Fading of colour-bands used on Pied Oystercatchers *Haematopus longirostris* and Sooty Oystercatchers *H. fuliginosus* in southeast Australia

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The Victorian Wader Study Group has been banding Pied and Sooty Oystercatchers with 'Darvic' colour-bands in southeast Australia since 1983. The estuarine and oceanic habitats of these birds would be expected to promote fading greater than that due to exposure to sunlight alone. Of the eight colours used, five were reported as either fading or becoming discoloured. However, fading colours rarely resulted in individuals not being identified.

INTRODUCTION

'Darvic' leg-bands and flags are important aids in a wide variety of wader studies. In Australia, Darvic colour-bands have been used on oystercatchers for over 18 years by the Victorian Wader Study Group (VWSG) to study their ecology and movements in Victoria. Colour change in Darvic bands is only a problem if the amount of change hinders the accurate reporting of the original colour. Studies in other parts of the world appear to suffer similar problems to those encountered in Australia (Ward 2000). If colour changes are monitored loss of data can be minimised.

The Pied Oystercatcher *Haematopus longirostris* occurs in Australia and southern New Guinea (Marchant & Higgins 1993). In Australia, it is continuously distributed around the coast except where cliffs replace beaches such as in the Great Australian Bight. Their feeding habitat is sandy rather than rocky beaches and they breed on the coast, mainly on sandy beaches, dune systems and shallow muddy bays. Breeding commences at about four years of age. Non-breeders form flocks in bays, augmented by adults in the non-breeding season (Marchant & Higgins 1993). The VWSG study in Victoria has shown that adults and juveniles move distances of up to 900 km between breeding and non-breeding areas (Collins & Jessop 1999).

The Sooty Oystercatcher *H. fuliginosus* is endemic to Australia. Two subspecies are recognized *opthalmicus* in the north and *fuliginosus* elsewhere. They have an almost continuous distribution around the Australian coast but are rare along the south and east coasts of the Gulf of Carpentaria, Eighty Mile Beach and the Great Australian Bight. Sooty Oystercatchers inhabit rocky coasts within 50 m of the shoreline and almost always breed on islands. As with Pied Oystercatchers, non-breeding birds form flocks in bays and are joined by adults in the non-breeding season (Marchant & Higgins 1993). The VWSG study in Victoria has shown that adult and juvenile Sooty Oystercatchers are less dispersive than Pied Oystercatchers. Movements of up to 550 km between breeding and non-breeding areas have been recorded, but most are local(VWSG unpublished data).

This study evaluates the fading of Darvic colour-bands used on oystercatchers in southeast Australia.

METHODS

The use of Darvic (pressed PVCU sheet) spiral colour-bands by the VWSG on Pied and Sooty Oystercatchers commenced in 1983. Since 1988, each bird has been assigned an individual colour combination consisting of two bands of the same colour on the left leg and three bands of different colours on the right leg. The left leg bands indicate the site at which the birds were originally captured, usually a wintering site.

Most of the colour-bands used in this study were made with 0.75 mm thick Darvic. Black bands were usually of 1.0 mm Darvic and light green, 0.5 mm. These differences reflect the availability of Darvic in the eight colours used. Colour-bands were purchased ready-made by the manufacturer. The internal diameter of stainless steel bands used on oystercatchers in Australia is 9.5mm (Lowe 1989). Colour-bands were applied using a similar technique to that outlined by Ward (2000). Originally only the outside of the spiral was glued to prevent the band from becoming tangled with twigs, fibres and other materials (Lowe 1989). Later the spiral was glued on both the inside and outside to ensure that grit or delamination of the band did not reduce its internal diameter (Minton 2000).

Eight colours are used by the VWSG: Blue (Spectrum Blue 69), Black (Jet Black 89), Orange (Flame Scarlet 16), Red (Crimson 108), Light Green (Opaline Green 162D), Green (Emerald Green 163), Yellow (Spectrum Yellow 55) and White (numbers and names in parentheses are those

assigned to each colour by Smithe (1975)).

During the course of catching oystercatchers of both species for an ongoing study, colour-bands on retraps were examined for colour change and other damage (see Minton 2000). If the colour change was considered to be so great that it might hinder identification in the field, the band was removed and replaced with a fresh band of the same colour. Old bands were labelled with the date of removal and the metal band number so that the date of banding was known and therefore the time that had elapsed between banding and recapture could be established. This enabled us to estimate the life of Darvic bands in the conditions of temperate Australia.

RESULTS

To the end of 2001, 1607 Pied Oystercatchers were caught and colour-banded and the majority, 1348, were given individual combinations. Of the birds individually banded, there were 2487 subsequent re-sightings involving 677 individuals (49.9% of the total). There were also 795 retraps of 570 individuals. Some of the retraps could not be identified by their colour-bands, only by the numbered metal band. 533 Sooty Oystercatchers were colour-banded during the same period with 223 re-sightings. However these relate to relatively few individuals: 98 (20%). 80 Sooty Oystercatchers were also retrapped. The reasons for the low level of re-sightings and retraps are not yet fully understood.

Most re-sightings of colour-banded Pied Oystercatchers were made in the first 12 months after banding. The oldest colour bands re-sighted were more than 10 years old. 161 re-sightings were reported to have colour-band combinations that had not been used. Of these, 98 could not be assigned to an individual with any degree of certainty. In some cases, the reason was the loss of one or more bands. In others, it is likely that colours had been confused in poor light conditions. In the remaining 63 cases, it is certain that colour-change had occurred due to fading or staining of the original colour (47 were due to staining). Some of these birds, however, could be identified as individuals through a process of elimination, especially where possible alternative combinations had not been used (Table 1).

It is not possible to evaluate these colour changes as they are all sightings in the field and the colours are those reported by observers. The black band that had apparently changed to olive is very likely an example of observer-error probably because of poor light conditions as this bird was retrapped later when no colour change was noted. The two cases of orange bands fading to a reported pink were established because the first choice, red, could be eliminated as it had not been used at the time.

Among bands removed from retrapped birds there were several instances of the same original colour changing in a variety of ways, some of which might lead to misidentification (Table 2).

DISCUSSION

It appears that Darvic colour-bands wear and fade in south-east Australia in a similar way to that reported for the United Kingdom by Ward (2000). However, for certain colours the extent of such change appears to be greater than in the UK. This difference is likely to be a consequence of the higher intensity of UV light in Australia.

Robinson & Oring (1997), in a study of colour bands used on three wader species in North America, noted colour changes in Darvic bands similar to those found by the VWSG, but over a much shorter period of time.

The number of misidentified bands would have been greater had we not systematically replaced bands showing colour-change. Moreover, many more bands showed a degree of colour-change that could be recognised and taken into account and so did not inhibit the correct identification of individuals. The fastest significant colour-change took place over 17 months, but the majority of bands retained their colour well over at least 36 months. The colours that appear to be the most susceptible to change are white, orange and yellow. Nevertheless some bands of these colours are still recognisable in the field after 10 years. The reason for this disparity is unclear. It is a widely held, but unproven, belief, however, that in some habitats birds come into contact with chemicals that change the plastic making the bands more susceptible to fading or colour-change.

Some blue bands tended to darken making them difficult to distinguish from black. To complicate matters, other blue bands appear to fade to a grey or pale blue as also reported in Denmark (Thorup 2000). Similarly, dark blue Darvic bands on breeding Sandwich Terns in the UK have also been found to fade to grey (R.M. Ward pers. comm.). It is thought that darkening is the result of staining while greying (fading) is caused by sunlight.

Other colour-bands used in Victoria change in a broadly similar way to that reported from Denmark by Thorup (2000), though orange bands in Australia have not yet been described as fading to yellow.

Over time, all colour bands change colour to some extent either in shade or intensity. Considering the harsh conditions of the coasts of southern Australia, the fading of colour-bands is surprisingly slight and is generally not considered a major problem. Any re-sighting that cannot be immediately assigned to an individual can often be resolved using know-

Table 1. Apparent colour changes in Victorian Pied Oystercatcher colour bands from bands read in the field where individual birds could be identified.

Original colour	Reported as	Date of banding	Date of sighting	Time elapsed (months)
red	light red	01/07/89	04/12/97	89
red	pink	16/04/89	13/09/93	65
red	pink	08/07/89	27/09/95	86
red	pink	22/08/88	28/05/94	69
red	pink	27/02/93	09/07/94	17
red	brown	05/08/89	17/12/95	76
yellow	white	16/04/89	24/01/93	57
yellow	white	23/06/91	28/01/96	55
yellow	white	28/04/91	02/12/95	56
yellow	white	13/07/91	29/04/95	45
orange	pink	06/08/89	29/05/91	33
orange	pink	06/08/89	22/11/92	51
orange	brown	06/08/89	08/01/94	53
orange	brown	21/03/92	01/09/95	42
orange	brown	21/03/92	27/09/95	42
blue	grey	16/04/89	08/09/98	121
blue	grey	07/05/93	05/12/97	53
blue	grey	16/04/89	26/04/97	104
blue	pale blue	18/05/96	08/02/97	9
black	olive	06/05/90	04/08/90	3

Table 2. Colour change in Darvic bands used on retrapped Pied Oystercatchers in Victoria, Australia, that could lead to misidentification.

Original colour	Changed to[1]	Time elapsed (months)	Colour recorded in the field	Metal band number
light green	opaline green 162D	62		10103676
light green	pistachio 161	72	white	10099373
light green	pistachio 161	99		10104304
green	paris green 63	97		10099307
green	spectrum green 62	99		10104304
orange	flesh ochre 132 D	23		10104034
orange	flesh ochre 132 D	33		10104020
orange	burnt orange 116	39	brown	10096923
orange	flesh ochre 132 D	45		10103963
orange	flesh ochre 132 D	47		10103980
orange	beige 219 D	56		10113985
orange	flesh ochre 132 D	60		10103557
orange	flesh ochre 132 D	60		10103557
orange	flesh ochre 132 D	72	faded red	10103662
orange	orange rufous 132C	75		10103581
orange	flesh ochre 132 D	81		10099424
orange	orange rufous 132C	83		10103662
orange	burnt orange 116	87	brown	10099424
orange	tawny 38	87	brown	10099424
orange	flesh ochre 132D	93		10085200
orange	chamois 123D	97		10099307
orange	orange rufous 132C	99	light brown	10104304
orange	flesh ochre 132 D	105		10096923
white	yellow ochre 123C	10		10115433
white	kingfisher rufous 240	12	red/orange	10103685
white	kingfisher rufous 240	25	red/orange	10104719
white	kingfisher rufous 240	25		10104648
white	yellow ochre 123 C	26		10115132
white	chamois 123D	39	yellow	10096923
white	kingfisher rufous 240	45		10103963
white	chamois 123D	87	yellow	10099424
white	yellow ochre 123C	93		10085200
white	chamois 123D	97		10199328
red	geranium 12	39	dark orange	10096923
red	spinel red 108 B	56		10103985
red	poppy red 108A	64		10099347
red	geranium pink 13	75		10103581
red	vinaceous pink 221C	96		10089993
red	spinel pink 108 C	98	pink	10099374
red	spinel pink 108 C	105		10096923
yellow	trogon yellow 153	39		10096923
yellow	trogon yellow	39	white	10104011
yellow	pale pinkish buff 121D	56		10103985
yellow	pale pinkish buff 121D	56		10103985
yellow	chamois 123 D	72	buff	10099373
yellow	warm buff 118	72		10099373
yellow	trogon yellow 153	83		10103662
yellow	vinaceous pink 221C	96		10089993 badly stained
yellow	warm buff 118	97		10199328
yellow	buff 124	124	white	10096502
blue	smalt blue 170	12	black	10103685
blue	smalt blue	32		10104855
blue	cobalt 68	61	black	10103621
blue	cobalt 68	97		10099307

[1] colour names and codes from Smithe (1975)

ledge gained of the way in which bands wear.

Encrustation by an orange deposit is a problem at one site in Victoria and this particularly affects white, orange and yellow bands changing them to brown or dark orange. If bands are badly affected identification may be impossible. The cause of this is not known though it is almost certainly a chemical process specific to this area. Incoloy metal bands are also affected. Similar encrustation has also been noted among wintering shorebirds marked in NE England, especially mudflat specialists (R.M. Ward, pers. comm.) and in passage Red Knots in Delaware Bay, USA (Atkinson *et al.* 2001).

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