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## Crab-plovers *Dromas ardeola* in the Gulf of Kutch

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An anomalous wader, the Crab-plover *Dromas ardeola* of the north-eastern Indian Ocean, was studied in and near the Gulf of Kutch Marine National Park in February and March 1984. Some 2,300 birds were counted throughout 40% of available intertidal flats, so the total population of the area may be 5,000 or more. Roosts were traditional, cohesive and tidally related. When feeding (which may also occur at night), adults spaced out evenly along the shoreline; most immatures foraged close to (some soliciting food from) adults. Two foraging techniques were: motionless waiting, then dash or walk and stab (commoner, for larger crabs); slow pause-peck-pause for smaller prey. Intra- and interspecific kleptoparasitism occurs. Handling of prey varied with size; immatures took smaller items and handled them longer. The breeding grounds of the Gulf of Kutch population are not known to be local.

Crab-plovers *Dromas ardeola* are extremely unusual waders. They have customarily been placed in a family of their own, Dromadidae, and were considered to be closely related to the stone-curlews Burhinidae (Jehl 1968), but DNA studies place them as a subfamily Dromadinae of the pratincoles and coursers Glareolidae, this in turn being placed in the superfamily Laroidea (i.e. closer to the gulls and terns than to true plovers) within the Charadriiformes (Sibley and Ahlquist 1985). Their breeding habits are unique within the Charadriiformes: they nest colonially in burrows in sandbanks and the females produce a clutch of only one egg; the young are precocial, but unable to walk at first and remain in the burrow, relying on the adults for food; they continue to be fed by the parents after they leave the nest and apparently remain dependent for a considerable period – indeed young have been seen to solicit food from adults on passage and in winter quarters, although begging becomes indiscriminate and juveniles may even beg from each other (Cramp and Simmons 1983).

Crab-plovers are confined to tropical coastlines and their range extends eastwards from the Red Sea and the west coast and islands of Africa, through the Arabian Gulf and the Indian Ocean, as far as the east coast of India and the Andaman Islands (Ali and Ripley 1969, Cramp and Simmons 1983, Urban *et al.* 1986). They have been recorded as winter visitors to Pakistan and the west coast of India (Ali and Ripley 1969) and, prior to this study, the Gulf of Kutch was reported to support a small but significant winter population (S. Chavan pers. comm.). It remains unknown whether the birds breed in the Gulf of Kutch. The nearest breeding records are from southern Iran and Oman, and possibly also Sri Lanka (Ali and Ripley 1969, Phillips 1978, Cramp and Simmons 1983).

The Gulf of Kutch Marine National Park provides the specialist habitats they need to obtain their diet of crustaceans and other marine invertebrates, i.e. shallow lagoons or tidal zones exposing mudflats and coral reefs (Archer and Godman 1937). Their behaviour in the winter quarters is gregarious with a crepuscular though tidal-based activity pattern (see Cramp and Simmons 1983).

The 1984 Oxford University Expedition to the Gulf of Kutch had an ideal opportunity to make a population estimate for the species in the Marine National Park and to make some additional observations on the wintering biology of this unusual and little studied bird.

## METHODS

Counts and observations of Crab-plover populations were made during the course of a five-day boat cruise along the south coast of the Gulf of Kutch (27 February–3 March) and over a period of six days spent on Pirotan Island (20–25 February). Incidental observations were made while travelling along the southern coast of the Gulf of Kutch between 7 February and 10 March 1984. Observations of numbers and behaviour were made at all stages of the tidal cycle, using binoculars and telescope.

Low-tide observations were made on the reef flats of several coral islands, namely Bhaidar, Mathechusna and Pirotan Islands and also at Bhaina Bet and the mudflats at Salaya Point and Rozi Bunder. High-tide roosts were located and counted on Bhaidar and Pirotan Islands, Goos Reef, Gandhnakadoi Reef and on the mudflats beyond the reclamation dam to the north of Jodiya (for all localities, see Figure).

## RESULTS

### *Population and distribution*

Maximum counts from the high-tide roosts are listed in the Table. Bhaidar Island held the largest roosting population and a maximum of 1,200 birds were counted at the roost at the northern end of the island. This island is surrounded by a relatively large area of reef flat, and at low tide only a narrow channel separates it from the Chusna Islands. We were unable to locate a roost on the Chusna Islands, although the surrounding reef flats were used for feeding at low tide. The main part of the Bhaidar population was seen feeding within 1,000 m of the high-tide roost. On Pirotan, the roost of up to 470 birds was on the western side of the island. The exposed northern side did not support many feeding birds, but 200 were seen feeding on the muddier and more sheltered south-western side.

**Table.** Maximum counts of Crab-plovers at high-tide roosts

Date	Location	Maximum count
17.02.84	Jodiya Dam	230
24.02.84	Pirotan Island	470
27.02.84	Goos Reef	260
27.02.84	Gandhnakadoi Reef	200
01.03.84	Bhaidar Island	1,200
Total		2,360

Immatures were easily recognised by their smaller size and browner coloration. The immature plumage is retained for up to two years, so accurate assessment of age was not possible. Immatures were present in all roosting flocks and on the feeding grounds. At Pirotan, it was possible to get close enough to make a count of the proportion of immatures in the flock. Out of a roost of 470 birds, 80 were immatures. Thus the immatures represented approximately 17% of the flock.

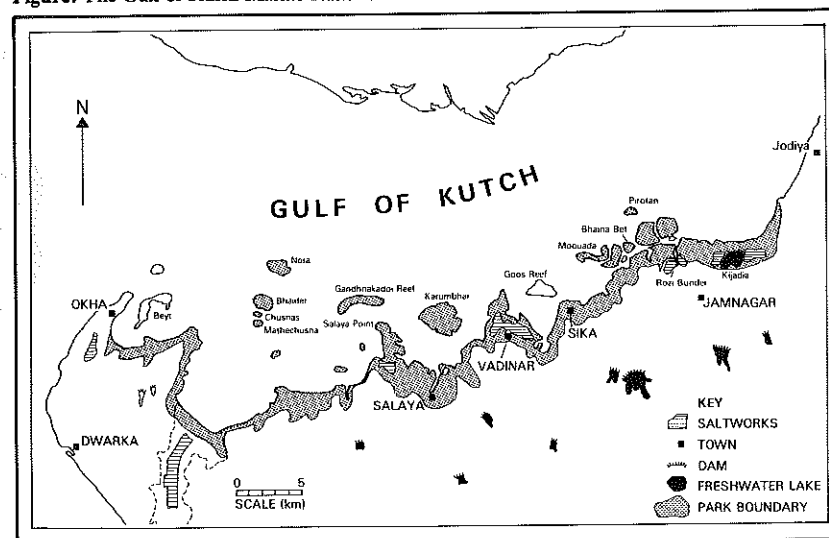
It is not known whether the wintering population of Crab-plovers is sedentary, but it appears from the limited evidence (see Foraging dispersion below) that the numbers of Crab-plovers on the exposed reef flats at low tide and then at high-tide roosts relate to the size of the available feeding area. A total of 2,300 birds were counted in the areas surveyed, which represents 40% of the available intertidal flats along the 160 km length of the south coast of the Gulf of Kutch. So a conservative population estimate would be about 5,000 birds.

### *Diurnal rhythm*

Activity was linked to the tidal cycle. At high tide, the birds gathered to roost on high ground. They could be found roosting an hour or two either side of high tide. Other waders started to feed as soon as the tide began to ebb, but Crab-plovers always remained on their roost for up to two hours before moving off to the water's edge to feed.

During our stay on Pirotan, high tide coincided with dawn and dusk and the roost was easily visible. In the mornings, the flock dispersed during the ebb tide to feeding grounds that could not be seen from the island. On the night of 24

**Figure.** The Gulf of Kutch Marine National Park



February, adults and immatures were heard on the shoreline of the northern part of the island at about 22h40. The rotating beam of the lighthouse revealed that they were feeding.

#### *Roosting*

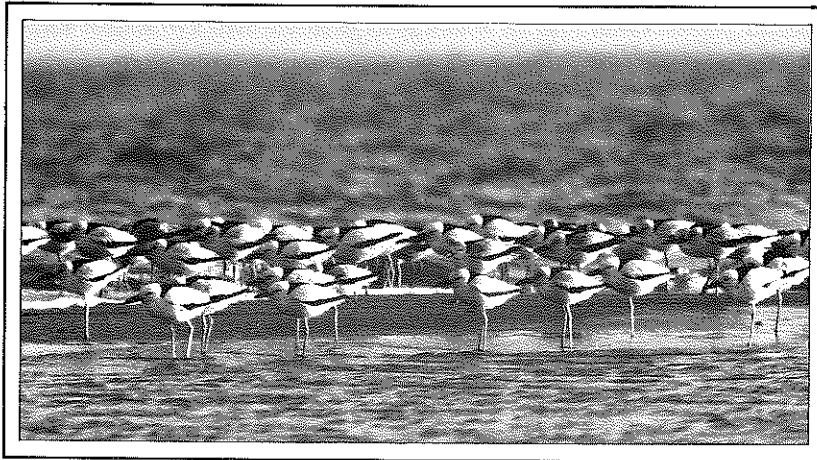
At Bhaidar and Pirotan Islands, the birds were always seen at the same roosts. They gathered well before high tide and, once settled, the single-species flock was tight and cohesive and over 70% of the flock would appear to sleep, while the rest would be preening or moving out of the way of the rising tide (see Plate). The immatures tended to be noisy and there would always be a few individuals trying to solicit food by standing in front of an adult with head lowered, calling continuously with a twittering sound and pecking at the beak of the adult. It was difficult to tell whether the birds were begging from a parent or from any adult nearby. Only one adult was seen to regurgitate food in response to such solicitation.

#### *Foraging dispersion*

Adult Crab-plovers would space out evenly along the shore. As the tide receded, the distance between the feeding birds increased. Distances between the birds were not quantified, but the impression was that at low tide birds would be spaced up to 50 m apart, a dispersion substantially greater than hitherto reported (Cramp and Simmons 1983, Urban *et al.* 1986). Feeding took place mainly at the edge of the water and along the tidal channels, particularly on the outer section of the reef flat where live corals were exposed. A few birds would feed further inshore on the reef flats where the corals are covered with sand.

Most immatures would forage in close attendance with a single adult. This may well have been one of the parents, but we did not see any birds foraging in family

Plate. Crab-plovers by Tom Owen Edmunds



groups of three. Some immature birds would run close behind a feeding adult, soliciting whenever food was located. Most immatures would obtain their own food, but they still remained in contact with an adult, although they might stray up to 50 m away at times. We did not observe any immature birds foraging entirely alone.

#### *Foraging techniques*

Two kinds of direct foraging techniques were observed. The commoner involved standing motionless, waiting for the prey, then taking 8–20 steps and standing still again for up to 70 s. When prey was detected, the bird would dash forward and stab at the victim, or move forward more slowly and probe with an open bill. This method yielded a prey item every 1–5 minutes and was used for hunting larger prey, usually crabs. In the less usual technique, when feeding on small items, the birds would pause briefly (1–10 s), then move forward 2–4 steps and either peck or pause again. This method usually gave rise to 3–4 pecks per minute. The prey items involved were too small for the observer to see how many of the pecks were successful.

Immatures tended to hunt by the second method, but if they found a large crab, they would stand still and call until the accompanying adult arrived. Thus it would appear that, despite the assertion that immatures in winter beg wholly indiscriminately (Cramp and Simmons 1983), a bond can persist between immature birds and at least one parent and that many of the immatures were feeding in co-operation with a parent.

Birds holding a large prey item were subjected to kleptoparasitism from neighbouring birds of their own species and fighting would then commonly develop. On one occasion, a bird with a large crab was followed by two Ruddy Turnstones *Arenaria interpres*. They appeared to be scavenging for any dropped pieces, rather than actually trying to appropriate the prey. Brown-headed Gulls *Larus brunnicephalus* and a second, unidentified *Larus* species were seen chasing Crab-plovers with prey.

#### *Handling prey*

Small items, including small crabs, were consumed whole. Large crabs took more handling, but were eventually swallowed whole, as long as the crab was small enough to be aligned in the beak. Very large crabs with pincers as long as the beak had to be prepared before they could be consumed.

Birds were not always successful in tackling large crabs. The crab would assume a defensive stance, with pincers spread, showing the brightly coloured body. The bird would circle the crab, stabbing at the pincers, but would eventually give up and move off.

Smaller crabs were picked up by one pincer and shaken, then dropped upside down and stabbed. The bird would then carry the prey off to dry ground. If other birds were attracted to the catch, it would be forced to fly a considerable distance to an isolated spot.

Once on dry ground, the process continued, and the crab was eventually swallowed, usually within 30 s. If the crab was too big for this, the limbs would be

eaten first, pincers before legs. To do this, the bird would hold one limb in its beak and shake its head until the crab fell to the ground, then swallow the limb left in the beak and rapidly grab the next one. The carapace was opened by wedging the bill inside the front of the shell, then shaking the head and beating the shell on the ground. The whole process took about three minutes.

Whether foraging independently or with an adult, immatures tended to catch smaller prey than adults and took longer to handle a prey item. Accompanied immatures tended to spend time begging from the adult and would often run up to beg when the adult was dealing with a prey item. On one occasion when an adult and an immature bird were foraging in close association the adult kept the immature away, with raised rump feathers, until it had consumed all the limbs of a large crab. It then moved off and left the young bird to deal with the carapace. The immature bird spent five minutes trying to open the carapace, which was eventually stolen by a nearby adult.

### DISCUSSION

The population estimate of 5,000 birds in the south of the Gulf of Kutch is probably a conservative one. It would be relatively easy to perform a complete census, making use of the fact that flocks use the same high-tide roosts over several days and possibly over longer periods.

Since Crab-plovers can only rear a maximum of one young per pair, a count of 17% birds less than two years old would suggest that breeding had been relatively successful. Bearing in mind the fact that very few of the immatures appeared to be foraging entirely independently it might perhaps be inferred that most of them were in their first year.

It was suggested to us by local ornithologists that breeding may occur within the Gulf of Kutch. The sand dunes on Bhaidar might be suitable for the construction of nest burrows. Further research and questioning of local people might well reveal more information, for despite its remoteness, the area is well visited by fishermen. It would also be worth investigating the north side of the Gulf.

The specialised feeding techniques of Crab-plovers restrict their feeding activities to the period of low water. With such a limited time available for feeding, it would seem likely that they need to hunt at every low tide. When one tide falls at night, they probably feed in darkness and indeed our observations confirmed that this does at least sometimes happen. It is possible, however, that the lighthouse on Pirotan Island could have influenced the night-time behaviour of the birds, as they were hunting close to the lighthouse in an area which they had never been seen to use during the day. (Night hunting presumably requires good eyesight and hearing; the large eyes of the Crab-plover suggest that it can utilise low levels of light.)

It was clear from our observations that Crab-plovers roost in the close vicinity of their feeding grounds. However, some form of artificial marking would be necessary to discover the movements between feeding and roosting grounds and the amount of exchange between islands. The monospecific high-tide roosts provide an ideal

opportunity for large-scale netting, for example with cannon-nets. Considering that the birds spend so much of their time roosting, the presence of suitable roosting sites is an important ecological requirement for the species.

Studies in Aldabra showed that birds fed in flocks of 7–50 (mean 22), with each bird 3 m distant from the next one without provoking aggression (Cramp and Simmons 1983). Our observations in the Gulf of Kutch revealed a very different pattern with birds much more spread out yet with fights a common occurrence. It was not clear whether the low-tide feeding distribution of Crab-plovers reflected the distribution of the prey, or if the birds spaced themselves out in an attempt to avoid interference from neighbours.

The prolonged association between immature birds and adults is of considerable interest. The immatures obviously take some time to become skilled at feeding themselves and continue to rely on at least one parent to help with the catching and preparation of larger food items. It is very difficult to interpret the bond between an immature bird and its parents, but from our observations, it appeared that a young bird would associate with one adult, rather than feeding in a family party. The matter was further confused by the impossibility of discriminating between first and second year birds in the field.

Some important questions must be asked in relation to the conservation of Crab-plovers in the Gulf of Kutch. How much of the intertidal area is suitable for feeding? How many undisturbed roosting sites are available? How does the deposition of sediment in the Gulf affect their feeding grounds? Is there a danger that their feeding habitat could be destroyed by an oil spill from the international oil terminal at Vadinar? Are Crab-plovers a useful indicator of the equilibrium of the coral ecosystem of the Gulf?

The significance of the Gulf of Kutch as a habitat for these rare and highly sophisticated birds has been recognised by the management of the Marine National Park, and it has been proposed that they should be the emblem of the Park. It is important that further studies should be carried out to try to understand the ecology of the Crab-plover, and the Marine National Park has the facilities for this.

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## The past and future of Gurney's Pitta *Pitta gurneyi*

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Gurney's Pitta *Pitta gurneyi*, whose plumages are described here with particular reference to the little-known juveniles and to those of Banded Pitta *P. guajana*, is known only from southernmost Burma (last record 1914) and from peninsular Thailand between 11°50'N and 7°30'N (last record – prior to 1986 – 1952). The species was considered relatively common at least until around 1920, but in the past 50 years has been seen in the wild only twice, although a few captive specimens have been known since the 1960s, the last such dying in 1985 (a sonagram of the one type of call produced by this individual is provided). The species appears to breed from late May through to November. Records suggest that it disappears from southern Burma in response to the monsoon rains (July to September), and so may not breed there. Its distribution in the peninsula coincides with the distribution there of its (almost sole) habitat, semi-evergreen rainforest, and only the most northerly records (possibly both migrants) and those from the mountain Khao Phanom Bencha in 1936 could refer to different (drier) habitats, these being the only cases where the species has been recorded away from lowland. Competition with Banded Pitta at most sites may have confined Gurney's to lowland forest, its disappearance (and possible extinction) being directly attributable to the almost entire deforestation of lowland peninsular Thailand. Khao Phanom Bencha and a few other sites are identified as conceivably still holding the species.

Gurney's (or the Black-breasted) Pitta *Pitta gurneyi* is endemic to the forests of peninsular (i.e. southernmost) Burma and Thailand, from south of 12°N to around 7°N. It is not known to extend into Malaysia, but this is just possible (see Natural constraints). Such a restricted range is unusual in a (non-montane) species in mainland South-East Asia, a fact remarked upon by Chasen (1939:203) and Wells (in Medway and Wells 1976:2). It is evidently this very limited distribution, combined with a lack of records in recent decades, that led to the species being considered by King (1978–1979) as threatened (IUCN status category 'Indeterminate'), although there is no mention of it in Jintanugool *et al.* (1985) or Blower (1985a). As King's treatment of the bird is somewhat cursory, a complete review of our knowledge of it seems appropriate; and indeed, the provision of every available detail relevant to the species's conservation is now essential in the face of evidence that, if it survives at all, it stands at the very edge of extinction.

In the following account, unless otherwise clearly stated, all coordinates and modern place-name spellings are derived from *The Times atlas of the world* (1980) or Office of Geography (1966a,b), the latter taking precedence over the former where discrepancies over coordinates occur. AMNH stands for American Museum of Natural History, ANSP for the Academy of Natural Sciences, Philadelphia, BMNH for British Museum (Natural History), BNHS for Bombay Natural History Society, CUMZB for Chulalongkorn University Museum of Zoology, Bangkok, IUCN for International Union for Conservation of Nature and Natural Resources, MAPS for Migratory Animal Pathological Survey, MCML for Merseyside County Museums, Liverpool, MNHN for Muséum National d'Histoire Naturelle, Paris, NRM for Naturhistoriska Riksmuseet, Stockholm, NUSZRC for National University of