

Proposal - Example

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Soliciting Behavior of Female *Macaca fascicularis* Monkeys on Tinjil Island, Indonesia

Introduction

Mating behavior of nonhuman primates has been the subject of intense investigation both in the field and in the laboratory in an attempt to validate/refute predictions of the sexual selection theory¹. The general goal is to be able to correlate sexual behavior with ecology and social structures and thus understand its adaptive advantages during evolution. For that reason, field studies are essential because they observe primates in a complex environment which does not compromise natural social interactions.

Macaca fascicularis is a species in the diverse *macaca* genus of Old World monkeys². Also known as long-tailed, crab-eating or cynomologous monkeys they are widely distributed throughout Southeast Asia³. They are commonly used in biomedical research, however, their social behavior has not been as extensively studied as that of their close relatives the Japanese and the rhesus macaques. *Macaca fascicularis* live in multi-male, multi-female groups with a male:female ratio of 1:5. Females form the social core of the group because they remain in their group for life and establish matriline, while males disperse upon reaching maturity³. Sexual dimorphism is not very pronounced with females having 69% of the weight of the male, and female alliances can often challenge the authority of the dominant male. Long-tailed macaques are non-seasonal breeders with only small seasonal variations in the number of matings observed. Mating in this species involves a single mounting, however, consort bonding between the male and the female can precede or follow the copulation for a varying length of time⁴.

The objective of the proposed study is to determine the extent to which female long-tailed macaques choose their mating partners and what strategies (active versus passive) they employ to exercise this choice. While such questions have been addressed for other species (baboons, gorillas), no literature is available on *Macaca fascicularis*. In general, there is a wide variability in the role that female primates play in mating (from almost exclusively initiating mating to being the unwilling partners in forced copulations) and it is

further complicated by intraspecies variations between studies in the field and in captivity^{5,6}. Therefore, the first goal of my project will be to establish the behavioral repertoire of females soliciting mating partners. Common gestures that signal interest in mating on the part of the female include presentation of the hindquarters, but can be as subtle as head movement and eye contact or as explicit as mounting or a slap in the face⁶. I will also conduct a more quantitative analysis on 1) the percentage of observed matings initiated by females vs. those initiated by males and 2) the percentage of female solicited matings vs. matings passively refused or accepted by the females. These numbers will provide a general estimate of whether there is a gender difference in the drive to initiate mating and in the strategies for choosing a mate. Previous studies on the subject of mate choice have mostly concentrated on male-male competition and these findings will offer a complementary perspective on this complex behavior. The short duration of this study will prevent a more detailed examination of the basis of female choice of partners, which would require intimate knowledge of the social interactions within a group. However, the presence of a correlation between male rank and female solicitations could be assessed.

Methods

Field study site and subjects

The proposed study will be conducted from 8 July until 31 July, 1999 on Tinjil Island, Indonesia, which is located south of West Java (Fig 1). *Macaca fascicularis* were first introduced on the island in 1988 when a Natural Habitat Breeding Facility was established there as a source of virus-free long-tailed macaques for medical research⁷. There are no large mammals on the island and the only predators of the monkeys are the pythons. The vegetation on the island consists of secondary growth rain forest which is very similar to the original habitat from which the monkeys were removed. 12 groups of monkeys were identified on the island and they represent relatively stable units of social structure even

though monkeys are periodically harvested for medical research⁸. All of the original animals are tattooed to facilitate identification. There are 11 feeder cages distributed throughout the island (Fig 2) for regular provisioning of the monkeys and individual groups have monopolized particular cages and spend a considerable part of their day around them. The open spaces around the cages increase visibility and make behavioral observations a lot easier to conduct than in the forest.

Sampling method

During the three week span of the field study I estimate to conduct 120-150 hrs of observation. An intended daily schedule would be from 7:00 - 8:00 am until 2:00 - 3:00 pm or until fatigue causes loss of concentration. A previous study has shown that long-tailed monkeys are most sexually active in the morning⁹ and therefore such work schedule would maximize the number of matings observed. Only matings around the feeder cage will be recorded, which might represent a bias in the sampling, however, following the monkeys in the forest for an extended period of time is not feasible. I would ideally try to concentrate on one group and systematically observe it every day, however, if a group is absent from its usual feeder cage on a particular day I will have an alternative group that I could study. Most suitable for this type of study will be to choose one of the groups that frequent cages close to the base camp⁸ like Harelip, Rip-ear, One-eyed or M26. Harelip and Rip-ear have the advantage of a small size (around 20 members), which would facilitate in the identification of animals, however, there are only two males reported in each group and that does not represent sufficient "choice" for the females. One-eyed and M26, on the other hand, have 69 and 81 members, and 5 and 8 males, respectively, so any trends in female choice of mating partners would be more apparent. M26 had its dominant male removed last year during one of the periodic harvests and that might be a complicating factor in trying to correlate female choice with male rank since a dominance ranking might

not be yet firmly established. Therefore, One-eyed appears to be the best group to study, although this is to be decided for certain on the island.

Within the group of choice observation will proceed using the “focal animal” method described by Altmann¹⁰ or referred to as “continuous sampling” by Crockett¹¹. Even though my study question pertains to the female choice of mating partners, due to the considerably larger number of females than males in the group I will use the males as focal animals. Each day I will randomly choose one male from the group and record all of his encounters with females and their outcomes for 30 min to 1 hr of focal sampling. I will then choose randomly from the remaining males in the group and continue like that until all males have been sampled once. In this way each male in the group will be observed for an approximately equal time each day. Each encounter of the focal male with a female would be classified as one of four categories (Fig 3): 1) male initiates the mating and the female accepts (MF); 2) male initiates the mating, but the female refuses to cooperate (Mf); 3) female initiates the mating and the male accepts (FM); 4) female initiates the mating and the male refuses to cooperate (Fm). A more detailed description of the encounter will be given in the “comments” section with an emphasis on the female’s reaction (the gesture used to indicate interest or to reject the approaching male). An advantage of this sampling method is that it concentrates on one animal at a time and thus allows plenty of time for taking notes. Therefore, other parameters can also be recorded: time of day, duration of the encounter, was the observed mating preceded or followed by a consort bonding with that partner, the state of the female (age group, pregnant or not, does it have infants or juveniles accompanying her). During the remainder of the observation day I will also make *ad lib* observations of agonistic interactions between males in order to determine dominance ranking in the group.

Data analysis

The number of encounters with females that resulted in mating will be added for all focal males during all the observation days to represent the total number of matings in the group. This number will then be used to divide the number of successful matings initiated by females to yield the percentage of all matings that were initiated by females.

$$\% \text{ of matings initiated by females} = FM / (MF + FM)$$

This number will provide the first indication of how many of the actual matings observed were the result of female soliciting efforts. Next, I would take into account all encounters between males and females even if they did not result in mating (i.e. one party refused the solicitations of the other) and determine what percentage of those represent examples of active choice by females.

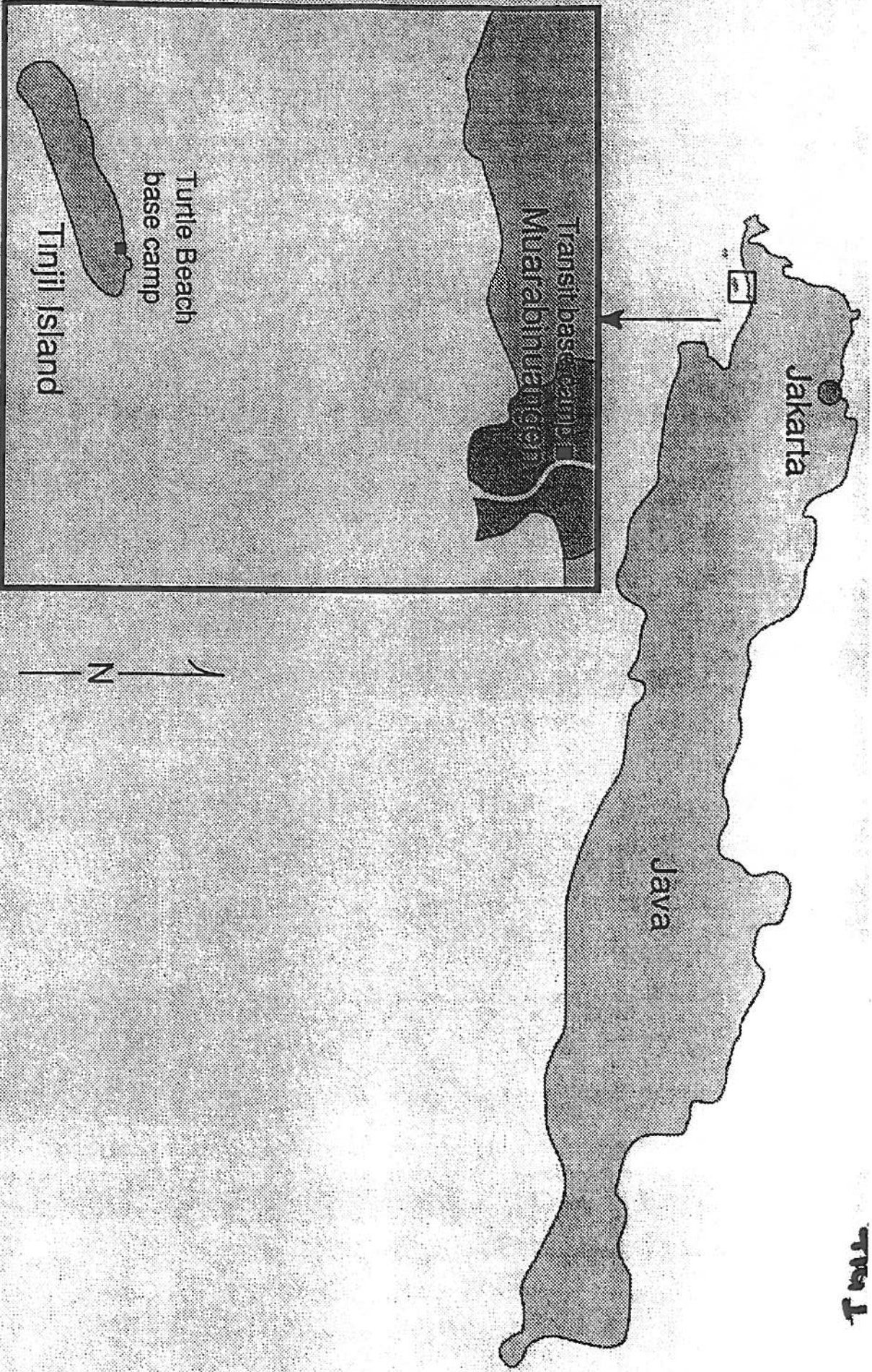
$$\% \text{ active female choice} = (FM + Fm) / (MF + Mf + FM + Fm)$$

Information on the dominance hierarchy among males can be used to determine if there is any correlation between rank and the number of female solicitations received by each male. A graph of rank (1 through 5, if the One-eyed group is observed) vs $(FM + Fm)$ can be used to calculate a correlation coefficient and determine its statistical significance.

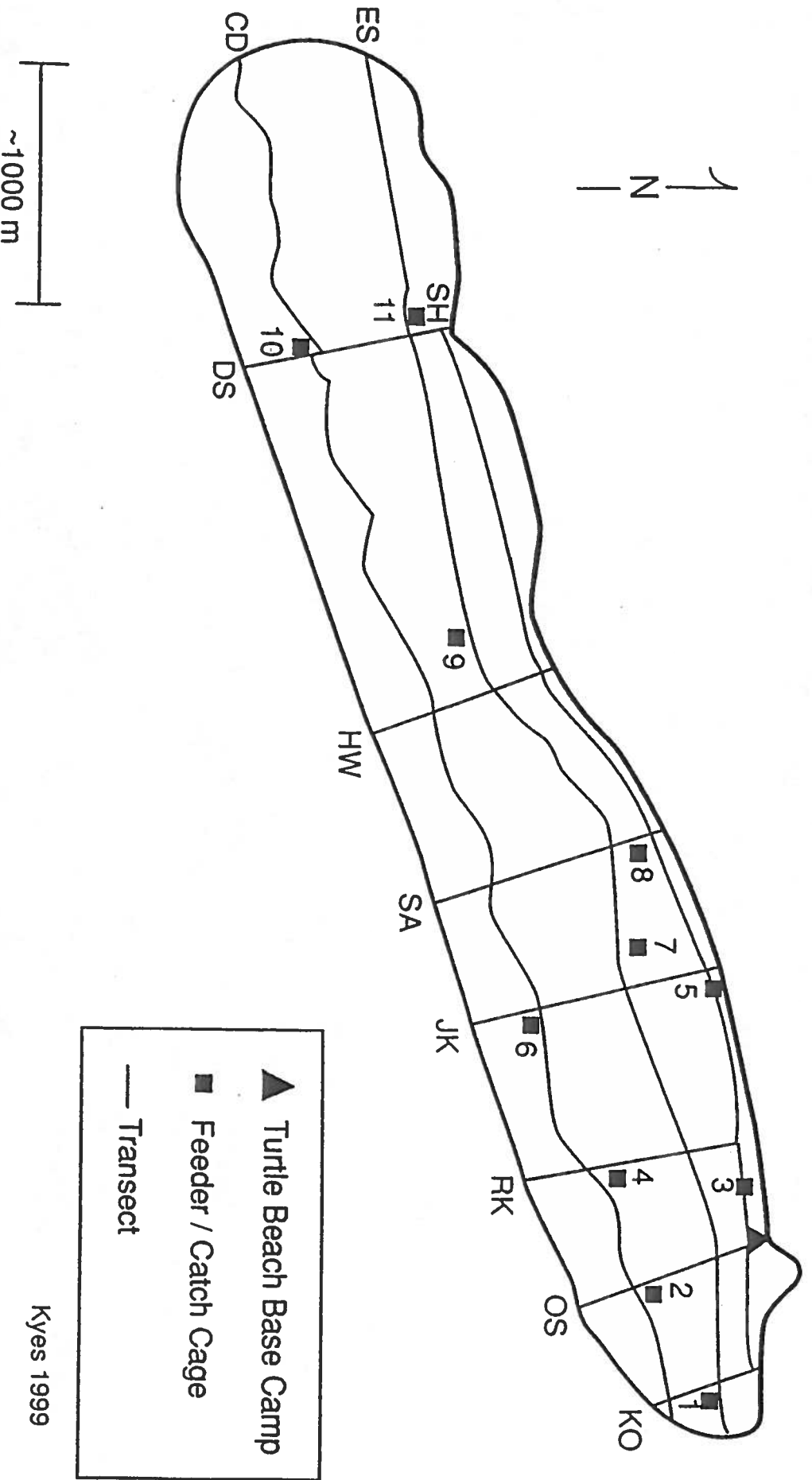
Observations recorded during the times when matings did not occur can be used to make more qualitative speculations of what some of the other factors in female choice might be (i.e. are the mates of choice most friendly and protect the female's infants, are they aggressive or not).

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TINJIL ISLAND



Kyes 1999

