

Durability, colour retention and incidence of encrustation of colour rings on Dunlins breeding on a brackish meadow

Ole Thorup

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INTRODUCTION

Recognition of individual birds by identification of unique colour ring combinations is a most useful tool in studies of breeding biology or migration. This method is especially suitable for studies of waders as most species frequently occur in wide open habitats thus allowing regular views of the birds' legs. Potential limitations in the use of this method in long-lived birds like waders are losses of rings due to wear or decomposition, fading of colours due to solar radiation, or encrustation by dirty sediment - all conditions that make identification impossible or at least very difficult. Most recently, difficulties in reading colour ring combinations have been discussed by Robinson & Oring (1997) and Browne & Mead (1998).

Data collected on durability and encrustation of colour rings during 1990-1998 at Tipperne, Denmark, were analysed and presented as a poster at the Wader Study Group Conference in Hungary, October 1998, together with an exhibition of a large number of dirty rings. In this small article the text is rewritten and 1999 data included. This presentation, however, is without the visual clues which were possible to show on the poster. Only durability can be described quantitatively. Since I have not used any scale to express the level of dirt, and the colours of the observed and replaced rings have only been determined and described in broad terms, it is only possible to present general features considering colour retention and encrustation.

STUDY AREA AND METHODS

Since 1990, I have carrying out a study of the breeding biology of Dunlins at the nature reserve Tipperne in Denmark (55° 53'N, 8° 12' E). A number of Dunlins were colour marked with plastic rings from a Swedish company (*PJ Art HB, Linneaborg, S-564 91 Bankaryd*) in the colours: dark blue, pale blue, pale green, orange, red, yellow, black, and white. In addition to a fixed pale green project code ring an individual four ring code was attached.

Between 1990 and 1992, 110 adults and 155 chicks were ringed with one ring above and two rings below the tarsal joint on each leg. From 1993 onwards, chicks were ringed with a two-ring year-code only, whereas 46 adult birds were individually ringed in 1993 and 1994 and another 52 were given two rings above the tarsal joint on each leg between 1995 and 1998.

By re-captures of ringed birds in subsequent years dirty and faded rings in the individual code were replaced. Regular visits to my study area produced 2,600 sightings of colour-ringed birds. Any changes in the colour of the rings and all losses were recorded and data saved in 'recovery files'. More information on the study is given in Thorup (1995, 1998, 1999).

RESULTS

Durability

Many rings were regularly controlled until five years after ringing, several six years after, and a few seven to nine years after ringing. Apart from dark blue rings not a single ring loss was observed (Table 1). This pattern is not biased by the presence of birds with lost rings that were not possible to identify - such birds were never observed. If dark blue rings are avoided, the use of this brand apparently guarantees that all rings will remain on a Dunlin during its total lifespan.

Dark blue rings with a smaller diameter were used on chicks to a limited extent. No ring losses were observed in such rings. Also the larger dark blue rings situated above the tarsal joint did fairly well. But below the tarsal joint a substantial proportion fell off after they had been carried for more than two years (Table 1).

Colour retention

Fading of colours of plastic rings has been reported to be extensive resulting in great difficulties in identification of colour combinations (Robinson & Oring 1997). In the plastic rings used at Tipperne fading was a problem in



Table 1. Proportion of rings on controlled birds still present one to nine years after ringing (number of controls in brackets). Observations are divided into rings above and below the tarsal joint (the 'knee'). Two ring sizes combined (inner diameter 3.5 mm and 3.0 mm, respectively) except in dark blue rings below 'knee': ¹⁾ 3.5 mm, ²⁾ 3.0 mm rings.

	ring carried:	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years
dark blue	above 'knee'	100% (37)	96% (27)	96% (23)	92% (12)	73% (11)	100% (1)	0% (1)	0% (1)	
	below 'knee' ¹⁾	100% (31)	100% (15)	82% (13)	44% (9)	50% (2)	0% (2)	0% (1)		
	below 'knee' ²⁾	100% (4)	100% (4)	100% (2)	100% (1)	100% (1)	100% (1)	100% (1)		
pale blue	above 'knee'	100% (88)	100% (67)	100% (46)	100% (26)	100% (17)	100% (4)			
	below 'knee'	100% (44)	100% (23)	100% (15)	100% (11)	100% (7)	100% (7)	100% (4)	100% (2)	
white	above 'knee'	100% (86)	100% (61)	100% (40)	100% (26)	100% (18)	100% (6)	100% (1)		
	below 'knee'	100% (54)	100% (34)	100% (16)	100% (12)	100% (5)	100% (5)	100% (3)	100% (1)	
yellow	above 'knee'	100% (98)	100% (76)	100% (47)	100% (32)	100% (19)	100% (6)	100% (1)		
	below 'knee'	100% (69)	100% (51)	100% (26)	100% (14)	100% (8)	100% (7)	100% (3)		
red	above 'knee'	100% (77)	100% (52)	100% (32)	100% (21)	100% (17)	100% (11)	100% (3)	100% (1)	100% (1)
	below 'knee'	100% (53)	100% (38)	100% (27)	100% (20)	100% (16)	100% (5)	100% (3)	100% (2)	
pale green	above 'knee'	100% (31)	100% (27)	100% (24)	100% (21)	100% (14)	100% (7)	100% (2)	100% (1)	100% (1)
	below 'knee'	100% (31)	100% (26)	100% (13)	100% (8)	100% (4)	100% (2)	100% (2)	100% (1)	
orange	above 'knee'	100% (34)	100% (26)	100% (18)	100% (8)	100% (7)	100% (6)			
	below 'knee'	100% (5)	100% (4)							
black	above 'knee'	100% (10)	100% (9)	100% (8)	100% (1)					



dark blue and orange rings. In a couple of years, dark blue rings became pale blue, and some of the rings turned greyish or whitish before they eventually fell off. Orange rings turned yellow in two to three years and in another one or two years they became almost white. White, pale blue, and pale green rings hardly faded at all, whereas red and yellow rings turned a little darker during the years. Some yellow rings started fading when they had been exposed to light and salt water for five years or more, but they still clearly retained a yellowish colour. Black rings have only been used since 1995. So far, no fading has been observed.

Most colour rings carried six to eight years remained colourful and were clearly identifiable. The conclusion by Robinson & Oring (1997): 'the readable life of a colour band combination will probably be less than five years even under optimal identification conditions' is luckily much too pessimistic considering colour ringed Dunlin at Tipperne.

Encrustation

The only serious problem at Tipperne in identification of colour combinations was encrustation. A large proportion of the replaced colour rings were coated brown or ochreous yellow by dirt from the sediment. Such encrustation took place on rings of all colours except the red ones. In the field, the result of the encrustation was that some birds could only be identified if it was possible to detect the colour of the upper margin of the ring and often this uncoated margin was just a few mm square. Frequently, a bird had to be left unidentified; this held true in about 5% of the cases in which otherwise all rings were visible.

Dirty rings were almost exclusively found on birds holding territory, incubating, or rearing chicks on the meadows. On the mudflats before and after breeding the colours on most rings were much more clearly visible. Furthermore, incidence of encrustation was strongly site-specific: birds breeding in some parts of Tipperne got dirty rings year after year, whereas birds breeding in other areas consistently had more brightly coloured rings. Early in the season, when the meadows were wet or moist and there was plenty of water in pools and gullies, much fewer birds were carrying dirty rings than later in the season. Rings did not have to be exposed to dirty sediment for long to become unidentifiable. A bird caught on the nest seven days after ringing had its rings so heavily encrusted that even in the hand the bird could only be identified by the numbered metal ring. Rings below tarsal joints were much more regularly coated with dirt than rings above, but even above the tarsal joints heavy encrustation was found in some 5% of the individuals during incubation and the chick rearing period.

CONCLUSION

If the colours dark blue and orange are avoided, and white and yellow are not used together in individual codes, this brand of colour rings will procure individually recognisable birds during a complete lifespan of a Dunlin. The sediment at a brackish meadow area like Tipperne does produce some obstacles, however, and experience with the colour changes due to encrustation is clearly an advantage, if not a must, in order to ensure safe controls.

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