NOTES ON THE BLUE-EYED SHAGS
(Genus Leucocarbo Bonaparte)

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ABSTRACT

This paper analyses the characters and the affinities of the seven species of "Blue-eyed Shags." The subgenus *Leucocarbo* is proposed as a full-rank genus, and three subgenera are proposed in it: *Leucocarbo* s. str., for *L. bougainvillii* and *L. magellanicus, Nesocarbo* subgen. nov. for *L. campbelli,* and *Euleucocarbo* subgen nov. for the other four species.

The Blue-eyed Shags constitute a group of related species which are largely distributed over the Southern Hemisphere, and which are usually united in the subgenus *Leucocarbo* Bonaparte, 1857. Some thirty forms have been described in this subgenus, and their status has long been controversial, and is still so for some of them. At present, seven species are usually distinguished, which are: *Phalacrocorax (Leucocarbo) verrucosus* (Cabanis, 1875); *P. (Leucocarbo) carunculatus* (Gmelin, 1789); *P. (Leucocarbo) albiventer* (Lesson, 1831); *P. (Leucocarba) atriceps* King, 1828: *P. (Leucocarbo) campbelli* (Filhol, 1878); *P. (Leucocarbo) bougainvillii* (Lesson, 1837); and *P. (Leucocarbo) magellanicus* (Gmelin, 1789) — (Murphy 1936; Holgersen 1945; Jouannin 1951; Falla, Sibson & Turbott 1966). *P. (Leucocarbo) bougainvillii* ("Carbo bougainvillii") was chosen as the type of this subgenus by Ogilvie-Grant (1898) by subsequent designation.

As Falla said in 1932, the Blue-eyed Shags ". . . are generally regarded as distinguishable from other Cormorants by well-marked external characters shared by most of them. These characters are the fleshy ring of blue skin surrounding the eye, the frequent presence of dorsal and alar patches of white feathers, the brightly metallic plumage of the upperparts and the flesh-coloured feet."

The first of these characters, the fleshy ring of blue skin surrounding the eye, does only exist in the four first species. In the three following ones, it is either absent *(P. magellanicus),* or green *(P. bougainvillii),* or mauve, purple or violet *(P. campbelli).* The presence of dorsal and alar patches of white feathers is even more inconstant. They do not exist in *P. verrucosus* nor in *P. bougainvillii* and *P. magellanicus.* The dorsal patch is absent in *P. albiventer;* it is poorly developed in *P. campbelli ranfurlyi;* it is present in only a few *P. campbelli colensoi* and missing in *P. c. campbelli.* The white alar bar is normally developed in *P. albiventer, P. carunculatus* and *P. campbelli ranfurlyi.* On the contrary, it is poorly developed in *P. campbelli colensoi* and completely lacking in *P. c. campbelli.*

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The brightly metallic plumage of the upper parts is a feature which may be found in several species of Cormorants. Nevertheless, this dark plumage shows a very distinctive pattern in all Blue-eyed Shags. The dark parts of the head, neck and back have a dull metallic greenish blue, or royal blue reflection, especially on the back. The wings, including the scapular region, have a strong, oil-green gloss. The tints are black. The quills and rectrices are blackish, with no reflections.

In life, the colour of the feet of the Blue-eyed Shags varies from fleshy to bright pink, with dark colours which are usually restricted to the back of the tarsi, the sole of the feet and the joints of the toes. This is one of the most constant features of the group.

The subgenus *Leucocarbo* may be characterized by other features as well: thus, the fairly constant presence of yellow or orange caruncules, sometimes reduced to a few papillae, at the base of the upper mandible. They are lacking in *P. magellanicus* and in *P. campbelli.* The unfeathered facial area is large, subtriangular and

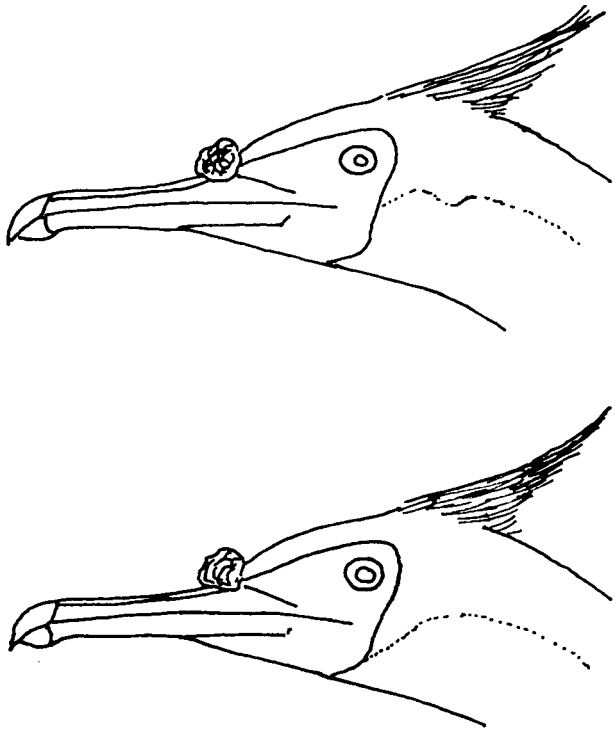

FIGURE 1 — Heads of *Leucocarbo albiventer melanogenis* (above) and of *Leucocarbo verrucosus* (below), showing the unfeathered facial area.

includes the eye (Fig. 1). All Blue-eyed Shags have a white chest and a white belly, and most of them have a white foreneck also. They possess 12 rectrices, which are fairly short, stiff and pointed.

Within the subgenus *Leucocarbo,* it is possible to characterize a homogenous group of species which exactly fit its description and particularly have plain blue rings around their eyes. These " True Blue-eyed Shags " are *P. verrucosus, P. carunculatus, P. atriceps* and *P. albiventer.* These birds have an austral, circumpolar distribution, and I already showed (1970) that a gradual change of certain of their characters (dimorphism, white patches on the upperparts, plumage of immatures, etc.) can be observed when these species are considered in the order in which they are encountered moving eastward from Kerguelen.

The Kerguelen Shag *(P. verrucosus)* seems to be the least differentiated, the least original of the true Blue-eyed Shags. On the whole, its colours are less bright, even that of the eye-ring, which, in life, seems to be greyish in comparison with that of *P. albiventer,* for instance. It is the only one which lacks both the white dorsal patch and alar bar. The demarcation line between the white and the dark colours of the head passes much under the ear opening, and reaches down the sides of the head under the base of the lower mandible. The feet of this bird are coloured with brown, but their fundamental colour is pink. The immatures of this species are dimorphic. The plumage of the light-phase ones is only a duller edition of that of the adults, except the foreneck, which becomes progressively dark upward, and the throat, which is as dark as the sides of the head. The chin is lighter.

Good illustrations of the Kerguelen Shag, both adult and immature, can be found in Falla (1937: 229 (photographs) and 233 (colour plate)).

On the other hand, *P. albiventer* and *P. atriceps* show a number of features which make them the most typical of the Blue-eyed Shags, mainly the latter. Their dark upperpart plumage is the most reduced in this group, consequently to the extension of the white parts. This is especially true of *P. atriceps* which, in postnuptial plumage, is certainly the whitest of all Cormorants. The metallic gloss of their dark plumage is much enhanced, and that of the neck and back has blue and purplish reflections rather than greenish blue ones, mainly in *P. albiventer.* In life, the fleshy rings of skin round their eyes are bright ultramarine blue, and their caruncles are bright orange. Their feet are bright pink, but the joints of the toes are stained with brown. Immatures of these species have a dull light brown and white plumage, with a very faint indication of gloss, if any, on their backs. They have white chins, throat and forenecks with a pattern reminding of that of the adults.

These two species are very closely related, and are so similar in certain plumages that they are difficult to distinguish in the field, as stressed upon by several authors like Murphy (1916, 1936), Jouanin (1951) and Behn & *al.* (1955).

The New Zealand representatives of this group constitute an assemblage of closely related forms *(P. carunculatus carunculatus, P. c. chalconotus* and *P. c. onslowi)*, the status of which has been the topic of much discussion. They have been alternately considered as mere subspecies of *P. carunculatus* (Alexander 1963; Falla, Sibson & Turbott 1966; OSNZ Checklist 1970) or as species of their own (Falla 1932; Oliver 1955). The species, or subspecies *ranfurlyi* has been reunited to this assemblage by some authors (Falla, Sibson & Turbott 1966) while others consider it as more closely related to *P. campbelli* (OSNZ Checklist 1970). But, even if their systematics are very intricate, these Cormorants do form an homogenous group, as stressed by several authors, and can be considered as a whole when examining their relations with other species of shags. So I will consider them as subspecies of *P. carunculatus* in the present paper, following the opinion of the OSNZ Checklist Committee (1970).

The Stewart Island Shag *(P. c. chalconotus)* and the Chatham Island Shag *(P. c. onslowi)* are the most typically true Blue-eyed Shags of the lot, mainly the latter. They resemble the Kerguelen Shag in many respects (Voisin 1970), especially in the pattern of the feathered and of the unfeathered parts of the head. But they show relation to both *P. albiventer* and *P. atriceps* in having large patches of white in the plumage of their upperparts. Moreover, the Stewart Island Shag is dimorphic, having a dark and a light phase, a condition which is also encountered in the immature Kerguelen Shag. Immatures of the New Zealand true Blue-eyed Shags and of the Kerguelen Shag have fairly similar upperpart plumages, which are a duller edition of that of the adults, with no patches of white feathers. On the contrary, the neck, throat and foreneck of the immature *P. carunculatus* are white, like that of young *P. atriceps* or *P. albiventer.*

The Rock Shag *(P. magellanicus)* and the Guanay *(P. bougainvillii)* appear as fairly non typical Blue-eyed Shags, even if their relations with the other members of this group are obvious (Murphy 1936). This is especially true of the former, in which the unfeathered facial area is of a uniform reddish colour, often bordered with black, and without any trace of an eye-ring. The latter does have such a ring, but it is green instead of blue. Even though they look very different, these two species possess some common features. They have no white alar bar nor dorsal patch, a fact which brings them closer to the Kerguelen Shag. Their necks are entirely of the same bluish black colour as their backs, and the black and white pattern of their head and throat shows distinct variations according to the breeding cycle, the white surfaces being reduced in breeding plumage. Moreover, certain plumage stages of immature are very like in both species, as shown by Murphy (1936).

Differences between both species have already been described with precision (Murphy 1936; Johnson 1955). Some of them are mostly adaptative characters. Like most other Cormorants, the Rock Shag is not a good flier; it haunts coastal waters, coves and channels,

and feeds in shallow waters. The Guanay on the contrary, is a very good flier, perhaps the most aerial of all Cormorants as Murphy (1936) thought, and it feeds on pelagic prey. Hence, a lot of remarkable specialisations, mainly in the form of the wings, which are comparatively long and pointed, are evident. Other differences are more significant. So is, for instance, the difference already cited in the colouration of the bare facial skin. The pattern of the head is very unlike in both species too, the Rock Shag having a white patch on each side of it, which is entirely lacking in the Guanay. The pattern of the downy chicks is very dissimilar in both species. These of *P. magellanicus* are entirely brown, while Guanay chicks are covered with a black and white down, producing a " pepper-and-salt " effect particular of this species (Murphy 1936). The feet of the Rock Shag have a very particular pattern, being pink with blackish webs. All these differences are important, and show that both species, though obviously related, have been separated for a long time.

It is difficult to tell which of them is the most closely related to the true Blue-eyed Shags. Falla (1937) already pointed out the relations between the Rock and Kerguelen Shags. But the differences between them are great, and if the Kerguelen Shag is more closely related to the Rock Shag than any other true Blue-eyed Shag, this relationship remains nevertheless remote (Voisin 1970). On its face, the Guanay retains much of the pattern of the true Blue-eyed Shags, still having an eye-ring, but on other sides it is a very particular Cormorant, as shown by Murphy (1936) and other authors. For the moment, it seems preferable to consider *P. magellanicus* and *P. bougainvillii* as a group of two species remotely related to *P. verrucosus* and hence to the other Blue-eyed Shags.

P. campbelli inhabits the Campbell Islands *(P. campbelli campbelli)* and the Auckland Islands *(P. campbelli colensoi)*. As already mentioned, the Bounty Islands Shag *(P. campbelli ranfurlyi)* has been alternately considered as belonging to this species or to *P. carunculatus.*

P. campbelli campbelli resembles *P. bougainvillii* in having no alar bar nor dorsal patch, in being slenderly built and in having a dark foreneck. But this foreneck pattern shows no variation according to the sexual cycle, and the chin and throat of this species remain entirely white. Moreover, this character is present in a few *P. campbelli colensoi,* and the dark zone on the foreneck is usually shorter in them than in *P. campbelli,* according to Oliver (1955). In most specimens of the Auckland Island Shag the white of the throat extends down as a narrow stripe to the upper abdomen. This is even more marked in *P. campbelli ranfurlyi,* which has a neck pattern similar to that of *P. carunculatus.* Yet the immatures of the three subspecies have a dark foreneck, contrary to the immature *P. carunculatus,* but reminding of that of the immature Kerguelen Shag.

If *P. campbelli campbelli* possesses no dorsal patch nor alar bar, these features are present in both other subspecies, although the former may be poorly developed or absent and the latter is reduced in *P. campbelli colensoi.* In all three subspecies, the general plumage pattern and colour is hardly distinguishable from that of the *carun-*

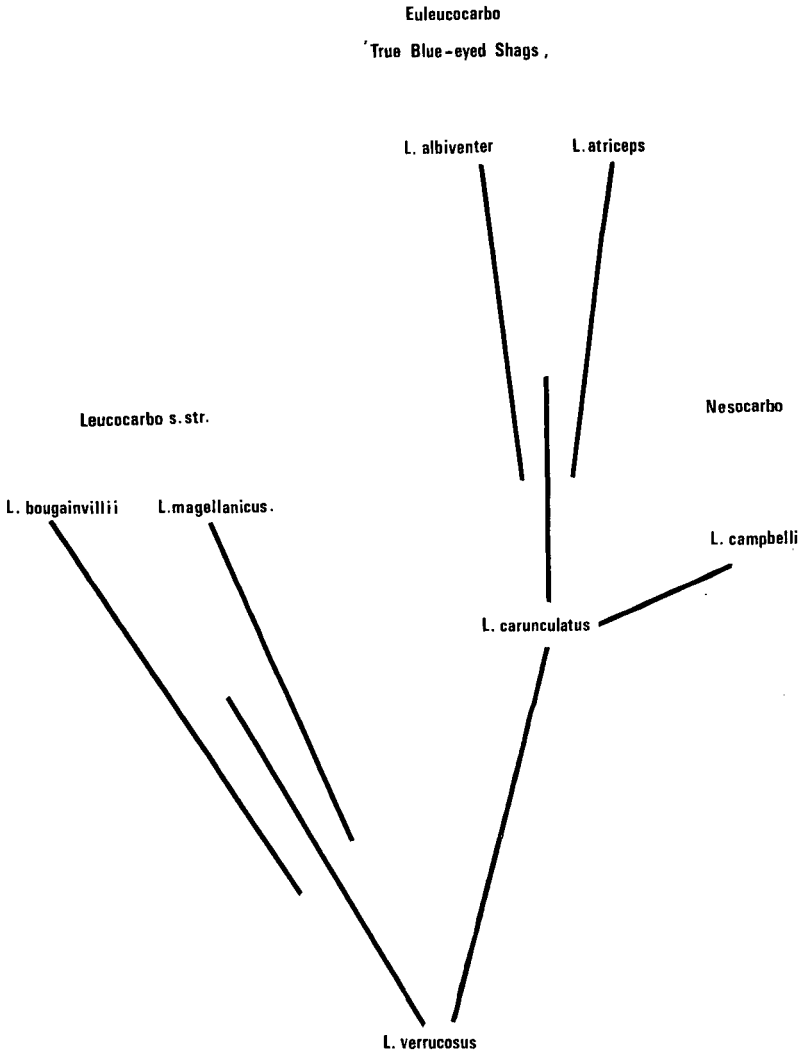

FIGURE 2 — Schematized affinities (not phylogeny!) of the species of *Leucocarbo.*

culatus group, but those of the unfeathered facial area is strikingly different. The eye-ring is purple or pinkish, and the facial skin varies from brown with orange spots *(campbelli)* to yellow *(colensoi)* and scarlet with black spots *(ranfurlyi)*. In brief, these birds show a mixture of original traits and of features which relate them closely to *P. carunculatus*. The dark foreneck of the immatures is an archaic feature, which is present in young Kerguelen Shags, Rock Shags and Guanays. Of the three subspecies, *P. campbelli campbelli* is the the most differentiated one, and the other two may be considered as *morphologically* intermediates between it and *P. carunculatus*. Without them, the relations of the nominate subspecies would remain fairly obscure, and it is no wonder that some authors of the end of the last century, like Filhol (1878) considered it as related to *P. bougainvillii*. But, at present, its affinities seem to be clearly with *P. carunculatus*, a fact which is illustrated by the above mentioned hesitations of some authors about the status of the subspecies *ranfurlyi*.

The relationships of the seven species of *Leucocarbo* may be summarized as in Fig. 2. All these species are clearly separated forms, and several of them have evolved into well recognizable subspecies, so that they must have been isolated from each other for a very long time. The fact that *P. verrucosus* is related to the other true Blue-eyed Shags as well as to the group *bougainvilli-magellanicus* does not mean, of course, that it is the ancestor of the others, nor that *Leucocarbo* started its evolution at Kerguelen. The Kerguelen Shag may only be considered as being closer to this ancestor than any other species of the subgenus, and may have come to Kerguelen from somewhere else. Fossil material of this subgenus is scarce, and we cannot be more precise about its exact phylogeny for the moment.

The subgenus *Leucocarbo* is a homogenous group, showing very original features. It may be rather considered as a genus of its own. This is what was very logically done by the OSNZ Checklist Committee (1970). In fact, the whole, very heterogenous genus *Phalacrocorax* needs a revision, but this would be far beyond the scope of this paper. If *Leucocarbo* is considered as a genus, the three divisions which I made in it — Guanay-Rock Shag, true Blue-eyed Shags, Campbell Island Shag — must be given the rank of subgenera. In this case, the subgeneric name *Leucocarbo sensu stricto* must be applied to the *magellanicus-bougainvillii* group, because *P. bougainvillii* is the type species of the genus. Then I propose the name *Euleucocarbo* for the " true " Blue-eyed Shags, and the name *Nesocarbo* for *Leucocarbo campbelli*. This last name is an allusion to the distribution of this species on remote islands.

In brief, the seven species of the genus may be arranged in the following order:

- Subgenus *Leucocarbo* s. str. (Bonaparte)
  - . *L. (Leucocarbo) bougainvillii* (Lesson)
  - . *L. (Leucocarbo) magellanicus* (Gmelin)

- Subgenus *Euleucocarbo* nov.
  - *L. (Euleucocarbo) verrucosus* (Cabanis)
  - *L. (Euleucocarbo) carunculatus* (Gmelin)
  - *L. (Euleucocarbo) albiventer* (Lesson)
  - *L. (Euleucocarbo) atriceps* (King)

- Subgenus *Nesocarbo* nov.
  - *L. (Nesocarbo) campbelli* (Filhol)

I propose *L. (Euleucocarbo) carunculatus* as the type species of the subgenus *Euleucocarbo.*

A look at a map shows that the related species of *Leucocarbo* are generally situated on the east of each other. I already mentioned that for the true Blue-eyed Shags, but it is true also of both species of the subgenus *Leucocarbo* s. str. and *L. verrucosus.* Thus, the Blue-eyed Shags must have spread eastward during their evolution, helped in that by the strong westerlies and the oceanic streams prevailing in the Antarctic and Subantarctic zone. The only exception is the Guanay, which went northward along the Pacific coast of South America and established its main distribution area from Northern Peru to Central Chile. It is worth noting that, recently, some pairs belonging to this species were found nesting on the coast of Central Argentina (Erize 1972).

As quoted above, *Leucocarbo* has clearly separated species. This is also true for the subspecies of *L. carunculatus* and of *L. campbelli,* which are sometimes given species status. But this is not true of the different subspecies of *L. atriceps* and *L. albiventer,* the great homogeneity of which has been emphasized by several authors (Murphy 1936; Falla 1938; Rand 1954). The birds of Prince Edward and Crozet Islands are even so alike that Rand (1954) considers them as belonging to the same subspecies, *melanogenis.* These forms must have been separated from each other much more recently than those mentioned above, so we can imagine that they colonized their present insular distribution area very recently too, while the other forms invaded theirs much earlier. Perhaps the Pleistocene glaciations, at least the last one, played a role in that story, stopping for a moment the spread eastward of the Blue-eyed Shags. Thus, the circumpolar distribution area of the subgenus was not completed until a short time ago. In absence of enough fossil material it is a mere hypothesis.

The invasion of new areas by the Blue-eyed Shags must have happened in a passive way. These rather bad-flying, coastal birds are not likely to undertake long voyages of their own at sea. But they swim quite well, and they surely are able to resist a long time at sea if taken away from their habitual haunts by the strong westerlies or the gales which blow quite hard in this part of the world, so they are able to be transported to far-off islands. Perhaps this phenomenon still happens from time to time today, but in the absence of proof it is only one more hypothesis.

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