



Predicting Population Rebound Following Treatment

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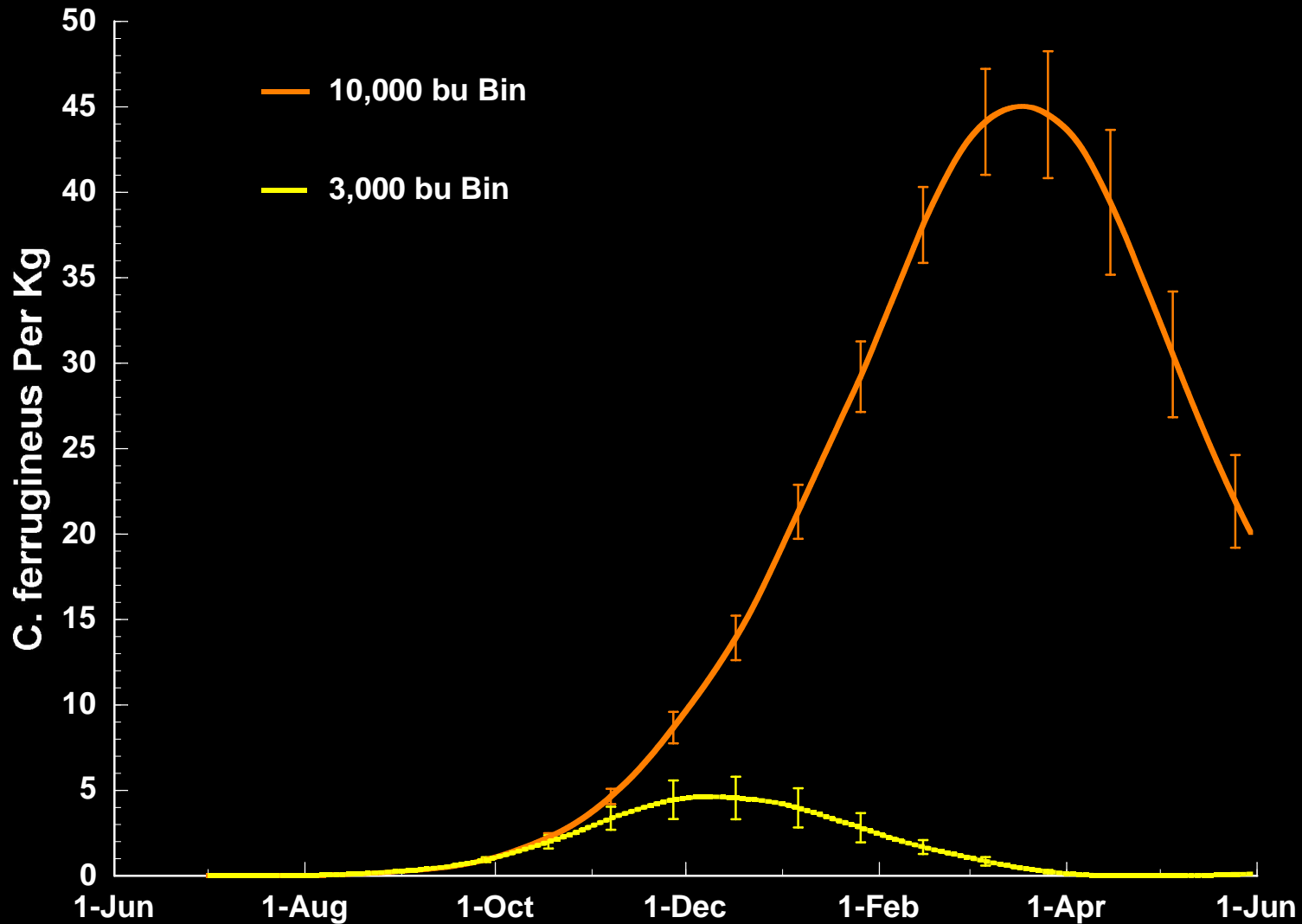
USDA, ARS, Grain Mktg & Prod Res Cen

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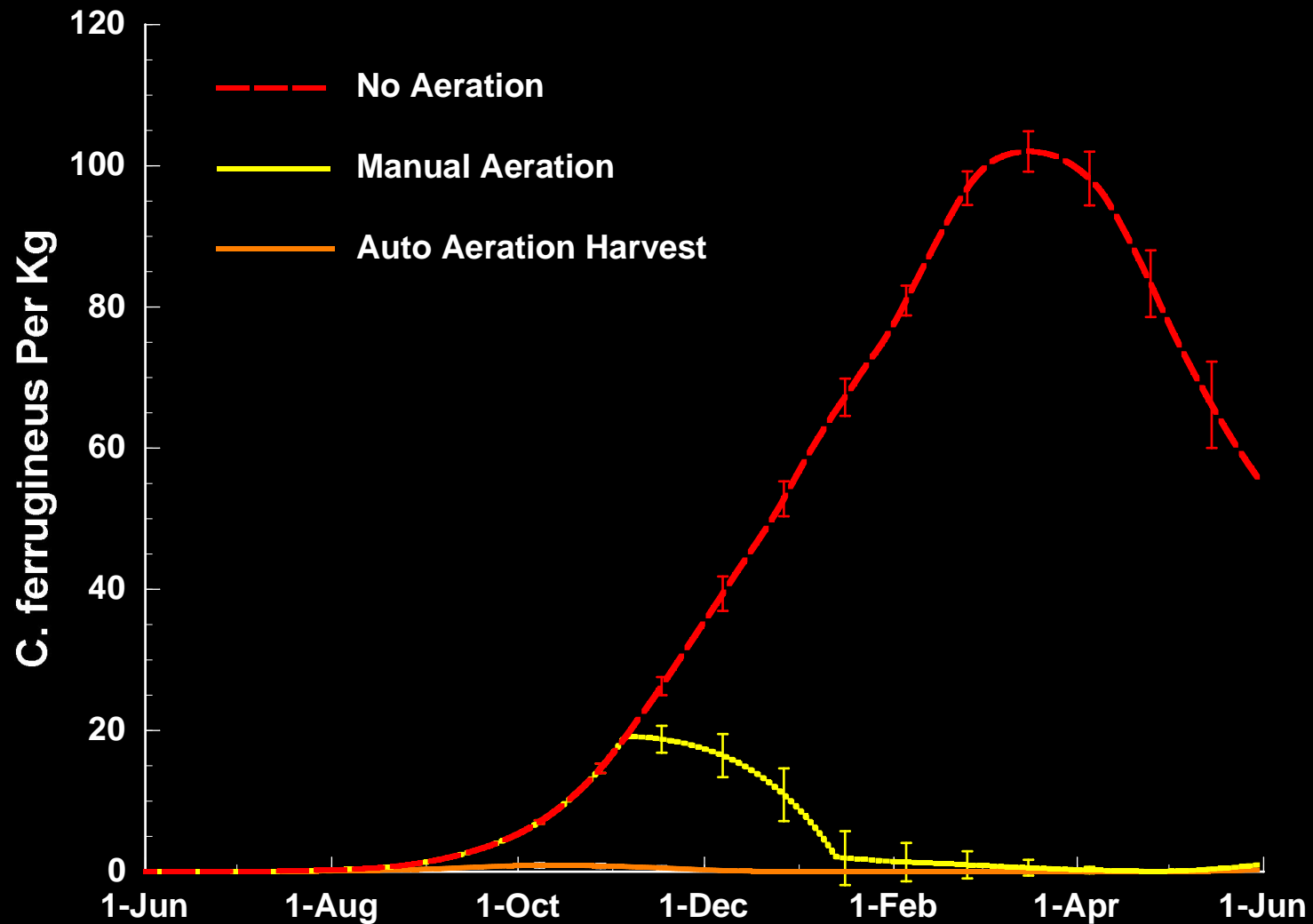
Introduction

- Models have been developed for several species of insects for stored grain
- These models have been validated and proven to be useful for predicting insect infestations in stored grain
- They have also been useful for developing strategies for the timing and optimal use of treatments for insect prevention and control
- It would be useful to develop a similar model for flour mills that could be used to predict infestations and to develop strategies for prevention and optimal timing of control methods

Large vs Small Bin, Un aerated



Comparison of Manual vs Automatic Aeration



Objectives

- To develop a computer model of the red flour beetle for flour mills
- The model will be able to predict population growth for all life stages of the red flour beetle
- The model will include Methyl Bromide, Sulfuryl Fluoride fumigation, and heat treatment
- Sanitation (refugia) in the mill, immigration from outside, and insect movement within the mill will also be included
- Result: a tool that can be used to investigate optimal preventative and treatment strategies for the red flour beetle in flour mills

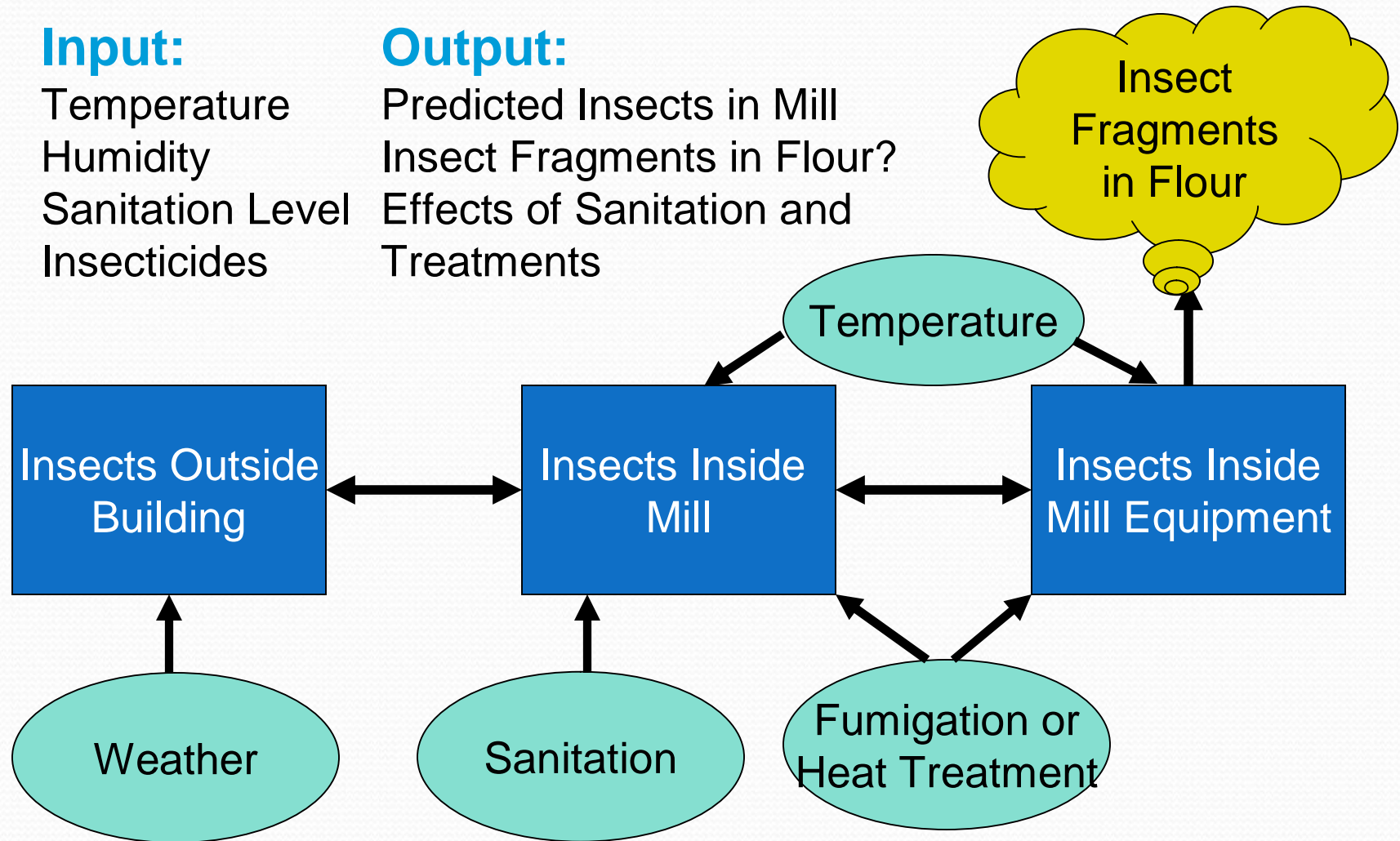
Model for the Red Flour Beetle in a Flour Mill

Input:

Temperature
Humidity
Sanitation Level
Insecticides

Output:

Predicted Insects in Mill
Insect Fragments in Flour?
Effects of Sanitation and
Treatments



Status of the Red Flour Beetle Model

- We have developed a computer model of the red flour beetle for flour mills based on a previous model for stored grain
- The model uses hourly temperature data for each of five floors to predict insect numbers for each floor (all stages)
- Model will include methyl bromide, sulfuryl Fluoride fumigation, and heat treatment
- Includes: sanitation (refugia) in the mill and immigration from outside

Main ✖

Red Flour Beetle Model

Basic Data Input
(Date Limits: 4/2003 - 8/2004)

Start Date

End Date

	Adults	Pupae	Larvae	Eggs
Floor 1	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>
Floor 2	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>
Floor 3	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>
Floor 4	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>
Floor 5	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>

Advanced Input

Method

Dates

Floor	Refugia Rate	Immigration Number
1	<input type="text" value="0"/> %	<input type="text" value="0"/>
2	<input type="text" value="0"/> %	<input type="text" value="0"/>
3	<input type="text" value="0"/> %	<input type="text" value="0"/>
4	<input type="text" value="0"/> %	<input type="text" value="0"/>
5	<input type="text" value="0"/> %	<input type="text" value="0"/>

Main

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Basic Data Input

(Date Limits: 4/2003 - 8/2004)

Start Date

End Date

	Adults	Pupae	Larvae	Eggs
Floor 1	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>
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Floor 3	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>
Floor 4	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>
Floor 5	<input type="text" value="13"/>	<input type="text" value="10"/>	<input type="text" value="41"/>	<input type="text" value="36"/>

Advanced Data Input

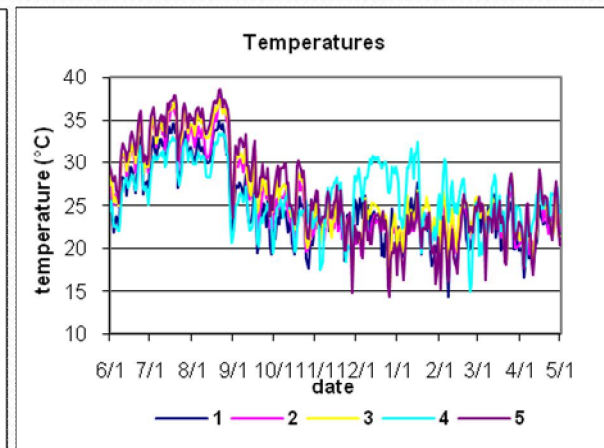
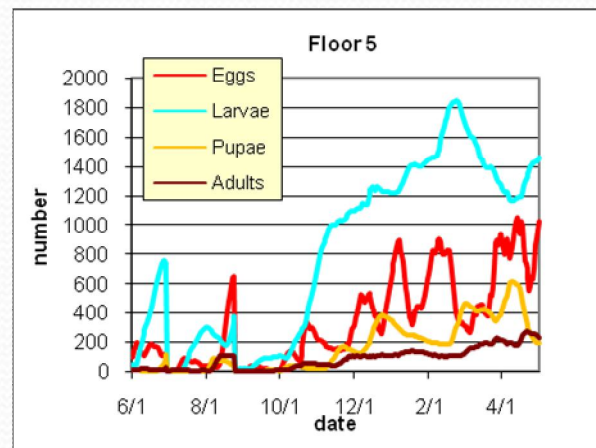
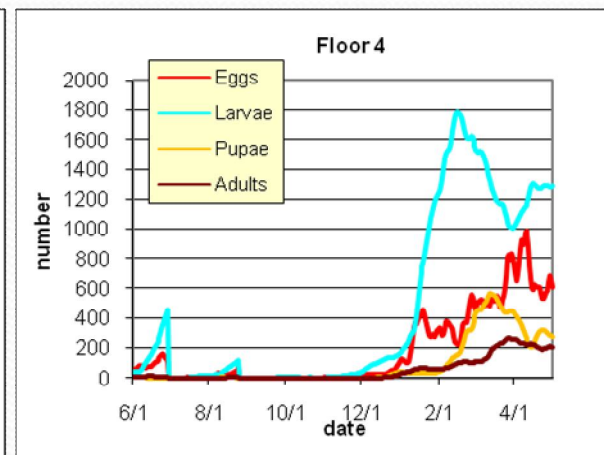
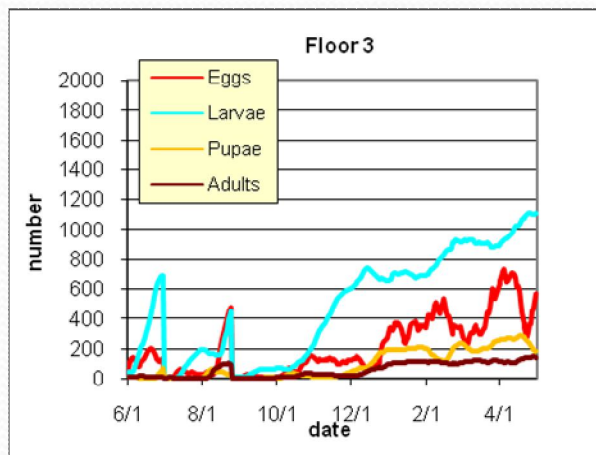
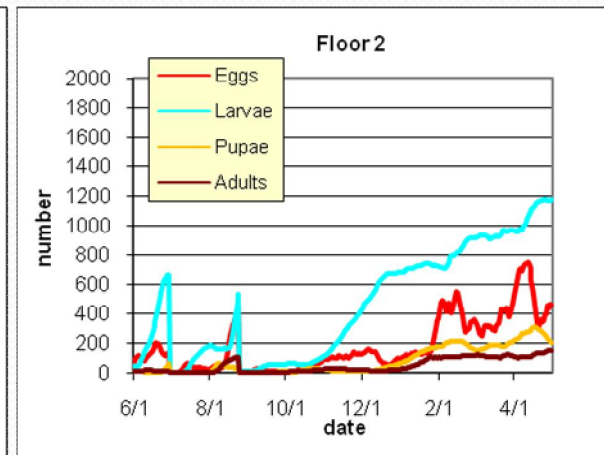
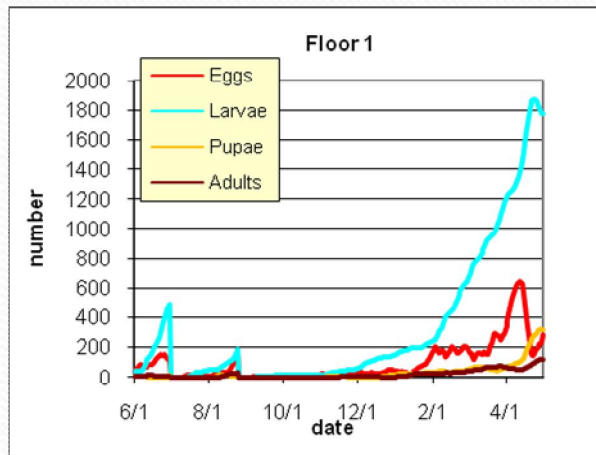
Treatment

Method

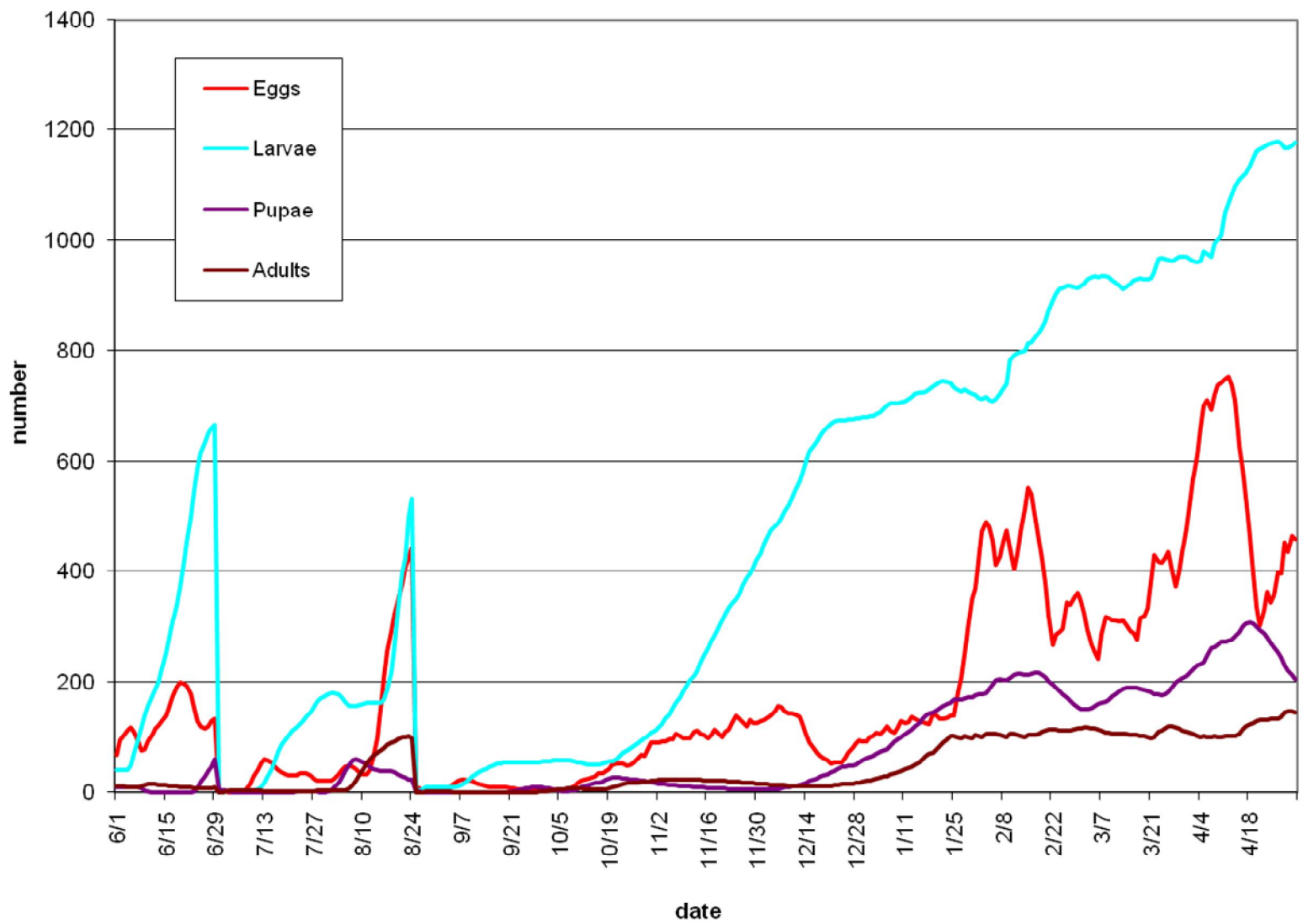
Floor	Refugia	Mortality Date
1	<input type="text" value="0"/> %	<input type="text" value="06/30/2003"/> <input type="text" value="08/25/2003"/>
2	<input type="text" value="0"/> %	
3	<input type="text" value="0"/> %	
4	<input type="text" value="0"/> %	
5	<input type="text" value="0"/> %	

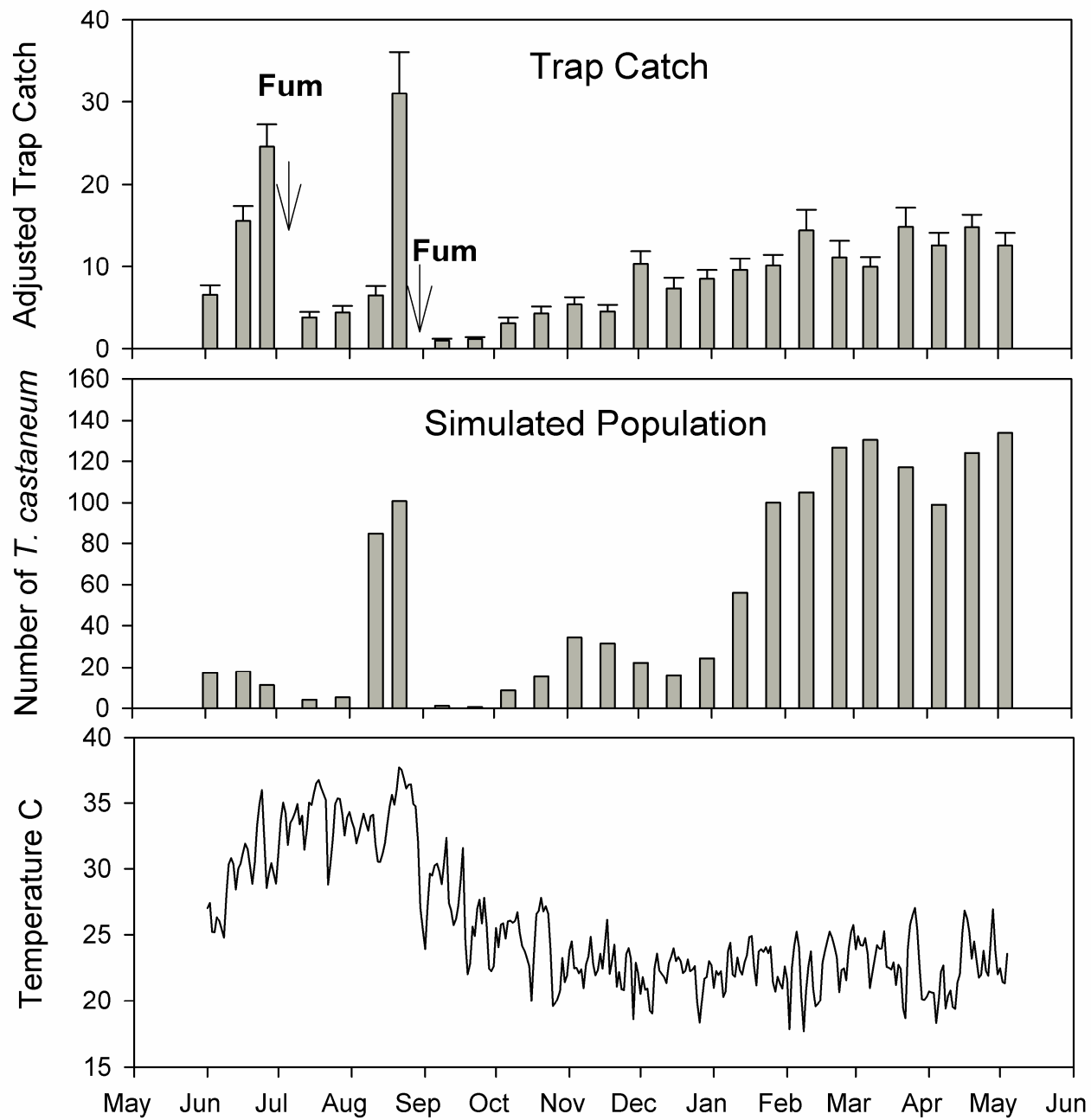
Immigration

Floor	Immigration # / week
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2	<input type="text" value="0"/>
3	<input type="text" value="0"/>
4	<input type="text" value="0"/>
5	<input type="text" value="0"/>



Beetles





Summary

- A lot of work still needs to be done on the model
- In the next few months we will be adding sulfuryl fluoride and heat treatment to the model
- We need to validate the model using field studies
- We need to add movement of adults between floors and seasonal immigration into the building
- A lot of potential: reducing the number of treatments/yr, finding the best date to fumigate, importance of sanitation, etc.