguments) and the key ways and means to achieve this?

Endangered species are accorded a high priority among biodiversity policy issues. . Canada's *Species at Risk Act*, which came into force in June 2003, occupies much of the biodiversity "policy space" at the federal level in Canada. Although integrated watershed management is in widespread use within Canada it tends to be aimed more at securing water supplies and protecting source water from pollution than at biodiversity issues. However, awareness is growing that an ecosystem approach to inland water ecosystems provides advantages in addressing multiple species at risk.

Much more emphasis needs to be placed on how wetland conservation and restoration can simultaneously achieve climate change, water, and biodiversity objectives. Greater awareness among policy makers of the economic value of the ecological goods and services provided by inland water ecosystems is needed.

13. What is the level of attention to this programme of work beyond the "environment sector"?:
a. amongst the production sectors (agriculture, forestry, fisheries etc.)?
b. is the private sector actively engaged in this POW? (please provide examples) ?

Freshwater resources are critical to Canada's natural resource sectors: agriculture, energy, fisheries, forestry, and minerals and mining. These sectors must pay significant attention to water management challenges and their implications for productivity. While the programme of work has received little if any attention in production sectors or in the private sector, current initiatives are achieving relevant outcomes. Recent developments (Natural Resources Canada 2007) include:

Government regulation
Effluent quality has improved considerably in recent decades, driven largely by the introduction of provincial and federal regulations. The Canadian Environmental Protection Act (CEPA) assists governments in controlling toxic chemicals throughout their life-cycle – from their development, manufacture, transport, distribution, use and storage, to their ultimate disposal. A number regulations, codes of practice and guidelines under CEPA and the Fisheries Act—e.g., the Pulp and Paper Effluent Regulations (PPER) and Metal Mining Effluent Regulations (MMER)—have reduced contaminants

significantly. Regulations are also being proposed to reduce Municipal Wastewater Effluent (MWWE)—one of the largest sources of pollution, by volume, discharged to surface water bodies in Canada.

Voluntary initiatives
Growing consumer advocacy and environmental awareness has led to the development of voluntary environmental management systems.

- The Forestry Sector has three forestry certification programs for forest management.
- The Minerals and Metals Sector has environmental codes of practice for metal mines, and base metal smelters and refineries, as well as the Toward Sustainable Mining (TSM) initiative.
- Sustainability indexes are external benchmarking initiatives that rate company sustainability performance for investors and the public.
- ISO 14000 environmental management standards exist to help organizations minimize their operations' negative impacts on environment, and comply with laws, regulations, and other environmentally oriented requirements.

Best practices
Recent industry initiatives have included:

- The Mining Association of Canada (MAC) has developed guidance for the management of tailings facilities.
- Unilever's Commitment to Water Sustainability – A series of initiatives put in place by Unilever Canada to enable its business to grow without increasing its water footprint, whether in its own operations, in the supply chain or consumer use of its products (*www.unilever.ca*)
- Coca-Cola Ltd. and Coca-Cola Bottling Company have committed to meet water conservation and greenhouse gas (GHG) emission reduction targets for their Canadian manufacturing facilities. They have also made a four-year, $1 million commitment to WWF-Canada to fund freshwater expertise, work with First Nations, communities, forestry companies and other interested parties to undertake conservation planning within the Skeena watershed in British Columbia (*www.cocacola.ca*)
- Multi-Stakeholder Approach (Alcan) – Organization of a multi-stakeholder council to discuss and build consensus on watershed issues in British Columbia (*www.alcaninbc.com/pages/ehs-first/watershed-management.php*)

14. What areas in the programme of work:
a. are the most critical?
b. are missing or need to be strengthened?

Experience in Canada confirms the importance of an ecosystem approach for conserving and sustainably using water resources – often known as integrated watershed management. The programme of work does not sufficiently emphasize that conservation of inland water ecosystems is crucial for sustaining ecological goods and services –

particularly freshwater supply given the anticipated impacts of climate change and future growth. The role of biodiversity conservation in enabling continued supply of goods and services from inland water ecosystems needs greater emphasis. It should be stressed that wetlands are hotspots of both biodiversity and ecosystem services and the economic/social value of ecological restoration of wetlands should be emphasized.

15. Please summarise what the critical issues are with this programme of work in terms of:
a. enhanced implementation
b. addressing barriers
c. technical or political constraints

Canada's experience to date confirms the importance of fostering an enabling environment based on integrated watershed management principles very similar to those in the programme of work. The following are some of the most critical elements for success, based on domestic experience:

Collaboration with the broader water resource community
Governance and coordination mechanisms are critical, particularly at the watershed level, for fostering transparency, accountability, and stakeholder involvement and collaboration. Adoption of integrated watershed management at the local level is vital and is in fact spreading across Canada and establishing a new standard for governance. As trends in watershed management continue, effective leadership will help energize stakeholders, recognize contributions made, and celebrate community successes.

Economic and legal instruments
A wide spectrum of tools needs to be applied – a "one size fits all" approach is not effective to deal with the increasing complexity of water management issues. While legal and regulatory tools act as a strong backstop, more tailored instruments can be used to suit various situations and challenges. Application of voluntary guidelines, promotion of targeted water policies, and consensus-based tools, such as accords and protocols, are an expanding part of the toolbox. There is also increasing recognition of the impacts that economic and information instruments can have, as well as the value of having transparent and structured planning processes to further lever integrated actions on water. Voluntary and consensus approaches have been shown to be ineffective when not backed by strict regulatory boundaries.

Research
Water science is a major building block for applying integrated watershed management. Water research plays an important role in helping develop environmental policy, regulations and guidelines, and instruments and tools, and in decision-making in general. Efforts continue to be made to strengthen linkages between researchers and decision-makers across governments and disciplines, as well as with other countries. For example, the Canadian Aquatic Biomonitoring Network (CABIN) is a collaborative programme developed and maintained by Environment Canada to establish a network of reference

sites available to all users interested in assessing the biological health of fresh water in Canada (http://cabin.cciw.ca/Main/cabin_about.asp?Lang=en-ca).

Monitoring and assessment
Water management information and reporting systems are needed to help guide and assess priorities and emerging issues. Active areas of collaboration include developing guidelines to assess water quality, building data collection networks, modelling, and developing indicators to report on water resource trends. For example, government and non-government partners collaborated in "Phase 1" of the Canadian Wetland Inventory, yielding significant innovations in remote sensing technologies for wetland inventory and mapping (http://www.wetkit.net/modules/1/showtool.php?tool_id=1857).

16. Please suggest the best strategies to address the critical issues identified, for example through:
a. highlighting status and trends in species?
b. addressing linkages to human development/livelihoods/poverty reduction?
c. improved valuations of ecosystem services provided?
d. technical solutions (which technical areas)?

Experience in Canada confirms the importance of fostering an enabling environment for integrated watershed management, based on principles very similar to those in the programme of work. Key implementation steps are to:

- Establish and strengthen governance mechanisms for integrated watershed management;
- Develop and improve decision support tools to analyze and guide water management, particularly at the watershed scale;
- Increase attention to quantitative assessment of cumulative impacts;
- Enhance the availability of data and information important to integrated watershed management – particularly aquatic biomonitoring, land use and cover, and hydrology - through surveys, monitoring, and enhancement of databases;
- Improve measurement and reporting systems to help guide and assess progress, through monitoring, modelling, and the development of indicators;
- Account for the full economic and social value of the ecological goods and services provided by inland water ecosystems and ensure appropriate weighting in decision-making through creation of appropriate incentives; and
- Strengthen and improve socioeconomic and physical science for water management, as a key strategy for addressing the previous steps, above.

References

Abell, R.A.; Olson, D.M.; Dinerstein, E.; Hurley, P.T.; Diggs, J.T.; Eichbaum, W.; Walters, S.; Wettengel, W.; Allnutt, T.; Loucks, C.J.; and Hedao, P. 2000. Freshwater ecoregions of North America: a conservation assessment. World Wildlife Fund – United States. Island Press, Washington, D.C.

CCSP. 2009. *Thresholds of Climate Change in Ecosystems.* A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Fagre, D.B., et al.] U.S. Geological Survey, Reston, VA, 156 pp

Chu, C.; Minns, C.K.; and Mandrak, N.E. 2003. Comparative regional assessment of factors impacting freshwater fish biodiversity in Canada. Can J. Fish. Aquat. Sci. 60: 624-634.

Cohen, S.; and Miller, K. 2001. North America; in Climate Change 2001: Impacts, Adaptation and Vulnerability, (ed.) J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken and K.S. White, contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, p. 735-800; also available on-line.

Dextrase, A.; and Mandrak, N.E. 2006. Impacts of alien invasive species on freshwater fauna at risk in Canada. Biological Invasions 8: 13-24.

Dodds, W.K.; Bouska, W.W.; Eitzmann, J.L.; Pilger, T.J.; Pitts, K.L.; Riley, A.J.; Schloesser, J.T.; and Thornbrugh, D.J. 2009. Eutrophication of U.S. freshwaters: Analysis of potential economic damages. Environ. Sci. Technol.,43:12-19

Dolbeer, R.A.; and Seubert, J.L. 2006. Canada goose populations and strikes with civil aircraft: positive trends for aviation industry. Poster Presentation for 8th Bird Strike Committee-USA/Canada meeting, St. Louis, Missouri, 21-24 August 2006. http://www.birdstrike.org/meetings/2006_papers/Dolbeer_goose.pdf

Dudgeon, D.; Arthington, A.H.; Gessner, M.O.; Kawabata, Z.-I.; Knowler, D.J.; Leveque, C.; Naiman, R.J.; Prieur-Richard, A.-H.; Soto, D.; Stiassny, M.L.J.; Sullivan, C.A. 2006. Freshwater biodiversity: importance, threats, status and conservation challenges. Biological Reviews 81:163-182.

Environment Canada. 2004. Threats to Water Availability in Canada. National Water Research Institute, Burlington, Ontario. NWRI Scientific Assessment Report Series No. 3 and ACSD Science Assessment Series No. 1.

Environment Canada. 2005. Water use in Canada, 2005. http://www.ec.gc.ca/water/en/manage/use/e_wuse.htm

Heinz Center. 2008. The Status of the Nation's Ecosystems 2008: Focus on Wildlife. http://www.heinzcenter.org/ecosystems/2008report/pdf_files/Wildlife_Fact_Sheet.pdf

Infrastructure Canada. 2008. Research Note: Integrated Water Resource Management. http://www.infc.gc.ca/research-recherche/results-resultats/rn-nr/rn-nr-2007-10-eng.html

Jelks, H.L., S.J. Walsh, N.M. Burkhead, S.Contreras-Balderas, E. Díaz-Pardo, D.A. Hendrickson, J. Lyons, N.E. Mandrak, F. McCormick, J.S. Nelson, S.P. Platania, B.A.

Porter, C.B. Renaud, J. J. Schmitter-Soto, E.B. Taylor, and M.L. Warren, Jr. 2008. Conservation status of imperilled North American freshwater and diadromous fishes. Fisheries 33(8):372-407.

Jeziorski, A.; Yan, N.D.; Paterson, A.M.; DeSellas, A.M.; Turner, M.A.; Jeffries, D.S.; Keller, B.; Weeber, R.C.; McNicol, D.K.; Palmer, M.E.; McIver, K.; Arseneau, K.; Ginn, B.K.; Cumming, B.F.; and Smol, J.P. 2008. The Widespread Threat of Calcium Decline in Fresh Waters. Science 322: 1374-1377.

Johnson, P.T.J.; Olden, J.D.; and Vander Zanden, M.J. 2008. Dam invaders: impoundments facilitate biological invasions into freshwaters. Frontiers in Ecology and the Environment 6: 357–363.

Metcalfe-Smith, J.L.; Staton, S.K; Mackie, G.L. and Lane, N.M. 1997. Biodiversity of freshwater mussels in the lower Great Lakes Drainage Basin. NWRI Contribution No. 97-90. http://www.eman-rese.ca/eman/reports/publications/nm97_mussels/intro.html

Minns, C.K., Moore, J.E., Shuter, B.J., and Mandrak, N.E. 2008. A preliminary analysis of some key characteristics of Canadian lakes. Can. J. Fish. Aquat. Sci. 65:1763-1778

National Research Council. 2008. Great Lakes shipping, trade, and aquatic invasive species. National Academy of Sciences, Washington, DC. http://dels.nas.edu/dels/rpt_briefs/St_Lawrence_Seaway_Final.pdf

SOLEC 2007. State of the Great Lakes 2007: Highlights. U.S. Environmental Protection Agency and Environment Canada. State of the Lakes Ecosystem Conference, Milwaukee, WI. http://binational.net/solec/English/sogl2007highlights_en.pdf

Zimpfer, N.L.; Zimmerman, G.S.; Silverman, E.D.; and Kone, M.D. 2008. Trends in Duck Breeding Populations, 1955-2008. U.S. Fish and Wildlife Service, Division of Migratory Bird Management. Laurel, MD