

## Hybrid Rockhopper-Macaroni Penguins, Interbreeding and Mixed Species Pairs at Heard and Marion Islands

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The genus *Eudyptes* consists of six species distributed throughout the subantarctic islands and the Antarctic Peninsula (Watson *et al.* 1971). At many of the breeding localities species are sympatric (Warham 1975).

There has been one published report of mixed species pair of *Eudyptes* penguins breeding, that of an Erect-crested *E. sclateri*-Rockhopper Penguin *E. chrysocome* pair on West Point Island in the Falkland Islands (South Atlantic Ocean) between 1961 and 1966 (Napier 1968). The only account of a hybrid eudyptid penguin was reported by Simpson (1985), who documented a Rockhopper x Royal Penguin *E. schlegeli* hybrid collected at Macquarie Island in 1957. Simpson (1985) also reported an Erect-crested-Royal Penguin pair during the moult period following the breeding season at Macquarie Island in January 1964.

We present details of three Rockhopper x Macaroni Penguin (*E. chrysolophus*) hybrids from Heard and Marion Islands.

### Methods

The observations were made at Heard Island (53°05'S, 73°30'E) by EJW during the 1987/88 ANARE (Australian National Antarctic Research Expeditions), between September 1987 and March 1988, and at Marion Island (46°54'S, 37°45'E) by CAG between August 1987 and April 1988 during the 44th Marion Island Expedition.

### Results

#### *Heard Island hybrid*

On 3 December 1987, a hybrid Rockhopper-Macaroni Penguin was observed standing next to an incubating Rockhopper Penguin in a Rockhopper colony at Magnet Point. The Rockhopper Penguin was captured for measuring and immediately the hybrid began incubating the three eggs present. The hybrid was then captured, measured and described. The pink gape of a Macaroni Penguin was present, there were grey smudges on the cheeks, a white patch on the tail feathers and the bill was massive. The voice and behaviour was that of a Macaroni Penguin; the

yellow crest feathers appeared half-way between those of Macaroni and Rockhopper Penguins in shape and colour: a series of thin yellow feathers initiated on the forehead and continued to just posterior of the eye where yellow-black feathers erupted. The crest feathers did not join on the forehead (Figs 1 & 2).

The bill length and bill width measurements of the hybrid (Table 1) were not significantly different from the means of these measurements collected from female Macaroni Penguins at Heard Island (*t*-tests,  $P > 0.05$ ), (E.J. Woehler unpubl. data), but were highly significantly different from the means of these measurements collected from male Macaroni and male and female Rockhopper Penguins at Heard Island, (*t*-tests,  $P < 0.05$ ), (E.J. Woehler unpubl. data). Therefore, it is possible that the hybrid was a female, although this could not be confirmed.

The bill length and bill width measurements of the Rockhopper Penguin partner (Table 1) were not significantly different from the means of these measurements collected from female Rockhopper Penguins at Heard Island (*t*-tests,  $P > 0.05$ ), (E.J. Woehler unpubl. data), but were significantly different from means of those collected from male Rockhopper Penguins at Heard Island (*t*-tests,  $P < 0.05$ ), (E.J. Woehler unpubl. data) and therefore this bird was presumed to be female.

Measurements of two of the three eggs (eggs 1 and 3,

TABLE 1 Body measurements of the Rockhopper-Macaroni Penguin hybrid and its partner from Heard Island. All measurements in mm, weight in g.

	Hybrid	Partner (Rockhopper)
Exposed culmen	55.7	39.7
Bill width	11.9	9.3
Bill depth	16.0	DNM
Total head length	DNM	112.5
Body weight	3100	2250

DNM: did not measure

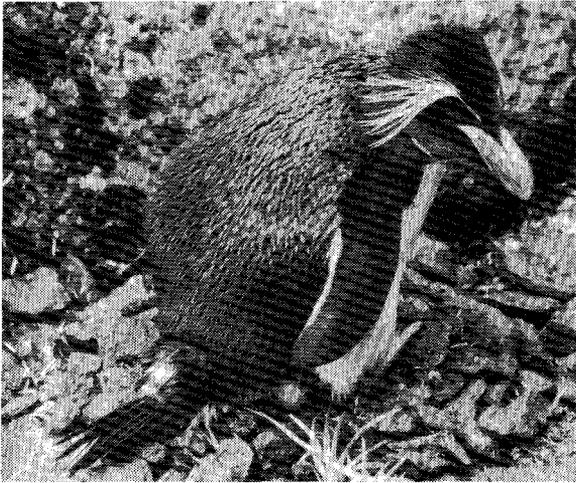


FIGURE 1 Hybrid Rockhopper-Macaroni Penguin at the nest site, Magnet Point, Heard Island on 3 December 1987. Photograph by E. J. Woehler, ANARE.

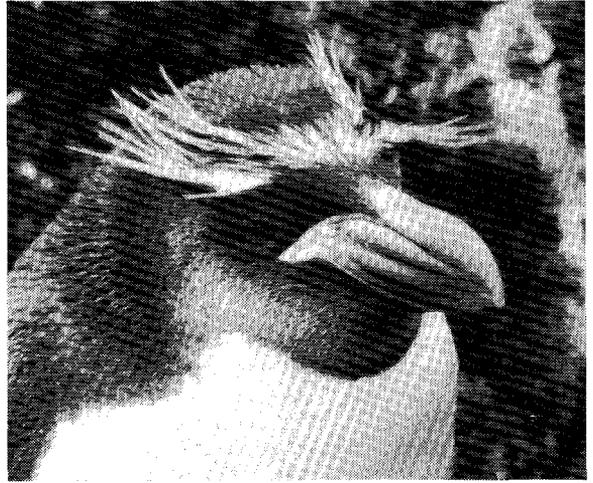


FIGURE 3 Macaroni Penguin at Heard Island. Photograph by J. Hughes, ANARE.



FIGURE 2 Hybrid Rockhopper-Macaroni Penguin: detail of head. Photograph by E. J. Woehler, ANARE.



FIGURE 4 Rockhopper Penguin at Macquarie Island. Photograph by L. Thompson, ANARE.

Table 2) were not significantly different from the mean measurements of length, breadth and weight of the A eggs of Rockhopper Penguins at Heard Island ( $t$ -tests,  $P > 0.05$ ), (E.J. Woehler unpubl. data). The measurements of the other egg, Egg 2, were not significantly different from the mean measurements of egg length and breadth of A eggs of Macaroni Penguins at Heard Island (Gwynn 1953) ( $t$ -tests,  $P > 0.05$ ).

#### *Marion Island hybrids*

On 1 December 1987, two Rockhopper-Macaroni Pen-

guin hybrids were observed for the first time in a Rockhopper Penguin colony at 'Landfall Beach'. One hybrid, paired with a Rockhopper Penguin, was incubating a single egg, the other hybrid was standing alone in the colony without an obvious mate and no eggs were present. On 18 December 1987, the Rockhopper Penguin was incubating two eggs and the hybrid partner was absent. The hybrid was seen to be brooding a three-day-old chick on 6 January 1988 and the Rockhopper Penguin was absent. This chick was gone on 15 January 1988 but both the hybrid and Rockhopper Penguins were present. The hybrid was measured on 19 January 1988.

The mated hybrid had crest feathers the same colour as those of a Macaroni Penguin but their shape was similar to those of a Rockhopper Penguin, and they did not join on the forehead. The bill was slightly larger than that of a Rockhopper Penguin and a pink gape was present. The body size appeared slightly larger than that of a Rockhopper Penguin but this was hard to determine due to the crouched incubating posture. There was no white patch on the tail feathers.

The un-mated hybrid was similar in size to the mated hybrid. The crest feathers were also similar in colour and shape but some feathers across the forehead were faintly speckled with orange-yellow. The pink gape was not noticeable but there was a prominent white patch on the tail feathers. The hybrid was observed again on 6 January 1988 and was captured and measured on 19 January 1988. On 6 April 1988, this hybrid was observed to be about to commence a moult.

Measurements from these two hybrids are presented in Table 3. The exposed culmen and bill depth measurements obtained from the two hybrids were significantly different

to means of those obtained from Macaroni and Rockhopper Penguins at Marion Island (*t*-tests,  $P < 0.05$ ), (Percy FitzPatrick Institute unpubl. data), except for the comparison between the breeding hybrid's bill depth and the mean bill depth of male Macaroni Penguins. Despite these significant differences, the hybrids' bill measurements were more similar to those means from Macaroni Penguins than Rockhopper Penguins.

#### *Mixed species pairs at Marion Island*

A mixed species pair of Rockhopper/Macaroni Penguins was observed on 28 November 1987 in a Rockhopper Penguin colony north of Ship's Cove. Mutual preening was observed, as was some defence of territory. No egg was present. On 12 and 17 December 1987, the Rockhopper Penguin was observed incubating two eggs and the partner was absent. On 20 and 27 December 1987, the Macaroni was incubating and the Rockhopper was absent. On 2 January 1988, only one egg was present, incubated by the Macaroni Penguin. On 18 January 1988, neither an egg nor a chick was present, although both adults were.

TABLE 2 Measurements of the three eggs in nest of hybrid-Rockhopper Penguin pair, Heard Island on 7 December 1987. The eggs are numbered for identification purposes only, and have no implied sequence of laying. Data (means  $\pm$  s.e.) for Rockhopper ( $n = 13$ ) and Macaroni ( $n = 10$ ) Penguins from Heard Island from E.J. Woehler (unpubl. data), except Macaroni Penguin A eggs ( $n = 13$ ) from Gwynn (1953).

	Egg 1	Egg 2	Egg 3	Rockhopper Penguin		Macaroni Penguin	
				Egg A	Egg B	Egg A	Egg B
Length (mm)	62.3	69.2	60.6	63.1 $\pm$ 0.6	71.3 $\pm$ 0.8	70.6 $\pm$ 1.3	80.2 $\pm$ 0.7
Breadth (mm)	43.9	49.1	44.0	46.5 $\pm$ 0.4	52.5 $\pm$ 0.4	49.1 $\pm$ 0.6	59.1 $\pm$ 0.4
Weight (g)	63	DNM	66	77.2 $\pm$ 1.8	110.2 $\pm$ 2.2	95.1 $\pm$ 2.0	157.8 $\pm$ 2.9

DNM — did not measure

TABLE 3 Measurements of hybrids from Marion Island, 19 January 1988. All measurements in mm. Data (mean  $\pm$  s.e.) for Macaroni ( $n = 15$ ) and Rockhopper ( $n = 15$ ) Penguins from Percy FitzPatrick Institute (unpubl. data).

	Breeding hybrid	Non-breeding hybrid	Macaroni		Rockhopper	
			Male	Female	Male	Female
Exposed culmen	51	51	61.4 $\pm$ 0.6	54.0 $\pm$ 0.8	44.2 $\pm$ 0.5	39.2 $\pm$ 0.3
Bill depth	29	23	28.3 $\pm$ 0.5	24.1 $\pm$ 0.3	20.6 $\pm$ 0.2	18.2 $\pm$ 0.2
Anterior edge of flipper	173	185				
Posterior edge of flipper	172	170				
Wrist to tip of flipper	112	105				
Tarsus	118	105				
Head width	57	52				
Flipper width	54	55				
Height	421	371				
Tail length	DNM	137				

DNM: did not measure

The second mixed species pair was observed on 6 December 1987 in a Rockhopper Penguin colony at Water Tunnel Bay. A Rockhopper Penguin was incubating one egg and a Macaroni Penguin was also in attendance at the nest site. This was the only observation of this pair.

### Discussion

The presence of three eggs in the nest supports the hypothesis that the Heard Island hybrid was a female and that the Rockhopper Penguin was also a female, since all species of *Eudyptes* penguins lay only two eggs (Warham 1975).

The data for the Marion Island hybrids are less clear. Neither of the partners was measured and the body measurements collected are ambiguous. The breeding hybrid may be a male and the non-breeder a female, based on bill measurements (Warham 1975) and the two hybrids are more similar to Macaroni than Rockhopper Penguins in measurements.

Why the isolating mechanisms that normally operate to maintain the specific integrity of breeding pairs should fail can not be easily explained. Breeding by mixed species pairs, Erect-crested and Rockhopper Penguins (Napier 1968), Royal and Rockhopper Penguins (Simpson 1985) and Macaroni and Rockhopper Penguins (this study), have one common factor — each have involved a Rockhopper Penguin. It would appear that this species may be more capable of entering into a mixed species pair than other eudyptids. However, all reports also reflect the presence of a vagrant within a Rockhopper Penguin colony. Perhaps un-mated Rockhopper Penguins 'adopt' the vagrants when they appear.

That such mixed species pairs are successful in fledging a chick is surprising, since each species has a strictly defined timetable of breeding events (Warham 1975) and it could be expected that the differences between species' timetables would result in the failure of the nesting effort. Our data are insufficient to determine the cause of the nest failures observed. Napier (1968) had reported the failure of two breeding efforts. In one season, one egg was infertile and the other hatched but the chick disappeared within a week. The following season both eggs were lost.

Our observations, and those reported previously, suggest the fledging rates of mixed species pairs is low. However, some chicks must survive to become the hybrids we report here. The low survival rate between fledging and the return to breeding colonies (Carrick 1972), suggests that the occurrence of hybrid chicks may be more frequent than is presently recognised.

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### Note added in proof

A Rockhopper-Macaroni Penguin hybrid was observed at 'Landfall Beach', Marion Island in April 1989. A third mixed species pair, of Rockhopper and Macaroni Penguins, was also sighted at the same location. The pair were observed moulting and allopreening (J. Crafford & J. Cooper pers. comm.).