

Field identification of the orange-fronted parakeet (*Cyanoramphus malherbi*): pitfalls for the unwary

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Abstract The field identification of the orange-fronted parakeet (*Cyanoramphus malherbi*) has been a problem since the species was first described in 1857. Separating this critically endangered species from its more common, but also declining sympatric relative, the yellow-crowned parakeet (*C. auriceps*), can be difficult, as both species are cryptic and phenotypically similar. To develop criteria for consistent identification, we assessed >2700 field observations on the orange-fronted parakeet and >10,000 field observations for the yellow-crowned parakeet, where the phenotypes of each bird was compared to the traits of the genetically defined species and verified type specimens. Observations on 117 nests also allowed observations of young from nestling to independence. We concluded that only 2 field marks can be used to reliably separate the 2 species but a clear view of either the frons or rump patch must be seen. The orange-fronted parakeet has an obvious orange frons and rump patch while these areas on the yellow-crowned parakeet are crimson. No other field traits consistently separated the 2 species. Even then, identification can be unreliable when observing juveniles, when light conditions are poor, or if the bird is high in the canopy. We recommend that unless the observer sees a clear and obvious colour in the frons or rump patch, then that bird must remain as unidentified to species.

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INTRODUCTION

The orange-fronted parakeet (*Cyanoramphus malherbi*) is a critically endangered and endemic species in New Zealand (Grant & Kearvell 2003; Birdlife International 2011; Kearvell 2013). Its identification has been a problem in the past (Buller 1869, Salvadori 1891 & Harrison 1970) and continues to be an issue at present (Kearvell 2013). Correct identification and reporting of a critically threatened species is vitally important

as misidentification can hinder its conservation. The problem lies in separating this species from its congener, the sympatric yellow-crowned parakeet (*C. auriceps*). Although identification is possible with a clear view of mature adults at close range and in good light, often the only view is of a bird high in the canopy.

The difficulty of identification is exacerbated as no current field guide fully describes the orange-fronted parakeet nor highlights the issues in separating them from the yellow-crowned parakeet. While all field guides state that the frons colour is different between the 2 species, there

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are no assessments of whether this trait can be used to identify juveniles or females or indeed the importance of obtaining clear views. Heather & Robertson (2005) failed to state that the head of recently fledged parakeets is only green (attained after about 3 weeks; Kearvell 2013), and are misleading when they state that the contour colour simply “lacks” the yellow of the yellow-crowned parakeet. They also categorise the orange-fronted parakeet as a colour phase of its congener (rather than a separate species; Kearvell *et al.* 2003). While Forshaw (2011) correctly stated that the forecrown is a paler yellow than in *C. auriceps*, it is impossible to use this as a field character as it is too similar to *C. auriceps*. They also failed to state that young fledglings have no head colour (apart from the green found in adults) and fail to mention the difference in contour feather colour. Neither state that a good close view in good light is essential.

The long debate over the specific status of the orange-fronted parakeet was resolved by Boon *et al.* (2001; see review in Kearvell *et al.* 2003). Analysis of mitochondrial DNA (mtDNA) by Boon *et al.* (2001) confirmed the species identity of presumed orange-fronted parakeets held in museum collections and to the descriptions of the type specimens. The description of the type specimen of the orange-fronted parakeet, held at the Metz Museum in France, is straightforward. It describes the bird as possessing an orange frons and rump patch, with blue-green shading to the contour feathers and a pale yellow crown (Souancé 1857). We recently (May 2014) asked the Metz Museum to send digital photographs of the type specimen in order that we could verify the description. These clearly showed that both frons and rump patch were a distinct orange (*pers. comm.* Françoise Clemang, Metz Museum). Recent digital photographs of the co-type, held at the Museum of Natural History in Paris and examined by the authors, confirmed that both the frons and rump patch of the orange-fronted parakeet is a distinct orange (*pers. obs.*).

Most morphological traits for both the orange-fronted parakeet and yellow-crowned parakeet are unlikely to be of use in field identification as both parakeet species are similar in size. Although the orange-fronted parakeet is a little smaller than the yellow-crowned parakeet (Anne Richardson, *pers. comm.*), the masses of both species and sexes overlap, although males are heavier than females (Kearvell 2013). Significant differences occur in the vocalisations but as there is extensive overlap, vocal traits cannot be used to separate the 2 species (Kearvell & Briskie 2003). Bill sizes have also been studied (Young & Kearvell 2002) and again, while significant differences occur, the traits overlap. Thus, there are currently no described criteria that can be used to reliably separate the 2 species.

The objective of this study is to summarise information on the field identification of the orange-fronted parakeet and to distinguish it from the yellow-crowned parakeet. We draw together an extensive set of observations from the Department of Conservation’s programme to save the species. These observations provided us with the opportunity to assess possible field traits to separate the 2 species.

METHODS

The observations summarised here were gathered by the 3 authors while they were working in the field on a project run by the Department of Conservation to save the orange-fronted parakeet. The type descriptions of the 2 parakeets were used to guide all field identifications of each species. This work was conducted in the 3 valleys where the last wild populations of the orange-fronted parakeet remain: the Hawdon (171° 44.52'E, 42° 58.13'S) and Poulter (171° 51.97'E, 42° 54.19'S) Valleys in Arthur’s Pass National Park and the South Branch Hurunui (172° 5'E, 42° 45'W) in Lake Sumner Forest.. No observations are included from islands where orange-fronted parakeets have been recently translocated, or any from studies of the captive population.

Most field work entailed the location and identification of parakeets to species within the remaining wild populations between September and April each austral breeding season. All presumed orange-fronted parakeets were followed for as long as feasible and where possible their nests were located and protected. A few additional observations were made between May and August, as field work sometimes extended into the winter months. All individual sightings were recorded onto data sheets with any unusual observations noted, including appearance. From 1995 to 2009, a little over 1800 observations of orange-fronted parakeet were made by the senior author. The 2 junior authors together made an additional 900 observations of orange-fronted parakeets, amassed over 8 years. A total of 117 orange-fronted parakeet nests were also monitored in detail by the authors. These observations included various ages of juveniles, from within nests to fledglings to breeding birds. The difficulty of identifying orange-fronted parakeets meant that a substantial number of observations of yellow-crowned parakeet were also made with pertinent details recorded for this species. We estimate that >10000 observations on yellow-crowned parakeet were made during the course of our study. Sex was determined by behaviour especially breeding behaviour and appearance.

It should be noted that all our observations are based on encounters of free-living birds. Due to the

Table 1. A summary of field traits for distinguishing mature orange-fronted parakeet (OFP) from yellow-crowned parakeet (YCP); key diagnostic traits are given in *italics*. For birds >5 weeks after fledging, juveniles attain field traits that can establish specific status.

	Frons	Rump patch	Crown	Contour feathers
OFP	<i>Orange</i>	<i>Orange</i>	Lemon Yellow	Blue-green
YCP	<i>Crimson</i>	<i>Crimson</i>	Golden yellow	Yellow-green
Juvenile OFP (<2 weeks)	Little or no colour	Little or no colour	Faint yellow or absent	Indistinct blue-green
Juvenile YCP (<2 weeks)	Little or no colour	Little or no colour	Faint yellow or absent	Indistinct blue-green
Juvenile OFP (2-5 weeks)	<i>Orange develops</i>	<i>Orange develops</i>	Lemon yellow develops	Indistinct blue-green
Juvenile YCP (2-5 weeks)	<i>Crimson develops</i>	<i>Crimson develops</i>	Golden yellow develops	Indistinct yellow-green

sensitivity of orange-fronted parakeets to capture during the nesting season, it was not possible to capture and identify birds in the hand and thus our observations are based solely on comparisons to descriptions based on the type specimens. As detailed descriptions of the plumage of the orange-fronted parakeet and colour photographs are provided in Kearvell (2013), our objective here is to summarise and assess the field traits that can be used to separate the 2 species of parakeets, and some of the pitfalls likely to be encountered in field identification.

RESULTS

Table 1 lists the field traits we used to separate the 2 species. The single most important diagnostic field trait was the colour of the frons or frontal stripe, which is the line of feathers which reaches the eyes and lies between the cere and the crown. In the orange-fronted parakeet the frons was always orange, while in the yellow-crowned parakeet it was always crimson. Similarly, the rump and flank spot (area just below the rump, under the edge of the folded primaries) in both species also appears diagnostic and is the same colour as the frons in each species, respectively. These two plumage traits are the only ones that we found can be used to separate orange-fronted from yellow-crowned parakeets in the field. Our examination of verified museum skins and digital photographs of the type specimens confirmed that these 2 colours are distinctly different when viewed by the human eye. We confirmed they were also readily separable in the field but only with good views. We recorded no apparent colour variation in the frons or rump patch of mature birds based on field observations. However, there did appear to be some variation in the size of the frons but this was infrequent (less than 10 adult individuals at 117 nests).

Although the plumage of males and females is similar in both species, field traits can be used to sex birds in some situations, especially if a pair is seen together. Male colouration is usually brighter to the human eye while the female may appear faded; this is most noticeable in the early part of the breeding season and more obvious when the birds are in fresh plumage, just after a moult. However, the timing of moult in the orange-fronted parakeet is little understood and is complicated by their variation in breeding periods from season to season. In some seasons they fail to breed while in others they may continue for 2 to 4 broods (Kearvell 2013). Thus, caution is needed in assigning sex based on an assumed timing of moult. Some differences in sexual colour may also be connected to the higher total pigment concentrations reported in males of some species of parrot (McGraw & Nogare 2005).

In adults of both sexes, the crown colour of the yellow-crowned parakeet was a golden yellow; while in the orange-fronted parakeet it was a pale lemon yellow. While this can be obvious in good light conditions, differences are subtle and therefore we believe of limited use when separating the 2 species.

Over the large number of observations reported here only one individual, a female, exhibited any aberration of colour and this was to the crown. Her contour plumage was the blue-green that is typical of an orange-fronted parakeet, and her rump patch was orange, but her crown colour was orange, and not yellow. Her frons could be seen as a distinct orange stripe that was slightly darker than the adjacent orange crown. She bred with a male orange-fronted parakeet and her offspring appeared to be normal phenotypic orange-fronted parakeets, indicating she was probably not a hybrid. Parrots are well known for their striking colours, largely derived from a unique class of pigments,

psittacofulvins (Berg & Bennett 2010) and also for aberrations in the colour of their plumage. It is entirely possible that this orange-crowned female is yet another example.

DISCUSSION

Our observations of both orange-fronted and yellow-crowned parakeets in the field and at their nests confirm that they can be difficult to separate in the field. The only reliable traits we found to be useful were the differences in the colour of the frons and rump. Even then, good views are needed.

While the differences in frons colour were described as early as 1857 (Souancé), much has also been written about the colour of the contour feathers of the orange-fronted parakeet. Buller (1869) described them as being a "pure cold-blue green." In contrast, those of the yellow-crowned parakeet are described as showing a strong yellow wash to the olive-green, especially on the breast (Kearvell 2013). When the males of both species are seen together the difference is noticeable. The contour feathers of the females are similar but can appear a little faded. However, under most field conditions, the slight differences in green colour of the contour feathers are not a reliable trait.

Both parakeet species start breeding in late December and will continue as long as food is available, which in a mast year can mean right through to the following November, and they may recommence again in December (Elliott *et al.* 1996). Thus, juveniles may be present at almost any time of year and this adds to the problems of identification and great care must be taken. Young fledglings are easy to identify as they are clumsy in their movements, have a squeaky character to their calls, little or no head colour (only green feathering), pink legs and bill, and often a short tail, though the latter will grow into a full adult tail in under 2 weeks. Pink legs seem to be the last character to develop an adult appearance, which are a dark grey to black colour as they progressively age. Pink legs can take months to darken and it is not unusual (~10% of nests) to see pink-legged females breeding with older grey-legged males, although this may be a result of reduced numbers of available females due to greater predation rates on females (Innes *et al.* 2010). The squeaky voice will also slowly take on the more adult timbre, over several weeks. The pink bill turns a metallic blue-grey in around 2 weeks after fledging.

When both species fledge they have little or no orange or yellow colour on their head or on their rump patch. There may be a small amount of yellow on the crown but the full development of colour on the head takes a few weeks to develop. Fledglings also have clean and fresh plumage, which in the yellow-crowned parakeet can appear similar to that

of the orange-fronted parakeet juvenile and adult. As the head colour develops the yellow appears indistinct and the frons of both species appear thin and similar in tone. Colour of the frons, at this stage, is difficult to determine. Most misidentification occurred at this stage, when observers reported seeing 'something different' to an adult yellow-crowned parakeet and decided it might be an orange-fronted parakeet. The only way to verify a juvenile to species is to wait until an adult returns to feed it. Otherwise, we found it must remain as unidentified.

Trait Consistency

Some adult individuals (<10) had a very indistinct frons and such individuals can present identification problems. We and other workers have spent long periods following such individuals in an attempt to verify specific status. They may be associating with another easily identified bird, and this could be used to assign species identity, but this will be of limited use as parakeets will often associate with the other species. Rarely, mixed pairs have also been recorded (4 since 2001), so even association at a nest cannot always be used to identify a difficult to assign individual. Some individuals with an indistinct frons, usually appearing too thin to verify colour, can still be identified to species by observation of their rump. This always appears to be the same colour as the frons and remains distinct even in individuals with a reduced frons. If the rump patch cannot be viewed, then the individual must remain as unidentified. Variation in frons size may simply be a natural variation, it may be linked with moult stage or be the result of some trauma or disease.

Further identification issues can arise when parakeets go into moult. Most of our observations were made during the breeding season and with little known about moult in parakeets, this can have the effect of masking some of the differences, such as the appearance and colour of the head. For example, one confirmed female orange-fronted parakeet (Hawdon 2010), on her second brood, could only be verified to species through the colour of her rump patch; her frons was reduced (probably due to feather loss or moult) and its colour was ambiguous. Her overall seeming poor condition, large brood patch and contour feather loss, may also have been the result of disease. Again, if no colour can be verified such individuals should remain as unidentified.

Recommendations

To correctly identify, and thus separate these 2 species of parakeet, a clear and unambiguous view of either the frons or rump patch must be seen; and only when a clear colour is identifiable. We found

that no other field trait can be used to reliably identify and distinguish the 2 species. For any observer reporting an orange-fronted parakeet, the colour of one (and preferably both) of these 2 traits must be assessed. No parakeet, within the work undertaken by the Department of Conservation, is now assigned to species unless at least one of these traits is verified. This has led to consistency in species identification. All other field traits, notably contour feather colour and crown colour, while proving useful supplementary guides to species verification, have proven to be inconsistent as diagnostic field traits on their own. It should be noted that the colour of the contour feathers is, amongst experienced field workers, considered a diagnostic field trait but further study of this character, using a spectrophotometer, is warranted before this can be confirmed.

Other traits have also proved useful in varying ways. Experienced field workers can, with quite high accuracy, sex individuals in the field outside of actual nest observations. This is done through a combination of overall colour intensity, bill length, comparative body size and overall behaviour, and has proved useful in identifying pairs. Experienced workers are also, to a surprising degree, able to positively identify species by call alone, using a combination of overall tone and interval between phrases. However, we believe such traits should only be used as a possible indication of species.

There is considerable scope for further research into the plumage characteristics of these 2 species and a quantitative study of reflectance using a spectrophotometer would be of great use. Orange-fronted parakeet are not handled in the wild, due to their propensity to stress, and so a study of this nature could only be undertaken with the use of museum skins, or through permission to use captive individuals or feathers obtained from wild birds non-invasively. Nevertheless, traits that can be distinguished only through the use of spectrophotometers will have little applicability in field identification for a species that currently has limited opportunities for in hand examination, and further work is needed on assessing the reliability of field traits.

We recommend that the only 2 field traits that can be used to verify species identity are the colour of the frons and rump spot. We also recommend that future field guides emphasise the considerable problems that exist when trying to separate these 2 species in the field, especially in relation to juveniles. Finally, it is important to stress that unless these 2 field traits can be adequately assessed, the identity of the individual must be assigned as unknown.

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