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ESTIMATES OF FISH STOCK BIOMASS AROUND SOUTH GEORGIA IN JANUARY/FEBRUARY 1985

Abstract

Catch data from a bottom trawl survey in January/February 1985 have been used to estimate stock sizes of the commercially exploited Notothenia rossii, N. guntheri, N. gibberifrons, Dissostichus eleginoides, Champsocephalus gunnari, Chaenocephalus aceratus and Pseudochaenichthys georgianus around South Georgia. Due to the small data base and the scarcity of comparative information the state of N. guntheri and D. eleginoides stocks is difficult to assess. The by-catch species N. gibberifrons, Ch. aceratus and Ps. georgianus have been considerably affected by the fishery. Stock sizes of N. gibberifrons and Ps. georgianus were at a level of about 25 - 40% of that of the pristine state. The stocks most greatly affected by fishing are still N. rossii and C. gunnari. Biomass estimates indicate a reduction in stock size to 10 - 20% of that estimated before the onset of heavy fishing. In C. gunnari the fishery is dependant on the abundance of the recruiting year class. Conservation measures adopted by CCAMLR in 1984 are discussed. Their effect on a recovery of the stocks seems, however, doubtful.

ESTIMATIONS DE LA BIOMASSE DE POISSONS AUTOUR DE LA GEORGIE DU SUD EN JANVIER/FEVRIER 1985

Résumé

Les données de prises à partir d'une étude par chalut de fond en janvier/février 1985 ont servi à évaluer la biomasse, autour de la Géorgie du sud, des espèces suivantes exploitées sur le plan commercial: Notothenia rossii, N. guntheri, N. gibberifrons, Dissostichus eleginoides, Champsocephalus gunnari, Chaenocephalus aceratus et Pseudochaenichthys georgianus. Vu la petite base de données et le peu de renseignements comparatifs, il est difficile d'évaluer l'état des stocks de N. guntheri et D. eleginoides. Les espèces prises accidentellement, N. gibberifons, Ch. aceratus et Ps. georgianus, ont été considérablement affectées par la pêche. Le niveau de la biomasse de N. gibberifrons et Ps. georgianus était d'environ 25-40% du niveau originel. Les stocks les plus sérieusement touchés par la pêche sont encore N. rossii et C. gunnari. Les estimations de biomasse indiquent une réduction de 10-20% du stock

évalué avant le début de la pêche intensive. Dans le cas de C. gunnari, l'abondance de la classe d'âge recrutée est primordiale pour la pêche. Les mesures de conservation adoptées par la CCAMLR en 1984 font l'objet d'une discussion. On peut cependant douter de leur effet sur le repeuplement des réserves.

ОЦЕНКА БИОМАССЫ РЫБНЫХ ЗАПАСОВ В РАЙОНЕ О-ВА ЮЖНАЯ ГЕОРГИЯ В ЯНВАРЕ-ФЕВРАЛЕ 1985 г.

Резюме

Данные уловов, полученные путем проведения в январе-феврале 1985 г. съемок донным тралом, использовались для оценки величины запасов Notothenia rossii, N. guntheri, N. gibberifrons, Dissostichus eleginoides, Champsocephalus gunnari, Chaenocephalus aceratus и Pseudochaenichthys georgianus, подвергавшихся коммерческому вылову. Вследствие небольшой базы данных и скудости сведений для сравнения трудно придти к оценке состояния запасов N. guntheri и D. eleginoides. Промысел оказал значительное влияние на запасы видов N. gibberifrons, Ch. aceratus и Ps. georgianus, входящих в состав прилова. Размер запасов N. gibberifrons и Ps. georgianus находятся на уровне около 25-40% первоначальной величины. Запасы N. rossii и C. gunnari продолжают оставаться подверженными влиянию промысла. Оценки биомассы указывают на снижение размера запасов до 10-20% предполагаемой величины до начала интенсивного промысла. Промысел C. gunnari зависит от численности годового класса пополнения. Обсуждаются меры по сохранению, утвержденные АНТКОМ'ом в 1984 г. Их воздействие на восстановление запасов представляется, однако, сомнительным.

CALCULOS DE LA BIOMASA DE LAS RESERVAS DE PECES ALREDEDOR DE GEORGIA DEL SUR EN ENERO/FEBRERO DE 1985

Extracto

Se han utilizado los datos de una inspección de arrastre de fondo en enero/febrero de 1985 para calcular el tamaño de las reservas de las explotaciones comerciales de Notothenia rossii, N. guntheri, N. gibberifrons, Dissostichus eleginoides, Champsocephalus gunnari, Chaenocephalus aceratus y Pseudochaenichthys georgianus alrededor de Georgia del Sur. Debido a que la base de datos es pequeña y la información comparativa es escasa resulta difícil evaluar el estado de N. guntheri y D. eleginoides. Las especies de captura accidental N. gibberifrons, Ch. aceratus y Ps. georgianus han sido afectadas apreciablemente por la pesca. El tamaño

de las reservas de N. gibberifrons y Ps. georgianus estaban a un nivel de aproximadamente un 25-40% del estado original. Las reservas que se encuentran más seriamente afectadas por la pesca siguen siendo N. rossii y C. gunnari. Los cálculos de la biomasa indican una reducción en el tamaño de las reservas de un 10-20% del que se calculaba antes de comenzar la pesca en grandes cantidades. En el caso de C. gunnari la pesquería depende de la abundancia del restablecimiento de la clase-año. Se delibera sobre las medidas de conservación adoptadas por CCAMLR en 1984. Sin embargo, parece ser dudoso el efecto que éstas tengan en la recuperación de las reservas.

1 Introduction

Published information on fish biomass in the Southern Ocean is still very limited. The "swept area" method (SAVILLE, 1977) has become an important tool in assessing Antarctic fish stocks quantitatively both in terms of weight and numbers. The method has its limitations (i.a. CARROTHERS, 1981; KOCK, 1985a) but nevertheless has been shown to provide acceptable results at least for some of the exploited fish stocks around South Georgia and Iles Kerguelen (KOCK, DUHAMEL & HUREAU, 1985).

In this paper catch data from a bottom trawl survey in January/February 1985 have been used to estimate stock sizes of commercially exploited species around South Georgia.

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. All sampling stations were chosen randomly but restricted to areas where fishing conditions were known to be moderate or good so as to reduce the chance of damage of the gear.

From 27 January to 10 February 1985 a total of 80 hauls operating the 200' bottom trawl used on previous surveys in the area (STEINBERG, 1978) were carried out by FRV "Walther Herwig" around Shag Rocks (7) and the mainland of South Georgia (73) during daylight hours. The following divisions (according to EVERSON, 1984) have been covered: 54-62, 64, 65, 91-93, 96, 99, 105 (fig. 1) and 89 around Shag Rocks (not shown here). They made up 10 064 nm^2 (= 34 516 km^2) which is 75.7 % of the total area between 50 and 500 m depth (EVERSON, 1984).

The area swept by the net is given by the distance between the tips of the net wings: 23.5 m (= 0.0127 nm) the speed of the vessel (3.5-5.3 kn) and the duration of the haul. Net height was 6 m. Net selection should have been negligible due to the use of a small meshed liner of 20 mm. No data are available to estimate the catchability factor C. A catching efficiency of 100 % (i.e. C=1) had therefore to be adopted as a conservative approach.

3 Results

Evaluations were carried out for the following species: Notothenia guntheri, N. rossii, N. gibberifrons, Dissostichus eleginoides, Champsocephalus gunnari, Chaenocephalus aceratus, Pseudochaenichthys georgianus.

3.1 Notothenia guntheri

Notothenia guntheri , a benthopelagic species, is so far only know from the Shag Rocks area. Evalutions are thus confined to division 89. Length frequency composition (fig. 2) shows that our catches cover a similar length range (9-23 cm) as the Soviet commercial catches (ANON. 1984). Evaluation of mean trawlable biomass is considerably biased by the small number of hauls and the exclusive use of a bottom trawl for the survey. The total biomass of 7256 t is similar or even below the annual catches and for this reason it appears unrealistically low.

3.2 Notothenia rossii

Although the species is known from the entire shelf area the main catches were concentrated to the east and southeast of the island in divisions 61 and 62 (fig. 3, fig. 1) mostly in the 250-500 m depth zone. This stratum was therefore further stratified by the observed fish abundance in estimating the biomass.

Length frequency distribution (fig. 4) indicate that the offshore part of the population was probably adequately covered by the sampling. The bulk of specimens were 45-55 cm long (see KOCK, 1985b). The biomass estimate (table 1) is however considerably biased by the patchy distribution of the species. Even though the variance is very high indicating that the estimated stock size may only be correct to within an order of magnitude it is clear that the stock size is very small and only a small proportion of its unexploited state.

3.3 Notothenia gibberifrons

The species was more or less evenly distributed over the whole shelf area with some larger concentrations in the southeast (fig. 5).The length composition (fig.6) indicates that with the exception of the early juve-

niles (age class 0 and 1) the entire population had been sampled adequately. In comparison to the latest length frequency (SLOSARCYK et al., 1984) distribution available from 1981/82 the proportion of specimens > 40 cm had slightly increased.

Stock size of 15 762 t (table 1) is obviously still at a low level and was only little more than one third of the 40 000 t estimated for the virgin stock in 1975/76 (KOCK, DUHAMEL & HUREAU, 1984, table 50).

3.4 Champsocephalus gunnari

Except for one haul yielding 1.4 t/30 min catches of C. gunnari were in general less than 100 kg/30 min which indicates an even distribution of the species over the shelf (fig. 7).

The length frequency distribution shows that catches consisted mostly of age classes I (mean length ~ 17 cm) and II (mean length ~ 25 cm) and a minor proportion of age classes III-V. Only single specimens larger than 40 cm was caught (fig. 8).

The biomass estimate was considerably biased by the single haul of 1.4t. Furthermore the benthopelagic mode of life of this species may have led to an underestimate of the actual stock size. Even under these constraints, however, stock size is assumed to be very low in comparison to that of 141 000 t at the onset of large scale commercial fishing in 1975/76 (KOCK,DUHAMEL & HUREAU, 1985).

3.5 Chaenocephalus aceratus

Chaenocephalus aceratus was more or less evenly distributed over the shelf with some larger concentrations in Royal Bay and the station on the eastern shelf where C. gunnari was abundant (fig. 9).

Catches consisted of juveniles from age class I onwards and adults (45 - 60 cm). Individuals larger than 60 cm which were still abundant in 1977/78, were only encountered occasionally (fig. 10).

The biomass estimate of 11 542 t (table 1) is similar to the 10 013 t given by SLOSARCZYK et al. (1984) for 1982/82 and about 62 % of that evaluated for the pristine stock in 1975/76 (KOCK, DUHAMEL & HUREAU, 1985).

3.6 Pseudochaenichthys georgianus

The species was evenly distributed over the shelf forming no concentrations (fig. 11).

Sampling covered mostly older juveniles (30-40 cm) and the adult part of the population. Length composition of the adults shows a distinct peak at 48-49 cm (fig. 12) which is an increase of more than 3 cm in comparison to the latest available length frequency distribution from 1981/82 (SLOSARCZYK et al., 1984).

Evaluated stock size of 8 134 t (table 1) may be an underestimate of the actual stock size as Ps. georgianus exhibits regular vertical migrations. It is nevertheless low (about 25 %) compared to the estimated stock size of 36-39 000 t before the onset of commercial exploitation (KOCK, DUHAMEL & HUREAU, 1985).

3.7 Dissostichus eleginoides

Except for some concentrations observed in the Shag Rocks area D. eleginoides was evenly distributed with catches rarely exceeding 50 kg/30 min. Juveniles of 30-70 cm predominated in the catches (fig. 13). In 1975/76 and 1977/78 catches consisted mostly of individuals of 50-80 cm.

Stock size evaluation was considerably influenced by some catches around Shag Rocks yielding up to 640 kg/30 min. Estimated stock size of 8 159 t may thus be rather inaccurate (table 1). It is in the order of the estimate for 1977/78 (KOCK, DUHAMEL & HUREAU, 1985).

4. Discussion

Due to the small data base and the scarcecity of comparative information from recent years the state of N. guntheri and D.eleginoides stocks is difficult to assess. Our catches of N. guntheri sampled the same length range

as given for the Soviet commercial catches. A length composition from February 1979 (NAUMOV et al., 1983) shows the same distinct peak at 15-16 cm as exhibited in fig. 2. The proportion of individuals > 16 cm was, however, considerably larger than in NAUMOV's length frequency distribution. According to Soviet investigations there has been little effect on the stock so far (ANON., 1984), although about 100,000 t had been taken from 1978/79 to 1982/83. In D. eleginoides a considerable decrease in mean length in the catches at the end of the 1970s has been observed compared to 1975/76 - 1977/78 (SLOSARCZYK et al., 1984). A similar trend is evident from our surveys. Due to the low annual catches reported for the species these changes can be hardly attributed to fishing influence. Furthermore it should be noted that it is still not known which proportion of the juvenile part of the population lives actually within the range of the fishery. The Patagonian stock has a vertical range down to 1500 m (KOCK, DUHAMEL & HUREAU, 1985).

Apart from single seasons N. gibberifrons, Ch. aceratus and Ps. georgianus does not appear to have supported a directed fishery. They have nevertheless been considerablyaffected by the fishery. In Ch. aceratus the proportion of individuals larger than 60 cm, which are exclusively females, has been considerably reduced compared to 1977/78. Mean length in catches of N. gibberifrons and Ps. georgianus in 1981/82 were close to length at sexual maturity after 6 or 7 years of fishing (KOCK, DUHAMEL & HUREAU, 1985). During our survey stock sizes were still at a level of about 25 - 40 % of that of the pristine state in 1975/76. An increase in the proportion of longer (= older) individuals in the populations both of N. gibberifrons and Ps. georgianus compared to 1981/82 may, however, indicate a slight improvement of the situation.

The stocks most greatly affected by fishing are still N. rossii (see KOCK, 1985b) and C. gunnari and are in need for conservation measures. Biomass estimate in C. gunnari indicates a reduction in stock size to 10 - 20 % of that estimated for 1975/76. Similar values had, however, been found already at the end of the 1970s in Polish surveys (SLOSARCZYK et al., 1984). Since the period of intensive fishing in 1976/77 when fish older than 5 years (> 35 cm) were still common, recent catches were seen dominated by 3 years old fish (age class II) which is presumably the recruiting year class. Variability in annual catches and CPUE may therefore directly reflect variability in recruitment. The dramatic increase in catches in 1982/83 to 128,000 t can thus partly be explained by the recruitment of one or two abundant year

classes. The dependance of the fishery on the abundance of the recruiting year class, however, makes fishing extremely vulnerable to any change in recruitment pattern.

Conservation measures were established by CCAMLR in 1984 which come into force from September 1985. The prohibition of fishing within 12 nm will protect its spawning grounds in nearshore and inshore waters. As far as it is known the spawning grounds have never been fished other than for scientific purposes. No direct effect can thus be expected from that measure.

A minimum mesh size of 80 mm, although its scientific basis (e.g. selectivity experiments) is not known, may increase size at first capture. A more suitable option to rebuild the spawning stock would, however, be to refrain from directed fishing for the species for two years on the premises of a normal recruitment. Minimum mesh size should then be set at 115 mm. Mean selection length ($\hat{=}$ length at first capture, l_c) would then be 32 cm ($\hat{=}$ 3.8 years) (ANON. 1984). This would minimize the risk of recruitment overfishing that may occur at the present state of exploitation and would lead to a more stable situation both in the spawning stock as well as in the fishery. It would furthermore result in a gain in Y/R of about 15 - 20 %.

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

	50 - 150 m				151 - 250 m				251 - 500 m				total	
	No. of hauls	Mean trawl. biomass (t)	s_d (%)	D_r (t/nm^2)	No. of hauls	Mean trawl. biomass (t)	s_d (%)	D_r (t/nm^2)	No. of hauls	Mean trawl. biomass (t)	s_d (%)	D_r (t/nm^2)	t	s_d (%)
N. gu ntheri Shag Rocks	1	5320	-	14.62	5	1902	203	2.66	1	100	-	0.07	7256	47.1
N. rossii	18	177	120.4	0.1	34	4026	101.1	0.97	21	8577	142.1	-	12781	99.9
N. gibberifrons	19	2625	49.6	1.21	39	9900	43.2	2.04	22	3236	33.2	1.07	15762	28.4
C. gunnari	19	999	71.0	0.46	39	13918	117.5	2.88	22	904	66.4	0.30	15821	101.4
Ch. aceratus	19	2904	95.4	1.33	39	6766	57.8	1.39	22	1872	30.5	0.62	11542	40.6
Ps. georgianus	19	1736	47.2	0.80	39	5160	49.9	1.06	22	1238	42.6	0.41	8134	33.0
D. eleginoides	19	1152	204.4	0.53	39	4892	116.9	1.01	22	2115	79.7	0.70	8159	76.5

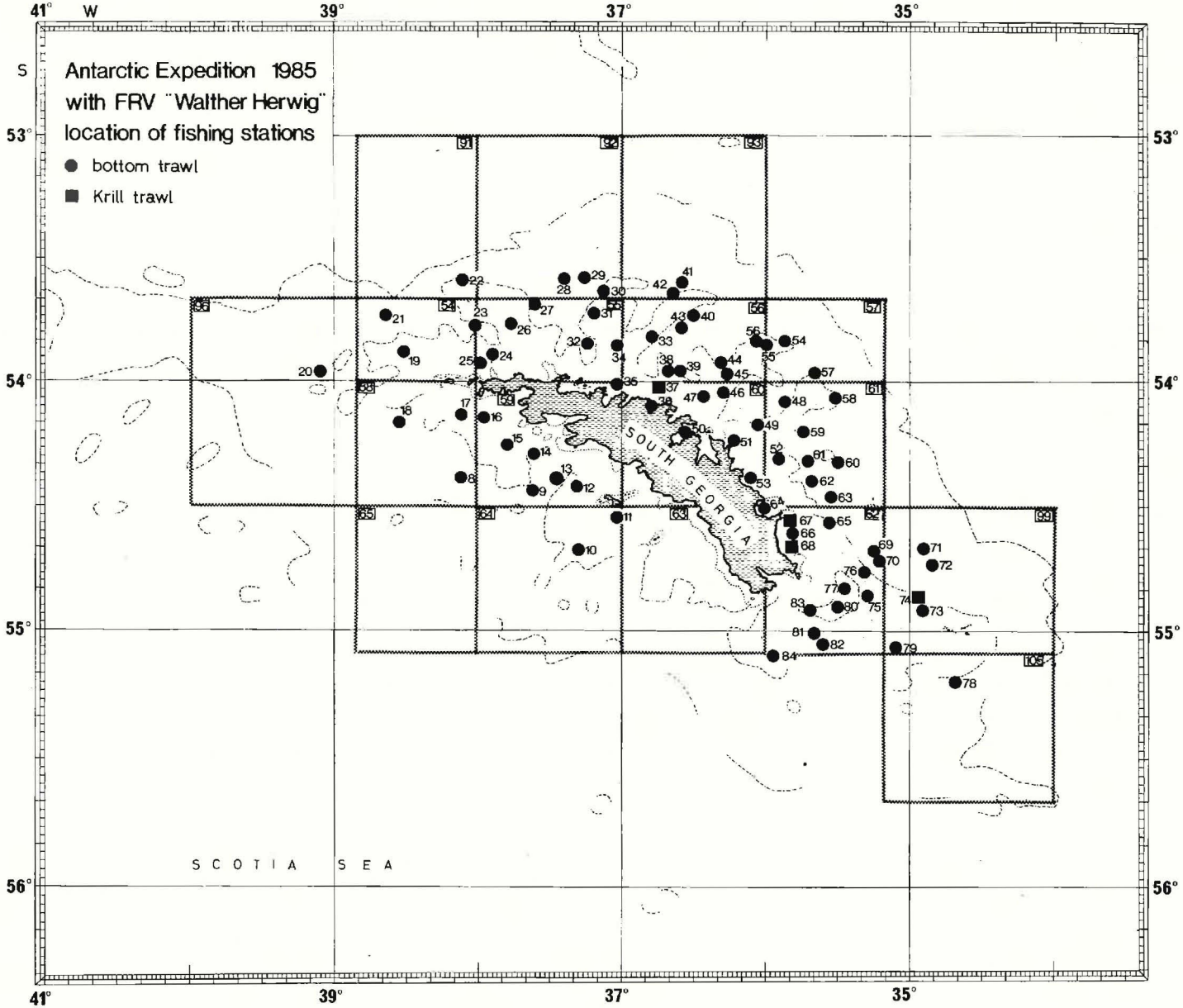

fig. 1: Location of fishing stations

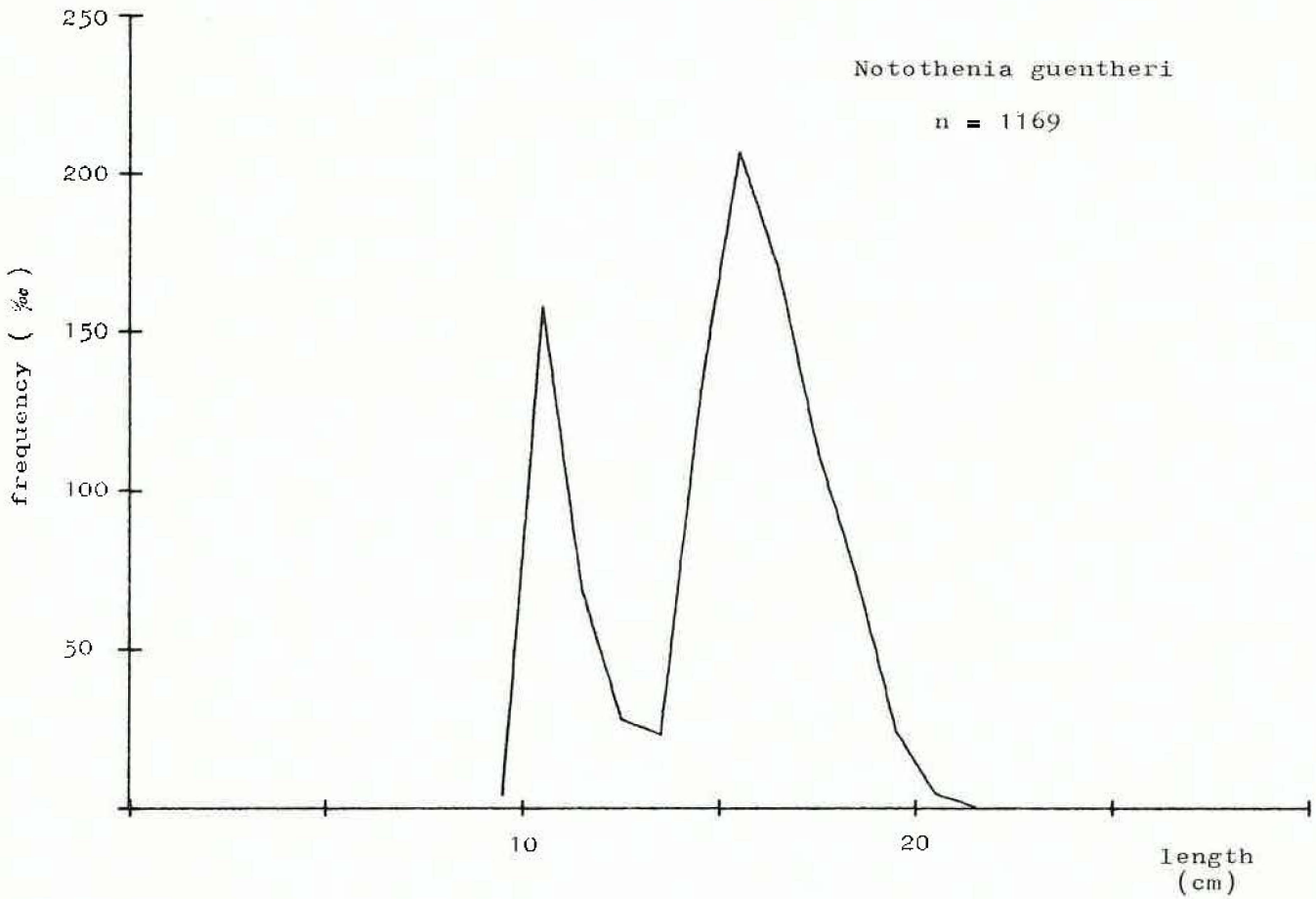

fig. 2: Length frequency distribution of Notothenia guentheri from Shag Rocks

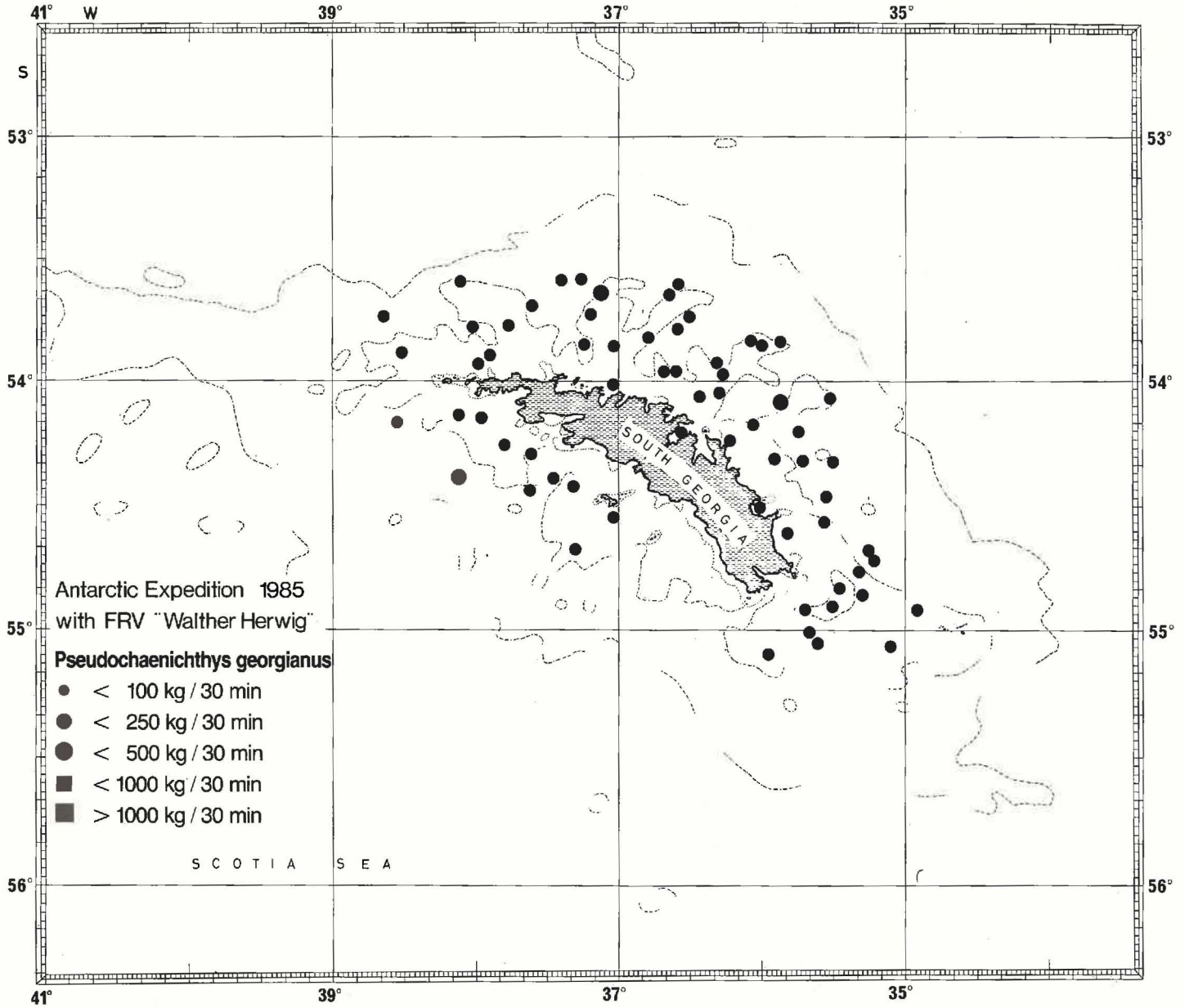

fig. 3: Catches of Notothenia rossii around South Georgia

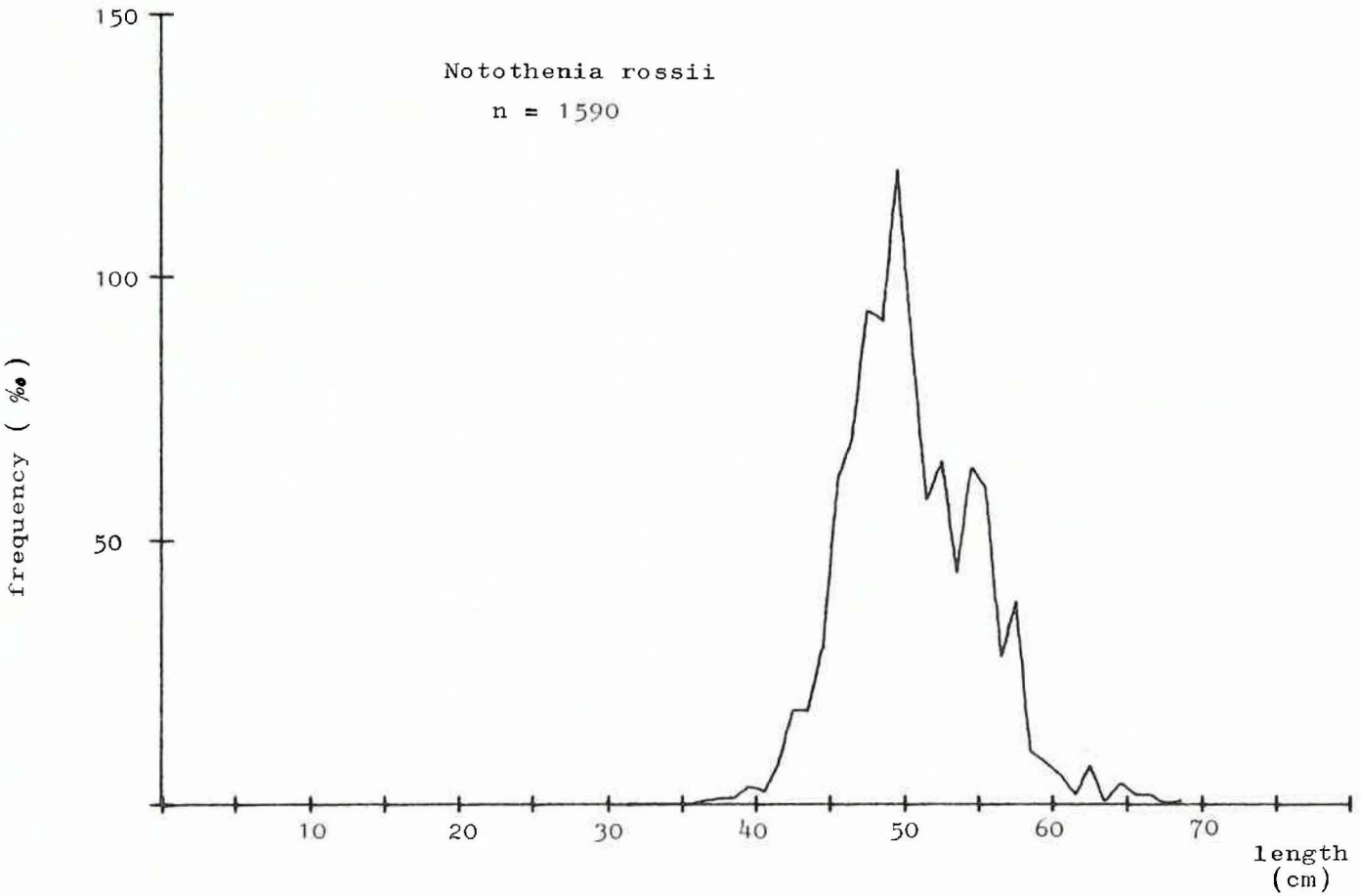

fig. 4: Length frequency distribution of Notothenia rossii from South Georgia

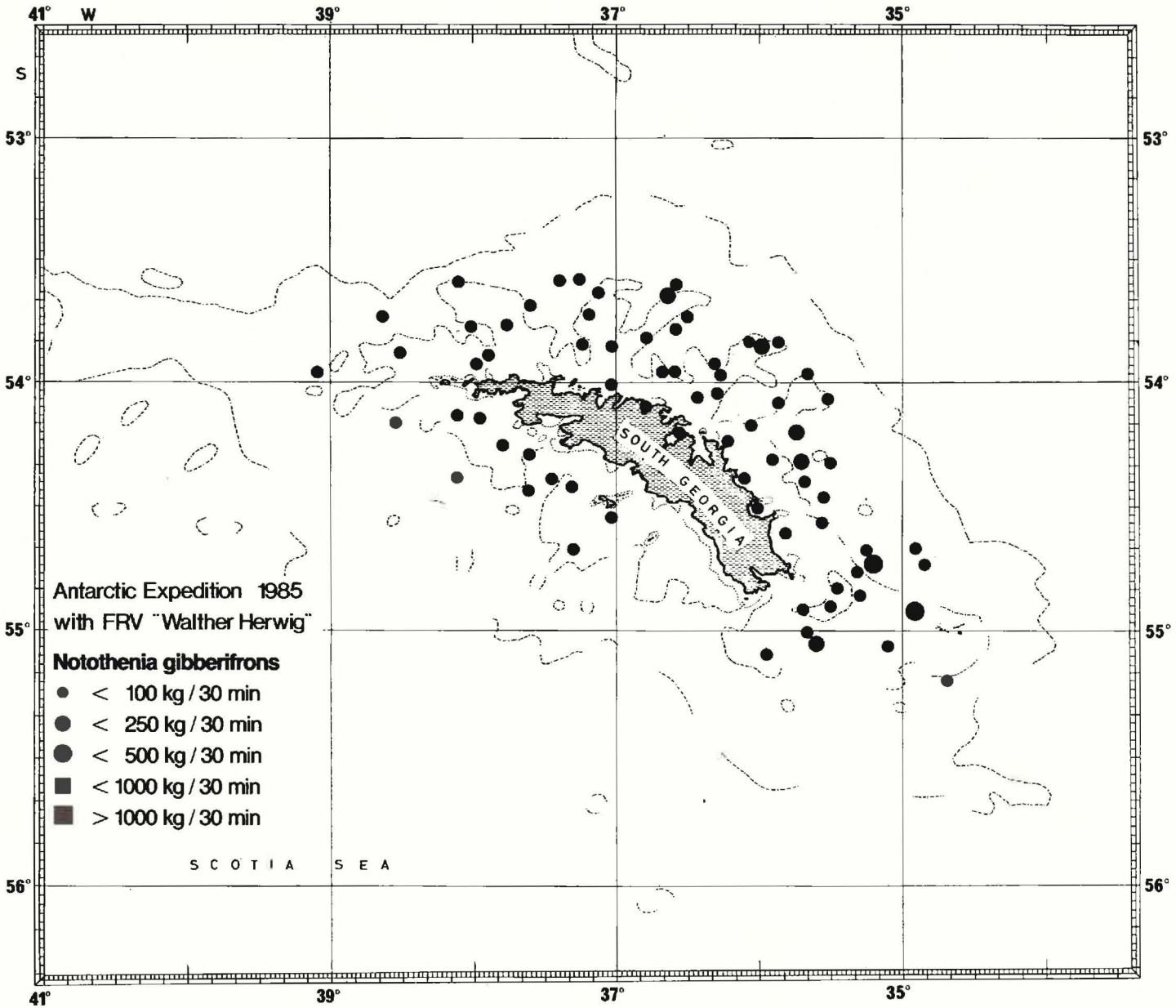

fig. 5: Catches of Notothenia gibberifrons around South Georgia

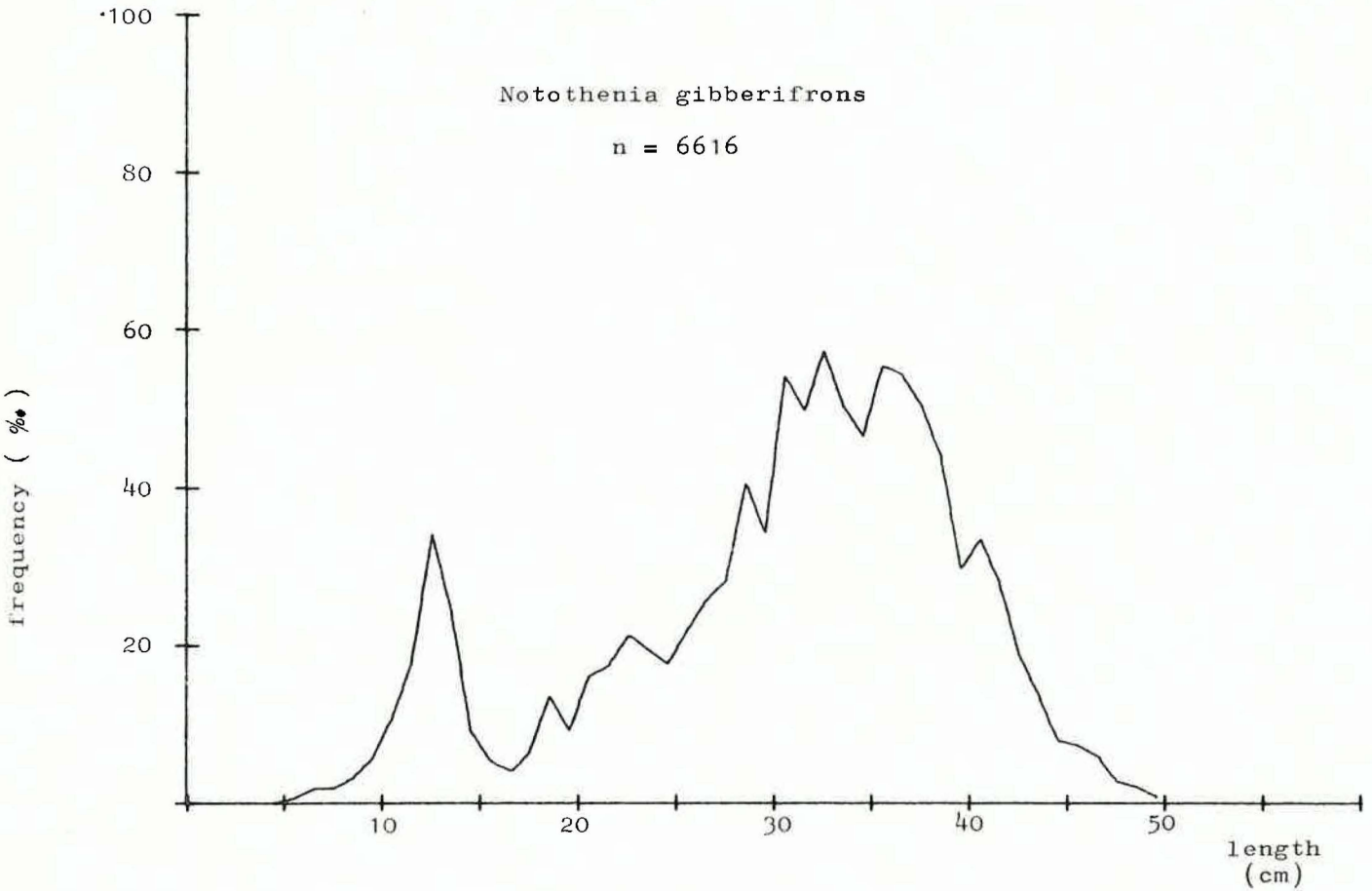

fig. 6: Length frequency distribution of Notothenia gibberifrons from South Georgia

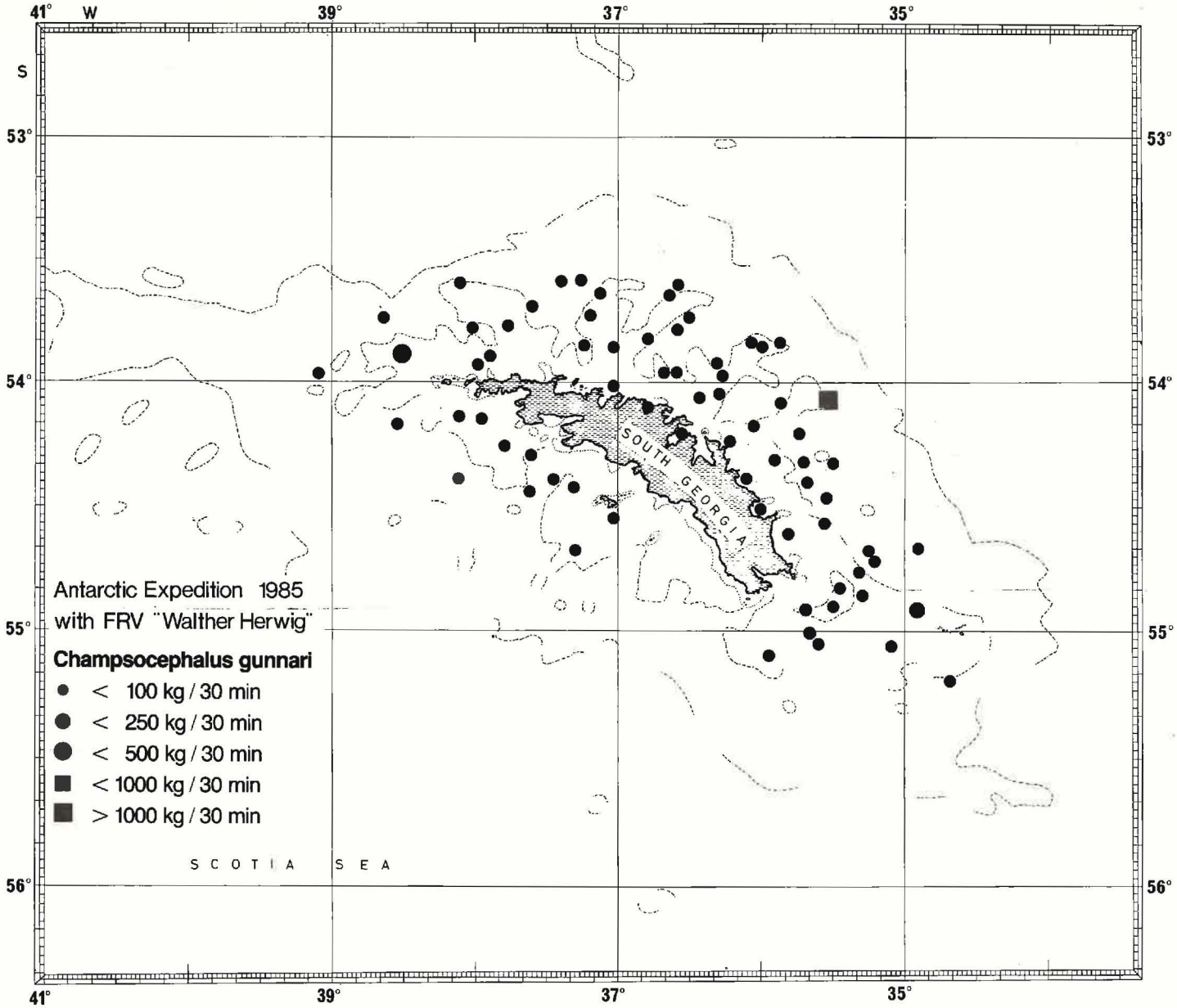

fig. 7: Catches of Champsocephalus gunnari around South Georgia

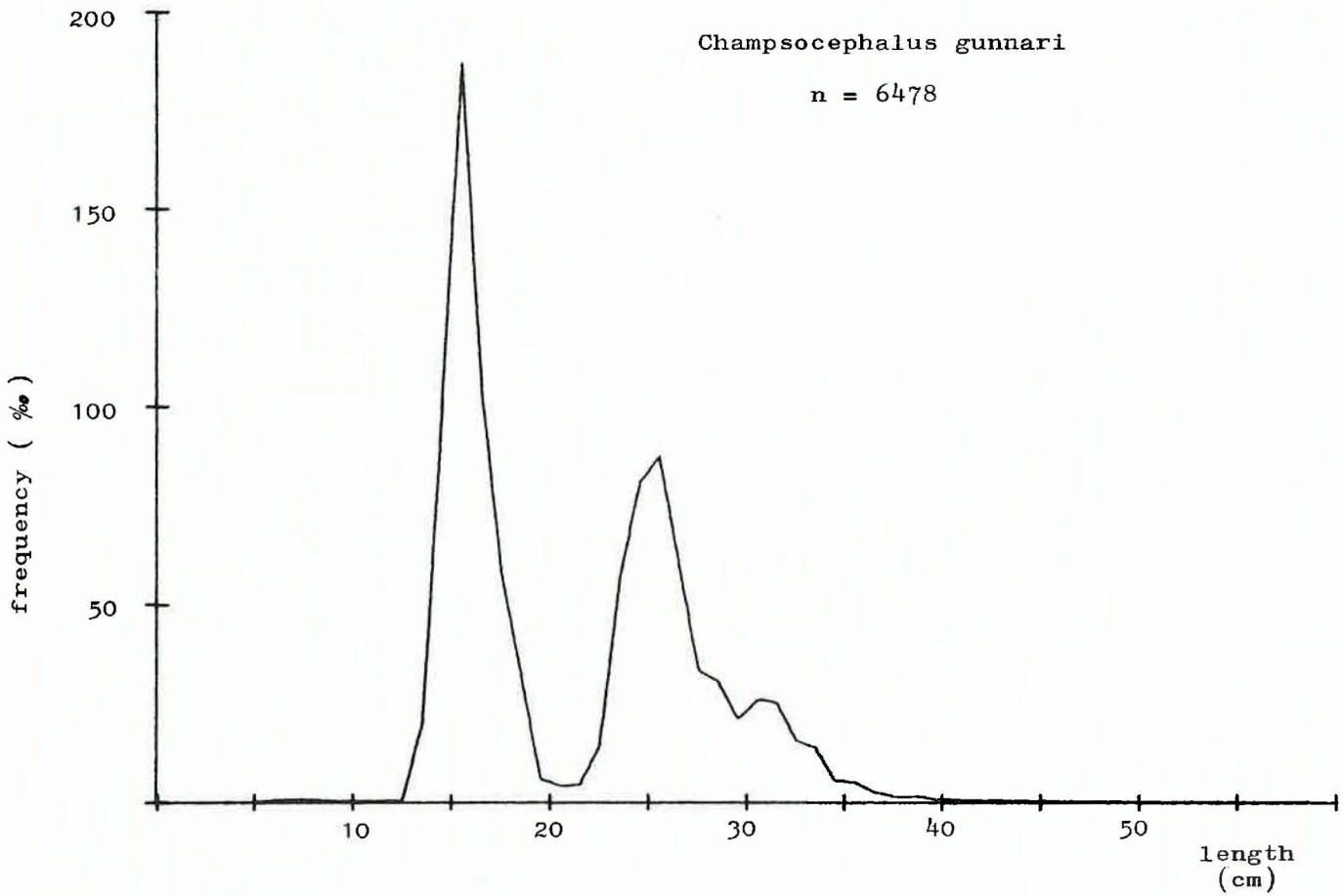

fig. 8: Length frequency distribution of Champsocephalus gunnari from South Georgia

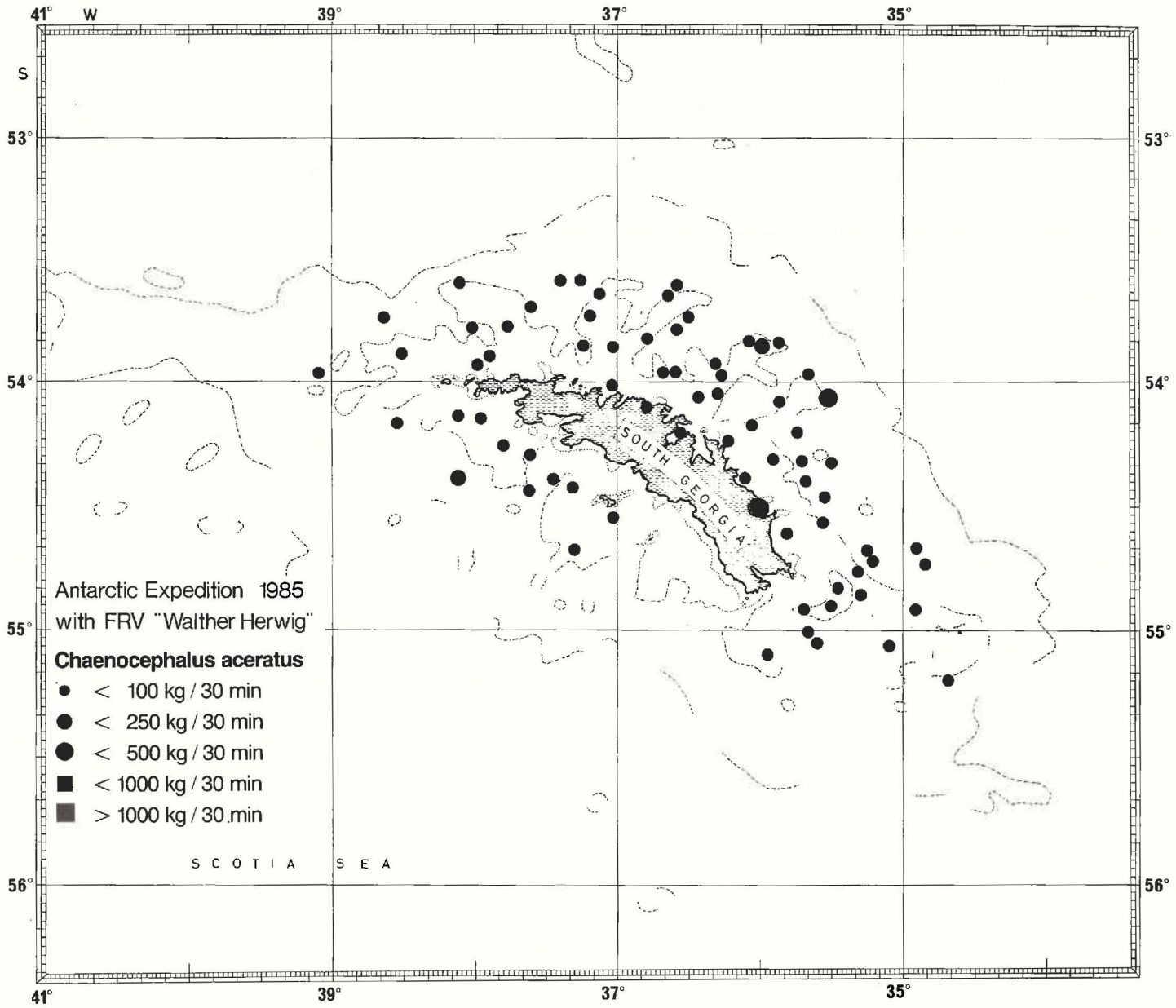

fig. 9: Catches of Chaenocephalus aceratus around South Georgia

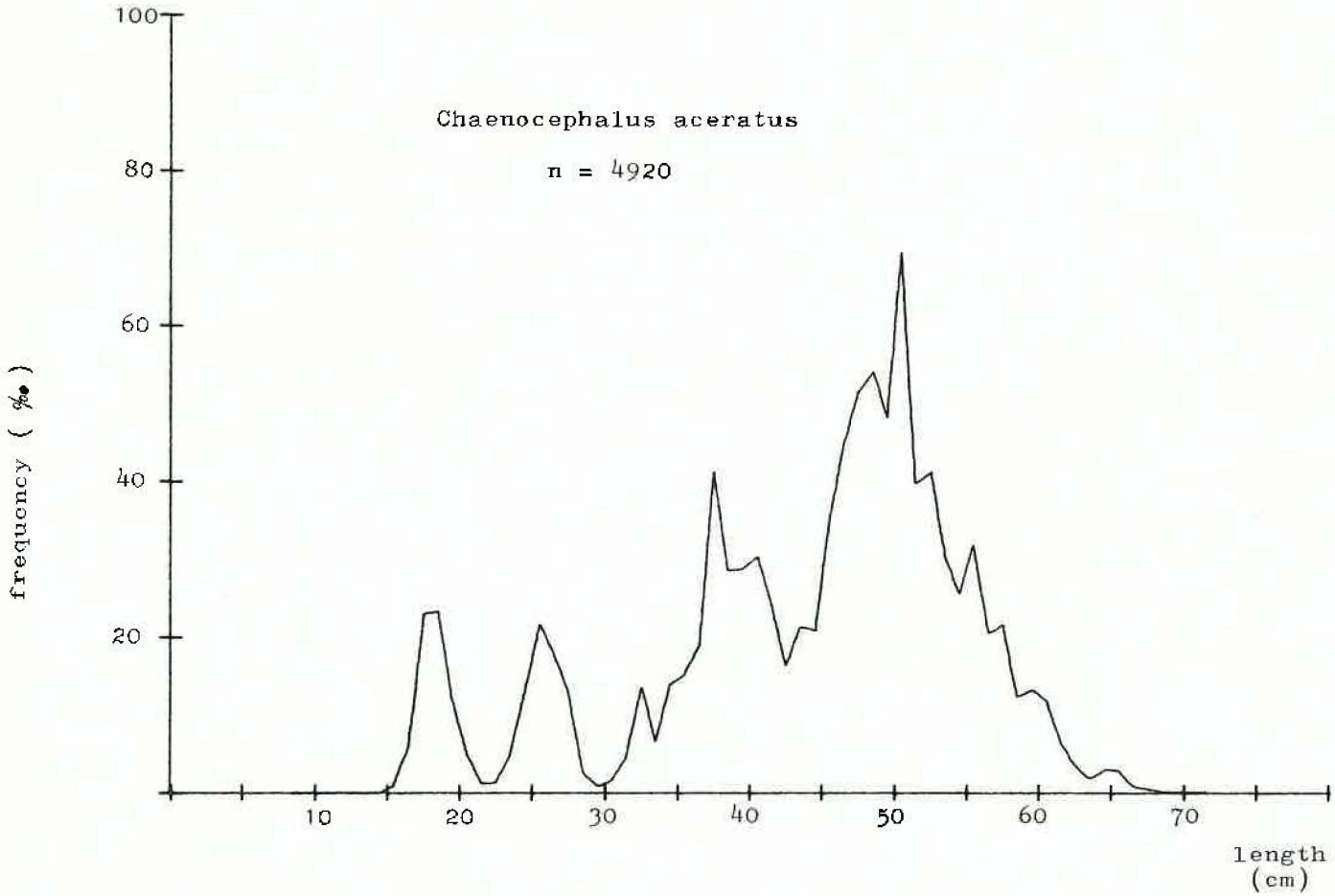

fig. 10: Length frequency distribution of Chaenocephalus aceratus from South Georgia

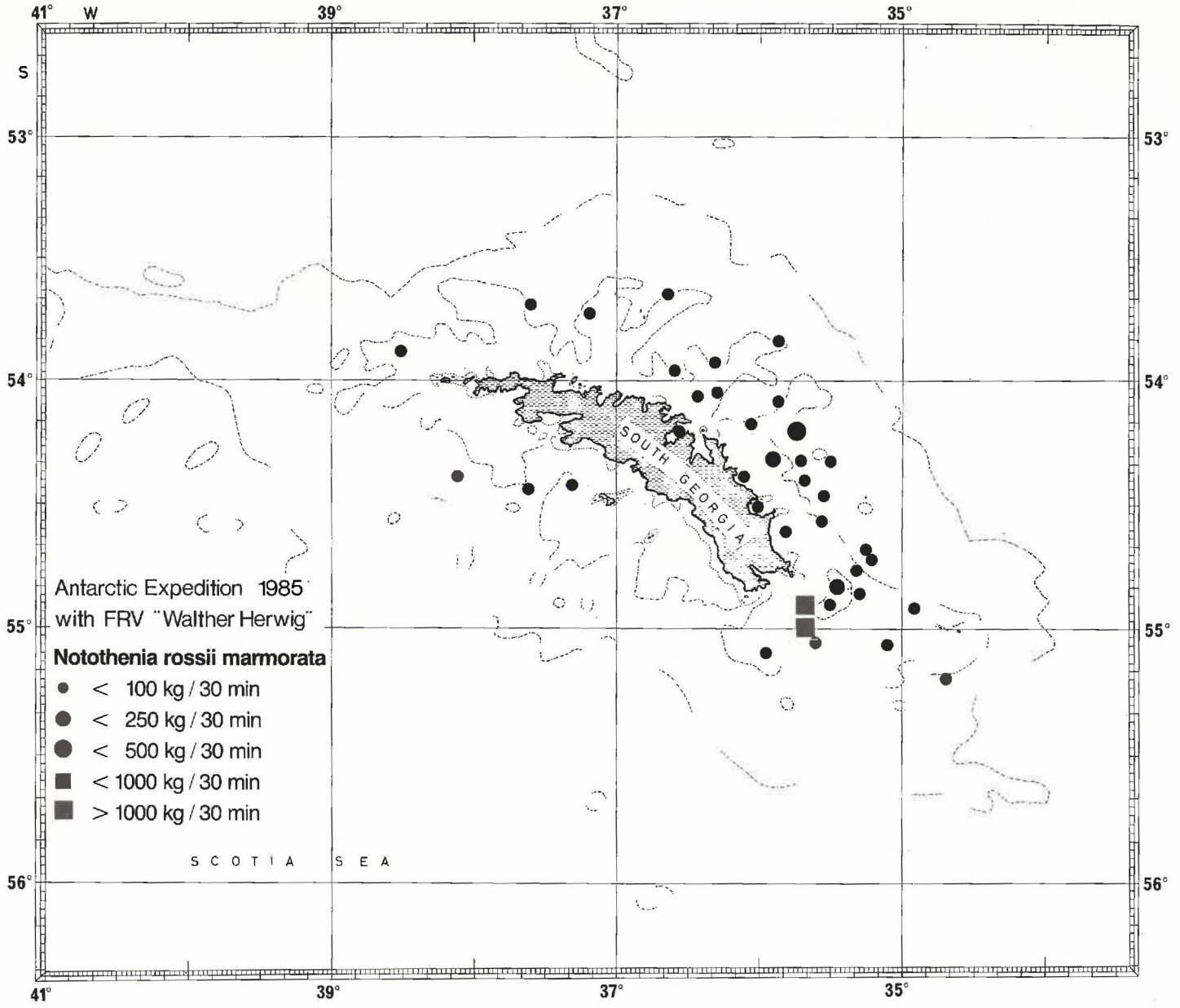

fig. 11: Catches of Pseudochaenichthys georgianus around South Georgia

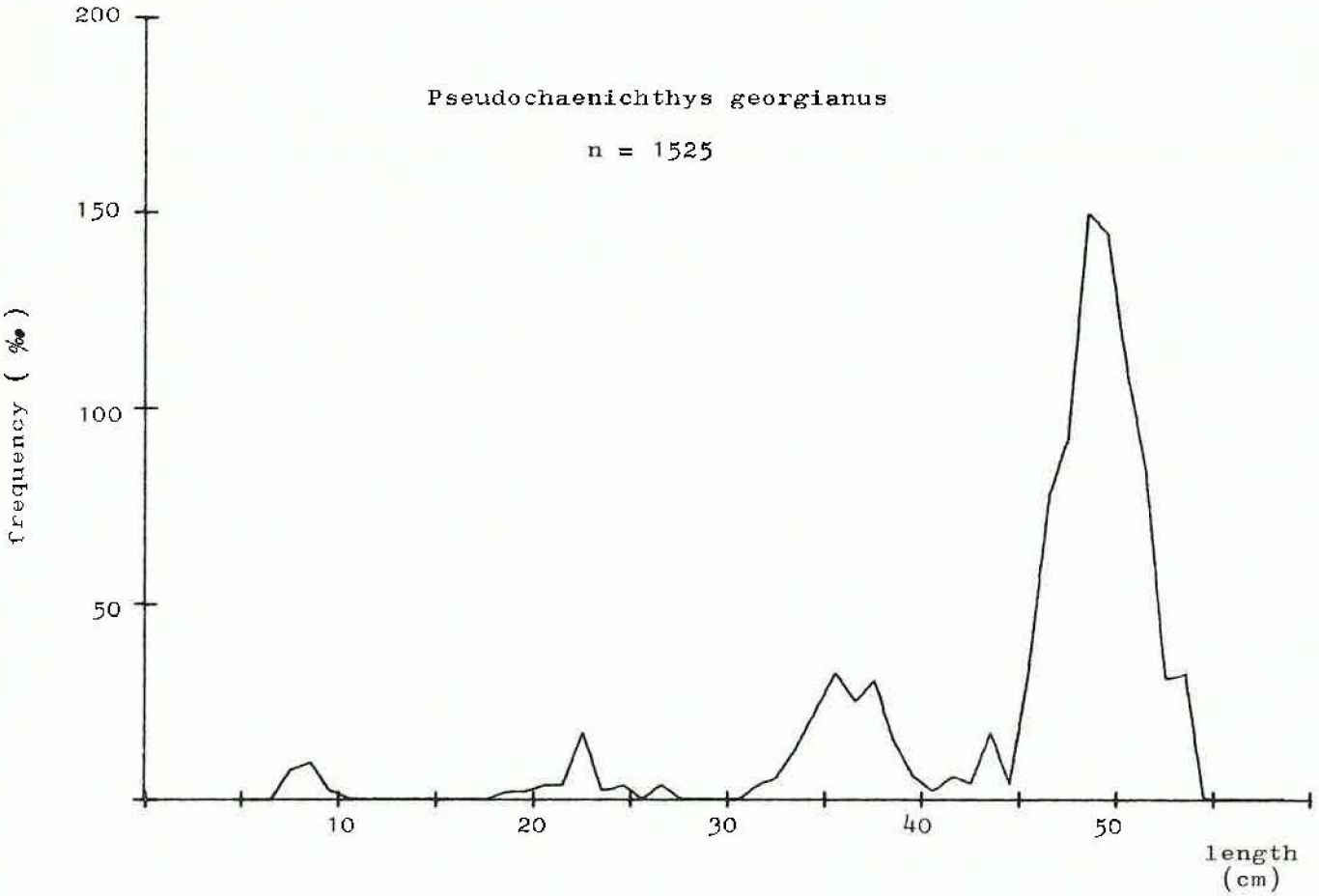

fig. 12: Length frequency distribution of Pseudochaenichthys georgianus around South Georgia

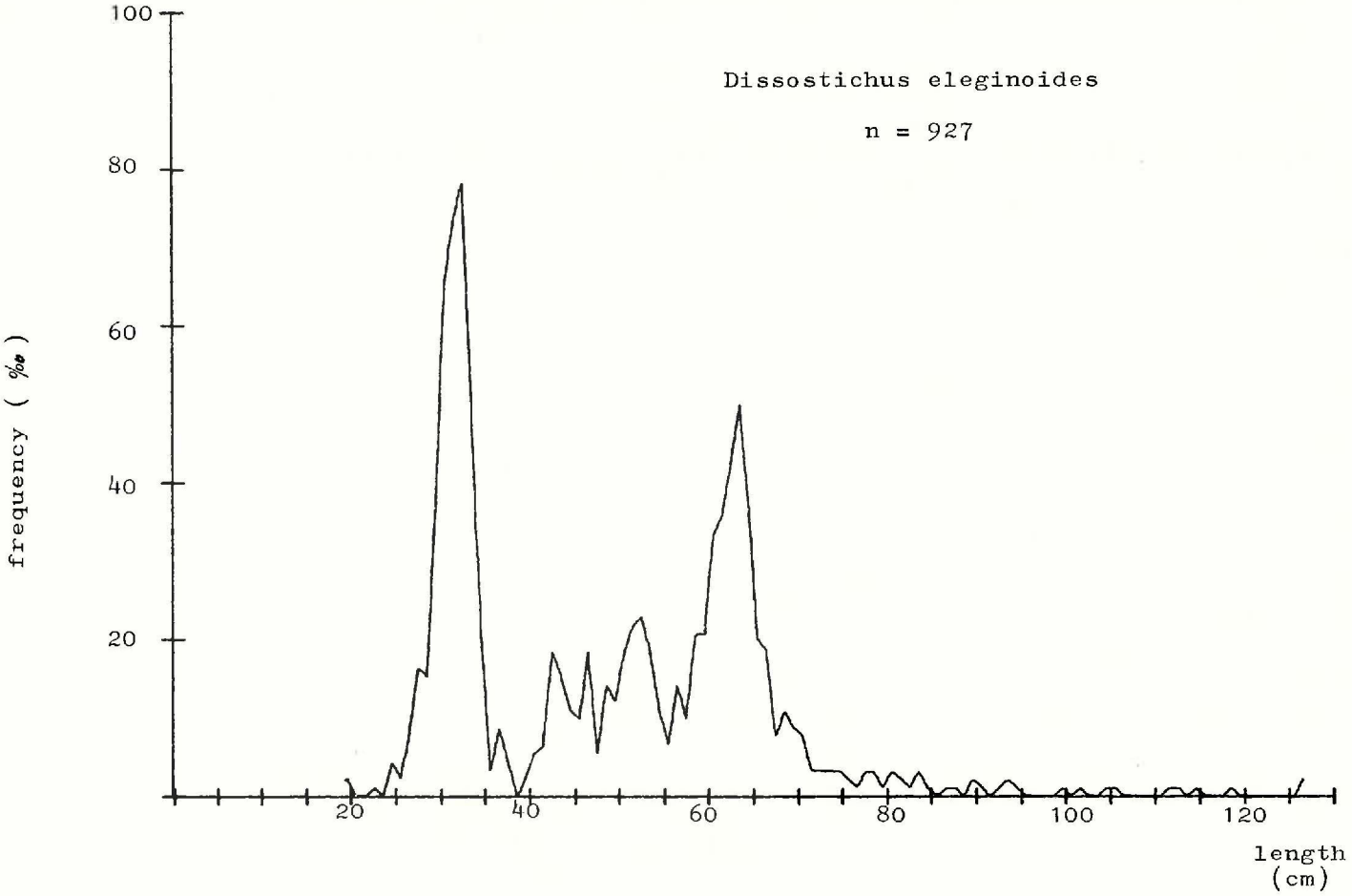

fig. 13: Length frequency distribution of Dissostichus eleginoides from Shag Rocks

List of Tables

List of Figures

Fig. 11: Catches of Pseudochaenichthys georgianus around South Georgia.

Fig. 12: Length frequency distribution of Pseudochaenichthys georgianus around South Georgia.

Fig. 13: Length frequency distribution of Dissostichus eleginoides from Shag Rocks.

Liste des Tableaux

Liste des Figures

Fig. 11 : Prises de Pseudochaenichthys georgianus authour de la Géorgie du Sud.

Fig. 12 : Répartition de fréquence de longueurs de Pseudochaenichthys georgianus autour de la Géorgie du Sud.

Fig. 13 : Répartition de fréquence de longueurs de Dissostichus eleginoides des Rochers Shag.

Список таблиц

Список рисунков

Рис. 11. Уловы вида Pseudochaenichthys georgianus в районе Южной Георгии.

Рис. 12. Распределение частоты длины особей вида Pseudochaenichthys georgianus в районе Южной Георгии.

Рис. 13. Распределение частоты длины особей вида Dissostichus eleginoides в районе Shag Rocks.

Lista de Cuadros

Lista de Gráficos