

K.-H. Kock
(FRG)

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PRELIMINARY RESULTS OF INVESTIGATIONS OF THE FEDERAL REPUBLIC OF GERMANY ON
NOTOTHENIA ROSSII MARMORATA (FISCHER, 1885) IN JANUARY/FEBRUARY 1985

Abstract

A bottom trawl survey carried out by FRV "Walther Herwig" in January/February 1985 was used to collect further basic data needed for stock assessment purposes, to assess the actual size of Notothenia rossii around South Georgia and Elephant Island and the extent to which the measures adopted by CCAMLR to rebuild the stock around South Georgia might be successful. Although reported catches in recent years have been low, N. rossii around South Georgia is still largely affected by the fishery. Stock size is probably still less than 10% of the pristine stock. Mean length in the catches has only slightly increased since 1981/82 and is still close to length at sexual maturity. The major part of the population consisted of age classes V - VIII. It seems doubtful if the conservation measures adopted in 1984 will really help to rebuild the stock around South Georgia.

RESULTATS PRELIMINAIRES DES ETUDES DE LA REPUBLIQUE FEDERALE D'ALLEMAGNE
SUR NOTOTHENIA ROSSII MARMORATA (FISCHER,1885) EN JANVIER/FEVRIER 1985

Résumé

Une étude par chalut de fond menée par le navire de pêche et de recherche "Walther Herwig" en janvier/février 1985 a permis de relever de nouvelles données de base à des fins d'évaluation de stock, pour permettre l'évaluation de la taille de Notothenia rossii autour de la Géorgie du Sud et de l'Ile Eléphant. Le but était aussi d'évaluer le succès éventuel des mesures adoptées par la CCAMLR pour reconstruire le stock autour de la Géorgie du Sud. Bien que les prises déclarées ces dernières années aient été faibles, N. rossii autour de la Géorgie du sud est encore grandement touché par la pêche. Sa biomasse est probablement encore inférieure à 10% du stock originel. La longueur moyenne des prises n'a que légèrement augmenté depuis 1981/82 et est encore proche de la longueur à la maturité sexuelle. La majeure partie de la population comprenait les classes d'âge V - VIII. Il semble peu probable que les mesures de conservation adoptées en 1984 permettront effectivement de reconstruire le stock autour de la Géorgie du Sud.

ПРЕДВАРИТЕЛЬНЫЕ РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ NOTOTHENIA ROSSII MARMORATA (Фишер, 1885), ПРОВОДИВШЕГОСЯ В ЯНВАРЕ-ФЕВРАЛЕ 1985 г. ФЕДЕРАТИВНОЙ РЕСПУБЛИКОЙ ГЕРМАНИИ

Резюме

Проводившаяся в январе-феврале 1985 г. с НИС "Вальтер Хервиг" съемка донным тралом использовалась для сбора дополнительных основных данных, требуемых в целях оценки запасов, чтобы определить фактический размер запаса Notothenia rossii в районе о-вов Южная Георгия и Элефант, а также степень успешности мер, утвержденных АНТКОМ'ом с целью восполнения запаса в районе Южной Георгии. Хотя полученные за последние годы данные говорят о низком вылове, промысел все же в большой мере оказывает влияние на запас N. rossii в районе Южной Георгии. Вероятный размер запаса все еще меньше 10% первоначальной величины. Средняя длина особей в уловах с 1981/82 г. увеличилась только очень незначительно и все еще близка к длине при половозрелости. Основная часть популяции состоит из годовых классов V-VIII. Представляется сомнительным, чтобы меры по сохранению, утвержденные в 1984 г., действительно помогли восстановить запас в районе о-ва Южная Георгия.

RESULTADOS PRELIMINARES DE LAS INVESTIGACIONES DE LA REPUBLICA FEDERAL DE ALEMANIA SOBRE NOTOTHENIA ROSSII MARMORATA (FISCHER, 1885) EN ENERO/FEBRERO DE 1985

Extracto

Se utilizó una inspección de arrastre de fondo efectuada por el FRV "Walther Herwig" en enero/febrero de 1985 para recolectar más datos básicos necesarios para fines de evaluación de reservas, para poder evaluar el tamaño mismo de Notothenia rossii alrededor de Georgia del Sur y de la Isla Elefante y para evaluar hasta que punto podrían tener éxito las medidas aprobadas por CCAMLR para restablecer las reservas alrededor de Georgia del Sur. A pesar de que los informes de las capturas en los últimos años las indican bajas, N. rossii alrededor de Georgia del Sur, sigue siendo afectada en gran parte por la pesca. El tamaño de la reserva probablemente sigue siendo menos del 10% de la reserva original. El largo

medio en las capturas sólo ha aumentado levemente desde 1981/82 y sigue aproximándose a la talla de madurez sexual. La mayor parte de la población consistía de clases de edad V-VIII. Parece dudoso que las medidas de conservación aprobadas en 1984 ayuden realmente a reconstruir la reserva alrededor de Georgia del Sur.

1. Introduction

The Westantarctic subspecies of the marbled notothenia, Notothenia rossii, marmorata, is present around the islands of the Scotia arc (FREYTAG, 1980). Before the onset of large scale commercial exploitation at the end of the 1960s the species was probably one of the most abundant (if not the most abundant) fish species around South Georgia: large near surface concentrations had already been noted by sealers in the early 19th (FANXING, 1833) and whalers in the early 20th centuries (LÖNNBERG, 1906). Dense concentrations occurring regularly off Elephant Island had been reported in the course of the Antarctic Expedition 1975/76 of the Federal Republic of Germany (KOCK, 1978). They were probably commercially fished there in 1979/80 for the first time. Stock sizes around the South Orkney Islands and South Sandwich Islands are obviously much smaller. Concentrations were only reported from the shelf east of Laurie Island in 300 - 400 m depth (ANON, 1984).

Preliminary stock assessments (BIOMASS, 1980; KOCK, DUHAMEL & HUREAU, 1985) based on rather incomplete material up to 1981/82 show that the populations around South Georgia and off Elephant Island have been greatly affected by the fishery and have obviously been reduced to a small fraction of their original sizes.

In September 1984 during its annual meeting CCAMLR established the following measures to help rebuild the spawning stocks around South Georgia principally Notothenia rossii:

- Prohibition of fishing other than for scientific purposes in waters within 12 nautical miles of South Georgia.
- Minimum mesh sizes of 120 mm for directed fishing on Notothenia rossii.

A prohibition of any directed fishing on N. rossii for a number of years, however, which would have been the most suitable option to restore the spawning stock, was not accepted. Fishing vessels are only requested to refrain from directed fishing for the species and to avoid its by-catch in directed fishing for other species in the 1984/85 season.

A bottom trawl survey carried out by FRV "Walther Herwig" in the Scotia arc region in late January/February 1985 gave us the opportunity to collect further basic data needed for stock assessment purposes, to assess the actual state of the stocks around South Georgia and Elephant Island and to indicate the extent to which the measures adopted by CCAMLR to rebuild the stock around South Georgia might be successful. As part of the material collected off Elephant Island is still under investigation this paper deals mainly with the South Georgia stock.

2. Material and methods

Before the survey the area had been stratified into the three depth zones 50 - 150 m, 151 - 250 m and 251 - 500 m based on data in EVERSON (1984). The number of hauls was allotted in proportion of the area of each depth stratum and weighted by the abundance from previous surveys.

Material was collected from 73 hauls around South Georgia (29 January - 10 February) and 37 hauls off Elephant Island (21 - 28 February) using a 200' bottom trawl with a small meshed liner of 20 mm (figs. 1,2).

Total length of the specimens was measured to the nearest cm below, total weight to the nearest 50 g below. Maturity stages were determined according to EVERSON's (1977) five point-scale. Age determination was carried out by means of scales following methods and results of FREYTAG (1980). Fish stock biomass was estimated by the "swept area" method (see KOCK, 1985).

For estimating size at sexual maturity fish have been grouped in 2 cm groups. Total length and age versus proportion mature for each sex (L_{50} , A_{50}) seem to conform the logistic equation

$$p = \frac{1}{1 + e^{-(a+bL)}}$$

where

- p = estimated proportion of mature fish
- L = total length
- a = coefficient
- b = coefficient for the steepness of the logistic curve
(Ni & Sandeman, 1984)

3. Results

3.1 The catches

Around South Georgia catches were mainly confined to the east and southeast of the island where yields varied between 2 and 5100 kg/30 min. The best catches were taken south off Cooper Island (Stations 81, 83) with 1.4 and 5.1 t. In other parts of the shelf only single specimens were caught (fig. 3).

Off Elephant Island N. rossii concentrated west and north of the island where catches from 1 to 1736 kg/30 min could be obtained. Only single specimens were found in other parts of the shelf.

3.2 Biomass estimate

The biomass estimate (table 1) is considerably influenced by the patchy distribution of the species in relation to the small number of hauls, although it has been tried to reduce the variance by restratification of the surveyed area according to the observed differences in abundance (KOCK, 1985a). Even if the estimated stock size might not be very accurate it may indicate the order of magnitude. It can thus be concluded that the biomass of the offshore part of the population is still very low and only a small fraction of the estimated pristine stock size of about 500,000 t (EVERSON, 1977). Evaluation of the stock size off Elephant Island has not been carried out yet.

3.3 Length composition

Around South Georgia length varied from 34 to 73 cm. The bulk of specimens measured 45 - 55 cm (fig. 4). Mean length was 49.9 cm (males: 50.2 cm, females: 51.2 cm).

The length frequency distribution off Elephant Island differed considerably from that of South Georgia: individuals of 40 - 50 cm predominated (fig. 4). Minimum length was 34 cm. No specimen larger than 58 cm had been observed. Mean length was 44.7 cm (males: 44.1 cm, females: 45.3 cm).

3.4 Length - weight relationship

Evaluation of the length - total weight relationship $W_t = a L^b$ was based on the entire length range sampled but the length range of 45 - 55 cm predominated (fig. 5). The equation

$$W = 0.014752 * L^{2.9886}$$

(n = 429, r = 0.96)

falls, however, within anticipated limits from other equations (KOCK, DUHAMEL & HUREAU, 1985, tab. 3).

3.5 Age composition

Results of age determination were similar to those of FREYTAG (1980) and BURCHETTI (1983) (see KOCK, DUHAMEL & HUREAU, 1985, tab. 14). Mean length at age and mean weight at age is set out in table 2. Age classes IV - XIII were present in the stock. Age groups V - VIII, however, predominated (table 3). Due to the lack of data from age classes 0 - III (IV) and those older than IX, data were not fitted to a growth curve.

3.6 Length and age at sexual maturity (L_{50}, A_{50})

Lengths at sexual maturity for South Georgia and Elephant Island and age at sexual maturity for South Georgia are set out in table 4.

Data base for the estimation of L_{50} for males from South Georgia and females from Elephant Island was small (fig. 6-8). Values in table 4 are approximations and thus given a brackets. Length at sexual maturity in our material was smaller than that estimated by SCHERBICH (1976) in the first years of commercial exploitation. Our data are close to those reported by DUHAMEL (1982) for the Kerguelen subspecies *Notothenia rossii rossii*.

Maturity in males is reached at a smaller size and about one year earlier than in females.

3.7 Recruitment to the offshore stock

The largest specimens in the inshore (= fjord) stock observed by BURCHETT (1983) were about 44 cm long, the bulk, however, measured less than 40 cm. Recruitment to the offshore part of the population starts at about 35 cm although few individuals less than 40 cm are caught (fig. 4). Due to the lack of quantitative information on recruitment from both parts of the population in the 84/85 season $L_r = 40$ cm may be taken as reasonable approximation for further analyses. Most of the specimens are then about 5 years old (table 3). Age class VI seems to be the first fully (more than 95 %) recruited age class. Age at recruitment t_r may thus be in the order of about 5 years.

4. Discussion

From our results it is obvious that N. rossii around South Georgia is still largely affected by the fishery although reported catches in recent years (1980/81 - 1982/83) have been low (KOCK, DUHAMEL & HUREAU, 1985, Table 30):

- a. Stock size is probably still less than 10% of the pristine stock estimated by EVERSON (1977)
- b. Mean length in the catches has only slightly increased (by about 2 cm) since 1981/82 and is still close to length at sexual maturity
- c. As in 1981/82 the major part of the population consisted of age classes V - VIII (on the premises that age determinations by SLOSARCZYK et al., 1984 and ours are comparable). This may indicate that the stock has changed little within a 3 years period even under low fishing pressure
- d. It is not known if the decrease in length at sexual maturity might be a response of the species to the heavy depletion of the stock or if it might be merely an artefact in the determination of maturity stages by different authors or from the different amount of material investigated.

It seems doubtful if the conservation measures set in force by CCAMLR from September 1985 onwards will really help to rebuild the stock of N. rossii.

Feeding grounds and spawning grounds, as far as they are known are mostly located outside 12 nautical miles of the island, so little effect can be expected from that measure. An increase of minimum mesh size to 120 mm may increase size at first capture. The 50 % retention length of 160 mm mesh size, however, is probably in the order of 43 - 46 cm (see ANON., 1984, p. 30). It can thus be assumed that a codend of 120 mm will still retain nearly all specimens sampled by the net.

It is obvious that the best option to restore the stock of N. rossii around South Georgia would be to stop any directed fishing on the species for a number of years. An alternative approach might be to close certain areas for the fishery, where it is known that N. rossii concentrate. One of these areas might be the region south and southeast of Cooper Island where we observed concentrations during all our surveys in 1975/76, 1977/78 and 1984/85.

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Table 1: Mean trawlable biomass (t), standard deviation (s_d) of the mean and mean density D_r of Notothenia rossii around South Georgia in January/February 1985

No. of hauls	50 - 150 m			No. of hauls	151 - 250 m			No. of hauls	251 - 500 m			total	
	Mean trawl. biomass (t)	s_d (%)	D_r (t/nm ²)		Mean trawl. biomass (t)	s_d (%)	D_r (t/nm ²)		Mean trawl. biomass (t)	s_d (%)	D_r (t/nm ²)	Mean trawl. biomass (t)	s_d (%)
18	177	120.4	0.1	34	4026	101.1	0.97	21	6577	142.1	-	12781	99.9

Table 2: Mean length (cm) and weight (g) of Notothenia rossii from South Georgia in January/February 1985

age class	n	mean length (cm)	mean weight (g) (1)	(2)
4	6	39.8	900	892
5	56	44.4	1236	1237
6	112	47.3	1503	1494
7	97	51.6	1950	1938
8	58	55.4	2432	2396
9	25	58.5	2758	2820
10	7	62.5	3514	3436
11	3	66.2	3916	4080
12	4	66.0	4450	4043
13	1	73.5	5800	5577

(1) direct measurement

(2) from length - weight - relationship $W = 0.014752 \cdot L^{2.9886}$

Table 4: Length and age at sexual maturity (L_{50} , A_{50}) in
Notothenia rossii

	South Georgia		Elephant Is.	Kerguelen
	(KOCK, this paper)	(SCHERBICH, 1976)	(KOCK, this paper)	DUHAMEL, 1982)
L_{50} (cm) ♂	(42.2)	49.1	42.2	43.0
^o +	46.9	51.0	(49.0)	48.5
A_{50} (years) ♂	(4.8)	-	-	5.5
^o +	6.3	-	-	6.5

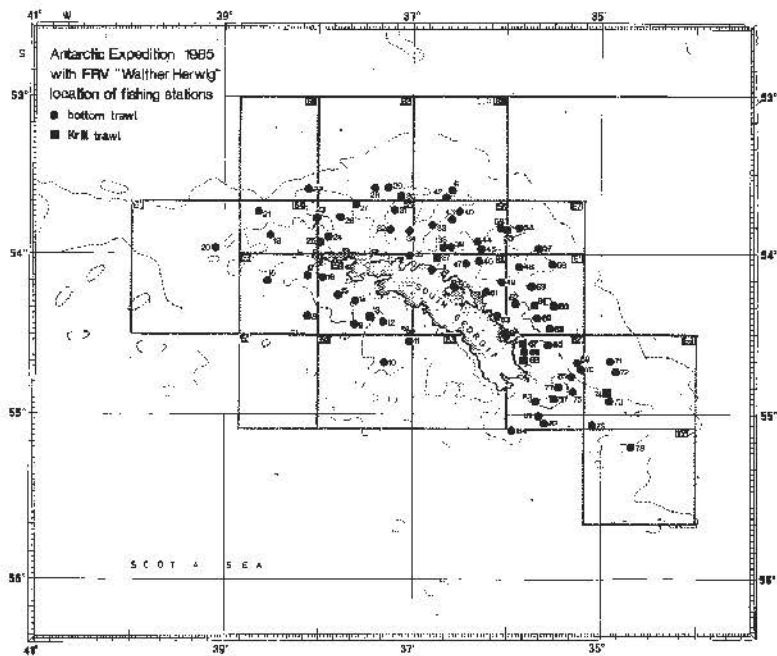


fig. 1: Location of fishing stations around South Georgia

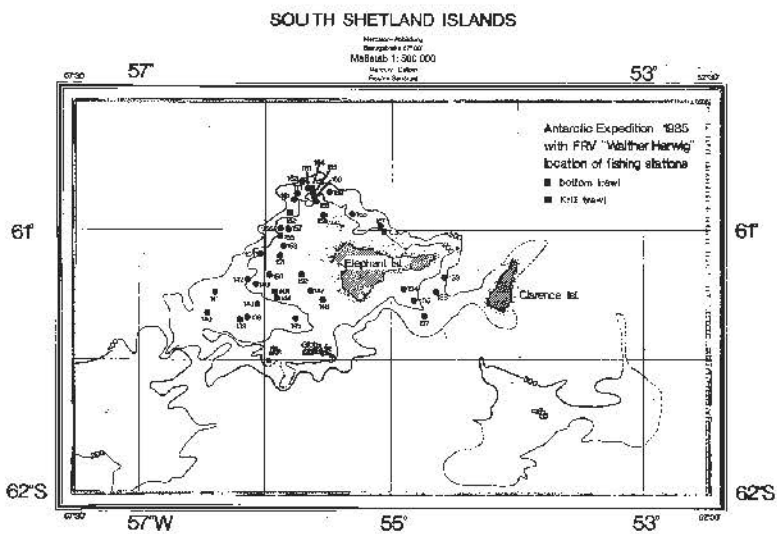
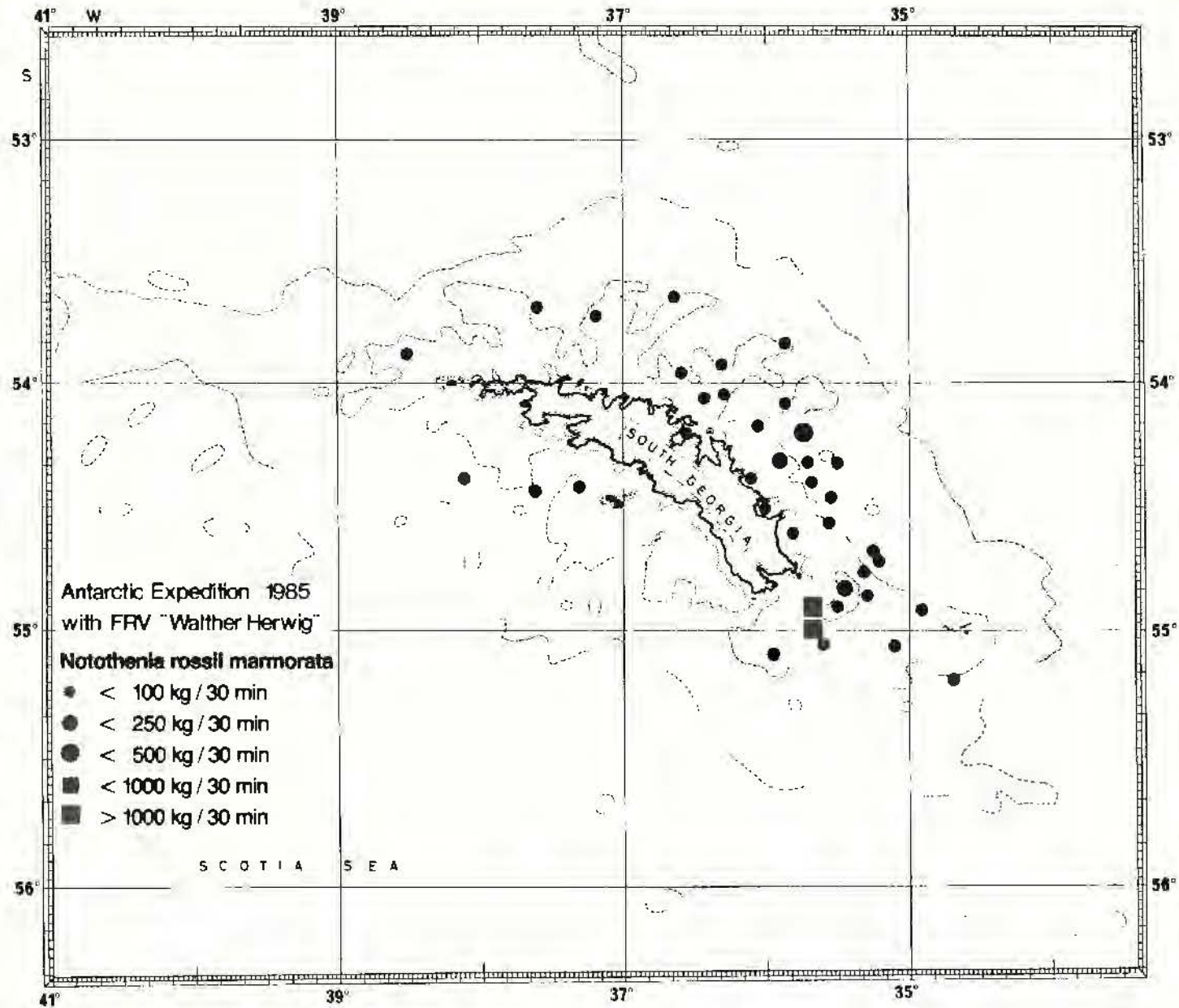


fig. 2: Location of fishing stations around Elephant Island

FIG. 3: Catches of *Notothenia rossii* around South Georgia



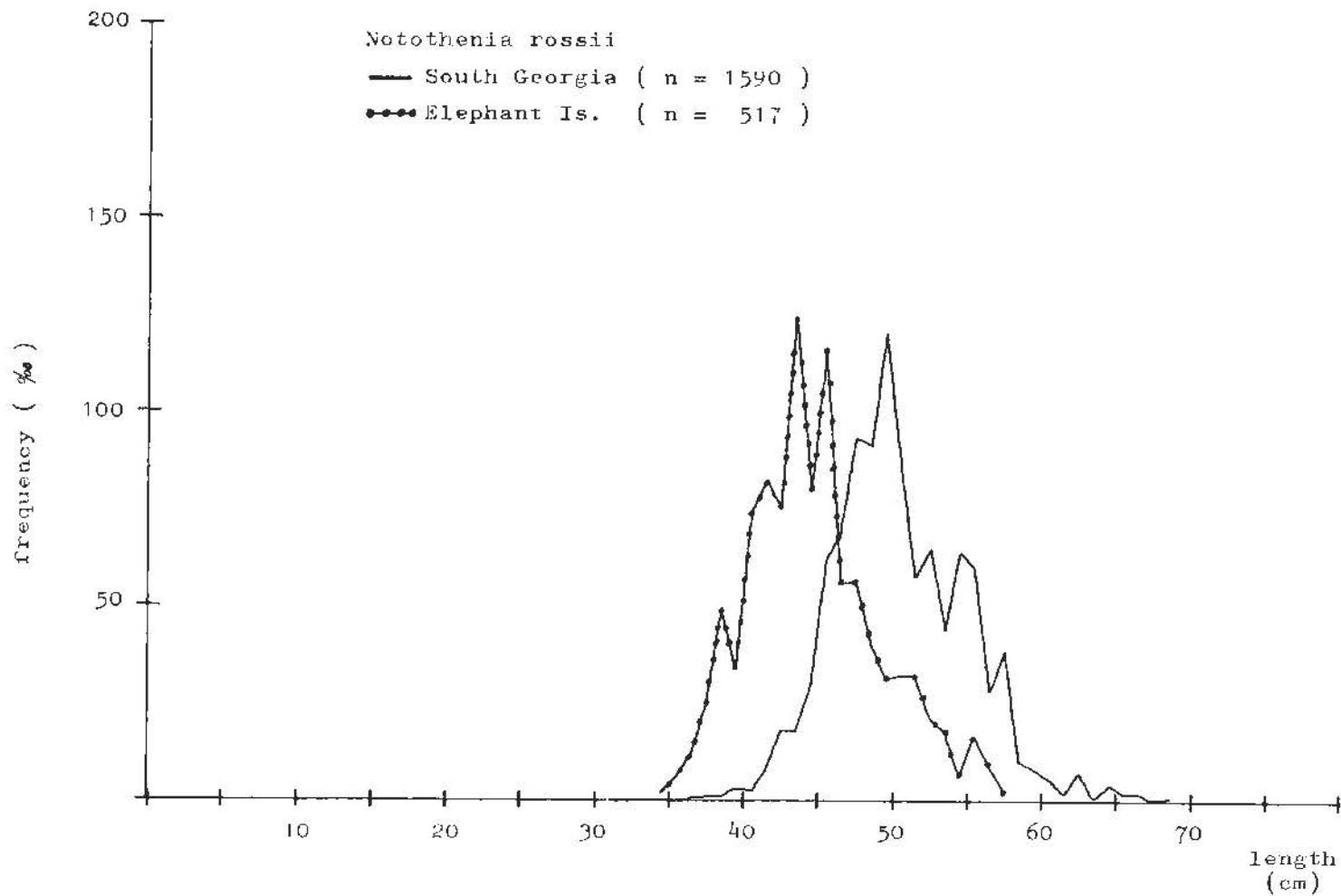


Fig. 4: Length frequency distributions of Notothenia rossii from South Georgia and Elephant Island

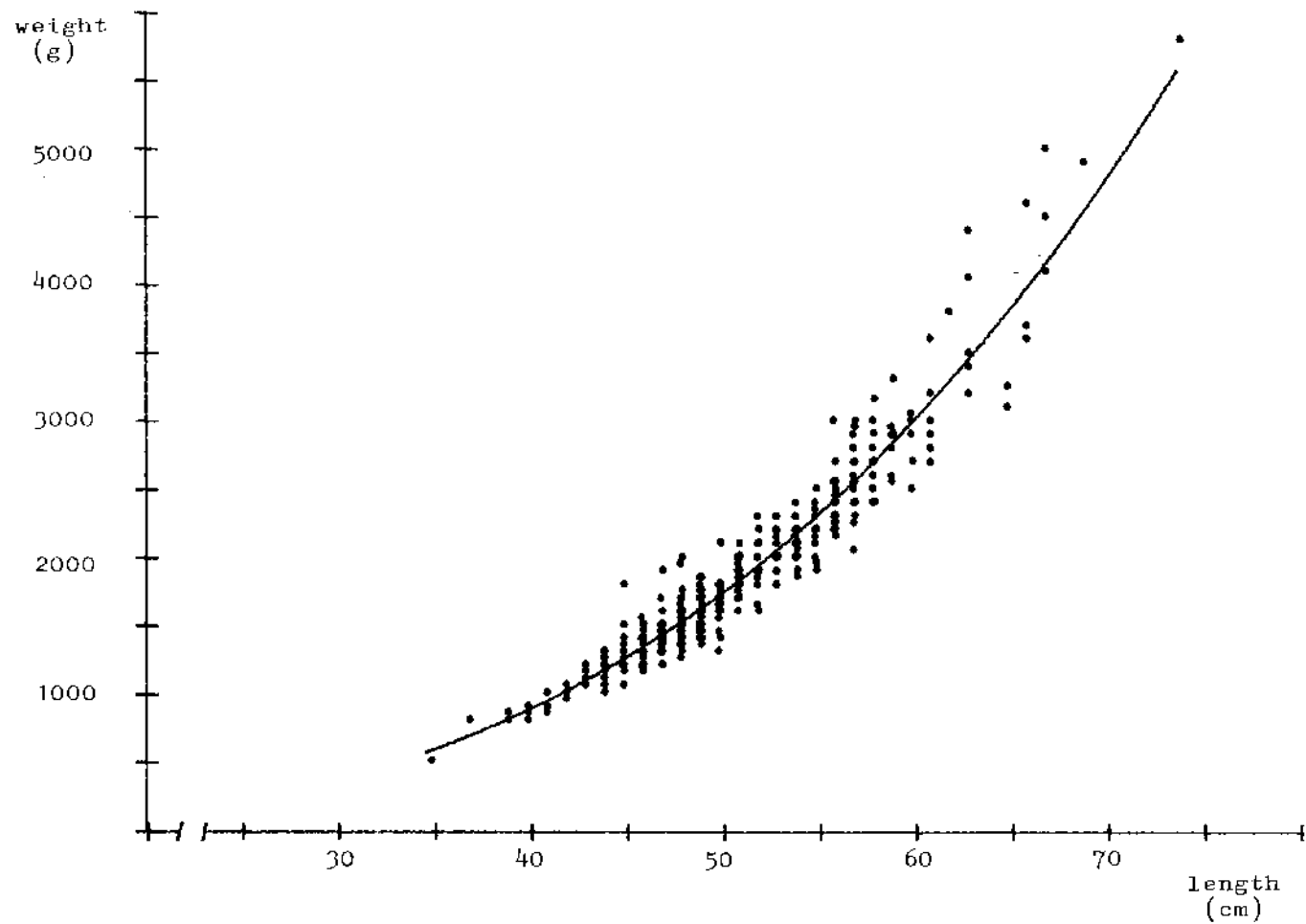


Fig. 5: Length - weight relationship for Nototothenia rossii from South Georgia .

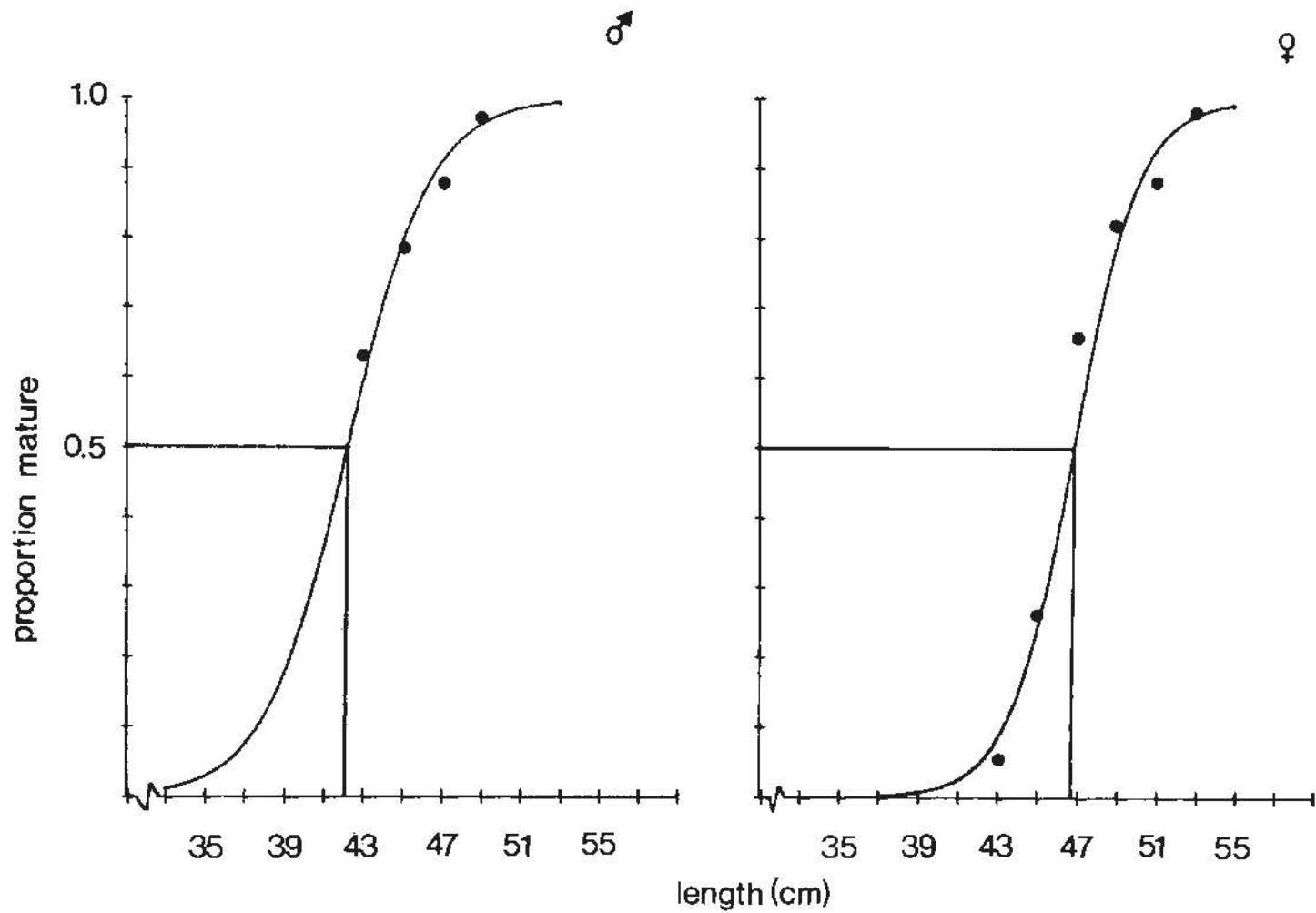


fig. 6: Length at sexual maturity in Notothenia rossii from South Georgia

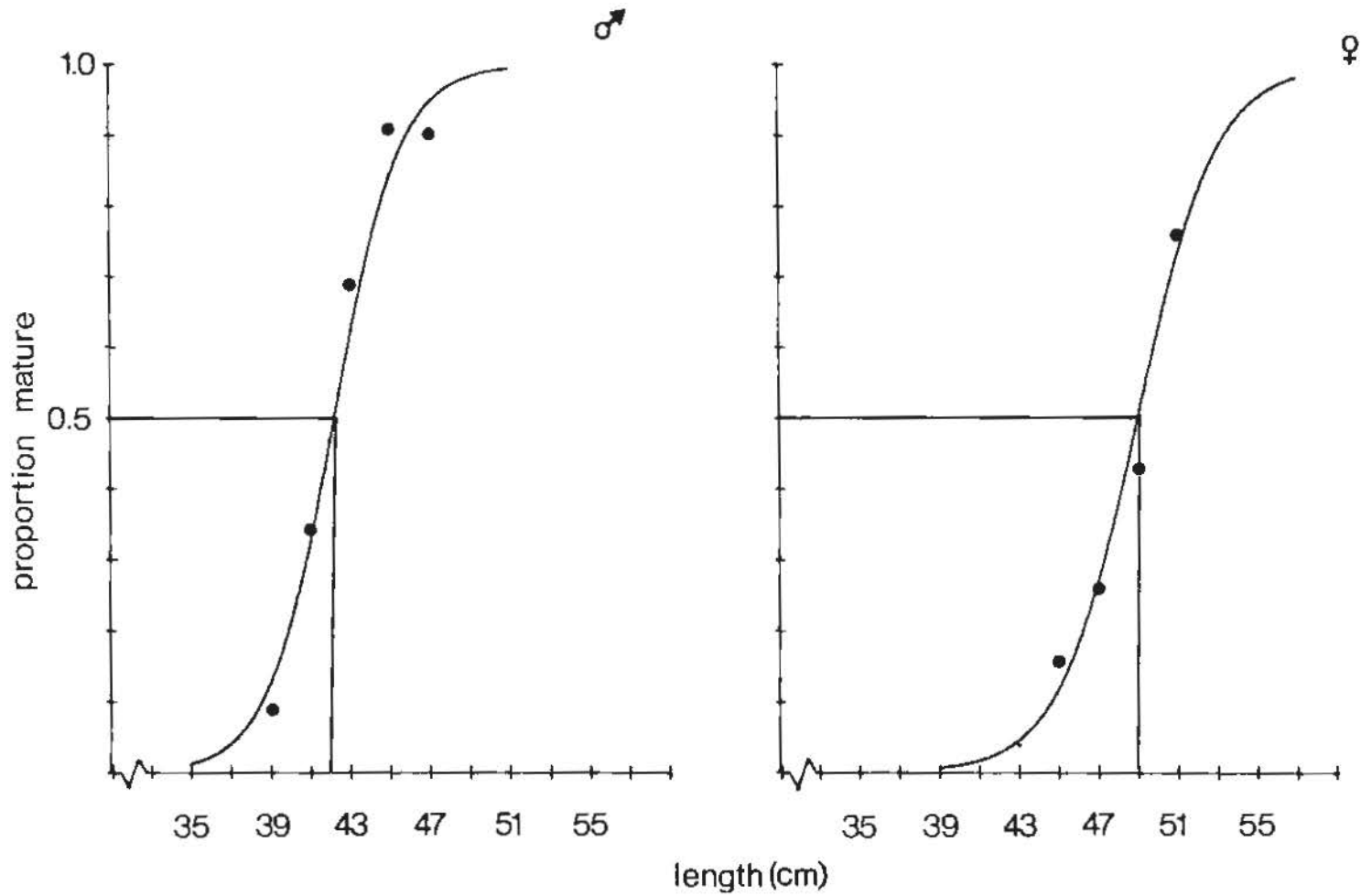


fig. 7: Length at sexual maturity in *Notolthenia rossii* from Elephant Island

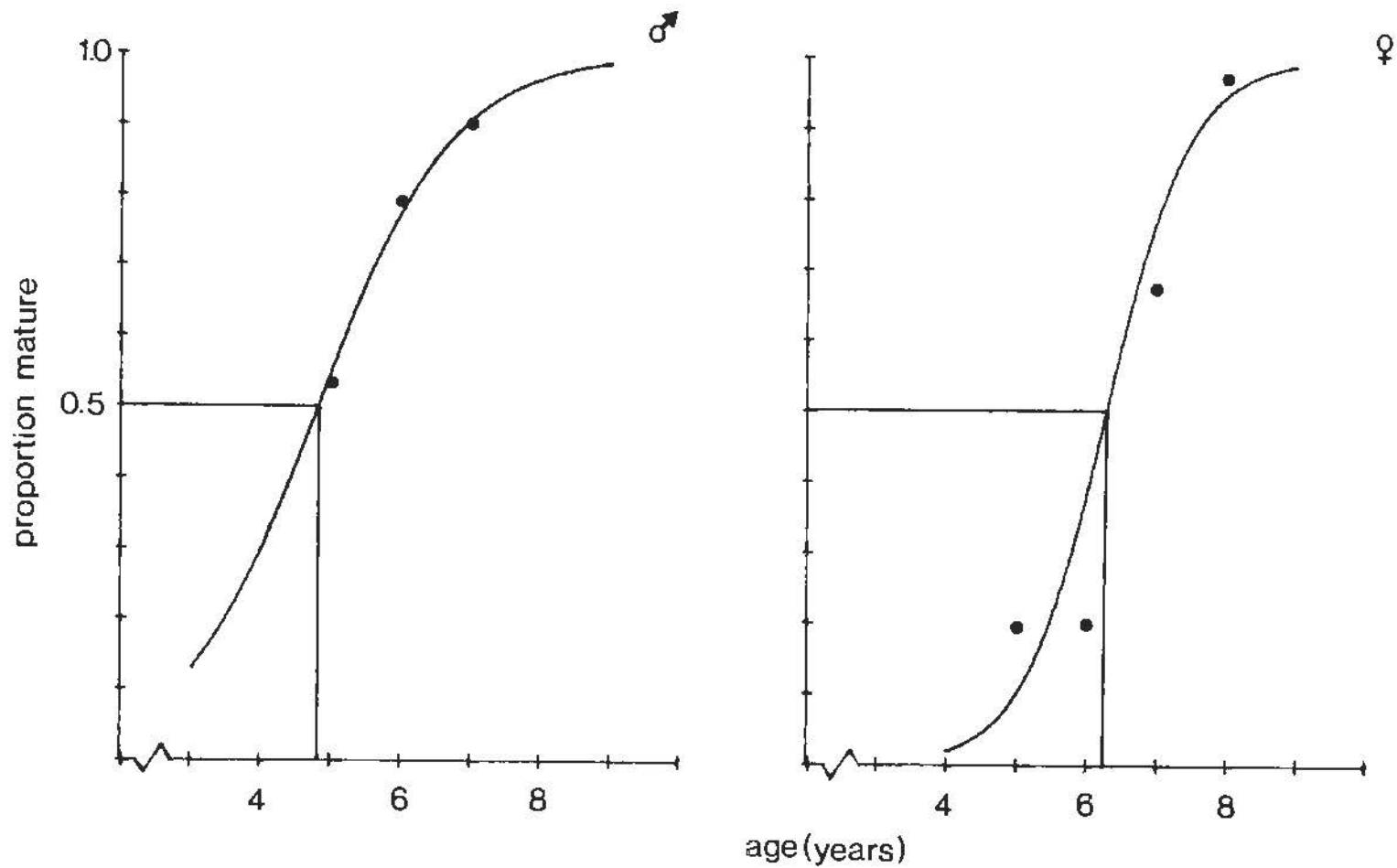


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- Gráfico 7: Talla a la madurez sexual de Notothenia rossii provenientes de la Isla Elefante.
- Gráfico 8: Edad a la madurez sexual de Notothenia rossii provenientes de Georgia del Sur.

