# THE HEMLOCK LOOPER IN MAINE - 1991
# and
# A FORECAST FOR 1992

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## Introduction

The infestation of hemlock looper [Lambdina fiscellaria (Gn.)], which first appeared in Maine in 1988 as abnormally heavy moth activity, has increased rapidly in size and intensity. The acreage showing heavy to severe defoliation increased from 450 acres in 1989, to 20,000 acres in 1990, and to 225,000 acres in 1991. Defoliation in 1991 was extremely intense in many portions of the outbreak area due to a combination of high larval density, excellent larval survival, and very dry conditions during larval feeding. While some infested areas experienced significant declines in population density and defoliation in 1991, other areas maintained high populations and received very heavy damage. Also, many areas of heavy damage were detected in previously uninfested regions. Most of the heavy to severe 1991 defoliation occurred in east-central Maine in Penobscot, Hancock, Washington, and Aroostook counties but, significant areas of intense feeding were mapped in a band along the coast from Kittery to Calais. Heavy defoliation occurred on hemlock, balsam fir, and white spruce.

In response to the greatly increased demand for technical information and assistance on the hemlock looper problem from individual landowners and forest based industries as well as its own mandate for resource protection, the Maine Forest Service (MFS), Insect and Disease Management Division (I&DM) increased detection and evaluation surveys of the looper infestation. Larval, damage, and predictive egg surveys will be described in this report. Data concerning the current hemlock looper infestation have been made available to town officials, forest industry representatives, and concerned individuals to assist in their management of this damaging pest.

## Larval Development

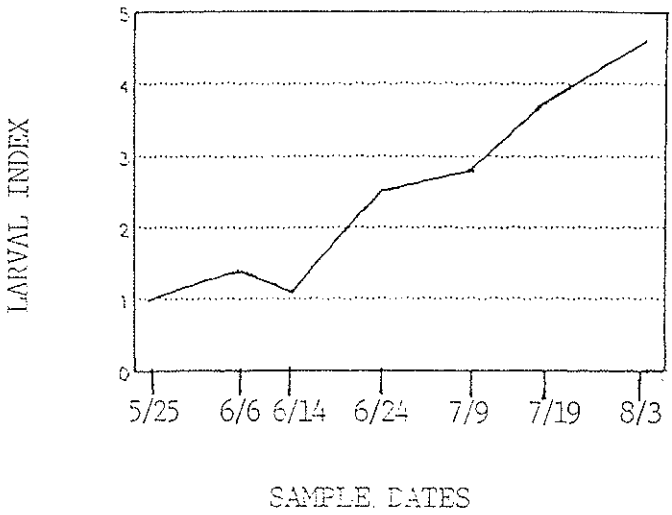
Seasonal development of hemlock looper larvae was tracked throughout the summer of 1991 in order to provide information to those interested in surveying or controlling looper populations. This data will also add to the historical record of this outbreak.

Development samples were collected periodically from two locations. One location in Jefferson was used to time a spray project undertaken by several area residents. Collections at this site were discontinued once spraying was completed. The other site in Lincoln was followed through most of the larval cycle. Larvae for each development sample were collected from branches of 3 to 5 overstory and 3 to 5 regeneration hemlock trees. At the Lincoln site populations were high and only a small portion of each branch was needed to obtain 50 to 100 larvae. Larvae were placed in a vial of alcohol and taken to Old Town for instar determination. Seven samples were taken at the Lincoln site during 1991.

A larval index was calculated by multiplying the number of larvae per instar by the number of the instar and then dividing by the total number of larvae. For example, 25 1st instar plus 25 2nd instar larvae would give an index of 1.5 (25x1 +25x2 = 75 /50 = 1.5). The seven development samples collected from Lincoln in 1991 were graphed to show the progression of development (Figure 1).

In Lincoln and in other areas there was an early emergence from the eggs and a relatively steady progression through the instars. Larval emergence in 1989 and 1990 had not occurred until the first week in June. In 1991 larvae were active in several areas by the 25th of May and this seven to ten day advance over 1989 and 1990 continued through the entire cycle. The first pupae and moths were also a week or more early compared to 1990. The stable warm and dry weather kept larvae developing at a steady rate. One unusual feature of 1991 development was an extremely long period of egg hatch that apparently had two distinct hatching peaks. The dip in the development curve on June 14 was not due to a sampling variation but rather to a delayed hatch of many eggs. The collection contained many tiny larvae which had just hatched and were smaller than 1st instar larvae collected on June 6. This second hatch was also noted in the Jefferson development samples. The reason for this occurrence is not known, but it does not seem to be related to a delay in hatching caused by weather.

Figure 1; Hemlock Looper Larval Development, Lincoln, Maine - 1991




## Larval Observations

Population levels predicted from 1990 egg density were checked in the spring of 1991 using a larval "beating" survey. Resources were not available to check all areas covered by the general egg survey but many areas where landowners had expressed an interest in the looper infestation were checked. The method for this survey was similar to procedures used in Newfoundland. A meter square beating frame (a wood frame with white cloth stretched over the frame) was held under a single meter long branch on the sample tree. The branch was then beaten with a stick to dislodge larvae, which would fall to the cloth. The larvae were then counted to assess population. This was done on three trees in each area sampled. While this method has limited accuracy, results did seem to reflect egg counts. Samples taken in areas where egg counts predicted low defoliation rarely produced larval counts exceeding 10 larvae per branch, whereas counts in high egg density areas usually exceeded 50 larvae per branch. Several areas with egg counts in the severe category had larval counts greater than 100 and some counts exceeded 250 larvae.

Moderate egg densities produced the most variable larval counts. In these areas larval count ranging from three to 172 larvae per branch.

Larval survival is difficult to assess for hemlock looper because larvae are very mobile and are easily dislodged from branches by wind and rain or during the sampling process. Larval counts from tree mid crowns will be much lower immediately after a heavy rain than they would be after a day without wind or rain. When large numbers of larvae are dislodged from the tree, the time necessary to climb back up the tree is highly variable. Also, many larvae are lost during this type of event. These sampling problems lead us to base our evaluation of survival on the results of periodic samples, tempered by subjective observations.

Larval survival was quite low in 1989 and 1990, ranging between 5 and 18%. The range of survival from first to fifth instar in 1991 was estimated at 14 to 23%. The 1991 survival was probably significantly better than survival in 1989 and 1990. The primary reason for this increased survival was probably the warm dry weather in 1991 and the lack of wind or heavy rain that would have knocked larvae to the ground. Several wind and rain events occurred in 1990.

Another factor known to significantly affect looper survival is disease. Larvae were not cultured for disease organisms in 1991, but populations were checked for obviously sick larvae and very few were observed except in the Lakeville area. Lakeville has one of the oldest and most persistent infestations observed during this outbreak. Preliminary egg sampling in this area shows that egg density for 1992 is far below the 1991 level. Populations in this area seem to be collapsing. Populations in other parts of the infested area have also collapsed where sick larvae were not seen.

## Defoliation

An aerial survey of 1991 hemlock looper defoliation was completed in late September and a generalized map of the area showing moderate to severe damage was prepared (Figure 2). The 225,000 acres shaded black on this map received heavy to severe defoliation (greater than 45% total tree defoliation of hemlock or balsam fir) in 1991. Lightly shaded areas on the map, representing more than 100,000 acres, contain stands that were moderately defoliated by looper. Because moderate defoliation by looper, especially on fir, can not be readily mapped from the air, some of the areas of moderate damage shown on the map represent the results of ground detection. Most of the moderate defoliation recorded occurred on fir. Figure 2 is only intended to show the general location of 1991 looper damage. The MFS also prepared more detailed computerized maps that were sent to town offices in the affected areas.

The 1991 aerial survey for looper damage began in August and continued through late September. The appearance of defoliated stands changed considerably through this period. Early in the survey, defoliated stands of both hemlock and fir were a very noticeable reddish-brown color. This color was caused by numerous partially eaten dead needles which persisted on the trees in looper silk. The summer of 1991 was relatively dry and there were few wind or rain storms to dislodge this accumulated dead foliage. This kind

# Hemlock Looper Larval Survey

Collection #_____ Town_____

Location_____ Date_____

Observer_____

| Tree # | # larvae/1 m branch |
|---|---|
| RI | |
| RII | |
| RIII | |

Comments: