

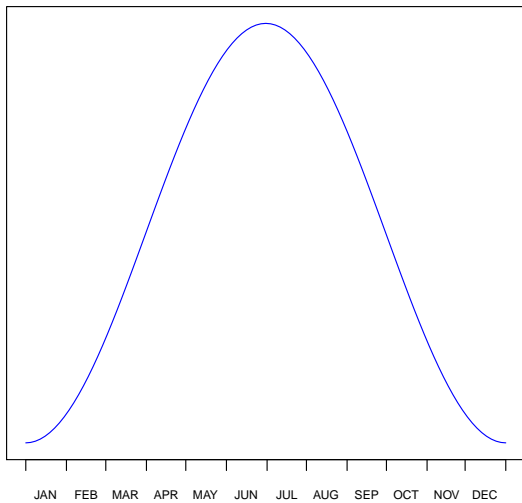
# Slightly Less Simple Mosquito Modeling

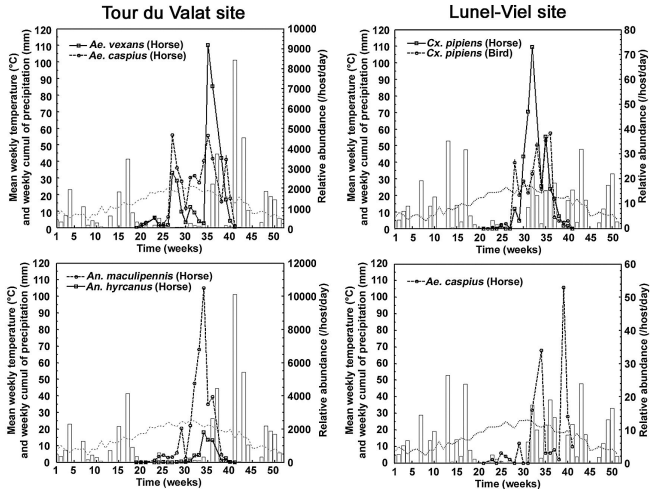
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Mosquito Abundance





**Figure:** Bicout et al. "Horse-, Bird-, and Human-Seeking Behavior and Seasonal Abundance of Mosquitos in a West Nile Virus Focus of Southern France". J. Med. Entomol. 43(5): 936-946 (2006)

## So, a Disconnect.

Specifically, it is impossible to match features like peak population, total population over a year, and turnover rate with a functional form

$$M(t) = C \sin(\omega t + \theta)$$

...and these features can be critical to predicting transmission dynamics, and thus planning interventions.

# Do Better, But Keep It Simple

What's appealing about this trigonometric representation?

Simplicity:

- ▶ two parameters
- ▶ no spatial features
- ▶ “easy” analytical form

Possible to identify alternatives that *can* match salient features, but still retain these features?

What are those salient features?

- ▶ every year,
- ▶ over a relatively short duration,
- ▶ the mosquito population rapidly increases,
- ▶ sits at a high level of activity,
- ▶ then rapidly declines,
- ▶ apparently connected with resource availability & environmental suitability

What's present in the trigonometric formulation?

- ▶ every year, **CHECK!** ... *but not the rest of:*
- ▶ over a relatively short duration,
- ▶ the mosquito population rapidly increases,
- ▶ sits at a high level of activity,
- ▶ then rapidly declines,
- ▶ apparently connected with resource availability & environmental suitability



1. useful to write models in terms of measurable parameters,
2. measurable parameters are not scale-free,
3. mathematics is more useful when scale free, therefore
4. dimensional analysis is awesome