

weather at the beginning of the austral summer of 1981-82. Moreover, some evidence of competition for nesting sites was found between wandering albatrosses and giant petrels.

In Februarie 1982 is 'n sensus opgeneem van die voëls en soogdiere wat op île aux Cochons (Crozet-groep) voorkom. Die resultate word met 'n vroeëre telling in 1974 (Derenne et al. 1976) vergelyk. Slegs by die twee spesies van die nellie ('giant petrel') was daar 'n duidelike toename in getalle. Die toename was besonder opmerklik by *M. halli* (300-400 persent), maar baie kleiner by *M. giganteus* (10-20 persent). Die getalle van die groot albatros het minstens 12,5 persent gedaal en dié van Crozet-seeduikers met sowat 30 persent. Die gebied wat deur gewone konyne bewoon is, het tot die eiland se suidelike punt teruggekrimp. Daar was geen noemenswaardige verandering in die voorkomssyfer van ander voël- en soogdierspesies nie, of anders was die veranderings hoogstens 10 persent. Dit is nog nie duidelik wat die waargeneemde veranderings veroorsaak het nie, maar getuienis ter plaatse dui daarop dat voëls wat naby die see nesmaak aan die begin van die suidelike somer van 1981/82 met 'n tydperk van slegte weer te kampe gehad het. Daar is ook aanduidings van mededinging tussen die groot albatros en die nellie om nesmaakplekke.

Un recensement des oiseaux et mammifères de l'île aux Cochons, archipel Crozet, a été effectué en février 1982 et ses résultats comparés à ceux obtenus par Derenne et al. (1976) en 1974. Seules les deux espèces de pétrels géants ont montré une nette augmentation de leurs effectifs. Celle-ci fut très forte chez *M. halli* (300 à 400%), et bien moins marquée chez *M. giganteus* (10 à 20%). Les Albatros hurleurs ont décliné d'au moins

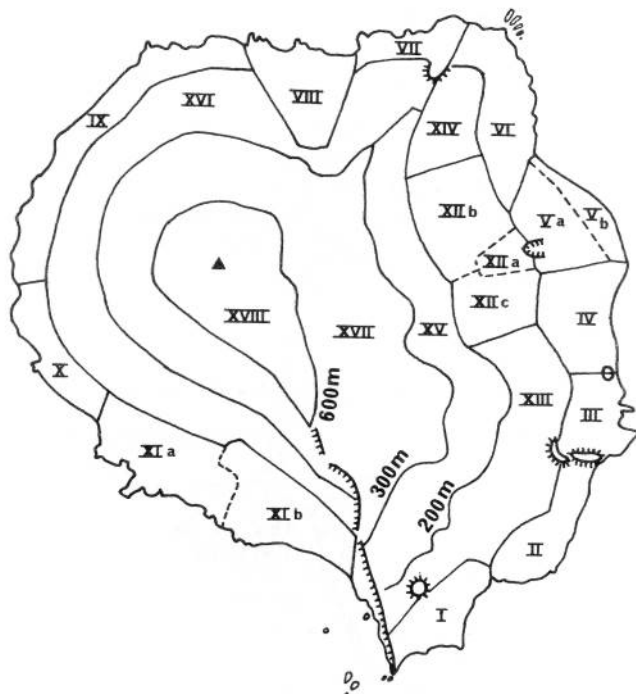


Fig. 2. Partition of Hog Island into sectors.

List of the sectors of the île aux Cochons

I: Pointe de la Houle, II: Plan, III: Plateau du Camp, IV: Morne Rouge — Delta, V: Delta, Va: Delta proprement dit, Vb: Plage du Delta, VI: Delta — Cinq Géants, VII: Côte nord, VIII: Plaine aux Albatros, IX: Côte nord-ouest, X: Côte sud-ouest, XI: Plaine sud, XIa: Plaine sud occidentale, XIb: Plaine sud orientale, XII: Grande Manchotière et abords, XIIa: Grande Manchotière proprement dite, XIIb: Abords nord, XIIc: Abords sud, XIII: Grande Manchotière — Sentinelle Rouge, XIV: Grande Manchotière — Côte nord, XV: Moyennes Pentes orientales, XVI: Moyennes Pentes occidentales, XVII: Haute Pentes, XVIII: Sommet de l'île.

12,5% en huit ans, et les Cormorans de Crozet voient leurs effectifs réduits d'un tiers environ. La zone habitée par le Lapin de Garenne s'est réduite à une petite région près de la Pointe de la Houle. Les autres espèces ne montrent pas de changements notables d'effectifs, ou bien ces changements sont de moins de 10%. Les restes de deux Pétrels gris ont été découverts sur l'île, sans trace de nidification. Une femelle de Canard d'Eaton avec quatre ou cinq petits a été observée sur le Delta. Les raisons des changements observés n'apparaissent pas toutes clairement. Il semble cependant, d'après les observations faites le long du littoral, que les espèces nichant près de la côte aient souffert d'une période de mauvais temps et de forte mer au début de l'été austral 1981-82. Des indices de compétition pour les sites de nids entre les Albatros hurleurs et les pétrels géants ont aussi été relevés.

Introduction

During the austral summer of 1981-82, members of a multi-disciplinary expedition, *Campagne Pluricro*, stayed at île aux Cochons, Crozet Group (Fig. 1), from 12 to 21 February 1982. During this visit counts of birds and mammals were made to compare with counts made by Derenne *et al.* (1976) from January to April 1974. To aid these comparisons the island was divided into several sectors (Fig. 2), based on differences in topography, vegetation and animal activity.

Contrary to 1974, the visit in 1982 was too short to make a detailed survey of the entire island. Most attention was therefore devoted to the eastern part of it (sectors II to VI, sector XII) and to the Plaine Sud (sector XI). A special visit was made to sectors VII and VIII, and sector IX was rapidly surveyed. Only a few visits were made into the central part of the island (sectors XV to XVIII). Thus, almost all breeding grounds of most species were surveyed, with the exception of prion, *Pachyptila* spp., and diving petrel, *Pelecanoides* spp., breeding grounds.

The topography of île aux Cochons had not noticeably changed since 1974, except along the eastern coast and in the Delta. In February 1982 most of the sand on beaches between Pointe de la Houle and Cap de la Déception had been washed away. This appears to have occurred shortly before the arrival of the expedition since, at a few sheltered coves (e.g. between Cap Verdoyant and Morne Rouge) small residual sand patches on rocks and boulders two to three metres above the level of the beaches were still present. A result of this was that the sea had advanced closer to the bottom of the coastal cliffs than was the case in 1974, and threatened several seabird nesting sites. Comparisons with photographs taken in 1974 as well as estimations made from known landmarks, indicated that the shore line had retreated by 15 to 25 m in places along this section of the coast. Conversely, beaches situated further north (e.g. Cap de la Déception to Cinq Géants) had much more sand than in 1974, especially at the Delta, where the surface area of sand had nearly doubled. The upper part of the Delta had also changed, with large quantities of newly deposited alluvial material in some places, and in other places erosion by the torrent drastically modifying the general appearance of the area.

Results

(a) Birds

King penguin, *Aptenodytes patagonicus* — in 1982 the huge king penguin colony at Grande Manchotière appeared much the same as it was in 1974. By comparison, the small colony at the foot of Morne Rouge, which comprised about 400 breeding birds in 1974 (Derenne *et al.* 1976) had disappeared,

as had the small sandy beach upon which it was established. Its existence was probably precarious anyway and this may not have been the first time it had disappeared. It was first observed by Ph. Dreux (*in litt.*), who, on 31 December 1963, counted 62 breeding birds there. The small colony at Baie de la Caverne, which comprised about 200 pairs in 1974 (Derenne *et al.* 1976), had declined to c. 12 pairs and all the sand had disappeared from the beach. However, compared to the huge numbers of birds at the Grande Manchotière colony (about 600 000 breeders in 1974, Derenne *et al.* 1976), these losses are negligible.

One adult, ringed at Possession Island (Baie du Marin) in November 1980 was found on 20 February 1982 at Le Platier, where it had just started moulting.

Gentoo penguin, *Pygoscelis papua* — the time of this expedition was not ideal for censusing gentoo penguins since many were moulting and some were probably at sea. Only a few had completed the moult and were engaged in pre-breeding activities, including the construction of complete nests. A total of 4 860 birds (Table I) was counted, comparing favourably with the estimate of 5 000 to 6 000 birds in 1974 (Derenne *et al.* 1976). Counts at four localities were lower in February 1974 (Table I) than in February 1982, suggesting a possible increase in numbers at the island. The localities of colonies had not significantly changed between 1974 and 1982.

Macaroni penguin, *Eudyptes chrysolophus*, and rockhopper penguin, *E. chrysocome* — the 1982 visit was also too short to make systematic counts of breeding macaroni and rockhopper penguins. Nevertheless, a very marked decrease was observed in the number of rockhopper penguins nesting along the eastern coast of the island. Many previous nesting sites were deserted or comprised only a few birds (e.g. between Morne Rouge and Cap Verdoyant, where 300 birds were counted in 1974; Derenne *et al.* 1976). This decrease in rockhopper penguin numbers is estimated to be between 2 000 and 3 000 pairs along the eastern coast. However, the larger colonies further inland did not seem to have changed in size or numbers from 1974. It is estimated that numbers of rockhopper penguins (c. 51 000 in 1974; Derenne *et al.* 1976) had declined by about 10 per cent in 1982.

A small number of macaroni penguins that were nesting near the sea in 1974 had disappeared, but the large colonies

Table I
Number of gentoo penguins at île aux Cochons in February 1982

Sector	Locality	No. of groups	No. of birds	Estimated population in Feb. 1974
II	Le Plan			
	Plage de la Caverne	3	440	?
	Le Plan proper	2	1100	?
III	Plateau du Camp			
	South of Morne Rouge	1	600	450
	Platier	3	280	?
IV	Morne Rouge — Delta			
	Cap de la Déception	2	800	?
	North of Morne Rouge	3	470	200
VI	Delta — Cinq Géants	3	320	?
VIII	Plaine aux Albatross	1	200	70-80
XI	Plaine Sud			
	Baie de L'Aiguille	2	350	270
	Cap des Gorfous	1	500	?
Total		21	4860	?

Table 2
Number of breeding pairs of wandering albatross at île aux Cochons in 1974 (after Derenne *et al.* 1976 and pers. obs.) and in 1982.

Sector (after Derenne <i>et al.</i> 1976)	Locality	Numbers of pairs			
		March 1974	Feb. 1974	Feb. 1982	Estimated change
VI	Les Cinq Géants	36)			
	Des Cinq Géants au Morne du Tamaris	42	43 ^d	48	+11,6%
V	Du Morne du Tamaris	6)			
IV	au Morne Rouge	31	35 ^f	32	-8,5%
III	Plateau du Camp	17	19 ^f	9	-52,6%
II	Le Plan	44	50 ^d	27	-46%
I	Pointe de la Houle	7	8 ^f	e	—
XI	Côte sud-est	100	118 ^d	87	-26,3%
IX	Côte nord-ouest	42	42 ^d	42a	0
VIII	Grande colonie d'Albatros de la côte nord	590	674 ^f	613	- 9,1%
VII	De la grande colonie d'Albatros aux Cinq Géants	11	15 ^f	13	-13,3%
Total		884	1004 (996) ^b	871 ^a (891)	-12,8%
	Rounded Total	890	1010	895	-12,5%

a = minus 20 nests discovered in 1982 in sector IX

b = minus 8 nests in sector I

d = actually counted in February 1974

e = very few (M. Massé and Y. Jony, pers. comm.)

f = estimates from data for March 1974.

situated further inland south of Le Plan and east of Plaine aux Albatros did not seem different from what they were in 1974. It thus seems likely that in 1982 the number of macaroni penguin breeding pairs at île aux Cochons was about the same as in 1974 (c. 272 000, Derenne *et al.* 1976).

Three white-faced macaroni penguins (Barré *et al.* 1976), were observed in 1982 in a small colony on the cliffs of Le Plan.

Many dying or recently dead macaroni penguins at île aux Cochons as well as at îles des Apôtres (6 February 1982) and île de l'Est (22 February-3 March 1982) were observed on land and even drifting off the latter island on 4 March 1982. Some of these showed signs of a paralysis of the hind limbs, similar to the effects of avian botulism.

Wandering albatross *Diomedea exulans* — results of the 1982 counts are given in Table 2. The 1974 census (Derenne *et al.* 1976) was conducted at the time of hatching (7-21 March) but in 1982 it was carried out during the incubation period from 12-20 February. Data for some areas in 1974 indicated a $\pm 12,5$ per cent mortality during the last month of incubation, which is similar to the results of Fressanges du Bost & Segonzac (1976) for île de la Possession. Using this estimate to arrive at an estimate for the number of nests occupied in February 1974 from the data of Derenne *et al.* (1976), a comparison with 1982 is made in Table 2. This indicates that about 12,5 per cent fewer nests were occupied in 1982 than in 1974. The decrease may have commenced before 1974, since Dreux counted 2 200 breeding pairs on the island in 1964 (Dreux & Milon 1967, Dreux *in litt.*) Croxall (1979) for South Georgia and Jouventin & Mougain (pers. comm.) for île de la Possession and île de l'Est (Crozetts) have also recorded decreases in breeding populations.

This decrease has not occurred equally in all sectors (Table 3). It was most marked on the eastern half of Plaine Sud, at Le Plan and on Plateau du Camp, was much less marked on other parts of the island and a slight increase was even observed in sector VI.

Table 3
Number of breeding giant petrels at île aux Cochons in 1974 (after Derenne *et al.* 1976 and pers. obs.) and in 1982.

Sector	Number of breeding pairs				
	1982		1974		
	<i>M. halli</i>	<i>M. giganteus</i>	<i>M. halli</i>	<i>M. giganteus</i>	
I	Pointe de la Houle	e		6	5
II	Le Plan	9	21	5	6
III	Plateau du Camp	18	11	3	0
IV	Morne Rouge — Delta	31	7	18	12
V	Delta	16	84	8	35
VI	Delta — Cinq Géants	16	5	20	29
VII	Côte Nord	2	0	2	0
VIII	Plaine aux Albatros	88	16	8a	5
IX	Côte Nord-ouest	16a	0a	12	18
XI	Plaine Sud	48	13	1	5
XII	Grande Manchotière et abords				
XII b	Abords nord	3	48	0	21
XII c	Abords sud	1	18	2	35
Total in February 1982:		248a	223a	—	—
Number of fledglings produced: (recalculated for <i>M. halli</i> in 1982)		413a	223a	85a	171
Estimated number of breeding pairs at the laying period		1000-1200	600	250-300	550-600

a = minimum estimate.

b-e = as for Table 2.

Only nine ringed birds were found in a sample of 110 controlled birds. All had been ringed as breeders on the island in 1974. Two of the nine were found at different sites to where they had been ringed (on Le Plan); one was nesting on Plateau du Camp and the other was nesting at the northern foot of Morne Rouge. The number of recoveries was low, as in 1974 we ringed 1 068 adults (Derenne *et al.* 1976). Assuming an average annual survival rate similar to that at île de la Possession (0,9642; Barrat *et al.* 1976), these ringed birds should represent about 16 per cent of the adult population at île aux Cochons. Moreover, early breeding failures leading to birds breeding two years in a row (Tickell 1968, Voisin 1969, Barrat *et al.* 1976) should have resulted in them being evenly distributed in the breeding population.

Lightmantled sooty albatross, *Phoebastria palpebrata*, and darkmantled sooty albatross, *P. fusca* — it was not possible to make a detailed survey of the breeding sooty albatrosses in 1982. However, along the eastern and southern coasts it was noted that a few *P. fusca* breeding sites were deserted. One of these deserted sites was that which I had photographed in 1974 (Derenne *et al.* 1976, p. 148). At other nesting areas the number of birds and/or nest sites did not seem much different from what they were in 1974. No new breeding site was found. Thus, the total number of *P. fusca* at île aux Cochons did not seem to have changed much since 1974 (400 to 500 pairs; Derenne *et al.* 1976).

Similarly, the number of breeding *P. palpebrata* seemed the same as in 1974 (50 to 100 pairs; Derenne *et al.* 1976). However, they were proportionally more numerous along the north coast cliffs, where they comprised about 50 per cent of the sooty albatross population. In 1974 they comprised a much smaller proportion of the population in this region.

Southern giant petrel, *Macronectes giganteus*, and northern giant petrel, *M. halli* — the counts of giant petrel nests at île aux Cochons in 1982 showed a general increase in numbers since 1974 (Table 3). This increase was very marked for *M. halli* but could not be quantified accurately since by mid-February, when the 1982 count was made, 40 to 50 per cent of the young had already left their nests (Voisin 1976, and field observations from 1982). Assuming that 40 per cent had left, I estimate that at least 400 chicks fledged in 1982. Using the pre-fledging mortality rate of 60-65 per cent given by Derenne

et al. (1976) and Voisin (1968b, 1976) it is estimated that 1 000-1 200 eggs were laid in the 1981/82 breeding season. This implies a three- to fourfold increase in numbers of *M. halli* between 1974 and 1982. By comparison over the same period, the increase in the *M. giganteus* population was much more moderate; between 10 and 20 per cent, implying 550 to 600 pairs present on the island at the onset of the 1981/82 laying period (Table 3). This estimate is more reliable than that for *M. halli*, because the departure of *M. giganteus* fledglings was just about to begin at the time of the 1982 survey and because pre-fledging mortality is low in this species (Voisin 1968b, 1976). The ratio of *M. halli*:*M. giganteus* has therefore undergone a reversal since 1974 with *M. halli* now being the more numerous (1:2,2 in 1974; 1:0,5 in 1982).

In 1982 the number of *M. halli* had increased in every sector of île aux Cochons where this species breeds with the exception of sector VI, where a slight decrease was observed, and of sectors VII and XII where numbers remained small and without marked changes (Table 3). In comparison, the increase in *M. giganteus* numbers occurred in sector XI and in the eastern sectors of the island except sector VI where a decrease was observed (Table 3). As in 1974, the eastern sectors again supported the largest giant petrel populations in 1982, and in similar proportions; 63 per cent *M. halli* nests in 1982 compared to 73 per cent in 1974, and 87 per cent *M. giganteus* nests in 1982 compared to 84 per cent in 1974 (Derenne *et al.* 1976).

At the Crozet Islands giant petrels often change breeding sites from one year to the next, and many colonies are therefore short-lived (Voisin 1968b, 1976). The same applies to île aux Cochons and, in 1982, the distribution of nests was very different from that in 1974. In 1982, colonies were situated much nearer to the sea than they were in 1974. The long, line-shaped colonies parallel to Grande Manchotière (Derenne *et al.* 1976) had been replaced by two large, oval-shaped colonies, one situated near the foot of Manchotière and the other some distance below this. The reason for these changes is not known. At other localities, such as the Falkland Islands, colonies of *M. giganteus* (*M. halli* does not breed there) have retained their positions over long periods (Voisin in press).

No white phase *M. giganteus* were observed at île aux Cochons in 1982.

Salvin's prion, *Pachyptila salvini*, and fairy prion, *P. turtur* — judging by the density of burrows and the frequency of occupied burrows, numbers of Salvin's prions had not undergone any important change since 1974 (Derenne *et al.* 1976, Derenne & Mougin 1976). Nevertheless, occupied burrows were noticeably less numerous on Plateau du Camp, and some had clearly been deserted for a long time as dense vegetation, especially *Rumex acetosella*, covered their entrances. On 18 February 1982 a completely fledged young, without down, was found in a burrow just west of Plaine aux Albatros.

During this survey fairy prions nested in large numbers in the cliffs along the southern coast of the island, and less abundantly in the cliffs of Le Plan and the northern coast. No significant changes seemed to have occurred in the number of this species.

Georgian divingpetrel, *Pelecanoides georgicus*, and common divingpetrel, *P. urinatrix* — *P. georgicus* seemed to be as abundant as in 1974 (Derenne *et al.* 1976), but insufficient breeding localities were examined to be quite sure that no change had occurred in their numbers. On the western slopes of the island, between 300 and 400 m altitude, the burrows of this species reached a density of about 7/100 m², with a maximum of about 15/100 m² at some localities. This density decreased markedly with increasing altitude, and burrows became rare over 600 m although a few were found at 690 m (B. Boudon and J.-F. Beaux, pers. comm.).

The presence of *P. urinatrix* was not confirmed in 1982. Derenne *et al.* (1976) suspected that it occurred at Plaine Sud in 1974.

Other petrel species — pintado petrels, *Daption capense*, were not observed in February 1982. None was observed at the cliffs of Cap Verdoyant as was observed in 1974 (Derenne *et al.* 1976). This species does not apparently breed, or breeds only very occasionally, at this island even though it is usually observed around ships offshore and nests at Possession and East Islands (Voisin 1968a, Despin *et al.* 1972), and probably also at Penguin Island (pers. obs.)

— the wings and legs of a greatwinged petrel, *Pterodroma macroptera*, were found on 18 February 1982 about 200 m above sea level west of Plaine aux Albatros. In 1974 one pair of wings was found on Le Plan, and birds have twice been observed near the coast of the island (Derenne *et al.* 1976).

— the remains (wings and legs) of two grey petrels, *Procellaria cinerea*, were found on 16 February 1982 about 2 km apart on Plaine Sud. One set of remains was probably a few months old, the other two or three years old, but they were still perfectly recognizable. This species was not found at the island in 1974 (Derenne *et al.* 1976), and this is therefore a new record for it.

— as in 1974 (Derenne *et al.* 1976), no whitechinned petrels, *Procellaria aequinoctialis*, were observed. The absence of this species, which breeds everywhere else in the Crozets (pers. obs.), contrasted sharply with its abundance around the M/S *Marion Dufresne* when she was lying at anchor off the island.

Crozet shag, *Leucocarbo albiventer melanogenis* — owing to the difficulty of counting cliff-dwelling shags, a detailed census of breeding shags in 1982 was made only in the region between the southern tip of Le Plan and Cinq Géants, in which the majority of nests have previously been found (88 % in 1974, Derenne *et al.* 1976; Derenne, Mary & Mougin 1976). The breeding population in sector II almost doubled from 1974 to 1982 (Table 4), whereas in sectors III and VI numbers decreased by half in the same period. The number of colonies had not changed significantly in these sectors between 1974 and 1982, but several on the coast north of Cap Verdoyant had

Table 4
Number of breeding Crozet shags along the eastern coast of ile aux Cochons in February 1974 (after Derenne *et al.* 1976 and pers. obs.) and in 1982.

Sector		1974		1982	
		colonies	nests	colonies	nests
II	Le Plan	1	20	4	36
III	Plateau du Camp (Platier and Cap Verdoyant)	3	44	2	21
VI	Delta to Cinq Géants	5	c.70	2	c.35
Total		9	c.134	8	c.92

disappeared and there were a few new colonies in the cliffs of Le Plan. Five adults controlled at the Le Platier colony had been ringed there, or nearby, in 1974.

The small colonies in the cliffs of Plaine Sud did not seem to have undergone any change since 1974. As was the case in 1974 the remaining coastline of the island did not support any colonies. According to the 1982 data (Table 4) an overall nest decrease of about 30 per cent has taken place between 1974 and 1982.

Breeding at the Le Plan and Le Platier colonies seemed to have started later in the season in 1982 than in 1974, or to have been more spread out. On 13 February 1974, eight nests of 23 examined contained eggs (35 %), whereas on 13 February 1982 only three out of 20 contained eggs (15 %). However, it is well-known that laying dates from colony to colony are variable in this species even on the same island (Derenne, Mary & Mougin 1976).

Other bird species — the status of the Crozet pintail, *Anas eatoni drygalskii* does not seem to have changed. Only two flocks, comprising about 15 birds altogether, were seen several times by members of *Campagne Pluricro* in February 1982. One flock of six to seven birds occurred along the coast of sector III near Le Platier. The other flock of seven to eight birds inhabited the same pond at Le Delta where the species was observed by Derenne *et al.* (1976) in 1974. It was also in the same part of Le Delta that Dreux saw 15 birds in January 1964 (Dreux & Milon 1967, Dreux *in litt.*).

A female with four or five chicks on the abovementioned pond was seen and photographed by J.-Y. Bodiou and J.-C. Colomines (pers. comm.) on 18 February 1982. This is the first breeding record for Crozet pintails at the island.

— no Crozet sheathbills, *Chionis minor crozettensis* were observed in February 1982. In 1974 I observed one breeding pair on Pointe de la Houle, but none was seen there in 1982 (L. Masse & Y. Jony pers. comm.). This species is therefore assumed to be only an occasional breeder at the island.

— the timing of the expedition was not ideal for censusing breeding subantarctic skuas, *Catharacta skua madagascariensis*, since they breed earlier in the season. Nevertheless, 100 pairs were counted in the zones visited, 50 of these being observed in sectors II to VI. It is assumed that the numbers of breeding skuas have not changed much from 1974 (about 100 pairs in early 1974; Derenne *et al.* 1976) to 1982.

— no change was noted in the status of the Dominican gull, *Larus dominicanus*, at the island.

— in 1982, as in 1974 (Derenne *et al.* 1976) no evidence of nesting by the Antarctic tern, *Sterna vittata*, nor by the Crozet tern, *Sterna virgata mercuri*, was found. Only one *S. vittata* pair was observed at Le Platier. In 1974 sightings of terns only became numerous at the island after the breeding season (Derenne *et al.* 1976). *S.v. mercuri* seems to be rare, only being observed on three occasions in 1974, whereas *S. vittata* was observed on 110 occasions (pers. obs.).

Mammals

Feral cat, *Felis catus* — in February 1982 the status of the feral cats did not seem changed from 1974. In 1982 cats were on average observed once every five days, whereas in 1974 they were observed on average once every 6,5 days (pers. obs.). Dreux (*in litt.*) observed them twice in 13 days during the period 27 December 1963 to January 1964.

Kerguelen fur seal, *Arctocephalus gazella*, and subantarctic fur seal, *A. tropicalis* — during this expedition no day passed without one or other member of the party reporting fur seals. These observations seemingly concerned at least four individuals, two of which frequented Le Platier. One of these was an *A. tropicalis*. A female of undetermined species with a pup was observed "east of Cap Nord" (J.-Y. Bodiou & J.-C. Colomines, pers. comm.; Jouventin *et al.* 1982). This is the first breeding record for fur seals at the island following their near-extinction locally by sealers in the last century.

Common rabbit, *Oryctolagus cuniculus* — in 1974 rabbits were not very abundant at the island (Derenne *et al.* 1976). Except for a few lone, scattered individuals, particularly west of Le Camp, near La Brioche and on Plaine Sud, they were mainly observed in 1974 in sector I and in a zone from the southern border of Grande Manchotière to Cap Nord, where they were numerous. In 1982, except for one individual sighted near Morne Rouge, none was observed outside sector I, where they were still common and occupied approximately the same area as in 1974 (L. Massé & Y. Jony, pers. comm.). It seems likely that the population has undergone a considerable decrease since 1974.

Other mammals — the time of this expedition was not suited to censusing breeding elephant seals, *Mirounga leonina*. No change in their status was observed.

House mice, *Mus musculus*, remained very common, but it was not possible to conduct surveys on the status of the population.

Discussion

Table 5 summarises the status of the 21 species of birds and mammals known to breed at île aux Cochons according to Derenne *et al.* (1976). To this list has been added *Arctocephalus* spp. as a result of the present expedition. For five of the 22 species listed there were insufficient data to determine whether or not changes have occurred in status between 1974 and 1982. Of the remaining species six showed no indication of a change in status, six showed some indication of change of the order +10% or -10%, due probably to normal seasonal fluctuations, and five showed definite indications of either an increase in numbers (two species — *Macronectes* spp.) or a decrease (three species *D. exulans*, *L. albiventer* and *O. cuniculus*). In the case of the giant petrels particularly *M. halli*, a substantial increase in numbers appears to have occurred. In the case of the wandering albatross and Crozet shag a definite decline seems to have occurred and the rabbit population seems to have declined quite substantially.

The reasons for the observed changes are not clear. The two *Eudyptes* species (*E. chrysolophus*, *E. chrysocome*), the Crozet shag (*L. albiventer*) and the darkmantled sooty albatross, *P. fusca*, which breed on or close to the coast and showed signs of a decrease in numbers, could have suffered as a result of one or more storms during which waves modified parts of the coast line as described previously. These adverse conditions may have provoked the partial or complete desertion of several breeding sites (e.g. along the entire eastern coast). These adverse conditions do not, however, totally explain the decrease in numbers of wandering albatrosses,

Table 5
Summarized variations in numbers of bird and mammal species breeding at île aux Cochons from 1974 to 1982.

Species	variation
<i>Aptenodytes patagonicus</i>	a
<i>Pygoscelis papua</i>	(+)
<i>Eudyptes chrysolophus</i>	(-)
<i>Eudyptes chrysocome</i>	(-)
<i>Diomedea exulans</i>	-
<i>Phoebastria palpebrata</i>	(+)
<i>Phoebastria fusca</i>	(-)
<i>Macronectes giganteus</i>	+
<i>Macronectes halli</i>	+++
<i>Pachyptila salvini</i>	a
<i>Pachyptila turtur</i>	?
<i>Pelecanoides georgicus</i>	?
<i>Leucocarbo albiventer</i>	---
<i>Anas eatoni</i>	a
<i>Chionis minor</i>	?
<i>Catharacta skua</i>	(+)
<i>Larus dominicanus</i>	a
<i>Mirounga leonina</i>	?
<i>Arctocephalus</i> sp.	a
<i>Felis catus</i>	a
<i>Mus musculus</i>	?
<i>Oryctolagus cuniculus</i>	---

Footnote: a = no observed variation; (+) = stable or slightly increasing; + = definite increase; +++ = strong increase; (-) = stable or slightly decreasing; - = definite decrease; --- = strongly decreasing.

since the decline seems to have commenced between 1964 (Dreux & Milon 1967) and 1974 (Derenne *et al.* 1976), and is paralleled by similar declines at île de la Possession and île de l'Est in the Crozets (P. Jouventin & J.-L. Mougin, pers. comm.) and also at South Georgia (Croxall 1979).

The decline in the rabbit population is difficult to understand. The vegetation of île aux Cochons had not noticeably changed between 1974 and 1982 based on a comparison of photographs. Increased predation by cats does not seem to be the cause because not only does the rabbit population of sector I, where cats are as abundant as elsewhere, seem to be unchanged, but also both species have coexisted on the island for over a century without the cats having eliminated the rabbits. Lastly, myxomatosis does not occur at île aux Cochons as far as is known.

The increase in numbers of giant petrels, and particularly of the northern species, is also difficult to explain. The latter forages north of the Subantarctic Convergence (Johnstone 1974). Thus the Crozet population of *M. halli* is able to forage near the islands, while the population of *M. giganteus* must forage further away, south of the convergence. This may partly be the reason for the more rapid increase of *M. halli*. The local availability of seal carcasses does not seem to have changed and numbers of penguins seem to have declined, so the reason(s) for the increase in numbers of giant petrels seems to be related to a change in pelagic food resources if anything.

There is a significant correlation between the decrease in the number of occupied ($r=0,8243$, $P=0,02$) nests of wandering albatrosses and the increase of those of giant petrels (Table 6). Of all sectors in which both breed, in only the sectors in which the number of giant petrel nests decreased, did the number of wandering albatross nests increase (sector VI) or show no change (sector IX). The changes in number of wandering albatross nests did not seem influenced by the species of giant petrel present in the sectors. Competition for nesting sites between *Macronectes* spp. and *D. exulans* has previously been suggested (Voisin 1968a). In the Crozet islands giant petrel

Table 6
Variation in number of occupied giant petrel and wandering albatross nests at île aux Cochons between 1974 and 1982.

Sector	Giant petrel		Wandering albatross	
	Number of nests	% change	Number of nests	% change
II	+19	+172,7	-23	-46
III	+26	+866,7	-10	-52
IV + V	+55	+75,3	-3	-8,5
VI	-28	-57,1	+5	+11,6
VII	0	0	-2	-13,3
VIII	+91	+669	-61	-9,1
IX	-14	-46,6	0	0
XI	+55	+916,7	-31	-26,3

nests are frequently observed in places where wandering albatrosses also breed, and on two occasions *M. halli* were seen occupying abandoned albatross nests, but behavioural interactions between giant petrels and wandering albatrosses are rare. There appears to be ample space for both species to breed at the Crozet Islands (Voisin 1968a) and competition for nesting sites could not be the original cause for the decrease in numbers of wandering albatrosses since the decline in their numbers apparently commenced before the increase in giant petrel numbers.

The paucity of many smaller seabird species at île aux Cochons is probably the result of predation by cats (Derenne *et al.* 1976). Autumn and winter breeders, such as the great-winged petrel and the grey petrel, are particularly exposed to cat predation because their presence coincides with the seasonal decline in the more abundant summer prey species such as Salvin's prion (Derenne *et al.* 1976). The same probably applies to juvenile Crozet sheathbills which arrive on île aux Cochons from nearby îles des Apôtres and île des Pingouins after the breeding season (many such juveniles were caught by cats in 1974, pers. obs.) as well as the Crozet pintail. Both are numerous at these other two islands and the small populations at île aux Cochons are probably maintained by emigration from those two islands which offsets the effects of cat predation.

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