Fading of UV-stable coloured bands on shorebirds

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"UV-stable" coloured plastic leg bands and coloured plastic tape were placed on American Avocets *Recurvirostra americana*, Black-necked Stilts *Himantopus mexicanus* and Killdeer *Charadrius vociferous* and recovered after one to two years. The environmental conditions experienced by free-living shorebirds would be expected to promote more fading than exposure to sunlight alone. Tape colours had less tendency to fade than did coloured bands. All band colours (except white) faded substantially after one year. Some combinations were difficult to distinguish after two years, and the readable life of a colour band combination probably would be less than five years even under optimal identification conditions. Fading of Darvic plastic is an important consideration for international shorebird banding schemes.

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METHODS

From 1991-1994 we individually marked American Avocets *Recurvirostra americana*, Black-necked Stilts *Himantopus mexicanus,* and Killdeer *Charadrius vociferous* at sites in northwestern Nevada and north-eastern California, USA. Adults were banded with unique combinations of three to five Darvic UV-resistant coloured bands (A.C. Hughes, Hampton Hill, Middlesex, U.K.) plus a numbered metal band. Chicks were banded with brood-specific combinations of one to three coloured bands plus a numbered metal band. Coloured plastic tape (3m, St. Paul, Minnesota), placed over the band, indicated hatching order within the brood. To avoid foot injuries (Salzert and Schelshorn 1979) all bands were placed on the tarsometatarsus of recurvirostrids. Killdeer bands were placed both on the tarsometatarsus and tibiotarsus. When marked birds were recaptured one or two years after initial banding, old bands and tapes were replaced and stored. To match colours, we used Smithe (1975) under natural light.

RESULTS

Even though colours used in bands were "UV-resistant," fading of some band colours occurred in 1 - 3 years (in contrast to Anderson 1980). Blue and yellow Darvic bands showed the most dramatic fading; some red bands faded while others turned brown (Table 1). 3M tapes used were slightly different colours than plastic bands and showed less fading. Green, red and yellow tapes (Spectrum Green [62], Spectrum Red [11], and Sulfur Yellow [157]) did not fade appreciably after two years. Blue tape faded much less than blue Darvic bands, from Spectrum Blue (69) to True Blue (168A) after two years.

In addition to the described fading, most bands and tapes became coated with a thin layer of dried mud (Colour 54, Cream Colour), which complicated field identification of the colours of older bands. We estimate that most colour combinations would be readable by experienced observers under ideal conditions for less than five years. A few colour combinations (particularly those that required distinguishing blue and black or yellow and white) became difficult to read after only two years.

DISCUSSION

Habitats of temperate-breeding shorebirds have attributes that are more conducive to band fading than habitats used by shorebirds on average. For example, recurvirostrids often wade in waters that are alkaline and/or saline (e.g. Schroeder *et al.* 1988, Robinson & Oring 1996). Most time is spent over water (e.g. Gibson 1978, Boettcher *et al.* 1995) providing increased exposure to UV light reflected off of the water surface. The long legs of recurvirostrids, and the necessity that all bands be placed on the tarsometatarsus might also increase the degree of exposure to UV. Thus, band fading on these shorebirds can probably be considered the maximum degree of fading likely to be observed. Similarly, band fading on shorebirds might be expected to be more rapid than for woodland birds (Lindsey *et al.* 1995)

The reduced tendency of fading in the plastic tape relative to the Darvic bands suggests that alternative methods of colour-marking might have prolonged colour life relative to bands that are commercially available. Further investigation to determine why tape was less prone to fading could lead to development of longer-lasting plastic leg bands.

International banding schemes for shorebirds rely on detection of coloured bands and flags made of Darvic plastic (Myers *et al.* 1983, Townshend *et al.* 1985, Sherman 1995). Given that maximum longevities of different shorebird species range from 5 to 25 years (Rydzewski *et al.* 1978), the readable life of coloured bands or flags is shorter than many shorebird lifespans. In addition, countries that are assigned flag colours with less fading might have longer-term detectability of flags than countries which are assigned colours that fade more rapidly.

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Table 1. Fading of Darvic (UV-resistant) coloured plastic bands used on American Avocets, Black-necked Stilts and Killdeer over three years. Colour names and colour numbers reference Smithe (1975), *n* = number of bands.

Initial Colour	Colour After 1 y, *n*	Colour After 2 y, *n*
Jet Black (89)	Jet Black (89), 3	Jet Black (89) to Blue Black (90), 5
Cobalt Blue (168)	Smalt Blue (170), 3	Ultramarine Blue (170A) to Flaxflower Blue (170C), 6
Spectrum Green (62)	Spectrum Green (62), 5	Emerald Green (163), 3
Spectrum Orange (17)	Spectrum Orange (17), 2	Salmon Colour (106), 5
Geranium (12)	Spectrum Red (11), 2	Brick Red (132 A) or Crimson (108), 3
White	White, 7	White, 3
Orange Yellow (18)	Trogon Yellow (153), 4	Yellow Ochre (123C) to Chamois (123D), 8