

Record numbers of grasshopper-eating waders (Oriental Pratincole, Oriental Plover, Little Curlew) on coastal west-Kimberley grasslands of NW Australia in mid February 2010

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Piersma, T. & Hassell, C. 2010. Record numbers of grasshopper-eating waders (Oriental Pratincole, Oriental Plover, Little Curlew) on coastal west-Kimberley grasslands of NW Australia in mid February 2010. *Wader Study Group Bull.* 117(2): 103–108.

Keywords: Oriental Pratincole, *Glareola maldivarum*, Oriental Plover, *Charadrius veredus*, Little Curlew, *Numenius minutus*, *Stropis maculosa*, Yellow-winged Grasshopper, *Gastrimargus musicus*, Spur-throated Grasshopper, *Austracris guttulosa*, Kimberley, Australia

Following a record count of close to 3 million Oriental Pratincoles *Glareola maldivarum* on Eighty Mile Beach, NW Australia, in Feb 2004, we report similarly large numbers of grasshopper-eating specialists representing three wader families (Glareolidae, Charadriidae and Scolopacidae) on grassland areas in the same region. In the late morning of 11 Feb 2010, as the midday heat had driven the grassland birds to the relative coolness of the Indian Ocean beaches, we counted 514,900 Oriental Pratincoles and 144,300 Oriental Plovers *Charadrius veredus* along 75 km of Eighty Mile Beach (165 km southwest of the town of Broome). Two days later similar numbers of Oriental Plovers were present along 45 km of the same beach, where we also counted 241,400 Oriental Pratincoles and over 14,200 Little Curlews *Numenius minutus*, the latter being absent during our previous count. Then, at Roebuck Plains cattle station (32 km east of Broome) during the late afternoons of 13, 14 and 17 Feb 2010, we recorded at least 60,000 Oriental Pratincoles moving around in flocks of up to 25,000. Huge numbers of small, 2–4 cm long, grasshoppers must have attracted the wader masses to these grasslands. Variation in seasonal rainfall is probably the main factor leading to these large aggregations of grassland waders. Relatively limited amounts of rain may result in a burgeoning grasshopper population, but persistent heavy rain may reduce the availability of food leading the birds to seek drier conditions elsewhere. In Feb 2010, these factors probably operated together and led to the aggregations of grasshoppers and waders we witnessed. The number of Oriental Plovers we counted doubles the population estimate for the region. Recent increases in the numbers of grassland waders recorded in NW Australia can probably be attributed to limited observer effort during the austral summer.

INTRODUCTION

Swarms of locusts have attracted the fear of farmers in tropical regions (Mullié 2009) and the imagination of writers, including those of the Bible. That swarms of these herbivorous insects may also attract similarly impressive swarms of their predators, was pointed out by Sitters *et al.* (2004) in their description of the record numbers of Oriental Pratincoles *Glareola maldivarum* encountered at midday on 7 Feb 2004 at Eighty Mile Beach. Their aerial count of 2.88 million Oriental Pratincoles implicated a 38-fold increase in the estimate of the flyway population (Delany & Scott 2006), and the large numbers of pratincoles “pretty much cleaned-up” the grasshoppers munching away at the vegetation at Anna Plains Station on that occasion (quote by J. Stoate of Anna Plains Station, Feb. 2010).

That Sitters and co-workers were able to come up with this estimate at all, was due to a fortuitous combination of weather conditions at the time (both locally and elsewhere in

Australia), the large food supply available, and the practicality of counting birds when they roosted on the beaches adjacent to the grassland feeding areas. They were also assisted by the availability of a light aircraft. At Anna Plains Station, extensive grasslands are bordered by a long open beach, Eighty Mile Beach (which is actually 225 km in length; Fig. 1), itself used by up to 500,000 waders that forage on the adjacent mudflats during low tide (Piersma *et al.* 2005). As the sun gains power in the morning, after only 2–3 hours of daylight feeding opportunities, Oriental Pratincoles cross the dunes behind the beach to join the marine waders on either the offshore mud or the beach, depending on the stage of the tidal cycle (Sitters *et al.* 2004, pers. obs.). Not only do pratincoles move from the grasslands to the beach, the other two grassland-feeding grasshopper-specialists, Oriental Plover *Charadrius veredus* and Little Curlew *Numenius minutus*, are known to do the same (Sitters *et al.* 2004, pers. obs.). In the grasslands, these birds are difficult to see, even when they are foraging; however in the middle of the day they retreat

Fig. 1. Location of the coastal west-Kimberley grasslands along the Great Northern Highway between Port Hedland and Broome, NW Australia. They are coloured grey by the marine-sediment soils that are so clearly distinguishable from the pindan-red, terrestrial soils of the higher ground. Eighty Mile Beach is the light border between sea and land. Anna Plains Station homestead is indicated by a black dot.



to the nearby beaches, apparently to avoid the oppressive heat of the plains, and there they are much easier to count. In Feb 2010, six years after Sitters *et al.* (2004) were amazed by seemingly endless stretches of beach covered by roosting Oriental Pratincoles, we encountered a similar scene.

METHODS

We aimed to spend three successive high tide periods on the mornings of 11–13 Feb 2010 at Eighty Mile Beach on a systematic search for Great Knots *Calidris tenuirostris*, Red Knots *Calidris canutus piersmai* and Bar-tailed Godwits *Limosa lapponica menzibieri* that had been individually colour-marked 165 km to the northeast in Roebuck Bay, Broome, in the context of efforts by the Global Flyway Network (Hassell 2010, Piersma 2007). With morning high tides predicted for 10:01, 10:30 and 10:57h respectively, we arrived at the beach at 06:30h each day so that we would be able to travel to distant stretches of beach in sufficient time to allow us to spend two hours of the incoming tide looking for individually marked foraging birds with a relatively low sun; then during the 4 hours centered on high tide we scanned the massed flocks of roosting waders. On each day we left the beach around 14:30h.

On 11 Feb, when we saw that large numbers of Oriental Pratincoles and the Oriental Plovers were present, we decided to use the return drive along the beach after high tide, from 13:00 to 14:30h, to count them along the whole 75 km of Eighty Mile Beach south of the Anna Plains access. One observer (TP) counted the birds in hundreds with the naked eye using a handheld counter as the vehicle was driven steadily along the beach at 30–50 kph. The car was frequently stopped to allow time to ensure that the Oriental Plovers were being accurately distinguished from the marine waders that steadily moved away onto the mud as the tide fell. Every 5 km, the accumulated counter tally was recorded. On 13 Feb, we carried out a repeat count between 13:30 and 14:30h along the 45 km south of the beach access, this time focusing on Oriental Pratincoles. However, we soon noticed that rather large numbers of Little Curlew were also present

and decided to include them as well. In the late afternoons of 11 and 12 Feb (17:15–18:30h), we spent time surveying the grasslands around Anna Plains homestead. We saw thousands of pratincoles and hundreds of plovers but it would have been very difficult to make accurate counts.

In the late afternoons of 13, 14 and 17 Feb (17:15 to 18:30h) we surveyed Roebuck Bay plains from the Great Northern Highway. On 14 and 17 Feb, we had permission to enter the paddocks to approach flocks seen from the Great Northern Highway that crosses the Roebuck Plains in a SE–NW direction. We ventured east of the highway into a grassland area dotted with termite mounds on 14 Feb, and west of the highway into the grasslands bordering Roebuck Bay on 17 Feb. We also surveyed the western part of Roebuck Plains on 18 Feb from 06–08h. All observations were carried out with binoculars and telescopes.

RESULTS

On the ebbing tide of 11 Feb, we counted 515,900 Oriental Pratincoles and 144,300 Oriental Plovers on the 75 km stretch of Eighty Mile Beach south of the Anna Plains access point. With 81,400 Oriental Pratincoles and 26,700 Oriental Plovers, densities for both species were highest in the 40–45 km section (Fig. 2), and this was the case again on 13 Feb when 90,000 Oriental Pratincoles were counted there during the ebbing tide (Fig. 3). The total count of Oriental Pratincoles on 13 Feb was 241,400 birds, and during this count 14,200 Little Curlews were also encountered. On both days numbers of pratincoles and plovers were lowest in the 20–35 km section (Fig. 2). On both afternoons from 17:15–18:15h, we surveyed the grasslands around Anna Plains Station and found numerous mixed flocks of Oriental Pratincoles and Oriental Plovers. The plovers were most abundant in areas with the sparsest vegetation. Both species would seem to feed on foot, but the pratincoles also made swirling movements in groups low over the grass or saltmarsh vegetation, movements that we initially interpreted as the communal chasing of grasshoppers to make them catchable.

On 13 Feb, returning from Anna Plains to Broome we

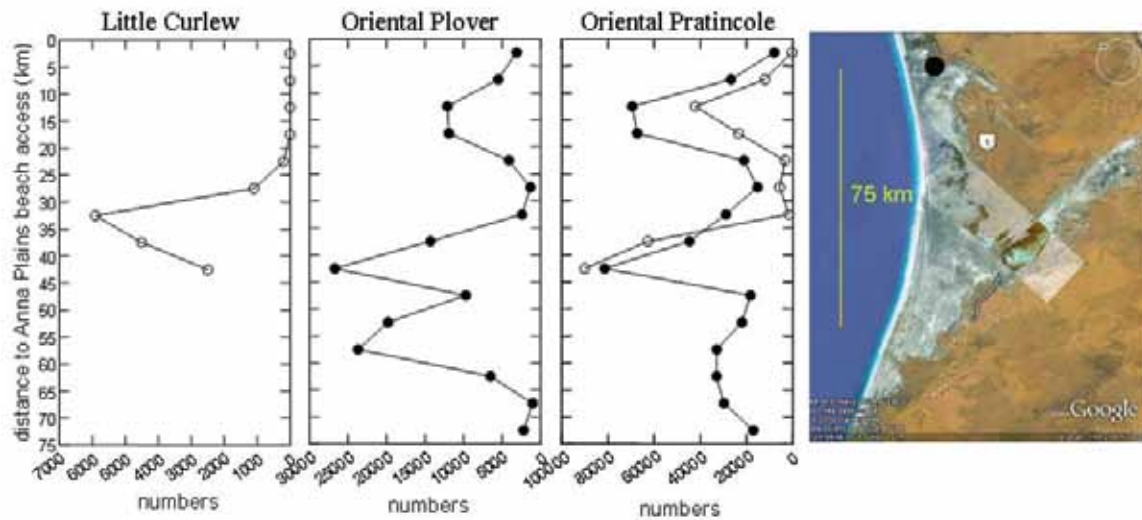


Fig. 2. The distribution of the three grasshopper-eating shorebirds, Little Curlew, Oriental Plover and Oriental Pratincole, along the 75 km long stretch of Eighty Mile Beach south of the Anna Plains access point counted in 5-km sections on 11 February (closed dots) and 13 February 2010 (open circles). On the right a Google Earth picture indicates the extent of grassland bordering the beach and strip of dunes. Anna Plains Station is indicated by the black dot.

crossed Roebuck Plains while travelling along the Great Northern Highway. We saw large flocks of Oriental Pratincoles over the grasslands and crossing the highway from east to west starting at 17:15h. Sometimes the flocks would descend and become invisible, and at other times the swirling movements of thousands of birds strongly reminded us of the aerial acrobatics of large Common Starling *Sturnus vulgaris* flocks (e.g. Ballerini *et al.* 2008). There was a steady movement of flocks towards the west. We estimated that we saw about 60,000 pratincoles altogether. This is very likely an underestimate of the total numbers using the grass plains as we could only see a relatively small area of the suitable habitat that was available to the birds.

The next day, 14 Feb, we encountered similar total numbers of Oriental Pratincoles east of the Great Northern Highway, and witnessed similar behaviour including a steady movement towards the west. From 17:40h, with a rapid build-up of thunderclouds from the south and in the brilliant evening light of a setting sun, ever larger numbers settled down on the ground in an area of huge termite mounds (Fig. 4). Around 18:10h, this concentration was estimated to comprise about 25,000 individuals. On the ground we found clusters of 5–8 dry droppings (c. 1–2 cm long, 8 mm diameter) containing the pinkish remains of ground-up arthropods, each cluster was 40–70 cm from the next. We interpreted each of these little dung-piles as representing the place where a single Oriental Pratincole had roosted (either by day or at night).

On 17 Feb, we were back on Roebuck Plains, but in contrast to the previous two afternoons there was no build-up of thun-



Fig. 3. Masses of Oriental Pratincoles on the section of Eighty Mile Beach 40–45 km interval south of the Anna Plains beach access point on 13 Feb 2010. (Photo: Chris Hassell.)



Fig. 4. Part of a large flock of Oriental Pratincoles standing with heads erect on Roebuck Plains, with the termite mounds in the background, close to sunset on 14 Feb 2010. (Photo: Adrian Boyle.)



Fig. 5. A large swirling flock of Oriental Pratincoles on Roebuck Plains during the late afternoon of 17 Feb 2010. (Photo: Adrian Boyle.)



Fig. 6. The masses of grasshoppers (nymphs of Spur-throated Grasshopper *Austracris guttulosa*); potential food for the grasshopper-eating shorebird species. Photograph taken on 17 Feb 2010 on the Great Northern Highway where it crosses Roebuck Plains. (Photo: Theunis Piersma.)

derclouds to the south. We first had difficulty finding any Oriental Pratincoles, but at 17:15h we saw flocks of hundreds to thousands flying rapidly in circles on stiff wings 600–700 m above the ground. It was evident that they were engaged in thermal soaring, a behaviour regularly seen in Oriental Pratincoles in NW Australia, often in the company of Pacific Swifts *Apus pacificus*. In the next half hour, birds steadily came down close to the ground and started swirling in tight flocks above the grassland vegetation (Fig. 5), behaviour that we had also encountered in the latter part of the previous two afternoons. This occurred from 17:45 to 18:20h. Then, mainly from 18:10 to 18:35h (sunset was at 18:25h), increasing numbers of birds landing on the ground in dense flocks among the sparse vegetation. When they

landed, the birds stood still with heads erect but were quite unwilling to move as we approached. We first thought they had landed in preparation to roost for the night, but from 10 min after sunset birds, mostly individually and from all parts of the dense flocks standing on the ground, started to fly off (mainly in a westerly direction, against the prevailing wind). At around 18:45h, greater numbers left in a steady stream, flying low over the ground and well spaced from each other. When it was almost too dark to see, we noticed that individual low flying birds would occasionally make an upward swoop, possibly to catch an insect. We interpreted the disappearance of the birds as the start of crepuscular feeding.

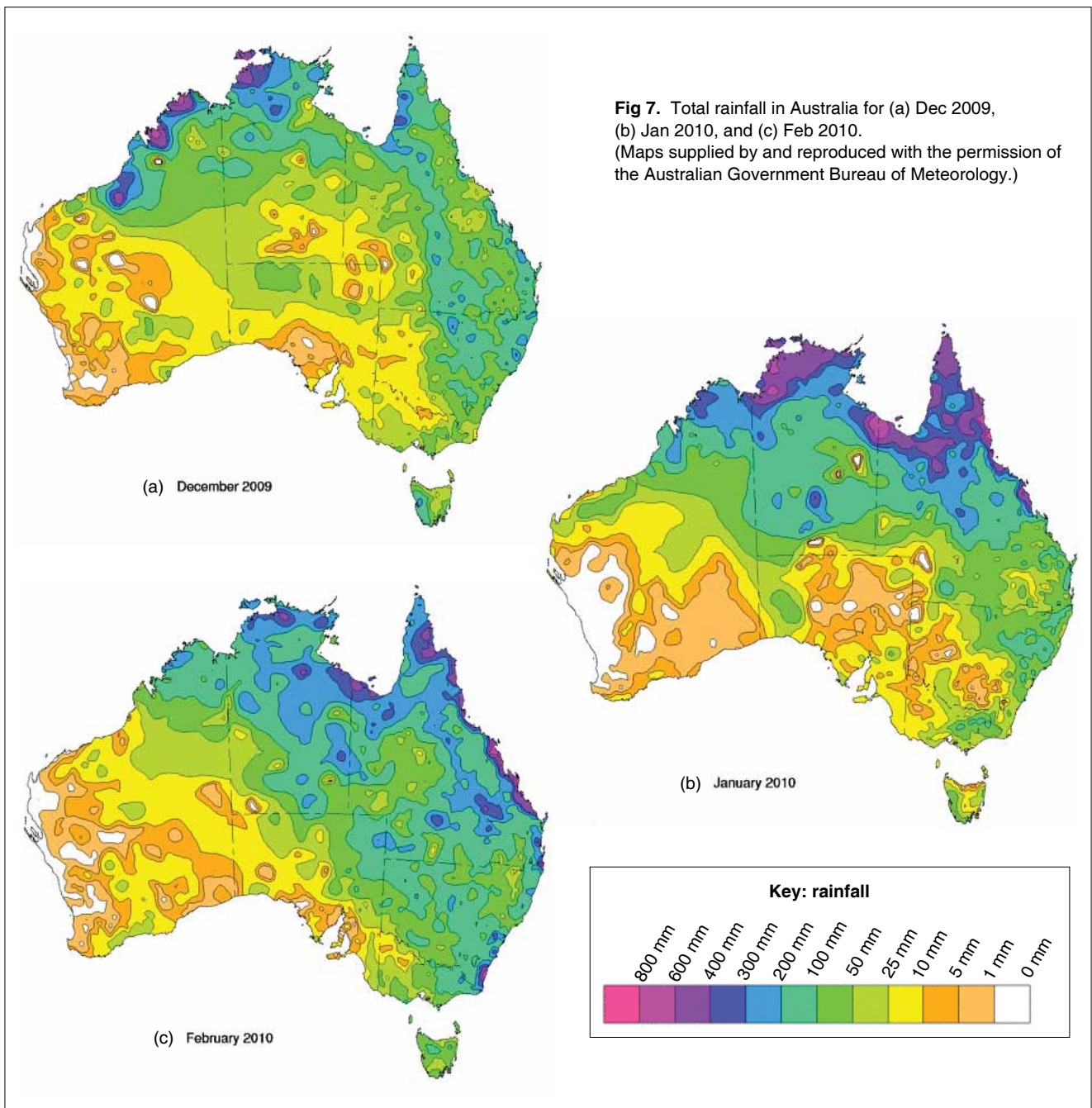
During the first hours of daylight on 18 Feb, scattered flocks of up to 100 Oriental Pratincoles were encountered around Kidney Bean Claypan in the western part of Roebuck Plains. They flew several metres above the low vegetation, mainly heading west into the wind, and seemed to be foraging. On one occasion a bird was seen to capture a grasshopper, and after several attempts succeeded in swallowing it.

On 25 Feb 2010, CH explored a 6-km transect of Roebuck Plains to the southwest of the highway. Both grasshoppers and pratincoles were still present but in much lower numbers. Two large flocks of pratincoles were seen, one of 7,000 and one of 4,000. As on the other days, at sundown the pratincoles flew westward, low over the ground.

DISCUSSION

Our count of Oriental Pratincoles at Eighty Mile Beach would have raised eyebrows prior to the extraordinary count of Feb 2004, but we now know that half a million is even to be expected in the right conditions. Had we had time and use of an aircraft, it is possible that we would have found many more. Indeed, our count of half a million over 75 km of beach south from the Anna Plains beach access is not very different to the Feb 2004 ground count of 818,000 along the northernmost 86 km of Eighty Mile Beach, suggesting that total numbers may well have been quite similar had we counted the whole beach in Feb 2010.

The count of Oriental Plovers doubles the previous es-



estimate of the world population of 70,000 (Bamford *et al.* 2008). Perhaps this is not so surprising, given that they use the same grassland habitats and have the same cool midday beach-roosting option as Oriental Pratincoles. The 2004 “pratincole-event” multiplied that population by a factor of 38, so a factor of 2 for Oriental Plovers is even modest! Oriental Plovers arrive at Eighty Mile Beach in large numbers between mid Oct and mid Nov and many subsequently disperse inland (C.D.T. Minton pers. comm.). It may be that the exceptional food available in 2010 caused them to remain at Anna Plains or return to the area. It is relevant to note that we saw fewer than 10 Oriental Plovers amongst the 60,000 Oriental Pratincoles on Roebuck Plains.

The count of Little Curlews represents 8% of an estimated world population of 180,000 (Delany & Scott 2006), but is not unique for the Anna Plains/Eighty Mile Beach area where 12,000 were counted on 31 Mar 1985 (Jaensch 1989).

Although we encountered no Little Curlews at Roebuck Plains, as many as 50,000 were found there in Mar 1985 (Minton 1987).

The lower numbers of grassland species encountered along the shore 20–35 km south of the Anna Plains access point (Fig. 2) corresponds with a length of beach that is rather narrower at high tide (50–100 m) than elsewhere (mostly 200–400 m). It is not an area where there is less grassland feeding habitat behind the dunes. Numbers of marine waders were also rather smaller along this stretch. These observations are consistent with the pratincole count of Feb 2004, when the largest concentrations of birds were found in an area of creek mouths (to the south of our study area) where the beach was very much wider than any other part of Eighty Mile Beach (Sitters *et al.* 2004). Therefore, just like the waders that use intertidal flats to forage and beaches to roost, these grassland species appear to avoid being close to vertical landscape

features (the sand dunes) from which raptors could launch surprise attacks (e.g. Rogers *et al.* 2006, van den Hout *et al.* 2008).

The large densities of small- and medium-size grasshoppers (Fig. 6), both on the Anna Plains grasslands and at Roebuck Plains, would at least partly explain why so many grasshopper-eating waders congregated in the west Kimberley region in Feb 2010. The grasshoppers encountered at Anna Plains Station were identified from photographs as adults of the grasshopper *Stropis maculosa*, Yellow-winged Grasshoppers *Gastrimargus musicus* and nymphs of Spur-throated Grasshopper *Austracris guttulosa*. The smaller green and bigger brownish grasshoppers that were the dominant species at Roebuck Plains (Fig. 6) were nymphs of the Spur-throated Grasshopper, which has a distribution that covers most of the Australian continent. The distribution, density and the species of grasshoppers was non-uniform across Roebuck Plains, but the greatest densities occurred in the central and eastern parts. Grasshoppers do not occur in such densities every wet season (pers. obs.) and the factors leading to the abundance we found are unknown. The Yellow-winged Grasshoppers that were so abundant during the 2004 event at Anna Plains were relatively uncommon in Feb 2010. Anna Plains had an unusually early cyclone in late Dec 2009 that dumped rain over the whole coastal plain (Fig. 7a). This was followed by much drier than normal, hot weather throughout Jan and Feb (Fig. 7b & 7c). Probably it was this pattern of rainfall that led to the abundance of grasshoppers that occurred at Anna Plains in Feb 2010.

Although the grassland waders must have been attracted by the plentiful food supply available in the west Kimberley region in Feb 2010, it is unlikely that their aggregations would have occurred if feeding conditions had not been less favourable elsewhere. It is likely that this was the case because throughout Jan and Feb 2010 most of the remainder of northern Australia suffered much higher rainfall than the west Kimberley (Fig. 7b & 7c) and persistent heavy rain leading to a reduction in the availability of grassland insects has been found to be the cause of birds moving away from an area in all three species (Higgins & Davies 1996). The Feb 2004 aggregation of Oriental Pratincoles was attributed to a similar rainfall pattern (Sitters *et al.* 2004).

In conclusion, from our chance encounters with grasshoppers and grasshopper-eating waders we have learnt:

1. That the world Oriental Plover population is at least double the most recent estimate.
2. That this is unlikely to be due to increasing population size, but rather to limited observer effort during the wet season particularly in years when rainfall patterns lead to high aggregations of grassland waders.
3. That the coincidence of a relatively cool – and easy-to-count – daytime roosting area (Eighty Mile Beach) in close proximity to good grassland feeding areas enables us to achieve more accurate population figures for the grasshopper-eating waders that occur there.
4. That recorded numbers of all three species at Roebuck Plains may be underestimates because the beaches of Roebuck Bay are not used by any significant numbers of them for roosting, probably because they are too distant from the plains and/or because the predation risk is too great (the beaches are backed by cliffs and trees which

afford cover for birds of prey which are very common).

5. That extensive, livestock-grazed grassland appears to afford important habitat for insect-feeding waders.

ACKNOWLEDGEMENTS

The trip to Anna Plains/Eighty Mile Beach was made in the pleasant company of Petra de Goeij, Clare and Grant Morton and Liz Rosenberg, and all contributed to the observations reported here. In addition, Adrian Boyle, Nik Ward and Mary Pfaffko joined trips to the Roebuck Plains and helped locating the widely dispersed flocks. Brian Hanich and Terry Houston of the Western Australia Museum kindly made identifications of the grasshoppers on the basis of photographs. Adrian Boyle kindly made photos available, and Broome Bird Observatory a congenial platform for the writing of this note. We are grateful to the Australian Government Bureau of Meteorology for permission to reproduce the rainfall maps (Fig. 7). We thank John, David and Helen Stoate for their great hospitality at Anna Plains Station, and Doug Miller of Roebuck Plains Station for permission to access the paddocks. We are also grateful to Clive Minton for comments on a draft, and Humphrey Sitters for further editorial work on this paper.

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