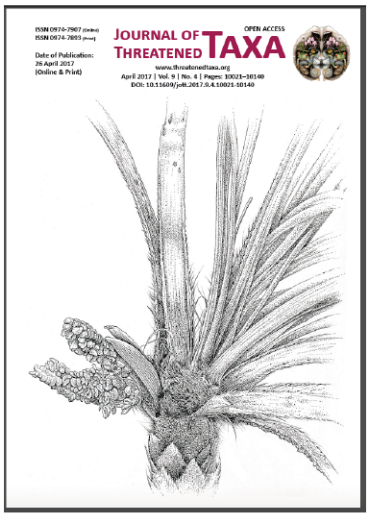

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SHORT COMMUNICATION

DENSITY AND OBLIGATORY FEEDING HABITS OF AN ISOLATED GOLDEN JACKAL *CANIS AUREUS* L. (MAMMALIA: CARNIVORA: CANIDAE) POPULATION IN PIROTAN ISLAND, GULF OF KACHCHH, INDIA

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Density and obligatory feeding habits of an isolated Golden Jackal *Canis aureus* L. (Mammalia: Carnivora: Canidae) population in Pirotan Island, Gulf of Kachchh, India

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Abstract: Efforts to arrest the decline of carnivorous mammals in isolated ecosystems have received little attention in India. The present study assesses the population density of a small Golden Jackal population, isolated on a water covered Pirotan Island in the Gulf of Kachchh Marine National Park, India. An average of 12 Golden Jackals/km^2 was found inhabiting the Island. The scat analysis revealed that the major diet of jackals was crab (89.5±2.36 %) followed by fish (2.7±0.82 %). Only 2.1% of their diets were from the Island source. They have well adapted to manage their water needs from their obligatory feeding habits.

Keywords: Density, Gulf of Kachchh, Golden Jackal, isolated population, obligatory feeding, Pirotan, scat analysis.

India is one of the 12 mega-biodiversity countries in the world, its species richness is mainly because of its location at the convergence of the three bio-geographic realms—Indomalayan, Paleartic and Ethiopian (Mackinnon & Mackinnon 1986). In spite of its fast depleting wildlife during the present century, India has a remarkable variety of large as well as small mammals and ranks second in terms of the number of threatened mammals (IUCN 2000). Although, a lot of attention has been paid to conserve the Indian mammal species/subspecies of other habitats, isolated ecosystems have received little attention so far (Beier 1995; Noss et al. 1996). The disappearance of the top predators from such isolated ecosystems may have community-wide implications (Ralls & White 1995; Sovada et al. 1998; Terborgh et al. 1999) and may lead to destruction of other faunal diversity. A small population of Golden Jackals, inhabiting a water covered Pirotan Island in Gulf of Kachchh Marine National Park is more susceptible to such threats. The Golden Jackal *Canis aureus* is also known as the 'Common Jackal' or 'Asiatic Jackal' or 'Reed Wolf'. Although similar to the small Grey Wolf, it is distinguished by a lighter tread, a more slender build, a sharper muzzle and a shorter tail. Its winter fur also differs from the wolves by its more fulvous-reddish color. The Golden Jackal is widespread in North Africa and northeastern Africa occurring from Senegal on the western coast of Africa to Egypt in the east, in a range that includes Algeria and Libya in the north to Nigeria,

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Chad and Tanzania in the south (Gupta 2011). They have expanded their range from the Arabian Peninsula into western Europe to Austria and Bulgaria (Sheldon 1992) and eastwards into Turkey, Syria, Iran, Iraq, central Asia, and the entire Indian sub-continent as well as east and south to Sri Lanka, Myanmar Thailand and parts of Indo-China. The Golden Jackal is fairly common throughout its range. High densities are reported in areas that have abundant food material and cover. It is an opportunistic predator and widely distributed in human settlements, semi-arid areas, deserts and shrub lands (Gianatos 2004; Jaeger et al. 2007). Golden Jackals can tolerate a wide range of temperature and their omnivorous diet helps them to survive in evergreen forests as well as hot deserts. The general dietary composition of golden jackal is birds, carcases, small mammals and other vertebrates, insects, small ungulates and even small fruits (Mukherjee et al. 2004). They are more nocturnal when occurring near human habitations. In relatively less disturbed areas, it may be diurnal (Fox 1975). They have a gestation period of 63 days and the litter size ranges from 1–4 pups. The main threat to this species comes from hunters and diseases such as distemper and rabies, which is mainly responsible for the death of large numbers of jackals. Also their habitat is being degraded due to increased industrialization, invasion of thorn plants like *Prosopis juliflora* and other developmental activities. Jackals feature on Schedule III of the Indian Wildlife (Protection) Act (1972) and are afforded the least legal protection (mainly to control trade of pelts and tails). They are also placed in 'Least Concern' status in the IUCN Red List of Threatened Species (Jhala & Moehiman 2008).

Despite playing an important role on the food chain in the isolated habitats and ecosystems, no data is presently available on the population status of the golden jackals from the Gulf of Kachchh. A study on population size, present status and feeding habits of an isolated golden jackal population inhabiting Pirotan Island would help its conservation.

Material and Methods

The Gulf of Kachchh is an east-west oriented indentation lying between the Kachchh mainland and the Saurashtra Peninsula along the northwestern coast of India. The southern shore has more than 42 Islands and inlets which harbour vast areas of mangroves and coral reefs (Fig. 1). Pirotan is the eastern most Island in the Gulf, located 12km from the coast (22^{0}35'03"N & 069^{0}57'27"E).

The density of the 'Golden Jackal' was estimated using the line transect method following Burnham et al. (1980).

Figure 1. The study site, Pirotan Island in Gulf of Kachchh, India

A 1.12km length transect was laid on randomly selected sites of the island and the Golden Jackals encountered during the line transect survey were recorded. Besides recording the group size, sighting angle and sighting distance were also documented at every sighting. The survey was conducted for a period of one year from May 2014 to April 2015 and all the surveys were conducted during the morning (06:00–7:00 hr) and evening (18:00–19:00 hr) once a week. From the transect data, density of the Golden Jackal was estimated using distance-sampling techniques following the software DISTANCE (version 6.0, Buckland et al. 2000). For feeding behaviour study, scat analysis was carried out following Korschgen (1980) and Ackerman et al. (1984).

Results

Pirotan Island covers an area of about 3km radius of inter-tidal zone during low tides, which is an ideal foraging ground for a variety of avifauna and terrestrial fauna inhabiting the Island. The present study covered a total of 140km of line transect walk and encountered 413 Golden Jackal observations with an average of 1.2 cluster/km (CV 5.32%). Density estimated using Distance 6.0 analysis revealed that the sampled area harboured an average of 12±2.79 Golden Jackal/km^2. The 95% confidence interval varied from 8–15 individuals/km^2 (Table 1). The scat analysis revealed that the major diet of the jackals was crabs (89.5±2.36 %) and some small percentage of fish (2.7±0.82 %). Only 1.8% of their diet were from the land source (rat remains (1.3±0.58 %) and fruit seeds 0.5±0.2 %) and more than 90% of their diet was from the marine source (Fig. 2). During the present study the number of jackal cubs encountered was only six. So it was not possible to conduct any age class dynamics among the

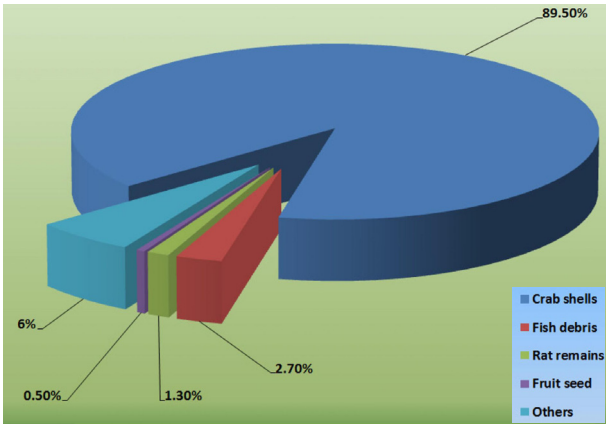

Figure 2. Percentage composition of scats of Golden Jackals from Pirotan Island

Table 1. Density analysis of Golden Jackals on Pirotan Island

Parameter	measurements
No. of transects	130
Effort (length in km)	140
Number of cluster detection (n)	132
Key function model	Hazard rate
Key adjustment	Simple polynomial
Detection probability (mean ± SE)	0.1 ± 0.27
Effective strip width (m) (mean ± SE)	18.6 ± 2.73)
Encounter rate of cluster/km (n/l)	0.3
Encounter rate of % CV	8.3
Cluster size (mean ± SE)	2.3 ± 0.13
Cluster density/km2 (mean ± SE)	11.2 ± 1.80
Cluster density % CV	16.8
Cluster density 95% CI	7.6–14.8
Individual density/km^2 (mean ± SE)	15.4 ± 3.31
Individual density % CV	12.8
Individual density 95% CI (individual/km2)	12.6–25.2
Minimum AIC	45.68

encountered population.

Discussion

Islands around the world are under tremendous pressure from growing human populations and the resulting exploitation of resources, habitat destruction and introduction of invasive species (Whittaker & Fernandez-Palacios 2007; Kreft et al. 2008). Of the 724 recorded animal extinctions in the last 400 years, about half were of Island species (Kasnoff 2000). At least 90% of the bird species that have become extinct in that period were island-dwellers (Kasnoff 2000). Competition, predation and other biotic factors play determining roles in the distribution, dispersal and extinction of animals and plants (Lomolino et al. 2010). The present study revealed that the Pirotan Island harbours an average of 12 Golden Jackal/km^2. Giannatos et al. (2005) estimated an average density of 1– 1.5 jackals/km^2 in the wetlands of northeastern Greece. Novaro et al. (2000) provided a density of 0.2–1.3 individuals/km^2 of Jackals from northwestern Patagonia in Argentina. The high population density of Jackal from the present study provides evidence of ample prey resource and less predation on Pirotan Island.

Golden Jackals are carnivorous or omnivorous and can be opportunistic foragers as well. Their diet also varies according to the season and the habitat (Jhala & Mohelman 2008). Due to their tolerance of dry habitats and their obligatory foraging, the golden jackals can live in a wide variety of habitats. Inter-tidal area of the Pirotan Island offers a variety of prey source for the Jackals during the low-tides consisting of neptune crabs and fishes (Image 1). The mangrove area of the Island has mud crabs and roosting birds. Scat analysis has been used in a wide variety of canid species to infer dietary composition (Lamprecht 1978; Macdonald 1983). Dietary composition analysis of jackals is based on the percentage weight of different food items in scats and their frequency of occurrence. The scat analysis of the present study also revealed that the crabs are the major diet (89.5%) for the Pirotan inhabiting Jackals. The feeding behaviour of the Jackals also depends on the tides cycle rather than being nocturnal or diurnal. The present work also inferred that the Jackals of the Pirotan Island are mainly dependent on marine resources for foraging. Terrestrial source of food includes (1.8%) rodents and small fruits. Radović & Kovacić (2010) recorded a considerable percentage of fruit and vegetables in the Jackals diet. Tendu fruit was reported as the major diet of Jackals (48.5%) in Van Vihar National Park, Madhya Pradesh, India (Prerna et al. 2015). Likewise, buffalo was the predominant diet (27.16%) of Jackals in Gir National Park, Gujarat (Alam et al. 2015). But during the present study the fruit seeds of *Salvadora* represented 0.5% only. As they get plenty of crabs in Pirotan, they may consume fruits in less quantities. Although the Island has no natural water source, the Jackals have adapted to manage their metabolic water needs from the crab meat. It was also observed that Jackals lick dew on the leaves in the morning, just after sun rise for their water needs (Image 2). They have adapted well to manage their water needs from the Island source itself. Islands are often acknowledged as a refuge

Image 1. Jackals feeding at the inter-tidal regions of Pirotan Island

Image 2. Jackals of Pirotan consuming dew on a man-made structure

for species with declining mainland distributions. As the finite size of Islands coupled with isolation can lead to genetic deterioration with insular population, the study of these systems is of great interest to the conservation of biological diversity or persistence.

References

Ackerman, B.B., F.G. Lindzey & T.P. Hernker (1984). Cougar food habits in southern Utah. *Journal of Wildlife Management* 48(1): 147–155.

Alam, M.S., J.A. Khan, C.H. Njoroge, S. Kumar & R.L. Meena (2015). Food preferences of the Golden Jackal *Canis aureus* in the Gir National Park and Sanctuary, Gujarat, India. *Journal of threatened Taxa* 7(2): 6927–6933; http://dx.doi.org/10.11609/JoTT.o3954.6927-33

Beier, P. (1995). Dispersal of juvenile cougars in fragmented habitat. *Journal of Wildlife Management* 59: 228–237.

Buckland, S.T., R.E., Russell, B.G., Dickson, V.A. Saab, D.N. Gormanand & W.M. Block (2000). Analysing Designed Experiments in Distance Sampling. *Journal of Agricultural Biological and Environmental Statistics* 14: 432–442.

Burham, K.P., D.R. Anderson & J.L. Laake (1980). Estimation of density from line transect sampling of water birds and wetlands in the Asia-Pacific Region: Result of the Asian Water birds Census. *Wetlands International* 1–78.

Fox, M.W. (ed.) (1975). *The Wild Canids: Their Systematics, Behavioral Ecology and Evolution*. Van Nostrand Reinhold Co., New York, 508pp.

Giannatos, G. (2004). Conservation Action Plan for the Golden Jackal (*Canis aureus* L) in Greece.

Giannatos, G., Y. Marinos, P. Maragou & G. Catsadorakis (2005). The status of the Golden Jackal (*Canis aureus* L.) in Greece. *Belgium Journal of Zoology* 135(2): 145–149.

Gupta, S. (2011). Ecology of medium and small sized carnivores in Sariska Tiger Reserve, Rajasthan, India. PhD Thesis. Saurashtra University.

IUCN (2000). Red List of Threatened Species. International Union for the Conservation of Nature and Natural Resources. Gland, Switzerland.

Jaeger, M.M., E. Haque, P. Sultana & R.L. Bruggers (2007). Day-time cover, diet and space-use of Golden Jackals (*Canis aureus*) in agro-ecosystems of Bangladesh. *Mammalia* 71(1/2): 1–10.

Jhala, Y. & P.D. Moehlman (2008). *Canis aureus*. The IUCN Red List of Threatened Species.Version 2014.3.Available online on 03 December 2014. www.iucnredlist.org

Kasnoff (2000). Craig. In the Wild Spotlight: Island Biogeography (and fragmentation). Http:// www.bagheera.com.

Kreft, H., W. Jetz, J. Mutke, G. Kier & W. Barthlott (2008). Global diversity of island floras from a macroecological perspective. *Ecology Letters* 11: 116–127.

Korschgen, L.K. (1980). Procedure for food habits analysis, pp. 113–128. In: Schemnitz, S.D. (ed.). *Wildlife Management Techniques Manual*. The Wildlife Society Washington, D.C.

Lamprecht, J. (1978). On diet, foraging behaviour and inter specific food competition of jackals in the Serengeti National Park, East Africa. *Mammalian Biology* 43: 210–223.

Lomolino, M.V., B.R. Riddle & J.H. Brown (2010). Biogeography. Sinauer Associates, Inc., Sunderland, Massachussetts, USA.

Macdonald, D.W. (1983). The ecology of carnivore social behaviour. *Nature* 301: 379–383; http://doi.org/10.1038/301379a0

MacKinnon, J.R. & K. MacKinnon (1986). *Review of the Protected Areas System in the Indo-Malayan Realm.* IUCN/UNEP, Gland.

Mukherjee, S., S.P. Goyal, A.J.T Johnsingh & M.R.P.L. Pitman (2004). The importance of rodents in the diet of Jungle Cat (*Felis chaus*), Caracal (*Caracal caracal*) and Golden Jackal (*Canis aureus*) in Sariska Tiger Reserve, Rajasthan, India. *Journal of Zoology* 262(4): 405–411.

Noss, R.F., H.B. Quigley, M.G. Hornocker, T. Merrill & P. Paquet (1996). Conservation biology and carnivore conservation. *Conservation Biology* 10: 949–963.

Novaro, A.J., M.C. Funes & R.S. Walker (2000). Calibración del índice de estaciones odorí feraspara estimart endenciaspo blacionales del zorrocolorado (*Pseudalopex culpaeus*) en Patagonia. *Mastozoología Neotropical* 7: 81–88.

Prerna, S., A. Edgaonkar & Y. Dubey (2015). Diet composition of Golden Jackals *Canis aureus* (Mammalia: Carnivora: Canidae) in Van Vihar National Park, India, a small enclosed area. *Journal of Threatened Taxa* 7(8): 7422–7427; http://doi.org/10.11609/JoTT.o4091.7422-7

Radović, A. & D. Kovačić (2010). Diet composition of the Golden Jackal (*Canis aureus* L.) on the Pelješac Peninsula, Dalmatia, Croatia. *Periodicum Biologorum* 112: 219–224.

Ralls, K.R. & P.J. White (1995). Predation on San Joaquin kit foxes by larger canids. *Journal of Mammalogy* 76(3): 723–729.

Sheldon, J.W. (1992). *Wild Dogs: The Natural History of The No Domestic Canidae*. Academic press Inc., San Diego, 248pp.

Sovada, M.A., C.C. Roy, J.B. Bright & J.R. Gillis (1998). Causes and rates of mortality of swift foxes in western Kansas. *Journal of Wildlife Management* 62: 1300–1306.

Terborgh, J., J.A. Estes, P. Paquet, K. Ralls, D. Boyd-Heger, B.J. Miller & R.F. Noss (1999). The role of top carnivores in regulating terrestrial ecosystems. pp. 39–64. In: Soule, M.E. & J. Terborgh (eds.). *Continental Conservation*. Island Press, Washington (DC).

Whittaker, R.J. & J.M. Fernandez-Palacios (2007). *Island Biogeography*. Second Edition. Oxford University Press, Oxford, UK.

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