

Efficacy and Potential for Non-Target Effects of Larvicides Used for West Nile Virus Control in Seattle Catch Basins



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A. General background

1. Washington State and West Nile virus
2. 2006, 2007 Sampling Schemes
3. 2006 Larval Abundance Results

B. 2006 efficacy for three larvicides

C. 2007 efficacy for watershed basin sets

D. 2007 outflow monitoring and potential for non-target effects

Washington State and West Nile Virus

- Appearances in Washington State
 - a. 2002
 - b. 2005
 - c. 2006
- Number and type of potential mosquito vectors
 - a. Species of concern for urban areas
 - b. Associated habitats



Genus: *Aedes*

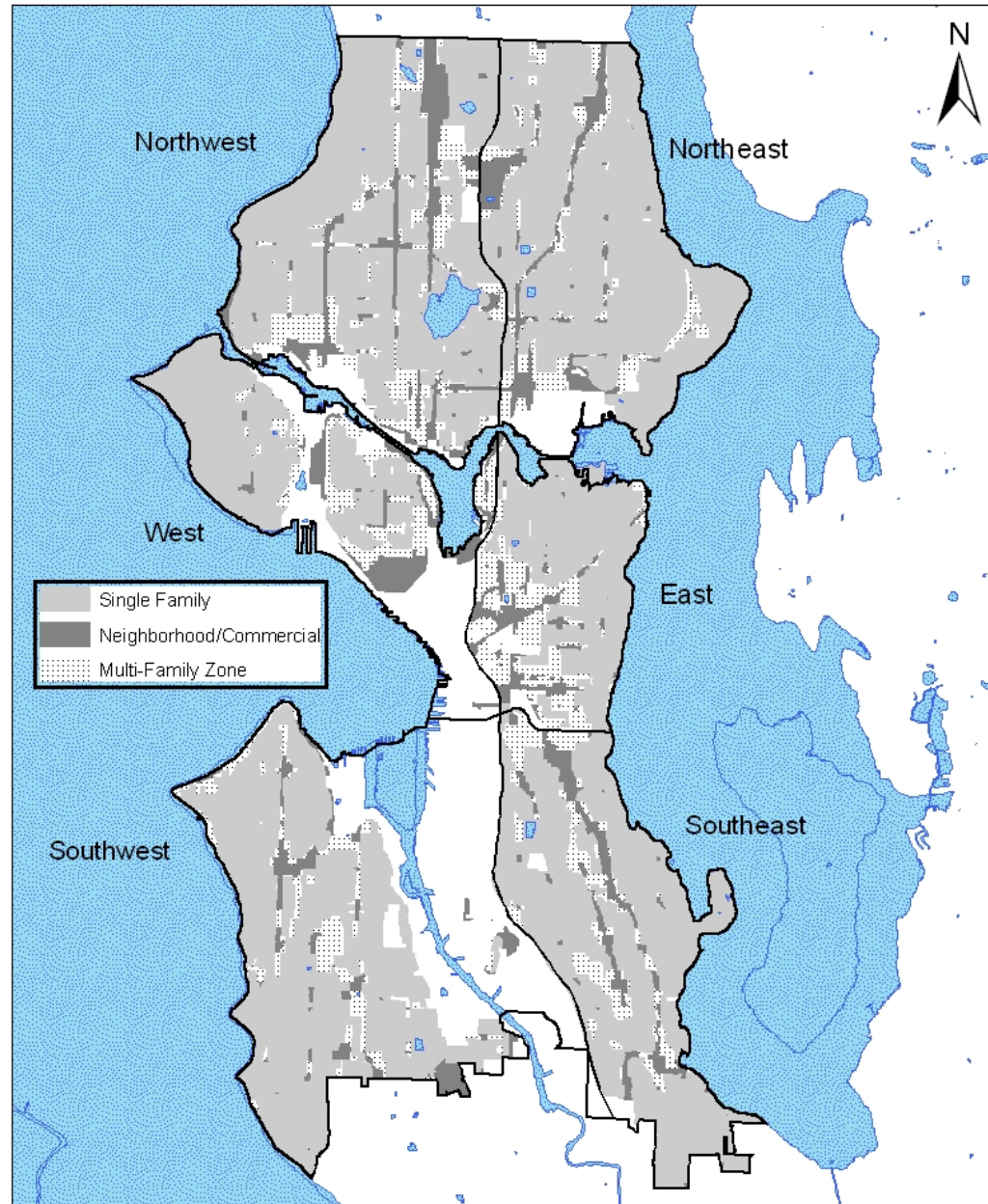


Genus: *Culex*



Round-top (left) and Grated-top (right) catch basins within the City of Seattle

City of Seattle Zones and Sectors



2006 Project Sampling Scheme

a. City-wide Monitoring

- 250 round-top untreated basins monitored from June – Sept.
- Basins proportional to city sector and zone

b. Efficacy

- 15 round-top basins for 4 treatment groups (3 larvicide-treatment groups, 1 control group)
- All basins in Northwest sector
- Monitored from July – Sept. (8 weeks)

2007 Project Sampling Scheme

a. City-wide Monitoring

- 150 treated round-top basins monitored from July - Sept.; 10 treated grated-top basins
- 50 control round-top basins monitored from June – Sept. (same as in 2006); 10 control grated-top basins

b. Efficacy

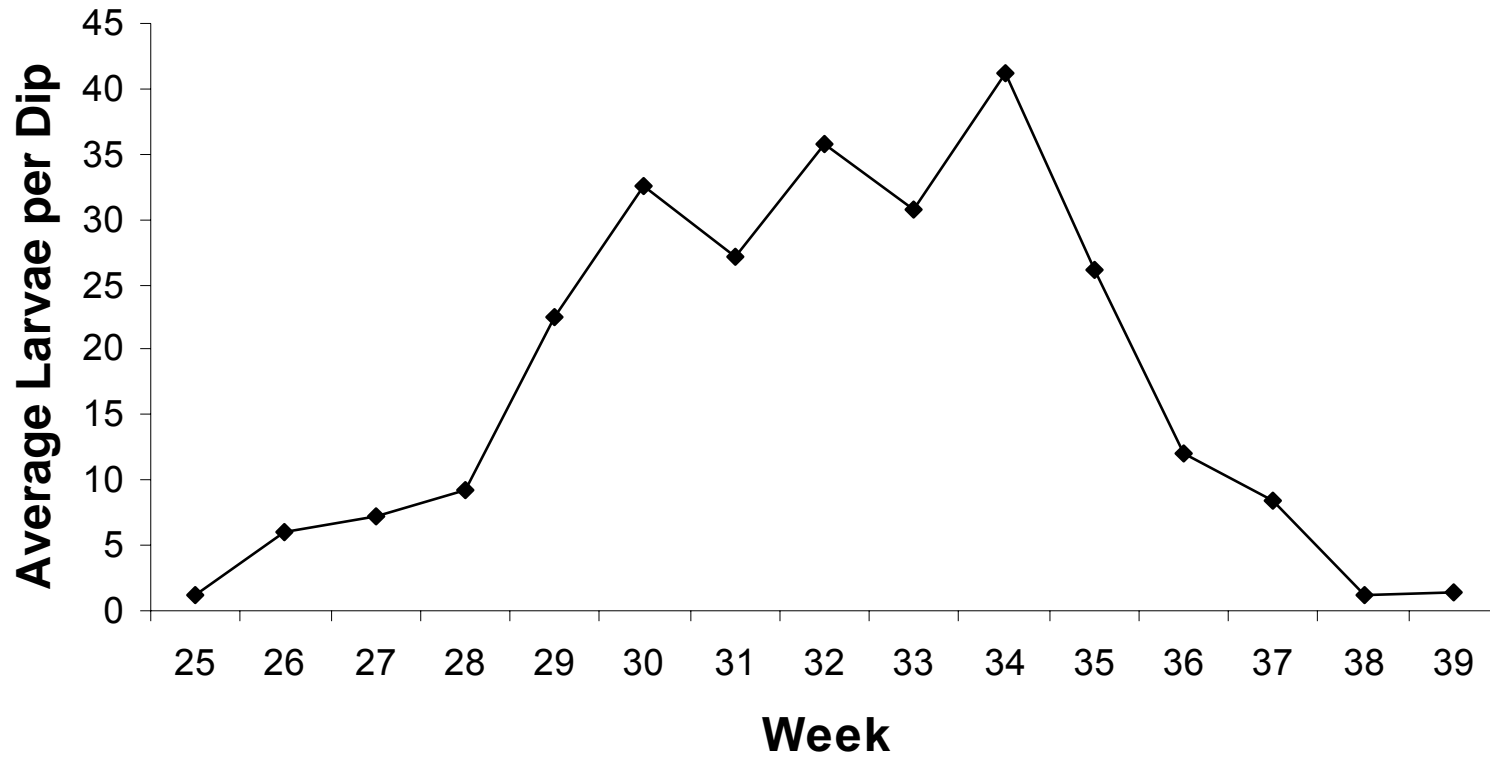
- Thornton sub-basin: 13 basins (11 GT, 2 RT)
- Pipers sub-basin: 9 basins (1 GT, 8 RT)
- Longfellow sub-basin: 8 basins (1 GT, 7 RT)

c. Outflow Monitoring

- Thornton (5 sites), Pipers (2 sites), Longfellow (3 sites)

2006

2006 Average Mosquito Larvae



2006

- Efficacy for 3 larvicides of interest

- a. Mosquito Dunks®
and Bits® (Bti),
VectoLex® WSP (Bs),
and Altosid®
Briquets (methoprene)



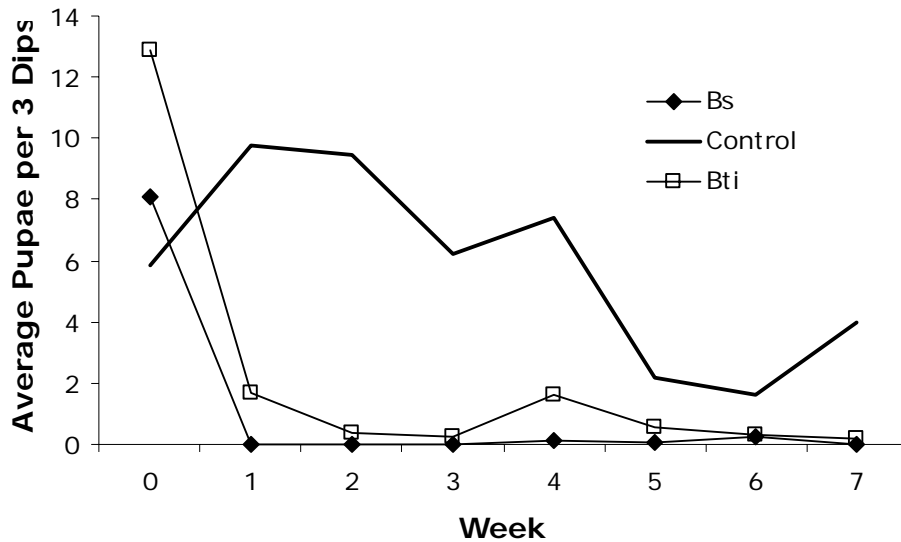
- b. Monitored for 8 weeks

- Number of pupae per 3 dips (Bs, Bti)
- Percent emergence success (methoprene)

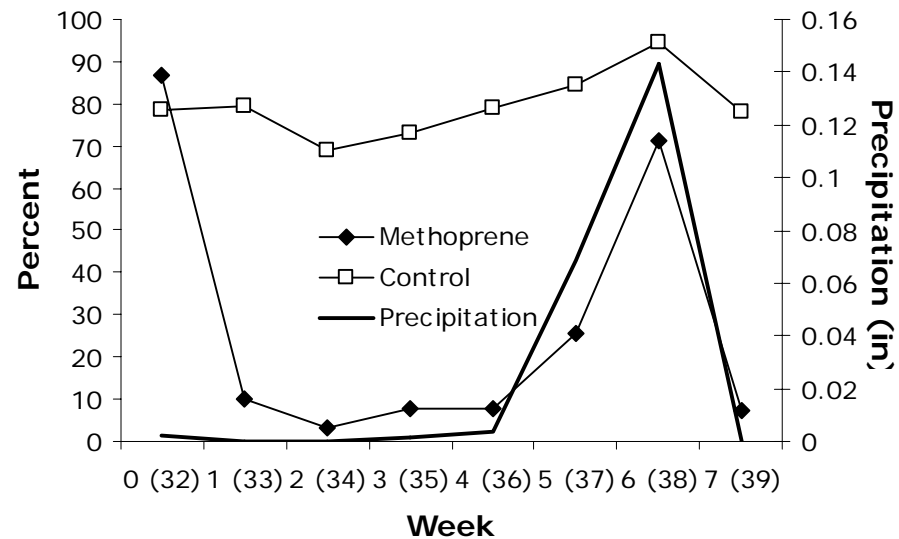
2006

- Bs, Bti efficacy
- Methoprene efficacy

Bs and Bti Efficacy



Efficacy (Adult Emergence) for Methoprene



*VectoLex® WSP (Bs) was most effective

2006 City-wide efficacy and abundance

- Mosquito season generally lasts from mid-June through Sept.
- VectoLex® WSP (Bs) was most effective

2007 Objectives

- Efficacy of city-wide larvicide treatments;
- Efficacy of larvicides within catch basins in the Longfellow, Thornton, and Pipers creek watersheds;
- Outflow monitoring within local watersheds and potential for non-target effects of four larvicides on coho salmon (*Oncorhynchus kisutch*)

2007 City-wide efficacy and abundance

Monitoring

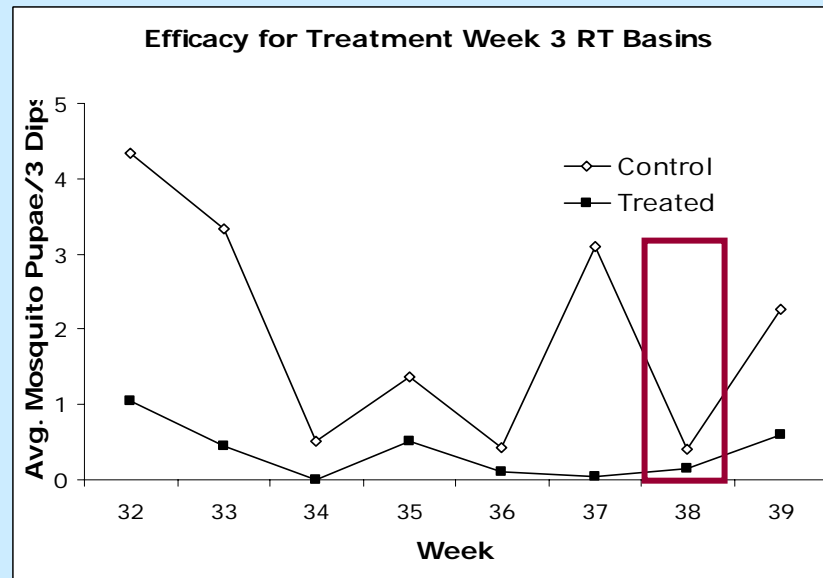
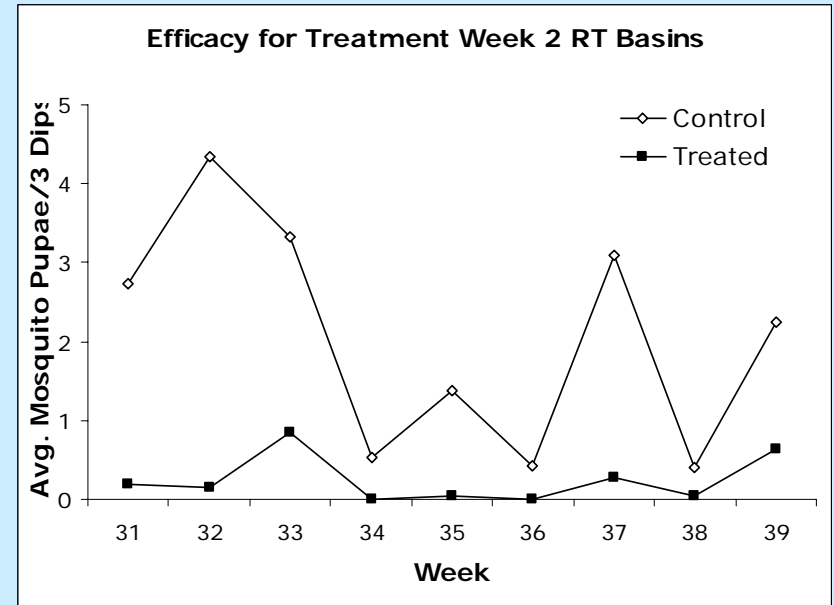
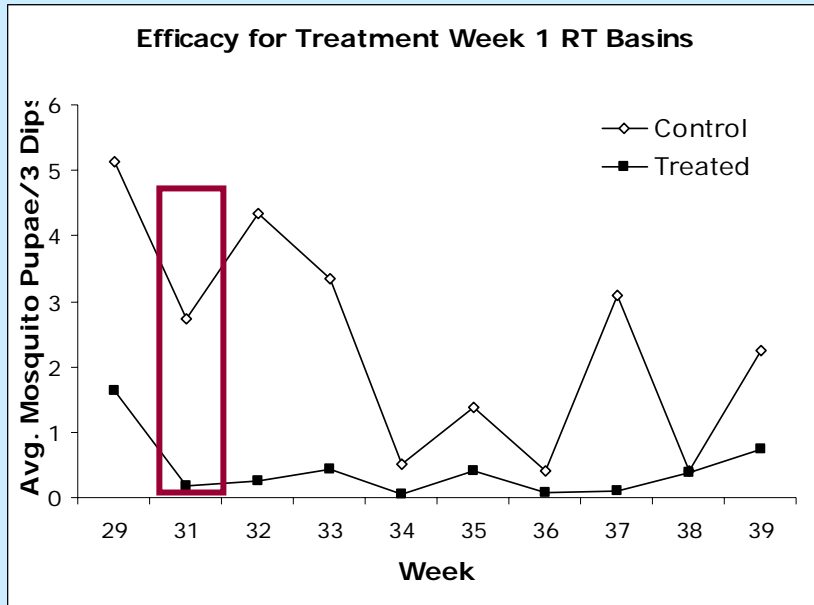
- Time frame: June through September
- Parameters measured: Dissolved oxygen, pH, basin water temperature, conductivity, type and extent of debris, larvae, pupae

Data analysis

- Efficacy determination: 1-sided Mann-Whitney test ($\alpha = 0.05$)
- Abundance comparison: Graphical comparisons

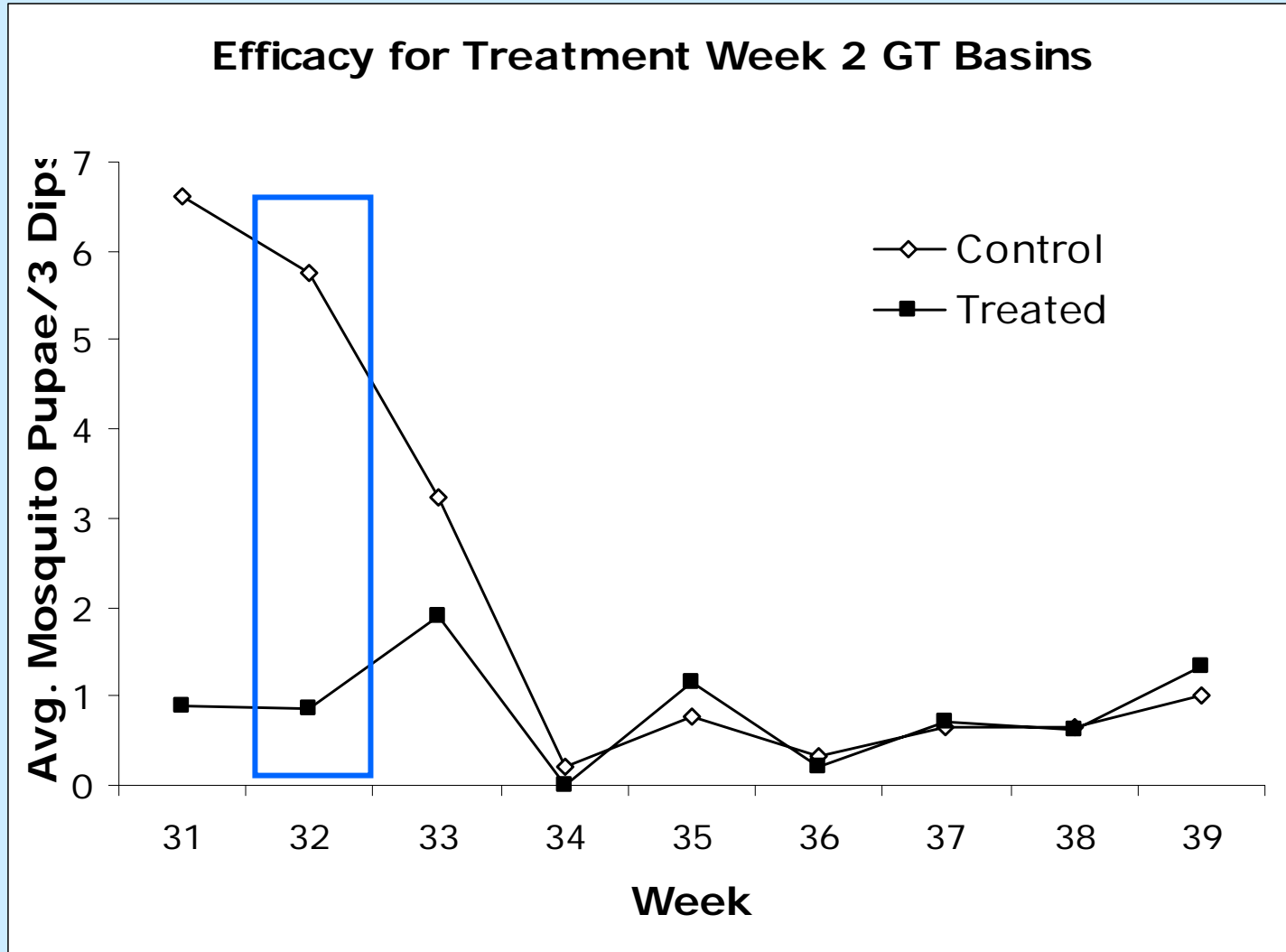
2007 City-wide efficacy and abundance

Round-top basins



2007 City-wide efficacy and abundance

Grated-top basins



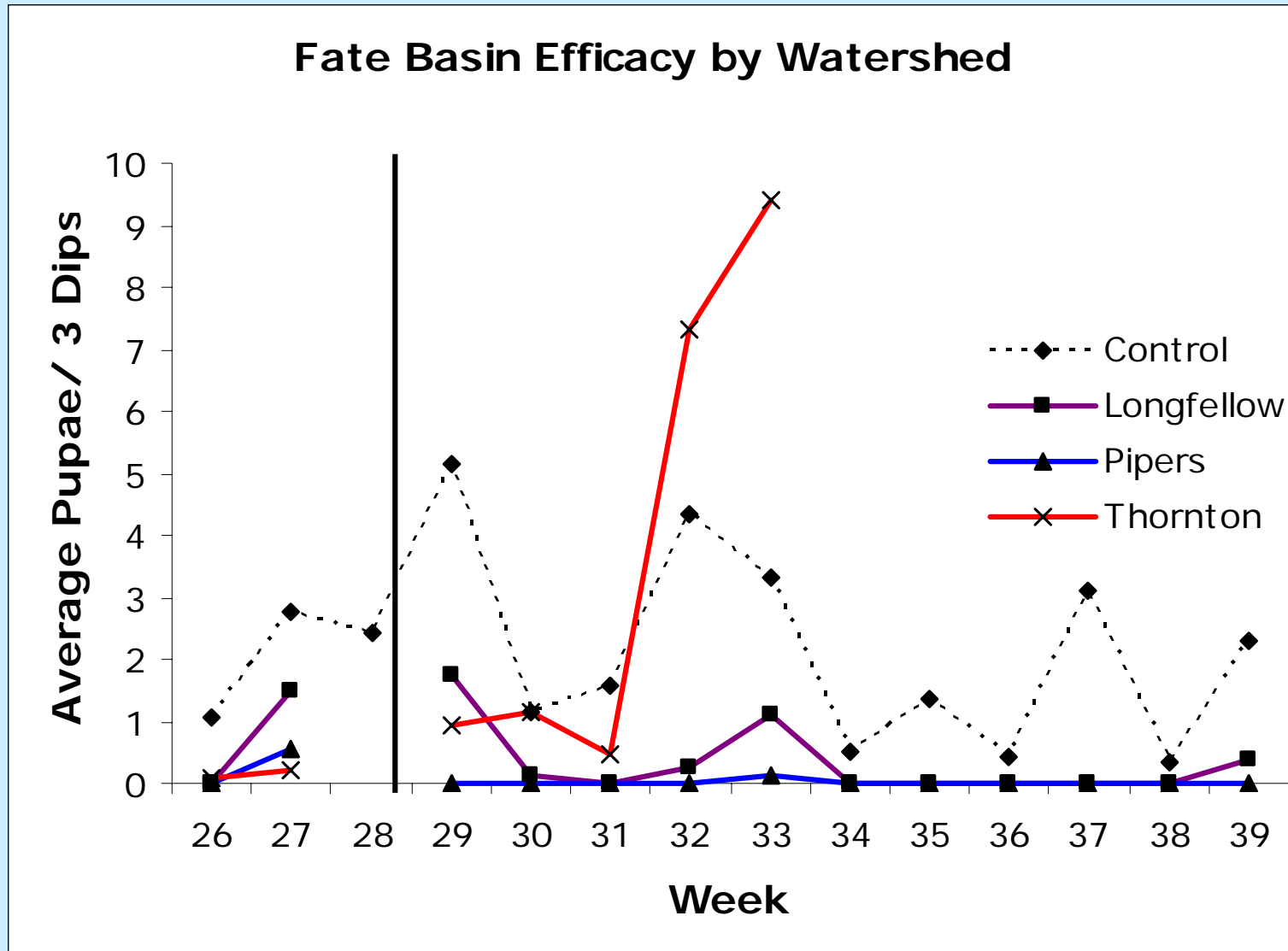
2007 City-wide efficacy and abundance

- RT basins realized statistical efficacy for almost every week
- GT basins realized statistical efficacy for only 1 week, however difference between control, treated minimized by precipitation
- Precipitation had dramatic effects on counts of pupae and larvae in 2007; relatively no precipitation in 2006

2007 Monitoring for watershed basin sets

- 2 weeks pre-treatment, 11 weeks post-treatment
- Average pupae/3 dips was efficacy indicator; treatments were efficacious if pupae counts for each set \leq city-wide control basins
- Collected water samples at -2, 1, 3, 5, and 7 weeks for Pipers and Longfellow; collected at -2, 1, 3, and 5 weeks for Thornton (cfu/ml)

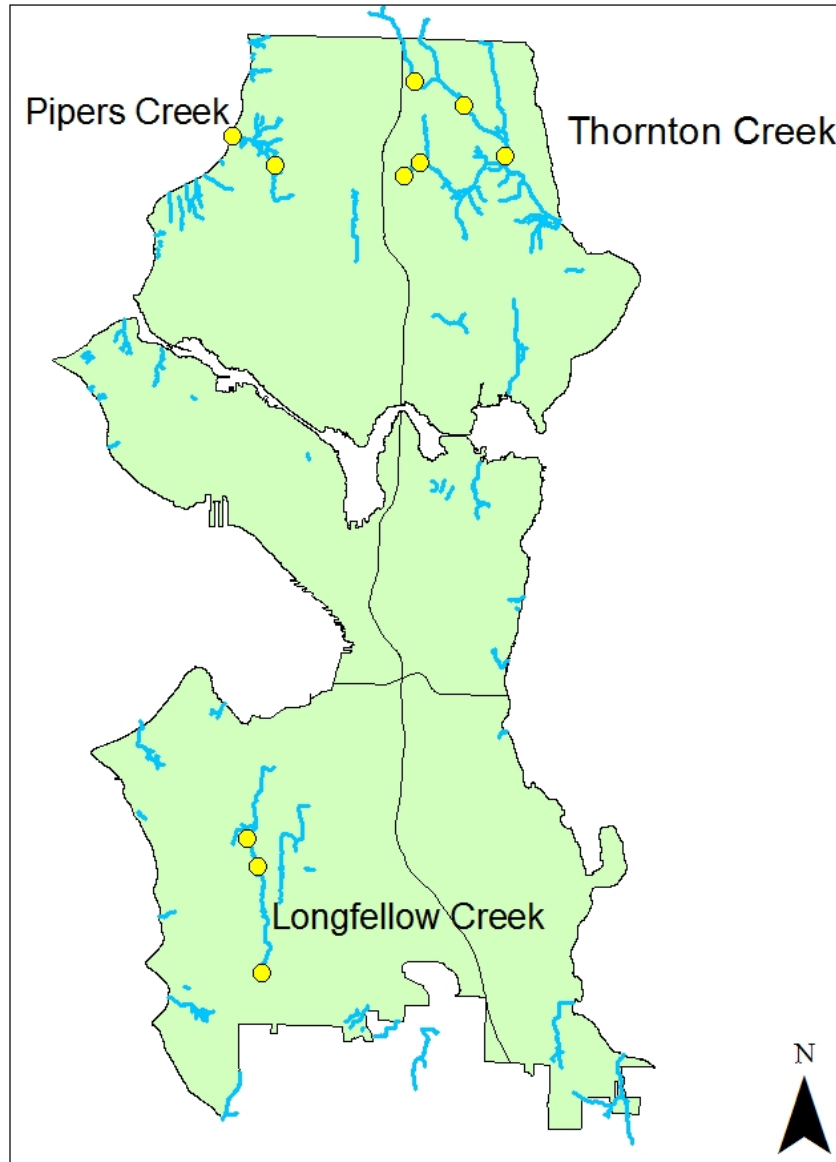
2007 Efficacy for watershed basin sets



2007 Efficacy for watershed basin sets

- Besides Thornton basins, treatment mostly reduced pupae to zero
- Lack of efficacy in Thornton associated with GT basins; may be due to greater mixing of larvicide

2007 Outflow Sampling Locations



2007 Outflow monitoring, potential for non-target effects



2007 Outflow monitoring, potential for non-target effects

- Monitoring

- Baseline water samples: pre-treatment and at least 5 weeks post-treatment
- Precipitation samples: 1 pre-treatment and 3 post-treatment samples
- Water samples taken if flow had increased (water height, width in outflow pipe) and at least 0.03 inches of rain accumulation

- Data analysis

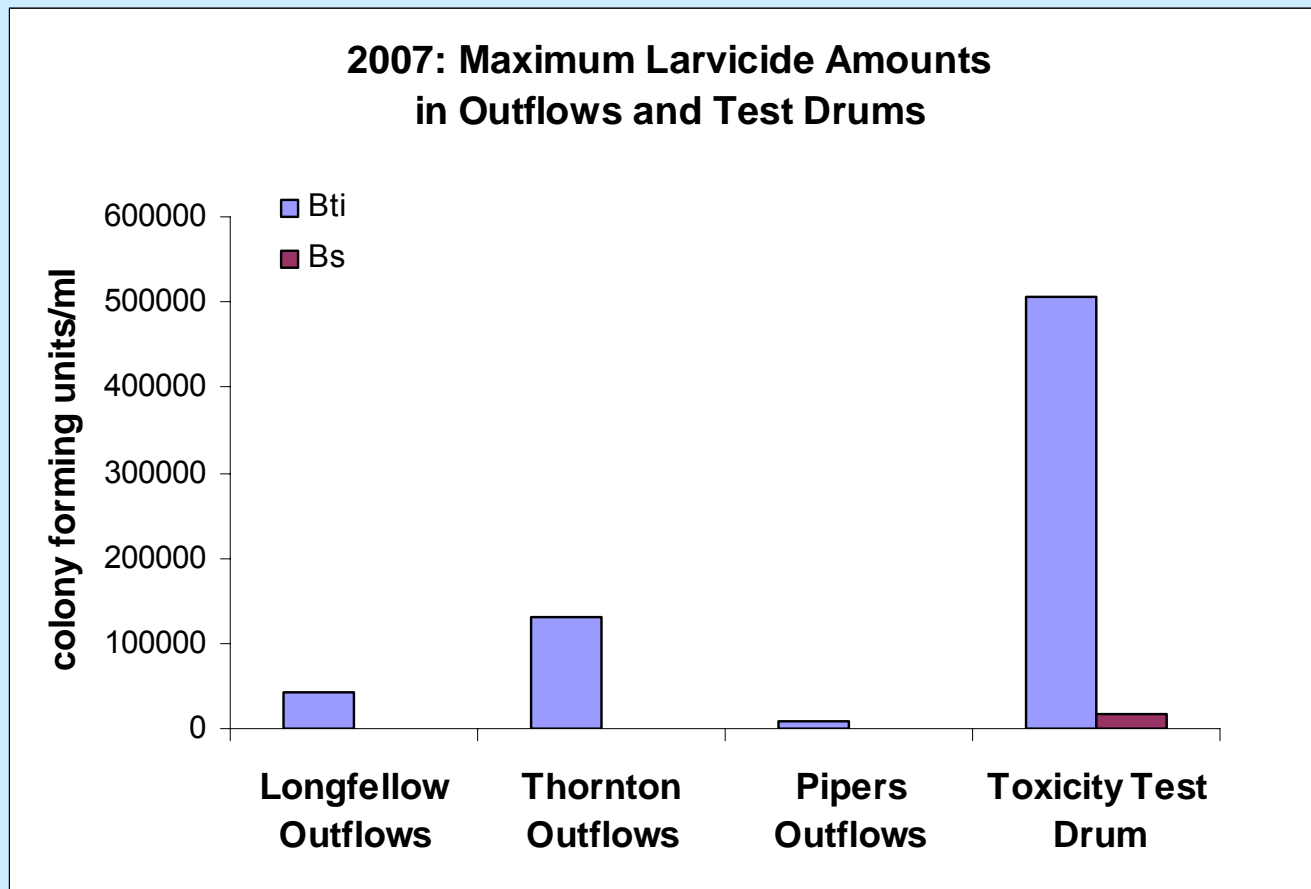
- Concentrations (cfu/ml) are compared graphically through time

2007 Outflow monitoring, potential for non-target effects

- Standard 96-hour toxicity tests
 - Test 1: Bs, Bti, methoprene larvicides singly
 - Test 2: Bs, Bti, methoprene larvicides in various combinations
- Methods
 - 50-Gallon Drums
 - Juvenile coho (0.8g/L fish weighting approximately 18 g)
 - Larvicides at max concentrations when fish were added
 - Collected water samples at hour 0 and hour 96



2007 Outflow monitoring, potential for non-target effects



2007 Outflow monitoring, potential for non-target effects

- In all samples, very little (if any) Bs was detected
- No adverse effects of larvicides on juvenile coho salmon even when larvicides were applied at maximum concentration

Summary

- Need for larvicide treatment is weather-dependent
- VectoLex® WSP (Bs, Bti) caused no adverse effects in coho and is effective at reducing mosquito pupae
- In subsequent research, even lower levels (cfu/ml) of Bs and Bti were detected in outflow samples

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