Are wader flocks random grouping? – a knotty problem

BRIAN A. HARRINGTON & LINDA E. LEDDY

Manomet Bird Observatory, Manomet, MA 02345, USA

Citation: Harrington, B.A. & Leddy, L.E. 1982. Are wader flocks random groupings? – a knotty problem. *Wader Study Group Bull.* 36: 20–21.

Ornithologists frequently work on the assumption that birds are randomly associated in their flocks. Our findings with Knots, and those of Furness & Galbraith (1980) with another species of wader, suggest such assumptions may be incorrect. Our result of non-random occurrence of marked birds between flocks indicates that care should be used in calculating population estimates using ratios of marked/unmarked birds unless broad, representative sampling is achieved.

In a recent *Bulletin* article, Furness & Galbraith (1980) described a non-random distribution of colour-marked waders and speculated on the possible causes of their observations. We found an analogous situation during three brief surveys of Red Knots *Calidris canutus* on the Florida west coast in 1981 and 1982, and speculate on the significance of our observations with respect to population estimates based upon sightings of colour-marked waders, and with respect to non-random association of Knots within and between flocks.

We captured and colour-marked 238 Red Knots (all adults) from a flock of 450 resting at Sands Point, Longboat Key near Sarasota, Florida on 6 January 1981 by using a rocket net (60 × 40 feet, 1 inch square, knotless nylon net) propelled by four rockets. All birds were processed at the capture site immediately following capture, marked with a saturated solution of picnic acid and 95% ETOH, and were released within six hours of the capture time. The birds were marked also with colored leg-flags. Subsequently we censused flocks of Knots in the Sarasota region from 7–9 January 1981, 9–16 October 1981 and 18–21 January 1982, concentrating our work in places where we knew Knots were gathering to rest at high tides or to feed along beach fronts on falling tides.

In most cases it was not possible to search systematically through complete flocks because birds were often milling about, or in some cases were repeatedly flushed by pedestrians. Our aim in searches was to obtain an estimate of the flock size and a tally of the proportion of the marked birds present. In some cases we were able to search through a flock more than once, resulting in a tally of birds checked that exceeded the flock size, while in other cases it was not possible to check a whole flock.

Whatever the situation, we always tried to collect ratio from representative sections throughout the flocks. It was always possible that marked birds could have been counted more than one time or that some marked birds in flocks were not seen.

Results

Intra-flock distribution of marked birds

While counting Knots we noticed that marked birds were not randomly distributed in either foraging or resting flocks. For example, on 7 January (Table 1) a large resting flock was gathered during a storm on the upper beach at the north end of Siesta Key, the only time we found Knots resting at this particular location which normally was heavily used by humans. Siesta Key is about 7 km south of Sands Point where the Knots were banded. A count of marked/unmarked Knots in one section of the Siesta Key flock yielded a ratio of 30/535 (= 5.6%) whereas the ratio in another section of 60/519 (= 11.6%) was significantly higher $\chi^2 = 10.9$, $p < 0.01$). Similarly, in one part of a foraging flock on a sandbar next to Siesta Key on 8 January the marked/unmarked ratio was 80/739 (10.8%) while it was 16/512 (3.1%) in another section ($\chi^2 = 23.4$, $p < 0.01$) of the same flock. The foraging flock took flight several times when disturbed, yet the tendency for marked birds to be concentrated in one section of the flock persisted, even though not necessarily in the same area of the tidal flat.

Non-random distribution between flocks

Not only was there non-random distribution of marked Knots within flocks, but there were also significantly different frequencies between flocks (Table 1). For example, between 7 and 10 January 1981 the proportion of marked birds (29/1059 [2.7%]) found at the banding location (Sands Point) was significantly lower than the proportion (186/2305 [8.1%] found at Siesta Key, 7 km to the south ($\chi^2 = 32.3$, $p< 0.01$). A non-random distribution persisted 8 and 12 months later (Table 1), after all the birds had completed a pre-alternate and pre-basic molt, and a round-trip migration to their arctic breeding range.

Discussion

The results of non-random distribution of marked Knots have two important implications for wader research. First, the non-random distribution of marked birds within flocks suggest that flocks are not random associations, a curious and unexpected finding. Except as described, the marked birds were not grouped in any way we could see, but instead were distributed amongst unmarked birds. We saw no evidence of segregation according to the presence or absence of dye and/or bands, no unusual aggressive behaviour, no evidence of fidelity by marked birds to particular spots, no evidence of territorial behaviour, nor did we see any other unusual reaction to marked birds by their neighbours. We are left with the idea that Knot flocks are not random associations of birds, and that there is some sort of social organisation to flocks. In contrast, Pete Myers (pers. comm.) did not find that Sand-

Table 1. Frequencies of Red Knots banded at Sands Point on 6 January 1981 and subsequently found in flocks at various locations.

	Location	Distance (km) from banding site	Flock size	No. of birds checked	No. marked	Percent marked
7 January 1981	Siesta Key	7	4,200	1,054	90	8.5%
8 January 1981	Sands Point	0	400	400	10	2.5%
8 January 1981	Siesta Key	7	2,230	1,251	96	7.7%
9 January 1981	Sands Point	0	900	659	19	2.9%
7 October 1981	Maderia Beach	62	550	622	15	1.4%
9 October 1981	Sands Point	0	350	735	31	4.2%
16 October 1981	Indian Shores	69	800	1,130	9	0.8%
18 January 1982	Manasota Key	42	1,125	1,906	29	1.5%
21 January 1982	Longboat Key	15	1,499	781	31	3.9%

erlings *Calidris alba* in California had complex, within-flock, social organisation.

Second, our result of non-random occurrence of marked birds between flocks indicates that care should be used in calculating population estimates using ratios of marked/unmarked birds unless broad, representative sampling is achieved. For example, at Sands Point in January 1981 we found 29 of the 238 marked Knots among 1,059 birds checked, giving an estimate of 8,691 Knots in the area population. On the other hand, at Siesta Key we found a ratio of 186 marked to 2,305 unmarked Knots, leading to population estimate of 2,949 Knots. Combining the ratios from both areas gives a population estimate of 3,724, much closer to the number we estimated (3,875) from counts made in an aerial survey on 31 December 1980.

To summarize, ornithologists frequently work on the assumption that birds are randomly associated in their flocks. Our findings with Knots, and those of Furness & Galbraith (1980) with another species of wader, suggest such assumptions may be incorrect.

Reference

Furness, R.W. & Galbraith, H. 1980. Non-random distribution in roosting flocks of waders marked in a cannon net catch. *Wader Study Group Bull.* 29: 22–23.

Rationale and suggestions for a hemispheric colour-marking scheme for shorebirds: a way to avoid chaos

J.P. MYERS[1], J.C. MARON[2], E. ORTIZ[3], G.V. CASTRO[3], M.A. HOWE[4], R.I.G. MORRISON[5] & B.A. HARRINGTON[6]

[1]Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103, USA; [2]Dept of Biology, University of North Dakota, Grand Forks, ND 58201, USA; [3]APECO, Atahualpa 335, Lima, Peru; [4]Patuxent Wildlife Research Station, Laurel, MD 20708, USA; [5]Canadian Wildlife Service, 1725 Woodward Drive, Ottawa, Canada, K1A OE7; [6]Manomet Bird Observatory, Manomet, MA 02345, USA

Citation: Myers, J.P., Maron, J.C., Ortiz, E., Castro, G.V., Howe, M.A., Morrison, R.I.G., & Harrington, B.A. 1983. Rationale and suggestions for a hemispheric colour-marking scheme for shorebirds: a way to avoid chaos. *Wader Study Group Bull.* 38: 30–32.

Within the next few years the number of shorebird colour marking projects in the New World is likely to expand considerably. One common goal shared by many of these programs is tracking movements between breeding and wintering grounds, and identifying stop-over sites used by specific populations during migration. The prospect for success in this work is enhanced greatly by expanding the number of projects involved. But this expansion may result largely in confusion, unless considerable effort is made to co-ordinate colour-marking schemes. We outline here a system that should function if adopted by shorebird banders working in the New World.

The system we proposed is based on a series of practical considerations and research goals, summarised below. The system is complex, but so is the problem it addresses. No perfect solution is available given the diversity of interests and countries and the limitations on materials and resources. We hope this system strikes a reasonable balance. We hope that researchers will provide feedback to us on its usefulness and drawbacks.

1. This system uses coloured leg bands and flags made of a plastic, darvic, with UV-stable colours to prevent fading. The flags provide extraordinary visibility when placed beneath the tarsometatarsal joint of shorebirds. The flags are long-lived and colour-fast, and until 1982 were virtually unused in New World shorebird banding. Flags are immediately distinguished in the field from coloured leg bands. Thus this