The marine fish fauna of the sub-Antarctic Prince Edward Islands

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The article reviews current knowledge of the species composition of the marine fish fauna (33 species) of the sub-Antarctic Prince Edward Islands in the Indian sector of the Southern Ocean and reports new distributional records for the region. Current taxonomical problems of Antarctic fishes are reviewed and biogeographical relationships with other sub-Antarctic islands of the Indian sector are discussed.

Hierdie artikel hersien heersende kennis van die spesiesamestelling (33 spesies) van die seevisfauna van die sub-Antarktiese Prins Edward-eilande in die Indiese sektor van die Suidelike Oseaan en gee verslag omtrent nuwe verspreidingsaantekeninge vir die streek. Huidige taksonomiese probleme van Antarktiese visse word hersien en biogeografiese verhoudinge met ander sub-Antarktiese eilande van die Indiese sektor word bespreek.

Introduction

The islands of Marion and Prince Edward are situated in the West Wind Drift (46°45′S, 37°55′E), close to two major frontal systems: the Antarctic Polar Front and the Sub-Antarctic Front (Lutjeharms & Valentine 1984). They are of volcanic origin and are estimated to be 0.25-0.50 m. years old (McDougal 1971). Close inshore, sea surface temperatures are fairly uniform throughout the year, ranging from 4.0 to 6.1°C (Schulze 1971). Situated in the Indian sub-Antarctic region, within the Kerguelen zoogeographic province (Knox 1960), the islands are at times under the influence of cold Antarctic water best expressed by the presence of a zooplankton community of mixed origin containing several Antarctic species (Grindley & Lane 1979, Miller 1982, 1985, Boden & Parker 1986). It has been postulated that nutrient run-off from land and wind-induced currents create an "island mass effect" which is thought to be responsible for the production and maintenance of the high biomass observed in the waters around the islands, particularly in the lee of the group (Allanson *et al.* 1985). Large numbers of marine birds and seals breed on the islands (Smith 1987). The Prince Edward Islands are most likely the first land mass encountered by animals from temperate regions carried by wind driven currents or transported by the Agulhas Retroflection from the South African shelf and Agulhas Bank, and temperate and Antarctic elements carried by the West Wind Drift from the Patagonia-Falkland Island region and the Scotia Sea respectively. Knowledge of the fish fauna of the islands is therefore of particular zoogeographical interest.

There are no indigenous freshwater fishes. In 1959 an unknown number of rainbow trout (*Parasalmo mykiss* (= *Salmo gairdneri*)) were introduced into streams on Marion Island but are now considered extinct (Watkins & Cooper 1986). Approximately 130 brown trout *P. trutta* fingerlings were introduced into Van den Boogaard River on Marion Island in 1964. Last sighting of a brown trout was in January 1984, but extinction still remains unproved (Cooper & Condy in press).

Scientific sampling of marine fishes around the Prince Edward Islands dates back to 1873 when the *Challenger* expedition visited the region and collected three species as new to science (Günther 1880). Almost 100 years passed before any further additions were made, and to the present day the marine fish fauna has remained comparatively poorly known. Andriashev (1971) identified the few fish specimens brought back from the South African expedition in 1965/66, resulting in two new distributional records. French scientists extended the species list considerably in 1976 when several trawls were made with the RV *Marion-Dufresne* during their sub-Antarctic inter-island research cruise MD08 (Arnaud & Hureau 1979, Hureau 1979, Duhamel *et al.* 1983).

Materials and methods

From the ecological point of view, the Prince Edward Islands' region is conceived as the ocean area within a radius of about 300 km delineated by the following coordinates: north – 43°45′S, 37°55′E; south – 49°32′S, 43°29′E; west – 46°45′S, 32°21′E; east – 46°45′S, 43°29′E. This determination was based on an estimate of the maximum daily foraging range of seabirds nesting on the islands (J. Cooper pers. comm.). Classification of nototheniid genera and species follows Balushkin (1984), with the exception of *Lindbergichthys* which we include as a subgenus in *Nototheniops*. Measurements of the family Nototheniidae follow DeWitt (1970). Body depth was measured at level of dorsal-fin origin; body width is the distance between both pectoral fin bases. Measurements of other families follow Hubbs & Lagler (1958) unless specified otherwise. Photophore designation in Myctophidae follows Hulley (1981). The following abbreviations are used in the diagnoses and tables below: SL – standard length; TL – total length; D – dorsal fin; A – anal fin; P – pectoral fin; V – pelvic fins; GR – gill-rakers; LL – lateral-line scales; ULL – upper lateral line; MLL – middle lateral line; LSS – lateral scale series; Vert – vertebrae; CIO – suborbital sensory canal; CSO – supra-orbital sensory canal; CT – temporal sensory canal; BD – body depth; IO – interorbital width; Sn – snout; UJ – upper jaw; LJ – lower jaw; SnD1 – distance from snout to D1 origin; SnD2 – distance from snout to D2 origin; SnA – distance from snout to anal-fin origin. The specimens used in this study are housed in the British Museum (Natural History), London (BMNH); Museum National d'Histoire Naturelle, Paris (MNHN); Swedish Museum of Natural History (NHRM); and the J.L.B. Smith Institute of Ichthyology, Grahamstown (RUSI). Throughout the text Prince Edward Islands is abbreviated as PEI.

Species accounts

ACHIROPSETTIDAE

Following Andriashev (1986), Evseenko (1985) and Hensley (1986), the 'armless' flounders described below are placed in the family Achiropsettidae rather than Bothidae.

Mancopsetta maculata (Günther, 1880)

Lepidopsetta maculata Günther 1880: 18, pl. XXX, fig. C (off Prince Edward Island).

MATERIAL: BM(NH): 1879.5.14.90, 113.0 mm SL, holotype, off Prince Edward Island, 550 m, *Challenger*, station 145.

DIAGNOSIS: D 118; A 100; GR 7+13; LL 118; vertebrae 53. Head length 3.9 in SL. Snout length 4.8, eye diameter 3.0, upper jaw 3.2 and lower jaw 2.3 in head length. Interorbital space narrow, 2.4 per cent of head length, and crested. Eyes oval, their dorsal surface scaled. Upper eye slightly in front of lower one. Nostrils close-set, front one with a small flap. Maxilla reaching behind front edge of lower eye. Teeth biserial on both jaws (see Remarks). All gill-rakers short and pointed. Dorsal-fin origin in front of eyes. Pelvic fin of eye side inserted in front of the blind-side fin. Pectoral fins absent. Scales minute, ctenoid on both sides of body.

In alcohol, both sides of body brown. Original colour pattern faded.

REMARKS: Kotlyar (1978) recognized two subspecies of *Mancopsetta maculata*: *M. m. maculata* from the Patagonian region and *M. m. antarctica* from the Scotia Sea area south of the Antarctic convergence. This subdivision was based on differences in the number of lateral-line scales, gill-raker morphology and dentition. The number of lateral-line scales of the holotype of *M. maculata* agrees with that ascribed by Kotlyar (1978) to *M. m. maculata*. The pointed gill-rakers and the biserial teeth arrangement, however, agree with Kotlyar's (1978) *M. m. antarctica*. The arrangement of the lower jaw teeth in Günther's holotype was difficult to determine due to the fragile state of the specimen and damaged jaw. It appears that the lateral section of the lower jaw of the blind side has only one series of teeth (A. Wheeler pers. comm.). The lower jaw teeth in a 98.0 mm SL specimen from off Mawson Station, provisionally identified as *M. m. antarctica* were biserial in front, tapering to a single row laterally. However, the number of lateral-line scales in this specimen was 118 (Gon, 1988, this volume), as in Günther's holotype.

Norman (1930) re-described *M. maculata* based on Günther's holotype and a much larger specimen from the Falkland Islands. His description of the uniserial dentition and his count of lateral-line scales (114-120) agree with *M. m. maculata*. Günther (1880), however, was not sure of the arrangement of the teeth in his holotype and described it as "apparently in a single series". Duhamel (1986), who collected *M. maculata* in the Crozet Islands of the sub-Antarctic Indian Ocean, mentioned that in their meristics and morphometrics his specimens concur with *M. m. maculata* of Kotlyar (1978). Unfortunately, he did not refer to gill-raker morphology and dentition.

Following these observations, Kotlyar's (1978) subdivision of *M. maculata* may be questioned on the ground that he did not compare his specimens with the holotype and/or other specimens from the type locality. It seems that Kotlyar may have chosen as the nominotypical subspecies the form which is less similar to the holotype of the species.

Mancopsetta milfordi Penrith, 1965

Mancopsetta milfordi Penrith 1965: 181, figs. 1, 2c, pl. 1 (off Cape Town).

Neoachiropsetta milfordi Kotlyar 1978: 718.

REMARKS: Two flatfishes were photographed at PEI during a study of the benthos conducted by the University of Cape Town. These were identified as *M. milfordi* based on the characteristic deeply concave dorsal profile of the head and the relatively wide interorbital space (6.0-10.0 % head length) (Fig. 1). In the closely related *M. maculata*, the

Fig.1. *Mancopsetta milfordi* on the bottom (286 m) between Marion and Prince Edward Islands (photograph by R. Bally, P. Brandt and D. Gianakouras).

snout is less pronounced and the interorbital space is narrower, 2.8-7.4 per cent head length (Heemstra in press). In addition, *M. milfordi* differs from *M. maculata* in having higher counts of dorsal-fin rays (134-137 versus 105-128), anal-fin rays (117-120 versus 89-101), lateral-line scales (168-188 versus 100-123) and vertebrae (65 versus 52-55) (Duhamel 1986). In placing *milfordi* within the genus *Mancopsetta* we follow Hensley (1986) and Heemstra (in press). Recently, Duhamel (1986) collected *M. milfordi* at Crozet and Kara Dag.

Pseudomancopsetta andriashevi Evseenko, 1985
Figure 2

Pseudomancopsetta andriashevi Evseenko 1985: 3, fig. 1 (45°49'S, 84°18'W)

MATERIAL: RUSI 27494, 46.6 mm SL, 46°43.58'S, 37°55.90'E, dredge, 243 m, *S.A. Agulhas*, cruise 49, station 28, 28 April 1987; RUSI 27495, 69.6 mm SL, 46°59.75'S, 38°00.65'E, dredge, 376 m, *S.A. Agulhas*, cruise 50, station 39, 26 August 1987.

DIAGNOSIS: D 81-89; A 70-74; V eye side 6, blind side 4; GR 8-10+17; LL of eye side 85-86, of blind side 90; vertebrae 42-43. Body depth 2.3 and head length 3.2-3.5 in SL. Snout length 5.0-5.6, eye diameter 3.2, upper jaw length 3.3-3.4 and lower jaw length 2.4-2.5 in head length. Caudal peduncle depth 0.4-0.6 in its length. Interorbital space very narrow, about two per cent of head length, and with a bony crest (see Remarks). Dorsal part of eyes scaled, lower eye slightly in front of upper one. Mouth small, maxilla reaching level of front half of eye. Upper jaw of blind side shorter

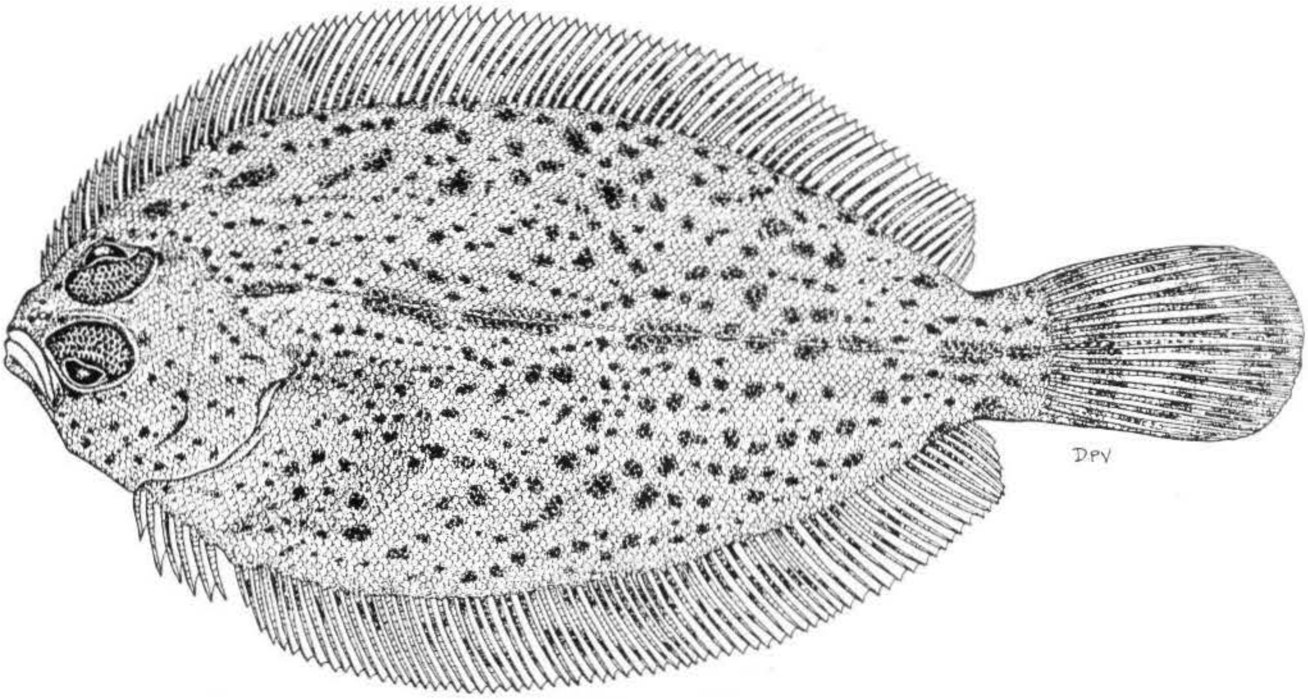

Fig.2. *Pseudomancopsetta andriashevi* RUSI 27495, 69.6 mm SL.

than jaw of eyed side. Upper jaw of eyed side toothless; blind side with a polyserial band of small, conical teeth tapering to a single series posteriorly. Lower jaw of both sides with a band of similar teeth, but wider and with larger teeth on blind side. Gill membranes separate. Dorsal-fin origin in front of eyes. Pelvic fin of eyed side inserted in front of blind-side fin and with a much longer base. Anus on ventral margin of body. Scales small and ctenoid on both sides of body, extending onto fin rays. Fin rays of all but caudal fin unbranched.

In alcohol, blind side pale. Eye side with dark spots of various sizes spreading onto fins. A series of short and thick, dark horizontal bars along lateral line, from opercle to caudal fin. Two or three dark stripes across caudal fin. Gill-rakers with minute dark spots.

REMARKS: The specimens described above generally agree with the description of Evseenko (1985). In our specimens, the anus is clearly on the ventral margin of the body and not shifted to the blind side. The anal-fin origin is immediately behind the anus which separates the last pelvic-fin rays and the first anal-fin ray. In addition, no noticeably shorter gill-raker was observed on the outer side of the epibranchial of the first gill-arch. Recently, Duhamel (1986) reported *P. andriashevi* from the neighbouring Crozet Islands (46°50′E).

ALEPISAURIDAE

Alepisaurus brevirostris Gibbs, 1960
Figure 3

Alepisaurus brevirostris Gibbs 1960: 2, pl. 1 (38°49′N, 64°02′W)

MATERIAL: RUSI 26635, 132.3 mm HL, Trypot Beach, from the bill of a giant petrel, April 1985.

DIAGNOSIS: P 13; V 9; GR 4+22. Snout length 3.0, eye diameter 5.7, and interorbital width 5.6 in head length. Mouth gape extends beyond eye. Upper jaw with a row of small conical teeth, decreasing in size posteriorly. Lower jaw with

Fig.3. Head of *Alepisaurus brevirostris* RUSI 26635, 132.3 mm HL.

three fangs, followed by a row of 11 small, laterally-compressed triangular teeth that form a saw edge. Each palatine with a large anterior fang, followed by a space and three smaller ones; posterior third of the bone with a row of eight small, laterally compressed triangular teeth. All teeth are fixed. Gill-rakers poorly developed, comprising a short base and 1-3 long and slender teeth projecting into the gill chamber. Dorsal-fin origin above middle of opercle.

REMARKS: *Alepisaurus brevirostris* was reported from Crozet Islands by Hureau (1967) and Shcherbachev & Meisner (1973), and from Kerguelen by Duhamel & Hureau (1982). In April 1985, the specimen reported above was retrieved from the bill of a giant petrel. It was fresh, but quite mutilated. Nevertheless, the data gathered from the specimen were sufficient for positive identification and agree well with previously published descriptions (Gibbs 1960, Hureau 1967, Shcherbachev & Meisner 1973, Francis 1981). By extrapolation from data in the literature, it was estimated that the length of the Marion Island specimen was between 910 and 950 mm SL.

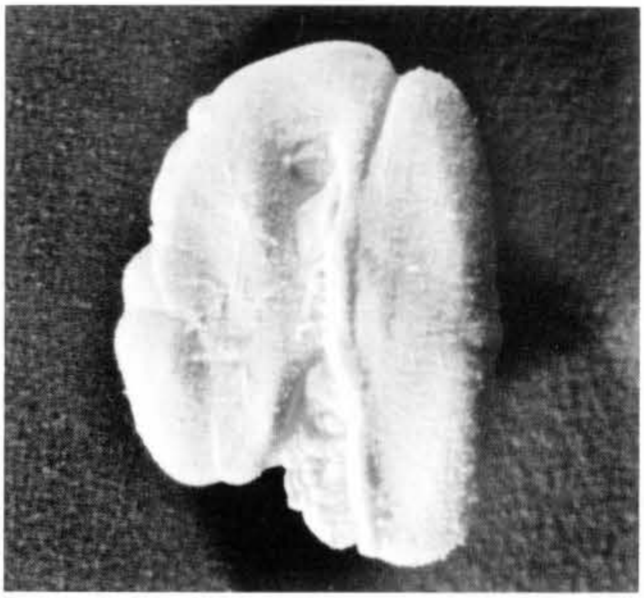

Fig.4. Otoliths of *Channichthys rhinoceratus* (2.0 mm diameter) retrieved from the stomach contents of gentoo penguin G-136 at Marion Island, 25 Feb. 1985; estimated mass of the fish 39.3 g and estimated length 207.6 mm TL.

CHANNICHTHYIDAE

Channichthys rhinoceratus Richardson, 1844

Channichthys rhinoceratus Richardson 1844: 461, Kerguelen.
Channichthys velifer Meisner 1974: 51, Kerguelen.

During January to March 1985, remains of 136 immature *Channichthys rhinoceratus* Richardson 1844, were found in the stomach contents of gentoo penguins nesting on Marion Island (Adams & Klages in press). Gentoo penguins, *Pygoscelis papua*, are permanent residents of PEI. Adams & Wilson (1987) found that their average foraging range is about 40km (maximum 103 km). Undoubtedly the penguins were feeding within the island waters as defined above (see Materials and Methods). *C. rhinoceratus* was previously considered as endemic to the Kerguelen-Heard plateau (Hureau 1979, 1985a). Identification was based on otoliths (Fig. 4) which were compared with otoliths of specimens from Kerguelen. The otoliths are lodged at the otolith reference collection of the Port Elizabeth Museum.

CHIASMODONTIDAE

Dysalotus cf. *alcocki* MacGilchrist, 1905

Dysalotus alcocki MacGilchrist 1905: 268 (Bay of Bengal); Alcock & MacGilchrist 1905, pl. 37, fig. 1 (figure only).

MATERIAL: RUSI 27493, 163.7 mm SL, female, Prince Edward Island, pumped from the stomach of an adult grey-headed albatross (*Diomedea chrysostoma*), 18 April 1987.

DIAGNOSIS: D ?X+26; A I,26; P 14; gill teeth about 25 on lower limb; branchiostegal rays 7; vertebrae 37. Head length 3.5, head depth (at level of preopercle) 1.9 and body width 9.9 in SL. Snout length 3.9, eye diameter 5.7, interorbital width 3.5, upper jaw length 1.3 and lower jaw length 1.2 in head length. Caudal peduncle depth 2.6 in its length and the length 7.0 in SL. Distances from tip of snout to first dorsal-fin origin 2.8, to second dorsal-fin origin 2.2, to pectoral-fin base 3.1, to pelvic-fin insertion 3.0 and to anal-fin origin 2.0 in SL. Mouth large, maxilla reaching as far as angle of preopercle. Both jaws with 5-6 rows of teeth in widest point, tapering to two series near symphysis and 1-2 series posteriorly. Teeth of outermost row smallest; inner teeth depressible and with slightly barbed tips. Palatines with a single row of teeth, similar in size to outermost row of upper jaw. No teeth on vomer.

REMARKS: Placement in the genus *Dysalotus* is based on the number of branchiostegal rays and rows of teeth in the upper jaw, as well as the presence of gill teeth (six branchiostegal rays in *Kali* and normal gill-rakers in *Chiasmodon*). Skin prickles are missing as the fish is partially digested. Therefore, identification to species is based on the absence of vomerine teeth (Johnson & Cohen 1974). The absence of supramaxilla is probably due to digestion. The uncertainty in positively identifying the specimen described above as *D. alcocki* stems from a number of differences compared to a published description by Johnson & Cohen (1974). The number of pectoral-fin rays (14) is higher than the range of 11-13 (usually 12) known for *Dysalotus*. The premaxillary teeth are larger in relation to the jaw length and are most numerous on the center of the bone (Fig. 5A) and not on the anterior part as described by them. Our specimen also differs in that the infraorbital bones have a large bony area partially enclosing distally the infraorbital sensory canal (Fig. 5B). Furthermore, the first infraorbital bone (lacrimal) has a large, thin and poorly ossified flap ventrally to the canalized part of the bone (Fig. 5b) not shown by Johnson & Cohen (1974).

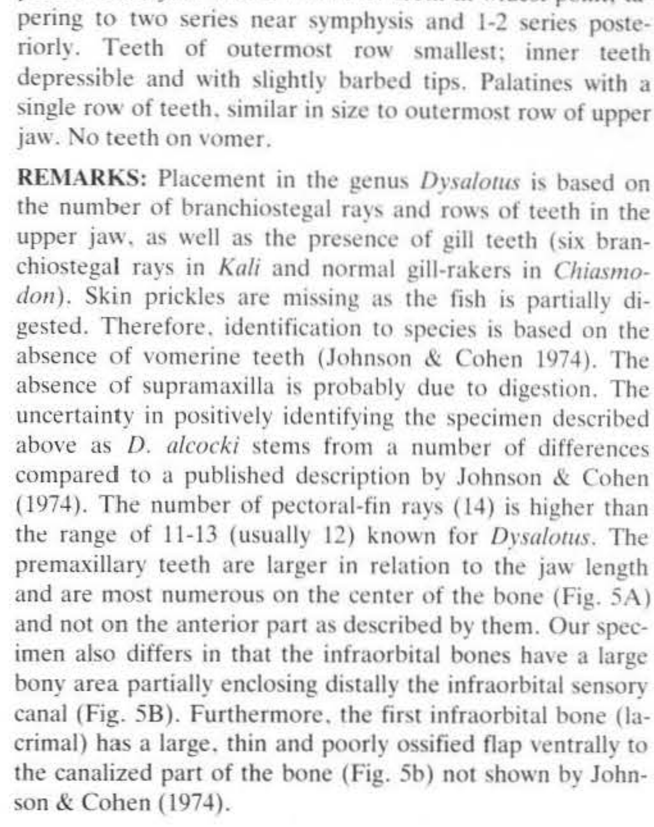

Fig.5. *Dysalotus* cf. *alcocki* RUSI 27493. A. Left ventrolateral view of premaxilla. B. Right lateral view of suborbital bones.

Chiasmodontid fishes are meso- or bathypelagic, distributed in the tropical and subtropical world ocean and are usually taken at depths exceeding 700 m (Johnson & Keene 1986). *D. alcocki* is not known south of 30°S, but its congener, *D. oligoscolus*, was reported from 44°S in the Pacific Ocean (Johnson & Cohen 1974). Recently, however, *Kali indica* Lloyd, 1909, was collected in the Bering Sea, 58°22.1'N, 175°01.8'W, surface water temperature of 6.3°C (Yabe & Cohen 1981), indicating that at least some chiasmodontids can survive in cold water. The grey-headed albatross, *Diomedea chrysostoma*, from which stomach our specimen was recovered, is considered an offshore feeder (Croxall 1984) with a potential foraging range of 615 km (Croxall & Prince 1987). It is apparently a night feeder spending, on average, 50 per cent of darkness sitting on sea, compared to only 15 per cent of daylight (Prince & Francis 1984). Judging by the relatively good condition of the specimen, it is assumed to have been taken by the albatross during the night, or within 14 hours before its stomach was pumped. Using the data given by Prince & Francis (1984) on the usual duration of foraging trips, we estimate that our specimen was caught by the albatross about 210 km off Marion Island, well within the waters of the PEI as defined above (see Materials and Methods). Since the grey-headed albatross is not a diver, the specimen described above was probably taken by the bird at the surface. Catch records of *D. alcocki* show that no adult fish was taken above 700 m (Johnson & Keene 1986). Nevertheless, since the behaviour of this species is not known, vertical migration is a possible explanation for the presence of the fish at the surface. Otherwise, it may have been either dead or dying when it was found by the bird.

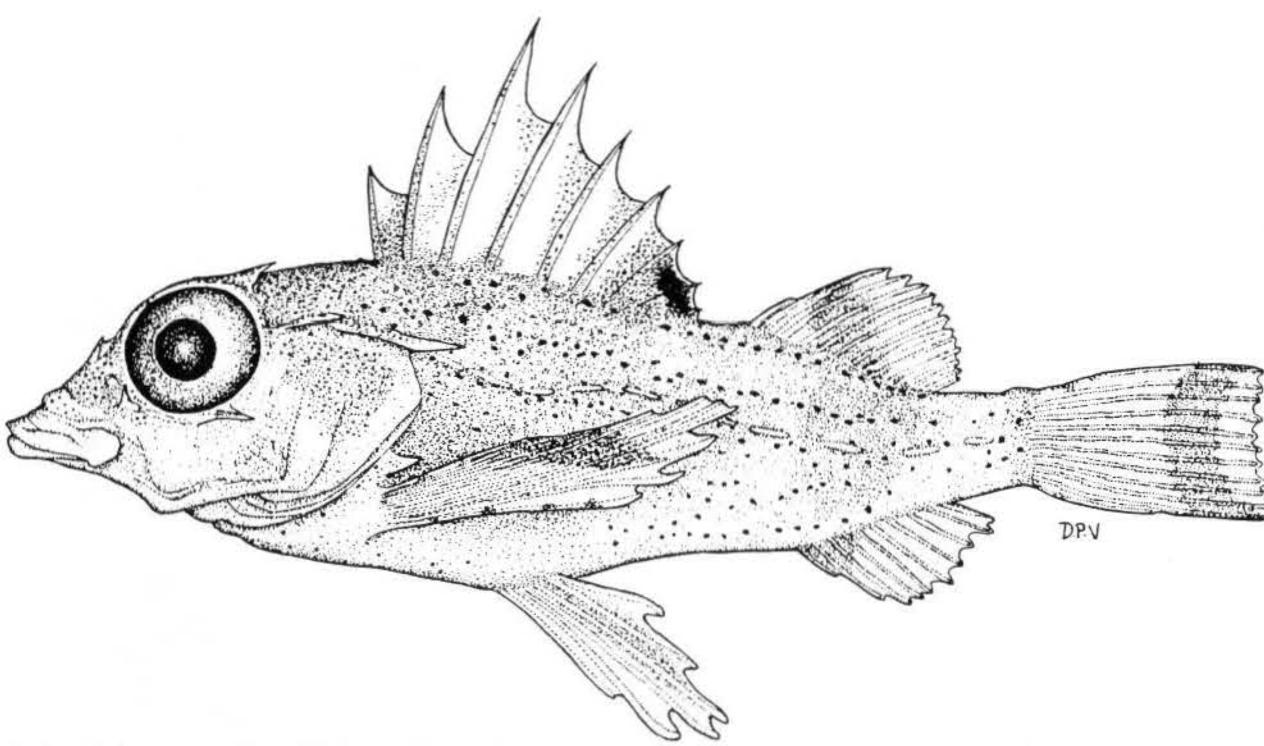

Fig.6. *Zanchlorhynchus spinifer* RUSI 26216, 41.9 mm SL, juvenile.

CONGIOPODIDAE

Zanclorhynchus spinifer Günther, 1880
Figure 6

Zanclorhynchus spinifer Günther 1880: 15, pl. 8, fig. A (Kerguelen).

MATERIAL: RUSI 26216, 41.8 mm SL, Marion Island, 5 miles off South Cape, 46°43.5′S, 38°01′E, dredge, 232 m, *S.A. Agulhas*, cruise 40, station 18, 25 April 1985.

DIAGNOSIS: D IX+14; A 10; P 9; LL 11; GR 10 (on lower limb); branchiostegal rays 6; vertebrae 33. Body depth 3.4 and head length 2.4 in SL. Snout length 3.2, eye diameter 3.0, interorbital width 7.1 and upper jaw length 2.5 in head length. Mouth small and protractile, maxilla nearly reaching front edge of orbit. Jaws with 1-2 irregular rows of small, conical teeth; no teeth on vomer and palatines. Gill opening small, restricted between spine above pectoral fin and upper end of opercle. First gill slit restricted by a membrane connected to the angle of the arch and the ventral third of its lower limb. Dorsal-fin origin in front of pectoral-fin base. Dorsal fins completely separated. First dorsal fin much higher than second fin and its base longer. Distances from tip of snout to first dorsal spine 3.0, to second dorsal-fin origin 1.5, to pelvic-fin insertion 2.2, and to anal-fin origin 1.3 in SL. Scales embedded in the skin and armed with a short spine that penetrates the skin. The erect spines give the body a prickly appearance. Lateral line consists of individual, well spaced, tubes.

In alcohol, general colour pale brown, head paler. Body with 4-5 irregular rows of black spots. Three faint bars; two on body, under posterior half of first dorsal fin and from second dorsal fin to anal fin; one bar across distal third of caudal fin. A black spot on rear end of first dorsal fin, encircled by a dusky area. Second bar extends onto anal and second dorsal fins. Middle rays of pelvic fin dusky. A dark diagonal mark across distal third of pectoral fin. Lowermost pectoral ray with about four faint spots.

REMARKS: At 41.8 mm SL the juvenile of *Z. spinifer* is similar to the adult in most aspects. A noticeable difference is in the dorsal profile of the head, which is an uninterrupted line in the juvenile (Fig. 6); in the adult (Hureau 1970b, 1985b) the snout is more produced and the eye bulges high above the profile. In the specimen described above the dorsal fins are completely separated whereas the illustration in Hureau (1970b) shows that the fins are connected to each other by a membrane. There is a slight difference in colour pattern. The rows of dark spots apparent on the body of the juvenile are probably remains of the larval pattern and are absent in the adult. In addition, the black spot on the rear end of the first dorsal fin of the juvenile is dispersed to cover the posterior third of this fin in the adult. *Z. spinifer* is known from the sub-Antarctic islands of the Indian Ocean and Macquarie Island, from within the kelp belt to 340 m (Hureau 1985b). Limited underwater observations on fishes within the kelp belt around Marion Island have failed so far to produce a sighting of *Z. spinifer*. However, a recent benthos survey using underwater camera implies that this species may be abundant in deeper water (Fig. 7).

mostly dark. Pectoral and pelvic fins dark, but with the outermost rays on both sides of the fins pale. Lower caudal-fin lobe dark; upper lobe pale.

REMARKS: The specimen described above was found on the deck of the *S.A. Agulhas* during the fourth circumnavigation of Marion Island. The possibility that the fish landed on deck somewhere during the passage between Cape Town and the PEI was ruled out since it was found in a fresh condition and the ship had already been in island waters for over a month. *Cheilopogon pinnatibarbatus* is considered as a subtropical and temperate species (Gibbs & Staiger 1970). Parin (1959) divided *C. pinnatibarbatus* into six subspecies some of which can tolerate cold water. For example, in Japan *C. p. japonicus* was caught in waters of 12.7°C (Abe 1960). In South Africa, Heemstra & Parin (1986) reported *C. p. altipennis* from Cape waters and Agulhas Bank. Previously, its southernmost record in the Indian Ocean was from the waters of Saint Paul and Amsterdam Islands (Parin 1959). As this finding is far south of the normal range of this subspecies, our specimen is probably an occasional, stray visitor to PEI area.

Fig.7. Dense concentration of *Zanclorhynchus spinifer* on the bottom (202 m) between Prince Edward and Marion Islands (photograph by R. Bally, P. Brandt and D. Gianakouras).

EXOCOETIDAE

Cheilopogon pinnatibarbatus altipennis (Valenciennes, 1846)

Exocoetus pinnatibarbatus Bennet 1831: 146 (Atlantic Coast of North Africa).
Exocoetus altipennis Valenciennes in Cuvier & Valenciennes 1846: 109 (Cape of Good Hope).

MATERIAL: RUSI 27491, 196.0 mm SL, Marion Island, 11 km offshore, deck of *S.A. Agulhas*, cruise 49, 24/25 May 1987.

DIAGNOSIS: D 13; A 11; P i,15; GR 6+15; predorsal scales *c*. 42; vertebrae 51. Body elongate, subcylindrical, depth 7.2 in SL and width 1.1 in the depth. Head small, 4.6 in SL. Snout length 3.3, eye diameter 3.7, interorbital width 2.9, upper jaw length 4.1 and lower jaw length 2.3 in head length. Caudal peduncle depth 1.7 in its length and the length 9.8 in SL. Distances from tip of snout to dorsal-fin origin 1.4, to pectoral-fin base 4.3, to pelvic-fin insertion 1.6 and to anal-fin origin 1.3 in SL. Mouth small, maxilla not reaching front edge of eye. Both jaws with a narrow band of small conical teeth, tapering to a single series posteriorly. A group of minute teeth on front end of palatines. Longest pectoral-fin rays reaching caudal-fin base. Pelvic fins inserted closer to head than to caudal-fin base, extending beyond rear end of anal-fin base. Anal-fin origin under base of fifth dorsal-fin ray.

In alcohol, body brownish grey above level of pectoral-fin base, gradually getting paler ventrally. Scale pockets on dark, upper half of body with black margin. Dorsal fin

HARPAGIFERIDAE

Harpagifer georgianus Nybelin, 1947
Figure 8

Harpagifer georgianus Nybelin 1947: 39, pl. 4, figs. 1-4 (South Georgia).

MATERIAL: RUSI 26228, 30.8 mm SL, Marion Island, Transvaal Cove, 0-5 m, November 1983.

DIAGNOSIS: D IV+24; A 18; P 17; GR 7 (on lower limb); LL 18; vertebrae 36. Body depth 4.6 in SL and body width 0.96 in its depth. Head large, somewhat flattened behind eyes; head length 2.9 in SL and head depth 1.7 in its length. Snout length 3.7, eye diameter 3.7, interorbital width 5.0, upper jaw length 2.9 and internostril space 7.6 in head length. Two thickened areas above eye; the anterior one low

Table 1
Frequency distribution of counts of *Gobionotothen marionensis*

Locality	D1			D2					A					GR			
	5	6	7	27	28	29	30	31	27	28	29	30	31	15	16	17	19
Scotia Sea Islands	7	12	2		1	4	11	5			2	6	13	2	8	9	2
Prince Edward Is.	1	3	2*	1	3	1*	1		1	3*	2				4	1*	1

	ULL							MLL											
	28	30	31	32	33	34	35	9	13	14	15	16	17	18	19	20	22	23	24
Scotia Sea Islands	1	3	5	4	3	3	1	1	2		3	2	1	1	3	2	2	1	2
Prince Edward Is.		1	1	1	1		2*	1*	4	1									

	LSS										Vertebrae				P		
	44	46	47	48	49	50	51	52	55	56	44	45	46	47	19	20	21
Scotia Sea Islands	1		2	2		5	3	3	2	2		3**	5	9	4	9	8
Prince Edward Is.		1	2*	1	1	1					1	3*	1		3*	3	

* Holotype of *G. marionensis*.
** Syntype of *G. angustifrons* (from Andersen 1984).

Table 2
Ranges of proportional measurements (as % SL) of *Gobionotothen marionensis*

	Scotia Sea Islands (n=17)		Prince Edward Islands (n=5)	
	min	max	min	max
Body width	18.8	24.1	18.1	20.4
Greatest depth	17.0	22.3	18.1	23.0
Head length	26.6	32.0	27.6	32.0
Snout length	6.7	11.0	6.8	11.2
Eye diameter	7.0	9.1	7.3	9.1
Interorbital	1.2	2.7	2.0	2.3
Length upper jaw	9.1	11.7	8.5	10.6
Length lower jaw	10.4	13.3	10.4	13.0
First dorsal-fin base	5.4	9.8	7.8	9.7
Anal-fin base	43.6	51.6	44.8	46.8
Pectoral-fin length	21.3	28.4	20.3	27.8
Pelvic-fin length	16.7	23.0	18.1	23.8
Peduncle depth	5.3	6.5	6.3	7.4
Peduncle length	3.9	5.9	4.9	6.0
Snouth to D1	30.4	35.2	32.9	36.2
Snouth to D2	42.0	47.2	45.8	48.5
Snouth to P	29.1	33.6	31.6	35.6
Snouth to V	23.4	28.3	23.3	28.6
Snouth to A	45.8	50.0	46.9	50.5
V to A	22.0	28.3	24.6	27.6
Depth at A level	15.3	18.0	17.3	19.7
Head depth	14.9	17.8	16.9	18.6
Snout to nostril	4.9	7.3	5.8	8.0
Nostril to nostril	3.4	5.3	4.2	4.7

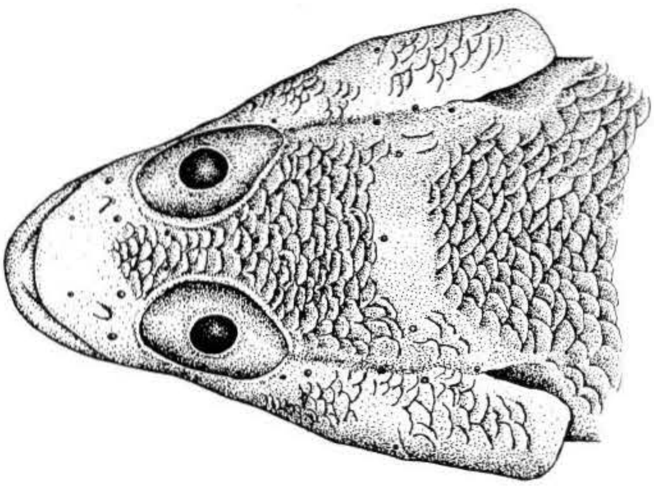

Fig.13. Dorsal view of the head of the holotype of *G. marionensis*.

The extent of scale cover on the opercle, the interorbital width and the number of upper lateral-line scales were used as diagnostic characters separating *G. acuta* from *G. marionensis* and *G. angustifrons* (Regan 1913, Norman 1938, Balushkin 1984, Hureau 1985d). Once again, although none of the Scotia Sea and PEI specimens had a fully scaled opercle, the extent of the scale cover varied between one to two thirds of the bone surface. In addition, we have examined three specimens of *G. acuta* of which only the specimen from Kerguelen (BM(NH) 1937.9.21.51) had a fully scaled opercle. In all its other characters, the latter resembled *G. marionensis* (including *angustifrons*). The other two specimens were re-identified as *G. marionensis*. The counts and measurements of the Marion Island specimen (MNHN 1985-925) were included in Tables 1 and 2. A future study may reveal that *G. acuta* is in fact identical with *marionensis* and *angustifrons*). In view of our limited material from Kerguelen (one specimen), we cannot make this synonymy. Moreover, we are compelled to consider *G. acuta* as present in PEI waters since we have not examined all the material collected at the islands, mostly by French expeditions.

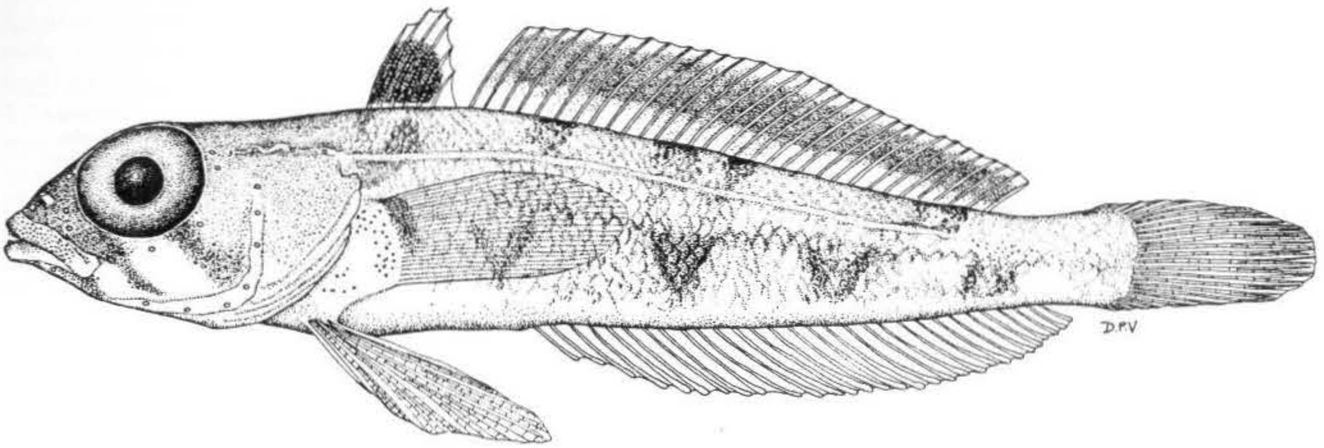

Fig.14. *Lepidonotothen squamifrons* RUSI 26211, 47.6 mm SL, juvenile.

Lepidonotothen squamifrons (Günther, 1880)
Figure 14

Notothenia squamifrons Günther 1880: 16, pl. 8, fig. C (Kerguelen).

MATERIAL: RUSI 26211, 2: 46.3-47.6 mm SL, Marion Island, 5 miles off South Cape, 46°43.5'S, 38°01'E, dredge, 232 m, *S.A. Agulhas*, cruise 40, station 18, 25 April 1985, RUSI 26212, 63.0 mm SL, between Marion and Prince Edward Islands, 200 m, *S.A. Agulhas*, cruise 36, August-September 1984.

DIAGNOSIS: D VI+32-34; A 29-31; P 24-25; GR 7-8+15-16; ULL 37-42; MLL 11; LSS 61; vertebrae 49-50. Body depth 4.8-5.0 in SL and width 1.2-1.4 in depth. Head length 3.1-3.2 in SL and head depth 1.7-1.8 in head length. Snout length 4.9-5.7, eye diameter 2.4-2.7, interorbital width 11.7-12.4 and internostril distance 7.2-7.7 in head length. Pectoral-fin length 4.6-5.0 and pelvic-fin length 3.7-4.1 in SL. Pelvic fin reaches to about third to fifth anal-fin ray. Distances from snout to first dorsal fin 3.0-3.2, to second dorsal fin 2.4-2.7, to upper pectoral-fin base 3.0-3.1, to pelvic-fin insertion 3.8-3.9, and to anal-fin origin 2.1 in SL. Scales on body and head ctenoid; head only partially scaled; scales across interorbital space 2-4. Both lateral lines of tubed scales; pitted scales present in front of tubed ones in lower lateral line.

In alcohol, body colour pale brown with three dark V-shaped vertical marks, frequently extending onto second dorsal fin in the form of three pairs of small, dark spots along its base. A vertical bar at end of second dorsal fin and on caudal-fin base. Two dark cheek stripes and a large dark spot on first dorsal fin.

REMARKS: The species of the "*squamifrons*" group created by Permitin & Sazonov (1974), are closely related. The issue of subspecies is still undecided in *L. squamifrons* (Hureau 1985d, Permitin & Sazonov 1974). Specimens of about 100 mm SL or less are difficult to identify to species, let alone subspecies. The specimens reported above generally agree with the Permitin & Sazonov (1974) definition of *L. squamifrons squamifrons*. However, being juveniles they lack scales on top of the eye balls, on most of the snout and anterior part of cheek. Slight differences, probably age related, were found in interorbital width (slightly narrower) and eye diameter (larger). At PEI, a 46.3 mm SL, *L. squamifrons* is a fully developed juvenile. The body is completely scaled and lateral line developed; head squamation is age related and generally advances forward, namely the tip of snout is the last to be covered by scales. Fins are well developed, with the pelvic and pectoral fins at full length. The sensory canal system is also fully developed. Remains of the postlarval colour pattern is a line of deeply buried melanophores, one at the base of each anal-fin ray, and a cluster of melanophores on the dorsal half of the body under the rear end of second dorsal fin and caudal peduncle. Juveniles make up a large proportion of the diet of the gentoo penguin at Marion Island (Adams & Klages in press).

Notothenia coriiceps Richardson, 1844

Notothenia coriiceps Richardson 1844: 5, pl. 3, figs. 1-2 (Kerguelen).

MATERIAL: RUSI 12903, 353.0 mm SL, Marion Island; RUSI 18233, 3: 330-370 mm SL, Marion Island, Transvaal Cove, May 1983: RUSI 18234, 297 mm SL, Prince Edward Island, north side, 25 May 1983; RUSI 20117, 3: 253-360 mm SL, Marion Island, Transvaal Bay, gillnet, November 1983; RUSI uncat. 2: 317-320 mm SL; RUSI uncat. 4: 277-365 mm SL.

DIAGNOSIS: D IV-VI+34-36; A 26-29; P 17-18; ULL 39-49; MLL 10-15; LSS 60-68; GR 5-6+10-14; vertebrae 51-52 (two specimens). Body depth 3.5-4.3 in SL and width 1.0-1.1 in depth. Head large, slightly depressed and lower than the body, length 3.3-3.8 and depth 2.3-2.4 in SL. Snout length 3.9-5.0, eye diameter 5.1-5.9, interorbital width 2.9-3.5 and internostril distance 4.9-5.7 in head length. Pectoral-fin length 4.0-5.3 and pelvic-fin length 4.9-6.6 in SL. Distances from snout to first dorsal-fin origin 3.2-3.4, to second dorsal-fin origin 2.3-2.5, to upper pectoral-fin base 2.9-3.1, to pelvic-fin insertion 3.1-4.0 in SL. Scales cycloid to weakly ctenoid; a few scales on upper cheek, behind eye, and a few more on upper part of opercle just below temporal sensory canal.

In alcohol, uniformly black except for a lighter area on abdomen which may vary from dark grey to white with grey blotches. (Measurements were taken from four specimens 253-353 mm SL.)

REMARKS: Nybelin (1951), relying on data from only four specimens of *Notothenia coriiceps* obtained at Kerguelen for comparison (Nybelin 1947), described similar material from South Georgia as a new species which he named *N. neglecta*. With the current knowledge of meristic and morphometric variability of nototheniid fishes his description of *N. neglecta* is unjustified. Unfortunately, published taxonomic data of *N. coriiceps* from the Kerguelen area still remains scanty.

Table 3
A summary of meristic and morphometric data of *Notothenia coriiceps*

	Marion (current study)	Kerguelen (Blanc 1958)	Kerguelen + Crozet (Nybelin 1951)	Scotia arc + Antarct. Penin. (Nybelin 1951)	South Orkneys (Bellisio 1965)	Terre Adelie (Blanc 1961) (Hureau 1970a)	South Georgia + Antarct. Penin. *N. neglecta* (Hureau 1985d)	Subantarctic Islands. *N. corriiceps* (Hureau 1985d)
D1	4-6	3-7	4-6	2-5	3-6	3-6	3-7	4-5
D2	34-36	35-40	35-38	37-40	36-40	37-41	37-41	35-38
A	26-29	27-31	26-30	28-32	27-32	28-32	28-32	27-29
P	17-18	17-18	17-18	17-19	17-19	17-19	17-19	16-17
ULL	39-49						34-49	34-49
MLL	10-15						6-17	6-17
LSS	60-68							
GR	5-6+10-14				3-6+10-14		?+11-13	?+11-13
Vert	51-52				50-53[1]	52-55		
SL/BD	3.5-4.3					3.8-4.6[3]	4.0-5.0	4.0-5.0
SL/HL	3.3-3.8					2.7-3.5	4.0	3.0
HL/Sn	3.9-5.0							
HL/eye	5.1-5.9					4.8-5.0[3]		
HL/IO	2.9-3.5	3.6-5.0	3.7-4.5	3.1-3.8	2.8-3.9	3.0-4.8	3.0-3.8	4.0-4.5
HL/LUJ	1.9-2.3							
SL/SnD1	3.2-3.4							
SL/SnD2	2.3-2.5							
SL/SnA	1.8-2.0							
n	14[2]	2	4	89	240	187		
Size range (mm SL)	253.0-370.0	56.0	253-343 (TL)	59.0-?	150-510	128-245[3]		

[1] Counted on 60 specimens out of 240 listed
[2] Measurements taken from 4 specimens
[3] From Blanc, 1961 (only 2 specimens)

Table 3 summarizes the available information throughout the range of *N. coriiceps* (and *neglecta*). Hureau (1970a) compared the meristics of 185 specimens of *N. coriiceps* from Terre Adélie with 19 collected in Kerguelen. He concluded that all specimens belong to one species, but divided them into two subspecies. At present, authors are still undecided on the issue and use both specific and subspecific classification (Anderson 1982, Burchett 1983d, DeWitt & Hureau 1979, Hureau 1973, 1985, Kock *et al.* 1984). In our opinion the existing data do not justify separation into two different species. Subspecific division may also be questioned since the differences between the stocks of Kerguelen on one hand and the Scotia Arc and Antarctica on the other hand are minimal (Table 3). The life cycle of *N. coriiceps* involves a number of life history stages each of which should be studied and compared separately in both areas. Details of the life cycle of this species at PEI are not known. Blankley (1982) studied the feeding habits of juveniles in the kelp zone of Marion Island.

Notothenia rossii Richardson, 1844

Notothenia rossii Richardson 1844: 9, pl. 5, figs. 1-2 (locality unknown).

MATERIAL: RUSI 17826, 284.0 mm SL, Marion Island.

DIAGNOSIS: D VII+33; A 21 (see remarks); P 22; GR 5+12; ULL 49; MLL 16; LSS 66; vertebrae 50. Body depth 4.6 in SL and width 1.1 in depth. Head length 3.2 in SL and head depth 1.8 in its length. Snout length 3.7, eye diameter 5.3, interorbital width 3.1, and internostril distance 6.5 in head length. Pectoral-fin length 4.1 and pelvic-fin length 5.2 in SL. Distances from snout to first dorsal-fin origin 3.1, to second dorsal-fin origin 2.6, to upper pectoral-fin base 2.9, to pelvic-fin insertion 4.4, and to anal-fin origin 1.7 in SL. Scales cycloid; head naked except for two small posterolateral patches of scales on each side, just above posterior section of temporal sensory canal. Upper third of cheek scaled and a patch of scales on upper part of opercle (at level of lateral-line origin) connected dorsally by a single row of scales.

Colour pattern lost.

REMARKS: The number of anal-fin rays is unusually low for *N. rossii* which has a range of 25-31 (Burchett 1983a). An examination of a radiograph of our specimen revealed three deformed areas on the vertebral column. Vertebra no. 32 is enlarged, probably as a result of vertebral fusion and bears 3 neural and haemal spines. Vertebra no. 35 appears to be shortened and twisted, its neural spine adjoins the spine of vertebra no. 34 and its haemal spine adjoins the spine of vertebra no. 36. A similar situation exists in vertebra no. 39 but here the neural spine is closer to that of vertebra no. 40 and the haemal spine lies next to that of vertebra no. 38. Fusion of fin rays and pterygiophores was observed in the anterior half of the anal fin. As a result of this fusion there are 23 anal-fin pterygiophores, of which the first 10 support seven fin rays. The dorsal and anal pterygiophores corresponding to the abnormal vertebrae are normal. The somewhat lower number of vertebrae (50 vs. 51-55 in the literature) is also a result of the abnormal 32nd vertebra.

Nybelin (1947, 1951) observed that the Kerguelen-Macquarie and South Georgia populations of *Notothenia rossii* are somewhat different from each other. His subspecific division of the species into *N. r. rossii* (Kerguelen) and *N. r. marmorata* has been largely accepted by subsequent authors.

Nybelin (1947) was not able to examine any specimens from Kerguelen and Macquarie Islands and compared the specimens he had from South Georgia and South Shetland Islands with the original descriptions of *N. rossii* Richardson, 1844 and *N. coriiceps* var. *maquariensis* Waite, 1916, a synonym of the former. Nybelin (1947) based his division on differences in colour pattern, squamation, pectoral-fin morphology, caudal peduncle proportions and the number of gill-rakers on the lower limb of the first gill arch. In a later work, and subsequent to the examination of more specimens from the Scotia Arc, Nybelin (1951) maintained his subspecific division even though he still did not examine any Kerguelen specimens. However, based on the new material he had examined, Nybelin (1951) acknowledged a wide range of variation in meristic characters and caudal peduncle proportions. DeWitt (1970) followed Nybelin (1947, 1951) in accepting subspecific division, but pointed out the scarcity of reports on specimens from the Kerguelen-Macquarie region. In addition, he rendered the information given by Waite (1916) and Blanc (1951, 1954, 1961) unsuitable for the purpose of comparison. DeWitt (1970), based on two additional specimens from Macquarie Island, expanded the basis for subspecific division by adding a few meristic and proportional differences, with a reservation that they may be attributed to differences in size. Hureau (1970a) examined 111 specimens from Kerguelen, but analysed only two morphometric characters (Table 4). Since the studies of DeWitt (1970) and Hureau (1970a), no further information pertaining to meristics and morphometry of *N. rossii* from the Kerguelen-Macquarie region has been published, let alone a study of the variability of this species throughout its geographical range. Table 4 summarizes published taxonomic data of *N. rossii.* The great difference in the number of specimens studied between the two regions immediately stands out. Although the total number of specimens that have been studied is large, the contribution of these studies to a meaningful comparison is minimal due to the absence of detailed morphometric data. Even if Nybelin's (1947) subspecific division of *N. rossii* may be justified, it is evident that at present the available meristic and morphometric data do not merit such a division. Furthermore, body proportions of *N. rossii* change with growth (Burchett 1983a), necessitating a study of the morphometry of different life history stages in both regions. In addition, a study of *N. rossii* at the other sub-Antarctic islands, between the Scotia Arc and Kerguelen, is essential for the understanding of population differences. The colour differences observed by some authors (Nybelin 1947, DeWitt 1970) refer to intensity rather than pattern, and may be attributed to differences in diet (Hureau 1970a, Tarverdiyeva 1972, Tarverdiyeva & Pinskaya 1980, Burchett 1983b).

Little is known about the occurrence and biology of *N. rossii* at PEI. Apart from the specimen reported above, *N. rossii* was collected at PEI by French expeditions (Duhamel *et al.* 1983). Studies on the biology and life cycle of *N. rossii* in South Georgia (Burchett 1983c) and Kerguelen (Duhamel 1981, 1982) have shown that brown phase fingerlings and juveniles inhabit sheltered bays and the kelp belt in these islands. They have never been collected or observed within the kelp belt at PEI.

Table 4

A summary of meristic and morphometric data of *Notothenia rossii*

	Macquarie (Nybelin 1951) (DeWitt 1970)	Kerguelen (Hureau 1970a)	Marion (this study)	Scotia Arc Juveniles & adults (Burchett 1983a) (Everson 1969) (Freytag 1980)	Scotia Arc Juveniles & adults (Nybelin 1947, 1951) (Norman 1938)
D1	5-7	4-6	7	4-7	4-7
D2	32-34	32-36	33	32-36	32-36
A	27-28	26-29	21[1]	25-30	26-30
P	21-23	21-23	22	20-24	21-23
ULL	40-57		49		45-52
MLL	15-17		16		10-18
LSS	55-57	55-62	66		55-62
GR	6+14		5+12		?+11-14
Vert	51	51-53	50[1]	51-55	
SL/BD	4.7		4.6		3.5-4.6
SL/HL	3.1	3.2-3.7	3.2		3.2-3.7
HL/Sn	3.3-3.7		3.7	3.5	
HL/eye	5.5-6.2		5.3	4.7	3.6-6.5
HL/IO	3.0-3.2	2.7-3.7	3.1	3.6	2.7-3.7
HL/LUJ	2.3-2.4		2.3		
SL/SnD1	3.0-3.3		3.1		
SL/SnD2	2.2-2.5		2.6		
SL/SnA	1.8		1.7		
n	2	111	1	>1000	90
Size range (mm SL)	342-461		284	150-710 (TL)	52-695

[1] see remarks for *N. rossii*

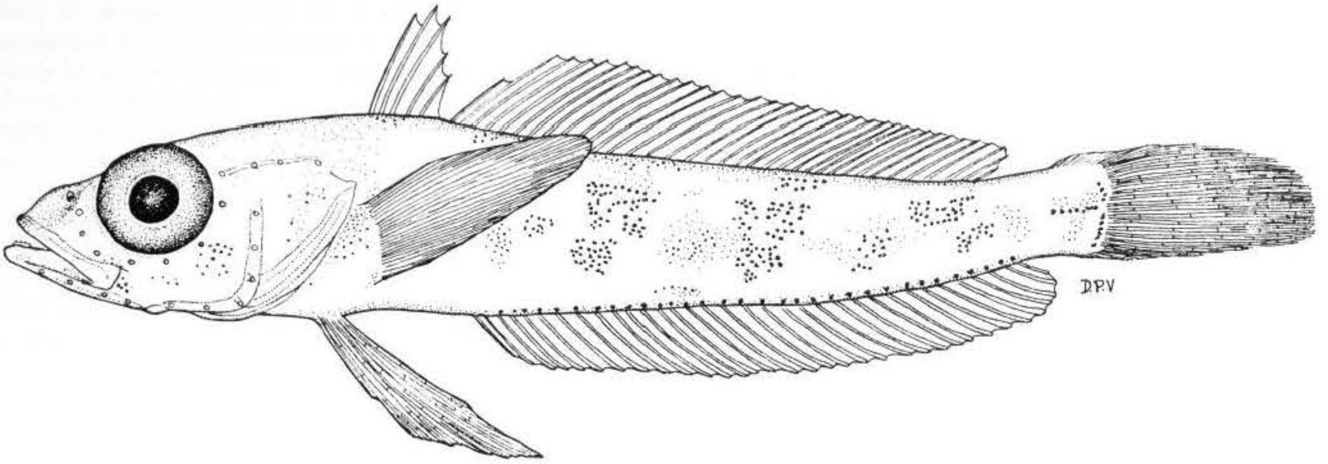

Fig.15. *Nototheniops larseni* RUSI 26210, 45.5 mm SL, juvenile.

Nototheniops larseni (Lönnberg, 1905)
Figure 15

Notothenia larseni Lönnberg 1905: 31, 46, pl. 1, fig. 3; pl. 2, fig. 6 (Shag Rock and South Georgia).

MATERIAL: RUSI 26210, 45.5 mm SL, Marion Island, 46°51'S, 38°04'E, dredge, 170 m, *S.A. Agulhas*, cruise 40, station 16, 23 April 1985; RUSI 27498, 2: 53.7-57.6 mm SL, 46°54.20'S, 46°55.65'E, dredge, 114 m, *S.A. Agulhas*, cruise 50, station 36, 20 August 1987; RUSI uncat., 87.0 mm SL, Marion Island, stomach content of a penguin.

COMPARATIVE MATERIAL: NHRM 3012, 176.0 mm SL, syntype, South Georgia, 5 June 1902; BM(NH) 1937.7.12.116-123, 4 (of 13): 73.1-78.4, South Georgia, off Cape Sounders, 132-148 m, large otter trawl, *Discovery*, station 148, 9 January 1927.

DIAGNOSIS: D V-VI+35-37; A 34-35; P 23-24; GR 6-8+14-16; vertebrae 15+36-37 (=51-52). Proportions are based on two specimens (45.5-53.7 mm SL). Body depth 5.1-5.9 in SL and its width 1.4 in the depth. Head length 3.2-3.3 in SL and head depth 1.7-2.0 in its length. Snout length 4.3-4.5, eye diameter 2.9-3.1, interorbital width 10.4-10.6, and internostril distance 6.3-7.4 in head length. Pectoral-fin length 4.7-5.0 and pelvic-fin length 3.9-4.0 in SL. Distances from snout to first dorsal-fin origin 3.0-3.3, to second dorsal-fin origin 2.5-2.7, to anal-fin origin 2.3, and to pelvic-fin insertion 3.5-3.8 in SL. Scales ctenoid, except for a ventral area in front of pelvic-fin bases in which scales are cycloid.

In alcohol, body colour pale, with faint vertical marks; dark spots present on pectoral-fin base and on cheek.

REMARKS: Balushkin (1976) defined the "*larseni*" group within the genus *Notothenia*, in which he included *Notothenia larseni* Lönnberg, 1905, as well as three new species, *loesha, nybelini* and *tchizh*. Although clearly belonging to the "*larseni*" group, the specimens reported above could not be identified to species with certainty and therefore, are provisionally referred to as *larseni*. Balushkin (1976) pointed out that his key to the species of the "*larseni*" group is of limited use for the identification of small fishes since it is largely based on the presence or absence of scales on the head, particularly on the ventral surface of the lower jaw. All of PEI specimens used in this study are juveniles. Difficulties were experienced while attempting to correlate our specimens with Balushkin's counts and colour. According to Balushkin (1976) each one of the "*larseni*" group species has a distinct pattern of distribution, by which only *N. tchizh* occurs in PEI. Table 5 compares our specimens with data taken from Balushkin (1976), as well as a syntype and four *Discovery* specimens of *N. larseni* from South Georgia. Rather than agreeing with a single species of the group, PEI specimens have different characters matching with different species. In addition, the data from the syntype and the four *Discovery* specimens of *N. larseni* increase the range of counts and body proportions given by Balushkin (1976) for this species, and overlap with most of the characters of the other three species (Table 5). Moreover, the silvery or metallic reflection of fish colours is due to guanine deposits. Depending on fixative, preservative and duration in preservative, as well as other chemical factors such as pH, other pigments break down exposing the guanine. The exposure usually occurs on the breast, between pectoral and pelvic-fin bases, lower half of opercle and cheek, but may also spread to the isthmus and abdomen. It seems that the silvery area on the breasts of the *Discovery* specimens and the larger Marion Island specimen is the outcome of fixation and preservation in the case of the former and, at least partially, digestion in the latter. Evidently, even though Balushkin (1976) may have been correct in creating the "*larseni*" group, further study is necessary in order to confirm the validity of his three new species and to provide better definition of member species within this group.

Efremenko (1983) described and illustrated the early life history stages of *N. larseni*, the postlarvae of which ranged from 48.0-58.0 mm SL. The smallest of PEI specimens is already a juvenile at a length of 45.5 mm SL (Fig. 15). Scales (mostly missing) were present on the body and most of the head, reaching anteriorly to the level of the second pore of the supraorbital sensory canal; the rest of the snout is naked. The only remaining postlarval characters are a row of dark spots along the anal-fin base, buried under the skin and not readily recognized; similar spots present in a vertical row along caudal-fin base and a horizontal row along midline of caudal peduncle.

Paranotothenia magellanica (Forster, 1801)

Gadus magellanicus Forster in Bloch & Schneider, 1801: 10 (seas about Tierra del Fuego).

Notothenia magellenica Richardson 1844: 9 (Tierra del Fuego).

Notothenia macrocephalus Günther 1860: 263 (Falkland Islands).

Table 5
Summary of meristic and morphometric data of *Nototheniops larseni*

	N. larseni Marion Id. (this study)	*N. tchizh*[1]	*N. nybelini*[1]	*N. loesha*[1]	*N. larseni*[1]	*N. larseni*	
						syntype	*Discovery* S.Georgia
D1	5-6	5	5	5	5-6	6	5-6
D2	35-37	37-39	38-40	36-37	37-39	39	38-39
A	34-35	36-37	36-39	34-36	37-38	38	37-38
P	23-24	25-27	22-25	25-27	25-26	25	24-26
GR	6-8+14-16	8-10+15-19	7-9+13-16	8-10+14-16	8-9+16-18	10+17	8-11+17-18
Vert	51-52 (15+36-37)	54 (16-17+37-38)	54-55 (16-17+35-37)	52-53 (16-17+35-37)			54-56
Scales on LJ	absent	absent	absent	present	present	present[2]	
HL(%SL)	31.0-32.7	26.4-28.8	26.5-28.4	28.7-30.2	24.7-27.3	27.9	28.1-29.3
IO(%HL)	9.6	9.0-10.5	5.4-6.7	5.9-7.2	6.4-7.5	8.4	8.1-8.5
Eye(%HL)	32.6-36.5	36.2-40.1	34.7-39.6	37.0-39.9	34.5-36.4	33.7	33.4-34.5
spot on breast	absent[3] present[4]	present	absent	absent	present	present	present
n	4	5	9	5	5	1	4
Size range (mm SL)	45.5-87.0	130-156	132-159	124-146	139-153	176.0	73.1-78.4

[1] From Balushkin (1976)
[2] According to Lönnberg (1905, p. 32)
[3] Smaller specimen.
[4] Larger specimen

MATERIAL: RUSI 18237, 3: 123.7-139.2 mm SL, Prince Edward Island, north side; RUSI 20118, 3: 202.0-216.0 mm SL, Marion Island, Transvaal Bay; RUSI uncat. 5: 235.0-328.0 mm SL, Marion Island; RUSI uncat. 4: 271.0-304.0 mm SL, Marion Island; RUSI 22502, 258.0 mm SL, Marion Island, Transvaal Bay, November 1983.

DIAGNOSIS: D III-V+29-31; A 22-24; P 16-17; GR 4-6+10-13; ULL 36-43; MLL 5-15; LSS 55-62; vertebrae 45-46. Body depth 3.5-3.9 in SL and body width 1.2-1.4 in the depth. Head length 3.4-3.7 in SL and head depth 1.2-1.4 in its length. Snout length 3.8-5.2; eye diameter 3.8-5.1; interorbital width 2.3-2.7, and internostril distance 4.0-4.7 in head length. Pectoral-fin length 3.8-4.3 and pelvic-fin length 5.0-7.0 in SL. Distances from snout to first dorsal-fin origin 2.9-3.2, to second dorsal-fin origin 2.3-2.4, to upper pectoral-fin base 2.9-3.1, to pelvic-fin insertion 3.5-4.0, and anal-fin origin 1.8-2.0 in SL. Scales cycloid to weakly ctenoid; head largely naked, except for a patch of small scales on upper half to two thirds of cheek and on opercle, at level of LL origin. These two patches are not connected.

In alcohol, body dark brown to black above level of pectoral fin and gradually paler below it, becoming white on abdomen, gular region and chin. All fins dark. (Measurements were taken from 6 specimens 123.7-216.0 mm SL).

REMARKS: *Paranotothenia magellanica* is the most abundant inshore species at PEI. The counts and measurements of the 16 specimens used in this study agree with results of Hureau (1970a) and DeWitt (1970). The smaller range of variation in comparison to DeWitt (1970) is probably due to the smaller number of specimens available to us and to the fact that DeWitt's study (1970) covered the entire range of *P. magellanica*. Hureau (1970a) studied aspects of the biology of *P. magellanica* at Kerguelen, including growth, food habits and reproduction. Blankley (1982) studied the food habits of *P. magellanica* at Marion Island. Although the diet at both localities consists of the same prey groups, differences were found regarding the relative importance of certain prey taxons. However, it should be noted that similar to *N. coriiceps* and *N. rossii*, *P. magellanica* has a number of life history stages each of which may have a different diet. In a limited sense, this principle was demonstrated by Blankley (1982). Both authors studied specimens of a wide range of sizes including juveniles as well as adults. Some basic information about the life cycle of *P. magellanica* in Marion Island has been gathered as a by-product of various marine research programmes at PEI. Fingerlings of 44.0-67.0 mm SL were collected on various occasions by plankton nets, during offshore surveys. The specimens were taken between the surface and 100 m depth and constitute a pelagic life history stage with typical colouration of a pelagic fish. It is not known when and at what length fingerlings move into shallow inshore water and transform into juveniles. Underwater observations and gillnet and trap catches showed distinct habitat preferences between juveniles and adults. Juveniles invariably stayed within the 10 m depth zone, mostly between 1-5 m. Adults were collected between 5-40 m, but mostly between 20-40 m. No fishing was attempted at greater depths. It is possible that adult *P. magellanica* venture into deeper water, but their dependence on the *Macrocystis* belt for food implies that an extension of their habitat far beyond the kelp bed is unlikely. Hureau (1970a) studied the reproductive behaviour of *P. magellanica* at Kerguelen and found that adults perform a spawning migration. At PEI, its reproductive behaviour and its early life history stages are unknown. *P. magellanica* is preyed upon by imperial cormorants, *Phalacrocorax atriceps* (Blankley 1981, Espitalier-Noël *et al.* in press) and to a lesser extent by Rockhopper penguins (Brown & Klages 1987). This is similar to the situation at Macquarie Island where small *P. magellanica* were the major food item of the king shag, *Phalacrocorax albiventer purpurascens* (Brothers 1985), and where it occurs in the diet of penguins (Williams 1988).

Otoliths of one partially digested specimen, tentatively identified as *Gobionotothen acuta* Günther, 1880, were found in diet samples from gentoo penguins at Marion Island (Adams & Klages 1987). Duhamel *et al.* (1983) also listed this species from trawls made off the islands (see also Remarks for *G. marionensis* above).

PARALEPIDIDAE

Magnisudis prionosa (Rofen, 1963)

Paralepis atlantica prionosa Rofen 1963: 1 (Antarctic).

REMARKS: A number of otoliths of *M. prionosa* were found in the stomachs of king penguins. Its presence in the area was previously unknown. This species was recently reported from Macquarie Island (Williams 1988). These otoliths were erroneously identified as *Paralepis coregonoides* by Adams & Klages (1987).

Discussion

A total of 13 families and 33 species are currently known from PEI (Table 6). As recently as 1984 only about a third of the species were reported from the islands, which makes their fish fauna one of the most poorly known compared to other islands in the Southern Hemisphere, second perhaps to Gough and Bouvet Islands in the South Atlantic Ocean. Apart from the studies of De Villiers (1976), Blankley (1982) and Hecht & Cooper (1986) on three inshore species, and in contrast to other active and on-going biological research programmes, South African ichthyologists have been unable to study the fishes of PEI. This is due to the lack of a trawling facility on the *S.A. Agulhas*, the South African supply/research vessel that visits the Islands twice a year. Nevertheless, small numbers of fish specimens have been collected fairly regularly by other means and made available to us through various research programmes. Juveniles of a few species were collected by a small dredge during surveys of the Islands' benthos made by the Zoology Department of the University of Cape Town. Recently completed studies on the diets of piscivorous seabirds undertaken by the Percy FitzPatrick Institute of African Ornithology of the University of Cape Town, have revealed a considerable amount of information on the fish fauna, particularly its pelagic component. Diet samples collected from the stomachs of imperial cormorants and four species of penguins: king, gentoo, macaroni and rockhopper, provided partially digested fishes and large numbers of otoliths. These have subsequently been identified to species by the Prey Identification Service of the Port Elizabeth Museum. These studies (Adams & Klages 1987, Adams & Klages in press, Espitalier-Noël *et al.* in press, Brown & Klages 1987, La Cock *et al.* 1984) clearly show the importance of fish as a major food resource for seabird populations of PEI, and their importance to the Islands' ecosystem as a whole. As all five birds forage in the marine environment and occupy different spatial and feeding niches, they sample a variety of depth strata at varying distances from the islands, from the shallow inshore waters to depths of more than 240 m and as far as 300 km off the islands (Cooper 1985, Adams 1987, Adams & Wilson 1987, Brown 1987). One drawback of using birds as biological samplers is the upper prey size they can comfortably handle. Fishes up to 30 cm standard length and a mass of about 0.5 kg appear to be the maximum that the largest avian predator, the king penguin, is able to swallow. Consequently, our knowledge of large fish in this area remains particularly meagre.

As a result of this study, the fish fauna of PEI has emerged richer than previously thought, though still inferior to that of Kerguelen Island. In Table 6 we have compared the fish faunas of the sub-Antarctic islands of the Indian Ocean. It is immediately apparent that no cartilaginous fish are known from Crozet and PEI proper. Recently, however, sharks were collected on the Crozet shelf (G. Duhamel unpublished data). *Raja barnardi* (= *R. leopardus*) was collected at the Kara Dag seamount (Meisner & Kratkii 1979) and *R. taaf* Meisner, 1987, was taken at both Crozet and Kara Dag (G. Duhamel pers. comm.). These captures may support the assumption that the absence of cartilaginous fish records from PEI reflects inadequate sampling rather than a genuine absence.

Although Kerguelen appears to have a much richer fish fauna than Crozet and PEI (Table 6), this may be attributed to the much larger shelf area of the Kerguelen plateau which can support larger populations of more species, and to the commercial fisheries activity and hence higher scientific interest in that area. In addition, as evident from Table 6, myctophid species compose a large part of the species "unique" to Kerguelen (see below). A more objective assessment of the similarity amongst the islands can be obtained by comparing their benthic and bentho-pelagic species. The Crozet and the PEI groups have 21 and 20 species respectively in this category compared to 33 in Kerguelen. There is greater affinity between Crozet and PEI than each one has with Kerguelen. Quantitatively, these relationships were expressed by Odum's (1971) index of similarity:

$$S = \frac{2C}{A+B}$$

where A and B represent the total number of species at each island group and C is the number of species common to both groups. The calculated values were $S_{PE\text{-}Kerguelen} = 0.60$; $S_{Crozet\text{-}Kerguelen} = 0.55$; $S_{PE\text{-}Crozet} = 0.78$. Fourteen of the 33 benthic and bentho-pelagic species found around Kerguelen were not collected in any of the other islands. Of these *Channichthys rhinoceratus* (including *C. velifer*), *Indonotothenia cyanobrancha*, *Harpagifer kerguelensis*, *Nototheniops mizops* and *Paraliparis copei kerguelensis* are currently considered endemic to the Kerguelen area (Andersen 1984, Andriashev 1986, Balushkin 1984, Hureau 1985a,c,d, Hureau *et al.* 1978/79). The others (Table 6), all known from other localities (Antarctic or subtropical/temperate) west of Kerguelen, are inhabitants of the deep sea. The difference in species diversity of bottom fishes between Kerguelen and the other two island groups is probably smaller than is apparent from the index of similarity values above. The latter is biased, to a certain extent, towards Kerguelen due to a larger sampling effort, especially in deep water.

The bottom fish fauna of PEI, as well as the other sub-Antarctic islands is similar in its origin and basic structure to the fauna of the Southern Ocean proper. Antarctic migrants (Nototheniidae, Channichthyidae, Harpagiferidae and Muraenolepidae) dominate the inshore and shelf waters. More northern elements in this zone are represented by the worldwide ranging Rajidae and the families Congiopodidae and Achiropsettidae. In deeper water, the bottom fauna is dominated by widely distributed northern families such as Liparidae, Macrouridae, Moridae, Notacanthidae, Squalidae and

Table 6

Comparison of the fish fauna of the sub-Antarctic islands of the Indian Ocean sector of the Southern Ocean. Based mainly on Anderson (in press), Andriashev (1986), Bekker (1985), Duhamel (1986), Duhamel & Hureau (1982), Duhamel *et al.* (1983), Fischer & Hureau (1985), Hureau (1979) and Meisner & Kratkii (1979)

	PRINCE EDWARD	CROZET	KERGUELEN
ACHIROPSETTIDAE:			
Achiropsetta tricholepis		X	X
Mancopsetta maculata	X	X	X
M. milfordi	X	X	
Pseudomancopsetta andriashevi	X	X	
ALEPISAURIDAE:			
*Alepisaurus brevirostris**	X	X	X
BATHYDRACONIDAE:			
Bathydraco antarcticus			X
CENTROLOPHIDAE:			
Pseudoicichthys australis			X
CHANNICHTHYIDAE:			
Champsocephalus gunnari			X
Channichthys rhinoceratus (=*C. velifer*)	X*		X
CHIASMODONTIDAE:			
Dysalotus cf. *alcocki*	X*		
CONGIOPODIDAE:			
Zanclorhynchus spinifer	X	X	X
EXOCOETIDAE:			
Cheilopogon pinnatibarbatus altipennis	X		
GEMPYLIDAE:			
Paradiplospinus gracilis		X	X
HARPAGIFERIDAE:			
Harpagifer georgianus	X		
H. kerguelensis			X
H. spinosus		X	
LAMNIDAE:			
Lamna nasus			X
LAMPRIDAE:			
Lampris immaculatus			X
LIPARIDIDAE:			
Paraliparis copei kerguelensis			X
Paraliparis operculosus			X
MACROURIDAE:			
Coelorhynchus fasciatus		X	
Coryphaenoides filicauda			X
Cynomacrourus pirieri			X
Macrourus holotrachys	X	X	X
MORIDAE:			
Antimora rostrata	X	X	X
Laemonema kongi	X		
Lepidion sp	X		X
MURAENOLEPIDIDAE:			
Muraenolepis marmoratus	X	X	X
M. orangiensis	X	X	X
MYCTOPHIDAE:			
Diaphus ostenfeldi			X
Diaphus sp	X*		
Electrona antarctica			X
E. carlsbergi	X*		X
E. paucirastra			X
E. subaspera	X*		
Gymnoscopelus bolini	X*		X
G. braueri			X
G. fraseri			X
G. nicholsi	X*		X*

Table 6 *(continued)*

	PRINCE EDWARD	CROZET	KERGUELEN
MYCTOPHIDAE: *(continued)*			
G. piabilis			X
Hintonia candens			X
Krefftichthys anderssoni	X*		X*
Lampanyctus australis			X
L. intricarius			X
Lampichthys procerus			X
Protomyctophum andriashevi			X
P. bolini	X*		X
P. luciferum			X
P. normani	X*		
P. parallelum			X
P. tenisoni	X*		X*
NOTACANTHIDAE:			
Polyacanthonotus challengeri			X
NOTOTHENIIDAE:			
Dissostichus eleginoides	X	X	X
Gobionotothen acuta	X*	X	X
G. marionensis	X	X	
Indonotothenia cyanobrancha			X
Lepidonotothen squamifrons	X	X	X
Notothenia coriiceps	X	X	X
N. rossii	X	X	X
Nototheniops larseni	X**	X	X
N. mizops			X
Paranotothenia magellanica	X	X	X
PARALEPIDIDAE:			
Magnisudis prionosa	X*		
Notolepis coatsi			X
RAJIDAE:			
Bathyraja eatonii			X
B. irrasa			X
B. murrayi			X
Raja taaf		X	
SQUALIDAE:			
Etmopterus lucifer			X
Somniosus microcephalus			X
ZOARCIDAE:			
Lycodapus antarcticus		X	X
Lycenchelys hureaui			X
Melanostigma gelatinosum			X
M. vitiazi		X	
		X	
TOTALS			
No. families	13	11	21
No. species	33	25	59

*Based on otoliths and/or specimens recovered from stomachs of fishes and penguins
**Including *N. tchizh* Baluskin, 1976.

Zoarcidae. There is little doubt that the most successful migrants into the waters of the sub-Antarctic islands of the Indian Ocean, both in diversity and abundance, are the Nototheniidae. Recently, Williams (1988) made a similar observation on the benthic fishes of Macquarie Island.

The pelagic component of the Indian sub-Antarctic fauna is almost exclusively dominated by families of non-Antarctic origin, the only exception being perhaps juveniles of the nototheniid *Dissostichus eleginoides*. The families Gempylidae, Myctophidae and Paralepididae are well established south of the Antarctic Polar Front, having species that reach their northern limit at the Indian sub-Antarctic and a few that venture further north along eastern boundary currents. These species have pan-Antarctic distribution (sensu Andersen 1984) and include *Paradiplospinus gracilis*, *Electrona antarctica*, *Gymnoscopelus braueri*, *G. nicholsi*, *Krefftichthys anderssoni* and *Protomyctophum bolini* (Bekker 1985, Bekker & Evseenko 1987, Hulley 1981, McGinnis 1982). Although a greater number of myctophid species have been reported from Kerguelen than from any other island, the occurrence of many of these species in Macquarie Island waters (Williams 1988) and recent studies across frontal zones in the south Indian Ocean (Bekker 1985, Hulley *et al.* in press) as well as transects across similar latitudes in the south-central Pacific Ocean (Bekker & Evseenko 1987) show that most, if not all, of these species have circumglobal distribution.

Since Nybelin (1947) subdivided *Notothenia rossii* into *N. r. rossii* and *N. r. marmorata* and separated *N. neglecta* from *N. coriiceps*, splitting to subspecies and breaking of widely distributed species to a number of geographically more restricted species has been attempted in species of *Harpagifer* (Nybelin 1947, Hureau *et al*. 1978/79), *Lepidonotothen squamifrons* and *Nototheniops larseni* (Permitin & Sazonov 1974, Balushkin 1976). Surprisingly, and in spite of known intraspecific variation, these changes were accepted with little questioning. We have shown above (see individual species accounts and Tables 3-5) that these divisions are at least questionable, if not taxonomically unjustified, largely due to great inequality in sample size between the sub-Antarctic and other samples, or inadequate samples in general. Furthermore, even in the case of *N. rossii* in which all samples were statistically acceptable, data from Kerguelen (Hureau 1970a) and the Scotia Arc islands are identical (Table 5).

In conclusion, we recommend that specific names be kept, without further divisions, for *N. rossii, N. coriiceps, L. squamifrons, N. larseni* and *Harpagifer georgianus* until such divisions are justified by new, more substantiated evidence. In addition, taking into account that meristic and morphometric data exist in the literature for about five specimens of *Gobionotothen acuta*, the taxonomic status of this species and *G. marionensis* should be re-evaluated. Considering the logistic difficulties in covering the complete range of the species mentioned above we suggest that such studies be done under the auspices of an international programme such as BIOMASS.

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