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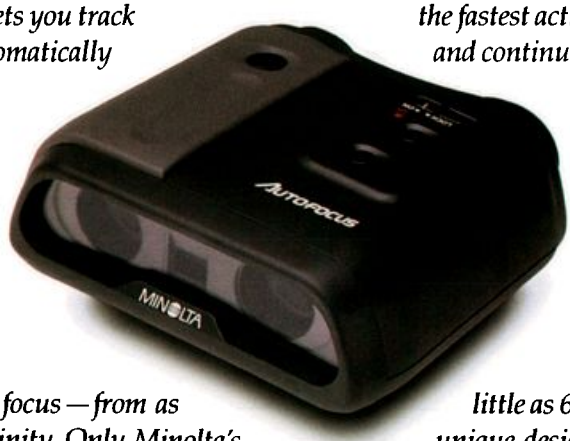

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James Bay: Birds at Risk

BY CHRISTOPHER C. RIMMER

An unprecedented ecological experiment is taking shape in the subarctic wilderness of northern Quebec — an experiment without controls, whose consequences may affect bird populations on a continental, if not hemispheric, scale. Since 1971, Hydro-Quebec has pursued a plan to dam the three major river drainages that run westward across vast expanses of boreal forest to James Bay. This massive project, the first phase of which is nearly complete, will create three of the world's largest reservoirs and generate peak hydroelectric power of roughly 27,000 megawatts, equivalent to about 13 Niagara Falls. Yet, despite the enormity of this engineering exploit, its long-term, cumulative ecological impacts are poorly known. Much is at stake, both for the indigenous Cree and Inuit people of the region and for migratory birds that depend on habitats there.

Harlequin Ducks may soon be flooded out of their habitat.

PHOTOGRAPH TIM FITZHARRIS/VIREO

The coastlines of James and Hudson bays constitute an immense, natural migratory funnel through which millions of subarctic and arctic breeding waterfowl, shorebirds, raptors, and passerine birds pass during spring and fall migrations. The James Bay coast has been identified as an area of critical international importance for a number of waterfowl and shorebird species (e.g., Morrison and Harrington 1979). The flat topography, relatively warm temperatures, moderate tidal ranges, and brackish conditions have resulted in numerous shallow bays, wide coastal marshes, and intertidal flats with highly productive vegetational and invertebrate food resources (Morrison and Gaston 1986). During migration these habitats attract huge concentrations of birds, which feed intensively and accumulate energy reserves that are crucial to many species.

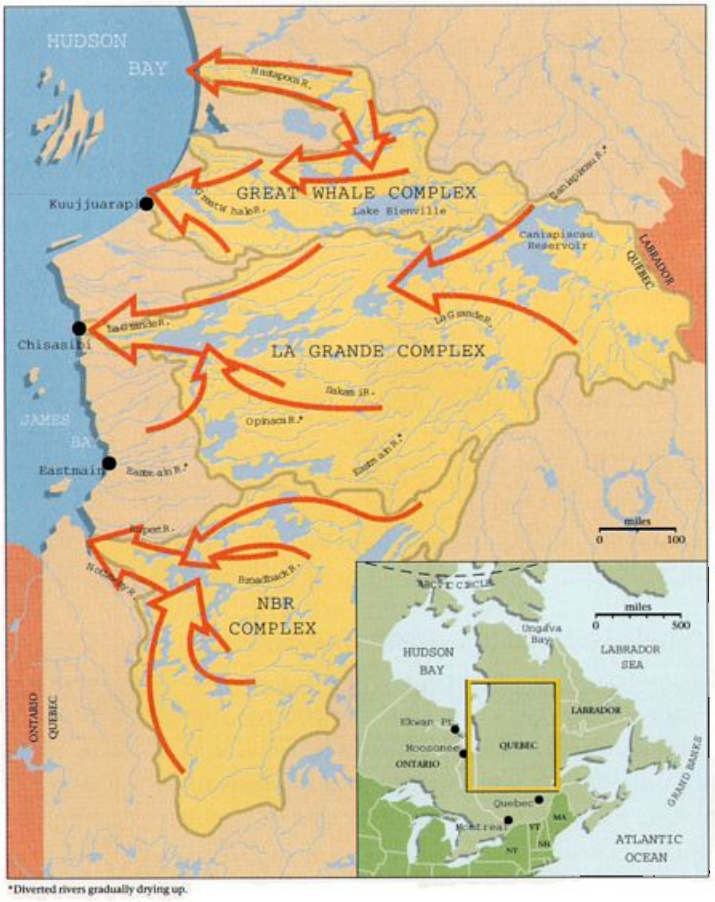
THE ENVIRONMENT

James Bay is an estuarine ecosystem, characterized by two major types of coastline (Morrison and Gaston 1986). The eastern (Quebec) coast consists of a broken, indented shoreline with rocky outcrops and numerous small bays and hilly islands. Many of the bays support significant populations of eelgrass (*Zostera marina*), an extremely important food source for many waterfowl (Curtis and Allen 1976). The low-lying, poorly-drained west (Ontario) coast is characterized by a uniform, gentle slope and tidal ranges of up to 3 meters, contributing to the development of extensive (several kilometers wide) intertidal flats and salt or brackish marshes. Exceptionally productive plant and invertebrate communities compensate for a short growing season. In addition to eelgrass, sedges and marsh grasses provide important food sources, particularly for waterfowl. Bivalves and other molluscs may reach densities of several thousand individuals per square meter, while mosquitoes

and biting flies have been estimated at five million per acre (Martini et al. 1980).

HYDROELECTRIC PROPOSALS

It is the large and fast-flowing river systems running into James Bay from the east that Hydro-Quebec intends to harness. The overall development is planned in three phases, each involving major diversions of existing rivers, the construction of numerous huge dams and dikes, and the installation of several power stations. At the scheduled completion of James Bay I (the La Grande complex, begun in 1971) in 1996, four rivers will have been diverted into a fifth, nine generating stations with a 15,719 megawatts capacity will have been installed, and 11,505 square kilometers of land will have been flooded. James Bay II, the Great Whale or La Grand Baleine project, is next on the construction schedule, but its future is uncertain, due mainly to concerted opposition from Native peoples, conservationists, and human rights activists. This phase will divert three rivers, flood 1,786 square kilometers of land in creating a 3,576 square kilometers reservoir, and be capable of delivering 3,168 megawatts from its three power stations. James Bay III, the Nottaway-Broadback-Rupert complex, would divert two large rivers into a third, affecting a watershed of some 130,060 square kilometers. The reservoirs created will have a surface area of 6,500 square kilometers, of which 3,900 square kilometers would be newly flooded land. In this scheme, eight generating stations would produce 8,400 megawatts (Hydro-Quebec, unpubl. data).



*Diverted rivers gradually drying up.

Begun in 1971, and scheduled for completion in 1996, the La Grande Complex will have diverted four rivers into a fifth.

MAP GREG WAKABAYASHI

ENVIRONMENTAL IMPACTS

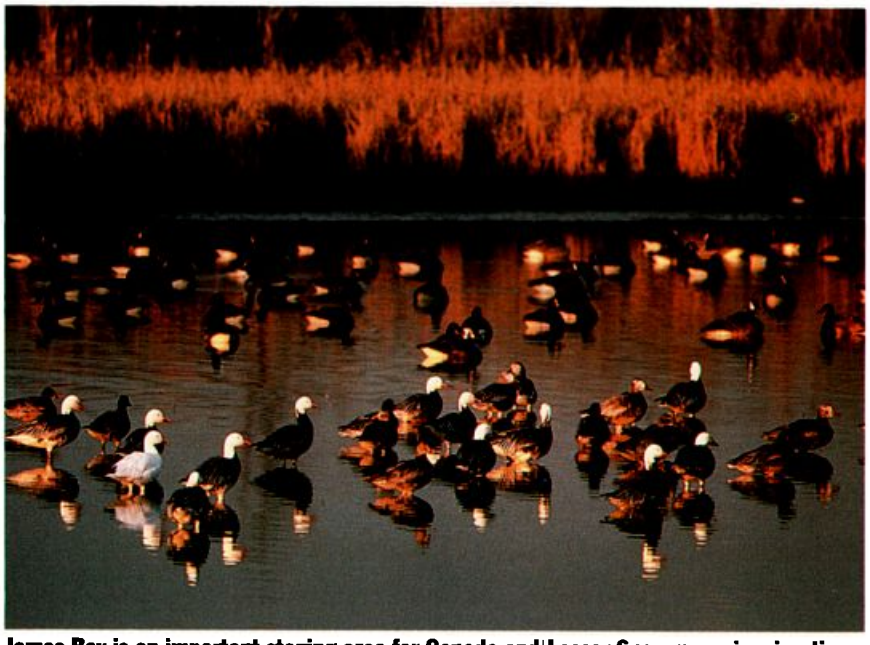
Ultimately, an ecosystem the size of California will be affected by the disruption of the waters in it. An area of more than 17,000 square kilometers of land will be inundated. Some of the direct and more localized environmental impacts are obvious. A number of productive lowland, wetland, and riverine areas have been and will be lost, their wildlife inhabitants permanently displaced. Fish spawning beds have been and will be destroyed. Methylmercury contamination in reservoirs of the La Grande complex already has rendered many fish unsafe for human consumption (e.g., Hazell 1991) and poses a clear threat to fish-eating birds like loons, Bald Eagles (*Haliaeetus leucocephalus*), and Ospreys (*Pandion haliaetus*). In general, however, the direct impacts on breeding or migrant bird populations in these flooded inland areas are unknown, because baseline data needed to evaluate them do not exist.

Of greater overall concern than the direct, project-by-project effects of hydroelectric development on James Bay bird populations are cumulative, long-term effects Freshwater input from rivers and streams appears to be the single most influential physical variable on the ecology of James Bay. Freshwater runoff contributes substantially to the Bay's circulation patterns, ice formation and breakup, salinity gradients, nutrient and sediment loads, and, ultimately, regional climate (e.g., Freeman et al 1982). All of these variables drive the biological processes that result in James Bay's distinctive plant and animal communities. The cumulative effects of significantly altered river discharges from hydroelectric developments could produce physical changes that lead to profound ecological changes. Any widespread, adverse effects on James Bay's plant and invertebrate food resources could prove damaging to populations of migratory birds that rely on them.

EFFECTS ON BIRDS

A number of waterfowl species appear to be especially vulnerable to ecological changes at James Bay. The Bay is an extremely important migration corridor and staging area for Lesser Snow Geese (*Chen caerulescens caerulescens*), Canada Geese (*Branta canadensis*), and Brant (*Branta bernicla*). More than two million arctic-breeding Lesser Snow Geese congregate on coastal sedge

meadows in spring, and over 1.5 million have been recorded in fall (Curtis and Allen 1976, Prevett et al. 1979). Tens of thousands of Canada Geese and Brant stage along the east James Bay coast (Curtis and Allen 1976). All three species depend heavily on nutrient reserves accumulated at James Bay to enable successful spring reproduction and to fuel their long-distance return flights in fall. Lesser Snow Geese and Canada Geese feed primarily on salt marsh vegetation, while Brant rely exclusively on eelgrass beds. Perturbations to these habitats might cause significant declines in entire populations of these species. American Black Ducks (*Anas rubripes*), a species of management concern in the northeastern United States, are abundant breeders and migrants at James Bay, particularly along the east coast (Curtis and Allen 1976). The outcome on their feeding ecology might have serious population consequences that would be reflected on their Atlantic coastal wintering grounds.



James Bay is an important staging area for Canada and Lesser Snow geese in migration.

PHOTOGRAPH R. SHALLENBERGER/VIREO

Several diving duck species that breed, molt, and stage at James Bay also appear to be at risk. Foremost among these is the Harlequin Duck (*Histrionicus histrionicus*), whose eastern North American breeding population is classified as endangered and may number less than 1000 birds (Goudie 1989). Some 200 Harlequin Ducks are thought to nest within the Great Whale project area. Their preferred habitat, fast-flowing rivers, appears likely to be completely lost to flooding. An important segment of the Atlantic coastal wintering population of Black Scoters (*Melanitta nigra*) has recently been discovered breeding within the Great Whale project area (A. Reed, pers. comm.). James Bay constitutes an extremely important molting and staging area for this species, with an estimated 200,000-300,000 individuals using nearshore waters along both coasts (Ross 1983). Direct losses of breeding habitat, combined with cumulative impacts to the benthic feeding areas of this species and its close relatives, the Surf Scoter (*Melanitta perspicillata*) and White-winged Scoter (*Melanitta fusca*), could have serious, adverse population consequences.

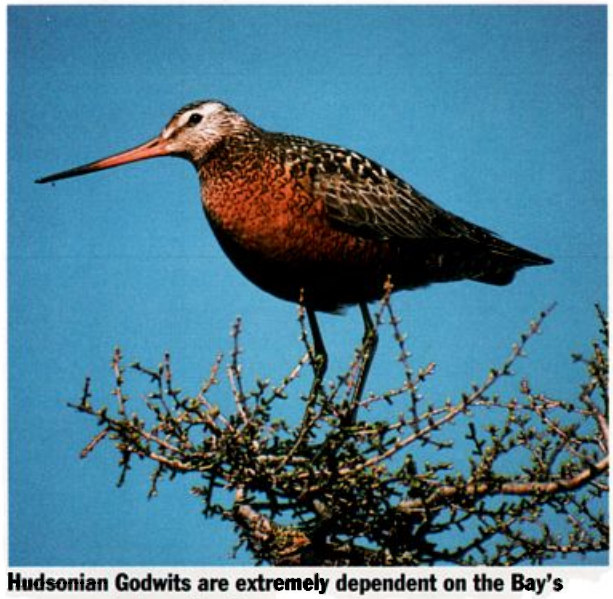
Among the many shorebird species that migrate through James Bay in spring and fall, Red Knots (*Calidris canutus rufa*), Hudsonian Godwits (*Limosa haemastica*), Semipalmated Sandpipers (*Calidris pusilla*), and Dunlin (*Calidris alpina hudsonia*) appear to depend most critically on the Bay's resources. The migration strategy of Red Knots, which depend on a very few key staging areas between James Bay and Argentina, is intimately linked to the ecology of their preferred bivalve prey, *Macoma balthica*, at James Bay (e.g. Morrison 1984). Disruptions to James Bay populations of Macoma could prove disastrous to North American Red Knots. Most Hudsonian Godwits undertake non-stop transoceanic flights of at least 4,500 kilometers from James Bay staging grounds to South America (Hagar 1966, Morrison and Harrington 1979). The energy reserves stored through intensive feeding at James Bay, primarily on *Macoma balthica*, are thought to be essential in making this spectacular migration possible. Cumulative ecological changes affecting the productivity of their invertebrate food resources might seriously threaten the entire eastern breeding population of this species. Semipalmated Sandpipers from central and eastern arctic breeding populations rely on a few restricted sections of the James Bay coast to accumulate the energy reserves that must carry them to farther Atlantic coastal staging areas (e.g Morrison 1984). Disruptions in this vital link of their annual cycle could seriously impair their ability to migrate successfully. James Bay constitutes an important molting ground for central arctic breeding populations of Dunlin. This species is unique among migrant shorebirds using James Bay in undergoing a complete molt of flight and body feathers prior to continuing south to wintering areas on the United States Atlantic and Gulf coasts. Ecological perturbations affecting the feeding efficiency of Dunlin on James Bay might inhibit the successful completion of this molt, as well as their ability to prepare physiologically for subsequent migratory flights.

Although waterfowl and shorebirds are the only groups adequately studied thus far at James Bay, detailed studies are needed on the habitat requirements, feeding ecology, breeding status, and migration patterns of most species. Knowledge of other bird groups using

James Bay is fragmentary at best. Particularly lacking is an understanding of the importance of James Bay's coastal and inland habitats to Common and Red-throated loons (*Gavia immer* and *G. stellata*), wading birds (herons, cranes, and rails), gulls and terns, raptors (eagles, hawks, falcons, and owls), and passerines. Virtually nothing is known about bird distribution and ecology in the offshore waters of James Bay. It is premature to assess the consequences of direct or cumulative impacts of hydroelectric developments on species in any of these groups, but risky to assume that none will occur.

For many waterfowl and shorebird species, direct migratory connections have been documented between James and Hudson bays and states or provinces to the south. For example, between New York State and James and Hudson bays alone, 1608 band recoveries of waterfowl and 195 sightings of color-marked shorebirds have been recorded (Rimmer 1992). These include 629 Canada Geese, 577 Brant, 200 American Black Ducks, 127 Mallards, and 175 Semipalmated Sandpipers. If James Bay populations of any of these species decline, the impacts to New Yorkers alone could be pronounced in the case of economically and recreationally valuable birds like Canada Geese and Brant. For birders, diminished populations of Semipalmated Sandpipers or Hudsonian Godwits would pose an equally disturbing, if less tangible, loss.

Concern for the fate of James and Hudson bays' migratory birds is widespread. Recognizing the ecological complexities involved in hydrodevelopment of the region and the paucity of adequate bird population data, conservation organizations such as the International Council for Bird Preservation (both in Canada and the United States), the National Audubon Society (Beyea et al. 1990), and the Canadian Nature Federation have urged a comprehensive environmental review of Hydro-Quebec's entire proposed scheme. So little is known, yet so much is at stake. This much is certain: the James Bay ecosystem is a vitally important avian staging area where seasonally abundant food resources are converted to fat and protein reserves. These energetic stores are essential as fuel supplies, both to enable long, non-stop flights over broad ecological barriers in fall, and to permit maintenance of body condition necessary for successful reproduction in spring. Significant disruptions to this vital link in the annual cycle of many migrant species will likely have far-reaching and adverse consequences.



Hudsonian Godwits are extremely dependent on the Bay's resources during migration.

PHOTOGRAPH: SAM FRIED/VIREO

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