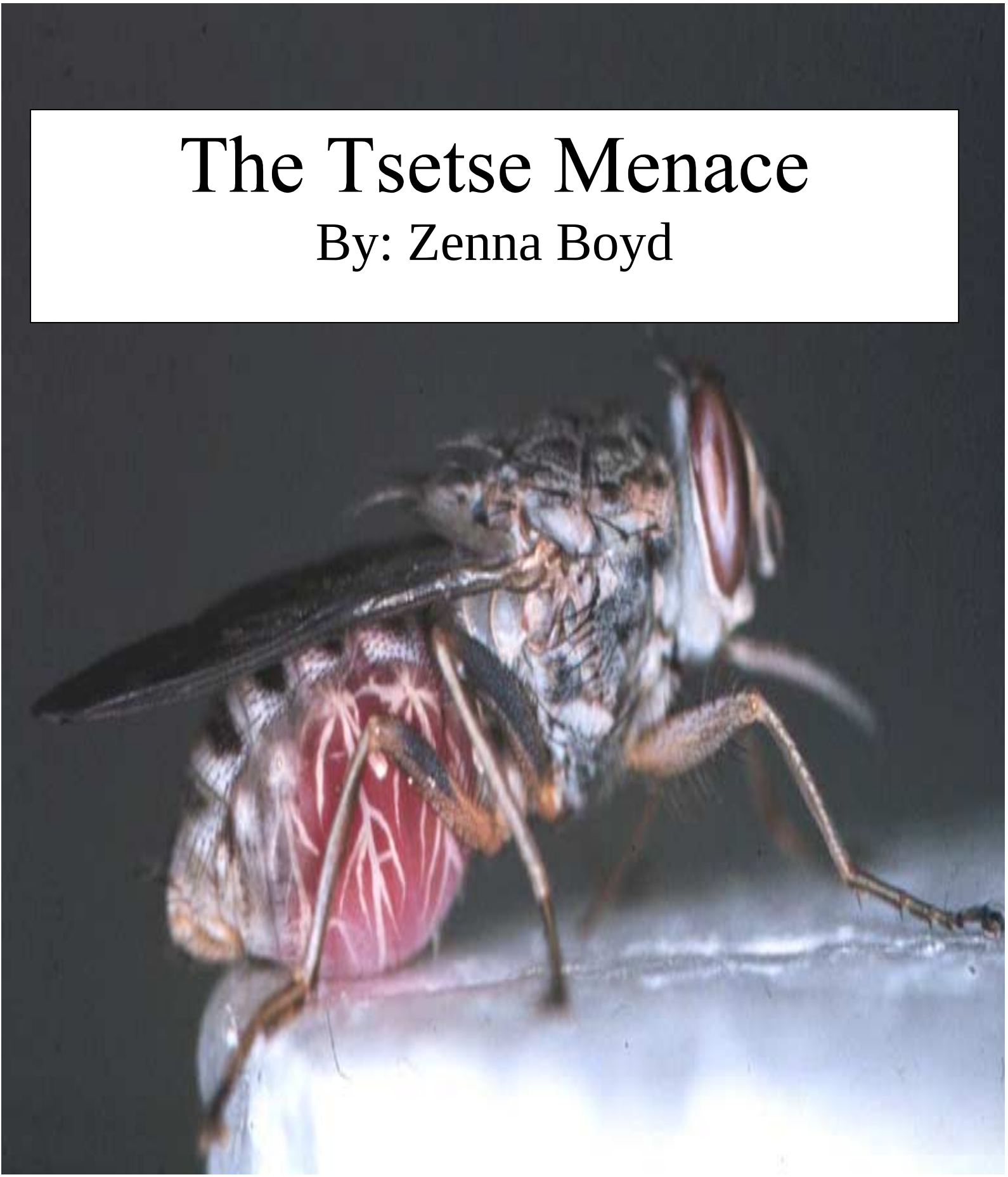
The Tsetse Menace

By: Zenna Boyd



The Tsetse Menace

Nairobi, Kenya, that is where I spent my summer. The International Centre of Insect Physiology and Ecology, that mouthful is what I called home for eight weeks. My name is Zenna Boyd, I live in Milton, Iowa. I attended the World Food Prize Youth Institute in October of 2000. It was an experience I will never forget. When my FFA advisor asked us at a summer meeting if anyone wanted to go overseas for eight weeks, I volunteered, never did I imagine I would actually get the opportunity. The most baffling part about it all was just how easy it was and for the life of me I couldn't understand why more people didn't apply. At first my sole purpose for going to the Youth Institute was to find out how I could apply for the internship. All I was interested in at the time was the trip to anywhere. After I attended the symposium my views changed completely, all I wanted to do was help in anyway I could. That was when I truly wanted the internship for the opportunity to help and do my part.

From the very beginning I told people, before I even applied, I am going to Kenya next summer. I had no way of knowing for sure or even of guessing, I just had a feeling. For me there was no other place I wanted to go, I would have gone anywhere, but I had my heart set on Africa, anywhere in Africa. After all the stress and anticipation of finding out if I had been chosen, then the relief of being accepted, I was faced with a new problems. People kept telling me how brave I was and what an experience this would be for me, they were right. Then after hearing every type of

disease, the crime rate, the AIDS issues, and countless other horror stories, I was ready to go.

ICIPE

The International Centre of Insect Physiology and Ecology, has a staff of over 300, hailing from 25 countries. Scientists, Ph.D. students, and technicians from all over the world come together to try and solve problems involving the 4-H's, Human Health, Animal Health, Plant Health and Environmental Health. ICIPE works to help solve problems of tropical countries involving anthropod issues. ICIPE works to help end poverty, ensure food security, improve human health, alleviate gender issues, and deals with some biodiversity issues. They do all of this and still ensure the safety of the environment. ICIPE's research is funded through grants, that each department applies for, from all over the globe. Beneficiaries come from governments, like Sweden, Denmark, Kenya, Switzerland, Norway, Finland, and France, also foundations and institutes from all over the world.

ICIPE was founded in 1970, by a Kenyan scientist, Professor T.R. Odhiambo. Currently the Director General, Dr. Hans Herren, a winner of the 1995 World Food Prize, keeps the center in good running order. With Kenya as the host country it stands to benefit directly from ICIPE's hard work.

My Assignment

Tsetse flies, that was my new companion for the next eight weeks. Let me tell you a story before I begin. Before leaving for the wilderness of Africa my mother and I proceeded to look up all the possible diseases I could contract, fun huh? Anyway my mom just happened to come across an article on African Sleeping Sickness, transmitted by the teet-se fly, now never having seen the word written, I was going on how my mom had pronounced it. So I promised to be careful but she continued to worry about my safety.

When I arrived in Nairobi I was more lost than when I had left. I had no idea what was expected of me and had no idea what I was to be doing for my summer vacation. The day after I arrived I met Dr. Rajinder Saini, he explained what he did and a little of what I could do if I worked with him, my other choice, Dr. Khan, being at a conference in Ethiopia. Never the less I was interested in the project Dr. Saini presented and decided to stay with him. As Dr. Saini explained about the tsetse fly, I didn't make the connection, until he mentioned something about Sleeping Sickness and it dawned on me, teet-se, was tsetse. But I was still interested in the project and Dr. Saini assured me that Sleeping Sickness in humans was not a problem where I would be working. The big challenge came when I had to tell my mom, but she took it a lot better than I thought, and she told me if I said it was safe she would trust me. I was ready to begin.

The first thing I had to do was decide just exactly what I planned to do. Dr. Saini left that up to me and he let me decide where I wanted to take this project. He

gave me some ideas on what I could do and then told me to write an outline of what I wanted to do. I decided to work with a social aspect of tsetse control and find out just how the farmers felt about ICIPE and their help.

Tsetse

There are 30 known species of tsetse flies, covering 36 African countries.(See Figure 1) Tsetse carry a parasite known as *Trypanosome,* which causes sleeping sickness in humans and animals. *Trypanosomiasis* account for 20-40% of loss in animal production, costing $0.6-1.2 billion annually. Sick animals produce less milk and meat products, things that the Maasi rely on to live. Female tsetse do not lay eggs, they give birth to live larvae. In favorable conditions females can give birth once every 10 days, but they only mate once in their lives. The larva is deposited, fully grown, on moist sand or soil, where it will bury itself and become pupa. The pupa, emerges a fly about 30 days later. Tsetse flies are commonly found on forest trails, near water edges, and near the forest edges. They are attracted by large moving objects, carbon dioxide and blue objects and cause very painful bites due to the fact that tsetse feed on the blood of their victims.

There are three main groups of tsetse, *Austenia, Glossina,* and *Nemorhina.* Nine species, belonging primarily to the *Glossina* and *Nemorhina* groups, carry the parasite *Trypanosome*. My work had me identifying tsetse: *Glossina pallidipes, Glossina longipennis, and biting flies: Tabanids* and *Stomoxis*. These types are mainly Savannah species, living in areas close to the Savannah. This area is also a prime location for animal grazing, giving the tsetse a steady food supply.

The Tsetse Menace

The parasite *Trypanosome*, is disastrous to the animal population in Kenya. For example a large, young adult male bull can be bought for $1200, and die in a few short days if infected and left untreated. This can have a devastating affect on the Maasi farmer's way of life. But even treatment can be tricky. Without a blood test, *Trypanosomaisis* is hard to detect, so many farmers will simply just treat animals for the disease, unknowingly. This has two affects, one is in time it may cause drug resistance, a factor which has already been a problem with some drugs. The second is, with the demand of these drugs so high, it gives an opportunity for fake drugs to be sold, this causing a problem in treatment. A farmer with 150 cattle can spend $600 on drugs a year, drugs that he may not need, and may not be able to rely on. This can cause a lot of problems economically for the farmers.

ICIPE's goal is to help control the tsetse populations, and to continue to clear areas with tsetse and keep them cleared. Many advances in their technology have helped already. One such advance is in the use of traps. Several traps have been designed, which I will talk about later in my paper. Another advance is repellents, this technology is still being tested and at the moment is not on the market for use.

My Comrades

Let me tell you a little about each of the people I worked with. Dr. Rajinder Kumar Saini, he graduated from the University of Punjab, India, with a Bachelor of

Science in Zoology, Botany and Chemistry. He then attended the University of Nairobi, Kenya and graduated with a Masters of Science in Agricultural Entomology, and then went to the University of Wales for a Ph.D. in Entomology. His current job title is Principal Scientist, Head of Animal Health Division and Tsetse Programme Leader. He has worked at ICIPE since 1976 and has received such awards in Organization of African unity, and the Inaugural ICIPE medal for innovative Research. Plus he has had several of his papers published on his work with tsetse and African trypanosomes.

Peter Muasa is a technician that works with Dr. Saini. He also is our departments' driver. He drove me to all of my fieldwork and acted as a tour guide at some points. John Andoke is another technician. John coordinated many of my experiments, he would work out the paper work and then Peter would help me with the fieldwork. Matthew Bett is currently a student working towards his Ph.D., he accompanied some of our trips to Nguruman to conduct his own field work.

Traps

ICIPE has been in the forefront in developing trap baits and odour baits that catch tsetse flies. One main goal of ICIPE was to make a trap that could be used on a sustainable basis by communities. Part of my work was to personally test three different designs of traps, then determine, on my own, which was most effective.

Each trap consisted of blue material, black material, and white mosquito netting. The traps are quite simple to make. Tsetse flies are attracted by the UV emission of the blue cloth that makes up the body of each trap, the black cloth is preferred for landing. After landing on the dark surface the flies want to move towards light (the sun)-which

is called ‘escape reaction’ and hence become caught in the plastic cages where they will eventually die from heat stress.

The specifics of the trap are very important. The color for one, tsetse are attracted by phthalogen blue, or royal blue, which promotes landing. Black and sometimes red, promote settling and entry response. Yellow, green, and brown are unattractive. The netting is important too, if it is too shiny the flies will not enter the trap.

The first trap I used was the NGU trap, developed by ICIPE and named after where it was developed, Nguruman, Kenya. The NGU trap was developed to provide an effective, cheap and easily made trap, to catch biting flies rather than just tsetse flies. It was designed to catch Savannah species’ of tsetse.(See Figure 2)

The next trap was the Biconical, which was developed in the early 1970’s by a French scientist in West Africa. The biconical trap is more suited in the trapping of ravine species of tsetse. It was preferred due to it’s portability, and ease of setting up. The draw back was that it required a skilled tailor to sew and needed a large amount of cloth to construct.(See figure 3)

The final trap was the NZI, which was also developed by ICIPE. The NZI trap is a spin off of the NGU trap. The significance of this trap is that it has wings, which will prevent the flies from just flying around and around the trap. It was designed to catch both tsetse flies and other biting flies.(See Figure 4)

Bait plays a very important role in the success of the trap. The traps alone can only attract flies passing by, where as the bait attracts them from distances. It has been discovered that certain chemicals of cattle are highly attractive to tsetse. The trap bait

is made of cow urine, in a container with a lid and an open hole in the side, and acetone, which is put in a glass bottle with a lid with a 2mm hole in it.

Nguruman

My first experiment was testing the effectiveness of the three traps. To do this I was sent to Nguruman, which is about an hour from Lake Magadi, a salt lake. My first impression of Nguruman was amazement. Nestled in the Great Rift Valley, this little village seemed to thrive, despite the lack of communications, and electricity.

Upon my first visit I meet Joseph, who is caretaker of the field station. He showed me the solar panels, and the generator, because most of the time the solar panels aren't strong enough to power the station. Also I finally got to cook for myself, which doesn't sound that great but it means I got to eat what I wanted to, a major plus. Upon a further stay I learned a great deal about Nguruman. I got to see the various types of insects, plants and animals. Also I got to see my first scorpion, which came to visit once a night to scare me to death as I walked in the dark to my room. While there I got my first mosquito bite, one that was soon to turn into a few more.

Nguruman introduced me to the Maasi people. As we drove across the rough roads, I would see young children watching cattle, goats, and donkeys. Women of various ages, carrying babies on their backs and water on their heads. Men lounging near a shop or walking to an unknown destination. The roles of these people were well defined. Their beautiful clothes of vibrant colors, contrasted to the browns of the savanna. Despite the way they live, the heat of the day, and the dust, the children will still run beside the truck yelling "Hi, how are you?" over and over again. Though many

of them attend school this is probably the only English they know. They were taught that the way to address a mzunga, is to say “Hi, how are you?” in which response you will get “Fine”. They will continue to ask this question until you answer accordingly. Another thing I learned is when greeting a young child you are to rub their heads, a custom that took a little to get used to.

Field Work

My first experiment was to test the three different traps (NGU,NZI, and Biconical) and determine which one was the most effective. This proved to be quite a task, though the testing only lasted three days, it consisted of quite a bit of hard work. We began by setting the three traps, in three different locations, in order to take into account site differences, such as wild animals, tsetse population, and domestic animal interference’s. The traps were shifted each day in a Latin square design. The experiment was repeated in a different location. In total I had six traps.

The sites were strung out across the forest, allowing about 100 meters(200 feet) at least between each trap. The only way to reach the sites was along a path that wound itself through the bush and forest. Each day at about the same time we collected the cages and moved the traps. Reaching the traps, collecting and resetting the traps each day took a little over an hour each day. After we finished in the field, we must come back and count the catch. I learned to distinguish between different species and also to sex certain species.

I found that the NGU and NZI traps work the best. They attracted more flies than the biconical, which did poorly in all species. The NZI trap was also very successful

for *Glossina longipennis, although it is said that it is* not always consistent in the species it caught. I was not surprised by the finding, because as you drive to the village you can clearly see that this test has been done and the NGU trap is the best choice. To find my results I calculated the mean of each traps total catch.(See Charts 1-9)

My next experiment was to test the repellent that ICIPE had developed and was currently testing in the field. While I was doing my testing Bett was testing some chemicals himself. He explained to me that the objective of the two was simple. A farmer would put the repellent on a few of his cattle, this would make the other cattle more attractive. On the rest of the cattle would be a killing agent, thus you create a "push-pull" effect. I again had six traps, a NGU trap unbaited, a NGU trap baited with cow urine and acetone (which served as my control), and a baited NGU trap with repellent. The repellent was dispensed from three 5cmx5cm sachets, each containing 5ml of the repellent, giving a release rate of 4.5 mg/hr and a total dose of 13.5 mg/hr/trap. The trial lasted for three days. The results showed that the baited trap with repellent had a significantly reduced catch compared to my control. The catch was reduced by about 80% when compared to the control. The catch reduction for *Glossina longipennis* was 40% for totals(males + females). To figure the index of each catch I would first find the mean of the catch, then divide it by the mean of the control.(See Charts 10-15)

Bett had 10 traps and it took about two hours with the collecting and resetting of 16 traps. During many of these collections we would see a wide range of animals in the bush, zebras, baboons, dikdiks, impalas, Thomson's gazelle, and once even an elephant.

Social Work

The last part of my project deals with the social aspect that I requested when I applied. I conducted a survey of the local farmers, speaking to not only males but a few females, the ones that run the farms. I was able to meet many new people through the experience, and I enjoyed it greatly. The survey consisted of 16 questions (See Figure 5), asked to each farmer, about tsetse flies and its control. I was able to interview 31 farmers during my stay at Nguruman. Many of the questions were general questions about tsetse and their knowledge on tsetse, but some were more personal, like asking how many cattle they owned and where they get their drugs from. The survey went quite well, most of the farmers could speak enough English to answer my questions and the ones that could not Peter would interpret for me. It was quit a learning experience.

The farmers I talked to had from 2-150 cows, and 10-200 goats. Many of them got about one-two liters of milk a day. My survey concluded that all the farmers thought tsetse flies were a problem in the area, and thought that the fly traps helped to control the population. But only about 71% of them used the traps. All agreed that tsetse control would mean higher milk and animal productions and a lower disease rate. Another interesting fact is they all agreed that ICIPE's work has been very helpful, but when ICIPE introduced the traps and left them on their own, the village stopped using the traps. 58% of the farmers I spoke to use pour ons (insecticides). 58% spend over $200 US on drugs. Only 32% would spend over $20 US on tsetse control.(See Chart 16) 48% when given a choice would prefer to use the traps, while 42% would prefer to use both.(See Chart18) The main source of drugs is Nguruman, 58% of the farmers get

there drugs locally, while 16% get it from Nairobi, and the remaining 26% get them elsewhere.(See Chart 17)

The Maasi people are an interesting people. The lack of their continued participation was not out of ingratitude, but out of speculation. They felt that at that time the traps were not making that big of a difference. Later they realized how much they really do help and have recently re-introduced them. The Maasi feel it is their right for people to help them and sometimes have a strange way of showing gratitude, but when asked, any will tell you that ICIPE has greatly helped them.

Conclusion

In the trap efficiency experiment we saw that the catch between the NGU and the NZI trap for *Glossina pallidipes* was not significantly different. The NZI trap had a higher catch of *Stomoxis* and *Tabanids* compared to both the biconical and NGU traps. However, in Nguruman NGU traps are still used as the choice due to its simple construction, since *Glossina pallidipes* is the threat in the area, people prefer NGU which is simple to make and easy to set up, not to mention equally effective. However. in the farmland where biting flies are a menace, those who can afford it, are encouraged to use the NZI trap. There is significant difference in catch between the NGU and NZI traps for *Glossina longipennis*, The Nzi performs better than the NGU trap for this species, but they both caught more than the biconical. As has been said before, NZI was developed from the NGU trap to improve its trappability of biting flies.

In the repellent experiment we saw a significant reduction in catch for *Glossina pallidipes* in the presence of the repellent. Up to 80% of the flies were repelled

compared to the trap baited with cow urine and acetone alone. There is no significant reduction in catch of *Glossina longipennis* except for the males which are reduced by 70%.

Through the use of these traps and the continued work of ICIPE, food security in some areas of Africa can be improved. By controlling tsetse, milk production and animal production will significantly heighten. Disease rates will lower, this in turn will benefit the lives of not only the Maasi, but Africa as a whole. Economically the people, not just farmers, will benefit. Without the continued partnership of ICIPE and the farmers tsetse will grow to an even larger problem.

This experience has changed my views on several levels. I feel my horizons have broadened and my future plans can be endless. My eyes have been opened to new opportunities and possibilities. I feel I can help ensure food security in my own ways.

I have grown up in a very non-diverse setting, and I was afraid that it would effect my experience negatively. In truth it had no effect, I learned many things about myself that only being in such a situation can discover. I have learned to allow others to help me, but still be independent. I have learned the value of a smile and a friendly greeting. Kenya has taught me to open myself to new experiences and expect more from myself. It has taught me that to get the good things out of life you must put up with some of the bad things. I have learned to appreciate all I have and to not take life for granted. Never waste a today worrying about yesterday, and have fun in life. This experience, I believe, has made me a better person, and taught me much. I am more open and more aware. I feel ready for whatever lies ahead and ready for my next lesson in life.

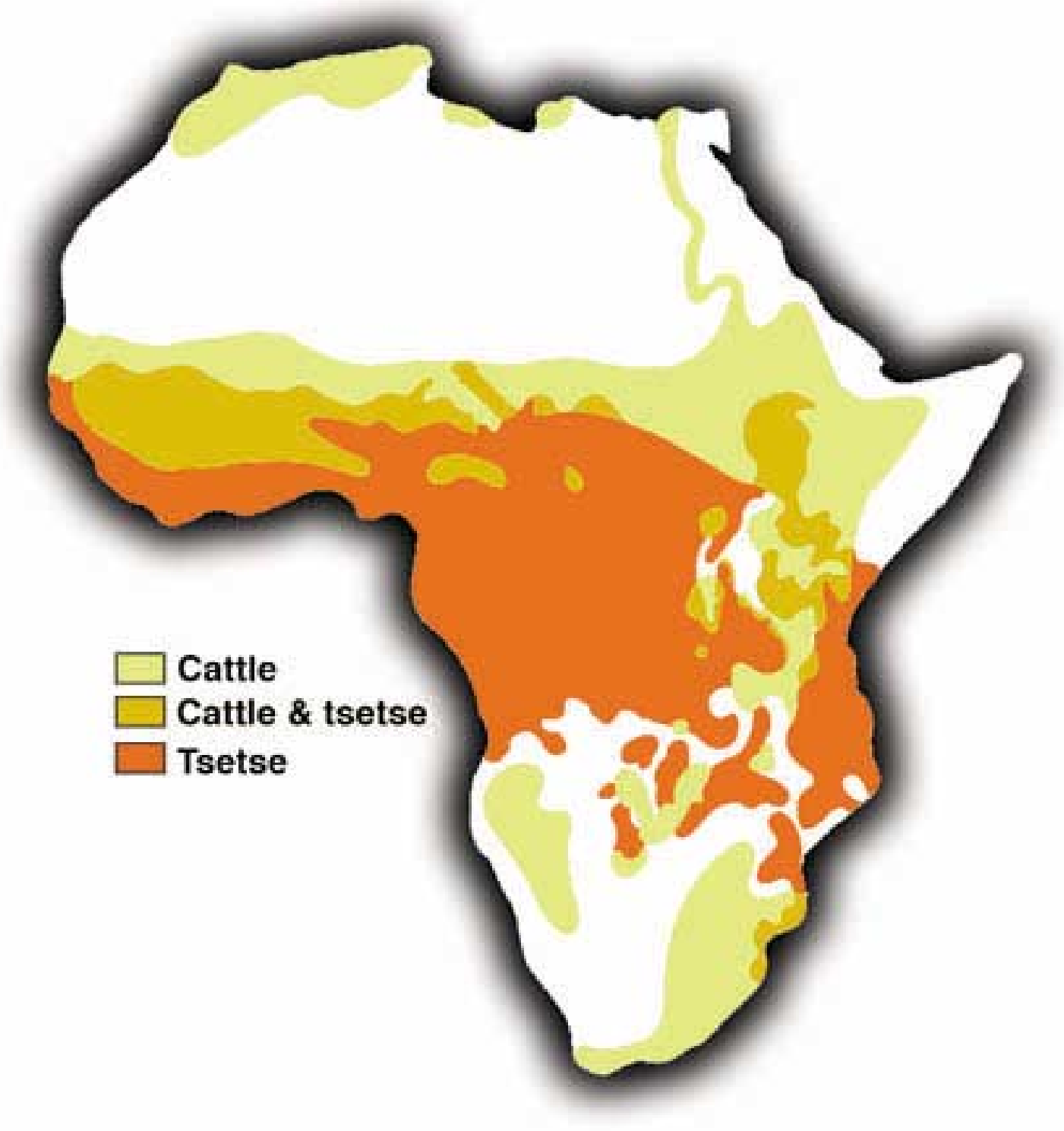


Figure 1

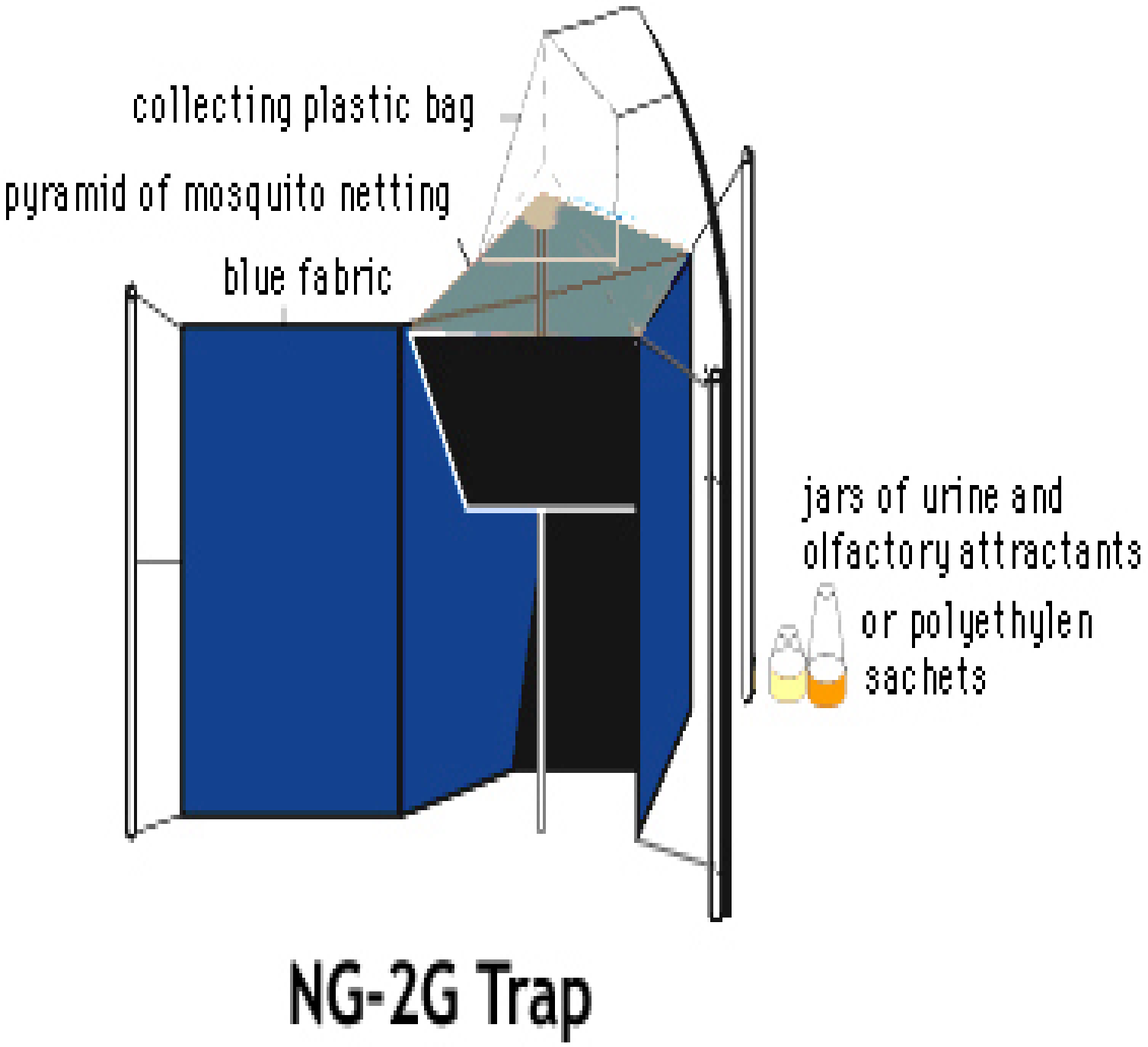

collecting plastic bag
pyramid of mosquito netting
blue fabric
jars of urine and
olfactory attractants
or polyethylen
sachets
NG-2G Trap

Figure 2

Figure 3

Figure 4

Name_____Date_____

1.How many cattle do you own?

2.How much milk do you get from your cows each day?

3.Do you think tsetse flies are a problem in your area?

4.Do you use tsetse fly traps developed by ICIPE?

5.Do you think that they help to control the tsetse population?

6.Would you use a repellent on your cattle to control tsetse?

7.Do you use a pour on, on your animals?

8.Would you like to use traps and the repellent together?

9.Do you use drugs to treat your animals? If yes how much?

10.What is the source of your drugs?

11.Have you experienced any problems with drug resistance?

12.How much do you spend annually on drugs?

13.How much would you spend on tsetse control?

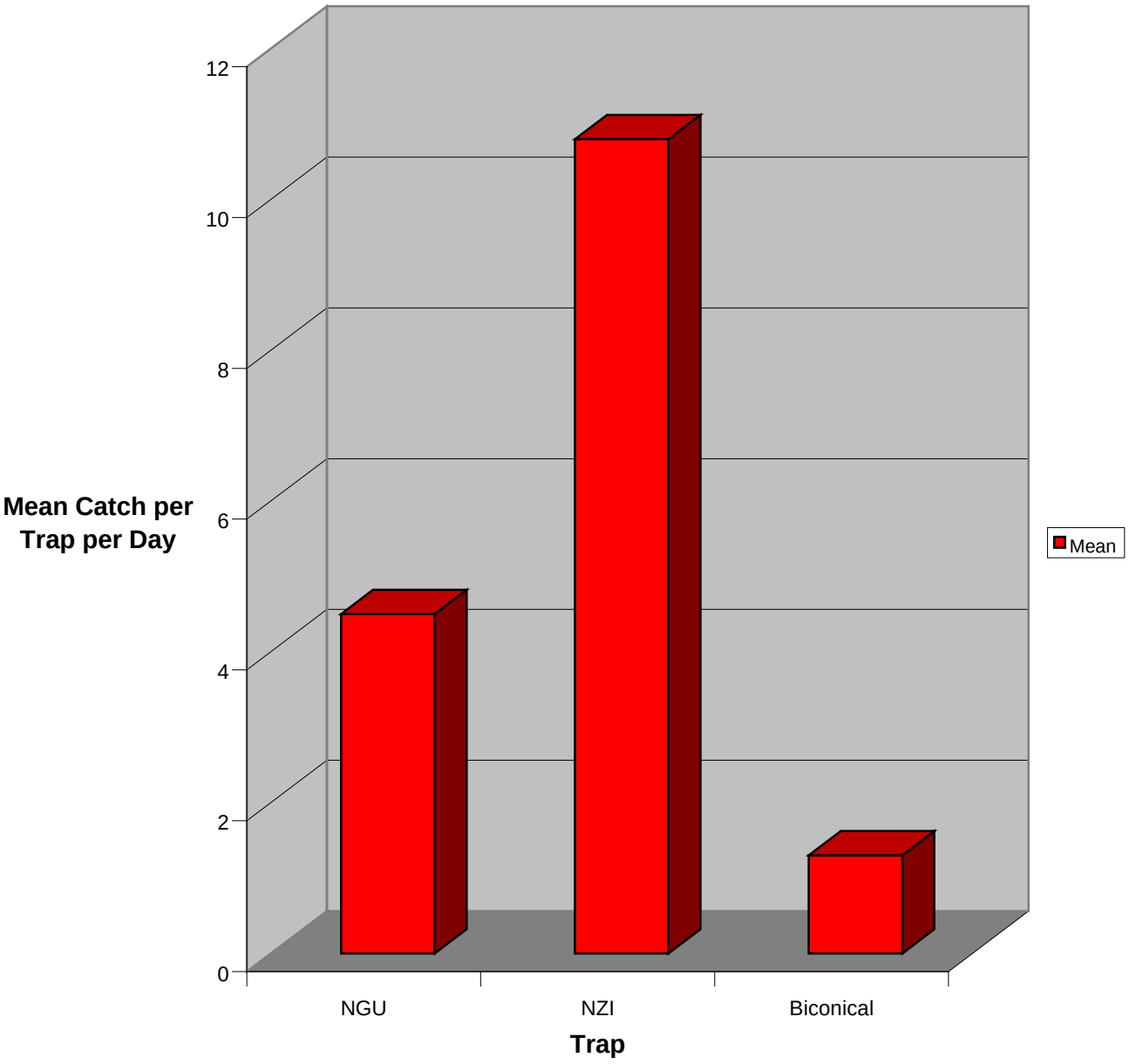
14.What will happen if tsetse were controlled in your area?

15.Given a choice which form of tsetse control would you prefer to use?

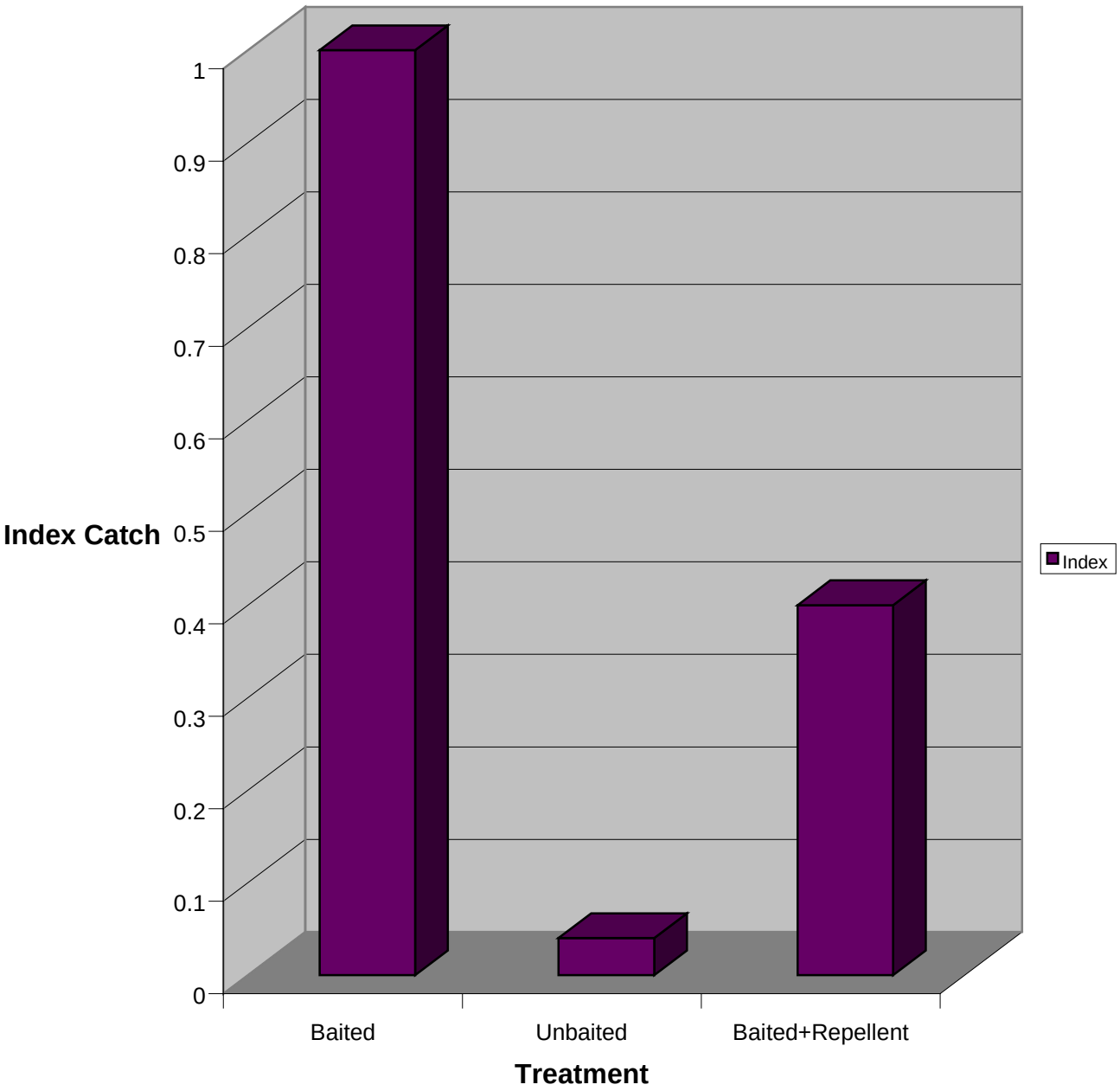
16.Has ICIPE's work been helpful to you?

Figure 5

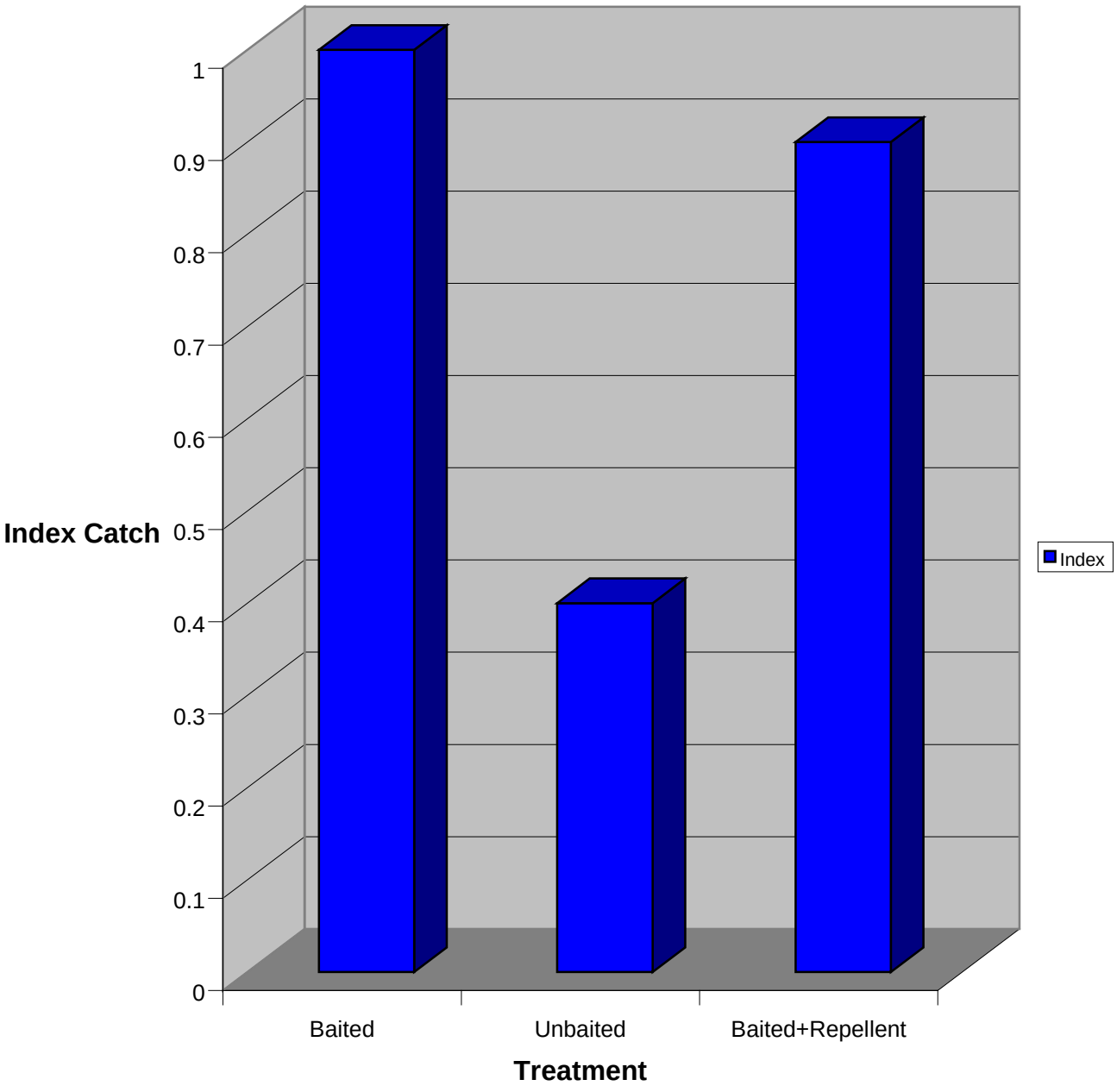
Trap Results-Glossina longipennis-totals



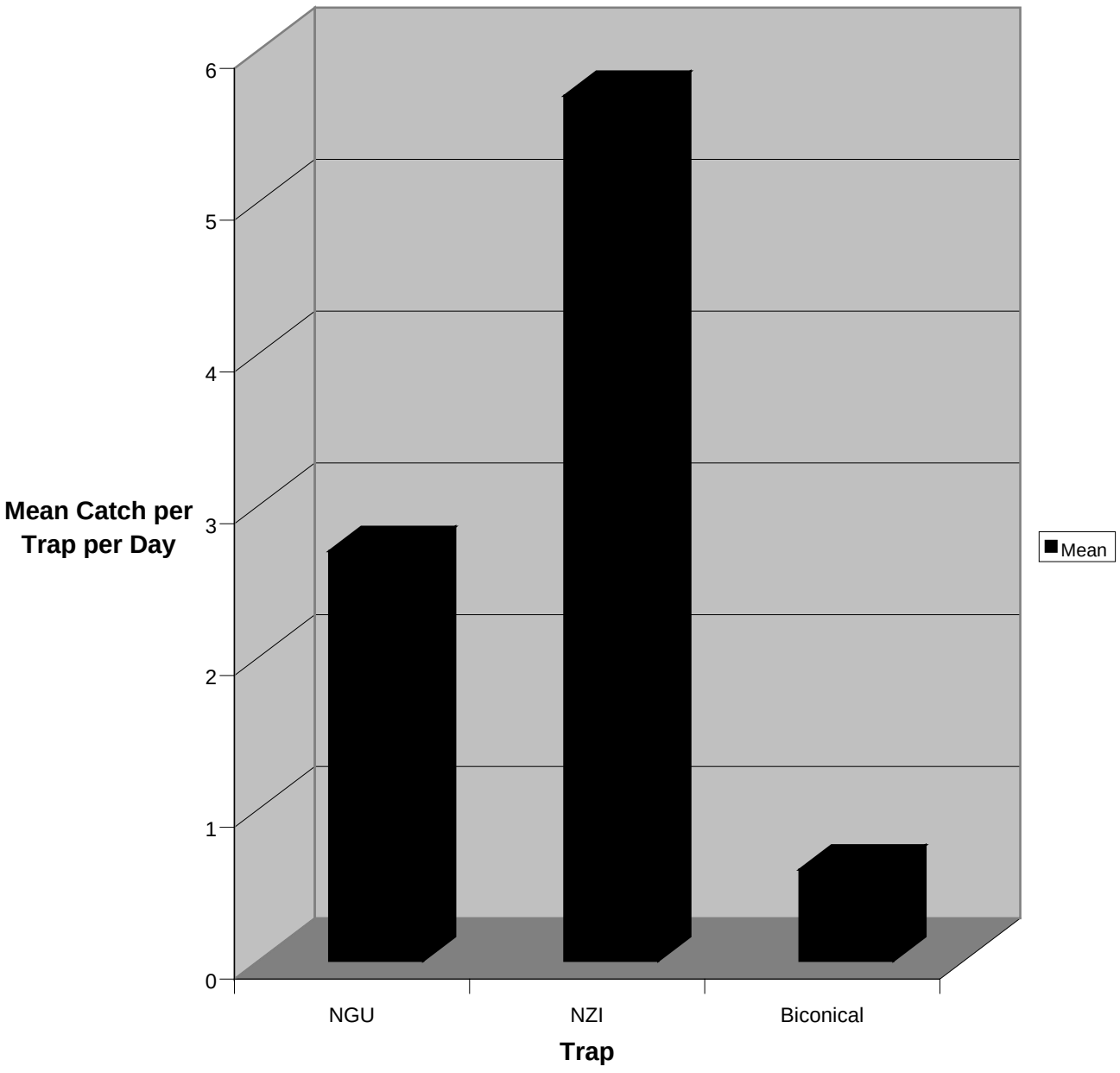
Repellency Test Results-Biting Flies-Stomaxis



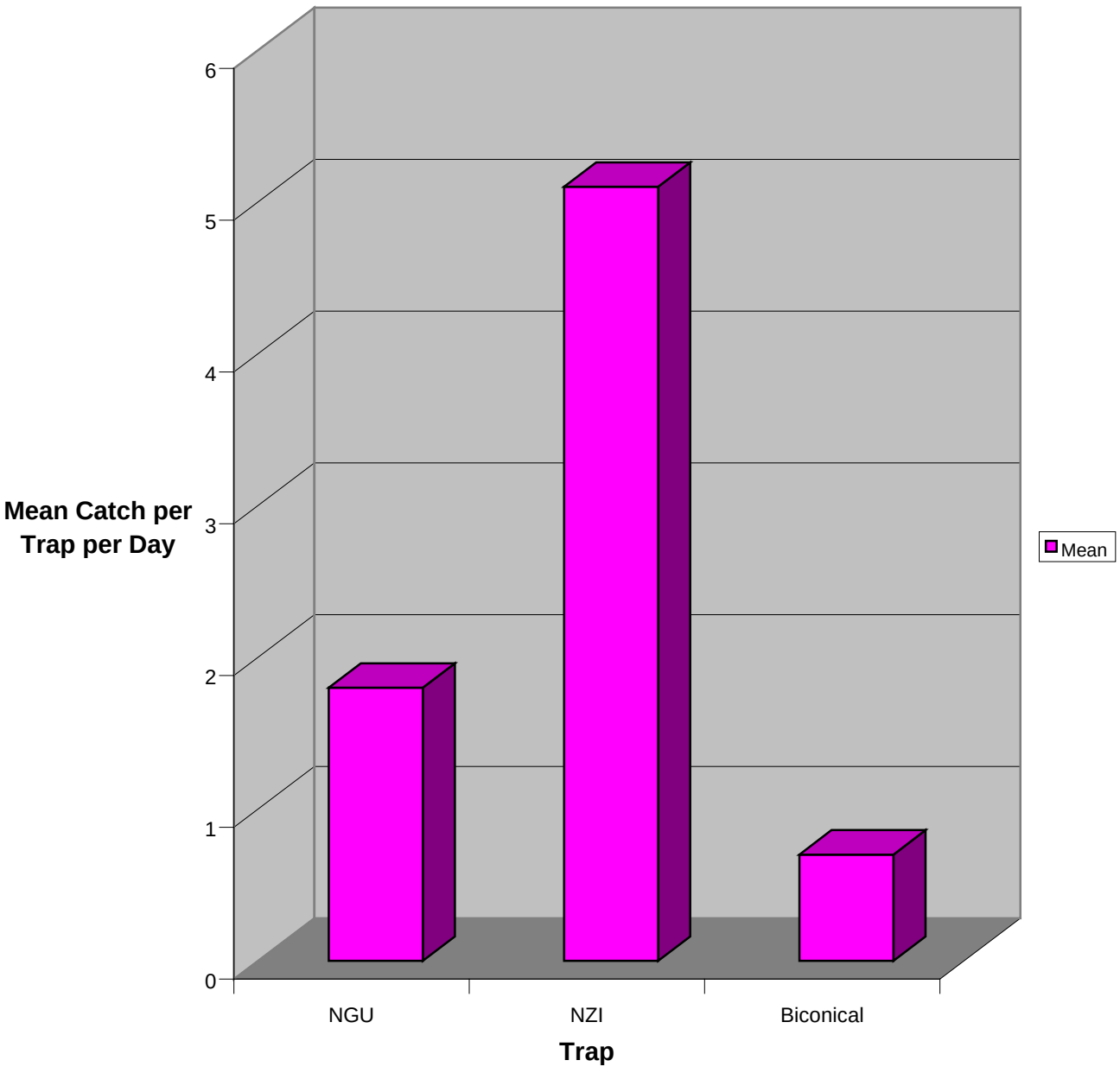
Repellency Test Results-Biting Flies-totals



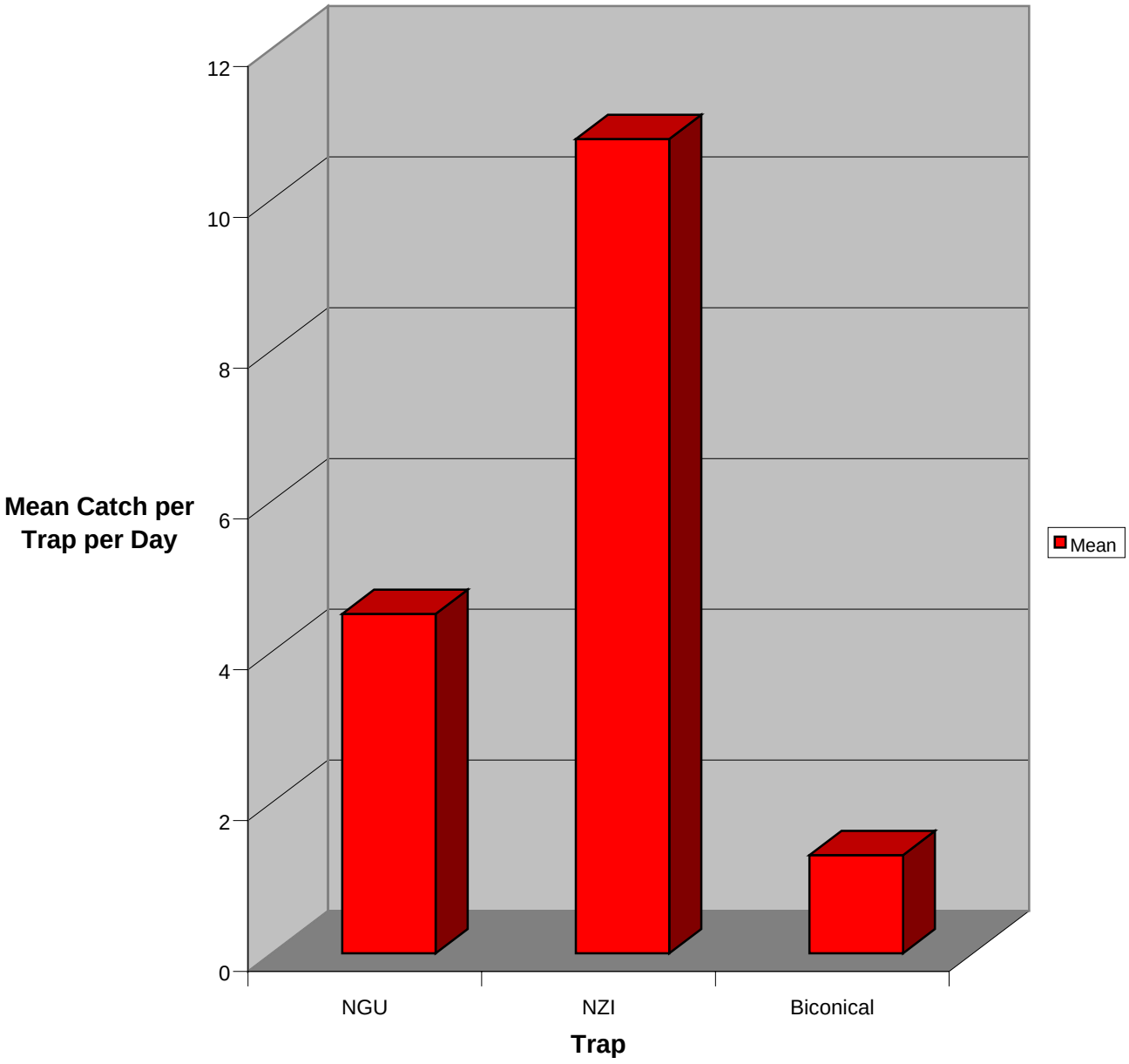
Trap Results-Glossina longipennis-males



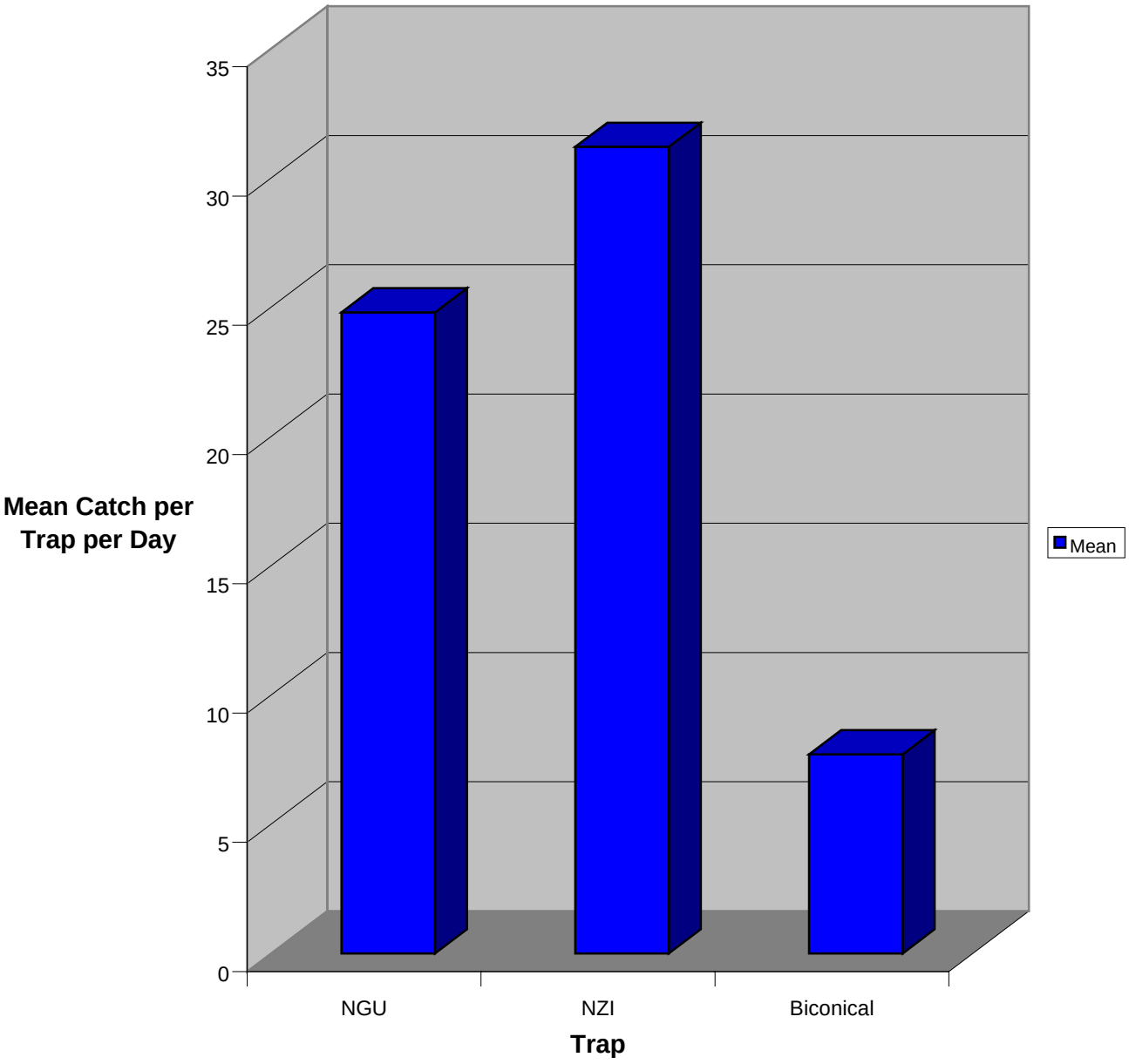
Trap Results-Glossina longipennis-females



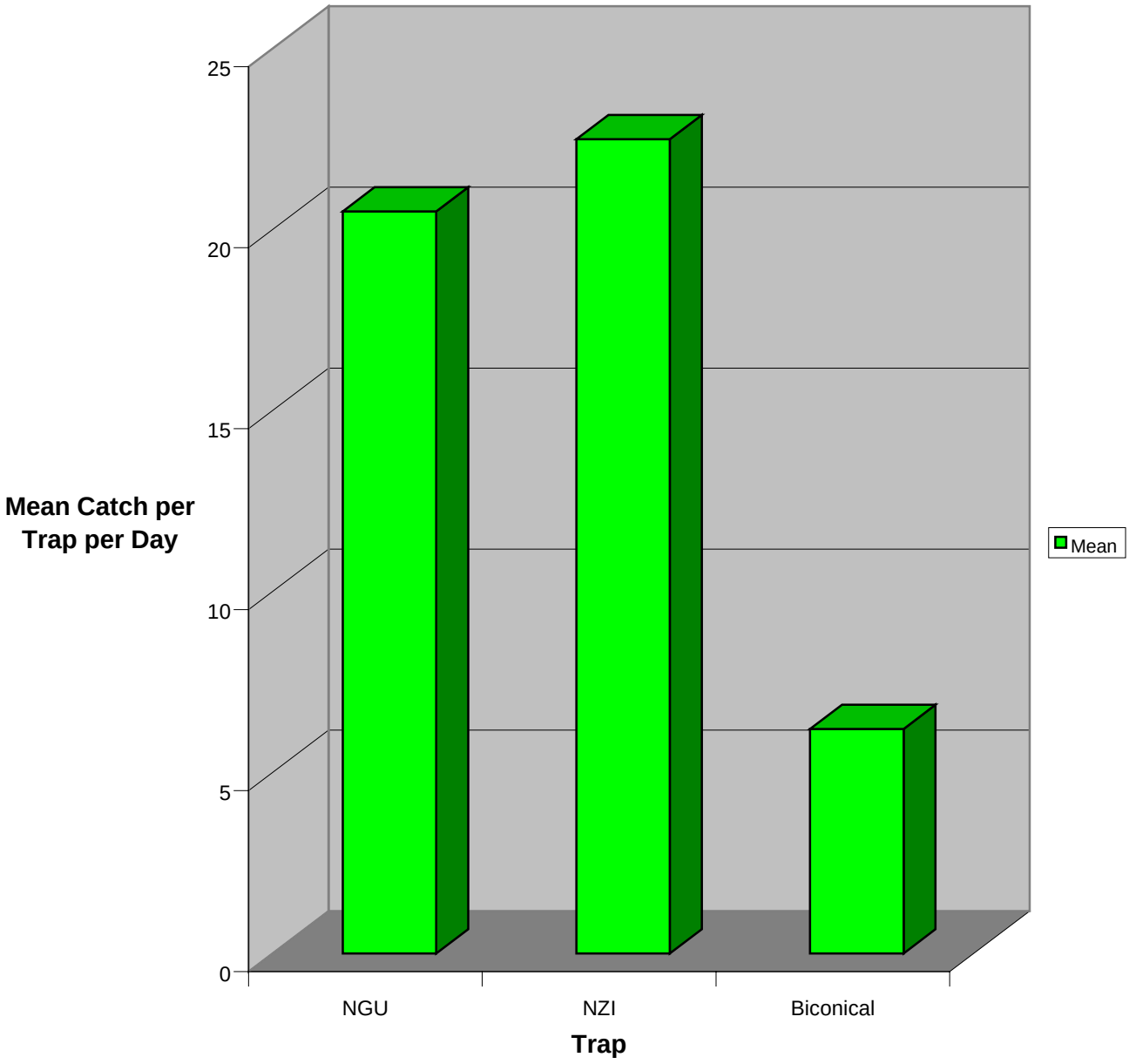
Trap Results-Glossina longipennis-totals



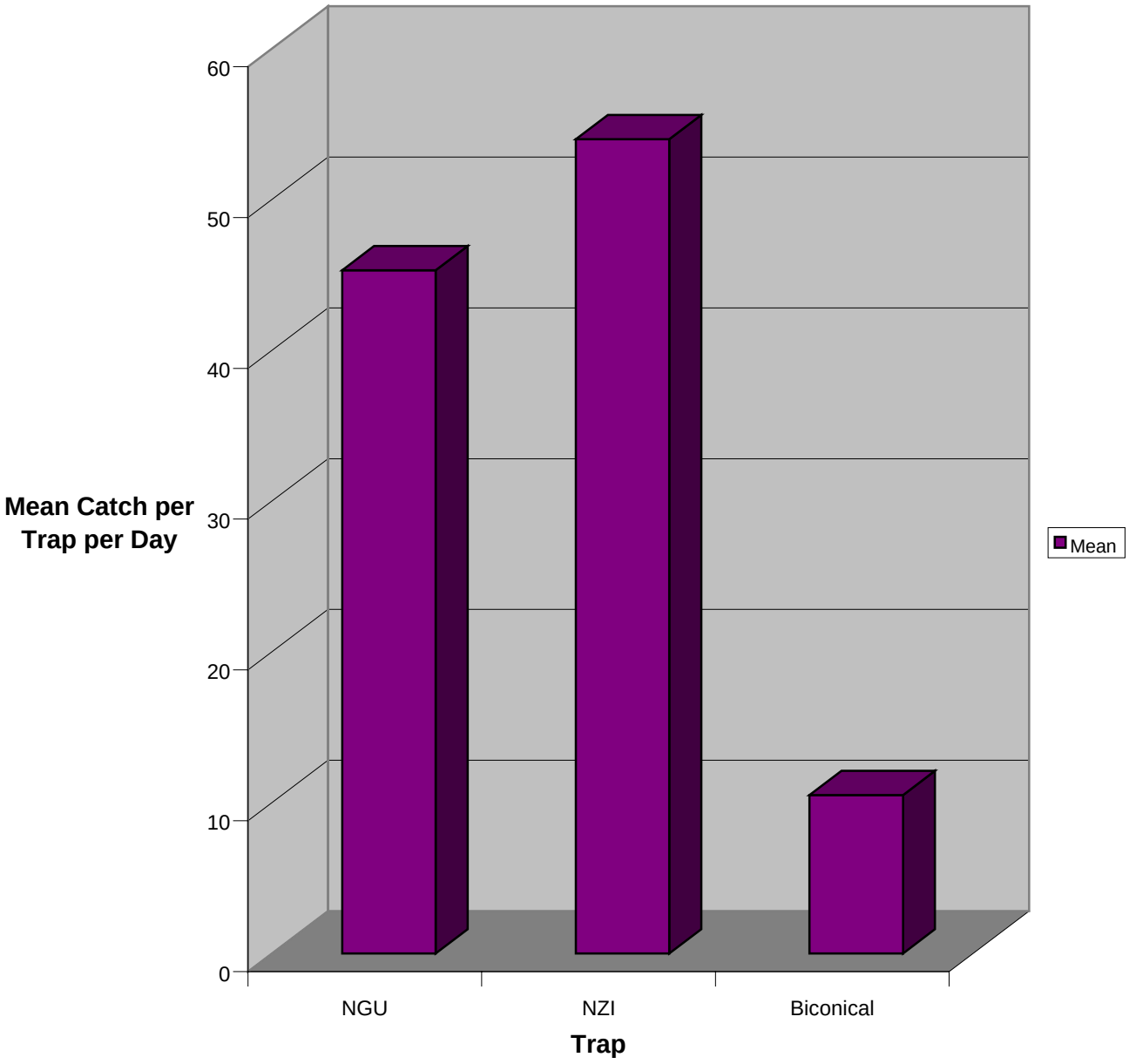
Test Results-Glossina pallidepes-males



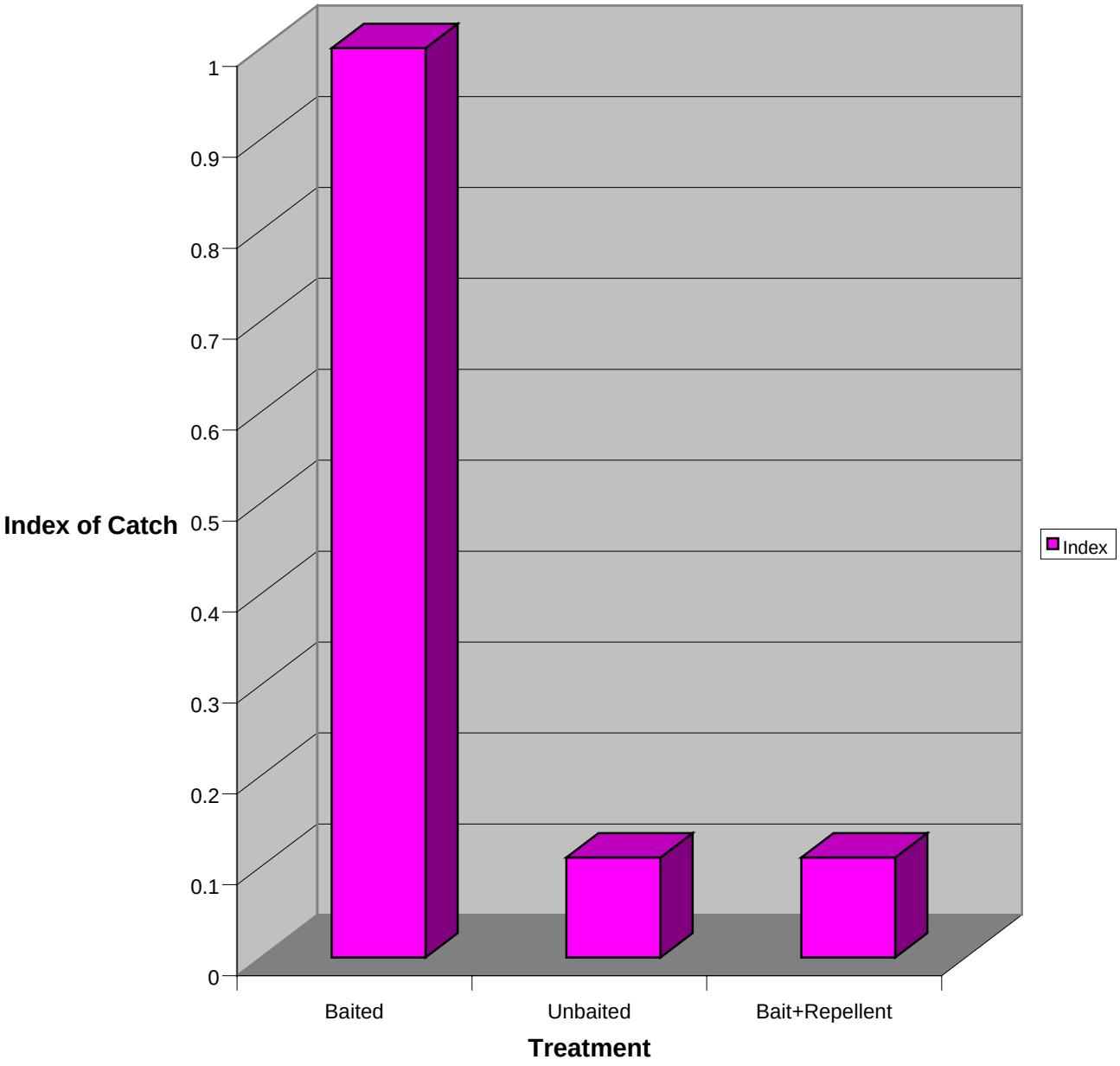
Trap Results-Glossina pallidipes-females



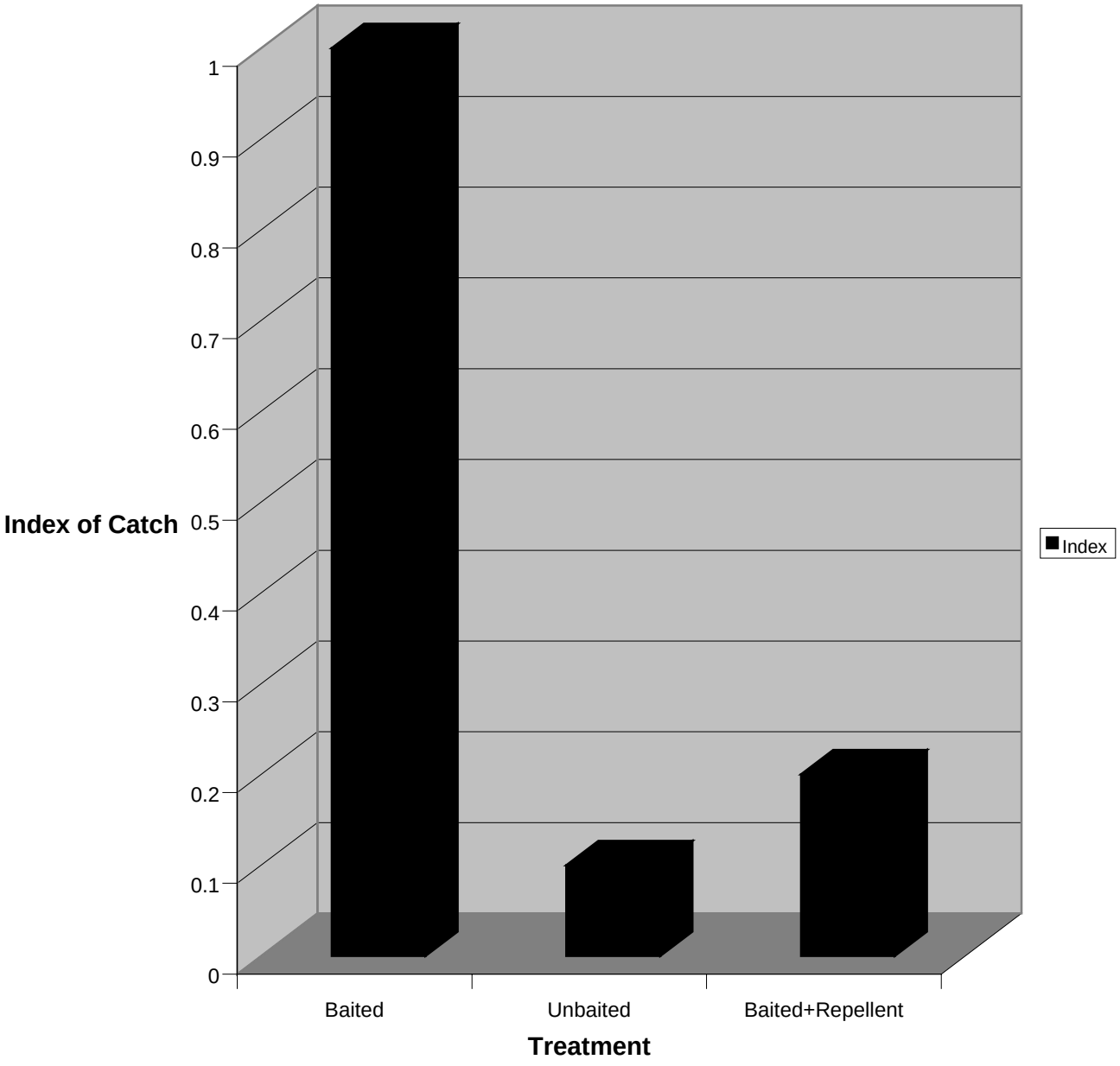
Trap Results-Glossina pallidipes-totals



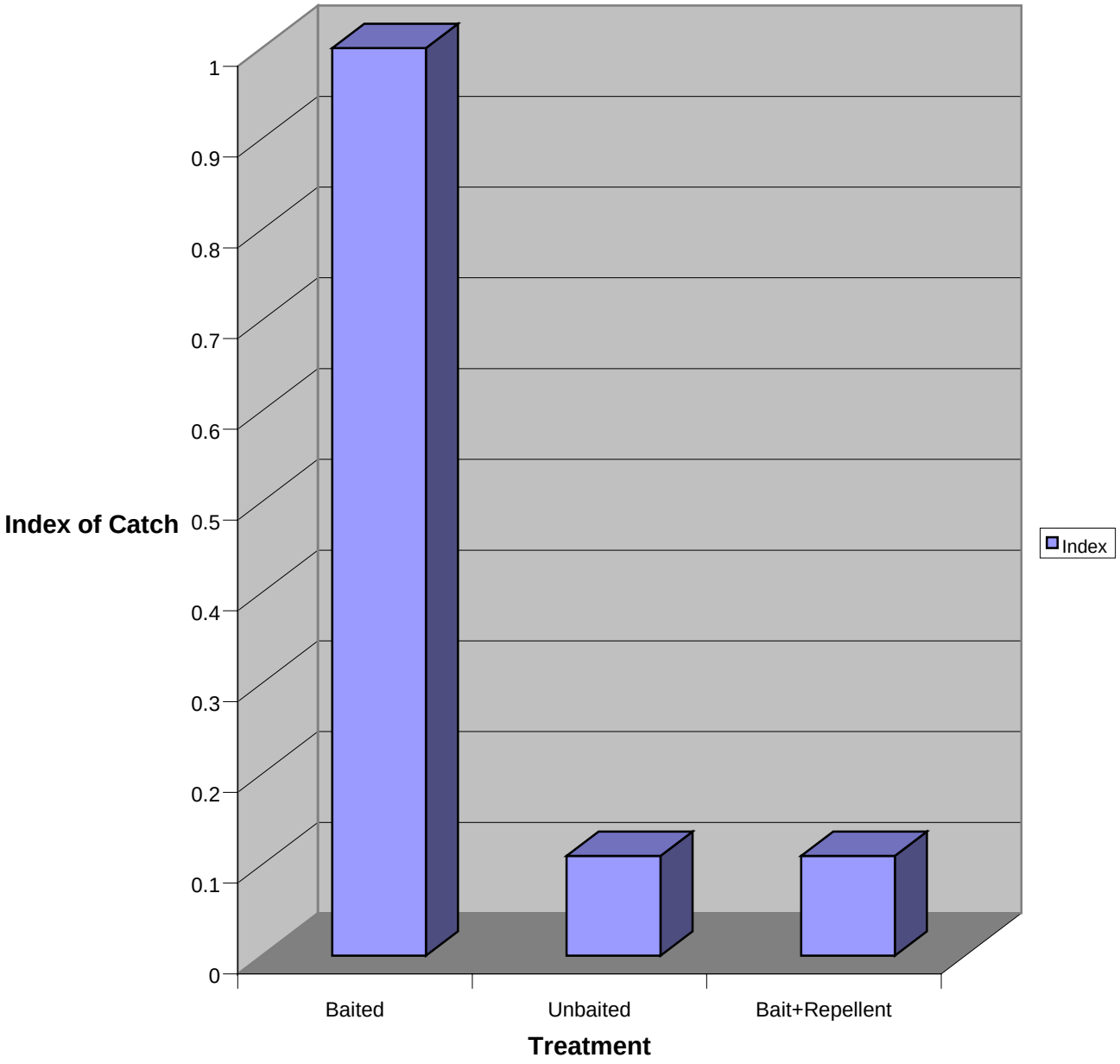
Repellency Test Results- Glossina pallidipes-males



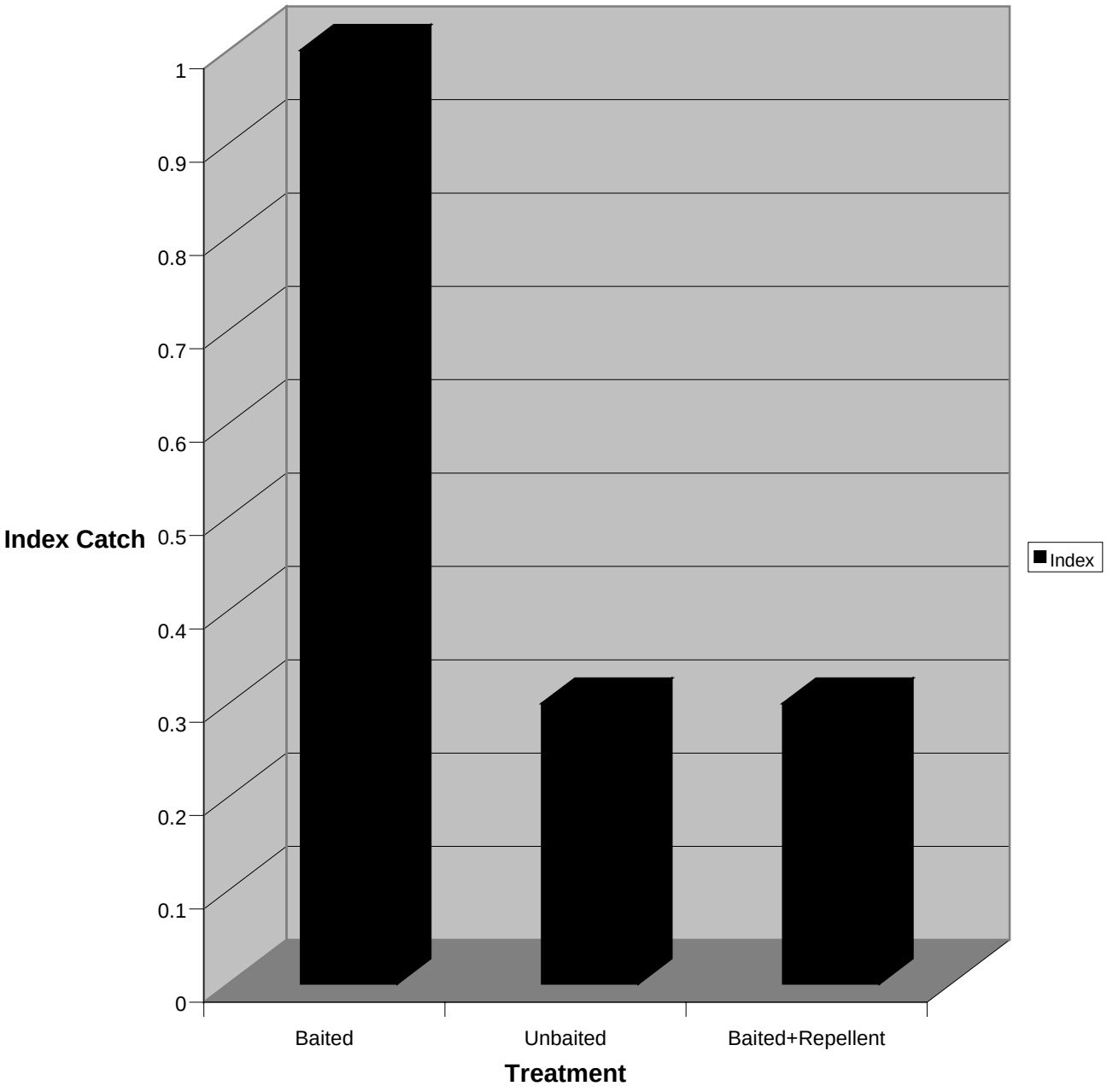
Repellency Test Results-Glossina pallidipes-female



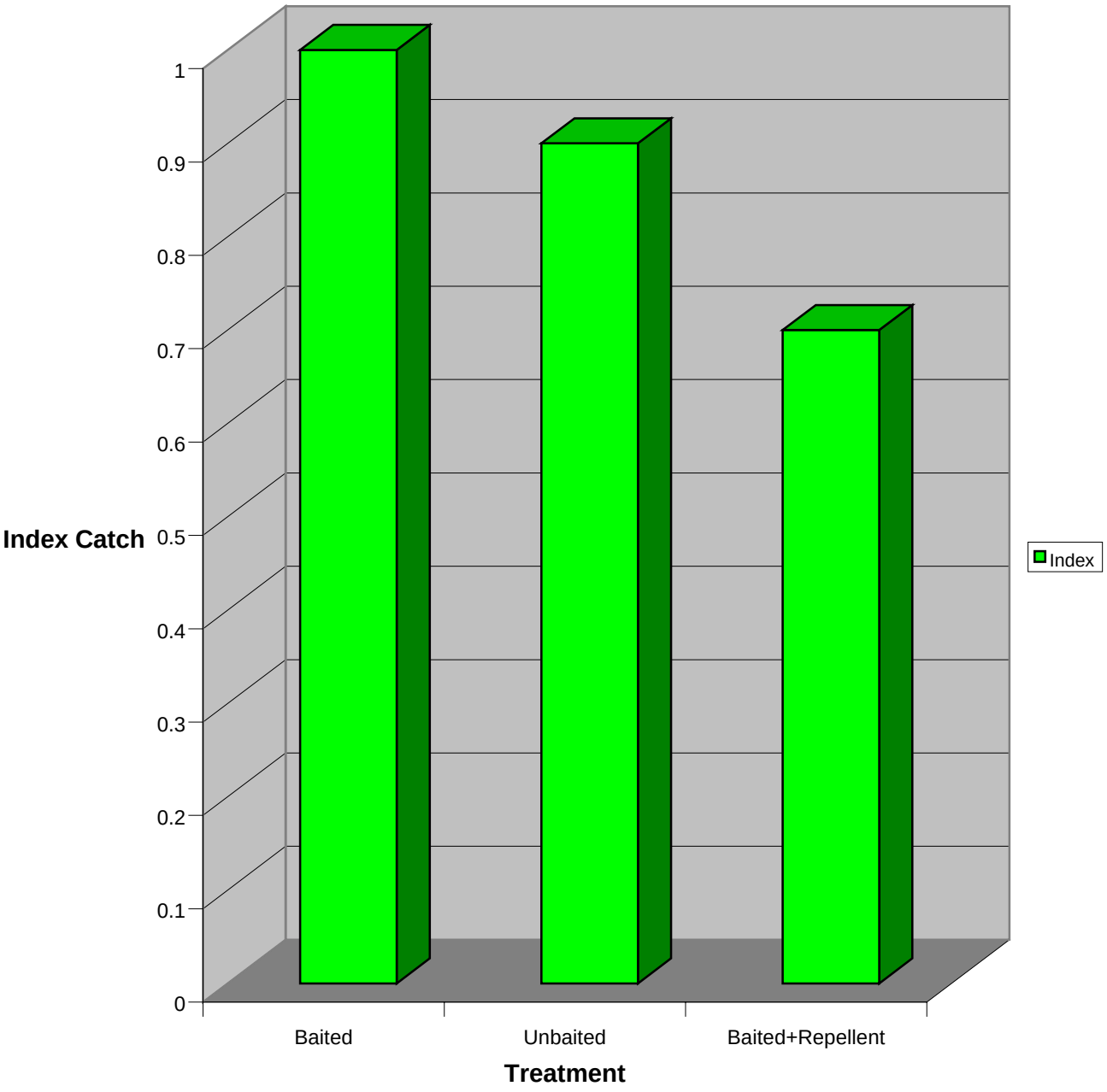
Repellency Test Results-Glossina pallidipes-totals



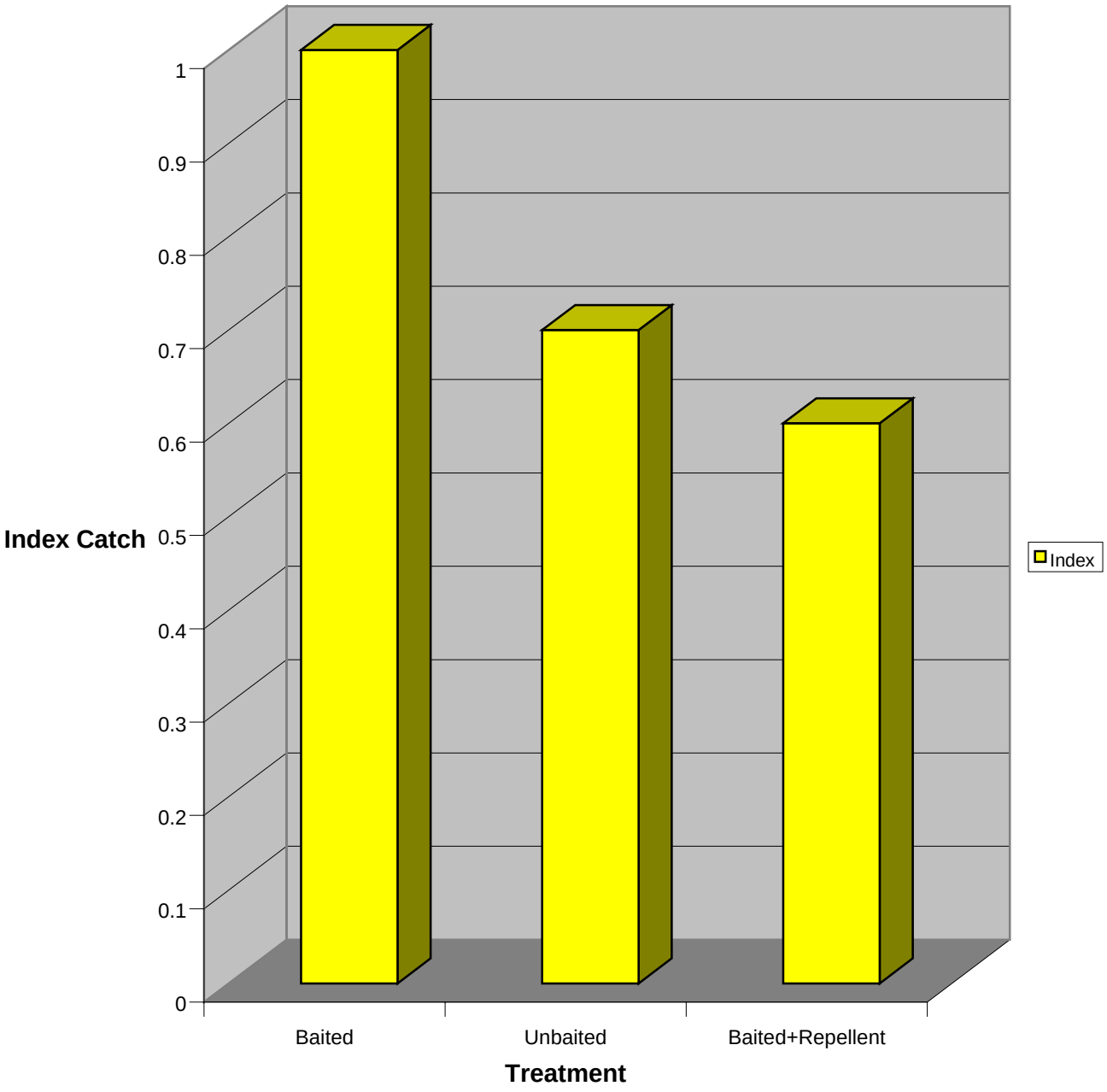
Repellency Test Results-Glossina longipennis-males



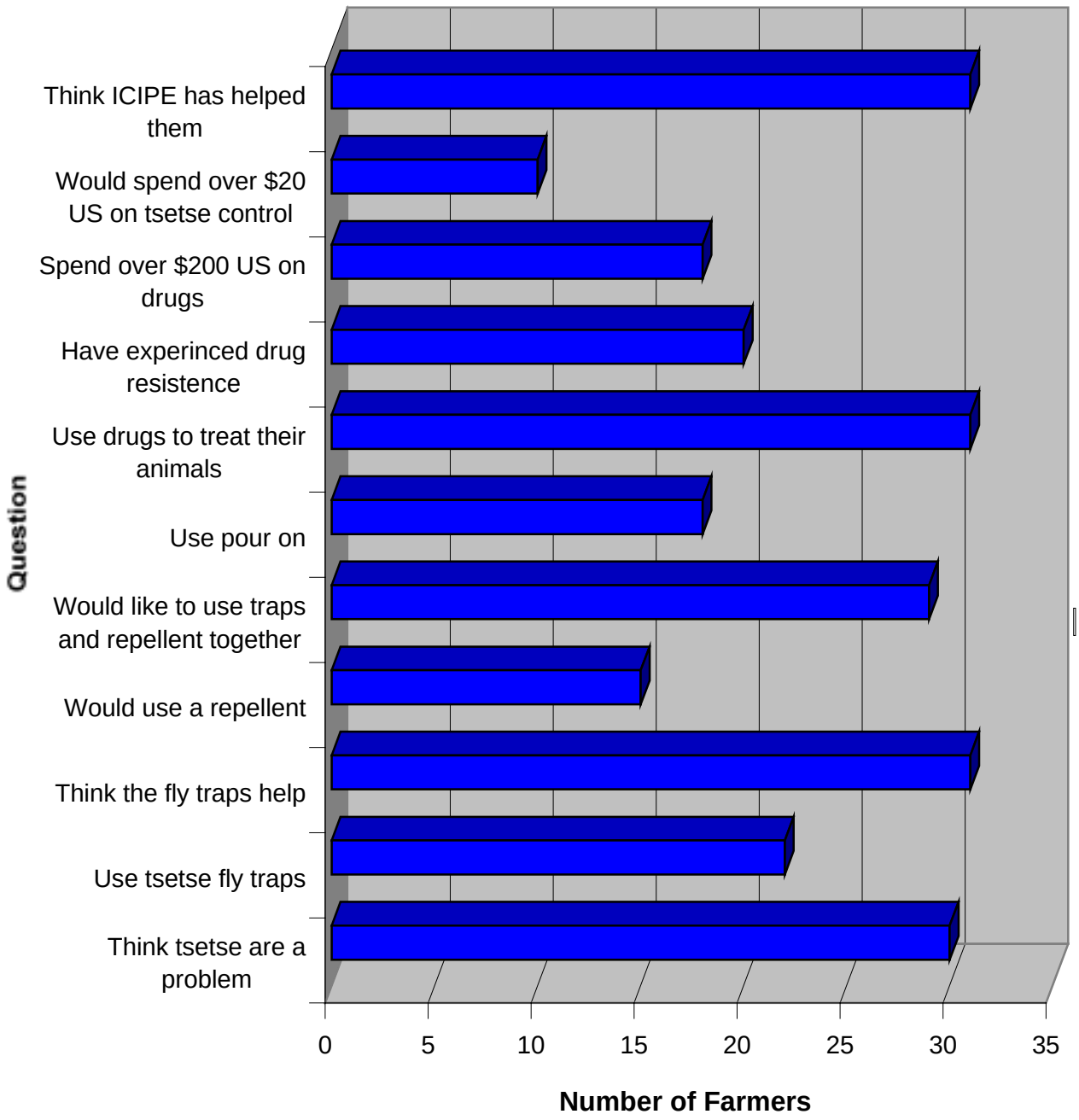
Repellency Test Results-Glossina longipennis-females



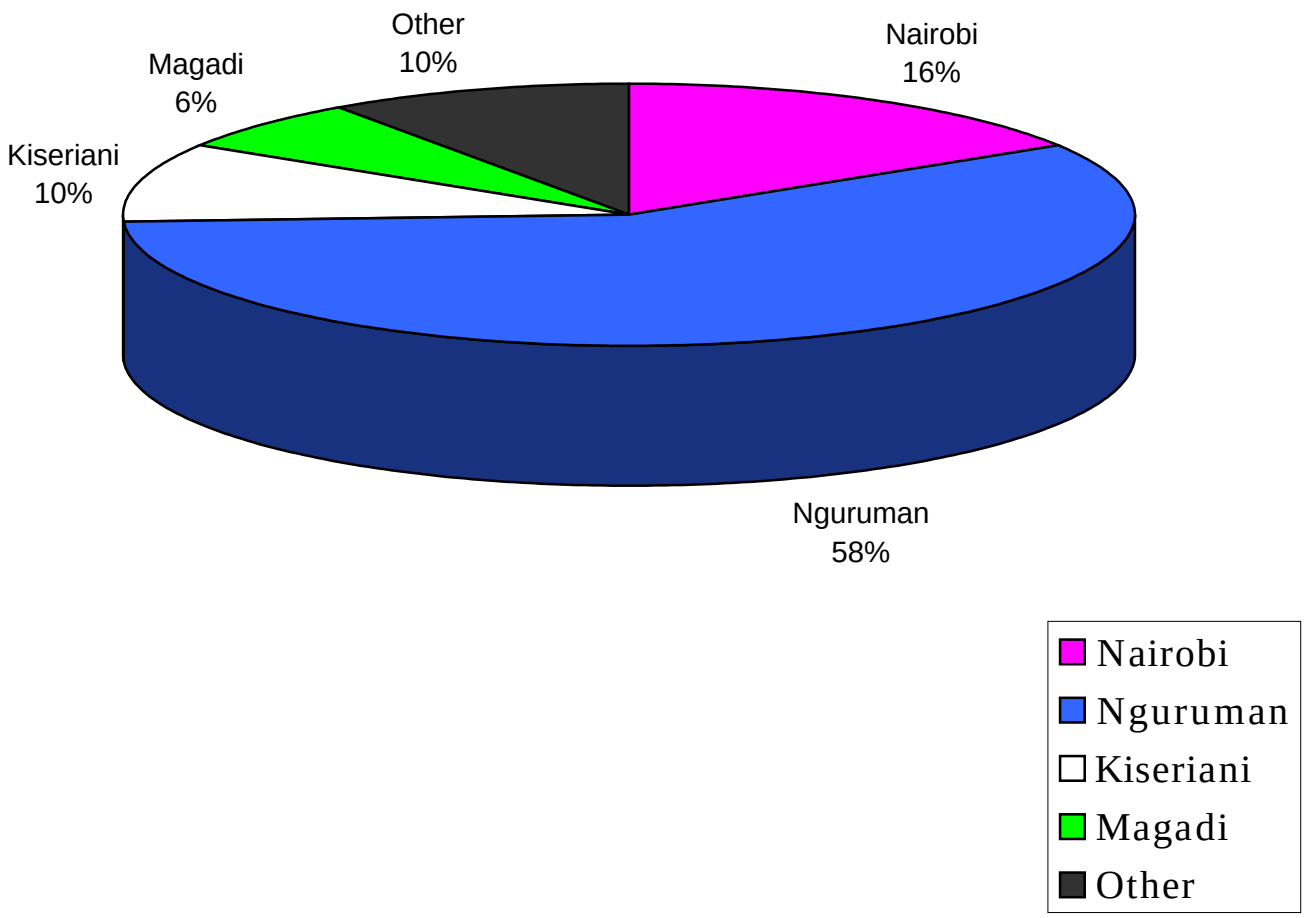
Repellency Test Results-Glossina longipennis-totals



Survey Results



Drug Sources



Tsetse Control Prefrence