Building a Better Bug Trap:

Petri dishes as a low cost and easy to use sticky trap

Joshua T. Smith, Theodore A. Kennedy, Jeffrey D. Muehlbauer
U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Southwest Biological Science Center, Flagstaff, AZ 86001

Introduction

- Insect emergence is a fundamental process in freshwaters: it represents a critical life history stage for aquatic insects and provides an important prey resource for terrestrial and aquatic consumers.
- Sticky traps are widely used for sampling these insects.
- A conventional trap consists of an acetate sheet coated in a non-drying adhesive that is attached to a wire frame or cylinder.
  - Can be time consuming and difficult to work with.
- Our goals were to develop a low cost sticky trap that could be prepared in advance, was easily transported, could be used to estimate flight direction of aquatic insects, and that could be rapidly deployed and recovered.

Methods

- We used 150 mm Petri dishes with lids, which can be coated cleanly and consistently with Tanglefoot® and stored indefinitely.
- A 2.5 cm x 2.5 cm of adhesive backed Velcro (pile side) squares to the center of each dish.
- The Petri is mounted to a 1.5 m section of 1.27 cm steel conduit.
- Using a large vise, we laterally compressed the top 150 mm of the pole and the next lower 150 mm perpendicular to the first compressed area.
- A 2.5 cm x 2.5 cm piece of adhesive backed Velcro (hook side) was applied to the center of each compressed area.
- Four dishes can be attached to the pole aligned in four cardinal directions, allowing investigators to easily estimate insect flight direction.
- The pole can be pushed or hammered into the ground, or when the ground is rocky a cairn of rocks can be built around the base of the pole near the high water line.
- After sampling, Petri dishes can be taped closed, and packed in boxes.

Fig. 1 Petri Trap Construction

Case Study

- Proof of concept study to test the efficacy of this method.
- Sticky traps placed at 0, 50, 100, 200, and 400 meters .
- On 29 May, 2013 a total of 18 poles were deployed with 72 petris over 1.2 kilometers for 24 hours
  - Upstream and downstream of the confluence
  - Both sides of the Paria River.

Pole	Water	Upstream	Downstream	Land	Total	Weight
PDR0	163	188	**557**	92	1000	6.55%
PDR50	153	136	126	**302**	717	4.69%
PDR100	100	207	**327**	76	710	4.65%
PDR200	362	198	**545**	307	1412	9.24%
PDR400	144	**442**	192	198	976	6.39%
PTL50	124	**245**	123	141	633	4.14%
PTL100	31	33	**52**	19	135	0.88%
PTL200	29	69	**105**	24	227	1.49%
PTR50	263	74	**335**	179	851	5.57%
PTR100	**23**	20	22	18	83	0.54%
PTR200	48	133	**192**	34	407	2.66%
PUR0	**1042**	638	114	213	2007	13.14%
PUR50	92	**218**	124	105	539	3.53%
PUR100	150	**565**	341	128	1184	7.75%
PUR200	322	**1988**	890	188	3388	22.18%
PUR400	104	375	**389**	141	1009	6.60%

Table 1. Individual pole data with weight against total maximum. Listed direction indicates insect flight direction.

Legend
PDR Downstream River
PUR Upstream River
PTL Tributary Left
PTR Tributary Right

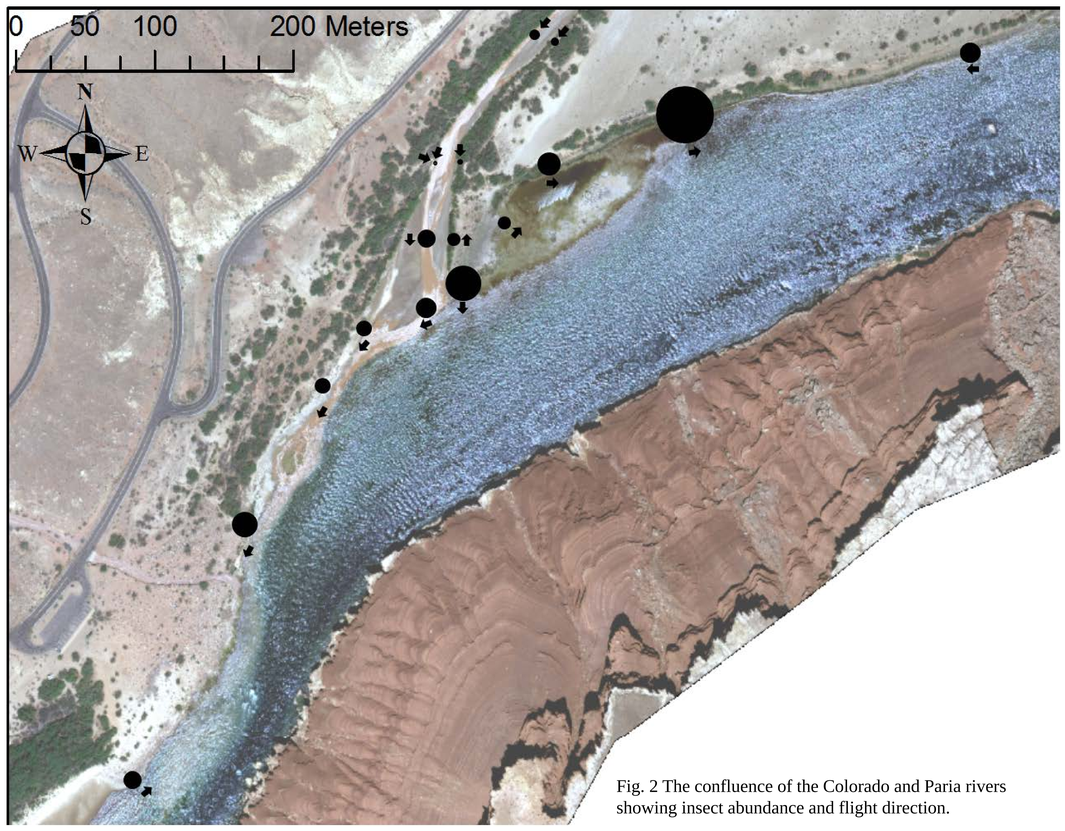

Fig. 2 The confluence of the Colorado and Paria rivers showing insect abundance and flight direction.

Results

- Petri traps are easy to use and fast.
  - Deployment time trials found petris to be:
    - **3.3X** faster than suspended acetate sheets.
    - **4.9X** faster than cylinder traps.
  - Similarly low cost to other sticky traps.
- Petri traps are effective.
  - **15278** aquatic insect caught.
  - Flight direction detected.
    - Chi Square test conducted on each pole and each group.
      - Results suggest catches are not random.

Direction	Observed	Expected	Sum/ X^2	p value
TW	518	584	159.32	**<0.001**
TU	574	584		
TD	**829**	584		
TL	415	584		
DW	922	1203.75	626.67	**<0.001**
DU	1161	1203.75		
DD	**1923**	1203.75		
DL	809	1203.75		
UW	1710	2031.75	2354.38	**0.00**
UU	**3784**	2031.75		
UD	1858	2031.75		
UL	775	2031.75		

Table 2. Chi Square test results. Listed direction indicates insect flight direction.

T - Tributary
D - Downstream
U - Upstream
L - Land
W - Water

Discussion

- The findings suggest a general outward flow of insects from the tributary into the mainstem.
  - Dispersal both upstream and downstream from the confluence (Fig. 2).,
- Another observation is reduced numbers of insects within the tributary compared to the mainstem.
  - Likely due to reduced area for production and a less productive substrate type.
- Also noted was an increase in insect abundance adjacent to more productive river substrates.

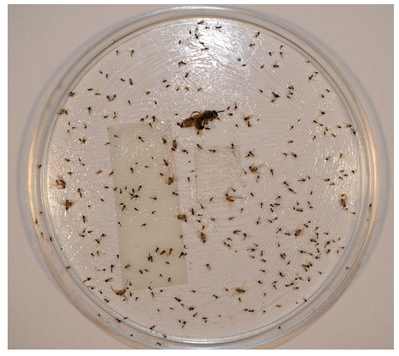

Fig. 3 A Result!

Conclusion

The Petri sticky trap performed well in our study environment. The convenience of having prepared traps allowed us to deploy a large array in a reasonably short amount of time. There are some trade-offs for convenience in that Petri traps require a considerable amount of space to store and transport. Large petri dishes are an ideal platform for sampling emergent insects, particularly when rapid deployment and recovery is critical.