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BRIEF REPORT

Survey of the Long-Tailed Macaques Introduced Onto Tinjil Island, Indonesia

RANDALL C. KYES
Department of Comparative Medicine, Bowman Gray School of Medicine of Wake Forest University, Winston-Salem, North Carolina; Department of Forest Resources and Conservation and Institut Pertanian Bogor Primate Research Center, Institut Pertanian Bogor, Indonesia; and the Regional Primate Research Center at the University of Washington, Seattle, Washington

From February 1988 though June 1990, 475 adult long-tailed macaques (*Macaca fascicularis*) were released on Tinjil Island to establish a breeding program that will provide monkeys for biomedical research while contributing to Indonesia's primate conservation efforts. A survey was conducted during the summer of 1990 to assess the status of the island's population. Basic demographic data were consistent with those from other field studies of long-tailed macaques, and estimates of reproductivity suggest a successful breeding program. The facility established on Tinjil Island should serve as a useful model for future primate resource and conservation programs.

Key words: survey, *Macaca fascicularis*, breeding program, conservation

INTRODUCTION

Tinjil Island, located off the south coast of West Java, Indonesia, provides a restricted natural habitat for the breeding of specific pathogen-free long-tailed macaques (*Macaca fascicularis*). The Pulau Tinjil Natural Habitat Breeding Facility (NHBF) was established in 1987 by the U.S. Primate Research Consortium (University of Washington Regional Primate Research Center, Oregon Regional Primate Research Center, and Bowman Gray School of Medicine of Wake Forest University) in collaboration with the Institut Pertanian Bogor as a means of providing monkeys for biomedical research while enhancing Indonesia's primate conservation efforts.

In 1981, the World Health Organization convened a meeting to address the feasibility of establishing, in countries with indigenous primates, national programs designed to manage the primate populations so to ensure the conservation of existing primate species and the availability of primates for biomedical research. The Ecosystems Conservation Group (of the International Union for Conservation of Nature) and the World Health Organization submitted a joint recommendation that only primates known to be "common" should be used for

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Address reprint requests to Randall C. Kyes, Department of Comparative Medicine, Comparative Medicine Clinical Research Center, Bowman Gray School of Medicine, Medical Center Blvd., Winston-Salem, NC 27157-1040.

biomedical research and that "wild caught primates be used primarily for the establishment of self-sustaining breeding colonies, the eventual goal of which should be to captive breed most or all of the primates used in research" [p. 1, as cited in MacKinnon, 1983]. The Tinjil Island NHBF represents one of the first sizeable attempts to establish, in a country with indigenous primates, a primate resource and conservation program in accordance with this recommendation.

Between February 1988 and June 1990, a total of 475 adult long-tailed macaques (captured at locations in West Java and South Sumatra) were released on Pulau Tinjil, an island previously uninhabited by nonhuman primates. Before their release on the island, each monkey underwent a quarantine and screening process to exclude any animals with tuberculosis, Retrovirus type D, or parasitic infection. Each monkey also received a chest tattoo to aid in identification once on the island.

This report describes the results of a survey of Tinjil Island's primate population conducted between July and September 1990. The objectives included estimating the distribution of monkeys on the island and the number of groups formed, estimating group size, composition, and reproductivity and evaluating feeder utilization.

METHODS

Study Site

Tinjil Island is located approximately 16 km off the south coast of West Java at approximately 7° 0′ S, 105° 45′ E (Fig. 1). The island is approximately 600 ha. in size (1 km wide and 6 km in length) and consists primarily of lowland, secondary tropical rain forest and coastal vegetation [for a thorough description of the vegetation see Hernowo et al., 1989]. Beginning in February 1988, the first of nine batches of monkeys was released on Tinjil Island. At the time of the survey, a total of 475 adults (58 males and 417 females) had been released on the island. The only permanent human inhabitants on Tinjil were two couples who served as caretakers for the facility.

Prior to the survey, seven transects had been cleared on the island—six running north and south (N-S) and one running east and west (E-W). Distance markers were posted at 25 m intervals along the transects to aid in identifying one's location.

To facilitate supplemental food provisioning and the eventual capture of monkeys, four feeder/catch cages were constructed at the eastern third of the island (Fig. 1). The primary food supplements included sweet potatoes, kernel corn, and bananas. Fresh water was also provided [for a complete discussion of provisioning see Kyes, 1990].

Data Collection

The survey was conducted over a 2-month period from 23 July through 19 September 1990 and involved 240 h of observation by the author. The first half of the study period involved reconnaissance and general observation while the second half consisted of a daily schedule of transect sampling and feeder observation. All sampling began at 0600 (sunrise) and consisted of 3 days of sampling along the three N-S transects at the eastern third of the island (several samples per day) followed by 3 days of sampling along the E-W transect (two samples per day). This survey schedule was repeated three times. During sampling, the rate of movement along a transect was approximately 1.5 km/h with frequent stops.

Following standard procedures detailed in *Techniques for the Study of Primate Population Ecology* [1981], the following information was recorded for each mon-

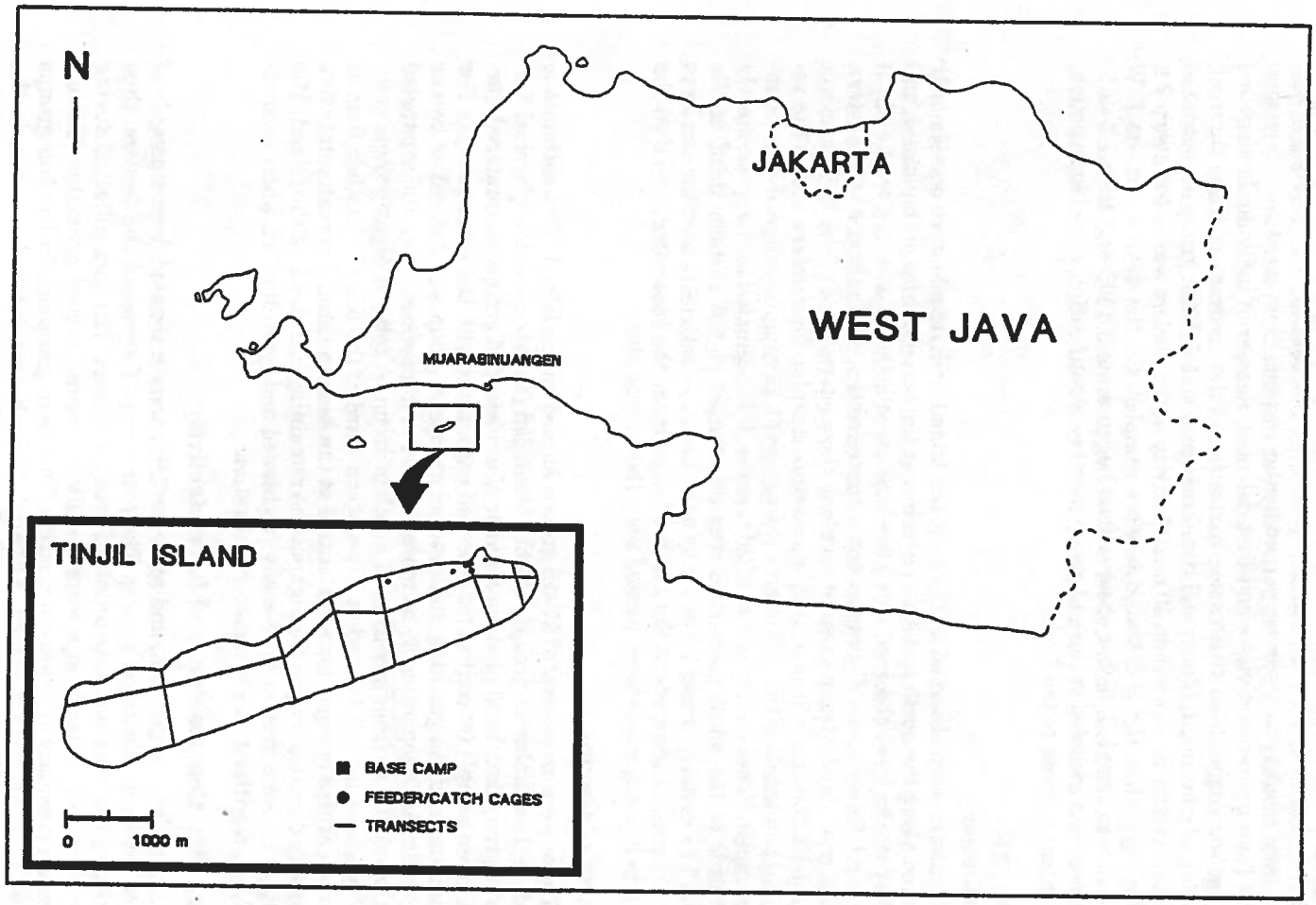

Fig. 1. Location of Tinjil Island.

key group encountered: time of contact; the group's location (based on transect markers); detection cue (i.e., auditory [vocal, tree movement, etc.] or visual); distance from monkey to observer; perpendicular distance from monkey to transect; height from ground; activity when first detected; number of individuals observed and age/sex composition (with some indication of the accuracy of these figures); direction of movement, if any; and time encounter ended. Each group encountered was observed for no more than 10 min. Activity at the feeders was noted every 2 h on the days when the N-S transects were sampled. On the days when the E-W transect was sampled, feeder observations began around 1500 and lasted 2–3 h. Data recorded included group and group member identification, social interaction, and order of access to the feeder.

RESULTS

Distribution

Monkeys were observed throughout the island. Individuals were occasionally observed along the north and south beaches at the eastern third of the island, and monkey tracks were observed along the beaches at both the east and west ends of the island. There was a disproportionate concentration of monkeys at the eastern third of the island. Group encounters along the eastern third of the E-W transect averaged 2.25/sample (range: 1–3 encounters/sample). Encounters along the remaining two-thirds of the E-W transect averaged 1.25/sample (range: 0–3 encounters/sample). Based on the results of this survey, it is estimated that approximately two-thirds of the adult population was distributed at the eastern third of the island. The easterly concentration may have been due to the fact that the monkeys were released at the eastern third of the island (near the base camp) and that the four provisioning cages were located near the release site.

Number of Groups

There were an estimated 17–18 groups formed on the island. This estimate is based on the number of groups reliably identified (by tattoos and/or physical features of group members) plus the number of unidentified groups encountered during a given sample (to control for repeated encounters with the same groups). For the purpose of distinguishing unidentified groups, a group was defined as two or more individuals separated by no more than 50 m from one another and separated by at least 100 m from members of another group. A total of eight groups were reliably identified, all located at the eastern third of the island. Another four or five unidentified groups also were located at the eastern third. Approximately five unidentified groups ranged throughout the remaining two-thirds of the island. The monkeys in these groups were easily frightened and typically fled when encountered, often without any warning vocalization.

Group Size, Composition, and Reproductivity

Group size, composition, and reproductivity were estimated from a sample of four of the eight identified groups. The four groups frequented the feeders, thus permitting the most complete counts of group members. The data collected during encounters with other groups were insufficient to make good estimates. Table I presents a summary of group composition. The mean group size for the four groups was 46.7 (±12.6 S.D.) members. Although there is considerable variation in the literature regarding group size in *M. fascicularis*, the data presented here are consistent with estimates provided by Angst [1975] and group size limits noted by van Noordwijk and van Schaik [1988].

The four groups sampled were organized in the characteristic multi-(adult)

TABLE I. Composition of Groups Visiting the Feeder/Catch Cages*

Group	Adults		Offspring		Total
	Males	Females	Infants	1–2 year-olds	
M26	10	27 (22) [5]	6	12	55
M44	8	28 (25) [1]	22	0	58
G-Hand	6	11 (10) [1]	4	9	30
P-Eyes	5	17 (16) [0]	5	17	44
$\bar{X}$	7.2	20.7	9.2	9.0	46.7

*Estimates of group size and composition are based on both the overall number of individuals identified by tattoo and group member counts during feeder observations. The numbers in parentheses represent adult females of reproductive consideration (i.e., females released on Tinjil Island at least 6 months prior to the end of the study period). The numbers in brackets represent adult females estimated to be in their last month of pregnancy.

male composition [Crockett & Wilson, 1980]. The other four identified groups appeared to be somewhat smaller with only one adult male observed in each. No solitary monkeys or same-sex groups were observed on the island.

An average of 56% of the females of reproductive consideration (i.e., those released on Tinjil at least six months prior to the end of the study period) had an infant (estimated by existing natal coat and relative size) or were pregnant (estimated to be in their last month of pregnancy, as determined by the size of the abdomen) by the end of the study period. As an estimate of birth rate, this percentage is considered to account for approximately a 10-month period (based on identification of infants ranging up to about 7 months of age at the beginning of the study, infants born during the 2-month study period, and females estimated to be in their last month of pregnancy at the end of the study period) and therefore represents a conservative estimate of the yearly birth rate. No estimate of mortality could be made, although no sick or dead monkeys were observed. If this percentage is applied (per a yearly basis) to the adult female population released on Tinjil since February 1988, the cumulative total offspring on the island (around the end of the study period) was approximately 300–325 monkeys (see Table II).

The limited duration of the study period prevented the acquisition of accurate data on the seasonality of breeding. The various stages of natal coats and pregnant females observed, however, suggest an extended birth season of at least 10 months (as estimated above). The apparent absence of seasonal reproduction is consistent with findings from other studies of *M. fascicularis* [Lindburg, 1987; van Schaik & van Noordwijk, 1985].

Feeder Utilization

Although the island offers numerous natural food sources (e.g., fruit, small lizards, crabs, and insects), supplemental provisioning was provided. The primary objective of the provisioning was to habituate the monkeys to the feeder/catch cages to facilitate the eventual capture of offspring. Only six groups were observed to use the feeders. Of the six, three groups (M26, M44, and G-hand) dominated the four feeders. The two easternmost feeders were used by group M26, the third feeder by M44, and the fourth by G-hand. These groups ranged close to their respective feeders and could often be seen at the feeders throughout the day.

Intergroup interaction at the feeders was minimal. No groups were ever observed to challenge the M26 group and on only one occasion was an interaction between the M26 and M44 group observed. Males from the M26 group blocked the

TABLE II. Estimated Number of Offspring Born on Tinjil Island*

Period ending	Number of females of reproductive consideration	Estimated number of offspring born	Cumulative total offspring
Sept. 1988	50 × 56%	28	28
Sept. 1989	185 × 56%	104	132
Sept. 1990	328 × 56%	184	316

*The percentage (56%) used to estimate the number of offspring born is a conservative estimate of the yearly birth rate (accounting for approximately a 10-month period) on Tinjil Island.

M44 group from approaching the third feeder which resulted in a mild agonistic interaction involving some chasing.

DISCUSSION

The results of this survey provide encouraging information concerning the status of the primate population on Tinjil Island. The monkeys appeared to be in excellent health as judged by their physical appearance, behavioral activity, and reproductivity.

It is important to note that the estimates of group size, composition, and reproductivity generated from the sample of identified groups visiting the feeders may be somewhat biased. There is considerable evidence that primate groups receiving supplementary feeding may have higher birth rates than unprovisioned groups [Loy, 1988]. Furthermore, the provisioning may also support an increase in group size. Estimates derived from the sample groups, therefore, may not be representative of the remaining population. Eight additional provisioning sites have been constructed throughout the island since the survey to encourage a more even distribution of monkeys on the island and permit the remaining population to benefit from supplementary feeding.

Since the survey, a total of 145 offspring (74 males, 71 females, approximately 1.5–2 years of age) have been removed from the island for use in biomedical research. This event represents an important step toward achieving the facility's original goal as a primate resource and conservation program.

CONCLUSIONS

1. Basic demographic data collected during the survey are consistent with those from other field studies of long-tailed macaques.
2. Preliminary estimates of the numbers of offspring born suggest successful breeding on the island.
3. The Tinjil Island NHBF represents a viable attempt to establish, in the country of origin, an effective primate resource and conservation program that should serve as a useful model for future programs.

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