

A grey cooler is positioned on a narrow path that winds through a dense thicket of green bushes and tall grass. The scene is captured from a slightly elevated angle, showing the texture of the foliage and the placement of the cooler. The overall atmosphere is natural and somewhat secluded.

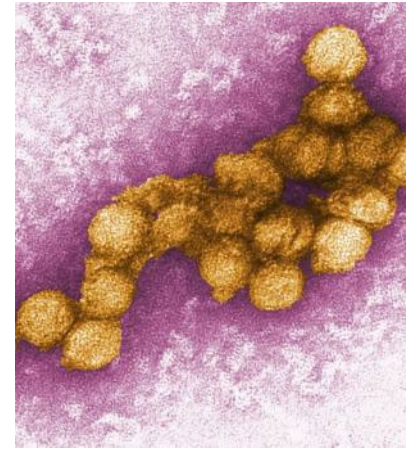
Gravid Emulsion Trial

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Introduction

- On average each year, *Culex pipiens* make up 75% of our total trap catches
- Gravid traps account for 50% of all trap nights
- We test only *Culex pipiens* for West Nile Virus
- Frequently looking for ways to increase collections of *Culex pipiens*



- Article published in the Journal of Medical Entomology in March 2022
- “Fish emulsion-infused water is often used for *Culex* surveillance in the American South. However, hay-infused water is more common in the rest of the United States”
- Study was conducted by Louisiana State University Dept. of Entomology
- Compared attractiveness of hay-infused gravid water to gravid water made from commercial fish fertilizer.
- Results found the fish emulsion collected more *Culex quinquefasciatus* than the hay infusion

Short Communication

A Comparison of Hay and Fish Emulsion-Infused Water as Oviposition Attractants for the CDC Gravid Trap

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Subject Editor: Theodore Andreadis

Received 28 July 2021; Editorial decision 1 November 2021

Abstract

Multiple oviposition attractants are used for *Culex* (Diptera: Culicidae) mosquito surveillance in the CDC Gravid Trap, including hay and fish emulsion-infused water. Despite the use of both in the United States, no research has compared their attractiveness. We conducted trapping throughout Louisiana to assess the attractiveness of hay and fish emulsion-infused water in various habitat types and climates. Our results indicate that fish emulsion-infused water attracts more mosquitoes overall, more *Culex quinquefasciatus* (Say, 1823), and a wider diversity of mosquitoes than hay-infused water. This trend was maintained, regardless of habitat type or climate.

Key words: CDC gravid trap, mosquito surveillance, oviposition attractant, *Culex*, mosquito control

West Nile virus (WNV) is the most significant mosquito-borne disease in the continental United States. It is primarily reservoired by migratory birds, with avian-feeding mosquitoes acting as the primary vectors (Turell et al. 2001, Reisen 2013). In Louisiana, the primary vector of WNV is *Culex quinquefasciatus* (Say, 1823). Significant effort is employed to monitor *Cx. quinquefasciatus* populations, as part of management programs aimed at reducing WNV transmission (McDonald et al. 2019, Rochlin et al. 2019). Multiple methods are used for population surveillance. However, the Centers for Disease Control and Prevention Gravid trap (gravid trap) is the principal tool used for *Cx. quinquefasciatus* (Reiter 1983, Mackay et al. 2008).

The gravid trap uses organically rich water to attract gravid females. Two common attractants are fish emulsion or hay-infused water (Reiter 1983, Jameson and Wessen 2016). Fish emulsion-infused water is often used for *Culex* surveillance in the American South. However, hay-infused water is more common in the rest of the United States (Jackson et al. 2005, Palmisano et al. 2005, Foppa et al. 2007, Gleiser et al. 2007, Unlu et al. 2010, Lowrie 2016, Varnado and Goddard 2016, Moise et al. 2018).

While previous research has examined the efficacy of fish emulsion as a mosquito attractant, these studies have been limited to container breeding mosquitoes (Holck et al. 1988, Beehler and

DeFoliart 1990, Trexler et al. 2003). The only study that directly compared fish emulsion and hay, Holck et al. (1988) observed higher rates of *Aedes albopictus* (Skuse, 1894) (Diptera: Culicidae) oviposition in fish emulsion-infused water than hay-infused water. While some anecdotal evidence exists, implying that this preference also exists in surface breeding *Culex* mosquitoes, and unpublished trials conducted by Iberia Parish Mosquito Abatement found fish emulsion-infused water more attractive to *Cx. quinquefasciatus* than hay-infused water, no published research has directly compared the effectiveness of the two oviposition attractants in surface breeding mosquitoes such as *Cx. quinquefasciatus* (Lowrie 2016; R. Pellerin, personal communication). This lack of published data is problematic for two reasons. First, there is a lack of information for mosquito abatement districts to use when developing surveillance programs. Second, it makes extrapolating the results of comparative trapping studies that use fish emulsion-infused water to other trapping studies difficult.

To bridge this lack of information, we compared water infused with fish emulsion and hay in gravid traps. We conducted this comparison in multiple Parishes across Louisiana to compare across multiple populations. Furthermore, we examined if preference varied due to climate and habitat to determine their potential effects on oviposition preference.

Comparison Trial Design

Round #1:

- Head-to-head comparison between **Norfolk Recipe** and **Fish Emulsion Recipe**
- Set 2 traps at each site
- Trap 2 consecutive nights
- Emulsion was dumped after the first night and replaced with fresh emulsion of the opposite recipe
- 1 site per week for 3 weeks.
- 3 Different Sites
- Epi Weeks 20-23

Emulsions

- **Norfolk Recipe**

- Straw
- 2 tbsp Brewers Yeast
- ½ cup Chicken Manure Fertilizer
- Water

All ingredients are mixed in a 55-gal trash can and left to ferment for 4 days (Thursday-Monday)





Emulsions

Fish Emulsion Recipe

- 5 oz Liquid Fish Fertilizer
- 5 gallons water

All ingredients are mixed in a 5-gal water cooler and left to ferment for 4 days (Thursday-Monday)



Fish Emulsion

Round #1

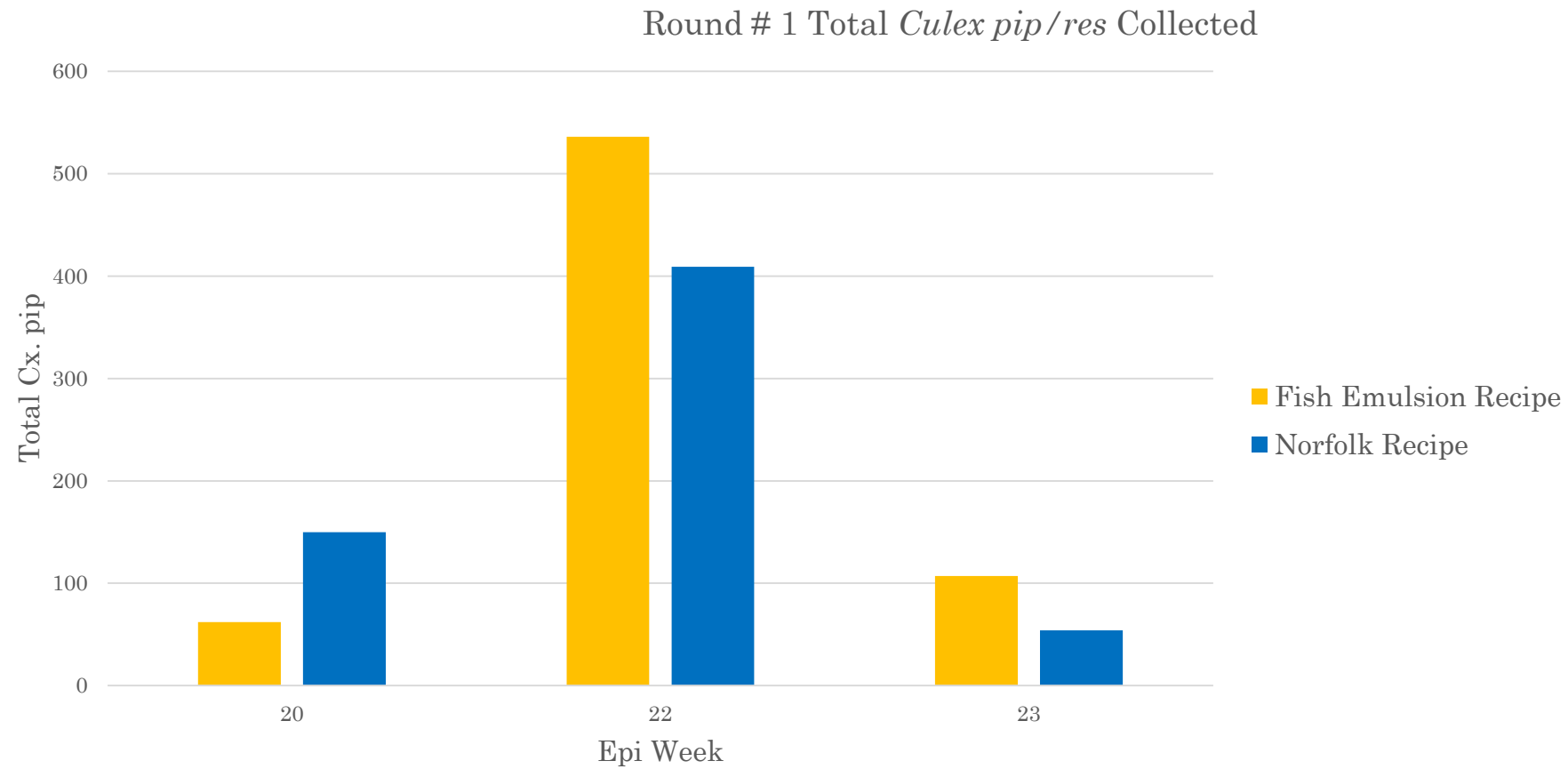
- 3 Sites selected:
 - 5250 Cape Henry Ave
 - 3000 Birch St
 - 2416 Pershing Ave
- All sites were pumpstations
- Traps were set two consecutive nights in a row.
- Emulsion, battery, and trap net were replaced after night #1.



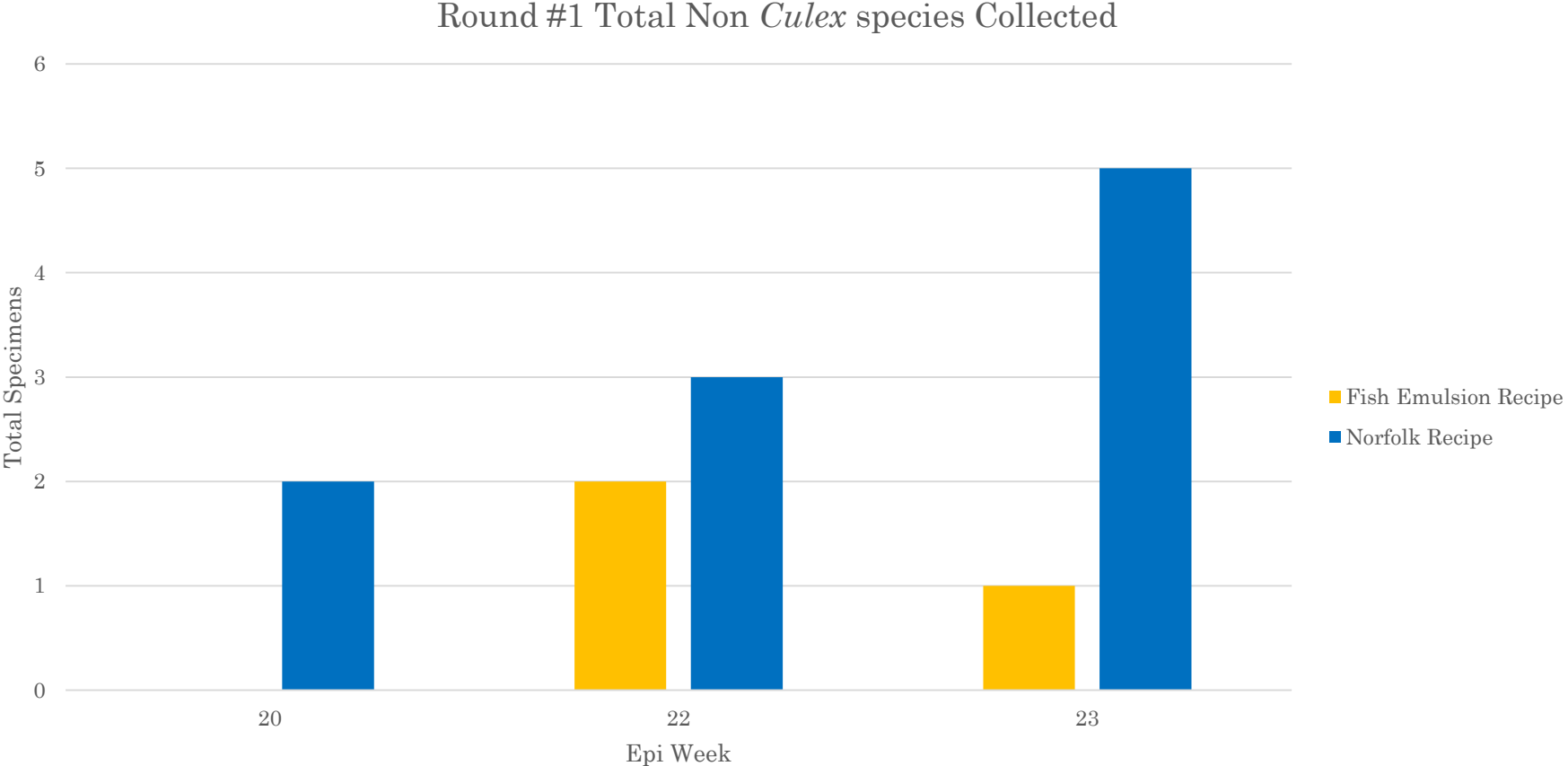
Round #1 Results

Date	Week	Address	TrapType	Aealb	Cxpip	Total
5/19/2022	20	5250 Cape Henry Ave, Norfolk, VA	Fish Emulsion Recipe		8	10
5/19/2022	20	5250 Cape Henry Ave, Norfolk, VA	Norfolk Recipe	1	91	99
5/20/2022	20	5250 Cape Henry Ave, Norfolk, VA	Norfolk Recipe		59	61
5/20/2022	20	5250 Cape Henry Ave, Norfolk, VA	Fish Emulsion Recipe		54	56
6/1/2022	22	3000 Birch St, Norfolk, VA	Fish Emulsion Recipe	1	253	258
6/1/2022	22	3000 Birch St, Norfolk, VA	Norfolk Recipe	1	202	210
6/2/2022	22	3000 Birch St, Norfolk, VA	Fish Emulsion Recipe	1	283	296
6/2/2022	22	3000 Birch St, Norfolk, VA	Norfolk Recipe		207	216
6/7/2022	23	2416 Pershing Ave, Norfolk, VA	Fish Emulsion Recipe	1	37	38
6/7/2022	23	2416 Pershing Ave, Norfolk, VA	Norfolk Recipe	4	37	43
6/8/2022	23	2416 Pershing Ave, Norfolk, VA	Fish Emulsion Recipe		70	72
6/8/2022	23	2416 Pershing Ave, Norfolk, VA	Norfolk Recipe	1	17	18

Round #1 Results



Round #1 Results



Comparison Trial Design

Round #2:

- Head-to-head comparison between **Norfolk Recipe**, **Fish Emulsion Recipe**, and **Norfolk + Fish Emulsion Recipe**
- Set 3 traps at each site
- Trap 3 consecutive nights, rotating the trap locations each night
- 1 site per week for 5 weeks
- 4 different sites
- Epi Weeks 24-37



Emulsions

Norfolk + Fish Emulsion Recipe

- 5 oz Liquid Fish Fertilizer
- 5 gal Norfolk Recipe Water

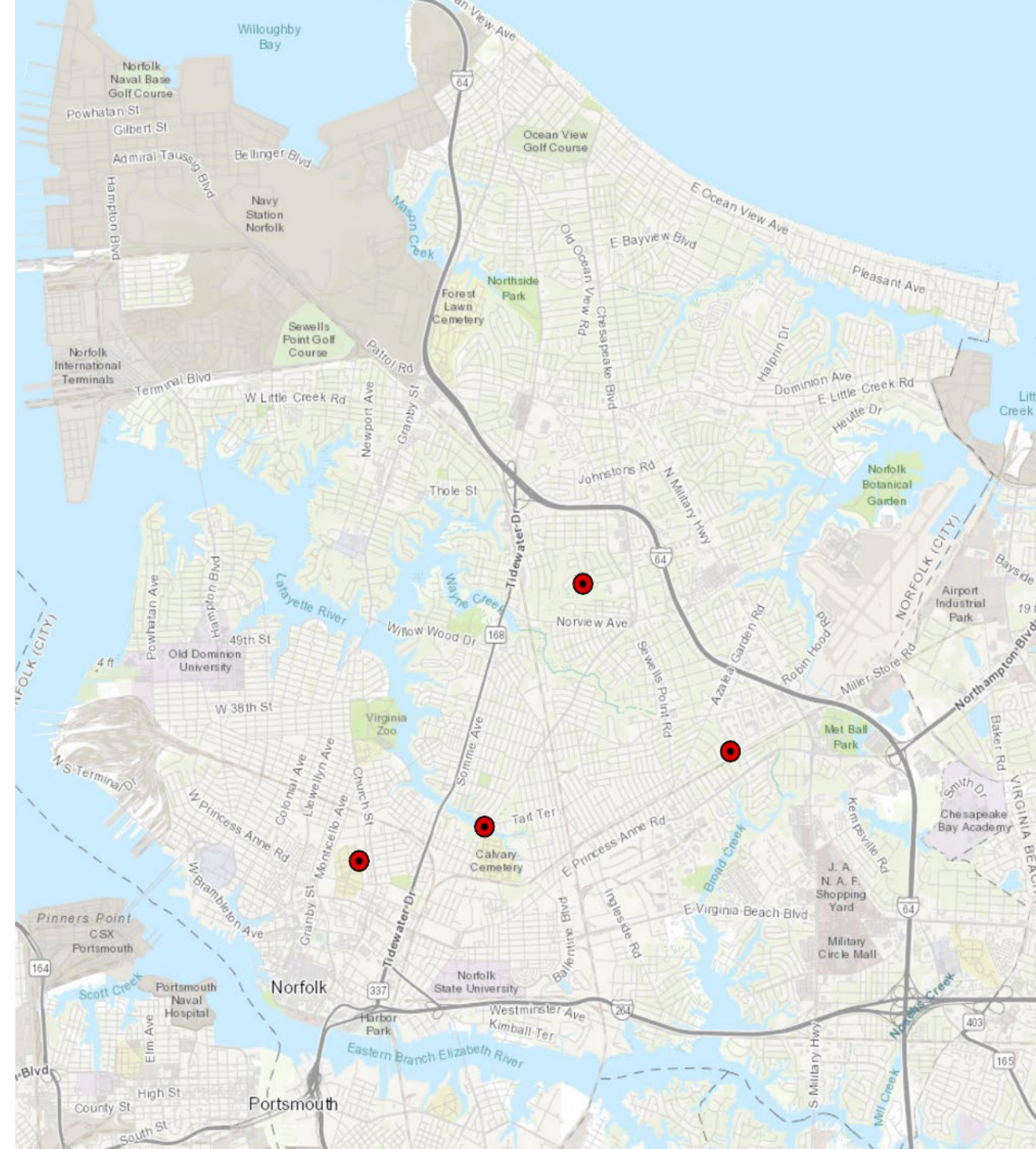
All ingredients are mixed in a 5-gal water cooler and left to ferment for 4 days.



1- gal jugs were labelled for each emulsion and used consistently

Round #2

- 4 Sites Selected:
 - 5250 Cape Henry Ave (Pumpstation)
 - 238 W Princess Anne Rd (Cemetery)
 - 6345 Devonshire Rd (Pumpstation)
 - 2510 Chesapeake Blvd (Pumpstation)
- 5 Trapping Cycles
- Sites were trapped for 3 consecutive nights = 9 traps total
- Emulsion, collection net, and battery were replaced every day





2510 Chesapeake
Blvd

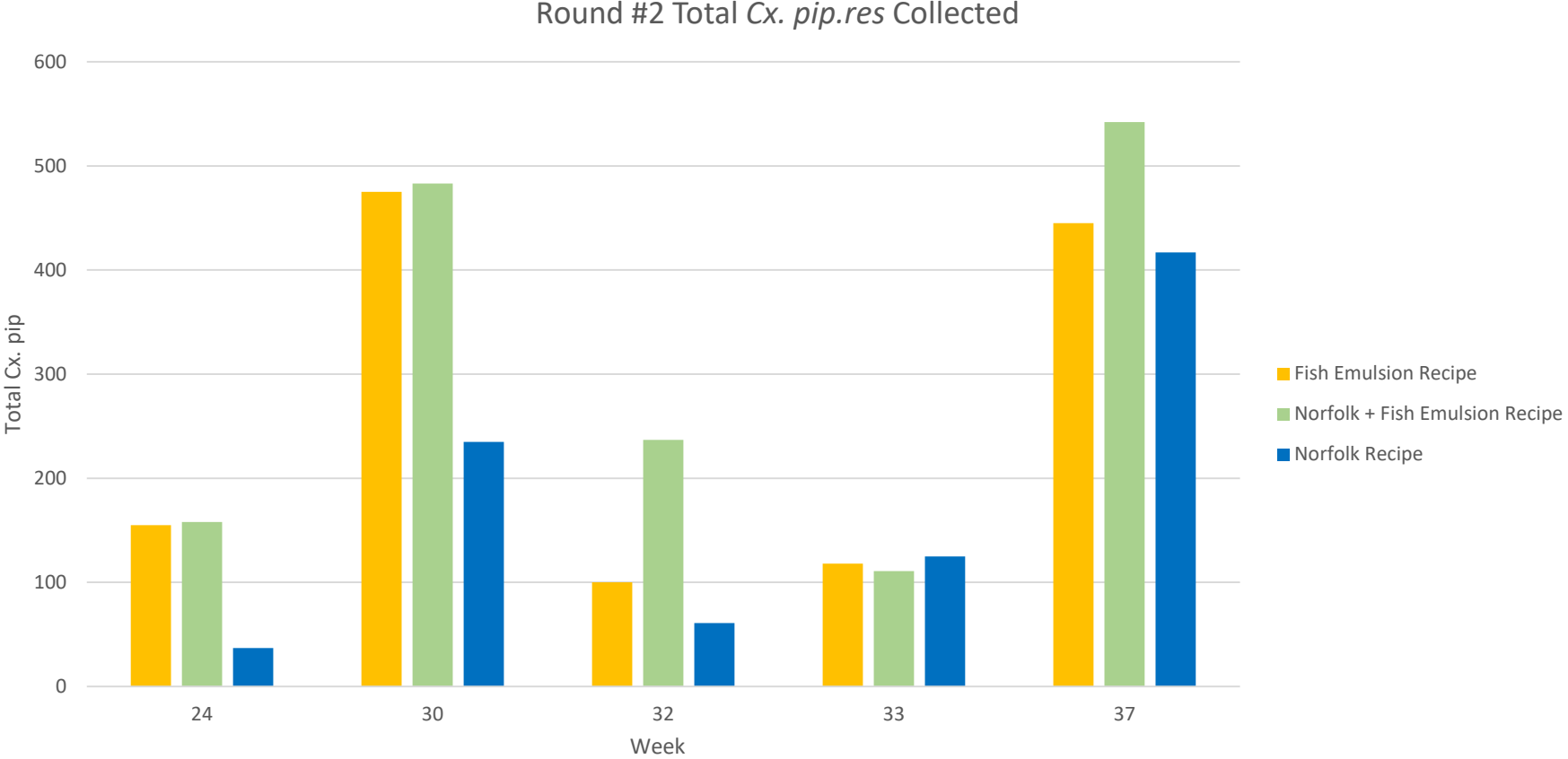


6345
Devonshire
Rd

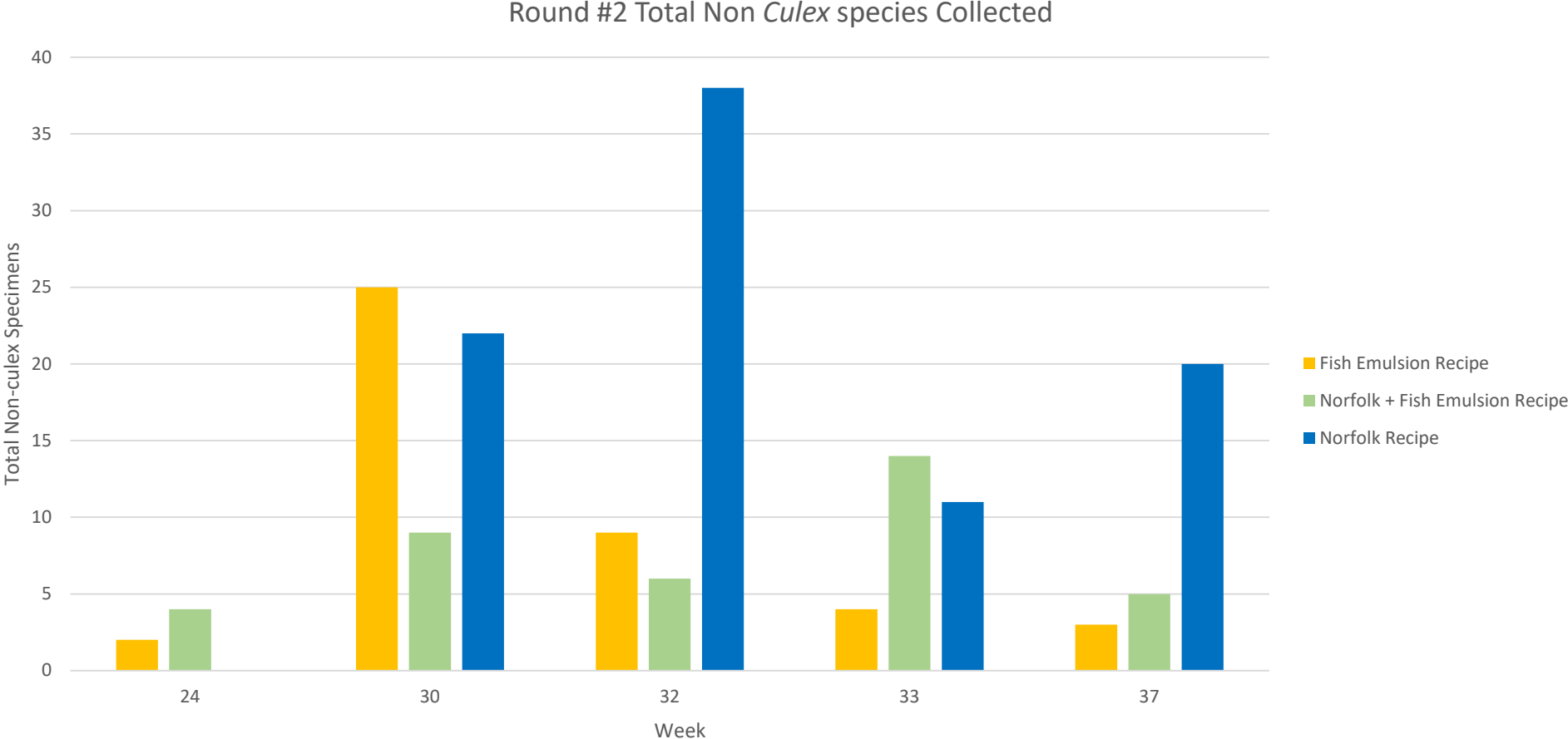


5250 Cape Henry Ave

Round #2 Results

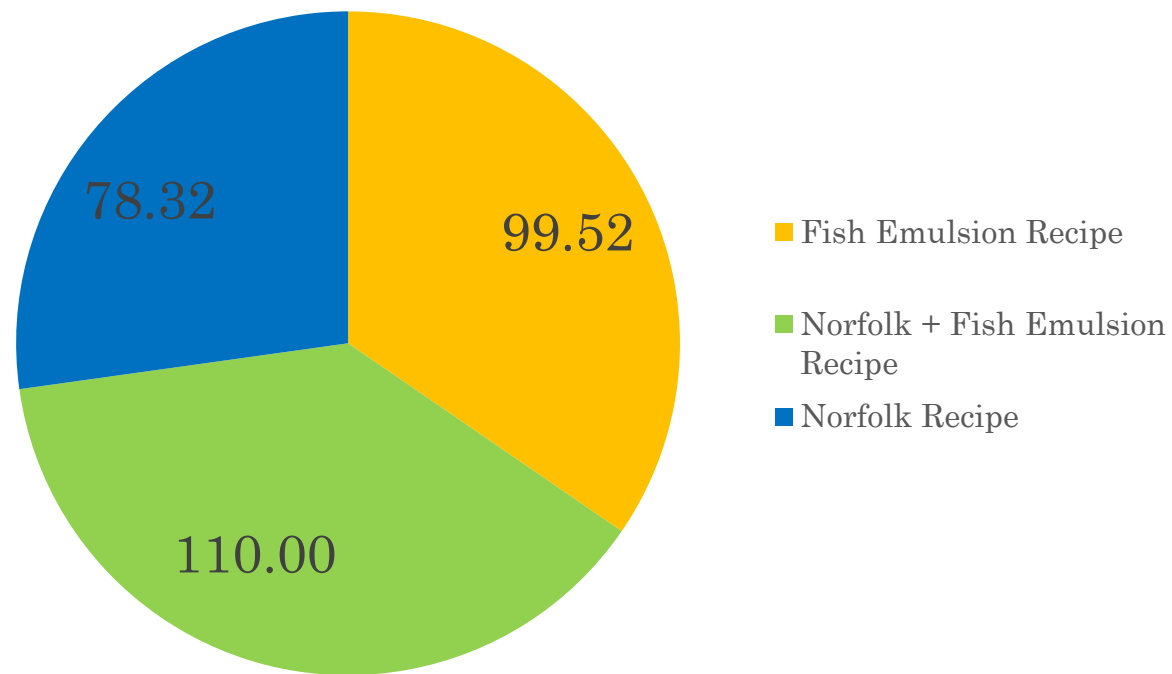


Round #2 Results



Overall Results

Average Number of *Culex pip/res* Collected from Each Trap Type



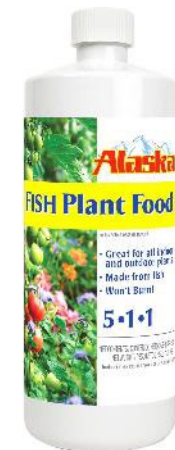
Norfolk + Fish Emulsion caught 40% *Culex pip/res* than the [Norfolk Recipe](#)

Conclusions

- **Norfolk + Fish Emulsion** collected more *Culex pip/res* on average than the other two formulations
- **Norfolk Recipe** collected more non-*Culex* species but was not statistically significant
- Moving forward, Norfolk will continue to use our original formulation with the addition of liquid fish fertilizer to increase trap collections
- Liquid Fish Fertilizer smells **BAD**. Really **BAD**.

Costs

- Purchased (2) 32oz bottles of Alaska brand Fish Fertilizer for \$12 each at Taylor-Do-It Center
- Using recipe in published study and trial, this would require adding 1.75 bottles to our 55-gal trash can recipe.
- Gravid water is renewed once a month
 - ~8x year
- Alaska Fish Fertilizer is available in other sizes:
 - 1-gal, \$29.99
 - 5-gal, \$97.14
- Annual cost to add fish fertilizer to our gravid recipe will be ~\$105



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Any
questions?

