

Notes on Avian Predators of *Neodiprion swainei* Midd.—The following observations were made during studies on the population dynamics of the Swaine jack-pine sawfly, *Neodiprion swainei* Midd., in a stand of jack pine on the Rivière à Mars watershed near Bagotville, Chicoutimi County, Quebec, and definitely established the following bird species as predators on larvae or pre-spinning eonymphs of *N. swainei*: the evening grosbeak, *Hesperiphona v. vespertina*; the black-capped chickadee, *Parus atricapillus*; the Acadian brown-capped chickadee, *Parus hudsonicus littoralis*; the myrtle warbler, *Dendroica c. coronata*; and the American robin, *Turdus m. migratorius*. The determinations were based on stomach analyses of birds shot on September 25 and 26, 1963 (Table 1), and upon direct observations of birds feeding on *N. swainei* larvae or pre-spinning eonymphs between September 24 and 27. Of the six species of birds shot, only the white-throated sparrow, *Zonotricha albicollis*, did not contain sawfly remains. All the others contained varying numbers of sawflies. The evening grosbeak appeared to have been

TABLE 1

Results of Stomach Analyses of Birds Shot on September 25 and 26, 1963, in a Jack Pine Stand on the Rivière à Mars Watershed, near Bagotville, Chicoutimi County, Quebec.

Species	Number shot	No. of specimens with <i>N. swainei</i> present	No. of specimens with <i>N. swainei</i> questionable*	No. of specimens without <i>N. swainei</i>
Evening Grosbeak..... (<i>Hesperiphona v. vespertina</i>)	1	1 (larvae)		
Black-Capped Chickadee..... (<i>Parus atricapillus</i>)	4	3 (larvae and pre-spinning eonymphs)	1	
Acadian Brown-Capped Chickadee..... (<i>Parus hudsonicus littoralis</i>)	1	1 (larva)		
Myrtle Warbler..... (<i>Dendroica c. coronata</i>)	4	3 (larvae)	1	
American Robin..... (<i>Turdus m. migratorius</i>)	2	1 (pre-spinning eonymph)	1	
White-Throated Sparrow..... (<i>Zonotricha albicollis</i>)	2			2

*Partial remains of what appeared to be *Neodiprion swainei* larvae or pre-spinning eonymphs.

feeding almost exclusively on sawfly larvae: its stomach contained 12 intact sawfly larvae plus massive quantities of sawfly remains. The black-capped chickadees, Acadian brown-capped chickadee, and myrtle warblers each contained one or two identifiable sawfly larvae or pre-spinning eonymphs as well as what appeared to be partial remains of sawfly larvae. In addition their stomachs contained an abundance of insect material including moths, chironomids, small beetles, and various lepidopterous larvae. The American robins were feeding on sawfly eonymphs which they apparently picked from the ground, in contrast to the other species which are arboreal. The stomach of one robin contained six identifiable *N. swainei* pre-spinning eonymphs in addition to large quantities of miscellaneous insects and seeds; the other individual contained partial remains of eonymphs.

In addition to the evidence provided by the stomach analyses, the evening grosbeak, black-capped chickadee, and myrtle warbler were actually observed feeding on sawfly larvae. The grosbeaks were observed on September 24 when a flock of five (1 ♂ and 4 ♀) alighted on the upper crowns of jack pine trees near a road. They stayed in the trees for nearly half an hour, feeding almost exclusively on *N. swainei* colonies. One female in particular had alighted on a branch approximately 6 in. from a colony which it methodically consumed to the last individual, the whole operation taking about 20 min. Along with the larvae, she was taking in bits of partially defoliated needles which she would spit out while consuming the larvae.

Black-capped chickadees and myrtle warblers were observed on numerous occasions between September 24 and 27 taking individual sawfly larvae. Unlike the grosbeaks, however, these birds were constantly on the move, usually never staying more than 1 min. in any tree. On one occasion, a black-capped chickadee was observed to take a sawfly larva in the upper crown of a tree after which it rapidly flew to one of the lower branches of the tree where it appeared to decapitate the larva, following which it consumed the body, then wiped its bill vigorously on the branch.

It must be emphasized that these notes were made during the course of the fall bird migration; at this time of the year the bird population in jack pine stands is apt to be considerably higher than during the breeding season; resident birds in jack pine stands are encountered only rarely. In terms of abundance during the course of the observations, the chickadees and myrtle warblers appeared to be most numerous; considerable numbers could be seen moving through the stands at almost any time of the day. Flocks of grosbeaks varying in number from five to over 20 could be observed daily and their calls were heard on numerous occasions. The sparrows and robins were considerably less abundant and appeared to restrict their feeding almost exclusively to the roadsides.

These results point to the potential importance of birds as mortality agents during the migratory period in late summer or early fall, when larvae of *N. swainei* are mature. Furthermore the above should not be interpreted as a complete list of avian predators of sawfly larvae, since there are many other species not encountered during the course of these observations which might be equally important. Studies will be continued more extensively during the coming field season.—J. M. McLeod.