

Observations on the birds of Kwajalein Atoll, including six new species records for the Marshall Islands

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Abstract—Kwajalein is the largest atoll in the world and is located in the western chain of the Marshall Islands. As part of a team of biologists from the U.S. Fish and Wildlife Service, I conducted bird surveys from 7–20 October 2004 on seven islets in Kwajalein Atoll that are leased by the U.S. Army. This proved to be exceptionally rich period for migratory birds on Kwajalein. I observed a total of 36 bird species, including 6 species not previously recorded in the Marshall Islands (Common Ringed Plover *Charadrius hiaticula*, Semipalmated Plover *Charadrius semipalmatus*, Common Greenshank *Tringa nebularia*, Red Knot *Calidris canutus*, Long-Billed Dowitcher *Limnodromus scolopaceus*, and Common Snipe *Gallinago gallinago*) and 4 species recorded only once before (Marsh Sandpiper *Tringa stagnatilis*, Red-necked Stint *Calidris ruficollis*, Curlew Sandpiper *Calidris ferruginea*, and White-winged Tern *Chlidonias leucopterus*). Many of the observations were documented with photographs. The water catchments, irrigated and fertilized lawns, and open fields on Kwajalein Atoll may attract migratory birds, or at least cause them to linger, making their detection more likely. Only 4 seabird species were documented or suspected to breed on the islets surveyed. Eradication of alien predators would greatly enhance the suitability of Army-leased islets as nesting sites for seabirds.

Introduction

Kwajalein is the largest atoll in the world and is located in the western chain of the Marshall Islands ($8^{\circ} 44' N$, $167^{\circ} 44' E$). It comprises 97 small islets around a central lagoon that is up to 120 km across. Politically, Kwajalein is part of the Republic of the Marshall Islands, but 11 islets in the Atoll are wholly or partially leased by the U.S. Army. The avifauna of Kwajalein Atoll has been relatively well documented compared to most parts of Micronesia and other Pacific Islands, thanks largely to the efforts of Schipper and Clapp beginning in the late 1970s (Schipper 1985, Clapp 1990, Clapp & Schipper 1990). Avifaunal surveys of the islets leased by the U.S. Army were initially conducted by Clapp (1990) as part of an Environmental Assessment of military activities at Kwajalein Atoll. The U.S. Fish and Wildlife Service (USFWS) has conducted similar surveys at Kwajalein

every other year since 1994 and has made recommendations to the Army for minimizing impacts and managing marine and terrestrial natural resources. In October 2004, I participated in a portion of the terrestrial surveys for the USFWS. This period proved to be exceptionally rich in migratory birds on Kwajalein. Here I report on new and noteworthy bird observations made during and incidental to those surveys.

Methods

As part of a USFWS team of biologists, I helped conduct terrestrial surveys at Kwajalein Atoll from 7–20 October 2004. Most of our time was spent on Kwajalein and Roi-Namur, the two largest islets in the atoll, but nine other islets leased by the U.S. Army were also surveyed (Fig. 1). I participated in surveys on Gagan, Omelek, Ennugarret, Enewetak, and Gellinam, and additional surveys were conducted on Meck, Ennylabegan, Legan, and Illeginni from 11–19 November 2004 by Naomi Bentivoglio and Patrice Ashfield.

Surveys of shoreline areas were conducted by walking the perimeter of each islet to count birds in shoreline and exposed reef habitats. Surveys coincided with low tides to maximize exposed reef habitat. The interior of smaller islets (those other than Kwajalein and Roi-Namur) also were surveyed entirely on foot. The interior of Ennugarret and Enewetak, which are covered with dense native littoral forest dominated by *Pisonia grandis*, *Guettarda speciosa*, *Pandanus tectorius*, *Cordia subcordata*, and *Neisosperma opositifolium* (Whistler and Steele 1999), were surveyed by walking parallel transects throughout the forest. On Kwajalein and Roi-Namur, the two largest and most developed islets, interior areas were surveyed on foot, bicycle, and by golfcart from existing roadways. The developed areas in the interior of Kwajalein and Roi-Namur were surveyed multiple times, and the number of birds observed was averaged for the more common species. Information on breeding status was recorded for each species. The effect of tide on the number and diversity of birds at the water catchment on Roi-Namur was investigated by conducting repeated surveys at different times and under different tidal conditions. Tide heights and times were obtained from the website <www.mobilegeographics.com:81/locations/3203.html>.

Results

I observed a total of 36 bird species during surveys at Kwajalein Atoll in October 2004, including 6 species previously unrecorded in the Marshall Islands (Common Ringed Plover *Charadrius hiaticula*, Semipalmated Plover *Charadrius semipalmatus*, Common Greenshank *Tringa nebularia*, Red Knot *Calidris canutus*, Long-Billed Dowitcher *Limnodromus scolopaceus*, and Common Snipe *Gallinago gallinago*) and 4 species recorded only once before (Marsh Sandpiper *Tringa stagnatilis*, Red-necked Stint *Calidris ruficollis*, Curlew Sandpiper *Calidris ferruginea*, and White-winged Tern *Chlidonias leucopterus*). The occur-

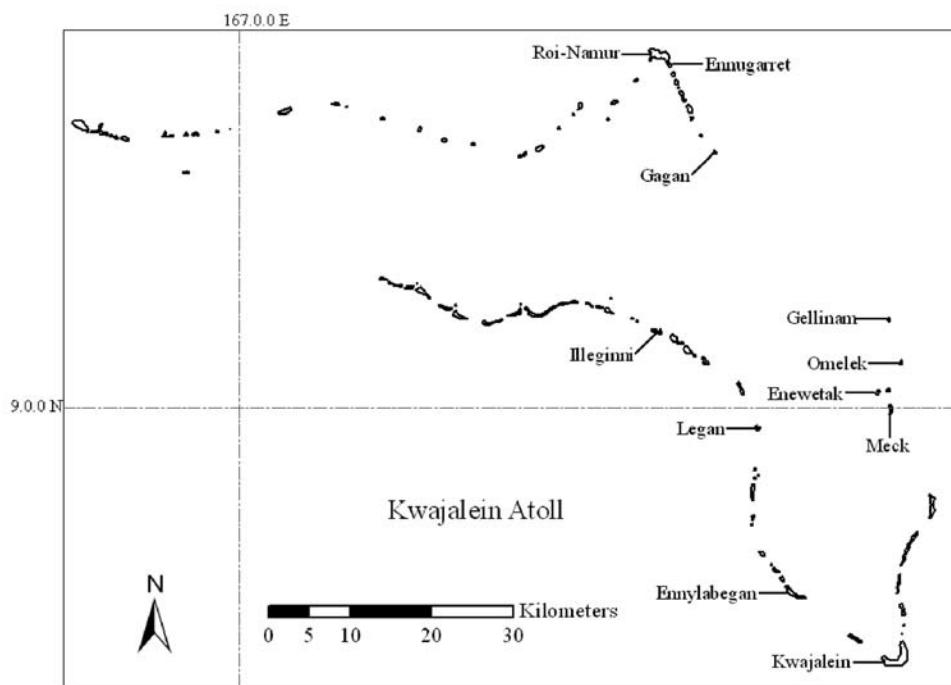


Figure 1. Map of Kwajalein Atoll, showing islets surveyed by the USFWS in 2004.

rence of many of these species was documented with photographs, some of which are included below. Details of these records and other noteworthy observations are given in the species accounts below. Nomenclature follows Wiles (2005). Other species observed during these surveys, but for which I have no noteworthy information, included Wedge-tailed Shearwater (*Puffinus pacificus*), Brown Booby (*Sula leucogaster*), Red-footed Booby (*Sula sula*), Great Frigatebird (*Fregata minor*), and Great Crested Tern (*Sterna bergii*).

SPECIES ACCOUNTS

Sooty or Short-tailed Shearwater (*Puffinus griseus* or *P. tenuirostris*). I observed five dark shearwaters flying southeast along the northern end of Roi-Namur during 30 minutes of observation on 9 October. On 18 October, I observed 52 dark shearwaters flying southeast along the southern side of Kwajalein during 65 minutes of observation. All birds were outside the barrier reef and were too far away to allow identification as Sooty or Short-tailed, but they could be distinguished by shape and color from Wedge-tailed Shearwaters (*Puffinus pacificus*), which were also flying past. No shearwaters were observed feeding and all appeared to be transiting the area. Hundreds of Short-tailed Shearwaters have been observed in May near Guam and Chuuk (Wiles et al. 2000) in western Micronesia, and it has been suggested that similar numbers may pass through

eastern and central Micronesia (Skira 1991). Short-tailed Shearwaters breed in southeastern Australia from September-April, and Sooty Shearwaters breed mainly on islands off New Zealand, Tasmania, and Chile in September-May. After breeding, both species are thought to embark on a clockwise migration around the Pacific, but the route taken by most birds is not well documented.

Pacific Reef-Heron (*Egretta sacra*). This species is a common resident on Kwajalein Atoll and throughout the Marshall Islands (Amerson 1969, Clapp 1990). In 2004, we observed small numbers on all islets surveyed, with the most birds on Roi-Namur (24) and Kwajalein (12), and a few on the nine smaller islets (1–6 each, 27 total). The pied color morph was most numerous (41%), followed by gray (38%), and white (21%). Clapp (1990) reported fewer total birds (26), but similar proportions of color morphs (42% pied, 27% gray, and 31% white).

Northern Pintail (*Anas acuta*). The Northern Pintail is an uncommon but regular migrant in the Marshall Islands, and is the most frequently observed waterfowl species in the region (Amerson 1969, Clapp 1990, Udvardy and Englis 2001). I observed up to six pintails on Kwajalein on 18 October 2004. Birds were seen in a puddle at the west end of the runway and flying around open areas near the runway. A flock of six waterfowl observed flying offshore 1 km south of Kwajalein on 18 October may also have been pintails, but they were too distant to identify with certainty.

Pacific Golden-Plover (*Pluvialis fulva*). This species is a common migrant in much of the Pacific, including the Marshall Islands (Amerson 1969, Clapp 1990). On Kwajalein Atoll it was abundant, and was the second most numerous bird species on most islets surveyed, after Ruddy Turnstone. The largest numbers were observed on Kwajalein (470) and Roi-Namur (278), with fewer birds on the nine smaller islets (7–39 each, 160 total). The number on Roi-Namur is similar to previous counts of 200 by Amerson (1969), 222 by Schipper (in Clapp 1990), and 230 by Clapp (1990). The total for Kwajalein is higher than a previous count of 180 by Clapp (1990). On Roi-Namur, many plovers roosted in the water catchment at high tide, when virtually all shoreline habitat was inundated. On Kwajalein, few plovers used the water catchment area, and most were dispersed over large grassy areas. On Roi-Namur and smaller islets, which were surveyed entirely, the number of plovers reported probably is an accurate census. Surveying all parts of Kwajalein Islet was not possible, so the number of birds reported is lower than the actual number present, but can be used as an index of abundance to monitor plover populations over time if the survey route remains consistent.

Lesser Sand-Plover (*Charadrius mongolus*). At least two Lesser Sand-Plovers were present on Roi-Namur on 8 and 10–12 October. A single bird was first observed foraging on exposed reef flat at low tide on the northeastern side of Roi-Namur on 8 October (Figure 2a). On 10–12 October, two birds were present at the water catchment (Fig. 2b), but only at high tide. All were in nonbreeding plumage. The legs were dark and the bill was black and fairly thin. The upperparts were sandy gray-brown, with a slightly darker mask and a white supercilium. The



Figure 2. (a, b) Lesser Sand-Plovers on Roi-Namur. (c, d) Common Ringed Plovers on Roi-Namur. (e) Semipalmated Plover on Roi-Namur. (f) Common Greenshank (right) with Pectoral Sandpiper on Roi-Namur. (g) Bar-tailed Godwit on Kwajalein Islet. (h) Red Knot (left) with Sanderling on Kwajalein Islet. (i) Red Knot. (j) Marsh Sandpiper on Roi-Namur. (k, l) Red-necked Stint on Roi-Namur. (m, n) Pectoral Sandpiper on Roi-Namur. (o) Curlew Sandpiper in partial breeding plumage on Roi-Namur. (p, q) Ruff on Roi-Namur. (r) Juvenile Long-billed Dowitcher on Kwajalein Islet. (s, t, u) Common Snipe on Kwajalein Islet. All photos by Eric VanderWerf.

underparts were white, with a broken breast band the same color as the back. Size was similar to Semipalmated Plover, but with longer legs. The Greater Sand-Plover (*C. leschenaultia*) is similar, but is larger and has a larger bill, longer legs, and a flatter head. Lesser Sand-Plovers are uncommon migrants in western Micronesia (Stinson et al. 1997), and appear to be rare migrants in the Marshall Islands, with previous records between 3 July and 12 December from several atolls, including Kwajalein (Schipper 1985), Enewetak (Hailman 1979, Temme 1990), and Ujelang (Anderson 1981).

Common Ringed Plover (*Charadrius hiaticula*). Based on plumage differences, at least four birds that were either Common Ringed Plovers or Semipalmated Plovers were present on Roi-Namur from 7–12 October, and one or two individuals were present on Kwajalein from 15–18 October. All four birds on Roi-Namur were photographed, and examination of the photos allowed identification of three of them. No photos were obtained of birds on Kwajalein, and they were not identified. These species can be distinguished by the extent of webbing between the toes, by vocalizations, by coloration of the plumage around the gape, and by the shape of the breast band, though the last character may be less reliable (Hayman et al. 1986, Pratt et al. 1987, Mullarney et al. 2005). None of the birds called, and none were seen closely enough to see the webbing, so identifications were based on plumage characters. The feathers around the gape are dark in Common Ringed Plover and light in Semipalmated Plover. The breast band tends to be wider and have bulges on the sides in Common Ringed Plover, and is narrower and of more even width in Semipalmated Plover. Two of the birds on Roi-Namur had dark feathers around the gape and relatively wide breast bands with bulges on the sides, identifying them as Common Ringed Plovers (Fig. 2c, d). A third bird had a breast band typical of Common Ringed Plover, but the color of feathers around the gape was peculiar and the identity was not determined. Common Ringed Plovers have been recorded on Palau, Guam, Saipan, and Midway (Clapp 1990, Wiles 2005). The birds photographed on Roi-Namur in October 2004 represent the first documented records in the Marshall Islands.

Semipalmated Plover (*Charadrius semipalmatus*). One of the four small plovers on Roi-Namur (see above account) had light plumage around the gape, a narrow, broken breast band of even width, a shorter bill, and a more compact overall appearance, all of which indicate it was a Semipalmated Plover (Fig. 2e). Semipalmated Plovers are uncommon but regular migrants in the main Hawaiian Islands (Pratt et al. 1987, Pyle 2002). There have been several previous sightings of ringed plovers in the Marshall Islands, including one on Kwajalein Islet by Schipper in October and November 1988, but none have been described in sufficient detail to verify identification (Clapp 1990, Wiles 2005). Pyle & Engbring (1985) believed that Semipalmated and Common Ringed Plovers were equally likely to occur in the Marshalls, and listed the latter as hypothetical based on a report by Finsch (1880). However, Wiles (2005) tentatively placed the Marshall records under Semipalmated Plover because specimens from Baker Island, Johnston Atoll, and the Hawaiian Islands (Clapp 1990) suggest this species is

more likely to reach the central Pacific than Common Ringed Plover. The bird photographed on Roi-Namur in October 2004 therefore represents the first documented record of this species in the Marshall Islands and Micronesia.

Marsh Sandpiper (*Tringa stagnatilis*). Two Marsh Sandpipers in non-breeding plumage were present at the water catchment on Roi-Namur from 9–12 October 2004. The birds were observed several times daily, resting, foraging, and in flight at distances as close as 10 m. The bill was moderately long, thin, and straight (Fig. 2j). The legs were dull greenish and long, projecting approximately 5 cm beyond the tail in flight. The underparts were white, though one bird had some indistinct gray streaking on the lower neck and upper breast. The upperparts were gray with pale edges on many feathers on the back and wings. The face was pale, with a white supercilium. In flight, the rump and lower back were white and the tail was lightly barred. In side-by-side comparison, the birds were much smaller and more lightly built than a Ruff, slightly smaller than tattlers, and similar in body size but taller than Sharp-tailed Sandpipers. They occasionally gave a soft “kip” call. Marsh Sandpipers are regular migrants in western Micronesia (Stinson et al. 1997, Wiles 2005), and there are two records in the Hawaiian Islands, from 25–26 October 1998 on Midway and 19 November 2002 through February 2003 on Oahu, but there is only one previous record from the Marshall Islands, a single bird at Roi-Namur in September 1987 (Clapp & Schipper 1990).

Common Greenshank (*Tringa nebularia*). I briefly observed a single Common Greenshank in non-breeding plumage at the water catchment on Roi-Namur on 8 October 2004. The bird had long greenish legs, a fairly heavy body, a long straight bill, and was much larger than nearby Sharp-tailed and Pectoral Sandpipers (Fig. 2f). The upperparts were dark grayish-brown with narrow pale edges on feathers on the back and wings. The underparts were white with gray-brown streaks on the sides of the neck and upper breast. This species is a regular migrant in western Micronesia (Pratt et al. 1987, Stinson et al. 1997), and there are several records from the Hawaiian Islands (Pratt et al. 1987, Pyle 2002), but there are no previous published records from eastern Micronesia. Three Common Greenshanks were reported on Kwajalein during surveys by USFWS personnel in 2002 (USFWS unpubl. data), but no details of the observation are available and the identification could not be confirmed.

Wood Sandpiper (*Tringa glareola*). I briefly observed a single Wood Sandpiper in non-breeding plumage on Kwajalein Islet on 17 October 2004, in a puddle on the north side of the taxiway. The legs were greenish-yellow and longer than those of a nearby Sharp-tailed Sandpiper. The bill was thin, straight, and of moderate length. The underparts were white, with dark streaking on the breast. The upperparts were gray-brown, with pale edges on many feathers on the wings and back. The crown was gray-brown and not noticeably rusty in color, and there was a conspicuous white supercilium. This species is an uncommon but regular migrant in western Micronesia, with stragglers reaching the Marshall Islands and northwestern Hawaiian Islands (Pratt et al. 1987, Stinson et al. 1997, Wiles 2005). There are previous records of this species from Roi-Namur on 16 October 1982,

and Enewetak Atoll in September 1968, November 1977, and March and April 1978 (Schipper 1985, Temme 1985, 1990).

Wandering Tattler (*Heteroscelus incanus*). Wandering Tattlers were common on Roi-Namur (23 birds) and Kwajalein (47 birds) islets, and a few (1–8 birds each, 31 birds total) were present on all of the smaller islets surveyed. On Roi-Namur, most birds foraged in shoreline and exposed reef flat habitats at low tide and rested and foraged in the water-catchment at high tide. On Kwajalein, few tattlers rested or foraged in the water catchment, and at high tide most birds rested on the fuel pier.

Gray-tailed or Siberian Tattler (*Heteroscelus brevipes*). On Roi-Namur, this species was less numerous (14 birds) than the Wandering Tattler, foraging in shoreline and exposed reef flat habitats at low tide and resting and foraging in the water catchment at high tide. On Kwajalein, Gray-tailed Tattlers were much less common (7 birds) than Wandering Tattlers and were only observed resting on the fuel pier, though they presumably must have foraged elsewhere on the islet at low tide. This species was not observed on any of the smaller islets.

Tattler Identification. During the breeding season Wandering and Gray-tailed Tattlers in alternate plumage can be reliably distinguished by the pattern of dark barring on their white undersides (Hayman et al. 1986, Pratt et al. 1987). Wandering Tattler has relatively coarse barring that extends from the throat all the way to the undertail coverts. Gray-tailed Tattler has finer barring that extends from the throat to the breast and flanks, but the belly and undertail coverts are plain white. During surveys in October 2004, approximately 20% of tattlers still had some ventral barring, allowing identification based on the extent and coarseness of the barring. In the non-breeding season (basic plumage), these species lose their ventral barring and are more difficult to distinguish. I found that in good light birds in basic plumage could be identified by the darkness of their plumage and the brightness of the supercilium. Wandering Tattler is darker than Gray-tailed Tattler, especially on the back, neck, and breast, and the dark coloration on the breast and flanks is more extensive. The supercilia are relatively narrow in Wandering Tattler and do not meet on the forehead, resulting in a dark-faced appearance. In Gray-tailed Tattler the supercilia are usually wider, brighter, and sometimes meet above the bill, resulting in a light-faced appearance (Pratt et al. 1987, p. 144). Vocalizations were not as reliable as commonly supposed in the literature. Particularly when flushed or during territorial interactions, birds of both species gave a variety of short calls and longer trills. Two other definitive characters, scaling pattern on the tarsus and length of the nasal groove (Hayman et al. 1986), are rarely visible in the field.

Whimbrel (*Numenius phaeopus variegatus*). Whimbrels are fairly common migrants in the Marshall Islands (Amerson 1969, Clapp 1990), and were the third most numerous shorebird at Kwajalein Atoll in 2004, after Pacific Golden-Plover and Ruddy Turnstone. On Roi-Namur, a maximum of 23 were present in the water catchment on 8 October. On Kwajalein, counts from 14–20 October yielded an average total of 52 birds. A few birds were present on most of the smaller islets (1

to 6 each, 19 total). The brown back, white rump with brown barring, and densely barred brown and white underwings allowed identification as the subspecies *variegatus*, which breeds in eastern Siberia (Hayman et al. 1986). The number of birds observed on Roi-Namur was similar to the maximum of 28 reported in December 1981 by Schipper (in Clapp 1990). The total on Kwajalein in 2004 was substantially higher than a count of eight in March 1988 by Clapp (1990).

Bar-tailed Godwit (*Limosa lapponica baueri*). This species is an uncommon but regular migrant in the Marshall Islands and other areas of the central Pacific (Pratt et al. 1987, Clapp 1990, Gill et al. 2005). One to six Bar-tailed Godwits were present on Kwajalein Islet on 7 and 14–20 October and 14–18 November, and four were present on Meck on 12 November (N. Bentivoglio, pers. comm.). All birds were in nonbreeding adult plumage, with gray-brown upperparts streaked with white, a whitish belly, and a grayish, indistinctly streaked breast (Fig. 2g). The bill was very long and slightly upturned, with a pale base. In flight, there was no distinct wing stripe, the back was gray-brown, the uppertail coverts were whitish with dark barring, and the tail was dark, allowing identification as the subspecies *baueri*, which breeds in western and northern Alaska and spends the nonbreeding season in New Zealand and eastern Australia (Gill et al. 2005). On the southward migration most individuals of this subspecies are thought to make a non-stop flight of 11,000 km across the Pacific, but small numbers stop on islands within the narrow migration corridor, which encompasses the Marshall Islands (Gill et al. 2005).

Ruddy Turnstone (*Arenaria interpres*). This species is an abundant migrant in the Marshall Islands (Amerson 1969, Clapp 1990), and was the most numerous bird species on most islets surveyed in 2004. The largest numbers were observed on Kwajalein (711) and Roi-Namur (333), with fewer birds on the nine smaller islets (5–23 each, 119 total). On Roi-Namur, large numbers of turnstones roosted in the water catchment at high tide, when virtually all shoreline habitat was inundated. On Kwajalein, few turnstones used the water catchment, and most were dispersed over the large grassy areas and runways. These numbers are generally similar to those reported by Clapp (1990). On Roi-Namur, Clapp (1990) counted up to 330 turnstones, but did not cover all parts of the islet, and estimated the total population on the islet was 375–400. Our count of 711 turnstones on Kwajalein Islet is higher than the maximum of 417 reported by Clapp (1990). It is possible that some birds were counted more than once because they moved during surveys, but substantial portions of the islet were not covered by our surveys, and 711 may be an underestimate of the population on Kwajalein.

Red Knot (*Calidris canutus*). A single adult Red Knot in non-breeding plumage was present on Kwajalein on 15 and 18 October 2004. The bird was seen in the water catchment between the runway and the taxiway and on the taxiway. The areas used by the knot were inaccessible because of their proximity to the runway, so the bird was observed from approximately 125 meters away. The legs were greenish-yellow and fairly short. The bill was short, dark, and moderately thick at the base. The underparts were white with indistinct gray barring that

formed a weak breast band. The upperparts were plain gray, with a white supercilium (Fig. 2i). Compared to other birds nearby, it was larger than a Sanderling (Fig. 2h), Ruddy Turnstone, and Sharp-tailed Sandpiper, and shorter and perhaps slightly smaller than a Pacific Golden-Plover. The similar Great Knot (*Calidris tenuirostris*) was ruled out by the fairly light barring on the breast, the relative size, and the only moderately thick bill. Red Knots have been recorded as rare migrants in several oceanic island groups, including Hawaii (Hayman et al. 1986, Pratt et al. 1986, Pyle 2002). This is the first record from the Marshall Islands and the first in Micronesia east of Guam (Wiles et al. 2000, Wiles 2005).

Sanderling (*Calidris alba*). This species is a common migrant in the Hawaiian Islands (Pratt et al. 1987, Pyle 2002) and an uncommon but regular migrant in the Marshall Islands (Amerson 1969, Clapp 1990). One to four Sanderlings were present on Kwajalein Islet every day from 15–20 October, and one bird was present on 14 November (N. Bentivoglio, pers. comm.). Sanderlings were observed most often in the water catchment between the runway and the taxiway, and also in puddles at the west end of the runway, and once roosting on a paved road.

Red-necked Stint (*Calidris ruficollis*). A single Red-necked Stint in non-breeding plumage was present at the water catchment on Roi-Namur on 11 and 12 October 2004 (Fig. 2k, l). The bill was short, black, fairly thin, and evenly tapered. The legs were black and short, imparting a stubby appearance. The upperparts were pale gray with narrow white feather edges and narrow dark feather centers. The underparts were white and unstreaked, except for a well defined gray patch on each side of the breast. In flight, there was a prominent white wing stripe, the outer tail feathers were white, and the central tail feathers were dark. In side by side comparison, it was smaller than Sharp-tailed Sandpiper, Lesser Sand-Plover, and Semipalmated Plover. Little Stint (*C. minuta*) is very similar, but was ruled out because that species tends to be more brownish above with broader dark feather centers on the back, has slightly longer legs, and often has a more complete breast band (Hayman et al. 1986). Western Sandpiper (*C. mauri*) and Semipalmated Sandpiper (*C. pusilla*) are also similar, but can be distinguished in nonbreeding plumage by their breast streaks and bill structure. Western Sandpiper has a longer bill with a distinct droop at the tip. Semipalmated Sandpiper has a thicker bill that broadens slightly at the tip instead of tapering. Red-necked Stint is a common to uncommon migrant in western Micronesia (Engbring 1988, Stinson et al. 1997), but there is only one previous record from the Marshall Islands, a single bird collected on Enewetak Atoll in July 1973 (Johnson & Kienholz 1975).

Pectoral Sandpiper (*Calidris melanotos*). A single Pectoral Sandpiper in non-breeding plumage was observed at the water catchment on Roi-Namur from 9–12 October 2004. The legs were yellow and of medium length, and the bill was straight and of medium length. Compared to nearby Sharp-tailed Sandpipers, it had a more densely streaked breast with a sharper lower border (Fig. 2m, n), a less prominent white supercilium, less rufous in the crown, and at times it appeared

slightly larger. Pectoral Sandpipers are rare migrants throughout much of the tropical Pacific, though they are more regular in the Hawaiian Islands (Pyle 2002). There are six previous records from the Marshall Islands: two birds on Roi-Namur in October 1982 (Schipper 1985), and single birds on Roi-Namur from 20–30 October 1982 and 12 and 19 March 1983 (Clapp 1990), Lojrong Islet in Taka Atoll on 20 October 1964 (Amerson 1969), Enekune Islet in Ujelang Atoll from 13–24 September 1975 (Anderson 1981), and Meck Islet in Kwajalein Atoll on 15 September 2002 (USFWS unpubl. data).

Sharp-tailed Sandpiper (*Calidris acuminata*). This species is considered an uncommon but regular migrant in the Marshall Islands (Amerson 1969, Clapp 1990), but it was fairly common in October and November 2004, with up to 42 birds on Kwajalein and nine on Roi-Namur. On Roi-Namur, it was observed exclusively in the water catchment, but on Kwajalein many birds were observed foraging in grassy fields and temporary rain puddles.

Curlew Sandpiper (*Calidris ferruginea*). A single Curlew Sandpiper in partial breeding plumage was present at the water catchment and the motorpool wetland on Roi-Namur every day from 7–12 October 2004 (Fig. 2o). The bill was dark and moderately long, with a distinct droop toward the tip. The legs were black and of medium length. The underparts were white with several rufous-red blotches of breeding plumage. The upperparts were gray, with a prominent white supercilium extending well behind the eye. It was similar in size to Sharp-tailed Sandpipers, and frequently foraged in belly-deep water. Curlew Sandpipers are rare to uncommon migrants in western Micronesia (Engbring 1988, Stinson et al. 1997), with vagrants reaching the Hawaiian Islands (Pyle 2002). This is the second record of the species in the Marshall Islands; the only previous record is a bird collected on Kwajalein Islet in March 1988 (Clapp & Schipper 1990).

Ruff (*Philomachus pugnax*). A single Ruff in non-breeding plumage was present at the water catchment on Roi-Namur from 9–12 October 2004. It was shy and did not allow me to approach closer than about 40 m. It was fairly heavy-bodied, with a relatively thick neck and small head (Fig. 2p). The legs were yellow and moderately long. The characteristic U-shaped white band on the rump was visible in flight (Fig. 2q). This species is a rare migrant in the Hawaiian Islands and Micronesia, with at least six previous records from Kwajalein Atoll (Temme 1985, Schipper 1985, Clapp 1990).

Long-billed Dowitcher (*Limnodromus scolopaceus*). I observed a single juvenile Long-billed Dowitcher on Kwajalein Islet every day from 15–20 October. Presumably the same bird was still present from 14–15 November (N. Bentivoglio, pers. comm.). It was seen in the water catchment between the runway and the taxiway, in a puddle at the west end of the runway, and in a flooded drainage ditch west north of the taxiway. The bird had a fairly heavy body and a long straight bill (Fig. 2r). The legs were greenish-yellow and moderately long. The underparts were light gray with dark streaking on the upper breast and neck. The upperparts were grayish-brown with broad rufous edges on some of the scapulars, identifying it as a juvenile. In flight, the rump and lower back were white. Several times it gave a soft

“kreek” call. Long-billed Dowitchers are uncommon migrants in the Hawaiian Islands (Pyle 2002), and there is one possible sight record from Johnston Atoll (Pratt et al. 1987), but the only previous records in Micronesia are from Guam (Wiles et al. 2000, 2004). This is the first record from the Marshall Islands.

Common Snipe (*Gallinago gallinago*). I observed a single snipe on Kwajalein Islet from 16–20 October, foraging in a partially flooded drainage ditch north of the taxiway and west of the helicopter hangar. The bird was not shy and allowed me to approach within 10 m before flushing, after which it usually flew in a wide arc and landed 50–100 m away in the same ditch. The bird was stocky and had a very long straight bill. It had conspicuous brown and whitish stripes on the head, with the dark eyeline wider at the base of the bill than the white supercilium (Fig. 2s). The tips of the secondaries had broad white tips, forming a conspicuous white trailing edge to the wing (Fig. 2t). The underwing coverts also had broad white tips, forming broad white bars (Fig. 2u). I also briefly observed a snipe in flight, presumably the same bird, on 14 October in the same area, and a “small bird with a long bill,” possibly either the Common Snipe or the Long-billed Dowitcher, was observed by Ken Sims on 11 October 2004.

Snipe are notoriously difficult to identify in the field, and there are several snipe species that potentially could occur at Kwajalein Atoll, but only Common Snipe and Wilson’s Snipe (*G. delicata*) have a prominent white trailing edge on the wing. The broad white bars on the underwing coverts confirmed the species as Common Snipe (Hayman et al. 1986). The only previous records of Common Snipe in Micronesia are from the Marianas and Wake Island (Johnson & McFarlane 1967, Wiles 2005). Only Latham’s Snipe (*G. hardwickii*) has been recorded with certainty in the Marshall Islands, based on a single specimen collected at Kwajalein on 3 November 1964 (Amerson 1969). Latham’s Snipe were reported by Temme (1990) on Aomon Atoll in March and April 1979, and on Kwajalein Islet in 1998 (USFWS unpubl. data), but no details of those observations are available and the identifications are uncertain.

Black-naped Tern (*Sterna sumatrana*). Black-naped Terns are widespread residents of the southwestern Pacific, including the Marshall Islands (Amerson 1969, Pratt et al. 1987). In October and November 2004 they often were observed foraging just outside the reef crest on many islets, and active nests were found on Gellinam (64 adults, 24 nests, and 5 volant juveniles on 19 October), Meck (27 adults and 7 nests on 12 November), Ennylebegan (2 adults and 1 nest on 14 November 2004), Illeginni (11 adults and one nest on 16 November), and Kwajalein (8 adults and 1 volant juvenile in October and one nest on 13 November). On Gellinam, six nests contained a single egg, 14 nests contained a single chick, and four nests contained two chicks. On Meck, two nests contained one egg, two contained one chick, and three contained two chicks. Clapp (1990) reported that this species was known to nest on Gagan (6 pairs), Gellinam (18 pairs), and Meck (1 pair), and was suspected to nest on Ennylabegan and Illeginni.

White-winged Tern (*Chlidonias leucopterus*). I briefly observed a single White-winged Tern in non-breeding plumage flying around the harbor on

Kwajalein Islet on 20 October 2004. The underparts were white, and the underside of the wings was mostly white with some dark markings. The head was white with a prominent black patch behind the eye and some indistinct dark marks on the crown. The tail was short and only slightly forked and the bill was short and black. This species is very similar to Whiskered Tern (*C. hybridus*) and Black Tern (*C. niger*); identification was based on the conspicuous black spot behind the eye, the lack of extensive dark markings on the crown and nape, and the lack of a dark bar on the side of the breast. This is the second record of White-winged Tern in the Marshall Islands; an adult in breeding plumage was seen on Majuro Atoll in May 1986 (Wiles et al. 2004). Anderson (1981) reported a bird near Kwajalein Atoll he believed was either a Common Tern (*Sterna hirundo*) or Arctic Tern (*S. paradisaea*), but no details were provided, and Clapp (1990) felt the bird could have been a *Chlidonias* tern in non-breeding plumage.

Brown Noddy (*Anous stolidus*). Brown Noddies are common residents in the Marshall Islands (Amerson 1969, Clapp 1990). They were the second most common species in offshore feeding flocks around Kwajalein Atoll in 2004, after Black Noddies, sometimes numbering several hundred birds, but relatively few were observed on land. On Ennugarret, 10 birds were observed perched in trees, including two that called repeatedly from a tree that contained old nests, indicating they may have been preparing to nest. On Enewetak, several birds were observed perching in palm trees, and more birds were heard calling from the dense forest canopy, but no evidence of nesting was observed. Clapp (1990) observed active nests on Legan and Illeginni in March, suggesting that our surveys in October and November 2004 were outside the nesting season.

Black Noddy (*Anous minutus*). Black Noddies are common residents in the Marshall Islands (Amerson 1969) and are the most abundant bird at Kwajalein Atoll (Clapp 1990). They formed up to 75% of several offshore feeding flocks that reached 1000 birds in size. Black Noddy nesting colonies were observed on Enewetak Islet (346 adults and 111 active nests), Illeginni (326 adults and 130 active nests), and Gellinam (82 adults and 12 active nests). On each islet, Black Noddies nested in the crowns of large trees, particularly *Pisonia grandis* and *Tournefortia argentea*. The count of birds on Enewetak is likely an underestimate because nests were difficult to observe in the dense forest canopy and because some birds took flight on our approach. This species seems to have decreased in numbers since Clapp (1990) reported 1,163 nests on Enewetak, 14 on Legan, 47 on Illeginni, 266 on Gellinam, and 4 on Omelek. On Enewetak we observed fire pits and evidence of human consumption of Black Noddies, which could explain the observed decline. However, Clapp's observations occurred in March, so the apparent decline could also be due to seasonality of nesting. Black Noddies generally do not range far from nesting colonies when foraging, so their abundance in offshore feeding flocks indicates the presence of large nesting colonies elsewhere on Kwajalein Atoll, perhaps including Kwadak Islet, where large numbers of Black Noddies were observed by boat.

White Tern (*Gygis alba*). White Terns were observed on all 11 islets surveyed, with the largest numbers on Kwajalein (85), Ennugarret (38), Roi-Namur (30), Gellinam (17), and Enewetak (11). Nests with eggs or chicks were observed on Kwajalein (10), Gellinam (1), and Enewetak (1). The number of White Terns on Kwajalein is probably a fairly accurate census, but the numbers on other islets are underestimates because most surveys were conducted from late morning to evening, when many White Terns were at sea foraging. On Kwajalein, I made special effort to conduct surveys of large trees used by White Terns early in the morning, so the number of White Terns reported is likely to be more accurate (VanderWerf 2003). On islets with dense forest, such as Enewetak and Ennugarret, White Terns were difficult to observe in the dense forest canopy. Some birds were located by their distinctive calls and others were seen when they flushed on approach, but it is likely that some silent birds that remained perched were missed. On Oahu in the Hawaiian Islands, the peak of egg laying by White Terns occurs in February and March (VanderWerf 2003), so it is possible that more nests would be observed at Kwajalein Atoll during those months.

Long-tailed Cuckoo (*Eudynamis taitensis*). I observed a single Long-tailed Cuckoo on Omelek on 14 October 2004. I first heard the distinctive raspy call of this species in a small patch of forest on the southern tip of the islet, and then saw the bird fly across the open interior of the islet to a large patch of forest on the northern end. Long-tailed Cuckoos breed in New Zealand during the austral summer and winter widely in the southern and central Pacific (Pratt et al. 1987). This species is considered a regular migrant in the Marshall Islands (Amerson 1969), but there are only two previous records from Kwajalein Atoll, one from Ennugarret in 1996 and one from Roi-Namur on 7 September 2002 (H. Freifeld, USFWS unpubl. data).

Eurasian Tree Sparrow (*Passer montanus*). This introduced species was common on Kwajalein Islet around buildings, and it often foraged in grassy areas along the runway. No attempt was made to census this species.

The abundance and diversity of birds at the water catchment on Roi-Namur were extremely variable, and surveys at different times and different tide conditions revealed that much of the variation was related to tide level, rather than time of day (Figure 13). More birds visited the catchment at higher tides, when reef flats were inundated. Pacific Golden-Plovers and Ruddy Turnstones were by far the most numerous species, but they were generally present only at high tide. Other species were less affected by tide level; the Curlew Sandpiper, Pectoral Sandpiper, Ruff, Marsh Sandpipers, and some Sharp-tailed Sandpipers were present on almost every visit, regardless of the tide, indicating they did not forage on reef flats. The Curlew Sandpiper was seen once in the brackish wetland near the motorpool, and other species may have been there when absent from the water catchment. An exceptionally high number of birds (378) was observed in the water catchment at dusk on October 7. The high tide that day was fairly low, but there was essentially no low tide that day, and thus virtually no reef flat was exposed during the entire day, causing many more birds to gather at the catchment. Surveys

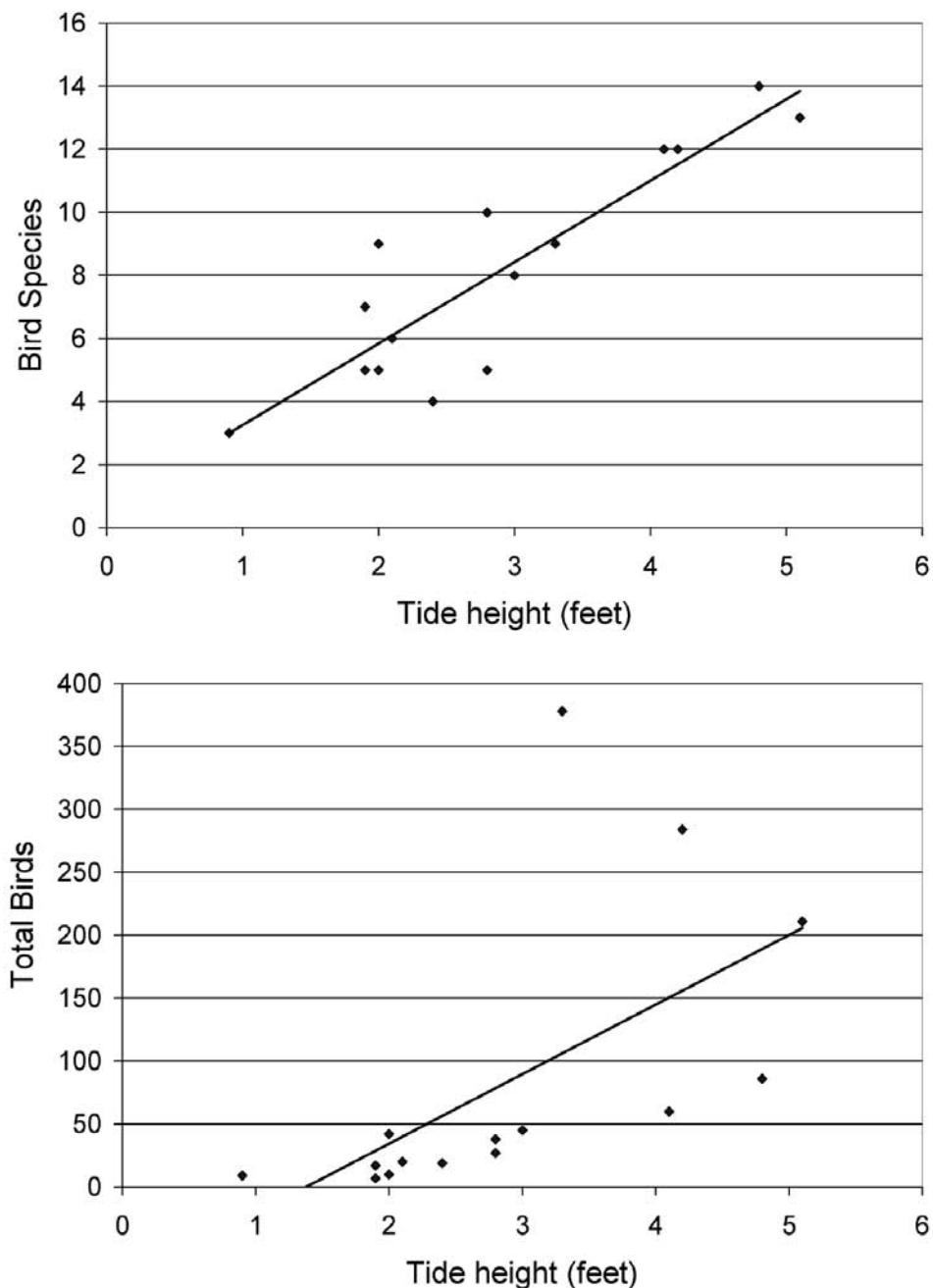


Figure 3. Tide level explained much of the variation in variety ($R^2 = 0.79$, $F_{1,13} = 47.83$, $p < 0.001$) and abundance ($R^2 = 0.34$, $F_{1,13} = 6.72$, $p = 0.02$) of birds using the water catchment on Roi-Namur in October 2004.

of the water catchment on such days may provide an accurate estimate of the total number of shorebirds on the islet and may be the most efficient method of censusing shorebirds in a short time. The influence of tide on shorebird behavior has been documented previously in North America (Fleischer 1983).

Discussion

An exceptional variety of migratory bird species was present on Kwajalein Atoll in October 2004, including six species that have not been recorded previously in the Marshall Islands, and four species that have been recorded only once before. It is remarkable to have observed so many apparently unusual species in such a short time, especially because the avifauna of Kwajalein has been relatively well-surveyed compared to that of many Pacific atolls (Schipper 1985, Clapp 1990, Clapp & Schipper 1990). The diversity and abundance of migratory birds at Kwajalein may be related to the presence of human-altered habitats, particularly water catchments, irrigated and fertilized lawns, and open fields. Such habitats, especially fresh water, are scarce on most atolls and may attract migratory birds, or at least cause them to linger, making their detection more likely. It is also possible that more migratory birds have resumed using Kwajalein as a stop-over site since the atoll was devastated during World War II, but much of the habitat recovery occurred decades ago and one might expect bird use to have resumed more rapidly.

Only four seabird species, White Tern, Black Noddy, Brown Noddy, and Black-naped Tern, were documented or suspected to breed on the islets that were surveyed, but other islets in the atoll are known to support a greater variety and larger number of breeding seabirds (Schipper 1985, Clapp 1990). The greatest factor limiting seabird nesting on most islets is the presence of alien predators, particularly black rats (*Rattus rattus*) and feral cats (*Felis catus*). Eradication of these predators would greatly enhance the suitability of Army-leased islets as nesting sites for seabirds. Development has reduced the amount of suitable nesting habitat for seabirds on certain islets, but some islets are no longer in active use, and military presence in the area may help protect seabird colonies from human disturbance to some extent.

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