

A SUCTION TRAP FOR HOURLY SAMPLING OF COASTAL BITING FLIES¹

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ABSTRACT. Construction of a suction trap for hourly collection of coastal biting flies is described. The trap uses a turntable collector, weighs about 35 lb, operates on a-c current, and is relatively simple and economical to build. Over 1,000 hr of operation in the field have proven the trap to be very reliable. With this

trap 10 species of biting flies were captured near a *Spartina alterniflora* Loiseleur dominated salt marsh in Carteret County, North Carolina. Coastal biting gnats (Diptera: Ceratopogonidae) comprised the greatest percentage of the catch.

INTRODUCTION

Suction traps have been used to study the aerial density, vertical distribution, diel flight activity, seasonal incidence, and flight direction of mosquitoes, biting gnats, and other hematophagous insects (Service 1976). Since they do not employ attractants, suction traps should give less biased samples of airborne insects than most other methods.

Suction traps have been developed for field use and some are commercially available (Johnson 1950, Taylor 1951, Johnson and Taylor 1955). The "Johnson-Taylor" exposed cone trap segregates the hourly catches by dropping discs into collecting tubes. Other methods of segregating catches (mostly light traps) utilize turntables (Williams 1935, Standfast 1965).

To conduct ecological studies of coastal biting flies in North Carolina a durable yet economical suction trap capable of seg-

regating catches into hourly intervals was designed. The trap uses a turntable to divide the catch into 12 1-hr samples, weighs about 35 lb., costs less than \$100 to build, and operates on a-c current.

DESCRIPTION OF TRAP

The insect sampler (Fig. 1) consists of a 1/70 hp 120 v duct fan (1974 Catalog No. 2C223)³ with its motor replaced by a more weather-resistant fully enclosed 1/70 hp 120 v kitchen fan motor (1974 Cat. No. 3M249)³. The fan had 6 blades (9 in. diam) and was mounted inside a 12 in. diam duct supported by 3 rigid conduit legs (¼ in. diam X 33 in.). A collector funnel of 40 mesh brass cloth (1974 Cat. Type 307)⁴ was mounted below the duct fan using 2 large hose clamps. The collector funnel tapered into a hole (1½ in. diam) in the top of the collector apparatus (partially enclosed turntable) which was supported on a 3 rigid conduit collector legs (½ in. diam x 36 in.) mounted at a slight angle to increase stability. The legs can be pushed into the ground for added support against the wind and to adjust the collector height. Power to rotate the turntable was supplied by a pulley and weight (2 lbs) suspended on polypropylene rope (¼ in. diam).

An exposed view of the collector appa-

¹This research was supported by NOAA, Office of Sea Grant, U. S. Department of Commerce, under Grant No. 04-3-58-40 and the North Carolina Department of Administration. Paper No. 5231 of the Journal Series of the North Carolina Agricultural Experiment Station, Raleigh, N.C. In this paper measurements and weights are given in the English system to facilitate purchase of materials and construction in the United States.

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ratus (Fig. 2) shows the relative positions of the various parts. The $\frac{1}{2}$ in. plywood top was painted bright yellow to preserve the wood and make it easier to see the sample jars. The exposed surface of the top and most of the rest of the trap were

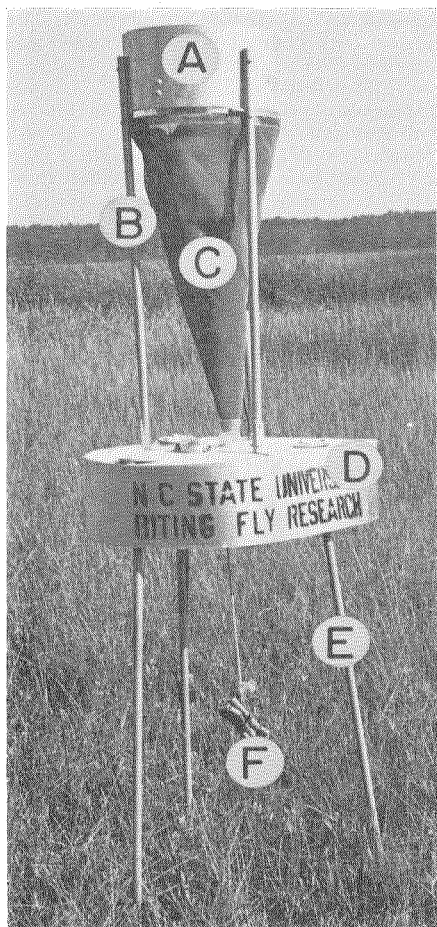


Fig. 1. Hourly suction trap (A) duct fan, (B) funnel legs, (C) collector funnel, (D) collector apparatus with turntable inside, (E) collector legs and (F) lead weight.

painted with gray enamel. The turntable ($\frac{1}{2}$ in. plywood) was notched around the circumference and bolted to a steel plate (3 in. diam x $\frac{1}{8}$ in.) which was welded to a steel shaft ($\frac{1}{2}$ in. diam x $8\frac{1}{2}$ in.). The shaft was mounted at both ends to a flange mounted pillow block bearing (1974 Cat. No. 4X727)³. One bearing was bolted to the plywood top and the other bolted to the steel turntable bracket (4 in. x 28 in.). The shaft had a 3 in. diam single-grooved sheave welded just above the lower bearing. A plastic rope was wound around the sheave and passed through a small pulley (1 in. diam) mounted on the turntable bracket. A weight suspended from the end of the rope provided power to rotate the turntable. A repeat cycle 120 v timer (1974 Cat. No. HR2-24)⁵ and duplex receptacle were mounted on the plywood top and the entire collector apparatus was shielded by a sheet metal skirt (4 in. x 68 in.).

The turntable dimensions are shown in Fig. 3. The plastic lids of glass specimen jars (1974 Cat. No. 71-5533)⁶ were drilled out (1 $\frac{1}{8}$ in. diam hole) and cemented over the 12 equally spaced holes in the plywood turntable. Jars, containing alcohol or other killing agents, were screwed into the mounted lids to collect the samples.

The changer mechanism (Fig. 4) consisted of two black steel slider bars fixed to a moveable black steel pivot arm. A coil spring (3 in.) was fastened to the pivot arm and the plywood top. A 120 v solenoid (1974 Cat. No. 4X239)³ was attached to the opposite side of the pivot arm via a heavy metal wire (1/16 in diam x 6 in.). The dimensions of the slider bars and pivot arm are given in Fig. 5.

The timer was wired to the solenoid and causes it to close for about 15 sec. every hr. This causes the pivot arm to pull the 1st slider bar from the notch in the turntable. The weight and pulley cause the turntable to rotate and be arrested by the advanced 2nd slider bar. When the solenoid closes,

⁵Herbach and Rademan, 401 East Eric Avenue, Philadelphia, PA. 19134.

⁶Fisher Scientific Co., 3315 Winton Road, Raleigh, N.C. 27604.

the spring returns the pivot arm and slider bars to the original positions. The turntable advances a short distance and is arrested by the 1st slider bar. This sequence of action repeats every hr. and advances the next collection jar to a position beneath the screen collecting cone. The weight will descend about halfway in 12 hr and may be repositioned by rotating the turntable counter-clockwise to wind the rope around the sheave. An automatic timer or photocell could be added to start and stop the sampler at designated hours or light intensities.

DISCUSSION

The trap described has been used in studies on the activity of coastal biting flies in North Carolina over a 2-yr period (> 1,000 hours). An example of the flies captured during some typical 12-hr periods in 1975 and 1976 near a *Spartina alterniflora*

Loiseleur dominated salt marsh in Carteret County, North Carolina is given in Table 1. The study area is the same as shown in Fig. 2 of Dukes et al. (1974) and described by Kline and Axtell (1977). The days and hours of operation were selected to coincide with the seasonal and daily abundance of the species sampled. The greatest number of insects captured per 12-hr period was *Culicoides furens* (Poey) (\bar{x} = 3204.9) followed by *Culicoides hollensis* (Melander and Brues) (\bar{x} = 512.3). Smaller numbers of *Anopheles atropos* Dyar and Knab (\bar{x} = 173.0), *An. bradleyi* King (\bar{x} = 33.9), and *Culex salinarius* Coquillett (\bar{x} = 10.5) were trapped. A few *Culicoides stelfifer* (Coquillett), *Aedes taeniorhynchus* Wiedemann *Ae. sollicitans* (Walker), *Ae. vexans* (Meigen) and *Chrysops atlanticus* Pechuman were also captured.

The trap was reliable during many days of operation. As long as the wooden parts of the trap are painted before as-

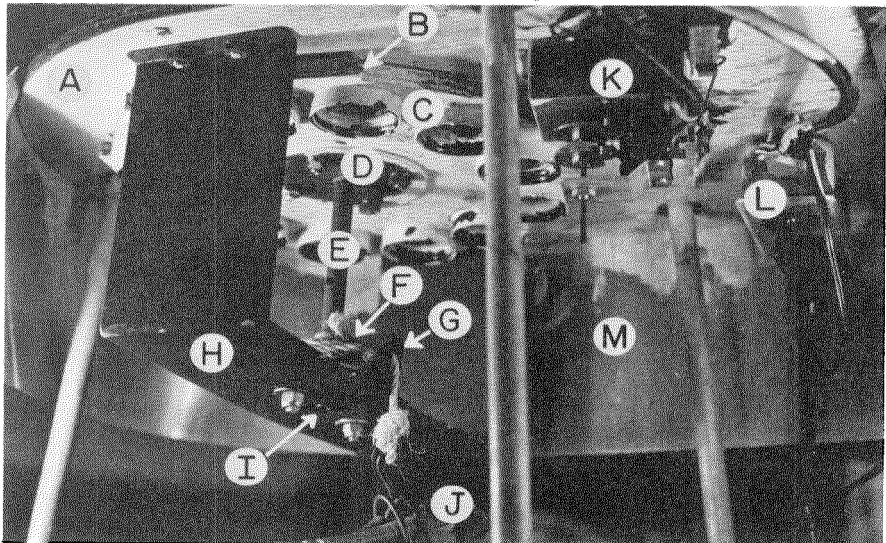


Fig. 2. Exposed view of collector apparatus (A) plywood top, (B) notch in turntable, (C) turntable with mounted lids, (D) steel plate, (E) steel shaft, (F) sheave wrapped with rope, (G) small pulley, (H) turntable bracket, (I) bearing, (J) weight, (K) cycle timer, (L) duplex receptacle and (M) skirt.

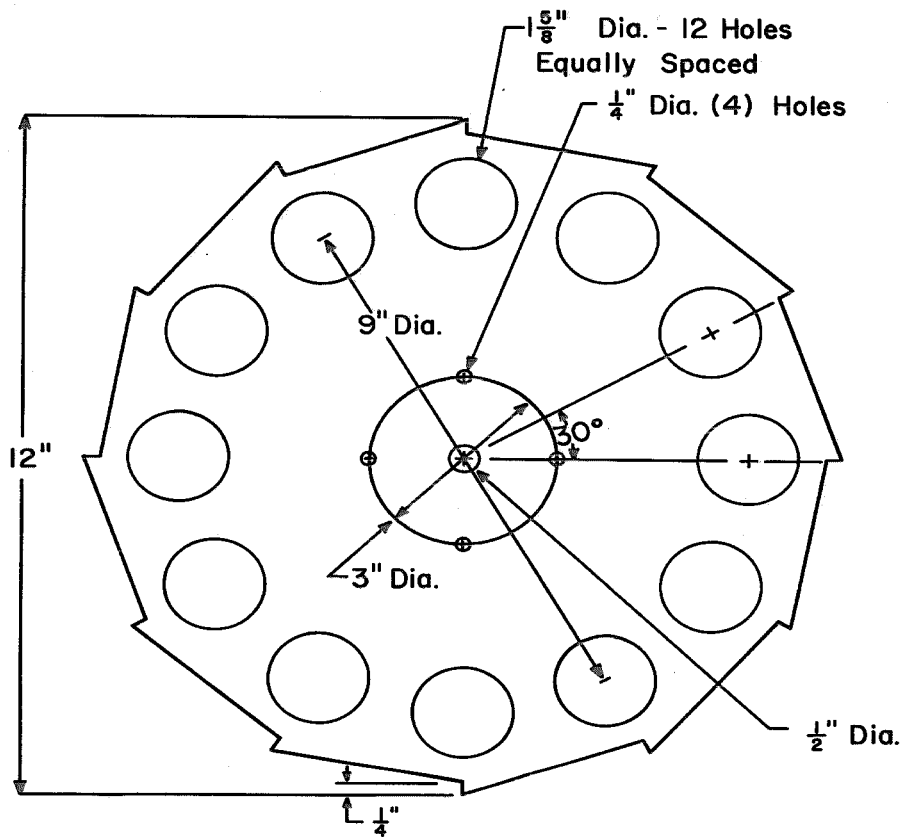


Fig. 3. Diagram of the collector turntable.

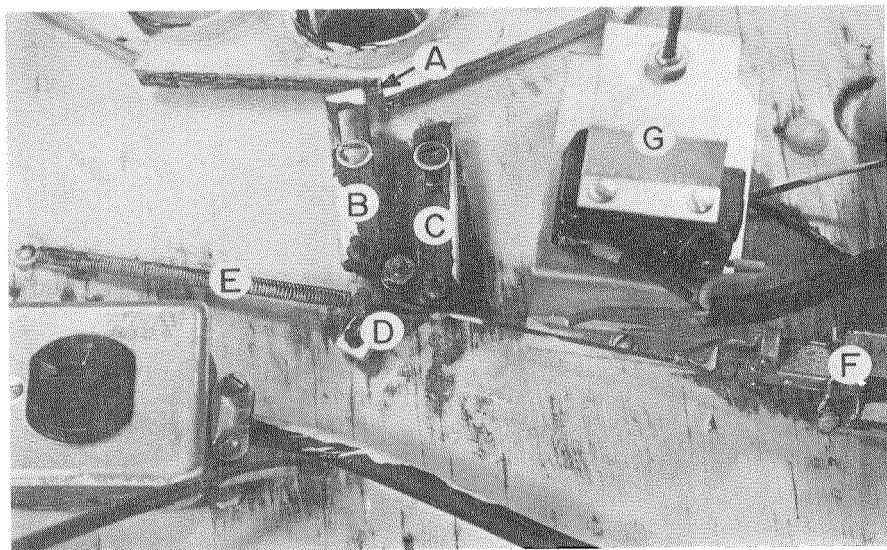


Fig. 4. View of the changer mechanism (A) notch in turntable, (B) first slider bar, (C) second slider bar, (D) pivot arm, (E) spring, (F) solenoid and (G) cycle timer.

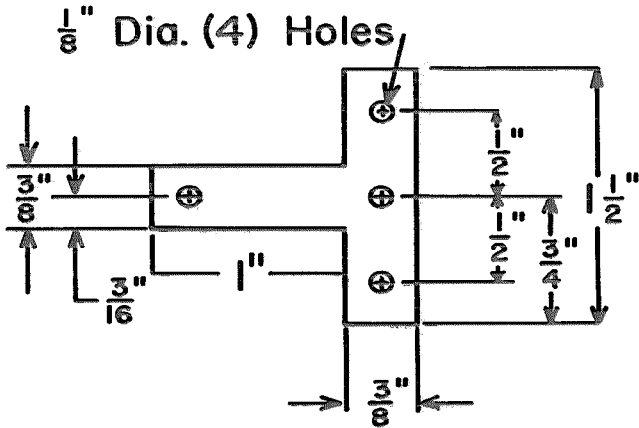
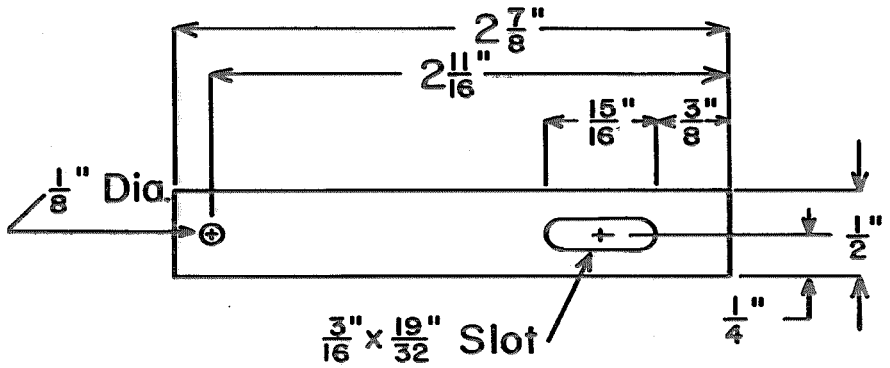


Fig. 5. Diagram of the slider bar (top) and the pivot arm (bottom).

Table 1. Hourly suction trap collection of biting flies near a *Spartina alterniflora* dominated salt marsh in Carteret County, North Carolina from selected days in 1975 and 1976

Species	No. Days Sampled	Average number of insects sampled per time period per day ¹											Avg. No. Per 12 hr. (x̄)	
		7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6		6-7
<i>Culicoides furens</i>	4	16.5	103.0	329.5	550.0	317.0	383.0	386.8	537.0	287.5	387.8	63.5	38.3	3204.9
<i>Culicoides hollensis</i>	4	115.5	50.8	28.8	30.5	67.3	40.3	39.3	38.0	27.0	22.0	21.0	31.8	512.3
<i>Anopheles atropos</i>	1	0.0	15.0	10.0	29.0	25.0	18.0	31.0	25.0	10.0	7.0	3.0	0.0	173.0
<i>Anopheles bradleyi</i>	3	0.0	2.0	4.0	3.0	4.0	3.3	4.0	3.0	6.3	2.0	1.3	1.0	33.9
<i>Culex salinarius</i>	4	0.0	1.0	1.0	0.0	1.7	2.0	1.0	0.7	0.7	1.7	0.7	0.0	10.5

¹Time periods were from 7 PM to 7 AM E.S.T. for all species except for *C. hollensis* which was from 7 AM to 7 PM E.S.T. due to day time flight activity of that species.

sembly to prevent swelling from rainwater, little maintenance is required. To maintain the trap efficiency, the collector funnel screen should be cleaned daily with a brush to prevent blocking of air movement.

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