Cahiers de géographie du Québec

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J. R. Bider

Volume 20, numéro 50, 1976

URI : https://id.erudit.org/iderudit/021327ar
DOI : https://doi.org/10.7202/021327ar

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Éditeur(s)

Département de géographie de l'Université Laval

ISSN

0007-9766 (imprimé)
1708-8968 (numérique)

Découvrir la revue

Citer cet article

Bider, J. R. (1976). The Distribution and Abundance of Terrestrial Vertebrates of the James and Hudson Bay Regions of Québec. *Cahiers de géographie du Québec*, *20*(50), 393–407. https://doi.org/10.7202/021327ar

Résumé de l'article

Grâce à des études de plus en plus nombreuses entreprises dans le nord du Québec nous avons un aperçu plus précis des ressources animales et de leur répartition. Un examen rétrospectif nous indique que la répartition des animaux semble dans la plupart des cas reliée à la répartition des aires riches en nutriments, tout comme la répartition des animaux dans le désert se fait en fonction de l'eau. Environ 50% de toute activité animale estivale se produit sur de vastes étendues d'habitat pauvre qui englobe 90% environ du territoire. Dans ces régions, les nutriments en faible concentration sont utilisés au bord des lacs ou dans les systèmes aquatiques rapides où ils sont captés et transformés par le processus des chaînes alimentaires en une variété de carnivores **tels** qu'on en trouve près de tous les rapides importants.

Dans la riche région de la mer de Tyrrell, les facteurs principaux qui semblent affecter les populations animales sont le drainage du sol et la turbidité de l'eau. La réduction du couvert végétal forestier semble avoir un effet sur les changements de composition des espèces plutôt que sur la fonction des animaux. En tenant compte des facteurs ci-haut mentionnés et des habitats connus des animaux, on peut diviser le Nouveau-Québec occidental en six zones zoogéographiques, dont trois sont affectées par les riches dépôts marins de la mer de Tyrell, la topographie et le climat, et les trois autres par les sols glaciaires extrêmement pauvres et par leur topographie et leur climat.

CAHIERS DE GÉOGRAPHIE DE QUÉBEC,
Vol. 20, No 50, septembre 1976, 393-408

THE DISTRIBUTION AND ABUNDANCE OF TERRESTRIAL VERTEBRATES OF THE JAMES AND HUDSON BAY REGIONS OF QUEBEC

by

J. R. BIDER

Department of Renewable Resources
Macdonald College of McGill University
Ste-Anne-de-Bellevue, Québec HOA 1C0

The classification of large geographic areas into biotic provinces has been used to convey the idea that if one goes to the middle of two adjacent provinces one should perceive a difference in the groupings of animals. This does not mean that one will necessarily see different species but rather that by and large there will be consistent differences in the proportions of different populations in the two areas. Differences will therefore be noted mostly in the relative importance of species within communities between different biotic provinces. The object of this paper is to try to order the salient factors which influence the well-being or success of populations in the James Bay and southern Hudson Bay regions of Québec, to suggest some limits to the biotic provinces of the region, and to describe their most important differences [1].

The simple correlation between animals and vegetation, or more rarely specific floristic elements, has limited application in the north and might even tend to draw our attention away from more important factors which affect the distribution and abundance of animals. To the correlation between specific vegetation types and specific herbivores, one must add the dimensions of time, density, productivity, and above all, the dynamic state of the animal populations. After five years observations, I believe that the edaphic conditions are the primary limiting factors in the north, and that other factors such as weather elements do little except to ultimately limit the distribution of heterotherms and plant species which in turn affect the distribution of specialized herbivores. An examination of the role of these factors as they affect distribution of species should help to delimit the biotic provinces of Radissonie.

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[1] I am extremely indebted to Hydro-Québec, La Société d'Énergie de la Baie James, Beauchemin Beaton Lapointe Ltée., and the Macdonald Raptor Research Centre, all of whom gave me tasks which allowed me to see and sometimes understand many areas in our large, awesome and sometimes enchantingly beautiful Nouveau-Québec. Most of the reference material consulted by the author derives from unpublished reports prepared by Hydro-Québec and the Société d'Énergie de la Baie James. For this reason, the titles of such reports are not cited.

THE QUALITY AND DISTRIBUTION OF WILDLIFE HABITATS

From an edaphic point of view the greatest part of the north is extremely poor. Two redeeming factors which somewhat compensate for this are the rich marine deposits such as those found in coastal areas of northern Québec and the occasional relatively flat expanses in which organic matter and eroded nutrient richer soils have accumulated. Although the clay deposits of the Tyrrell sea once covered a vast area which extended beyond 100 km from the coast in many areas of the James Bay region the total clay area is now much reduced. Marine clays can still be found in large expanses in flat areas adjacent to James Bay, however they remain only in lake bottoms and valleys in the more abrupt landscape adjacent to Hudson Bay.

All plant successions on rich sites are not of equal value to wildlife and this is most apparent on the clay sites of the James Bay region. The poorly drained sites which are covered predominantly with mosses and ericaceous plants seem to be of little use to terrestrial vertebrates. In contrast, the aquatic sites or well drained sites in the clay belt seem to produce vegetation structures which are apt to support a great many forms and number of terrestrial vertebrates. In one study underway in the James Bay region it was determined that only about four to five percent of the area comprised willow stands which indicate the presence of richer wet alluvial deposits. The scarce willow stands are most important and even curcial to forms of wildlife such as Ptarmigan (Lagopus spp.). I estimate that another five percent of this same area might comprise shallow weedy productive habitats useful to dabbling waterfowl, bits of wetland habitat such as water impoundments in sphagnum bogs which are useful to specific forms of amphibians and finally some forms of grass fens important to rodents, amphibia and waterfowl particularly geese (Anserinae). The remaining ninety percent of the region comprising poorly drained clays, tills, stone outcrops, and sand beaches supports vegetation structures of little or limited use to terrestrial wildlife.

The Importance of Size and Distribution of Productive Areas

Since animals are often gregarious it is not surprising that the distribution of the small rich « islands » of productive habitat seems to be a major factor in the utilization of such areas by less mobile species. Within the future L.G. 2 basin I have noted a few magnificent fens which should, but do not contain breeding pairs or flocks of moulting subadult geese. Two hundred km to the northwest in the Lac Bienville area where there are large concentrations of similar habitats they seem to be consistently utilized by geese. Many black ducks (*Anas rubripes*) and a few diving ducks (Anatidae) were found in an isolated few hundred hectares of good habitat north of the L.G. 2 dam site. Small isolated areas comprising a few hectares of similar habitat within 30 km seemed relatively unused by the dabbling ducks, and yet it was not uncommon to see diving ducks in these same

small isolated situations. Although these conditions probably in large part reflect the fact that the population is below the carrying capacity of the land it is certainly true that there is a minimum size of habitat that can be used by a successful group of animals.

I have used examples from waterfowl observations because they demonstrate more clearly one general problem of land utilization, that is the need for adequate size of habitat types. There are however other species which demonstrate how sometimes even a fraction of a hectare of a specific habitat can releive a limiting factor and allow a small colony of animals to be present in an area. The smallest viable unit of isolated habitat which I am aware of is a rich small remnant of an open sphagnum bog. This pond could not have measured more than 0,1 ha and yet it contained a thriving population of mink frogs (*Rana septentrionalis*), the most northern site described for this species. Similarly, everytime one sees a small island with what appears to be classical tundra vegetation in the Lac Bienville area we find a colony of arctic terns (*Sterna paradisaea*).

Feeding Strategies on Barren Lands

Because Northern Québec encompasses large expanses of all habitat conditions ranging from very poor to very rich, different feeding strategies of animals become extremely important. Where food resources are sparse it is critically important to increase the probability of contact with food resources. This condition can be met on the two dimensional terrestrial sites if animals are not sedentary, but rather relatively large in contrast to the food available within their reach, and continually on the move, or extremely small relative to the resource pockets.

The most prominent members of the animal community which meet the first option are the caribou (*Rangifer tarrandus*), bear (*Ursus americanus*), ptarmigan and many seed-eating birds such as redpolls (*Acanthis flammea*). Rodents on the other hand, which are sedentary and live within small home ranges, are never important where food resources are sparse such as in the lichen crust and ericaceous savanna areas.

The second option is represented by the myriads of planktonic forms which can utilize low levels of nutrients in a three dimensional world. The problem in this case however, gets taken to a higher trophic level. If fish were to evolve to utilize the sparse resource of plankton in poor northern lakes then they would have to move at ecliptic rates to encounter enough of the drifting food to maintain life. The energy required to meet this need (especially in an aqueous medium) would be so great that this type of fish could not evolve. The key to the system is simply to have a transformer trophic level which filters out the organic matter at locations where the food has a high probability of encountering a sessile animal. Although lakes in the north can be poor we have many situations wherein insect larvae such as those of blackflies (Diptera, Simuliidae) and caddis flies (Trichoptera), etc. simply filter out organic matter wherever there

is fast water. This is why brook trout (*Salvelinus fontinalis*) and grey trout (*Salvelinus namaycush*) and other carnivores essentially abandon lakes and are found extremely localized at fast water or near the edges of lakes in the very nutrient poor areas of the James and Hudson Bay regions. The fish resource at rapids in this nutrient poor country is the key to the very existence of a great many terrestrial forms. Dependent on this aquatic community are the insectivorous birds such as swallows, and some warblers such as the Yellow (*Dendroica petechia*) and the Wilson (*Wilsonia pusilla*), the fish-eating birds such as the mergansers (*Mergus merganser*), terns (*Sternidae*), gulls (Laridae), and ospreys (*Pandion haliaetus*) and the fish-eating mammals particularly the mink (*Mustela vison*), and otter (*Lutra canadensis*).

Faunal Changes Related to the Evolution of Plant Successions

With age and the increased accumulation of organic matter in a watershed, fast water communities can be established in smaller and slower streams however, when this happens the vertebrates which can use these resources tend to be smaller thus favouring mink for instance over otter and ultimately aquatic Northern water shrew (*Sorex palustris*) over mink. The larger fish-eating birds connot survive on the sparse and sometimes inaccessible food resource and these give way to the smaller Kingfisher (*Megaceryle alcyon*), and in this case, amphibians become very important. As shallow lakes age and accumulate organic matter filter feeding bivalves and snails eventually establish themselves and proliferate to a point where some species of ducks, scoters (*Melanitta* spp.) in particular, are quick to utilize these resources. As the soils and organic matter accumulate, marsh areas and stands of grasses establish themselves to form fens and it is in these habitats that microtine rodents and weasels (Mustelidae) become very abundant occasionally. From a terrestrial vertebrate point of view the successional stages between marsh and spruce forest involving plant communities consisting mostly of hydrophytic ericaceous plants and sphagnum mosses are extremely poor except for toads (*Bufo americanus*) and eventually shrews as the sites dry out and develop increased forest cover.

The Animals of the Interface

There are very few species which can survive exclusively on the vast expanses of homogeneous vegetation as do the caribou and bear and yet many other species in fact do survive and even flourish in the region. A large number of species live on these poor sites at the interface of major vegetation types or along water or stream edges. Two good examples of this come to mind. Red squirrels (*Tamiasciurus hudsonicus*) cannot survive on black spruce (*Picea mariana*) seeds alone because the energy requirements for feeding exceed the energy consumed. However where there are ericaceous savannas on moraines with many berries and particularly mushrooms next to spruce bogs, red squirrels do survive. They use the black

spruce for shelter and feed on its cones but spend a good deal of time foraging for larch seeds. In the fall when storage of winter food is important the red squirrels move onto moraines and jack pine barrens to collect cones and store food, particularly mushrooms which they hang in trees. A second example is that of the Canada goose (*Branta canadensis*). The goose is always associated with marshy fens of Scirpus and sedges which occur frequently in the James Bay region. Geese however need open water where they can escape and rest. Thus the large consolidated fens which are quite common in the L. G. 2 area are unoccupied while smaller fens which as yet only form the edges of shallow lakes or ponds do harbour Canada geese. Finally it was found that all species of vertebrates except the porcupine (*Erethizon dorsatum*) are significantly more active in the first 30 meters along lake edges and waterways than in areas farther from water in the James Bay region.

The Consequences of Beaver and the Creation of New Terrestrial Habitats

It was said by Aldo Leopold that the only animal in North America that increases the rate of terrestrial nutrient flow toward the sea other than man is the beaver (*Castor canadensis*). However, in the nutrient impoverished area of the James Bay-Hudson Bay region, the beaver seems to play an extraordinary role in the conservation of nutrients and the creation of suitable habitat for other species. Wherever beaver had establishes themselves it seems that animal use of the old abandoned ponds has improved dramatically. It seems the reason for this is that over the years the old dams have trapped organic matter and silt to form rich terrestrial sites. It is in these small grass ringed ponds that, for instance, large numbers of amphibians breed successfully. Although the beaver of the James Bay region frequently construct their huts and dams of black spruce, once the first dams are constructed and the conifers die, soils accumulate and willow, alders and grasses soon take over. Young newly established willow and alder are utilized by hare (*Lepus americanus*) and ptarmigan but those stems which escape destruction and become small trees soon become the food base for the beaver which will recolonize the area some years later after being trapped out. At this time there does not seem to be an indication that many new areas are being colonized by beaver and old abandoned huts and dams, still in good condition, are relatively common in the James Bay area.

Population Fluctuations and Habitat Use

The populations of animals which characterize the generalized patterns of resource utilization mentioned above by and large are stable. Changes in numbers from one year to the next at any point are likely to be a reflection of changes in migratory routes or of success at remote breeding sites as in the case of the ptarmigan. There are however among terrestrial mammals several relatively sedentary species whose populations errupt periodically. This phenomenon is well documented for several species

of rodents, the snowshoe hare and their predators, however the causes underlying these changes in populations are still being debated.

Wherever there is vigorous plant growth near the ground in the form of grasses, sedges or forbes we tend to find rodents. This kind of habitat is most often disjunct, found along stream bed bottom lands, around the margins of abandoned beaver ponds, lake and pond edges, or in narrow bands along the interface between spruce bogs and drier sites. As a result we find that the activity of rodents is significantly higher at these locations as is that of their predators, the weasels and fox (*Vulpes fulva*). Since this type of habitat is localized and represents a relatively small area and since these microtine populations have high reproductive potentials it is possible that these rodents overharvest their local resources periodically as they have been shown to do in some studies undertaken in the Arctic. Thus when grasses and forbes recover the rodents quickly catch up and soon exceed their resources within a year or two and dramatic fluctuations (possibly even cycles) are perceived. The weasels merely keep up to the microtines.

Preferred hare habitat in the region consists of vigorous open grown young spruce stands interspersed with willow birch or simply the alder and willow bottoms near soft-wood cover. In winter and when populations are high, hare expand their range into jack pine forests and old burns as long as there is enough cover. While the numbers of hare are low relative to their food resources, their numbers increase so that eventually they outstrip their habitat and the population collapses. Their predators, the lynx (*Lynx canadensis*), on the other hand continually produce the same number of young per litter and as the number of hare increases so does the survival of young lynx. The two populations fluctuate hitting peaks roughly every ten years or so, the decline of the hare population occuring one or two years ahead of that of the lynx.

For efficient resource utilization this feeding strategy is excellent. A few animals always remain in the preferred habitat which is relatively stable due to the life form of the plants such as willow and birch. The population however, responds well to new resources such as post-fire jack pine forests once these are well established (10-15 years) and before the food value of available branches becomes nutrient deficient.

Species like hare therefore play an exceptionally important role in utilizing transitory resources by means of a characteristically unstable population.

Water Turbidity and Shifts in Seasonal Use of Habitat

Now that Radissonie can easily be explored in all seasons of the year, biologists are beginning to see seasonal shifts in land use and understand the reasons for them. The most important single element which affects seasonal changes of land utilization in Radissonie is natural erosion with

large amounts of soil being carried by the spring flow of water in the Tyrrell Sea area. So turbid are the spring waters of all the major rivers in these areas that they are almost completely devoid of waterfowl during spring migration. In the fall shallow sections of these rivers which have received their annual charge of nutrients are full of luxuriant aquatic and shoreline vegetation. Thus, during late summer and fall, large numbers of waterfowl can be seen in the lower shallow slow stretches of the large rivers and in the adjacent fertile lakes. The rich willow bottom along these same shorelines are invaded by the ptarmigan and utilized throughout the winter.

It is thus apparent that the waterfowl moving northward or westward across Québec must either concentrate along the coast in narrow leads or utilize areas farther inland than the limits of the Tyrrell Sea. Most of the large bodies of water are too slow to thaw in the spring to be useful for waterfowl and the shallow ponds which do tend to thaw quickly seem to be too small to attract large numbers of migrants. Thus large numbers of migrant birds such as loons (*Gavia immer* and *Gavia stellata*), geese, brant (*Branta bernicla*), three species of scoters, and several other species of ducks in smaller number, utilize the slow flowing open waters around the discharges of large lakes or the calmer open waters below the rapids of large rivers beyond the limits of the Tyrrell Sea.

THE VERTEBRATES OF WEST AND NORTH QUÉBEC

The Heterotherms

Heterotherms (poikilotherms or cold-blooded animals) unlike homeothermic mammals and birds seem to be severely affected by the weather element, particularly temperature. Twenty-two species of heterothermic vertebrates can be found in the Saint-Jovite area of the Laurentians. In Abitibi this number is reduced to 7 or 8, and seven species have been recorded near La Grande rivière (Table 1). Between the La Grande rivière watershed and the Great Whale (Grande rivière de la Baleine) watershed there seems to be a rapid decline of species to the point where only two or probably three species reach the Leaf River watershed.

Populations of snakes and turtles are probably excluded from the northern areas because their eggs which generally are deposited in the ground could not develop within two summers. Turtle eggs in the Montréal region are laid in June or July of one year and hatch the following year. Both garter snakes (*Thamnophis sirtalis*) and red-bellied snakes (*Storeria occipitomaculata*) produce live-born young and the adult female can hasten the development of her eggs by basking in sunny locations. It is therefore not surprising that garter snakes reach as far north as the La Grande rivière, but it is surprising that red-bellied snakes do not.

North and Central America have more species of salamanders than the rest of the world put together. The largest part of these are associated to

Table 1

The Distribution of Heterotherms in Western Québec

Species			Region				
			Laurentians	*Abitibi*	*James Bay*	*Whale R. Basin*	*Ungava Pen.*
Turtles :							
Chelydra serpentina	Snapping Turtle	Chélydre serpentine	X				
Clemmys insculpata	Wood Turtle	Tortue des bois	X				
Chrysemys picta	Painted Turtle	Tortue peinte	X				
Snakes :							
Storeria o. occipitomaculata	N. Red-bellied	Couleuvre à ventre rouge	X				
Natrix sipedon	N. Water	Couleuvre d'eau	X				
Thamnophis sirtalis	Garter Snake	Couleuvre rayée	X	X	X		
Diadophis punctatus	N. Ringneck	Couleuvre à collier	X				
Opheodrys vernalis	Smooth Green	Couleuvre verte	X				
Salamanders :							
Notophthalmus viridescens	Red-spotted Newt	Triton vert	X				
Ambystoma laterale	Blue-spotted	Salemandre à points bleus	X	X	X		
Ambystoma maculatum	Spotted	Salamandre maculée	X				
Plethodon cinereus	Red-backed	Salamandre cendrée	X				
Eurycea bislineata	Two-lined	Salamandre à deux lignes	X				
Toads and Frogs :							
Bufo americanus	American Toad	Crapaud d'Amérique	X	X	X	X	
Hyla crucifer	Spring peeper	Rainette crucifère	X	X	X		
Hyla versicolor	Grey tree frog	Rainette versicolore	X				
Rana palustris	Pickerel	Grenouille des marais	X				
Rana septentrionalis	Mink frog	Grenouille du nord	X	X	X	R	
Rana pipiens	Leopard frog	Grenouille léopard	X	X	X		
Rana clamitans	Green frog	Grenouille criarde	X				
Rana catesbeiana	Bull frog	Oua-oua-ron	X				
Rana sylvatica	Wood frog	Grenouille des bois	X	X	X	X	

X : found throughout the area
R : unofficial report
Data based on composite of :

Conant, R. (1975) *A field guide to the reptiles and amphibians of eastern and central North America.* Peterson Field Guide Series (2nd Edition). Houghton Mifflin Co., Boston.
MacCulloch, R. D. and J. R. Bider. New records of amphibians and garter snakes in the James Bay area of Québec. *Can Field-Nat.* 89 : 80-82.

the wet cool montain regions. For this reason one would expect that the few species found in the Laurentians would be present much farther to the north. Such is not the case, as only one species of five has been recorded in the La Grande rivière region. It could very well be that most species have not been able to establish themselves in the north because of the prolonged droughts which tend to completely dry out the terrestrial sites where aquatic breeding salamanders spend a lot of time.

The toads and frogs fare much better than the other groups. Of nine Laurentian species more than half reach the La Grande rivière and two or three species probably reach the Leaf River (Rivière aux Feuilles) if not farther to the north. It is noteworthy that all the species which do not reach the northern latitudes are late breeders (July and August) in the Laurentians, and both the Green frog (*Rana clamitans*) and Bull frog (*Rana catesbeina*) larvae must overwinter in lakes and streams before their metamorphosis the following summer.

In summary it would seem that soil temperatures limit the snakes and turtles from Radissonie, while occasional prolonged summer dry spells limit salamanders. The early breeding frogs with quick larval development are part of the Radissonien fauna and indeed activity studies show that the toads are the most active terrestrial insectivores of the northern James Bay region.

The Mammals

As we move northward from the Laurentians to the Leaf River watershed there is a more gradual reduction of mammalian species than is seen among reptiles and amphibians (Table 2). Beyond this point there is an abrupt decline in numbers of species. For example there are 47 species recorded in the Laurentians, 36 of those are found in Abitibi, at least 29 in some of the areas adjoining James Bay, 22 in the area between the La Grande and the Leaf Rivers and seven north of the Leaf River in the Ungava Peninsula. Four Arctic species are sometimes found as far south as James Bay and up to the northern tip of the Province and the Woodland caribou (*Rangifer caribou*) is now more or less restricted to the area from Abitibi to the southern region of the Ungava Peninsula. Several older Inuits from Saglouc told me that there were some caribou in the Deception Bay (Baie de Déception) area approximately forty years ago.

Most striking in the analysis of the species list (Table 2) is that the major decline in species from the Laurentians to the more northerly regions occurs essentially among the insectivorous mammals, including the shrews (Soricidae), moles (Talpidae), and bats (Chiroptera). As both flying and biting insects are most often in adequate numbers in the north during the summer, one might expect to find insectivorous animals, however either the kinds of insects available, or the physiological or behavioural adaptations of these very small mammals are such that they do not occupy the territory. As a corollary to this it is not surprising to find extremely suc-

Table 2

The Distribution of Mammals in Western Québec.

Species			Region				
			Laurentians	*Abitibi*	*James Bay*	*Whale R. Basin*	*Ungava Pen.*
Insectivores :							
Sorex cinereus	Masked Shrew	Musaraigne cendrée	X	X	X	X	
Sorex funeus	Smoky Shrew	Musaraigne fuligineuse	X				
Sorex arcticus	Arctic Shrew	Musaraigne arctique		X			
Sorex palustris	N. Water Shrew	Musaraigne palustre	X	X	X	X	
Microsorex hoyi	Pygmy Shrew	Masaraigne pygmée	X	X	X		
Blarina brevicauda	Short-tailed Shrew	Grande masaraigne	X	X			
Condylure cristata	Star-nosed Mole	Condylure étoilé	X	X	X	P	
Parascalops breweri	Hairy-tailed Mole	Taupe à queue velue	X				
Myotis keeni	Keen Myotis	Chauve-souris de Keen	X				
Myotis lucifugus	Little brown Myotis	Chauve-souris brune	X	X	X		
Myotis subulatus	Small-footed Myotis	Chauve-souris pygmée	X				
Lasionycteris noctivagans	Silver-haired Bat	Chauve-souris argentée	X	X			
Lasiurus borealis	Red Bat	Chauve-souris rousse	X	X			
Eptesicus fuscus	Big Brown Bat	Grande Chauve-souris brune	X				
Lasiurus cinereus	Hoary Bat	Chauve-souris cendrée	X	X			
		Number of Species	14	10	5	3	
Carnivores:							
Thalarctos maritimus	Polar bear	Ours polaire			X	X	X
Ursus americanus	Black bear	Ours noir	X	X	X	X	
Procyon lotor	Raccoon	Raton laveur	X				
Martes pennanti	Fisher	Pékan	X	X	X	X	
Martes americana	Marten	Martre	X	X	P		
Mustela rixosa	Least Weasel	Petite belette	X	X	X	X	X
Mustela erminea	Short-tailed Weasel	Hermine	X	X	X	X	X
Mustela frenata	Long-tailed Weasel	Belette à queue longue	X				
Mustela vison	Mink	Vison	X	X	X	X	
Lutra canadensis	River Otter	Loutre de rivière	X	X	X	X	X
Gulo luscus	Wolverine	Carcajou			X	X	X
Mephitis mephitis	Skunk	Mouffette rayée	X	X	P		
Canis latrans	Coyote	Coyote	X	X	X		
Canis lupus	Grey Wolf	Loup	X	X	X	X	X
Vulpes fulva	Red Fox	Renard roux	X	X	X	X	X
Alopex lagopus	Arctic Fox	Renard arctique			X	X	X
Felis concolor	Mountain Lion	Cougar rare	*				

Table 2

The Distribution of Mammals in Western Québec (Cont'd)

Species			Region				
			Laurentians	*Abitibi*	*James Bay*	*Whale R. Basin*	*Ungava Pen.*
Lynx rufus	Bobcat	Lynx roux	X				
Lynx lynx	Lynx	Loup cervier	X	X	X	X	
		Number of Species	16	12	14	12	8
Herbivores :							
Marmoto monax	Woodchuck	Marmotte commune	X	X	X	X	
Tamias striatus	Eastern chipmunk	Suisse	X	X	P		
Sciurus carolinensis	Eastern grey squirrel	Ecureuil griis	X				
Tamiasciurus hudsonicus	Red squirrel	Ecureuil roux	X	X	X	X	
Glaucomys sabrinus	N. Flying Squirrel	Grande polatouche	X	X	X		
Castor canadensis	Beaver	Castor	X	X	X	X	
Peromyscus maniculatus	Deer mouse	Souris sylvestre	X	X	X	X	
Synaptomys cooperi	S. bog lemming	Campagnol-lemming de Cooper	X	X			
Synaptomys borealis	N. bog lemming	Campagnol-lemming boréal		X	X	X	
Clethrionomys gapperi	Boreal Redback vole	Campagnol à dos roux de Gapper	X	X	X	X	P
Phenacomys intermedius	Mountain phenacomys	Phenacomys	X	X	X	X	P
Dicrostonyx hudsonicus	Collared lemming	Lemming variable				X	X
Microtus pennsylvanicus	Meadow vole	Campagnol des champs	X	X	X	X	X
Microtus chrotorrhinus	Rock vole	Campagnol des rochers		X			
Ondatra zibethicus	Muskrat	Rat musqué	X	X	X	X	P
Zapus hudsonius	Meadow jumping mouse	Souris sauteuse des champs	X	X	X	P	
Napeozapus insignis	Woodland jumping mouse	Souris sauteuse des bois	X	X	P		
Erithizon dorsatum	Porcupine	Porc-épic	X	X	X	X	
Lepus arcticus	Arctic hare	Lièvre arctique				P	X
Lepus americanus	Snowshoe hare	Lièvre d'Amérique	X	X	X	X	
Odocoileus virginianus	White-tail deer	Cerf de Virginie	X	X			
Alces alces	Moose	Orignal	X	X	X	rare**	
Rangifer caribou	Woodland caribou	Caribou		X	X	X	P
		Number of Specie	17	29	16	14	7
		Total Number of Specie	47	42	35	29	15

X : found throughout area.
p : range extends only partially into area.

Data : Banfield, A. W. F. (1974) *The Mammals of Canada.* Toronto, University of Toronto Press.

* Bider, J. R. (1968) Animal activity in uncontrolled terrestrial communities as determined by a sand transect technique. *Ecol. Monogr.*, 28 : 268-308.

** Visual observation by author.

cessful populations of amphibians (frogs and toads in particular) farther north, all of which are exclusively insectivorous.

The few carnivorous and herbivorous species whose ranges do not extend beyond the Laurentians are typically hardwood seed-eater types or open farmland species very common to the St. Lawrence Valley region and southward. Although the decline in number of species of carnivores is quite gradual from south to north of the Province this is not true of the herbivores. The decline in number of species of herbivores between regions up to the Leaf River Basin are 5, 7, and 6 species. Between the Great Whale-Little Whale watershed and the Ungava Peninsula, there is a drop of 14 species. This drop is surely a reflection of the lack of significant stands of black spruce or other trees to the north of the Leaf River.

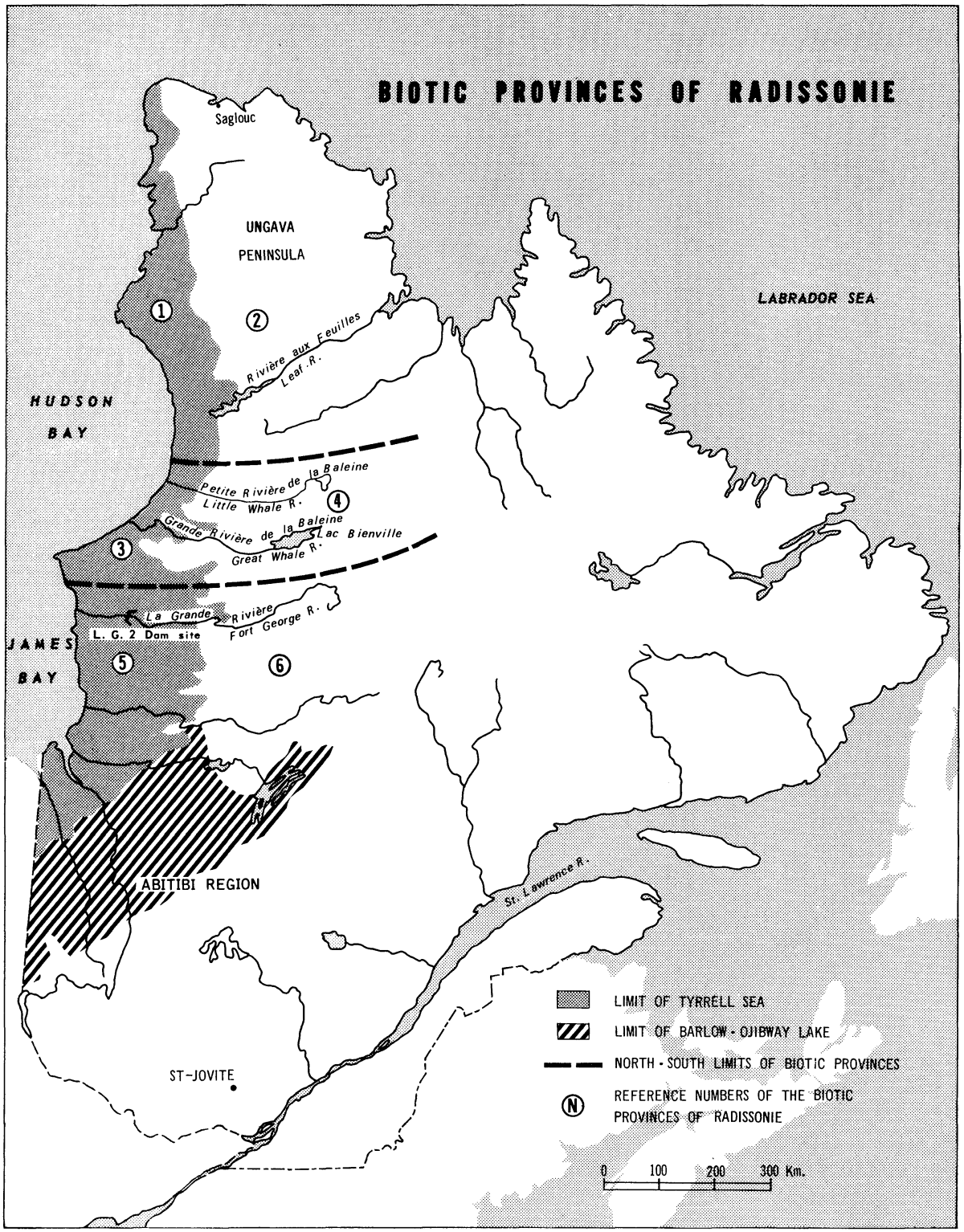
The Birds

New range extensions of nesting birds are being established each year as work progresses in north central Québec, and a report at the species level at this time would not only be outdated before going to press but would not clarify the general picture. As in the case of the mammals there is a slow decline in the number of species as you move northward to the La Grande rivière region but then there is probably a fairly distinct zone between the La Grande and Leaf Rivers watersheds. In this zone there seems to be a strong encroachment of nesting Arctic species such as Arctic tern (*Sterna paradisaea*), Red-throated loons, possibly Harlequin ducks (*Histrionicus histrionicus*), Semi-palmated plovers (*Charadrius semipalmatus*), Phalaropes (Phalaropodidae), and ptarmigan. Added to this are large numbers of Black (*Oidemia nigra*) and Surf (*Melanitta perspicillata*) scoters which seem to be quite well established in this zone. From reading many in-house reports of surveys done sporadically in the James Bay area and from my personal observations it seems that some of the southern forms of birds are more common in the Great Whale watershed than they are to the south. Ospreys, for example, are not common in the James Bay region but they are rather common in the Great Whale region. Several species of dabbling ducks — Black ducks (*Anas rubripes*), Green-wing Teal (*Anas carolinensis*), Pintails (*Anas acuta*) and Mallards (*Anas platyrhynchos*) — seem as common in the Lac Bienville area as they are all along the coast and more common than in areas directly south.

AN ATTEMPT TO DRAW RELEVANT LINES ON A MAP

There is nobody as unsure as a biologist drawing a line on a map. However, some must be brave enough to establish a point to argue from (figure 1). I feel that the most significant geographic feature that influences the distribution and abundance of animals in Radissonie is the former Tyrrell Sea. Super-imposed on this first division are two east-west lines which are the illdefined northern limits of Little Whale River (Petite rivière

Figure 1


BIOTIC PROVINCES OF RADISSONIE
Saglouc
UNGAVA
PENINSULA
LABRADOR SEA
HUDSON
BAY
Rivière aux Feuilles
Leaf R.
Petite Rivière de la Baleine
Little Whale R.
Grande Rivière de la Baleine
Great Whale R.
Lac Bienville
La Grande Rivière
Fort George R.
L. G. 2 Dam site
JAMES
BAY
ABITIBI REGION
St. Lawrence R.
ST-JOVITE
1
2
3
4
5
6
LIMIT OF TYRRELL SEA
LIMIT OF BARLOW - OJIBWAY LAKE
NORTH - SOUTH LIMITS OF BIOTIC PROVINCES
N
REFERENCE NUMBERS OF THE BIOTIC PROVINCES OF RADISSONIE
0 100 200 300 Km.

de la Baleine) basin and the southern limit of the Great Whale River basin. The size of the zones thus delimited each have their own fairly distinct characters particularly when seen at all seasons of the year. All the Tyrrell Sea coastal areas are rich areas with late springs and late falls, which are of great importance to late breeders, fall migrants and winter residents. The area to the north of the Little Whale River basin coincides with the tree line in western Québec and it would seem that there is a sharp faunal change at that point from a mixed fauna in the Little Whale — Great Whale basin to a vritually pure Arctic complex with few exceptions. In the productive areas of the Great Whale — Little Whale watersheds there is a distinct area of intermingling of northern and southern forms which is not only odd but very exciting in that the populations are fairly well-developed albeit localized. From the La Grande rivière to the Laurentians any sub-zones would be difficult to delimit. The only truly noticeable line of demarcation might be the southern Laurentians with their rich intrusion of southern forms of amphibians, reptiles and insectivorous mammals. From the Laurentians to the La Grande rivière the numbers of amphibian, reptile, mammalian and probably bird species change very little and the most significant change is the decrease in mammalian insectivores which is counteracted by an increase in amphibian numbers and activity.

RÉSUMÉ

BIDER, Roger : Répartition et fréquence des vertébrés terrestres dans la partie occidentale du Nouveau-Québec (baie de James et mer d'Hudson)

Grâce à des études de plus en plus nombreuses entreprises dans le nord du Québec nous avons un aperçu plus précis des ressources animales et de leur répartition. Un examen rétrospectif nous indique que la répartition des animaux semble dans la plupart des cas reliée à la répartition des aires riches en nutriments, tout comme la répartition des animaux dans le désert se fait en fonction de l'eau. Environ 50% de toute activité animale estivale se produit sur de vastes étendues d'habitat pauvre qui englobe 90% environ du territoire. Dans ces régions, les nutriments en faible concentration sont utilisés au bord des lacs ou dans les systèmes aquatiques rapides où ils sont captés et transformés par le processus des chaîne alimentaires en une variété de carnivores tels qu'on en trouve près de tous les rapides importants.

Dans la riche région de la mer de Tyrrell, les facteurs principaux qui semblent affecter les populations animales sont le drainage du sol et la turbidité de l'eau. La réduction du couvert végétal forestier semble avoir un effet sur les changements de composition des espèces plutôt que sur la fonction des animaux. En tenant compte des facteurs ci-haut mentionnés et des habitats connus des animaux, on peut diviser le Nouveau-Québec occidental en six zones zoogéographiques, dont trois sont affectées par les riches dépôts marins de la mer de Tyrell, la topographie et le climat, et les trois autres par les sols glaciaires extrêmement pauvres et par leur topographie et leur climat.

MOTS-CLÉS : Zoogéographie, distribution spatiale des ressources animales, habitats de la faune sauvage, vertébrés terrestres, Nouveau-Québec, Radissonie.

ABSTRACT

BIDER, Roger : The Distribution and Abundance of Terrestrial Vertebrates of the James and Hudson Bay Regions of Québec

From an increasing number of surveys conducted in northern Québec interior at all times of the year, a view of animal resources and their distribution is crystallizing. In retrospect the distribution of animals seems for the most part related to the distribution of nutrient rich areas much like the distribution of animals in the desert relates to water. About 50% of all summer animal activity takes place on vast areas of poor habitat which comprises approximately 90% of the region. The small concentrations of nutrients from these regions where they are captured and transformed through food chains to a variety of carnivores such as those found at all major rapids. In the rich Tyrrell Sea the most salient factors which affect the populations seem to be the drainage of the soil and the turbidity of the water. The reduction of forest crown cover seems to affect the changes in species composition rather than the function of animals. In reviewing all the above factors and the known ranges of the animals it seems that western Nouveau-Québec can be divided into six zoogeographical entities, three of which are affected by the rich marine deposits of the Tyrrell Sea, topography and climate, the three others by the extremely poor glacial soils, topography and climate.

KEY WORDS : Spatial disribution of animal resources, Zoogeography, Wildlife habitats, Vertebrates, Nouveau-Québec, Radissonie.