

**Homing Behavior of Female and Male Poison Dart Frogs (*Oophaga pumilio*)
in Boca del Drago, Ísla Colon, Bocas del Toro, Panama**

Lila Blaustein and Hannah Winthrop, ITEC 2019

Abstract

Our study compares the return times of male and female *Oophaga pumilio* to their territory at the Bocas del Toro Biological Station. Frogs were placed at varying distances away from home territory between 20 and 80 meters and were recorded upon return. 70% of the females returned to the site, whereas 50% of the males returned. On average, the males returned faster than the females. Limited time for our study size resulted in our sample size being small, and of our data did not show a statistically significant difference between males and females.

Introduction

Oophaga pumilio have specific territories within the rainforest. When taken away from their home territories, they are always able to navigate their way back (Lahanas, personal communication 2019). As Lahanas described, research has shown that frogs can return to their home territories after being brought 200 meters away, taking about a day to travel every 20 meters. Little is known about how the frogs are able to navigate back to their home territories.

Female *Oophaga pumilio* use their internal “GPS” when returning to feed their young. After the frogs mate, the male frog protects the eggs until they hatch into larvae. Once they are larvae, the female *O. pumilio* takes each larva to a separate tree, and deposits it in a bromeliad. She then returns every day to each larva and feeds them another egg for 1 to 9 days. Little is known about how the female navigates back to each tree every day (Lahanas, personal communication 2019).

Since female *O. pumilio* need to know where each larva is, we wondered if they can navigate their way back to their home faster than males. Are males equally as good at knowing where they are in the forest? These answers can tell us more about their internal “GPS”, along with the difference between the behavior of the sexes of the frogs. Although both the male and female frogs have an incentive to be in the home territory during the reproductive process, the female frog seems to be more practiced in using internal “GPS” and navigating to familiar locations within the forest. Because of the constant need to navigate, we hypothesized that the female frogs will find their way back to their home territory faster than the males, and a greater percentage of females will return than males.

Materials and Methods

Materials

- Tape measure
- Notebook
- Pen
- 4 plastic ziploc bags
- Camera
- Sharpie

Methods

1. We labeled our four bags with 20, 40, 60, and 80, to represent the meters each frog would be taken away from their original territory.
2. We randomly selected a 10 x 10 m plot of land about 10 minutes into the forest at the Bocas del Toro Biological Station, marking the boundaries with small flags
3. We collected as many frogs as possible from within the plot, identified each one as male or female, took a photograph that clearly displayed the spot pattern on the back of each frog, and named them
4. Placed at least 2 male frogs and two female frogs into the 20, 40, 60, and 80 bags.
5. Recorded the name of the frog, the sex, and the bag it was placed into
6. We walked 80 meters away from the edge of the plot using a tape measure to release 80m frogs

7. Repeated step 6 for 60, 40, and 20, in the four cardinal directions.
8. Recorded release date and time
9. Returned twice a day (mid-morning and late afternoon) for 45 minutes to look for released frogs. Record if found.
10. Repeated step 9 for 4 day

Results

Table 1. Return Time for Frogs Released at 20, 40, 60, and 80m.

Name	Sex (F/M)	Distance Taken (m)	Release Date/ Time	Return Date/ Time	Time Taken to Return (hrs.)
Tina	F	20	Friday 11:55am	Sunday 8:42am	45
Alex	F	20	Friday 11:55am	Saturday 5:10pm	29
Croaker	M	20	Friday 11:55am	Sunday 9:10am	45
Mira	F	20	Friday 11:55am	Monday 9:47am	70
BJ	M	20	Friday 11:55am		
Cassandra	F	40	Friday 11:50am		
Chad	M	40	Friday 11:50am	Sunday 9:05am	45
Elliott	M	40	Friday 11:50am	Monday 9:20am	70
Hazel	F	40	Friday 11:50am	Monday 9:53am	70
Rebecca	F	40	Friday 11:50am		
Bertha	F	60	Friday 11:23am		
Billy	F	60	Friday 11:23am	Monday 5:30pm	78
Blake	M	60	Friday 11:23am		
Richard	M	60	Friday 11:23am		
Faith	F	80	Friday 11:05am	Monday 5:47pm	78
Judy	F	80	Friday 11:05am	Monday 9:22am	70
Samuel	M	80	Friday 11:05am	Monday 5:29pm	78
Leon	M	80	Friday 11:05am		

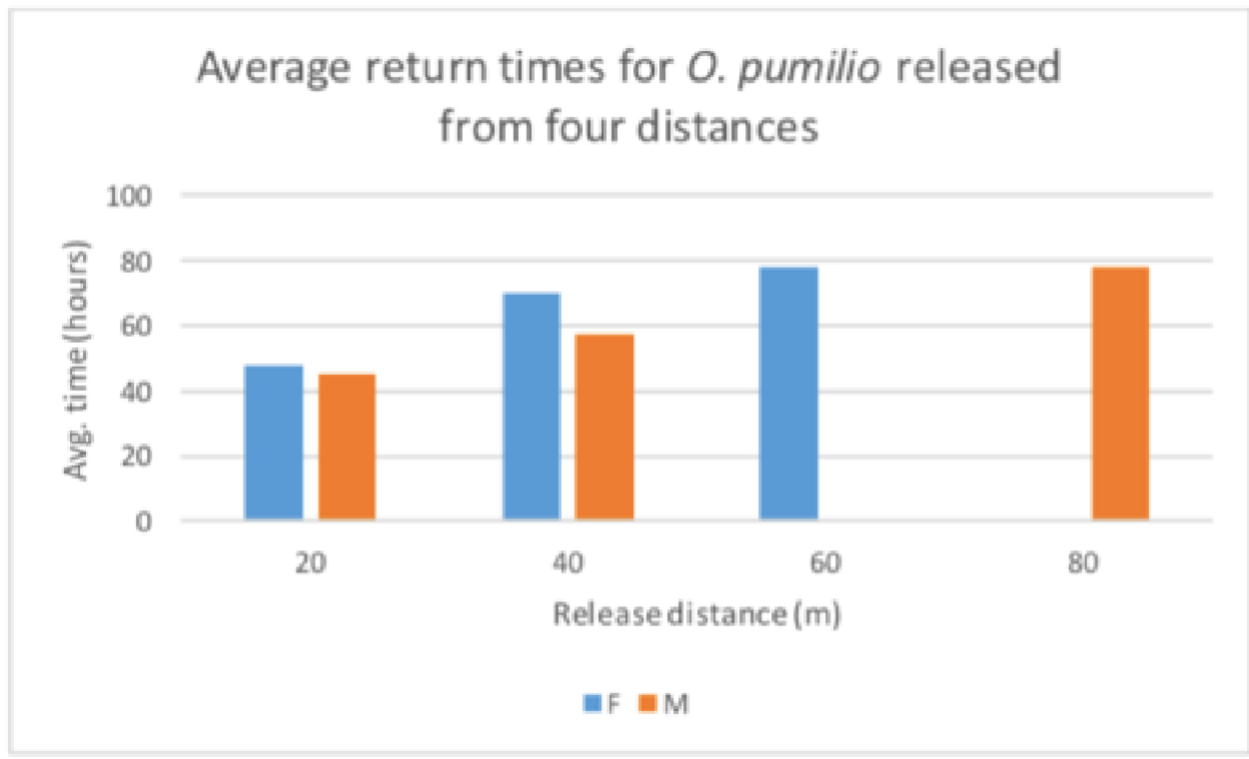


Figure 1 Average return times for *Oophaga pumilio* released from four different distances from their home range.

Table 2. Average return times for male and female *Oophaga pumilio*

Sex (M/F)	20m (hrs.)	40m (hrs.)	60m (hrs.)	80m (hrs.)
M		45	57.5 -	78
F		48	70	78
				74

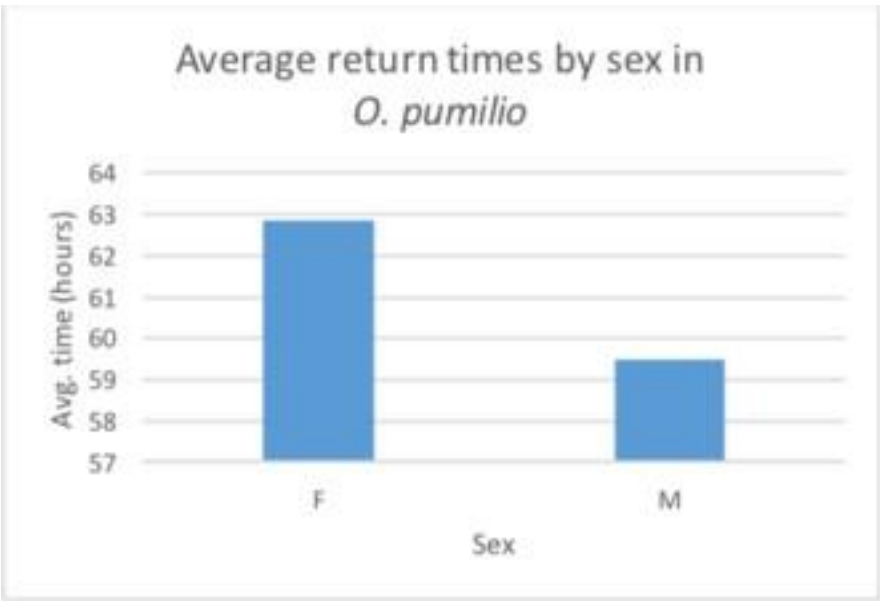


Figure 2 Average return times for male and female *Oophaga pumili*

Table 3. Return Percentage by Sex

	Female	Male
Total #	10	8
Total Returned	7	4
Percentage Returned	70%	50%

7 females returned, whereas 4 males returned. Returned males (1) deposited 20m away had an average return time of 45 hours. Returned females (3) deposited 20m away had an average return time of 48 hours. Returned males (2) deposited 40m away had an average return time of 57.5 hours. Returned females (1) deposited 40m away had an average return time of 70 hours. No male frogs returned from 60m. Returned females (1) deposited 80m away had an average return time of 78 hours. Returned males (1) deposited 80m away had an average return time of 78 hours. Returned females (2) deposited 80m away had an average return time of 74 hours.

Discussion

Table 3 supports our hypothesis, but Table 2 shows the opposite of what we predicted. None of our data can be considered significant, as we do not have a large sample size. However, within our sample, a trend showed that females returned at a higher percentage and males had faster return rates on average. All frogs returned later than expected.

There was probably no difference in the return rates and times of the *O. Pumilio* because both sexes have a time sensitive reason to return to their home territories. The females need to carry the larvae up the trees and feed them, whereas the males need to return because if they are away from their territory too long, another male can come in and take over. The males also need to guard the eggs before they hatch. Lahanas (personal communication 2019) suggested that if we were to do this study several more times, it is probable that there would be no difference between males and females.

We recaptured one of the frogs while she was carrying a larva up to a tree. This is particularly interesting because Faith actually needed to return to her home territory in order to feed her larvae.

Sources of error

We could have missed several frogs in the 10x10m plot. We also did not walk a perfectly straight line from the plot to deposit the frogs, so our distance measurements were not exact. It is also possible that on the first day we captured frogs that were outside of their home plot, which would make their return not to our 10x10 plot but to a different plot that we were not checking. In addition, because we only checked for frogs twice a day, we were unable to distinguish exactly when they returned, putting all frogs captured in the same session as having about the same return times. Finally, we did not put the exact same number of frogs at each location with the exact same ratio of male to female frogs.

If someone were to do this experiment again, they should capture more than 18 frogs, spend more time at once in the rainforest, and return to the forest more often. They should also make sure to have the same ratio of male to female frogs.

Conclusion

The data showed a trend of male frogs returning in fewer hours and female frogs returning at a higher percentage. Neither rates were significant most likely due to the fact that both sexes have a distinctive reason to return to their home territory and due to our small sample size. Further studies could perhaps better explain why *Oophaga pumilio* have an internal “GPS”, how they use it, and when it is used most often. This could possibly lead to a deeper understanding of all animals’ internal “GPS” and ability to return to their home territory.

Sources:

Lahanas, Peter, personal communication March 2019