Title
Using geometric probability to compare the random and actual mating success of the Platypus,

*Ornithorhynchus anatinus.*

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Abstract

The platypus, *Ornithorhynchus anatinus*, is a semi-aquatic animal common to the country of Australia, and a part of the monotreme family. In this study I calculated the random probability of mating success and compared it to the actual mating success for the Australian Platypus. The random probability was estimated to be .2%. The actual probability of mating success with in the platypus increases to 100% for the males when they court, and hold on to their females for an extended point in time, until they are ready, they will pin her down with his body weight, ensuring successful entrance into her cloaca.
Introduction

The Australian Platypus can be found in freshwater rivers or lakes in eastern Australia. The platypus is active mostly at night, staying in self-made burrows for shelter and protection. Platypus feed on insect larvae, worms and other freshwater insects. They accomplish this with the use of their bills, turning up mud and using the electroreceptors found in their bills to locate the insects. The platypus will store the food in pouches located behind their bills, and consume their findings when they have returned to the surface of the water. The platypus biggest threats are snakes, foxes, goannas and rats.

The platypus mates once a year, between the Australian spring months of June to October. The females will lay 2-4 eggs at a time, and incubation takes close to two weeks. The females will secrete milk from her glands to feed the once born baby platypus. The males however have spurs, about 15 millimeters in length, located behind each hind leg. This spur is connected to a venom gland, which aids in the protection against its predators, aiding in its survival. Courtship plays a large role in mating success, because the male will court his female for close to an hour. This allows the female to be comfortable, when the male proceeds to bite the gape of the females’ neck, and pin her down. Courting will aid in the success in producing offspring. In this study, using a method of geometric probability, I compared the random mating success with the actual mating success of the Platypus.

Method

Random mating means, if you were to close your eyes and throw one hundred darts at the body of the female Platypus, what would be the chance of hitting the cloaca’s bull’s-eye? Random mating success was calculated based on two geometric figures (Fig. 1). The surface area of the females’ body was represented by a rectangle for the body. The bull’s eye (equivalent to
the vagina) was represented by a smaller oval underneath the tail of the Platypus. The bull’s-eye is where the males’ engorged penis has to deposit his sperm to accomplish successful mating. Random mating success was calculated as the surface area of the cloaca divided by the total surface area of the female body as presented to the male.

**Figure 1:** This image of the platypus was obtained from google images. The large rectangle (Cylinder) represents the surface area as a male would see her. The small oval represents her cloaca.

**Results**

Target Surface area (cylinder): \((2 \times 3.14 \times 2.5^2) + (2 \times 3.14 \times 2.5 \times 17) = 39.25 + 266.9 = 306.15\) mm\(^2\)

Target Surface Area (oval): \(3.14 \times .5^2 = .785\) mm\(^2\)

Probability of Hitting the Bulls eye: \(.785/306.15 = .002 \times 100 = .2\%\)
According to my geometric calculations the surface area of the bull’s-eye is only .2% of the total surface area of the target (cloaca). Thus by chance alone, only two tenths of 100 darts would hit the bull’s eye.

**Discussion**

In this study, we found that unless timing, body size, availability, courtship, and willingness based on courtship, is just right there are only ~ two tenths of a chance out of 100 that males could find, mount and successfully inseminate females with their eyes closed.

How males and females increase this .2% of random mating success to 100% actual mating success? Platypuses time their reproductive urges by mating only during the Australian spring season when the water is warmer. A female does not choose her mate, the male will seek out a female by biting her tail, and holding on while swimming in the water. This can last up to an hour. This courtship is loud, and very vigorous. When they finally begin mating, the male will bite the gape of the females’ neck, and pin her down, so he is able to insert his penis into her cloaca. Then sperm is deposited to fertilize the eggs.

The male, post coitus will then swim around with the female for up to another hour. After this is complete the male will go on his way, only to complete this task with another female. The male sticking around after mating helps to ensure the safety of the females’ fertilization.

Each pair of platypus can produce 2-4 eggs per mating season; however the lifespan of the “platypups” is not very long.
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doi: 10.1071/RD01110

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