

**SOCIAL BEHAVIOR
OF
THE COLLARED PECCARY (*Tayassu tajacu*)
IN CAPTIVITY**

By

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COMPENDIO

Se estudió el comportamiento social de catorce pecaris (*Tayassu tajacu*) en cautiverio en el zoológico de Brookfield Illinois, durante doscientas horas de observación. Se describen las varias clases de comportamiento social entre los miembros de una manada de pecari y se hace especial énfasis en detallar la relación de las distintas clases del "frotamiento" aquí descritas con la edad y sexo de los miembros de la manada y su papel en la estructuración social de la misma. Se discuten diez tipos de comportamiento social observados durante el mismo periodo. Este estudio se realizó como parte del Animal Behavior Program de la Chicago Zoological Society. El presente trabajo es un resumen del reporte original presentado en agosto de 1974 a la Chicago Zoological Society, Chicago Illinois.

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OBJECTIVES

The objectives of my investigation were:

- 1.—Open the road in Honduras to the understanding of the biology of animals, a road which will aid all the social strata of the country in understanding the correct form of using the natural richness which our country still possesses.
- 2.—Motivate the government of the country to formulate and enforce laws which protect our natural resources, for it is these resources which can help change Honduras from an underdeveloped to a developed country.
- 3.—Give a copy of this work to the authorities of the University of Honduras so that they will support scientific investigations, museums, herbariums, expeditions and expositions of the biology department.
- 4.—Motivate the students and professors of the Biology Department to study the behavior of animals of Honduras the majority of which are unknown to the Hondurans themselves due to the lack of zoos, museums, etc.
- 5.—Support the project of creating a zoo in Honduras with fauna of Honduras.

ACKNOWLEDGEMENTS

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Brookfield Zoo – August 1974.

INTRODUCTION

1.—PHYSICAL CHARACTERISTICS

The adult are grey with each bristle composed of black and white alternating rings. The dark band of bristles is raised when the animal is startled or when he is playing, fighting or running. The young are born with this capacity. Both the young and adult posses a yellowish band which extends from the throat to the shoulders.

A striking characteristic of the peccary is the musk gland situated about 7" above the base of the tail; with a diameter of 7.4 cm; this zone lacks bristles but is covered with the long bristles of adjacente regions.

Various functions have been proposed for the gland including:

- 1) Marking of the territor, Sows (1969); the individuals expose the gland by raising the covering bristles and deposit the secretions on rocks and trees with sideways and up and down movement.
- 2) Individual recognition; accompanied by mutual rubbing with the head of the gland of the neighbor, Neal (1959).
- 3) Prevention of eye infections: the mutual rubbing prevents the accumulation of dirt in the lacrimal region.
- 4) Prevent the loss of members of the band when the band is fleeing; the peccaries run with the gland exposed so that members who lag behind can follow the trail of odor left by the other members of the band.

2.—TERRITORY

The collared peccary is a social animal living in groups of from 5 to 15 or more individuals; the band is nomadic within a territory which varies in size from 0.5 to 1 square mile, Schweinsburg (1971). There is generally more than one band in a region each with its own territory. There may be zones of overlap from 100 to 200 yards but these common zones are only used by one band at a time. The size of the territory and

the number of bands in a region depends on the overall density of peccaries in the region.

Each territory consists of a central zone used exclusively by the members of the band, and the border areas which are also used by members of an adjacent band. The defense of the territory does not seem to be as in other species, but there have been reports of interband aggression in the border areas. According to Schweinsburg (1971), each band has place within the territory which are preferred; these preferred regions vary according to the season. For example, in summer a preferred area might be a cool area near a stream.

The resting zones are marked by rubbing the musk gland against rocks and trees. The peccary uses the same defecation site each time he returns to the resting zone. These defecation zones may be in protected areas or in exposed regions.

3.—FOOD

Various authors classify peccaries as omnivores; they feed mainly on vegetable product including fruits, roots, bulbs leaves and grain. Starken (1959) reports that damage to corn fields is not rare. In addition they may supplement their diet with bird and turtle eggs, insects, worms and small rodents.

Farmer (1970) reports that, as in the suidae, peccaries eat serpents and appear to be immune to their venom.

4.—THE BAND AND SOLITARY INDIVIDUALS

During the feeding time the peccaries are dispersed emitting a characteristic call. When the foliage is dense the calls are answered and if the call is not answered the sender emits a longer and louder call. The composition of band in the wild has not been studied intensively.

The sudden encounter with another animal precipitates the flight of the band in the opposite direction. A strange noise elicits a series of "woofs" and the retreat of the band. These sudden retreats often result in the loss of a member of the band for a period of several days. A lost member is seen sniffing the air and the vegetation for traces of the musk left by the retreating band.

There is generally no interacting between bands, but cases have been reported where individuals change bands and may or may not return to their original group.

The solitary individuals are generally old males, and sick or wounded individuals which can not keep up with the group. According to Schweinsburg (1971), members are not expelled from the group. But Farmer (1970), reports several cases in the Jersey Zoo of an individual being expelled from the group. The expelled individual eats and sleeps alone and seldom rejoins the group.

5.—REPRODUCTION

The peccary can reproduce throughout the year. The groups inhabiting desert regions in the Southwest U.S. and northern Mexico have the majority of their young in June, July and August, with the peak in August. During these months there is more rainfall with a consequent increase in the scant Vegetation. Gestation periods have been reported of 96, 112, 116, 120, and 145 days. Pairing takes place during January, February, and March, Sowls (1961), Sowls (1965).

Female generally gives to twins but births of 1, 3 and 4 are not uncommon.

The sex ratio tends to favor the females. Sowls found that in 1162 deaths of peccaries between 1956 and 1963, 510/o were females and 490/o males. Females reach reproductive age between 40 and 70 weeks, an age in which they are still growing, and the males develop feasible sperm at an age of 46 to 47 weeks, Sowls (1966). Estrus last from 3.5 to 4.8 days and occurs every 22.6 to 24.6 days. Post partum estrus has been reported, Sowls (1966), Sowls (1965). Fighting between males for a female is not common.

The new born weigh less than 2 pounds and is capable of following the mother a few hours after birth. In less than two days they are equipped with two pairs of canines and are aggressive from this age onward. At the age of one month they begin to eat solid food.

Walker,(1956) reports that in the wild weaning occurs

between 2 and 3 months during which time they remain with the mother. The maternal bonds do not appear to be very strong. When startled, the mother abandons the young and does not return in less than two hours.

6.—SICKNESS AND PARASITES

The peccary suffers infections caused by wounds inflicted by other peccaries or by dogs. The eyes are frequent sites of infection. External parasites include fleas, ticks, and flies while internal parasites include cestodes *Moneszia benedeni*, Alicata (1932); *Balantidium* sp., Jacobson (1941), and nematodes, Schwarte and Alicata (1933). A lack of vitamins and a diet deficient in proteins causes abnormalities in estrus, degeneration of the blastocist, abortion and resorption of embryos.

7.—SENSE ORGANS

Among vision, olfaction, and hearing, vision is the least developed in the peccary. The eyes are small as in the visual field. Olfaction is the most developed and is used to find roots and bulbs at a depth of more than one foot.

8.—ENEMIES

The bands of peccaries prefer to run in the presence of danger or a strange noise. Predators include the wild cat, jaguar, coyote, ocelot and mountain lion. They prey on young peccaries which have become isolated from the group in order to prevent an encounter with an adult peccary.

9.—DIFFERENCES BETWEEN THE FAMILIES SUIDAE AND TAYASSUIDAE

In spite of the great similarity of appearance of the peccary and the pig, the peccary is not a pig nor does it pertain to the family Suidae. The taxonomists have found several characteristics which distinguish the two.

Fifty million years ago in the period Eocene of the era Cenozoic the pig and the peccary had a common ancestor. From this common ancestor one branch gave rise to the wild pigs and the other to the peccary. The pigs evolved in the old world and

the peccaries in the new world. Fossils of the extinct peccary **Platygonus** have been found in the United States of Mexico.

In contrast to the Suidae the peccaries do not have a visible tail, and possess only a rudiment of two inches. The fourth metacarpus and the second metatarsus are more developed than in the pigs. The metatarsi are united to form one bone, a structure considered more advanced from an evolutionary point of view. These changes in the foot result in the fact that peccaries have 4 toes on the front and 3 toes on the hind foot, walking on the third and fourth.

The old world pig possess 44 teeth and the peccary 38, having lost one pair of upper incisors and one pair of first premolars in both the maxila and the mandible. The canines are well developed in both families, but are larger in the wild pig than in the peccary. In the peccary, the canines are straight and pointed; each canines is a triangle in cross sections with the three borders sharply defined. The lower canine is longer than the upper and sharpens the upper. In the wild pig the upper canines curved upwards and are larger than the lower canines. The lower canine of the peccaries measures 3 1/2 inches from the root while the upper canines of the wild pig of Europe measures 9 1/2 inches.

Other differences are found in the digestive tract. The pig has a simple stomach and possess a bile gland while the peccary has a three — chambered stomach and lacks a bile gland.

PRESENTATION

The band of peccaries studied lives in a corral (Map 1), in the Chicago Zoological Park, Chicago Illinois. The ground is hard and without vegetation, with one area kept muddy.

The group consisted of 14 peccaries, 6 males and 8 females. The order of presentation does not correspond exactly with the dominance hierarchy but with the age of the animals; figure A — show the nasal disc used in the identification of the individual.

G—Glen: Oldest male of the group with an age of more than 10 years. He is differentiated from the rest by his grey head and robust body. He moves slowly. In the morning when they are called to eat he is the last to arrive and is always the last to flee when the group is alarmed. Glen is the most tolerant with the juvenils, letting them eat at his side and take the food from his mouth. "Glen" comes when his name is called.

B—Becky: Adult female of approximately 10 years. She is the smallest of the adults and contrary to "Glen", is the first to arrive at the food and is intolerant of juvenils when feeding. Three of the group are her sons and daughters. She is easy to recognize by her small size, light color and her long thin face. She also comes when called.

C—Che: A female a little older than becky but with a body as robust as Glen's. She is the mother of two of the peccaries and the gran-mother of three all of which are present in the group.

♂—C Camilo: Adult male, son of "♀C" (Clara), more than one year old.

♀ H—Honduras: Adult female of approximately 10 years of age. She has no offspring present in the group and her last one was born dead. She can be distinguished by the spot in her nasal disc and by her walk. Her canines are well developed.

♀ C—Clara: Young female of approximately 5 years of age. She

is the mother of three males in the group. She can be distinguished by the spot on her nasal disc. Her canines are well developed.

- 4—Regina: Sub-adult female, daughter of “♀C”, 1 year 2 months old, no offspring. She has a small body and her canines are not well developed.
- 3—Roatan: Sub-adult female, less than a year old (between 8 and 12 months), origin unknown. She is smaller than “4” and has no offspring.
- 2—Norma: Sub-adult female, 8 months old. She is smaller than “3”. Her parents are unknown.
- 1—Hugo: Son of Becky, 7 months old. His twin died of liver parasites. His canines are small (less than 1 cm).
- F—Fito: Juvenile son of “♀C”, 6 months old. Canines small (less than 1 cm).
- P—Paco: Juvenile male, twin of “F”.
- bl—Lempira: Son of “Becky”, 4 months old. Small pointed canines, without spot on the nasal disc.
- bs—Tita: Twin sister of “bl”, without spot on the nasal disc.

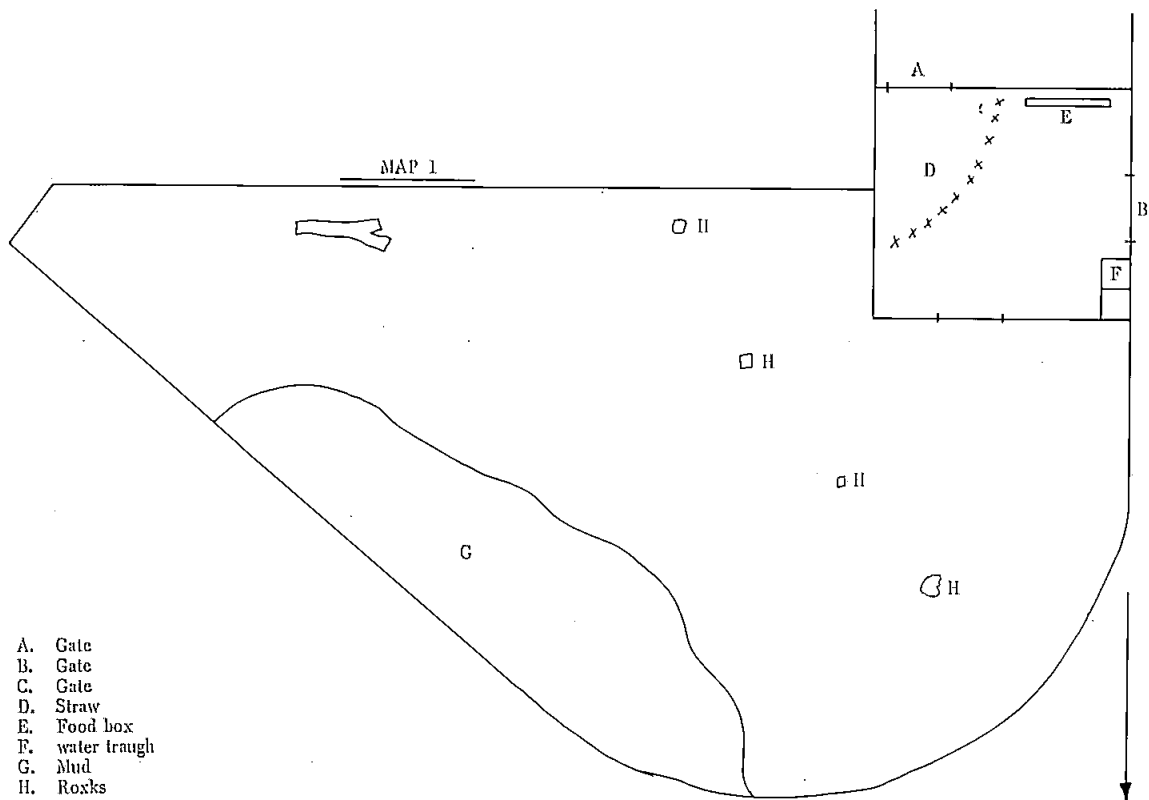
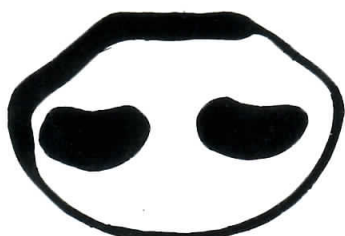


FIGURE A

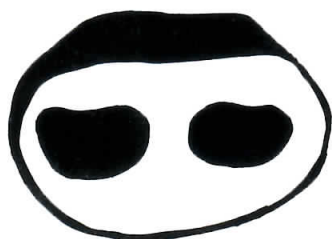
Nasal disc with the different spot patterns used in identification of the individual peccaries, the letters before the names are the codes used in the paper to denote the individuals.



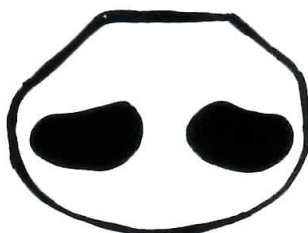
G - Glen



B - Becky



♀ H - Honduras



C - Che



♀ C - Clara



♂ C - Camilo



4 — Regina



3 — Roatan



2 — Norma



1 — Hugo



P — Paco



F — Fito



bl — Lempira



bs — Tita

METHODS

The observation period lasted from June 12, 1974 to August 24, 1974 with 200 hours of observation during all hours of the day and night with a concentration between 8 and 10 AM and 4 and 6 PM. The first week the different classes of behavior were noted and later the frequency and duration of each behavior were also recorded. Individuals (except adults) were marked with paint which the zoo possesses for this purpose.

Statistical analysis were run on the behavior for which the frequency permitted. The statistical method used was chi square with the expected calculated using the law of probability (such that the number of individual doing a certain behavior pattern can be more or less than the number of individual receiving the behavior pattern). The data were significantly different if the difference between the observed and the expected was greater or equal to three times the square root of the expected: (Taken from R. J. Andrew Normal and Irrelevant Toilet Behavior in *Emberiza* sp.; The British Journal of Animal Behavior, Vol. IV, 3, 1972).

RESULTS

Social behavior includes those interactions between two or more members of the same group. In 200 hours of observation I observed 10 different types of social behavior:

- 1.—Rubbing
- 2.—Play
- 3.—Attack
- 4.—Sniffing another member
- 5.—Nose rubbing
- 6.—Placing the head between the legs of another
- 7.—Mud bathing
- 8.—Sexual Behavior
- 9.—Intervention in attacks
- 10.—Gnashing of the teeth

1) RUBBING: Neal (1959) a), Schweinsburg (1969), Schweinsburg and Sowls (1972). This behavior has been described by various authors and basically the same elements are observed in the field and in captivity. The rubbing defined by these authors is my "normal rubbing" from which are derived four other types depending on the position of the individuals and the place in which the gland is rubbed. To facilitate statistical analysis I have divided normal rubbing into four classes.

Normal rubbing: a) Ignored rubbing
b) Late rubbing
c) Material rubbing
d) Out-of-place rubbing
e) Abnormal rubbing in a sitting position.

Normal Drawing rubbing: in this typical rubbing the individuals stand with their sides touching facing in opposite directions; the side of the head is rubbed on the musk gland of the neighbor with up-and-down movements. Each participant exposes his gland by raising the bristles covering it, (see drawing No. 2), Fotos No. 1 illustrate normal rubbing between adults; before rubbing with the head there may be stimulation of the gland by several slight pressures with the nasal disc (see drawing No. 3). After the rubbing which consists of from 1 to 20 movements of lasting from 1 to 20 or more seconds, the two participants may end with a sniff of the gland or the anal region

followed by the separation of the two individuals. The two peccaries may begin rubbing at the same time and the movements may or may not be synchronized. Either participant may end the rubbing at which time the other may stop or make two or three more movements.

a) **Ignored rubbing:** in this variation one member does not respond to the rubbing initiated by the other member. The non-responding member may remain passive or may respond with sniff at the anal region or at the gland (drawing No.4).

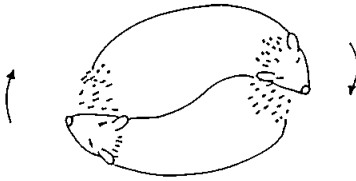
b) **Late rubbing:** in this variation one member does not respond immediately but begins rubbing a little later. In photo No. 4 the peccary in the foreground initiated the rubbing and in photo No. 5, taken seconds later, the second peccary responds to the rubbing.

c) **Material rubbing:** in the wild and in captivity peccaries have been seen rubbing the gland against inanimate objects such as rocks and trees; in my group the peccaries were observed rubbing the gland against the bars of the corral, the brick wall and gate A. In this rubbing the peccary lowers his hind quarters, bending his back legs and arching his back to reach the desired rubbing object; circular rubbing movement are performed, (see drawing No. 5).

d) **Out-of-Place rubbing:** this is the most infrequent type of rubbing. The position of the body and the lateral movement are the same as in material rubbing but in place of a rock or tree trunk, the body of another peccary is used (see drawing No. 6).

e) **Abnormal rubbing in a sitting position:** the active participant is standing while the passive member is seated, (see drawing No. 7).

FIGURES 8



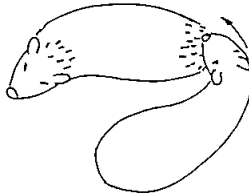
Drawing No. 1

Peccaries seen from above, rotation, Normal Rubbing.



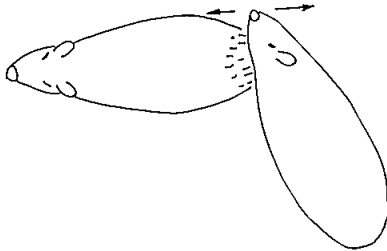
Drawing No. 2

View from behind exposing the gland by raising the bristles.



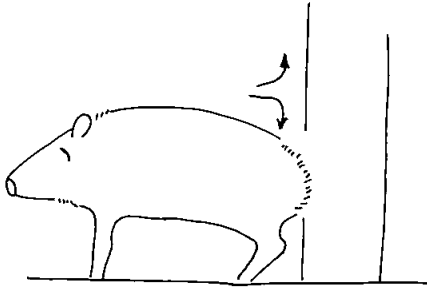
Drawing No. 3

Peccaries seen from above. Stimulation of the gland prior to rubbing.



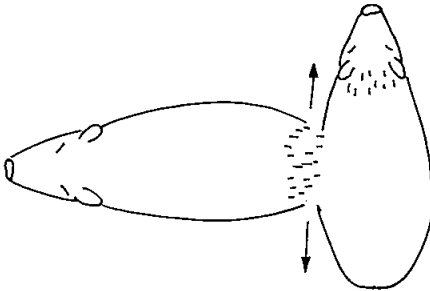
Drawing No. 4

Peccaries seen from above, both standing, Ignored rubbings.



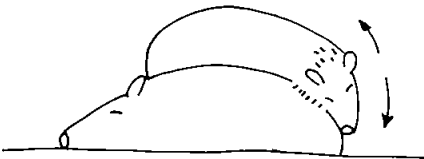
Drawing No. 5

Side view Material rubbing.



Drawing No. 6

Peccaries seen from above, both standing out-of-place rubbing.



Drawing No. 7

Side view abnormal rubbing in a sitting position.

RESULTS AND DISCUSSION OF THE RUBBING DATA

This discussion center on those types of rubbing for which there were data sufficient to perform statistical analysis; there include: a) Normal rubbing (beginning simultaneously, both rubbing); b) Late rubbing (non-simultaneous beginning, both rubbing); c) Ignored rubbing (only one individual rubs).

Of these three types of rubbing here discussed, 34o/o of the total corresponded to Normal rubbing, 39o/o to Late rubbing, and 26o/o to Ignored rubbing.

RESULTS OF THE DATA FROM NORMAL RUBBING (BEGINNING SIMULTANEOUSLY, BOTH PARTICIPANTS RUBBING).

FIGURE 1

	A ♂	A ♀	Sub ♂	Sub ♀	Juv ♂	Juv ♀	In ♂	In ♀
A ♂	0 * (15)	58 * (30)	1 (2.6)	10 (5.2)	0 (2.4)	2 (1.2)	0	0
A ♀		20 * (60)	2 (5.2)	8 (10.5)	3 (4.8)	6 + (2.4)	1	0
Sub ♂			/	7 (3.7)	15 + (7.7)	5 (3.8)	1	1
Sub ♀				3 (7.5)	10 (15.5)	5 (7.7)	1	0
Juv ♂					2 (5.3)	5 (2.6)	12 (4.6)	0 (4.6)
Juv ♀						/	2 (2.3)	0 (2.3)
In ♂							/	0
In ♀								/

Note: The numbers without parentheses are the observed data, the number in the parentheses are the expected.

* very significant.

+ slightly significant.

☐ rubbing not possible because there is only one individual in this class.

A ♂ = adult male.

Juv ♂ = juvenile male.

A ♀ = adult female.

Juv ♀ = juvenile female.

Sub ♂ = sub-adult male.

In ♂ = infant male.

Sub ♀ = sub-adult female.

In ♀ = infant female.

Results of figure 1: a) it is significant that the A ♂ and A ♀ rub more than the A ♀ rub each other; b) it is slightly significant that the Juv ♀ rub more with the A ♀ than with the A ♂; c) it is slightly significant that the Juv ♂ rub more with the Sub ♂ than with the sub ♀.

FIGURE 2

	A	Sub	Juv	In
A	78 (57)	21 (28)	11 (20)	1 + (13)
Sub		10 (14)	35 * (10)	3 (6.6)
Juv			7 (12)	14 (8.4)
In				0 (5.6)

Results of Figure 2: It is significant that the juvenile rub more with the sub-adult than with the adults.

FIGURE 3

	♂	♀
♂	31 (52)	107 * (70)
♀	107 * (70)	42 (93)

Results of figure 3: It is significant that the males and the females rub more than the females rub with each other, or the males rub with each other.

	A	Juv
A	78 *	11
Sub	11	35 *

FIGURE 4

It is significant that the adults rub more with each other than with the sub-adults, and that the juv rub more with the sub than with the A.

	Juv	In
Sub	35 *	3
Juv	7	14

It is significant that the juv rub more with the sub than with the A.

	Sub	Juv
A	21	11
Sub	10	35 *


Its is significant that the juv rub more with the sub than with the A.

FIGURA 5

Results of the data from Late rubbing(non-simultaneous, beginning, both rubbing).

	A♂	A♀	Sub♂	Sub♀	Juv♂	Juv♀	In♂	In♀
A♂	0 (18)	58 (35.5) *	6 (4)	9 (7.7)	14 (7.7) +	6 (4)	4 (1) *	1 (1)
A♀	50 (35.5)	52 (71)	12 (7.7)	8 (15.5)	9 (15.5)	6 (7.7)	1 (2)	0 (2) *
Sub♂	0 (2.4)	5 (4.8)	— (2.3)	4 (4.6)	7 (5.5)	4 (2.7)	5 (1.3) *	1 (1.3)
Sub♀	5 (4.8)	12 (9.7)	11 (4.6) +	6 (9)	9 (11.1)	5 (5.5)	2 (3)	0 (3) +
Juv♂	1 (1.5)	4 (3.1)	11 (6.6)	7 (13.3)	0 (2.2)	1 (1.1)	9 (3.7) *	1 (3.7)
Juv♀	0 (0.7)	2 (1.5)	6 (3.3)	6 (6.6)	4 (1.1) *	— (0.5)	1 (1.8)	0 (1.8)
							—	

Note: The numbers without parentheses are the observed data, the numbers in the parentheses are the expected.

A ♂	:adult male
A ♀	:adult female
Sub ♂	:sub-adult male
Sub ♀	:sub-adult female
Juv ♂	:juvenile male
Juv ♀	:juvenile female
In ♂	:infant male
In ♀	:infant female
*	very significant
+	slightly significant
	rubbing not possible because there is only one individual in this class.

The individuals in the horizontal line are the effectors of the behavior and in the individuals in the vertical line are those who respond. For example: A ♂ initiated rubbing 50 times with A ♀, and A ♀ initiated rubbing 58 times with A ♂.

Results of figure 5: It is highly significant that the adult males (G and ♂C).

a) It is significant that the A ♂ initiate rubbing more frequently to the A ♀ than to the A ♂, and that the A ♀ initiated rubbing more with the A ♂ than with the A ♀.

b) It is slightly significant that the sub ♂ initiate rubbing more with the sub ♀ than with the sub ♂.

c) It is slightly significant that the juv ♂ initiate rubbing more with A ♂ than with the A ♀; but in this frequency, 93o/o correspond to ♂C and only 7o/o to G.

d) It is significant that the juv ♂ initiate rubbing more with the juv ♀ than with the juv ♂.

e) It is slightly significant that the juv ♂ initiate rubbing more with the In ♂ than with the In ♀.

f) It is significant that the In♂ initiate rubbing more with the A♂ than with the A♀ .

g) It is significant that the In♂ initiate rubbing more with the sub♂ than with the sub♀ .

h) It is significant that the In♂ initiate rubbing more with the juv♂ than with the juv♀ .

Discussion of figure 5: A♂ do not rub each other. A♂ rub more with A♀ than with A♂ . The adults of both sexes do not initiate rubbing with the infants of both sexes but the infants initiate rubbing with the adults. The sub-adult males initiate rubbing more with the adult females and sub-adults females than with the males and sub-adults males.

The juvenile males initiate rubbing more with the adult males and infant males than juvenile females. The infant males initiate rubbing more with the adult males, sub-adult males and juveniles males.

As can be seen the adult males have a social relation of zero (with respect to this type of rubbing) with the younger males. In the sub-adult males the frequency of rubbing between males is slightly higher but not significant. In the juveniles the frequency of rubbing is greater still and slightly significant for rubbing with adult and infant males. In the infant males rubbing is significant with adult, sub-adult and juvenile males. Therefore, in males, the frequency of this type of rubbing decreases with increasing age.

FIGURE 6

	A	Sub	Juv	In
A	160 _# (105)	35 (52)	35 (29)	6 _* (19)
Sub	22 _* (52)	21 (26)	25 _* (14)	8 (9.8)
Juv	7 (17)	30 _* (8.8)	5 (10)	11 (6.9)
In	0 _* (11)	7 (5.8)	12 (6.9)	1 (4.6)

Note: same data as in figure 5 grouped by age categories.e.g. the adult initiate rubbing 22 times with sub-adult.

Results of figure 6: a) it is significant that adults initiate rubbing more with adults than with sub-adults; b) it is significant that the adults do not initiate rubbing with the infants and that the juveniles initiate rubbing more with the infants and that the juveniles initiate rubbing more with the sub-adults than with infants; c) it is slightly significant that the juveniles initiate rubbing more with the adults than with the sub-adult and that the infants initiate rubbing more with the sub-adults than with the adults.

FIGURAS 7

	A	Sub
Sub	22	21
Juv	7 *	30 *

It is significant that the sub initiate rubbing more with the juv than with the sub, and that the adults initiate rubbing more with the sub than with the juv.

	Sub	In
A	35	6
Sub	21	8 *

It is significant tha the In Sub initiate rubbing more with the sub than with the A.

	Sub	Juv
Sub	21	25
Juv	30	5 *

It is significant that the juv initiate rubbing more with the sub than with the juv.

	A	Juv
Juv	7	5
In	0	12 *

It is significant that the juv initiate rubbing more with the In than with the juv.

	Juv	In
Sub	25 *	8
Juv	5	11

It is significant that the juv initiate rubbing more with the sub than with the juv.





	Sub	Juv
Juv	30*	5
In	7	12

It is significant that the sub initiate rubbing more with the juv than with the In.

Note: The numbers are the observed data.

Discussion of the Ignored rubbing data (only one individual rubs).

FIGURE 8

	A♂	A♀	Sub♂	Sub♀	Juv♂	Juv♀	In♂	In♀
A♂	0* (8)	31* (16)	9 (5.6)	12 (11)	21* (7.7)	7 (3.8)	8* (2)	1 (2)
A♀	22 (16)	19 (32)	18 (11)	12 (22.6)	13 (15)	5 (7.7)	3 (4)	0 (4)
Sub♂	0 (0.4)	1 (0.8)		6 (3.7)	2 (3.7)	0 (1.8)	5* (1.6)	1 (1.6)
Sub♀	0 (0.8)	3 (1.7)	9* (3.7)	2 (7.5)	11 (7.5)	4 (3.7)	3 (3.3)	1 (3.3)
Juv♂	1 (2)	7 (4)	5 (2.4)	4 (4.8)	4 (4.4)	2 (2.2)	5 (2.3)	0 (2.3)
Juv♀	0 (1)	1 (2)	1 (1.2)	1 (2.4)	4 (2.2)		1 (1.1)	1 (1.1)
In♂	0	2	2 (1.1)	3 (2.3)	1 (0.8)	1 (1.6)		0
In♀	0	1	0 (1.1)	2 (2.3)	1 (0.8)	2 (1.6)	0	

Note: The numbers without the parentheses are the observed data, the numbers in - parentheses are the expected values.

Results of figure 8: a) The A♂ to the A♂ have a frequency of zero, which is the same as in abnormal rubbing. The A♀ initiate rubbing with the A♂ more than with the A♀ (the A♂ Ignore rubbing more than the A♀); b) the sub♀ initiate rubbing with the sub♂ more than with the sub (the sub♀ Ignore rubbing more than the sub♂); c) the juv♂ initiate rubbing more with the A♂ than with the A♂ Ignore rubbing more than the A♀); d) the In♂ initiate rubbing more with the A♂ than with the A♀ (the A♂ Ignore rubbing more than the A♀); e) the In♂ initiate rubbing more with the sub♂ than with the sub♀ (the sub♀ Ignore rubbing more than the sub♀).

Discussion of figure 8: These results are the same as for ab-normal rubbing; in other words, in the adult males the relation with the other males is zero; the adult males Ignore rubbing more than the adult females when the rubbing is

initiated by the adult females; the sub-adult females Ignore rubbing more than the sub-adult males when the rubbing is initiated by the sub-adult male. The adult males ignore the juvenile and infant males than do the adult females.

FIGURE 9

	A	Sub	Juv	In
A	72 (64)	51* (32)	46 (34)	12 (22.6)
Sub	4* (32)	17 (16)	17 (17)	10 (11)
Juv	9 (12)	11 (6)	10 (7.9)	7 (5.2)
In	3 (8)	7 (4)	5 (5.2)	0 (3.5)

Results of figure 9: It is significant that the adults initiated more rubbing with the adults than with the sub-adult; the adults ignore more rubbing by the sub-adult than the sub-adults ignore rubbing by the adults.

FIGURE 10

	♂	♀
♂	63 (51)	78 (68)
♀	84 (68)	54* (91)

Results of figure 10: It is significant that the males Ignore rubbing initiate by the females more than the females ignore rubbing initiate by the females.

FIGURES 11

	A	Juv
A	72	46*
Sub	4*	17

It is significant that the adult Ignore rubbing by the juveniles more than the sub-adults Ignore rubbing initiated by the juveniles; and also that the sub-adults Ignore rubbing initiated by the adults less than the adults Ignore rubbing initiated by the adults.

	A	In
A	72*	12
Sub	4*	10

It is significant that the sub-adults Ignore rubbing initiated by the adults less than the adults Ignore rubbing initiated by the adults.

DISCUSSION OF THE GRAPHS

a) Late rub

Graphs No. 1, 2, 3, 4 are plots of Late rub with rubbing per hour on the vertical scale and time in weeks on the horizontal axis. Graphs 1 and graphs 4 correspond to data of individuals who initiate the rubbing and graphs 2 and graphs 3 correspond to individuals who receive the rubbing.

Discussion of graphs 1, Late rub (adults who initiate) and graphs 2 (adults who receive).

The male (δ C) who follows G in age had, during the period of observation, a low frequency of initiating or giving and a high frequency of receiving. δ C received 40o/o of his rubs given by adults and 60o/o of rubs by non-adults; while G received 87o/o of his rubs by adults and 13o/o by non-adults.

ϕ H (pregnant female who gave birth in the seventh week) shows a low participation both in giving and receiving, but during the seventh week receiving increased somewhat.

In the seventh week great difference can be seen in the frequencies of giving and receiving by G, C and δ C. (It was during the seventh week that C was in estrus. δ C maintains a low frequency of giving while G increases his initiating and C decreases his initiating of rubbing. Graph 1; in the seventh week G received no rubbing while the number of rubs received increases for C and δ C.

Discussion of graphs 3 Late rub (non-adults who receive) and graphs 4 (non-adults who initiate)

Among the infants, bl developed the behavior of initiating rubbing earlier than bs (twin sister of bl) (graphs 3, 4). Comparing P and F (twin males) it can be seen that P has a higher frequency of both initiating and receiving, with the

frequency of receiving by F being almost equal to the amount of rubbing receiving by bl. In the seventh week there is an increase of initiating rubbing by bl and bs which corresponds to the development of the musk gland.

Male I (third in age following G and ♂C) shows the highest frequency of initiating and receiving (graphs 3, 4) followed by P (the male fourth in age).

b) Ignored rub

Graphs 5, 6, 7, and 8 are plots of "ignored rubbing" with rubbing per hour on the vertical scale and time in weeks on the horizontal axis. Graphs 5 and graphs 7 correspond to data from individuals who initiated rubbing and graphs 6 and graphs 8 correspond to individuals who received, but ignored, the rubbing.

Discussion of graphs 5 (adults who initiate) and graphs 6 (adults who ignored rubbing).

In general in ignored rubbing adults are more prone to ignore (graphs 6) than to give rubbing (graphs 5) while non-adults are more prone to give (graphs 7) than ignore rubbing (graphs 8). In graphs 5, the frequency for ♂C as initiator of rubbing is the lowest (as in graph 1) while his frequency as receiver is the highest (as in graph 2). G and C do not show a significant variation in the seventh week (when C was in estrus).

Discussion of graphs 7 (non-adults who initiate) and graphs 8 (non-adults who ignored rubbing).

In graph 7 (as in graph 1) there is a difference in the frequency of rubs initiated by bl and bs, and these two peccaries also show a slight difference in the frequency of rubs ignored (graph 8). Comparing P and F in the frequency of initiating rubbing the difference is significant (as in graph 4). Comparing the behavior of I and ♂C it can be seen that the frequency of initiating by I tends to decrease (graph 7) while the graph of ♂C is lower. ♂C shows a higher frequency of ignoring rubbing (graph 6) but I shows a great increase from the sixth week onward (graph 8). P shows a high frequency of initiating and slight increase in the frequency of ignoring rubbing in the sixth week.

Graph 9

This graph presents the distribution of rubbing during the day. In the morning the greatest amount of rubbing occurs after "breakfast" (between 7 and 8 AM). There is a gradual diminishing during the day with an increase after 4 PM, which is the time they become active again (between 12 noon and 4 PM they are lying or sitting down). After 5 PM the frequency decreases again.

DISCUSSION

Histogram No. 1

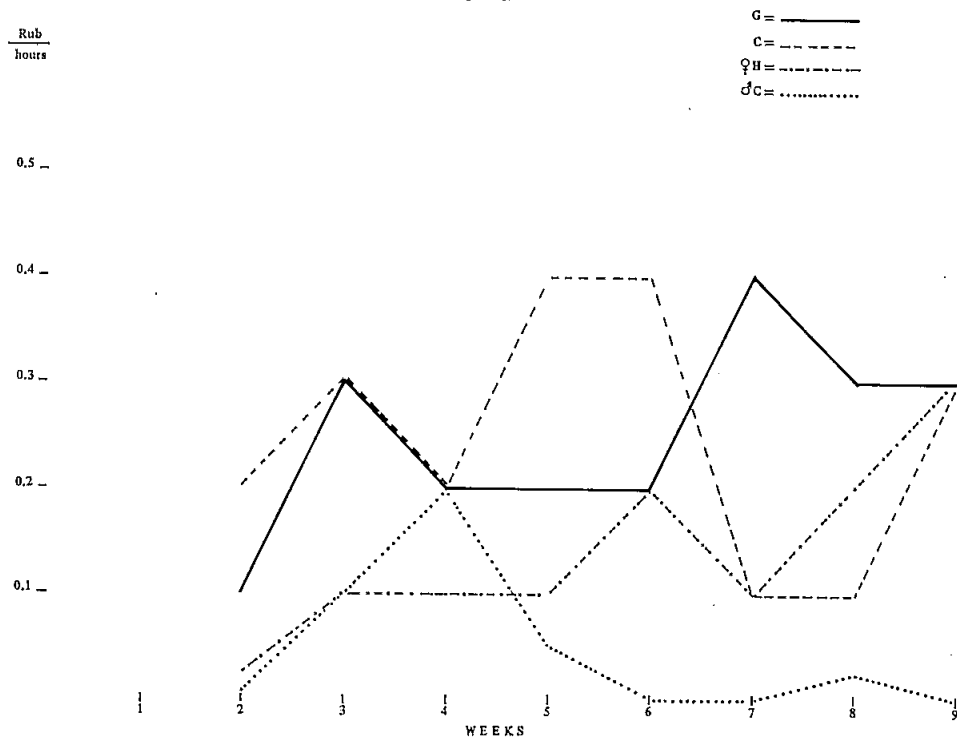
In general the non-adults show a greater proportion of ignored rub than the adults. There is a similarity in per cent among I, P, F and bl, the four non-adult males, and there is also a similarity in per cent among 4, 3, and 2, the three non-adult females. Among the adults, only G and B show a slight similarity. ♂C only ignores 60/o of the rubs followed in ascending order by B, ♀C, G, C, ♀H. ♂C also initiated the least number of abnormal rubbing followed in ascending order by ♀H, G, B, ♀C and C.

Histogram No. 2

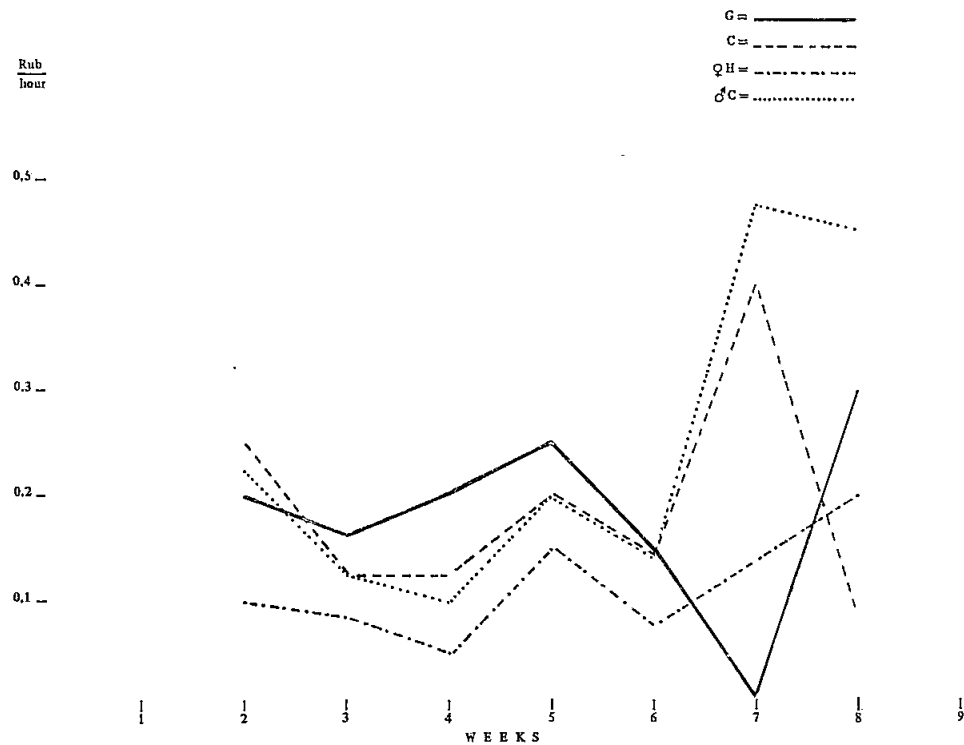
In general the adults show a greater proportion of ignored rub than the non-adults. Of the non-adults, (I, 2, P), (4, and bl) show the most similarity, and of the adults (♀H, ♀C, C), (G, and B), show the most similarity.

♂C shows the most variation of the adults, while C only varies in abnormal rub, or in other words, in terms of per cent he gives more than he receives. Of the non-adults, I and P ignore rubbing less than they are ignored.

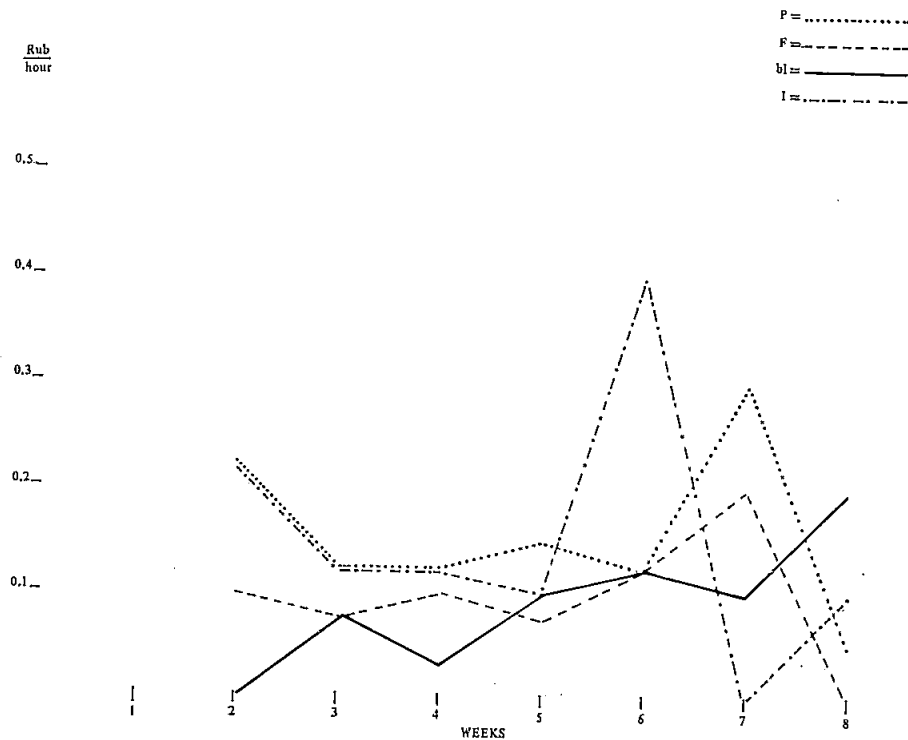
GRAPHIC No.1
(Late rub) non-simultaneous beginning, both rub, RUBS GIVEN BY ADULT.



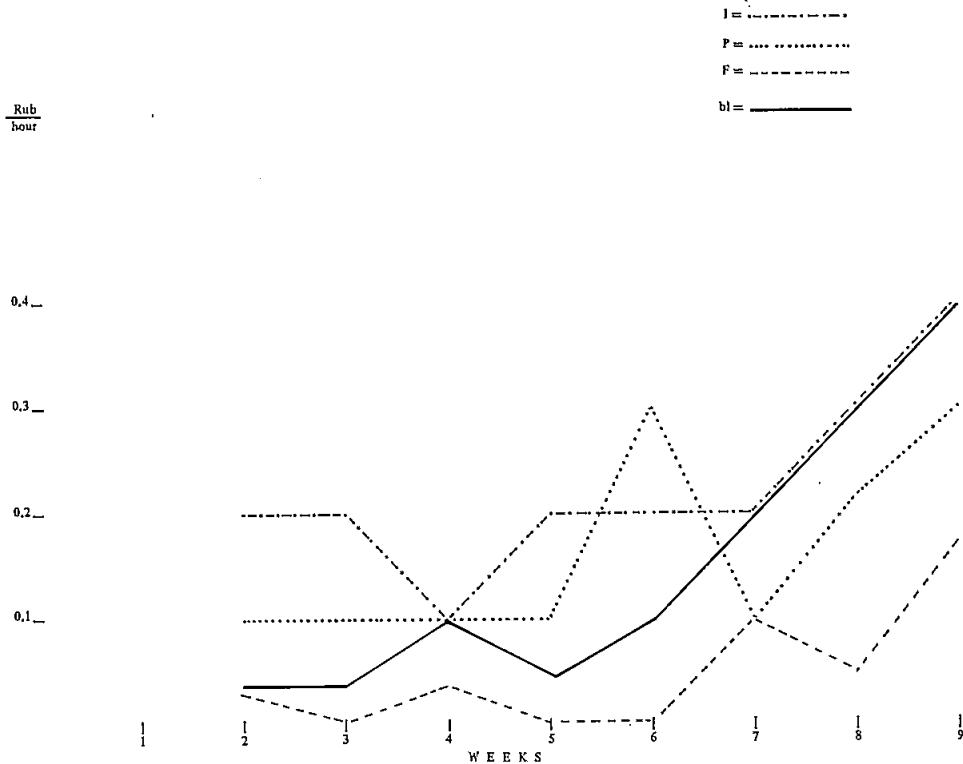
GRAPHIC No. 2
(Late rub) non simultaneous begining, both rub. RUBS RECEIVED by ADULTS.



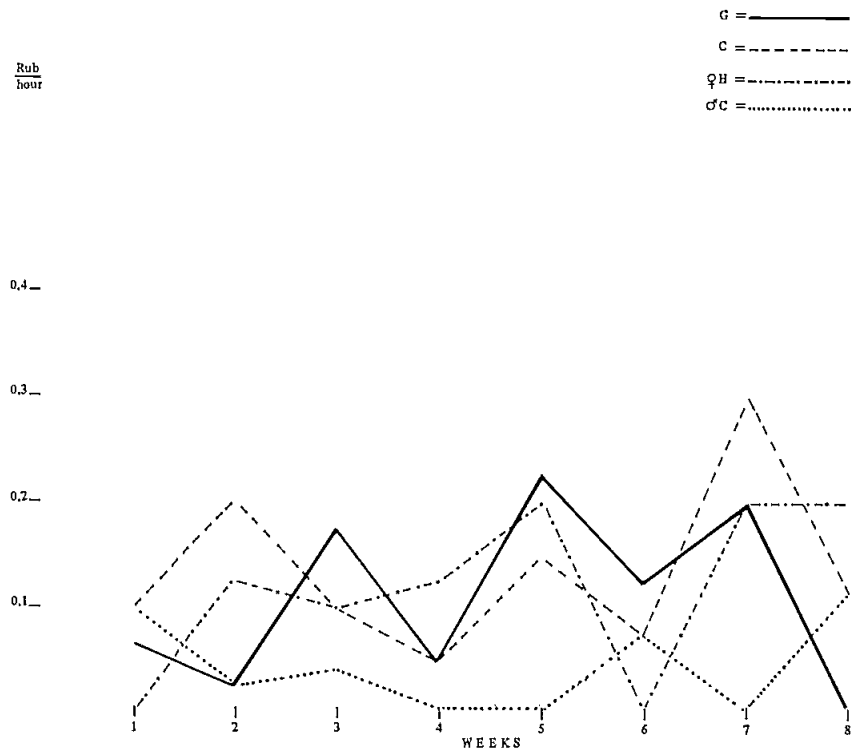
GRAPHIC No.3
 (Late rub) non-simultaneous beginning, both rub, RUBS RECEIVED by NON ADULT.



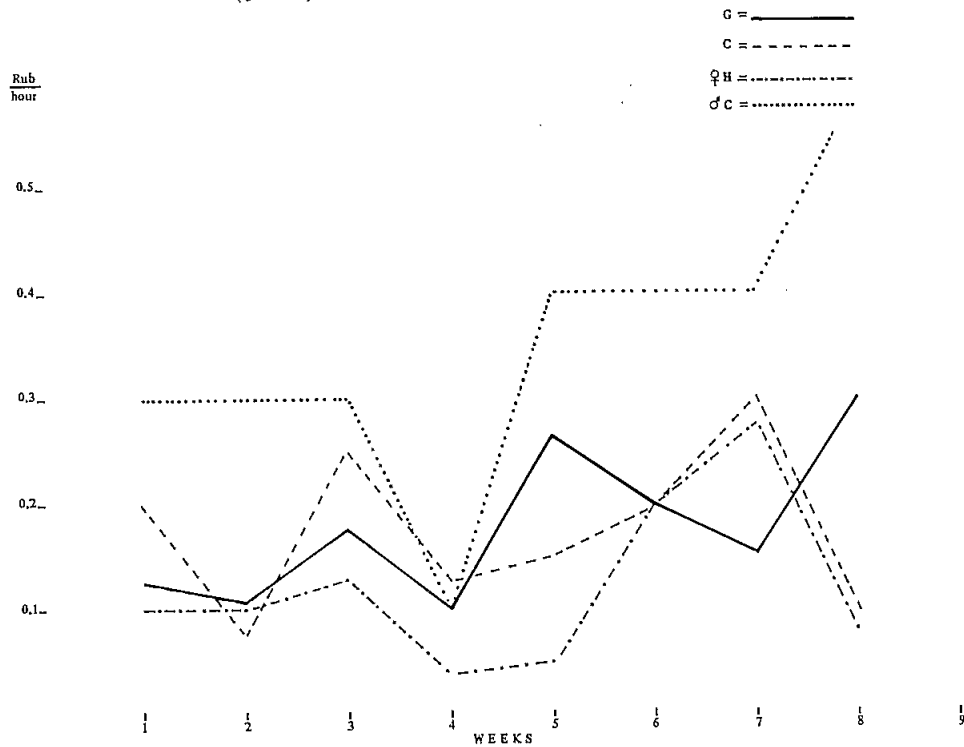
GRAPHIC No. 4
 (Late rub) non-simultaneous beginning, both rub. RUBS GIVEN BY NON ADULTS.



GRAPHIC No.5
(Ignored rub) non simultaneous beginning, only one rubs. RUBS GIVEN BY ADULT.

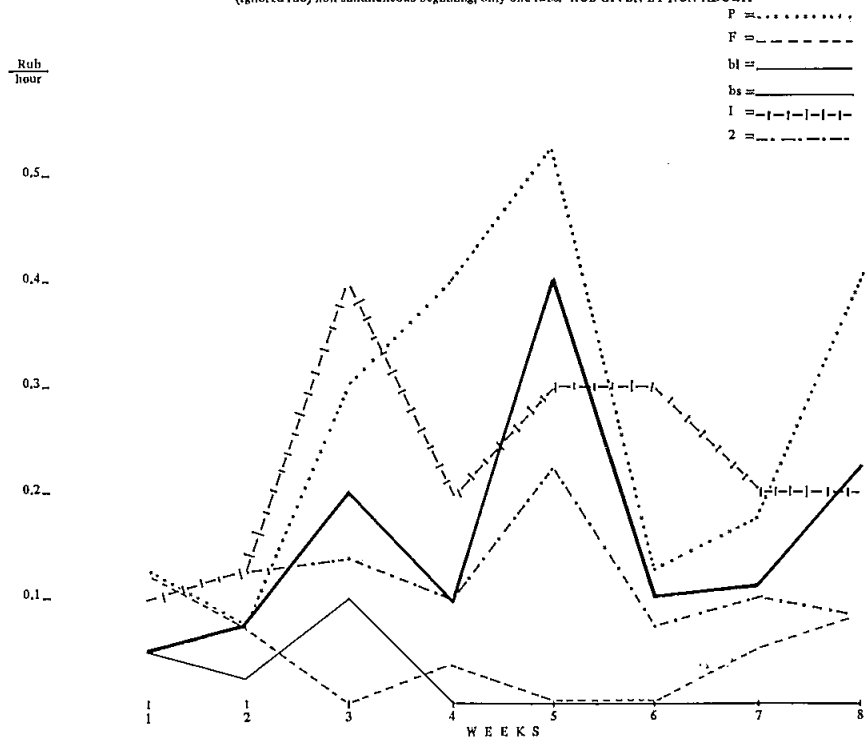


GRAPHIC No. 6
(Ignored rub) non-simultaneous beginning, only one rubs. RUBS IGNORED BY ADULT.

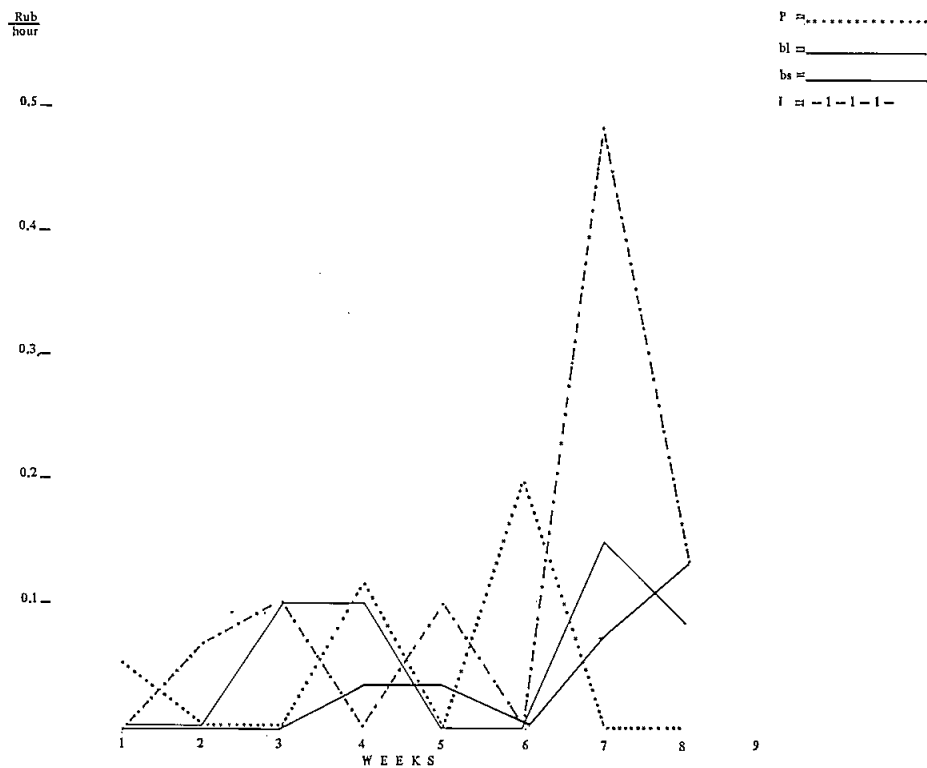


GRAPHIC No.7

(Ignored rub) non simultaneous beginning, only one rubs. RUB GIVEN BY NON ADULT.



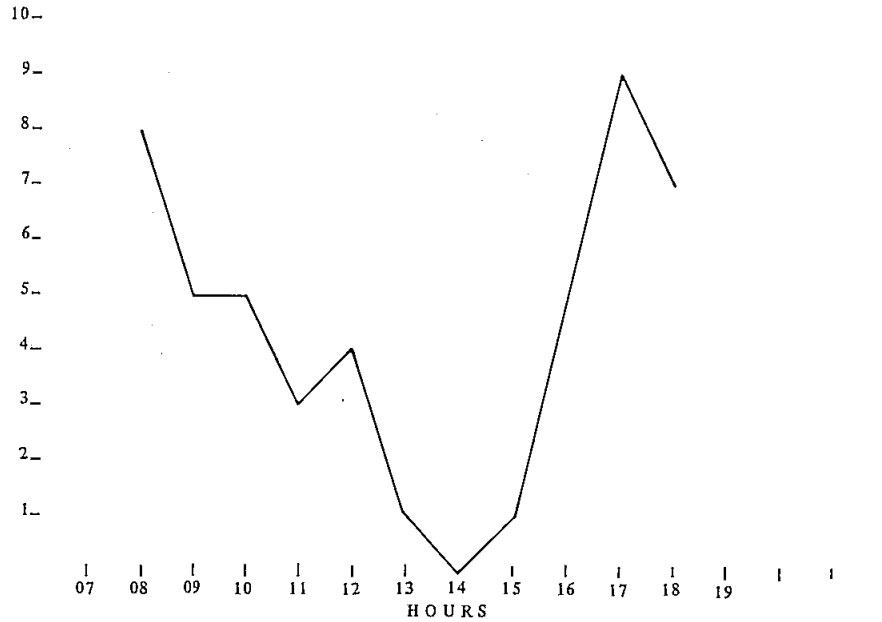
GRAPHIC No.8
 (Ignored rub) non-simultaneous beginning, only one rubs. RUBS IGNORED BY NON ADULT.



GRAPHIC No.9

Graphic 9: The distribution of rubbing during the day.

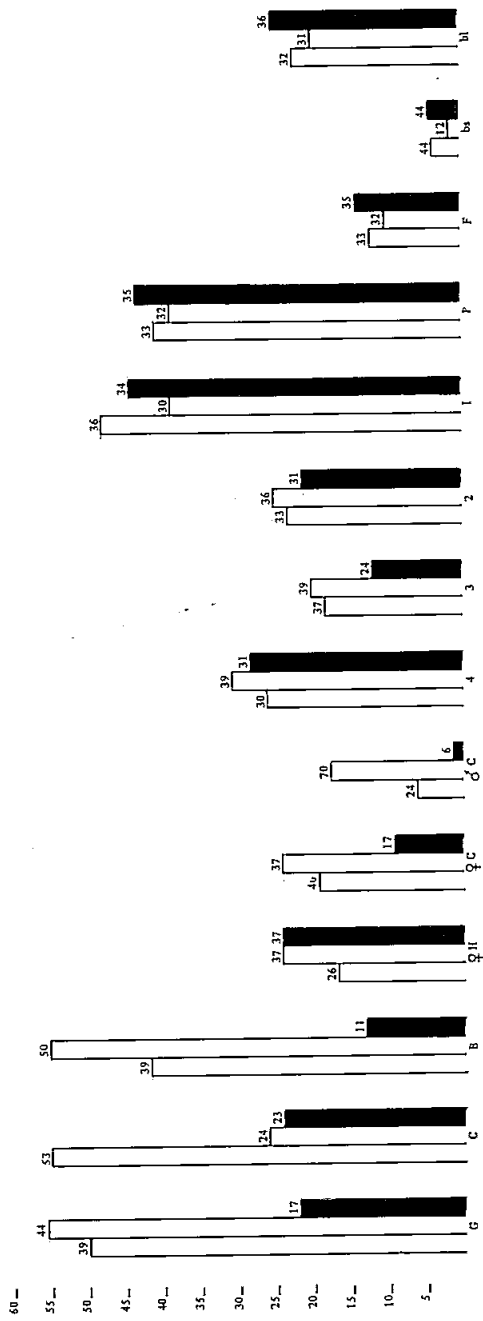
\bar{X} of rubbing in 18 hours.



HISTOGRAM No. I

Comparison of frequency and type of the 3 forms of rub
in the individual (during the 200 hours of observation)
The frequencies are of rub given.

Column 1 = Late rub
Column 2 = Normal rub
Column 3 = Ignored rub

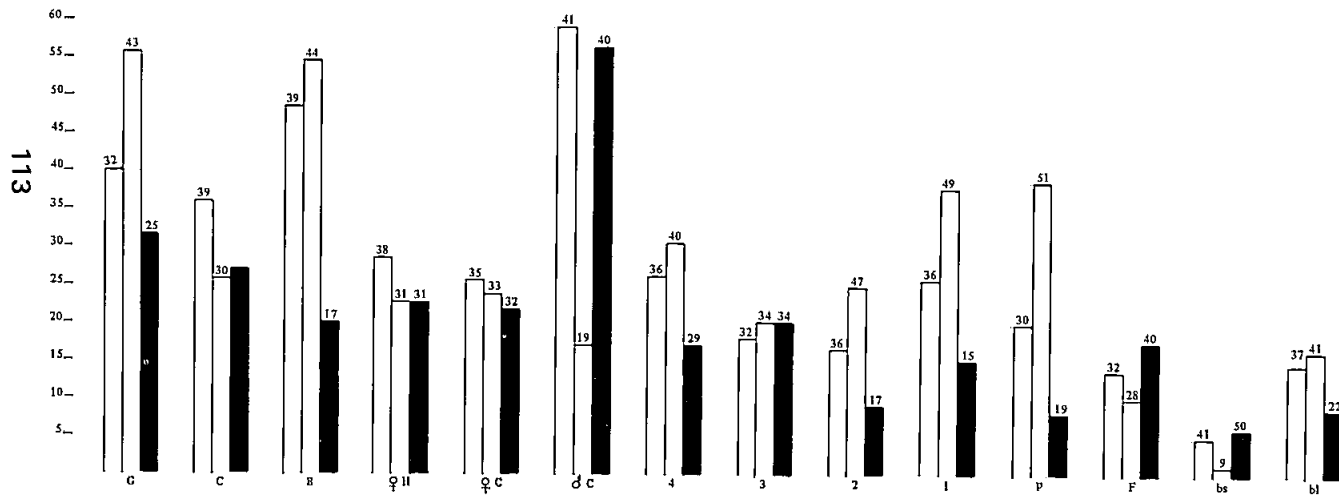


HISTOGRAM No. 2

Frequency of rub
in 200 hours

Comparison of frequency and of the 3 form of rub in
the individual (during the 200 hours of observation).
The frequencies are of rub received.

Column 1 = Abnormal rub
Column 2 = Normal rub
Column 3 = Ignored rub



FIGURES 14

Table which show the results of summing the data from Late rubbing and Ignored rubbing. The individuals in the vertical column are the initiator of rubbing, and the individuals in the horizontal column are receiver of the action.

Result of figure 14

G received 72o/o of his rubs by adults, with 66o/o from C and B; C received 67o/o from adults and 54o/o from G; B received 86o/o from adults and 64o/o from G and C; ♀ H received 37o/o from adults and 15o/o from G and C; ♀ C received 39o/o from adults and 25o/o from C; ♂ C received 28o/o from adults and 10o/o from C; 4 received 39o/o from adults; 3 received 21o/o from adults; 2 received 10o/o from adults; I received 15o/o from adults; P received 20o/o from adults; F received 20o/o from adults; bs received 0o/o from adults; bl received 5o/o from adults.

As can be seen G shared the majority of rubbing with C and B, both initiating and receiving. He shared very little with the adult females ♀ H and ♀ C. Of the adults, G, C, and B received the highest percentage of rubs; a second group is formed by ♀ H, ♀ C, ♂ C, 4 and 3; 2, I, P, F, bs, and bl form a third group.

	G	C	B	♀H	♀C	♂C	4	3	2	I	P	F	bs	bl	Total
G		32	30	2			1								66
C	17		13	4	10	11	7	4	1	3	2	2		1	75
B	28	1		5	2	9	1	1							47
♀H	1	3	10		4	7	1			2	3	3			34
♀C	2	2	5	4		3	3	2	1	1		1			24
♂C		2			1		3	1							7
4	5	6	1		5	6		3	3	8	3	5		4	49
3	2		2	2		6	4		4	2		2	1	2	27
2	1	3	1	3	2	12	4	5		3		3	4	1	42
I	3	2	1	14	11	11	10	7	5		9	6		3	82
P		3		4	4	27	8	9	5	6		4	2	7	79
F	2	2	2	2	4	7	1	1	1	2				2	26
bs						2			1	2	1				6
bl	5		2		1	7		5	2	10	12	5			49
Total	66	56	67	40	44	108	43	38	23	39	31	31	7	20	

DISCUSSION

The roll of rubbing behavior in the social structure of the group of peccaries is slightly significant in the analysis of social behavior. **Glen** the older male, shower some dominance and leadership, like remaining behind the group or Affronting any sudden noise, or being the last to arrive at the food box. He showed rank in the hierarchy over the male ♂C in sexual predominance. **Glen** was also the most tolerant adult with the infants and juveniles never attacking but offering a defense for them.

The relationship of **Glen** with the rest of the group in terms of rubbing behavior indicates a lack of contact except for Becky and Female ♀C Which were the two older females. The male ♂C, the second oldest males received the majority of the rubbing, especially from the non-adults. Only **Glen** didn't display any rubbing behavior toward ♂C. **Glen** was more aggressive to ♂C during the estrous period of the female ♀C. ♂C was the peccary that received the most rubbing and gave the least. **Glen** received and gave the same percentaje.

One fact appears clear and that is that adults have a closer relationship between them with the non-adult. The male ♂C appears to be the dividing point between adults and non-adults in this group. The non-adults seem to have a preference for ♂C in rubbing behavior but the roll at rubbing behavior is not completely clear in defining the hierarchy of the group. Rubbing behavior appears to exist based on sex age or individual preference according to data resulting from this project.

More observations of rubbing behavior are needed however to construct the social hierarchy of the group.

2.—Play

The two most common types of play are a) play fighting and b) running play. In play fighting the two peccaries are touching each other with the face and lightly biting the nose, ears, cheeks and shoulders; the movements are light and there are no vocalizations, photos 5. When one of the peccaries bites the other ear, he twists the head of his partner with a downward circular motion throwing him to the ground. At the same time the initiator falls to the ground also with his head on top of his

partner; he keeps biting and shaking his head. Next, one of the 2 rights himself rapidly and bites the one who remains on the ground. Instead of righting themselves they may remain on the ground rolling on their backs while trying to bite the other one. While two peccaries are play fighting, other peccaries may come near and bite the peccary who is on the ground.

In running play two or more peccaries participate. It begins when one begins galloping and one or more follow him; when the leader stops, the others bite at his feet, or fight and begin running again. At times at the same moment two groups will follow different individuals. It is significant that the sub-adults play more with the infants than with juveniles and the juveniles play more with the infants than with the juveniles.

3.—Intraespecific attacks (photo No. 4) .

Intraespecific aggression has been described by Schweinsburg and Sows (1972). In my study I took as attack any aggressive behavior which involved a bite with the incisors in any part of the body; (attacks of less than 5 seconds in which the aggressor retreated immediately after biting and the attacked responded by growling without moving from the site). A second form of aggression occurs when both individuals growl and make biting movements without actually touching each other. This type of aggression is directed to the face and nose. Motivation is higher in this type of aggression which tends to last no more than 25 seconds. It is significant that the adult males effect more aggression between them than with the adult female.

It is significant that adults attack adults more than they attack sub-adults; sub-adults attack adults more than they attack sub-asults; sub-asults attack juveniles more than they attack infants and, infants attack infants more than they attack juveniles.

4.—Sniffing another individual

Sniff— In this action the peccary puts his nose very close to (within several centimeters) or touching the individual without moving his head, Sniffing does not last more than 10 seconds.

Results

It is significant that the adult males sniff more at adult females than at adult males, adult males sniff more at sub-adult females than at sub-adult males, adult females sniff more at juvenile males than at juveniles females, and sub-adult males sniff more at adult females than at adult males.

5.—Nose rubbing

This is performed by rubbing the nose over any surface of the body of another individual. The movements are ascending and the intensity varies from just barely touching the bristles to an energetic rub which raises the bristles and actually moves the body of the other individual. The nose rubbing may last for more than one minute and the individual receiving the nose rub never offers any opposition.

Results

It is significant that the adult males effect nose rubbing more with the adult females than with the adult males. The adult females nose rub more with each other than with adult males; the adult females effect nose rubbing more with the juvenile males than with the juveniles females, and the adult males effect nose rubbing less with the infant females than with infant males.

6.—Head between legs of other peccary.

The peccary effecting this behavior kneels or stands in front of the recipient and puts his head and neck between the front feet of the recipient. The effector rubs lightly with his nose and face the ventrum of the recipient, while the recipient remains passive till the action stops or ignores the effector and continues on.

Results

It is significant that the juveniles effect this behavior more with adults than with sub-adult; it is significant that infants effect this behavior more with adults than with sub-adults.

7.—Mud bathing

The mud bath begins when the peccary enters the mud and begins to dig with slow movements of his front feet; with these movements he excavates a pool which gradually fills with water, alternating with movements of the feet are movement of the nose which serve to enlarge the edges of the pool.

The movements with the nose consist in putting the nose in the mud and raising it slowly and vertically so that it falls on the neck and back, photo No. 6. This is not done more than five times in any session and is done while the peccary is standing. With the nose full of mud he scratches the hindquarters, and with his hind feet he scratches his shoulders which he sits in the middle of the pool moving his head and neck around in the mud. After this, which lasts less than 40 seconds, he gets up scratches himself again or immediately begins to shake with the bristles raised so that water and mud fly off in all directions.

The peccaries bathed in the mud with a frequency that varied from every day to every 5 days. A peccary was never observed mud bathing more than once a day.

The mud bathing was done between 9 and 10 in the morning and between 4 and 5 in the afternoon. In their daily routine 9 and 10 in the morning are the hours after eating and 4 and 5 in the afternoon are the hours when they get up after lying in the house all afternoon. One June 27, after being kept enclosed in rooms 1 and 2 for two days, the first thing they did on being left out at 4 in the afternoon was mud bathe. That all bathed at the same time during which G gashed his teeth at ♂C; C bit F; and 3 growled at 2.

The adults always begin the mud but do not always follow the steps in the same order. G began bathing 7 times in three of which no other peccaries arrived. ♀H did it three times, 2 two times and B two times. ♀C did it only once. When an adult enters the mud and begins bathing the others who arrive walk around and dig around the one who is bathing, and occasionally the new arriver will sit in the mud also. At times the original bather will growl or attack other members if they come near. After the adult has left the mud, the non-adults stay walking around and digging in the mud.

On July 3rd bl (2 months, 8 days old) sat in the mud and rubbed in the same manner as the adults. He did not dig out a pool with his feet, nor did he nose the mud enlarging the edges of the pool. He did not transfer mud to his back.

On July 17th. I observed F (5 months, 6 days old) raising mud with his nose and rubbing his hind quarters with his nose full of mud.

On August 4th p (5 month, 23 days old) dug a pool and raised mud with the nose, but his movements were more rapid than those of the adults.

The place used for mud bathing changed frequently and it is interesting when other peccaries arrived, they picked spots to bathe near the peccary who arrived first. This proximity gives rise to attacks and growls.

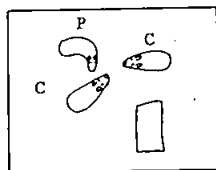
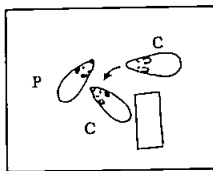
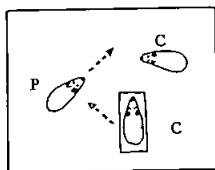
8.—Sexual behavior

The males perform a ceremony that involves smelling and rubbing gently with their nose the female's body. In the first instant, the male licks insistently the female's vulva afterwards, he walks towards the head of the female and places his nose directly behind her ear for five or then seconds. The mouth of the male is usually closed and only in certain case is the male seen biting the ear, back and legs of the female. In another instant, the male may rub the neck with his nose or place his lower jaw over the back of the female with his body perpendicular to hers, after this, the male mounts; the copulatory movements are slow and few (many times, I observed males mounting for a minute without any movements). In the photo No. 3, I at the age of four months and 20 days mounts ♀C. there was no fighting amongst the males who limited themselves to smelling the female's vulva while the other males mounted her. The first time P. was observed mounting a female was on 4/7 at the age of four months and 19 days. During the observation period, I mounted seventeen times of which five were with ♀C, four with C and two with ♀H, C, 3 and 4. The longest time that I mounted a female was three minutes and 30 seconds and the shortest time was two seconds with an average time of 38 seconds with 3.6 copulatory movements in each 38 second period. P mounted four times: twice with C and once with 3 and 4; his shortest time mounted was two seconds with an average of 47 seconds.

9.—Intervention in attacks

I observed five cases of participation by a third peccary when an adult attacked or growled at a juvenile. The cases are:

a) P was walking at a distance of about 1 meter from C who was standing and eating from the food box (Drawing one) C, advanced and bit P in the ribs with the result that P sat down and growled loudly. During this interaction, Glen has been sitting down in front of C at a distance of about 1 meter (Drawing two). When P sat down and growled, Glen got up rapidly, advanced two paces growling at C who responde, C and glen tossed their heads biting at the air with their snouts at the same height for 10 seconds (Drawing three); after which Glen's teeth gashed, retreated and sat down. C then left.



b) July 13th C bit the snout of bs who immediately responded sitting down and vocalizing. Glen advanced toward C growling slightly; to which C paid no attention to and walked away.

c) On July 19 th, C was eating from the food box when bl passed at a distance of 2 feet. C moved his head toward bl who immediately turned rapidly to face C giving the same vocalization, and then rapidly walked away. Glen who was eating with C raised his head and lightly gashed his teeth at C who pais no attention.

At that moment, I passed near C, and C bit him in the hindquarters. I fell to the ground vocalizing and Glen advanced and gashed his teeth more strongly at C who responded by gashing his teeth also.

d) On June 13th, the females 2 and 3 were growling at each other. C who was at a distance of about 4 feet advanced silently and lightly pushed 2's head with his head, at which point 3 and 2 stopped growling.

In all these cases, the only peccary who adopted a submissive attitude was the peccary that was first attacked. This type of attack against a non-adult can not be differentiated from an attack against other members. In many cases, an adult advances silently and bites a non-adult; the other adults present do not intervene. These attacks do not seem provoked.

10.— Teeth gnashing

This action consists in bringing the teeth together rapidly; the intensity varies according to the motivation. Teeth gnashing occurs as a threat generally when they are eating but it was also observed when a peccary was walking and without another peccary closer than 4 meters.

Results

It is significant that adults teeth gnash more at each other than at sub-adults; adults teeth gnash more at juveniles than at infants.

SUMMARY

Social behavior was studied of 14 peccaries (*Tayassu tajacu*) in captivity in the Brookfield Zoo Illinois, from 200 hours of observation there are described different types of social behavior between the members of the group, with special emphasis on the relation of "rubbing behavior" and the age and sex of the members. The role in the social structure of 10 different types of social behavior are discussed. This study was done in the Animal Behavior Program of the Chicago Zoological Society. The present work is an abstract of the original report presented in August, 1974 to the Chicago Zoological Society, Chicago, Illinois.

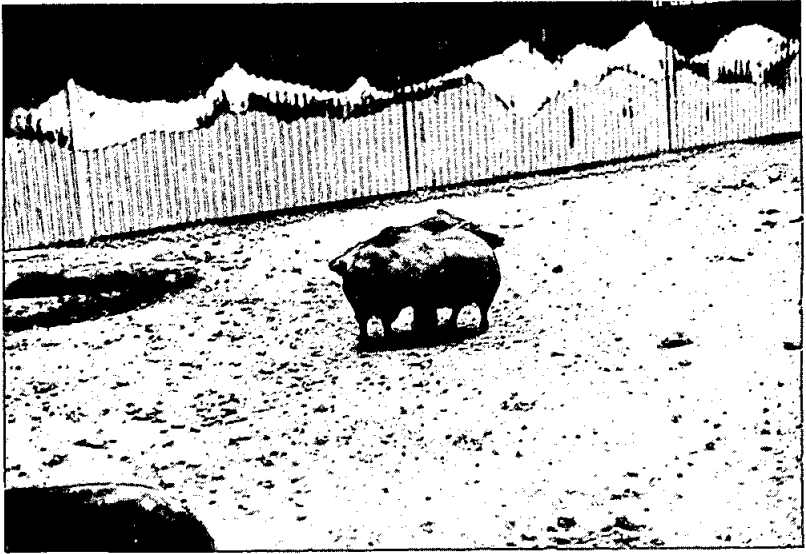


PHOTO 1
 "Normal rubbing" between adults.

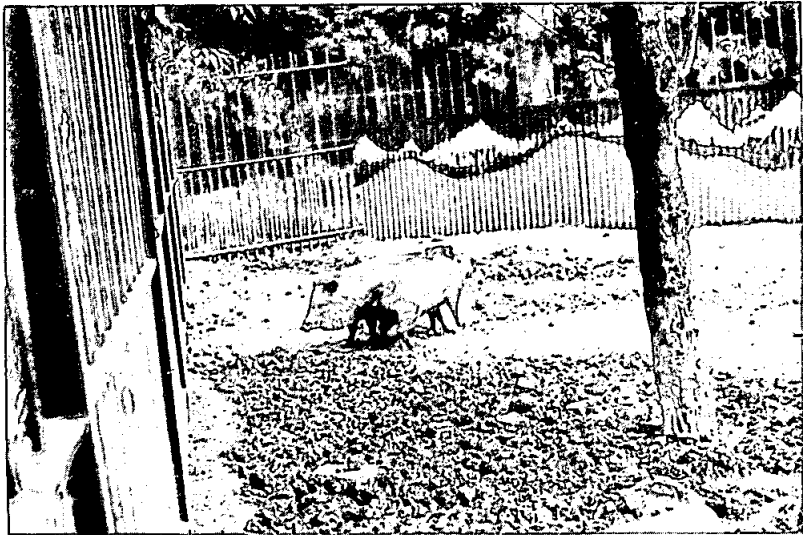


PHOTO No.2
 Shows the "ignored rubbing"; one member does not respond to rubbing initiated by the other member.

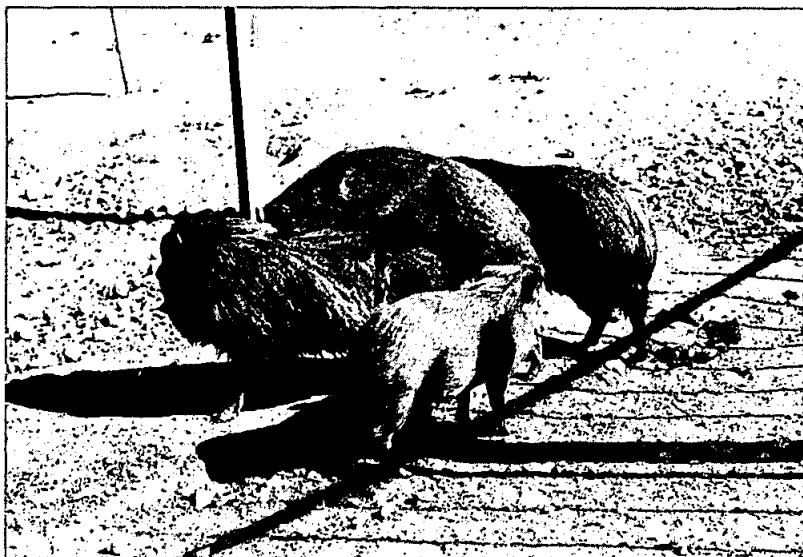


PHOTO No.3

The male I at the age of four months and twenty days mounts the female ♀ C. The two peccaries on the sidelines are the male ♂ C and male P.



PHOTO No. 4

Intra-specific aggression

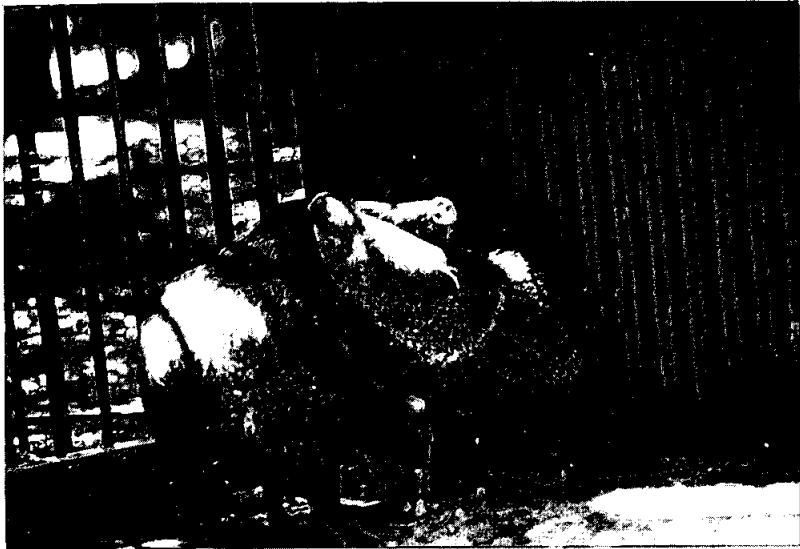


PHOTO No.5
Play fighting



PHOTO No.6
Mud bathing

LITERATURE CITED

- CABRERA, A. Orden artiodáctila; catálogo de los mamíferos de América del Sur. s.n.t., 1961. v.4, pp.315-319.
- y YEPES, J. Historia natural: mamíferos sudamericanos. Buenos Aires, Compañía Argentina de Editores, 1940. s.p.
- EDDY, T.A. Foods and feeding patterns of the collared peccary in Southern Arizona. J. Wildl. Manage (Estados Unidos) 25(3): 248-257. 1961.
- ELLISOR, E. y HARWELL, E. Movility and home range of collared peccary in Southern Texas. J. Wildl. Manage (Estados Unidos) 23(2):425-427. 1969.
- HALL, E.R. y NELSON, K.R. Order artiodactyla. The mammals of North America (Estados Unidos) 2: 994-998. 1959.
- HARWELL, F. Bells in the brush. Texas Parks & Wildlife (Estados Unidos) Aug. 1968: 3-6.
- Evasive javelina. Texas Parks & Wildlife (Estados Unidos) Oct. 1973: 6-8.
- Slandered brush hog. Texas Parks & Wildlife (Estados Unidos) Jun. 1968: 26-28.
- HILL, C.A. The great peccary headache. Zoonooz San Diego Zoo. (Estados Unidos) 1970: 12-18.
- NEAL, B.J. A contribution of the life history of the collared peccary in Arizona. American Naturalist (Estados Unidos) 61(1): 177-190. 1959.
- Techniques of trapping tagging the collared peccary. J. Wildl. Manage (Estados Unidos) 23(1): 11-16. 1959.
- SCHWEINSBURG, R.E. Home range movements and herd integrity of the collared peccary. J. Wildl. Manage (Estados Unidos) 35(3): 455-460. 1971.

- Social behavior of collared peccary (**Pecari tajacu**) in the Tuckson Mountains. Ph. D. Thesis University of Arizona, 1969. 115 p.
- SOWLS, L.K. Aggressive behavior and related phenomena in the collared peccary. Z. Tierpsychol (Estados Unidos) 1972: 30-32, 145.
- Hunter, checking Station for collecting data on the collared peccary (**Peccary Tajacu**). Transaction of the 26 th. North American Wildlife Conference. s.n.t., 1961. pp. 497-505.
- Reproduction in the collared peccary (**Tayassu Tajacu**). Comparative Biology of REproduction in Mammals (Estados Unidos) 15: 155-1972. 1966.
- Reproduction in the collared peccary (**Tayassu tajacu**). J. Reprod. Fertil (Estados Unidos) 9:371-372. 1965.
- VISLOCKI, G.B. Notes on the female reproductive tract (ovaries uterus and placenta) of the collared peccary (**Peccary angulatus**), Bangsi Golfman. J. Mammals (Estados Unidos) 12:143-149. 1931.