

## **The Effect of Larval Control of Black Fly (*Simulium vittatum* species complex) conducted in Winter Harborages**

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### **Abstract:**

The comparison of two seasons of treatment for Black Flies in Twin Falls County, Id. Between the first and second season, treatments targeting overwintering larva were conducted. Much of the Black Fly production in southern Idaho results from the colonization of the Irrigation canal systems. Past Abatement work only targeted canals for treatment. Treatments of winter harborages resulted in a significant early season drop in Black Flies and improved control through most of the summer season.

### **Introduction:**

The Black Fly of *Simulium vittatum* species complex as found in southern Idaho are “premier colonizer of temporary streams” (Alder et al 2004). Dispersal of adults is one factor contributing to rapid colonization. While not fully understood what factors influence dispersal, adults have been known to disperse distances up to 225Km (Alder et al 2004). Unfed females have been documented flying 104 Km (Hocking 1953) with dispersal distances of 15km assumed to be more typical. (Alder et al 2004)

Another behavior that contributes to rapid colonization is that females emerging after winter can reproduce autogenously. Some females have been shown to also lay a second smaller autogenous batch of eggs. An average of 562 eggs is produced by a female larva that overwintered. (Colbo & porter 1981). The tendency for autogenous egg laying decreases as water temperatures rise. (Chuter 1970) This early Black fly production is the start of a population that grows exponentially as water temperatures increase reducing maturation time of Larva while adult dispersal opens up new areas to colonization. Big rivers are capable of producing a billion flies per km per day (Amrine 1982)

The larval stage only exists in moving water. Control of Larva leads to control of adults. Black Fly Larvae can be found at all times of the year and tolerate extreme temperatures. Larvae can be found growing slowly under the ice.

Black Fly Control in Twin Falls County Idaho using *Bacillus thuringiensis* subspecies *israelensis* (Bti) can be costly due to the large volume of water to be treated. A 1970's study by the University of Idaho highlighted a 10 mile section of Irrigation Canal as high Black Fly larval production in Twin Falls County (Jessen 1977). Subsequent treatments were later directed at this location. Since this time changes in water quality and canal management has resulted in a

large increase in suitable Black Fly Habitat and production in the canal systems. High larval populations can be found in all parts of the irrigation system in Twin Falls and surrounding counties during the summer months. Treating the entire length of the canal systems as mentioned previously is a costly endeavor; The Twin Falls County Pest Abatement district is trying to increase treatment efficiency by targeting a potential weak link in the Black Fly life cycle. In the winter months the canals are dry and larvae present die. The nearby Snake River and other small streams provide a year round water source and overwintering harborage of Black Fly larva that later hatch, disperse and colonize the canal system in the summer months. Water flows are often low in the winter months while upstream reservoirs are being filled preparatory for the summer irrigation season. Low water flow and limited areas to treat may provide a more efficient opportunity to target Black Flies in the winter months.

### **Study Area:**

Twin Falls County in Idaho is located in the south central portion of the state. This is an arid area and farming is possible through irrigation. Over 1,000 miles of Irrigation canals provide Black Fly habitat. These canals are dry during the winter months.

In 2009 over 200 locations were sampled in Twin Falls County, mostly this was to provide information on treatment distances and kill rates. From these locations study sites were chosen in 2010 that gave good representation of the study area.

Sample site #1 was chosen in the eastern portion of the county near where the Snake River water enters the canal system at Milner dam. The canal travels approximately 10 miles paralleling the Snake River to Murtaugh Lake where the shallow lake allows the water to warm some before entering back in to the canal system. The outlet of the lake causes tumbling of the water and great mixing and aerations. This is the area highlighted by the University of Idaho for the highest black fly production. A few miles below this outlet, the canal runs adjacent to the canyon rim with the Snake River several hundred feet below in the gorge. The sample site is .6 miles from the river. River flows can vary between 300cfs and 30,000cfs annually and this area has class 4 rapids and great Black Fly habitat. Treatments of the Snake near this sample point began March 24<sup>th</sup> 2010.

Site #2 is located in the Highline Canal where it travels near the South Hills and .4 miles from Rock Creek. Rock Creek is a year round stream with flows that can vary between 40cfs and 300cfs annually. Rock Creek drains from the South hills and winds over to Twin Falls and then empties into the Snake River. Rock Creek and the High Line Canal were found to have BF in abundance in 2009 The Canal was treated in 2009; treatment of Rock Creek began May 18, 2010.

Survey site #3 is located directly south of Twin Falls in the High Line Canal. It is located 3.4 miles from Rock Creek, and 9 miles from Snake River. The Canal is dry during the winter months and generally starts flowing in mid April through October.

### **Survey Methods:**

Survey samples consisted of 3 foot lengths of yellow poly twisted rope 5/8 inch in diameter suspended in the canal with light tie wire from bridge supports. Two ropes were placed at each location. Each rope had a 6 inch section marked off with black electrical tape. The rope floated and the wire allowed the rope to rise and fall with the water levels. The marked section was examined weekly through the summer and the results recorded. The percentage of coverage for eggs, larva and pupa was recorded.

In 2009, all canal systems were treated with Vecto Bac 12AS at 80% to 100% of label rates. Treatment intervals in the canals are generally every 4-5 miles. Treatment timing was based on water temperature, and larval stage. Treatments of canals started in started in May. In 2010, all canals were treated along with limited treatments in the Snake River and Rock Creek. BF in Rock Creek and SR were sampled by pulling up rocks and vegetation.

All adult Black Fly data came from standard light traps baited with dry ice. Traps were set through the county on a weekly basis. 2009 data is skewed slightly as some unidentified gnats were included in the totals. This was a result of trapping being conducted primarily for mosquito sampling at the time. While actual numbers may have been lower, the trend line shown is useful in providing a comparison of the two years.

### **Results**

Treatment of overwintering larva when conducted early gave measurable results early in the season and reduced the early hatch of Black Flies by a significant amount. This in turn led to an overall reduction of Black Fly Adult numbers for most of the summer months (Fig.1). The Reduction of Black Fly eggs in the month of May was nearly 100% This reduced the need for larval treatment by such a significant amount that even though the area treated in 2010 was greatly expanded compared to 2009, a similar quantity of product was used both years. Over all adult numbers were lower for the entire season.

### **Discussion**

In conducting Bti treatments in the winter months I found kill rates of Black Fly larva to be quite variable. In the cold water, feeding activity appeared much slower, most BF larvae are found hiding under the edges of rocks and in protected areas where it is possible that not as much product passes by for them to feed on. Treatments needed to be repeated multiple times to

achieve high larval kill. Also some of the larva passed the winter in the pupa stage and possible the egg stage. Rock Creek did not receive treatment as early as the Snake River and as a result had a great deal of Black Fly already in the pupa stage when treatments were applied. Bright sunny days seemed to trigger a change from larva to pupa. There also seemed to be new larva showing up. Larval drift was a frequent occurrence especially when there was a change in water levels. It also appeared as if some of the new larva showing up were a result of eggs beginning to develop after laying dormant for a period. Despite the difficulty in obtaining good kills and the need for multiple treatments it cost much less to treat 300cfs of water than several thousand cfs. Water levels were constantly monitored to catch the most opportune time to treat. Hydroelectric Power is produced in the Snake River sometimes leading to rapid water level changes. Treatments in the Snake River were discontinued when high flows arrived.

One concern was that seasonal variation in weather and its impact on water and air temperature could be impacting Black Flies in the canal so temperatures for the two years were tracked with no significant differences between years.

Eggs found on the sample ropes resulted from Black Flies produced locally or adults that dispersed into Twin Falls County. By tracking both larval and pupa found on the sample ropes we have an idea of what survived our Bti treatments to adulthood. Any time larva were found to be at the proper stage, treatments were conducted in a effort to remove all or most of the larva before they developed into the pupa stage. In the pupal stage no feeding occurs and therefore they are not susceptible to Bti treatments. Fig.3 shows the % of our samples that were covered with surviving pupa. We were able to keep overall adult numbers lower in 2010 most likely due to starting the year with an overall lower Black Fly population(Fig 2).

Because of dispersal distances of Black Flies, treatment programs would give better results on a regional level rather than just a county level. The same conditions that produce high numbers of populations in Twin Falls are found in the surrounding Counties. There are likely other factors that affect adult dispersal and colonization that we don't understand at this point that would contribute to more effective control. Based on the results of this trial, identifying and targeting areas of winter harborage within the dispersal range of Black Flies would be a effective way of reducing overall black fly numbers as part of a Black Fly control program.

## References

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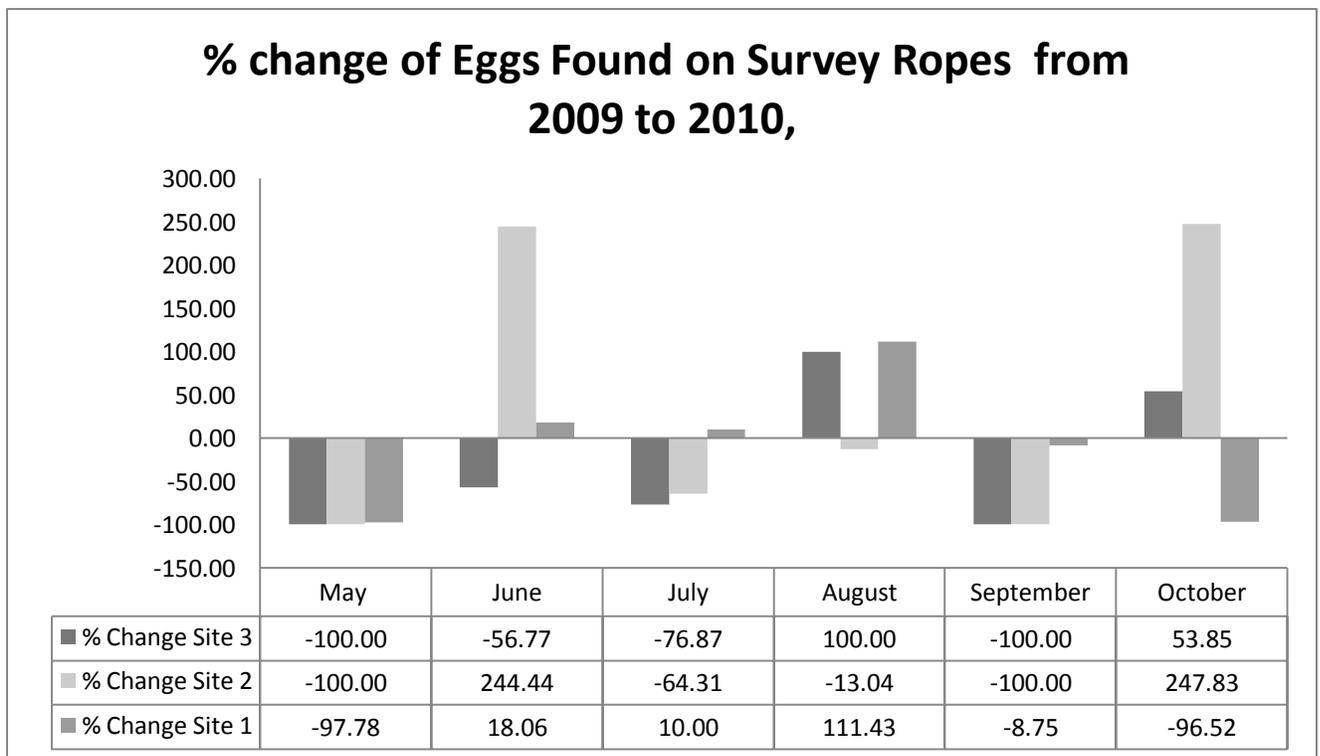


Figure 1

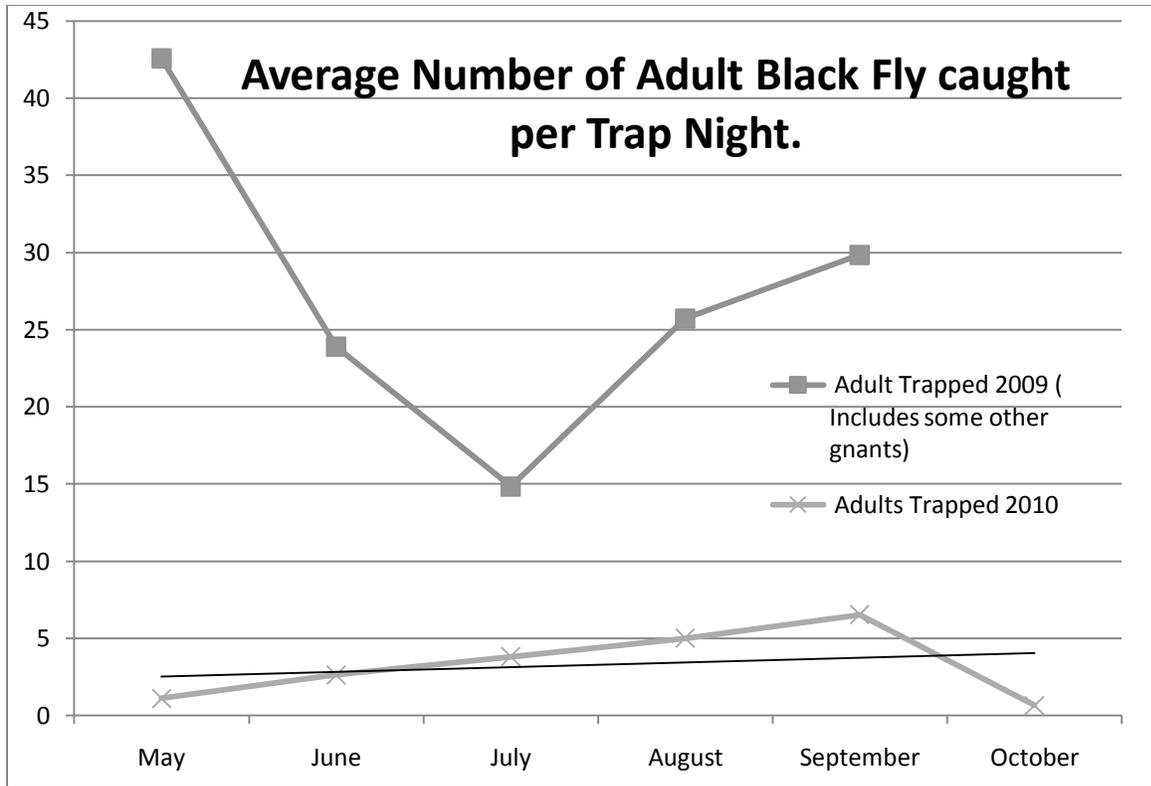


Figure 2

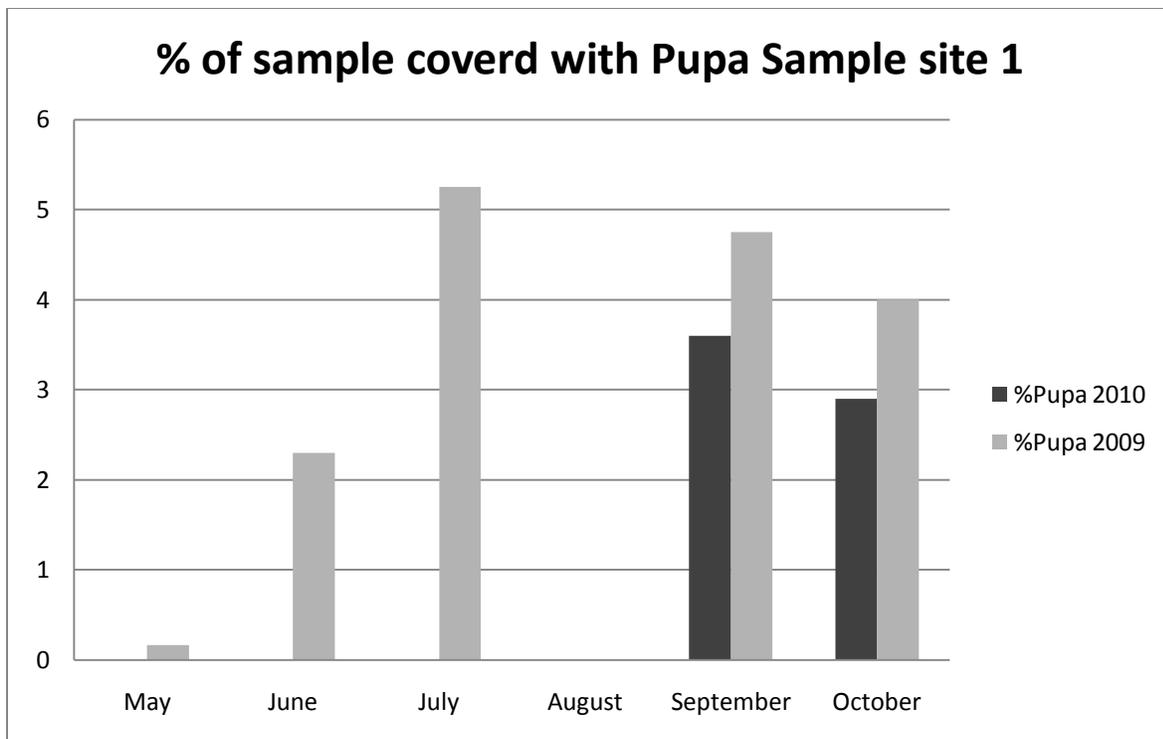


Figure 3

