PRIMATES, Vol. 7, No. 2, 1966

A Sociological Study of Solitary Male Monkeys

TOSHISADA NISHIDA

Laboratory of Physical Anthropology
Kyoto University, Kyoto

INTRODUCTION

For a long time hunters have spoken of seeing large male monkeys living alone, away from monkey troops. In the essays written by KUNIO YANAGIDA (1939) we can find such descriptions. With the end of World War II an ecological study of Japanese monkeys was commenced by the Primates Research Group. The social organization of these animal troops was disclosed for the first time at Takasakiyama (ITANI 1954). Two solitary monkeys were found then and the fact drew the attention of the investigators. Since then they have had many occasions to study the way of life of Japanese monkeys in various fields, and each time in every field adult male monkeys were found living lone lives.

In nearly every case the socionomic sex ratio (CARPENTER 1942) of the Japanese monkey troop was found to be less than 100 (TOKUDA 1961), which suggested the presence of adult male monkeys living outside these troops. It has long remained a troublesome problem that the aggregate total number of the solitary male monkeys so discovered plus the number of the adult male monkeys living in the troop should always be in sum smaller than the number of the adult female monkeys of the troop.

According to statistics, the birth rate of Japanese male monkeys is reported to be somewhat higher than that of female monkeys (KAWAI 1964), but the number of male monkeys that die from disease or wounds as they grow up is said to exceed that of the females. We must take into consideration the duality of the social organization of this species—the central part and the peripheral part—and, therefore, the possibility of more peripheral male monkeys dying at the hands of poachers. But even so the numerical gap between male and female monkeys remained too large to be comprehended.

Thus it was reasoned that there should be many solitary males that left the troops they were born in and now live lone lives far away from the nomadic ranges of their troops (ITANI et al. 1964). Actually there were several cases (refer to

Chapter IV) found of such solitary individuals living in places unimaginably far off the nomadic ranges.

The number of solitary males that have been found in each field so far was extremely small, which led to the assumption that the solitary males were abnormal beings. The use of such a technical term as "estranged individual" (MIZUHARA 1957) represents this kind of reasoning.

The present specia (IMANISHI 1949, 1957, & 1960a) of the Japanese monkeys torn asunder by the onrushing current of human civilization has generally been split into small troops and consequently maintain their lives amidst isolated unnatural surroundings. Nearly all of the monkey troops on which intensive surveys were conducted were such isolated troops.

Imagining that there would be difficulties in trying to gain a true picture in such surroundings of the normal way of life the solitary monkeys lead, I selected for such research the Takagoyama area of Chiba Prefecture (KAWAMURA, ITANI & TOKUDA 1955; KAWAMURA & TOKUDA 1955) where there were at least seven wild monkey troops living in close proximity. There I carried out investigations on the monkeys in general, putting special emphasis on the study of the solitary males. The survey took place at the feeding grounds of the I and the III monkey troops of the Takagoyama area (refer to Figs. 1, 2). The monkeys were individually discriminated and almost complete records were taken of the solitary male monkeys.

I came across several solitary male monkeys on various occasions at spots other than the regular feeding grounds and also in the nomadic range of the II troop, but I left them out of this report on purpose since distance prevented me from discriminating them accurately. Investigations on the I troop of the Takagoyama area were carried out for two days in March, 1964, 28 days in July and August, and during the breeding season nine days in November, and four days in January, 1965; on the III troop five days in March, 1964, 14 days in August, and during the breeding season seven days in November, and three days in January, 1965; 43 and 30 days respectively in total.

I also conducted a general survey of Motokiyosumiyama area and ascertained the distribution of the monkeys in this region. This took six days in April and May, 1965. The Motokiyosumiyama area was the only habitat of wild monkeys on the Boso Peninsula except for the Takagoyama area.

The investigation revealed that the solitary lives led by the Japanese monkeys are essentially the same as the normal lives of the male monkeys living in a troop, that the Japanese monkey troop is not a closed society (KAWAI 1964) and that outbreeding is a normal performance.

For a contrast an isolated monkey troop at Hagachi, Shizuoka Prefecture was selected and investigated for 24 days in all; three days in May, 1964, 15 days in September and six days in December during the breeding season.

I intend to make in Part I of this paper a detailed description of my observation

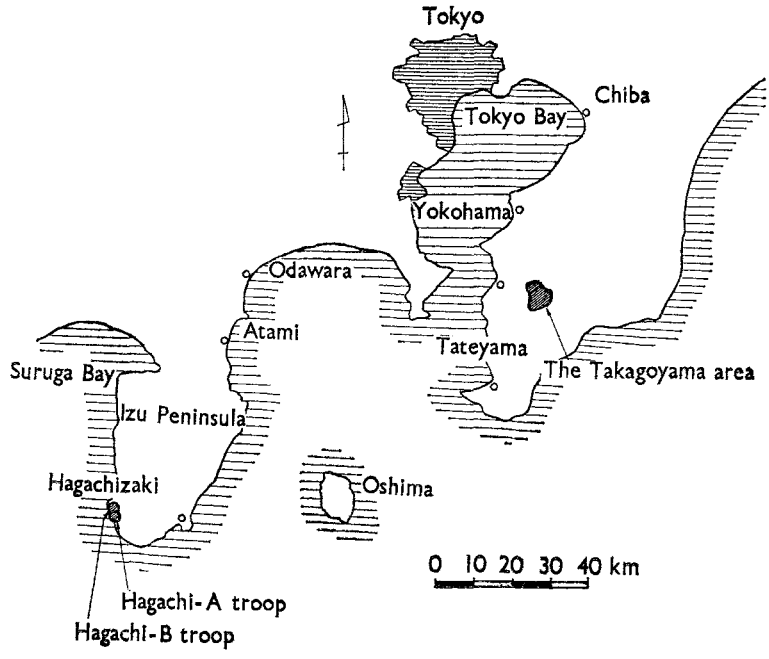

Fig. 1. Locations of the investigation field.

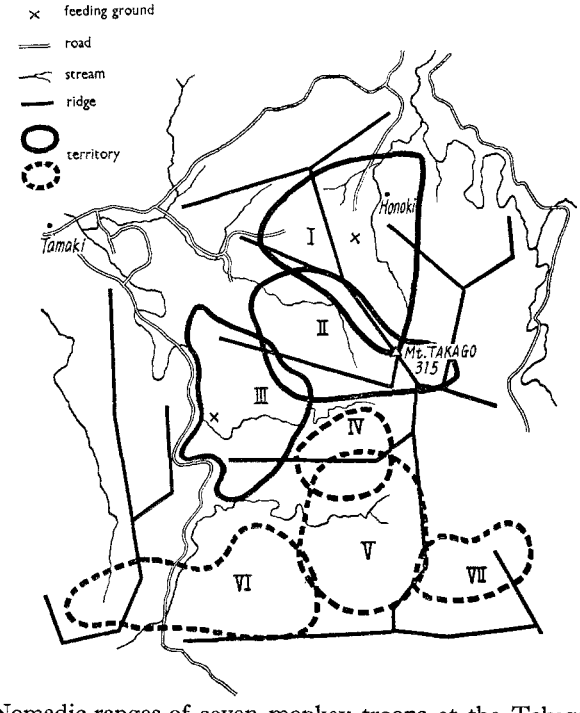

Fig. 2. Nomadic ranges of seven monkey troops at the Takagoyama area. (The ranges of the IV, V, VI, and VII troops are quoted from KAWAMURA and TOKUDA, 1957.)

done in the Takagoyama area, especially at the feeding ground of the I troop. In Part II, I will take up the questions dealing with the way of existence of the Japanese male monkeys as based on my observation.

This paper is the result of the valuable help I received from Professor Kinji Imanishi and from many members of the Laboratory of Physical Anthropology, Kyoto University and the Primates Research Group. Dr. Junichiro Itani offered guidance from the very onset of this investigation to the completion of this paper. Mr. Yoshio Furuya supplied me with detailed information on the question of solitarization obtained in the monkey troop in Gagyusan. Dr. Yukimaru Sugiyama permitted me to read his valuable unpublished manuscripts. Mr. Kazuo Kano provided me with many of his precious unpublished data on the solitarization of monkeys in Takasakiyama. (The discussions I had with him were very useful.) Mrs. Satsue Mito of the Koshima islet sent me detailed data in the matter of solitarization.

In carrying out my investigation Mr. Kazue Hanzawa (Takasakiyama National Park), Mr. Hachiroemon Miura (Takagoyama Natural Zoological Garden), Mr. Iwao Miura (ditto) and Mr. Yohei Hida (Hagachi Wild Monkey Park) offered much valuable assistance.

I am profoundly grateful to these people for the guidance, help, and friendship they extended to me.

Part I. Natural Troops of the Japanese Monkeys in Takagoyama

I. WILD MONKEY TROOPS IN THE TAKAGOYAMA AREA

I will describe in this chapter the condition of life of the monkeys of Takagoyama (Mt. Takago) area, the state of the monkey troops there and deal lightly with the question of the social organization of the troops that were investigated.

There were found in 1955 (KAWAMURA, ITANI, & TOKUDA 1955) about seven wild monkey troops that lived in close proximity in the Takagoyama area (Kimitsu County, Chiba Prefecture). The Takagoyama-I troop was provisionized in January, 1960 and the Takagoyama-III troop in 1955. Supervision of the former was undertaken by the inhabitants of Seiwa village and the latter by those of Amaha town. In 1963 provisionizing succeeded once with the II troop, but the troop went back to its former state when the provisionizing came to a stop after one month (MIURA, personal communication). The remaining four troops are still left wild. A presumptive map of the nomadic areas of these seven troops may be found in the aforementioned paper. The present nomadic ranges of the I, II, and III troops, after the provisionization, are set down clearly in detail. Figure 2 shows the nomadic ranges of the I, II, and III monkey troops, correcting the aforesaid map, but the

nomadic ranges of the IV to the VII troop remain unaltered. The Takagoyama area is not a geographically isolated piece of land. It is a mere section of the low lying mountain range that extends from the central to the southern part of the Boso Peninsula. Here only, excepting the neighborhood of Motokiyosumiyama, live the Japanese monkeys. The Takagoyama area is a stretch of land where extensive forestation and timber felling are done, and it is made up of successive strata of all kinds (NUMATA et al. 1955) which supply the monkeys with a rich variety of food despite the low altitude of the land, 100-300 meters above sea level. Another cause which it is believed contributes to the existence of the Japanese monkeys of this region is the steep lay of the land.

The total number of monkeys occupying the Takagoyama area is estimated at around 700. As will be described later, the I troop consists of 158 individuals, the III troop 72, and the II troop, according to the estimate of IWAO MIURA, 200 individuals. The population of the remaining four troops was in average 20 to 40 respectively, according to an estimate made in 1955 and will probably have reached 60 in average by now, taking into account estimated growth over the past ten years. There is in addition an estimated number of 60 solitary males, thus making about 700 individuals altogether. I consider this figure a just approximation.

1) The Social Construction of the Takagoyama-I Troop

A population census of the I troop was carried out during July-August, 1964.[1] All the individuals over 6 years old were individually identified while those below this age were checked by the marking method. To estimate the age of each monkey the method ITANI et al. (1964) adopted was employed. To estimate the age of female monkeys we checked their grooming relationships, by which their children were identified, then added three to five years to the age of the eldest child. Figure 3 was made in this way.

The I troop consisted of 158 individuals, of which 73 were males and 85 females. There were five full adult males (over 8 years old), of which three, as leaders, placed themselves in the central part of the troop, while two, a little younger than the leaders and second in ranking, lived mainly in the peripheral part and only occasionally entered the central part. In age they corresponded to the upper-class peripheral males of the Takasakiyama troop (ITANI 1957), but I will classify them here as sub-leaders since they are distinguishable from 3～8-year-old males, and the leaders of this troop are still young. These males, among other male monkeys, form the peripheral part of the troop, while the males of 2 years old and under live in the central part.

Of these 3～8-year-old males only *Japheth* (6 years old) was tolerated and

1) Social construction of monkey troops described in this chapter are based on their state as it was observed during the non-breeding season, that is, during July-August at Takagoyama and September at Hagachi.

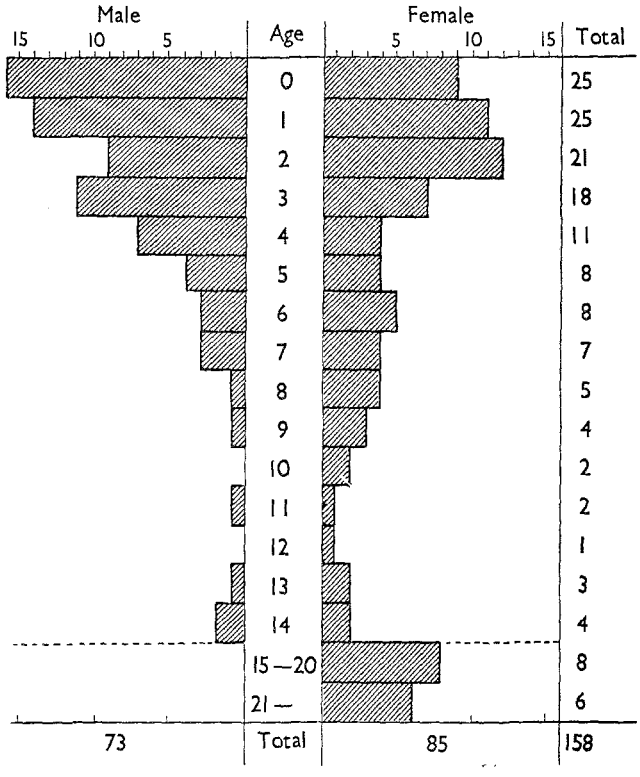

Fig. 3. The age-composition of the Takagoyama-I troop.

given free access to the central part of the troop and was assumed from his grooming relationship to be the son of the first ranking female *Hela*.

The central and the peripheral part of the troop are very distinct. When a troop returns from a nomadic moving, it is always the peripheral part that arrives first at the feeding ground. I have seen many times the peripheral part of the troop arrives about 30 minutes in advance of the central part.

A remarkable fact to be noted in the age composition of the male monkeys is the absence of certain age groups (Table 1). There is a complete absence of individuals over 15 years old, the adults II and seniles (KAWAI 1964). This contrasts strikingly with the females where nothing of the kind may be observed. There is also a lack of some age group in the male monkeys of the Takasakiyama troops. This is said to have been due not only to solitarization of the males but also to troop fissions which occurred twice (ITANI et al. 1964).

There occurred no fission[2] in the Takagoyma-I troop by the end of August. The majority of the missing generation may now be living as solitary males. Among

2) There was a troop fission in October, 1964 (to be referred to later).

Table 1. The male class organization of the Takagoyama-I troop (as of Aug. 1964).

Class	Rank order	Individual name	Age
Leader	1	*Solomon*	14
	2	*David*	14
	3	*Herod*	13
Subleader	1	*Sem*	11
	2	*Ham**	9
Peripheral male	1	*Samson*	8
	2	*Glaucos**	7
	3	*Japheth*	6
	4	*Peragon*	5
	5	*Peter*	5
	6	*Kon*	5
Solitarized peripheral male	1	*Nehleus*	7
	2	*Goldwater*	6
	3	*Oedipus*	7
	4	*Heimon*	6

* got lost in October 1964.

the peripheral males there were four individuals whose social status were rather low in consideration of their age and who placed themselves in outer part of the periphery. (They will be referred to hereafter as marginal young males.)

These marginal young males left the troop sometimes and moved about separately (*Nehleus* for two days, *Heimon* for five days, *Goldwater* for three days, and *Oedipus* for two days moved singly or forming a small group). At times they suffered cooperative attacks by 3~5-year-old lower peripheral males. The social rank of these marginal young males was not necessarily below the younger males,[3] but I have put them in another category from other monkeys that share an equal social status. Members of this category ought to belong to the class of the peripheral male in the original meaning of the term "class" that implies an aggregation of the individuals that share the same form of life, but in respect to the social relations they had with the troop they are distinguishable from the common peripheral males and I decided to classify them in a separate group.

According to my records three monkeys *Heimon*, *Goldwater*, and *Oedipus* were often found behaving in unison, though temporarily, with the solitary males; *Heimon* three times, *Goldwater* once, and *Oedipus* also once. I have the impression that these three individuals were progressing toward solitarization.

There was hardly any social differentiation to be seen among the females, and they all placed themselves in the central part of the troop. There were about ten adult female monkeys, however, that had a very low social status, although the positions they maintained in the troop bore no trace of it. They had a strong

3) For instance, *Nehleus* was higher in rank than *Peter* but lower than *Japheth* and *Peragon*.

inclination at the feeding ground to bear away from the central part of the troop in the direction of the periphery.

According to the investigation carried out in November, 1964 there were found missing about 30 monkeys including these ten low ranking females plus *Pinc* (the second ranking female), and *Ham* and *Glaucos* (the adult males). A troop fission must have taken place. It might have been in October (KAZUE HANZAWA, personal communication) but there was no apparent sign of it at the time of the investigation made in August. Photo 1 shows the monkeys of the central part of the I troop.

2) The Social Structure of the Takagoyama-III Troop

The nomadic ranges of the III and the I troop overlap that of the II troop (refer to Fig. 2). The border line of the III troop is 1.2 km away from the nearest border line of the I troop.

In August, 1964 the III troop was composed of 72 individuals in this troop, of which 33 were males and 39 females (Fig. 4).

There were eight adult males (over 8 years old); one was a leader, one a sub-leader and the rest peripheral males (Table 2). The peripheral part of this troop consisted of male monkeys ranging from 3 to 13 years old. This was quite a large age range considering the small size of the troop, so that the peripheral part could be divided into two sections, higher ranking males from 9 to 13 years old and lower ranking ones from 3 to 8 years old. The individual classified into the sub-leader class was considered to have the qualification for this class because he could enter the central part of the troop at times and he may be also regarded as the

Table 2. The male class organization of the Takagoyama-III troop (as of Aug. 1964).

Class	Rank order	Individual name	Age
Leader		*Komasa*	18
Sub-leader		*Nonkibo*	14
Peripheral male			
Upper subclass	1	*Gaston*	13
	2	*Kentauroi*	11
	3	*Prudon*	10
	4	*Simon*	9
	5	*Nelson*	9
Lower subclass	6	*Cydon*	7
	7	*Promp*	7
	8	*Marx*	6
	9	*Soba**	≧21
	10	*Meson*	5

* He had a special status.

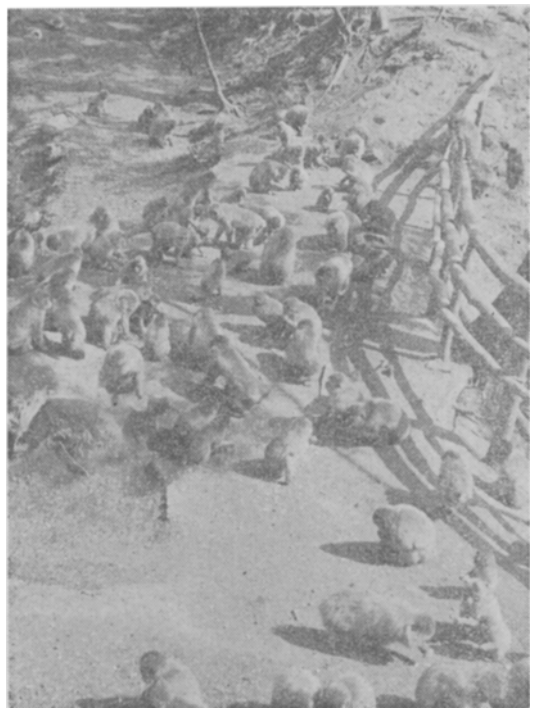

Photo 1.
The feeding ground of the Takagoyama-I troop. Monkeys of the central part gathering at the feeding ground. About 80 monkeys seen in this picture, but actually there gathered 120 monkeys. No peripheral male is found. A monkey sitting in the center with his back turned on us is the leader No. 1 *Solomon*.

head of the higher ranking juvenile males. The I troop with its peripheral part made up only of males under 8 was a very cohesive troop in good contrast to the III troop with its peripheral part composed of males of varied ages. KAWAMURA who previously investigated this troop reported that the peripheral part was made up of two groups with no regard to age (KAWAMURA 1959), but when I made my investigation nothing like this was seen. However, there was one exceptional monkey. He was a male monkey named *Soba* over 20 years old, the oldest member of this troop. He placed himself in the outer section of the peripheral part, and his rank was very low for his age (refer to Table 2). The leader of this troop was an 18-year-old male, younger than *Soba*. Judging from his very low status and peculiar behavior, I assumed that he was not a declining leader as MIZUHARA (1957) stated but rather a new-comer in the III troop, that is, a member from another monkey troop who had made his entrance into this troop only in very recent years. According to the population census (unpublished) of this troop taken by KAWAMURA in 1962, the oldest monkey has been reported to have been *Komasa*. Therefore, it is most probable that it was after the census that *Soba* joined up. This well illustrates what sort of status the solitary males get once they rejoin a monkey troop.[4]

4) KANO had many occasions at Takasakiyama to see male monkeys leave the A troop and join the B or the C troop. In all cases, these males ordinarily settled for a social status that was far below what they formerly had in the A troop.

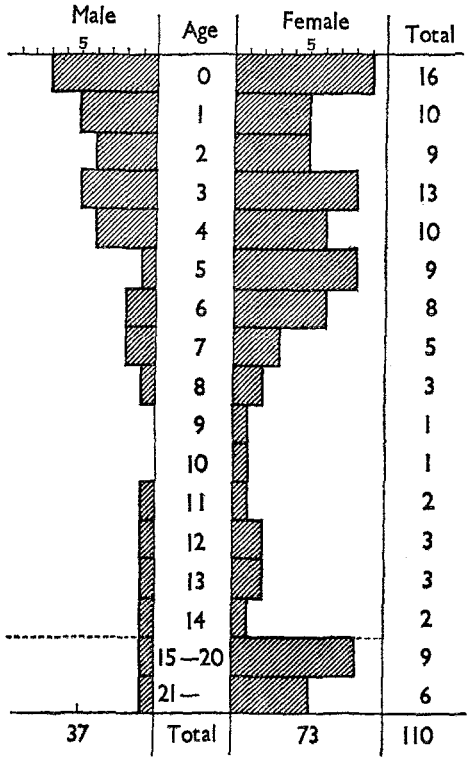

Fig. 4. The age-composition of the Takagoyama-III troop.

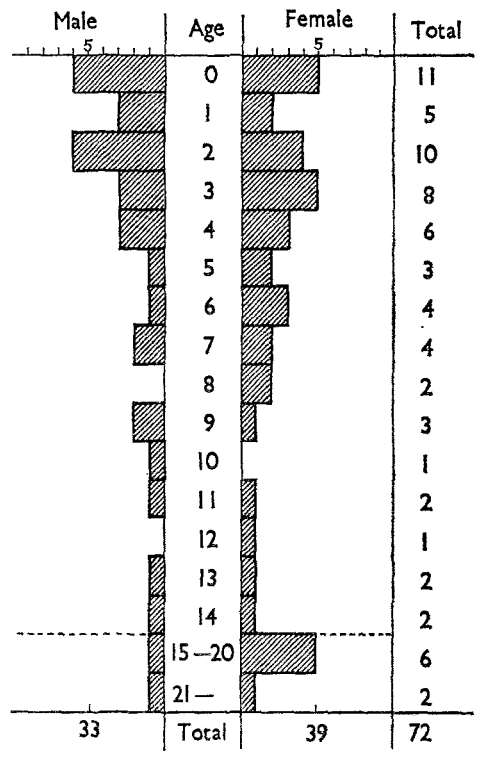

Fig. 5. The age-composition of the Hagachi-A troop.

Soba usually acted in common with the peripheral males. His social status was low but it was a stable one.

Here also the female monkeys grouped together in the central part of the troop. Similar to the I troop there was no social difference to be observed among these females, but there were found some individuals with extremely low social ranks. The first ranking female *Andromaquet* enjoyed a high status as compared with that of the other females. She often displayed controlling behavior toward the peripheral males that came attacking the female and baby monkeys.

The socionomic sex ratio[5] of this troop was $(12/23) \times 100 = 52.2$ during the non-breeding season, and was much higher than that of the I troop, $(16/46) \times 100 = 34.8$.

This may show that the I troop discharged more male monkeys out of the troop as solitaries.

3) The Social Structure of the Hagachi-A Troop

Hagachi lies in the south west part of the Izu Peninsula, Shizuoka Prefecture

5) The socionomic sex ratio is calculated: ♂ age over 4.5 years/ ♀ age over 3.5 years × 100.

(refer to Fig. 1). The vegetation of this region consists of broad-leaved evergreen forest. The monkey troop of this area was provisionized in March, 1955. The mountain range where the monkey troop roams stretches to the north as far as Mt. Amagi. Topographically, it is not an isolated piece of land, but only one monkey troop was to be found there. When it was provisionized the troop consisted of more than 70 individuals, which grew to more than 100 in 1959. It underwent a troop fission in 1961. The resulting branch troop (which will be called the Hagachi-B troop hereafter) occupies a nomadic range which does not overlap that of the main troop (A troop) (HIDA 1964). The B troop appeared at the feeding ground of the A troop sometimes but only a few times a year (HIDA, personal communication). It led more or less a pure wild life. A population census was carried out on the A troop in September, 1964 (Fig. 5).

The A troop embraces 110 individuals, or 37 males and 73 females. The sex ratio[6] 50.7 is remarkably low in comparison with those of the three Takasakiyama troops 99.4 (ITANI et al. 1964), the Takagoyama-I troop 85.9 and the Takagoyama-III troop 84.6.

There are 6 adult males and two leader class individuals. *Miyakodori*, the second leader was identified in his younger days and had been known to be the head of the peripheral males (HIDA 1964). The third ranking male was once the head of the peripheral males a year ago (HIDA, personal communication), but he now resides in the central part of the troop. He ranks as a sub-leader as his behavior identifies and distinguishes him from the other monkeys of the leader class. The peripheral part is comprised of 18 males ranging from 13 down to 3-year-old individuals with social status corresponding more or less to their respective ages. *Shippo* (11 years old), *Teziro* (7 yeards old), and *Kostero* (7 years old) had ranks somewhat lower than that which their respective age would qualify them for. These three had inclinations toward solitarization: In March, 1964 *Shippo* left his troop for about a week and moved by himself, and when he returned he found his rank lowered from the third to the fourth ranking peripheral male (HIDA, personal communication). During the investigation I saw *Kostero* several times staying on all alone at the feeding ground for over an hour after his troop left. But during the survey in December he failed to appear and is believed to have solitarized with the coming of the breeding season. Compared with *Kostero*, *Teziro* kept himself in more contact with the peripheral males, but he too once appeared alone at the feeding ground.

There was a very interesting case that concerned the peripheral part of the Hagachi-A troop. During the delivery season peripheral males often detached themselves completely from the central part and the higher ranking peripheral male group, and went out on separate nomadic trips. While I carried out a 3-day

6) Total males/Total females $\times 100$.

Table 3. The male class organization of the Hagachi-A troop (as of Sept. 1964).

Class	Rank order	Individual name	Age
Leader	1	*Ishimatsu*	20
	2	*Miyakodori*	17
Sub-leader		*Iincho*	14
Peripheral male			
Upper subclass	1	*Sanko*	13
	2	*Choromatsu*	12
	4	*Shippo*	11
Lower subclass	3	*Kocho*	8
	5	*Franco*	6
	6	*DeGaul*	6
	7	*Teziro*	7
	8	*Kostero*	7
	9	*Avott*	5

investigation in May, 1964 nine peripheral males (*Kocho*, *Teziro*, two 4-year-old and five 3-year-old males) grouping around *Kocho*, the third ranking peripheral male, made daily appearances at the feeding ground, but none appeared from the central part or the higher ranking peripheral part. According to HIDA this seems to be quite a common phenomenon in this season. The survey carried out in September, 1964 did not reveal any such division in the peripheral part. These facts as well as the fact that during the breeding season the peripheral males 11 years old and over completely enter the central part of the troop while those 8 years old and less do not, justify the appropriateness of dividing the peripheral part into two groups, the group made up of males under 8 years old and another 11 years old and over (refer to Table 3).

The nature of this grouping of peripheral males under 8 years old in the delivery season differs from that of the marginal young males of the Takagoyama-I troop. In the Hagachi-A troop there was in the peripheral male class a dual stratum which was formed and based on the life form, while in the Takagoyama-I troop the grouping seemed to be more of a loose unit of marginal young males that inclined strongly toward solitarizing.

Here again we find lacks of certain age groups in males. This was due to the departure of some of the monkeys when the troop underwent a fission and was also due to the solitarization of others.

There were 46 females over 3 years old, all of which were situated in the central part of the troop, but some had low social status and were often seen loitering around the edge of the central part.

The socionomic sex ratio of this troop was very low $(12/46)\times 100=26.1$. This was due to the fact that among the monkeys joined the branch troop, the rate

of males to females was high,[7] a phenomenon corresponding to the unbalanced socionomic sex ratio described in page 151. Figure 5 shows the presence of more females than males in the 0～3-year-old age group. This is the exact opposite of the Takagoyama-I and III troops and reveals a removal of the children to the B troop, which was largely made up of males.

To reproduce the socionomic sex ratio of the A troop before the troop fission, we have, by utilizing the figures in the footnote 7, $(12+10)/(46+16)\times 100=35.4$, which is slightly higher than that of the Tagkagoyama-I troop and is representative of a ratio normal to the wild Japanese monkey troops.

II. THE LIFE OF SOLITARY MALES IN THE NON-BREEDING SEASON

We will study in this chapter the results of the observations made on solitary males at the feeding ground of the Takagoyama-I troop during the non-breeding season, from July to August.

The non-breeding season of the Takagoyama-I troop extends over eight months, from around the end of February to around the beginning of October. The delivery season is from April to July but records show 94.7% of the total births seen during the three months of April, May, and June (Table 4).

Solitary male monkeys maintain hardly any continuous relation with the troop during the non-breeding season. It is in this season that they are distinguished clearly from the others as "solitary males."

Table 4. Birth of infants in the Takagoyama-I troop (cited from HANZAWA, pers. comm.).

	1692	1963	1964	Total (%)
Apr.	4 individ.	7	4	15(19.7)
May	12	7	13	32(42.1)
June	7	10	8	25(32.9)
July	1	1	1	3(4.0)
Aug.	0	0	1	1(1.3)
Total	24	25	27	76(100.0)

1) Number of the Solitary Males

The investigation made at the feeding ground of the Takagoyama-I troop was from July 14 to August 9 and also on August 19, totaling 28 days. In average ten hours (from 8:00 to 18:00) were spent a day on the observation and it was for five

7) The B troop consists of six adult males, 16 adult females, four peripheral males (over 6 years old), four 2-year-olds, five 1-year-olds and seven yearlings, in total 42 individuals (HIDA, personal communication. Investigated in the autumn of 1963).

days, on July 14, August 1, 4, 5, and 19 that the troop failed to appear at the feeding ground during the investigation period.

The troop stayed on in the feeding ground 6.1 hours on average during the 22 days when they appeared there. Solitary males seldom appeared on the feeding ground when the troop occupied it, but it was only for six days in total, on July 25, 26, 28, 29, 30, and August 3, that the troop stayed on over nine hours, and they came out on the feeding ground on other days before or after the troop and gave us opportunities to observe them.

Solitary males were observed 78 times. There were 42 occasions when only one solitary male appeared, 31 when two appeared in a group, and five when a group of three. I have described previously about the marginal young males leaving their troop sometimes and moving about independently. There were two occasions when they joined one solitary male and three when they joined a group of two solitary males.

Altogether 12 solitary males were identified during the period of this investigation. This was by far the largest number of solitary males that were ever seen in any field of any troop during the length of a month.

2) The Life Space of the Solitary Males

The number of solitary males that appeared during the 28 days of investigation was nine males one to four days, and three males 12 to 19 days (Fig. 6). The latter three males (*Priamos*, *Hector*, and *Paulo*) were supposed to spend their lives in the nomadic range of the Takagoyama-I troop,[8] while the remaining nine were said to maintain a life space in a vast area that far exceeded the nomadic range of the I troop.

As a proof I will give an instance of a solitary male, *Ishi*, whose behavior was well recorded.

He was born in the III troop (MIURA, personal communication) and left the troop at about the age of ten. I happened to see him during my investigation in March, 1964. He appeared as a solitary male in the corner of the feeding ground of the III troop. He had suffered the loss of his left eye and this made him very easily distinguishable. After May, 1964 he stopped coming to the feeding ground of the III troop (MIURA, personal communication), but on August 1, during my investigation, he made a sudden appearance at the feeding ground of the I troop.

The next time *Ishi* appeared at the feeding ground was on August 22. Then he stayed away during the month of September and reappeared on the 3rd and the 9th of October (HANZAWA, personal communication). He was lost after that but in the early part of December a forest officer reported coming across at Kururi a large male monkey without the left eye and that the individual had put up quite an ag-

8) This should not be interpreted as the so-called "subjective solitaries" (KAWAI 1964). The life space of these three males was completely out of the range of the troop.

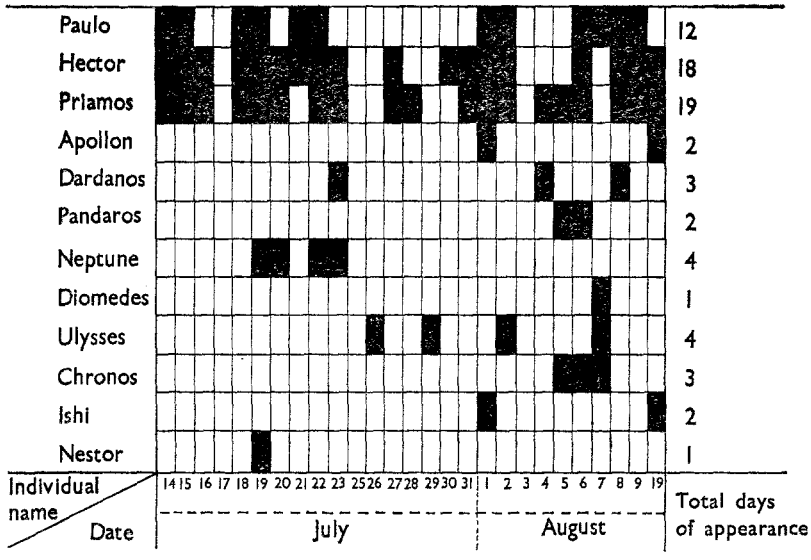

Fig. 6. The appearance of solitary males in the non-breeding season.

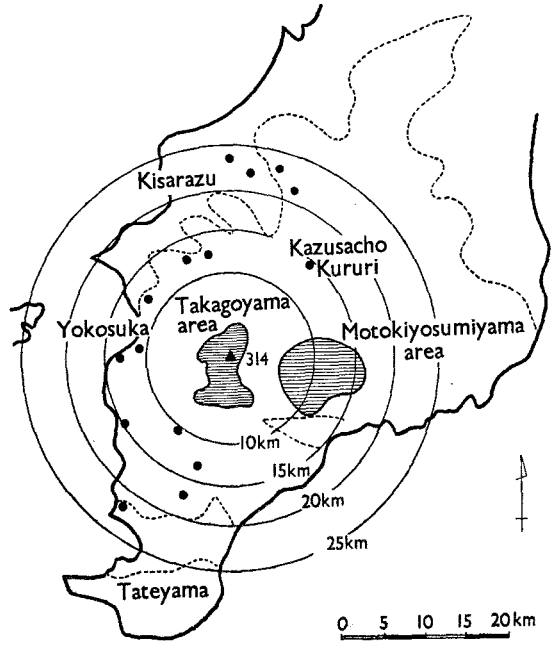

Fig. 7. The life space of solitary males.
●: places where solitary monkeys appeared.

gressive attitude toward him (MIURA, personal communication). There is hardly any doubt that this solitary male was *Ishi* (refer to Fig. 7).

Many solitary males were also found in places that were very far away from the Takagoyama area. In Figure 7 places where solitary monkeys appeared are shown according to the information collected by MIURA and other people and the data I collected, walking around in early May, 1965.

I have heard that solitary males are often seen in these places in May and June, and in Kururi where they appear frequently they are rarely seen except in the months of May and June. Since in other places too they are said to appear only very rarely during the breeding season, probably the majority of them approach the Takagoyama or the Motokiyosumiyama area during the breeding season to get into contact with the monkey troops. Loquats or peanuts cultivated in some towns about 25 km distant from the nomadic range are damaged by solitary males and the fact leads us to assume that some of them leave and travel a long distance from the Takagoyama area in search of food, however, this could not be the only reason because the months of May and June are generally the time when food is found in abundance anywhere.

The most distant spot where a solitary male was found was about 25 km away from the peak of Takagoyama (altitude 314 meters) in a straight horizontal line. This proves that at least the life space of the solitary male is an extensive one which far exceeds the nomadic range of a monkey troop.

We cannot tell what difference there is between the three solitary males that spend most of their time in the nomadic range of the I troop and the nine that utilize a wider life space. What we know is that of the three solitary males, *Priamos*, who belonged to the I troop, deserted his troop in autumn 1963 (HANZAWA, personal communication). The fact that *Hector* and *Paulo* are still young as solitary males (estimated age 10 and 7 respectively) leads us to assume that only a short time has passed since they solitarized from the I troop.

3) Groups of Solitary Males and Interrelations of Solitary Males

We have seen in section 1) that solitary males very often move about in groups of two or three. MIZUHARA (1959) saw a group of three solitary males made up of *Sam*, *Pin*, and *Nul* at Taishakukyo. This was a group of young males respectively 10, 7, and 4 years old.

At Takagoyama a group of full-grown solitary males was seen. As a group it was not strongly bound. They kept together in a group for about three days at most, however it shows that such groups can be easily formed again.

Groups made up of three solitary males were observed five times. In all cases, these groups had the same members *Priamos*, *Hector*, and *Paulo* (Photo 2). The trio seemed to be in a very intimate relation. A grooming relationship existed between *Hector*↔*Paulo*, *Hector*↔*Priamos*, and *Paulo*→*Priamos*.

They maintained a distinct ranking order, *Priamos*>*Hector*>*Paulo*. This

Photo 2. Grooming among solitary monkeys.
A trio of solitaries. *Hector* and *Paulo* are grooming *Priamos*. They are often observed to groom with one another. This grouping broke up at the breeding season.

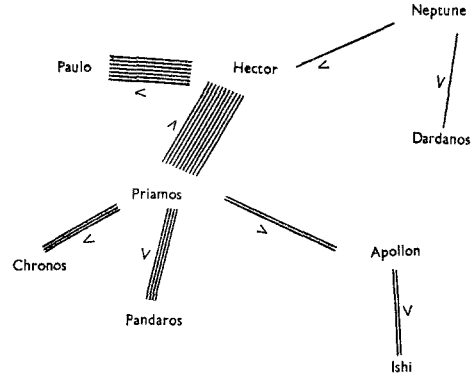

Fig. 8. The "tandem grouping" of solitary males.
The number of lines represents the frquency in the tandem grouping.
>: the dominancy.

group had such a strong bond that at times the trio would carry out joint attacks on other solitary males.

Case 1. August 1. 11:57. Violent barking sounds <ga><ga> (C-1 sound, ITANI 1963) came from the edge of the feeding ground. *Ishi* first rushed out into the feeding ground, then the trio, *Hector*, *Paulo*, and *Priamos* followed. They rushed out after *Ishi* in this order and disappeared furiously into the bushes.

According to a record on August 8 the trio repeatedly emitted the vocal sound <huii> (A-2 sound, *op. cit.*) as they ate at the feeding ground. This vocalization conveys a social meaning *(op. cit.)* and this implies a formation of a group of three, at least at the time.

As to monkey groups consisting of two solitary males we have 31 instances of

eight different group combinations (Fig. 8). *Priamos* and *Hector* or *Hector* and *Paulo* made up most of these combinations which suggest that there was some sort of an interrelation among these three before.

Other group combinations were mainly made up by *Priamos* and other solitary males. This may have been because *Priamos* had more chances of encountering other solitary males as he seldom left the neighborhood of the feeding ground, but another cause could have been the fact that he was a very dominant male. In any group combination of two there is always found a great difference in their ranks which itself seems to weigh heavily on the formation of such groups.

How the two-monkey groups made their appearances at the feeding ground is as follows.

A dominant male approaches a subordinate who gives way and displays a presenting behavior. Sometimes he even wears a "tearful face." The dominant male always carries his tail high while the subordinate male has it drooped. When the dominant male starts moving away from the feeding ground, the subordinate male follows though he may want to stay behind and feed.

There was no mutual grooming behavior observed between the males of this combination except in the combinations of *Hector-Paulo* and *Priamos-Hector*.

The forming of a two-monkey group was observed several times. Here is a representative example.

Case 2. August 1. 14:45. *Apollon* appeared on the scene of the feeding ground carrying his tail high.[9] He calmly ate the peanuts and at 15:05 disappeared in the direction of Tamaki. 15:34. *Apollon* reappeared. All of a sudden *Priamos* came out from the direction of Honoki. *Apollon* noticed and looked at him but he did not move away. *Priamos* spotted *Apollon* and ran up to a large pine tree standing in the feeding ground. He made a quick ascent to the top and emitted vocal sounds <gwa · · ·> (C-5 sounds, ITANI 1963) undertaking a violent tree-shaking behavior at the same time. On seeing this *Apollon* lowered his tail, walked slowly out of the feeding ground toward Tamaki and squatted by the path. *Priamos* climbed down, crossed the feeding ground over to *Apollon*. *Apollon* crouched low and with a "tearful face" cries <giya> (B-1 sound, *op. cit.*). He assumed a posture of presenting and kept clear of *Priamos*, who unconcernedly walked by. *Apollon* got up and with his tail down followed. They soon disappeared out of my sight. 15:44. *Priamos* and *Apollon* came out in the feeding ground, this time as a group. *Apollon* mounted *Priamos*,[10] whereupon *Priamos* put his face to *Apollon*'s buttocks and took sniffs.[11] 15:50. *Apollon* made a presenting behavior to *Priamos*, who put his hands on the haunches of the other. He refrained from mounting, however. Then *Apollon* mounted *Priamos* again.

Whenever two solitary males encountered each other, there always followed

9) The solitary male almost always carries his tail high when he is alone.

10) This is a mounting behavior in reverse order—a subordinate monkey mounting a dominant monkey.

11) This is a normal behavior performed in accordance with the ranking order. Normally, it is the dominant monkey that takes sniffs at the buttocks of the subordinate monkey.

the same pattern—the dominant male emitting the vocal sound <gwa···> (C-5 sound) accompanied by the tree-shaking behavior and the ensuing defensive behavior of the subordinate male, then the dominant male approaching the subordinate male and then the mounting behavior. If the subordinate male takes the initiative and approaches the dominant male first, it would be the subordinate male that performs the presenting behavior.

I feel that this sort of a behavioral pattern takes place between two solitary males who seldom meet though they know each other. In all cases, dominance was determined whenever two solitary males encountered each other. Whether it had been predetermined at a previous encounter or whether it was fixed the moment the two met is not known.

Analyzing the behavior of the subordinate male, we find him wishing to run away from the dominant male on one hand and wishing to approach him on the other hand. This is an ambivalent behavior (CHANCE 1961, 1963).

Looking further into their behavior at the feeding ground, we always see the subordinate male following after the dominant male whenever the latter leaves the feeding ground, but when the former makes a sudden leave, the latter makes no attempt to follow and in this case a group is not formed. Judging from this, it is the subordinate male that holds the key to a bond formation between two solitary males.

When a two-monkey group leaves the feeding ground, the dominant one leads the way with his tail up, the subordinate one following with his tail down. As they move in a tandem form like two horses hitched lengthwise to a coach, I would like to call this "tandem grouping" (Photo 3).

So far, we have observed how a group was formed. Now, even if two solitary

Photo 3. Tandem grouping.
A tandem grouping of *Hector* (Dominant) and *Kontiki*. This grouping lasted for at least two days. This is one of the two instances observed at the breeding season. (Such a grouping decreases in number at the breeding season.)

males come across each other they do not always form a group. On the contrary, the subordinate male more often runs away from the feeding ground.

In such cases the dominant male behaves in the same manner as when a group is formed, that is, he performs the tree-shaking behavior but the subordinate male acts differently. He leaves the spot without going through the ambivalent behavior. The subordinate male sometimes perfoms the tree-shaking behavior, but the performance is usually feeble.

Though we may assume that dominant relationships have been determined among the 12 solitary males (or will be determined at the very moment of their encounters), there is no knowing whether there is a linear dominance order existing among them. However, we know that *Priamos*, who encountered every solitary male at the feeding ground[12] except *Neptune*, was the most dominant of them all.

HIDA (1964) and HAZAMA (1962) report on having seen several two-solitary-monkey groups. As such groups were reportedly seen at Takasakiyama (TOYOSHIMA, personal communication) this is not a phenomenon peculiar only to the solitary males of Takagoyama.

4) The Solitarization of the Marginal Young Male Monkeys

Groups of solitary males made up in company with the marginal young males are more temporary in nature than the groups of only solitary monkeys and tend to be short lived. A dominant relationship is found between the marginal males and the solitary males, but it cannot be said generally which is the more dominant.

Heimon, for instance, was subordinate to *Neptune* but more dominant than *Nestor*. He has been observed mounting *Nestor*. *Oedipus* was more dominant than *Paulo* but subordinate to *Hector*. Generally solitary males in the prime age are said to be more dominant than the marginal young males.

Beside the age factor as well as the physical and psychological individuality of the monkey the dominant-subordinate relationship of the solitary males seems to be determined largely by whether or not the solitary male is familiar with the terrain in which it encounters another party.

At the feeding ground of the III troop *Ishi* was very aggressive toward the troop monkeys with his tail raised high, but when he appears at the feeding ground of the I troop, he first stopped outside to see how things were, then went on in timidly with his tail drooped even though there was no other monkey in sight. *Nestor* was observed only once, but he too showed the same attitude as *Ishi* did[13] and as stated before he was mounted by *Heimon*, a troop member. Therefore, in the determining of the dominant-subordinate relationship of the solitary males there

12) *Priamos* encountered *Ulysses* and *Diomedes* in the breeding season but not in the non-breeding season.

13) Of the solitary males that appeared alone at the feeding ground of the I troop in the non-breeding season only *Ishi* and *Nestor* appeared with a drooped tail.

seems to be a sort of a circumstantial force at work. This circumstantial force has its significance in being one of the important factors that determine the dominant-subordinate relationship between the solitary males and the troop males.

Though we did sometimes encounter cases where the behavior of the marginal young males could not be distinguished from that of the solitary males, they were troop members, since they spent most of their time in the peripheral part of the troop and when in company with the troop they were often seen attacking the solitary male monkeys that came near.

5) The Relationship between the Solitary Male and the Troop

Solitary male monkeys act absolutely independently of the troop during the non-breeding season. It may be better said that they purposely stay away from the troop and lead solitary lives. This may be inferred by the fact that it is after the troop leaves the feeding ground and goes far away that the solitary males are most frequently seen there.

However, 12 cases were observed where the solitary males came out into the feeding ground when the troop was still there. This was only because foods had lured them there. Solitary males come to the feeding ground in search of food just as troop monkeys do, but as long as the troop stays there they cannot enter. Only when the troop monkeys are at rest, at which time there are only a few monkeys in the feeding ground, or only when the troop has begun to move, at which time there are only a few peripheral males remaining—only at such times do a few solitary males encroach into the feeding ground and feed nervously.

There were 12 instances, of which eight consisted of a troop monkey attacking and chasing the solitary males away (refer to Table 5 and Photo 4). Of these eight, four consisted of a plural number of the troop members making joint attacks on the solitary males. Of these instances, the leading roles of attacks and pursuits were

Table 5. Antagonistic interactions between solitary males and troop members.

Date	Troop individ. who attacked a solitary male	Troop individ. who made a co-operative attack	Solitary attaked	Min. of contact
Jul. 19	*Nehleus*	*Samson* and a few others	*Priamos*	1
Jul. 22	*Goldwater*		*Hector*	3
Jul. 29	*Japheth*		*Ulysses*	5
Jul. 30	*Hela* (♀No. 1)		*Hector*	16
Aug. 6	*Samson*		*Paulo*	0
Aug. 7	*Goldwater*	*Samson*	*Chronos*	1
Aug. 7	*Kohmori* (♀No. 6)	many monkeys	*Ulysses*	15
Aug. 7	*Japheth*	*Kosa* (low-ranking female)	*Diomedes*	23

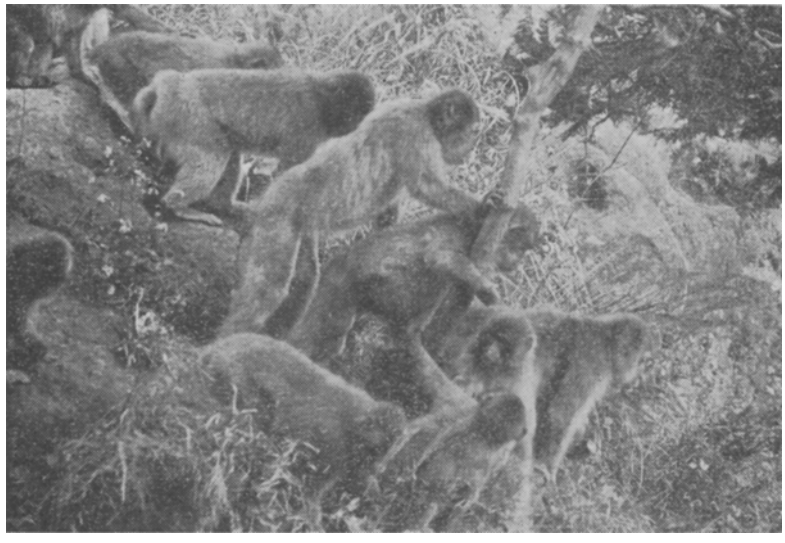

Photo 4. Higher-ranking females and infants of the central part attacking jointly a solitary monkey.
The adult female in the right below=*Panma* (7th ranking). The adult female barking in the center=*Kohmori* (4th ranking). (This picture was taken in the early breeding season, but such a state of attacking is the same with that observed in the non-breeding season.)

played in three instances by the marginal young males, three by the peripheral males, and two by the higher ranking females of the central part of the troop. As cooperators there was one instance in which a low ranking female of the central part of the troop, took part, two instances in which a peripheral male took part and, another where the participants numbered ten consisting of females, infants, and peripheral males.

There were four instances where the solitary males were not chased away, but even in such cases the solitary males went away voluntarily after remaining at the feeding ground only a few minutes or at most some scores of minutes.

In the cases where the solitary males were not chased away *Priamos* was involved twice (he stayed with the troop for about 14 minutes at one time and two minutes at the other time) and *Ulysses* also did so twice. In one of these cases *Samson*, the first ranking juvenile of the troop behaved peculiarly toward *Priamos*. It is worth quoting from my field notes.

Case 3. July 28. 8:10. *Priamos* was found feeding at the feeding ground all alone. 8:22. All of a sudden he climbed up on the fence surrounding the feeding ground and raising his tail cried <ga, ga, · · ·> (C-1 sound, ITANI 1963), then urinated. At the same time there returned to the feeding ground from a nomadic trip several peripheral and marginal young males, namely *Samson*, *Peragon*, *Oedipus*, *Goldwater*, *Peter*, and a few others. *Samson* approached *Priamos* at once and performed a presenting behavior. *Priamos* put

his hands on *Samson*'s buttocks and started to mount but left off. No response was seen from the other members of the troop. 8:24. *Priamos* left the feeding ground.

This *Samson*'s attitude is incomprehensible since on July 19 it was he who cooperated with *Nehleus* to attack and chase *Priamos* away (refer to Table 5). In addition to this case where in the non-breeding season a troop male displayed a submissive behavior toward a solitary male, three more were observed at Hagachi. I assume that it is a behavior similar to the ambivalent behavior which was seen among two solitary males mentioned above.

Ulysses came across the troop four times and was tolerated twice. This shows that he must have had some kind of a relationship with the troop in the past. This is inferred from the following fact. On August 2 *Ulysses* was at the feeding ground. He suffered no active attacks from the troop members although there were present several young peripheral males, *Hela*[14] (the first ranking female), *Debouragh* (the third ranking female), *Sem* (the first ranking sub-leader), and *David* (the second ranking leader). He was also observed mutually grooming a 3-year-old female outside of the feeding ground. *Ulysses* settled down completely inside the troop during the 1964 breeding season. I imagine that he used to belong to the troop in the past in the breeding season and that he, therefore, was tolerated by the other monkeys of the troop.

When troop members attack solitary males and also when the attack is a joint venture, they almost invariably emit the C-1 sound (ITANI 1963). There was, however, one case where the A-11 sound (*op. cit.*) was emitted instead.

Case 4. July 30. 13:48. Six infants were feeding in the feeding ground. Most of the troop members were scattered out taking rests and naps. 13:49. *Hector* appeared and hastily popped some peanuts into his mouth. 13:57. *Hector* climbed up a tree and looked toward the bushes in the direction of Honoki where many troop members were expected to be. *Hela* appeared. The distance between her and *Hector* was 20 meters. *Hector* kept on eating, but cast frequent glances at *Hela*. 14:05. *Hela* started emitting vocal sounds <huia><hui><uii> (A-11 sounds) and drew nearer to *Hector*. He ran away when she shortened the distance to 5 meters. *Hela* stopped vocalizing.

Since A-11 sounds are emitted when monkeys want to call the troop members (*op. cit.*), it is assumed that *Hector* was conscious of the presence of the troop or the leaders.

To summarize, solitary males are generally antagonistic toward troop members in the non-breeding season, but it is not such an intense attitude. It could be reduced to the minimum depending on what past contacts the solitary males had with the troop. The most significant feature to be observed in this season is the general trend of the solitary males to stay away from the troop. When troop

14) *Hela* and the following three individuals appeared at the feeding ground after *Ulysses*.

members chase a solitary male away, he walks away slowly with a raised tail, without assuming any defensive expression. It demonstrated his wish to stay away from the troop in the non-breeding season. We shall see later how the solitary male is compelled to take a submissive attitude in order to enter the troop (refer to Chapter III).

6) The Solitary Males of the Takagoyama-III Troop and the Hagachi-A Troop

Ishi (already described) of the Takagoyama-III troop appeared every day in March in the vicinity of the feeding ground to feed himself. In August *Omasa*[15] made several visits to the feeding ground when the troop was not around. *Lumunba* put in only one appearance.

During the September investigation *Chimba*, with a limp caused by fused right foot toes, appeared daily at the Hagachi feeding ground. He climbed up an electric pole about 50 meters away when the troop occupied the feeding ground, and frequently went through the tree-shaking behavior apparently to threaten the troop away. The peripheral males and several troop leaders attacked and frequently chased him away.

III. THE LIFE OF THE SOLITARY MALE IN THE BREEDING SEASON

The breeding season of the Takagoyama troops continues for four months, from mid-October to mid-February.

It is a well known fact that during the breeding season solitary males approach the troops for sexual activities with the female monkeys (ITANI 1956).

Assuming that in the way of life of the solitary males there should be a great difference in the non-breeding season and in the breeding season, my investigation was carried out for nine days, from Nobvember 4 to 12 and for four days, from January 16 to 19, 1965 to study the state of the troop and the behavior of the solitary males in both seasons.

The Takagoyama-III troop was investigated for seven days, from November 13 to 19 and for three days, from January 20 to 22, 1965. The Hagachi troop was investigated for six days, from December 11 to 16.

1) The State of the Monkey Troop[16] during the Breeding Season

A remarkable change was observed in the way of life of the troop during the breeding season. The nomadic range narrowed immensely and the troop frequently spent most of its time in and around the feeding ground.

15) He was the second ranking male of the leader class of the III troop. On May 28, 1958 he deserted the troop (MIURA, personal communication).

16) Unless otherwise stated, the descriptions apply to the Takagoyama-I troop. General descriptions also apply to the Takagoyama-III troop and the Hagachi-A troop.

A change was also observed in the phase of the social structure of the troop along with this phenomenon of settling down at the feeding ground. In the non-breeding season the central part of the troop was sharply distinguishable from the peripheral part, but the distinction became obscure in the breeding season. Of the estrous females younger monkeys went out into the peripheral part and caused a "diffusion" of the central part.

On the other hand there was no grouping to be observed in the peripheral part of the troop as had been seen in the non-breeding season. Peripheral males of 5 years old and over started going into the central part though the frequency differed according to individuals, and the distinction between the central part and the peripheral part often became obscure. The distinction became clear again, when large amounts of food were scattered in the feeding ground and attracted the great majority of the monkeys. Even on such occasions a few solitary males and higher ranking peripheral males were found around the edge of the central part.

The grooming behavior was observed very often among the monkeys of the leader class during the non-breeding season (eight cases were observed among the first and the second ranking leaders, four cases among the first and the third leaders and three cases among the second and the third leaders), but not a single case during the breeding season. The behavior of monkeys of the leader class tended more toward individualistic one. There was even one individual of the leader class that did not appear at the feeding ground for a whole day. Sex was evident in this season in all phases of the behavior of the monkeys. The lateral organization (IMANISHI 1964) of the troop made up by identical life-forms showed signs of weakening in all the individuals except the infants under 2 years old. Individual-to-individual sexual relationship began to appear clearly.

In November adult males, *Ham* and *Glaucos*, with adult females, *Pinc* (second ranking female) and ten other low ranking females, disappeared from the feeding ground. It seems that they formed a branch troop. This branch troop did not appear on the feeding ground during the period of my investigation, and details of its construction are not known. I may add however that there was a possibility of some of the solitary males having joined up because troop fission took place immediately before or at the beginning of the breeding season, and because at most only two male adults from the main troop joined up and yet they were still young.

2) The Appearance of New Solitary Males

During the breeding season new solitary males that were not around in the non-breeding season appeared at the feeding ground. During my November investigation I confirmed the existence of seven of them and in January two more (Table 6).

On the other hand seven monkeys did not appear during the breeding season, though they were around in the non-breeding season. Only five appeared in both

Table 6. Solitary males observed in the feeding ground of the Takagoyama-I troop.

Individual name	July-Aug. 1964	Nov. 1964	Jan. 1965
Paulo	12 days	+	+++
Hector	18	+	++
Priamos	19	+	+
Apollon	2		
Dardanos	3		
Pandaros	2		
Neptune	4		
Diomedes	1	+++	+++
Ulysses	4	+++	+++
Chronos	3		
Ishi	2		
Nestor	1 day		
Boutin		+++	+++
Bodin		+++	+++
Borodin		1 day	
Deborin		1	
Heiler		1	
Gepperus		1	
Kontiki		3 days	++
Nasalius			+
Hermes			+

\+ : be in the place where they could establish a sexual relationship with females of the troop.
++ : got into the peripheral part of the troop.
+++ : settled in the troop.
Figures show the number of days on which the solitaries appeared when the troop was in the feeding ground.

seasons; *Paulo*, *Hector*, *Priamos*, *Ulysses*, and *Diomedes*.

In this way 16 out of the 21 solitary males identified at the feeding ground of the Takagoyama-I troop changed largely their nomadic area in the breeding season from that in the non-breeding season. Generally, solitary males travel over an area far larger than the nomadic area of the troop in the non-breeding season, and from the change of the members of the solitary males that appear at the feeding ground we can see that their nomadic area is very large and distant, especially from around the time the breeding season commences. And they travel such long distances in order to approach a troop and enter into sexual relationship with the female monkeys there as to be accounted for later.

My investigation on the Takagoyama-III troop in November revealed the presence of four new solitary males and three more in January. In total seven new solitary males were found seeking contacts with the troop. The two solitary

males that appeared at the feeding ground in August did not appear during the breeding season.

At Hagachi three new solitary males appeared in the breeding season. *Chimba* used to come almost every day in September, but he failed to appear during this season. These facts prove the above-stated account that solitary males move long distances.

3) The Solitary Males—Their Approaching the Troop and Their Breeding Participation

At least 10 out of the 14 solitary males that were identified during the breeding season at the feeding ground of the Takagoyama-I troop had contacts with this troop in some or other way. In November *Ulysses* and *Diomedes* completely settled inside the troop, while *Boutin* and *Bodin* were found loitering around the periphery. *Paulo*, *Hector*, and *Priamos* appeared in the troop periphery at times and were in a position to have sexual relationship with the troop females. The above-mentioned seven solitary males were those that moved almost always with the troop in November.

Kontiki, *Heiler*, *Borodin*, *Deborin*, and *Gepperus* appeared at the feeding ground while the troop was away, but it was only *Kontiki* that reappeared in January.

In January *Boutin*, *Bodin*, and *Paulo* as well as *Ulysses* and *Diomedes* completely settled inside the troop. *Hector*, *Kontiki*, and *Nasalius* constantly hovered about the outer circle of the troop while *Priamos* and *Hermes* made a few appearances in the troop periphery. Since the relationship the solitary males maintain with the troop differs according to individuals in this way, their activities will be accounted for by classifying them in the following three types.

Type I. Such as *Ulysses*, *Diomedes*, *Boutin*, *Bodin*, and *Paulo* who settled themselves completely in the troop.

A linear ranking was observed among these five in the order of *Ulysses*>*Diomedes*>*Bodin*>*Paulo*>*Boutin*. This ranking order seemed to have been formed not only by the factor of physical strength but also by psychological factors as to who entered the troop earlier and who was more familiar with the troop and its surroundings.

Though they were quite often attacked by the other monkeys of the troop,[17] they were not chased too far and returned to the troop a short while. In rank they rated below the adult males over 6 years old.[18]

The solitary males usually walked with a drooped tail which occasionally lifted when hardly any troop member was seen around. Peripheral male monkeys fre-

17) During November and January 22 cases were recorded of the troop monkeys chasing the solitary males out of the feeding ground. Seven of these cases involved joint attacks made by two to ten individuals of the troop.

18) ITANI (1956) has already stated the same view as to the dominance relation between solitary males and young males of the troop.

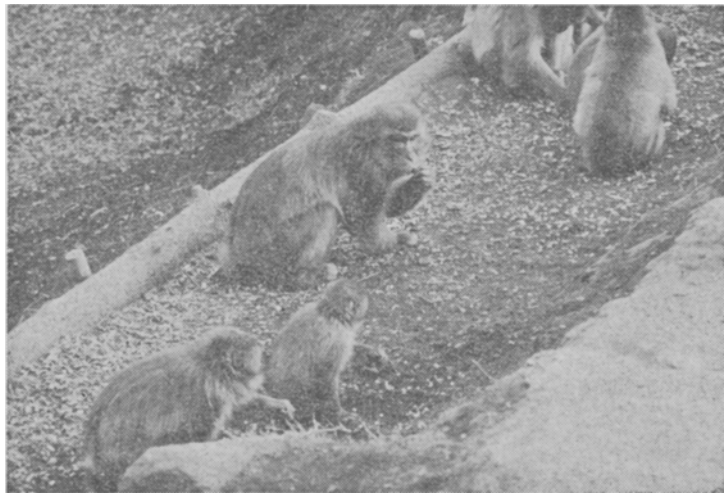

Photo 5. A solitary monkey feeding among troop members.
Diomedes is strained and does not settle down while feeding. He is surrounded by the monkeys of the central part.

quently mounted these solitary males, which shows that the social status of the latter was lower and more or less fixed within the troop. They sometimes performed the presenting behavior to troop males of the status lower than the peripheral males.

They seemed to be quite tense at the feeding ground when troop monkeys fed with them. They behaved submissively throughout (Photo 5). When the troop left the feeding ground *en masse* they stayed on behind for a short while. Mutual mounting behavior was observed among them.

The amiable relationship these solitary males seemed to have with the troop monkeys was a sexual one, but they were observed to embrace and to be groomed with infants. *Ulysses* once played the role of an arbitrator in quarrel that broke out between a female monkey and an infant.

Type II. Such individuals as *Hector*, *Kontiki*, and *Nasalius* had no desire to settle inside the troop, and approached the troop with tails up and with a threatening behavior toward the troop monkeys. By no means was their behavior submissive. *Hector* was especially aggressive. He made trouble with *Herod*, the third ranking leader, and even once chased the leader away.

Hector and *Kontiki* were once seen walking around in a tandem grouping for at least two days. The tandem grouping which was observed frequently in the non-breeding season was rarely formed in the breeding season. Only one more case of the tandem grouping made up by *Heiler* and *Gepperus* was observed in November.

Type III. Such as *Priamos* and *Hermes* who kept further away from the troop than those of type II. Not a single case was observed of their feeding in company with the troop monkeys. *Priamos* was always threatening the troop monkeys with

his tail up and frequently took to the tree-shaking behavior. *Hermes* did not threaten the troop monkeys.

In January I was able to classify the solitary males in this way in accordance with the degree of contacts they had with the troop and their behavior toward the troop members, but here I should like to note that this was done merely for the purpose of making my descriptions clear.

The dominant-subordinate relationship of these different types of individuals is rather confused. *Priamos* of type III was the most dominant male. *Ulysses* of type I was more dominant than *Hermes* of type III. Individuals that held certain social status within the troop (type I) were not necessarily more dominant than those who did not.

4) Sexual Activities of the Solitary Males

There is no need to say that it is for the purpose of performing sexual activities with the troop females that the solitary males approach the troop in the breeding season. Records were taken of every single case of sexual activity observed, whether of a troop member or of a solitary male, during the investigation carried out in November and January. Table 7 shows the number of times of true copulation actually confirmed of all the monkeys including the solitary males.

Table 7. Consort relationship of adult males to estrous females.

Class	Individual name	Age	Frequency of true copulation	No. of consort ♀
Leader	*Solomon*	14	6	4
	David	14	4	2
	Herod	13	3	2
Sub-leader	*Sem*	11	5	3
Peripheral male	*Samson*	8	3	3
	Japheth	6	1	1
	Peragon	5	0	0
	Peter	5	0	0
	Kon	5	0	0
	Nehleus	7	1	1
	Goldwater	6	0	0
	Oedipus	7	0	0
	Heimon	6	0	0
Solitary male	*Ulysses*	10–14	1	1
	Diomedes	10–14	1	1
	Bodin	25–29	1	1
	Boutin	25–29	1	1
	Hector	10–14	0	0
	Priamos	15–19	2	2
	unidentified	20–24	1	1

Table 7 also shows that the higher the status of the male the more often he has consort relationship with the females,[19] but we should take notice of the fact that

19) Tokuda (1961) observed a similar phenomenon in the Koshima troop of Japanese monkeys.

the observations were all limited to spots within a 50 meters radius of the feeding ground where a wide field of vision was obtainable. At such spots it is rather the male monkeys of high social status that most frequently copulate and apparently this fact may have largely reflected itself in Table 7. The sexual activity of the monkeys of lower status and of solitary males was observed less since it was most often conducted at comparatively distant spots, away from the feeding ground or in the bushes (MIZUHARA 1957).

We have seven cases of copulation observed in the solitary males. What was most characteristic was that the majority of consort females of these cases were young. There were 23 cases of copulation in the adult males of the troop. The consort females in all the cases were over 5.5 years old, while those that had sexual relations with the solitary males—three instances were observed—were 3.5 years old and had reached the age of puberty for the first time that year. Copulation between *Hokem*, a solitary male, and a 3.5-year-old female was the only case observed at the investigation at Hagachi. These facts prove that the solitary males that have participated in the troop are given comparatively low social status and also that the younger troop females little discriminate the troop males from the solitary males. The above three happened at the feeding ground while the other monkeys of the troop looked on, and the other four (copulation with female monkeys over 5.5 years old) at places some distance away from the feeding ground where there were not many troop monkeys (Photo 6).

The solitary males, *Hector*, *Kontiki*, *Nasalius*, *Hermes*, and *Paulo* could not be observed in the actual copulation, but they were seen in the performance of the behavior of following estrous females, of making sexual attacks on them, and females' presenting behavior toward them, which justify our assumption that they must have copulated.

On November 12, about one hour after her troop left the feeding ground *Tarumi* (a female of the central part of the troop, about 14 years old) was observed to copulate with a large solitary male in the shadows below the feeding ground. Distance prevented a clear identification of the solitary male,[20] but it was not one of those that had approached the troop or participated in it at the time. Intervening between the mounting behavior the mutual grooming was observed and the posture of the female monkey confirmed her ejaculation.

This example shows that the estrous female does not necessarily follow her troop when it moves on when she has consorted with a solitary male. Therefore, a solitary male can copulate outside a troop with the estrous females that come out into the periphery.

No behavioral difference was observed in the sexual behavior of the solitary males and the troop males. The so-called "display behavior" was infrequently

20) His age estimated to be over 20. He was not listed among the 21 solitary males seen at Takagoyama (see Table 6).

Photo 6. Copulation of a solitary monkey.
Copulation between a solitary male, *Diomedes* and *Nataly* (female, about 18 years old). The site is about 50 meters away from the feeding ground, and there are only infants nearby.

Photo 7. Copulation of a solitary monkey.
Priamos mating with a 6.5-year-old female, 30 meters away from the feeding ground. Various displays were observed before the copulation.

seen on occasions of sexual activities of the solitary males at the feeding ground, but *Priamos*, who performed at a spot a little away from the feeding ground, put up a "magnificent" display of this behavior (Photo 7) in advance by clutching at the face of the female and making turns (MIZUHARA 1957). We came across only one case of a solitary male being attacked by a troop male during copulation.

5) Relation between the Solitary Males and the Troop Individuals

This section concerns the solitary males that participated in the Takagoyama-III troop.

We have already noticed four new solitary males that approached the Takagoyama-III troop in November during the breeding season and settled inside it successively. My January investigation revealed the presence of three more new solitary males in the troop. One of them entered the troop around the middle of December (MIURA, personal communication). In all, there were seven solitary males that entered the troop in the breeding season (refer to the right two columns in Table 8).

Table 8. Solitary males observed in the feeding ground of the Takagoyama-III troop and the Hagachi-A troop.

TAKAGOYAMA-III Individual name	Mar. 1964	Aug. 1964	Nov. 1964	Jan. 1965
Ishi	5 days			
Omasa		3 days		
Lumunba		1 day		
Dankan			+++	+++
Robes			+++	+++
Hige			++	+++
Nomen			++	+++
Fox				+++
Don				+++
Tabun				+

HAGACHI-A Individual name	Sep. 1964	Dec. 1964
Chimba	11 days	
Hokem		+++
Yosaburo		1 day
Chuzi		+

Refer to Table 6 as to + marks.

In November, during the course of my investigation, I was able to observe the process of a solitary male, an outsider, entering the troop. Here is an account.

Dankan had already entered the peripheral part by November 13 and attained the state where troop monkeys rarely attacked him. I saw *Hige* loitering about the edge of the troop this day. This seemed to have been the first time he appeared in the vicinity of the feeding ground (MIURA, personal communication). On November 16 a solitary male, *Robes*, a complete stranger, made his appearance. Members of the troop chased him away time after time but he kept on returning. They chased him away less often and finally on November 20 he settled down

completely in the peripheral part. On November 19 *Nomen*, an aged monkey over 30 years old with an eye disease, appeared in the evening for the first time at the feeding ground. *Robes* chased him away at once, but he stayed on in the neighborhood of the troop. By January 20-22 these four individuals were already settled down in the troop enjoying a comparatively stable status in the periphery.

Besides these four there were *Fox* and *Don* who had already settled. There was *Tabun* who approached the troop sometimes, but seldom appeared at the feeding ground. No dominance interaction was witnessed between *Tabun* and the other six solitary males, but a linear rank order was established among these six, a stated corresponding to that of the solitary males of type I seen in the Takagoyama-I troop. *Tabun* is equal to the type II males.

The linear rank order of these six solitary males that settled in the troop completely was: *Dankan*>*Robes*>*Hige*>*Fox*>*Don*>*Nomen*. This ranking order shows that the earlier the entry of the solitary male in the troop the higher this ranking rises. Though *Nomen* entered the troop much earlier than *Fox* and *Don* probably his old age compelled him to accept the lowest rank.

These individuals, however, were ranked lower than any of the troop males over 7.5 years old, but *Dankan* and *Don* were more dominant than *Marx*, a 6.5-year-old male, and *Nomen* ranked below *Marx*.[21] Remarkable instances of dominance interaction between solitary males and troop males are as follows.

We have first the following case in which a solitary male mounted a troop male.

Case 5. January 21. 12:50. *Tabun* left the feeding ground and ascended the hill. 12:51. A 4.5-year-old male was seen lying on the top of the hill. He saw *Tabun* approaching and stood up, but he did not move. *Tabun* drew nearer. The 4.5-year-old male moved toward him and showed a presenting behavior. *Tabun* mounted him immediately. He dismounted and the 4.5-year-old male started grooming him.

Generally, solitary males seem to be more dominant than the troop males below the age of 4.5.

In general, the peripheral males over 7.5 years old do not chase solitary males away even at the feeding ground. It is commonly observed that solitary males co-feed with the peripheral males over 7.5 years old.

The co-feeding relation may be associated with the submissive behavior the peripheral males display especially toward solitary males and adult troop males.

Case 6. January 22. 15:00. *Simon* and *Marx* were co-feeding at the feeding ground. 15:05. *Don* entered the feeding ground. As soon as *Don* drew near, *Simon* mounted him. 15:07. *Kentauroi* approached the feed-box. *Don* put his face near *Kentauroi*, who peeped into *Don's* buttocks.[22] *Don* put on a defensive expression.

21) I could not observe any dominance interaction of the other solitary males with *Marx*.
22) The dominant monkey peeps into the buttocks of the subordinate monkey. One of the dominance interactions.

Case 7. November 19. 12:48. *Gaston* drew near *Dankan* who was squatting in the corner of the feeding ground, and stretched himself out on the ground in front of *Dankan*. *Dankan* started grooming *Gaston*.

A dominance-subordinate interaction sometimes take place in this way between the peripheral male and the solitary male before their co-feeding relationship is established, but usually this phase of dominance interaction is skipped. Higher ranking peripheral males are usually comparatively friendly with the solitary males, but when adult females are involved that sometimes start attacking solitary males emitting defensive sounds, they join the females in cooperative attacks. Such cases were not infrequently observed.

Solitary males seem to maintain multiple relationships with adult females. To some females they are friendly and to others antagonistic. Their behavior toward the same female may change depending upon the prevailing circumstances. This was quite a common scene to observe. When one to one a female confronted by a solitary male usually attempted a get-away.

Single-handed, young females of 3.5~4.5 years old and lower ranking peripheral males of 3.5~5.5 years old are weaker than the solitary males, but in a group they sometimes make attacks on the latter. In general, however, their relationship is not antagonistic. Some get so friendly with the solitary males that they groom them.

Infants under 2.5 years old feed under less strain even when the solitary males draw near. Infants under 1.5 years old make no attempts to run away. In fact they do not seem to discriminate the solitary males from the troop members (Photo 8). Infants of the 1.5~2.5-year-old age group of this troop were often seen grooming the solitary males. I have seen one case of each of the following—*Dankan* was groomed by three 2.5-year-old individuals, *Hige* by two 1.5-year-old males, and *Nomen* by a 2.5-year-old individual.

0.5-year-old baby monkeys do not fear the solitary males, neither do the latter attempt any assault on the former. As a matter of fact I have even seen solitary males taking care of baby monkeys several times. Extraordinary was *Dankan* who used to carry in his arms the baby of *Debby* (adult female of the lowest rank) as he fed himself. He tolerated the baby so much that he did not even scold when it climbed up to the top of his head (Photo 9).

Troop leader *Komasa* assumed a more or less indifferent attitude toward the solitary males. Ordinarily, solitary males move away and leave the feeding ground when a troop leader approaches. I have seen several times around the beginning of the breeding season *Komasa* attacked the solitary males that attempted to approach the troop. His attitude is comparable to that of the upper ranking peripheral males. He sometimes joined female monkeys in their attacks as with shrill cries of defense they chased solitary males away. Troop leaders incline more often toward performing the tree-shaking behavior in the breeding season. This should

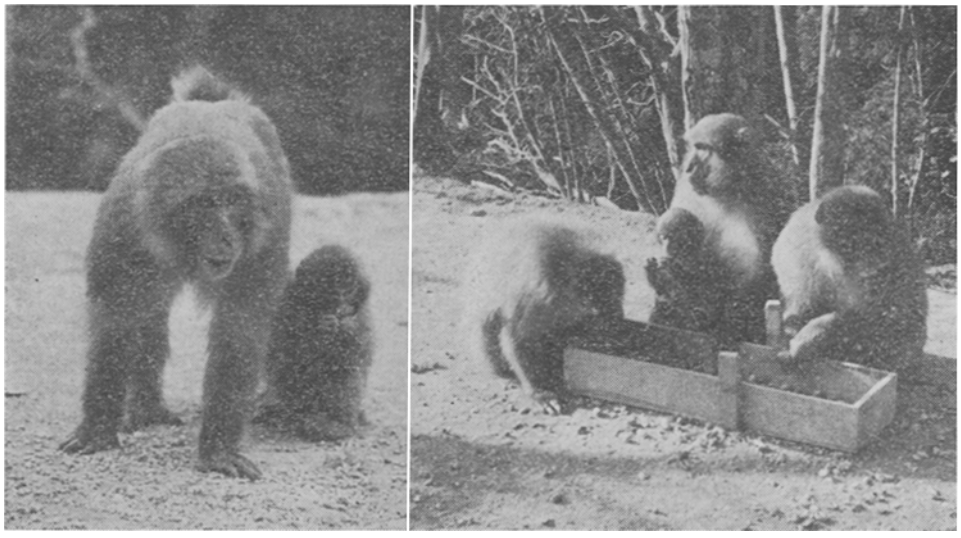

Photo 8. *Fox* assuming an aggressive posture toward a low-ranking female of the central part. The infant is not afraid of *Fox*.

Photo 9. The infant of *Debby* eating peanuts in *Dankan*'s arms. This infant mounted *Dankan*'s head or touched him on the face, but he did not chase the infant. On the left of *Dankan* is *Debby* (a low-ranking female) and on the right is *Nelson* (15th ranking peripheral male).

be taken as a sexual behavior rather than a behavior performed when a solitary male is spotted coming out into the troop, as KAWAI (1964) explains. It is a behavior that develops largely not only among troop leaders but also among young adult males and solitary males in the breeding season.

Resembling the type I individuals of the Takagoyama-I troop, the six solitary males of the Takagoyama-III troop also had certain social status in the troop. Though there was only one case of grooming I observe—*Nomen* grooming *Dankan*—these solitary males generally tolerated each other and co-fed very often. I often saw three or four solitary males co-feeding in the evening at the feeding ground when the troop was about to leave for the hills.

Solitary males that entered the troop also performed "troop centered" behavior (IMANISHI 1957). The longer they remained with the troop, the more inclined they seemed toward displaying control behavior in settling troubles that arose among female monkeys and infants. When adult males of the troop were away from the feeding ground, *Dankan* was often seen making control attacks whenever trouble broke out among females and infants. *Robes* has been also observed to make such control attacks twice. Solitary males at the feeding ground look up toward the hills when trouble seems to have broken out there and screams of females and infants reach their ears. They get on their feet, run excitedly to the hills and emit C-1 sounds (ITANI 1963). This sort of a behavior may correspond to the control behavior. It has been observed with *Dankan*, *Don*, *Hige*, and *Robes*.

Lastly, I will describe *Soba*, a peripheral male of the III troop, who occupied a special position in the monkey society because of his old age. His social status remained unchanged even during the breeding season, and his status was very similar to that solitary males occupied in the troop. He maintained, however, no intimate relationship with any of them.

So far I have somewhat elaborately described the behavior of the solitary males of the III troop. These observations may be considered to be more or less applicable to the I troop.

6) The Solitary Males of the Hagachi-A Troop

Investigations carried out at Hagachi during the breeding season covered a period of six days, from December 11 to 16. *Chimba* who used to appear nearly every month and behaved antagonistically toward the troop members disappeared in September (described previously).

Three new solitary males appeared in the breeding season. One of them, *Hokem*, settled completely down in the troop and walked about with a drooped tail. He was seen twice in copulation with young females and an ejaculation was once confirmed. His status in the troop corresponded to that of the individuals of type I of the Takagoyama-I troop. This individual, of all the solitary males I observed, maintained the most intimate relationship with the troop monkeys. I never saw him attacked by the troop monkeys. He was seen groomed twice by *Marlboro*, a high ranking adult female, and once by *Garappa*, a low ranking female. A sub-leader once mounted him.

Yosaburo appeared for the first time on December 11 after the troop left the feeding ground. He came back with his tail raised high but was chased away by several young peripheral males that returned from the hills. That was the last I saw of him. *Yosaburo* is said to have been a member of the A troop, and that he transferred himself to the B troop when it branched off (HIDA, personal communication).

Another solitary male that appeared for the first time in the breeding season was *Chuzi*, a very large, hairy individual in his prime. He put in his presence on December 13 and 14 at the top of a cliff near the feeding ground. On December 13 he walked to and fro on the top of the hill and kept looking down antagonistically on a group of ten or more troop monkeys including the leader (*Ishimatsu*) and *Cleopatra* (a high ranking female). His behavior consisted of a tree-shaking behavior accompanied by shrieks of C-5 sounds (ITANI 1964) and a posture with the head lowered in glaring ferocity. The troop leader merely looked up at *Chuzi* without any further response. *Chuzi* visited the feeding ground in early December when the troop was not around. He was accompanied by a few female monkeys, one of which he copulated with (HIDA, personal communication). These female monkeys returned to the troop later, but it shows that the breeding season is the time where

there exists a great possibility of a troop fission.

7) The Birthplace of the Solitary Males

So far we have observed cases wherein many solitary males came out during the breeding season for the purpose of performing sexual activities with the female monkeys in such troops as the Takagoyama troops, which were not a topographically isolated ones.

We will now study the question of their birthplace—the question, whether or not the solitary males that approached the troop during the breeding season were those that originally belonged to the troop.

The original troop where most of the solitary males that I observed came from is not known. Judging from the behavior of three solitary males during the breeding season whose original troops were known, *Omasa*, originally from the Takagoyama-III troop, was often found in the nomadic area of this troop during the non-breeding season, but he made no approaches to it during the breeding season. *Ishi* also came from the III troop and appeared at the feeding ground of this troop until May. He then disappeared and failed to return even in the breeding season.

Next are the records in Takasakiyama. ITANI (1956) believes that the large solitary males that appeared in the breeding season at Takasakiyama originally came from other monkey troops, judging by the shape of their bodies. According to observations made in this field for a duration of 15 years by ITANI, MIZUHARA, SUGIYAMA, KANO, YOSHIBA, and TOYOSHIMA, it is known that nearly all the solitary males that leave their troop fail to return. At Gagyusan we find that *Aka*, *Matsu*, and *Goro* did not return to the troop they originally came from.

These indirect evidences point to the possibility that the majority of the solitary males that appeared in the breeding season are from other monkey troops. At least no case has been confirmed of the solitary males returning to their original troops even in the breeding season. More and sufficient data should be collected on the question and studied. I take a hypothetical standpoint that sexually the Japanese monkey society is not a closed society. I will dwell on this hypothesis in more details in Part II.

Part II. The Form of Existence of the Japanese Monkeys

IV. THE ORIGINATION OF THE SOLITARY MALES

In this chapter I will deal with the questions—when and how do male monkeys leave their troops and why? In the next chapter I will discuss the form of existence of the Japanese male monkeys.

Having had only a short time for investigation, I could record only one instance

of a troop male solitarizing from his troop. However, extensive data during the investigations carried out intermittently over a period of 15 years have been collected by the Primates Research Group at Koshima and Takasakiyama, and a part made available to me. The following people allowed me the use of their data. The number shows the instances in which the age of solitarization is known.

ITANI and others	Takasakiyama	14
KAZUO KANO	Takasakiyama	25
KENJI YOSHIBA	Takasakiyama	3
SATSUE MITO	Koshima	10

1) The Age of Solitarization

There are two or three papers that deal with the question—at what age do troop males ordinarily leave their troops and become solitary males? Basing his idea on three instances observed at Takasakiyama and Koshima, ITANI (1956) states that it might be at the age of 5~8 that troop males normally solitarize. KAWAI (1964) divides in two the period of the origination of the solitary males; the juvenile period and the ensuing period. He states that solitarization in the former period is strongly connected with sexual maturation and in the latter with social pressure.

To ascertain the period of the origination of the solitary males the estimated ages of the 34 solitary males that I identified at Takagoyama and Hagachi will be of reference (Fig. 9). The age of each individual was guessed at by taking into account the size and the build of the body, the redness of the face and the testicles, the wrinkles on the face, the posture, etc. Though it was a rough ascertaining, I may say that it would be more or less accurate if the individuals were classified in age groups with a 3-year gradation.

Figure 9 shows that the solitary males range over all the age groups of matured males from 7 to over 30 years old, though those from 8 to 16 years old account for 53%. There are only two individuals in the 7-year-old group, but if we take into account those marginal males of the Takagoyama-I troop (four 6~7-year-olds), *Kostero* (7 years old) who solitarized at Hagachi, *Teziro* (7 years old) who has an inclination to do so, etc., an impression is obtained that the age of 7~8 may be the peak of solitarization,

Next is the data obtained at Takasakiyama and Koshima. Development of the individuals born after 1948 has been traced quite thoroughly up to the present day. In the Koshima troop 14 males out of the 16 that were born during 1948-57 solitarized, leaving only two (Table 9) in the troop. The age of ten of those that solitarized is known.

As to the Takasakiyama troops, ITANI and others (1964) have reported the life history of 44 males ever since they were identified in 1955 (over 4 years old then) up to December, 1962. When investigated in 1962, 24 of them were missing from the troop. Three were dead, four had gone over to the B troop and 17 had

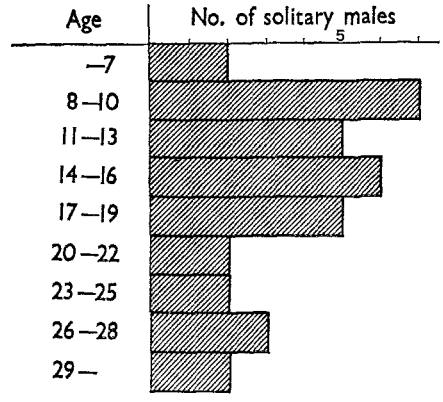

Fig. 9. Presumed age-composition of 34 solitary males identified at Takagoyama and Hagachi.

Table 9. Solitarization of young males in the Koshima troop (cited from MITO, pers. comm.).

Individual name	The year of birth	The year of solitarization	Age of solitarization
4♂	1948	1954	6
5♂	1949	1956	7
6♂	1950	unknown	unknown
7♂	1950	unknown	unknown
8♂	1951	1957	6
9♂	1951	1957	6
10♂	1951	not becoming a solitary	
11♂	1952	unknown	unknown
12♂	1952	not becoming a solitary	
13♂	1953	unknown	unknown
14♂	1954	Feb. 1962	8
15♂	1954	Feb. 1961	7
16♂	1956	Aug. 1964	8
17♂	1956	Jan. 1961	5
18♂	1957	Dec. 1964	7
19♂	1957	1964	7

solitarized, etc. Of these 17 some got missed and some may have died, but I will treat them here as solitarized individuals. The age at the time of solitarization of 14 of them is known and is shown in the right column of Figure 10.

The total number of the males that solitarized from the three Takasakiyama troops up to March, 1963 since the above investigation time is 25. The age of all of them is known (KANO, unpublished data). There were three more instances of solitarization from April, 1964 to December, all confirmed (YOSHIBA, unpublished data). They are shown in the left column of Figure 10.

In addition to these data there were three instances recorded by MIZUHARA (1965) with the Taishakukyo-A troop, three instances recorded by FURUYA (1960)

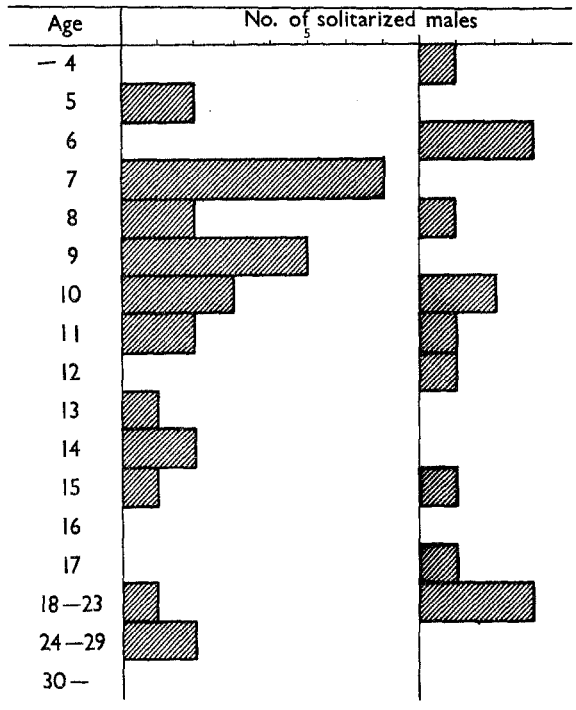

Fig. 10. Age of solitarization in the Takasakiyama troops.

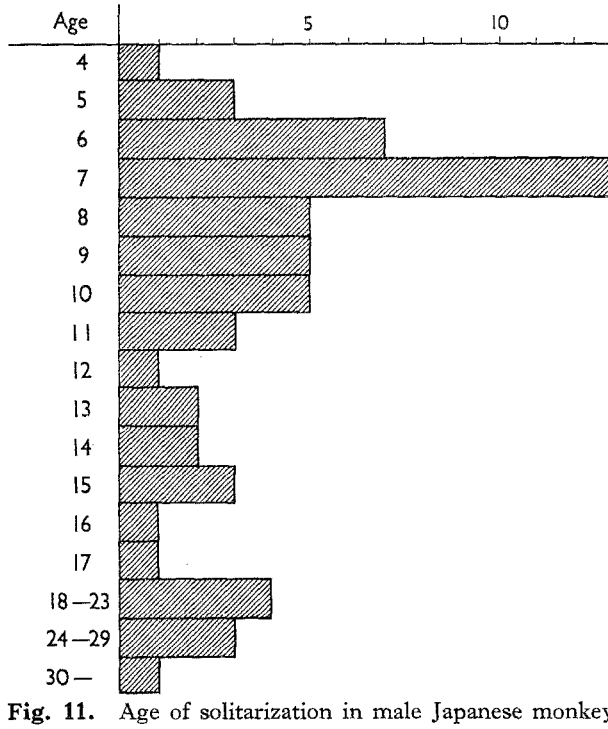

Fig. 11. Age of solitarization in male Japanese monkeys.

at Gagyusan, two that HIDA (personal communication, June 1965) and I verified at Hagachi. The aggregate total is 57 instances as found in Figure 11.

Figure 11 tells us that the average age of solitarization is 11.2. The mode is 7 years old. Solitarization starts at the age of 4, from where there is a gradual increase to reach the peak at the age of 7. Then it declines away. The 8～11-year-old age group represents many cases and we find solitarization a common phenomenon until the 15-year-old age group is reached. We also find that the phenomenon is not rare among individuals even over the age of 16. It thus can be realized that the age curve of solitarization has one maximum point, and that solitarization takes place without leaving any gap in the age stratum. The uninterrupted curve points to my doubt of KAWAI's (1964) dualism theory that solitarization in the juvenile period is caused by social pressure.

According to Figure 11 the majority (adout 80%) of the solitarization cases takes place in the age period ranging from 5 to 15 years old or in the terms of the developmental stage of the juvenile period (5.5～8 years old) to the early stage of the adult male period (8～15 years old.)

It is said that in the Minoo-A troop, which had 17 to 18 males which were 1-2 years old in 1955, all except two males solitarized by 1958 (KAWAMURA 1965). A similar case is also known in the Shodoshima-K troop and the Minoo-B troop (*op. cit.*). However, they are rather rare cases. KAWAMURA (*op. cit.*) compares these solitarization cases with a few solitarization cases[23] of the Takasakiyama and other troops and stated that the ratio and age of solitarization differ with the troop, and that there is a large possibility that this could be a "subculture." However, considering the communicating ability of the Japanese monkeys, cannot we consider that they have no ability to pass on to their descendants the knowledge of the ratio and the age of solitarization? Accordingly, the wholesale process of solitarization of the males of the early juvenile stage in the Minoo-A troop and others should be considered merely as a temporary or an accidental phenomenon.

2) Seasonal Changes of Solitarization

So far the question as to whether or not there are seasonal changes in the phenomenon of solitarization has not been taken up in any of the papers that have dealt with solitary males, but the question has its value for our true understanding.

There are cases of solitarization that take place gradually (which will be described later), and it is difficult to check at which season such solitarization occurs, but even then it would be going too far to say that solitarization is not associated with the seasons at all. The difficulty to see or to determine when the solitarization of a given individual has begun could be one of the reasons why this question has been left unsolved.

I collected such cases of solitarization, as the time of commencement is known

23) Among them most are the cases of solitarization of males over 8 years old.

Table 10. The month when solitarization occurred and the number of solitarized monkeys.

Field	Koshima	Takasaki-yama	Arashi-yama	Hagachi	Takago-yama	Gagyu-san	Total
Jan.	1	2					3
Feb.	2	5					7
Mar.		1	1				2
Apr.		2					2
May		1	2		1		4
Jun.			2			2	4
Jul.		4	3				7
Aug.	1	6	5			1	13
Sep.		2	2	1			5
Oct.		3	2	2			7
Nov.			1	1			2
Dec.	1	3		1			5
Total	5	29	18	5	1	3	61
Source	MITO (pers. comm.)	KANO and others (pers. comm.)	HAZAMA (1962)	HIDA (1964)	MIURA (pers. comm.)	FURUYA (pers. comm.)	

by a difference of a month more or less. Five such cases have been obtained from Koshima (MITO, personal communication), five from Hagachi (HIDA, personal communication and my observation), 29 from Takasakiyama (KANO et al., unpublished data; ITANI et al. 1964), one from Takagoyama (IWAO MIURA, personal communication), 18 from Arashiyama (HAZAMA 1962), and three from Gagyusan (FURUYA 1960), in total 61 (Table 10).

It would be a mere mechanical summing-up to list and classify all these instances by the month because the life cycle of the monkeys differs with the troop (KAWAI 1964; HIDA 1964); the breeding season at Koshima is from January to April, at Takasakiyama from December to March and at Arashiyama, Hagachi, Gagyusan, and Takagoyama from November to February. Accordingly, all the different life cycles have been put together and the year split into 12 periods. The result is Figure 12.

Sixty-one cases are by no means a sufficient number. No remarkable tendency has been found in them. For an accurate judgment accumulation of further data must be made, but what the data teaches us at the present stage is that many cases of solitarization are seen to take place from the middle of the delivery season to the time immediately prior to the breeding season.

As we proceed in search of the cause what first comes up in our mind is the question of food supply. Food supply in any of these fields increase rapidly around the beginning of delivery season so it is justified to disregard the connection of food supply with solitarization. Secondly, as to the social organization of the troop, we find a very clear-cut distinction between the central part and the peripheral part of the troop in the beginning of delivery season, and the class

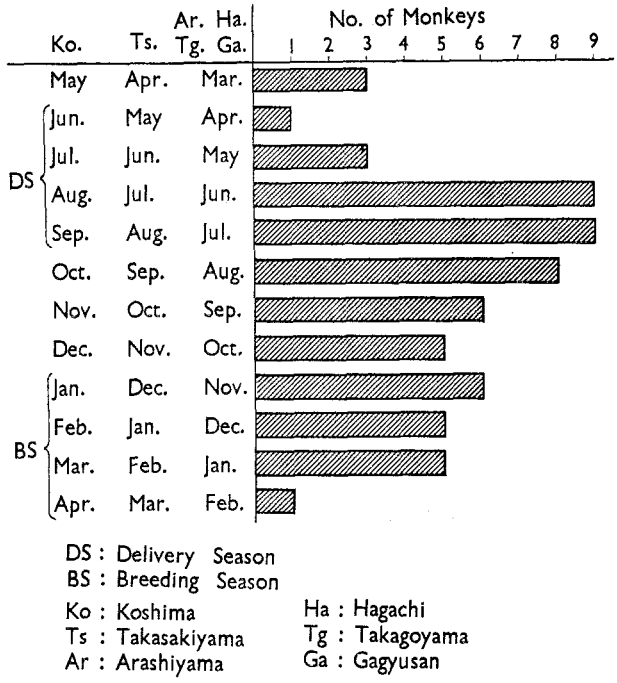

Fig. 12. Reproductive cycle and frequency of solitarization.

organization is maintained more severely. Dominance interaction among troop individuals may, therefore, have connections with the phenomenon of solitarization. In the third place, as we find in Figure 12, there is an interrelation between solitarization and the annual sexual life cycle of the monkeys. It brings to us the possibility of solitarization having connections with hormonal rhythm.

In spite of all this, solitarization is a phenomenon that may be witnessed throughout the year, and many may be observed even during the breeding season. This demonstrates how complicated an aspect this phenomenon of solitarization is.

3) Solitarization of the Leaders and the Sub-leaders

As we have seen in Section 1, about 80% of the solitarization cases occurs in the age group of the 5~15-year-olds. The age group differs according to the monkey troop, but it consists more or less in the middle or the upper classes of the peripheral part. This gives us an impression that solitarization occurs in general among the males whose social status is more or less unstable, but there are also cases of the leaders and the sub-leaders, which are not at all few nor rare. On the contrary, it is a rather common phenomenon.

The whereabouts of the six leaders and the ten sub-leaders identified in 1954

at Takasakiyama are known (MIZUHARA 1965; YOSHIBA, personal communication). By 1964 two of the six leaders were dead, and two still hold the status of leaders in the troop, while *Pan* and *Monk* solitarized at the estimated age of 22 and 23 respectively. The cause was neither old age nor illness (MIZUHARA 1957). *Bacchus*, at present in the troop, left it when he was 27 years old and returned four months later.

Two of the sub-leaders died in 1959 and 1960. In 1962 *Uzen* and *Kuro* left the troop at the estimated age of 21 and 22. By 1964 *Yubi* and *Achilles* had solitarized respectively at the estimated age of 21 and 24. They were neither physically weak nor ill prior to the solitarization. On the contrary they seemed to have been more vigorous. Such cases of solitarization have been observed.

At Hagachi, *Ishimatsu*, the second troop leader, solitarized in September, 1958 and returned in 1960 to the central part where he is now the first leader. In 1962, the first leader, *Koma* solitarized all of a sudden and in 1960 so did the second leader, *Ohma* (the above statement, HIDA 1964, personal communication).

At Arashiyama we find *Zao*. He was the first leader in 1955, but he suddenly left the troop in 1959. *Gongen*, the second leader left in 1958. *Lincoln* which had been a sub-leader became the first leader in 1959 but he too disappeared in 1960. *Shan* had been a sub-leader who rose to be the second leader in 1959 and the first leader in 1960, but he also disappeared in 1961 (all above, HAZAMA 1965). There seems to be the possibility of their having fallen into the hands of poachers at Arashiyama (*op. cit.*), but could it be only the leader monkeys that suffer so? The majority of them therefore must have turned solitary males.

In 1955 the Taishakukyo-A troop was a very small troop consisting of only 29 monkeys. The class construction of the males rested in one leader, one declining leader, and three 5~8-year-old juveniles (MIZUHARA 1957). The declining leader, *Baltro* solitarized in 1956 and the leader *Garcia* in 1958.

In the Takagoyama-III troop there were three leaders at the time of the provisionization in 1955. In 1961 the first leader fell ill and left the troop. Just about this time the second leader *Omasa* solitarized (MIURA, personal communication).

In the Shiga-A troop the first leader also solitarized (WADA 1964).

At Gagyusan, the fifth leader, *Goro* solitarized at an age estimated to be over 30 (FURUYA 1960).

In the Koshima troop there are two leaders that still occupy the same position at least from 1952 till now, June, 1965, but this is rather a rare case. We still find many cases of solitarization of the male monkeys of the leader class, and realize that they too are no exception.

4) The Cause of Solitarization

Cases are not rare of solitarization caused by old age and illness. Known

cases are *Titan* of Takasakiyama (YOSHIBA, personal communication), *Jirocho* of the Takagoyama-III troop (IWAO MIURA, personal communication), *Baltro* of Taishakukyo (MIZUHARA 1965), etc. I will take up here the solitarization of healthy and strong males in general. The most important problem is essentially whether solitarization is caused by factors on the individual level or by factors on the social level.

I will first examine what MIZUHARA (1957) says, who emphasizes the cause to lie on the social level. He refers to the wholesale solitarization in the upper juvenile class at Takasakiyama, the solitarization of *Uzen*, the first sub-leader, the wholesale solitarization of several 5~6-year-old males of the middle juvenile class, etc. that occurred since 1955, and states that the cause thereof lay in the rigidness of the class structure of the monkey society and in the inconsistency of their social status (low status) which was not allowed to rise up to the extent their physical maturity qualified. He termed these solitary males as "Entfremdte individuals." This evidently is a sociological conception.

As at the time the Takasakiyama troop increased rapidly in population and grew to a very large one that would be hardly conceivable of a troop in a pure wild state (*op. cit.*), his explanation seemed convincing. How then, however, can occurrences of similar phenomenon in other monkey troops be explained where no state of over-population exists? There is the Shodoshima-S troop for example, where nine of the twelve 8~10-year-old males solitarized (KAWAMURA 1965).

We have seen phenomenon of the solitarization of the leader and the declining leader of the Taishakukyo troop (cf. p. 184). In 1956 the two peripheral males also solitarized. MIZUHARA explains, "peripheral males of the smaller troops that consist of only a few individuals are apparently reluctant to solitarize and leave their troops, but in actuality they do. In such smaller troops only one leader[24] is enough to effectively perform almost all of the functions of the social status of males, which leaves the status of peripheral males undiversified functionally and their solitarization comes about . . . ." MIZUHARA asserts throughout in this way in explaining the cases at Takasakiyama and Taishakukyo that the cause of solitarization lay in the low status of such male monkeys, that did not qualify to their age and in the lack of appropriate share of social role.

If we assume that MIZUHARA's theory is correct, the socionomic sex ratio of the smaller troops ought to be low, but this contradicts the actual fact. The socionomic sex ratio of the smaller troops inclines to be higher than that of the larger troops (ITANI et al. 1964). Moreover, the fatal weakpoint of his theory lies in its inability to explain away the phenomenon of solitarization of the individuals of the leader class. MIZUHARA's comment on the cause of the solitarization of *Garcia*, a leader of the Taishakukyo troop, was "reason unknown." As we have seen in

24) The aforesaid juvenile male of the central part became a leader later.

section 2, the solitarization of the leaders is quite a common phenomenon, so according to him the solitarization of all the leader monkeys would be due to "reasons unknown." That is, his concept of "Entfremdte individual" cannot explain every single case of solitarization of all the solitary males.

Such an explanation which bases the cause of solitarization on the relation between the social structure of the troop and the status of the troop males does not have universal validity. I stand on the point that solitarization is a phenomenon which has its cause basically on the biological level.

Is not solitarization an attribute of the Japanese male monkeys? Is it not the nature of the Japanese male monkeys, a nature that genetically exists in the Japanese male monkeys?

Critics may regard my standpoint as easy-going in bringing in anything like "attribute" for an explanation. However, my viewpoint is that for the Japanese male monkeys the troop life being their way of life so it is also their way of life to solitarize and leave their troops to lead a nomadic life.

The basis of my theory lies in the following facts: (1) that the number of solitary males, as we have seen at Takagoyama, exceeds that of the mature males in the troop; (2) that there is in the age curve of solitarization a single maximum point which forms the peak and that an uninterrupted curve declines down from both sides, all of which suggesting the presence of a deep relationship of solitarization also occurs among the leaders. Such facts lead me to perceive in the male monkeys the presence of an attribute that make them desert the troop and lead solitary lives. This attribute I would like to call "aggregariousness."

The inconsistency, as MIZUHARA states, that lies between the social status and the physical maturity of the male monkey is, however, not entirely unrelated to "aggregariousness." It is probably better to see much relationship between them. What is said to be the cause on the sociological level, however, is in fact merely a direct motive that brings about solitarization and not the real cause. That on the sociological level is mere secondary mechanism of solitarization which serves more or less to influence the male that has a propensity toward solitarization. On this point I shall dwell in details in Chapter V.

Lastly, there is the explanation on a sociological level which attributes the cause of solitarization of male monkeys to quarrels or fights between individuals or to "ostracism" by the troop members. This is a popular belief and in truth there are cases that do appear so.

Kuro (the first sub-leader) of the Takasakiyama troop suffered a joint attack from *Titan*, *Ohkem*, and a few others and was unable to return to his troop (ITANI, personal communication). There is another case however where *Sarutahiko*, sub-leader, suffered a joint attack by some of the leaders (*Boor*, *Monk*, *Pan*), but in spite of the heavy injuries he sustained he remained on with the troop (ITANI 1954).

5) The Solitary Males that Join the Troop

As we have seen, there are many solitary males that join the troop only in the breeding season, but here I shall dwell on those solitary males leading solitary lives that not only join the troop but also come to occupy a stable status in it, that is, those that become members of the troop.

Once a male monkey solitarizes he generally stays away from his troop for years (Chap. III, § 7), but exceptions have been observed.

At Koshima there was 4♂ (*Hiyoshi*) who left his troop in 1954 and started approaching it again from March, 1961. He finally rejoined it. 8♂ and 9♂ solitarized in 1957 but joined the troop again later, the former in 1963 and the latter in December, 1964 (MITO, personal communication).

Being an island, Koshima is a closed environment. The male monkeys there that solitarize therefore cannot move far away. If they want to join a troop they have no alternative but to return to their own troop. There were also many cases observed of males at Koshima where the solitary males were seen coming in and out of the troop without detaching themselves from it completely (KAWAI 1965). The particular closed environment the island presented must have been also the cause of this phenomenon.

At Koshima beside these three monkeys 15♂ solitarized in February, 1961 and in August swam a distance of about 200 meters across a narrow strip of water to the opposite shore of Ishinami and swam back in August, 1964 to return to the Koshima troop (MITO, personal communication).

At Hagachi we find *Ishimatsu*, the present troop leader. In September, 1958 (he was the second leader at that time) he solitarized, then in August, 1960 he rejoined his troop and settled in the central part. He was the fourth ranking male at the time of his return but solitarization or death of his predecessors since raised him to the rank of the first leader in October, 1962. He still enjoys this position (refer to Chap. IV, § 3).

Except for these three Koshima instances, there are known to us only the above stated two instances of solitary males having returned to their own troop after an absence of several years.

From the fact that there were hardly any cases observed of the solitary males rejoining the troops they left, ITANI et al. (1964) admit in the Japanese monkeys, besides causes on the sociological level, an inclination to avoid "intra-troop mating" and tend toward "inter-troop mating." This inclination of avoiding "intra-troop mating" should be regarded as a biological interpretation of what I have stated, the "aggregariousness" of the male monkeys.

In contrast we have a few cases of the solitary males joining troops other than those they originated in. These cases include *Chikusha* (HAZAMA 1962) who solitarized from the Arashiyama troop and joined the Hiei-A troop; *Sen* (KAWAI 1964) who left the Choshikei troop of Shodoshima and joined the T-troop there.

There is a good possibility of *Soba* of the Takagoyama-III troop (refer to Chap. I, § 2) to be included in this category.

It is not a common phenomenon and not an easy task that solitary males completely settle inside troops other than those they originated in.

There is on the other hand at Takasakiyama an evident moving about of male monkeys among the present three troops, which came into existence as the result of the first troop fission in 1959-1960 (B troop was born) and the second in 1963 (C troop was born).

The whereabouts of the 33 males that solitarized from January, 1963 to June, 1965 have been verified and are presented in Figure 13 (unpublished data of KANO,

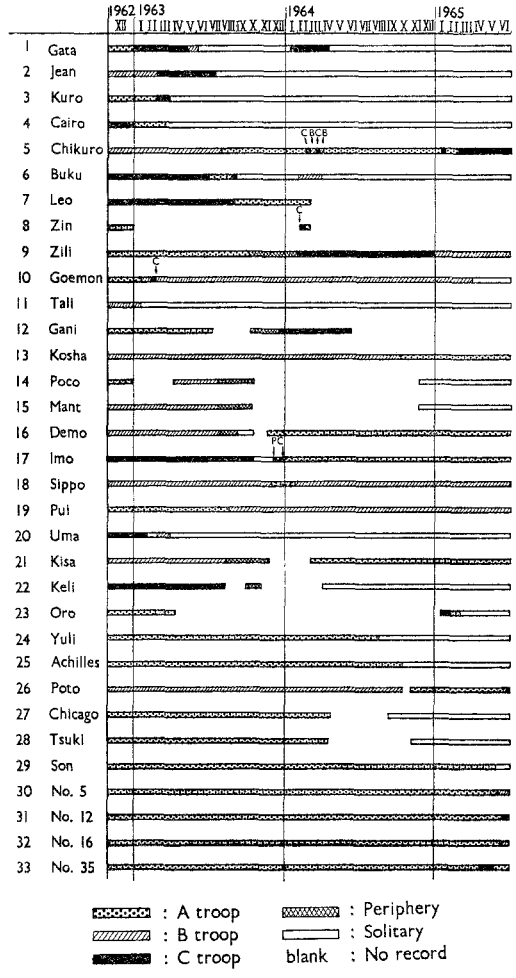

Fig. 13. The relation between 33 solitarized males and the troops in the Takasakiyama area.

YOSHIBA, and TOYOSHIMA).

These individuals after solitarization now maintain with these monkey troops varied degrees of relationship, which are still in the process of undergoing changes. Their states[25] in March-May, 1965 are; 17 males (51.5%) as solitaries and 16 (48.5%) that belong to or are approaching one of the troops. Thirteen of these 16 males maintain relationships ultimately with the troops other than those they originated in and three have returned to their original troops. Here again we see the tendency of the solitary males not desiring to return to the troops they originally came from. At Takasakiyama 27 males entered other troops, including temporary entries.[26] The ranks they occupy in the troop on such occasions are far lower than the social ranks they used to have in their original troops before their solitarization and are commonly very unstable. There were only five individuals, *Goemon*, *Demo*, *Imo*, *Pui*, and *Kisa* that kept their low but stable status over 12 months. In spite of the fact that he maintained a certain status in the B troop for 25 months since March, 1963, *Goemon* left his troop again in April, 1965 and disappeared from Takasakiyama. There is a good possibility of the majority of these 13 individuals, already referred to, leaving their troops to lead solitary lives.

The Takasakiyama B and C troops are the branch troops of the A troop and share a common feeding ground with it. Since the majority of the troop members know each other there is a large scale interflow of the males, which may not be observed in other fields. This noteworthy interflow of the males should not be disregarded. It is the aftermath of the two-time troop fisson, that is, it is the process of a social readjustment taking place among these Takasakiyama wild monkey troops. I anticipate the results of the investigation KANO made in this respect.

V. THE WAY OF EXISTENCE OF THE JAPANESE MALE MONKEYS

In this chapter, while trying to present more data, I should like to dwell on the conclusion drawn from and the problems raised on what I have so far stated. I should like to state first that behaviorally the solitary male is a normal male monkey, and then that the lone life he leads is simply a normal way of his life, that the existence of solitary males helps in the development of the species, that the process of development of the males in a troop is deeply related to this way of life, and the way the troop exists in the specia of the Japanese monkeys. Lastly, I shall attempt a simple comparison with the societies of other specia of the anthropoids from the

25) As the state actually was in December, 1962 and in March-May, 1965 as to which troop they belonged. Any change there may have been in the intervening period is not taken into account.

26) Including also those who ultimately became solitary males.

viewpoint of outbreeding.

1) The Solitary Life Is a Normal Way of Existence of the Male Monkeys and the Solitary Male Is a Normal Monkey

The solitary male is commonly called an "ostracized" monkey. MIZUHARA calls it an "Entfremdte individual" (previously stated). These terms convey to us the sense that as a way of life the lone life is something exceptional or abnormal.

In reality the actual state at Takagoyama called for a correction to this reasoning. The total number of solitary males that I identified at the feeding grounds of the Takagoyama-I and III troops was 30, whereas the total number of the males (7 years old and over) in these two troops was only 19. Two out of these 19 were believed to be on the brink of solitarization. Though such a simple comparison of figures does not form any absolute proof that in fact the solitary males number more than the troop males, we may conclude, as I have repeatedly stated, that a solitary life is the universal and numerically normal way of existence of the Japanese male monkey.

What leads to the thought that the solitary male is abnormal is the general impression derived from his behavior, which is generally rude and strongly inclines toward unsociability. As behavioral characteristics of the solitary male ITANI (1956) cites the following facts: (1) He seldom emits vocal sounds. (2) When in a consort relation to a female he does not reciprocate by grooming her as she did him. (3) New varieties of food propagate among them with difficulty. ITANI (1954) also states that the solitary male rarely emits vocal sounds other than <ga·ga·ga · · ·> (C-1, C-5 sounds, ITANI 1963). This is true, but this amply serves his purpose when he is all alone,[27] and this is not the case when there are more than two solitary males together. According to my records collected in July-August, 1964, when a dominant individual approaches a subordinate the latter ordinarily faces the former and emits the vocal sounds <kiya> (B-2 sound, *op. cit.*) or <giya> (B-1 sound). These sounds seem to have the effect of warding the dominant monkey off. We have already seen that behavioral communications such as mounting and presenting are most commonly observed, following these sounds.

Our attention is drawn here to the vocal sounds the solitary males emit, to what ITANI (1963) terms the sound group that is connected to the social integration.

This <huu> is an A-2 sound and has a social meaning (ITANI 1963). This case well illustrates the fact that when unnecessary they commonly refrain from emitting vocal sounds.

Case 8. July 22. 14:38. The central part of the troop had left the feeding ground. Seven peripheral males still remained behind. *Priamos* and *Paulo* entered the scene. *Priamos* chased the peripheral males away, but *Goldwater* ran only a short distance away.

27) ITANI (1956) also points this out.

14:44. *Goldwater* mounted *Priamos*. 14:45. *Priamos* cried <huu>. *Goldwater* responded *Priamos*. 14:45. *Priamos* cried <huu>. *Goldwater* responded immediately with <huu, gu> and *Paulo* with <huu>. 14:46. *Paulo* cried <huu> whereupon *Goldwater* cried <huu, gu>, then *Paulo* again <huu>, then *Goldwater* <huu>. These vocal sounds were emitted alternately by the two for a while.

On the second question concerning grooming, we read on page 170 that the male does not necessarily reciprocate the female grooming. There was another case of reciprocative grooming observed in *Diomedes*. As we have studied in detail in Chapter III §3, §4, and §5, the fact that generally the solitary males do not have antisocial tendencies may be proved from some cases in which they look after baby monkeys, or undertake control attacks in the troop.

KAWAI (1964) states that "an interesting question lies in the phase of personality psychology as to what kind of an individual becomes the solitary male." However, there is no data—even if it may be possible to investigate—to prove that there is something common in all the solitary males that discriminates their personality from that of the troop males.

It is held in general that physically many of the solitary males have permanent scars on their bodies. I also share the same impression. Actually, the scars proved a great help in identifying the individuals. This forms one of the bases of the theory that solitary males are those that have been chased out of their troops.

However, on closely examining the male troop monkeys it has been found that there are more individuals than expected that have permanent scars.[28] Out of the 34 solitary males, I could check thoroughly the physiques of 31 and compared permanent scars found in them with those of 28 adult troop males over 6 years old (that is, the total number of the males of the three troops investigated).

Most of the permanent scars were ear lobes severed, followed in less numbers by fingers bent and immovable, damaged mouth and lips. Others included damage done to the eyes and nose, and the toes being unbendable. To avoid confusion I have listed in Table 11 the number and the percentage of the individuals that

Table 11. Comparison of numbers of scarred troop males with those of solitary males.

Age groups	Troop males			Solitary males		
	Individuals observed	scarred individuals	ratio	Individuals observed	scarred individuals	ratio
7	7	0	0 %	2	0	0 %
8-15	17	6	35.3	14	5	35.7
15-25	3	3	100	10	6	60
25-	1	1	100	5	4	80
Total	28	10	35.7	31	15	48.4

28) ITANI et al. (1964) have already made a report on this on the male monkeys of Takasakiyama.

had at least one of these permanent scars.

The list shows evidently that the number of the solitary males with such scars is larger, almost running up to 50%. There is hardly any noticeable difference by age, but it is true that the percentage increases with age.

Breaking it up by age, there is hardly any difference to be seen among the solitary males, but in general we may see among the solitary males a comparatively larger number of individuals with permanent scars than among the troop males. But this is because there are more aged individuals among the solitary males. In other words, the impression that there are more solitary males with permanent scars merely means that there are less aged monkeys among the troop males.

Therefore, the permanent scars had been inflicted upon these individuals before they solitarized, that is, while they were still in the troop, or when they were making attempts to approach the troop or entered the troop and stayed there in the breeding season. It was not the lone lives they led that subjected them to more chances of the infliction of permanent scars.

Thus, solitary males do not differ behaviorally and physically at all from males of a troop.

2) Development and Sociability of Male Monkeys

In Chapter IV § 4, I stated that as the cause of solitarization it is justifiable to recognize "aggregariousness" in males as an instinctive trait that appears in them for the first time when they reach a certain age. We must also consider the idea however that the Japanese male monkeys also have the very opposite attribute since a good number of males also stay on to lead troop lives. This I shall term "centripetal tendency."[29] Reasoning from the fact that there is no fixed breeding season in most of the primates, ZUCKERMAN (1932) asserted that it was sexual attraction that kept the males remaining inside the troop, but his theory was denied on the basis of the fact that despite the presence of a fixed breeding season in the Japanese monkeys there are nevertheless male monkeys that remain in the troop throughout the whole year (IMANISHI 1960a). Since then the problem of finding the cause of "centripetal tendency" of the primates has remained unsolved.

Admitting that these two contradictory inclinations do exist as phenomena, I will trace how they develop in the male monkeys with their growth.

The Japanese male monkey depends entirely on its mother until it is one year old and remains in the central part of the troop. When he reaches the age of about 2.5~3.5, he goes occasionally to play in the peripheral part. By the time he is 3.5 years old he moves out there. This stage of peripheralization is one which almost all the males, with a very few exceptions, pass through. It is not a phenomenon which occurs because the leaders and females attack them as they grow up, but it is a stage they arrive at in the natural course of development.

29) CHANCE (1961) states that it was originally a means of protection against feline predators.

What then does peripheralization mean? IMANISHI (1960b) compares it to the phenomenon of the troop fission of the male deers, and states that "it may be proper to regard the process of solitarization of male monkeys as consisting of not one leap but of two leaps between which there is a period of peripheral life, one when the male leaves for the periphery and one when it leaves the troop....." I also share his view that the males' departure for the periphery is the first stage of solitarization. The age of 3.5 may be considered the age when a sense of solitarization starts making itself evident in males. This may be reasoned from the fact that peripheralization occurs at about the age of 4, though rare, almost simultaneously with solitarization.

Male monkeys around four years old are still prematurely developed, and finding it difficult to shift for themselves, they are obliged to lead temporary lives in the periphery and keep on depending upon the troop. That the peripheral life is the preliminary stage of solitarization is all the more evident when we observe the process of solitarization.

The process of solitarization—young males devoid of stable status in the troop but not yet immediately solitarizing often spend a certain part of their lives in the periphery prior to solitarization relying on the support of the troop, but mature males tend to skip this intermediary stage and solitarize at one step (KAWAI 1964).

According to ITANI (1957), the stage of development of the peripheral after the age of 3.5 is divided into three periods.[30] The first period (3.5~5 years old) is when primary rankings are formed. In the second period (6~7 years old) sexual maturity is reached and primary rankings disintegrate. In the third period (8~11 years old) secondary rankings are formed which is the period when the centripetal tendency appears.

As solitarization occurs most often in the second and the third period, the disintegration of primary rankings and the formation of secondary rankings may be said to be deeply related to solitarization on the social level.

Having been brought down by ranking regulation, 6~7-year-old males may sometimes solitarize as the result of their social ranks, but as far as the observation on the marginal young males of the Takagoyama-I troop was concerned, the impression was that the earlier the individuals became conscious of solitarization the earlier their social ranks dropped at the time of the ranking regulation.

The individuals that do not solitarize although their ranks were lowered by the ranking regulation must have strong centripetal tendencies. We have some cases at Takasakiyama where some of the upper young male class solitarized prematurely in the order of their ranks. The cause may have been due, as MIZUHARA (1957) says, to their having confronted "a deep inaccessible ditch of class discrimination" compelled them to solitarize.

Certainly there must be various other factors on the sociological level that

30) As investigated in the Takasakiyama troop.

work the male toward solitarization, but to give it a thorough analysis data is still insufficient. In addition to the rank system blood relationship must also be an important factor that works on the sociological level.

3) The Solitary Males that Formed the Core of Branch Troops

There are so far ten known cases of troop fission; the first (SUGIYAMA 1960) and the second troop fission at Takasakiyama (KANO 1964), five times of fission at Gagyusan (FURUYA 1960, and unpublished data), the first fission of the Hagachi-A troop (HIDA 1964), the second[31] (HIDA, personal communication, June, 1965), and the first fission at Mt. Hiei (HAZAMA 1964).

It should be noted that in these ten cases of troop fission, three resulting branch troops were formed around the core of solitary males. In 1962, *Yama*, a solitary male of about 15 years old approached the Takasakiyama-A troop and acting as the core formed a branch troop (KANO 1964).

Around 1961, a solitary male called *Hiratemiki*, about 12 years old, formed a branch troop at Hagachi, and in March 1965 three solitary males approached Hagachi from around the end of 1964 to January 1965 and becoming the core formed the second branch troop.[32]

The first sign of a troop fission ordinarily appears in the breeding season (KANO 1964) and females of very low status often participate in it (ITANI et al. 1964). In the breeding season estrous female monkeys usually avoid peripheral and solitary males or otherwise take a tolerant attitude toward the males attacking them. Female monkeys of low status have more chances of copulating with peripheral males and solitary males. The mechanism of troop fission probably lies in the females of higher status.

Solitary males and mature males[33] of the periphery who have a strong and constant inclination toward solitarization have always the possibility of becoming the core of a troop fission. The great significance of the existence of these male monkeys lies in the important task they shoulder of widening the realm of existence, the task to develop the specia.

4) The Way of Existence of the Troops in the Specia of the Japanese Monkeys—the Internal Organization of the Specia

In areas where there are several troops they segregate their nomadic ranges

31) The Hagachi-A troop split again in March, 1965 after my investigation.

32) Roughly, this troop is composed of four adult males, 14 adult females, two 4-year-olds, four 2~3-year-olds, four 1-year-olds and ten newborn babies, in total 38 individuals (HIDA, personal communication).

33) When the first troop fission took place at Takasakiyama two 13-year-old males and one 12-year-old male, in all three males, became the core of the branch troop. At the time of the second fission at Hagachi *Shippo* joined the second branch troop and became its fourth ranking male.

according to the ecological balance of the troop population and the overall food supply. Unless a troop fission occurs, the boundaries of the nomadic ranges remain unchanged.[34] Neither does one part of a troop join another troop. Therefore, contacts among the troops are maintained only by the solitary males.

Solitary males travel over a wide area that far exceeds the extent of the nomadic area of the troops even in the non-breeding season. In this season they generally keep away from the troop. If they do approach the troop members usually behave antagonistically. It is said that when the breeding season begins many solitary males move a long distance with the evident aim of approaching the troop. In this season there is seen a relaxation of the rigid dual structure of the troop consisting of the central part and the peripheral part, and the troop itself comes to take a tolerant attitude toward the solitary males. The extent of tolerance depends on the extent of the sexual drive of each individual. The solitary males approach the troop and some of them enter it. I call this phenomenon breeding participation.

The purpose of breeding participation lies in securing sexual relationship with the troop females, but it is not always necessary for the solitary males to enter the troop for this purpose because estrous female monkeys tend to leave the troop temporarily at times. However, for a continuous sexual relationship with the female monkeys solitary males have to keep themselves in continuous contact with the troop and join it. They participate in the troop at the beginning of the breeding season and leave it at the end.

The breeding season lasts for about four months which is believed sufficient for the solitary males that enter the troop to make various contacts with the troop members.

First of all I will take up the question of sexual activities or the interflow of blood. It is evident that the blood of the solitary males flows into the troop, but to what extent? It is a regret that due to insufficient data available on the question as regards the Takagoyama troops nothing definite can be said. However, it may be permitted to fix some indices and make some tentative assumptions.

First is the comparison of the number of the males in the troop which are able to copulate with that of the solitary males. There were 16 sexually mature males (5 years old and over) in the Takagoyama-I troop, and ten solitary males were capable of copulation with the female monkeys of the troop. The outbreeding ratio is $10/26 \times 100 = 38.4\%$, if it is to be assumed that all these males have equally the same possibility of making the female monkeys pregnant.

Secondly, when we compare the total number of times of consort relationships

34) Ten years have passed since the Takagoyama-III troop was provisionized, but hardly any change has been observed in the boundaries of the nomadic areas, though some parts have decreased in utilization (MIURA, personal communication).

the troop males had with the females with that of the solitary males, the former is 23 times and the latter seven times. The index shows an outbreeding ratio of $7/30 \times 100=23.3\%$.

Thirdly, the number of different females each male had consort relationship with. The index shows 16 females on the part of the troop males and seven on the part of the solitary females. The outbreeding ratio is $7/23\times100=30.4\%$.

The first reasoning is based on the assumption that the probabliity of pregnancy is equal for all the females. Both CARPENTER (1942) experimenting of the rhesus monkeys and TOKUDA (1961) on the Japanese monkeys show in regard to the troop males that the higher their social ranks the more often they have consort relationship and the higher the number of different females they have it with. However, it must be noted in either case that observations may have been made in the open, and that consequently the observers were more drawn to the copulation of the troop males of higher social ranks (refer to Chap. III, § 4).

The second reasoning has its weakness in that it treated in the same manner the case, for instance, of three consort relationship of one male with the same female and the case of three consort relationships which one male had with three different females.

The defect in the third reasoning consists in giving the same value to the two males involves, for instance, in such a case wherein one estrous female, after having had several consort relationships with one male, has another with the other male.

The first and the third index tend to estimate the outbreeding ratio higher than the true ratio and the second index inclines to estimate lower.

Furthermore, none of these indices take into account the tendency of the males of very high social status being capable of having many consort relationships with the females at their height of estrousness where their pregnancy rate is very high (TOKUDA 1961). If this is taken into consideration, the outbreeding ratio would certainly fall much lower.

Solitaries have many opportunities of copulating with female monkeys that are more or less disregarded by the troop males and have become estrous for the first time (refer to Chapter III). This means that there is a good possibility that their first born child has been fathered by a solitary male.

Reasoning in this way, we arrive at the conclusion to regard as justifiable that 20% or thereabout should be the proper figure of the exogamous ratio of the Japanese monkeys as far as what little data available to us on the Takagoyama-I troop allows us to assume. A more correct and clearer picture of the exogamous ratio may be drawn in the near future when more data accumulates from observation. It is not correct to regard the consort relationship of solitary males with troop females as "undoubtedly a rare exception" as TOKUDA (1961) says.

Let us then proceed to the next question—the behavioral propagation through solitary monkeys. The propagation of behavior is a difficult phenomenon to observe

and not a single report has been submitted yet concerning this question.[35] However, suggestive data has been obtained in the Takagoyama area.

(1) In the nomadic ranges of the Takagoyama troops there were many crop fields. But they were never seen to ravage these fields until 1955 when the III troop was provisionized. Several years after the III troop was provisionized in a spot near human dwellings, the troop monkeys started plundering the fields, and with it the fields in the nomadic areas of the IV and the VI troops also began to be pillaged. This was said to be the mischief of not only one monkey (solitary male) but of several monkeys or perhaps more than ten, and probably they were the monkeys (probably the peripheral males) of the IV and the VI troops (MIURA, personal communication). (2) It took a very long time to provisionize the Takagoyama-I and the III troops, five years with the former and three with the latter. In striking contrast it took only 40 days to provisionize the II troop in January, 1963 (MIURA, personal communication).

What is related in (1) is understandable, if we imagine that there was a male in the III troop that acquired the habit of ravaging fields, and after solitarizing and entering the IV and the VI troops in the breeding season his habit propagated among them. That which is described in (2) may be reasoned as follows: A male of the I or the III troop that was accustomed to the presence of human beings solitarized and entered the II troop, as a result of which the troop members learned to be less cautious of men. It could have been the result of improved technique of provisionizing, but then there is too large a difference in the time that was required for the provisionizing. The phenomenon described in (2) has also been reported by HAZAMA (1965) when he provisionized monkey troops at Mt. Hiei.

The positions of the monkey troops in the specia of the Japanese monkeys become clear in this way. Monkey troops live in separate nomadic areas and do not mingle with other troops but the solitary males that spring from the troops cover a wide area of activity, paying no attention to nomadic border lines and especially in the breeding season keep contacts with other monkey troops, and some even enter the troop altogether. In this way is maintained the specific integration of the Japanese monkeys, both morphologically and behaviorally. The troop is by no means unit that is sexually isolated and detached within the specia.

A group of females is a basic population which has a connection with the range and a certain number of males join them, and other males solitarize, move freely around in the specia, and approach other troops in the breeding season. Is this not the form of the monkey troop in the specia?

It is true that this reasoning still remains a hypothesis, but it is quite possible that the number of the solitary males in the Takagoyama area far exceeds that of

35) ITANI (1958) pointed this out previously and remarked on its difficulty, but simultaneously he asserted the need to give more rating to its possibility.

the mature males in the troop.[36]

It is said that monkeys in Japan have no natural enemies at present except human beings. Their ecological niche must be taken into consideration and I am of opinion that sooner or later a long term observation will do it.

Lastly, I will take up the question—why is it that, despite so many solitary males being found in the Takagoyama area, only such a small number have been found in other fields so far investigated?

There were only two solitary males identified when the population of the Takasakiyama troop was 220. There were only two solitary males identified at Yugawara, three at Hagachi, and not a single one at Gagyusan in the breeding season of 1965. On the other hand, four solitary males were identified in the neighboring Taishakukyo troop despite its small size of only 29 individuals. There is in Table 12 a comparison of the number of the solitary males that appeared in one breeding season in an isolated troop and in a non-isolated troop.

Table 12. The number of solitary males that had relations to the troop in the breeding season.

Troop	Troop size	No. of neighboring troops	No. of solitary males	Source
Takagoyama-I	158	6	10	see Chap. III
Takagoyama-III	72	6	7	see Chap. III
Taishakukyo-A	29	2	4	MIZUHARA (1957)
Geographically isolated troop				
Takasakiyama	ca. 220	0	2	ITANI (1954)
Yugawara	ca. 70	0	2	UESAWA (pers. comm. 1965)
Hagachi	110	0*	3	see Chap. III
Gagyusan		0*	0	FURUYA (pers. comm. 1965)

* except for the branch troop.

Why is it that only a small number of solitary males were found with an isolated monkey troop, while many were found with a non-isolated troop? The question is easily answered if we reason that solitarization takes place not biologically aimlessly, not as the result of social ostracizing but on the basis of aggregariousness aimed at approaching other monkey troops. (Aggregariousness has a survival value.)

At Takasakiyama there is no other monkey troop within the radius of at least 20 km. The male monkeys there solitarize to a far distance and there is little possibility of solitary males from other monkey troops appearing in Takasakiyama. In other words, the solitary males in Takasakiyama are "excessively exported" and

36) The total number of the male monkeys over 6 years old in the I and III troops is 19, while that of the solitary males identified totals 30.

"too little imported."

In the Takagoyama area there are more than seven wild monkey troops that exist in adjoining areas. The male monkeys that solitarize do not have to leave the Takagoyama area[37] but can make their selection out of the three adjoining monkey troops to make approaches to in the breeding season. That is, the "import and export" of the solitary males is well-balanced. This may be why there are so many solitary males to be found in this vicinity in much greater numbers than are never seen in Takasakiyama and in other isolated troops. Here in the Takagoyama area the solitary male monkeys are "accumulated."

At present the specia of the Japanese monkeys is partitioned by the onflow of human civilization, but this is a state that was brought about artificially. It is by no means its real and natural state. At such places where monkey troops are isolated and the topography offers little opportunity of exchange of solitary males with other monkey troops, the inbreeding ratio is increasingly large and with it recessive characteristics of the troop members become evident.

The monkey troops of Takasakiyama, Koshima, Hagachi, Arashiyama, and Gagyusan are isolated units in varying degrees with little interchange of solitary males. In these troops are found quite a few individuals with physical deformations, albinism of the limbs, and other degenerate physical characteristics.[38]

On the other hand at Takagoyama no evidence was found of individuals with albinism of the limbs or other physical deformations either in the I troop or the III troop.[39] No such individuals are known to exist in Taishakukyo.

Whether physical deformation and albinism of the limbs, etc. are hereditary still remains a question unsolved but the possibility is large because in the Hagachi troop there was a pair of monkeys, apparently a mother and child, both with noticeable albinism in the same spot of the left hand.

Isolated troops cannot be regarded as representative of a healthy specia of the Japanese monkeys.

5) Solitary Males in Phylogenetical Perspective

Hardly any detailed report has yet been made on primate species except that

37) Of course, some of them may approach the wild monkey troops in the Motokiyosumi-yama area.

38) At Koshima a few individuals were found with albinism of the limbs. There was one 10-year-old underdeveloped male with a very slow moving gait (investigated by the writer in August, 1963). As regards Takasakiyama, refer to ITANI et al., 1964. At Hagachi five deformed individuals and more than six with albinism in the limbs were found. At Gagyusan the population census carried out on May 27-29, 1963 by FURUYA (personal communication) revealed the existence of 14 individuals—ten males and four females—with deformed limbs (fingers missing or stuck together). At Arashiyama at least five deformed individuals were found (KOYAMA, personal communication).

39) There was one individual found in the III troop with albinism in a part of the body hair. It was a 4.5-year-old female.

on the Japanese monkeys, but a general knowledge has been gained on many other species. In the following are the principal ones.

On the lemurs we have the study of J.J. PETTER (1962) and the review of F. BOURLIÉRE (1963) based on PETTER's investigation. The *Lemur macaco*, the most non-specialized and generalized species, morphologically and ecologically, of the Madagascar lemurs lead lives in small diurnal groups composed of 4 to 15 individuals. Curiously, the number of the females of the troop is almost always less than that of the males. There were also found one solitary male and one solitary female.

The socionomic sex ratio of the howler monkey (*Alouatta palliata*) is 50% and half of the males are presumably solitary males (CARPENTER 1934).

The spider monkeys (*Ateles geoffroyi*) form subgroups. There have been found small groups consisting only of a few males and males living lone lives (CARPENTER 1935).

With red-tailed monkeys (*Cercopithecus ascanius*), about 10% of the total number of the individuals are solitary males (HADDOW 1952).

With langurs, a detailed investigation has been made on the hanuman langur (*Presbytis entellus*) (SUGIYAMA 1964; SUGIYAMA et al. 1965). The unit of the hanuman langur is a one-male troop[40] and as the term "bisexual troop" implies, the socionomic sex ratio of the one-male troop is very small and an overwhelming majority of the males live outside the troop. Groups have been found consisting of males only. SUGIYAMA found five such groups consisting respectively of 2, 7, 10, 11, and 32 individuals. These groups sometimes got together to form larger groups. There was once found a big male group of 59 individuals (SUGIYAMA). Such male groups are therefore unstable and may be subdivided in any way. The life of solitary males is merely regarded as a temporary way of life of male group members. The male group is made up of individuals in various stages of development, the mature male, the young adult male, and the male infant. A mature male of the male group invades a bisexual troop and becomes its leader after having chased his predecessor out. Such cases are not rare and have led SUGIYAMA to conclude that "the majority of the males exist as a stockpile of the troop males."

As regards the apes there has been confirmed the existence of not only solitary males but also solitary females among the gibbons (CARPENTER 1940), chimpanzees (GOODALL 1964), and gorillas (SCHALLER 1963). It shows that the set-up of the ape society is becoming substantially different from that of the monkey society.

SCHALLER reports that the lone gorilla male sometimes lives as far as 20 or more miles away from his troop and that he actually found such an individual that lived all by itself for 12 months. The lone males extend in age over a wide range from the small black-back male, the adult silver-back male to the senile silver-back male. Lone males approach troops and sometimes live in temporarily, but they are said to select the troop by weighing the temperament of the dominant male of

40) cf. KUMMER & KURT, 1963.

the troop. One case was observed of a grouping that was made up of only two lone males (a silver-back male and a black-back male).

No permanent chimpanzee troops were discovered nor was the social structure made known, but the 350 cases GOODALL observed show that 48% of such groupings was made up from a one-male group, which suggests what little difference there is in the structure of the chimpanzee society to the gorilla society.

A neighborhood relationship serves as a tie among various chimpanzee groups and gorilla groups (IMANISHI 1960b) and it is assumed that the lone males occupy appropriate positions in the specia.

The fact that solitary males are found in this way in all the stages of development of the primates proves that their existence is indispensable to troop life. A troop is advantageous in being able to protect itself collectively from enemies and provide ways and means of breeding, but there always exists the danger of intra-troop marriage.

We find the presence of solitary females in apes, but unlike the males it is only a temporary phenomenon. It means that the solitary life is the proper way of life for the males in all the developmental stages of the primates, and suggests that a study of dimorphism on the physiological level may offer a solution to the understanding of the mechanism of solitarization.[41]

The outbreeding ratio of the Japanese monkeys is estimated to be 20-25% (refer to Chap. V, § 4). When the solitary langur male attacks a troop, chases the leader out, and assumes in turn the leadership, the outbreeding ratio will become 100%. The one-male group, in this connection, is more effective than the large macaque type troop. Among the apes a very efficient outbreeding process through a highly psychological means of communication may exist without passing through such a drastic process as we have observed in the langur.

So far many different terms have been used to represent the solitary male.

CARPENTER (1942) used such terms as "extra-troop male," "solitary," "excess male," "isolates," etc. SCHALLER (1963) and GOODALL (1964) made use of the term "lone male" while HALL et al. (1965) employed the word "isolated adult male."

I do not think it proper, from what I have so far related, to term the solitary male as an individual that resulted out of quarrels among monkeys. The terms "solitary male" or "lone male" should be used. The term "wanderer" may be all the more proper.

In social relationship the position and way of behavior of the solitary males may vary according to the species they belong to, but what they have in common in the

41) When a male in a cattle herd, sheep flock, and other nomadic troops is castrated, he is found not to solitarize. Nomadic tribes have adopted this very effective means to control their cattle herds (UMESAO 1965). There is a need to operate on and castrate the males of primate troops in the same way and see what influence it may have on the phenomenon of solitarization.

process of the social development of the primates is the role of shouldering the continuous work of specific integration.

SUMMARY

1. In the Japanese monkey solitary or lone male monkeys are commonly the adult males that do not lead a troop life but a lone life.

2. In the non-breeding season they avoid the troop and the troop acts antagonistically toward them.

3. They usually move about alone but it is not rare to see them moving about in an unit of two or three.

4. They travel an extensive territory that far exceeds the boundaries of the nomadic range of the troop. They have been seen to travel a distance of 20-30 km.

5. By elaborate behavioral communications solitary males often prevent occurrences of fights among themselves.

6. Immediately before the breeding season many solitary males leave their abode of the non-breeding season, and travel far to approach monkey troops to have consort relations with the troop females.

7. The troop shows little antagonistic behavior toward them in this season.

8. The social status of the solitary males that have completely settled inside a monkey troop is low. It equals more or less the social status the 6~7-year-old males occupy in the troop.

9. Compared with the male monkeys of the troop they cannot be regarded as specially antisocial.

10. They usually leave the troop when the breeding season ends.

11. A far larger number of solitary males than mature troop males has been found at Takagoyama, and this shows that their solitary life is the normal way of existence of the Japanese male monkeys.

12. Solitarization is an instinctive nature that appears in mature males of the Japanese monkey and occurs in the age group of 5 to 15 years old, the age of 7 being the maximum point.

13. Solitarization occurs most frequently from the mid-delivery season to the period immediately prior to the breeding season, which suggests its cause to lie in the social construction and the hormonal rhythm of the Japanese monkeys.

14. Judging from the process of development of the Japanese male monkeys, the ranking order seems to work as the mechanism of solitarization on a social level.

15. They travel about in the specia of the Japanese monkeys and behaviorally and morphologically preserve the uniformity of the species. Thus inbreeding is prevented in the monkey troop. The Japanese monkey troop society is not a closed system.

REFERENCES

BOURLIÉRE, F., 1961. Patterns of social grouping among wild primates. *Social Life of Early Man* (S.L. WASHBURN ed.).

CARPENTER, C.R., 1934. A field study of the behavior and social relations of howling monkeys. *Comp. Psychol. Monogr.* 10(2): 1-168.

————, 1935. Behavior of red spider monkeys in Panama. *Jour. Mammal.* 16: 171-180.

————, 1940. A field study in Siam of the behavior and social relations of the gibbon (*Hylobates lar*). *Comp. Psychol. Monogr.* 16(5): 1-212.

————, 1942a. Sexual behavior of free ranging rhesus monkeys (*Macaca mulatta*). II. Periodicity of estrus, homosexual, autoerotic and non-conformist behavior. *Jour. Comp. Psychol.* 33: 143-162.

————, 1942b. *Societies of monkeys and apes in primate social behavior* (SOUTHWICK ed.).

CHANCE, M.R.A., 1961. The mature and special features of the instinctive social bond of primates. *Social Life of Early Man* (WASHBURN ed.).

————, 1963. The social bond of the primates. *Primates* 4(4): 1-22.

FURUYA, Y., 1960. An example of fission of a natural troop of Japanese monkeys. *Primates* 2(2): 149-180.

GOODALL, J.M., 1964. *The chimpanzee.* (unpublished)

HADDOW, A.J., 1952. Field and laboratory studies on an African monkey, *Cercopithecus ascanius schmidti* MATCHIE. *Proc. Zool. Soc. Lond.* 122: 297-394.

HAZAMA, N., 1964. Weighing wild Japanese monkeys in Arashiyama. *Primates* 5(3-4): 81-104.

————, 1965. Wild Japanese monkeys in Hieizan. (Mimeograph)

HALL, K.R.L., R.C. BOELKINS, & M.J., GOSWELL, 1965. Behavior of patas monkeys *Erythrocebus patas* in captivity with notes on the natural habitat. *Folia Primat.* 3: 22-49.

HIDA, Y., 1964. Yohei's Diary. Zitsugyo-no-nipponsha, Tokyo. (in Japanese)

IMANISHI, K., 1949. Social life of semi-wild horses. *Group and Environment of Organisms.* Iwanami-Shoten. (in Japanese)

————, 1957a. The standpoint of the primates research group. *Shizen* 12(2): 3-9. (in Japanese)

————, 1957b. Learned behavior of Japanese monkeys. *Jap. J. Ethnol.* 21: 185-189.

————, 1960a. Social organization of subhuman primates in their natural habitat. *Cur. Anthrop.* 1(5-6): 393-407.

————, 1960b. The origin of human family. *Jap. J. Ecol.* 25: 119-130. (in Japanese)

————, 1964. The individual in the society of Japanese monkeys. *Japan Quarterly* 11(4): 293-360.

ITANI, J., 1954. Japanese monkeys in Takasakiyama. *Nihon-Dobutsuki II* (K. IMANISHI ed.). (in Japanese)

————, 1956. Solitary males in the Japanese monkey society. (Lecture at the Zoological Society of Nippon held in Kanazawa, Oct. 1956)

————, 1957. The personality of Japanese monkeys. *Iden* 11(1): 29-33. (in Japanese)

————, 1958. On the acquisition and propagation of new food habits in a natural group of Japanese monkeys at Takasakiyama. *Primates* 1(2): 84-98. (in Japanese)

————, 1959. Paternal care in the wild Japanese monkey, *Macaca fuscata fuscata. Primates* 2(1): 61-93.

———, 1960. Life and society of the anthropoid. *Life of Mankind* (S. IZUMI ed.), pp. 27-71.
———, 1963. Vocal communication of the wild Japanese monkey. *Primates* 4(2): 11-66.
———, et al. 1964. The social construction of natural troop of Japanese monkeys in Takasakiyama. *Primates* 4(3): 1-42.
KANO, K., 1964. The second fission of the natural troop of Japanese monkeys in Takasakiyama. *Wild Japanese Monkeys in Takasakiyama*, pp. 42-73. (in Japanese)
KAWAI, M., 1964. *Ecology of Japanese monkeys*. Kawade-Shobo, Tokyo. (in Japanese)
KAWAMURA, S., J. ITANI, & K. TOKUDA, 1955. An ecological study of wild Japanese monkeys (*M. fuscata*) in Takagoyama, Chiba. *Bull. of Cultural Assets of Chiba Pref.* 1. (in Japanese)
TOKUDA, K., 1955. The inter-group relationship of wild Japanese monkeys (*Macaca fuscata*). *Bull. of Cultural Assets of Chiba Pref.* 1.
KAWAI, M., 1956. Social organization of the natural group of Japanese Macaque—The case of the Minoo-B group—. *Jap. J. Ecol.* 6(2): 45-50. (in Japanese)
KAWAMURA, S., 1959. Individuality in the social behavior of mammals. *Societies and Individuals in Animals*. (K. IMANISHI ed.). (in Japanese)
———, 1965. Pre-culture among Japanese macaques. *Monkeys and Apes* (S. KAWAMURA & J. ITANI ed.). pp. 237-289. (in Japanese)
KUMMER, H. & F. KURT, 1963. Social units of a free-ranging population of hamadryas baboons. *Folia Primat.* 1: 4-19.
MIZUHARA, H., 1957. Japanese Monkeys. Sanichi-Shobo. (in Japanese)
———, 1965. Status organization of wild *Japanese monkeys* at Takasakiyama. *Monkeys and Apes* (S. KAWAMURA & J. ITANI ed.).
NUMATA, S., K. IDA, & H. YAMAI, 1955. The vegetation around Takagoyama. *Bull. of Cultural Assets of Chiba Pref.* 1. (in Japanese)
PETTER, J.J., 1962. Ecological and behavioral studies of Madagascar lemurs in the field. *The Relatives of Man* (J. BUETTNER-JANUSCH ed.). *Annals N.Y. Acad. Sci.* 102, ART 2.
SCHALLER, G.B., 1963. *The Mountain Gorilla; Ecology and Behavior*. The Univ. of Chicago Press.
SUGIYAMA, Y., 1960. On the division of a natural troop of Japanese monkeys at Takasakiyama. *Primates* 2(2): 109-148.
———, 1964. Short report on the social life of hanuman langurs (*Presbytis entellus*). *Physiol. & Ecol.* 12(1-2). (in Japanese)
———, K. YOSHIBA, & M.D. PARTHASARATHY, 1965. Home range, breeding season, male group, and inter-troop relations of hanuman langurs (*Presbytis entellus*). (in press) (in Japannese)
TOKUDA, K., 1961. A study on the sexual behaviors in the Japanese monkey troop. *Primates* 3(2): 1-40.
UMESAO, T., 1965. The hunting and nomadic world—the evolution of natural society. *Shiso* No. 490.
WADA, K., 1964. Some observations on the life of monkeys in a snowy district of Japan. *Physiol. & Ecol.* 12(1-2).
YANAGIDA, K., 1939. *An Essay on Lone Males*. (Koen-zuihitsu) Sogen-sha. (in Japanese)
ZUCKERMAN, S., 1932. *The Societies of Monkeys, Apes and Man*.

[Received Feb. 11, 1966]