Insects of Keewatin and Mackenzie

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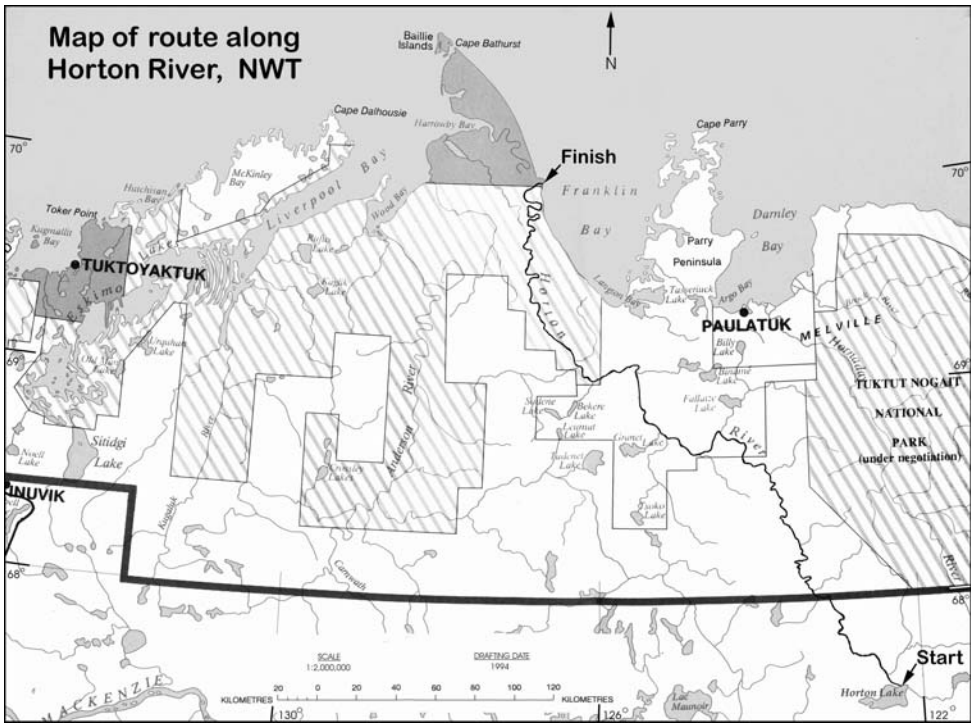
Introduction

The Canadian north remains among the most inadequately surveyed areas in North America in terms of its insect fauna. During the late 1940's and early 1950's the Departments of Agriculture and National Defence collaborated on a project called The Northern Insect Survey. Although the resulting collections provided valuable insights about insect diversity in the far north, relatively few sites were sampled and material collected is unsuitable for modern analysis (e.g., cytology, DNA sequence data). Problems associated with lack of access and infrastructure continue to hinder efforts to document insect diversity in much of northern Canada.

With completion of the Insects of the Yukon book, it seems appropriate to direct attention towards the inadequately surveyed territory between the Mackenzie River and Hudson Bay. This area, which constitutes mainland Northwest Territories and Nunavut, corresponds with the Districts of Mackenzie and Keewatin. Scientific Committee members Doug Currie (Royal Ontario Museum and University of Toronto) and Donna Giberson (University of Prince Edward Island) are leading a multiyear initiative to survey representative areas throughout the region. Given the short collecting season and logistical constraints, the focus of the survey reflects the interests of partici-



pating scientists. However, mass collecting techniques (e.g., Malaise traps, sweep netting, aquatic kick sampling) provide representatives of many 'non-target' organisms. The survey is expected to generate valuable new insights about the diversity and biogeography of northern insects, as well as to provide information about energetics and food web dynamics.

The Horton River

The Horton River was selected as the venue for the first year of the project because of its close proximity to the eastern boundary of Beringia. It is situated mainly within the Northern Interior Plain region of the Mackenzie Lowlands and is characterized by hilly topography marked with numerous lakes and small streams. Originating north of Great Bear Lake, the river flows in a northwesterly direction for approximately 700 km before emptying into Franklin Bay on the Beaufort Sea. There are no settlements along the Horton River and even the Inuit of Paulatuk (situated some 100 km east on the arctic coast) rarely travel that far. The water is clear in the upper reaches and flows over limestone-dominated sedimentary rock through a series of cobble riffles and long deep pools. The water here is characterised by generally high pH (8.0-8.5) and low conductivity (160-200 μs/cm). The surrounding vegetation consists of sedge- and shrub tundra with scattered black spruce. Spruce, willow and alder are confined mainly to the valley and south-facing slopes. Approximately 180 km downstream of Horton Lake the river enters an area with sheer limestone cliffs; and over the next 150 km it flows through a series of three canyons, each characterised by deep bedrock pools and whitewater rapids. Following the canyon section the geology changes and the surrounding landscape is characterised by eroding hillsides and muddy tributaries, which significantly increase the turbidity of the river. The final 100 km of the Horton River passes through sparsely vegetated badlands dominated by vast deposits of lignite and sulphur. Lignite spontaneously combusts when exposed to oxygen and the area is aptly named the Smoking Hills. Tributaries in the Smoking Hills are muddy and typically highly acidic, reducing the pH of the Horton River to 6.5-7.5.

The 2000 Horton River Expedition

The process of obtaining a Scientific Research Licence proved to be exceedingly cumbersome and time consuming. Because our proposal involved two different first nations settlement regions, approval was needed from both Sahtu and Inuvialuit authorities (i.e., various Hunters and Trappers Associations and Renewable Resources Councils within the two regions). The NWT Environmental Impact Screening Committee then reviewed our proposal, taking into consideration the views and comments of various stakeholders. Finally, a Land Use Permit from the Inuvialuit Land Administration was needed before a licence could be issued. It arrived in the mail less than a week before departure.

Our team of 5 entomologists convened in Norman Wells on July 17. Doug Currie and Donna Giberson were joined by Peter Adler (Clemson University), Brian Brown (Natural History Museum of Los Angeles), and Malcolm Butler (North Dakota State University). The five of us, along with our guide Tim Gfeller (Wilderness Adventure Company), boarded a chartered Twin Otter for the hour and a half flight to Horton Lake. We carried all our gear and enough food to support our expedition for one month. Given the absence of roads and the high cost of air transportation, our plan was to travel 620 km by canoe from Horton Lake to the Beaufort Sea. Although strenuous, this approach gave us access to a wide variety of microhabitats along the way. The route also provided a south-to-north transect from the High Subarctic Ecoclimatic Region to the Low Arctic Ecoclimatic Region.

Although insects were the focus of our expedition the Horton River proved equally favourable for viewing wildlife. Numerous species of birds were observed including Arctic loon, ptarmigan, peregrine and gyrfalcons, bald and golden eagles, mergansers, scoters, plovers, and jaegers, to name a few. Hundreds of caribou were also seen throughout the journey,

along with occasional sightings of muskoxen, moose, fox, wolf, and grizzly bear. Arctic grayling, lake trout and burbot 'collected' from the Horton River were welcome additions to our larder.

Twenty four days were needed to travel the entire length of the river with only 2 days of respite from paddling. The weather ranged from stifling heat (30°C+) during the first part of the trip to uncomfortably cool (4°C) towards the end. On August 9 a chartered Twin Otter retrieved us from a gravel bar near Franklin Bay and flew us to Inuvik.

Preliminary results

Black Flies (Diptera: Simuliidae)

Doug Currie and Peter Adler made collections at 52 sites along the Horton River and its tributaries. Immature stages were collected from watercourses that ranged in width from a few centimetres to more than 100 metres. Larvae were collected mainly into Carnoy's fixative to facilitate cytological study; selected larvae and adults were fixed in 95% ethanol to facilitate molecular analysis. Adults were collected through a combination of Malaise trapping, aspirating from team members and the insides of tents, and rearing of pupae. Identification at the morphospecies level revealed a total of 18 taxa in 3 genera: *Simulium*, *Metacnephia*, and *Cnephia*. Although the actual number of species will undoubtedly be higher following cytological screening, it is clear that the simuliid fauna is depauperate relative to that of similar drainages in Alaska and the Yukon Territory. This probably reflects, in part, the short period that the Horton River and its valley has been deglaciated. Interestingly, the Horton drainage includes species that are sparsely represented or absent from Beringia. The biogeographical implications of this pattern are a focus of study. Larvae are currently being studied chromosomally by Peter Adler. Doug Currie is curating the adults and his University of Toronto graduate student, Miranda Smith, is analysing molecular sequence data from selected species.

Chironomus (Diptera: Chironomidae)

Mac Butler focused on lentic Chironomidae, especially *Chironomus*. This genus is well-studied cytogenetically, and karyotypes are necessary to confirm identification of most species. In collaboration with an international group of colleagues, he has recently been investigating biogeographic patterns of genetic variation of *Chironomus* from Europe, Siberia, and North America. Twenty lentic habitats were sampled along the 620 km route: ten pools or ponds (<1m depth), and a like number of small lakes. *Chironomus* larvae were found in eight of these sites, and pupal exuviae only were collected from an additional lake. A number of other lentic Chironomidae larvae were collected as well, primarily Tanypodinae and Tanytarsini. *Chironomus* was quite rare in shallow habitats south of the coastal tundra, but larvae were found in all three ponds sampled in the Smoking Hills. All *Chironomus* larvae were fixed for karyotype analysis, but the material has not yet been examined. It is estimated that at least half a dozen species will be present, perhaps more. In many cases only a few larvae were collected at each site, and not all specimens are likely to provide good-quality karyotypes. Material collected at three sites may be sufficient for characterizing populations in terms of prevailing inversion frequencies, and hopefully to make comparisons with populations from other parts of the Holarctic Region. Nonetheless, the simple knowledge of what cytologically-defined species live in this part of the Arctic is a sufficient outcome from the expedition.

Phorid flies (Diptera: Phoridae)

Phorid flies were collected using mostly Malaise traps. A total of 28 Malaise trap samples were collected, most of which were overnight samples; a few traps were left up for two days worth of collecting. The samples vary widely in the number of insects they contain, due mostly to variation in the weather: warm sunny days produced large diverse catches whereas cold overcast days led to sparse collections. The higher flies (Brachycera) are being removed from the Malaise samples by Brian

Brown, after which the residues will be forwarded to Doug Currie to extract lower flies and Donna Giberson will look at the mayflies, stoneflies and caddisflies. The phorid fauna has not yet been analyzed in detail, but it is much more diverse than the literature on northern insects indicates. At least two genera, *Megaselia* and *Triphleba*, were collected, with the former predominating in numbers and species richness. It was interesting to see that phorid flies were abundant in samples collected on the tundra. Malaise traps were set on tundra sites using canoe paddles as poles, when the already sparse black spruce stands along the river disappeared.

Energetics and Food Web Ecology of the Horton System

Donna Giberson took samples representing different aquatic insect feeding guilds at approximately 20-30 km intervals along the river. Stable isotope (carbon and nitrogen) analysis of the insect samples, along with potential food sources (e.g., detritus, fine particulate organic matter, biofilms) should provide information about food sources and feeding patterns of the dominant taxa. Stable isotope analysis is a chemical analysis of food sources that takes advantage of the fact that different isotopes of common elements are sequestered by the body in different, but predictable ways, allowing researchers to trace food sources and trophic levels by analysing the ratios of the isotopes in the body tissues. Donna also collected water samples along the river to determine basic water chemistry variables (DO, pH, conductivity) and primary productivity, in collaboration with Joseph Culp at the National Hydrology Research Institute. Donna will also be identifying the Ephemeroptera, Plecoptera, and Trichoptera collected during the trip.

Plans for 2001

Discussions concerning 2001 field season are now underway. We plan to undertake a similar expedition in Nunavut or northern Manitoba, although a specific destination has yet to be identified. The Thelon, Kazan, and Seal Rivers have been discussed as possible venues, but further information is needed about logistical problems associated with each river. Regardless of the destination chosen, the resulting collections will provide a basis for comparison with collections made along the Horton River in 2000. A number of western species attain their eastern limit before Hudson Bay; and other species (e.g., *Simulium giganteum*) are known in the Nearctic Region only from the vicinity of Hudson Bay. A west-to-east transect along any of the three rivers should provide more detailed information about the distribution and composition of northern insects. Such data are fundamental to developing sound biogeographical hypotheses. Anyone interested in participating in this project is encouraged to contact us at the addresses given above.