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# **Frequently Asked Questions on *Culicoides* population surveillance**

Webinar African Horse Sickness –  
An overview of *Culicoides* biology, ecology and vector status

# How to collect adult *Culicoides*?

- Reference trap is the **OVI trap**
  - Set up at night, next to animal facilities (animals will serve as bait)
  - Black-light to disrupt flying midges and attract them, air fan to suck them down into the beaker
  - Robust, easy to use, can be use on regular main power or car battery
- The trap collects almost exclusively females, as being the hematophagous stage (in search for a blood meal)
- **The trap is not a control tool.** It will only collect a small portion of the active flying population



# Can I use mosquito traps to collect *Culicoides*?

- Mosquito traps (CDC light trap & related, BG-sentinel trap) will collect biting midges **BUT** ...
  - Dried midges are very difficult to sort out from other insects and to identify, midges need to be collected in a solution
  - High variability in *Culicoides* abundance in space and time, even at a very local scale or on a daily basis, difficult to compare with other data if not collected with the same device



From Probst et al 2015

# Can I use mosquito traps to collect *Culicoides*?

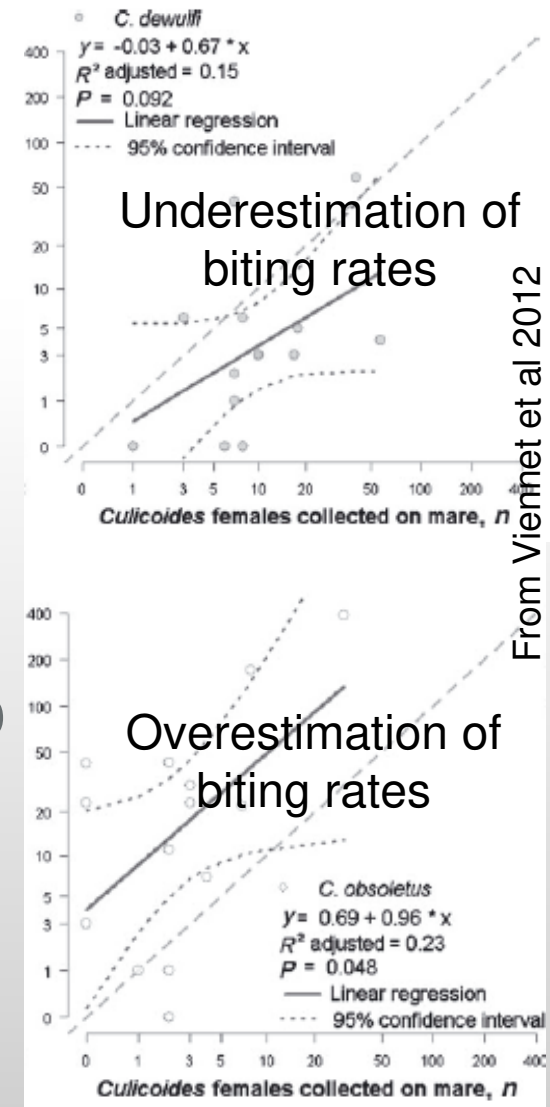
- Long series of trap comparison studies in the literature with other trap types (white/dark light/light LED diodes), with/without baits, different ecological zones & species diversity
  - Some species does not respond to baits like carbon dioxide



- **If choice, the OVI trap is the gold standard to (i) accurately assess species diversity & abundance and (ii) compare datasets from different studies**

# What is the correlation between abundance from light trap collections and biting rates?

- Host-baited collection should be the standard to characterize host preferences of main (vector) species and quantify biting rates
- Evidence that black-light trap collections could be used cautiously after established correlation, but also evidence of bias with overestimated/under underestimated biting rates for some species



# What is the best vector surveillance protocol?

- There is no perfect design. It depends on the objective of authorities & stakeholders
  - Determine the species diversity and identify species associated with all potential hosts *vs* only horse populations
  - Characterize abundance, dynamics (low abundance period) & distribution (low abundance area)
- **Vector surveillance must help the authorities & stakeholders in their risk assessment and management procedure *vs* research study**
- This will lead the surveillance protocol design (Nb of studying sites, ecological zones, collection nights) together with the epidemiological situation

# What is the vector free period/low abundance period?

- Relation between high population abundance and virus circulation, authorities use *Culicoides* abundance as a proxy for risk of virus transmission
  - Usually people consider all *Culicoides* species, and not only recognized vector species
- “Vector free period” means a time window for which the abundance of *Culicoides* is below a transmission risk threshold
  - related to meteorological drivers, spatial variations

# What is the *Culicoides* population dynamics in tropical areas?

- Effect of the rainy season on population abundance?
  - Heavy rains wash away immatures stages from breeding sites
  - Disrupt adult flying activities
- In tropical areas, the critical time period is the start or the end of rainy season, even though some species have continuous dynamics
  - Soils are adequate for immature stages development
  - Warm temperatures for adult activity and virus replication

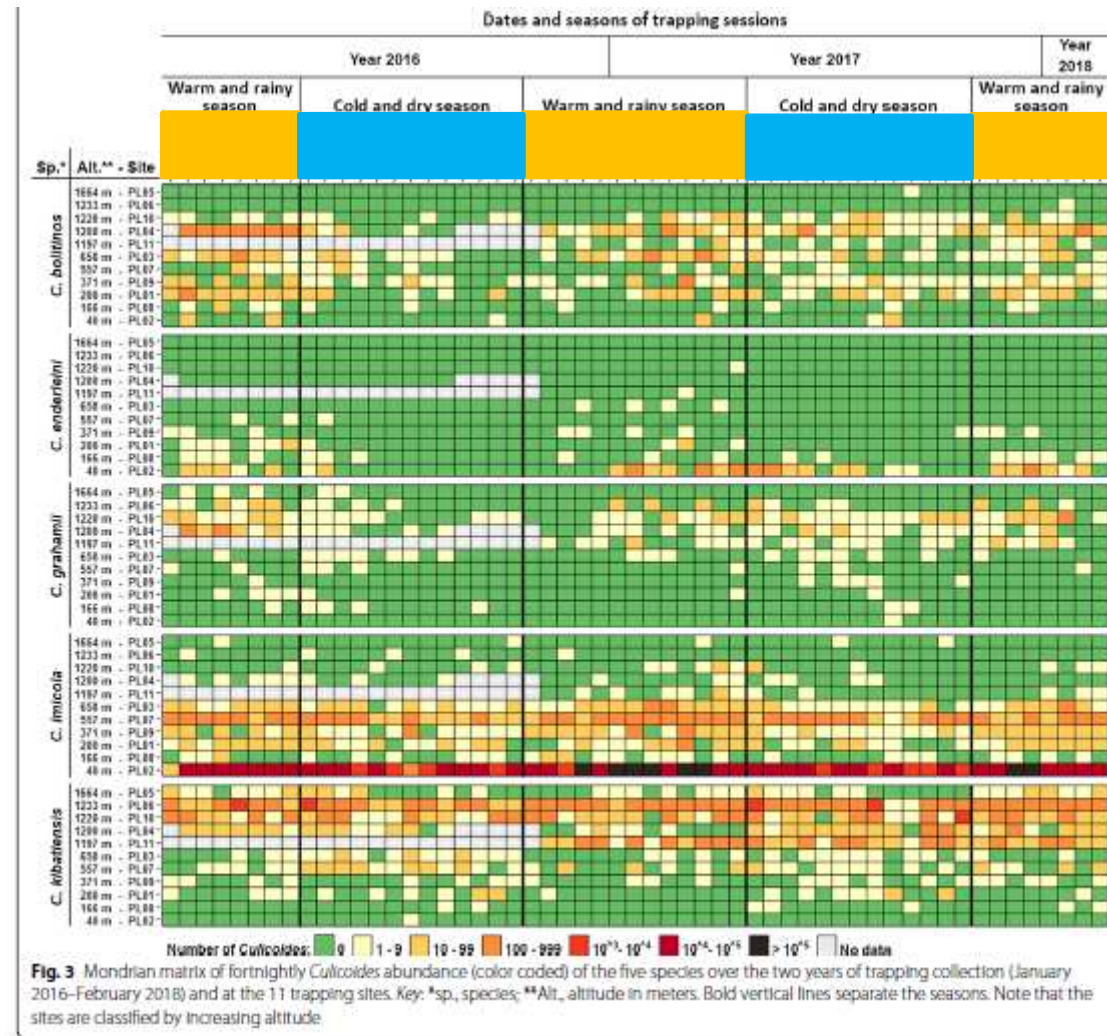


# Dynamics from tropical areas: example from La Réunion Island, Indian Ocean

Higher abundance at the end of the rainy season



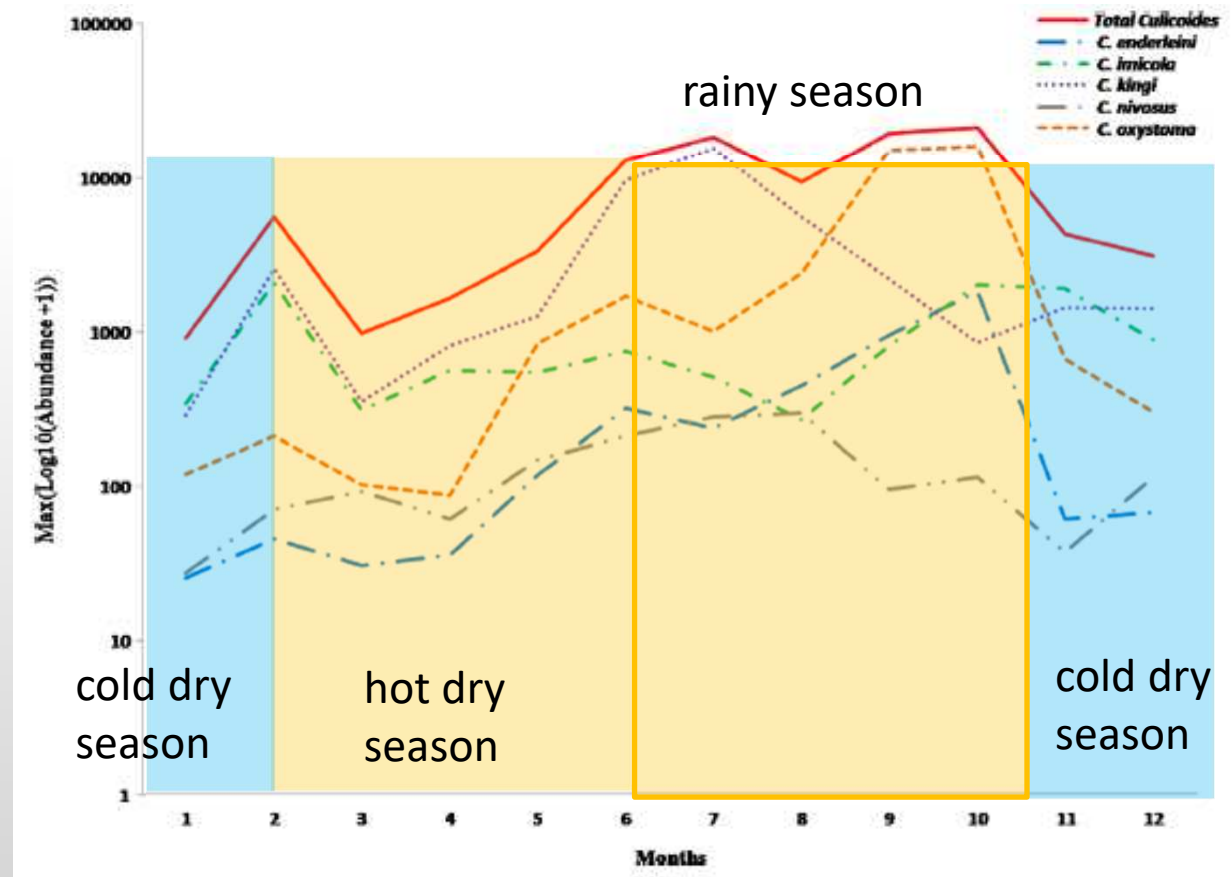
Continuous dynamics



From Grimaud et al 2019

# Dynamics from tropical areas: example from Senegal

- Continuous dynamics
- Abundance decreases during the cold dry season
- Abundance peak at the start and end of the rainy season



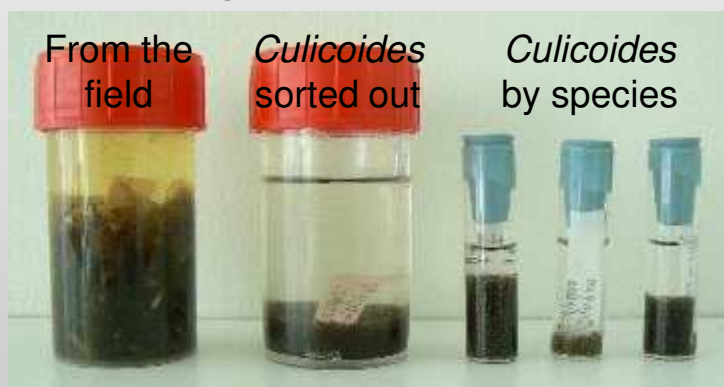
From Diarra et al 2014

# How the European BT experience can help?

- Long-term and wide scale studies are important to implement to have sufficient and accurate data for risk management
  - Baseline for further modelling studies
  - Huge inter-annual variations in relation to meteorological parameters
  - Of interest for the AHS-free status application
- Main bottleneck: morphological identification of samples
  - Time consuming, need expertise and dedicated staff
- **Huge long-term benefit for the authorities for the current AHS outbreak, and beyond for *Culicoides*-borne diseases**

# Do we need to identify all the specimens? What about molecular identification?

- Subsampling protocol accepted and published (Van Ark et al 1992, modified from Van Ark et al 1992)
- There is no molecular identification assays to be used in routine (PCR-based assays for European species), **however** useful to
  - confirm morphological identification (link to molecular databases)
  - develop a molecular barcode library on your local fauna



# Can we screen *Culicoides* populations for virus presence as surveillance tool?

- **Not as a routine surveillance tool**
  - Time consuming (need to screen 1000+ of monospecific pools of females)
  - Expensive, no virus isolation from midges stored in alcohol
  - Need to be implemented as a research study
- Very low rates of virus circulation in field-collected populations (usually below 1%)
  - Field vector infection rate of 0.91% in Namibia, no viable AHSV could be isolated from tested pools (Goffredo et al 2015)
- Clinical & active surveillance in host populations has more benefits



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# Where can I buy the OVI trap?

- Not sold by regular mosquito/vector control companies
- Two suppliers: IZSAM, Italy & OVI, South Africa
  - Model depends on suppliers : 12 V for battery - 220 V - 12V/220 V
  - Given the current Covid worldwide situation, big delays in producing and shipping
  - € 428,00 per unit (IZSAM)
- Research institutes may have some stock



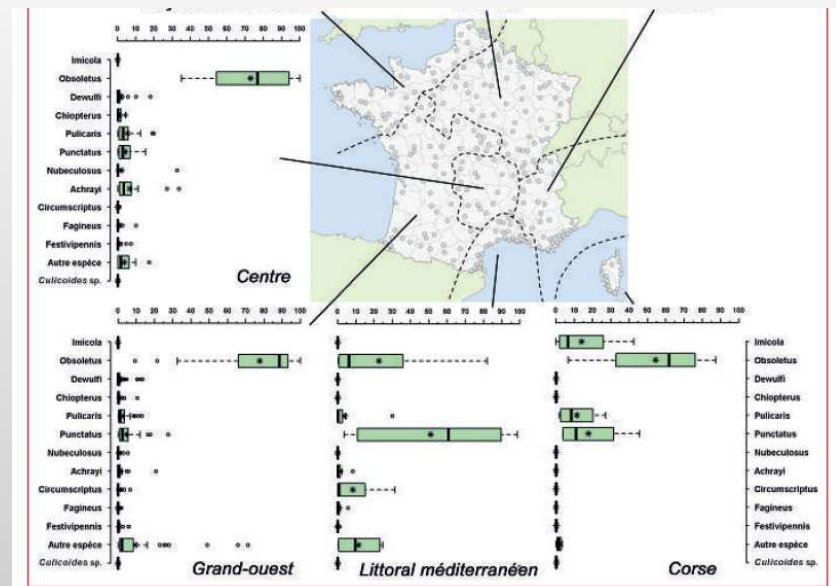
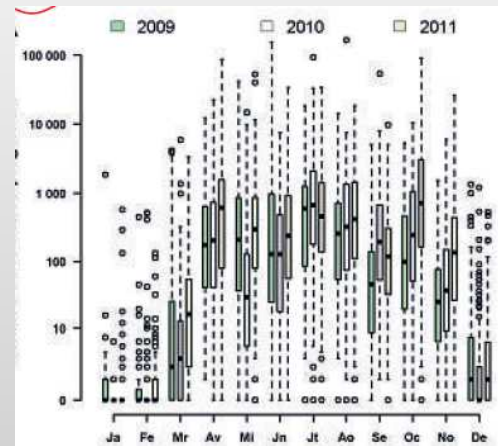
# How did we face BTV emergence in France in terms of vector surveillance?

- **2006: BT emergence in France**, massive economic impact on domestic ruminants (cattle, sheep, goats)
- Very limited background on vector species, bio-ecology, dynamics and distribution
- Mandatory to set up vector surveillance (OIE-listed disease)



# How did we face BTV emergence in France in terms of vector surveillance?

- Wide scale monitoring
  - 4 years of monitoring, 160 sites, weekly or monthly collection depending on season
  - Morphological identification of all individuals, use of a subsampling protocol



# How did we face BTV emergence in France in terms of vector surveillance?

- Largescale dataset of *Culicoides* diversity and vector species, abundance and dynamics to help defining **the start, time and end of the vector free period for each administrative** unit to reduce the ban of domestic ruminant movements (together with virological evidence)

