Notes on the golden jackal *(Canis aureus)* in Bangladesh

by R.M. POCHÉ [1], S.J. EVANS [2], P. SULTANA [3], M.E. HAGUE [3], R. STERNER [4] and M.A. SIDDIQUE [3]

[1,4] *Denver Wildlife Research Center, Federal Center, Denver, CO., U.S.A.*

[1] *Present address : Lipha Chemicals, Inc., Chempar Division, 3101 W. Custer Ave., Milwaukee, WI 53209, U.S.A.*

[2] *Davy Agro, Dacca Air Bag, Dept. of Foreign Affairs, Canberra, A.C.T., Australia*

[3] *Bangladesh Agricultural Research Institute, Vertebrate Pest Section, Joydebpur, Dacca, Bangladesh*

Summary. — Jackals are numerous in Bangladesh, and play an important role in scavenging. Studies on food habits showed the species to be opportunistic in feeding. Jackals are a menace to agriculture by feeding on crops such as corn, sugarcane, melons, and vegetables. Individuals were trapped for immobilisation, radio-tracking, food habits, and morphological research. Data on body measurements and organ weight and stomach contents are presented. The home ranges for a male and female were, 1.1 and 0.6 km² respectively. Jackal damage to sugarcane did not correlate to variety, sugar content, nor rind hardness. Control implications are discussed in view of the dense human population and methods of control available.

Résumé. — Les chacals sont nombreux au Bangladesh et jouent un rôle important en tant que charognards. Des études de leurs habitudes alimentaires ont montré que l'espèce est opportuniste. Les chacals sont nuisibles à l'agriculture car ils se nourrissent des récoltes : maïs, canne à sucre, melons et légumes.

On a capturé des chacals pour tester les méthodes d'immobilisation, de radio-tracking, de choix d'aliments, et pour des recherches de morphologie. Des données sur les mensurations du corps, le poids des organes et les analyses des contenus stomacaux sont présentées. Les domaines d'un mâle et d'une femelle ont été respectivement de 1,1 et 0,6 km². Les dommages faits aux cannes à sucre sont sans corrélation avec la variété, le contenu en sucre ou la dureté des tiges.

Les implications d'un contrôle des chacals sont discutées en fonction de la densité du peuplement humain, et aussi des méthodes de contrôle possibles.

INTRODUCTION

Bangladesh is situated east of India in South Asia and has as area of 140,000 km², with a population of over 85 million people. Agriculture is the

backbone of the economy and accounts for 55 % of the gross national product, 87 % of all employment, and 80 % of the country's exports (Anon. 1980).

Formerly known as East Pakistan, the country has a tropical climate with intensive agricultural practices and a high human density, which results in an array of pest problems in agriculture. As part of a farmer survey for vertebrate pest problems completed in 1979, thirteen of 115 farmers questioned reported golden jackals *(Canis aureus)* as a nuisance primarily in field crops (sugarcane and maze) and frequently preyed up on poultry.

The golden jackal is a wide-ranging species and is found from East Africa, the Middle East, and southern Europe and Asia. Ecological studies have been completed on several jackal species, but most of the work, however, was done on the African continent. For examples, see Lamprecht (1978), Rowe-Rowe (1975, 1976), and du Plessis (1970).

Mendelssohn (1972) reported golden jackals as a menace to agriculture in Israel and the associated complications of control efforts. From Asia, Taryannikov (1973) presented data on the distribution and density of golden jackals in the U.S.S.R. and Volozheninov (1972) and Taryannikov (1974) discussed jackal food habits. In India, Pratner (1965) presented ecological notes on the golden jackal along with behavioral information. The latter author discussed the relative paucity of information on the ecology of the species.

In 1979, the Bangladesh government implemented a vertebrate pest research project and rodents were quickly identified as a severe problem in agriculture. Before proceeding with large-scale rodent control research programs using rodenticides, non-target wildlife hazard potentials were examined. The jackal was observed as one of the most abundant potential predators and scavangers of rodents. A study, therefore, was organized with these main objectives : (1) to examine to what extent jackals prey on rodents by means of a jackal food habits study, (2) to better understand the impact of jackals on agriculture, (3) to monitor jackal movements through the use of radio-tracking techniques, (4) to test an immobilizing drug on jackals, and (5) to record general morphological, ecological, and behavioral information on the species.

METHODS

Capture techniques.

Jackals were captured using No. 3 Victor steel traps with off-set jaws. These were positioned in areas of known jackal usage, such as along trials, drainage ditches in fields, near corn or sugarcane fields, on the edges of cities, or within city limits near garbage dumps.

Each trap had a 0.5 meter-long heavy duty chain attached to a 30 cm long steel rod. The rod was driven into the ground to anchor the trap. The chains were secured to small trees during the rainy season because a trapped animal could easily pull the rod loose. A 10 to 15 cm diameter hole was dug and the rod driven into the ground. The trap was placed over the anchored rod and chain and covered carefully with fine soil. Bait was placed approximately 20 to 25 cm behind the trap. Branches or banana leaves were used to block three sides of the set and force the animal to approach the bait from only one direction.

Various baits were used to attract jackals to the sets, including fish, banana, corn on the cob, dead rats, sardines, chicken entrals, and jackal urine.

Traps were set at dusk and checked at 2 to 3 hour intervals throughout the night. Trapped jackals were handled using a noose attached to the end of a 3-m long aluminum pipe.

Immobilization.

Ketaset (1) (Ketamine hydrochloride) was used to immobilize trapped jackals. The canids were pinned to the ground with the loop and pole held securely by the tail and the chemical injected with a syringe in the hip region. Notes were kept on the effects of the drug from the onset of immobilization to recovery.

Necropsy.

Jackals were necropsied for reproductive parameters, body measurements (mm) and organ weights. A *Pesola* spring scale was used to obtain organ weights in the field. Stomach contents were examined and identified as to the relative frequency of occurrence. Notes were kept on the general physical condition, parasites, and body weights of each animal.

Radio tracking.

This portion of the study was completed at Ishurdi on the B.A.R.I. Research Farm. One male and female jackal were instrumented with coyote *(C. latrans)* sized 164 MHz transmitters, designed and built by the Denver Wildlife Research Center. The null method (Cochran and Lord 1963) was used in determining direction of signal source. A jackal was considered active if variation in radio signal intensity was heard. A tracking system described by Poché *et al.* (1980) was employed and triangulation data obtained from two tracking stations. One station was atop a 20 m high water tower and the second was 0.5 km to the east on a building top on the edge of an expanse of fields. Home ranges were determined by the geometric center of activity method (Hayne 1949) plotted on graph paper.

Field testing using fixed beacon transmitters revealed the system to be accurate to within 20 m at a distance of 0.5 km. Radio location points were recorded at 15-minute intervals and were plotted on grid sheets to discern areas of nightly activity.

Jackal damage to sugarcane.

Farmers often complained of jackal damage to mature sugarcane. We examined for possible correlations between the incidence of jackal-damaged cane with its sugar content, variety and rind hardness. Sugar content was approximated using a durometer. Rind hardness reading and sugar content were determined from the damaged stalk and the nearest five stalks.

(1) Bristol Myers Company, Syracuse, New York.

RESULTS

Captures.

During this study 19 golden jackals were captured and immobilized. No particular bait item seemed to be preferred, however, more field testing of particular items is required before premature conclusions may be drawn. Basically, any food used in a trap set attracted a jackal if it came near. On June 17, 1980, we used jackal urine as an attractant from a necropsied animal and trapped a small Indian civet *(Viverricula indica).*

Several adult jackals consistantly avoided traps, but escaped with the baits. At the onset of the study, we thoroughly washed the traps in hot water after each capture and soon discovered this to be unnecessary. Carefully covering the trap with 0.5 cm of loose soil was sufficient to mask most of the human odor. We also noted that dropping small amounts of bait or fish oil directly onto the soil above the trap, enhanced trap success.

Jackal behavior after capture ranged from high anxiety with much tugging on the chain in attempts to escape to initial excitement followed by lying next to the trap. Upon our approach to captured animals however, individuals exhibited attack postures and advanced with displayed teeth and growling, and readily lunged towards us.

Immobilization.

The pole with the noose on the end proved to be an invaluable tool in restraining jackals. This phase of the capture generally proceeded quickly with little difficulty.

Ketaset proved to be a good immobilizing drug for the golden jackal. Table 1 presents the recovery time data. Recovery time included the period from complete immobilization of the animal, until the time when the canid was able to walk away from the capture site.

Injected dose levels varied from 15 to 80 mg per kg of body weight for individuals, and recover time response ranged from 32 to 300 minutes, depending upon the dose level. Harthoorn (1976) recommended 20 mg/kg for immobilization of jackals. Our data shows that Ketaset is relatively consistent and safe against jackals. None of the animals injected with Ketaset died from the drug.

The correlation between dose level (mg/kg body weight) and recovery time in minutes (Y) yielded a regression equation of $Y = 3.6707 \times - 24.1247$ and a correlation coefficient of $r = 0.9472$ ($P < 0.01$). Time of recovery after injection was relatively constant and dependent on the dose level.

Two immobilized males, after injected with 30 mg/kg Ketaset, were transported 2 km by vehicle. During this time they showed no side-effects and recovered with no apparent complications.

In addition to the jackals, several other animals were captured in a sugarcane field and immobilized with Ketaset. A 6.5 kg large Indian civit *(Viverra viverra)* was restrained for about one hour with only 2 mg/kg of Ketaset. Similar results were observed in a jungle cat *(Felis chaus)* which was injected with 14.3 mg/kg of the drug. The cat weighed 3.5 kg and was immobilized and handled within 2 minutes and remained sedated for 1.75 hours. Both animals recovered rapidly with no side effects.

TABLE 1. — Recovery time in golden jackals dosed with Ketamine hydrochloride in Bangladesh.

Date	Sex	Weight (kg)	Dose (mg/kg)	Recovery Time (minutes)
2/27/80	M	10.5	57.14	150
5/6/80	M	3.0	33.3	80
5/6/80	M	3.3	15.0	22
6/17/80	M	10.0	30.0	100
2/26/80	F	8.0	80.0	300
5/6/80	F	2.9	34.5	75
6/17/80	F	8.5	20.0	85

Regression Equation: Y = 3.67 x - 24.12

Correlation Coefficient: r = 0.947

Description of recovery.

The recovery process in jackals followed a similar pattern among individuals. The recovery events of a male captured on February 27, 1980 illustrates an example. The animal was injected with 6 cc of Ketaset (57.14 mg/kg) at 2255 hours. Ninety seconds after injection the animal began showing signs of the drug, with wobbly movements and swinging its head from side to side. Two minutes and 30 seconds after the injection, the animal was completely immobilized. The mean time of immobilization for all jackals in this study was 2 minutes 15 seconds. At midnight the animal began licking its lips. At 0012 hours there was a slight head movement ; 0022 hours the hindlegs moved slowly in a stretching motion and the head was lifted slightly ; 0044 hours the jackal tried to sit but struggled ; 0047 hours it managed to roll over but still had trouble holding its head erect ; 0110 hours the animal sprang up, attempted to run then fell over ; 0115 it moved 10 meters into a wheat field and dropped ; finally, at 0122 it walked off into the dark near complete recovery.

A 3 kg male was injected and completly immobilized within 75 seconds (33.3 mg/kg). It recovered and walked off 80 minutes after immobilization.

Necropsy.

Body measurements were taken from seventeen individuals. The average weight for adult males and females was 10.3 kg and 8.5 kg respectively (Table 2). Heart, liver, kidney, spleen, and lung weights were taken from 5 males and 5 females. Organ weights correlated with the body weight of the individual animals (Table 3).

All but one individual necropsied appeared well nurished as evidenced by much fatty tissue on most internal organs, especially the kidneys, and subcutaneously. The specimen collected from Shylet had mange and a missing tail.

Stomach contents.

Table 4 lists the variety of vertebrate, invertebrate and vegetable food items found in the stomach contents of twelve necropsied jackals. Carrion, including human, was the most frequently observed food item found in 45 % of those animals examined. The general diet is varied and dependent primarily upon availa-

TABLE 2. — Necropsy data from golden jackals collected in Bangladesh.

Animal Number	Locality	Sex	Weight kg.	Measurements (mm)					Organ Weights (g)					Notes
				Tot.l L.	Tail L	Hindpaw L.	Hft. L.	Ear L.	Heart	Liver	Kidney (paired)	Spleen	Lungs	
03	Dacca	M	11.5	1070	200	60	158	65						
04	Ishurdi	M	11.0	1100	250	60	165	79	96	490	87			
06	Akhola	M	10.5	1050	250	50	150	70	90	330	65	30	83	
07A	Ishurdi	M	10.5	1050	250	52	160	80						
07	Ishurdi	M	8.25	1030	270	64	165	70	63	316	50	43	64	
10*	Ishurdi	M	10.0	1060		56	180	75	68	326	54	56	110	
13	Ramu	M	6.5	900	250	40	152	63	40	226	40	58	44	
05*	Ishurdi	M	10.5	1050	250	52	160	80						Radioed
F-1*	Ishurdi	M	3.0	700	155	40	130	62						Marked
P-2*	Ishurdi	M	3.3											Marked
Mean			10.3	1058.6	245.0	56.3	162.6	74.1	79.2	365.5	64	43	85.7	
Standard Deviation			0.95	20.30	21.41	4.63	8.52	5.49	14.02	72.06	14.37	10.61	18.87	
01	Shylet	F	9.0	951	226	60		70						
02	Shylet	F	10.0	1035	225	65		73						
05	Ishurdi	F	7.75	1010	210	48	148	60	71	318	39	68	66	
07	Ishurdi	F	8.0	1000	200	60	150							
08	Ishurdi	F	2.9	715	175	40	130	55	19	99	26	70	29	
09	Ishurdi	F	8.5		220	55	180	72	62	290	58	104	50	
11	Ishurdi	F	8.0	1060	250	58	103	72	80	265	40	54	78	
12*	Ishurdi	F	3.5	630	200	50	125	73	28	185	34	12	44	
04	Ishurdi	F	8.0	1000	200	60	150							Radioed
Mean			8.46	1009.3	220.1	58	146.2	69.4	71	297.7	45.7	75.3	64.7	
Standard Deviation			0.74	33.67	17.16	4.58	24.66	4.8	7.35	14.52	8.73	21.1	11.47	

*Individuals not considered adults and data not incorporated in analysis.

TABLE 3. — Correlation between body weights and organ weight in golden jackals from Bangladesh.

	Sample Size	Regression Equation	Correlation
Heart	10	Y = 8.729 x 5.427	.934
Liver	10	Y = 34.288 x 22.827	.908
Kidney	10	Y = 5.515 x 6.888	.851
Spleen	9	Y = 1.277 x 45.648	.135
Lungs	9	Y = 7.729 x 6.521	.859

TABLE 4. — Summary of food items found in twelve golden jackal stomachs from Bangladesh (one stomach was empty).

VERTEBRATES	% FREQUENCY	VEGETATION	% FREQUENCY
Carrion	45	Rice Stems/ Leaves	45
Chicken	18	Zizaphus spp.	27
Chicken Feathers	18		
Misc. Bird Feathers	9	Fruit	9
Indian Myna	9	Tree Bark	9
Toad	9	Dates	9
Fish	9	Grass	9
		Corn	18
INVERTEBRATES		Misc. Plants	9
Beetles	9		
Crab	9		

ble of food types. There was no evidence of jackals consuming field nor urban rodents in this study.

Reproduction.

Jackals pups were observed throughout the year. A female collected from the Syhlet Distict on January 31, 1980 had three foetuses with average crown-rump lengths of 80 mm. Captured females had 7 or 8 mammae.

Radio-tracking.

A 10.5 kg male golden jackal (No. 05) was captured and equipped with a transmitter on February 26, 1980. The following night an 8 kg female (No. 04) was trapped and a transmitter attached. Two nights later we began monitoring the movements of the two animals from the tracking stations.

The transmitter on the female was not detected after March 18 while the signal emitted from the device on the male was received as late as June 29.

Figures 1 and 2 display plotted triangulated data points and depict the areas frequented by each animal. Both animals seemed to travel the same area nightly

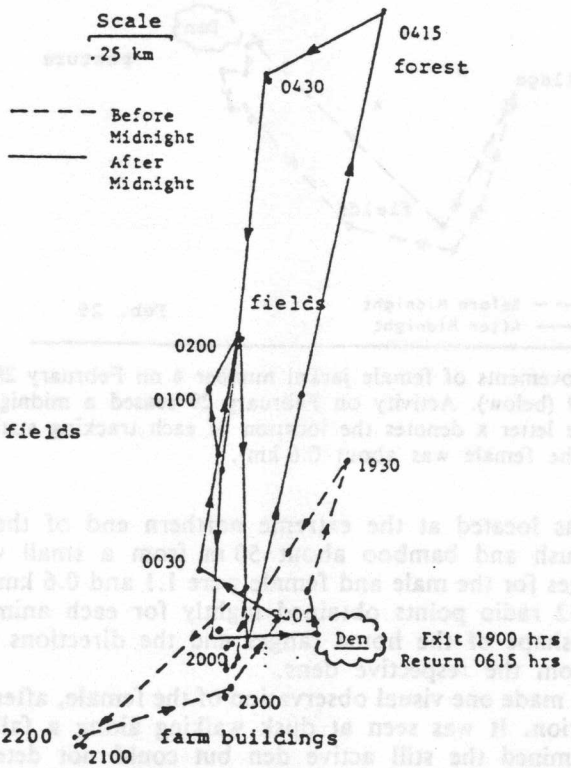

Fig. 1. — Movements of male jackal number 5 on the night of March 18, 1980. The arrows depict the direction of movement and the dots are radio recapture points. This animal had a home range of approximately 1.1 km².

with variations in local movements. As depicted in the movements of female No. 04 in Figure 1, the animal followed the same general trail for two successive nights on February 28 and 29. We were able to locate the den, which was only 75 meters from the eastern tracking station. It was situated in the middle of a fenced pasture. There was little surface ground cover to camouflage the entrance and it was located only 30 meters from an abandoned office building.

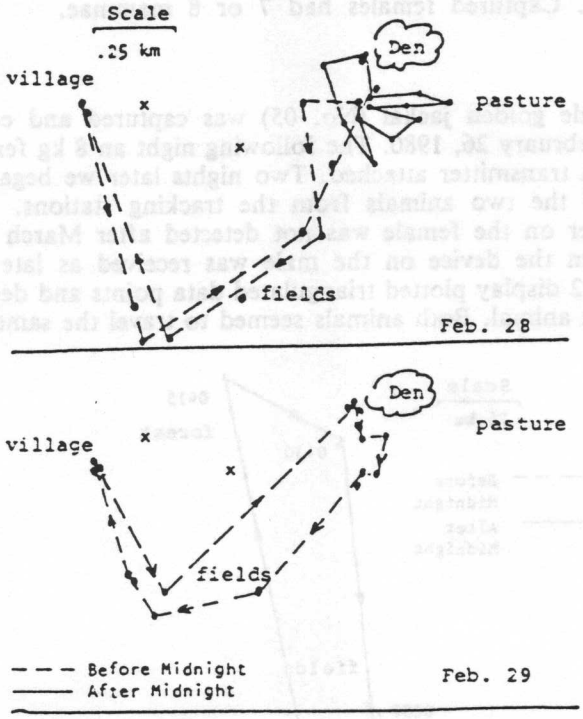

Fig. 2. — Nightly movements of female jackal number 4 on February 28, 1980 (above) and February 29 (below). Activity on February 29 ceased a midnight when heavy rains began. The letter x denotes the location of each tracking station. The home range size for the female was about 0.6 km².

The male's den was located at the extreme northern end of the home range in a thicket of brush and bamboo about 50 m from a small village.

The home ranges for the male and female were 1.1 and 0.6 km² respectively. This is based on 52 radio points obtained nightly for each animal. Figures 1 and 2 picture the shape of the home ranges and the directions of movement after emergence from the respective dens.

On April 4, we made one visual observation of the female, after the transmitter ceased to function. It was seen at dusk walking along a fallow field. On March 18, we examined the still active den but could not detect a signal.

The male displayed longer linear movements than the female (7.5 km per night). On March 17, the animal emerged from its den at 1900 hours and travelled along fields and roads in a direct line to the research station. Near midnight

it made a long trek north of the site then returned to the den at 0615 on the following morning.

On March 13, workers observed a jackal equipped with a transmitter at 2300 hours near a rice threshing floor on the research farm, where it walked up to within 30 m of talking workers and made off with stored meat. The same individual, identified as the female, was seen again on May 5 at 0030 on the same threshing floor. This was apparently one of her regular nightly stops during its scavanging.

At 0520 hours on May 6, we observed the female trotting back to its den, which had been moved about 100 m north of the original site, possibly due to heavy rains and birth of young.

Although the tracking data presented herein is preliminary, the information, the results indicate that jackals frequent the same general area each night. These data along with information on calling behavior suggest the species in Bangladesh is territorial (unpublished notes). In sugarcane fields, however, members of different packs appeared to share common trails at differing time intervals such as along roads or ditchbanks.

Damage to sugarcane.

Many farmers complained of jackal damage to sugarcane. As the sugar content increases jackals bite into the stalk and chew one or several joints.

During the study, we examined for jackal damage in 8 varieties of sugarcane for which damage was observed in 7 varieties. The results of 175 sampled stalks

Date	Variety	Damaged Brix	Rind Hardness
8/14	B070	12.5	40.2
9/20	ISD9/57	12.2	36.7
9/20	C01158	12.5	39.5
10/25	C0975	11.8	39.1
10/30	1.112/67	20.2	46.9
10/30	C0975	17.1	42.0
10/31	BS96	13.4	48.6

Undamaged (Range in Values)

Date	Brix	Rind Hardness
10/30-31	15.6-20.7	37-55
Damaged	17.1	42.0
	20.2	46.9
	13.4	48.6

TABLE 5. — The results of sugarcane rind hardness and sugar content (brix) of stalks damaged by golden jackals.

are summarized in Table 5. There appeared to be no selection for individual stalks by jackals. Neither sugar content nor rind hardness of individual stalks are important factors in determining why a particular stalk was damaged. From late October 1980, for example, rind hardness in undamaged stalks sampled ranged between 37 and 55, while damaged cane averaged 45.8. Likewise the brix in undamaged cane ranged between 15.6-20.7, and the damaged stalks averaged 16.9.

Although jackal damage may be high in localized areas, the overall impact on sugarcane production is minimal in Bangladesh. We did observe area where jackals damaged up to 65 stalks within a 10 m radius. To the average farmer, however, who may grow sugarcane on 0.5 to 1.5 hectares, jackal damage may impose severe economic difficulties.

DISCUSSION

Although the sample size, in the jackal food habit analysis is relatively small (n = 12), all indications are that the jackal does not feed heavily on field rodents in Bangladesh. The animal is mainly a scavanger playing an important role by eating garbage and animal carrion in and around towns and villages. The diet is dependant upon the availability of food items and ranges from watermelons and rice stems to crabs. We, therefore, feel that well supervised large-scale rodent control efforts in Bangladesh would not pose a threat to jackal numbers, provided the rodenticides used are relatively safe and have demonstrated little primary or secondary hazard potential.

With regard to jackal control in agriculture, wide-spread control of the canid is not advisable at this time. The most readily used method of control of wild candid involves the use of compound 1080. The product, however, has been proven to be toxic secondarily to birds of prey, and other wildlife (Hegdal *et al.* 1981). The use of such a product in Bangladesh is not advisable because of the dense human population, intensive agricultural practices, and relatively high populations of other wild carnivores and birds of prey.

Mendelssohn (1972) reported on jackal control efforts in Israel using strychnine where only moderate control was achieved. However, there was a concurrent decline in numbers of griffon vultures *(Gyps fulvus).* Similarly, in 1964-65 jackal control was undertaken using a 15 % fluoroacetamide injected into baits. Jackals were virtually eliminated, but, so were other carnivors feeding on the baits, such as mongooses, wild cats, and foxes. The omnivorous hooded crow *(Corvus corone)* declined drastically in numbers. The reduction in jackals resulted in an increase in hares *(Lepus europaeus)* which led to more damage to agriculture than previously inflicted by jackals.

The rather compacted agrosystem found in Bangladesh may be more sensitive to jackal control than as reported is Israel. The role of the jackal in Bangladesh food chains is a major one. Removal of the jackal may result in more Indian hare *(L. nigricollis)* damage to field crops. Interviews with 115 farmers selected at random in 1979 revealed 12 % viewed the Indian hare as a menace to agriculture under present conditions.

Jackals play an important role in scavenging in and around cities in Bangladesh. The topic of jackal control is by far no easy decision, since the pros and cons have to be carefully reviewed. One fact is almost certain, however, and that is if the jackal is removed in large numbers, another more severe problem in agriculture may blossom, whether it be hares or rodents.

The jackal does pose problems in isolated areas and it is ofen a menace. In 1979, for example, two young children were attached and killed by jackals near the edge of a village in southern Bangladesh. Also, more than likely the

canid plays an important role in the epidemology of rabies, which is common to the region.

There are some areas where jackals should be removed because the canid density is high and this results in frequent encounters with humans. The safest and perhaps most effective means of reducing jackal numbers to a « tolerable » level is by means of steel traps (described in the methods section). Trapping and removing individual animals from an area may reduce contact with humans.

We did trap up to 5 individuals from the same trap placement over a several month period. The species does not seem to be adversely affected by the loss of a group member, nor increased human activity.

Since jackals were observed to attack other individuals and jackal entrals were used as effective bait for traps, we feel that the removal method may be the only effective means of limited, temporary control. The questions, as to when, where, and how many to remove are dependent on a number of factors including amount of damage to crops or livestock, frequency of human contact and impending danger, and labor intensity for the control program. This study provided basic data on jackal ecology in Bangladesh. More detailed studies should be completed before reduction in jackal numbers is undertaken. At this time, it is recommended that an alternative to chemical control be used. .

BIBLIOGRAPHY

ANON., 1980. — *Bangladesh Agricultural Research System.* Report Team, Minister of Agriculture and Forest, 148 p.

COCHRAN, W.W., and R.D. LORD, 1963. — A radio tracking system for wild animals. *J. Wildl. Mgmt.*, 27 : 9-24.

HARTHOORN, A.M., 1976. — *The chemical capture of animals.* Bailliere Tindall, London, 416 p.

HAYNE, D.W., 1949. — Calculation of size of home range. *J. Mammal.*, 30 : 1-17.

HEGDAL, P., T.A. GATZ and E.C. FITE, 1981. — Secondary effects of rodenticides on mammalian predators. *The Worldwide Furbearer Conference Proceedings :* 1781-1793.

LAMPRECHT, J., 1978. — On diet, foraging behavior, and interspecific food competition of jackals in the Serengeti National Park, East Africa. *Z. Säugetierkd.*, 43 (4) : 210-223.

MENDELSSOHN, H., 1972. — Ecological effects of chemical control of rodents and jackals in Israel. *In : The Careless Technology : Ecology and International Development :* 527-548.

PLESSIS, S.S. DU, 1970. — Predation by black-backed jackals on new-born blesbok lambs. *35th North American and Natural Resources Conference, Transactions :* 85-92.

POCHÉ, R.M., M.Y. MIAN, P. SULTANA, R. STERNER and M. SIDDIQUE, 1980. — *Rodent movements in wheat fields.* Vertebrate Pest Division Report. Bangladesh Agricultural Research Institute, Joydebpur, 18 p.

PRATNER, S.H., 1965. — *The book of Indian animals.* Bombay Natural History Society. Bombay, India, 324 p.

ROWE-ROWE, D.T., 1975. — Predation by black-backed jackals in a sheep farming region of Natal. *J. Southern Afr. Wildl. Mgmt. Ass.*, 5 (1) : 79-81.

ROWE-ROWE, D.T., 1976. — Food of the black-backed jackal in nature conservation and farming areas in Natal. *E. Afr. Wildl. J.*, 14 : 345-348.

TARYANNIKOV, V.I., 1973. — Distribution and density of the jackal in the Uzbek-SSR. *UZB Biol. ZH*, 17 (4) : 45-47.

TARYANNIKOV, V.I., 1974. — Feeding of the jackal *Canis aureus aureus* in the Syrdarya Basin Uzbek-SSR, USSR. *Zool. ZH*, 53 (10) : 1539-1547.

VOLOZHENINOV, N.N., 1972. — Feeding of *Canis aureus aureus*, *Vulpes vulpes flavescens* and *Felis chaus oxianus* in Southern Uzbekistan. *Zool. ZH*, 51 (7) : 1048-1053.