# Djúpfiskarannsóknir

**Framlag Íslands til rannsóknaverkefnisins**
**EC FAIR PROJECT CT 95-0655**
**1996-1999**

**Icelandic contributions to the deep water research project**
**EC FAIR PROJECT CT 95-0655**
**1996-1999**

**Sub-Task 1.5: To describe the deep-water fisheries of Iceland**
Jakob Magnússon, Jutta V. Magnússon, Klara B. Jakobsdóttir

**Sub-Task 2.6.: To compile existing Icelandic survey data**
Klara B. Jakobsdóttir, Jútta V. Magnússon, Jakob Magnússon

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Jutta V. Magnusson, Jakob Magnússon, Klara B. Jakobsdóttir

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# Efnisyfirlit

# Inngangur

Á árinu 1995 var Íslandi boðin þátttaka í alþjóðlegri samvinnu um rannsóknir á djúpfiskum. Rannsóknirnar voru styrktar af Evrópusambandinu (ES). Rannsóknaáætlunin hljóðaði upp á þrjú ár frá 1. desember 1995 að telja og var auðkennd sem: EC FAIR PROJECT CT95-0655. Titillinn var: Developing deep-water fisheries: data for their assessment and for understanding their interaction with impact on a fragile environment.
Megin ástæðan fyrir því að þessari rannsóknaáætlun var hrint af stað var sú, að á undanförnum árum hafði sókn í fiskistofna á djúpslóð stóraukist. Mörg dæmi voru um, að veiðar sem byrjað höfðu vel, entust stutt eins og t.d. veiðar á slétthala (*Coryphaenoides rupestris*). Menn gerðu sér grein fyrir því að þekking á djúpslóðinni og fiskum þar var af svo skornum skammti að erfitt var að koma við skynsamlegri stjórnun veiðanna. Snemma á síðasta áratug fór að komast hreyfing á þessi mál: Innan Evrópusambandsins var þingað um málið, Alþjóðahafrannsóknaráðið setti á laggirnar vinnunefnd um djúpfiska og NATO gekkst fyrir ráðstefnu um djúpfiska (í Hull) 1994 með þátttöku ES, UK Fish Industry Authority og Scottish association for Marine Science. Íslendingum var boðið til þeirrar ráðstefnu og þeir hafa einnig tekið þátt í störfum djúpfiskavinnunefndarinnar innan Alþjóðahafrannsóknaráðsins. Það hefur hvatt til aukinna rannsókna á djúpslóðinni og til aðgáttar við nýtingu.
Alls tóku 12 rannsóknastofnanir frá 10 löndum þátt í nefndri EC-FAIR áætlun með þátttöku Hafrannsóknastofnunarinnar af Íslands hálfu. Þátttökulönd auk Íslands voru:Stóra Bretland, Frakkland, Þýskaland, Írland, Ítalía, Grikkland, Portugal, Spánn og Noregur.
Rannsóknaáætluninni var skipt niður í 5 megin verkefni:

<u>Verkefni 1</u>: Að lýsa þeim djúpfiskaveiðum sem eru í gangi í þátttökulöndunum svo og skipagerðum og veiðafærum, sem notuð eru við veiðarnar

<u>Verkefni 2:</u> Að skrá og tölvuvæða öll eldri gögn úr leiðöngrum og sjá um að eldri gögn verði varðveitt og gerð aðgengileg. Að veita aðstoð við úrvinnslu leiðangursgagna

<u>Verkefni 3:</u> Að lýsa og meta umfang aukaafla og smælkis við djúpfiskaveiðar smb. Verkefni 1.

<u>Verkefni 4:</u> Að safna gögnum úr lönduðum afla djúpfiska og skrá magn og tryggja að tegundir séu rétt skráðar.

<u>Verkefni 5:</u> Að vinna úr líffræðilegum gögnum, bæði gömlum og nýjum, úr lönduðum afla og leiðöngrum

Íslendingar tóku þátt í öllum verkefnunum nema verkefni 3. Verkefnin voru síðan skipt í undirverkefni eftir löndum.
Áfangaskýrslur voru skrifaðar á meðan á ES verkefninu stóð. Öll löndin skiluðu inn lokaskýrslu fyrir hvert verkefni sem þau höfðu tekið að sér. Umsjónamaður verkefnisins, Dr. J.D.M. Gordon yfirfór allar lokaskýrslunar og þær felldi síðan saman í eina lokaskýrslu upp á meira en 1000 blaðsíður.Við þessa yfirferð voru lokaskýrslunar lítillega styttar og sums staðar felldar niður myndir.
Þessi lokaskýrsla hefur verið sett á diskling (CD) og dreift þannig til þátttökulandanna. Hún verður hinsvegar ekki gefin út á prenti í heild sinni.
Í íslensku lokaskýrslunum er ýmis konar nýr fróðleikur og upplýsingar, sem talið var að gera ætti aðgengilegri. Það var því ákveðið að birta í Fjölriti Hafrannsóknastofnunarinnar þrjár lokaskýrslur, þ.e. fyrir verkefni 1,2 og 5, semallar hafa verið ritstýrðar.

Texti og myndefni er tekið beint úr lokaskýrslunni á disklingnum. Númer á töflum og myndum eru látin halda sér óbreytt svo og tilvísanir í texta. Töflur og myndir fá númer undirverkefnis í upphafi hvers töflu- og myndanúmers. Í þessu Fjölriti eru birt á ensku eftirfarandi undirverkefni ásamt númeri:

1.5: To describe the deep-water fisheries of Iceland
2.6: To compile existing Icelandic survey data
5.11.: Icelandic studies on the biological parameters of deep-water species

Fyrir tilstilli þessa verkefnis (EC-FAIR) var farið í leiðangur á djúpslóð á Reykjaneshrygg sumarið 1997. Umfjöllun um hann hefur verið birt á íslensku í ÆGI (11.tbl. 1997) og í Hafrannsóknastofnun Fjölrit Nr. 65,1998. Auk þess hafa verið ritaðar á ensku ráðstefnuritgerðir og greinar í erlend tímarit um sérstök afmörkuð svið í tengslum við verkefnið. Þar hefur m.a. verið fjallað nánar um tvær tegundir háffiska og tvær tegundir af móruætt. Það er því ekki fjallað um þessar fjórar tegundir í lokaskýrslunni (verkefni 5.11), en vísað til ritgerðanna í texta.

Yfirumsjón með verkefninu hafði Dr. John D.M. Gordon frá Skotlandi og stjórnaði hann fundum á vegum þess og sá um öll tengsl verkefnisins við ES. Honum eru færðar þakkir fyrir mikið og gott starf við umsjón á
EC FAIR PROJECT CT95-0655 og ritstýringu á lokaskýrslu.

Vilhelmína Vilhelmsdóttir (Jutta V. Magnússon), fiskifræðingur á Hafrannsóknastofnuninni hafði yfirumsjón með íslenska hluta verkefnisins. Einn líffræðingur, Klara B. Jakobsdóttir, var gagngert ráðin til að sinna því og dr. Jakob Magnússon starfaði að miklu leyti við það þennan tíma. Margir aðrir starfsmenn Hafrannsóknastofnunarinnar komu að verkefninu með ýmsum hætti, svo sem við söfnun gagna, innslátt o.m.fl. Þeim er þakkað þeirra framlag.

# Introduction

In 1995, Iceland was invited to participate in an international research programme titled: "Developing deep-water fisheries: data for their assessment and for understanding their interaction with an impact on a fragile environment "(EC FAIR CT 95/0655). This multinational research programme was financially supported by the European Union (EU). The duration of the project was three years starting in December 1995. Twelve Marine Research Institutes from ten countries participated in the programme. The participating countries were United Kingdom, Ireland, Iceland, France, Spain, Portugal, Italy, Greece, Germany and Norway.
The objectives of this project were divided into five main tasks:

Task 1: To describe the present deep-water fisheries by the member states and the fleets and fishing gears used for specified fisheries
Task 2: To make an inventory of existing survey data on deep-water resources and ensure that histrorical data are preserved and are accessible. To support the working up of survey data.
Task 3: To describe and quantify the by-catch of unwanted species and undersized fish of target species in the fisheries identifiedin Task 1
Task 4: To sample the markets and record the quantities of species landed and ensure the correct identification of the species
Task 5: To evaluate the information collected and provide data on biological parameters both of target and non-target species.

Dr. John D.M. Gordon, UK, was appointed coordinator for the project . He took care of all communications with the European Union in connection with the project. On behalf of Iceland, the Marine Research Institute (MRI) participated in all tasks except for task 3. The tasks were divided into sub-tasks by countries.

During the project progress reports were written. At the end of the project the participating countries submitted final reports for each task in which they had participated. The final reports were edited by the coordinator and put together into one final report of nearly 1100 pages produced on a CD which was then distributed to the participating institutes.

The MRI decided that the content of the Icelandic final reports should be published in order facilitate access to them. The text, tables and figures are reproduced directly from the CD. Thus, numbering of tables and figures are maintained as in the edited final report. In this volume of the "Fjölrit", the final reports of the following sub-tasks are published:

1.5.: To describe the deep-water fisheries of Iceland
2.6.: To compile existing Icelandic survey data
5.11.: Icelandic studies on the biology of deep-water species

The financial support by the Eyropean Commission for this project is greatly appreciated.

# Sub-task 1.5: To describe the deep-water fisheries of Iceland


## Partner 11: Hafrannsóknastofnun Marine Research Institute (MRI), Reykjavik, Iceland

by

Jakob Magnússon, Jutta V. Magnússon and Klara B. Jakobsdóttir


**Introduction**

The objective of Sub-Task 1.5 was to describe the deep-water fisheries of Iceland and particularly to record the catch statistics of deep-water fish landings, to describe the respective fisheries and to compile an inventory of the fishing fleet and fishing gears.

During the first half of this century the fishing industry in Iceland developed rapidly from a hand and longline fishery carried out from open and small decked hand- and wind powered boats, through various stages of motorized cutters and steam trawlers to the modern trawlers. However, the fishery remained in relatively shallow waters (< 400 m) and the target species, dominated by cod (*Gadus morhua*), did not change.

In the 1930s steam trawlers ventured into deeper waters and the fishery for redfish (*Sebastes marinus*) commenced. This in turn led to some exploration of even deeper waters but it was not until the 1950s that a fishery developed for deep-sea redfish (*Sebastes mentella)*, in depths of 300 to 500 m. This fishery increased in intensity in the 1970s and also began to target a number of other deep-water species. The following species have been targeted with varying intensity: deep-sea redfish (*Sebastes mentella*), Greenland halibut (*Reinhardtius hippoglossoides*), blue ling (*Molva dypterygia dypterygia*), orange roughy (*Hoplostethus atlanticus*) and greater silver smelt (*Argentina silus*). There have also been reports of incidental catches of roundnose grenadier (*Coryphaenoides rupestris*), roughhead grenadier (*Macrourus berglax*), Rabbit fishes (Chimaeridae) and deep-water sharks (Squalidae).

Some of these deep-water fisheries are well-established while others are either comparatively new or in an experimental phase or are purely incidental.

The development of deep-water fishing (>500 m) in the 1970s was rapid and within a few years it was of great importance to the Icelandic demersal fishery. The most important species were the deep-sea redfish (*Sebastes mentella)* and the Greenland halibut (*Reinhardtius hippoglossoides*). The landings of deep-water species in the 5 year period between 1991 to 1995 contribute on average about 15 % of the total landings of demersal species and approximately 20 % of the total value.

The definition of a deep-water fishery is somewhat arbitrary because some species have a wide depth distribution from the shallow shelf to the deeper continental slope. In this study a fishery was considered to be deep-water if the main fishing effort on a particular species is at depths >500 m. Some species have a relatively equal distribution in both shallow and deep water and where historically the fishery has been on the banks and has only recently ventured into deeper water, these have not necessarily been considered as deep-water fisheries. An example of this is the fishery for tusk (*Brosme brosme*).

The two main fishing fleets are trawlers and to a lesser extent, longliners. As a general rule, the fleets move between the different fisheries and use the same types of gear. These gears are essentially the same as for fishing in shallower water with only some minor modifications.

The bottom topography of the ocean region around Iceland forms barriers which drastically influence the hydrographic conditions in the region, causing a very variable deep-water environment off the different coasts.

## Material and Methods

The official catch statistics, log books and fleet register have been examined and appropriate data relating to deep-water fish and fisheries were extracted and entered into a computer database. Further information has been gathered from the database of the Marine Research Institute (MRI), Iceland. Information was also collected from gear manufacturers and their technical experts. The captains of fishing vessels were interviewed and consulted. Information was collected from several publications and from unpublished reports. New information from a deep-water cruise in June/July 1997 was also included.

## Results

### Hydrography

**Topography** (Figure 1.5.1)

Iceland is situated on a submarine ridge which extends from Scotland to Greenland. This ridge forms a barrier which separates the bottom water of the Arctic region from that of the Atlantic. The width of the continental shelf of Iceland is variable. South of Iceland, the coastal region is quite narrow and the continental slope is steep. The north-east coast has a similar steep slope. Off the west, north, east and south-east coasts, the shelf is generally broader and the slopes are not quite as steep. However, these slopes are bisected by a number of submarine canyons. Between Iceland and Jan Mayen there is a deep basin of almost 3000 m which is delimited by ridges extending from the Icelandic shelf and Jan Mayen and the Iceland-Greenland Ridge.The Reykjanes Ridge extends far to the south-west of Iceland and merges with the Mid-Atlantic Ridge.

Thus, topographically there are four different deep-sea basins around Iceland (Figure 1.5.1).

1. In the north, the basin between Iceland and Jan Mayen (Iceland Sea and Iceland-Greenland Channel)
2. The basin east of Iceland (Norwegian Sea)
3. In the south, the basin between the Reykjanes Ridge and the Iceland-Faroe Ridge (Iceland basin)
4. West of Iceland, between the Iceland-Greenland Ridge and the Reykjanes Ridge (Irminger Sea).

This topography forms barriers to the movement of the different water masses that occur around Iceland and hence there is considerable geographical variation in the hydrography. To the south of Iceland, the relatively warm Atlantic water dominates, while off the north and east coasts water masses of other origins i.e. colder and less saline dominate.

**Temperature and Salinity**

The upper layer (between the surface and 400 - 500 m) of the sea north of Iceland consists of waters of differing characteristics depending on their origin and formation. Underlying this heterogeneous upper layer the water column has a very uniform composition and consists of Arctic bottom water. This water is characterised by a salinity of about 34.92 ‰ and a low temperature (<0° C). In the deepest part of the basin north of Iceland, a very low temperature of -0.9° C is reached. The Arctic bottom water is also dominant in the basin to the east of Iceland and the Iceland-Faroe Ridge where its salinity is approximately 34.9 ‰ and the temperature is about 0° to 1° C at about 500 m depth. The temperature decreases with depth and reaches about -1.0° C at depths of about 2000 m.

The conditions to the west and south of Iceland are quite different. The deep water west of Iceland is influenced by an overflow of cold water (approx. 0°C) of relatively low salinity (34.80 ‰) over the Iceland-Greenland Ridge from the area north of Iceland. Thus, temperatures of 3° to 4° C and salinities of 34.85 to 34.90 ‰ dominate at depths between 500 and 2000 m. In the slope area closest to the Icelandic shelf these values are somewhat higher at depths between 500 and 1000 m.

Conditions in the Iceland basin between the Reykjanes Ridge and the Iceland-Faroe Ridge are again different. The temperature is higher at greater depths than in other areas. At about 500 m, the temperature is usually about 7°C and decreases gradually down to about 3° to 4°C at depths of 2000 m.

In the slope areas of the Iceland-Faroe Ridge and the Iceland-Greenland Ridge the overflow component creates special situations where cold water, sometimes of relatively low salinity, forms the bottom water layer in these areas.

## Statistics

**Redfish (*Sebastes*)** (Figure 1.5.2.)

In the 1960s and 1970s, deep-sea redfish comprised a substantial part of the German redfish fishery at Iceland. After the German fleet ceased to fish at Iceland in 1977, the Icelandic fleet intensified the fishery on deep-sea redfish and it subsequently became an important part of the total Icelandic redfish catch. The total catch of deep-sea redfish increased considerably between 1988 and 1994 reaching a maximum in 1994, with almost 57000 t. The catch per unit effort (CPUE) decreased greatly during the same period. Quota regulations for each of the *Sebastes* species were introduced in 1994 and the landings declined to 35000 t in 1996 (Figure 1.5.2).

The deep-sea redfish is almost exclusively taken in bottom and midwater trawls. In the statistics, it is not possible to distinguish between *Sebastes marinus* and *S. mentella* in the smaller landings from other gears such as gillnets and longline although more recently, negligible quantities of deep-sea redfish may have been caught by longline.

**Greenland halibut (*Reinhardtius hippoglossoides*)** (Figure 1.5.3., Table 1.5.1.)

An Icelandic longline fishery for Greenland halibut began in 1969 and this was followed by a bottom trawl fishery in 1973. However, the landings remained moderate until 1977 when they reached 10000 t. In the following years the landings increased and the annual catches levelled at about 30000 t in the period 1982 to 1986. In 1987 the landings increased suddenly and reached a maximum of 45000 to 60000 t in the period 1987-1989. Since then, the fishery on Greenland halibut has declined and the catch per unit of effort (CPUE) declined drastically after 1989 (Figure 1.5.3). Currently, the fishery is managed by a strict quota regulation.

Table 1.5.1 shows the Icelandic landings of Greenland halibut by gear. Greenland halibut is now mostly caught by bottom trawl, mainly by trawlers larger than 500 gross register tons (G.R.T). In 1995 55.3 % of the landings were taken by trawlers of >500 G.R.T and 33.4 % by trawlers < 500 G.R.T. Thus, almost 89 % of the landings were taken by the trawler fleet. 9.8 % of the landings of Greenland halibut were caught by longliners of the 201-500 G.R.T. size category and minor quantities were landed as bycatch from shrimp trawlers. Thus, 98.5 % of the landings were taken by three vessel size categories.

**Blue ling (*Molva dypterygia*)** (Figure 1.5.4.,Table 1.5.2)

Figure 1.5.4 shows the total Icelandic landings of blue ling from 1969 to 1996. In most years the landings, which were exclusively bycatches, amounted to about 2000 to 3000 tons. The peaks in the landings in the early 1980s and in 1993 are the result of a targeted fishery on spawning aggregations. Until recently, 90 to 95 % of the landings of blue ling were caught by bottom trawl. However, in recent years a longline and gillnet fishery for cod and tusk has developed in deeper waters and the bycatch of blue ling has increased. The landings by gear type are given in Table 1.5.2.

**Greater silver smelt (*Argentina silus*)** (Table 1.5.3.)

The landings of greater silver smelt have been moderate and variable from year to year with a range of 42 tons in 1987, to 1255 tons in 1993 (Table 1.5.3).

**Orange roughy (*Hoplostethus atlanticus*)** (Table 1.5.3.)

The catches of orange roughy were small. The highest recorded landings were 715 tons, in 1993 (see Table 1.5.3).

**Other species** (Table 1.5.3.)

The catches of deep-water species other than those mentioned above have been very small (Table 1.5.3). It should be noted that the landings of roundnose grenadier (*Coryphaenoides rupestris*) could include some roughhead grenadier (*Macrourus berglax*).

**Fisheries**

**Redfish** (Figure 1.5.5.)

Small quantities of redfish (*Sebastes marinus*) were commonly caught, together with cod, in relatively shallow waters. The first directed fishery for redfish at Iceland was by German trawlers before World War I. This fishery began in a small way but increased considerably in the 1920s and 1930s. The German fishery at Iceland ceased at the start of World War II.

The Icelandic redfish fishery has been well-established since the mid 1930s. The first records of landings of redfish in Iceland date back to 1932. This directed redfish fishery expanded rapidly but during World War II the Icelandic landings declined. However, soon after the war both Iceland and Germany recommenced their fisheries. This fishery took place almost exclusively in depths of <400 m and therefore was not a targeted deep-water fishery in the modern sense.

At the start of the fishery on *Sebastes marinus* neither the fishermen nor the scientific community were aware of the existence of the deep-sea redfish, *Sebastes mentella*. Although a different type of redfish had been detected by German trawlers fishing at Iceland as early as 1940 it was not until 1951 that it was described as a separate species, *Sebastes mentella*. Both species, *Sebastes marinus* and *S. mentella* have a similar geographical distribution at Iceland but they occupy different depths with some overlap. Thus, a trawler fishing in a given area might be fishing pure *S. marinus* or pure *S. mentella* or mixed catches of both species, depending on the fishing depth. Before 1994 the two species were not separated on board the vessels or at the port of landing and consequently the landing statistics are for both species combined. However for scientific purposes the landings were apportioned into species by an indirect method involving an intensive sampling of the landings from trawls from known areas and depths. This separation of the redfish catches was carried out from 1978 to 1994. Before 1978, only statistics on total landings of redfish (both species combined) are reliable.

Knowledge of the migrations of deep-sea redfish is very limited because tagging has not been successful with this species. The migration pattern has been observed by other means and is connected with maturation, feeding and the release of larvae. There are extensive nursery areas for redfish on the East Greenland shelf and to a smaller degree, at Iceland. The maturing fish initially migrate to certain banks and localities near to or at the edge of the shelf for feeding. When they reach sexual maturity they migrate to the areas where the release of larvae takes place. During the late winter months mature deep-sea redfish, particularly females, migrate along the western and southern slope of the continental shelf towards the south-west part of the shelf area and the Reykjanes Ridge before eventually leaving the shelf area and releasing the larvae bathypelagically in the Irminger Sea off south-west Iceland. No release of larvae has been observed off East Greenland. Another migration takes place after the release of larvae, i.e. a feeding migration back to the slope areas both south and west of Iceland, also extending to the slope area off East Greenland to some extent. During the summer feeding period, the fish is distributed along the slope area west, south and south east of Iceland. During this period there are areas of concentrations where the main fishery takes place, mainly off the west, south-west and south-east coasts. In autumn, during the mating period between September and November, the deep-sea redfish aggregates off the bottom in the Reykjanes Ridge area and along the slope of the south coast. Heavy fishing with midwater trawls is carried out at this time. The main fishing areas for deep-sea redfish at Iceland are shown in Figure 1.5.5. The fishery takes place mostly at depths of 500 to 700 m. Deep-sea redfish are not usually common in depths <400 m but there are exceptions, probably depending on the hydrographic conditions in different areas. Thus, deep-sea redfish is observed in somewhat shallower water on the Iceland-Faroe Ridge than, for example, in the area south-west of Iceland.

**Greenland halibut** (Figure 1.5.6.)

Greenland halibut (*Reinhardtius hippoglossoides*) was known to the Icelandic fishermen for a long time from incidental catches on longline and in bottom trawls, particularly off the north coast of Iceland. However, because there was no market for this species and the fleet was not equipped for fishing in deep water there was little interest in developing a fishery.

The fishery developed in the 1960s when the Federal Republic of Germany (FRG) followed by the German Democratic Republic (GDR) and the Soviet Union (USSR) began to exploit Greenland halibut in Icelandic waters. In the 1970s Poland and the United Kingdom joined in the fishery. Iceland started a directed longline fishery on Greenland halibut in 1969 off the north coast of Iceland. All other nations fished with bottom trawl, mainly off the west coast. The main fishing areas for Greenland halibut at Iceland are shown in Figure 1.5.6.

During the summer feeding phase, mature and immature Greenland halibut inhabit the deep, cold waters off the north and east coasts of Iceland, where the water temperature is usually below 0°C. In autumn, Greenland halibut off the north coast migrate to warmer regions west of Iceland but also, to a lesser extent, to areas off the south-east coast. During the summer it is also dispersed in deep water along the slope to the west of Iceland and along the Reykjanes Ridge. In the latter area, Greenland halibut has recently been observed south to about 59°N.

The main known spawning areas of the Greenland halibut are in deep waters along the slope to the west of Iceland where the temperature is about 3.0° to 4.0°C and the salinity is about 34.90 ‰. After spawning, mature Greenland halibut migrate back to the summer feeding grounds off the north and east coasts. On its migration back, Greenland halibut aggregates in a rather limited area between 65°N and 66°N and 27°W and 28°W. In this area, the major bottom trawl fishery used to take place in April to June mainly in depths of

700 to 1000 m. In recent years, the seasonal character of the fishery has been maintained, but many more catches are now taken outside this limited area and at other times of the year.

**Blue ling (*Molva dypterygia*)** (Figure 1.5.7.)

The blue ling fishery of Iceland is basically a bycatch fishery, mainly linked to the deep-sea redfish fishery. Thus, the catches of blue ling were moderate until 1978 when the landings increased considerably. Previously the greatest catches of blue ling had been taken by foreign fleets, especially Germany. However, there were occasional Icelandic targeted fisheries for blue ling. These took place only when spawning aggregations were located as, for example, during 1980 to 1984 and in 1993. These spawning aggregations were located in very restricted areas and apparently new spawners do not recruit to these particular areas. No subsequent spawning concentrations have been observed in the area which gave good catches in 1980-1983. The main fishing areas for blue ling at Iceland are shown in Figure 1.5.7.

**Greater silver smelt (*Argentina silus*)** (Figure 1.5.8.)

The greater silver smelt or argentine is quite abundant in Icelandic waters and although it was caught as a bycatch in the redfish fishery over a long period of time it was never landed. When wider codend meshes were introduced in trawls in the 1970s the bycatch of greater silver smelt was considerably reduced. Recently there has been some interest in exploiting the greater silver smelt. However, besides marketing difficulties, there are also some technical problems. Usually, the greater silver smelt is mixed with redfish on the fishing grounds, but from time to time the two species may form separate shoals on the same grounds and at the same depths. As a result some hauls will consist almost exclusively of greater silver smelt. However the results of extensive experimental fishing for greater silver smelt have indicated that on most fishing grounds at least 50 % of the catches consist of species other than the target species, mainly redfish. Any targeted fishery on greater silver smelt would require smaller meshes in the codend than in, for example, the redfish fishery which in turn would mean that the fishery would be limited to carefully selected areas.

Very little is known about the migration and spawning aggregations of greater silver smelt. As with redfish, there are migrations of maturing fish from shallower shelf areas (nursery grounds) to the slope. Probably, the greater silver smelt spawns bathypelagically, since spawning specimens are relatively seldom caught in bottom trawls at Iceland. The fishery takes place on feeding aggregations along the slope area. The main fishing areas for greater silver smelt are off the south coast and are shown in Figure 1.5.8.

Although greater silver smelt stays mostly well off the bottom, it is still too close to the bottom to use midwater trawls. The fish is therefore caught with high-opening bottom trawls, mostly four-panel trawls with 80 mm mesh in the codend. The fishing depth varies according to the area but is mostly caught 400 and 700 m.

**Orange roughy (*Hoplostethus atlanticus*)**

The fishery on orange roughy (*Hoplostethus atlanticus*) in Icelandic waters is only a small fishery of recent origin. During research cruises in the 1970s and 1980s orange roughy was observed from time to time mostly as single or a few specimens in deep water off the south-west and the south-east coasts of Iceland. In 1991, a single trawler made some noteworthy catches of orange roughy off the south coast of Iceland. During the following years, the catches of orange roughy were only moderate, despite a great interest and considerable effort. It has proved difficult to locate concentrations of this species. The bottom conditions were extremely difficult for trawling where this species was detected. This is a small targeted bottom trawl fishery at Iceland which is confined to a limited area in deep water (around 1000 m).

**Other species**

Several other species than those mentioned above are on record in the catch statistics. These species are:

| | |
|---|---|
| Black dogfish | *Centroscyllium fabricii* |
| Portuguese shark | *Centroscymnus coelolepis* |
| Rat-tail | *Chimaera monstrosa* |
| Knifenose chimaera | *Rhinochimaera atlantica* |
| Smoothhead | *Alepocephalus bairdii* |
| Spine eel | *Notacanthus chemnitzii* |
| Roughhead grenadier | *Macrourus berglax* |
| Roundnose grenadier | *Coryphaenoides rupestris* |
| Blue antimora | *Antimora rostrata* |
| Black scabbard fish | *Aphanopus carbo* |

The landings of these species and also the greater silver smelt and orange roughy for the last 10 years are given in Table 1.5 3.

In recent years the landings and also the variety of deep-water species have increased as a result of a marketing effort by the fishing authorities. The rat-tail (*Chimaera monstrosa*) has also been caught in waters shallower than 500 m depth but this information is not recorded separately in the landings. Interviews with captains have revealed that some of deep-water species are regularly caught as bycatch in the various fisheries. Thus, for example, greater silver smelt is regularly caught in the redfish fishery, although in small quantities. Other species such as the roughhead and the roundnose grenadiers and, less commonly, the smooth-head and black scabbard fish are a bycatch of the fisheries for Greenland halibut and deep-sea redfish, but they are discarded because of marketing difficulties. This also happens to most of the sharks and dogfishes. Sometimes large incidental catches of roundnose grenadier are taken but they are mostly discarded for the same reason.

Several other species such as tusk, halibut (*Hippoglossus hippoglossus*) and monkfish (*Lophius piscatorius*) have a wide depth distribution. These species are occasionally caught as bycatch in deep water but the main landings come from shallower waters.

**Inventory of the fleet** (Table 1.5.4., Figure 1.5.9)

An overview of the composition of the Icelandic fishing fleet and its development between 1991-1995 is given in Table 1.5.4.

There has been a considerable reduction in most of the vessel categories (number of vessels, gross registered tonnage and power) as a result of the government's policy to reduce the fishing fleet to compensate for the decreased availability of fish stocks, particularly cod, on the traditional fishing grounds,. This reduction of the fleet in most of the size categories does not necessarily indicate a decrease in effort because of the technical improvements which are continually taking place.

However, one category of vessel, the trawlers larger than 500 G.R.T., showed a great increase in number of vessels as well as in the G.R.T. and power. The number of vessels increased by 52 % and the G.R.T. and the power (kW) by about 68 %. This indicates an increase in both the size and power of the individual vessels. The remarkable expansion of this vessel size category is explained by an increasing number of big freezer trawlers which, in most cases, process the catch on board. These trawlers are able to make longer trips, fish in distant waters, handle bigger and heavier gear and, consequently, are predestined for fishing in deep waters. The vessels engaged in deep-water fishing belong mainly to this vessel category, but some trawlers of less than 500 G.R.T. also conduct deep-water fishing, particularly for deep-sea redfish.

In the case of redfish, it is difficult to draw a meaningful line between the vessels catching deep-sea redfish (*S. mentella*) and the golden redfish (*S. marinus*). The number of vessels catching 'redfish' is higher than the number of vessels catching Greenland halibut. This is explained by the fact that a number of smaller trawlers of the same fleet which fish for redfish are not equipped or are not able to fish effectively in deep water for Greenland halibut. Also trawlers fishing for other deep-water species are also part of this fleet.

The power of the trawlers engaged in the deep-sea redfish fishery cannot be analysed because of the lack of distinction between the fishery for deep-sea redfish (*S. mentella*) and the golden redfish (*S. marinus*). However, such an analysis can be carried out on the Greenland halibut fishery.

Figure 1.5.9 shows how the average horse power of the trawlers and longliners has changed between 1969 and 1996. Initially, the average Hp was rather stable (1800 to 2000 Hp) until the 1990s when the average power increased to approximately 2400 Hp. It is probable that the corresponding figures for the deep-sea redfish fishery would be similar. The engine power of the longliners fishing for Greenland halibut between 1969 and 1974 was mostly about 500-600 Hp. The longline fishery in 1978-1981 and since 1993 was carried out by vessels with 500 to 700 Hp.

**Fishing gear** (Figure 1.5.10)

There are three types of gear which have been used for deep-water fishing by the Icelandic fleet:

1. Bottom trawl
2. Gloria midwater trawl
3. Deep-sea longline

1. Bottom trawl

The bottom trawl is used for the two well-established deep-water fisheries for Greenland halibut and deep-sea redfish. In general, the same kind of trawl is used for both fisheries and by the whole fleet. Individual captains make minor alterations to both the trawl itself and/or its rigging with the result it is rare to find trawls and rigging which are identical in all details. The trawl is characterised as a high opening two-panel trawl developed from the so-called Bacalao type. It has a longer belly than the conventional trawls used previously and is popular as the 200 mm mesh size in the front of the trawl results in less drag whilst towing. The codend has the prescribed 135 mm mesh size. The lower part of the wing ends are omitted and only the top wing (flyer) part is used. This is attached to the footrope by a chain. The length of the sweeplines are at least 70 fathom and the bridles 30 fathom and these are attached directly to the headline and the footrope extension, respectively. Usually, there is a heavy chain at the end of the single sweepline where the bridles are attached to it. The lower sweeplines frequently consists of chains of different strength. The weight of the chains depends upon individual experience.

The trawl doors used with this kind of trawl are oval, heavy duty doors with a slot. The weight and size may vary, depending on the vessel size and/or power. The most commonly used doors are the so-called POLY-ICE doors no. 9 to 12 (8 to 11.7 $m^2$) weighing from 2.8 to 3.5 tons or even 4 tons. The standard width of the slot is 18 cm but some captains prefer to have it bigger, even up to 25 cm. It does not have an impact on the effectiveness of the doors but makes it easier to heave in this heavy gear.

Chains (20 mm) are used in the back-strops. Some use three door bridles. From the door bridles to the sweepline a 20 mm chain is inserted the length of which depends on the length of the ramp of the vessel.

2. Gloria midwater trawl

In recent years during September to November, considerable catches of deep-sea redfish have been taken with a midwater trawl. All trawlers use the same type of trawl, i.e. the Gloria midwater trawl which is a four-panel trawl, with very wide meshes in the front part. A schematic drawing of the 2560 m Gloria trawl, together with the bridle arrangements is shown in Figure 1.5.10. The wing ends are split and attached to 64 to 300 m long bridles, depending on the size of the trawl and otter boards. The bridles are shackled to the upper and lower back corner of the doors, the headline bridle to the upper corner and the footrope bridle to the lower corner. The lower bridle is longer than the upper one and attached to the wing end with a chain which is 20 to 25 m long in the bigger trawls. The size of this trawl is somewhat variable depending on the towing power of the respective vessels, and ranges from 1792 to 3072 metres. The size is indicated by the length in metres of the circumference at the greatest width of the belly by stretched meshes.

Special otter boards of Suberkrub type are used for this midwater trawl. The POLY-ICE type is used by all the vessels but they are of variable size. Compared to bottom trawl doors, the midwater otter boards are bigger but lighter. Thus, for example, doors no. 9 and 12 are 10.4 $m^2$ and 13.5 $m^2$ respectively, weighing 2.2 tons and 2.8 tons. No weights in front of the lower wings are used on the Gloria trawl. The latest types are provided with a "Super Foil" at the front of the board which increases the spreading force and creates less resistance.

3. Deep-sea longline

The longline fishery in Iceland used to be a bank and shallow water fishery for cod, haddock and several other species of the continental shelf. In recent years, longliners have ventured into greater depths, targeting tusk and ling along with Greenland halibut. The longline used in deep water does not differ from that used in shallower waters, except for having somewhat thicker lines. Most recently, however, there has been a rapid increase of interest in fishing in very deep water with longlines, targeting mainly Greenland halibut and 'giant' redfish (a *Sebastes marinus* type). Specially designed longlines have been developed for this kind of fishing. Only a few vessels have been engaged in deep-water longlining but their number is increasing. However, it is premature to define it as a well-established fishery.

The main features of this deep-sea longline is the use of a strong synthetic and relatively thin line to which the snoods are clipped by a swivel. The deep-sea longline is under continuous development. At present, a new type of DYNEX line with increased sinking rate is being used. This line has a higher breaking strength than previous ones but is of the same thickness. It sinks faster and drifts less than the regular lines. The snood is attached to the line by swivel which also can rotate around the line.

**Discussion**

It is generally believed that most deep-water species are slow-growing and long-living and that recruitment to the adult stock takes a long time. Such stocks are very vulnerable to over-fishing. A good example is the fishery on Greenland halibut. After a rather stable fishery in the 1980s based on quota regulations, a sudden increase in the fishery took place between 1987 and 1989. This sudden rise and the high CPUE was partly due to the extension of the fishing area, but also to an increase in prices. To make the quota fishing more flexible, vessels were allowed to convert a certain amount of a quota for one fish species to another. There is a defined conversion factor for each fish species. Between 1987 and 1989 it became very profitable to convert the quota for other species to that for Greenland halibut. Finally, the very effective fishing fleet belonging to the vessel size category of > 500 tons was expanding and becoming involved in the Greenland halibut fishery. It is most likely that this very intensive fishing effort over a relatively short period (3 years) caused the drastic drop in CPUE for Greenland halibut after 1989. This emphasises the point that fisheries on deep-water species should be conducted with great caution.

The increase in the most efficient part of the fleet, i.e. the >500 tons size category in later years is remarkable. Not only has the number of trawlers increased, but also the size and engine power. Also, the rapidly developing improvements of electronic devices and gear have made this part of the fishing fleet extremely efficient and able to fish in areas where trawling was considered impossible only a few years ago. Considering the development in the Icelandic deep-water fisheries, it can be concluded that an intensive fishery most likely causes less availability of fish and probably a decline in the stocks. The recent technical developments in processing the catch at sea, a task which was formerly almost entirely done ashore, has impacted on the economic and social structure of communities.

From interviews with trawler captains it is obvious that the bycatches of several deep-water species are considerable. The landings do not give any realistic idea of the availability of those species. In Iceland, no stable market has been developed for these species, the prices are very low and the fishermen consider it not worthwhile to process and/ or land these catches. They are therefore discarded and no records are kept of these discards. However, there is reason to believe that there is a considerable potential for at least some of these discarded species.

This emphasises the urgent need to put much more effort into research of deep-water stocks in order to be able to give advice to the industry **before** the fishery has depleted the stocks.

## References

A wide variety of sources were used in the preparation of this report. They are listed in full in Project Document No. 36. A selection, based mainly on accessibility, follows:


Hopper, A.G. (1995) (ed.). Deep-water Fisheries of the North Atlantic Oceanic Slope. NATO ASI Series

Jónsson, G. (1992). Íslenskir fiskar. Reykjavík, 2nd edition.

Magnússon, J. (1980). On the relation between depth and redfish in spawning condition, SW of Iceland. ICES, C.M. 1980/G:46

Magnússon, J.V. (1996). Greater silver smelt, *Argentina silus* in Icelandic waters. Journal of Fish Biology, **49**(Supplement A), 259-275.

Magnússon, J. and J.V. Magnússon, (1978). On the Proportion of the Two Species of Redfish, *Sebastes marinus* and *Sebastes mentella* in Research Catches from Icelandic and East Greenland Waters. ICES C.M.1978/G:37

Magnússon, J.V., O.A. Bergstad, N.-R. Hareide, J. Magnússon and J. Reinert (1997). Ling, blue ling and tusk of the Northeast Atlantic. Nordic Council of Ministers,Tema Nord 1997:535, 61pp.

**Table 1.5.1** Greenland halibut. Icelandic landings (t) by gear 1985-1996.

| Year | 1985 | | 1986 | | 1987 | | 1988 | | 1989 | | 1990 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Types of gear | tons | % | tons | % | tons | % | tons | % | tons | % | tons | % |
| Longline | 831 | 2,8 | 265 | 0,9 | 8 | | 4 | | + | | 7 | |
| Bottom trawl | 27425 | 93,9 | 28732 | 92,5 | 42222 | 94,3 | 47594 | 97,0 | 57351 | 98,3 | 35856 | 98,1 |
| Shrimp trawl | 945 | 3,2 | 2047 | 6,6 | 2515 | 5,6 | 1460 | 3,0 | 953 | 1,6 | 689 | 1,9 |
| Net/gillnet | 6 | | 3 | | 29 | 0,1 | 4 | | 19 | | 3 | |
| Other | 3 | | 4 | | - | | 4 | | 10 | | 1 | |
| Total | 29210 | 100,0 | 31051 | 100,0 | 44774 | 100,0 | 49066 | 100,0 | 58333 | 100,0 | 36556 | 100,0 |

| Year | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Types of gear | tons | % | tons | % | tons | % | tons | % | tons | % | tons | % |
| Longline | 188 | 0,5 | 9 | | 626 | 1,8 | 2200 | 7,9 | 2820 | 10,3 | 2333 | 10,8 |
| Bottom trawl | 33668 | 96,7 | 31015 | 97,1 | 32321 | 95,2 | 24200 | 87,4 | 23995 | 87,7 | 19357 | 89,2 |
| Shrimp trawl | 959 | 2,8 | 929 | 2,9 | 1009 | 3,0 | 1246 | 4,5 | 559 | 2,0 | - | |
| Net/gillnet | + | | 1 | | 11 | | 3 | | + | | - | |
| Other | 8 | | - | | + | | 39 | 0,1 | + | | - | |
| Total | 34823 | 100,0 | 31954 | 100,0 | 33967 | 100,0 | 27688 | 100,0 | 27374 | 100,0 | 21690 | 100 |

* Provisional figures

**Table 1.5.2** Blue ling. Icelandic landings (t) by gear 1991-1996.

| Year | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Types of gear | tons | % | tons | % | tons | % | tons | % | tons | % | tons | % |
| Longline | 46 | 2,9 | 121 | 4,7 | 43 | 0,8 | 111 | 6,2 | 272 | 17,3 | 370 | 31,8 |
| Gillnet | 22 | 1,4 | 26 | 1,0 | 32 | 0,6 | 46 | 2,6 | 42 | 2,7 | 24 | 2,1 |
| Danish seine | 4 | 0,3 | 13 | 0,5 | 1 | 0,0 | 18 | 1,0 | 10 | 0,6 | 9 | 0,8 |
| Bottom trawl | 1451 | 91,7 | 2348 | 91,8 | 5181 | 97,4 | 1616 | 90,0 | 1224 | 77,9 | 750 | 64,4 |
| Midwater-trawl | | | | | | | | | | | 2 | 0,2 |
| Norway lobster trawl | 55 | 3,5 | 2 | 0,1 | 17 | 0,3 | 5 | 0,3 | 5 | 0,3 | 4 | 0,3 |
| Shrimp trawl | 5 | 0,3 | 48 | 1,9 | 43 | 0,8 | 32 | 1,8 | 19 | 1,2 | 5 | 0,4 |
| Total | 1583 | 100,0 | 2558 | 100,0 | 5317 | 100,0 | 1796 | 100 | 1572 | 100,0 | 1164 | 100,0 |

*Provisional figures

**Table 1.5.3** Icelandic deep-water fisheries. Catches and bycatches (tons)*.

| English names | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Black dogfish | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 4 | 6 |
| Portuguese shark | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| Rat-tail | 0 | 0 | 0 | 0 | 498 | 106 | 3 | 60 | 106 | 21 | 794 |
| Knifenose chimaera | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 1 | 6 |
| Smooth-head | 0 | 0 | 0 | 0 | 0 | 10 | 3 | 1 | 1 | 0 | 15 |
| Greater silver smelt | 42 | 206 | 8 | 112 | 246 | 657 | 1255 | 613 | 492 | 808 | 4439 |
| Spine eel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Rough head grenadier | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 28 | 6 | 15 | 50 |
| Roundnose grenadier | 0 | 2 | 2 | 3 | 48 | 210 | 276 | 210 | 398 | 139 | 1288 |
| Blue antimora | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| Orange roughy | 0 | 0 | 0 | 0 | 65 | 382 | 715 | 158 | 64 | 40 | 1424 |
| Black scabbard fish | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

* Deep-sea redfish,Greenland halibut and blue ling are omitted

**Table 1.5.4** The Icelandic fleet 1991-1995. Number, G.R.T. and Power (kW) are shown for each vessel category (t).

| | Cutters | | | | | | | | Trawlers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Vessel categories (t) | | | | | | | | | | |
| | ≤ 12 | 13-20 | 21-50 | 51-110 | 111-200 | 201-500 | 500-800 | > 800 | ≤ 500 | > 500 | |
| **Year** | Number of vessels | | | | | | | | | | **Total** |
| **1991** | 438 | 49 | 83 | 114 | 99 | 82 | 10 | 5 | 80 | 33 | **993** |
| **1992** | 427 | 47 | 81 | 103 | 91 | 82 | 10 | 5 | 69 | 38 | **953** |
| **1993** | 421 | 47 | 80 | 100 | 94 | 77 | 10 | 5 | 68 | 41 | **943** |
| **1994** | 363 | 50 | 76 | 88 | 89 | 78 | 10 | 4 | 64 | 45 | **867** |
| **1995** | 341 | 48 | 73 | 84 | 82 | 69 | 10 | 4 | 64 | 50 | **825** |
| | G.R.T. | | | | | | | | | | |
| **1991** | 3506 | 802 | 2598 | 8962 | 15346 | 23142 | 6879 | 4443 | 31005 | 24947 | **121630** |
| **1992** | 3333 | 766 | 2505 | 8091 | 14120 | 23503 | 6879 | 4443 | 26843 | 29913 | **120396** |
| **1993** | 3269 | 766 | 2480 | 7859 | 14715 | 21758 | 6750 | 4443 | 26660 | 32529 | **121229** |
| **1994** | 2780 | 813 | 2354 | 6913 | 13989 | 22139 | 6750 | 3622 | 25388 | 37039 | **121787** |
| **1995** | 2581 | 778 | 2292 | 6620 | 13038 | 20106 | 6764 | 3622 | 25635 | 41930 | **123366** |
| | Power (kW) | | | | | | | | | | |
| **1991** | 43519 | 6833 | 18123 | 42718 | 55125 | 66117 | 19497 | 10651 | 99926 | 63911 | **426420** |
| **1992** | 44980 | 6445 | 17867 | 38769 | 51454 | 66496 | 19497 | 10651 | 87369 | 80487 | **424015** |
| **1993** | 45491 | 6492 | 17603 | 37751 | 53697 | 61708 | 18865 | 10651 | 86594 | 86639 | **425491** |
| **1994** | 40895 | 7101 | 16637 | 33139 | 51345 | 63231 | 18865 | 8444 | 82455 | 98838 | **420950** |
| **1995** | 38548 | 7019 | 16014 | 31587 | 47285 | 56433 | 18865 | 8444 | 83743 | 107401 | **415339** |

**Figure 1.5.1** Chart showing the bottom topography around Iceland.

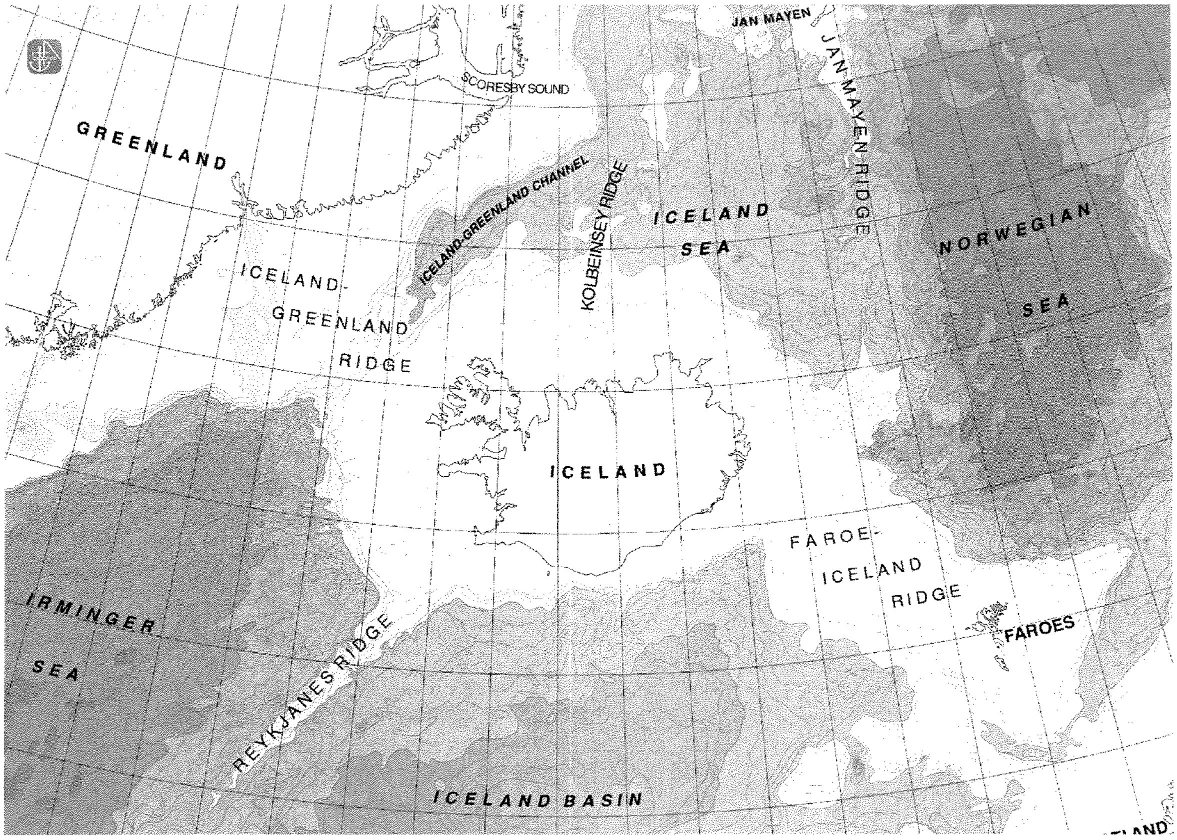



**Figure 1.5.2** Deep-sea redfish. Total landings 1978-1996 and CPUE since 1985.

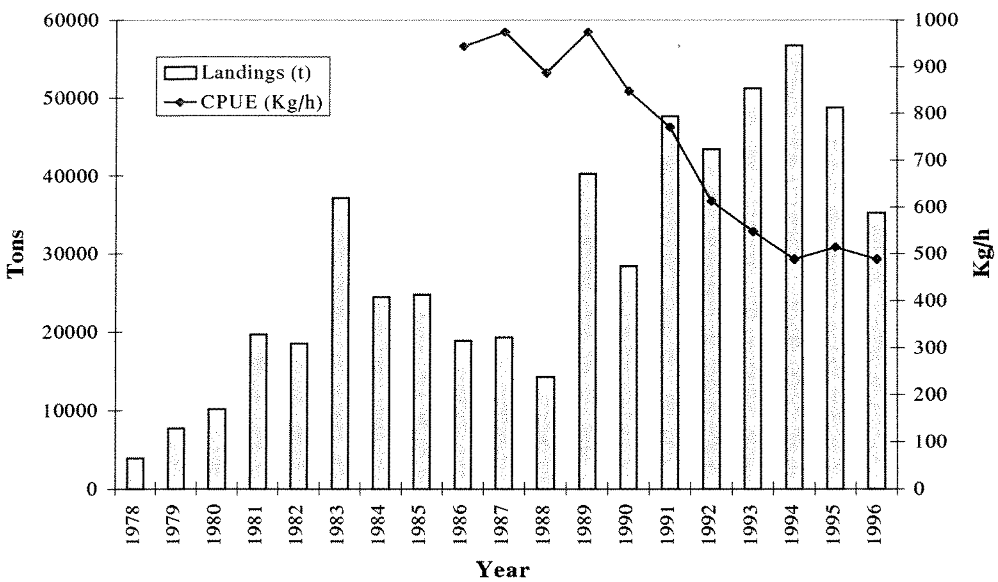


**Figure 1.5.3** Greenland halibut. Total landings 1969-1996 and CPUE since 1985.

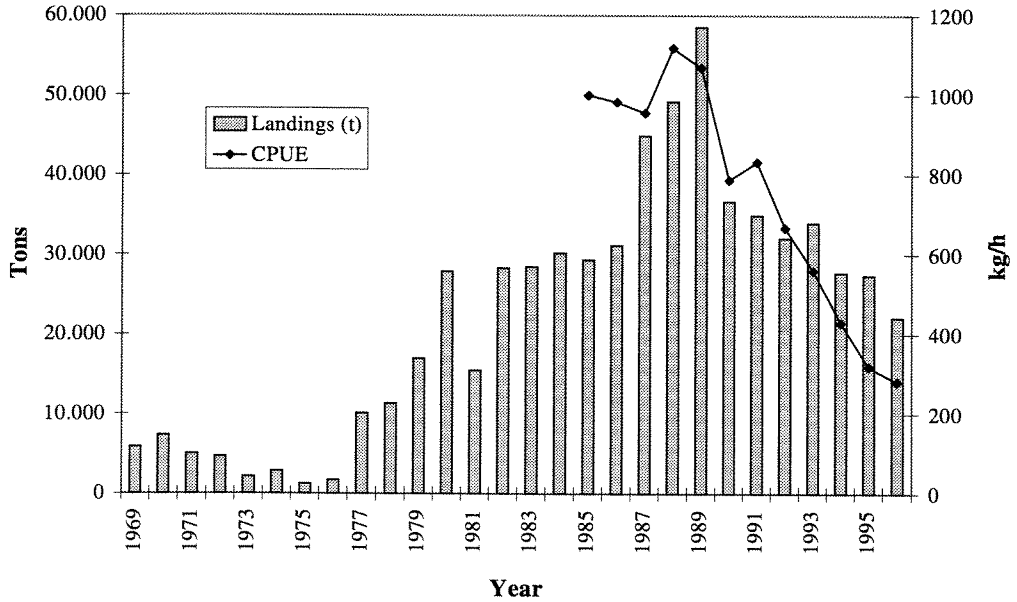



**Figure 1.5.4** Blue ling. Total Icelandic landings of blue ling 1969-1996.

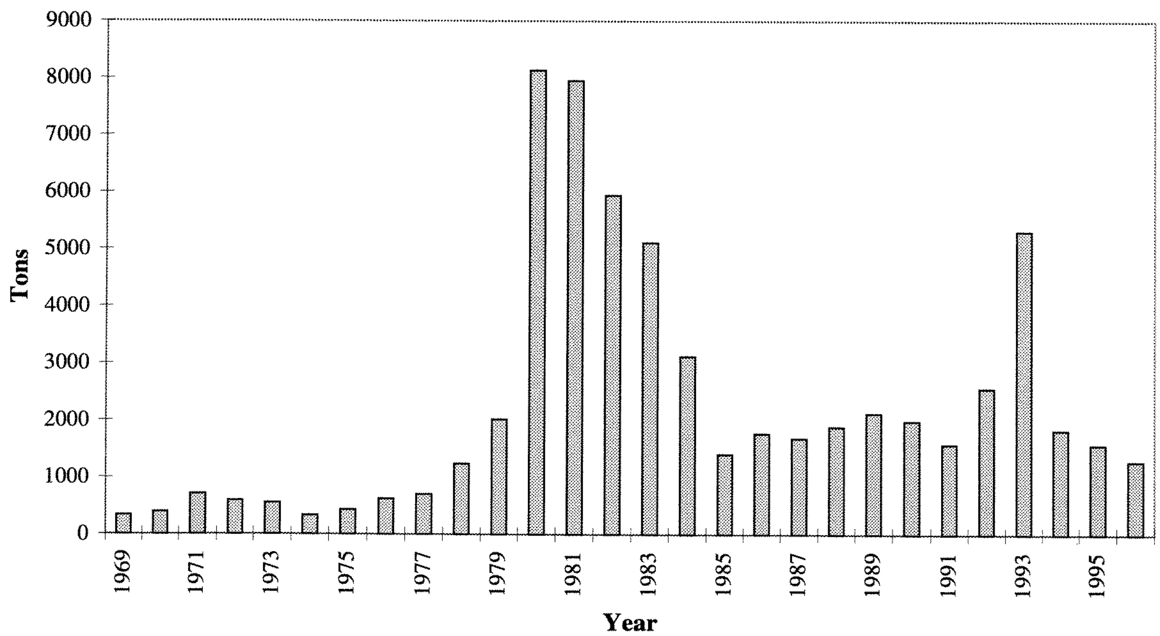


**Figure 1.5.5** Deep-sea redfish. Main fishing areas based on tons per n.m.$^2$ over four years (1992-1996).

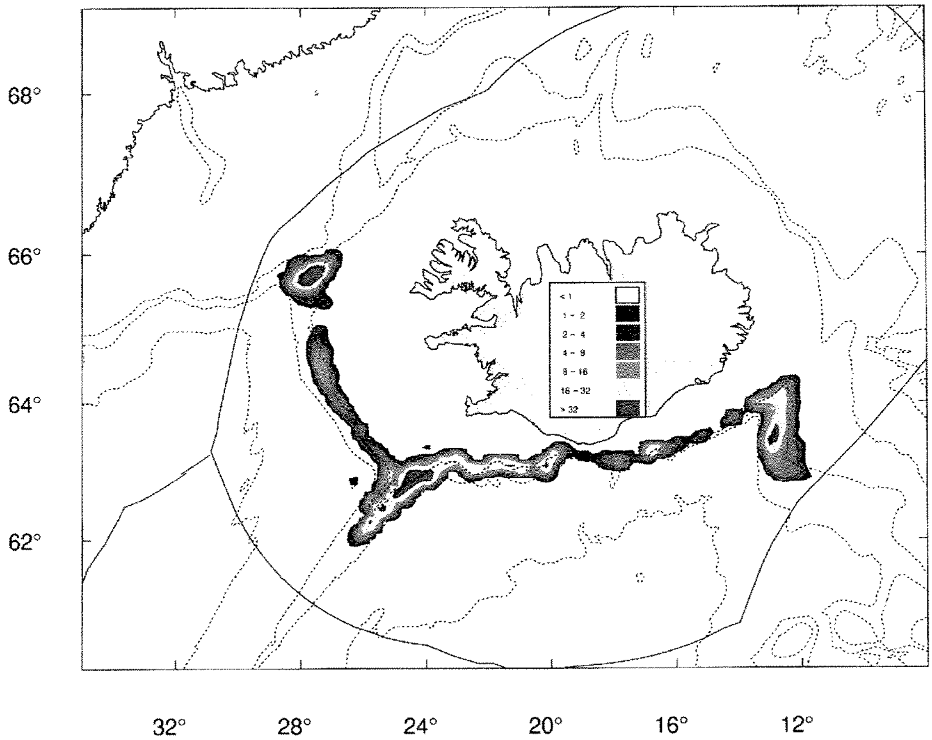



**Figure 1.5.6** Greenland Halibut. Main fishing areas based on tons per n.m.$^2$ over four years (1992-1996).

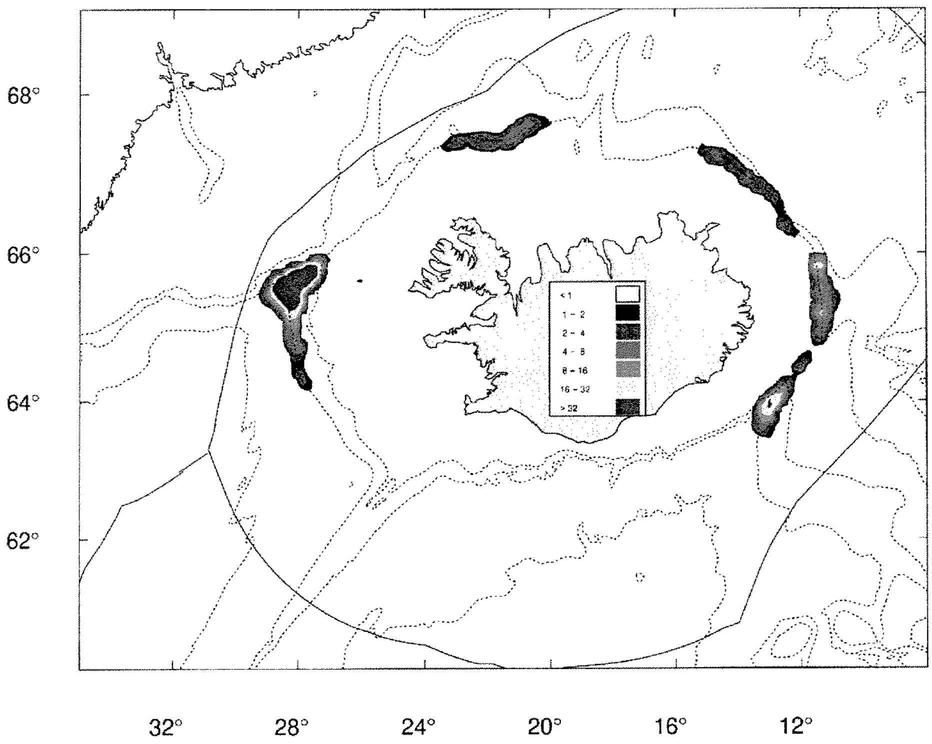


**Figure 1.5.7** Blue ling. Main fishing areas based on tons over four year (1992-1996).

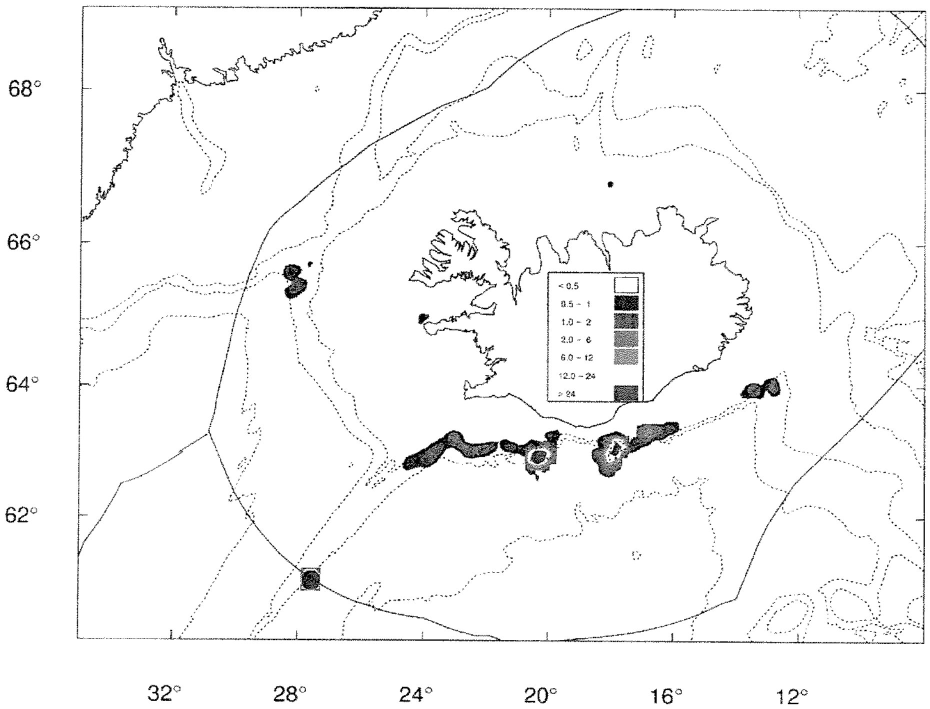



**Figure 1.5.8** Greater silver smelt. Area of commercial fishing activities in 1995.

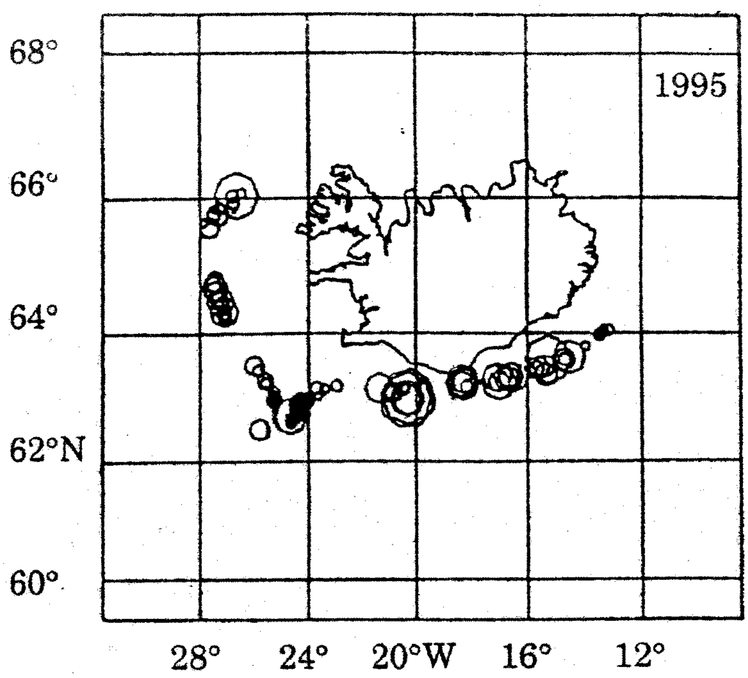


**Figure 1.5.9** Icelandic Greenland halibut fisheries. Average Hp of the fleet 1969-1995.

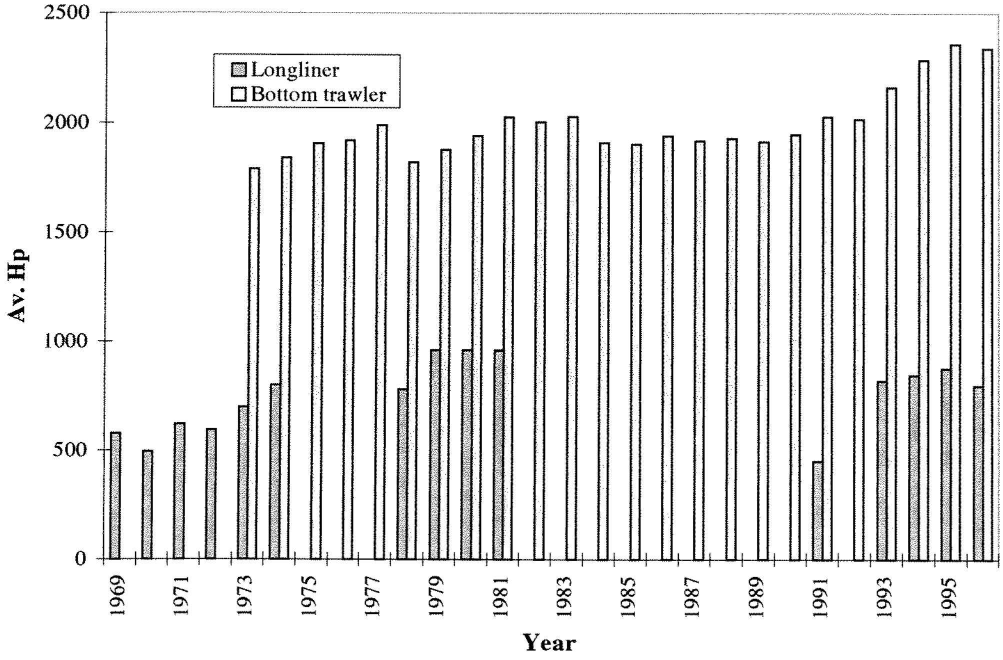
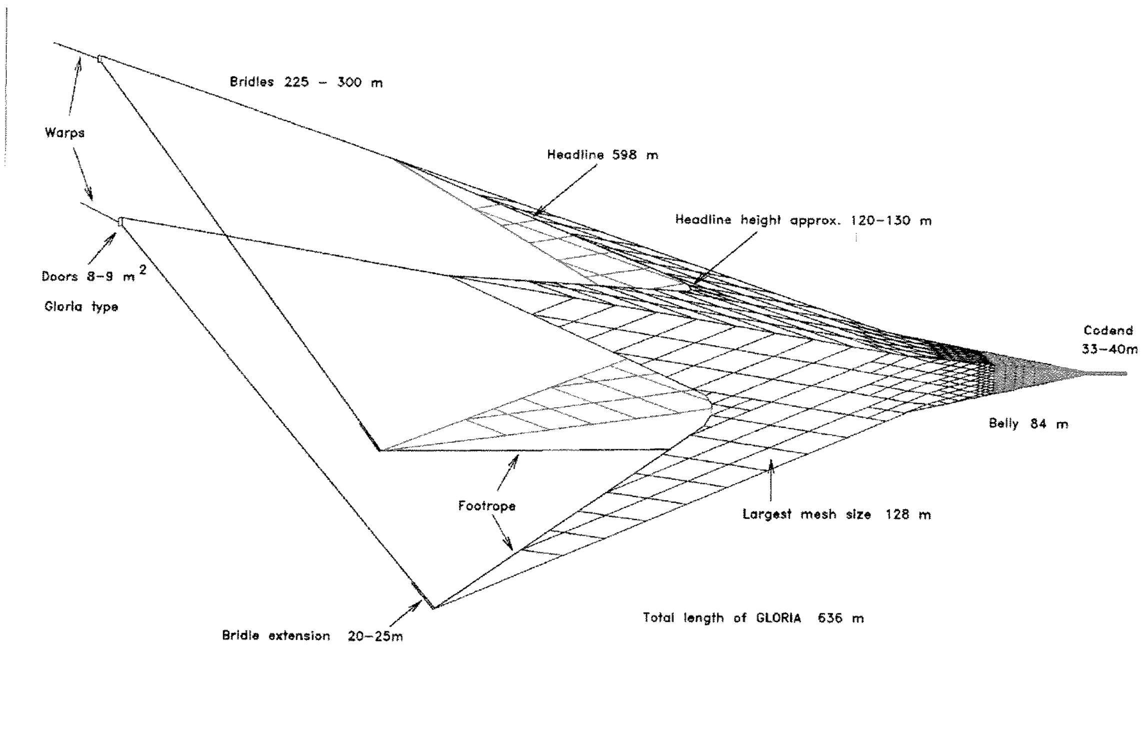



**Figure 1.5.10** Gloria midwater trawl.



# Sub-task 2.6: To compile existing Icelandic survey data

## Partner 11: Hafrannsóknastofnunin Marine Research Institute (MRI), Reykjavik, Iceland

by

Klara B. Jakobsdóttir, Jútta V. Magnússon and Jakob Magnússon

## Introduction

The objectives of this sub-task were:

1) To screen all survey data on non-target deep-water fish species from 1975 onwards and to enter those that had not been computerised into a computer database.
2) To improve the existing data in the database
3) To scan all hauls taken in deep water for information on deep-water species. This would include information from landings of such species.

In this report, an overview on existing material of the Marine Research Institute (MRI) on deep-water fish species during the period 1975 to 1997 is given in table format. Most of the available data on non-target deep-water fish species are from the southwest and south of Iceland (Deep-water Areas 04 and 05 – see Figure 2.1.1)

Out of at least 87 cruises conducted by the MRI where deep-water fishes were recorded in the period 1975-1997, 29 cruises were either primarily or secondarily directed to deep water. In the remaining 58 cruises, deep-water fish species were caught occasionally or incidentally. In about 45 cruises, specimens had been recorded as counted without any biological measurements. Those cruises are not listed in this report. Most of the surveys recorded here were focused on commercially exploitable stocks such as Greenland halibut (*Reinhardtius hippoglossoides*) and deep-sea redfish (*Sebastes mentella*), i.e. on species that are of direct commercial interest to the fishery. In some surveys, the main target was a species of particular potential interest to the fishery such as roundnose grenadier (*Coryphaenoides rupestris*) and blue ling (*Molva dypterygia*). In other surveys, research on deep-water species was only secondary to the main task and during some surveys, occasional single incidental hauls were taken in deep water.

When screening the survey data on deep-water fish species, it was decided to exclude species which had been commercially exploited for a long period of time *i.e.* at least 10 to 20 years. These species *e.g.* Greenland halibut (*Reinhardtius hippoglossoides*) and deep-sea redfish (*Sebastes mentella*) have been sampled and dealt with in the regular research programmes of the MRI. Also excluded were species such as ling (*Molva molva*), tusk (*Brosme brosme*), and monkfish (*Lophius piscatorius*) which appear in deep water but are more common in shallower waters and are bycatch species. All other species which inhabit depths > 400 m were included. Of those species, some have been or are occasionally target species for the commercial fishery such as orange roughy (*Hoplostethus atlanticus*), blue ling (*Molva dypterygia)* and greater silver smelt (*Argentina silus*) (see also Sub-task 1.5).

**Material and Methods**

**The trawls used in the surveys included both bottom and mid-water trawls of a variety of types, sizes, rigs and codend mesh sizes. Sometimes the codends had fine-meshed liners.**

The main emphasis was on improving the existing database by screening all survey data for all deep-water species. A considerable time had to be spent on gathering material from old logbooks and records. Often, the computation of deep-water non-target species had been restricted to counts of specimens per station although data on, for example, length existed. The correction of these data was very time-consuming. Especially in recent years, information at least on length, were available for a few deep-water fish species, mainly blue ling and greater silver smelt. These data were collected by fisheries inspectors, the MRI sampling team and during research surveys with different primary objectives. It was decided to include these data into the compilation of data on deep-water fish species in order to make the inventory as complete as possible. Data on deep-water fish species were collected every year during this period (1975-1997) but not all could be located and some original data may have been lost. For example, no data on deep-water fish species was available for 1977. In several years, the records on deep-water fish species are scarce. In some instances, the fishing depth was not recorded and data from such hauls were omitted.

In recent years with the increased interest in deep-water fish species, the sampling and storing of data has improved considerably. Thus, a greater variety of information is now available. Along with the basic data on date, position, gear, depth and sometimes on the near bottom temperature, the biological information also improved with length, maturity and weight data. Since 1996, all data collected on surveys have been computerised directly at sea.

**Results**

The data are stored in an ORACLE database of the MRI and presented here in table format. Table 2.6.1 lists the cruises and surveys from which biological data on non-target deep-water fish were obtained. Each fish species was given a unique computer number (Table 2.6.2). The gear types are listed in Table 2.6.3. All the variants of trawls were given separate computer numbers and these numbers are applied in Table 2.6.5. An overview of the entire biological material on deep-water fish species in Iceland (MRI) is given in Tables 2.6.4 and 2.6.5 by year and cruise respectively.

**Discussion**

Iceland has put considerable effort into research of deep-water fish species. Much of the information was obtained sporadically or even incidentally. It is apparent from Table 2.6.1 that there were a greater number of cruises aimed at deep-water fish species in 1975 and 1976. This was probably due to rather poor catches of deep-sea redfish and Greenland halibut at that time. Further, there seems to be a connection between a generally declining trend in catches in the traditional fisheries and the exploratory fishing activities in deep water. Thus, for example, the landings of cod decreased by almost 30 % in the period 1970 to 1978. At the same time the fleet was changing from side trawlers to stern trawlers which meant that there was a much greater capacity of trawling in deep water. The authorities also granted some extra funds for explorations in deeper water.

The government funding of deep-water research in the hope that it would lead to new commercially exploitable species or stocks and the promotion of deep-water species has led to a greater variety of fish species being landed in recent years. Sampling can now be done on the landings of species which were previously discarded. The increased interest in the deep-water fishery has also led to an improvement in the recording of deep-water species and an increased emphasis on collecting biological data on both target and non-target species.

The task of screening and compiling old data, which has been initiated in this project will continue and perhaps some of the missing data will be recovered The tables given in this report reflect the present situation and are constructed so as to quickly show what kind of data are available and how it can be accessed.

**Table 2.6.1** Icelandic Deep-water surveys 1975-1997

| No. | Year | Cruise | Task* | No. | Year | Cruise | Task* |
|---|---|---|---|---|---|---|---|
| 1 | 1975 | B5-75 | 3 | 47 | 1988 | HK1-88 | 3 |
| 2 | 1975 | B7-75 | 2 | 48 | 1988 | LSJ1-88 | 3 |
| 3 | 1975 | B11-75 | 2 | 49 | 1988 | LSJ2-88 | 3 |
| 4 | 1976 | B4-76 | 3 | 50 | 1988 | LYM1-88 | 3 |
| 5 | 1976 | R1-76 | 1 | 51 | 1988 | TO1-88 | 3 |
| 6 | 1976 | R2-76 | 1 | 52 | 1989 | TB1-89 | 3 |
| 7 | 1976 | R3-76 | 1 | 53 | 1989 | TH1-89 | 3 |
| 8 | 1976 | K1-76 | 1 | 54 | 1989 | TR1-89 | 3 |
| 9 | 1976 | K2-76 | 1 | 55 | 1989 | TV1-89 | 3 |
| 10 | 1978 | B7-78 | 1 | 56 | 1990 | TL1-90 | 3 |
| 11 | 1978 | B10-78 | 2 | 57 | 1990 | TV1-90 | 3 |
| 12 | 1978 | B11-78 | 3 | 58 | 1991 | B9-91 | 3 |
| 13 | 1979 | G1-79 | 3 | 59 | 1991 | TH1-91 | 3 |
| 14 | 1979 | H1-79 | 1 | 60 | 1991 | TV1-91 | 3 |
| 15 | 1980 | B4-80 | 2 | 61 | 1992 | B9-92 | 3 |
| 16 | 1980 | B6-80 | 3 | 62 | 1992 | B12-92 | 3 |
| 17 | 1980 | B14-80 | 2 | 63 | 1992 | BESS1-92 | 3 |
| 18 | 1981 | A9-81 | 3 | 64 | 1992 | TJ1-92 | 2 |
| 19 | 1981 | B3-81 | 1 | 65 | 1992 | TV1-92 | 3 |
| 20 | 1981 | H1-81 | 3 | 66 | 1993 | B3-93 | 1 |
| 21 | 1981 | H2-81 | 3 | 67 | 1993 | B10-93 | 3 |
| 22 | 1981 | H3-81 | 3 | 68 | 1993 | B12-93 | 3 |
| 23 | 1982 | B7-82 | 3 | 69 | 1993 | D9-93 | 3 |
| 24 | 1982 | H3-82 | 2 | 70 | 1993 | A12-93 | 3 |
| 25 | 1982 | H5-82 | 2 | 71 | 1993 | S1-93 | 1 |
| 26 | 1982 | H6-82 | 1 | 72 | 1993 | TBA1-93 | 3 |
| 27 | 1983 | H1-83 | 3 | 73 | 1993 | TBR1-93 | 3 |
| 28 | 1983 | H3-83 | 3 | 74 | 1994 | B10-94 | 3 |
| 29 | 1983 | H4-83 | 3 | 75 | 1994 | B12-94 | 3 |
| 30 | 1984 | A4-84 | 3 | 76 | 1994 | TBR1-94 | 3 |
| 31 | 1984 | B3-84 | 3 | 77 | 1994 | TV1-94 | 3 |
| 32 | 1984 | L4-84 | 3 | 78 | 1995 | B10-95 | 3 |
| 33 | 1985 | B3-85 | 2 | 79 | 1995 | TB1-95 | 3 |
| 34 | 1985 | H1-85 | 1 | 80 | 1996 | B6-96 | 2 |
| 35 | 1985 | TH1-85 | 3 | 81 | 1996 | TH1-96 | 3 |
| 36 | 1985 | TP1-85 | 3 | 82 | 1996 | TL1-96 | 3 |
| 37 | 1985 | TV1-85 | 3 | 83 | 1996 | TR1-96 | 3 |
| 38 | 1986 | B5-86 | 3 | 84 | 1996 | TM3-96 | 2 |
| 39 | 1986 | TL1-86 | 3 | 85 | 1997 | B13-97 | 3 |
| 40 | 1986 | TV1-86 | 3 | 86 | 1997 | KA1-97 | 1 |
| 41 | 1987 | B2-87 | 2 | 87 | 1997 | TBR2-97 | 2 |
| 42 | 1987 | B4-87 | 1 | | | | |
| 43 | 1987 | TL1-87 | 3 | | | | |
| 44 | 1987 | TV1-87 | 3 | | | | |
| 45 | 1988 | B2-88 | 1 | | | | |
| 46 | 1988 | B7-88 | 2 | | | | |

*1 Deep sea fishes main task of the cruise
2 Deep sea fishes secondary task
3 Occasional hauls taken

**Table 2.6.2** Deep-water fish species in alphabetical order.

| Species | Comp no |
|---|---|
| *Alepisaurus ferox* | 142 |
| *Alepocephalus agassizii* | 178 |
| *Alepocephalus bairdii* | 161 |
| *Ammodytes marinus* | 83 |
| *Anarhichas denticulatus* | 47 |
| *Anoplogaster cornuta* | 227 |
| *Anotopterus pharao* | 233 |
| *Antimora rostrata* | 172 |
| *Aphanopus carbo* | 173 |
| *Apristurus laurussonii* | 114 |
| *Arctozenus rissoi* | 123 |
| *Argentina silus* | 19 |
| *Argentina sphyraena* | 124 |
| *Argyropelecus olfersi* | 131 |
| *Artediellus atlanticus atlanticus* | 74 |
| *Astronesthes gemmifer* | 140 |
| *Bajacalifornia megalops* | 217 |
| *Bathylagus euryops* | 136 |
| *Bathyraja spinicauda* | 82 |
| *Benthodesmus elongatus simonyi* | 206 |
| *Benthosema glaciale* | 209 |
| *Boreogadus saida* | 71 |
| *Borostomias antarcticus* | 106 |
| *Careproctus micropus* | 229 |
| *Careproctus reinhardti* | 70 |
| *Cataetyx laticeps* | 228 |
| *Centrophorus squamosus* | 163 |
| *Centroscyllium fabricii* | 96 |
| *Centroscymnus coelolepis* | 174 |
| *Centroscymnus crepidater* | 164 |
| *Ceratoscopelus maderensis* | 221 |
| *Chaenophryne longiceps* | 231 |
| *Chalinura mediterranea* | 224 |
| *Chauliodus sloani* | 138 |
| *Chiasmodon bolangeri* | 247 |
| *Chiasmodon niger* | 246 |
| *Chiasmodon sp.* | 245 |
| *Chimaera monstrosa* | 39 |
| *Chirolophis ascanii* | 73 |
| *Coelorhynchus coelorhynchus* | 225 |
| *Coryphaenoides guentheri* | 117 |
| *Coryphaenoides rupestris* | 10 |
| *Cottunculus microps* | 81 |
| *Cottunculus thomsonii* | 153 |
| *Cryptopsaras couesi* | 148 |
| *Cyclopterus lumpus* | 48 |
| *Cyclothone pseudopallida* | 244 |
| *Epigonus telescopus* | 166 |
| *Etmopterus princeps* | 64 |
| *Etmopterus spinax* | 165 |
| *Etmopterus sp.* | 125 |
| *Galeus murinus* | 118 |
| *Gonostoma elongatum* | 119 |
| *Halagyreus johnsonii* | 134 |
| *Hariotta raleighana* | 169 |
| *Holtbyrnia macrops* | 218 |
| *Hoplostethus atlanticus* | 49 |
| *Hydrolagus affinis* | 145 |
| *Hydrolagus mirabilis* | 168 |
| *Lampadena speculigera* | 222 |
| *Lampanyctus ater* | 239 |
| *Lampanyctus crocodilus* | 223 |
| *Lampanyctus intricarius* | 208 |
| *Lampanyctus macdonaldi* | 243 |
| *Lepidion eques* | 58 |
| *Lepidopus caudatus* | 170 |
| *Linophryne lucifera* | 146 |
| *Liparis fabricii* | 110 |
| *Liparis sp.* | 92 |
| *Lycenchelys kolthoffi* | 249 |
| *Lycenchelys muraena* | 102 |
| *Lycodes esmarki* | 63 |
| *Lycodes eudipleurostictus* | 98 |
| *Lycodes frigidus* | 214 |
| *Lycodes pallidus* | 113 |
| *Lycodes reticulatus* | 59 |
| *Lycodes rossi* | 91 |
| *Lycodes seminudus* | 69 |
| *Lycodes sp.* | 85 |
| *Lycodes squamiventer* | 216 |
| *Lycodes vahli gracilis* | 79 |
| *Lycodonus flagellicauda* | 252 |
| *Macrouridae sp.* | 122 |
| *Macrourus berglax* | 62 |
| *Magnisudis atlantica* | 248 |
| *Malacosteus niger* | 120 |
| *Maurolicus mülleri* | 130 |
| *Melamphaidae sp.* | 256 |
| *Melanostomias bartonbeani* | 220 |
| *Micromesistius poutassou* | 34 |
| *Molva dypterygia dypterygia* | 7 |
| *Mora moro* | 128 |
| *Myctophidae, unidentified* | 75 |
| *Myctophum punctatum* | 232 |
| *Myxine glutinosa* | 137 |
| *Nansenia groenlandica* | 116 |
| *Nemichthys scolopacaeus* | 103 |
| *Nezumia aequalis* | 205 |
| *Notacanthus chemnitzii* | 105 |
| *Notoscopelus kroeyeri* | 204 |
| *Oneirodes anisacanthus* | 240 |
| *Oneirodidae sp.* | 262 |
| *Onogadus argentatus* | 88 |
| *Paralepididae sp.* | 250 |
| *Paralepis coregonoides* | 141 |
| *Paraliparis bathybius* | 230 |
| *Paraliparis copei* | 253 |
| *Phycis blennoides* | 76 |
| *Platyberyx opalescens* | 111 |
| *Platytroctidae sp.* | 100 |
| *Poromitra crassiceps* | 241 |
| *Raja fullonica* | 86 |
| *Raja fyllae* | 87 |
| *Raja hyperborea* | 90 |
| *Raja spinacidermis* | 135 |
| *Rhadinesthes decimus* | 219 |
| *Rhinochimaera atlantica* | 175 |
| *Sagamichthys schnakenbecki* | 133 |
| *Schedophilus medusophagus* | 278 |
| *Scopelogadus beanii* | 226 |
| *Scopelosaurus lepidus* | 207 |
| *Sebastes viviparus* | 60 |
| *Serrivomer beani* | 154 |
| *Species unidentified* | 108 |
| *Stomias boa ferox* | 127 |
| *Symbolophorus veranyi* | 242 |
| *Synaphobranchus kaupi* | 107 |
| *Thalassobathia pelagica* | 234 |
| *Trachipterus arcticus* | 155 |
| *Trachyrhynchus murrayi* | 171 |
| *Trigonolampa miriceps* | 121 |
| *Urophycis tenuis* | 93 |
| *Xenodermichthys copei* | 104 |

**Table 2.6.3** List of gears by computer number

| Comp.no. | Gear | Remarks* |
|---|---|---|
| 1 | Longline | |
| 6 | Bottom trawl | |
| 7 | Midwater trawl | |
| 13 | Capelin midw.trawl | |
| 14 | Shrimp trawl | |
| 19 | Bottom trawl | 1 |
| 22 | Bottom trawl | 2 |
| 23 | 0-group,pelagic trawl | |
| 33 | Gloria midwater trawl | 2 |
| 34 | Gloria midwater trawl | 2 |
| 60 | Bottom trawl | |
| 68 | Bottom trawl | |
| 73 | Bottom trawl | 2 |
| 74 | Bottom trawl | 2 |
| 78 | Bottom trawl | 2 |

*1 Designed for Argentines

*2 Codend covered with fine-meshed net

**Table 2.6.4** Quantitative overview of available biological data on deep-water fish species during the period 1975 to 1997. Fishes recorded in depths below 400m. Average depth includes only average bottom-trawl-depth.

| | 1975 | | | | | 1976 | | | | | | 1978 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spec.no* | *length* | *sex* | *maturity* | *counted* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *counted* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *counted* | *av depth* |
| **7** | 460 | 457 | 457 | | 597 | **7** | 2289 | 1127 | 1127 | 109 | 626 | **7** | 534 | 491 | 491 | 3 | 616 |
| **10** | 1444 | 935 | 935 | 914 | 667 | **10** | 3879 | 2407 | 2407 | 5802 | 772 | **10** | 764 | 709 | 709 | 231 | 757 |
| **19** | 488 | 476 | 476 | 3 | 591 | **19** | 1920 | 1188 | 1188 | 776 | 597 | **19** | 386 | 369 | 369 | 5 | 575 |
| **34** | 11 | 0 | 0 | 312 | 556 | **34** | | | | 2067 | 602 | **34** | 5 | 3 | 3 | 3129 | 699 |
| **39** | 33 | 9 | 9 | 252 | 621 | **39** | 3 | 0 | 0 | 523 | 653 | **39** | 2 | 0 | 0 | 347 | 0 |
| **47** | | | | 163 | | **47** | | | | 623 | | **47** | | | | 142 | |
| **49** | | | | | | **49** | 9 | 9 | 9 | 5 | 954 | **49** | 1 | 1 | 1 | | 800 |
| **58** | 350 | 157 | 157 | 287 | 629 | **58** | 256 | 135 | 135 | 1251 | 696 | **58** | 356 | 137 | 137 | 275 | 631 |
| **60** | 103 | 49 | 47 | 15 | 538 | **60** | 60 | 27 | 27 | 344 | 538 | **60** | 98 | 31 | 31 | 45 | 556 |
| **62** | 52 | 52 | 52 | | 667 | **62** | 1458 | 1052 | 1052 | 15 | 739 | **62** | 49 | 49 | 49 | 17 | 736 |
| **63** | | | | 33 | 568 | **63** | 1 | 0 | 0 | 74 | 691 | **63** | 15 | 4 | 4 | 17 | 652 |
| **64** | | | | | | **64** | | | | | | **64** | | | | 112 | |
| **70** | | | | 1 | 600 | **70** | | | | 11 | 536 | **70** | | | | 8 | |
| **71** | | | | | | **71** | 1 | 0 | 0 | 1 | 477 | **71** | | | | | |
| **76** | 3 | 1 | 1 | 2 | 438 | **76** | | | | 9 | 525 | **76** | 5 | 5 | 5 | | 687 |
| **79** | | | | 2 | 533 | **79** | | | | 3 | 485 | **79** | | | | | |
| **81** | | | | 2 | 525 | **81** | | | | 34 | 566 | **81** | 1 | 0 | 0 | 22 | 613 |
| **82** | | | | | | **82** | 8 | 2 | 0 | 2 | 962 | **82** | 2 | 2 | 0 | | 1209 |
| **86** | | | | | | **86** | | | | 1 | 997 | **86** | | | | 3 | |
| **87** | | | | | | **87** | 37 | 0 | 0 | 29 | 736 | **87** | | | | 28 | |
| **88** | | | | 9 | 629 | **88** | | | | 44 | 721 | **88** | 10 | 0 | 0 | 19 | 521 |
| **90** | | | | | | **90** | | | | | | **90** | | | | 6 | |
| **93** | | | | | | **93** | | | | 1 | 403 | **93** | | | | | |
| **96** | | | | 593 | 698 | **96** | | | | 2001 | 762 | **96** | | | | 411 | |
| **98** | | | | | | **98** | | | | | | **98** | 10 | 9 | 9 | 10 | 590 |
| **102** | | | | | | **102** | | | | 11 | 846 | **102** | | | | 1 | |
| **103** | | | | 5 | 533 | **103** | 2 | 0 | 0 | 9 | 830 | **103** | | | | 7 | |
| **105** | 30 | 30 | 30 | 17 | 719 | **105** | 29 | 14 | 14 | 81 | 767 | **105** | 14 | 7 | 7 | 10 | 663 |
| **107** | | | | | | **107** | 1 | 0 | 0 | 4 | 891 | **107** | | | | | |
| **111** | | | | | | **111** | | | | | | **111** | | | | 1 | |
| **114** | | | | 13 | 704 | **114** | | | | 2 | 903 | **114** | | | | | |
| **118** | | | | 14 | 709 | **118** | 5 | 2 | 0 | 42 | 764 | **118** | | | | 21 | |
| **120** | | | | | | **120** | | | | | | **120** | 1 | 0 | 0 | 1 | 0 |
| **123** | | | | | | **123** | | | | 5 | 731 | **123** | | | | 4 | |
| **125** | | | | 198 | 716 | **125** | 1 | 0 | 0 | 431 | 796 | **125** | | | | 151 | |
| **126** | | | | 1 | 460 | **126** | | | | | | **126** | | | | | |
| **127** | | | | 1 | 530 | **127** | | | | 1 | 1064 | **127** | 27 | 0 | 0 | 93 | 0 |
| **128** | 2 | 0 | 0 | 41 | 747 | **128** | | | | 38 | 779 | **128** | | | | | |
| **130** | | | | 1 | 530 | **130** | | | | | | **130** | 18 | 0 | 0 | 22109 | 0 |
| **133** | | | | | | **133** | | | | | | **133** | | | | 1 | |
| **135** | | | | | | **135** | 3 | 2 | 1 | | | **135** | | | | | |
| **136** | | | | | | **136** | | | | 30 | 873 | **136** | | | | | |
| **138** | | | | 1 | 530 | **138** | | | | 1 | 520 | **138** | | | | | |
| **148** | | | | | | **148** | | | | 1 | 1040 | **148** | | | | | |
| **153** | | | | | | **153** | | | | 5 | 970 | **153** | | | | 1 | |
| **161** | 164 | 162 | 162 | 23 | 766 | **161** | 820 | 502 | 500 | 314 | 864 | **161** | 47 | 42 | 42 | 1 | 702 |
| **163** | | | | 13 | 648 | **163** | 4 | 1 | 1 | 21 | 633 | **163** | | | | 9 | |
| **164** | | | | 17 | 572 | **164** | | | | 434 | 679 | **164** | | | | 4 | |
| **165** | | | | 54 | 532 | **165** | | | | 186 | 526 | **165** | | | | 162 | |
| **166** | | | | | | **166** | 25 | 19 | 13 | 6 | 554 | **166** | 1 | 1 | 1 | 5 | 590 |
| **167** | | | | | | **167** | | | | 1 | 970 | **167** | | | | | |
| **168** | | | | 253 | 666 | **168** | | | | 892 | 700 | **168** | | | | 323 | |
| **169** | | | | | | **169** | 15 | 4 | 0 | 29 | 823 | **169** | | | | 10 | |
| **170** | | | | | | **170** | | | | 1 | | **170** | | | | | |
| **171** | | | | 15 | 800 | **171** | 50 | 0 | 0 | 1085 | 867 | **171** | 32 | 9 | 9 | 2 | 944 |
| **173** | 7 | 7 | 5 | 13 | 714 | **173** | 15 | 8 | 8 | 70 | 793 | **173** | 14 | 13 | 11 | 3 | 711 |
| **174** | 24 | 24 | 24 | 68 | 711 | **174** | 10 | 1 | 1 | 451 | 798 | **174** | | | | 43 | |
| **175** | 23 | 23 | 16 | 32 | 720 | **175** | 103 | 30 | 9 | 163 | 801 | **175** | | | | 78 | |
| **204** | | | | | | **204** | | | | | | **204** | 3 | 0 | 0 | 19 | 0 |
| **205** | | | | | | **205** | 4 | 0 | 0 | | | **205** | 8 | 8 | 8 | 1 | 0 |
| **209** | | | | | | **209** | | | | | | **209** | | | | 3250 | |

w1=ungutted weight     w2=gutted weight

# **Table 2.6.4** continued

| 1979 | | | | | | 1980 | | | | | | 1981 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spec.no* | *length* | *sex* | *counted* | *maturity* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *counted* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *counted* | *av depth* |
| **7** | 427 | 311 | 30 | 311 | 551 | **7** | 800 | 777 | 776 | | 599 | **7** | 255 | 254 | 254 | 19 | 902 |
| **10** | 16 | 12 | | 12 | 567 | **10** | 579 | 574 | 556 | | 735 | **10** | 771 | 659 | 644 | 264 | 924 |
| **19** | 554 | 518 | 125 | 518 | 542 | **19** | 871 | 866 | 866 | 128 | 580 | **19** | 70 | 70 | 70 | | 940 |
| **34** | | | 29 | | | **34** | | | | 772 | 571 | **34** | 13 | | | 24 | 737 |
| **39** | | | 137 | | | **39** | | | | 245 | 617 | **39** | | | | | |
| **47** | | | 37 | | | **47** | | | | 93 | 605 | **47** | | | | 20 | 800 |
| **49** | | | | | | **49** | 3 | 3 | 3 | | 878 | **49** | 2 | | | 2 | 850 |
| **58** | 44 | | 29 | | 555 | **58** | 154 | 117 | 117 | 860 | 608 | **58** | 24 | 24 | 24 | 72 | 837 |
| **60** | 5 | | 7 | | 546 | **60** | 28 | | | 321 | 552 | **60** | 6 | 6 | 6 | 4 | 665 |
| **62** | 7 | 7 | | 7 | 597 | **62** | 14 | 14 | 14 | 39 | 629 | **62** | 417 | 399 | 399 | 19 | 956 |
| **63** | | | 7 | | | **63** | | | | 10 | 532 | **63** | | | | 13 | 610 |
| **64** | | | | | | **64** | | | | | 805 | **64** | | | | | |
| **70** | | | | | | **70** | | | | 2 | 405 | **70** | | | | 3 | 676 |
| **73** | | | | | | **73** | | | | 1 | | **73** | | | | | |
| **76** | | | 1 | | | **76** | 2 | 2 | 2 | 14 | 454 | **76** | | | | | |
| **79** | | | | | | **79** | | | | 1 | | **79** | | | | | |
| **81** | | | 1 | | | **81** | | | | 14 | 405 | **81** | | | | 6 | 775 |
| **82** | | | | | | **82** | | | | | | **82** | | | | 2 | 1015 |
| **85** | | | | | | **85** | | | | 1 | | **85** | | | | | |
| **86** | | | | | | **86** | | | | | | **86** | | | | 2 | 866 |
| **87** | | | | | | **87** | | | | 2 | 698 | **87** | 1 | 1 | | 6 | 874 |
| **88** | | | | | | **88** | | | | 11 | 405 | **88** | 1 | | | 17 | 911 |
| **90** | | | | | | **90** | | | | | | **90** | 1 | 1 | | | 980 |
| **96** | | | 58 | | | **96** | | | | 406 | 742 | **96** | | | | 563 | 888 |
| **102** | | | | | | **102** | 1 | | | | 783 | **102** | | | | | |
| **103** | | | | | | **103** | | | | | | **103** | | | | 4 | 870 |
| **104** | | | | | | **104** | | | | | | **104** | 1 | | | | 835 |
| **105** | | | 2 | | | **105** | 4 | 4 | 4 | 2 | 677 | **105** | 79 | 21 | 21 | 13 | 975 |
| **114** | | | | | | **114** | | | | 11 | 823 | **114** | | | | 1 | 965 |
| **116** | | | | | | **116** | 8 | | | 1 | 438 | **116** | | | | | |
| **117** | | | | | | **117** | 1 | | | | 785 | **117** | | | | 1 | 1090 |
| **118** | | | | | | **118** | 1 | | | 30 | 782 | **118** | | | | 5 | 988 |
| **119** | | | | | | **119** | | | | | | **119** | 1 | | | | 835 |
| **123** | | | 3 | | | **123** | 2 | | | 1 | 425 | **123** | | | | | |
| **125** | | | 29 | | | **125** | | | | 549 | 696 | **125** | | | | 88 | 913 |
| **127** | | | | | | **127** | 3 | | | | 438 | **127** | | | | | |
| **128** | | | | | | **128** | 16 | 4 | 4 | 31 | 795 | **128** | | | | 3 | 898 |
| **130** | | | | | | **130** | | | | | 438 | **130** | | | | | |
| **136** | | | | | | **136** | | | | | | **136** | | | | 17 | 1000 |
| **137** | | | | | | **137** | | | | | | **137** | | | | 1 | |
| **138** | | | | | | **138** | | | | | | **138** | | | | 1 | |
| **141** | | | 1 | | | **141** | | | | | | **141** | 1 | | | 1 | 898 |
| **153** | | | | | | **153** | 1 | | | | 783 | **153** | 1 | | | 7 | 940 |
| **161** | | | | | | **161** | | | | 18 | 875 | **161** | 26 | 23 | 23 | 87 | 989 |
| **163** | | | 1 | | | **163** | | | | 1 | 649 | **163** | | | | | |
| **164** | | | 2 | | | **164** | | | | 65 | 171 | **164** | | | | | |
| **165** | | | 21 | | | **165** | | | | 150 | 542 | **165** | 1 | | | 1 | 921 |
| **166** | 3 | 2 | | 2 | 550 | **166** | | | | | | **166** | | | | | |
| **168** | | | 15 | | | **168** | | | | 112 | 664 | **168** | 5 | | | 2 | 906 |
| **169** | | | | | | **169** | | | | 4 | 753 | **169** | | | | 10 | 994 |
| **170** | | | | | | **170** | | | | | | **170** | 1 | 1 | 1 | 3 | 898 |
| **171** | | | | | | **171** | | | | 30 | 768 | **171** | 54 | 23 | 23 | 100 | 998 |
| **172** | | | | | | **172** | | | | | | **172** | 18 | 1 | | 10 | 1045 |
| **173** | | | | | | **173** | 10 | 9 | 9 | 31 | 763 | **173** | | | | | |
| **174** | | | 6 | | | **174** | | | | 93 | 749 | **174** | 4 | | | 52 | 928 |
| **175** | | | | | | **175** | | | | 73 | 798 | **175** | | | | 20 | 925 |
| **204** | | | | | | **204** | 5 | | | | 438 | **204** | 1 | | | | |
| **205** | | | | | | **205** | 4 | | | 1 | 970 | **205** | 2 | | | 1 | 932 |
| **209** | | | | | | **209** | | | | | 450 | **209** | 1 | | | | |
| **222** | | | | | | **222** | 8 | | | | 138 | **222** | | | | | |
| **232** | | | | | | **232** | 2 | | | | 450 | **232** | | | | | |
| **278** | | | | | | **278** | 1 | | | | 450 | **278** | | | | | |

w1=ungutted weight w2=gutted weight

**Table 2.6.4** continued

| | 1982 | | | | | | 1983 | | | | | | 1984 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spec.no* | *length* | *sex* | *maturity* | *wl* | *counted* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *counted* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *wl* | *w2* | *counted* | *av depth* |
| **7** | 934 | 834 | 834 | | 3 | 569 | **7** | 80 | 80 | 80 | 24 | 518 | **7** | 963 | 662 | 598 | 0 | | 147 | 764 |
| **10** | 85 | 124 | 124 | | 23 | 672 | **10** | 179 | 146 | 146 | 801 | 552 | **10** | 122 | 98 | 98 | 45 | | 164 | 848 |
| **19** | 837 | 837 | 837 | | 12 | 566 | **19** | 134 | 131 | 131 | 235 | 531 | **19** | 69 | 28 | 28 | 12 | | 21 | 704 |
| **34** | 6 | 1 | 1 | | 139 | 572 | **34** | | | | 651 | 497 | **34** | | | | | | 118 | 553 |
| **39** | | | | | | | **39** | | | | | | **39** | | | | | | 106 | 884 |
| **47** | 28 | 24 | 2 | | 57 | 590 | **47** | 3 | | | 12 | 448 | **47** | | | | | | 6 | 549 |
| **48** | 4 | | | | 1 | | **48** | 3 | 3 | | | | **48** | | | | | | | |
| **49** | | | | | | | **49** | 1 | 1 | 1 | | 805 | **49** | | | | | | | |
| **58** | 249 | 248 | 100 | 225 | 182 | 580 | **58** | 47 | 39 | 36 | 43 | 601 | **58** | | | | | | 74 | 861 |
| **60** | 78 | 29 | 29 | | 35 | 528 | **60** | 13 | | | 539 | 486 | **60** | 14 | | | | | 290 | 677 |
| **62** | 62 | 65 | 65 | | 65 | 664 | **62** | 13 | | | 7 | 622 | **62** | 162 | | | | | 69 | 1039 |
| **63** | | | | | 40 | 595 | **63** | 7 | | | 20 | 454 | **63** | | | | | | 5 | 514 |
| **64** | | | | | | | **64** | | | | | | **64** | | | | | | 28 | 988 |
| **69** | | | | | 5 | 458 | **69** | 4 | | | | 487 | **69** | | | | | | | |
| **70** | | | | | 13 | 583 | **70** | 2 | | | 17 | 484 | **70** | | | | | | 6 | 512 |
| **71** | | | | | 8 | 453 | **71** | 1 | | | 3 | 486 | **71** | | | | | | 1 | 425 |
| **73** | 1 | | | | 1 | 468 | **73** | 3 | | | | | **73** | | | | | | | |
| **76** | 2 | 1 | 1 | | 1 | 486 | **76** | | | | 3 | 460 | **76** | | | | | | | |
| **79** | | | | | 3 | 430 | **79** | 5 | | | 1 | 437 | **79** | | | | | | | 430 |
| **81** | | | | | 12 | 716 | **81** | 1 | | | 53 | 463 | **81** | | | | | | 2 | 875 |
| **82** | 2 | | | | | 688 | **82** | | | | | | **82** | 1 | | | | | 8 | 882 |
| **86** | 5 | 1 | | | | 721 | **86** | | | | 1 | 440 | **86** | | | | | | 2 | 1338 |
| **87** | 2 | | | | 3 | 773 | **87** | | | | | | **87** | 2 | | | | | 8 | 685 |
| **88** | 2 | | | | 42 | 651 | **88** | 3 | | | 15 | 486 | **88** | 2 | 1 | 1 | | | 12 | 695 |
| **90** | | | | | | | **90** | | | | | | **90** | | | | | | 3 | 1290 |
| **96** | 10 | | | | 69 | 690 | **96** | | | | 33 | 696 | **96** | | | | | | 171 | 980 |
| **98** | | | | | | | **98** | 6 | | | | 488 | **98** | | | | | | 5 | 512 |
| **103** | 9 | | | | 1 | 1045 | **103** | 46 | | | 4 | | **103** | | | | | | 2 | 1281 |
| **104** | | | | | | | **104** | 3 | | | 4 | 411 | **104** | | | | | | | |
| **105** | 8 | 8 | 8 | | 5 | 704 | **105** | 1 | 1 | 1 | 2 | 736 | **105** | | | | | | 14 | 1017 |
| **107** | | | | | | | **107** | | | | | | **107** | | | | | | 4 | 1082 |
| **111** | | | | | | | **111** | 1 | | | | | **111** | | | | | | | |
| **114** | | | | | | | **114** | | | | 7 | 805 | **114** | | | | | | 22 | 1007 |
| **116** | 2 | | | | | | **116** | 10 | | | 21 | | **116** | | | | | | | |
| **117** | | | | | | | **117** | | | | | | **117** | | | | | | 44 | 1267 |
| **118** | | | | | | | **118** | | | | 3 | 805 | **118** | | | | | | 21 | 1191 |
| **120** | | | | | 1 | 836 | **120** | | | | | | **120** | | | | | | | |
| **121** | | | | | | | **121** | | | | | | **121** | | | | | | 1 | 917 |
| **123** | | | | | | | **123** | 10 | | | 3 | | **123** | | | | | | 4 | 1043 |
| **124** | | | | | 5 | | **124** | | | | | | **124** | | | | | | | |
| **125** | | | | | 478 | 679 | **125** | | | | 125 | 714 | **125** | | | | | | | |
| **127** | | | | | | | **127** | | | | | | **127** | | | | | | 5 | 1002 |
| **128** | 1 | | | | 7 | 778 | **128** | 15 | | | | 805 | **128** | | | | | | 23 | 912 |
| **130** | 1 | | | | 1 | | **130** | | | | 16 | 460 | **130** | | | | | | | |
| **135** | | | | | | | **135** | | | | | | **135** | | | | | | 6 | 950 |
| **136** | | | | | | | **136** | 7 | | | 2 | 940 | **136** | | | | | | 7 | 1205 |
| **138** | | | | | | | **138** | | | | 3 | 534 | **138** | | | | | | 4 | 970 |
| **141** | 6 | 1 | 1 | | | 677 | **141** | | | | | | **141** | | | | | | 6 | 977 |
| **145** | | | | | | | **145** | | | | | | **145** | | | | | | 3 | 700 |
| **148** | | | | | | | **148** | | | | 1 | | **148** | | | | | | | |
| **153** | 2 | 2 | 1 | | | 821 | **153** | | | | | | **153** | | | | | | 7 | 1067 |
| **154** | | | | | | | **154** | | | | | | **154** | | | | | | 12 | 1025 |
| **155** | | | | | | | **155** | 5 | 3 | 3 | 1 | | **155** | | | | | | | 1000 |
| **161** | 15 | 2 | 1 | | 2 | 843 | **161** | 38 | 38 | 38 | 1 | 798 | **161** | | | | | | 87 | 1070 |
| **164** | | | | | 3 | 628 | **164** | | | | 7 | 728 | **164** | | | | | | 2 | 929 |
| **165** | | | | | 22 | 577 | **165** | | | | | | **165** | | | | | | | |
| **168** | | | | | 10 | 660 | **168** | | | | 5 | 728 | **168** | | | | | | | 700 |
| **169** | | | | | 1 | 720 | **169** | | | | | | **169** | | | | | | 17 | 1252 |
| **170** | | | | | 1 | 885 | **170** | 1 | | | | 940 | **170** | | | | | | | 1830 |
| **171** | 10 | | | | | | **171** | 7 | | | | | **171** | | | | | | 85 | 1122 |

w1=ungutted weight    w1= gutted weight

# Table 2.6.4 continued

| | 1982 | | | | | | 1983 | | | | | | 1984 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spec.no | length | sex | maturity | | counted | av depth | Spec.no | length | sex | maturity | counted | av depth | Spec.no | length | sex | maturity | w1 | w2 | counted | av depth |
| **172** | 10 | | | | | | **172** | | | | | | **172** | | | | | | | |
| **173** | 3 | 3 | 3 | | | 818 | **173** | | | | 1 | 650 | **173** | | | | | | 7 | 1000 |
| **174** | | | | | 12 | 635 | **174** | | | | 15 | 728 | **174** | | | | | | 22 | 1072 |
| **175** | | | | | 13 | 700 | **175** | | | | 4 | 805 | **175** | | | | | | 4 | 993 |
| **204** | | | | | | | **204** | 24 | | | 24 | 940 | **204** | | | | | | | |
| **209** | | | | | | | **209** | | | | 1204 | 1400 | **209** | | | | | | | |
| **250** | 4 | | | | | | **250** | 2 | | | | | **250** | | | | | | | |

w1=ungutted weight w2=gutted weight

| | 1985 | | | | | | 1986 | | | | | | 1987 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spec.no | length | sex | maturity | | counted | av depth | Spec.no | length | sex | maturity | counted | av depth | Spec.no | length | sex | maturity | w1 | w2 | counted | av depth |
| **7** | 374 | 332 | 316 | | 93 | 762 | **7** | 114 | 54 | 40 | | 438 | **7** | 1049 | 1047 | 1000 | | | | 629 |
| **10** | 613 | 345 | 345 | | | 824 | **10** | | | | 13 | 404 | **10** | 1518 | 1371 | 1371 | 387 | 386 | 1101 | 773 |
| **19** | 418 | 289 | 289 | | | 603 | **19** | 151 | 71 | 68 | 3617 | 435 | **19** | 2715 | 2715 | 2714 | 988 | 494 | 2426 | 585 |
| **34** | 141 | | | | 487 | 559 | **34** | | | | | | **34** | 12 | | | | | 73 | |
| **39** | | | | | 24 | 831 | **39** | | | | | | **39** | 2 | | | | | 407 | 558 |
| **47** | 14 | | | | 4 | 684 | **47** | 36 | | | | | **47** | 11 | | | | | | 433 |
| **58** | | | | | 65 | 769 | **58** | | | | | | **58** | 338 | 33 | 33 | | | 136 | 550 |
| **60** | 131 | 2 | 2 | | 96 | 602 | **60** | 71 | | | 215 | 437 | **60** | 862 | 374 | 362 | | | 5066 | 552 |
| **62** | 34 | 33 | 33 | | | 912 | **62** | 4 | | | | | **62** | 168 | 157 | 157 | | | | 783 |
| **63** | | | | | 21 | 481 | **63** | | | | | | **63** | | | | | | 580 | 404 |
| **64** | | | | | 50 | 733 | **64** | | | | | | **64** | | | | | | 66 | 670 |
| **70** | | | | | 12 | 550 | **70** | | | | | | **70** | | | | | | 307 | 445 |
| **71** | | | | | | | **71** | | | | | | **71** | | | | | | 1563 | 435 |
| **76** | | | | | | | **76** | | | | | | **76** | 3 | 1 | 1 | | | | 542 |
| **81** | | | | | 1 | 641 | **81** | | | | | | **81** | | | | | | | |
| **87** | | | | | 3 | 702 | **87** | | | | | | **87** | 5 | 4 | | | | | 523 |
| **88** | | | | | | | **88** | | | | | | **88** | 1 | | | | | 4 | 458 |
| **92** | | | | | | | **92** | | | | | | **92** | | | | | | 6 | 439 |
| **93** | | | | | | | **93** | | | | | | **93** | 2 | | | | | 1 | 428 |
| **96** | | | | | 160 | 831 | **96** | | | | | | **96** | | | | | | 88 | 675 |
| **105** | 7 | 7 | 7 | | | 879 | **105** | | | | | | **105** | 3 | 2 | 2 | | | 1 | 685 |
| **114** | | | | | 7 | 869 | **114** | | | | | | **114** | | | | | | 2 | 771 |
| **117** | | | | | | | **117** | | | | | | **117** | 1 | | | | | | 660 |
| **118** | | | | | 5 | 933 | **118** | | | | | | **118** | | | | | | 5 | 771 |
| **123** | | | | | 2 | 421 | **123** | | | | | | **123** | 2 | | | | | | 540 |
| **125** | | | | | 85 | 892 | **125** | | | | | | **125** | | | | | | | |
| **128** | | | | | 54 | 831 | **128** | | | | | | **128** | 1 | | | | | | 771 |
| **134** | | | | | | | **134** | | | | | | **134** | 1 | 1 | | | | | 560 |
| **138** | | | | | | | **138** | | | | | | **138** | 1 | | | | | | 578 |
| **141** | | | | | | | **141** | | | | | | **141** | 5 | | | | | | 585 |
| **154** | | | | | | | **154** | | | | | | **154** | 5 | | | | | 1 | 602 |
| **161** | 1 | 1 | 1 | | 7 | 838 | **161** | | | | | | **161** | 3 | 3 | 3 | | | | 771 |
| **163** | | | | | 29 | 933 | **163** | | | | | | **163** | | | | | | | |
| **164** | | | | | 20 | 831 | **164** | | | | | | **164** | | | | | | 130 | 641 |
| **165** | | | | | 2 | 769 | **165** | | | | | | **165** | | | | | | | |
| **166** | 3 | 1 | 1 | | | 838 | **166** | | | | | | **166** | 19 | | | | | 53 | 548 |
| **168** | | | | | 3 | 933 | **168** | | | | | | **168** | 1 | | | | | 17 | 655 |
| **169** | | | | | 9 | 933 | **169** | | | | | | **169** | 1 | 1 | 1 | | | 2 | 716 |
| **170** | | | | | | | **170** | | | | | | **170** | 33 | | | | | 1 | 595 |
| **171** | | | | | 1 | 924 | **171** | | | | | | **171** | 3 | | | | | | 771 |
| **173** | 1 | | | | | 933 | **173** | | | | | | **173** | | | | | | | |
| **174** | | | | | 11 | 933 | **174** | | | | | | **174** | | | | | | 1 | 771 |
| **175** | | | | | 47 | 879 | **175** | | | | | | **175** | 1 | 1 | | | | 4 | 667 |
| **207** | | | | | 1 | 933 | **207** | | | | | | **207** | | | | | | | |
| **223** | | | | | | | **223** | | | | | | **223** | 3 | | | | | 2 | 563 |
| **250** | | | | | | | **250** | | | | | | **250** | 10 | | | | | | 514 |
| **256** | 1 | | | | | 851 | **256** | | | | | | **256** | | | | | | | |

w1=ungutted weight w2=gutted weight

# **Table 2.6.4** continued

| 1988 | | | | | | | | 1989 | | | | | | | 1990 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *pec.n* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* | *pec.n* | *length* | *sex* | *maturity* | *w1* | *counted* | *avdepth* | *pec.n* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *avdepth* |
| **7** | 1563 | 1558 | 19 | 1544 | | 2 | 568 | **7** | 59 | | | | | 428 | **7** | 33 | 28 | 28 | 28 | 28 | | 420 |
| **10** | 807 | 526 | 527 | 807 | 1 | | 700 | **10** | | | | | | | **10** | | | | | | | |
| **19** | 3234 | 2668 | 2668 | 1474 | 1 | 6515 | 567 | **19** | 99 | 23 | 23 | | 239 | 426 | **19** | 100 | 50 | 50 | | | 1477 | 418 |
| **34** | | | | | | 1 | 411 | **34** | | | | | 965 | 415 | **34** | | | | | | 7077 | 419 |
| **39** | | | | | | | | **39** | | | | | | | **39** | | | | | | 26 | 431 |
| **47** | | | | | | | 443 | **47** | 4 | | | | | 416 | **47** | 5 | | | | | | 430 |
| **58** | 450 | 196 | 196 | | | | 720 | **58** | | | | | 30 | 411 | **58** | | | | | | | |
| **59** | | | | | | 111 | 499 | **59** | | | | | 63 | 441 | **59** | | | | | | 48 | 403 |
| **60** | 329 | 329 | 295 | 0 | | 1694 | 518 | **60** | 54 | | | | 183 | 423 | **60** | 55 | | | | | | 419 |
| **62** | 20 | 9 | 9 | | | 8 | 707 | **62** | 3 | 2 | | | | 515 | **62** | | | | | | | |
| **63** | | | | | | 38 | 435 | **63** | | | | | 261 | 431 | **63** | | | | | | 113 | 442 |
| **69** | | | | | | 631 | 446 | **69** | | | | | | 425 | **69** | | | | | | 23 | 403 |
| **70** | | | | | | 126 | 467 | **70** | | | | | 168 | 466 | **70** | | | | | | 378 | 499 |
| **71** | | | | | | 266 | 465 | **71** | | | | | 631 | 467 | **71** | | | | | | 795 | 462 |
| **74** | | | | | | 65 | 439 | **74** | | | | | 305 | 433 | **74** | | | | | | 951 | 443 |
| **79** | | | | | | 31 | 509 | **79** | | | | | 7 | 423 | **79** | | | | | | 99 | 428 |
| **81** | | | | | | | | **81** | | | | | 26 | 516 | **81** | | | | | | 67 | 499 |
| **82** | | | | | | | | **82** | | | | | 3 | 424 | **82** | | | | | | 3 | 419 |
| **88** | | | | | | 22 | 547 | **88** | | | | | 23 | 490 | **88** | | | | | | 69 | 480 |
| **90** | | | | | | | | **90** | | | | | 11 | 448 | **90** | | | | | | 31 | 534 |
| **91** | | | | | | | | **91** | | | | | 186 | | **91** | | | | | | 16 | 422 |
| **92** | | | | | | | | **92** | | | | | 30 | 517 | **92** | | | | | | | 579 |
| **98** | | | | | | 148 | 456 | **98** | | | | | 123 | 428 | **98** | | | | | | 164 | 429 |
| **110** | | | | | | 15 | 517 | **110** | | | | | | | **110** | | | | | | | |
| **249** | | | | | | 1 | 430 | **249** | | | | | | | **249** | | | | | | | |

| 1991 | | | | | | | | 1992 | | | | | | | 1993 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *pec.n* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* | *pec.n* | *length* | *sex* | *maturity* | *w1* | *counted* | *av depth* | *pec.n* | *length* | | *maturity* | *w1* | *w2* | *counted* | *av depth* |
| **7** | 77 | | | | | | 475 | **7** | 767 | 94 | | | 3 | 904 | **7** | 713 | 382 | 292 | 507 | | 4078 | 881 |
| **10** | | | | | | | | **10** | 367 | 21 | | | 26923 | 1066 | **10** | 1785 | 1108 | 569 | 1785 | | 8868 | 960 |
| **19** | 142 | 18 | 18 | | | 7403 | 553 | **19** | 382 | 182 | 160 | 98 | 466 | 651 | **19** | 281 | 278 | 277 | 274 | | 312 | 741 |
| **34** | | | | | | 2383 | 472 | **34** | 51 | 2 | | | 449 | 844 | **34** | 128 | | | 2 | | 1 | 788 |
| **39** | | | | | | 57 | 510 | **39** | 6 | 3 | | | | | **39** | 31 | 29 | 7 | 31 | | 9 | 808 |
| **47** | 1 | | | | | | | **47** | 58 | 24 | | | 1 | 940 | **47** | 29 | 11 | 7 | 13 | | | 915 |
| **49** | | | | | | | | **49** | 66 | 1 | | | | 925 | **49** | 70 | 69 | 69 | 10 | | 1 | 816 |
| **58** | | | | | | 452 | 541 | **58** | 100 | | | | 1083 | 820 | **58** | 326 | 277 | 203 | 277 | | 80 | 848 |
| **59** | | | | | | | | **59** | 2 | | | | | 570 | **59** | 85 | | | | | 77 | 460 |
| **60** | 79 | | | | | | 440 | **60** | 94 | | | | 106 | 570 | **60** | 93 | 15 | 15 | 53 | | | 627 |
| **62** | 1 | 1 | | | | | 490 | **62** | 288 | 2 | | | | 1009 | **62** | 17 | 12 | 10 | 14 | | 5 | 1095 |
| **63** | | | | | | 72 | 438 | **63** | 105 | 1 | | | | 744 | **63** | 132 | | | | | 10 | 463 |
| **64** | | | | | | 34 | 447 | **64** | 52 | 52 | | | | 1064 | **64** | 363 | 324 | 29 | 363 | 11 | 14 | 947 |
| **69** | | | | | | 128 | 456 | **69** | 56 | | | | | 667 | **69** | 411 | | | | | 102 | 472 |
| **70** | | | | | | 5 | 430 | **70** | | | | | 21 | 690 | **70** | 239 | | | | | 235 | 482 |
| **71** | | | | | | | | **71** | 11 | | | | | 651 | **71** | 5 | | | | | 3409 | 464 |
| **73** | 1 | | | | | | | **73** | 16 | | | | | | **73** | 7 | | | | | | |
| **74** | | | | | | 146 | 438 | **74** | 1 | | | | | 500 | **74** | 28 | | | | | 1372 | 451 |
| **79** | | | | | | 15 | 431 | **79** | 21 | | | | | 672 | **79** | 40 | | | | | 1 | 527 |
| **81** | | | | | | 36 | 443 | **81** | 21 | 1 | | | 1 | 819 | **80** | | | | | | | |
| **82** | | | | | | | | **82** | 18 | 18 | | | | 859 | **81** | 32 | 6 | 2 | | | 15 | 484 |
| **83** | | | | | | | | **83** | 82 | | | | 589 | | **83** | 15 | | | | | | |
| **86** | | | | | | | | **86** | | | | | | | **86** | 2 | | | 2 | | | 668 |
| **87** | | | | | | 4 | 430 | **87** | 4 | 3 | | | | 835 | **87** | 13 | 10 | | 4 | | | 944 |
| **88** | | | | | | 10 | 448 | **88** | 27 | | | | | 781 | **88** | 133 | 4 | | 10 | | 25 | 730 |
| **90** | | | | | | | | **90** | 7 | 7 | | | | 821 | **90** | 122 | 121 | | 1 | | | 1363 |
| **91** | | | | | | | | **91** | 1 | | | | | 703 | **91** | 6 | | | | | | 416 |

w1=ungutted weight          w2=gutted weight

# Table 2.6.4 continued

| 1991 | | | | | | | | 1992 | | | | | | | 1993 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pec.n | length | sex | maturity | w1 | w2 | counted | av depth | pec.n | length | sex | maturity | w1 | counted | av depth | pec.n | length | sex | maturity | w1 | w2 | counted | av depth |
| **92** | | | | | | | | **92** | 3 | | | | | 824 | **92** | 3 | | | | | 75 | 481 |
| **96** | | | | | | | | **96** | 575 | 559 | | | 209 | 1036 | **96** | 414 | 379 | 9 | 414 | 22 | 16 | 971 |
| **98** | | | | | | 55 | 435 | **98** | 120 | | | | | 664 | **98** | 663 | 4 | 4 | | | 148 | 485 |
| **102** | | | | | | | | **102** | 2 | | | | | 647 | **102** | | | | | | | |
| **103** | | | | | | | | **103** | | | | | | | **103** | 5 | | | 1 | | 1 | 1526 |
| **104** | | | | | | | | **104** | 4 | 3 | 1 | | | 1050 | **104** | 25 | 3 | | 15 | | | 975 |
| **105** | | | | | | | | **105** | 339 | 6 | | | | 1028 | **105** | 54 | 8 | 2 | 20 | | | 977 |
| **106** | | | | | | | | **106** | 7 | 5 | | | | | **106** | 9 | 1 | | 7 | | | |
| **107** | | | | | | | | **107** | 66 | | | | | 1067 | **107** | 105 | 82 | 81 | 105 | 0 | | 1093 |
| **108** | | | | | | | | **108** | 5 | | | | | | **108** | 19 | | | | | | 971 |
| **111** | | | | | | | | **111** | 1 | 1 | | | | | **111** | 3 | | | 3 | | | 1152 |
| **113** | | | | | | | | **113** | 12 | | | | 1 | 718 | **113** | 422 | | | | | 104 | 471 |
| **114** | | | | | | | | **114** | 61 | 60 | | | | 1074 | **114** | 165 | 113 | | 165 | 8 | 1 | 1008 |
| **116** | | | | | | | | **116** | | | | | | | **116** | 2 | | | 1 | | | |
| **118** | | | | | | | | **118** | 35 | 35 | | | | 967 | **118** | 9 | 3 | | 7 | | | 1036 |
| **120** | | | | | | | | **120** | 1 | | | | 8 | | **120** | 12 | 1 | | 5 | | | 843 |
| **121** | | | | | | | | **121** | 1 | | | | | 829 | **121** | 2 | | | | | | |
| **122** | | | | | | | | **122** | 6 | | | | | 1264 | **122** | 18 | | | | | 110 | 971 |
| **123** | | | | | | | | **123** | 8 | | | | 2 | 1111 | **123** | 128 | 8 | 8 | 12 | | 1219 | 838 |
| **124** | | | | | | | | **124** | 1 | 1 | | | | | **124** | | | | | | | |
| **125** | | | | | | | | **125** | 5 | 5 | | | | 671 | **125** | 1 | 1 | | 1 | | | 1213 |
| **127** | 6 | | | | | 1 | | **127** | 2 | | | | 74 | | **127** | 161 | | | 16 | | 333 | |
| **128** | | | | | | | | **128** | | | | | | | **128** | 75 | 74 | 9 | 75 | 0 | | 811 |
| **130** | | | | | | | | **130** | | | | | | | **130** | 15 | | | | | 3 | |
| **131** | | | | | | | | **131** | | | | | | | **131** | 1 | | | 1 | | | |
| **133** | | | | | | | | **133** | | | | | | | **133** | 5 | | | | | | |
| **134** | | | | | | | | **134** | 9 | | | | | 1024 | **134** | 3 | | | | | | |
| **136** | | | | | | | | **136** | 24 | | | | 100 | 1413 | **136** | 97 | | | 6 | | 229 | 1326 |
| **137** | | | | | | | | **137** | | | | | | | **137** | 24 | | | 24 | 0 | | 1022 |
| **138** | 2 | | | | | | | **138** | 11 | | | | 87 | 915 | **138** | 193 | 2 | | 32 | | 624 | 876 |
| **139** | | | | | | | | **139** | | | | | | | **139** | | | | | | 1 | |
| **140** | | | | | | | | **140** | | | | | | | **140** | 2 | | | 2 | | | 1139 |
| **141** | | | | | | | | **141** | 9 | | | | | 1180 | **141** | 8 | 3 | | 6 | | | 859 |
| **142** | | | | | | | | **142** | | | | | | | **142** | 1 | 1 | 1 | 1 | | | 970 |
| **145** | | | | | | | | **145** | 3 | 2 | | | | 1264 | **145** | | | | | | | |
| **146** | | | | | | | | **146** | | | | | | | **146** | 1 | | | 1 | | | |
| **147** | | | | | | | | **147** | | | | | | | **147** | | | | | | 1 | 174 |
| **148** | | | | | | | | **148** | | | | | | | **148** | 2 | | | 2 | | | 925 |
| **153** | | | | | | | | **153** | 3 | 2 | | | | 1135 | **153** | 3 | | | 2 | | 1 | 1061 |
| **154** | | | | | | | | **154** | 4 | | | | 5 | 1181 | **154** | 163 | | | 23 | | 47 | 1149 |
| **155** | | | | | | | | **155** | | | | | | | **155** | 2 | | | 2 | | | 1064 |
| **158** | | | | | | | | **158** | | | | | | | **158** | 3 | | | | | | |
| **161** | | | | | | | | **161** | 525 | | | | 643 | 1076 | **161** | 437 | 374 | 255 | 431 | 0 | 7 | 991 |
| **163** | | | | | | | | **163** | | | | | | | **163** | 8 | 7 | 4 | 5 | | | 850 |
| **164** | | | | | | | | **164** | 5 | 5 | | | | 895 | **164** | 270 | 266 | 106 | 270 | 1 | | 852 |
| **165** | | | | | | | | **165** | | | | | | | **165** | 1 | | | 1 | | | 547 |
| **166** | | | | | | | | **166** | | | | | | | **166** | 3 | 2 | | 2 | | | 766 |
| **168** | | | | | | | | **168** | 29 | 29 | | | | 901 | **168** | 159 | 159 | 29 | 159 | 0 | 2 | 815 |
| **169** | | | | | | | | **169** | | | | | | | **169** | 31 | 30 | 10 | 31 | 0 | | 979 |
| **170** | | | | | | | | **170** | | | | | | | **170** | 3 | | | 2 | | | 971 |
| **171** | | | | | | | | **171** | 225 | | | | 192 | 1045 | **171** | 356 | 35 | 30 | 280 | | 98 | 1009 |
| **172** | | | | | | | | **172** | 52 | 3 | | | | | **172** | 76 | 62 | 8 | 76 | 0 | | 1187 |
| **173** | | | | | | | | **173** | 57 | 4 | | | 7 | 978 | **173** | 294 | 292 | 202 | 294 | 0 | 310 | 873 |
| **174** | | | | | | | | **174** | 44 | 42 | | | | 1121 | **174** | 41 | 22 | 1 | 37 | | | 1057 |
| **175** | | | | | | | | **175** | 25 | 5 | | | | 1044 | **175** | 46 | 45 | 19 | 46 | 0 | | 978 |
| **178** | | | | | | | | **178** | | | | | | | **178** | 9 | | | 4 | | | 821 |
| **204** | | | | | | | | **204** | | | | | | | **204** | 53 | | | 37 | | 8 | 1000 |
| **205** | | | | | | | | **205** | | | | | | | **205** | 84 | 3 | | 56 | | 2 | 1059 |
| **206** | | | | | | | | **206** | | | | | | | **206** | 16 | 7 | | 11 | | | |

w1=ungutted weight w2=gutted weight

## **Table 2.6.4** continued

| 1991 | | | | | | | | 1992 | | | | | | | 1993 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *pec.no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* | *pec.no* | *length* | *sex* | *maturity* | *w1* | *counted* | *av depth* | *pec.no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* |
| **207** | | | | | | | | **207** | | | | | | | **207** | 7 | | | 5 | | | 946 |
| **208** | | | | | | | | **208** | | | | | | | **208** | 26 | | | | | 174 | |
| **209** | | | | | | | | **209** | | | | | | | **209** | 454 | | | | | 7993 | |
| **212** | | | | | | | | **212** | | | | | | | **212** | 1 | | | | | | 1355 |
| **214** | | | | | | | | **214** | | | | | | | **214** | 23 | | | 2 | | 27 | 1347 |
| **217** | | | | | | | | **217** | | | | | | | **217** | 26 | 25 | 21 | 26 | 0 | | 821 |
| **218** | | | | | | | | **218** | | | | | | | **218** | 36 | | | 21 | | | 1438 |
| **219** | | | | | | | | **219** | | | | | | | **219** | 5 | 1 | | 2 | | | 1065 |
| **220** | | | | | | | | **220** | | | | | | | **220** | 2 | 1 | 1 | 1 | | | 788 |
| **221** | | | | | | | | **221** | | | | | | | **221** | 19 | | | 1 | | 3 | |
| **222** | | | | | | | | **222** | | | | | | | **222** | 41 | | | 1 | | 63 | |
| **223** | | | | | | | | **223** | | | | | | | **223** | 11 | 6 | | 11 | 0 | | |
| **224** | | | | | | | | **224** | | | | | | | **224** | 24 | 21 | 4 | 24 | 0 | | 1211 |
| **225** | | | | | | | | **225** | | | | | | | **225** | 2 | 2 | 1 | 2 | 0 | | 946 |
| **226** | | | | | | | | **226** | | | | | | | **226** | 20 | | | 6 | | | 1138 |
| **227** | | | | | | | | **227** | | | | | | | **227** | 1 | | | 1 | | | 967 |
| **228** | | | | | | | | **228** | | | | | | | **228** | 1 | 1 | 1 | 1 | | | 1355 |
| **229** | | | | | | | | **229** | | | | | | | **229** | 2 | 1 | 1 | 2 | | | 1140 |
| **230** | | | | | | | | **230** | | | | | | | **230** | 3 | | | 2 | | | 1049 |
| **231** | | | | | | | | **231** | | | | | | | **231** | 1 | | | 1 | | | 821 |
| **232** | | | | | | | | **232** | | | | | | | **232** | 58 | | | | | 17 | |
| **233** | | | | | | | | **233** | | | | | | | **233** | 2 | | | 1 | | | |
| **234** | | | | | | | | **234** | | | | | | | **234** | 2 | | | 2 | | | |
| **239** | | | | | | | | **239** | | | | | | | **239** | 17 | | | | | 6 | |
| **240** | | | | | | | | **240** | | | | | | | **240** | 1 | | | | | | |
| **241** | | | | | | | | **241** | | | | | | | **241** | 54 | | | | | 152 | |
| **242** | | | | | | | | **242** | | | | | | | **242** | 15 | | | | | 67 | |
| **243** | | | | | | | | **243** | | | | | | | **243** | 63 | | | | | 198 | |
| **244** | | | | | | | | **244** | | | | | | | **244** | 1 | | | | | | |
| **245** | | | | | | | | **245** | | | | | | | **245** | 5 | | | | | | |
| **246** | | | | | | | | **246** | | | | | | | **246** | 7 | | | 1 | | | 1120 |
| **247** | | | | | | | | **247** | | | | | | | **247** | 1 | | | | | | |
| **248** | | | | | | | | **248** | | | | | | | **248** | 10 | | | | | | |
| **249** | | | | | | | | **249** | | | | | | | **249** | 3 | | | | | | |
| **250** | | | | | | | | **250** | | | | | | | **250** | 1 | | | | | | |
| **253** | | | | | | | | **253** | | | | | | | **253** | 3 | | | | | | |
| **255** | | | | | | | | **255** | | | | | | | **255** | 1 | | | | | | |
| **262** | | | | | | | | **262** | | | | | | | **262** | 1 | | | 1 | | | 714 |

w1=ungutted weight w2=gutted

**Table 2.6.4** continued

| 1994 | | | | | | | | 1995 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spec.no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* |
| **7** | 184 | 176 | 176 | 99 | 98 | | 578 | **7** | 170 | 70 | 70 | 70 | 98 | | 656 |
| **10** | | | | | | | 1244 | **10** | 10 | 10 | 10 | 10 | 0 | 242 | 737 |
| **19** | 155 | 20 | 20 | | | 26 | 544 | **19** | 228 | 228 | 228 | 227 | 0 | 751 | 579 |
| **34** | 8 | 0 | 0 | | | 38 | 544 | **34** | 7 | 0 | 0 | 0 | 0 | 29599 | 771 |
| **39** | | | | | | 4 | 437 | **39** | 19 | 10 | 0 | 11 | 0 | 470 | 599 |
| **47** | 1 | 0 | 0 | | | 4 | 476 | **47** | 6 | 4 | 0 | 6 | 0 | 3 | 466 |
| **48** | 13 | 2 | 0 | | | | 425 | **48** | 1 | 1 | 0 | 0 | 0 | 0 | 410 |
| **58** | | | | | | | | **58** | 101 | 36 | 36 | 101 | 0 | 561 | 618 |
| **59** | | | | | | 510 | 529 | **59** | | | | | | 154 | |
| **60** | 42 | 0 | | | | | 420 | **60** | 59 | 59 | 59 | 59 | 0 | 34 | 485 |
| **62** | 278 | 258 | 231 | 164 | 164 | | 769 | **62** | | | | | | | |
| **63** | | | | | | 1066 | 484 | **63** | 1 | 0 | 0 | 0 | 0 | 5962 | 463 |
| **67** | | | | | | 2 | 424 | **67** | | | | | | | 695 |
| **69** | | | | | | | 476 | **69** | | | | | | 385 | 463 |
| **70** | | | | | | | 460 | **70** | | | | | | 346 | 462 |
| **71** | | | | | | 6504 | 462 | **71** | | | | | | 1036 | 465 |
| **73** | 44 | 0 | 0 | | | | 2059 | **73** | | | | | | | |
| **74** | | | | | | 3318 | 448 | **74** | | | | | | 999 | 445 |
| **76** | 1 | 0 | 0 | | | | | **76** | | | | | | 1 | 677 |
| **79** | | | | | | 200 | 452 | **79** | | | | | | 156 | 435 |
| **81** | | | | | | 58 | 446 | **81** | | | | | | 79 | 508 |
| **82** | | | | | | | | **82** | | | | | | 1 | 453 |
| **87** | | | | | | 13 | 421 | **87** | 4 | 4 | 0 | 4 | 0 | 9 | 515 |
| **88** | | | | | | 262 | 462 | **88** | 1 | 0 | 0 | 1 | 0 | 223 | 468 |
| **90** | | | | | | 9 | 531 | **90** | | | | | | 9 | 471 |
| **91** | | | | | | 50 | 447 | **91** | | | | | | 301 | 440 |
| **92** | | | | | | 601 | 472 | **92** | | | | | | | 759 |
| **96** | | | | | | | | **96** | 14 | 14 | 0 | 14 | 0 | 11 | 565 |
| **98** | | | | | | | | **98** | | | | | | 1257 | 461 |
| **103** | 1 | 0 | 0 | | | | | **103** | | | | | | 22 | 709 |
| **104** | | | | | | | | **104** | 1 | 0 | 0 | 1 | 0 | | 759 |
| **106** | 8 | 0 | 0 | | | | | **106** | 1 | 0 | 0 | 0 | 0 | | |
| **110** | | | | | | | | **110** | | | | | | 288 | 461 |
| **113** | | | | | | 1680 | 471 | **113** | | | | | | 1413 | 453 |
| **118** | | | | | | | | **118** | 2 | 1 | 0 | 2 | 0 | | 565 |
| **120** | 6 | 0 | 0 | | | | | **120** | | | | | | | |
| **123** | 7 | 0 | 0 | | | | | **123** | 2 | 0 | 0 | 2 | 0 | 34 | 576 |
| **124** | | | | | | | | **124** | | | | | | 6 | 643 |
| **127** | 15 | 0 | 0 | | | | | **127** | 21 | 0 | 0 | 12 | 0 | | |
| **133** | | | | | | | | **133** | | | | | | 1 | 759 |
| **134** | | | | | | | | **134** | | | | | | 20 | 684 |
| **136** | 8 | 0 | 0 | | | 234 | | **136** | 1 | 0 | 0 | 1 | 0 | | |
| **138** | 9 | 0 | 0 | | | 102 | | **138** | 101 | 5 | 5 | 101 | 0 | 656 | 624 |
| **139** | 20 | 0 | 0 | | | 1165 | | **139** | | | | | | | |
| **141** | 1 | 0 | 0 | | | | | **141** | 4 | 0 | 0 | 4 | 0 | 1 | |
| **146** | 1 | 0 | 0 | | | | | **146** | | | | | | | |
| **148** | | | | | | | | **148** | | | | | | 3 | 709 |
| **152** | 1 | 0 | 0 | | | | | **152** | | | | | | | |
| **154** | 34 | 0 | 0 | | | 90 | | **154** | 4 | 0 | 0 | 4 | 0 | 38 | |
| **158** | 3 | 0 | 0 | | | | | **158** | | | | | | | |
| **165** | | | | | | | | **165** | 42 | 40 | 0 | 42 | 0 | | 565 |
| **171** | | | | | | | | **171** | | | | | | 116 | 633 |
| **173** | | | | | | | | **173** | 1 | 1 | 1 | 1 | 0 | | 565 |
| **175** | | | | | | | | **175** | | | | | | 2 | 677 |
| **204** | 8 | 0 | 0 | | | 593 | | **204** | | | | | | | |
| **208** | 2 | 0 | 0 | | | | | **208** | | | | | | | |
| **209** | 97 | 0 | 0 | | | 1445 | | **209** | | | | | | | |
| **211** | 21 | 0 | 0 | | | | | **211** | | | | | | | |
| **217** | 5 | 0 | 0 | | | | | **217** | | | | | | | |
| **218** | 5 | 0 | 0 | | | | | **218** | | | | | | | |
| **223** | 2 | 0 | 0 | | | | | **223** | | | | | | 12 | 448 |
| **226** | 5 | 0 | 0 | | | | | **226** | | | | | | | 727 |
| **227** | 1 | 0 | 0 | | | | | **227** | | | | | | | |

w1=ungutted weight  w2=gutted

# **Table 2.6.4** continued

| 1994 | | | | | | | | 1995 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spec.no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* | *Spec.no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* |
| **241** | 1 | 0 | 0 | | | | | **241** | | | | | | | |
| **246** | 2 | 0 | 0 | | | | | **246** | | | | | | | |
| **247** | 6 | 0 | 0 | | | | | **247** | | | | | | | |
| **248** | | | | | | | | **248** | | | | | | 1 | |
| **249** | | | | | | 24 | 483 | **249** | | | | | | 21 | 456 |
| **250** | | | | | | 12 | 470 | **250** | | | | | | | |
| **252** | | | | | | 1 | 450 | **252** | | | | | | | |
| **260** | 3 | 0 | 0 | | | | 1880 | **260** | | | | | | | |

| 1996 | | | | | | | | 1997 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spec. no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* | *Spec. no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* |
| **7** | 419 | 115 | 115 | 164 | 199 | 1 | 815 | **7** | 491 | 91 | 91 | 79 | 441 | | 813 |
| **10** | 474 | 410 | 402 | 207 | | 34200 | 986 | **10** | 3172 | 2600 | 2592 | 3150 | 2107 | 49918 | 1193 |
| **19** | 352 | 350 | 350 | 172 | | 5168 | 588 | **19** | 1239 | 643 | 524 | 969 | 24 | 595 | 630 |
| **34** | 190 | | | | | 16078 | 624 | **34** | 209 | 7 | 6 | | | 7868 | 641 |
| **39** | 21 | 2 | 1 | 25 | | 1 | 588 | **39** | 28 | 8 | 6 | 10 | 6 | 18 | 757 |
| **47** | 29 | 27 | 6 | 7 | | | 679 | **47** | 44 | 29 | 28 | 29 | 4 | | 778 |
| **48** | 2 | 2 | | | | | 504 | **48** | 5 | 5 | 2 | 2 | | | 621 |
| **49** | 33 | 33 | 6 | 7 | | 7 | 1011 | **49** | 122 | 122 | 122 | 119 | 69 | 1706 | 998 |
| **58** | 182 | 139 | 113 | 167 | | 102 | 802 | **58** | 206 | 166 | 158 | 203 | | 2 | 891 |
| **59** | 141 | 86 | 31 | | | 326 | 547 | **59** | 51 | 43 | 42 | 11 | | 2 | 635 |
| **60** | 61 | 30 | 30 | 26 | | 261 | 575 | **60** | 115 | 89 | 86 | 3 | | 89 | 626 |
| **62** | 213 | 211 | 210 | 85 | | 3460 | 974 | **62** | 171 | 170 | 170 | 171 | 97 | | 1155 |
| **63** | 268 | 212 | 101 | 1 | 1 | 253 | 577 | **63** | 158 | 153 | 153 | 116 | | 7 | 603 |
| **64** | 115 | 94 | 80 | 117 | | 9 | 859 | **64** | 331 | 326 | 318 | 325 | 265 | 39 | 1095 |
| **69** | 284 | 209 | 134 | | | 290 | 727 | **69** | 97 | 93 | 93 | 55 | | 39 | 710 |
| **70** | 169 | 92 | 0 | 12 | | 324 | 639 | **70** | 102 | 21 | 0 | 31 | | 10 | 729 |
| **71** | 31 | 0 | 0 | | | 895 | 481 | **71** | 55 | 26 | 26 | | | | 572 |
| **73** | | | | | | | | **73** | | | | | | | |
| **74** | 83 | | | | | 2575 | 488 | **74** | 50 | 9 | 0 | 5 | | 61 | 505 |
| **79** | 75 | 40 | 15 | | | 87 | 656 | **79** | 14 | 11 | 8 | 6 | | | 854 |
| **81** | 99 | 52 | | | | 11 | 716 | **81** | 4 | 3 | 0 | | | | 614 |
| **82** | 3 | 2 | 2 | 1 | | | 834 | **82** | 13 | 13 | 7 | 4 | | | 666 |
| **85** | 48 | 3 | 0 | 16 | | 2617 | 619 | **85** | | | | | | | |
| **86** | | | | | | | | **86** | 1 | 1 | 1 | 1 | | | 1647 |
| **87** | 16 | 11 | 10 | 16 | | | 554 | **87** | 1 | 1 | 1 | 1 | | | 436 |
| **88** | 196 | 112 | 0 | | | 84 | 677 | **88** | 49 | 33 | 0 | 34 | | | 725 |
| **90** | 150 | 148 | 139 | 166 | | 104 | 834 | **90** | 63 | 59 | 52 | 50 | 2 | | 856 |
| **91** | 3 | 1 | | | | | 567 | **91** | 6 | 6 | 0 | | | | 517 |
| **92** | | | | | | 46 | 413 | **92** | | | | | | | |
| **96** | 516 | 424 | 329 | 469 | | 187 | 939 | **96** | 781 | 775 | 771 | 700 | 650 | 200 | 1063 |
| **98** | 421 | 328 | 222 | | | 1394 | 646 | **98** | 182 | 163 | 162 | 133 | | 95 | 710 |
| **103** | 3 | | | | | 2 | 772 | **103** | 4 | 3 | 1 | 4 | | | 1187 |
| **104** | 1 | 1 | | | | | 610 | **104** | 11 | 7 | 1 | 11 | | | 940 |
| **105** | 204 | 190 | 9 | 2 | | 63 | 947 | **105** | 296 | 240 | 235 | 270 | 1 | 18 | 1104 |
| **106** | 5 | 5 | 5 | 2 | | | 987 | **106** | 5 | 3 | 1 | 2 | | | 1461 |
| **107** | 96 | 79 | 3 | | | 26 | 1095 | **107** | 212 | 168 | 66 | 90 | | 2 | 1230 |
| **110** | 49 | 17 | 0 | | | 1 | 673 | **110** | 1 | 0 | 0 | | | | 739 |
| **111** | 2 | 2 | | | | | 599 | **111** | 3 | 3 | 2 | 3 | | | 819 |
| **113** | 237 | 180 | 141 | | | 593 | 648 | **113** | 28 | 27 | 27 | 18 | | 16 | 726 |
| **114** | 28 | 28 | 21 | | | 1 | 1086 | **114** | 74 | 73 | 64 | 64 | 59 | 3 | 1268 |
| **116** | | | | | | | | **116** | 1 | 1 | 0 | 1 | | | 884 |
| **118** | 23 | 21 | 17 | 25 | | | 878 | **118** | 134 | 131 | 108 | 113 | 101 | | 1208 |
| **120** | 2 | 1 | | | | | 787 | **120** | 7 | 5 | 3 | 7 | | | 1454 |
| **122** | 40 | 1 | | 57 | | 141 | 1073 | **122** | 6 | 0 | 0 | 1 | | 58 | 1487 |
| **123** | 9 | | | 2 | | 2 | 542 | **123** | 18 | 6 | 6 | 24 | 1 | 2 | 1000 |
| **124** | | | | | | 1 | | **124** | 1 | 1 | 1 | 1 | | 1 | 1214 |
| **125** | 12 | 12 | 12 | 13 | | | 501 | **125** | | | | | | | |
| **127** | 5 | 1 | 0 | | | | 931 | **127** | 1 | 0 | 0 | 1 | | | 1519 |
| **128** | 8 | 0 | 0 | | | | 804 | **128** | 16 | 13 | 13 | 13 | | | 1063 |
| **133** | 1 | | | | | | | **133** | | | | | | | |
| **134** | | | | | | | | **134** | 1 | 1 | 0 | | | | 878 |

w1=ungutted weight w2=gutted

**Table 2.6.4** continued

| 1996 | | | | | | | | 1997 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spec. no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* | *Spec. no* | *length* | *sex* | *maturity* | *w1* | *w2* | *counted* | *av depth* |
| **136** | 16 | 6 | | | | 21 | 1065 | **136** | 149 | 112 | 0 | | | 26 | 1327 |
| **137** | 3 | | | | | 1 | 736 | **137** | 3 | 0 | 0 | | | | 1129 |
| **138** | 19 | 2 | | 2 | | 2 | 812 | **138** | 28 | 16 | 0 | | | 1 | 1251 |
| **141** | 14 | 13 | | | | | 1079 | **141** | 3 | 0 | 0 | | | | |
| **145** | 1 | 1 | 1 | 1 | | | 1437 | **145** | 2 | 2 | 2 | 2 | 1 | | 1188 |
| **147** | 1 | | | | | | | **147** | | | | | | | |
| **148** | | | | | | | | **148** | 1 | 1 | 0 | | | | 1244 |
| **152** | | | | | | | | **152** | 1 | 1 | 0 | | | | 964 |
| **153** | 12 | 11 | | | | | 933 | **153** | 25 | 12 | 0 | | | | 1131 |
| **154** | 17 | 11 | | | | 2 | 989 | **154** | 61 | 47 | 30 | | | 4 | 1306 |
| **161** | 330 | 328 | 324 | 90 | | 142 | 1069 | **161** | 937 | 912 | 883 | 921 | | 533 | 1097 |
| **163** | 1 | 1 | 1 | 1 | | 1 | 787 | **163** | 1 | 1 | 1 | | | | 875 |
| **164** | 12 | 12 | 11 | 12 | | | 766 | **164** | 29 | 29 | 25 | 28 | 12 | | 887 |
| **165** | 3 | 2 | 2 | 3 | | | 631 | **165** | 57 | 31 | 31 | 32 | 31 | 10 | 501 |
| **167** | | | | | | | | **167** | 6 | 4 | 3 | 5 | 3 | | 1465 |
| **168** | 4 | 4 | 3 | 3 | | 1 | 935 | **168** | 27 | 27 | 26 | 27 | 8 | | 852 |
| **169** | 5 | 3 | 3 | 3 | | | 1139 | **169** | 9 | 9 | 8 | 7 | 3 | | 1320 |
| **170** | 8 | 8 | 1 | 1 | | 1 | 916 | **170** | | | | | | | |
| **171** | 267 | 262 | 261 | 88 | | 97 | 1088 | **171** | 687 | 599 | 578 | 673 | | 133 | 1196 |
| **172** | 21 | 15 | 1 | | | | 1160 | **172** | 326 | 294 | 291 | 295 | 236 | 3 | 1368 |
| **173** | 7 | 7 | 5 | 4 | | | 857 | **173** | 174 | 173 | 170 | 173 | | 2 | 975 |
| **174** | 49 | 43 | 41 | 44 | | 10 | 992 | **174** | 43 | 42 | 42 | 42 | 40 | | 1169 |
| **175** | 8 | 3 | 4 | 4 | | | 1034 | **175** | 14 | 14 | 12 | 13 | | | 1071 |
| **178** | 56 | 55 | 12 | | | | 1250 | **178** | 728 | 727 | 724 | 725 | | 437 | 1411 |
| **205** | | | | | | | | **205** | 347 | 208 | 124 | 58 | | 128 | 1341 |
| **207** | 23 | 19 | 1 | | | | 1062 | **207** | 56 | 47 | 0 | | | | 1134 |
| **212** | | | | | | | | **212** | 1 | 0 | 0 | | | | 875 |
| **214** | 9 | 8 | | | | | 956 | **214** | 7 | 7 | 7 | 2 | | | 1004 |
| **216** | 72 | 65 | 42 | | | 45 | 958 | **216** | 6 | 6 | 4 | 4 | | | 869 |
| **217** | | | | | | | | **217** | 15 | 14 | 6 | 2 | | | 1475 |
| **222** | | | | | | | | **222** | 50 | 29 | 12 | | | | 1348 |
| **223** | | | | | | 4 | 437 | **223** | | | | | | | |
| **224** | | | | | | | | **224** | 103 | 92 | 82 | | | 2 | 1505 |
| **226** | 1 | 1 | | | | | 777 | **226** | 3 | 1 | 0 | | | | 1116 |
| **227** | | | | | | | | **227** | 4 | 2 | 0 | | | | 1472 |
| **228** | 2 | 2 | 2 | 1 | | | 1280 | **228** | 2 | 2 | 2 | 2 | | | 1434 |
| **229** | 2 | | | | | | 616 | **229** | | | | | | | |
| **230** | 3 | 3 | | | | | 1111 | **230** | 18 | 11 | 0 | | | | 1101 |
| **231** | 3 | | | | | | 1124 | **231** | 3 | 0 | 0 | | | | 1043 |
| **233** | 6 | | | | | | | **233** | | | | | | | |
| **243** | | | | | | | | **243** | 2 | 0 | 0 | | | | 1157 |
| **248** | 46 | 24 | 23 | | | 1 | 910 | **248** | 239 | 75 | 69 | 237 | | 12 | 985 |
| **249** | 2 | | | | | | 558 | **249** | | | | | | | |
| **250** | 9 | 7 | | | | 1 | 1001 | **250** | 1 | 1 | 0 | | | 3 | 755 |
| **253** | 3 | 2 | | | | | 1050 | **253** | | | | | | | |
| **256** | | | | | | | | **256** | 11 | 1 | 0 | | | | 1357 |
| **260** | | | | | | | | **260** | 2 | 0 | 0 | | | | 1501 |
| **262** | 2 | | | | | | 1174 | **262** | 3 | 1 | 0 | 1 | | | 1243 |
| **275** | 4 | 2 | | 3 | | | 1027 | **275** | 14 | 11 | 0 | 2 | | | 1263 |
| **276** | 20 | 15 | | 28 | | 1 | 1096 | **276** | | | | | | | |
| **277** | | | | | | | | **277** | 47 | 30 | 2 | | | 6 | 1463 |

w1=ungutted weight w2=gutted

**Table 2.6.5** Information on cruises and indication on available biological data on deep-water fish species during the period 1975 to 1997. Excluded are cruises with only counted specimens.

| Cruise | B5/75 | B7/75 | B11/75 | B4/76 | K1/76 | K2/76 | R1/76 | R2/76 | R3/76 | B7/78 | B10/78 | B11/78 | G1/79 | B4/80 | B6/80 | B14/80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 04 | 04/05 | 04/05 | 04 | 05 | 04 | 04/05 | 04 | 04/05 | 04/05 | 04/05 | 04/05 | 04/05 | 05 | 04 and 05 | 04 |
| Month | apr-may | jun-jul | sep-oct | may | oct-nov | nov | may-jun | jun | jun-jul | apr-may | jul | aug-sep | jun | mar-apr | apr | sep |
| ss/os * | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss |
| gear | 6 | 6/22 | 6/22 | 6 | 6/22 | 22 | 6 | 6 | 6/22 | 22 | 22 | 23 | 6 | 6/22 | 22 | 22 |
| B.t °C | - | - | - | - | - | - | - | 1.7 | - | - | - | - | - | 5.7 | - | 4.0 |
| Species no. | | | | | | | | | | | | | | | | |
| 7 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| 10 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| 19 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| 34 | x | | | | | | | | | x | | x | | | | |
| 39 | x | x | | | x | | | | | | | | | | | |
| 49 | | | | | | x | | | | x | | | | | x | |
| 58 | x | x | x | | x | | x | | x | x | x | x | x | | x | |
| 60 | x | x | x | | x | | x | | x | | x | x | x | | x | |
| 62 | x | x | x | x | x | x | x | x | x | x | x | | x | | x | x |
| 63 | | | | | | | | | x | x | x | | | | | |
| 71 | | | | | | x | | | | | | | | | | |
| 76 | x | | | | | | | | | x | x | | | | x | |
| 81 | | | | | | | | | | | x | | | | | |
| 82 | | | | | x | | | x | | | x | | | | | |
| 87 | | | | | x | | | | x | | | | | | | |
| 88 | | | | | | | | | | | x | x | | | | |
| 98 | | | | | | | | | | | x | | | | | |
| 102 | | | | | | | | | | | | | | | x | |
| 103 | | | | | | | x | | | | | | | | | |
| 105 | x | x | | | x | | x | | x | x | x | | | | x | |
| 107 | | | | | | x | | | | | | | | | | |
| 116 | | | | | | | | | | | | | | | x | |
| 117 | | | | | | | | | | | | | | | x | |
| 118 | | | | | | | x | | | | | | | | x | |
| 120 | | | | | | | | | | | | x | | | | |
| 123 | | | | | | | | | | | | | | | x | |
| 125 | | | | | | | x | | | | | | | | | |
| 127 | | | | | | | | | | | | x | | | x | |
| 128 | x | | x | | | | | | | | | | | | x | |
| 130 | | | | | | | | | | | | x | | | | |
| 135 | | | | | x | | | | | | | | | | | |
| 153 | | | | | | | | | | | | | | | x | |
| 161 | x | x | x | | x | | x | | x | x | x | | | | | |
| 163 | | | | | | | x | | | | | | | | | |
| 166 | | | | | x | | x | | | x | | | x | | | |
| 169 | | | | | x | | | | | | | | | | | |
| 171 | | | | | x | | x | | | x | x | | | | | |
| 173 | x | x | | | x | | x | | x | x | | | | | x | |
| 174 | x | x | | | x | | x | | | | | | | | | |
| 175 | x | x | | | x | x | x | | | | | | | | | |
| 204 | | | | | | | | | | | | x | | | x | |
| 205 | | | | | | x | | | | x | | | | | | |
| 209 | | | | | | | | | | | | | | | x | |
| 222 | | | | | | | | | | | | | | | x | |
| 232 | | | | | | | | | | | | | | | x | |
| 278 | | | | | | | | | | | | | | | x | |

* ss=survey sampling/os=other sampling

## Table 2.6.5 continued

| Cruise | A9/81 | B3/81 | H1/81 | H3/81 | B7/82 | H3/82 | H5/82 | H6/82 | VERBL/82 | H1/83 | H3/83 | H4/83 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 04 and 05 | 04 and 05 | 04 and 05 | 04 | 04 | 04 and 05 | 04 | 05 | | 04 and 05 | 04 and 07 | 04 |
| Month | aug | feb-mar | aug | oct | apr | may | aug | sep | apr | March | April | August |
| ss/os * | ss | ss | ss | ss | ss | ss | ss | ss | os | ss | ss | ss |
| gear | 23 | 6 | 22/23 | 22 | 6/22 | 6/7/22 | 23 | 6/22 | 6 | 22 | 7/22 | 22/23 |
| B.t °C | - | - | 3.2 | - | - | 5.8 | - | - | - | - | 6.0 | - |
| Species no. | | | | | | | | | | | | |
| 7 | | x | x | x | x | x | | x | x | x | x | x |
| 10 | | x | x | x | | x | | x | | x | x | |
| 19 | | x | | | | x | | x | | x | x | |
| 34 | x | | | | | x | | x | | | | |
| 47 | | | | | x | | x | | | x | | |
| 49 | | | x | | | | | | | | x | |
| 58 | | x | | | | | | x | | | x | |
| 60 | | x | | | | x | | x | | | x | |
| 62 | | x | x | x | | x | | x | | x | | |
| 63 | | | | | | | | | | x | | |
| 69 | | | | | | | | | | x | | |
| 70 | | | | | | | | | | x | | |
| 71 | | | | | | | | | | x | | |
| 73 | | | | | | | x | | | | | x |
| 76 | | | | | | x | | | | x | | |
| 81 | | | | | | | | | | x | | |
| 82 | | | | | | | | x | | | | |
| 85 | | | | | | | | | | x | | |
| 86 | | | | | x | | | | | | | |
| 87 | | x | | | | | | x | | | | |
| 88 | | x | | | | x | | | | x | | |
| 90 | | x | | | | | | | | | | |
| 96 | | | | | x | | | | | | | |
| 98 | | | | | | | | | | x | | |
| 103 | | | | | | x | | | | | x | |
| 104 | | | x | | | | | | | | x | |
| 105 | | x | x | x | | x | | x | | | x | |
| 111 | | | | | | | | | | | x | |
| 116 | | | | | | x | | | | | x | |
| 119 | | | x | | | | | | | | | |
| 123 | | | | | | | | | | | x | |
| 128 | | | | | | | | x | | | x | |
| 130 | | | | | | | x | | | | | |
| 136 | | | | | | | | | | | x | |
| 141 | | | x | | | | | x | | | | |
| 153 | | x | | | | | | x | | | | |
| 155 | | | | | | | | | | | x | |
| 161 | | x | x | x | | | | x | | | x | |
| 170 | | x | | | | | | | | | x | |
| 171 | | x | x | | | | | x | | | x | |
| 172 | | x | | | | | | x | | | | |
| 173 | | | | | | x | | x | | | | |
| 174 | | | | x | | | | | | | | |
| 204 | x | | | | | | | | | | x | |
| 205 | | x | | | | | | | | | | |
| 209 | x | | | | | | | | | | | |
| 250 | | | | | | x | | | | | x | |

* ss=survey sampling/os=other sampling

**Table 2.6.5** continued

| Cruise | A4/84 | B3/84 | L4/84 | SS*-84** | VER97/84 | B3/85 | H1/85 | TH1/85 | TP1/85 | TV1/85 |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | | 05 | | 05 | | 04 and 05 | 05 | 05 | 02 | 04 and 05 |
| Month | may | apr | mar | | | sep-oct | feb | feb | mar | may |
| ss/os * | ss | ss | ss | os | os | ss | ss | ss | ss | ss |
| gear | 14 | 68 | 6 | 6 | | 22 | 22 | 22 | 73 | 19/22 |
| B.t °C | - | - | - | - | - | - | - | -1 | 1 | 6 |
| Species no. | | | | | | | | | | |
| 7 | | x | x | x | x | x | x | x | x | x |
| 10 | x | | | x | | x | x | | | |
| 19 | x | x | | | | x | x | x | | x |
| 34 | | | | | | x | x | | | |
| 47 | | | | | | x | x | | | |
| 60 | | x | | | | x | x | x | x | x |
| 62 | | | | x | | x | x | x | | |
| 87 | x | | | | | | | | | |
| 88 | x | | | | | | | | | |
| 105 | | | | | | | x | | | |
| 161 | | | | | | | x | | | |
| 166 | | | | | | | x | | | |
| 170 | | | | | | | | | | |
| 173 | | | | | | | x | | | |
| 256 | | | | | | | x | | | |

* ss=survey sampling/os=other sampling
** includes several landsamplings (SS94-84,SS97-84,SS98-84,SS96/99-84,SS52-84)

| Cruise | B5/86 | TL1/86 | TV1/86 | B2/87 | B4/87 | TL1/87 | TV1/87 |
|---|---|---|---|---|---|---|---|
| Area | 04 and 05 | 03/05 | 04 and 05 | 04 | 04 and 05 | 05 | 04 |
| Month | feb-mar | mar | mar | feb-mar | may | mar | mar |
| ss/os * | ss | ss | ss | ss | ss | ss | ss |
| gear | 22 | 73 | 73 | 22 | 19/22 | 73 | 73 |
| B.t °C | - | - | 5.5 | 4.9 | 6.2 | 1.4 | 4.6 |
| Spec. no. | | | | | | | |
| 7 | x | x | x | x | x | x | x |
| 10 | | | | x | x | | |
| 19 | x | x | x | x | x | x | x |
| 39 | | | | | x | | |
| 47 | | | | x | x | x | x |
| 58 | | | | | x | | |
| 60 | x | | x | x | x | x | x |
| 62 | x | | | x | x | | |
| 76 | | | | | x | | |
| 87 | | | | | x | | |
| 88 | | | | | x | | |
| 93 | | | | | x | | |
| 105 | | | | | x | | |
| 117 | | | | | x | | |
| 123 | | | | | x | | |
| 128 | | | | | x | | |
| 134 | | | | | x | | |
| 138 | | | | | x | | |
| 141 | | | | | x | | |
| 154 | | | | | x | | |
| 161 | | | | | x | | |
| 166 | | | | | x | | |
| 168 | | | | | x | | |
| 169 | | | | | x | | |
| 170 | | | | | x | | |
| 171 | | | | | x | | |
| 175 | | | | | x | | |
| 223 | | | | | x | | |
| 250 | | | | | x | | |

| Cruise | B2/88 | B7/88 | HK1/88 | LSJ1/88 | LSJ2/88 | LYM1/88 | TO1/88 | TB1/89 | THI/89 | TR1/89 | TV1/89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 04 and 05 | 04 and 05 | | 04 and 05 | 05 | 05 | 04 | 03 | 05 | 04 | 04 and 05 |
| Month | feb-mar | aug | dec | mar | nov | dec | mar | mar | mar | mar | mar |
| ss/os * | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss | ss |
| gear | 22 | 19/22 | 6 | 6 | 6 | 19 | 73 | 73 | 73 | 73 | 73 |
| B.t °C | 5.5 | 6.4 | - | - | - | - | - | -0.7 | 4.3 | 3.5 | 4.2 |
| **Species no.** | | | | | | | | | | | |
| **7** | x | x | x | | | | x | | x | | x |
| **10** | x | x | x | | | | | | | | |
| **19** | x | x | x | x | x | x | x | | x | | x |
| **47** | | | | | | | | x | x | x | |
| **58** | x | | | | | | | | | | |
| **59** | | | | | | | | | | | |
| **60** | x | x | | | | | x | | x | | x |
| **62** | x | x | | | | | | | x | | |

* ss=survey sampling/os=other sampling

## **Table 2.6.5** continued

| Cruise | TL1/90 | TV1-90 | B9/91 | SS/91 | TH1/91 | TV1/91 | B9/92 | B12/92 | BESS1-92 | SS/92 | TJ1/92 | TV1/92 | VER/92 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 03 and 05 | 05 | 04 and 07 | 04 | 03 and 05 | 05 | 04 | 04 and 07 | 04 and 05 | 04 and 05 | 04 and 05 | 05 | 04 and 05 |
| Month | Mar | Mar | Aug | Jan-feb | Mar | Mar | Jun-Jul | Aug | Jul | Dec-Jan | May-Jun | Mar | Apr-Dec |
| ss/os * | ss | ss | ss | os | ss | ss | ss | ss | sss | ss | ss | ss | os |
| gear | 73 | 73 | 23 | 6 | 73 | 73 | 34 | 23 | 6 | 6 | 74 | 73 | 6/14 |
| B.t °C | 4.0 | 5.9 | - | - | 3.8 | 7.15 | 5.0 | - | 6.9 | - | 3.0 | 6.9 | - |
| Species no. | | | | | | | | | | | | | |
| 7 | x | x | | | x | x | | x | | x | x | x | x |
| 10 | | | | | | | | | | | x | x | |
| 19 | x | x | | x | x | x | | | x | | x | x | |
| 34 | | | | | | | | | | | x | | |
| 39 | | | | | | | | | | | x | | |
| 47 | x | | | | x | | | | | | x | | |
| 48 | | | | | | | | x | | | | | |
| 49 | | | | | | | | | | x | x | | x |
| 58 | | | | | | | | | | | x | | |
| 59 | | | | | | | | | | | x | | |
| 60 | x | x | x | | x | x | | | x | | x | x | |
| 62 | | | | | x | | | | | | x | | x |
| 63 | | | | | | | | | | | x | | |
| 64 | | | | | | | | | | | x | | |
| 69 | | | | | | | | | | | x | | |
| 71 | | | | | | | | | | | x | | |
| 73 | | | x | | | | | | | | x | | |
| 74 | | | | | | | | x | | | | | |
| 76 | | | | | | | x | x | | | x | | |
| 79 | | | | | | | | | | | x | | |
| 81 | | | | | | | | | | | x | | |
| 82 | | | | | | | | | | | x | | |
| 83 | | | | | | | | x | | | | | |
| 85 | | | | | | | | | | | x | | |
| 87 | | | | | | | | | | | x | | |
| 88 | | | | | | | | | | | x | | |
| 90 | | | | | | | | | | | x | | |
| 91 | | | | | | | | | | | x | | |
| 92 | | | | | | | | | | | x | | |
| 96 | | | | | | | | | | | x | | |
| 98 | | | | | | | | | | | x | | |
| 102 | | | | | | | | | | | x | | |
| 104 | | | | | | | x | | | | x | | |
| 105 | | | | | | | | | | | x | | |
| 106 | | | | | | | x | | | | | | |
| 107 | | | | | | | | | | | x | | |
| 108 | | | | | | | x | | | | | | |
| 111 | | | | | | | x | | | | | | |
| 113 | | | | | | | | | | | x | | |
| 114 | | | | | | | | | | | x | | |
| 118 | | | | | | | | | | | x | | |
| 122 | | | | | | | | | | | x | | |
| 123 | | | | | | | x | | | | x | | |
| 124 | | | | | | | x | | | | | | |
| 125 | | | | | | | | | | | x | | |
| 127 | | | x | | | | | x | | | | | |
| 134 | | | | | | | | | | | x | | |
| 136 | | | | | | | x | | | | x | | |
| 138 | | | x | | | | x | | | | x | | |
| 141 | | | | | | | | | | | x | | |
| 145 | | | | | | | | | | | x | | |
| 153 | | | | | | | | | | | x | | |
| 154 | | | | | | | | | | | x | | |
| 161 | | | | | | | | | | | x | | x |
| 164 | | | | | | | | | | | x | | |
| 168 | | | | | | | | | | | x | | |
| 171 | | | | | | | | | | | x | | |
| 172 | | | | | | | | | | | x | | |
| 173 | | | | | | | | | | | x | | |
| 174 | | | | | | | | | | | x | | |
| 175 | | | | | | | | | | | x | | |

* ss=survey sampling/os=other sampling

**Table 2.6.5** continued

| Cruise | A12/93 | B3/93 | B10/93 | B12/93 | D9/93 | S1/93 | SS-93 | TBA1/93 | TBR1-93 | VER/93 |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | 02 and 03 | 04 and 05 | 04 and 07 | 04 and 07 | 02 | 04 | 04 and 05 | 05 | 04 and 05 | |
| Month | Jul | Mar | Aug | Sept | Jul | Mar | Apr-aug | Sep-Oct | Mar | Dec-Jan |
| ss/os * | ss | ss | ss | ss | ss | ss | ss | ss | ss | os |
| gear | 14 | 22/24 | 23 | 33/34 | 14 | 22 | 6 | 74 | 73 | 6/14/60 |
| B.t °C | -0.1 | 5.3 | - | - | -0.4 | - | - | -0.5 | 5.5 | - |
| Species no. | | | | | | | | | | |
| 7 | | x | x | | | x | x | x | x | x |
| 10 | | x | | | | x | | x | | |
| 19 | | x | | | | x | | x | x | x |
| 34 | | x | | | | | | x | | |
| 39 | | x | | | | x | | | | |
| 47 | | x | | x | | x | | x | | |
| 48 | | | x | x | | | | x | | |
| 49 | | x | | | | x | | | | x |
| 58 | | x | | | | x | | x | | |
| 59 | x | | | | x | | | x | | |
| 60 | | x | | | | | | x | | |
| 62 | | x | | | | | | x | | |
| 63 | x | | | | | | | x | | |
| 64 | | x | | x | | x | | x | | |
| 69 | x | | | | x | | | x | | |
| 70 | | | | | | | | x | | |
| 71 | | | x | | | | | x | | |
| 73 | | | x | x | | | | | | |
| 74 | | | | | | | | x | | |
| 79 | | | | | x | | | x | | |
| 81 | | | | | | | | x | | |
| 82 | | | | | | | | x | | |
| 83 | | | x | | | | | | | |
| 85 | | | | | | | | x | | |
| 86 | | x | | | | | | | | |
| 87 | | x | | | | | | x | | |
| 88 | | x | x | | | | | x | | |
| 90 | | x | | | | | | x | | |
| 91 | | | | | x | | | x | | |
| 92 | | | | | | | | x | | |
| 96 | | x | | | | x | | x | | |
| 98 | x | | | | x | | | x | | |
| 103 | | x | | x | | | | | | |
| 104 | | x | | x | | | | | | |
| 105 | | x | | | | x | | x | | |
| 106 | | x | | x | | | | | | |
| 107 | | x | | | | | | | | |
| 108 | | x | | x | | | | | | |
| 110 | | | | | | | | x | | |
| 111 | | x | | | | | | | | |
| 113 | x | | | | x | | | x | | |
| 114 | | x | | | | x | | | | |
| 116 | | x | | x | | | | | | |
| 118 | | x | | | | | | x | | |
| 120 | | x | | x | | | | x | | |
| 121 | | | | x | | | | | | |
| 123 | | x | | x | | | | x | | |
| 125 | | x | | | | | | | | |
| 127 | | x | x | x | | | | | | |
| 128 | | x | | | | | | | | |
| 130 | | | | x | | | | | | |
| 131 | | x | | | | | | | | |
| 133 | | | | x | | | | x | | |
| 134 | | | | | | | | x | | |
| 136 | | x | | x | | | | | | |
| 137 | | x | | | | | | | | |
| 138 | | x | x | x | | x | | x | | |
| 140 | | x | | | | | | | | |
| 141 | | x | | x | | | | x | | |
| 142 | | | | | | x | | | | |

**Table 2.6.5** continued

| Cruise | A12/93 | B3/93 | B10/93 | B12/93 | D9/93 | S1/93 | SS-93 | TBA1/93 | TBR1-93 | VER/93 |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | 02 and 03 | 04 and 05 | 04 and 07 | 04 and 07 | 02 | 04 | 04 and 05 | 05 | 04 and 05 | |
| Month | Jul | Mar | Aug | Sept | Jul | Mar | Apr-aug | Sep-Oct | Mar | Dec-Jan |
| ss/os * | ss | ss | ss | ss | ss | ss | ss | ss | ss | os |
| gear | 14 | 22/24 | 23 | 33/34 | 14 | 22 | 6 | 74 | 73 | 6/14/60 |
| B.t °C | -0.1 | 5.3 | - | - | -0.4 | - | - | -0.5 | 5.5 | - |
| Species no. | | | | | | | | | | |
| 146 | | x | | | | | | | | |
| 148 | | x | | | | | | | | |
| 153 | | x | | | | | | x | | |
| 154 | | x | | x | | x | | | | |
| 155 | | x | | | | | | | | |
| 161 | | x | | | | x | | | | |
| 163 | | x | | | | x | | x | | |
| 164 | | x | | | | | | x | | |
| 165 | | x | | | | | | | | |
| 166 | | x | | | | | | | | |
| 168 | | x | | | | x | | x | | |
| 169 | | x | | | | | | | | |
| 170 | | x | | | | | | | | |
| 171 | | x | | | | x | | x | | |
| 172 | | x | | | | | | | | |
| 173 | | x | | | | x | | x | | |
| 174 | | x | | | | x | | x | | |
| 175 | | x | | | | | | | | |
| 178 | | x | | x | | | | | | |
| 204 | | x | x | x | | | | | | |
| 205 | | x | | | | | | | | |
| 206 | | x | | x | | | | | | |
| 207 | | x | | x | | | | | | |
| 208 | | | | x | | | | | | |
| 209 | | x | x | x | | | | | | |
| 214 | x | x | | | | | | x | | |
| 216 | | | | | | | | x | | |
| 217 | | x | | x | | | | | | |
| 218 | | x | | x | | | | | | |
| 219 | | x | | x | | | | | | |
| 220 | | x | | x | | | | | | |
| 221 | | x | | x | | | | | | |
| 222 | | x | | x | | | | | | |
| 223 | | x | | | | | | | | |
| 224 | | x | | | | | | | | |
| 225 | | x | | | | | | | | |
| 226 | | x | | x | | | | | | |
| 227 | | x | | | | | | | | |
| 228 | | x | | | | | | | | |
| 229 | | x | | | | | | | | |
| 230 | | x | | | | | | x | | |
| 231 | | x | | | | | | | | |
| 232 | | | x | x | | | | | | |
| 233 | | | x | x | | | | | | |
| 234 | | | x | | | | | | | |
| 239 | | | | x | | | | | | |
| 240 | | | | x | | | | | | |
| 241 | | | | x | | | | x | | |
| 242 | | | | x | | | | | | |
| 243 | | | | x | | | | | | |
| 244 | | | | x | | | | | | |
| 245 | | | | x | | | | | | |
| 246 | | | | x | | x | | | | |
| 247 | | | | x | | | | | | |
| 248 | | | | | | | | x | | |
| 249 | | | | | | | | x | | |
| 250 | | | | | | | | x | | |
| 252 | | | | | | | | x | | |
| 253 | | | | | | | | x | | |
| 262 | | | | | | | | x | | |

* ss=survey sampling/os=other sampling

# Table 2.6.5 continued

| Cruise | B10-94 | B12-94 | SS-94 | TBR1-94 | TV1-94 | VER-94 | VOG09-94 | B10-95 | SS-95 | TB1-95 | VOG04-95 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 04 | 04 | 04 and 05 | 03 and 05 | 04 and 05 | 04 and 05 | 04 | 04 and 07 | 04/ 05/04 | 05 | 05 |
| Month | jul | aug | dec-jan | mar | mar | dec-jan | jul | jun-jul | jan-dec | mar | apr |
| ss/os * | ss | ss | ss | ss | ss | os | os | ss | ss | ss | os |
| gear | 34 | 23 | 19 | 73 | 73 | 6/14/30 | 1 | 6/34 | 60 | 73 | 60 |
| B.t °C | - | - | - | 4.6 | 6.0 | - | - | 6.4 | - | -0.4 | - |
| Species no. | | | | | | | | | | | |
| 7 | | x | | | | x | | x | | | x |
| 10 | | | | | | | | x | | | |
| 19 | | | x | | | | | x | x | x | |
| 34 | | x | | | | | | x | | | |
| 39 | | | | | | | | x | | | |
| 47 | x | | | | | | | x | | | |
| 48 | x | x | | | | | | | | x | |
| 58 | | | | | | | | x | | | |
| 60 | | x | | | | | | x | | x | |
| 62 | | | | | | x | x | | | | |
| 63 | | | | | | | | x | | | |
| 73 | | x | | | | | | | | | |
| 76 | | x | | | | | | | | | |
| 87 | | | | | | | | x | | | |
| 88 | | | | | | | | x | | | |
| 96 | | | | | | | | x | | | |
| 103 | x | | | | | | | | | | |
| 104 | | | | | | | | x | | | |
| 106 | x | | | | | | | x | | | |
| 118 | | | | | | | | x | | | |
| 120 | x | | | | | | | | | | |
| 123 | x | | | | | | | x | | | |
| 127 | x | x | | | | | | x | | | |
| 136 | x | | | | | | | x | | | |
| 138 | x | | | | | | | x | | | |
| 139 | x | x | | | | | | | | | |
| 141 | x | | | | | | | x | | | |
| 146 | x | | | | | | | | | | |
| 152 | x | | | | | | | | | | |
| 154 | x | | | | | | | x | | | |
| 158 | x | | | | | | | | | | |
| 165 | | | | | | | | x | | | |
| 173 | | | | | | | | x | | | |
| 204 | x | | | | | | | | | | |
| 208 | | x | | | | | | | | | |
| 209 | | x | | | | | | | | | |
| 211 | x | | | | | | | | | | |
| 217 | x | | | | | | | | | | |
| 218 | x | | | | | | | | | | |
| 223 | x | | | | | | | | | | |
| 226 | x | | | | | | | | | | |
| 227 | x | | | | | | | | | | |
| 241 | x | | | | | | | | | | |
| 246 | x | | | | | | | | | | |
| 247 | x | | | | | | | | | | |
| 259 | x | | | | | | | | | | |
| 260 | x | | | | | | | | | | |

* ss=survey sampling/ os=other sampling

## **Table 2.6.5** continued

| **Cruise** | **B6-96** | **TH1-96** | **TL1-96** | **TM3-96** | **TR1-96** | **VER-96** | **VOG11-96** | **B13-97** | **LS-97**** | **KA1-97** | **TBR1-97** | **TBR2-97** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Area** | 04 | 04 | 05 | 02/03/04/05 | 02 | 02 and 04 | 05 | 04 | 04 and 05 | 04 and 07 | 04 and 05 | 02/03/04/05 |
| **Month** | jun | oct | mar | oct | mar | jan-dec | may-aug | oct | jan-dec | jun-jul | mar | oct |
| **ss/os *** | ss | ss | ss | ss | ss | os | os | ss | os | ss | ss | ss |
| **gear** | 13 | 34 | 73 | 78 | 73 | 1/14 | 1/6 | 77 | 1/6/14/ 19/33/60 | 6 | 73 | 78 |
| **B.t °C** | 6.6 | - | -0.5 | 1.5 | -0.1 | - | - | 5.9 | | 4.4 | | 1.7 |
| **Spec.no** | | | | | | | | | | | | |
| **7** | x | | | x | | x | x | x | | x | x | x |
| **10** | x | | | x | | | | | | x | | x |
| **19** | x | | | x | | | | x | x | x | x | x |
| **34** | | x | | x | | | | x | | x | | x |
| **39** | x | | | x | | | | x | | x | | x |
| **44** | x | | x | x | x | | | | | x | | x |
| **47** | x | | x | x | | | | x | | x | | x |
| **48** | | | | x | | | | | | | | x |
| **49** | | | | x | | | | | | x | | x |
| **53** | | | | | | | | | | | | x |
| **54** | | | | x | | | | | | | | |
| **56** | | | | | | | | | | | | x |
| **58** | x | | | x | | | | x | | x | | x |
| **59** | x | | x | x | x | | | | | | | x |
| **60** | x | | | x | | | | x | | x | | x |
| **62** | | | | x | | | | | | x | | x |
| **63** | | | x | x | x | | | | | | | x |
| **64** | x | | | x | | | | | | x | | x |
| **65** | | | | | | | | | | | | x |
| **67** | | | | | | | | x | | | | |
| **69** | | | | x | | | | | | | | x |
| **68** | | | x | | | | | | | | | |
| **69** | | | x | x | x | | | | | | | |
| **70** | | | x | x | x | | | | | | | x |
| **71** | | | | x | x | | | | | | | x |
| **74** | | | x | x | x | | | | | | | x |
| **79** | | | | x | x | | | | | | | x |
| **80** | | | | x | | | | | | | | |
| **81** | | | x | x | x | | | | | | | x |
| **82** | | | | x | | | | | | | | x |
| **85** | | | | x | | | | | | | | |
| **86** | | | | | | | | | | x | | |
| **87** | x | | | x | | | | | | | | x |
| **88** | | | x | x | x | | | | | x | | x |
| **90** | | | | x | x | | | | | x | | x |
| **91** | | | x | x | | | | | | | | x |
| **94** | | | x | | | | | | | | | |
| **96** | x | | | x | | | | | | x | | x |
| **98** | | | x | x | x | | | | | | | x |
| **103** | | | | x | | | | | | x | | x |
| **104** | | | | x | | | | | | x | | x |
| **105** | x | | | x | | | | | | x | | x |
| **106** | | | | x | | | | | | x | | x |
| **107** | | | | x | | | | | | x | | x |
| **110** | | | x | x | | | | | | | | x |
| **111** | | | | x | | | | | | x | | x |
| **113** | | | x | x | x | | | | | | | x |
| **114** | | | | x | | | | | | x | | x |
| **116** | | | | | | | | | | | | x |
| **118** | x | | | x | | | | | | x | | x |
| **120** | | | | x | | | | | | x | | |
| **122** | x | | | x | | | | | | x | | |
| **123** | x | x | | x | | | | | | x | | x |
| **124** | | | | | | | | | | x | | |
| **125** | | | | x | | | | | | | | |
| **127** | | x | | x | | | | | | x | | |

* ss=survey sampling/ os=other sampling

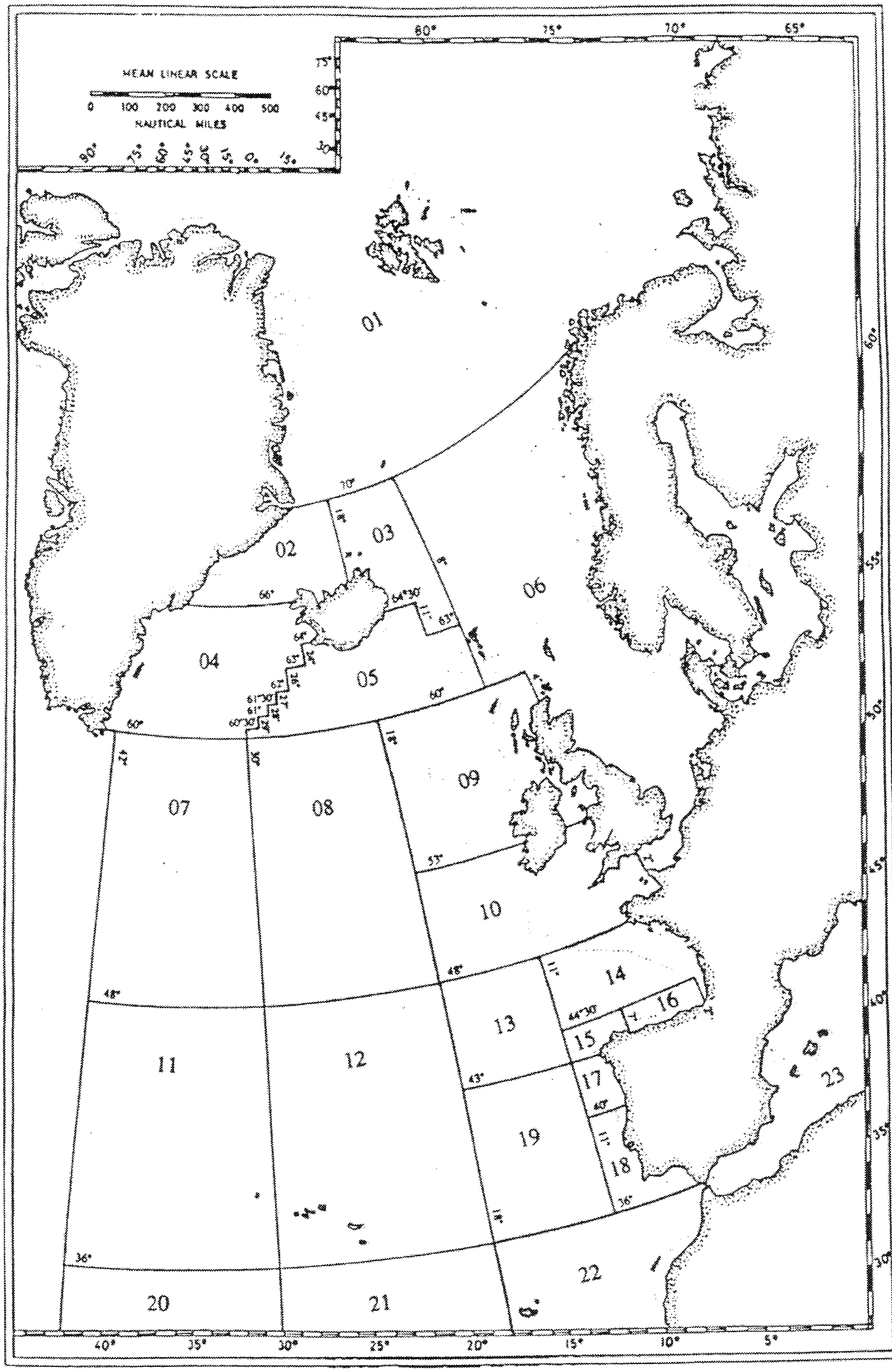
# **Table 2.6.5** continued

| Cruise | B6-96 | TH1-96 | TL1-96 | TM3-96 | TR1-96 | VER-96 | VOG11-96 | B13-97 | JUT-97 | KA1-97 | TBR1-97 | TBR2-97 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 04 | 04 | 05 | 02/03/04/05 | 02 | 02 and 04 | 05 | 04 | 04 and 05 | 04 and 07 | 04 and 05 | 02/03/04/05 |
| Month | jun | oct | mar | oct | mar | jan-dec | may-aug | oct | jun/sep/nov | jun-jul | mar | oct |
| ss/os * | ss | ss | ss | ss | ss | os | os | ss | os | ss | ss | ss |
| gear | 13 | 34 | 73 | 78 | 73 | 1/14 | 1/6 | 77 | 19/60 | 6 | 73 | 78 |
| B.t °C | 6.6 | - | -0.5 | 1.5 | -0.1 | - | - | 5.9 | - | 4.4 | | 1.7 |
| Spec.no | | | | | | | | | | | | |
| 128 | | | | x | | | | | | x | | x |
| 133 | | x | | | | | | | | | | |
| 134 | | | | | | | | | | x | | |
| 136 | | x | | x | | | | | | x | | x |
| 137 | | | | x | | | | | | x | | |
| 138 | | x | | x | | | | | | x | | x |
| 141 | | | | x | | | | x | | | | |
| 145 | | | | x | | | | | | x | | x |
| 147 | | x | | | | | | | | | | |
| 148 | | | | | | | | | | x | | |
| 152 | | | | | | | | | | | | x |
| 153 | | | | x | | | | | | x | | x |
| 154 | | x | | x | | | | | | x | | x |
| 161 | | | | x | | | | | | x | | x |
| 163 | | | | x | | | | | | | | x |
| 164 | x | | | x | | | | | | x | | x |
| 165 | x | | | x | | | | x | | | | x |
| 167 | | | | | | | | | | x | | |
| 168 | | | | x | | | | | | x | | x |
| 169 | | | | x | | | | | | x | | x |
| 170 | | | | x | | | | | | | | |
| 171 | | | | x | | | | | | x | | x |
| 172 | | | | x | | | | | | x | | x |
| 173 | x | | | x | | | | | | x | | x |
| 174 | | | | x | | | | | | x | | x |
| 175 | | | | x | | | | | | x | | x |
| 176 | | | | | | | | | | | | x |
| 177 | | | | x | x | | | | | | | |
| 178 | | | | x | | | | | | x | | x |
| 205 | | | | | | | | | | x | | x |
| 207 | | | | x | | | | | | x | | x |
| 212 | | | | | | | | | | | | x |
| 214 | | | | x | | | | | | x | | x |
| 216 | | | | x | | | | | | x | | x |
| 217 | | | | | | | | | | x | | x |
| 222 | | | | | | | | | | x | | x |
| 224 | | | | | | | | | | x | | |
| 226 | | | | x | | | | | | x | | x |
| 227 | | | | | | | | | | x | | x |
| 228 | | | | x | | | | | | x | | |
| 229 | | | | x | | | | | | | | |
| 230 | | | | x | | | | | | | | x |
| 231 | | | | x | | | | | | | | x |
| 233 | | x | | | | | | | | | | |
| 243 | | | | | | | | | | | | x |
| 248 | | | | x | | | | | | x | | x |
| 249 | | | | x | | | | | | | | |
| 250 | | | | x | | | | | | | | x |
| 253 | | | | x | | | | | | | | |
| 256 | | | | | | | | | | x | | |
| 260 | | | | | | | | | | x | | |
| 262 | | | | x | | | | | | x | | x |
| 267 | | | | | | | | | | x | | |
| 268 | | | | | | | | | | x | | |
| 275 | | | | x | | | | | | x | | x |
| 276 | | | | x | | | | | | | | |
| 277 | | | | | | | | | | x | | |

* ss=survey sampling/ os=other sampling

**LS-97=several landsampling: "JUT-97","REK2-97" and "SS-97"

**Figure 2.1.1** The Deep-water Fishing Areas developed for the FAIR Project (95-0655).



# Partner 11: Hafrannsóknastofnun Marine Research Institute (MRI), Reykjavik, Iceland

by

Jútta V. Magnússon, Jakob Magnússon and Klara B. Jakobsdóttir

## Introduction

The objective of this Sub-task was to study the biological parameters of deep-water species in Icelandic waters. Included within this task was a deep-sea research cruise which was carried out on a commercial trawler (Kaldbakur EA) capable of trawling down to a depth of 1700 to 1800 m. This cruise was carried out in June-July 1997 and has been reported in Magnússon et al., 1997 and 1998.

As stated in Sub-task 1.5 no major fisheries on deep-water species were developed in Iceland until the 1970s. There were, however, records on diverse deep-water species from earlier times. These were mostly specimens which were occasionally washed ashore during gales, usually from a southerly direction. Already in 1772, such records, i.e. for fish seen rarely at that time, could be traced in the comprehensive work by Eggert Ólafsson and Bjarni Pálsson on their travels in Iceland during 1752-1757 (1975). In the 19th century, Benedikt Gröndal (new edition 1975) also reported on such findings for the period between 1874-1905. In later decades, further records were received, in particular from fishermen on bottom trawlers, but also from longliners and gillnetters. Bjarni Sæmundsson (1926) deals in his book, Fiskarnir (Pisces Islandiae), with the whole Icelandic fish fauna known at that time. This book can be regarded as a milestone in the knowledge of fishes in Icelandic waters. Many of the fishes were considered rare and very rare, not only in Icelandic waters, but also in a global sense.

After World War II, when fishing ventured into somewhat greater depths than previously, reports on deep-water fishes increased. However, most were still considered to be rare. During the 1950s, and to a lesser extent the 1960s, the Icelandic Marine Research Institute (MRI) conducted exploratory fishing cruises with commercial trawlers. During these cruises, occasional hauls were taken at greater depths than those usually exploited by the commercial fleet. It soon became obvious that several of the species which had been considered as rare species, proved not to be rare. In the 1970s, and in particular during the latter half of the decade, both the commercial fisheries and the researchers ventured into greater depths than previously exploited. A directed fishery on some of the deep-water species commenced.

Reports on rare fishes, including deep-water species from Icelandic waters, were frequently published by several authors in the ICES, Annales Biologiques, from 1950 until the publication of this journal ceased in 1984. Further reports on rare fishes in Icelandic waters were published annually in the Icelandic periodical "Aegir" by Gunnar Jónsson (1967-1975), by G. Jónsson, Jakob Magnússon and Vilhelmína Vilhelmsdóttir (1976-1993), and by G. Jónsson, J. Magnússon, V. Vilhelmsdóttir and Jónbjörn Pálsson (1994-1998). Besides these reports, articles have been published on diverse deep-water species in several journals not listed here. Jónsson (1992) has included all fishes known in Icelandic waters in his book on Icelandic fishes. In 1995, an evaluation of some biological data on various deep sea fishes was published (Magnússon and Magnússon, 1995).

Early records of deep-water fishes were restricted to the location or place of observation, sometimes giving information on length and/or weight, gear and depth. Later, when such observations became much more frequent, other biological observations were added. However, these were still very limited except for species which had become the subject of a directed fishery. Then, a systematic biological sampling programme was initiated for assessment and monitoring purposes. Observations on many of the non-target species were, however, limited to counting. Thus, most of the biological observations on non-target deep-water species are from the mid 1970s onwards, and in particular from the 1990s.

In Iceland, there remains a keen interest in the deep-water fish fauna of Icelandic waters. Also, the industry has shown some interest with attempts being made to market some of the deep-water fishes and also, some other bycatch species. An urgent need for increased knowledge on deep-water fishes has emerged. The MRI only had very limited manpower and restricted financial means and, therefore, welcomed the offer to participate in the EC FAIR PROJECT CT 95-0655. It enabled the institute to deploy much more effort than was previously possible.

The distribution, variety and biology of fish species is drastically influenced by the specific topography and hydrographic conditions in the Icelandic region. The topography and the hydrographic conditions are briefly outlined in Sub-task 1.5 (see also Magnússon et al., 1998). For the purposes of this project, species living mainly in depths >400 m are considered as deep-water species. Some species live both in deep and shallow waters. Species which are primarily caught at depths of <400 m are excluded from the present evaluation, e. g. tusk (*Brosme brosme*). A well established directed fishery is conducted on some of the deep-water species. These species are also the subject for intensive research and are not included here, e.g. deep-water redfish (*Sebastes mentella*), and Greenland halibut (*Reinhardtius hippoglossoides*). Nevertheless it was sometimes difficult to decide which species should be included in this report. Some of the cold water species were more abundant in shallow waters, i.e. <400 m depth, than in deep water. When a substantial number of such species were also obtained in deep water, it was decided to include them in this evaluation because they are not exploited and no systematic research has been carried out on them. Examples of such species are *Anarhichas denticulatus* and *Lycodes esmarki*.

The data are almost exclusively obtained with bottom trawls. There were two exceptions, *Anarhichas denticulatus* and *Bathylagus euryops,* which were taken with a midwater trawl. *Anarhichas denticulatus* is very common both in shallow and deep water on the shelf and the slope but is also frequently reported from deep-water pelagic hauls in the Irminger Sea. *Bathylagus euryops* is quite frequently caught with bottom trawls in deep water on the slope but is caught in greater quantities in deep hauls with midwater trawls in the Irminger Sea.

It should be borne in mind, that much of the basic material was collected in an incidental way, i.e. on cruises with a special target species, e.g. *Sebastes mentella* or *Reinhardtius hippoglossoides*. General exploratory fishing cruises also included some deep-water hauls. Finally, there were a few deep-water cruises directed to a specific area (eg. the Reykjanes Ridge). Much of the older data are records on location, depth, number and, sometimes, length of the fish. Comprehensive biological data have been collected from 1990 onwards and are the basis of this report. However, older data were included, whenever possible, in preparing the distribution charts and depth analyses. Regarding the length measurements, some of the older data were collected in different ways, e.g. total length instead of standard length. Therefore, it was difficult and sometimes impossible to combine these data with more recent data.

It can be seen from the distribution charts in the report, that there is a deep-water area off the south-east coast where the distribution is interrupted. The reason for this is that the bottom conditions in this area are unsuitable for bottom trawling

# Material and Methods

All data on deep-water fishes available in MRI have been compiled and computerised, from 1975 onwards (Sub-Task 2.6). Biological information was usually limited to relatively few species at the beginning of this time period but eventually, more and more species were biologically sampled, with at least the length of the fish being measured. Since 1990, most deep-water species caught are subject to biological sampling. This study on biological parameters of deep-water fishes of Iceland is based on an extract from the data collection from 1975 onwards (Sub-Task 2.6).

The most comprehensive data are from seven deep-water surveys in the 1990s. Three of these were deep-water groundfish surveys on the Reykjanes Ridge. Two of them (S1/93 and B3/93) were carried out simultaneously, in March 1993 and the other (KA1/97) was in June-July 1997. The remaining four surveys were carried out with the main objective of investigating Greenland halibut (*Reinhardtius hippoglossoides*): one (TJ1-92) off West Iceland, the other three (TM3-96, TBR2-97, and TBR2-98) all around Iceland. Surveys before 1990 were of many kinds, which included variable numbers of deep-water hauls. Some had a definite target species, others were of a more general nature and yet others were opportunistic.

Many of the older records do not contain much biological information, e.g. information on maturity is mainly from relatively recent observations (mostly since 1990), except for those fish of direct commercial interest. However, the older data give valuable information on the distribution and abundance of deep-water species.

The material was almost exclusively collected with bottom trawls from both research vessels and commercial trawlers. The collection of material on board commercial trawlers took place during cruises on chartered trawlers, by collectors or fisheries inspectors on fishing trips and by skippers collecting frozen samples. On research vessel cruises and cruises on chartered trawlers, the codend was lined with fine-meshed net (35-40 mm). On other trips, the prescribed 135 mm mesh size in the codend was used.

During the data analysis, it was decided to follow a standardised procedure for presentation in this report. Thus, information on 33 selected species is presented in the following ways:

- Distribution and relative abundance
- Depth distribution by size and in most cases by sex
- Length distribution by sex in most cases
- Length/weight relationship
- Information on maturity

The 33 species were selected from the 121 species listed Sub-Task 2.6 by using the following criteria.

- Species which were already, or were in the process of becoming, commercially important.
- Species which were considered to be of potential commercial value in the near future e.g. species which were of important commercial value elsewhere but had not been exploited in Icelandic waters to date, e.g. *Aphanopus carbo*.
- Other species occurring in considerable numbers and/or are of particular general biological interest.

The distribution and relative abundance are represented mainly in form of a distribution chart for each species separately. For most species, filled circles were used but for some, very frequently caught species, open circles were applied because such presentation tends to give a better idea of different densities within the distribution area.

**The depth distribution is given in depth zones of 100 or 200 m intervals depending on the depth range, by size and sometimes also by sex.**

In most cases length measurements are given as total length (TL) measured to the nearest cm. For those species where the caudal fin is frequently damaged, standard length (SL) is applied. Macrouridae are measured from the tip of the snout (rostrum) to the first ray in the anal fin (PAFL) and Chimaeridae are measured from the tip of the rostrum to the anterior beginning of the supra-caudal fin (PSCFL). The change in the method for length measurement of macrourids from TL to PAFL, has led to problems concerning the older data with regard to these species. Considering the huge amount of old data that would require much time and effort for screening, it was decided only to use material from 1990s for analyses of length and depth distribution. One exception was made, for *Rhinochimaera atlantica,* where TL from older data is also presented.

The fish were weighed to the nearest gram.

For the maturity determination of the osteichthyes, the four stage scale of Sivertsen (1937) was used:

**Stage I: Immature**
Stage II: Maturing
**Stage III: Spawning**
Stage IV: Newly spent.

For the maturity determination of chondrichthyes, the scale prepared by Dr. M. Stehmann (1998) and accepted by the Project was applied.

The maturity data have sometimes been pooled from many areas and it should be noted that differences in the timing of maturity in different areas cannot be excluded. For example, the maturity conditions might be affected by the fact that the deep-water area west of Iceland is topographically and hydrographically different from that in the south. However, this has not been taken into consideration in this evaluation due to lack of time. For the presentation of maturity the year, beginning in January, has been divided into quarters.

# Results

There was a difference in the number of hauls in each of the depth zones between 1975 and 1999 (Table 5.11.1). The greatest number of hauls were at a depths between 500 and 600 m (1539 hauls) and fewest (three hauls) in the deepest depth zone (1700 to 1800 m).

The length/weight relationships for 32 of the 33 species are given in Table 5.11.2.

### Pleurotremata

***Apristurus laurussonii* (Deep-sea cat shark)** (Figs.5.11.1-5.11.6)

- **Distribution** (Figure 5.11.1)

*Apristurus laurussonii* has a similar distribution to *Galeus murinus* in Icelandic waters. According to the catches from research cruises, the abundance also appears to be similar.

- **Depth** (Figures 5.11.2 and 5.11.3)

*Apristurus laurussonii* showed a wide length distribution in all depth zones but it was most numerous in depths >900 m. Also, the largest number of small fish was observed in the 900-1000 m depth zone and again in depths >1100 m, but relatively few were observed in depths < 800 m. A definite size/depth relationship could not be established.

- **Size** (Figure 5.11.4)

The ratio of males to females was 1.55. The overall size ranged from 16 to 86 cm, the bulk being over 60 cm. Although the size distribution was similar for both sexes, males were markedly larger than females. The mean length of males was 66.31 cm while it was 58.37 cm for females.

- **Length/weight relationship** (Figure 5.11.5)

The length/weight relationship was similar for small fish up to a length of 50 cm (500 g). For larger fish, females were somewhat heavier than males.

- **Maturity** (Figure 5.11.6)

In the 3rd quarter (July), a considerable proportion of both sexes were still immature. Spawning males and females were observed but no newly spent individuals were seen. In the 4th quarter, the larger proportion of males was spawning or close to it but few females were newly spent. These observations might indicate that some spawning is ongoing, at least in summer and early winter.

***Galeus murinus* (Mouse catshark)** (Figs.5.11.7-5.11.12)

- **Distribution** (Figure 5.11.7)

*Galeus murinus* was relatively evenly distributed over almost the entire survey area off the south and west coasts. However, the species was never observed in dense concentrations.

- **Depth** (Figures 5.11.8 and 5.11.9)

*Galeus murinus* was caught at depths of 656 to 1731 m. The length distribution was similar for both sexes in the different depth zones. The smallest fish were, however, more common in the shallowest depth zone (<800 m).

- **Size** (Figure 5.11.10)

The ratio of males to females was 0.77. It could, however, vary greatly according to time and/or area. The length for both sexes ranged from 20 to 85 cm but the bulk of fish were within the 50-60 cm range. The distribution was very similar for both sexes, males being somewhat larger (mean length 53.60 cm) than females (mean length 49.26 cm).

- **Length/weight relationship** (Figure 5.11.11)

The length/weight relationship was similar for both sexes up to approximately 50 cm in length (about 500 g in weight). For fish larger than 50 cm, females became slightly heavier.

- **Maturity** (Figure 5.11.12)

In the 3rd Quarter, although mainly in July, the majority of the females were immature. However, a few were close to spawning or spawning. None were observed as newly spent. In 4th Quarter (October), the immature females were relatively few. However, spawning and newly spent specimens were observed. Since a similar situation was observed for males, it might indicate a winter spawning.

***Centroscyllium fabricii* (Black dogfish)**

The information on this species has been published (Jakobsdóttir, 1998, Mimeo; Jakobsdottir, 2000, Fisheries Research, in press).

***Centroscymnus coelolepis* (Portuguese shark)** (Figs.5.11.13-5.11.18)

- **Distribution** (Figure 5.11.13)

This shark is frequently caught in Icelandic waters but mostly in small quantities. It has mainly been caught off the south-west coast during research cruises. This species appears to be more confined to the slope of the continental shelf rather than to the Reykjanes Ridge area.

- **Depth** (Figures 5.11.14 and 5.11.15)

*Centroscymnus coelolepis* was observed at depths of 432-1594 m and was relatively equally distributed throughout all depth zones, from <800 to >1100 m. Small fish were also observed in all depth zones and there was no trend in the size/depth relationship. Females outnumbered the males in the catches.

- **Size** (Figure 5.11.16)

The sex ratio of males to females was 0.13. The overall length distribution was from 65 to 120 cm, the bulk being over 100 cm. Males were much smaller than females, the mean lengths being 88.40 and 105.07 cm, respectively. Most of the males were less than 100 cm in length while most of the females were >100 cm in length.

- **Length/weight relationship** (Figure 5.11.17)

The length/weight relationship appeared similar for males and females, but the weight of fish of the same size could vary greatly. For example, a 110 cm female could weigh from about 7.5 kg to 15 kg.

- **Maturity** (Figure 5.11.18)

The maturity stages of 96 females were determined for the 4$^{th}$ Quarter (October). All 7 stages were represented for females but the majority were in ovarian stages 1-3 and stage 7 (spent). Only 9 males were observed, from stages 1 and 2. In the 3$^{rd}$ Quarter, mainly July, only 8 females were observed of which four belonged to stage 7 and the other three to stages 1 and 2. No males were observed in that time period. Thus, there is an indication that the young are born in winter but the lack of reliable maturity determination at other times of the year makes it impossible to say much about the maturity cycle. The 50% maturity was reached for females at a length of 93.16 cm.

***Centroscymnus crepidater* (Longnose velvet dogfish)** (Figs.5.11.19-5.11.24)

- **Distribution** (Figure 5.11.19)

*Centroscymnus crepidater* does not appear be very abundant in Icelandic waters. It is most common off the south-west coast, including the eastern slope of the Reykjanes Ridge. It is less common off the west and south-east coasts.

- **Depth** (Figures 5.11.20 and 5.11.21)

*Centroscymnus crepidater* was observed at depths of 456 to 1410 m. Both males and females were most abundant in the 700-800 m depth zone. Males dominate at depths <600 m and females at depths >800 m. Although no trend in the size/depth relationship could be observed, the lowest mean length for both sexes combined was recorded at depths >800 m.

- **Size** (Figure 5.11.22)

  The sex ratio males/females was 1.49. The overall size ranged from 18 to 89 cm, the majority being over 60 cm. The sexes were recorded in two distinct size groups with very little overlap. Males ranged from 58 to 68 cm and females, from 71 to 89 cm. Fish smaller than 58 cm belonged to both sexes. The overall mean length for males was 62.80 cm and for females, 73.07 cm.

- **Length/weight relationship** (Figure 5.11.23)

  The length/weight relationship was similar for both sexes in spite of the great difference in the length distribution. Females were slightly heavier than males.

- **Maturity** (Figure 5.11.24)

  In the 3rd quarter, mainly July, only a few fish were obtained. Immature females dominated but the few mature specimens of both sexes were found in uterine stages 4 and 5. In the 4th quarter, on the other hand, females were observed in almost all stages except for stage 6 but the greatest number was found in stage 2 (maturing) or stage 7 (spent). Males were found in maturing/adult stages 2 and 3.

***Deania calceus* (Birdbeak dogfish)** (Figs.5.11.25-5.11.30)

- **Distribution** (Figure 5.11.25)

  Although *Deania calceus* was observed along the slope to the west of Iceland, it is much more abundant off the south-west coast and on the eastern slope of the Reykjanes Ridge. Large catches have not yet been made and catches with >100 specimens were not common.

- **Depth** (Figures 5.11.26 and 5.11.27)

  The depth range of *Deania calceus was* from 547 to 1363 m but it was most abundant at 600-900 m. The smallest fish (<65 cm) occurred only in depths greater than 700 m but fish larger than 65 cm were most abundant in 600-700 m depth zone. The mean length was generally greater in the shallower depth zones than in the deeper ones.

- **Size** (Figure 5.11.28)

  The sex ratio of males to females was 0.62. Males were both fewer (38%) and considerably smaller (mean length = 85.47 cm) than females (mean length = 97.28 cm). The overall length distribution ranged from 71 to 114 cm.

- **Length/weight relationship** (Figure 5.11.29)

  The length/weight relationship was similar for both sexes up to about 85 cm (c. 2200 g). Specimens larger than 85 cm differed slightly in weight as females became heavier.

- **Maturity** (Figure 5.11.30)

  The material available on this subject was very limited. In the 3rd quarter (July), there was only one male (5.6 %) and 17 females (94.4%). The male was adolescent and the females were almost equally divided between stage 1 (immature) and stage 7 (newly spent). In the 4th quarter, the sex ratio shifted to 77% males and 23 % females. Most of the males were in stage 3 (mature) while the females were either immature or in uterine stage 4.

***Etmopterus princeps (Greater lantern shark)***

The information on this species has been published (Jakobsdóttir, 1998; Mimeo, Jakobsdottir 2000, Fisheries Research, in press).

***Etmopterus spinax*** **(Lantern shark)** (Figs.5.11.31-5.11.36)

- **Distribution** (Figure 5.11.31)

*Etmopterus spinax* is very common in the slope area, south-west of Iceland. It is also frequently reported off the west coast but is rather scarce off the south-east coast and has so far not been reported from the north coast nor from the Reykjanes Ridge area, except close to the shelf.

- **Depth** (Figures 5.11.32 and 5.11.33)

*Etmopterus spinax* was caught at depths of 263 to 1008 m but was most abundant in the 500-600 m zone. The size distribution was greatest in the 400-500 m depth zone. The smallest fish were abundant at depths of < 400 m. There was a clear increase in the mean length, with increasing depth for both sexes combined, ranging from 29.80 cm in the shallowest depth zone (<400 m) to 50.94 cm in the deepest zone (>600 m).

Considering the sexes separately, males outnumbered females in all depth zones except for 400-500 m depth, where the number of females was slightly higher. Further, both sexes were most abundant in the 500-600 m depth zone and the depth related sizes were not as obvious as when sexes were combined.

- **Size** (Figure 5.11.34)

The ratio of males to females was 1.96. The overall size of *Etmopterus spinax* ranged from 24-64 cm but differed between the sexes. Most of the males ranged in size from 47-53 cm while females were more or less distributed over the whole length range. Males were bigger than females, the mean length being 48.51 cm and 45.09 cm for males and females respectively.

- **Length/weight relationship** (Figure 5.11.35)

The length/weight relationship was similar for both sexes except for the larger fish where females became heavier than males. A fish of 50 cm in size was approximately 500 g in weight.

- **Maturity** (Figure 5.11.36)

Information on maturity was only available for October. Immature male and female fish were the most numerous. However, almost all other stages of maturity were present for both sexes. This situation could indicate the onset of spawning since there were very few newly spent females. The 50 % retention was reached for males at a length of 49.24 cm.

# Hypotremata

***Raja hyperborea*** **(Northern Skate)** (Figs.5.11.37-5.11.42)

- **Distribution** (Figure 5.11.37)

*Raja hyperborea* prefers cold water and is mainly caught off the north- and east coasts. It has also been observed elsewhere in Icelandic waters but usually as single specimens.

- **Depth** (Figure 5.11.38 and 5.11.39)

*Raja hyperborea* has been observed at a great range of depths, from 185 m to 1543 m. In all depth zones, the size range was wide. Small fish were most numerous at depths from 600 to 1000 m. No definite trend in the length/depth relationship was observed, but the greatest mean length for both sexes combined was observed at depths of <600 m.

- **Size** (Figure 5.11.40)
  Females were outnumbered by males, the sex ratio being 1.52. However, the length distribution pattern was similar for both sexes. The overall length ranged from 8 to 113 cm. Females were smaller than males, the mean length of females being 37.62 cm and for males 42.67 cm.

- **Length/weight relationship** (Figure 5.11.41)
  The length/weight relationship was similar for both sexes up to a length of approximately 60 cm and a weight of 2000 g.

- **Maturity** (Figure 5.11.42)
  Data on maturity stages were mainly available for the 4$^{th}$ quarter. A female caught on the Reykjanes Ridge during July was the largest specimen recorded (113 cm) and was at stage 6 (extruding). In October, most specimens of both sexes were immature. Some males were found maturing or active and the majority of mature females were observed in the ovarian stages 2 or 3. Apparently, some spawning takes place at this time of the year.

***Raja fyllae* (Round ray)** (Figs.5.11.43-5.11.48)

- **Distribution** (Figure 5.11.43)
  *Raja fyllae* has a scattered distribution off the south-west and west coasts but off the south-east coast, it has been observed to be in much denser concentrations and is more numerous.

- **Depth** (Figure 5.11.44 and 5.11.45)
  *Raja fyllae* was observed in a depth range of 198 to 1744 m. The length range was large in all depth zones. Medium sized fish of both sexes were almost lacking at all depths. The largest fish were dominant at depths of <400 m.

- **Size** (Figure 5.11.46)
  The overall size ranged from 10 cm to 97 cm. Males were larger than females, the mean length being 44.59 cm and 34.79 cm respectively. A larger number of length measurements were available for unsexed fish, with a mean length of 39.52 cm.

- **Length/weight relationship** (Figure 5.11.47)
  The length/weight relationship for both sexes combined showed a weight of approximately 300 g for 40 cm fish.

- **Maturity** (Figure 5.11.48)
  Information on maturity was only available for a few specimens in the 4$^{th}$ quarter. The nine females were immature (stage 1) while males (n=7) were in stages 1, 2 and 4, i.e. ready for spawning.

# Chimaerea

***Hariotta raleighana* (Longnosed chimaera)** (Figs.5.11.49-5.11.50)

- **Distribution** (Figure 5.11.49)

*Hariotta raleighana* is mainly observed off the south-west coast and on the Reykjanes Ridge. It has been caught off the west coast and has also been reported from the south-east area. It is not as numerous as *Rhinochimaera atlantica,* although these two species are frequently caught together.

- **Depth**

The depth range was from 547 to 1610 m but most specimens were in the 1000 - 1100 m depth zone. Males were observed down to 1400 m but females down to over 1600 m.

- **Size**

A total of 46 specimens were measured. The total length (TL) was used for 28 specimens from older data and they ranged from 19 to 112 TL (mean length 82.82 cm). The overall PSCFL length ranged from 18 to 80 cm (n=18). The mean length for males was 60.25 cm and for females, 68.3 cm. Males were only recorded within the length range 59 to 62 cm (PSCFL). One juvenile female (18 cm PSCFL) was recorded at a depth of 1047m, at 65°00' N and 28°14' W.

- **Length/weight relationship**

Relatively few specimens were weighed. The average weight for males was 1243 g and for females, 2606 g.

- **Maturity** (Figure 5.11.50)

Information on maturity is available for the 3rd and 4th quarters. In the 3rd quarter only females were recorded, in stages 2 (adolescent) to 4 (active). In the 4th quarter both sexes were recorded, males in stages 3 (mature) and 4 (active), while females were in maturing stages 2-4. The juvenile female of 18 cm PSCFL (see above) was immature.

***Rhinochimaera atlantica* (Knifenose chimaera)** (Figs.5.11.51-5.11.55)

- **Distribution** (Figure 5.11.51)

*Rhinochimaera atlantica* is mainly distributed off the south-west coast but is also found along the western slopes. Some specimens have been reported off the south-east coast of Iceland.

- **Depth** (Figure 5.11.52)

*Rhinochimaera atlantica* has been observed in a depth range of 550 to 1629 m. The majority were caught in the depth range 600 to 1000 m. Small specimens were only observed in depths > 800 m.

- **Size** (Figure 5.11.53)

The ratio of males to females was 1.39. Before the PSCF length measurement was applied in about 1994, total length was measured. Small specimens (31-41 cm, TL) were caught in one haul at 63°46' N 27°17' W, in a depth of 1278 m. The overall length range was

31 to 144 cm TL, the mean length being 110.72 cm TL. Males were smaller (mean length 111.57 cm, TL) than females (mean length 128.36 cm TL).

The overall PSCFL size range was from 61 to 101 cm (not shown in Figure 5.11.53). The mean length was 83.87 cm PSCFL. Males were smaller than females, the mean length being 83.67 cm for males and 86.89 cm for females.

- **Length/weight relationship** (Figure 5.11.54)

Relatively few specimens were weighed. The average weight for males was 3284 g (length range 76-90 cm PSCF), and for females 3926 g (length range 76-101 cm PSCF).

- **Maturity** (Figure 5.11.55)

Information on maturity was only available for the 4$^{th}$ quarter. Most fish of both sexes were immature. Males were in stages maturing to active (2 to 4) and the females, maturing and developing (2 and 4).

# Isospondyli

*Alepocephalus agassizii* **(Agassiz' smoothhead)** (Figs.5.11.56-5.11.61)

- **Distribution** (Figure 5.11.56)

In Icelandic waters, *Alepocephalus agassizii* is not as common as the related *Alepocephalus bairdii.* The main distribution of both species is different, although to some extent overlapping. *A. agassizii* is much more abundant in the deeper waters of the Reykjanes Ridge. It has not been observed in Icelandic surveys on the Iceland-Faroe Ridge. However, since it inhabits greater depths than *A.bairdii* the reason might be that sufficiently deep hauls have not yet been carried out in that area.

- **Depth** (Figure 5.11.57 and 5.11.58)

*A. agassizii* was observed at depths between 821 and 1731 m but was most abundant at depths greater >1500 m. The length range was large in every depth zone and there was no depth related trend in size.

- **Size** (Figure 5.11.59)

The size range of *A. agassizii* was from 10 to 76 cm SL with most between 30 and 60 cm SL. Males were slightly more numerous than females (ratio 1.32) but the length distribution pattern was similar for both sexes, the mean length being 45.8 cm SL and 47.1 cm SL for males and females respectively.

- **Length/weight relationship** (Figure 5.11.60)

The length/weight relationship was similar for males and females, the average weight for both sexes combined being 1185 g. A 60 cm SL fish weighed approximately 2.3 kg.

- **Maturity** (Figure 5.11.61)

Observations on maturity were available from the months of June, July and October. Males in all maturity stages were found in each month. Spawning females were only observed in July. The presence of maturing adults (stage II), spawning (stage III) and newly spent specimens in all months indicate a prolonged spawning period. Males reach maturity at a length of 42.36 cm, females at a length of 49.26 cm.

*Alepocephalus bairdii* **(Smoothhead)** (Figs.5.11.62-5.11.67)

- **Distribution** (Figure 5.11.62)

The smoothhead is very common off the west and south-west coasts of Iceland and on the Reykjanes Ridge. It has also frequently been observed at the western slope of the Iceland-Faroe Ridge but only in small quantities.

- **Depth** (Figure 5.11.63 and 5.11.64)

The smoothhead was observed in depths from 582 m to 1653 m and was most abundant between 900 and 1100 m. The size range was wide in all depth zones but especially in the 800 to 900 m depth zone where the largest fish was observed. The depth distribution pattern of males and females was similar although males were more numerous at all depths. The smaller fish were most common in depths of <1000 m. The mean length increased with depth, i.e from 32.30 cm (<800 m depth) to 45.68 cm (> 1200 m) with the exception of the 800-900 m depth zone where the mean length was 52.18 cm.

- **Size** (Figure 5.11.65)

The ratio of males to females was 1.21. The total length distribution ranged from 11 to 79 cm SL with most between 30 and 60 cm SL. The size distribution for males and females was similar, the males being slightly smaller. The mean length was 44.57 cm SL for males and 47.65 cm SL for females.

- **Length/weight relationship** (Figure 5.11.66)

The length/weight relationship was similar for both sexes, the average weight being 745 g. A fish of 60 cm SL weighed on average about 1.8 kg.

- **Maturity** (Figure 5.11.67)

The proportion of immature fish (stage I) was high (50-60%) in all seasons. Spawning specimens of both sexes were recorded in March and during June-July. Newly spent fish were quite numerous in all periods, particularly in October. Spawning appears to take place between January and March and also between June and July. Spawning might take place in winter and spring extending into summer, indicating a rather prolonged spawning season. Males reach 50% maturity at a length of 42.77 cm, females at a length of 42.29 cm.

## Salmonoidei

*Argentina silus* **(Greater silver smelt)** (Figs.5.11.68-5.11.71)

Since the publication of a paper on *Argentina silus* in Icelandic waters (Magnússon, 1996) the species has become subject of a substantial directed fishery and considerable additional material has been collected.

- **Distribution** (Figure 5.11.68)

This species is very common in the warm Atlantic water, from the north-west, south- and eastwards to the south-east coasts of Iceland and the Iceland-Faroe Ridge. It is most frequently caught during research cruises in the south-western slope area. Off the north and east coasts, it is very seldom observed and then, only as single specimens. In shallower waters, *A. silus* is frequently observed during research cruises mainly as small, immature fish.

- **Depth**

The depth distribution was described by Magnússon (1996). A wide length range was recorded in each depth zone and generally, the mean length per depth zone increased with increasing depth although there were differences between areas. The new data confirm this depth distribution.

- **Size** (Figure 5.11.69)
  The sex ratio males to females was 1.52. The overall length for males and females ranged from 12 to 59 cm. The males were smaller than females, the mean length being 40.59 cm and 43.05 cm, respectively.

- **Length/weight relation**ship (Figure 5.11.70)
  The length/weight relationship was almost the same for both sexes. The average weight for males was 536 g and 634 g for females. Therefore, there was no noteworthy change from the observations made in 1996, although the material was much more extensive.

- **Maturity** (Figure 5.11.71)
  Additional material on maturity was now available. The results presented in the paper (Magnússon 1996) were confirmed, i.e. some spawning takes place year round but the main spawning season is in late winter and spring (April-June). The 50% maturity was reached at 36.27 cm in males and at 37.23 cm in females.

***Bathylagus euryops* (Goitre blacksmelt)** (Figs.5.11.72-5.11.76)

- **Distribution** (Figure 5.11.72)
  Although this species has frequently been caught in bottom trawl off west and southwest Iceland and along the western slope of the Reykjanes Ridge, most have been caught in deep hauls with midwater trawls, in the Irminger Sea.

- **Depth** (Figure 5.11.73)

This depth information is only for the bottom trawl catches. The depth range was from 770 to 1731 m, although this species was most abundant in depths of 1400 to 1600 m. Relatively few fish were caught at depths of <1000 m and >1600 m. No definite trend in the size distribution with depth could be established but the length range was wide for all depths. For females, the mean length increased with increasing depth down to 1600 m.

- **Size** (Figure 5.11.74)
  The ratio males to females was 0.56. The overall size range for males and females was from 12 to 26 cm. Both sexes showed a distribution pattern with one peak each but the females were larger than males, the mean length being 17.32 cm and 16.09 cm respectively. 50% maturity was reached for males at a length of 15 cm and for females, at a length of 14.32 cm.

- **Length/weight relationship** (Figure 5.11.75)
  The length/weight relationship was similar for both sexes. Fish of 8 cm in length weighed 5 g and those of 15 cm in length, 34 g. The largest fish was 20 cm in size and weighed 65 g.

- **Maturity** (Figure 5.11.76)
  Information on maturity was only available for the month July. The majority of both sexes were at stage II (maturing). Stage I (immature) was also represented for both sexes but only females were observed in stage IV. No spawning specimens were recorded.

# Apodes

***Synaphobranchus kaupi* (Longnose eel)** (Figs.5.11.77-5.11.82)

- **Distribution** (Figure 5.11.77)

*Synaphobranchus kaupi* is most common off the west coast and on the Reykjanes Ridge. Only a few specimens have been recorded off the south and south-east coasts.

- **Depth** (Figure 5.11.78 and 5.11.79)

*Synaphobranchus kaupi* was observed in depths from 777 to 1610 m. It was most abundant within the depth range from 900 to 1300 m. The length distribution was wide and similar in all depth zones. The mean length was smallest in depths <900 m and >1500 m (50.93 cm and 52.31 cm, respectively). Males were common in depths of 900-1300 m. Very few males were observed in depths >1300 m, while females were relatively common in all depths >900 m.

- **Size** (Figure 5.11.80)

The sex ratio males to females was 0.36. The size of *Synaphobranchus kaupi* ranged from 24-75 cm. Females were on the average, slightly larger (mean length 56.69 cm) than males (mean length 53.39 cm). The majority of both sexes were in the length range of c.50 to 65 cm.

- **Length/weight relationship** (Figure 5.11.81)

The length/weight relationship was the same for both sexes up to a size of about 50 cm (weight 130 g). With larger size, females became somewhat heavier than males. For example, at 60 cm, females weighed 225 g, and males, 200 g.

- **Maturity** (Figure 5.11.82)

The distribution of maturity stages was similar for all seasons of observation (1$^{st}$, 2$^{nd}$ and 3$^{rd}$ quarters). Only very few males were recorded and no fish in spawning condition were observed. Females as well as males in all quarters were observed in maturity stage II (maturing). A few specimens of both sexes were immature (stage I) and some, newly spent (stage IV) except for the 3$^{rd}$ quarter when no male was observed in stage IV. In the 4$^{th}$ quarter (October), only 5 females were observed, in maturity stage IV. This distribution of maturity stages does not indicate any seasonal differences. The species reaches 50% maturity at a size range 45 to 53 cm.

# Heteromi

***Notacanthus chemnitzii* (Spine eel)** (Figs.5.11.83-5.11.88)

- **Distribution** (Figure 5.11.83)

The spine eel has a wide distribution in Icelandic waters. It is most common off south-east and north-west coasts where the overflow of the cold water off North- and East-Iceland takes place and mixes with the warmer Atlantic water. The species was also observed along the Reykjanes Ridge as far south as 56°30' N.

- **Depth** (Figure 5.11.84 and 5.11.85)
  Records of *Notacanthus chemnitzii* are available from depths of 336 to 1731 m but the species is most abundant in the 1000-1200 m depth zone. The overall mean length decreased with increasing depth, from 84.82 cm in depths <800 m, to 71.05 cm, in depths >1200 m. This decrease in the mean length is partly due to males being smaller (and less abundant) than females and to the larger number of small specimens in the deepest depth zone. The relationship between size and depth was particularly evident for females.

- **Size** (Figure 5.11.86)
  The ratio of males to females was 0.38. Females were also larger than males, the mean lengths being 83.94 cm and 65.18 cm, respectively. The overall length was from 31 to 121 cm. The bulk of the females were within the range of 75 to 105 cm, and for males, between 55 and 75 cm.

- **Length/weight relationship** (Figure 5.11.87)
  The length/weight relationship was similar for both sexes up to approximately 80 cm (ca 1300 g). At 100 cm in length, the difference was about 500 g, i.e. males weighed about 2600 g and females about 3100 g.

- **Maturity** (Figure 5.11.88)
  Maturity data were available for both sexes during all quarters. However, the number was limited, particularly for males, except for the $4^{th}$ quarter (October) when both sexes were relatively well represented. In this quarter both sexes were found at all four stages of maturity, including stage III (spawning). Since both maturing (stage II) and newly spent fish (stage IV) were represented in the samples, it can be concluded that spawning takes place during this quarter. The maturity stages which were also represented in the other quarters give an indication that, at least to some extent, spawning might be spread over the whole year. Both sexes reach maturity at a size of between 58 and 60 cm, females at 58.75 cm.

## Anacanthini

***Coryphaenoides rupestris* (Roundnose grenadier)** (Figs.5.11.89-5.11.94)

- **Distribution** (Figure 5.11.89)
  The roundnose grenadier is one of the most common deep-water fish species in Icelandic waters. The distribution is confined to the slope region west and south of Iceland and to the Reykjanes Ridge. Although the research vessel samples off the south-east coast do not contain large quantities of roundnose grenadier, aggregations have been observed in this area. The largest incidental catches have been taken in this area. It is known that in the late 1960s, vessels from the Soviet Union obtained good catches of roundnose grenadier at south-east of Iceland.

- **Depth** (Figure 5.11.90 and 5.11.91)
  Only material from the 1990s has been used for the analysis of length and depth distribution. *Coryphaenoides rupestris* was caught at depths between 547 and 1731 m. The size range was wide for all depth zones. The greatest numbers were caught at depths >1200 m. Small fish were most numerous in depths down to 1100 m. The average PAFL was greatest in the shallowest (<900 m) and deepest (>1200 m) depth zones, for both of the sexes combined and separated (10.41 cm and 11.03 cm, respectively).

- **Size** (Figure 5.11.92)

The ratio males to females was 1.44. The overall PAFL ranged from 2 to 25 cm. Most of the males were in the length range 5-15 cm and females 8-18 cm, the mean length being 10.24 cm for males and 12.27 cm for females. Both small and large fish appeared to be present in all areas of investigation.

- **Length/weight relationship** (Figure 5.11.93)

The length/weight relationship was similar for both sexes. A fish of 15 cm PAFL weighs about 700 g and a 20 cm PAFL fish weighs about 1630 g.

- **Maturity** (Figure 5.11.94)

Immature fish were most abundant in all quarters (60-80%). Spawning specimens of both sexes were also present in all quarters, from 0.1-0.8 %. Maturing and newly spent specimens were also observed in all quarters, in similar proportions. This indicates a year-round spawning. The males become mature (50%) at a smaller size than females, i.e. at 13.34 cm, and 14.21 cm PAFL respectively.

***Macrourus berglax* (Roughhead grenadier)** (Figs.5.11.95-5.11.100)

- **Distribution** (Figure 5.11.95)

Roughhead grenadier (*Macrourus berglax*) has been observed all around Iceland, off East Greenland and on the Reykjanes Ridge as far south as to almost 56°N. Thus, this species has a wider distribution than the roundnose grenadier (*Coryphaenoides rupestris*). The roughhead grenadier is, however, not as abundant as the roundnose grenadier. It is most abundant in the slope area off West Iceland and East Greenland between 64°N and 66°N and 27°W and 32°W, i.e. in the Vikuráll and Dohrnbank areas. Foreign fleets have fished for roughhead grenadier in association with the Greenland halibut fishery in the 1960s and early 1970s.

- **Depth** (Figure 5.11.96 and 5.11.97)

Only length data recorded after 1990 have been used. The depth range of *Macrourus berglax* was between 201 and 1744 m. The length range was wide in all depth zones. Disregarding the length distribution, *M. berglax* was most numerous in depths <900 m, and again, in the 1100-1300 m depth zone. Small *M. berglax* were most numerous in 700-1300 m depths. Large fish were observed in all depth zones. Considering the sexes separately, the average PAFL for males decreased with increasing depth, from 25.78 cm in depths <700 m to 11.55 cm in the 1100-1300 m depth zone. Large fish were lacking in depths >700 m. For females, on the other hand, the PAFL increased with increasing depth, from 18.60 cm in the 700-900 m depth zone to 28.74 cm in depths >1300 m. Small females were lacking in all depth zones.

- **Size** (Figure 5.11.98)

The sex ratio was 1.54 for males to females. The overall size ranged from 3 to 47 cm PAFL. Males were smaller than females, the mean PAFL being 13.46 cm and 23.94 cm, respectively.

- **Length/weight relationship** (Figure 5.11.99)

The length/weight relationship was different for larger fish. At 25 cm PAFL, males weighed about 1200 g while females of the same length weighed 1400 g.

- **Maturity** (Figure 5.11.100)
  All maturity stages were observed in all seasons for both sexes, indicating a year-round spawning.

***Nezumia aequalis* (Common Atlantic grenadier)** (Figs.5.11.101-5.11.106)

- Distribution (Figure 5.11.101)
  The distribution of *Nezumia aequalis* is mainly on the Reykjanes Ridge and along the western slope of the shelf. There was only one record of this species off the south coast and none off the south-east coast.

- **Depth** (Figure 5.11.102 and 5.11.103)
  *Nezumia aequalis* was caught in depths of 882 to 1731 m. The widest length range and the greatest abundance was observed in depths >1500 m. It was also abundant in depths <1200 m but with a smaller length range. The smallest fish dominated in depths <1300 m. Remarkably few specimens were observed in 1300-1400 m depth zone. The mean length increased with increasing depth for both sexes.

- **Size** (Figure 5.11.104)
  The sex ratio of males to females was 1.13. The overall length (PAFL) ranged from 1.5 to 12 cm. Males were slightly smaller than females, the mean length for males and females being 7.33 cm and 8.34 cm PAFL respectively.

- **Length/weight relationship** (Figure 5.11.105)
  The length/weight relationship was similar for both sexes. A specimen of 5 cm PAFL weighs about 15 g.

- **Maturity** (Figure 5.11.106)
  Information on maturity was only available for the 3rd quarter. Most of the fish were in maturity stage I (immature) and a few in stage II (maturing). None were observed spawning or newly spent.

***Trachyrhynchus murrayi* ( Roughnose grenadier)** (Figs.5.11.107-5.11.112)

- **Distribution** (Figure 5.11.107)
  The roughnose grenadier is a very common deep-water species in Icelandic waters having a very similar distribution to the roundnose grenadier (*Coryphaenoides rupestris*). It is, however, not as abundant as the roundnose grenadier and large catches have not been recorded.

- **Depth** (Figure 5.11.108 and 5.11.109)
  The overall depth range of *Trachyrhynchus murrayi* was from 710 to 1647 m. The smallest fish were most frequent in depths <1000 m but generally, the species was most abundant in depths of 900-1100 m. The mean length increased with increasing depth. This was the case for males but not necessarily for females.

- **Size** (Figure 5.11.110)
  The ratio of males to females was 0.78. The overall PAFL ranged from 3 to 25 cm. Females were larger (mean length 14.73 cm PAFL) than males (12.80cm PAFL). The major-

ity of the females were 10-18 cm PAFL while the corresponding lengths for males were 8-16 cm PAFL.

- **Length/weight relationship** (Figure 5.11.111)

There was a considerable range in weight at a given length shown by this species. The length/weight relationship was almost the same for both sexes. The weight of a 15 cm PAFL fish was about 200 g.

- **Maturity** (Figure 5.11.112)

From the distribution of the maturity stages in the different seasons it is difficult to say anything definite about a spawning season. Active females were observed in the 2nd quarter and active males, in October. Newly spent males were observed in June, and both sexes, in the 3rd quarter. In the 1st quarter only immature and maturing fish were recorded.

***Molva dypterygia dypterygia* (Blue ling)** (Figs.5.11.113-5.11.117)

- **Distribution** (Figure 5.11.113)

The distribution of *Molva dypterygia,* based on research vessel catches extends over a wider area than that of the fishery. However, the greatest densities are recorded in the same areas, i.e. off the south- and south-west coasts and at a location on the Reykjanes Ridge. *Molva dypterygia* is scarce off the north- and east coasts of Iceland.

The fishery is basically a bycatch fishery, especially associated with the fishery on deep-sea redfish (*Sebastes mentella*). In shallower waters, mostly small *M. dyterygia* were recorded. Information at depths <400 m is more plentiful because more research cruises have been carried out in shallower water. Also, the relatively frequent appearance of *M. dypterygia* in the shelf area is based on much more intensive research than in the deep part of the slope.

- **Depth** (Figure 5.11.115)

A substantial part of the research catches of *M. dyterygia* were taken in depths <400 m. In these relatively shallow waters, a high proportion of the fish were immature, i.e. males less than 70 cm and females less than 80 cm. However, large fish up to 130 cm were also frequently caught in this depth zone. The presence of small fish in the depth zone 400-600 m and deeper continually decreased and in depths >1000 m, they were totally absent. *M. dypterygia* was scarce in depths >1200 m.

- **Size** (Figure 5.11.114)

The ratio of males to females was 0.94. The overall size ranged from 9 to 152 cm. The mean length for males and females was 80.16 cm and 91.45 cm respectively. Most males were in the size range 70-100 cm and for females the range was 70-120 cm.

- **Length/weight relationship** (Figure 5.11.116)

The length/weight relationship was very similar for both sexes. A fish of 100 cm in size weighed about 4 kg.

- **Maturity** (Figure 5.11.117)

The main spawning takes place in the 1st quarter and is most intense in February and March. In April, the main spawning seems to be over, the newly spent dominate and maturing fish (stage II) are few. Males become mature at 73.86 cm and females, at 88.95 cm.

***Onogadus argentatus* (Silver rockling)** (Figs.5.11.118-5.11.123)

- **Distribution** (Figure 5.11.118)

  *Onogadus argentatus* is very common off the north- and east coasts of Iceland but it has also been recorded elsewhere e.g on the Reykjanes Ridge southwards to 61°N, and on the East Greenland shelf. O-group *O. argentatus* has frequently been observed in the Irminger Sea, during the annual O-group surveys in August/September.

- **Depth** (Figure 5.11.119 and 5.11.120)

  *Onogadus argentatus* is a species which occurs both in shallow and deep water. It was caught in a depth range of 55 to 1427 m. The length distribution is very wide in all depth zones. Large specimens were rarely observed in depths <300 m but in deeper waters, they were quite abundant. The mean length increased with increasing depth down to 700 m. For both sexes, it increased again in depths >900 m.

- **Size** (Figure 5.11.121)

  The ratio of males to females was 0.82. The overall size range for males and females was from 13 to 43 cm. Females were larger than males, the mean length of females and males being 27.79 cm and 24.49 cm respectively. Specimens smaller than 13 cm were quite common, particularly in depths <500 m. However, they were also observed in greater depths.

- **Length/weight relationship** (Figure 5.11.122)

  The length/weight relationship was similar for both sexes. Females of 30 cm in size weighed 225 g while males of the same size weighed 219 g.

- **Maturity** (Figure 5.11.123)

  Information on maturity was mainly available for the 4$^{th}$ quarter. The majority of males and females were immature (stage I). Females were also observed in stage II (maturing) and IV (newly spent), males were observed in stage II. A spawning female was recorded in May and four immature females in August. *Onogadus argentatus* seems to reach 50 % maturity at a length of 26-30 cm for males, and 34-35 cm for females.

***Antimora rostrata* (Blue antimora)**

The information on this species has been published (Magnússon, 1998, mimeo; Magnússon 2000, Fisheries Research in press)).

***Lepidion eques* (North Atlantic codling)**

The information on this species has been published (Magnússon, 1998 mimeo; Magnússon, 2000, Fisheries Research (in press) ).

***Mora moro* (Morid cod)** (Figs.5.11.124-5.11.128)

- **Distribution** (Figure 5.11.124)

  This species has mainly been observed on the slope area east of the Reyjanes Ridge and on the Ridge itself. Occasionally, it has also been observed off the west coast and some-what more frequently, off the south-east coast and on the western slope of the Iceland-Faroes Ridge.

- **Depth** (Figure 5.11.125)
  The depth of *Mora moro* ranged from 547 to 1299 m. Very few specimens were observed in depths <700 m. It was most abundant in the 800 to 900 m zone consisting mainly of medium sized fish. Only small fish and few medium sized ones were present in the 700 to 800 m depth zone. The largest specimens were recorded in depths >900 m. The mean length increased from 19.69 cm in the 700-800 m depth zone to 37.19 cm in depths >900 m.

- **Size** (Figure 5.11.126)
  The ratio males/females was 0.72. The overall size of males and females of *Mora moro* ranged from 17 to 58 cm. Females were larger than males, the mean length being 33.64 cm and 27.54 cm, respectively. The length distribution was similar for both sexes.

- **Length/weight relationship** (Figure 5.11.127)
  The length/weight relationship was very similar for both sexes. *Mora moro* of 45 cm in length weigh about 600 g.

- **Maturity** (Figure 5.11.128)
  Although information on maturity was available for all quarters, the amount of data were small. No spawning specimens were observed, although quite a number of newly spent females (stage IV) were present in the 1$^{st}$ and 4$^{th}$ quarters. Immature fish of both sexes were dominant in the 2$^{nd}$ and 4$^{th}$ quarters. Maturity is reached at a length of 34-35 cm for females, probably somewhat smaller for males.

## Berycomorphi

### *Hoplostethus atlanticus* **(Orange roughy)** (Figs.5.11.129-5.11.134)

- **Distribution** (Figure 5.11.129)
  Although orange roughy is not commonly caught during research cruises, it is quite numerous at certain localities. It has been observed at several locations in small quantities, in particular on the Reykjanes Ridge which might indicate aggregations of that species at some localities in this area. In the two very restricted areas (south-west and south of Iceland) where *Hoplostethus* had been caught in noticeable quantities, the bottom conditions are extremely rough and thus, difficult for trawling. The preferred habitat appears to be the tops and the slopes of narrow underwater peaks. In the Reykjanes Ridge area, there are numbers of such peaks, most of them very difficult if not impossible for bottom trawling.

- **Depth** (Figure 5.11.130 and 5.11.131)
  The depth of *H. atlanticus* ranged from 512 to 1519 m. The depth of maximum abundance is difficult to determine because most of the material to hand is from a few large samples and a somewhat greater number of small samples. For example most in the depth category >900 m originate from two or three samples in depths of 900 to 950 m (average depth 927 m). It is assumed that the location of the large samples might also have had a bearing on the depth distribution but according to our material, *H. atlanticus* is common from 500 to 1000 m depth, the main concentrations depending on the location. No length/depth relationship was established but the mean length varied somewhat from one depth to another. Males which are smaller than the females have the lowest mean length in the >900 m depth category while the second lowest mean length was observed for females in this depth category.

- **Size** (Figure 5.11.132)

  The sex ratio of males to females was 1.07. Males were smaller than females. The overall range was from 30 cm to 71 cm. Most males were between 50 and 60 cm and females between 55 and 65 cm. The mean length was 56.74 cm for males and 59.21 cm, for females.

- **Length/weight relationship** (Figure 5.11.133)

  The length/weight relationship was similar for both sexes. A 60 cm fish weighs about 3.7 kg.

- **Maturity** (Figure 5.11.134)

  In 1st quarter the majority of both sexes were in maturity stage II (maturing) but this stage was most common in all quarters for both males and females. Some spawning (stage III) of both sexes and newly spent females (stage IV) were also observed during this period. In the 2nd quarter (mainly June) large numbers of both sexes were newly spent. Very few females were in stage IV in the 3rd quarter but the number increased again in 4th quarter. This was also seen for males. Since spawning specimens were only observed during the first quarter of the year, there is an indication that the main spawning takes place in winter time.

# Trichiuroidei

*Aphanopus carbo* **(Black scabbard fish)** (Figs.5.11.135-5.11.140)

- **Distribution** (Figure 5.11.135)

  The black scabbard fish is quite common off the west and south coasts of Iceland and on the Reykjanes Ridge. It is not very abundant in the bottom trawl catches and large catches are apparently unknown.

- **Depth** (Figure 5.11.136 and 5.11.137)

  Black scabbard fish was observed in depths between 512 and 1281 m but was most abundant between 800 and 1000 m. The length distribution was wide in all depth zones but there was no definite trend between size and depth in either sex.

- **Size** (Figure 5.11.138)

  The ratio males to females was 0.71. The overall length ranged from 56 to 125 cm. Females were larger than males, the mean lengths being 100.30 cm and 93.27 cm, respectively. The majority of females were 90 to 110 cm in length while males were 85 to 105 cm.

- **Length/weight relationship** (Figure 5.11.139)

  There was no noteworthy difference in the length/weight relationship between males and females, the mean weight being 1280 g. A fish of 100 cm in length weighs about 1300 g.

- **Maturity** (Figure 5.11.140)

  A considerable proportion of the black scabbard fish catches were of immature fish (stage I) except during the 1st quarter. Newly spent fish (stage IV) were, on the other hand, most numerous in the 1st quarter but only a few were observed in this stage in the 4th quarter. The few spawning specimens (stage III) were observed from January to September. They were most numerous in July and were lacking in October. Judging from the proportion of stage IV (newly spent) and the occurrence of stage III (spawning), the spawning period seems to be rather prolonged from winter into summer time. The 50% maturity was reached by males at 84 to 88 cm and by females at 92 to 97 cm.

## Blennioidei

***Anarhichas denticulatus* (Jelly cat)** (Figs.5.11.141-5.11.146)

- **Distribution** (Figure 5.11.141)

  *Anarhichas denticulatus* is very common all around Iceland, both in shallow and deep waters. Its distribution is very scattered and usually only single or few specimens were obtained per haul. Besides being caught by bottom trawl, it was not uncommon in pelagic deep-water catches, in the Irminger Sea.

- **Depth** (Figure 5.11.142 and 5.11.143)

  The depth range for *A. denticulatus* was from 65 to 1530 m but it was most abundant in depths <400 m. The length range was wide in all depth zones. The mean length decreased with increasing depth, for males down to over 1000 m but for females, down to 800 m. In depths greater than 800 m, the mean length for females increased again. The lack of medium sized males in depths >400 m is notable.

- **Size** (Figure 5.11.144)

  The ratio of males to females was 0.73. The size range for males and females was 7 to 172 cm. Females were larger than males but the distribution pattern was similar.

- **Length/weight relationship** (Figure 5.11.145)

  The length/weight relationship seems to be very similar for both sexes. Females were slightly heavier than males.

- **Maturity** (Figure 5.11.146)

  No spawning specimens were observed. Between April and December, stages I, II and IV were present for both sexes except that the males of stage II were lacking from April to September. Maturity was reached at a length of 60 to 61 cm.

***Lycodes esmarki* (Esmarks' eelpout)** (Figs.5.11.147-5.11.152)

- **Distribution** (Figure 5.11.147)

  *Lycodes esmarki* is very common in the cold deep water off the north-west, north- and east coasts of Iceland. It has not been recorded off the south coast but its distribution extends southwards along the slope west of Iceland as far south as to the Reykjanes Ridge and to the western slope of the Iceland-Faroe Ridge in the south-east.

- **Depth** (Figure 5.11.148 and 5.11.149)

  The depth range for this species was between 156 and 1196 m. Larger fish were most abundant in depths <500 m and the smallest fish were absent in depths >500 m. Males decreased in size with increasing depth with a mean length of 43.21 cm in the 400 - 500 m depth zone and a mean length of 39.65 cm in depths >700 m. Females were similar with a mean length of 48.16 cm in depths <400 m and a mean length of 39.68 cm in depths >700 m.

- **Size** (Figure 5.11.150)

  The sex ratio males to females was 1.07. The overall length range was between 8 and 79 cm. The length range for both sexes was from 21 to 66 cm. Females were larger than males (mean lengths 43.22 cm and 41.62 cm, respectively) but the length distribution pattern was very similar. Many measurements relate to fish that were not sexed, including some specimens smaller than 21 cm.

- **Length/weight relationship** (Figure 5.11.151)

There was almost no difference in the length/weight relationship between the sexes. Fish of 50 cm in size were about 550 g in weight.

- **Maturity** (Figure 5.11.152)

Most of the information on maturity was from the 4th quarter. Males and females were present in all four stages of maturity, most of them in stages I (immature) and II (maturing) but a considerable number were also in stage IV (newly spent). Some specimens of both sexes were spawning (stage III). It appears that spawning begins in this quarter. Between April to September very few maturity stages were determined. The 50% maturity was reached at 37.36 cm for males and at 36.22 cm for females.

***Lycodes reticulatus* (Arctic eelpout)** (Figs.5.11.153-5.11.158)

- **Distribution** (Figure 5.11.153)

*Lycodes reticulatus,* a typical coldwater species, is very common off the north- and east coasts. No records exist from the south- and west coasts. It is particularly abundant off the western part of the north coast.

- **Depth** (Figure 5.11.154 and 5.11.155)

The depth distribution of *Lycodes reticulatus* ranged from 128 to 1165 m. The greatest number were observed at depths between 300 and 400 m. The length range was wide in all depth zones. Fish smaller than 13 cm were abundant especially in the 300-400 m depth zone. The mean length per depth category decreased down to 500 m but increased in depths >500 m. There was a distinct increase in mean length with increasing depth for both males and females.

- **Size** (Figure 5.11.156)

The sex ratio males to females was 1.12. The overall size range for males and females was from 7 cm to 74 cm. The mean length was very similar for both sexes as well as the distribution pattern.

- **Length/weight relationship** (Figure 5.11.157)

There was some difference in the length/weight relationship of the sexes. Males at a given length were heavier than females.

- **Maturity** (Figure 5.11.158)

Information on maturity was only available from the month of October. Both sexes were present in all four stages of maturity. It is obvious that spawning is taking place in this month. The 50% maturity was reached at a length of about 20 cm.

# Scleroparei

***Careproctus reinhardti*** **(Sea tadpole)** (Figs. 5.11.159-5.11.164)

- **Distribution** (Figure 5.11.159)

  *Careproctus reinhardti* is a very common species in the cold deep water off the north- and east coasts. It is also found quite frequently in shallower waters in the same area but here it is not as numerous as in deep waters. It has not been observed in the warmer waters off the south and west coasts.

- **Depth** (Figure 5.11.160 and 5.11.161)

  The species was observed in a depth range of 125 to 1162 m. The length range in each depth category was wide. Although small fish was observed in all depth zones, they were most abundant in depths <600 m. This was also reflected in the mean length per depth zone. Large fish were most numerous in depths >600 m.

- **Size** (Figure 5.11.162)

  The sex ratio of males to females was 0.68. The overall size range for males and females was 6 to 28 cm. Males were smaller than females, the mean lengths being 17.66 cm and 19.33 cm respectively. Fish smaller than 11 cm were quite abundant, mainly at <600 m depth.

- **Length/weight relationship** (Figure 5.11.163)

  There are some differences in the length/weight relationship of males and females. Females are heavier than males, especially at the larger sizes.

- **Maturity** (Figure 5.11.164)

  Observations on maturity are only available for October. Both sexes were most numerous in stage II (maturing). Some spawning males were observed and some females in stage IV (newly spent).

# Discussion

In general, the deep-water species in Icelandic waters have a large depth range which may vary from one area to another for the different species. Water temperature and other environmental conditions might have a determining influence on the depth distribution. However, there is a great difference between species in this respect. Among those showing an extremely wide depth range are, for example, the two skates *Raja hyperborea* and *Raja fyllae*, which were observed in depths of between 185 and 1543 m and 198 and 1744 m respectively.

In this report the abundance in relation to depth has been described irrespective of the number of hauls or samples in each depth zone. In general, most of the selected deep-water species had a wide length range in most depth zones. There appear to be several depth distribution patterns.

- For some species, the smallest fish were most numerous in the shallowest depth zones usually mixed with some larger fish, e.g. *Onogadus argentatus.*
- For other species, the proportion of small fish increases with increasing depth, e.g. *Notacanthus chemnitzii.*
- Sometimes, the largest fish were most numerous in the shallowest depth zones, e.g. *Lycodes esmarki.*

- In some cases, both small and large fish were observed in all depth zones and the medium sized fish were scarce, e.g. *Raja fyllae.*
- Still other species showed a mixture of all sizes in all depth zones, e.g. *Alepocephalus agassizii.*
- Finally, there are species which cannot be placed in any of these categories.

In this report, all length measurements for each species were pooled. It was noted, however, that the size of fish could vary according to area. For example, only large *Macrourus berglax* were observed in the Reykjanes Ridge area while smaller fish were quite common in the Anton-Dohrn Bank-Vikuráll area. Several species showed a continuous increase in the mean length with increasing depth although most sizes were present in all depth zones, e.g. *Trachyrhynchus murrayi.* Frequently, this trend could be observed down to a certain depth and, after an interuption, the increase in mean length continued. For other species, the mean length decreased with increasing depth, e.g. *Notacanthus chemnitzii.*

The abundance of fish could vary greatly by depth zone. The abundance of some species which were caught at the greatest depths was smaller between 1100 and 1400 m than in the shallower and deeper depth zones. This could be a sampling problem because relatively few hauls were made at these depths. These depths were also sampled in fewer areas during the 1990s when the most intensive research was carried out.

The Icelandic shelf, the Iceland-Greenland Ridge and the Iceland-Faroe Ridge form the northern boundary of many deep-water species which are common in more southerly regions. The presence of small fish and even spawning individuals in Icelandic waters indicate that most of the species, if not all, are basically non-migratory. However, migratory deep-water species are known, e.g. *Epigonus telescopus*. This species was observed in considerable numbers in some years but in most years it was absent, even although hauls were taken annually at similar locations and depth. This migratory species was, therefore, not discussed in this report.

Some cold-water species such as for example the *Lycodes* spp. are most abundant in depths <400 m. Since they are also quite numerous in deep water, they are presented in this report mainly because little is known about their biology in Icelandic waters.

For most of the 33 species discussed here, the knowledge of their habitat in Icelandic waters was fragmentary, even although extensive material on some species had been gathered for quite a period of time. With the support of the EC FAIR PROJECT CT 95-0655, it has been possible to expand the information on those species. Although the outcome has to be considered as a rough and sometimes very incomplete overview, it should be considered as another step forward in the knowledge of the deep water fish fauna in Icelandic waters and it is hoped that for many species, it will give rise to further and more detailed studies in the future.

# References


Gröndal,B. 1975. Dýraríki Íslands (The Fauna of Iceland in Pictures.Prepared in 1874-1905). *Örn og Örlygur h/f* 1975.

Jakobsdóttir, K.B. 1998. Maturity and other biological aspects of two deep water squaloid sharks, *Centroscyllium fabricii* (Reinhardt, 1825) and *Etmopterus princeps* (Collett, 1904) in Icelandic waters. *ICES CM 1998/0:35.* 24 pages. Mimeo.

Jakobsdóttir, K.B 2000. Biological aspects of two deep water squalid sharks, *Centroscyllium fabricii* (Reinhardt, 1825) and *Etmopterus princeps* (Collett, 1904) in Icelandic waters. *Fisheries Research,* (in press).

Jónsson, G. 1966-1974. Rare fishes recorded by the Marine Research Institute in Reykjavík during 1966,1967,1968, 1970,1971,1972,1973,1974. *Annales Biologiques,* **Vol. 23-31.**

Jónsson G. 1967-1975. Sjaldséðir fiskar. *ÆGIR,* ***60-68***

Jónsson, G. 1992. Íslenskir fiskar. *Fjölvaútgáfan.* Reykjavík

Jónsson, G., J. Magnússon, J.V. Magnússon. 1975-1984. Icelandic observations on rare fish in 1975,1976,1977,1978,1979,1980,1981,1982,1983,1984. *Annales Biologiques,* **Vol. 32-41.**

Jónsson,G., J. Magnússon, V. Vilhelmsdóttir, J. Pálsson.1994-1998. Sjaldséðir fiskar. *ÆGIR.* ***87-91.***

Jónsson,G., J. Magnússon, V. Vilhelmsdóttir. 1976-1993. Sjaldséðir fiskar. *ÆGIR.* ***69-86***

Magnússon, J., V. Vilhelmsdóttir and K.B. Jakobsdóttir. 1997. Könnun á djúpslóð. *ÆGIR 90 (11)*

Magnússon, J. 1998. Deep water fisheries at Iceland. *ICES CM 1998/0:66.* Poster and Mimeo.15 pages.

Magnússon, J., V. Vilhelmsdóttir and K.B. Jakobsdóttir. 1998. Djúpslóð á Reykjaneshrygg. Könnunarleiðangrar 1993 og 1997 (Deep water area of the Reykjanes Ridge. Research surveys in 1993 and 1997). *Hafrannsóknastofnun Fjölrit* nr. 65, 50 pp.

Magnússon, J.V. & Magnússon, J. 1995. The distribution, relative abundance, and biology of the deep-sea fishes of the Icelandic slope and Reykjanes Ridge. In: A.G. hopper (ed.), Deep-water fisheries of the North Atlantic Oceanic Slope. *NATO ASI* Series E, **296**, 161-199.

Magnússon, J.V. 1996. Greater silver smelt, *Argentina silus* in Icelandic waters. *Journal of Fish Biology,* **49,** (Supplement A), 259-275.

Magnússon, J.V. 1998. Age, maturity and other biological parameters of two morid species *Lepidion eques* (Günther, 1887) and *Antimora rostrata* Günther, 1878, in Icelandic waters. *ICES CM 1998/0:32.* 22 pages. Mimeo.

Magnússon, J.V. 2000. Age, maturity and other biological parameters of two morid species *Lepidion eques* (Günther, 1887) and *Antimora rostrata* Günther, 1878, in Icelandic waters. . *Fisheries Research,* Vol. 46 (in press).

Ólafsson,E. & B. Pálsson. 1975. Ferðabók um ferðir þeirra á Íslandi árin 1752-1757. (Sórey, Denmark 1772). Icel. translation Steindór Steindórsson 1942. *Örn og Örlygur h/f.* 1975

Stehmann, M. 1998. Revised maturity scale for sharks, rays and chimærids. In: *EC Fair Project CT 95-0655. Document no.40,pp.17-21*

Sivertsen, E. 1937. Torskens gytning. Undersoekelser 1934-35. *Fiskeridirektoratets Skrifter. Serie Havundersoekelser* V(3), 1-24.

Sæmundsson, B. 1926. Fiskarnir (*Pisces Islandiae*). Reykjavík. Bókaverslun Sigfúsar Eymundssonar.

**Table 5.11.1** Total number of Hauls in 100 m depth intervals 1975-1999.

| Depth intervals | No. of Hauls |
|---|---|
| 501-600 | 1539 |
| 601-700 | 1076 |
| 701-800 | 552 |
| 801-900 | 485 |
| 901-1000 | 490 |
| 1001-1100 | 318 |
| 1101-1200 | 75 |
| 1201-1300 | 41 |
| 1301-1400 | 26 |
| 1401-1500 | 13 |
| 1501-1600 | 12 |
| 1601-1700 | 5 |
| 1701-1800 | 3 |
| Total | 4635 |

**Table 5.11.2** Length-weight relationships for 32 deep water fish species.

| Number | Species | | | | Males | | | Females | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | a | b | $r^2$ | a | b | $r^2$ | a | b | $r^2$ |
| 3.1.1 | Apristurus laurussonii | | | | 0.020 | 2.644 | 0.921 | 0.010 | 2.777 | 0.895 |
| 3.1.2 | Galeus murinus | | | | 0.004 | 3.010 | 0.963 | 0.002 | 3.223 | 0.961 |
| 3.1.3 | Centroscyllium fabricii | | | | 0.004 | 3.050 | 0.955 | 0.001 | 3.399 | 0.976 |
| 3.1.4 | Centroscymnus coeloepis | | | | - | - | - | 0.0003 | 3.695 | 0.848 |
| 3.1.5 | Centroscymnus crepidater | | | | 0.003 | 3.107 | 0.927 | 0.004 | 3.072 | 0.983 |
| 3.1.6 | Deania calceus | | | | 0.100 | 2.921 | 0.797 | 0.002 | 3.142 | 0.909 |
| 3.1.7 | Etmopterus princeps | | | | 0.003 | 3.196 | 0.987 | 0.004 | 3.058 | 0.979 |
| 3.1.8 | Etmopterus spinax | | | | 0.005 | 2.948 | 0.923 | 0.003 | 3.113 | 0.983 |
| 3.2.1 | Raja hyperborea | 0.006 | 3.154 | 0.982 | | | | | | |
| 3.2.2 | Raja fyllae | 0.003 | 3.154 | 0.996 | | | | | | |
| 3.3.2 | Rhinochimaera atlantica | 0.008 | 2.921 | 0.637 | | | | | | |
| 3.4.1 | Alepocephalus agassizii | 0.009 | 3.042 | 0.945 | 0.008 | 3.078 | 0.950 | 0.010 | 3.023 | 0.958 |
| 3.4.2 | Alepocephalus bairdii | 0.005 | 3.153 | 0.968 | 0.005 | 3.136 | 0.947 | 0.005 | 3.103 | 0.953 |
| 3.5.1 | Argentina silus | | | | 0.002 | 3.351 | 0.969 | 0.002 | 3.309 | 0.971 |
| 3.5.2 | Bathylaus euryops | 0.005 | 3.232 | 0.937 | 0.010 | 3.000 | 0.921 | 0.068 | 2.329 | 0.885 |
| 3.6.1 | Synaphobranchus kaupi | | | | 0.001 | 2.966 | 0.864 | 0.0003 | 3.304 | 0.909 |
| 3.7.1 | Notacanthus chemnitzii | | | | 0.001 | 3.183 | 0.941 | 0.0002 | 3.555 | 0.957 |
| 3.8.1 | Coryphaenoides rupestris | 0.222 | 2.971 | 0.941 | 0.226 | 2.965 | 0.932 | 0.202 | 3.008 | 0.957 |
| 3.8.2 | Macrourus berglax | | | | 0.828 | 2.252 | 0.882 | 0.214 | 2.732 | 0.889 |
| 3.8.3 | Nezumia aequalis | 0.113 | 2.997 | 0.874 | | | | | | |
| 3.8.4 | Trachyrhynchus murrayi | 0.091 | 2.840 | 0.915 | 0.078 | 2.903 | 0.935 | 0.084 | 2.864 | 0.920 |
| 3.8.5 | Molva dypterygia | | | | 0.001 | 3.355 | 0.982 | 0.001 | 3.379 | 0.986 |
| 3.8.6 | Onogadus argentatus | | | | 0.002 | 3.516 | 0.974 | 0.002 | 3.404 | 0.928 |
| 3.8.7 | Antimora rostrata | | | | 0.001 | 3.519 | 0.970 | 0.001 | 3.605 | 0.983 |
| 3.8.8 | Lepidion eques | | | | 0.001 | 3.498 | 0.975 | 0.001 | 3.585 | 0.969 |
| 3.8.9 | Mora moro | | | | 0.001 | 3.596 | 0.971 | 0.0004 | 3.729 | 0.982 |
| 3.9.1 | Hoplostethus atlanticus | 1.019 | 1.990 | 0.802 | 0.363 | 2.241 | 0.748 | 1.335 | 1.927 | 0.687 |
| 3.10.1 | Aphanopus carbo | 0.0001 | 3.625 | 0.901 | 0.0001 | 3.614 | 0.915 | 0.0001 | 3.645 | 0.858 |
| 3.11.1 | Anarhichas denticulatus | | | | 0.013 | 2.995 | 0.982 | 0.021 | 2.873 | 0.985 |
| 3.11.2 | Lycodes esmarki | | | | 0.001 | 3.325 | 0.974 | 0.001 | 3.406 | 0.968 |
| 3.11.3 | Lycodes reticulatus | | | | 0.019 | 2.603 | 0.916 | 0.023 | 2.514 | 0.918 |
| 3.12.1 | Careproctus reinhardti | | | | 0.018 | 2.929 | 0.850 | 0.023 | 2.887 | 0.921 |

**Figure 5.11.1** *A. laurussonii*. Distribution and relative abundance in numbers.

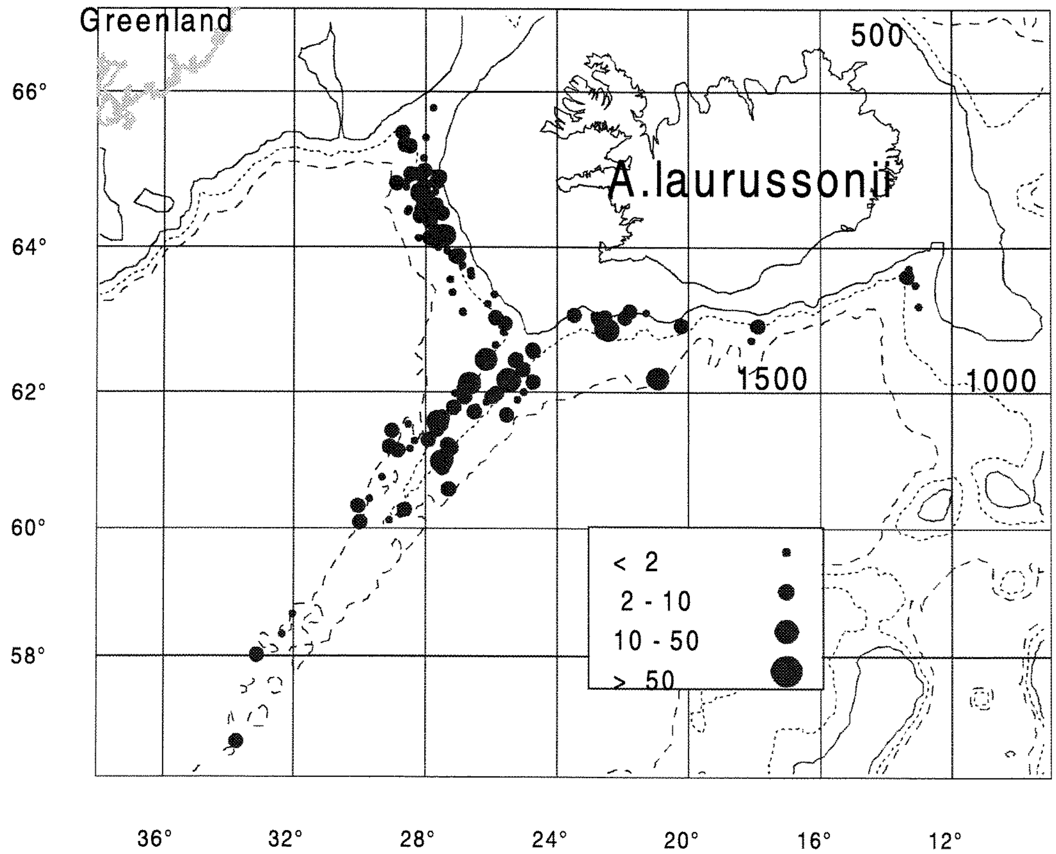



**Figure 5.11.2** *A.laurussonii.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

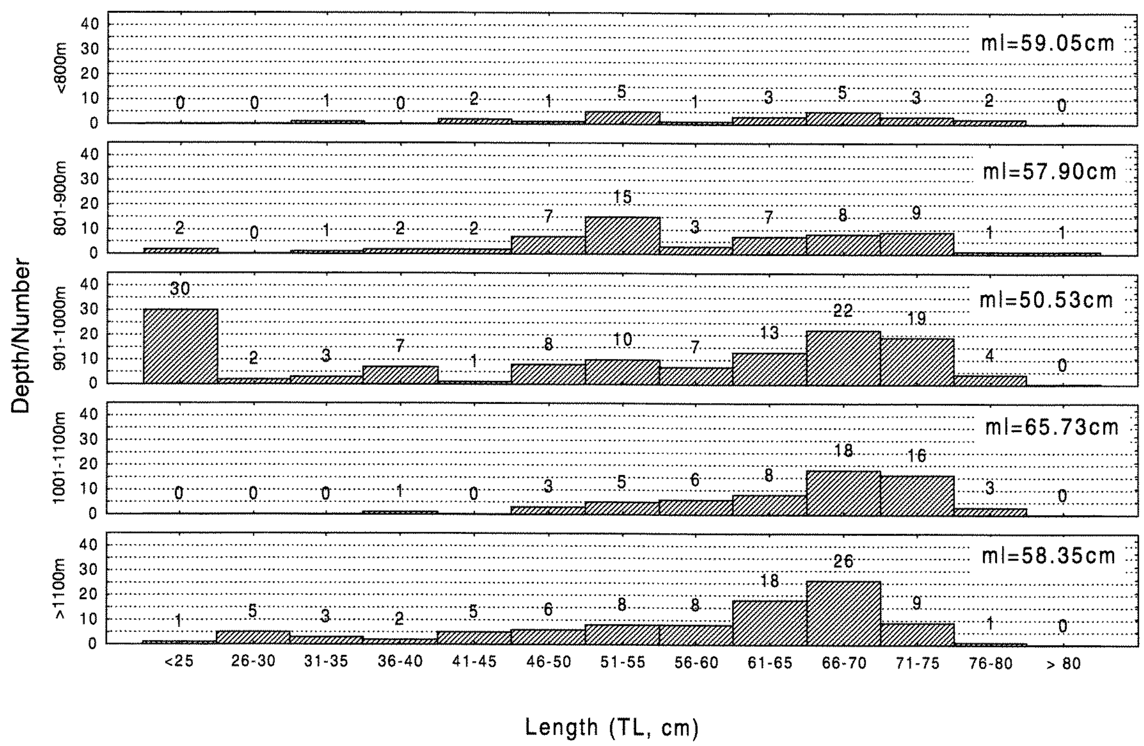


**Figure 5.11.3** *A. laurussonii.* Length and mean length (ml) by depth intervals and sex.

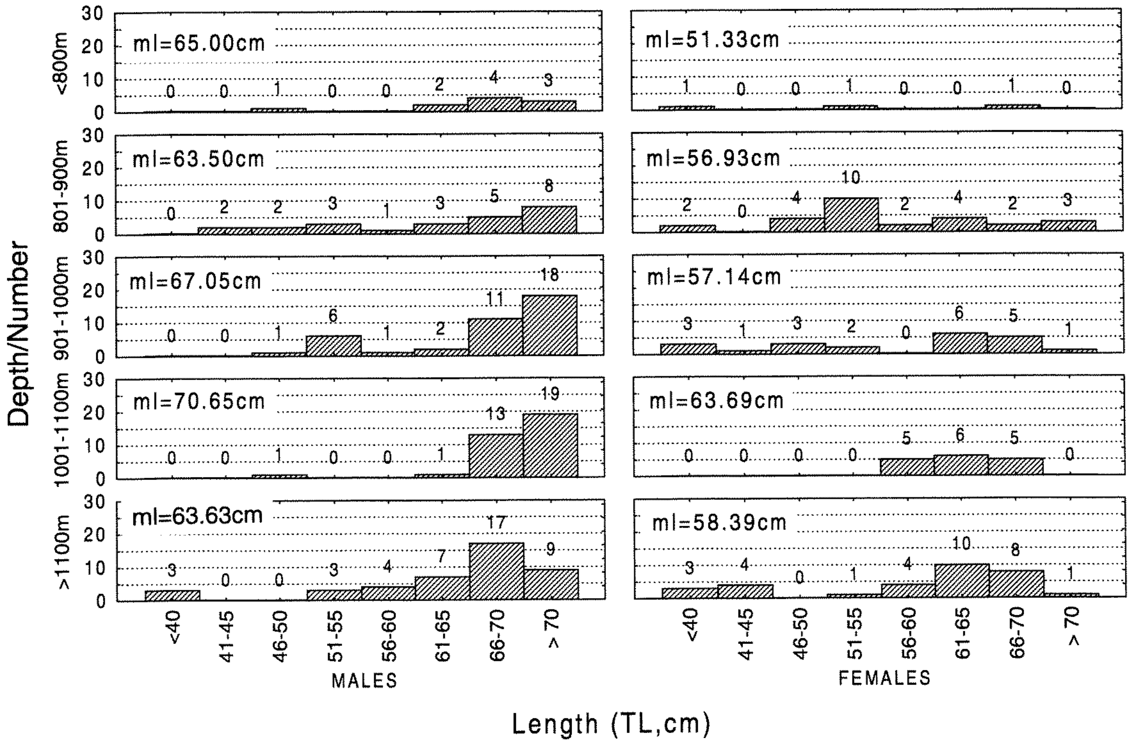



**Figure 5.11.4** *A. laurussonii.* Length distribution by sex.

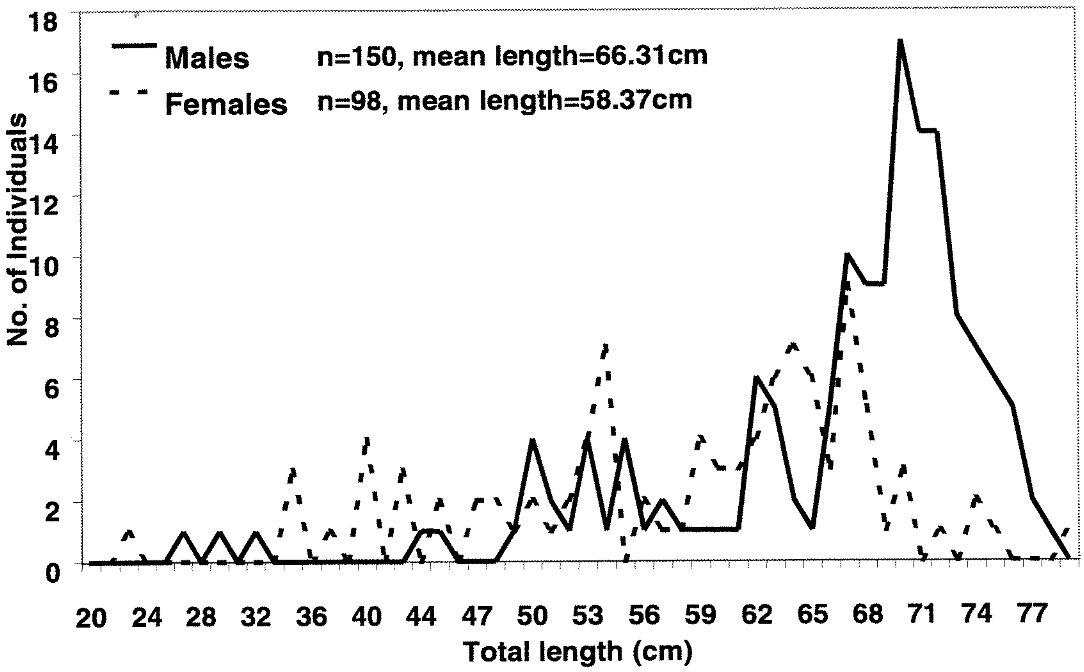


**Figure 5.11.7** ***G. murinus.*** Distribution and relative abundance in numbers.

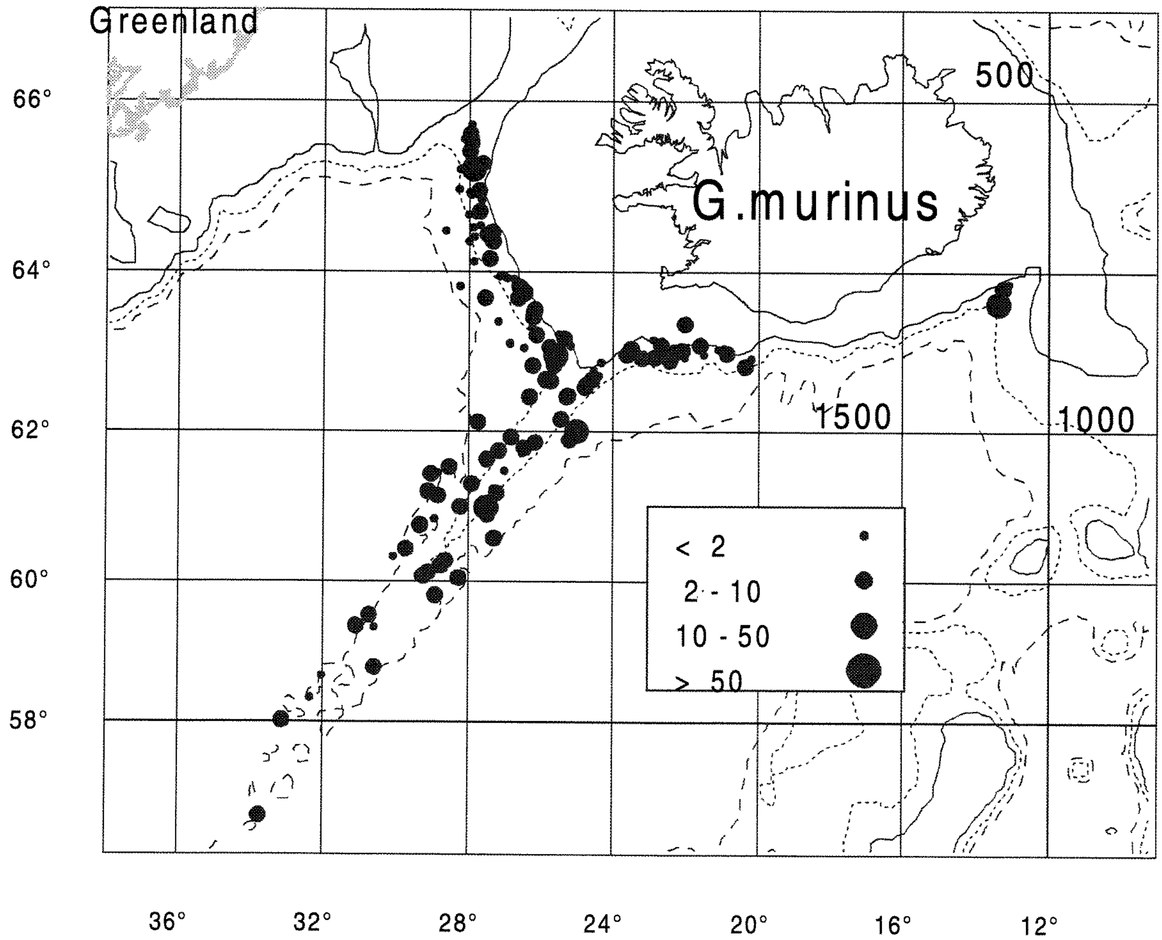



**Figure 5.11.8** ***G. murinus.*** Length-depth relationship and mean length by 200 m depth intervals

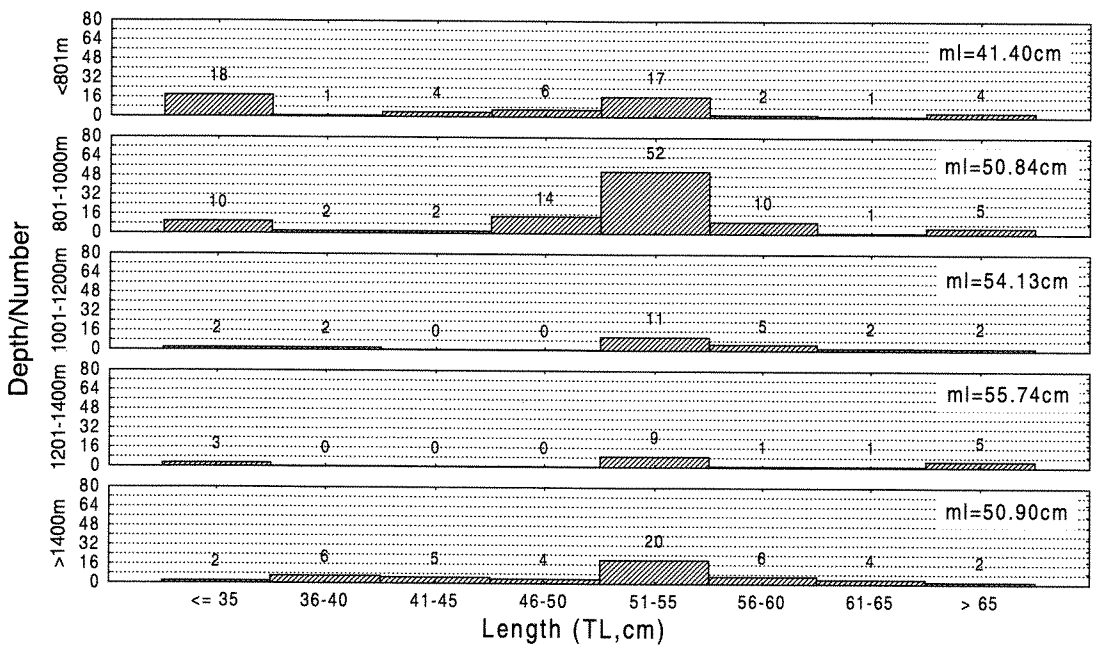


**Figure 5.11.9** *G.murinus.* Length and mean length (ml) by depth intervals and sex.

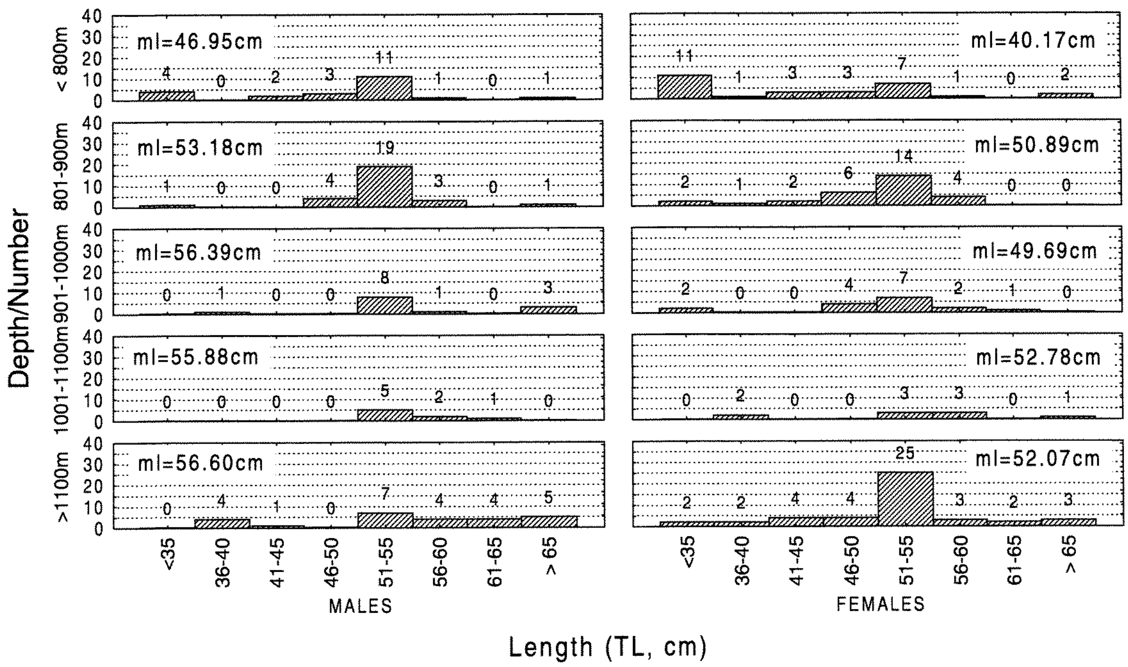



**Figure 5.11.10** *G.murinus.* Length distribution by sex.

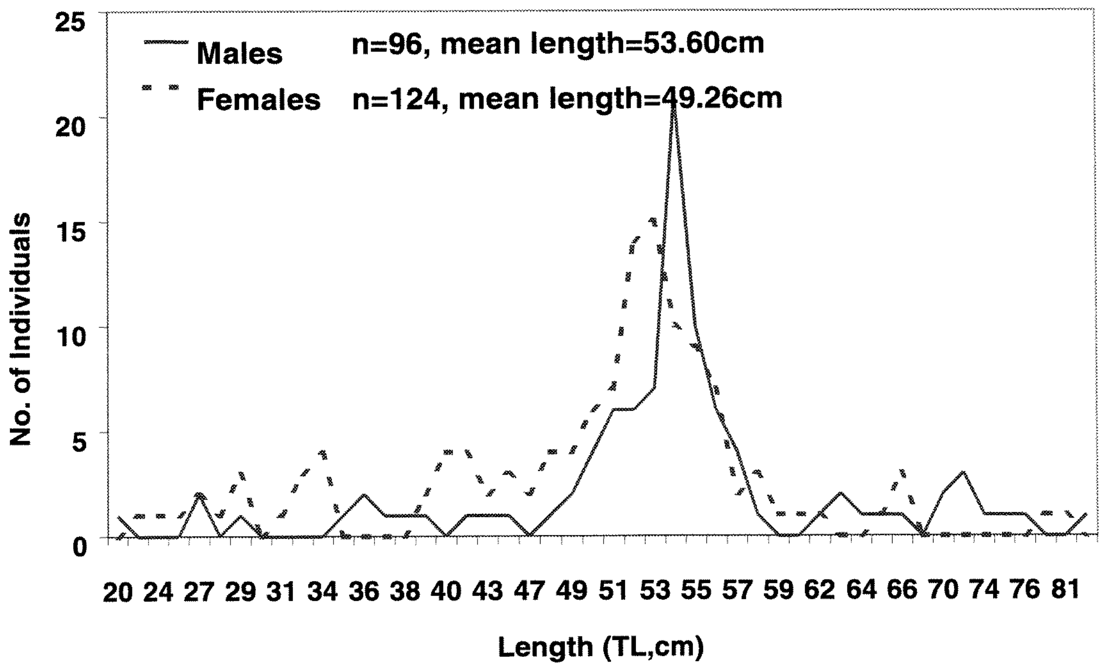


**Figure 5.11.11** *G.murinus*. Length/weight relationship by sex.

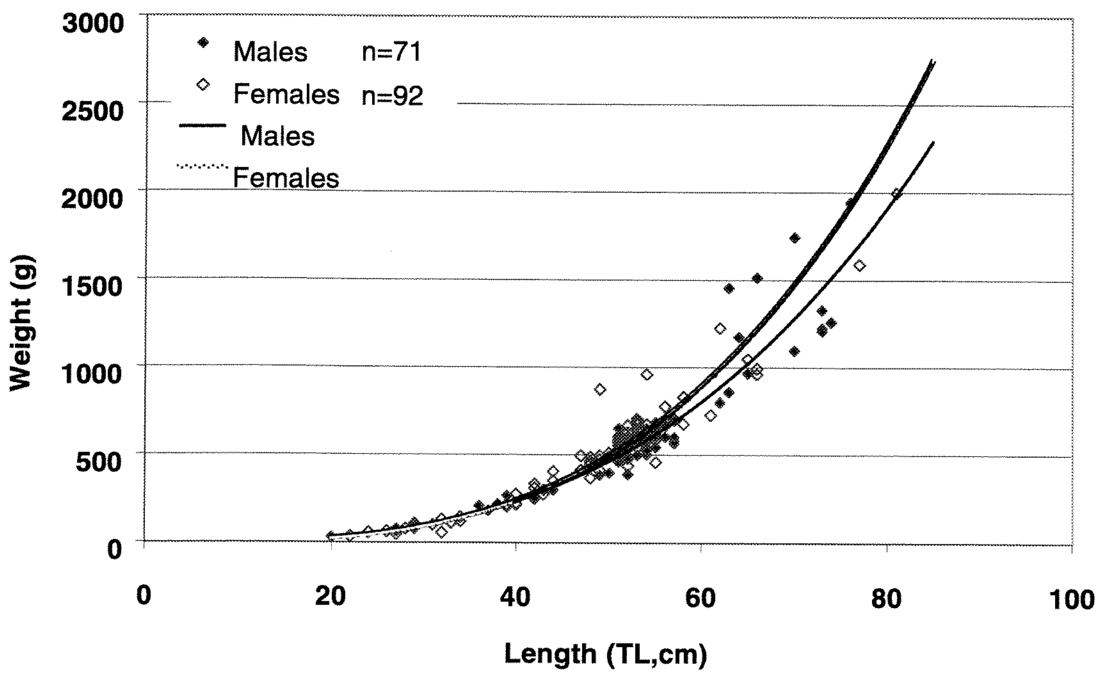
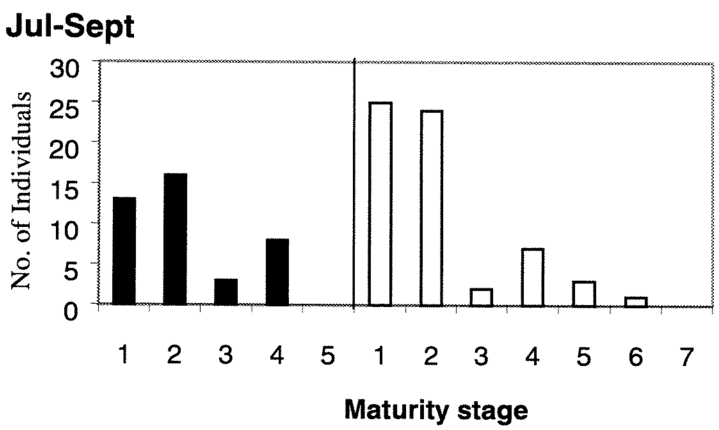



**Figure 5.11.12** ***G. murinus.*** Maturity stages by season (males: filled bars, females:



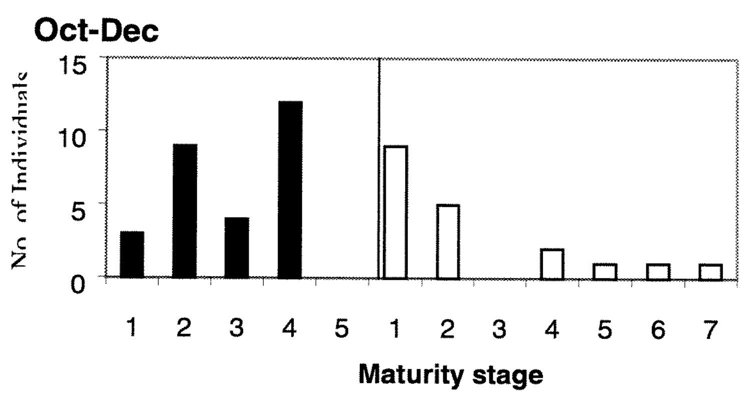



**Figure 5.11.13** *C. coelolepis*. Distribution and relative abundance in numbers.

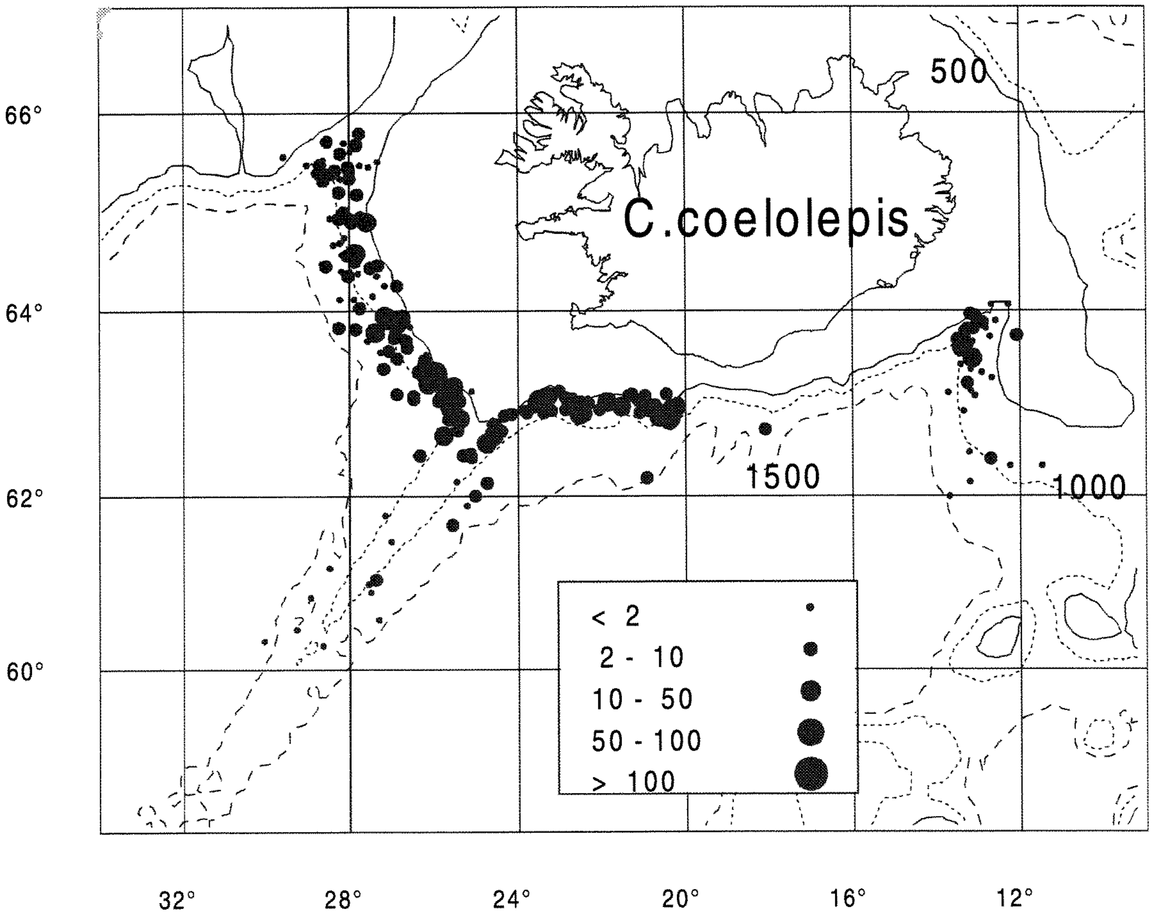



**Figure 5.11.14** *C. coelolepis*. Length-depth relationship and mean length by 100 m depth intervals.

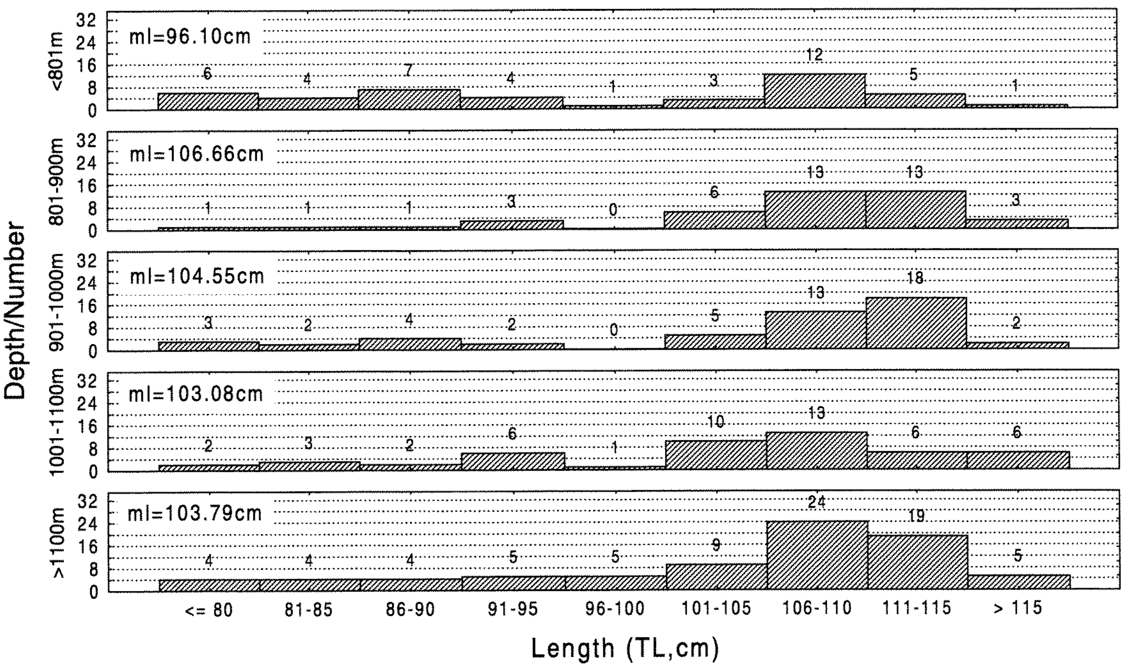


**Figure 5.11.15** *C. coelolepis.* Length and mean length (ml) by depth intervals and sex.

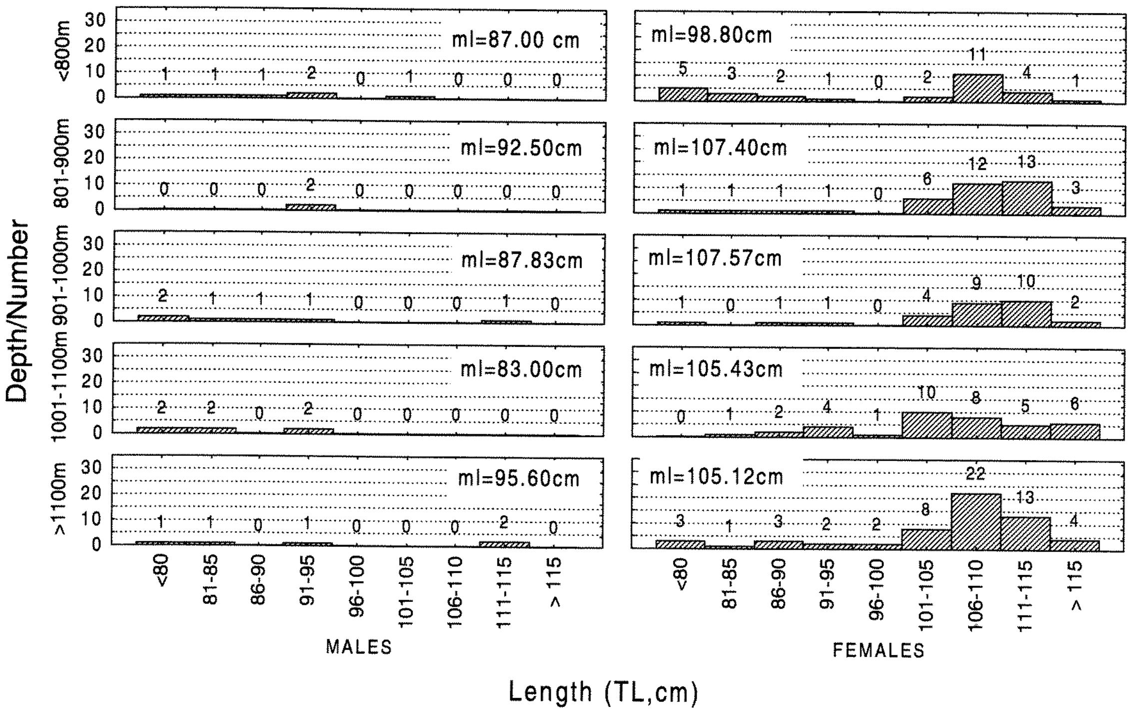



**Figure 5.11.16** *C. coelolepis.* Length distribution by sex.

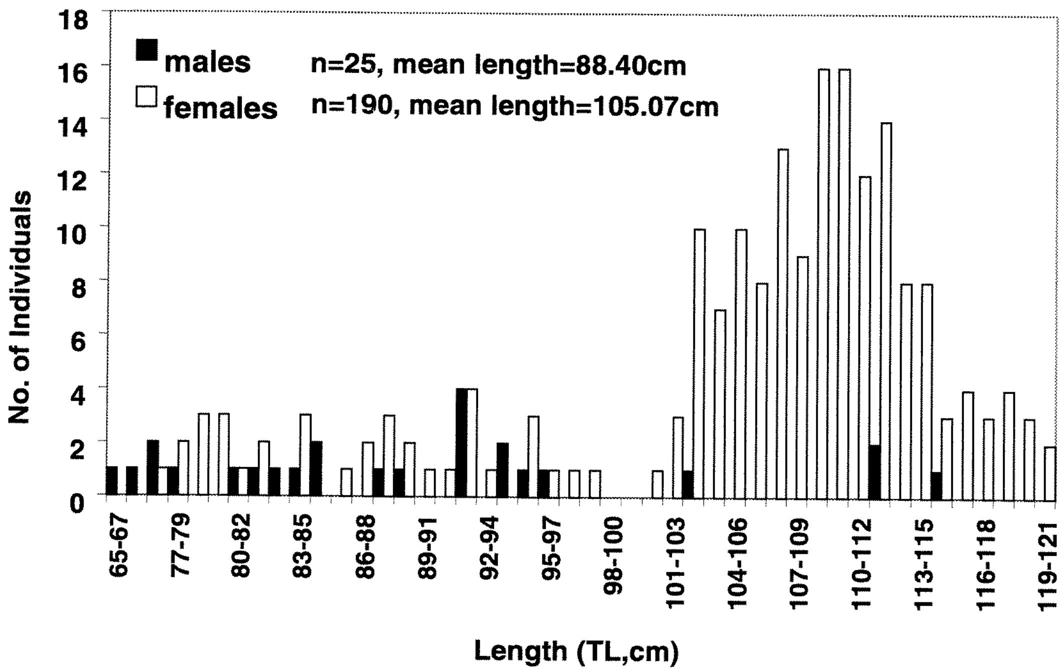


**Figure 5.11.17** *C. coelolepis.* Length-weight relationship by sex.

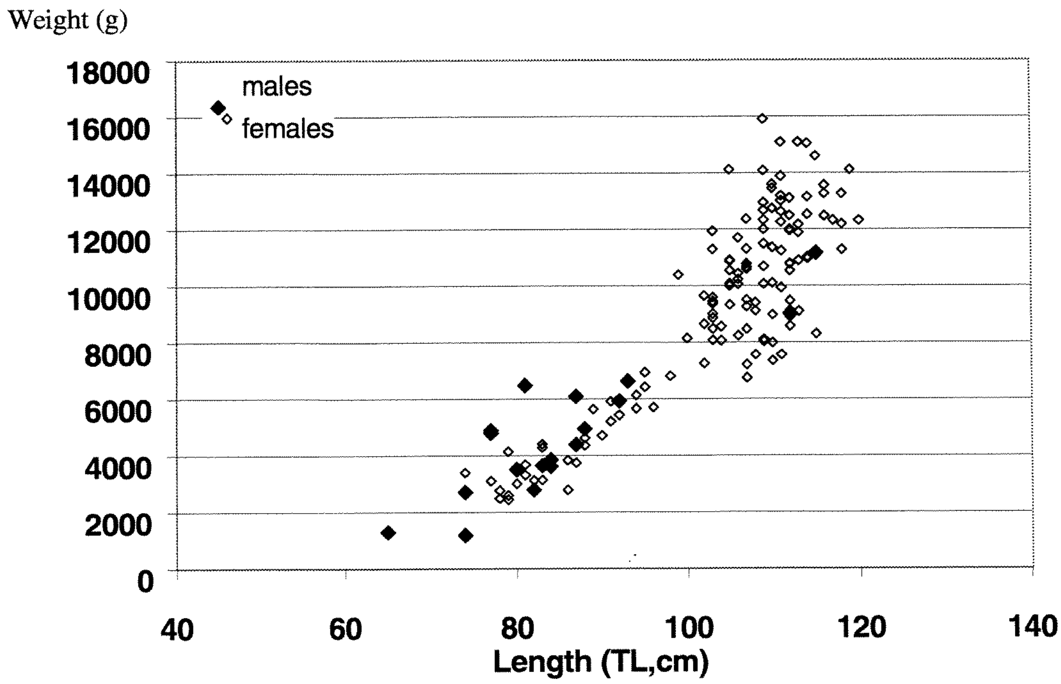



**Figure 5.11.18** *C. coelolepis.* Maturity stages by season (males filled bars, females open bars).

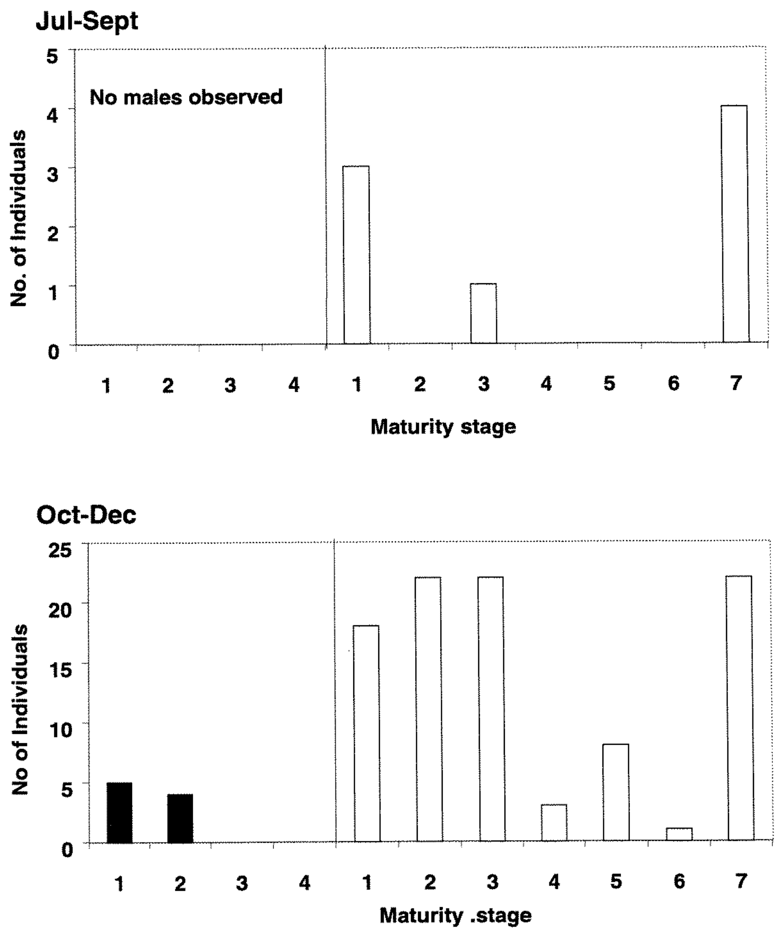


**Figure 5.11.19** *C. crepidater.* Distribution and relative abundance in numbers.

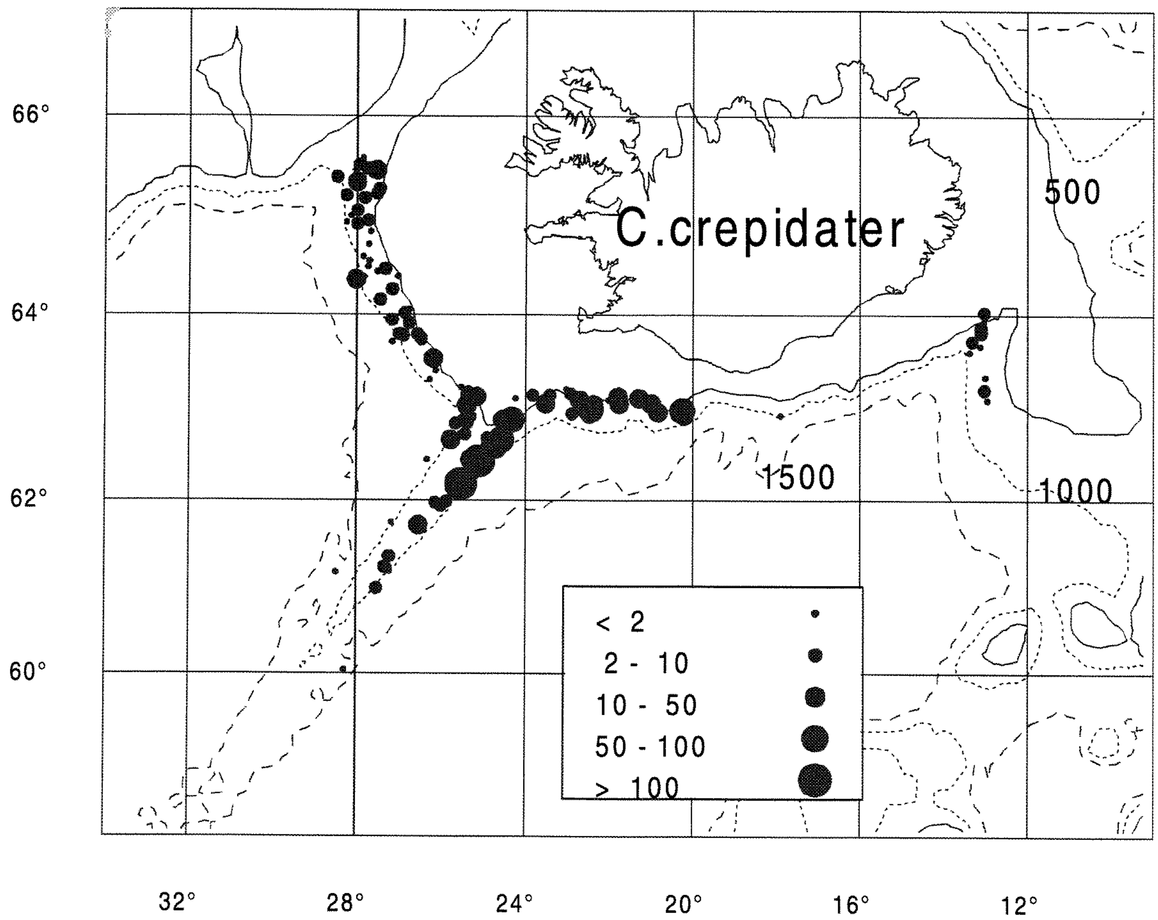



**Figure 5.11.20** *C. crepidater.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

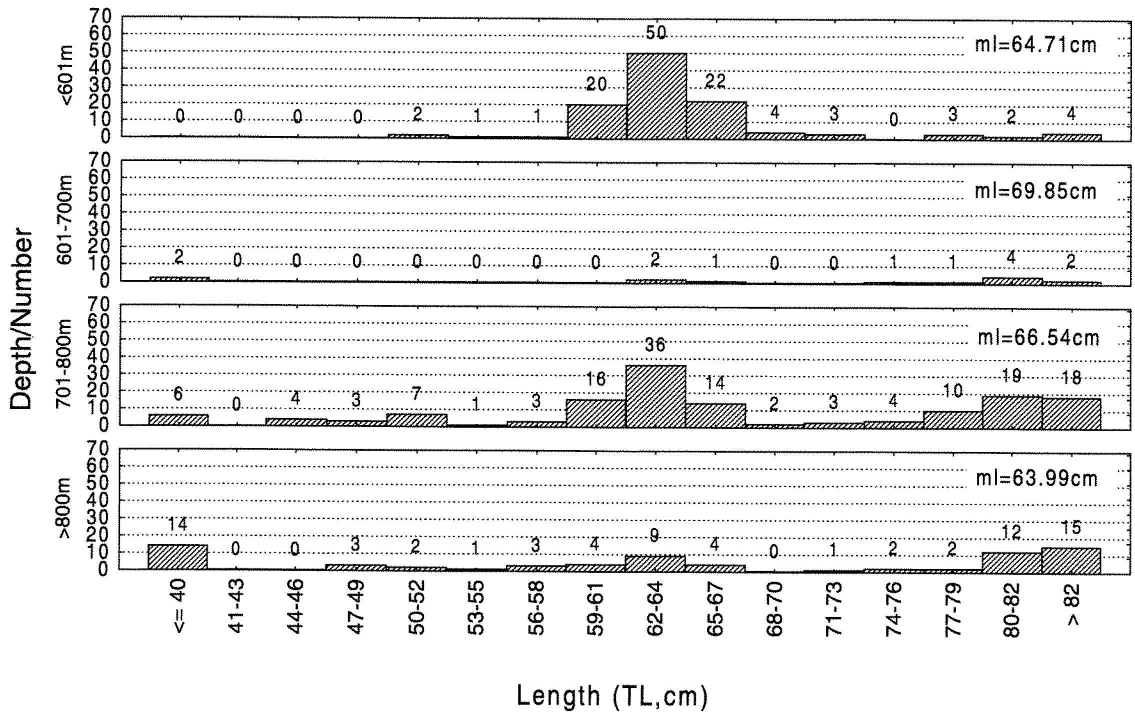


**Figure 5.11.21** *C. crepidater.* Length and mean length (ml) by depth intervals and sex.

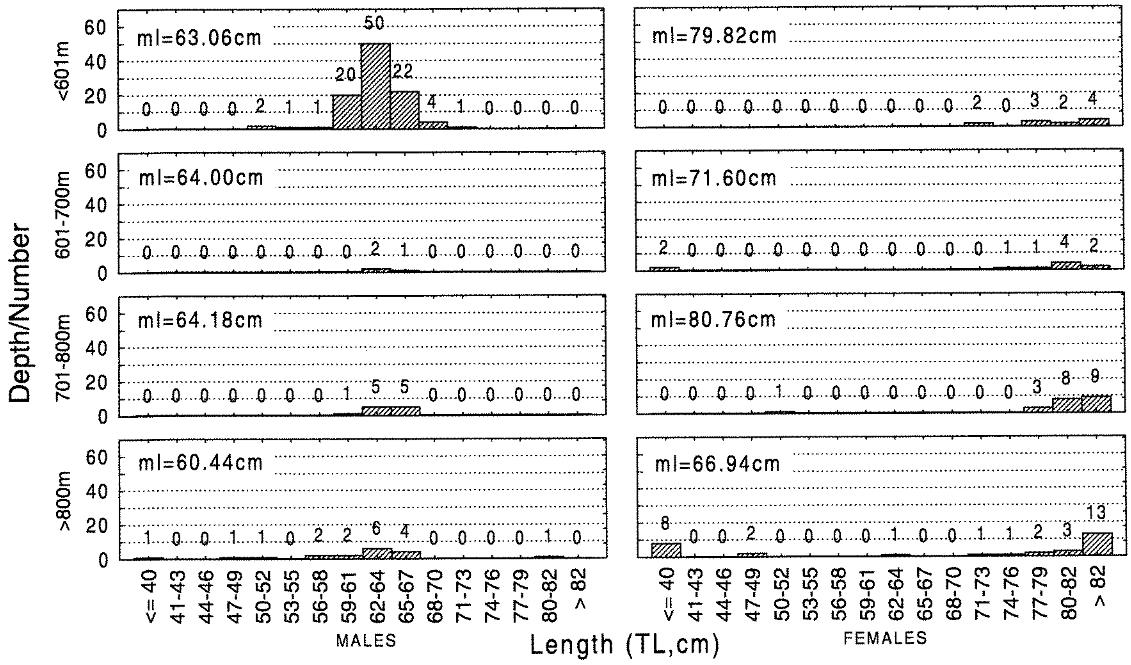


**Figure 5.11.22** *C. crepidater.* Length distribution by sex.

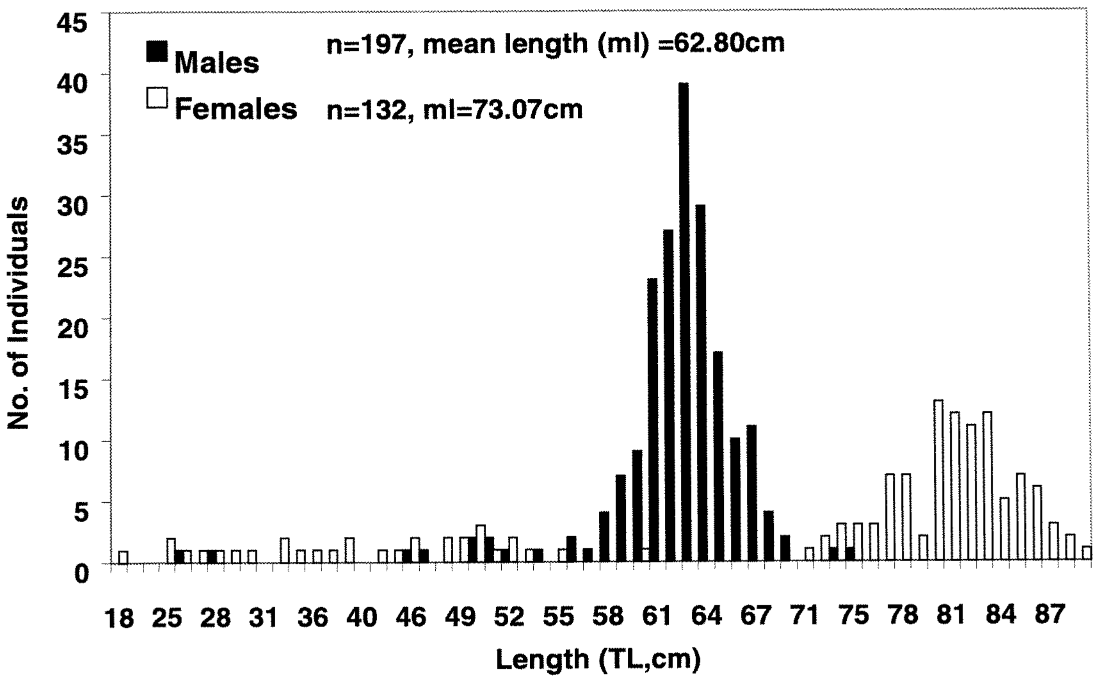


**Figure 5.11.23** *C. crepidater*. Length-weight relationship by sex.

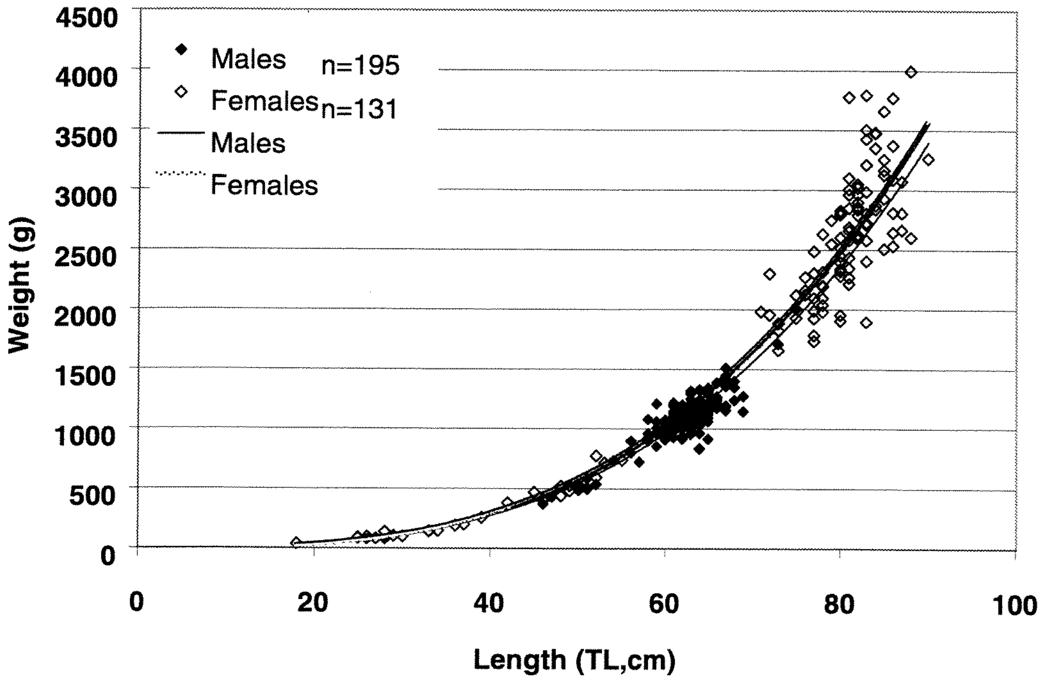



**Figure 5.11.24** *C. crepidater*. Maturity stages by season. (Males: filled bars, females: open bars).

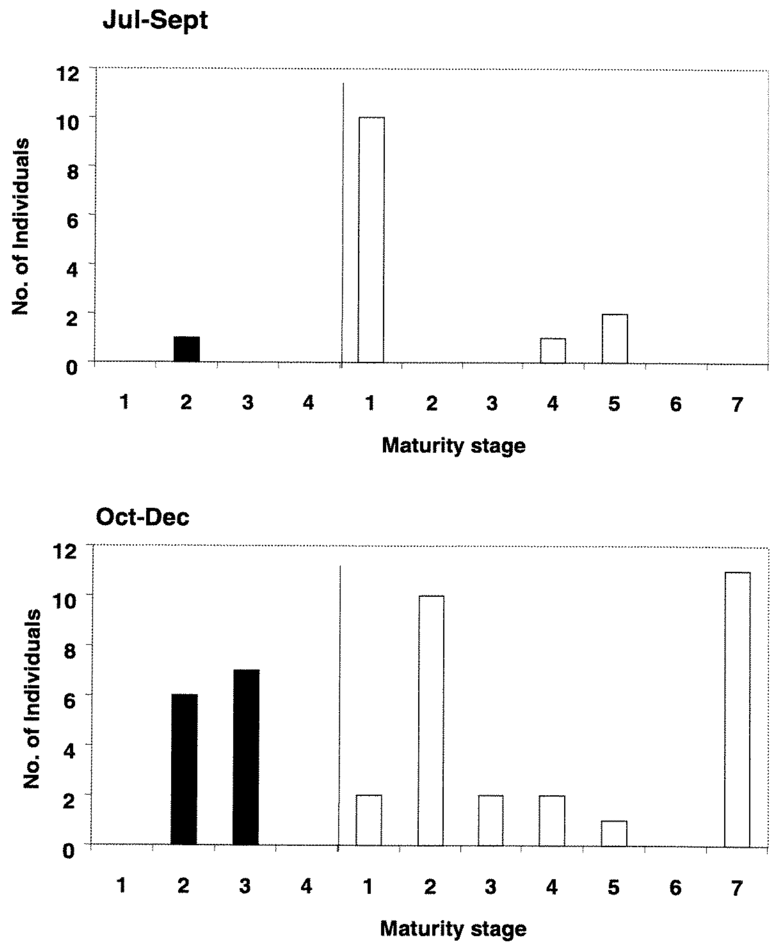


**Figure 5.11.25** *D. calceus.* Distribution and relative abundance in numbers.

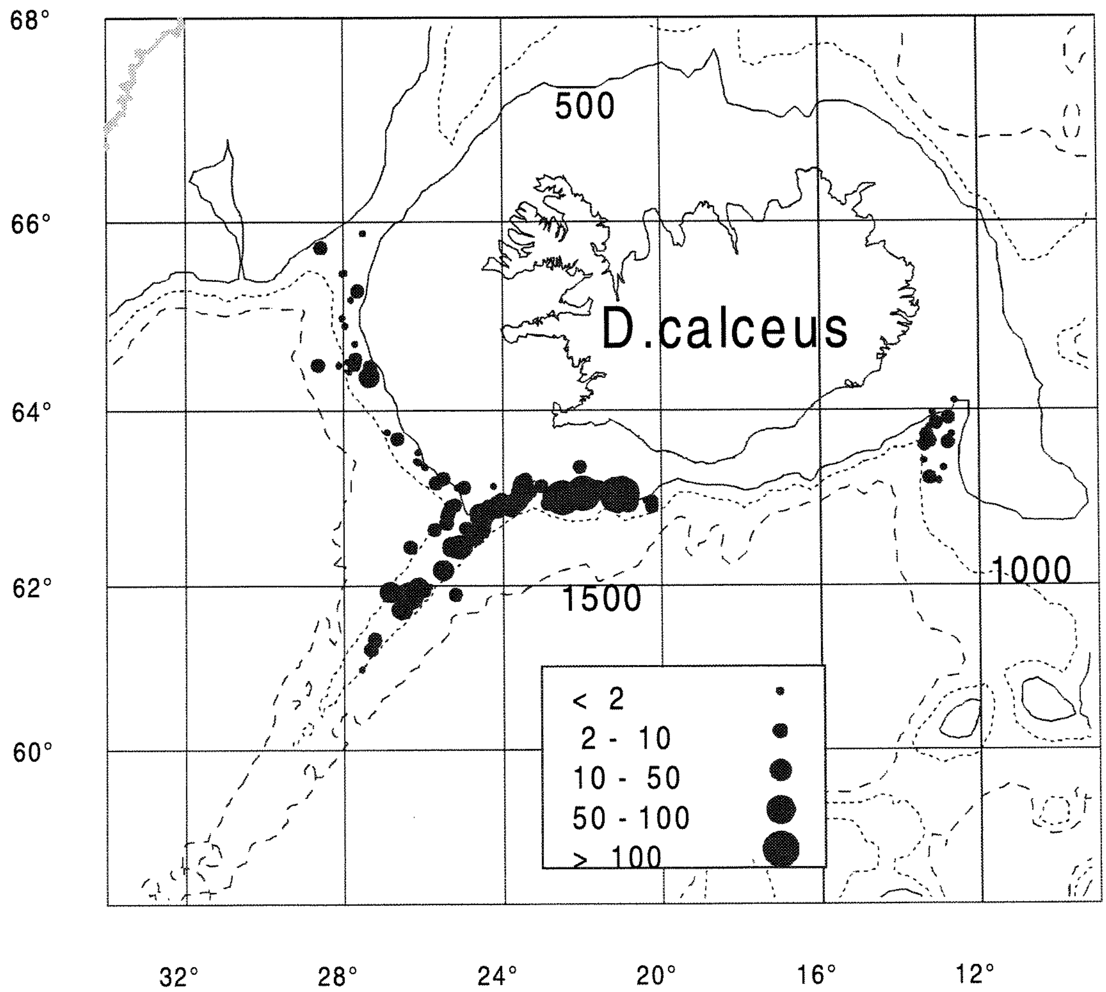



**Figure 5.11.26** *D. calceus.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

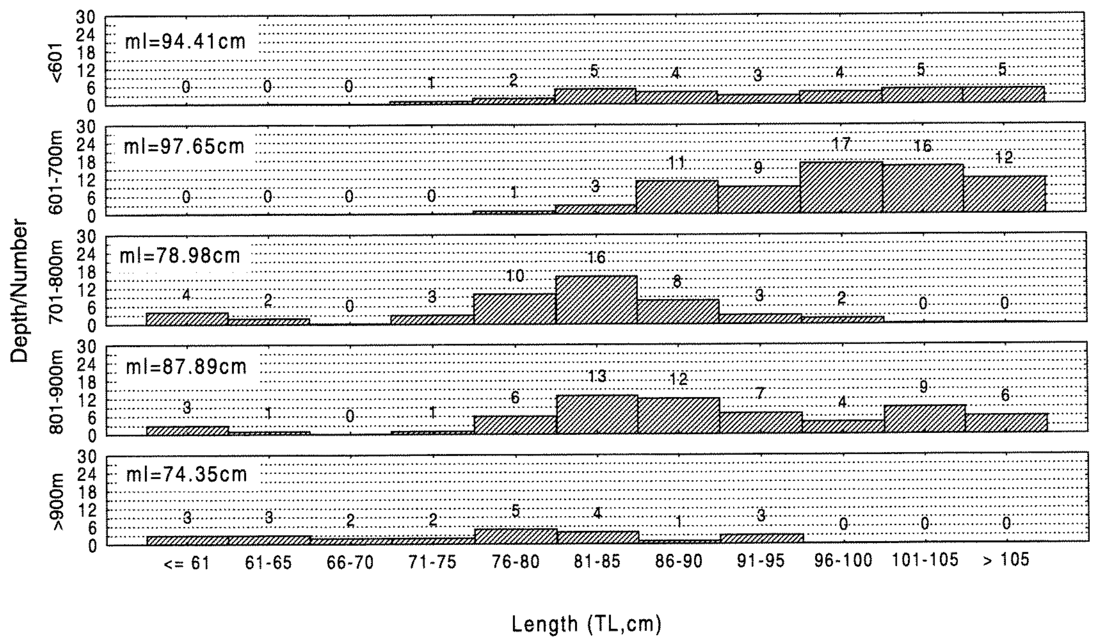


**Figure 5.11.27** *D. calceus.* Length and mean length (ml) by depth intervals and sex.

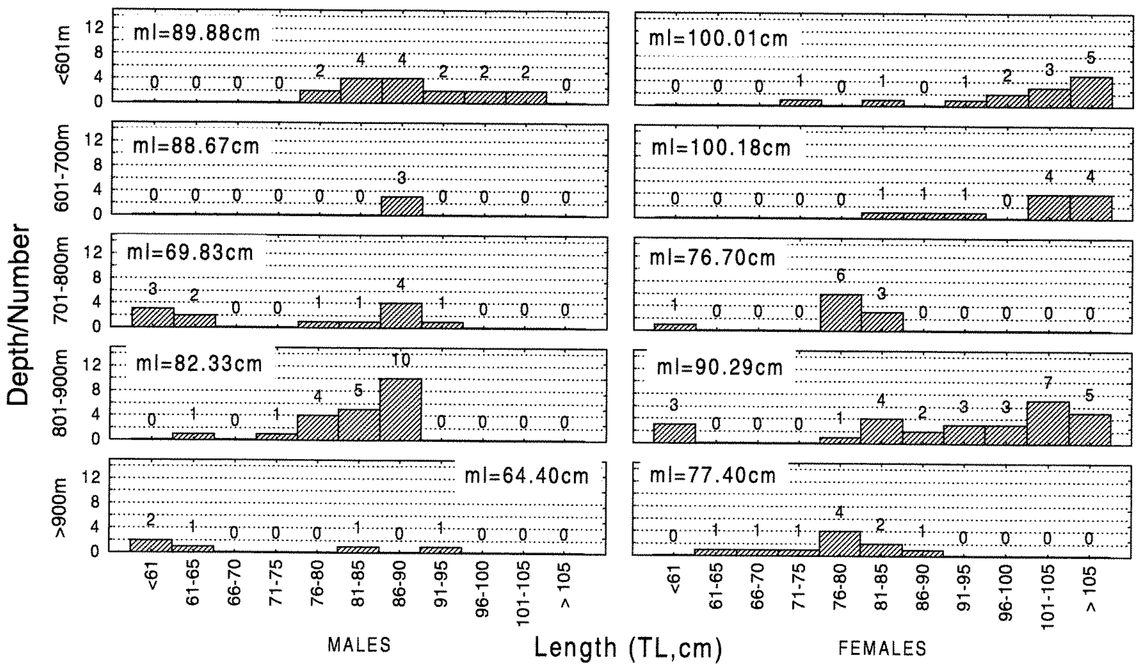



**Figure 5.11.28** *D. calceus.* Length distribution by sex.

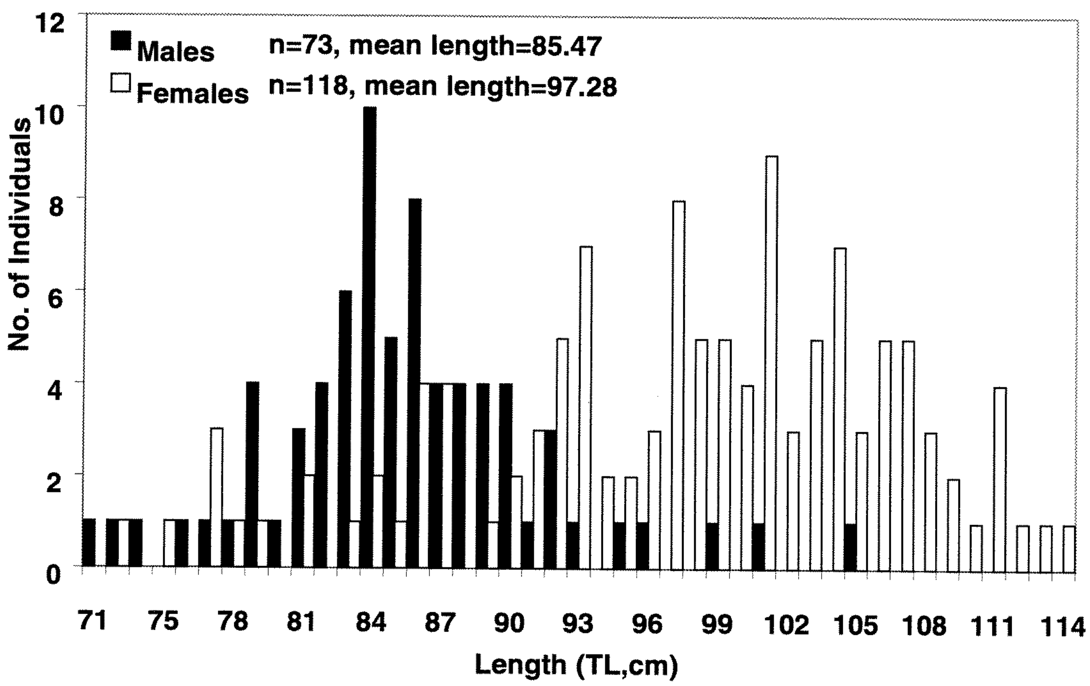


**Figure 5.11.29** *D. calceus.* Length weight relationship by sex.

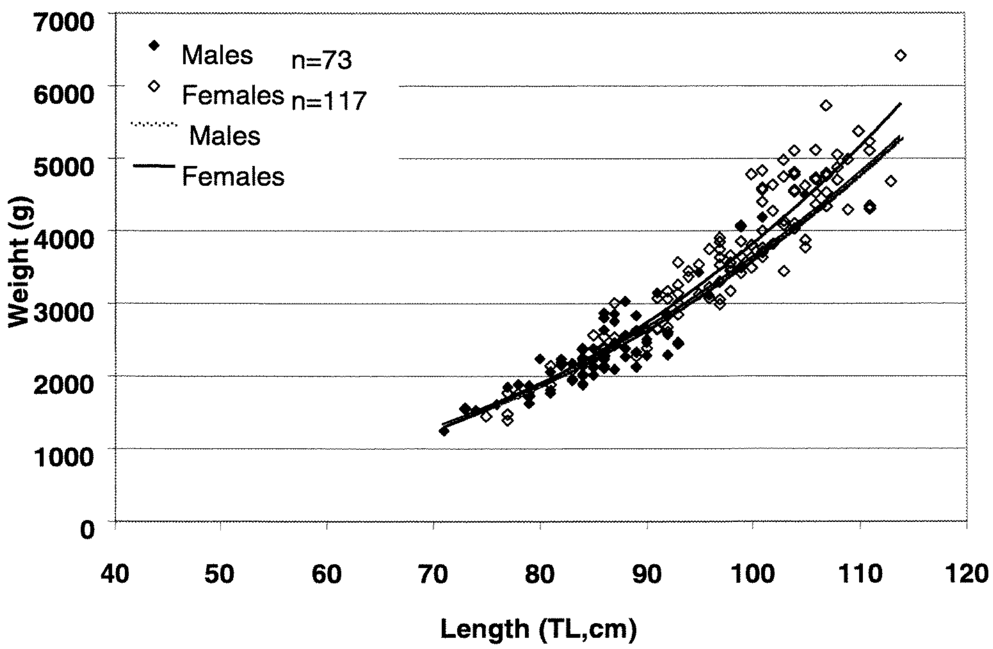
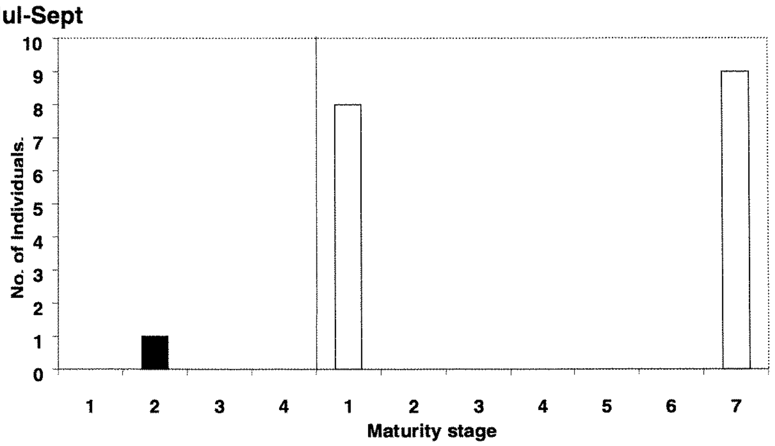



**Figure 5.11.30** *D. calceus.* Maturity stages by season (males: filled bars, females: open bars).



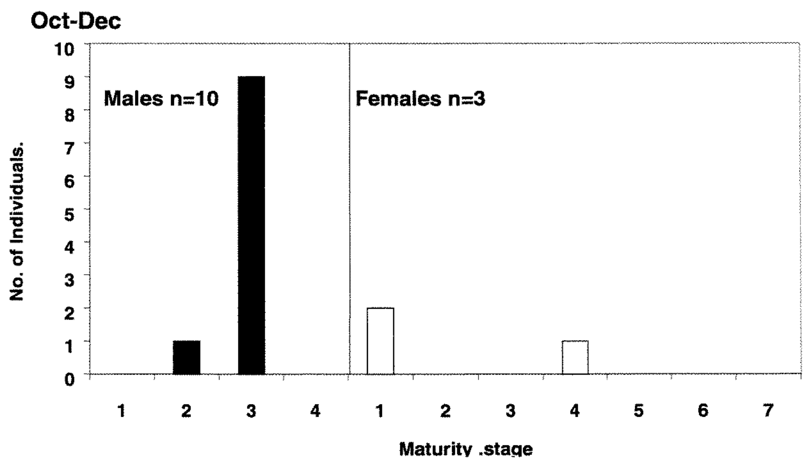



**Figure 5.11.31** *E. spinax.* Distribution and relative abundance in numbers.

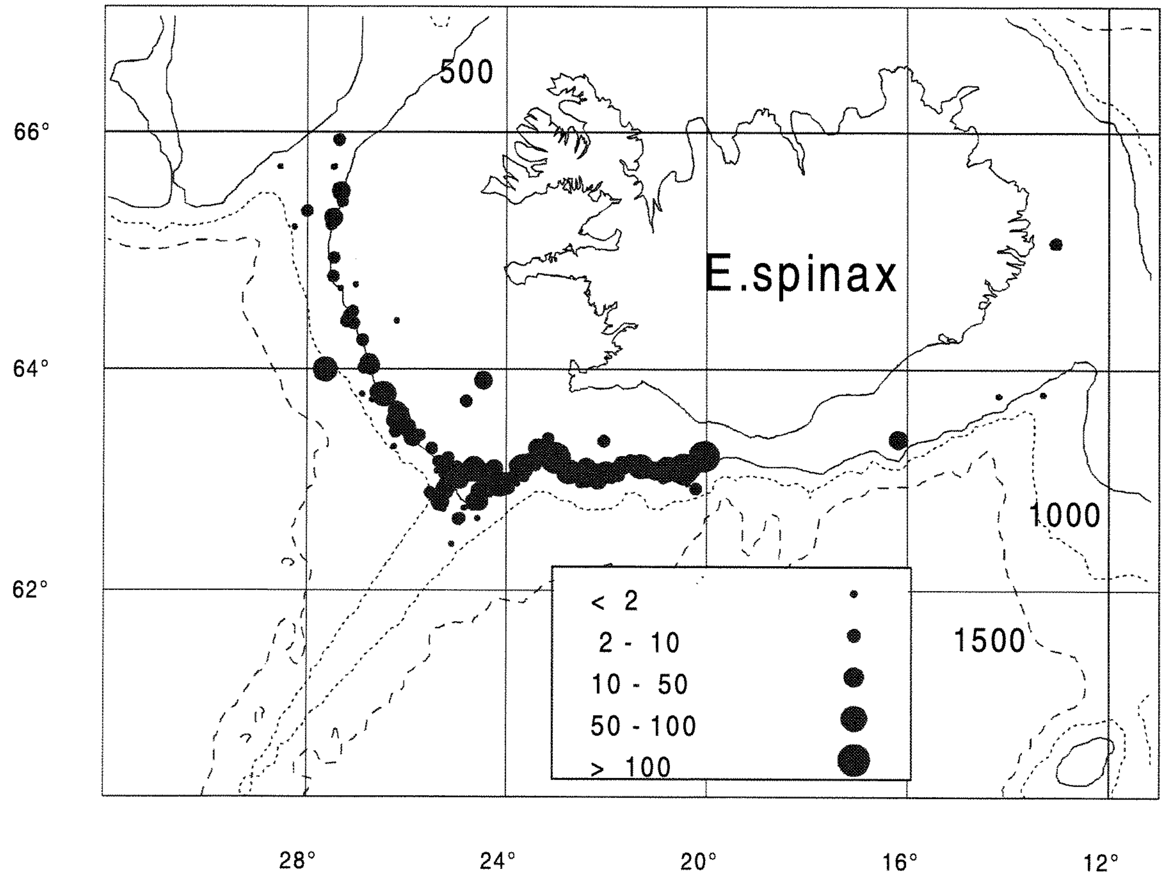



**Figure 5.11.32** *E. spinax.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

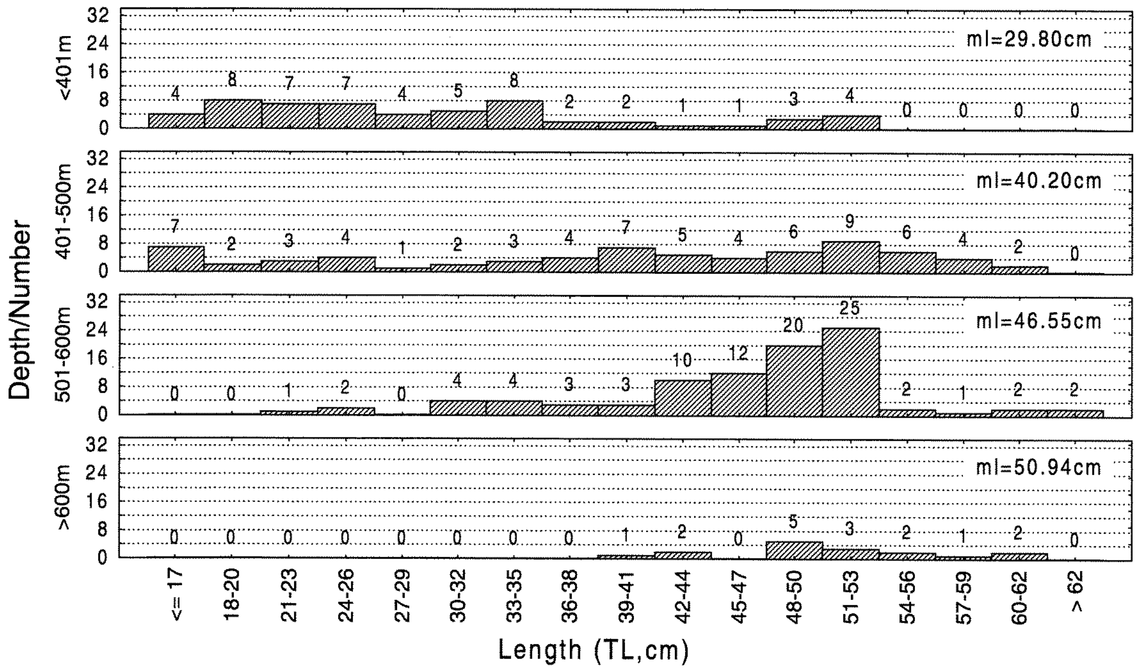


**Figure 5.11.33** *E. spinax.* Length and mean length (ml) by depth intervals and sex.

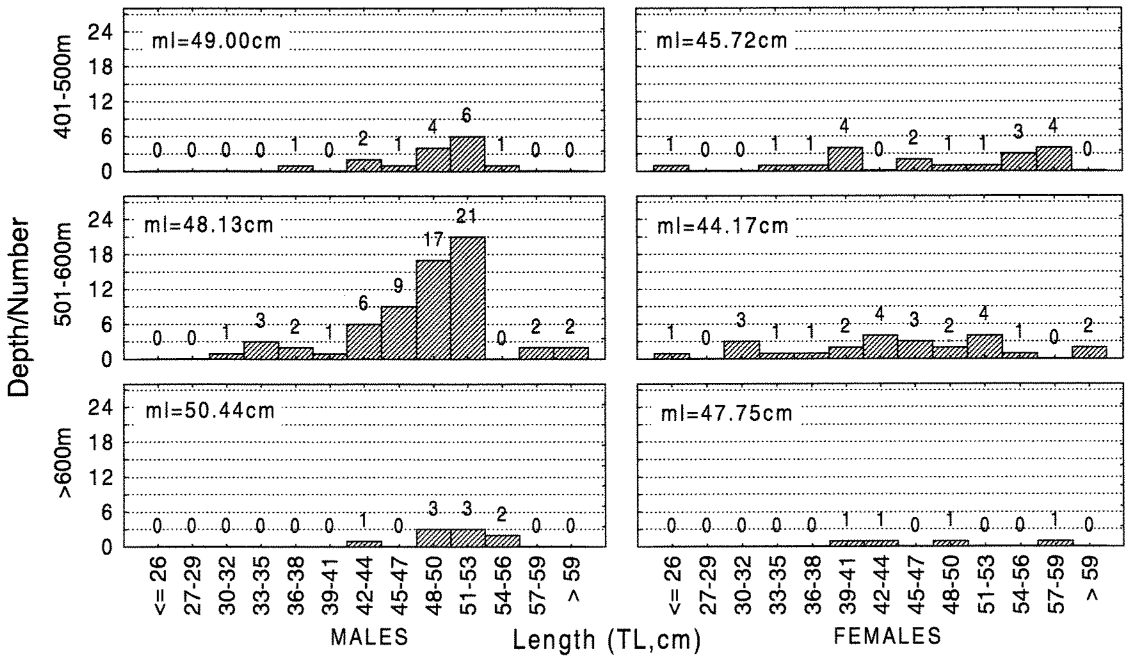



**Figure 5.11.34** *E. spinax.* Length distribution by sex.

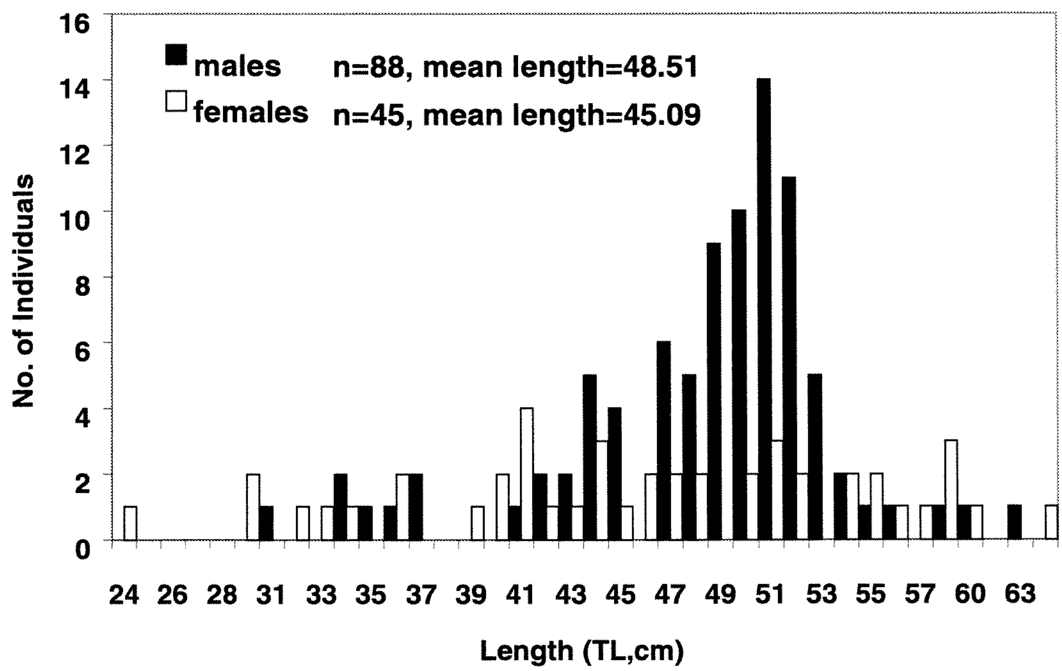


**Figure 5.11.35** *E. spinax*. Length-weight relationship by sex.

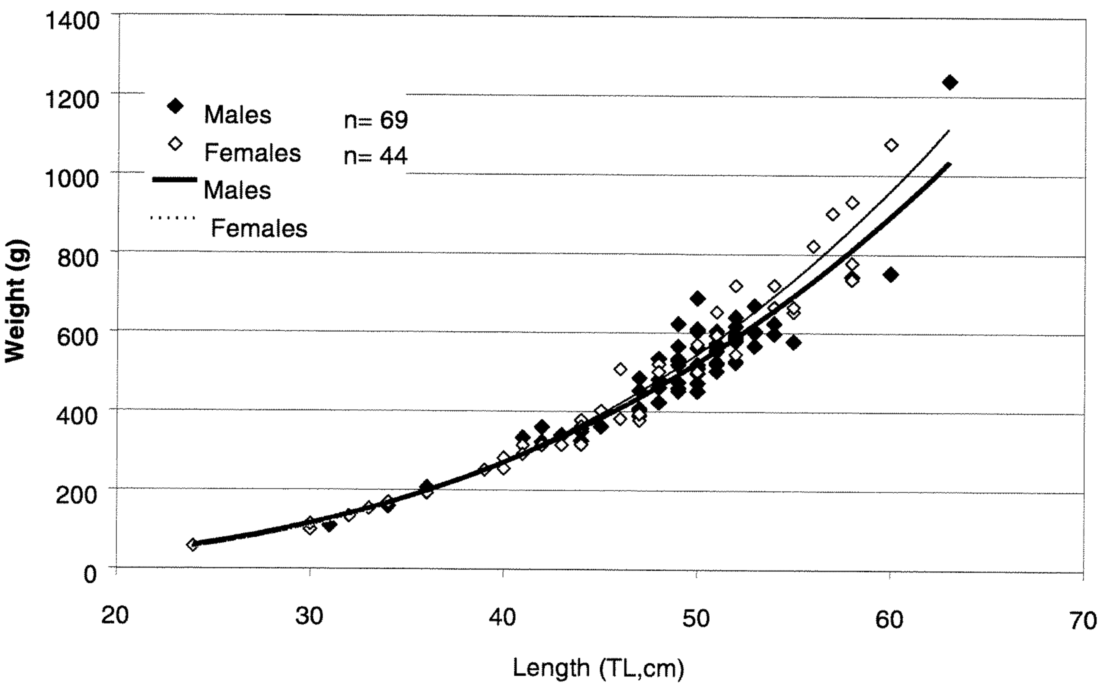



**Figure 5.11.36** *E. spinax*. Maturity stages in October-December (males: filled bars, females: open bars).

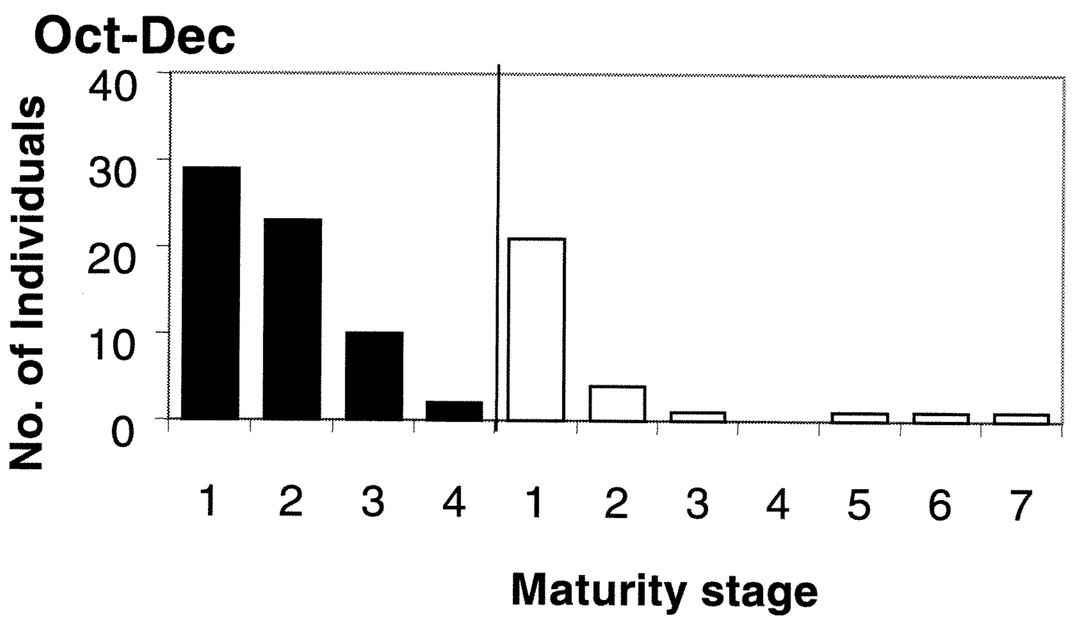


**Figure 5.11.37** *R. hyperborea.* Distribution and relative abundance in numbers.

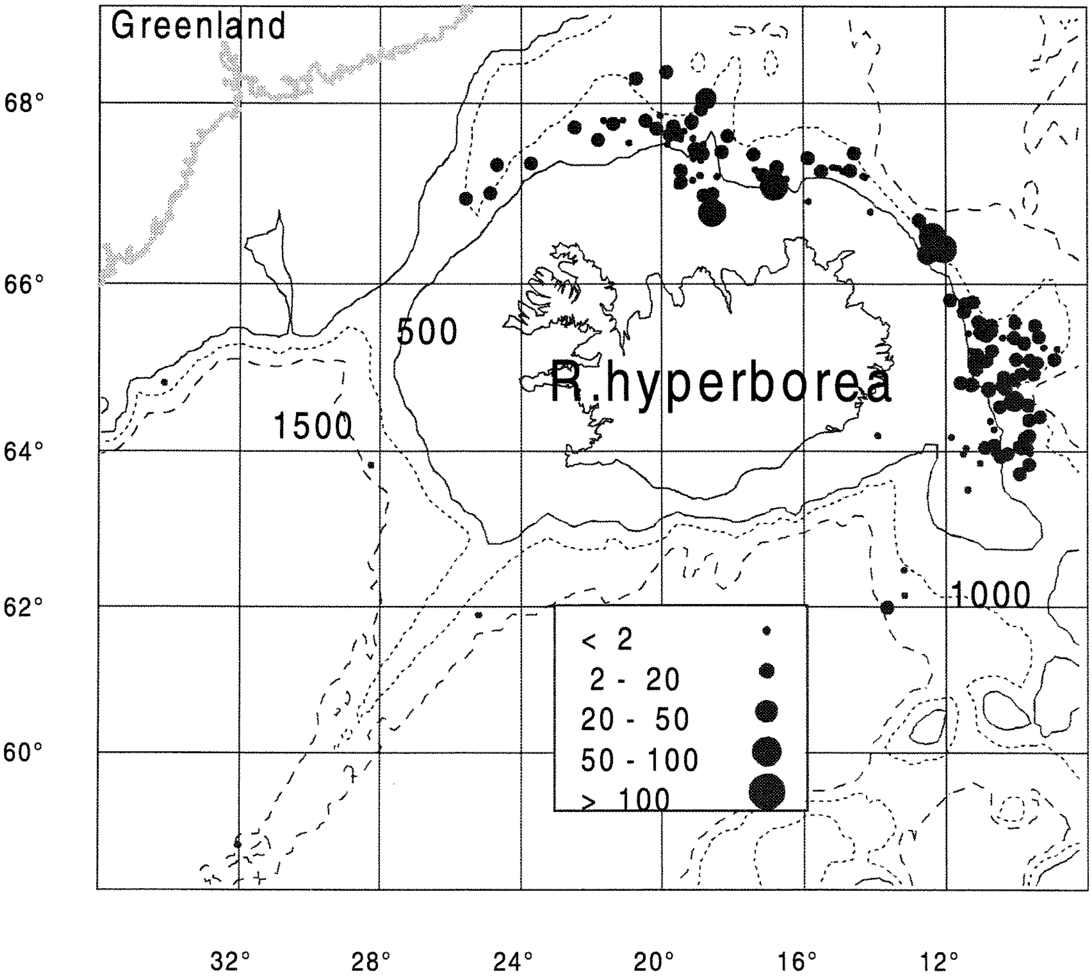



**Figure 5.11.38** *R. hyperborea.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

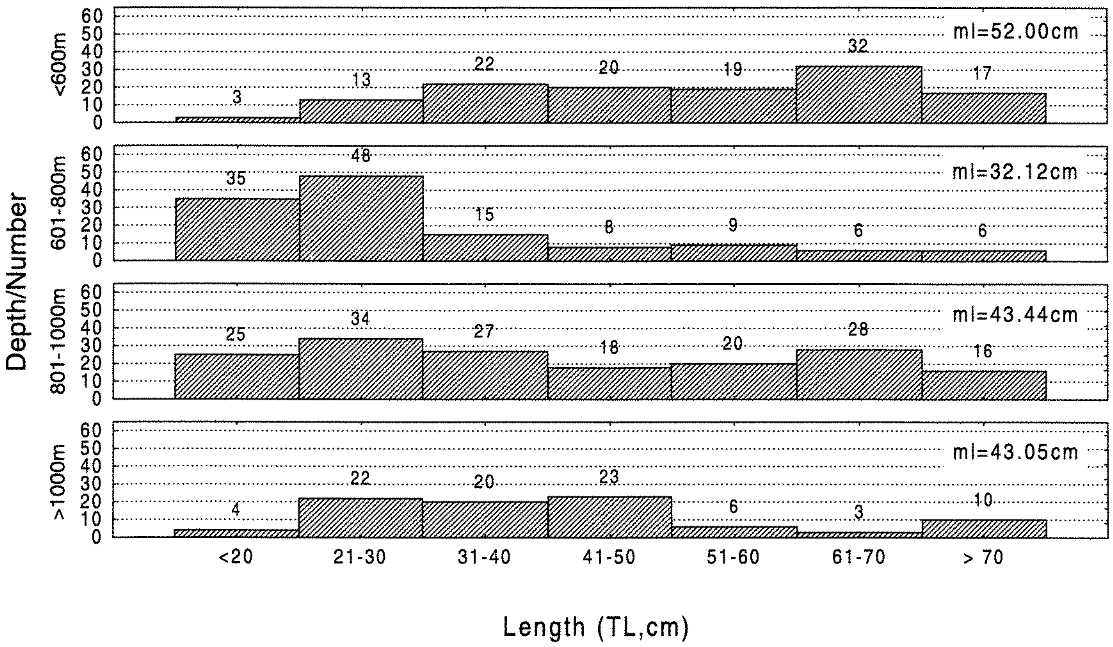


**Figure 5.11.39** *R. hyperborea.* Length and mean length (ml) by depth intervals and sex.

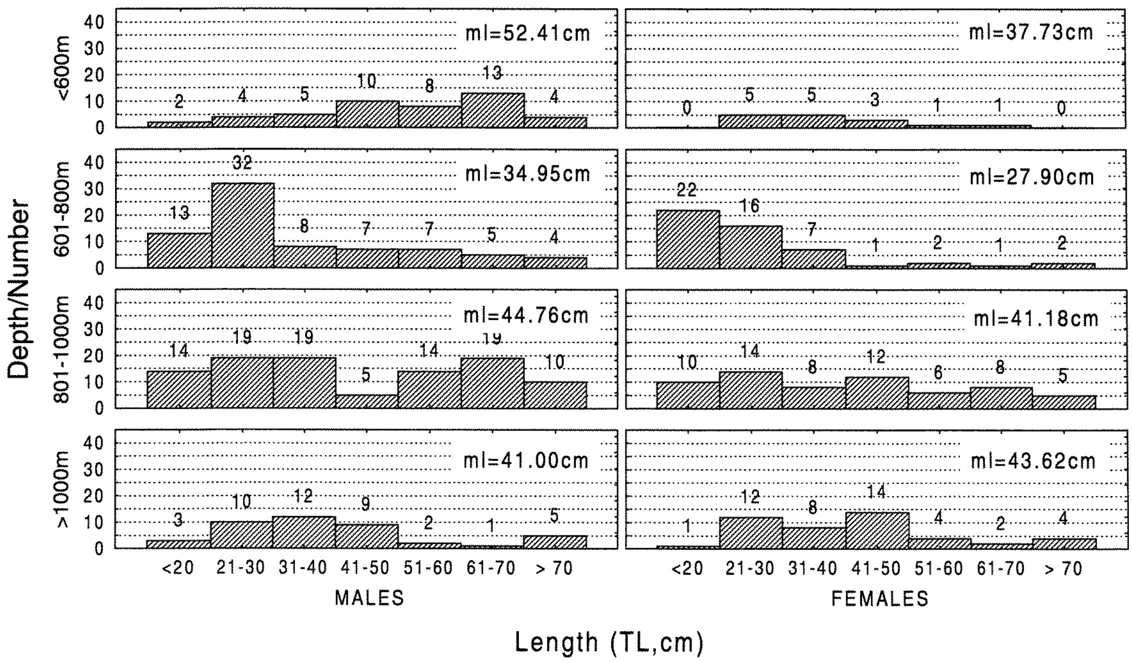



**Figure 5.11.40** *R. hyperborea.* Length distribution by sex.

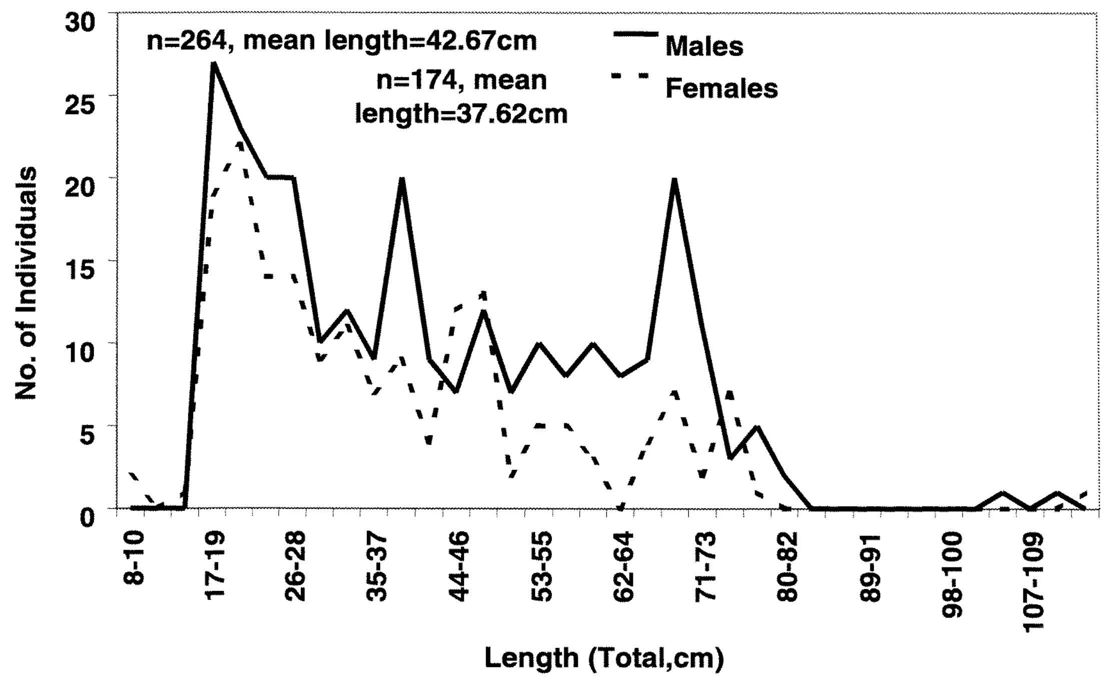


**Figure 5.11.41** *R. hyperborea.* Length-weight relationship by sex.

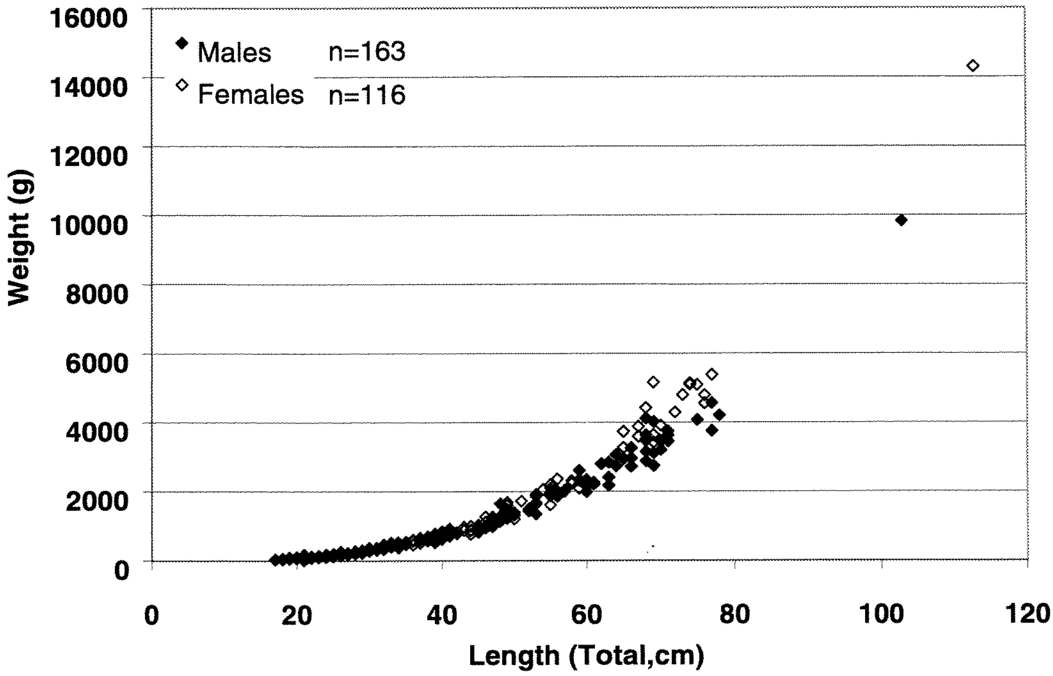



**Figure 5.11.42** *R. hyperborea.* Maturity stages in October-December (males: filled bars, females: open bars).

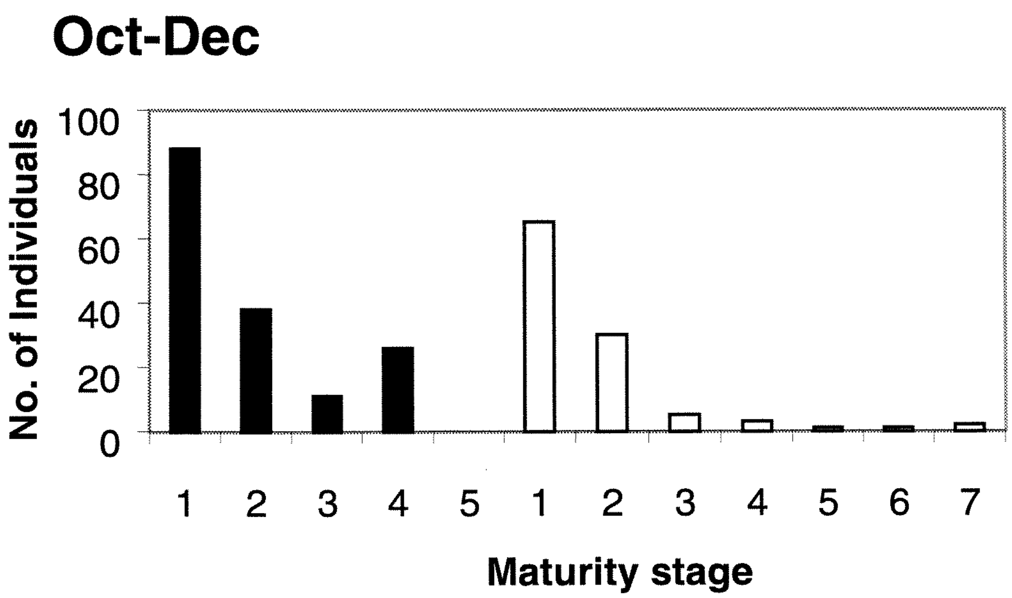


**Figure 5.11.43** *R. fyllae.* Distribution and relative abundance in numbers

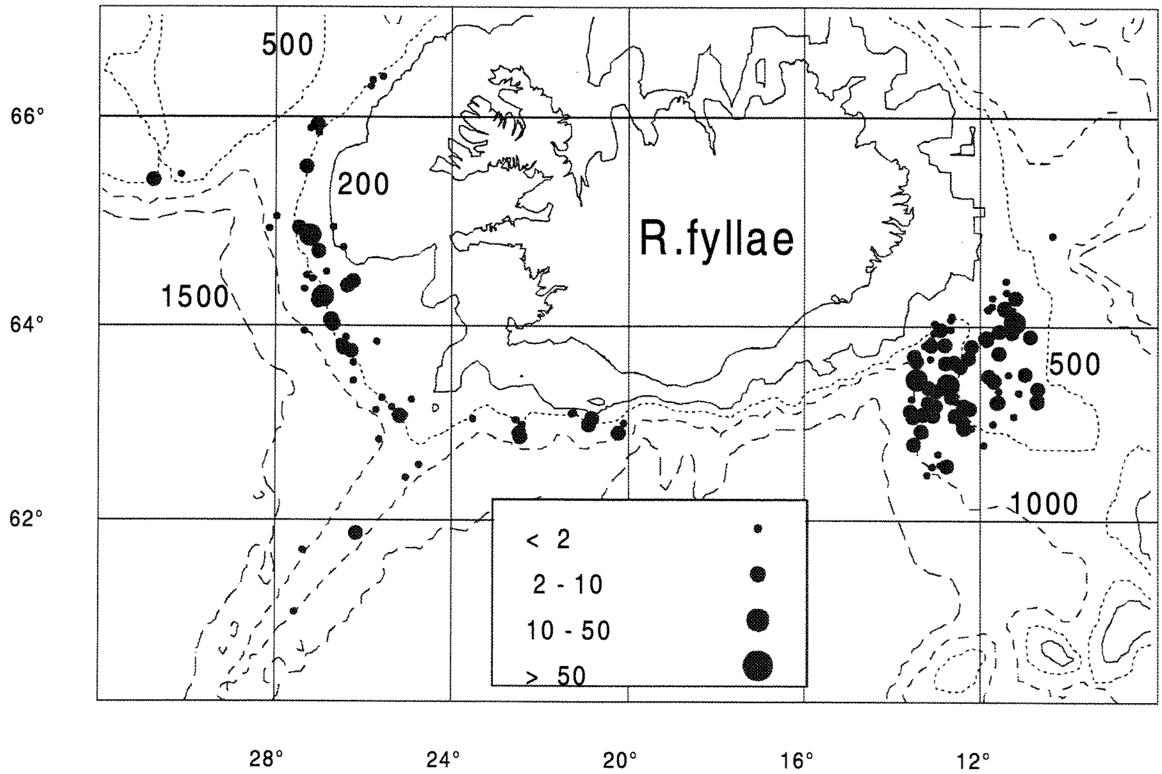



**Figure 5.11.44** *R. fyllae.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

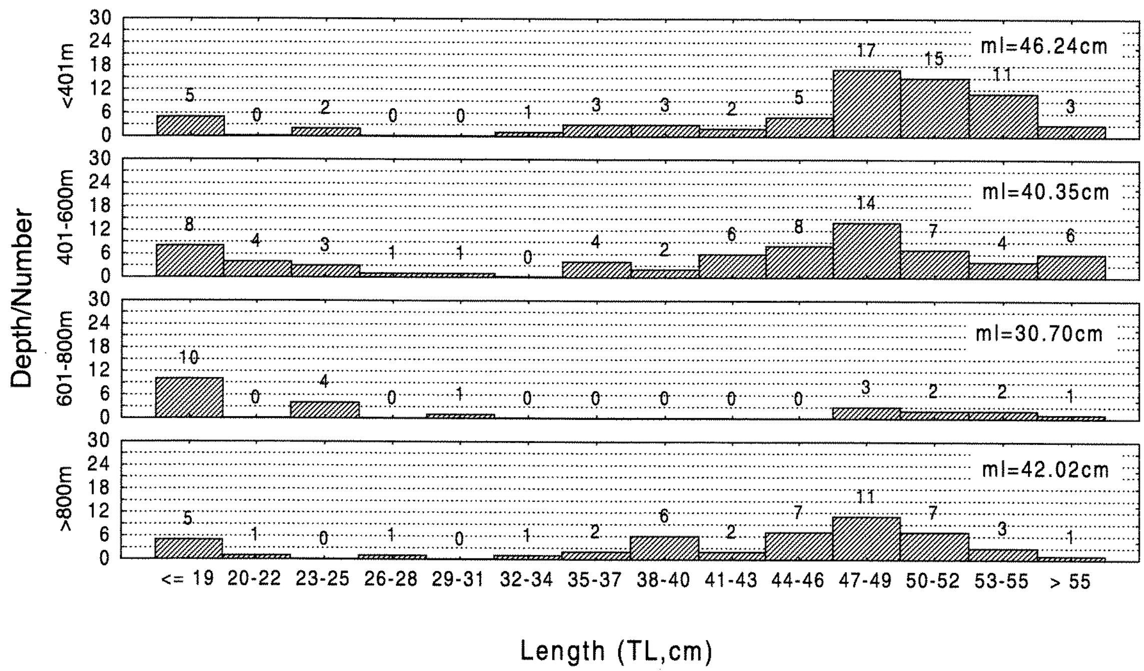


**Figure 5.11.46** *R. fyllae.* Length distribution by sex and unsexed material.

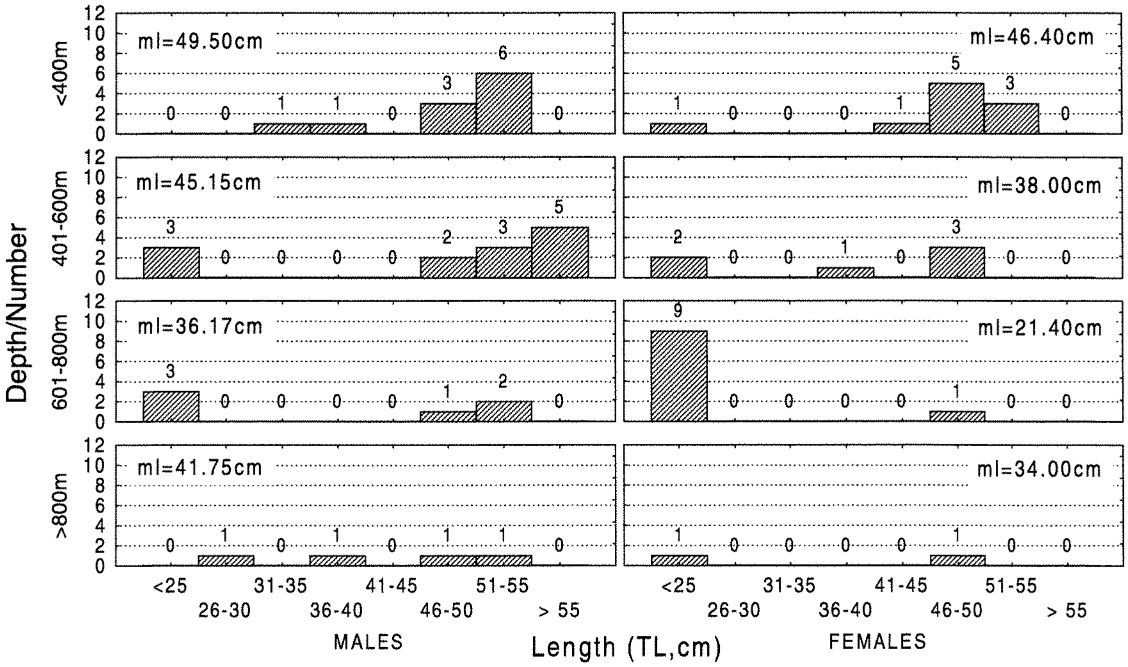



**Figure 5.11.45** *R. fyllae.* Length and mean length (ml) by depth intervals and sex.

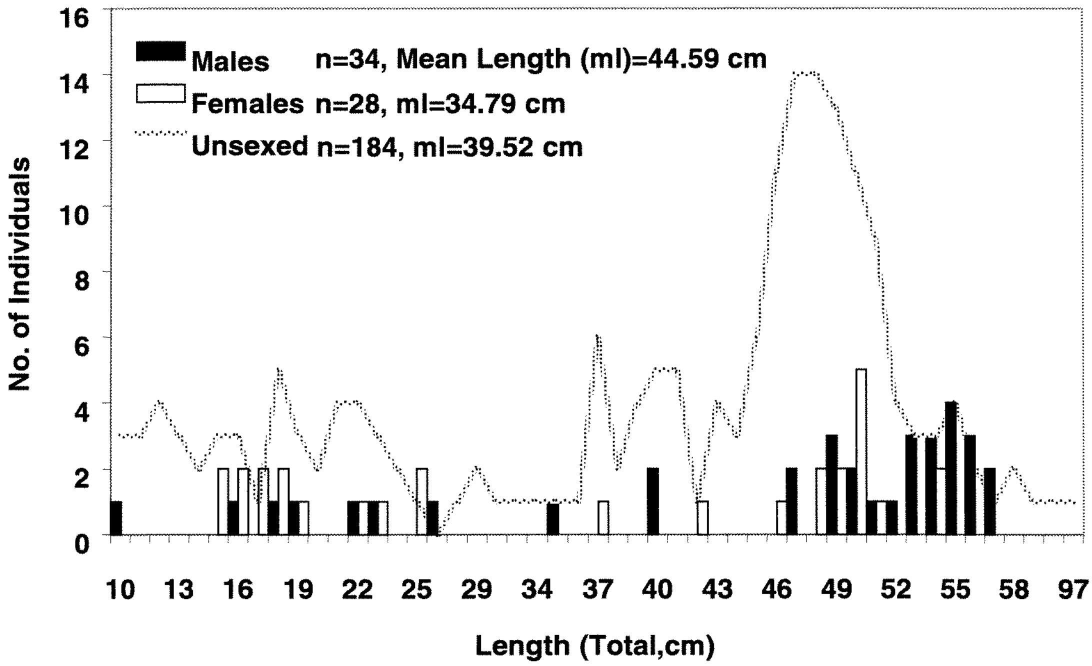


**Figure 5.11.47** *R. fyllae.* Length-weight relationship.

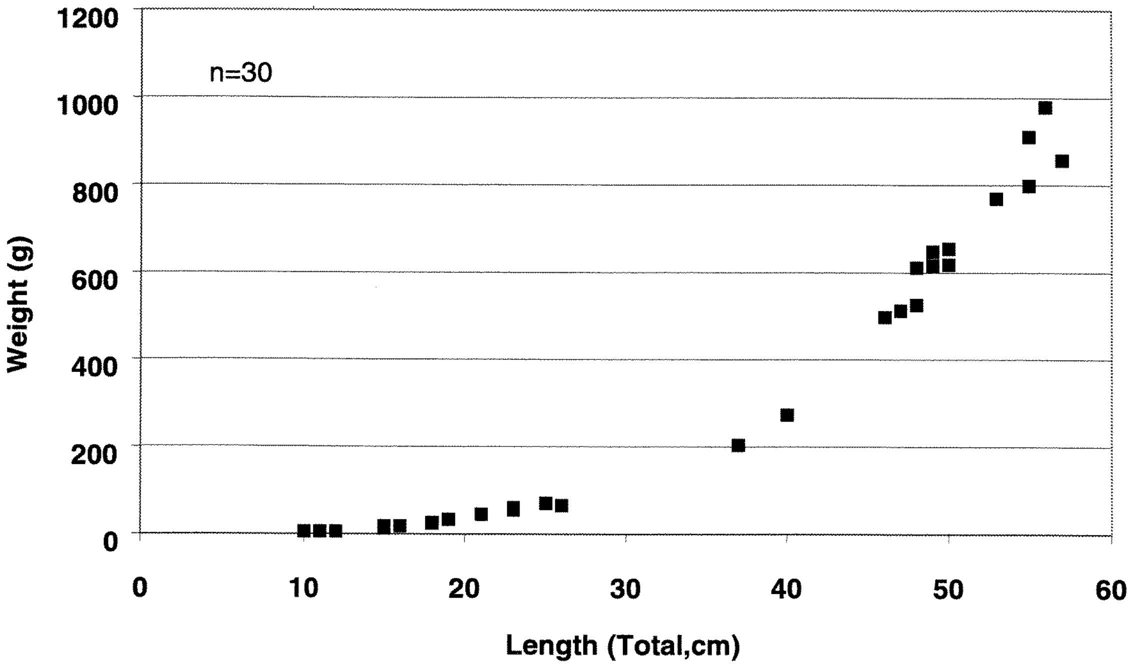



**Figure 5.11.48** *R. fyllae.* Maturity stages in October-December (males: filled bars, females: open bars).

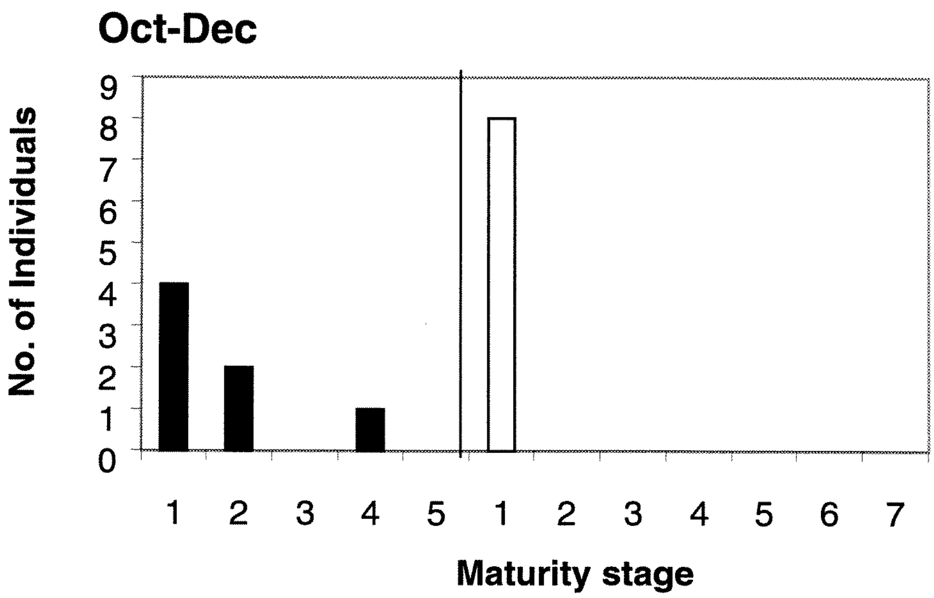


**Figure 5.11.49** *H. raleighana.* Distribution and relative abundance in numbers.

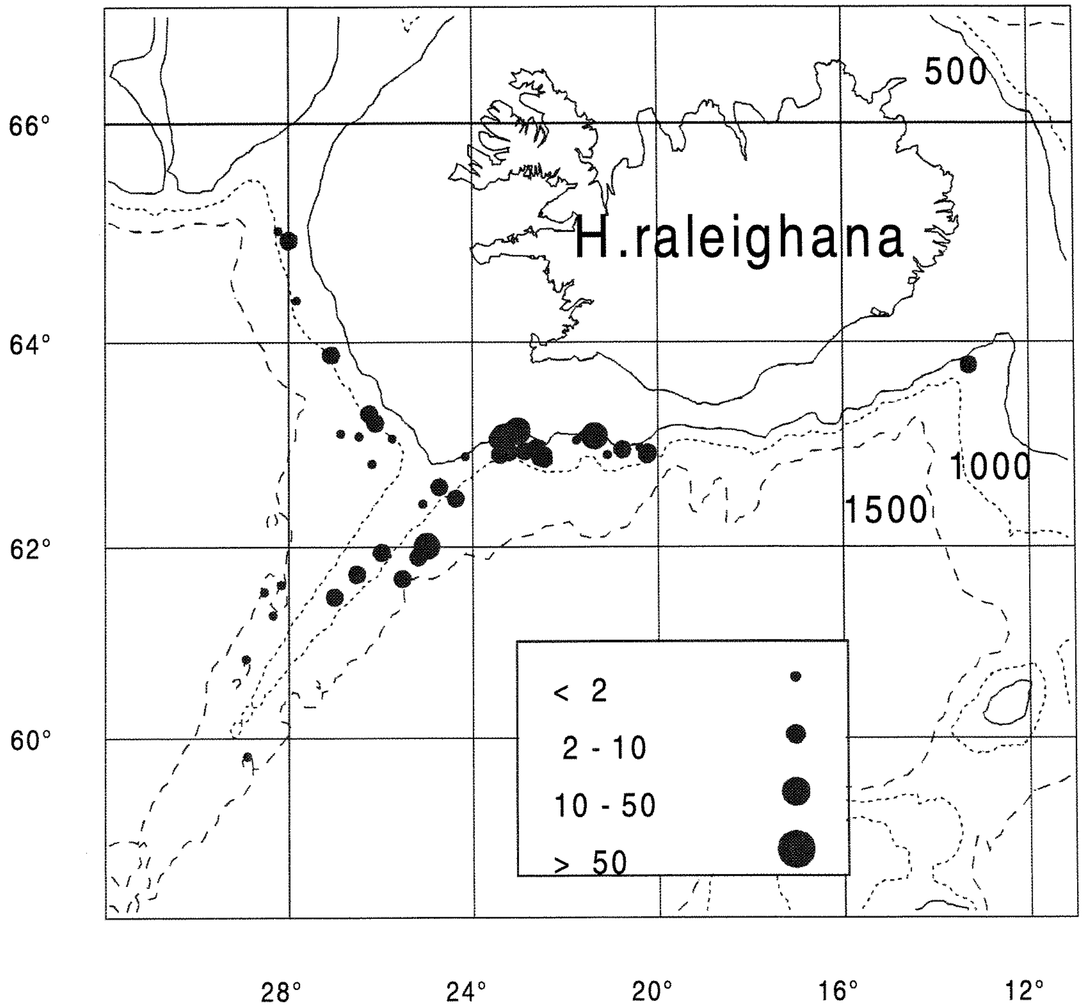



**Figure 5.11.50** *H. raleighana.* Maturity stages in October-December (males: filled bars, females: open bars).

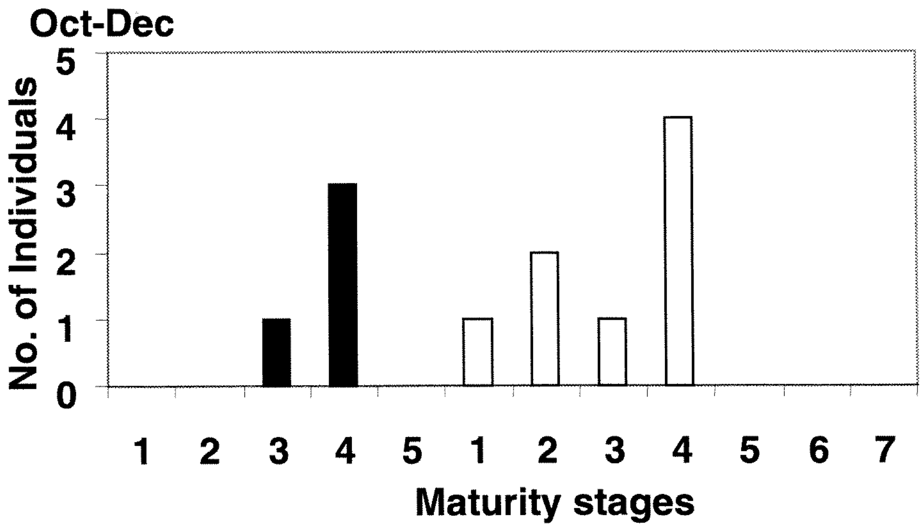


**Figure 5.11.51** *R. atlantica.* Distribution and relative abundance in numbers.

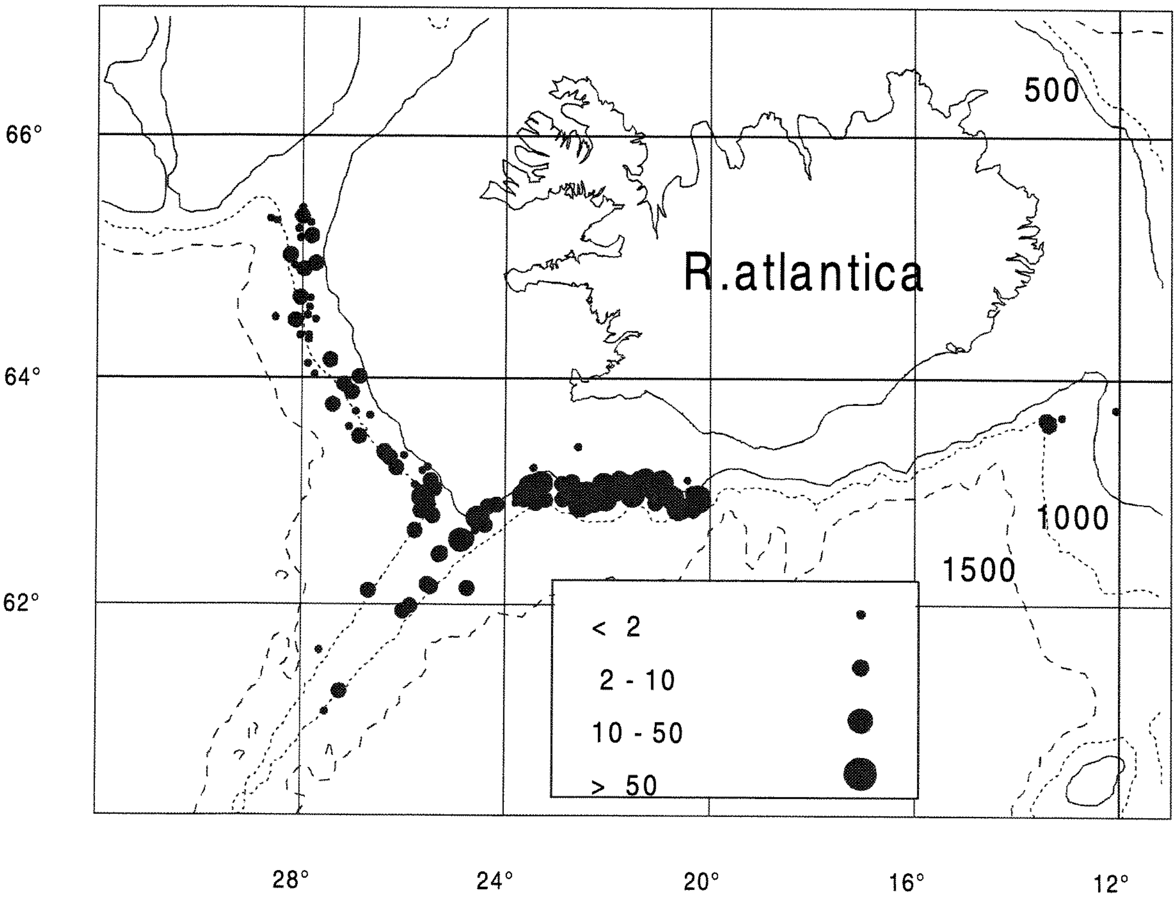



**Figure 5.11.52** *R. atlantica.* Length-depth relationship and mean total length (ml) by 200 m depth intervals.

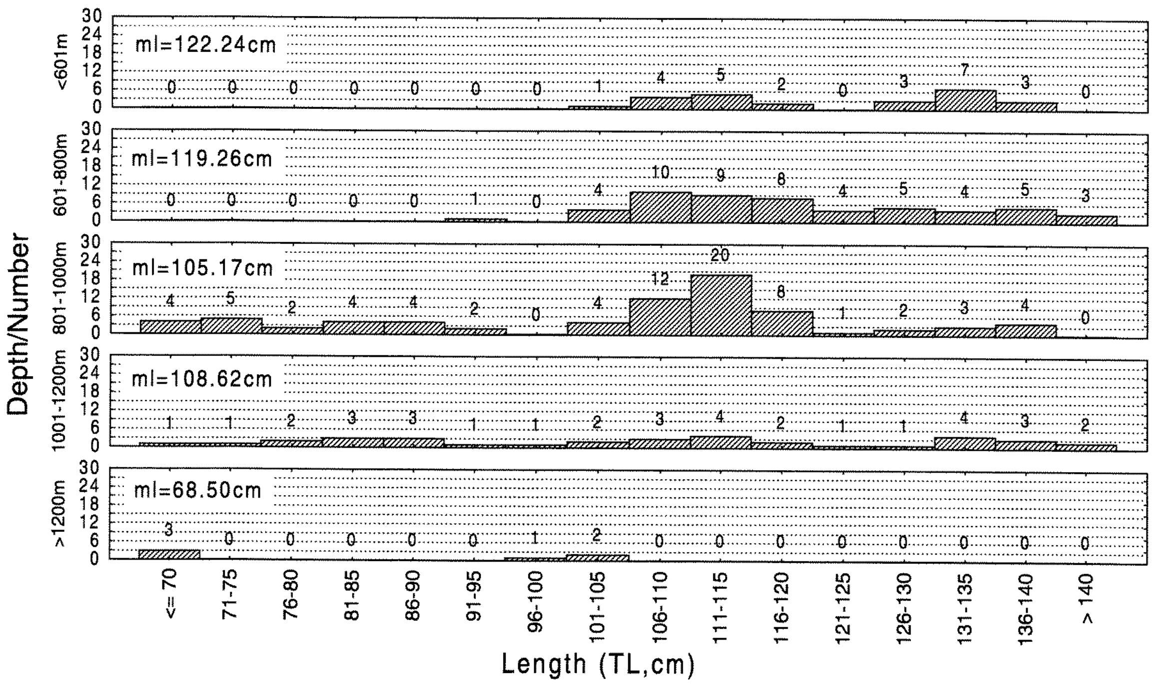


**Figure. 5.11.53** *R. atlantica.* Length distribution by sex.

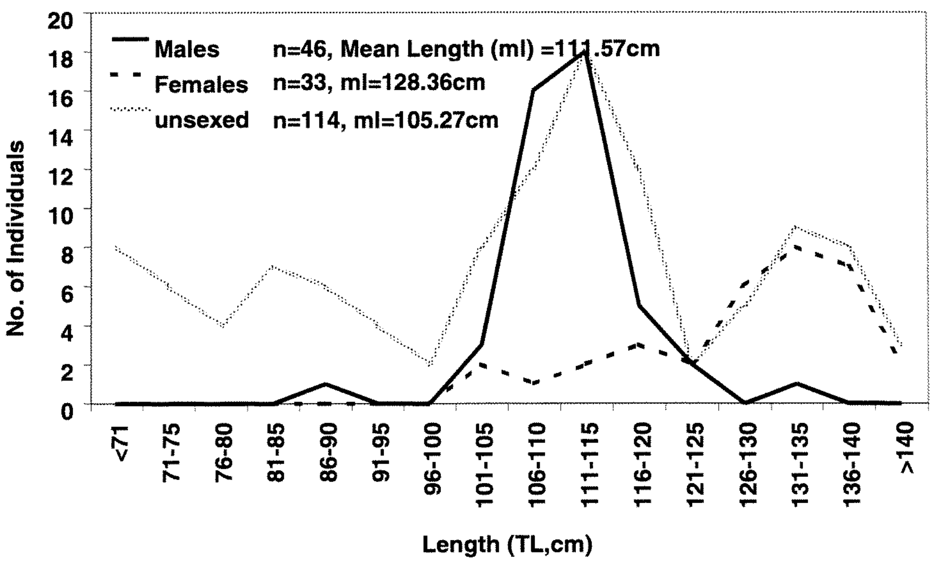



**Figure 5.11.54** *R. atlantica.* Length-weight relationship.

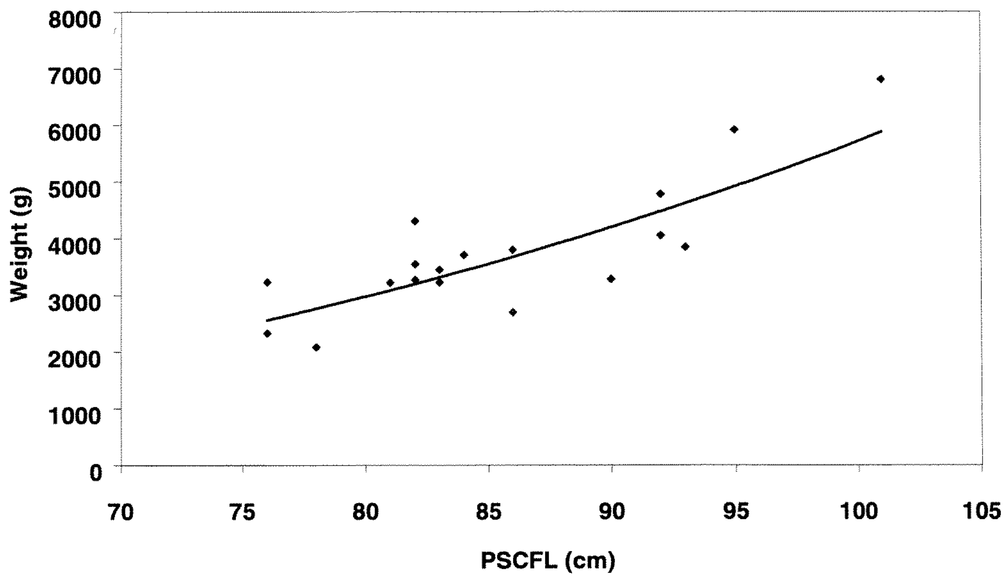



**Figure 5.11.55** *R. atlantica.* Maturity stages in Oct – Dec (males: filled bars, females: open bars)

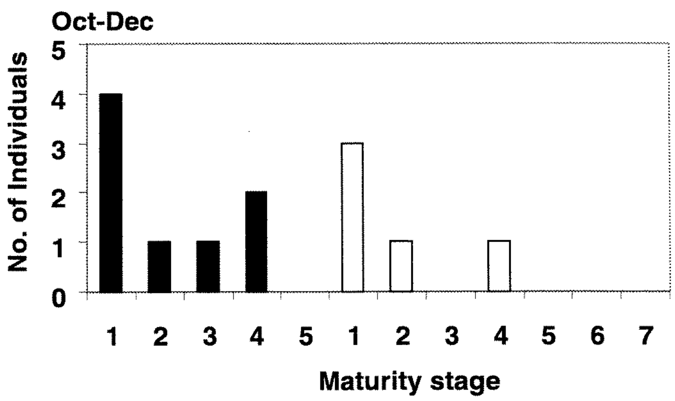


**Figure 5.11.56** *A. agasizii.* Distribution and relative abundance in numbers.

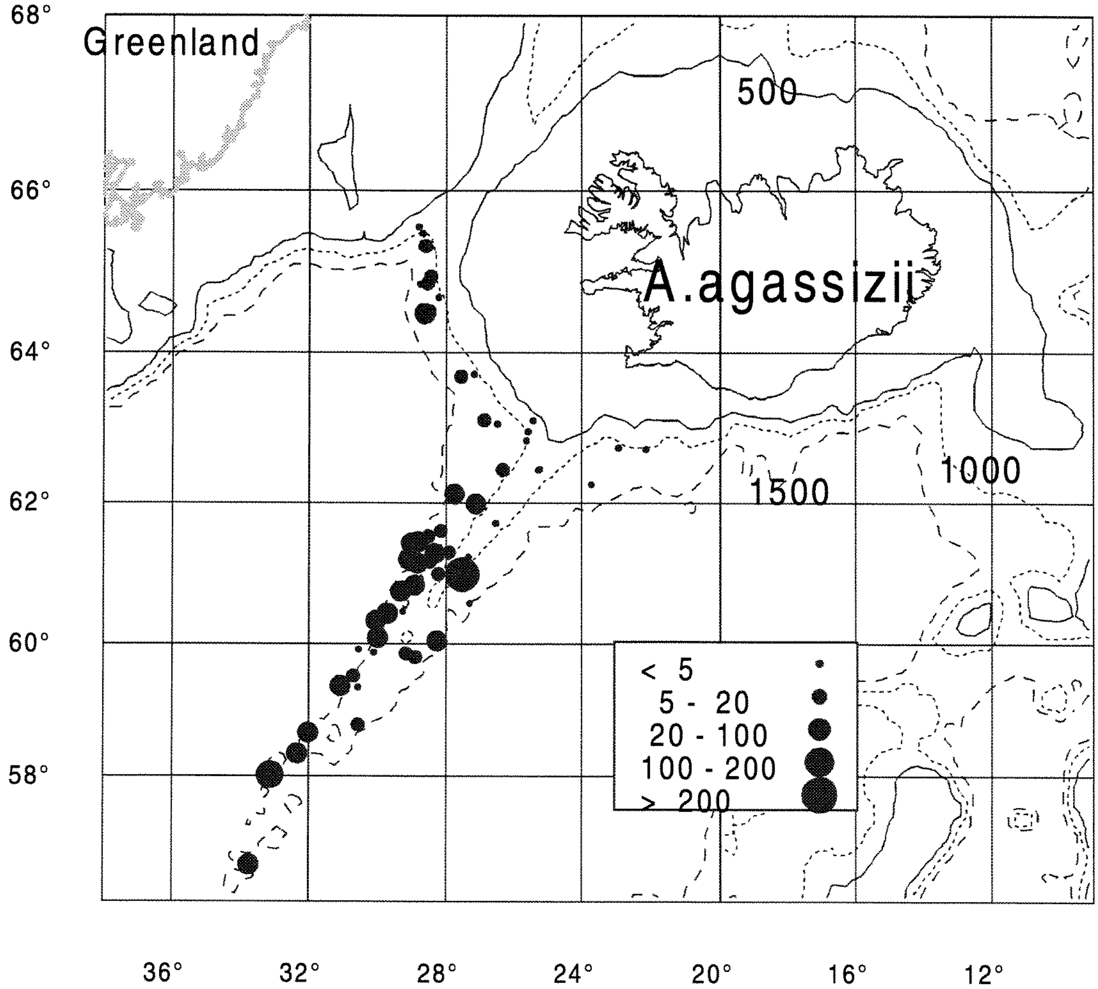



**Figure 5.11.57** *A. agassizii.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

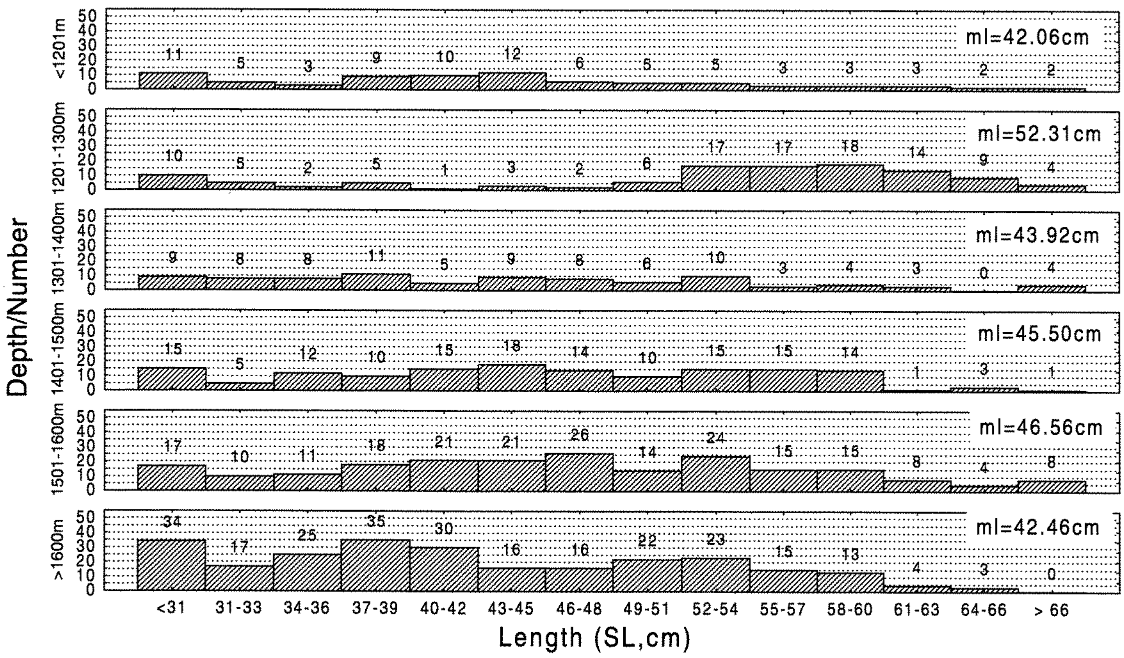


**Figure 5.11.58** *A. agassizii.* Length and mean length (ml) by depth intervals and sex.

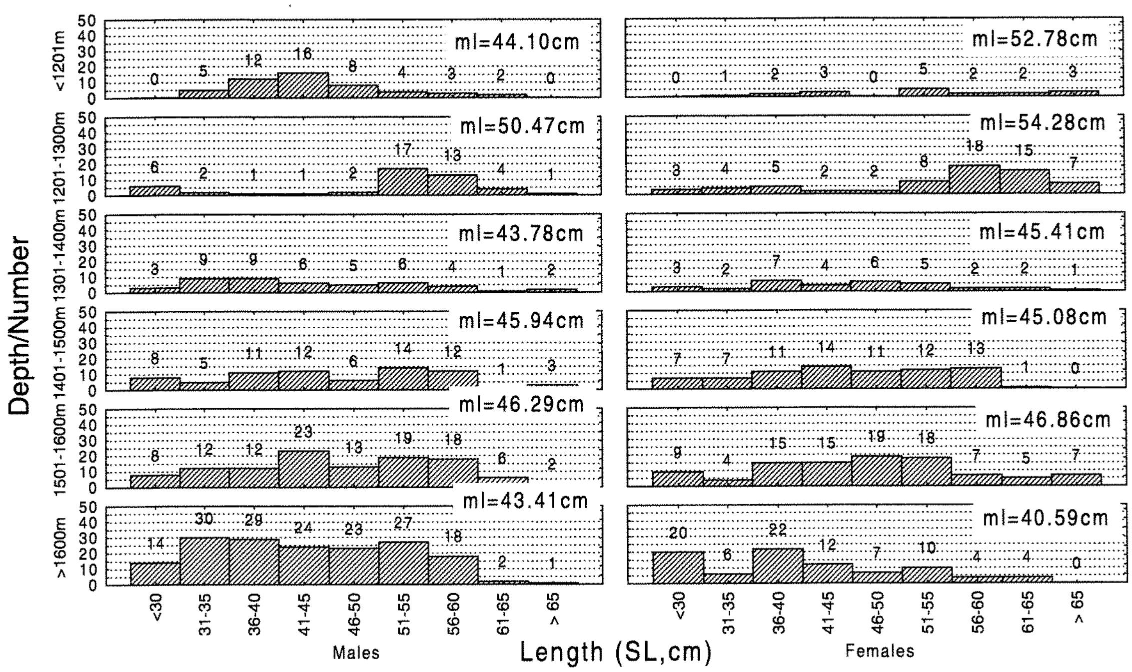



**Figure 5.11.61** *A. agassizii.* Maturity stages by season (males: filled bars, females: open bars).

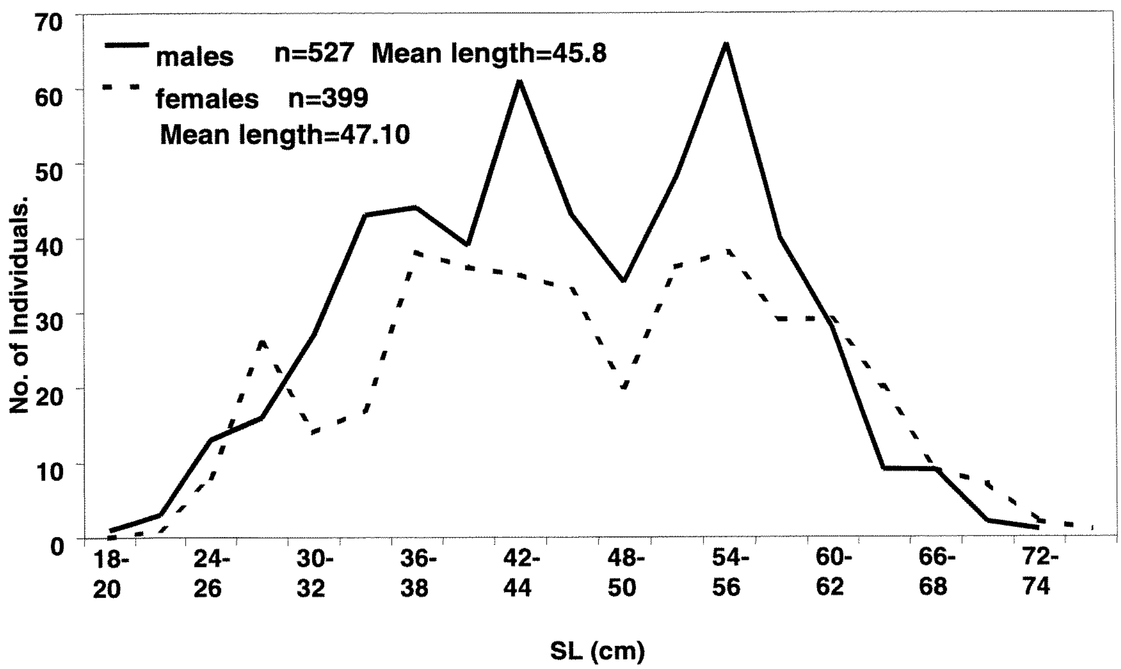


**Figure 5.11.60** *A. agassizii.* Length-weight relationship.

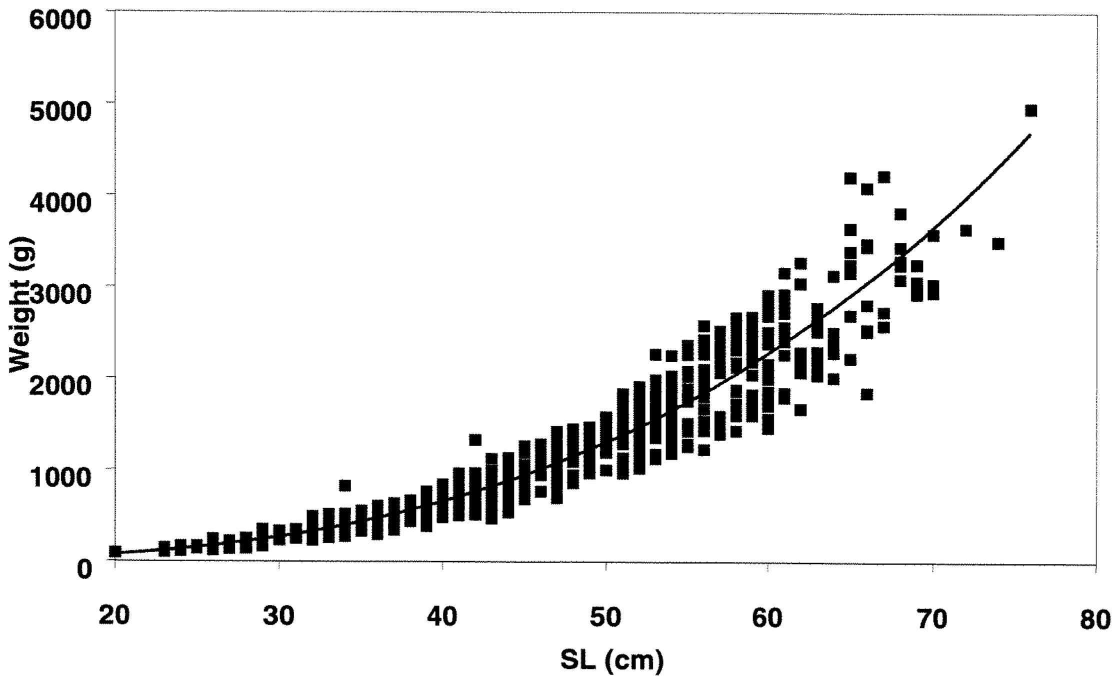



**Figure 5.11.59** *A. agassizii.* Length distribution by sex.

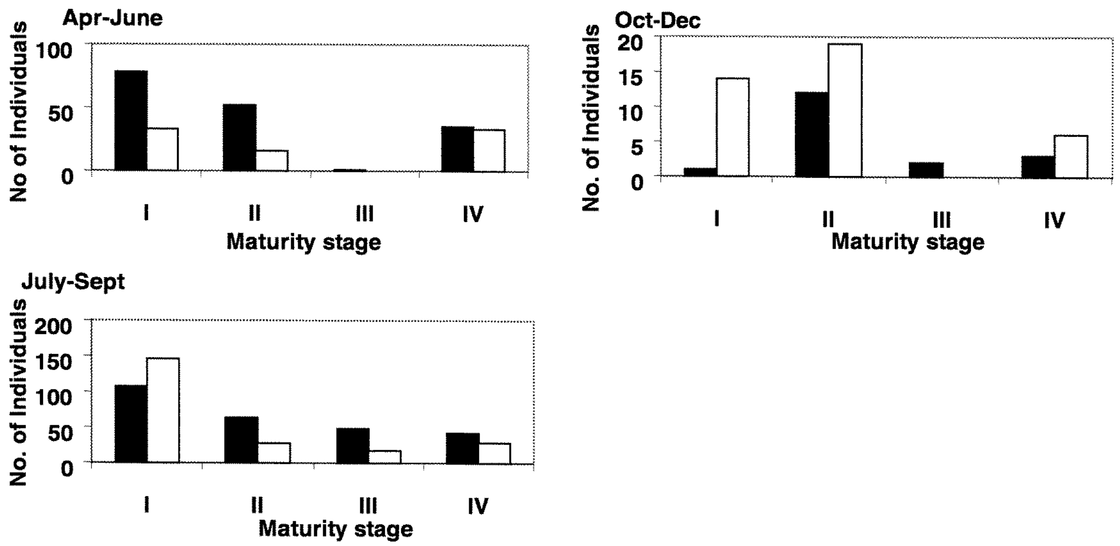


**Figure 5.11.62** *A. bairdii.* Distribution and relative abundance in number.

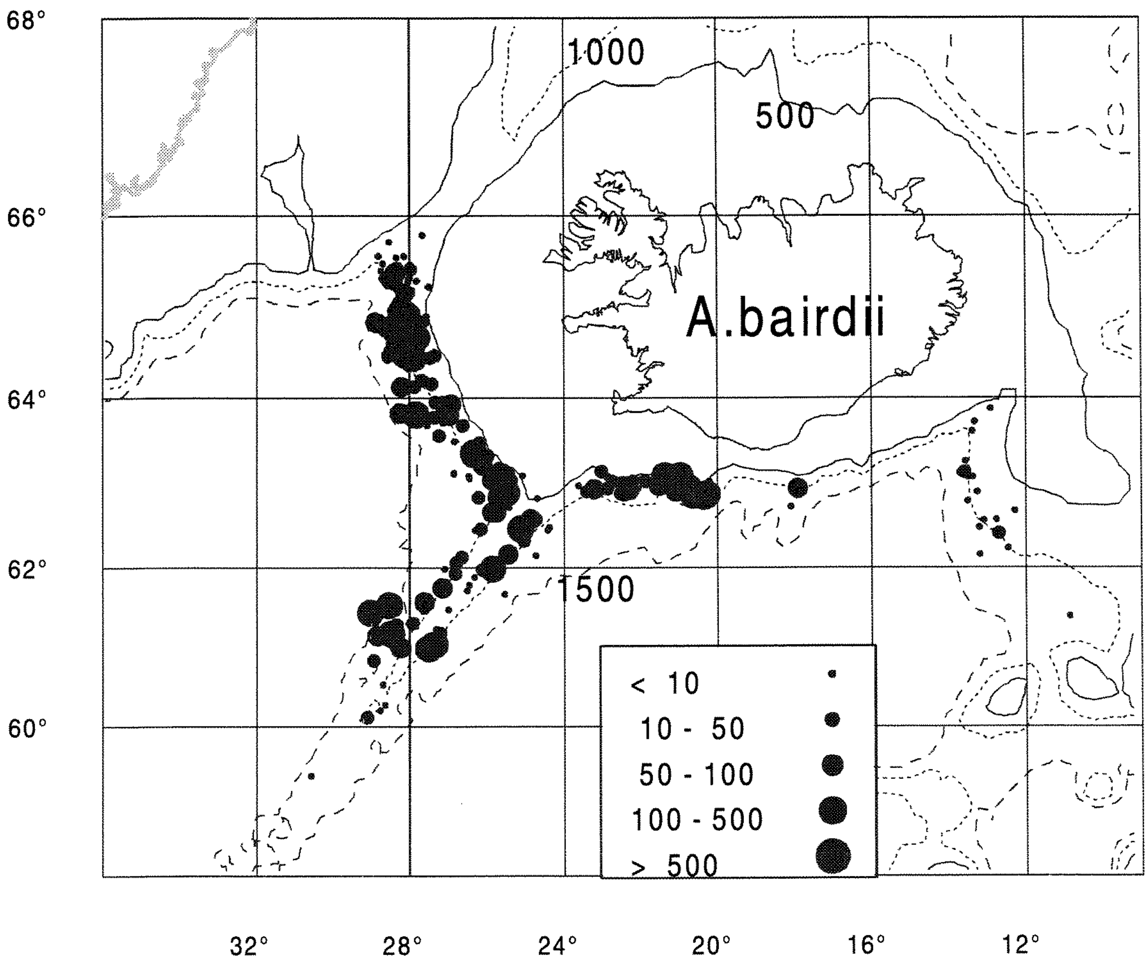



**Figure 5.11.63** *A. bairdii.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

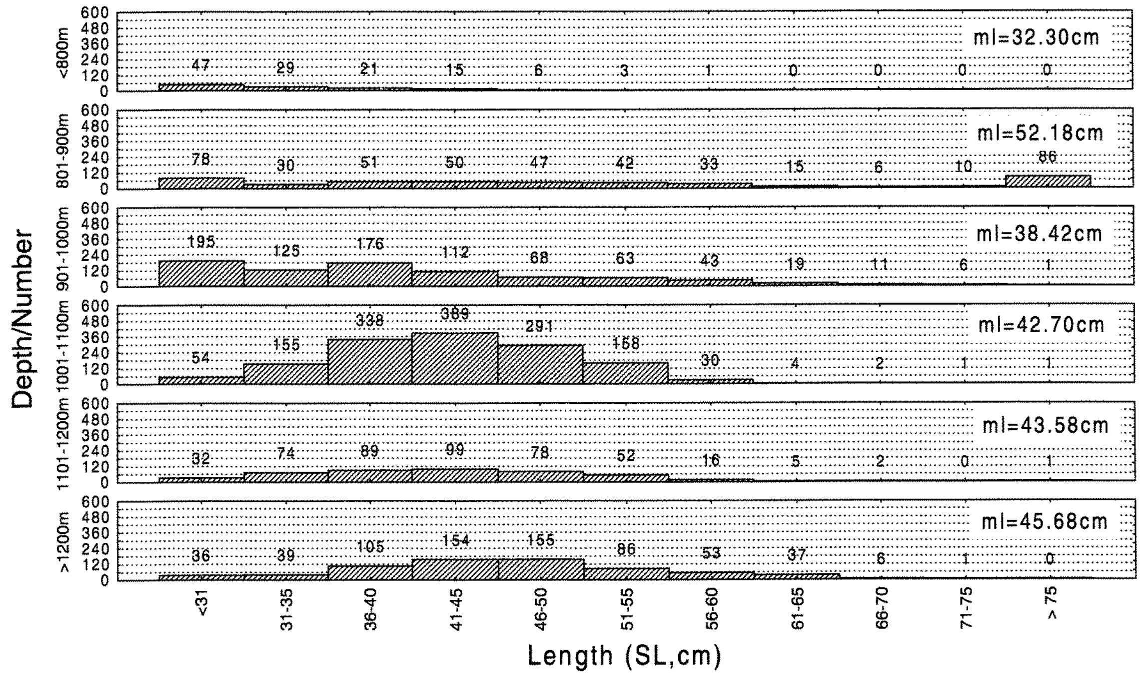


**Figure 5.11.64** *A. bairdii.* Length and mean length (ml) by depth intervals and sex.

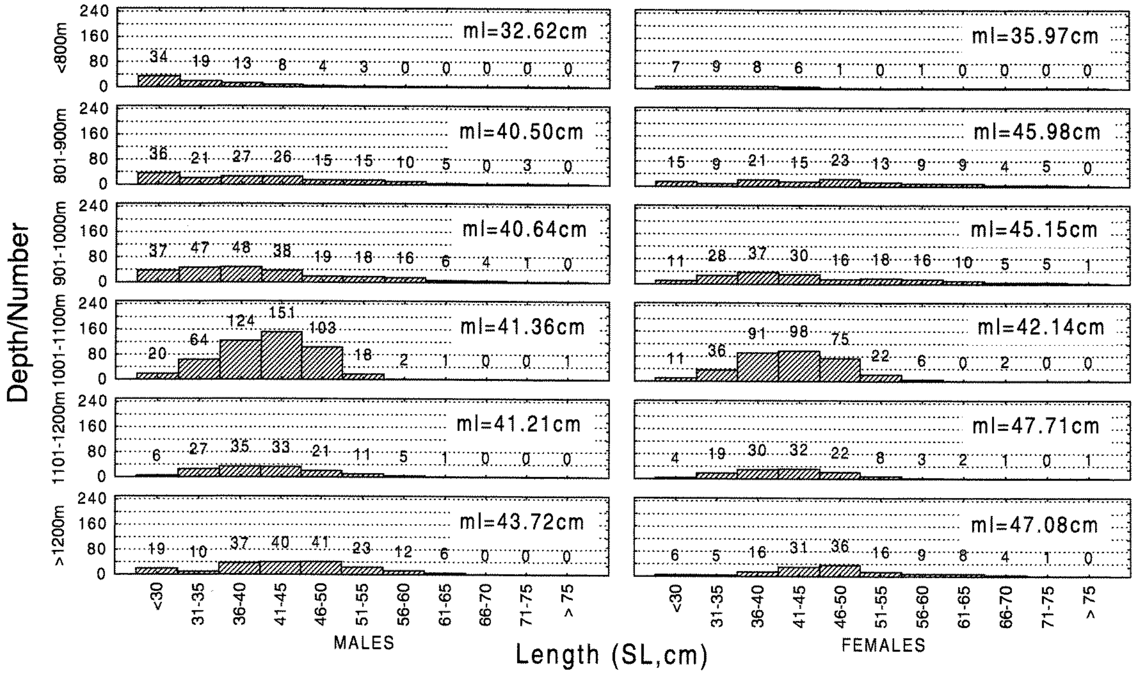



**Figure 5.11.65** *A. bairdii.* Length distribution by sex.

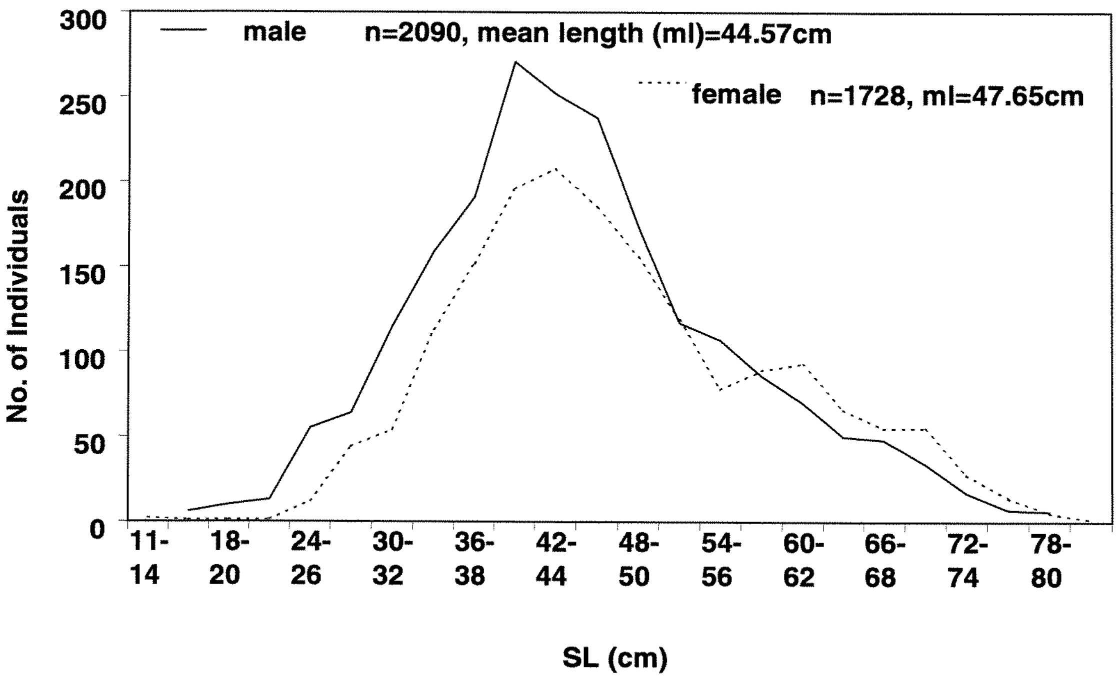


Figure 5.11.66 *A. bairdii.* Length-weight relationship.

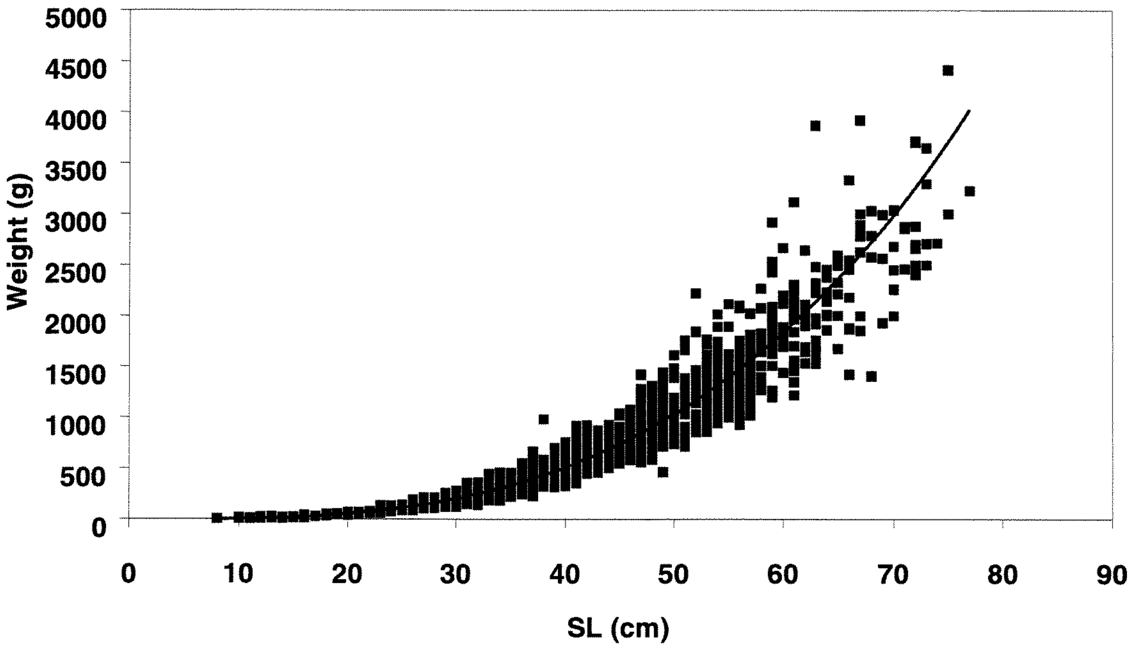



Figure 5.11.67 *A. bairdii.* Maturity stages by season (males: filled bars, females: open bars).

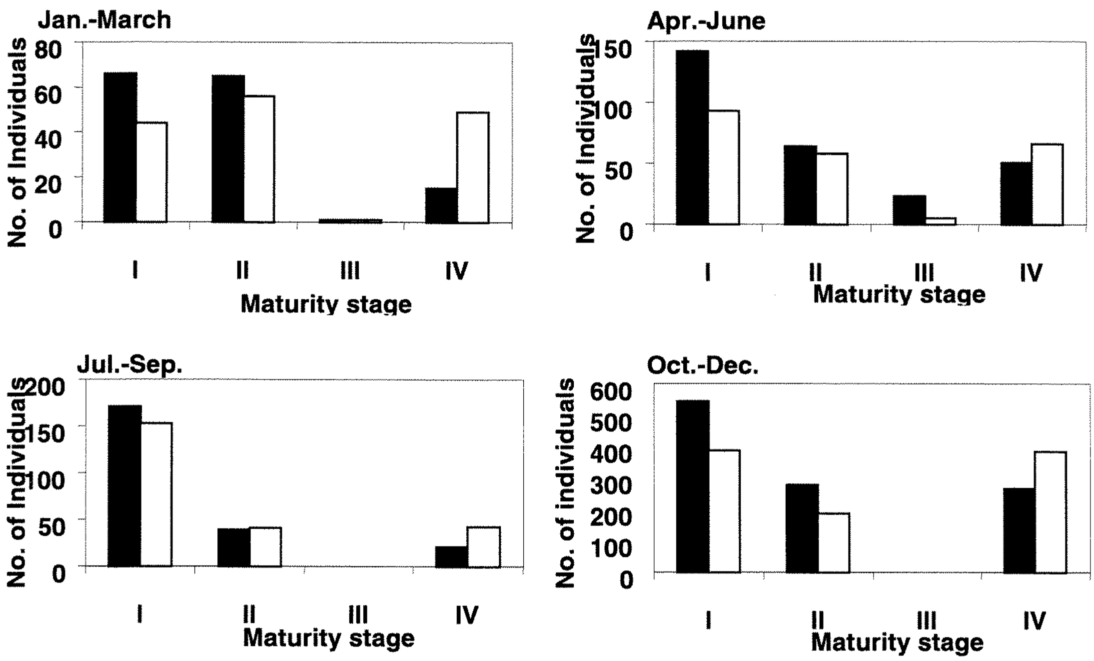


**Figure 5.11.68** *A. silus.* Distribution and relative abundance in numbers.

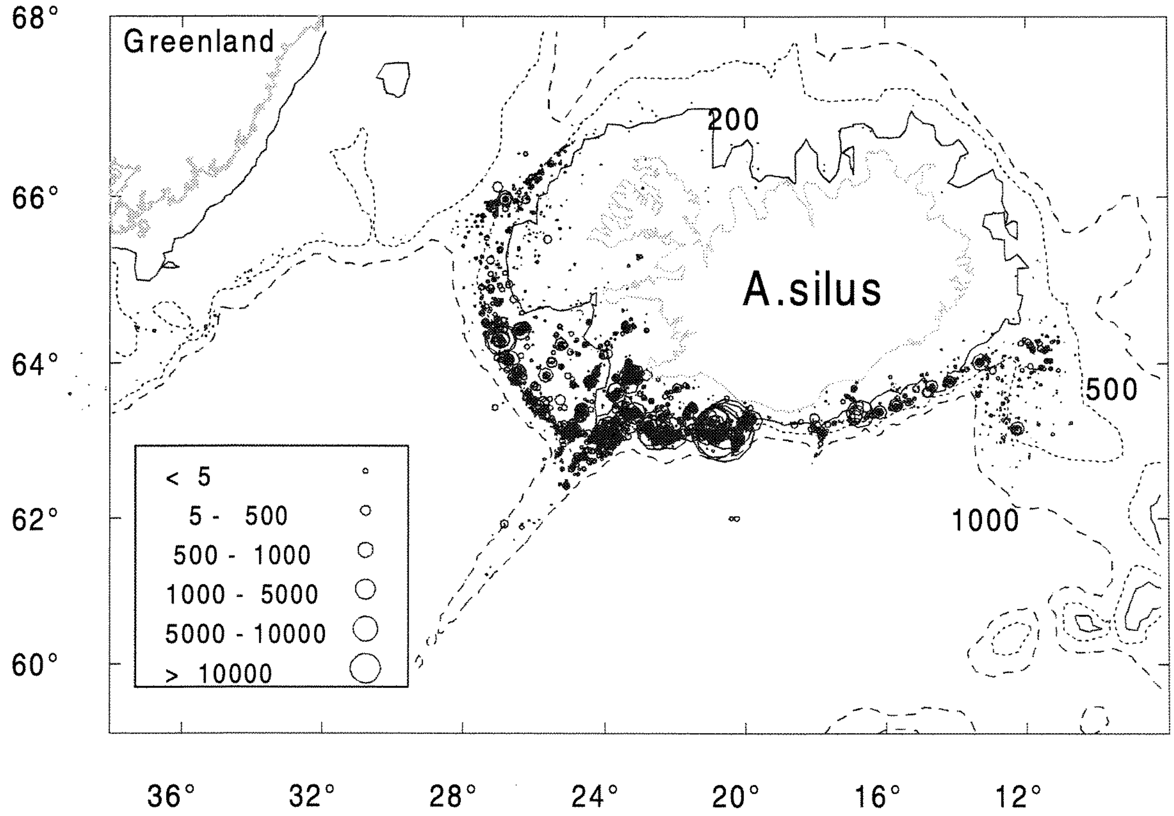



**Figure 5.11.69** *A. silus.* Length distribution by sex.

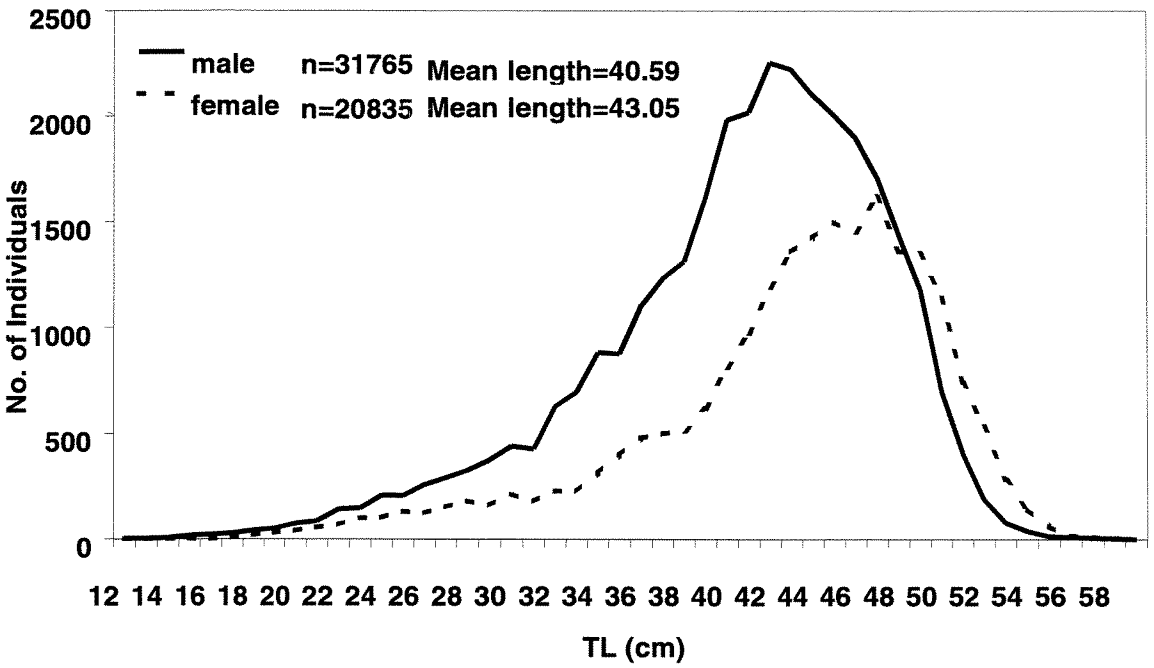


**Figure 5.11.70** *A. silus.* Length-weight relationship by sex.

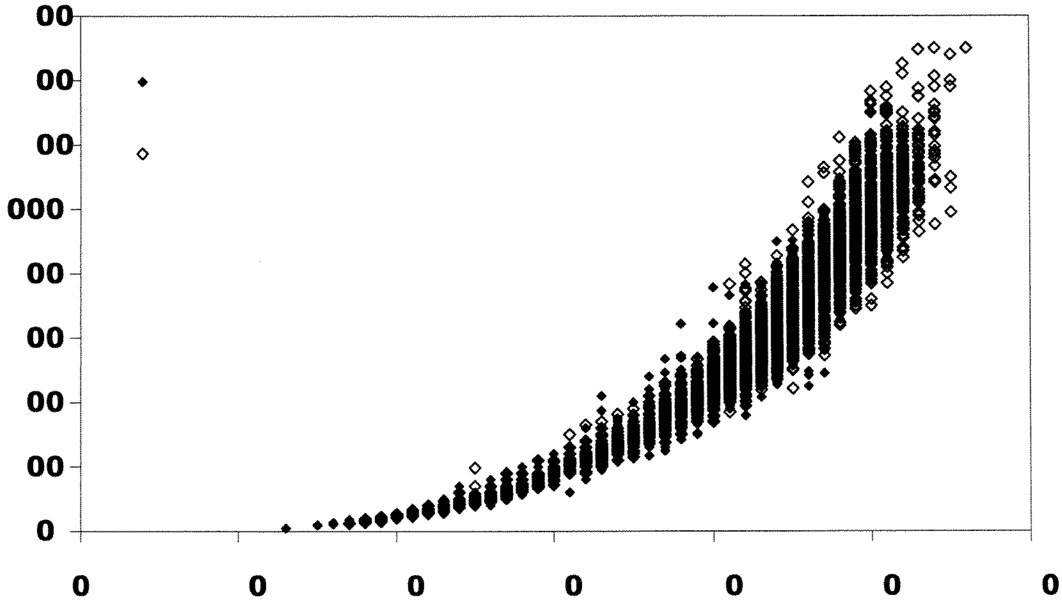



**Figure 5.11.71** *A. silus.* Maturity stages by season (males: filled bars, females: open bars).

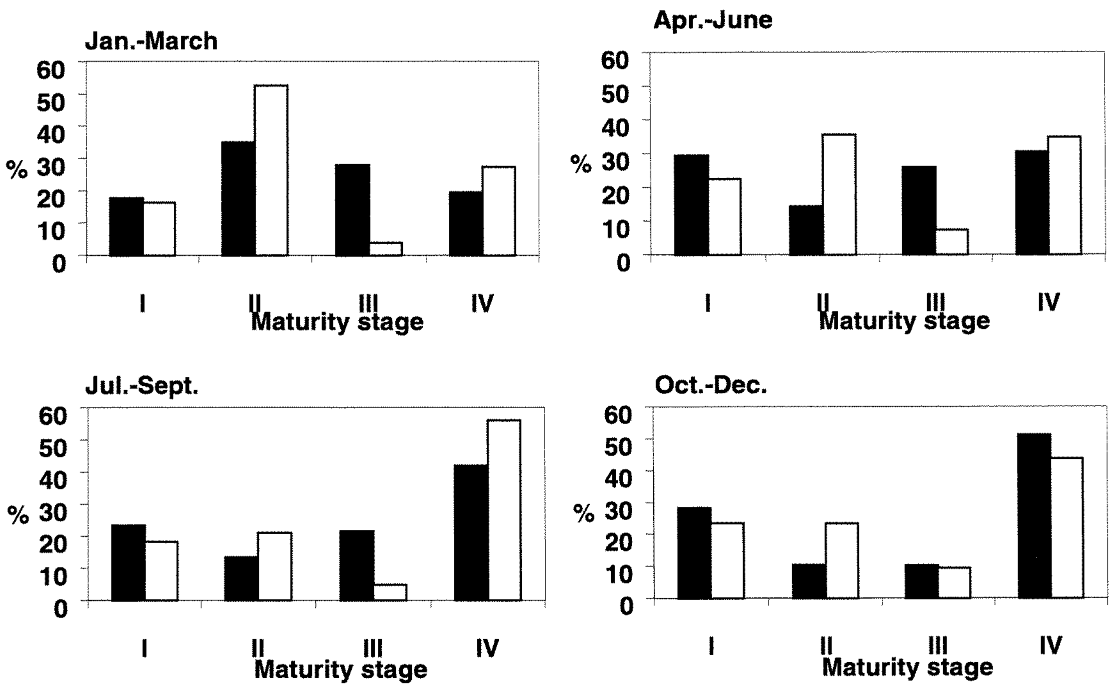


**Figure 5.11.72** *B. euryops.* Distribution and relative abundance in numbers.

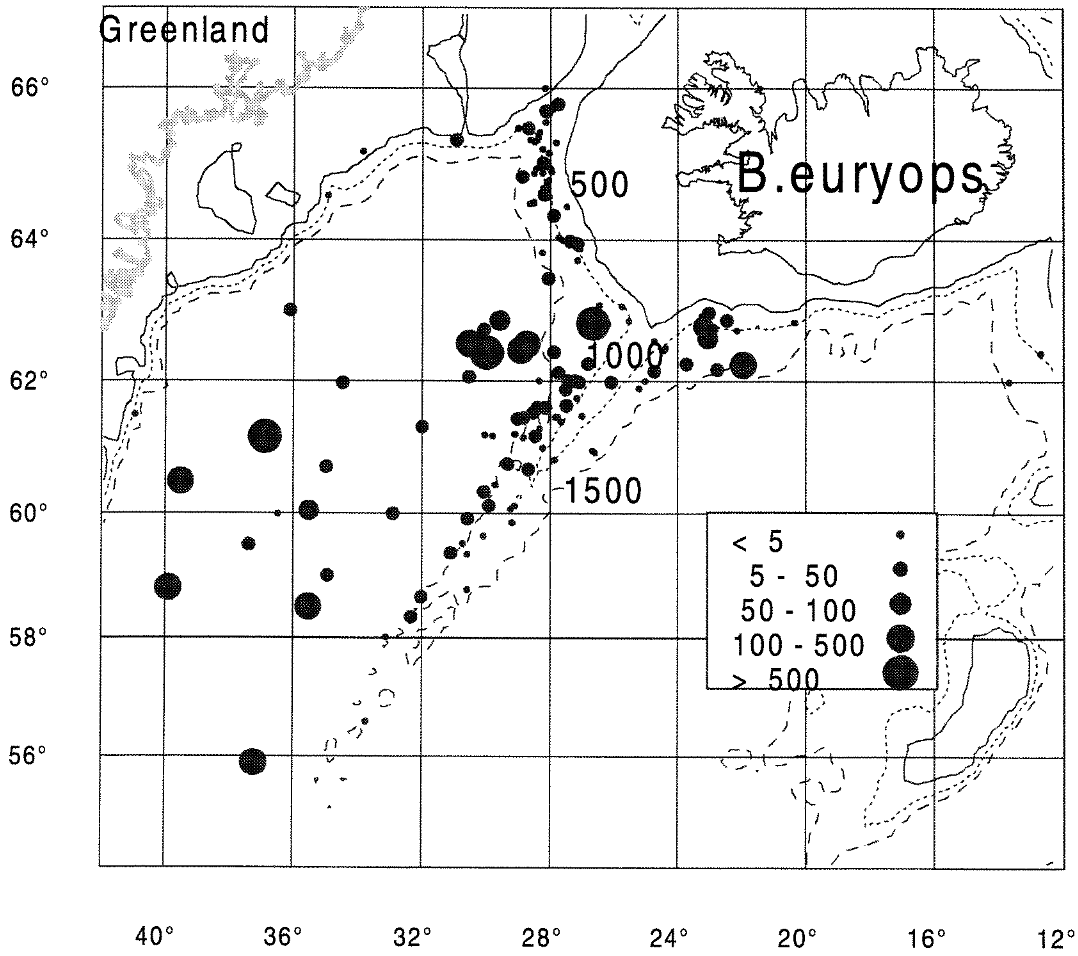



**Figure 5.11.73** *B. euryops.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

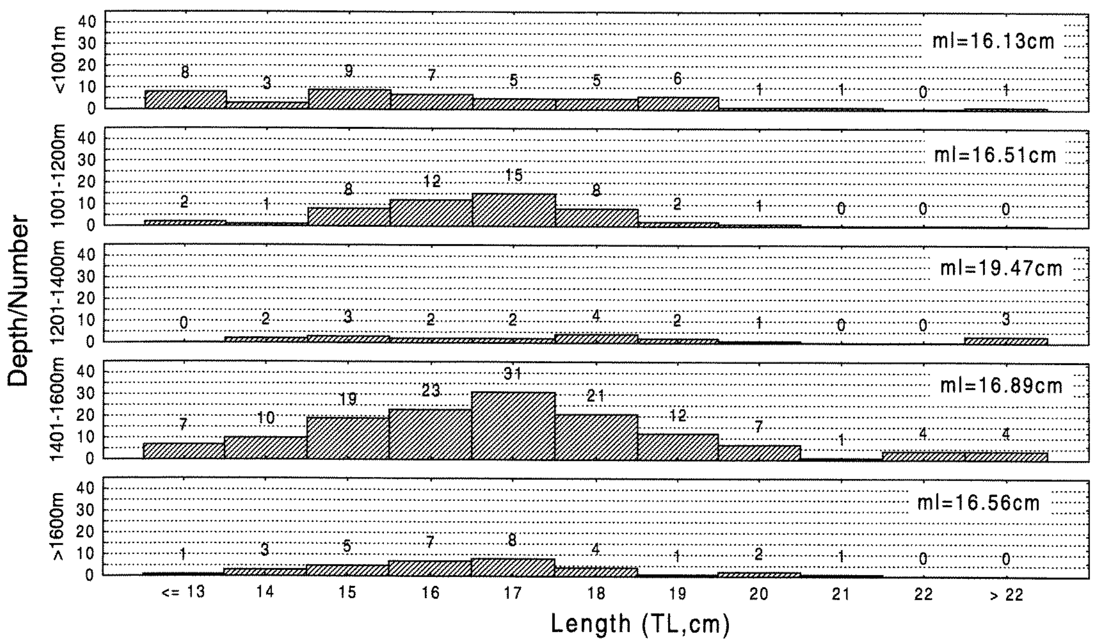


**Figure 5.11.74** *B. euryops.* Length distribution by sex.

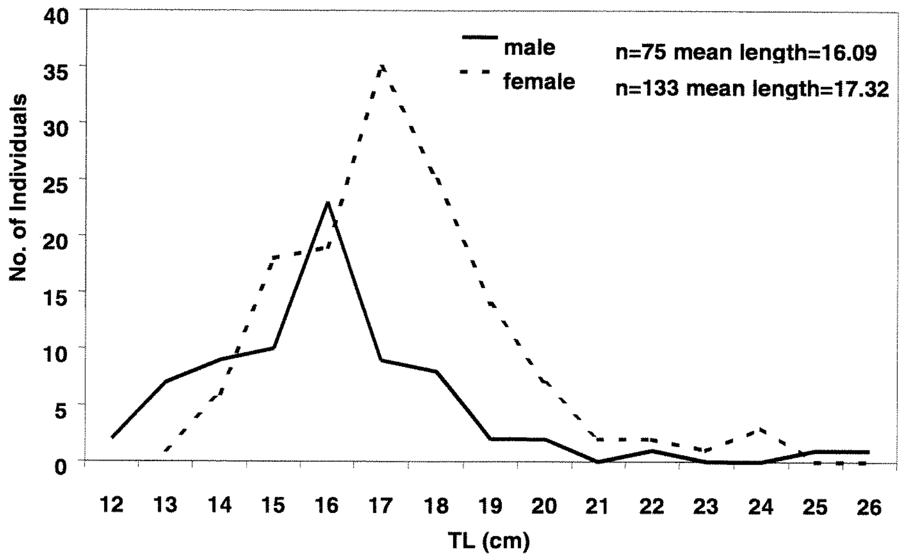



**Figure 5.11.75** *B. euryops.* Length-weight relationship.

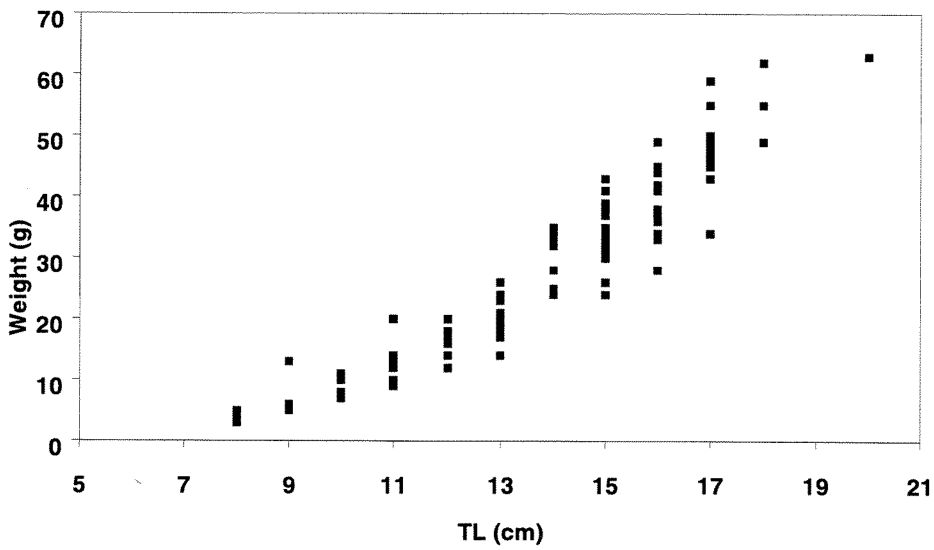



**Figure 5.11.76** *B. euryops.* Maturity stages in July-September (males: filled bars, females: open bars).

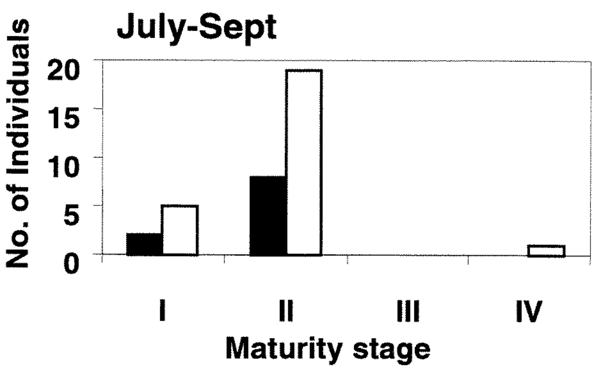


**Figure 5.11.77** *S. kaupi.* Distribution and relative abundance in numbers.

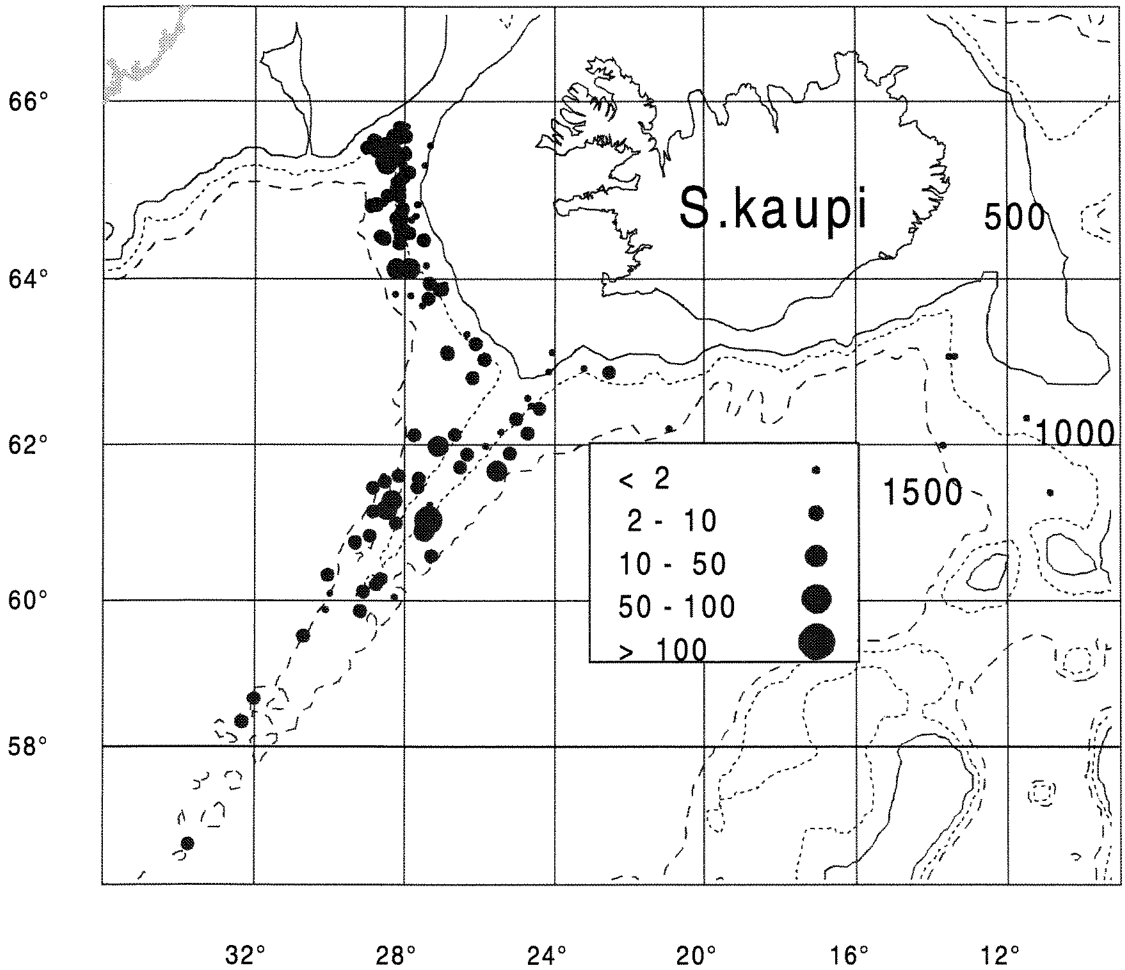



**Figure 5.11.78** *S. kaupi.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

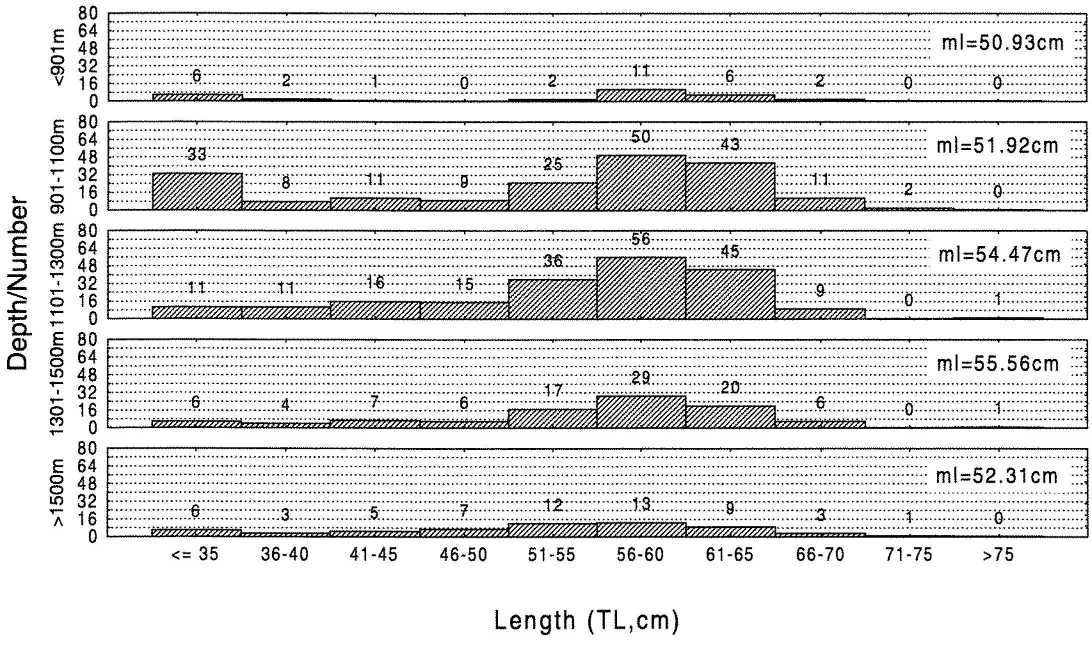


**Figure 5.11.79** *S. kaupi.* Length and mean length (ml) by depth intervals and sex.

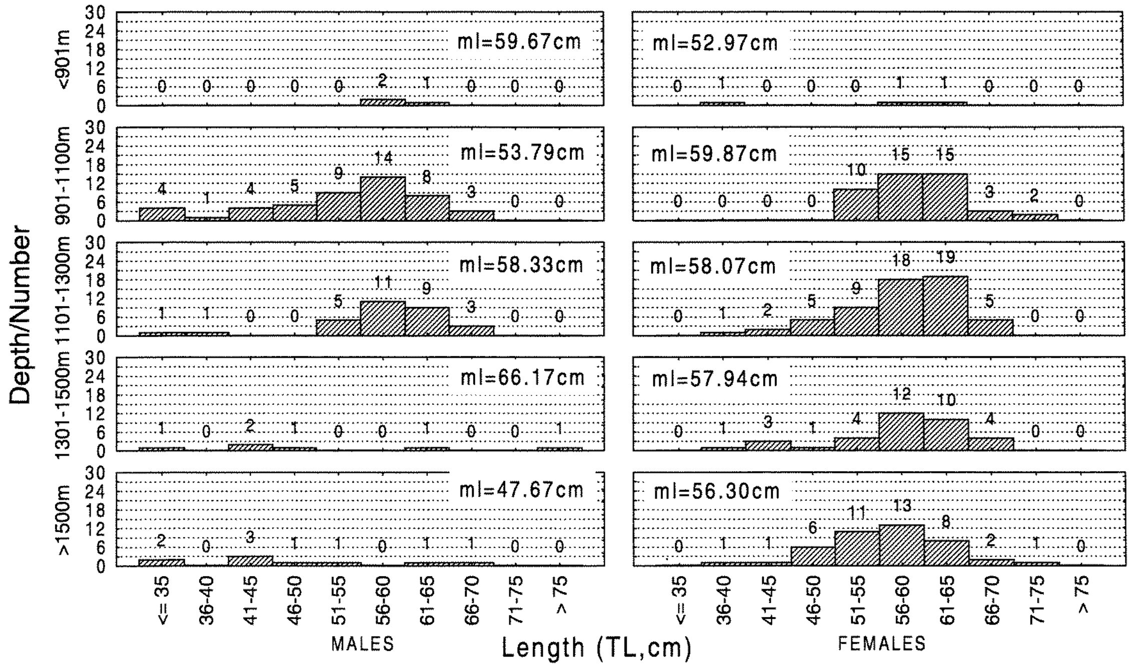



**Figure 5.11.80** *S. kaupi.* Length distribution by sex.

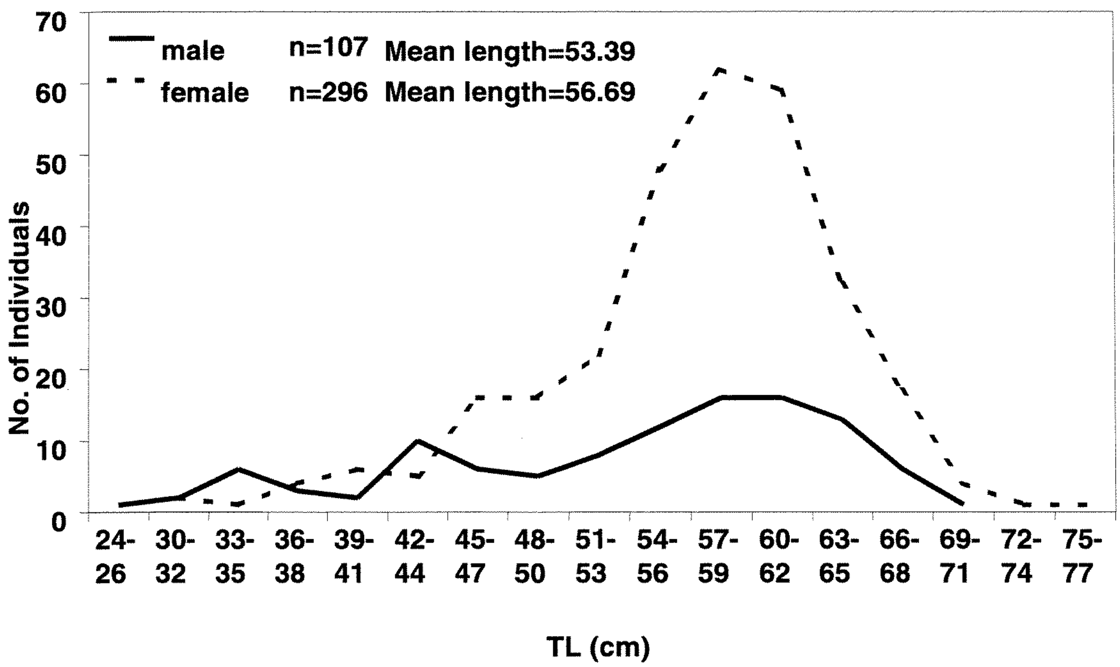


**Figure 5.11.81** *S. kaupi.* Length weight relationship by sex.

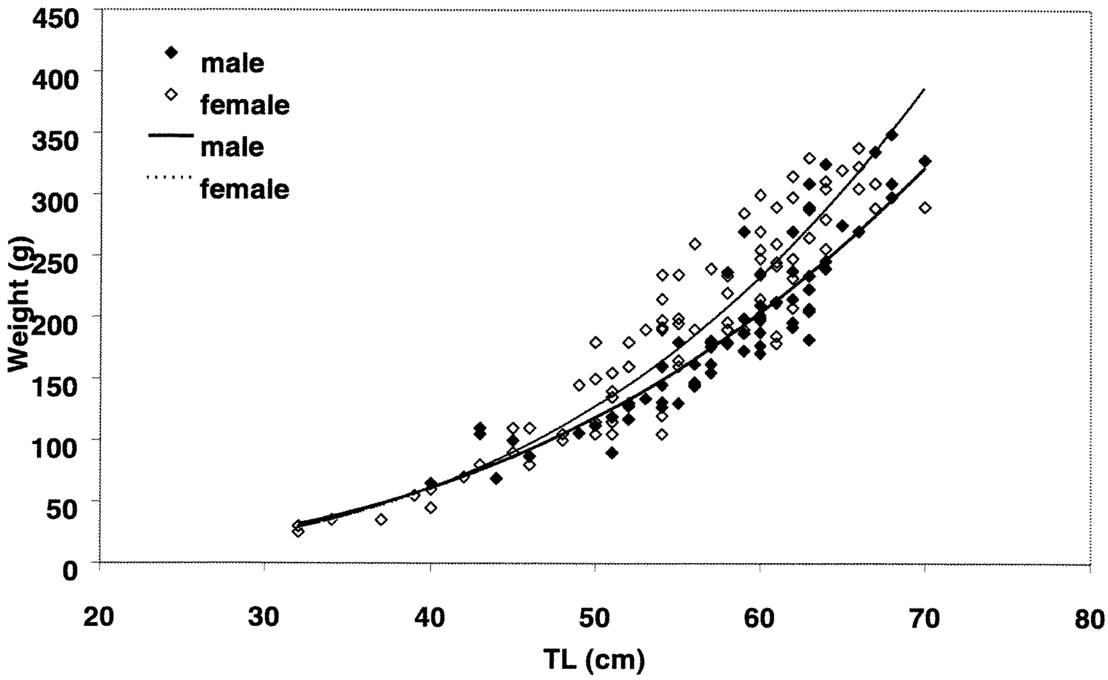



**Figure 5.11.82** *S. kaupi.* Maturity stages by season (males: filled bars, females: open bars).

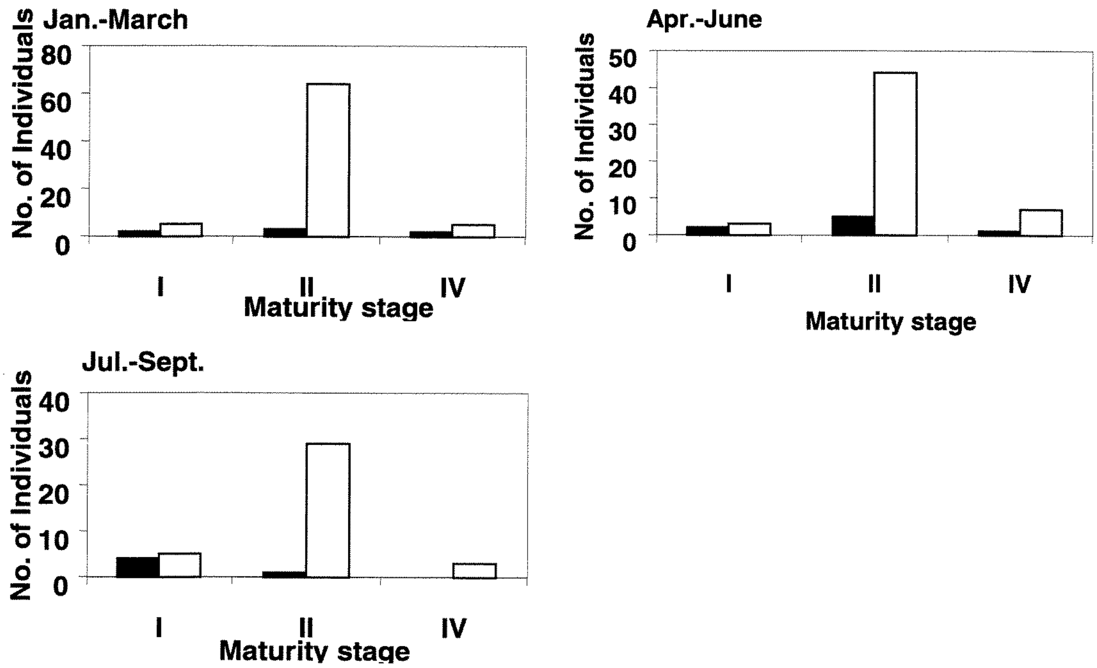


**Figure 5.11.83** *N. chemnitzii.* Distribution and relative abundance in numbers.

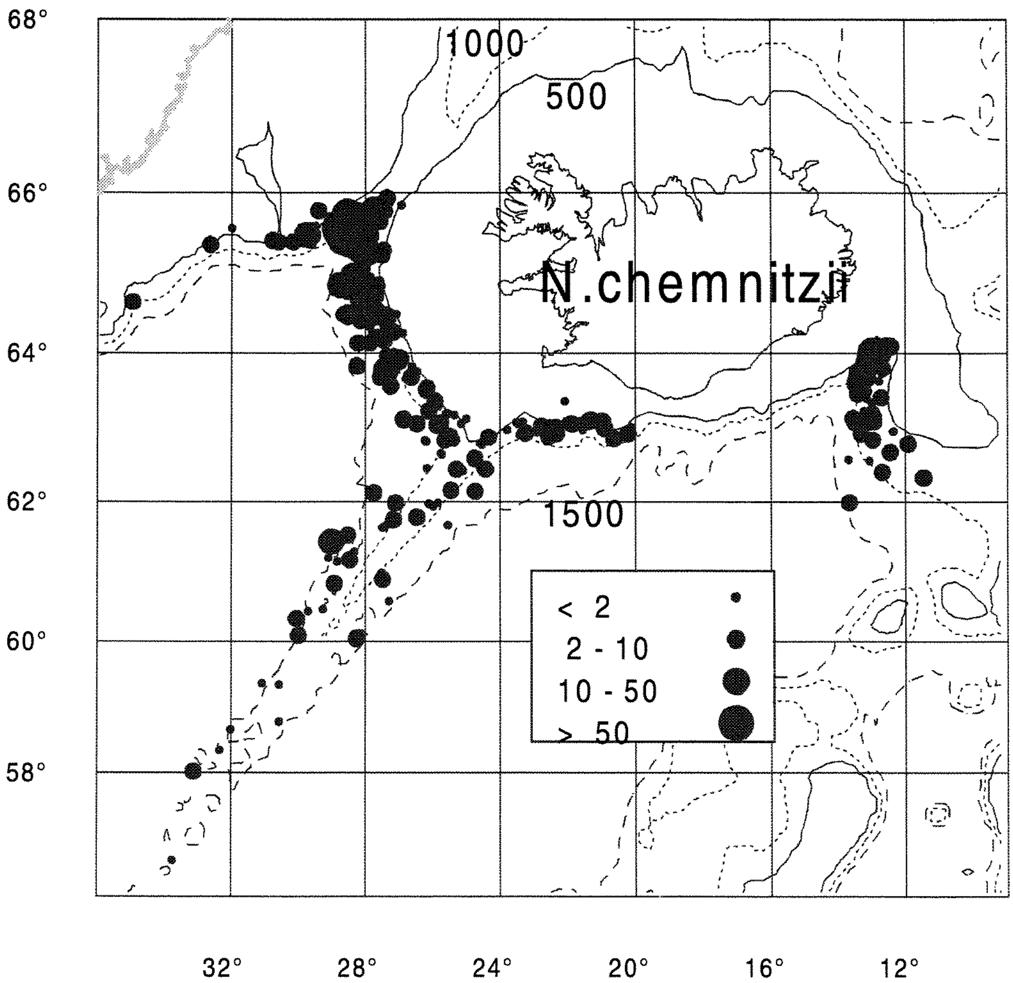



**Figure 5.11.84** *N. chemnitzii.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

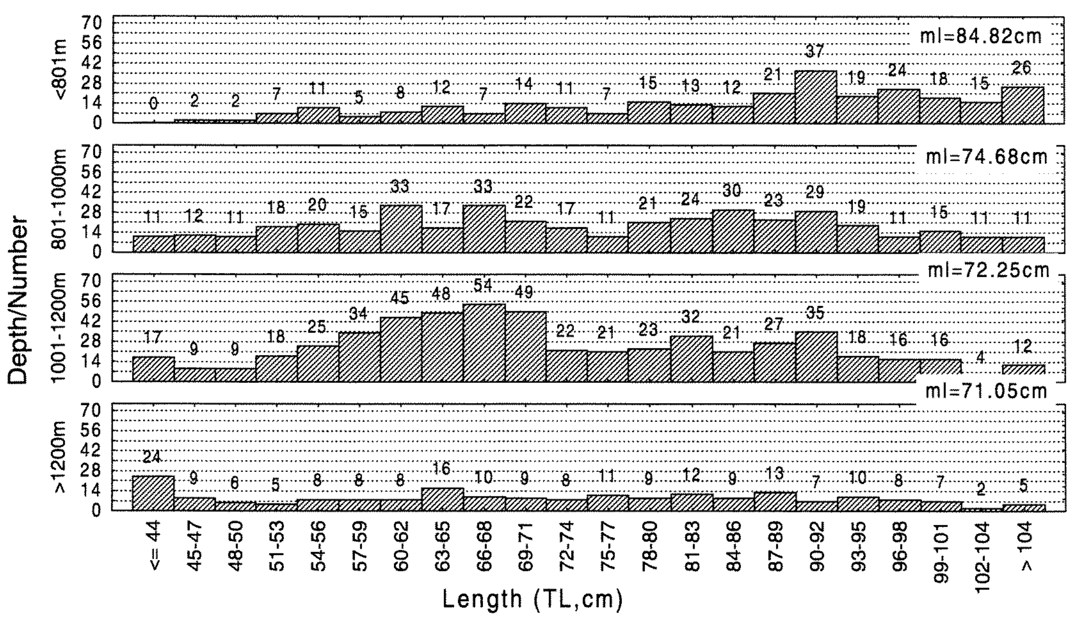


**Figure 5.11.85** *N. chemnitzii.* Length and mean length (ml) by depth intervals and sex.

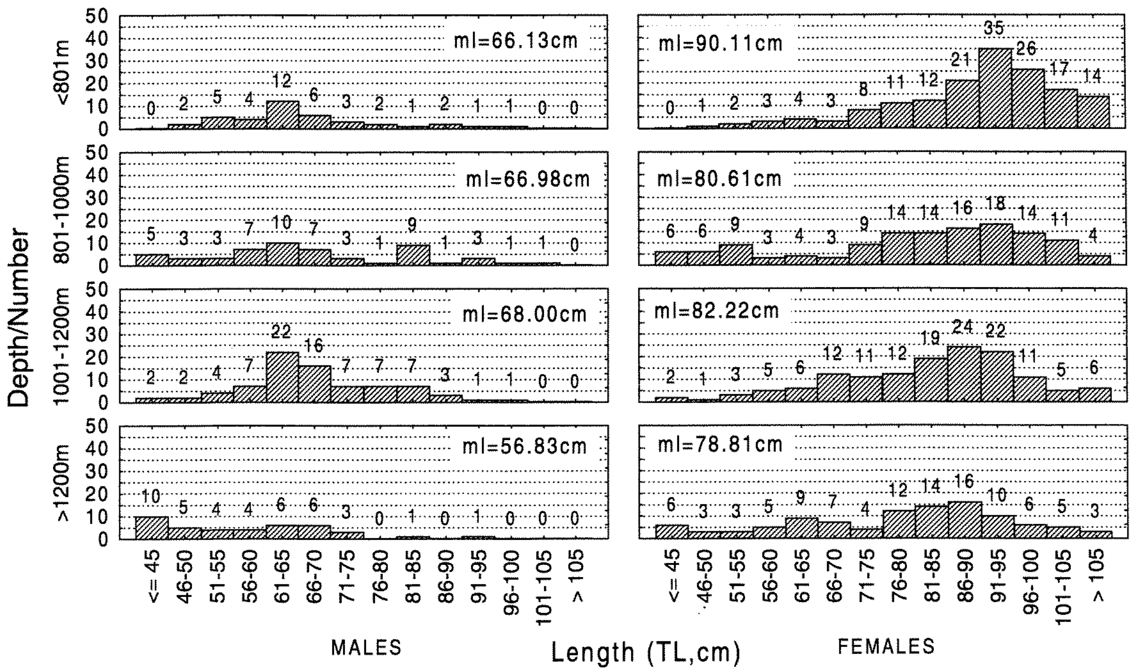



**Figure 5.11.86** *N. chemnitzii.* Length distribution by sex.

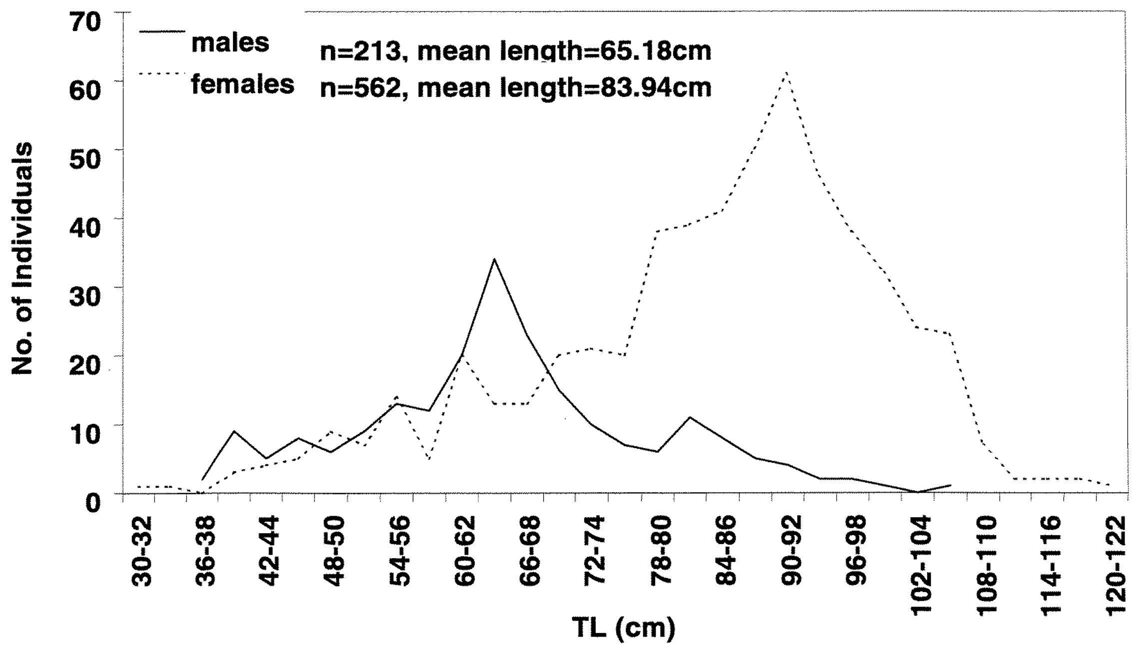


**Figure 5.11.87** *N. chemnitzii.* Length-weight relationship by sex.

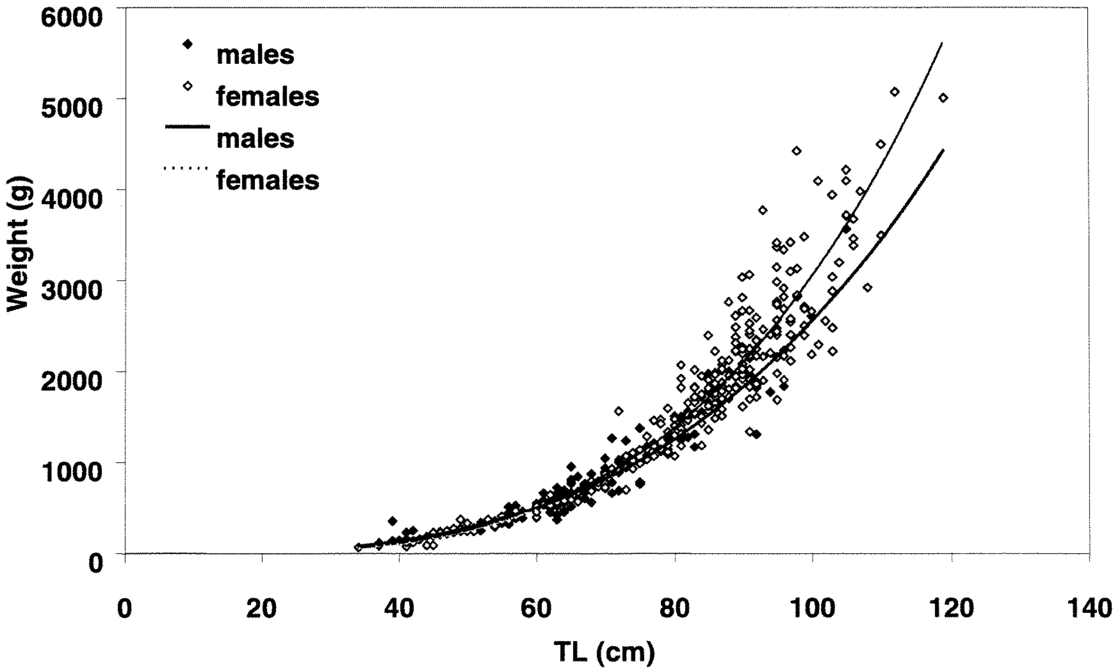



**Figure 5.11.88** *N. chemnitzii.* Maturity stages by season (males: filled bars, females: open bars).

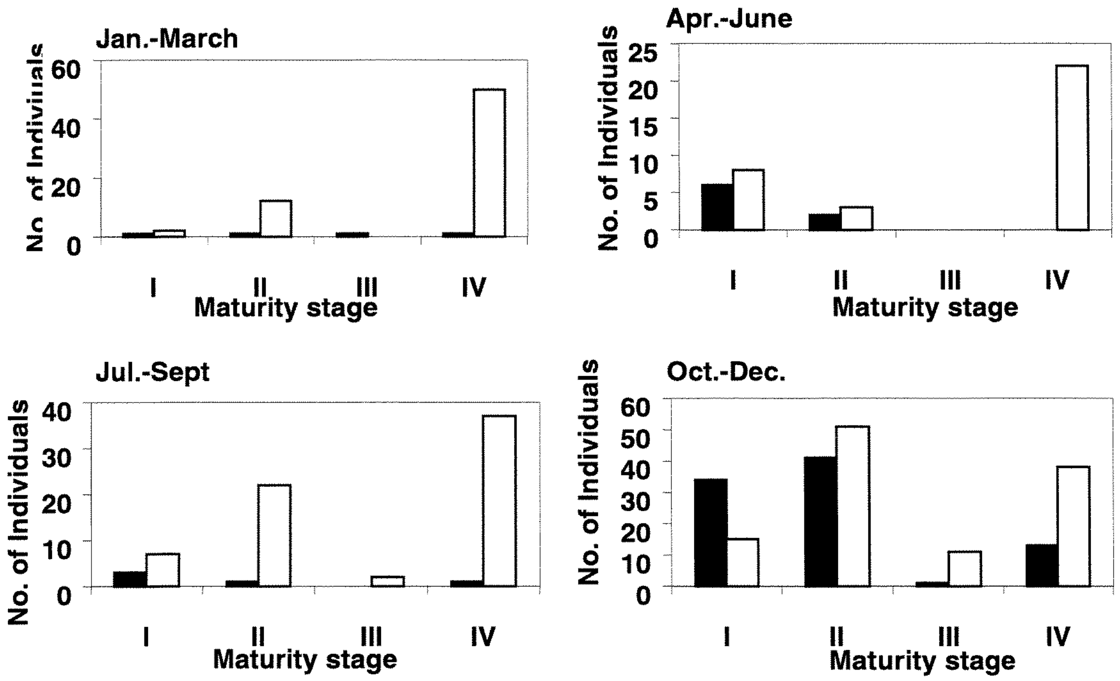


**Figure 5.11.89** *C. rupestris.* Distribution and relative abundance in numbers.

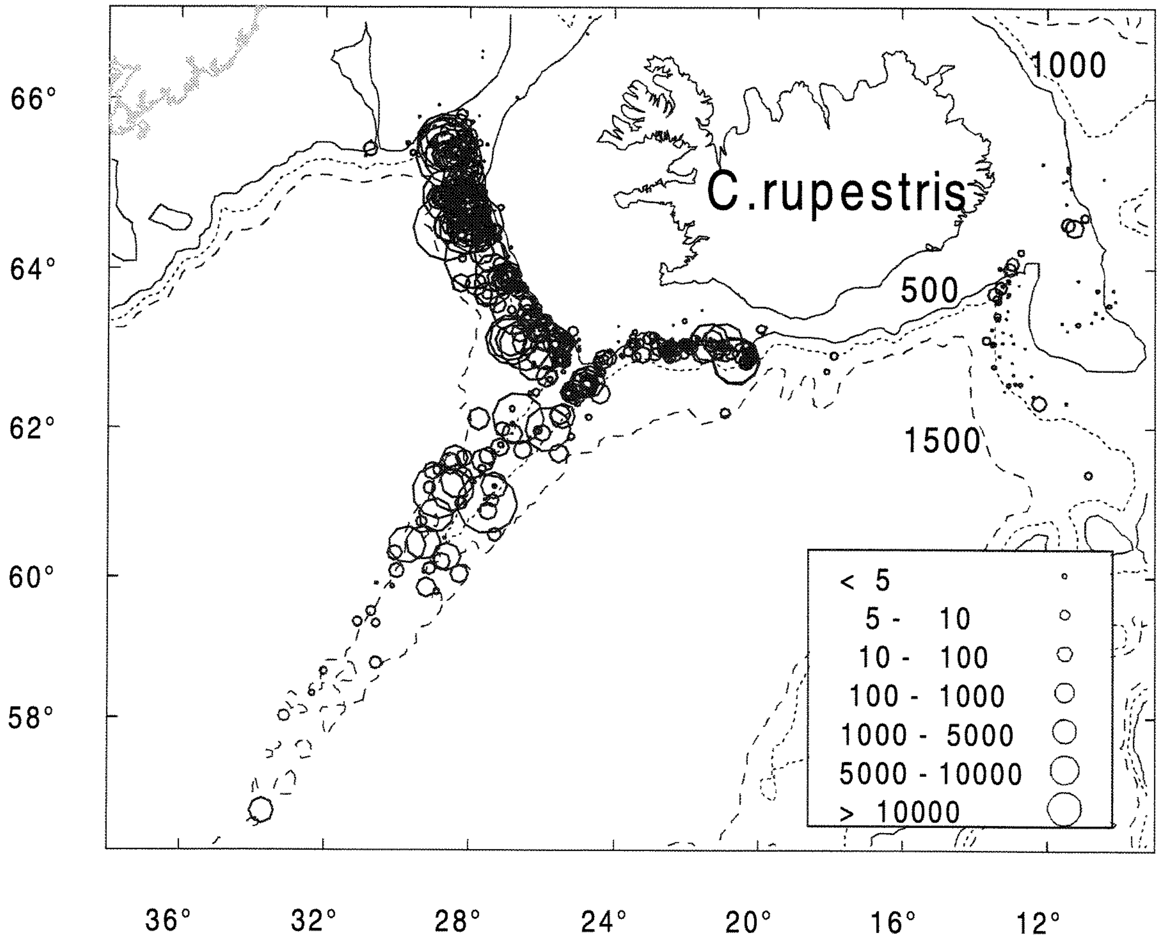



**Figure 5.11.90** *C. rupestris.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

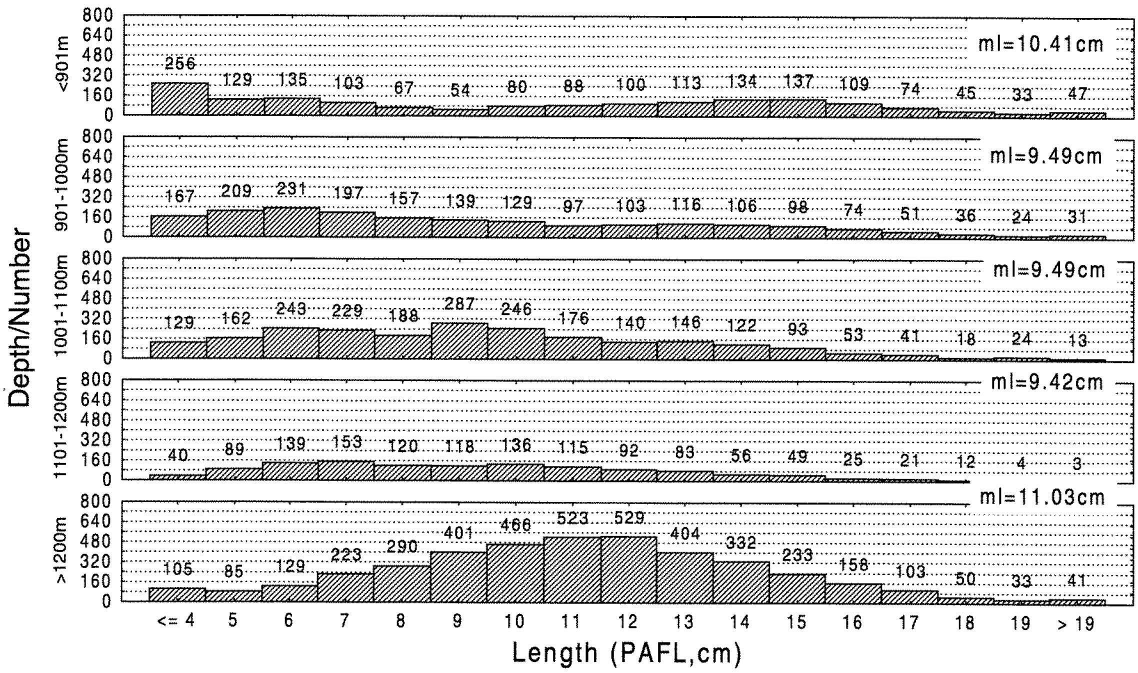


**Figure 5.11.91** *C. rupestris.* Length and mean length (ml) by depth intervals and sex.

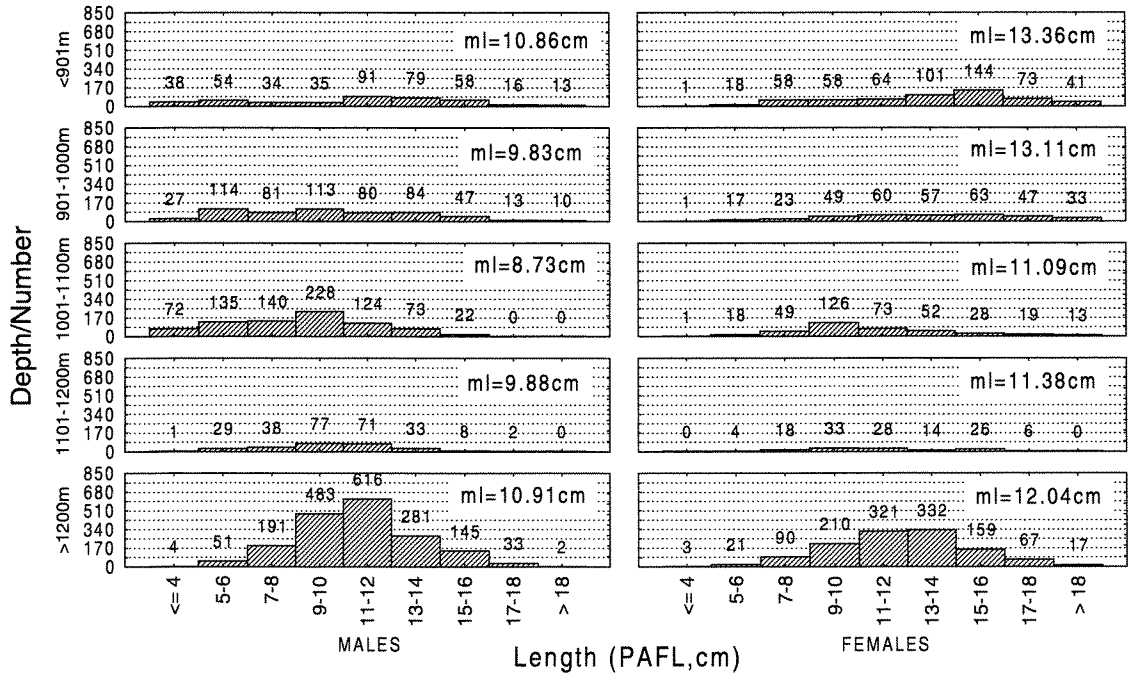



**Figure 5.11.92** *C. rupestris.* Length distribution by sex.

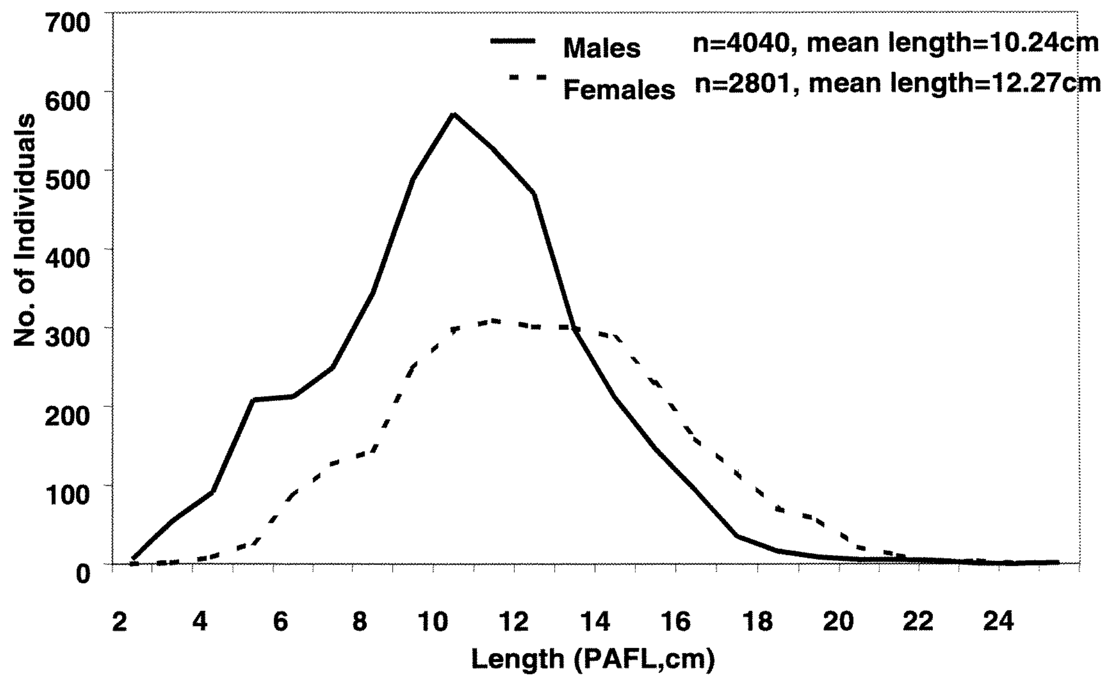


**Figure 5.11.93** *C. rupestris.* Length-weight relationship by sex.

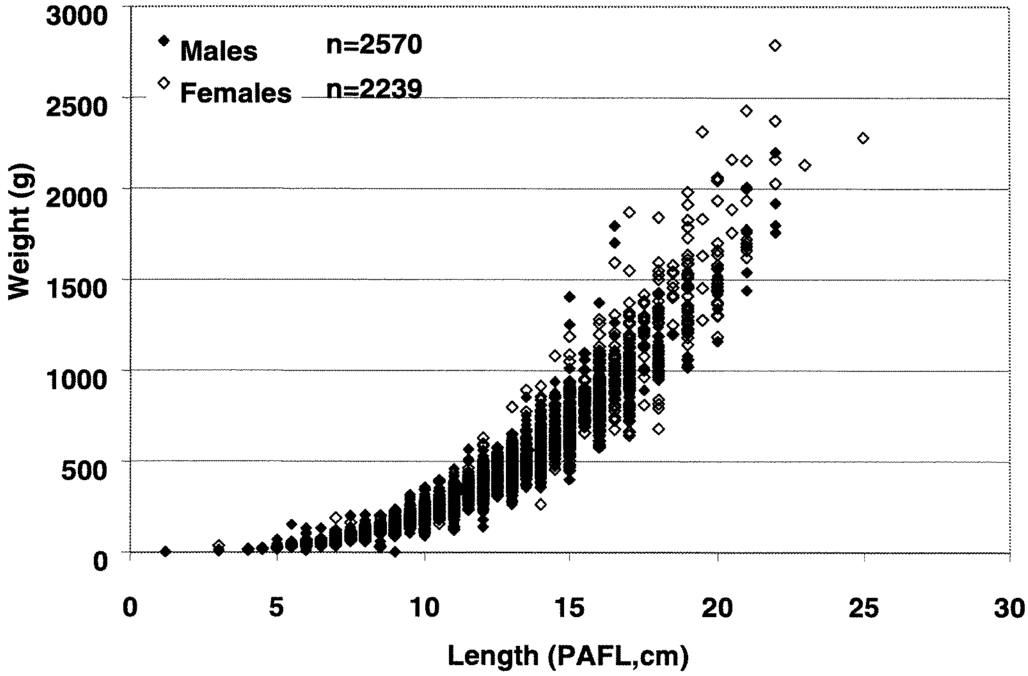



**Figure 5.11.94** *C. rupestris.* Maturity stages by season (males: filled bars, females: open bars).

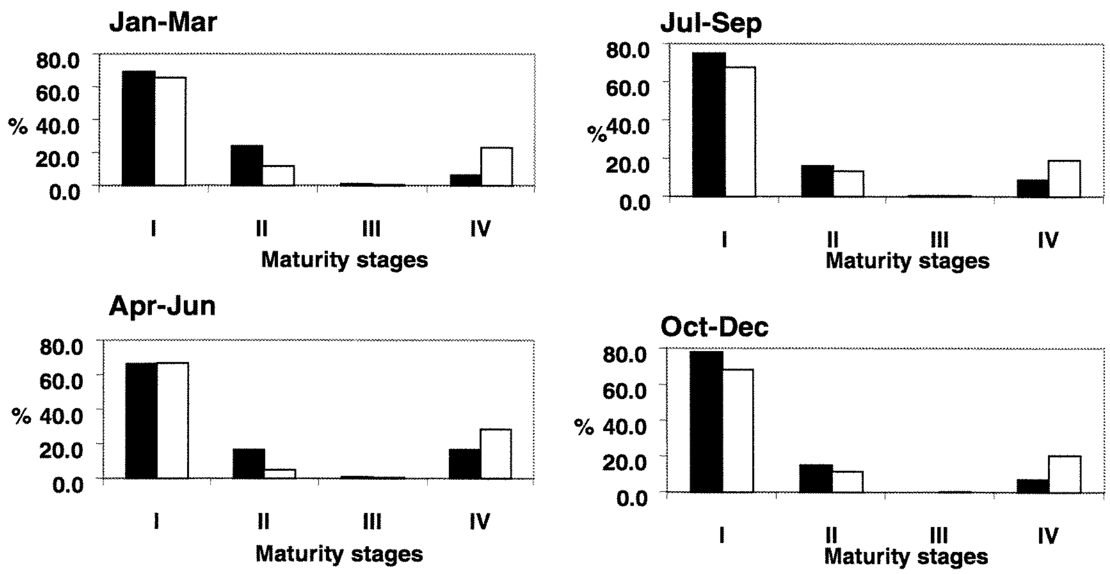


**Figure 5.11.95** *M. berglax.* Distribution and relative abundance in numbers.

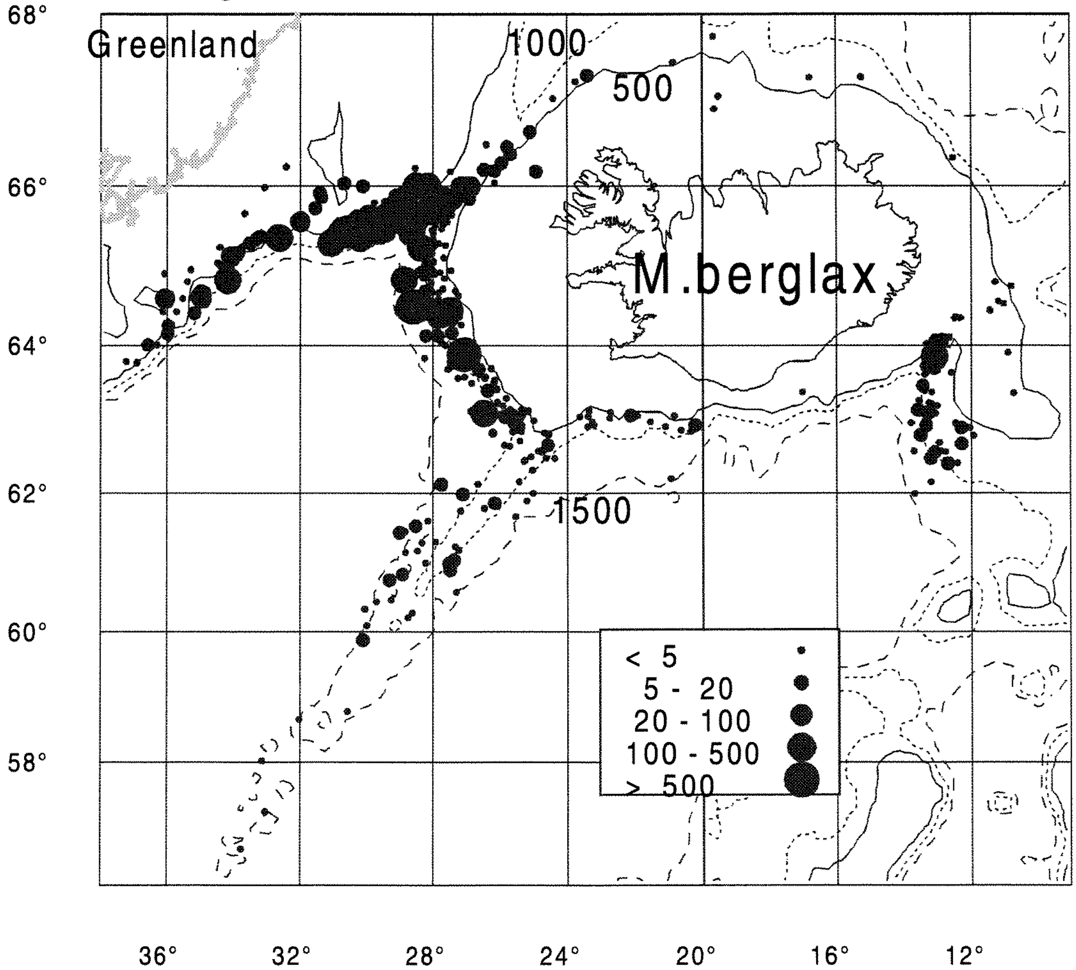



**Figure 5.11.96** *M. berglax.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

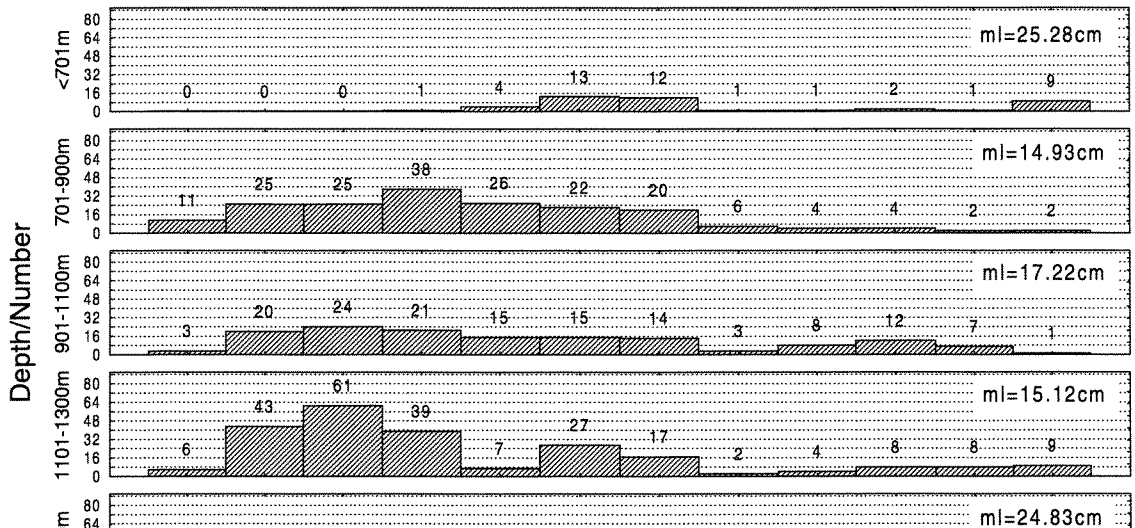


**Figure 5.11.97** *M. berglax.* Length and mean length (ml) by depth intervals and sex.

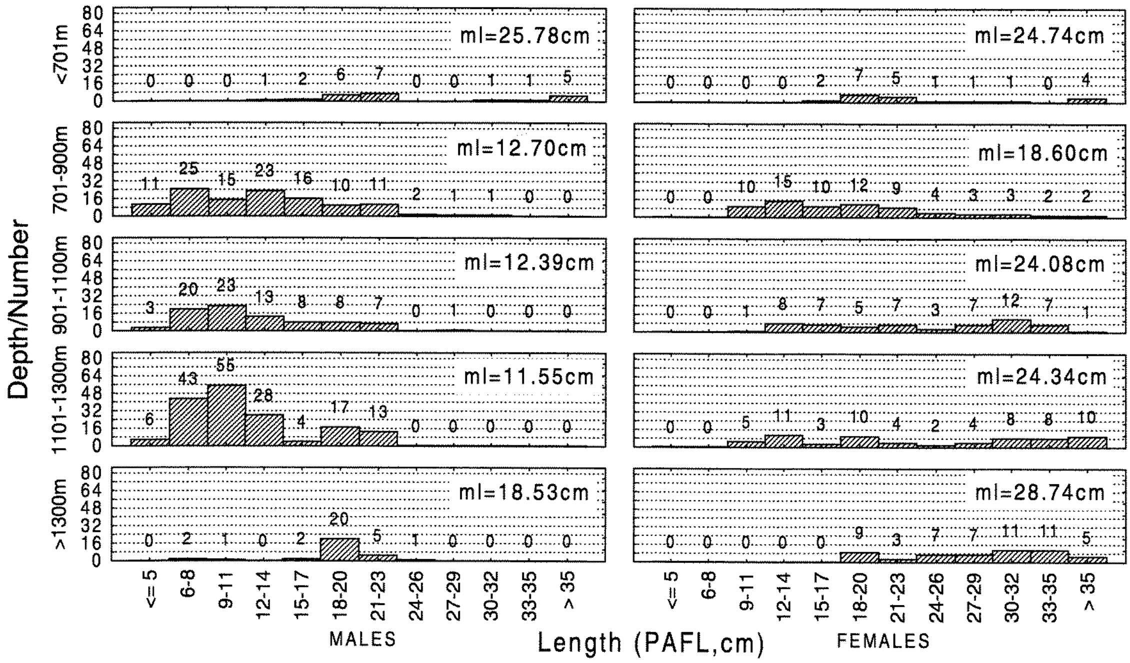



**Figure 5.11.98** *M. berglax.* Length distribution by sex.

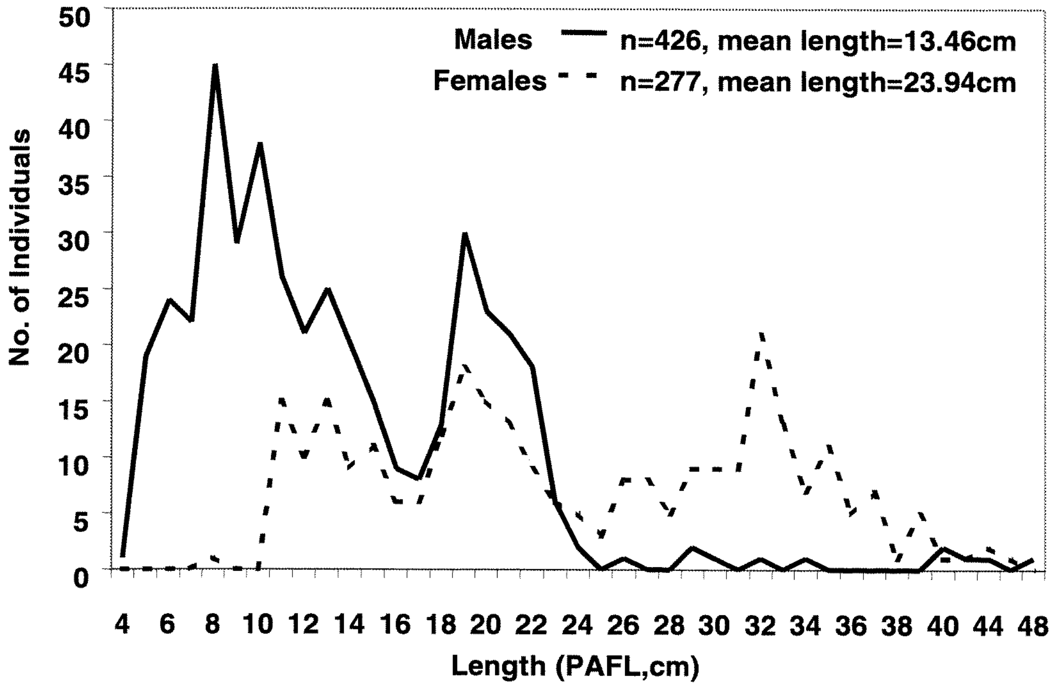


**Figure 5.11.99** *M. berglax.* Length-weight relationship by sex.

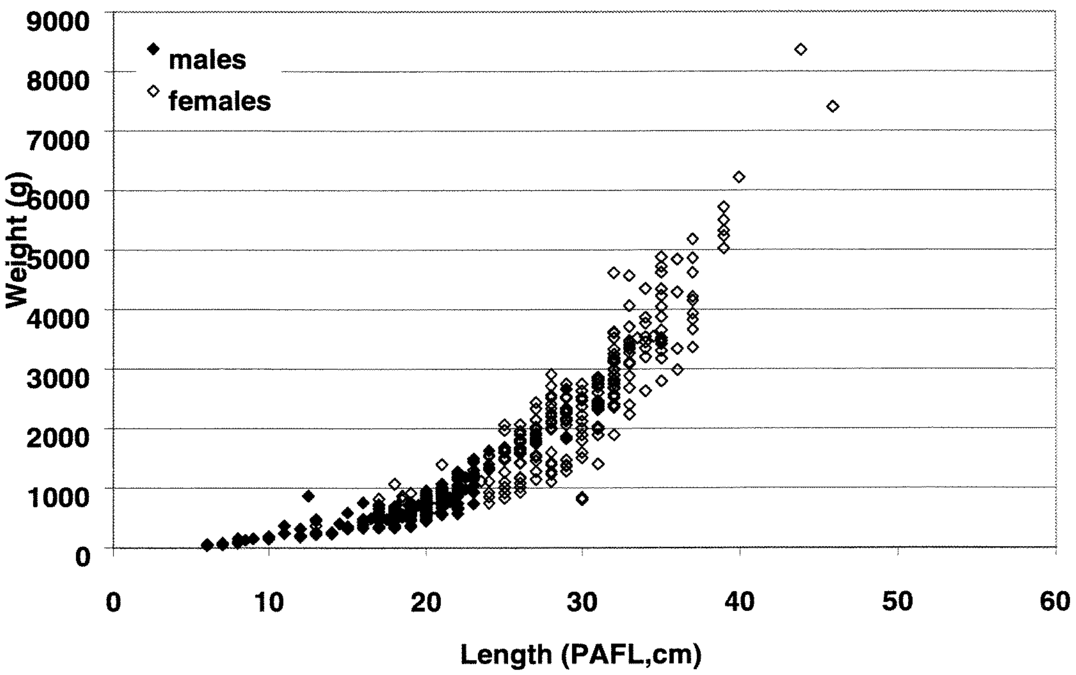



**Figure 5.11.100** *M. berglax.* Maturity stages by season (males: filled bars, females: open bars).

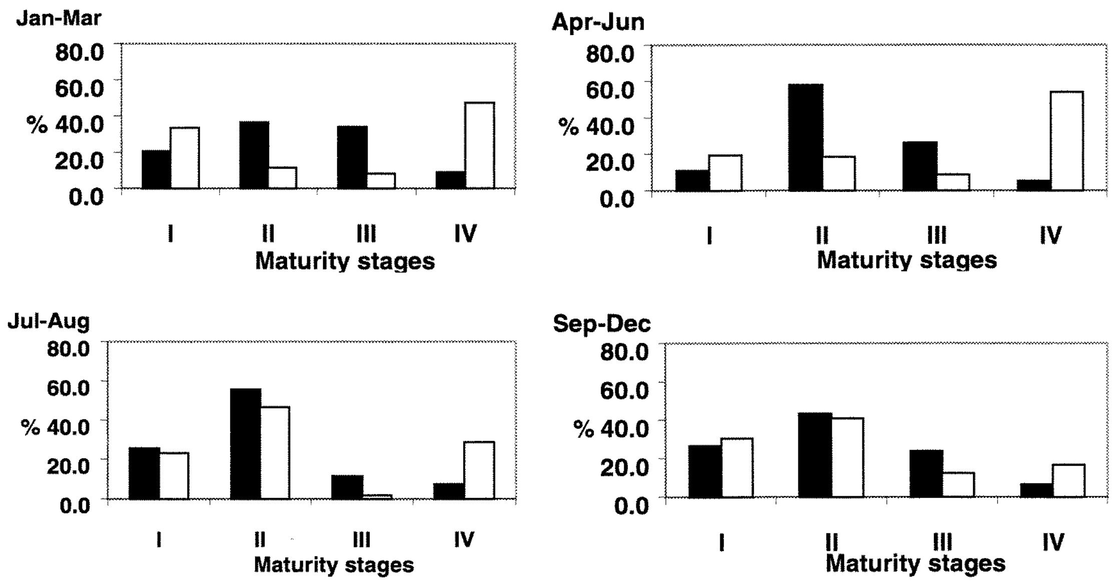


**Figure 5.11.101** *N. aequalis.* Distribution and relative abundance in numbers.

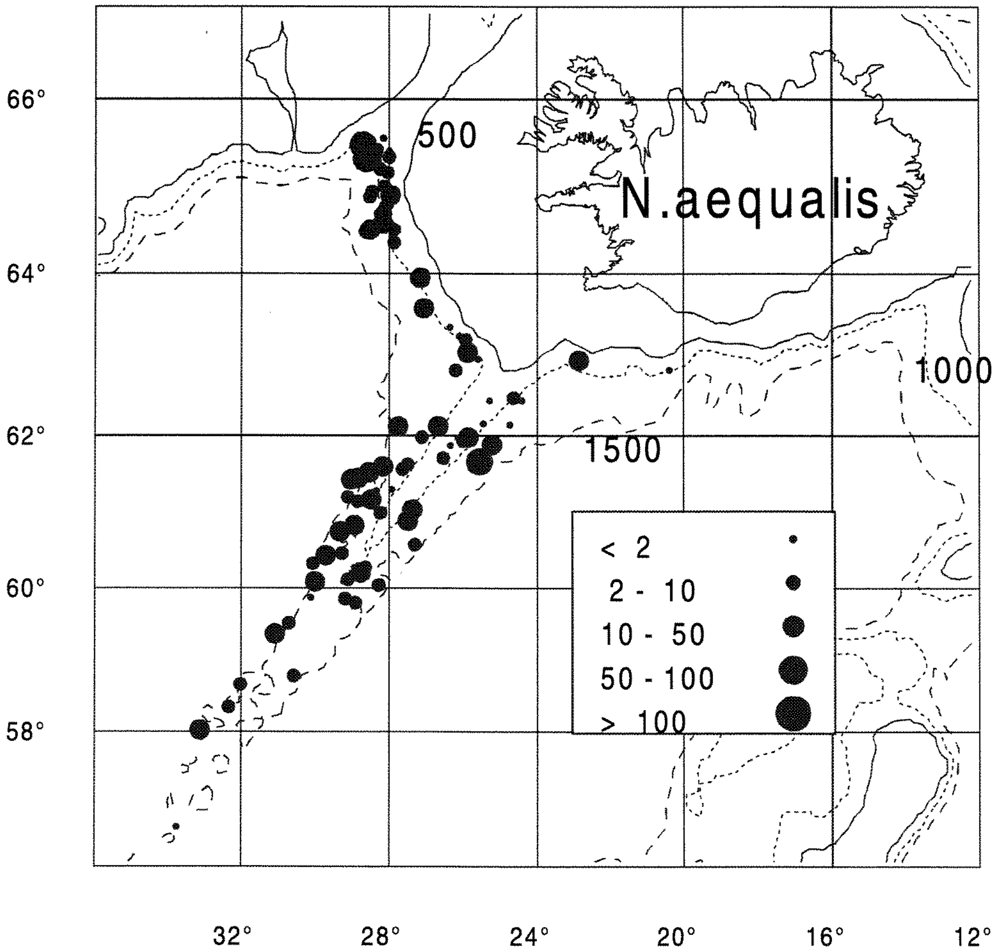



**Figure 5.11.102** *N. aequalis.* Length-depth relationship and mean length (ml) by 100

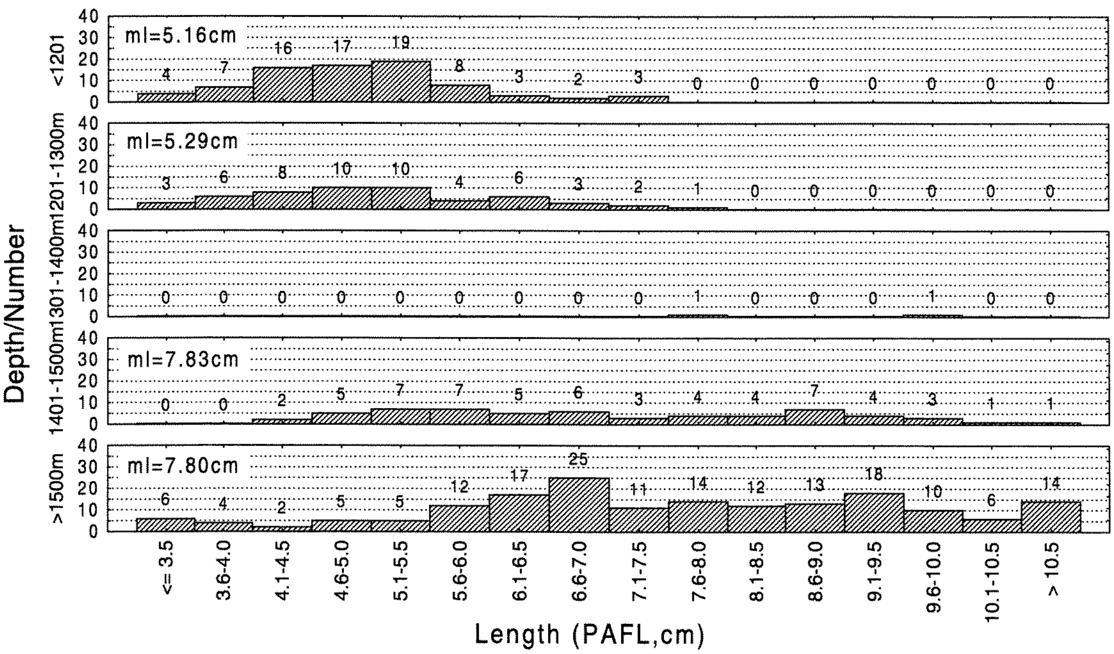


**Figure 5.11.103** *N. aequalis.* Length and mean length (ml) by depth intervals and sex.

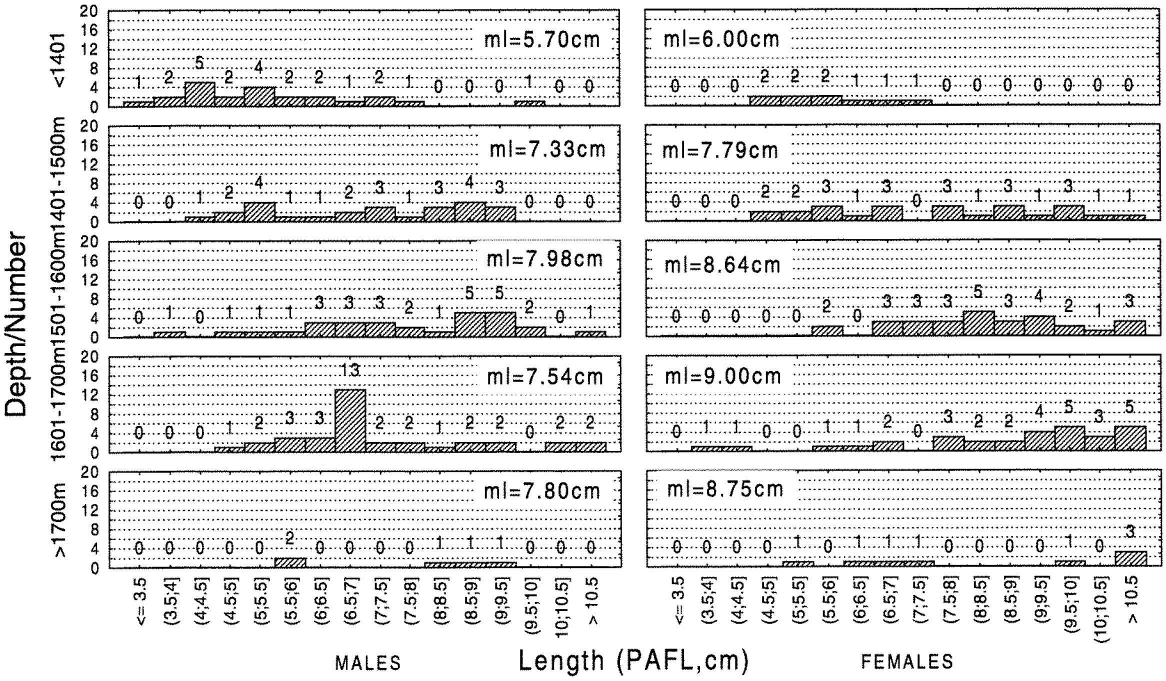



**Figure 5.11.104** *N. aequalis.* Length distribution by sex.

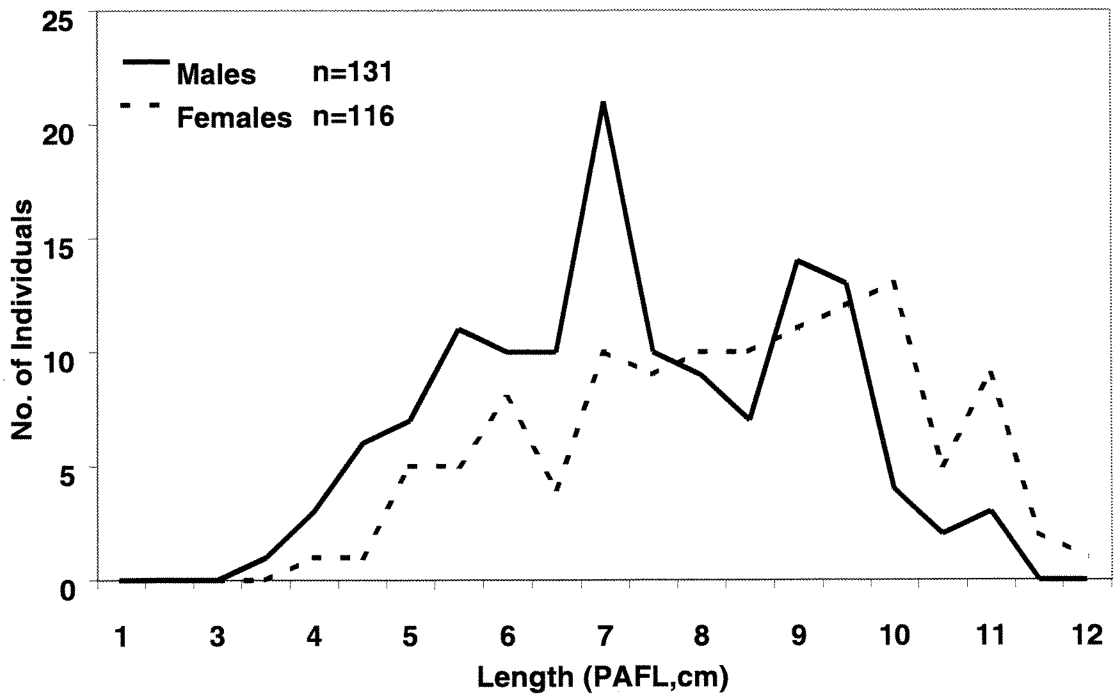


**Figure 5.11.105** *N. aequalis.* Length-weight relationship.

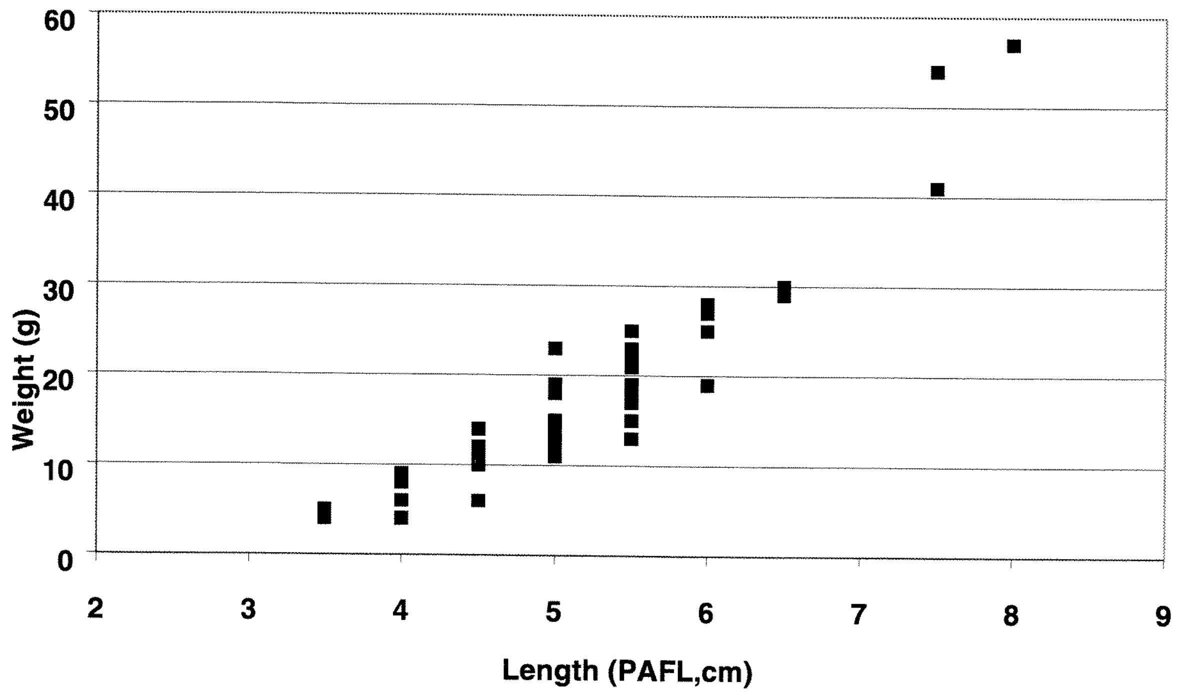



**Figure 5.11.106** *N. aequalis.* Maturity stages in July-September (males: filled bars, females: open bars).

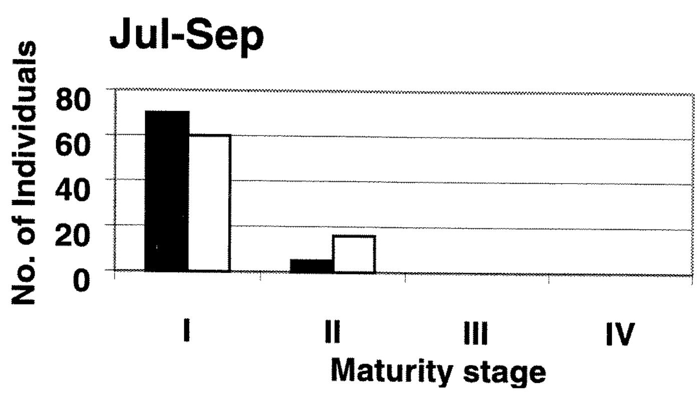


**Figure 5.11.107** *T. murrayi.* Distribution and relative abundance in numbers.

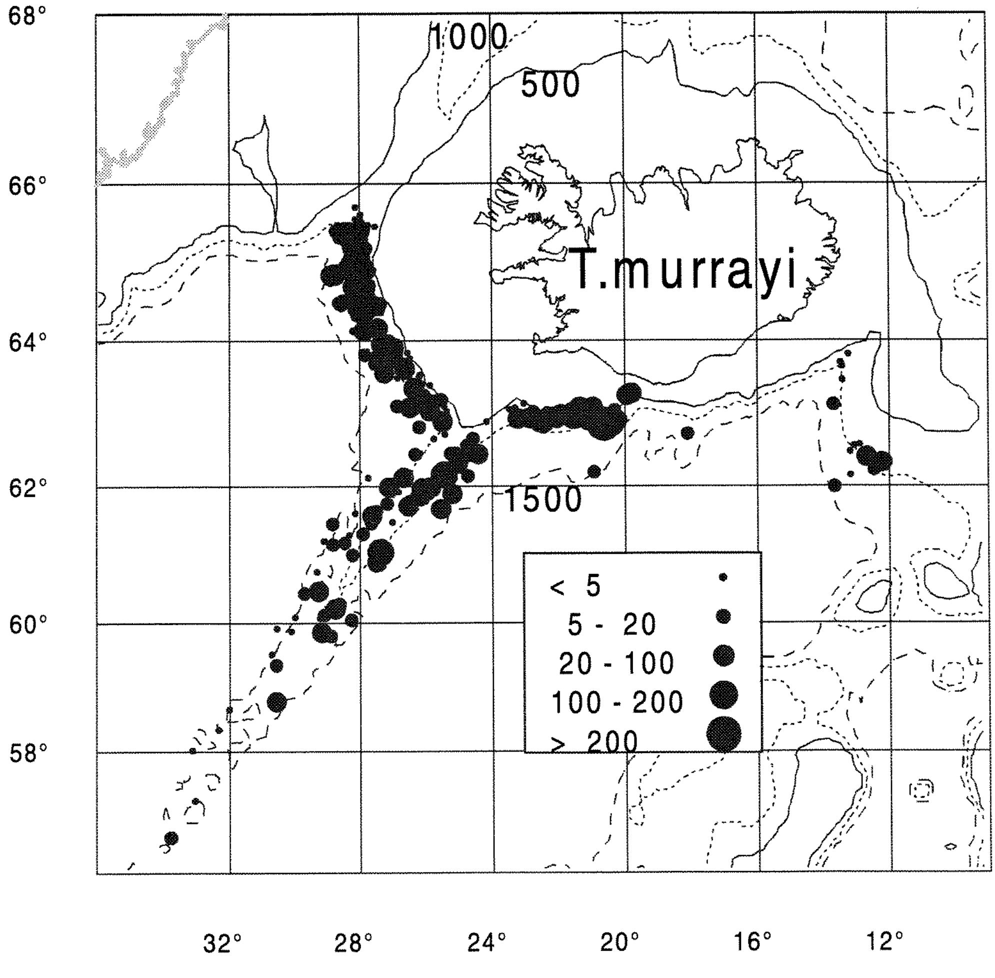



**Figure 5.11.108** *T. murrayi.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

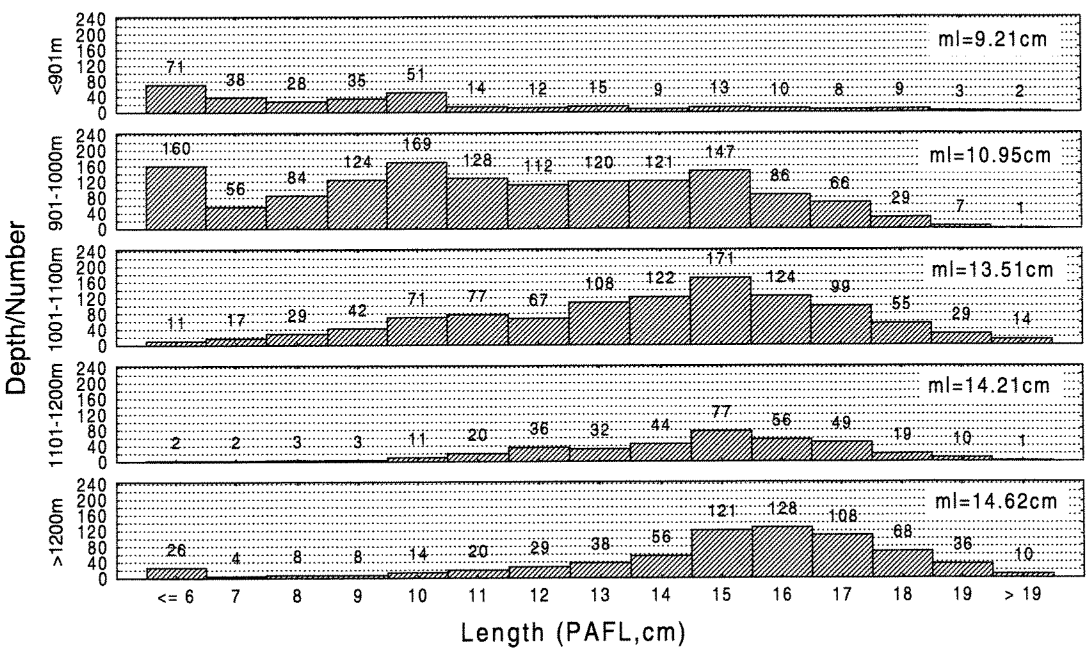


**Figure 5.11.109** *T. murrayi.* Length and mean length (ml) by depth intervals and sex.

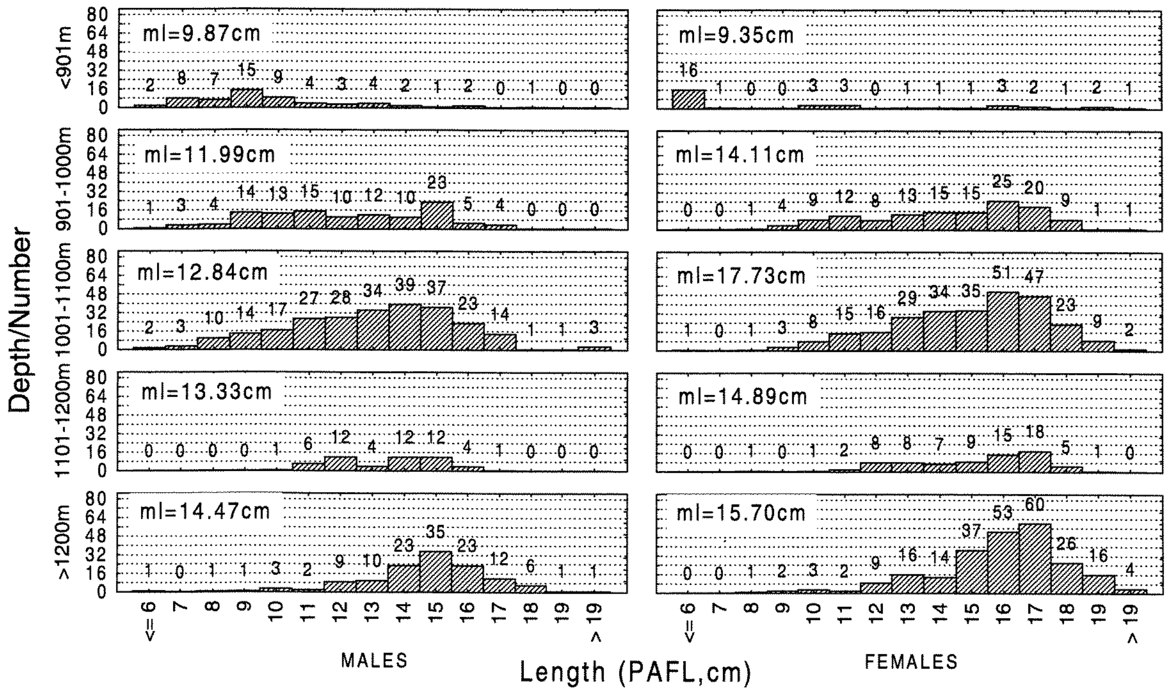



**Figure 5.11.110** *T. murrayi.* Length distribution by sex.

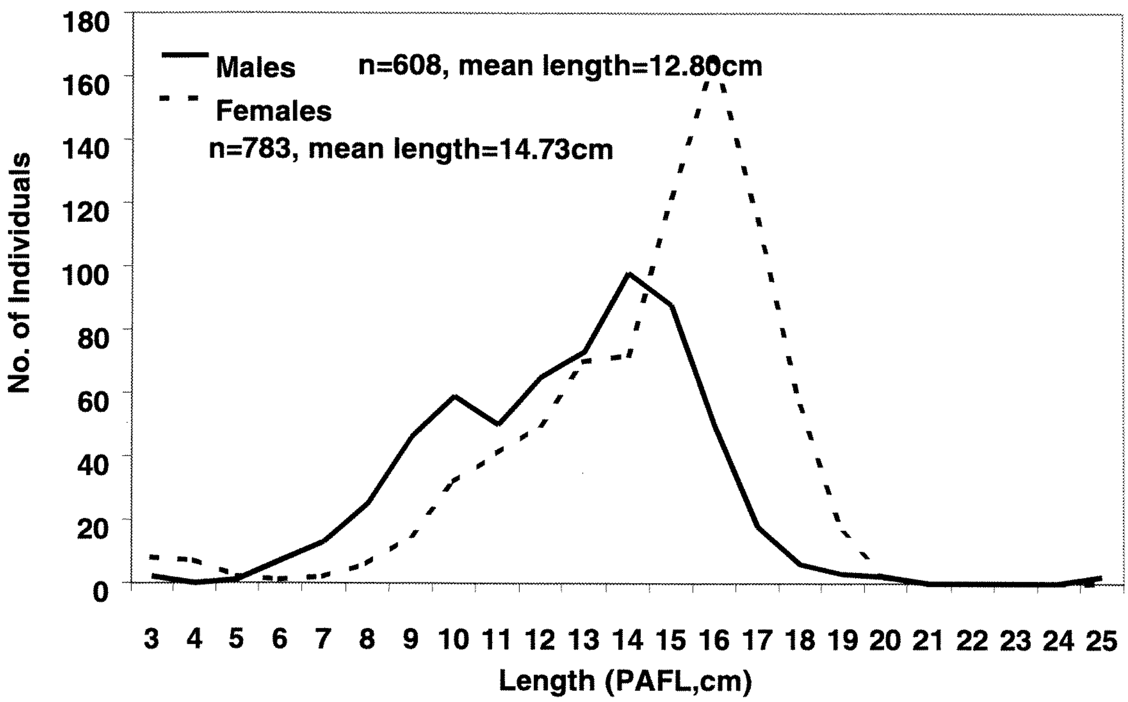


**Figure 5.11.111** *T. murrayi.* Length-weight relationship by sex.

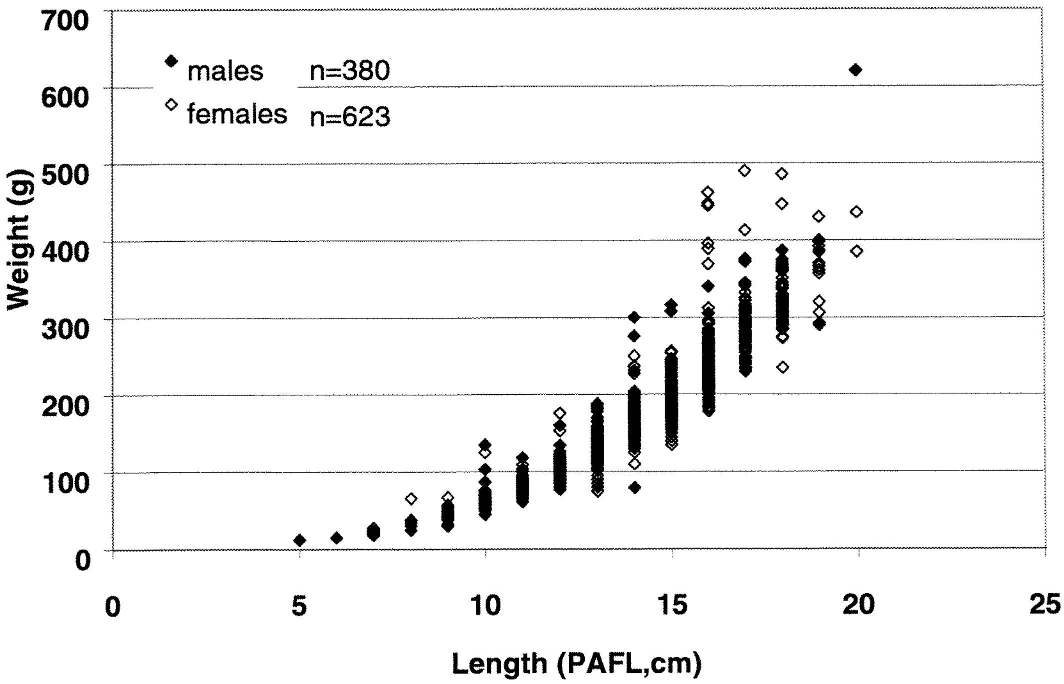



**Figure 5.11.112** *T. murrayi.* Maturity stages by season (males: filled bars, females: open bars).

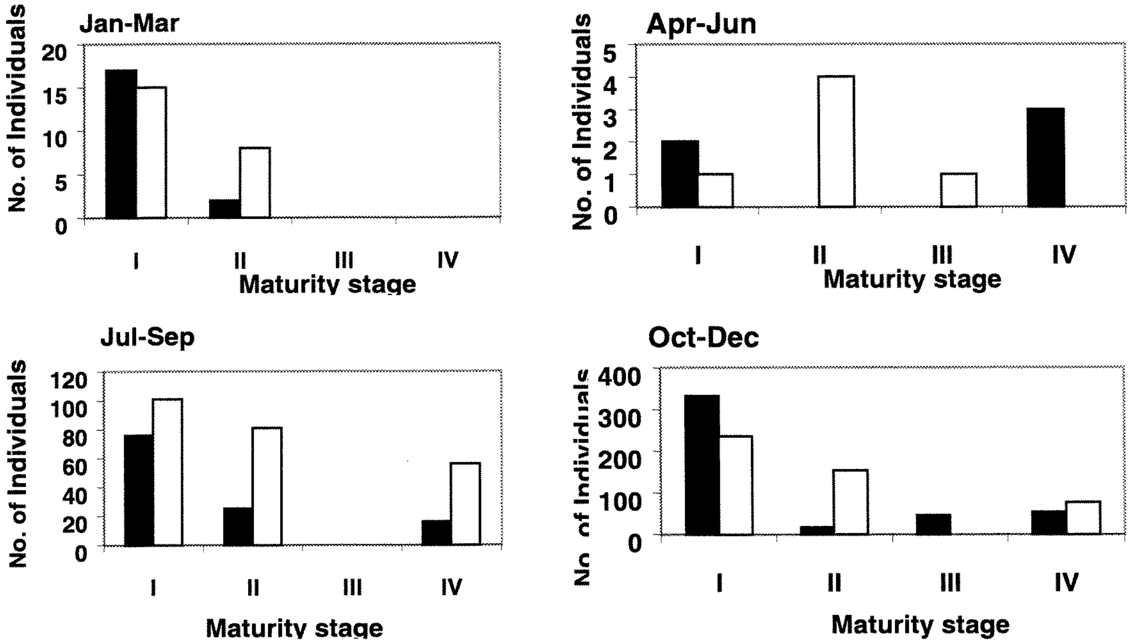


**Figure 5.11.113** *M. dypterygia.* Distribution and relative abundance in numbers.

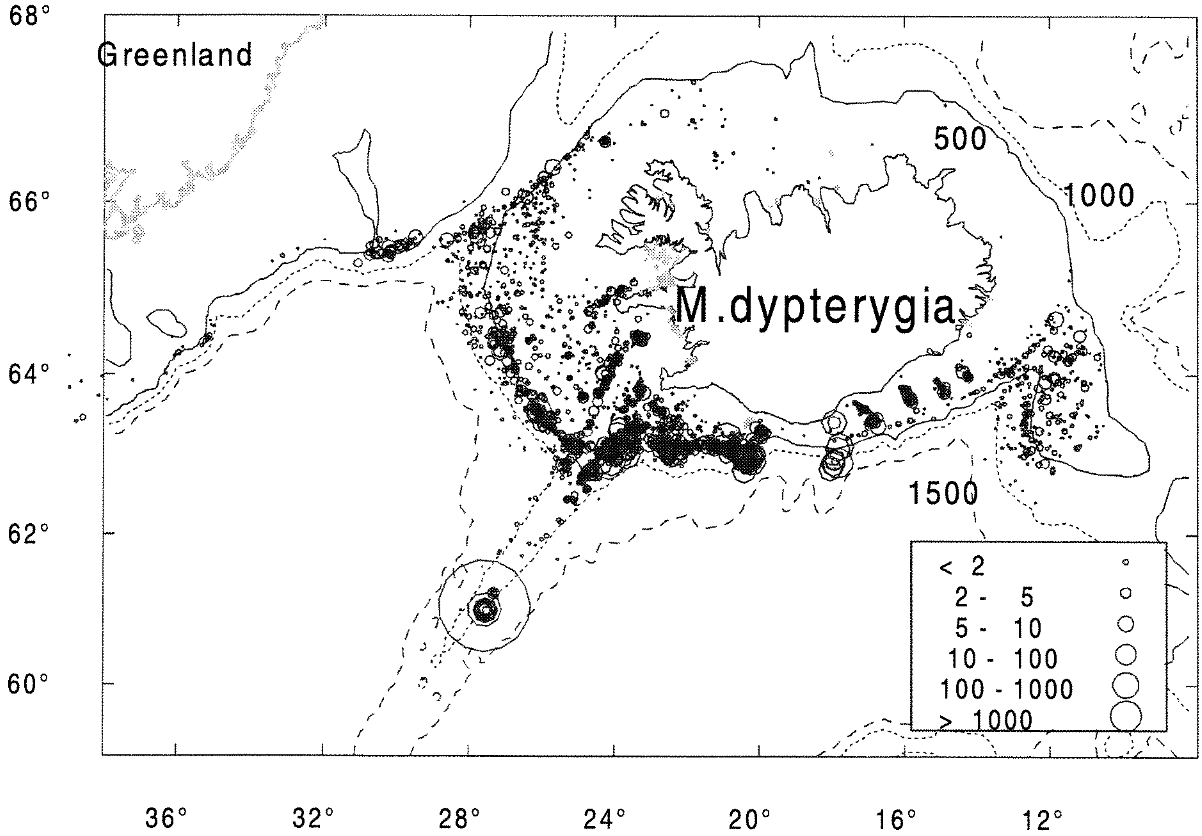



**Figure 5.11.114** *M. dypterygia.* Length distribution by sex.

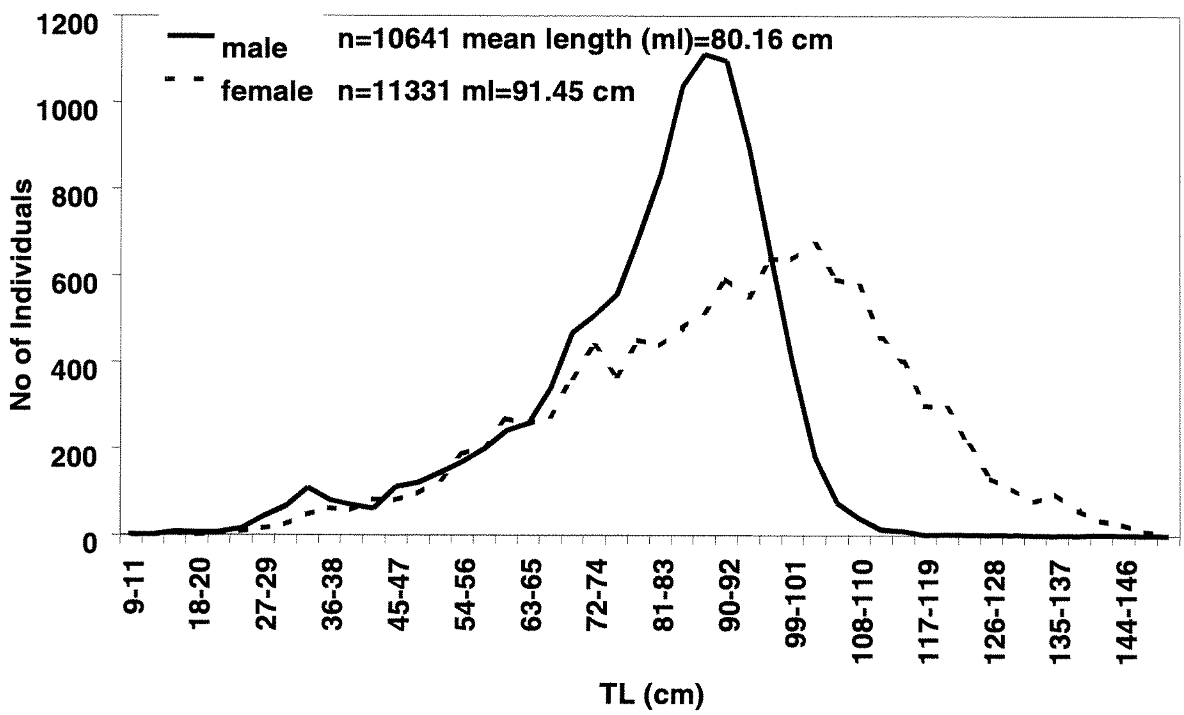


**Figure 5.11.115** *M. dypterygia.* Length-depth relationship by 200 m intervals.

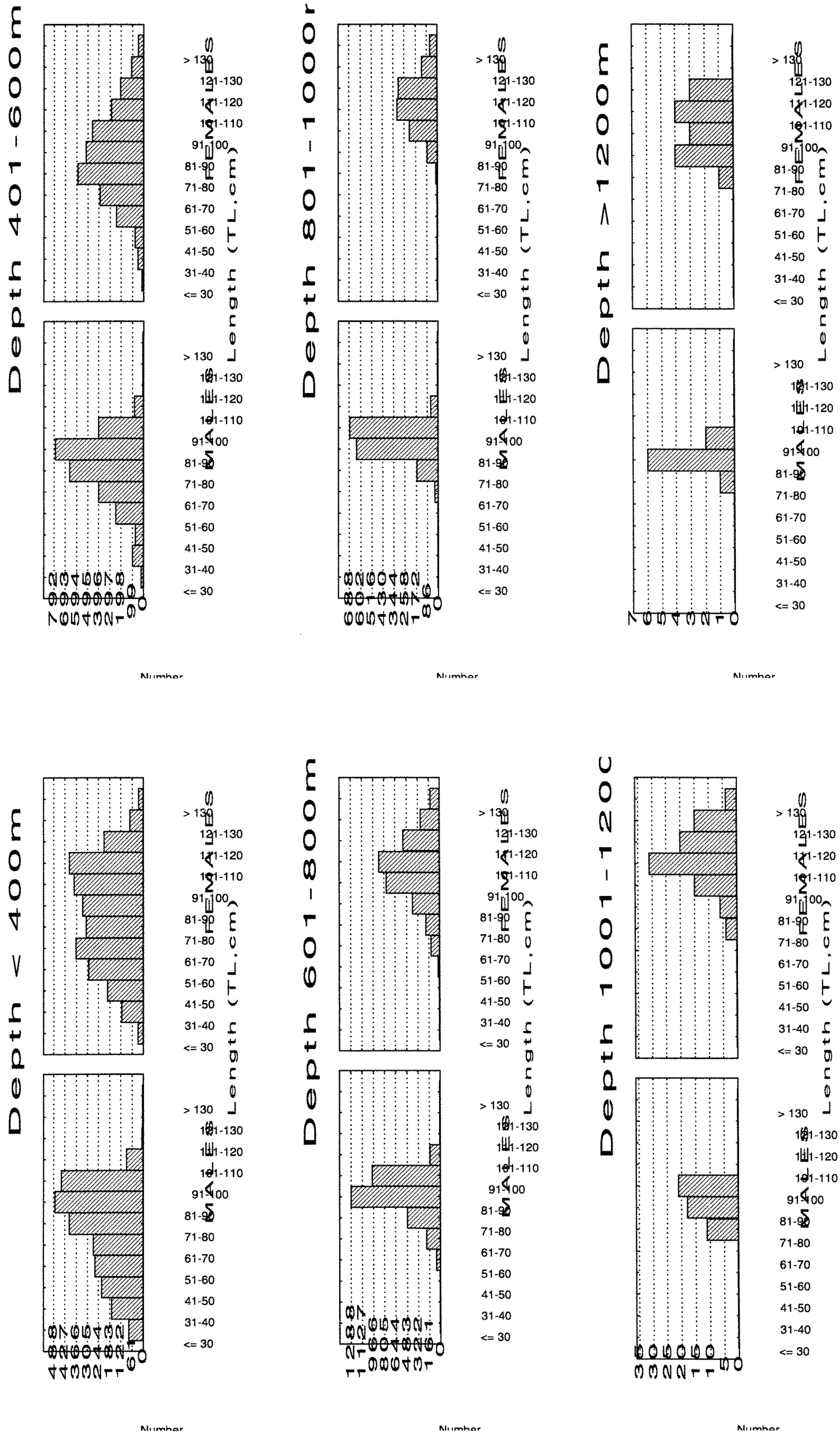


**Figure 5.11.116** *M. dypterygia.* Length-weight relationship by sex.

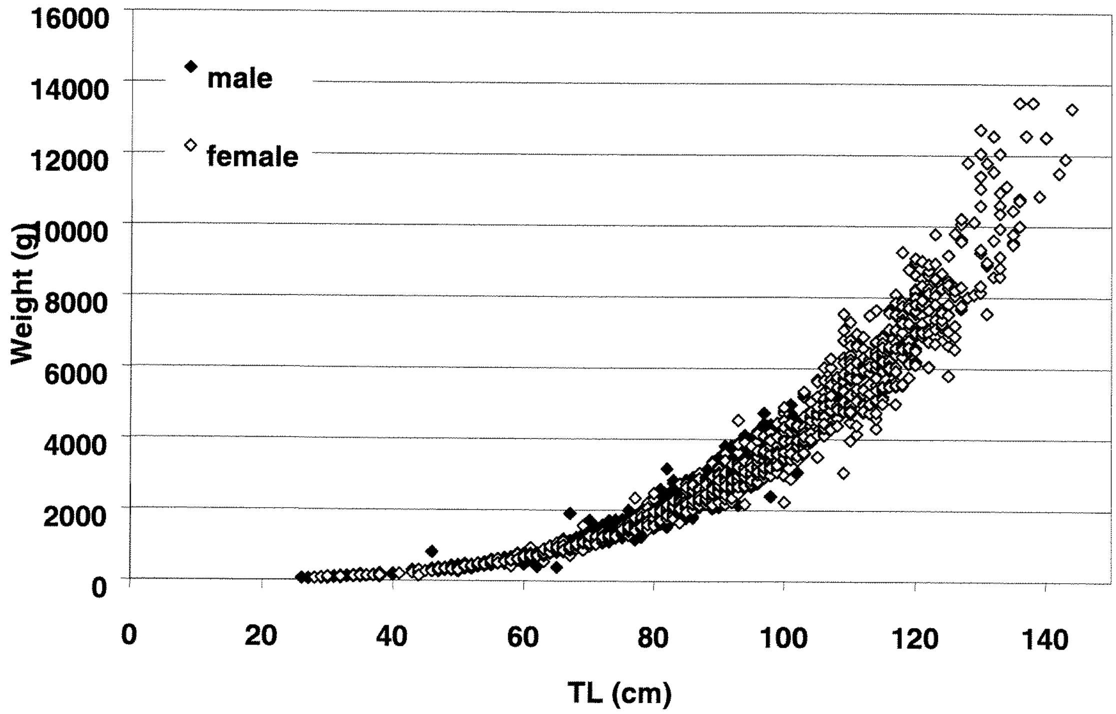



**Figure 5.11.117** *M. dypterygia.* Maturity stages by season (males: filled bars, females: open bars).

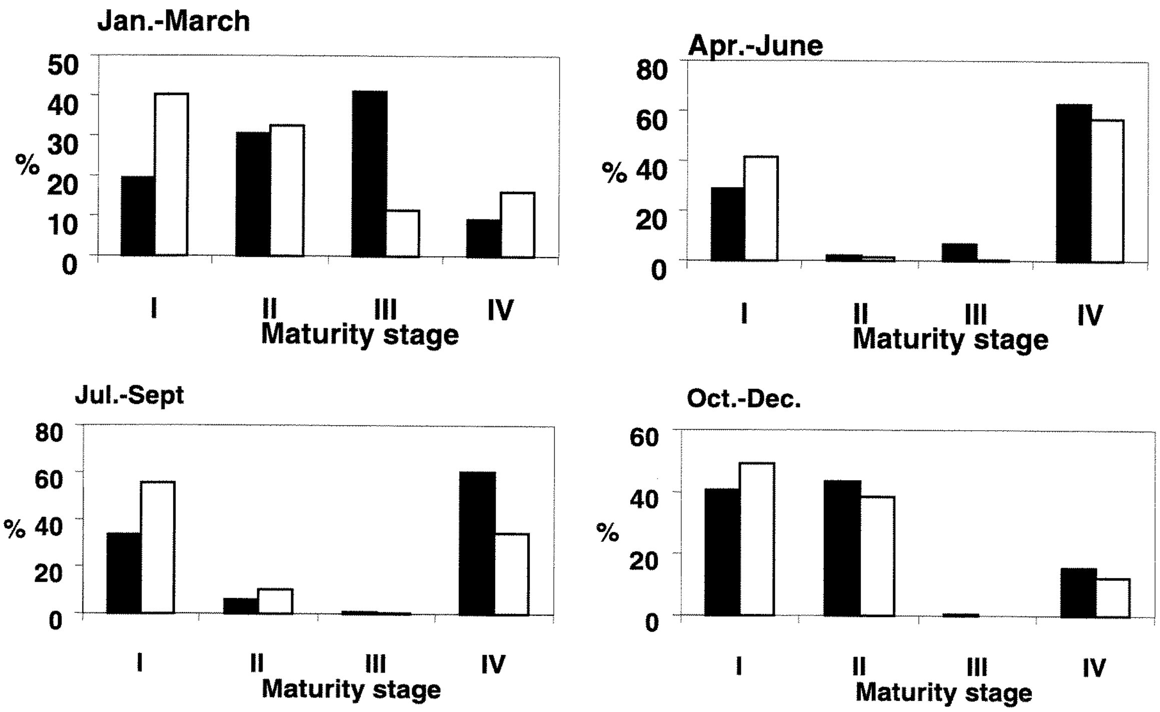


**Figure 5.11.118** *O. argentatus.* Distribution and relative abundance in numbers.

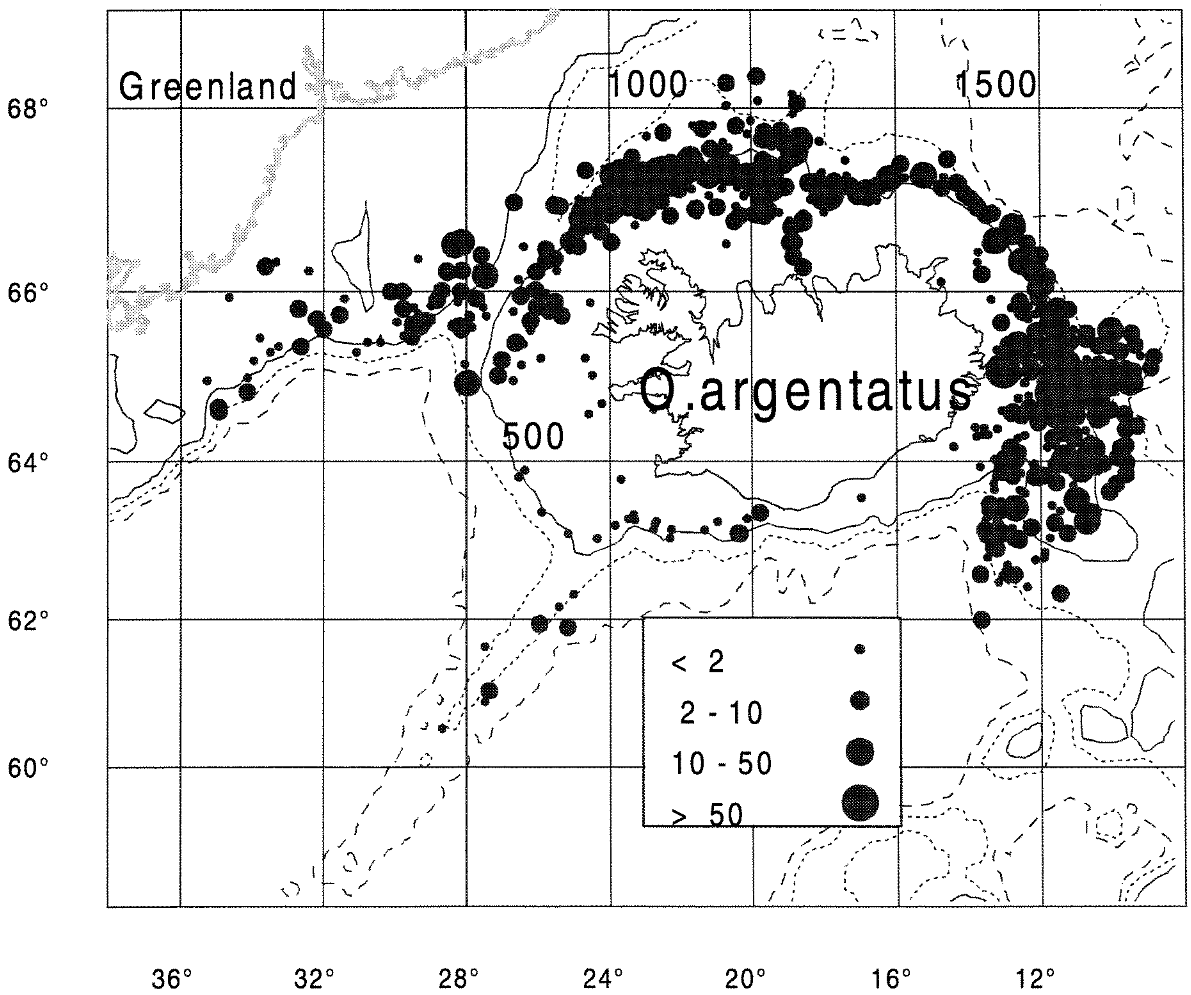



**Figure 5.11.119** *O. argentatus.* Length-depth relationship and mean length (ml) by 200 m intervals.

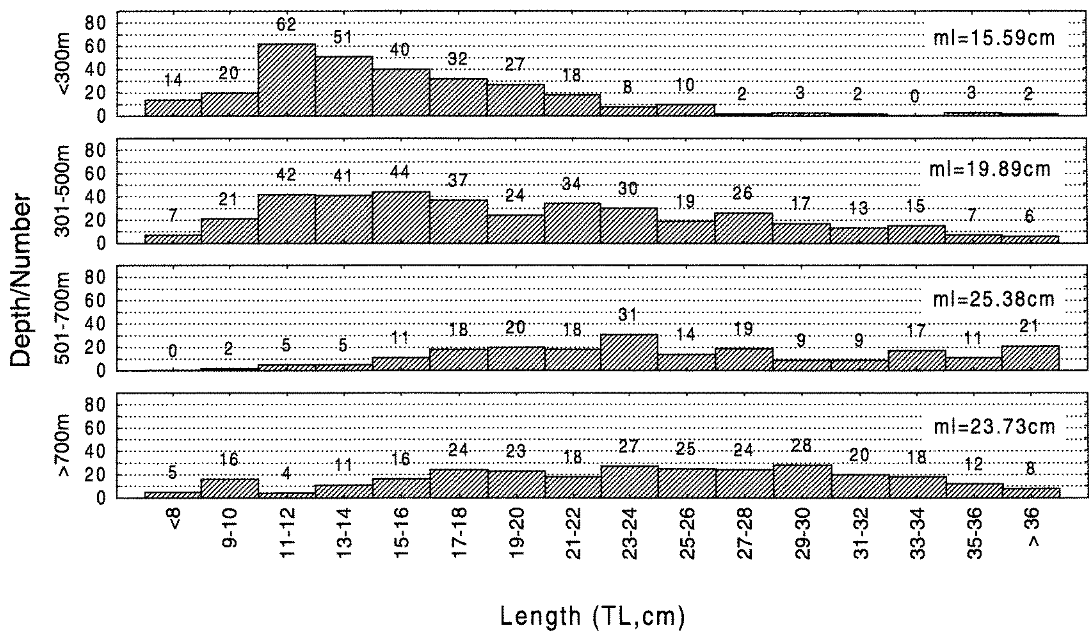


**Figure 5.11.120** *O. argentatus.* Length and mean length (ml) by depth intervals and sex.

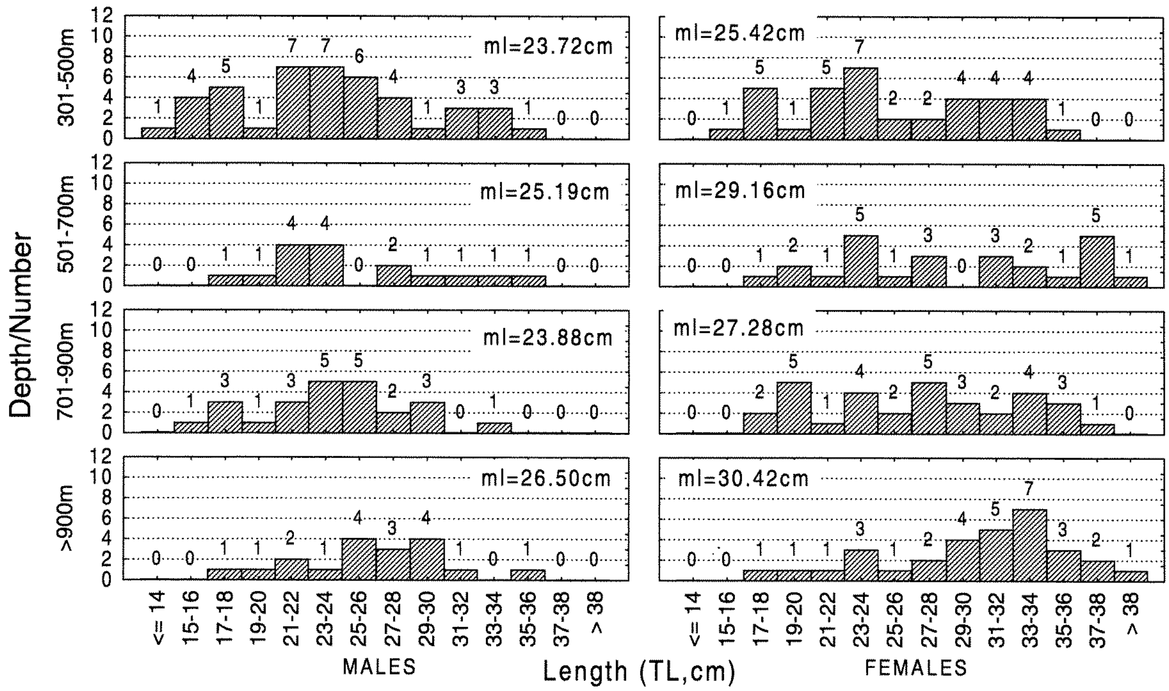



**Figure 5.11.121** *O. argentatus.* Length distribution by sex.

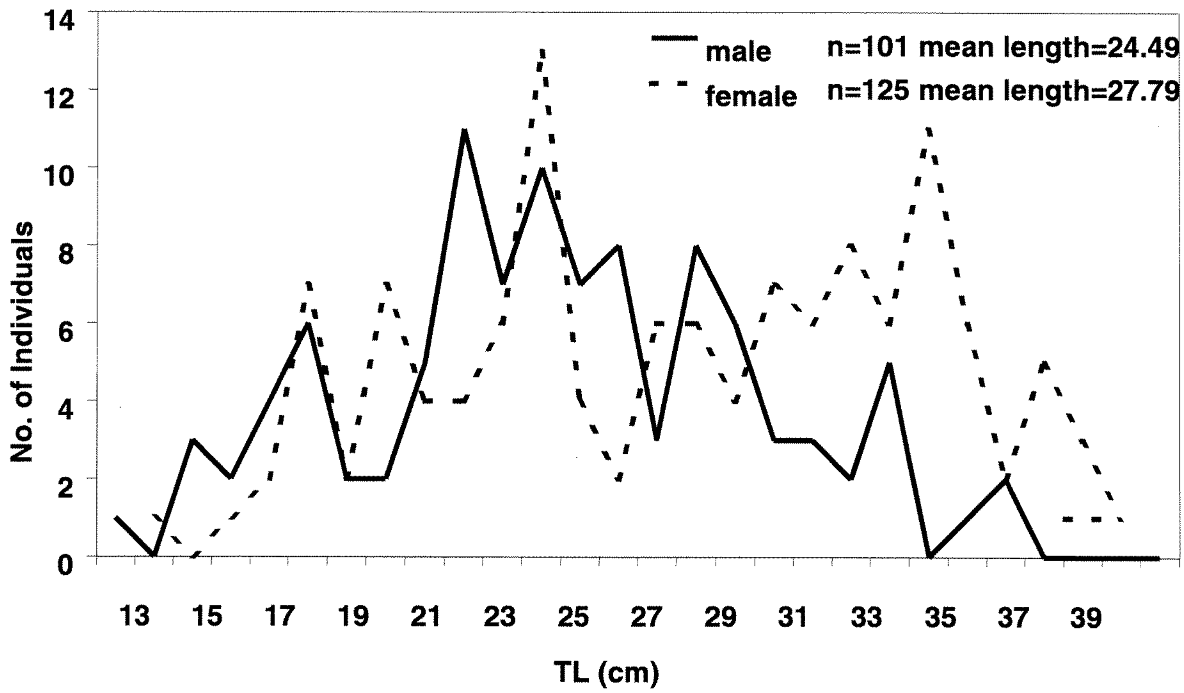


**Figure 5.11.122** *O. argentatus.* Length-weight relationship by sex.

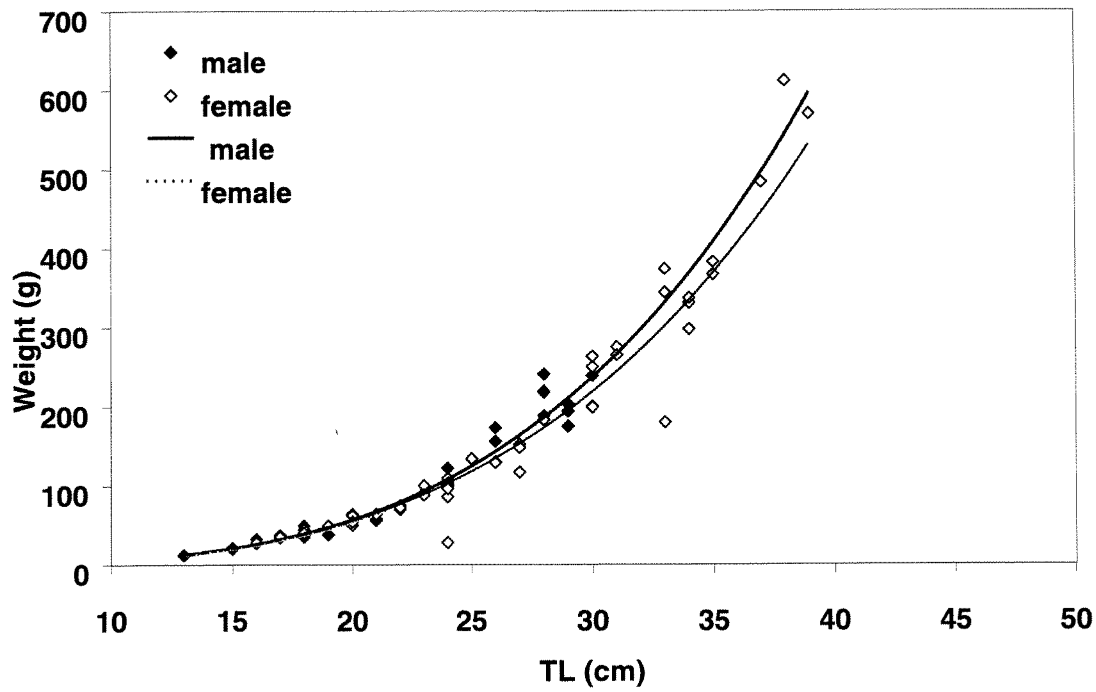



**Figure 5.11.123** *O. argentatus.* Maturity stages in October-December (males: filled bars, females: open bars).

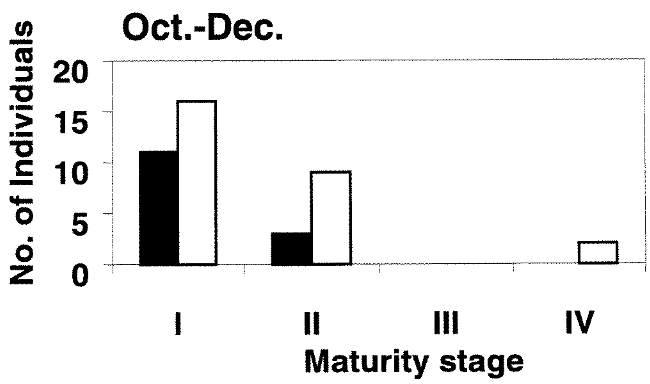


**Figure 5.11.124** *M. moro.* Distribution and relative abundance in numbers.

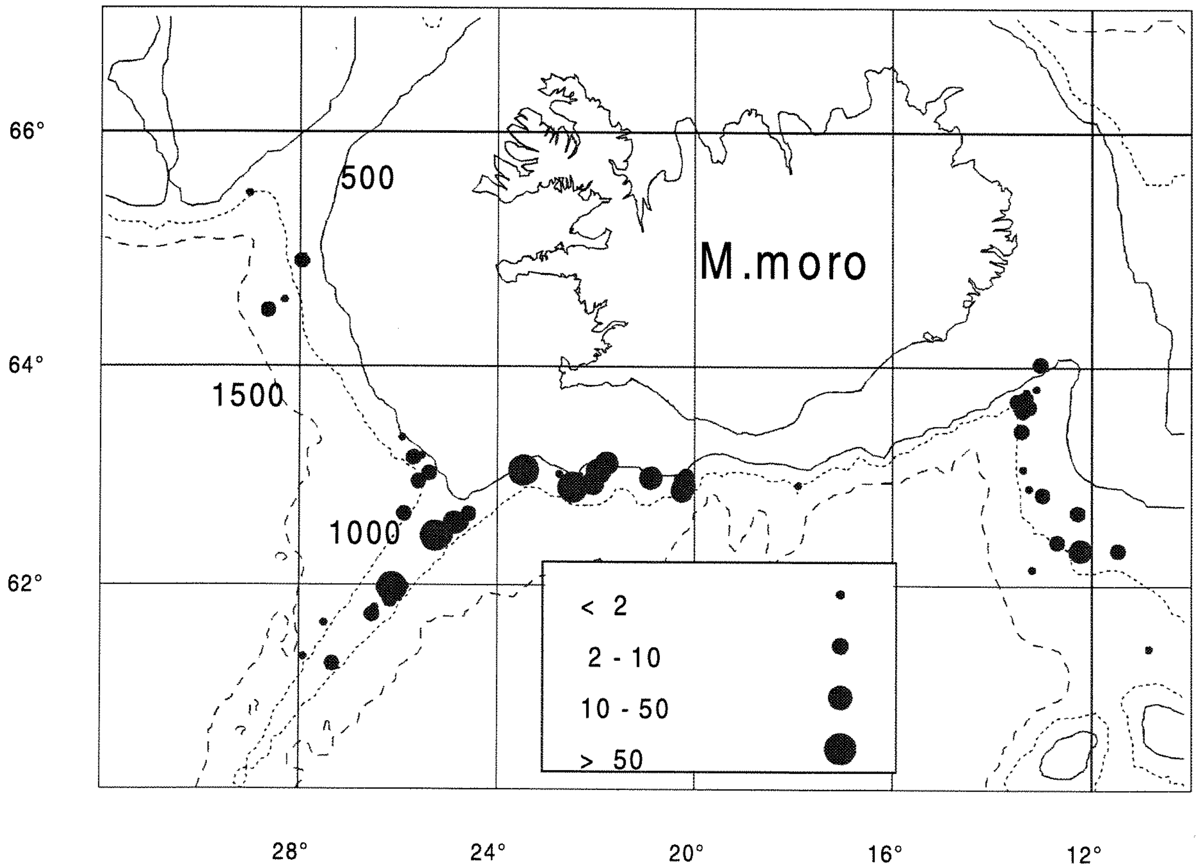



**Figure 5.11.125** *M. moro.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

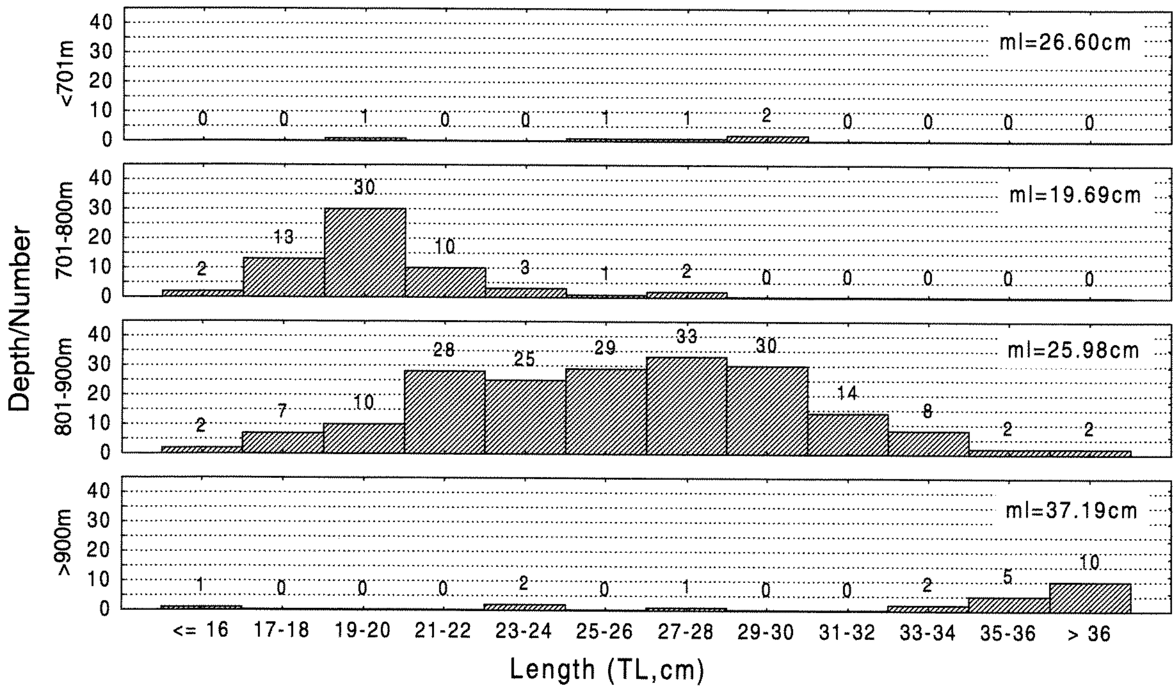


**Figure 5.11.126** *M. moro.* Length distribution by sex.

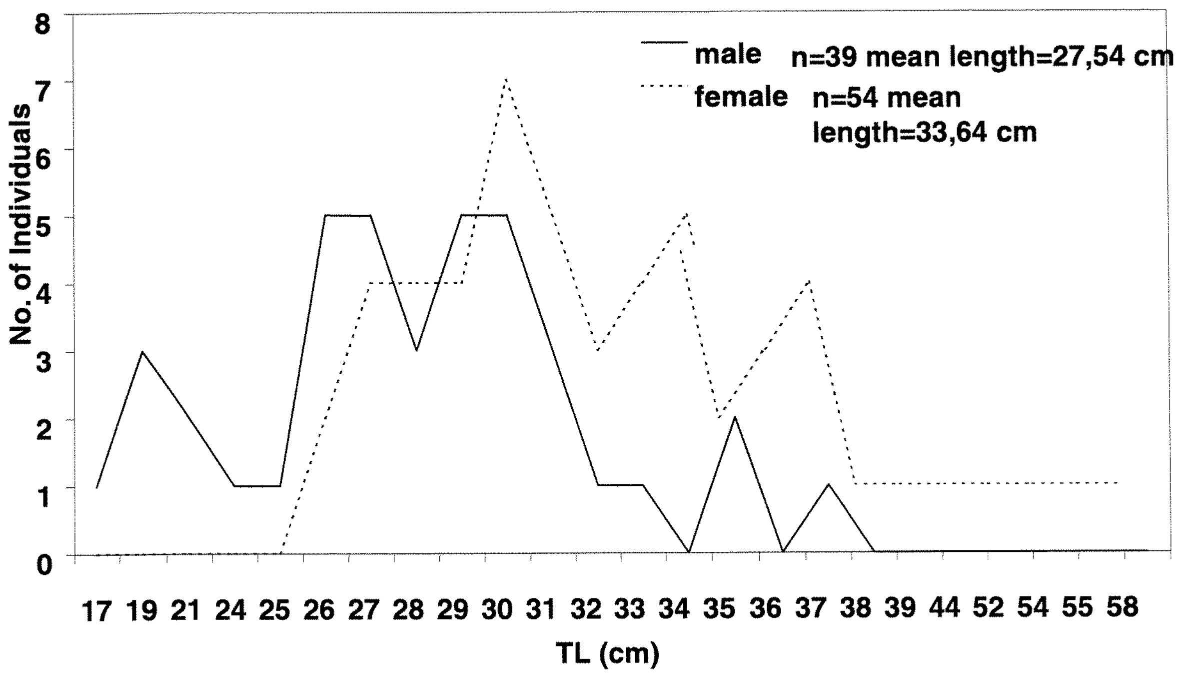



**Figure 5.11.127** *M. moro.* Length-weight relationship by sex.

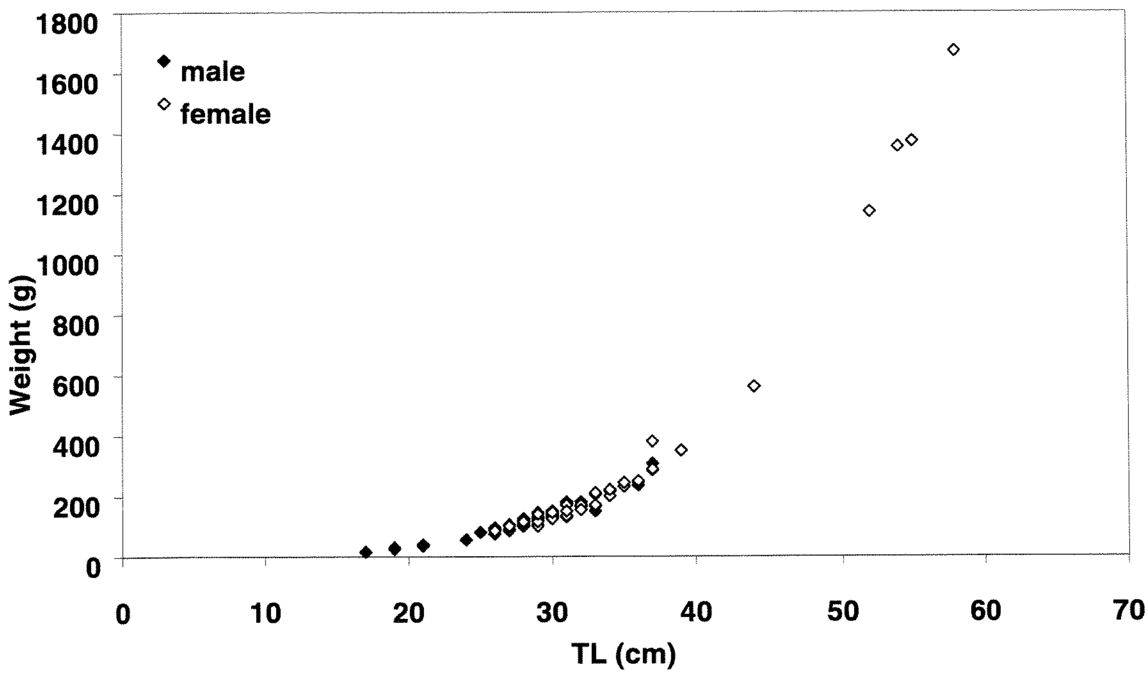


**Figure 5.11.128** *M. moro.* Maturity stages by season (males: filled bars, females: open bars).

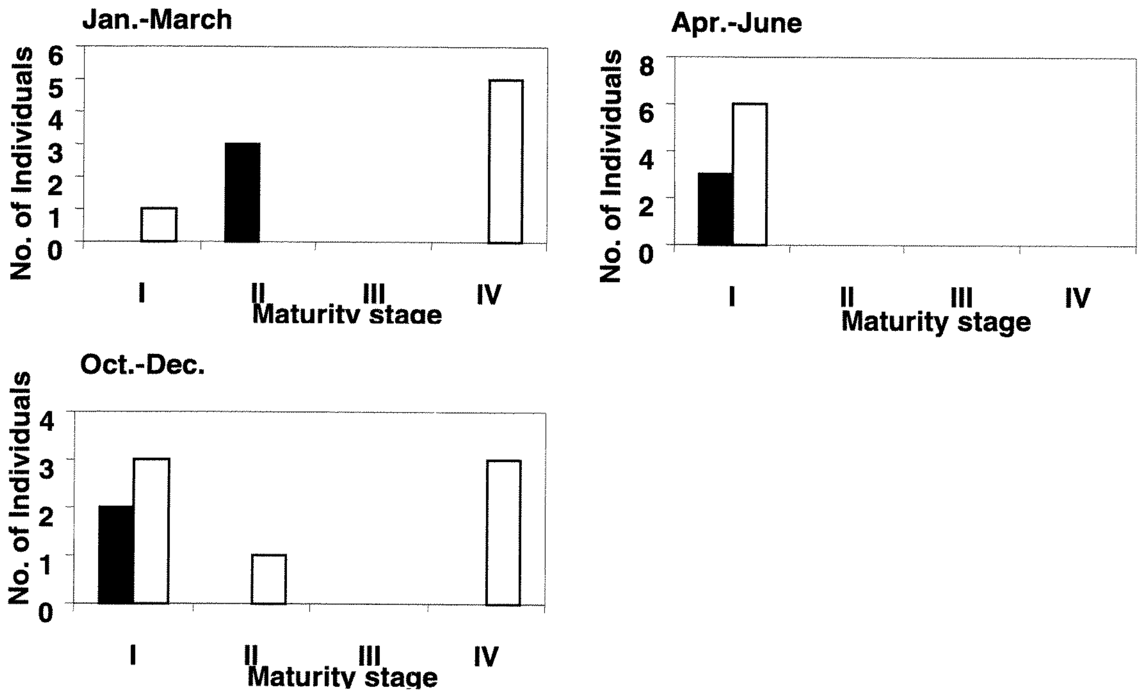


**Figure 5.11.129** *H. atlanticus.* Distribution and relative abundance in numbers.

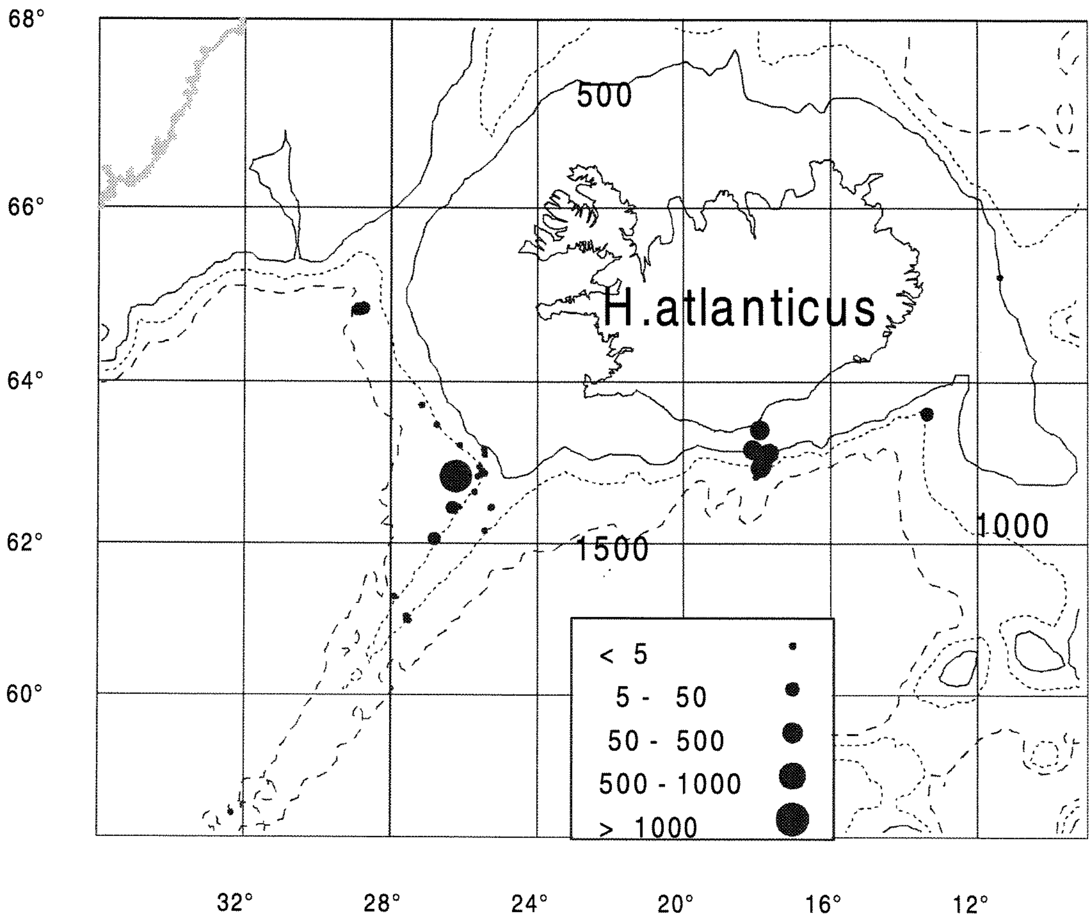



**Figure 5.11.130** *H. atlanticus.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

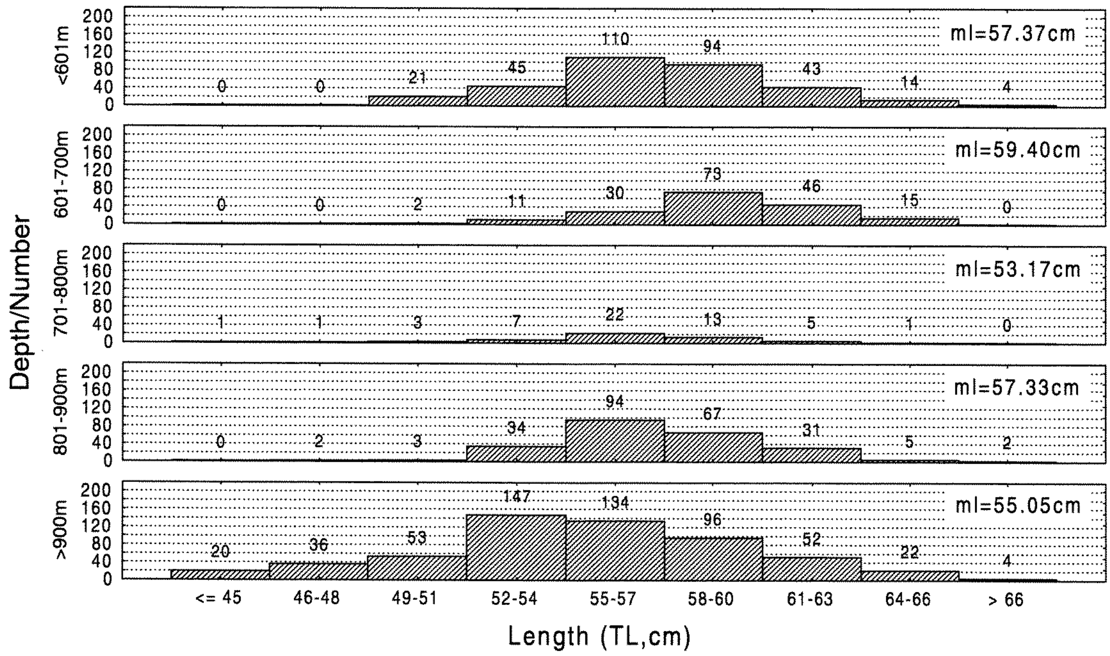


**Figure 5.11.131** *H. atlanticus.* Length and mean length (ml) by depth intervals and sex.

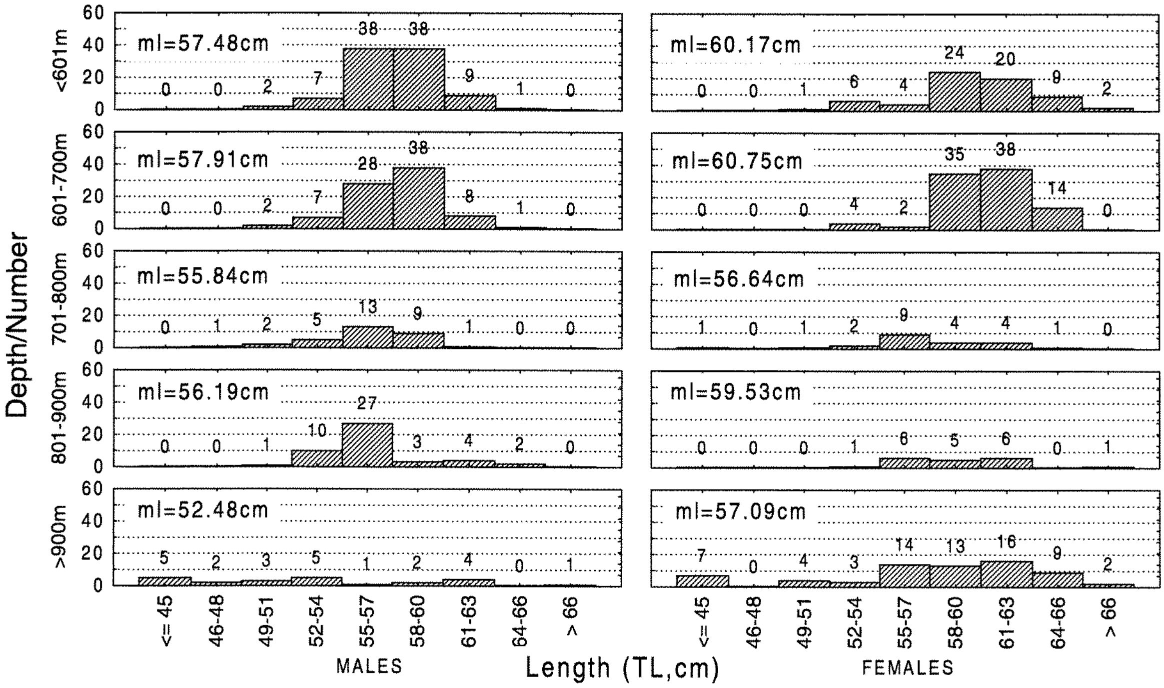



**Figure 5.11.132** *H. atlanticus.* Length distribution by sex.

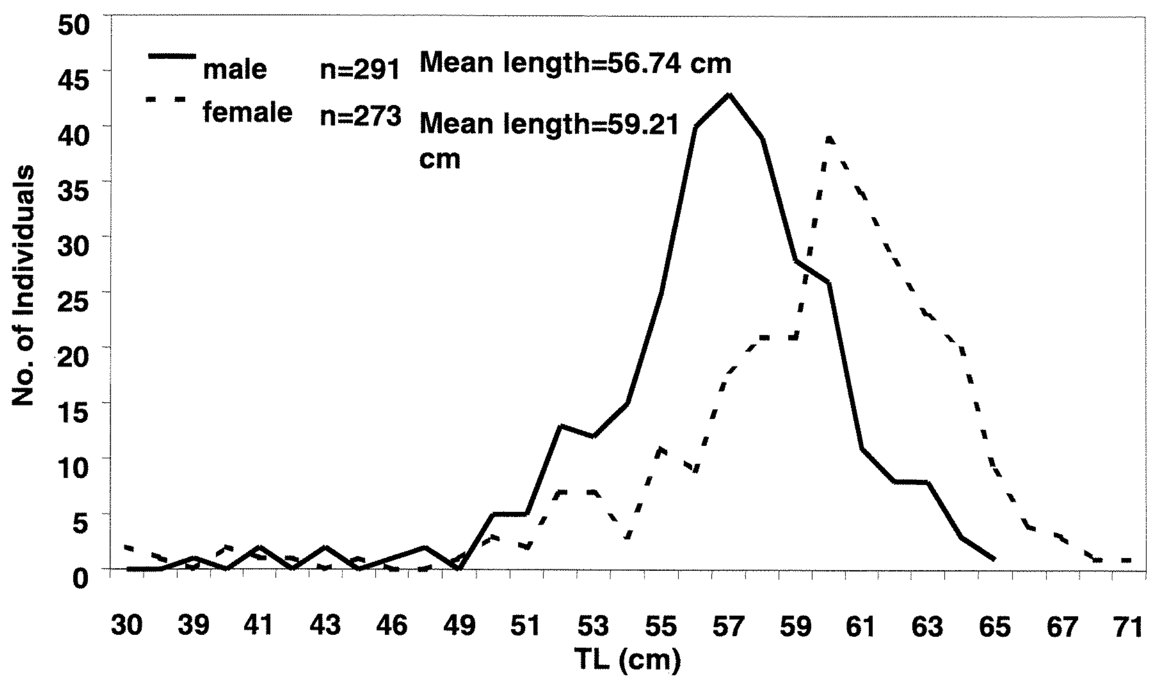


**Figure 5.11.133** *H. atlanticus.* Length-weight relationship by sex.

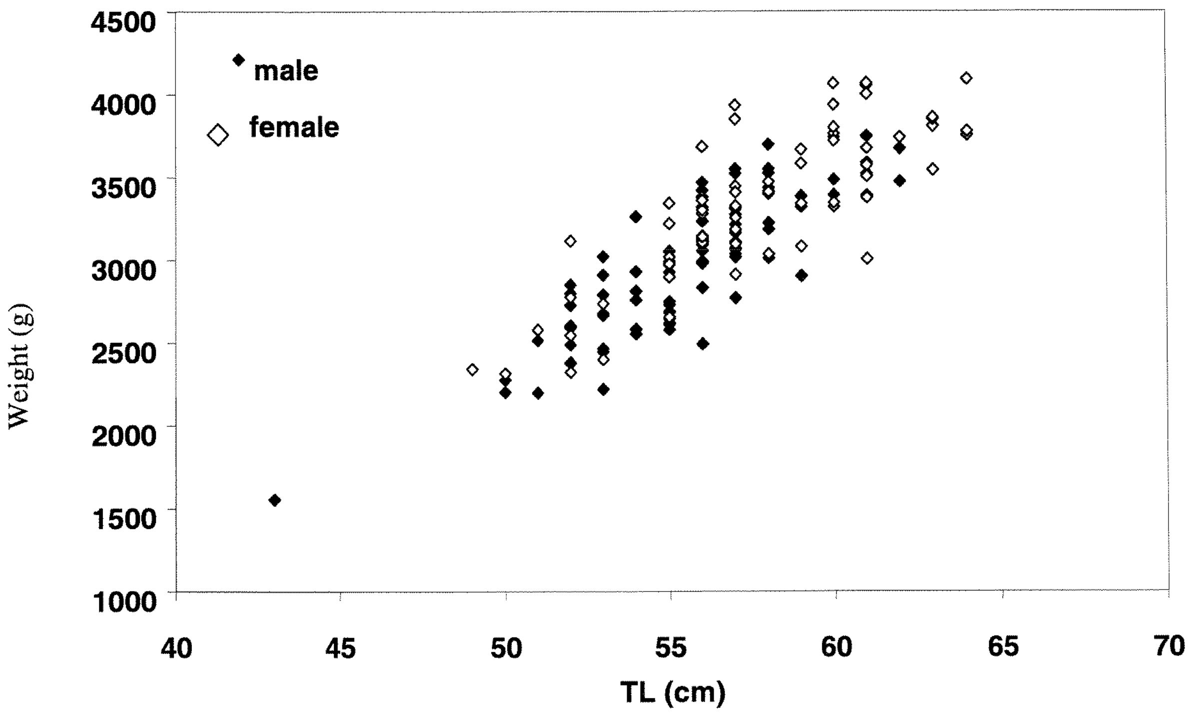



**Figure 5.11.134** *H. atlanticus.* Maturity stages by season (males: filled bars, females: open bars).

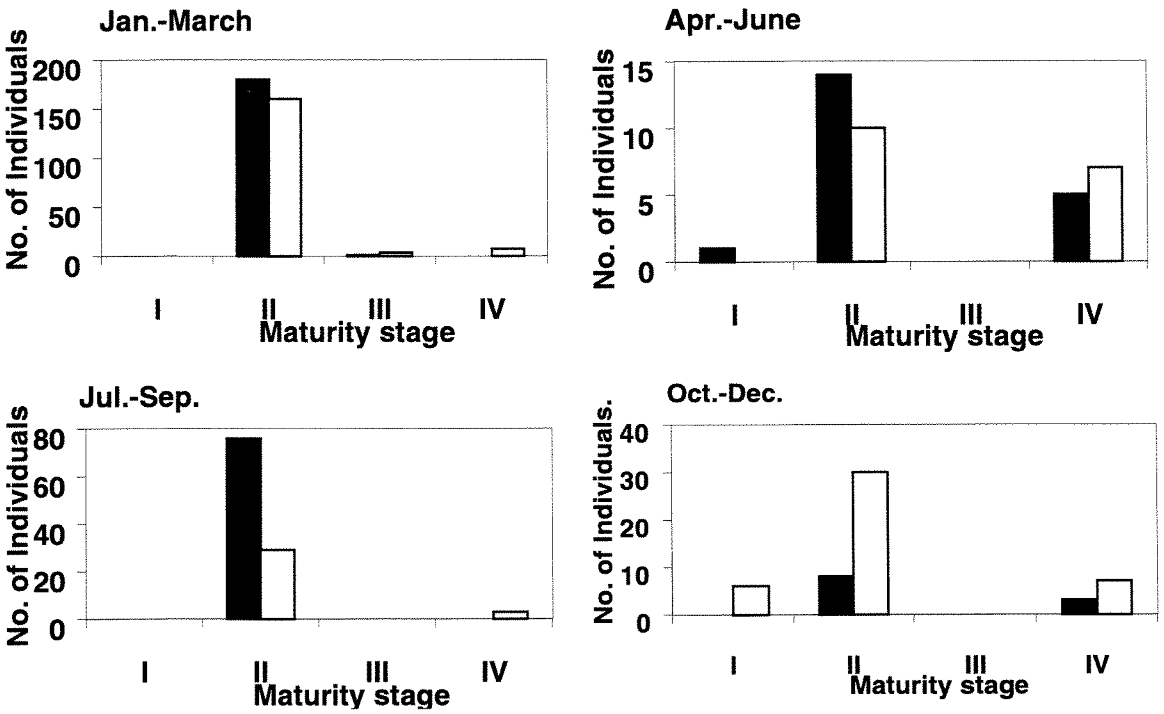


**Figure 5.11.135** *A. carbo.* Distribution and relative abundance in numbers.

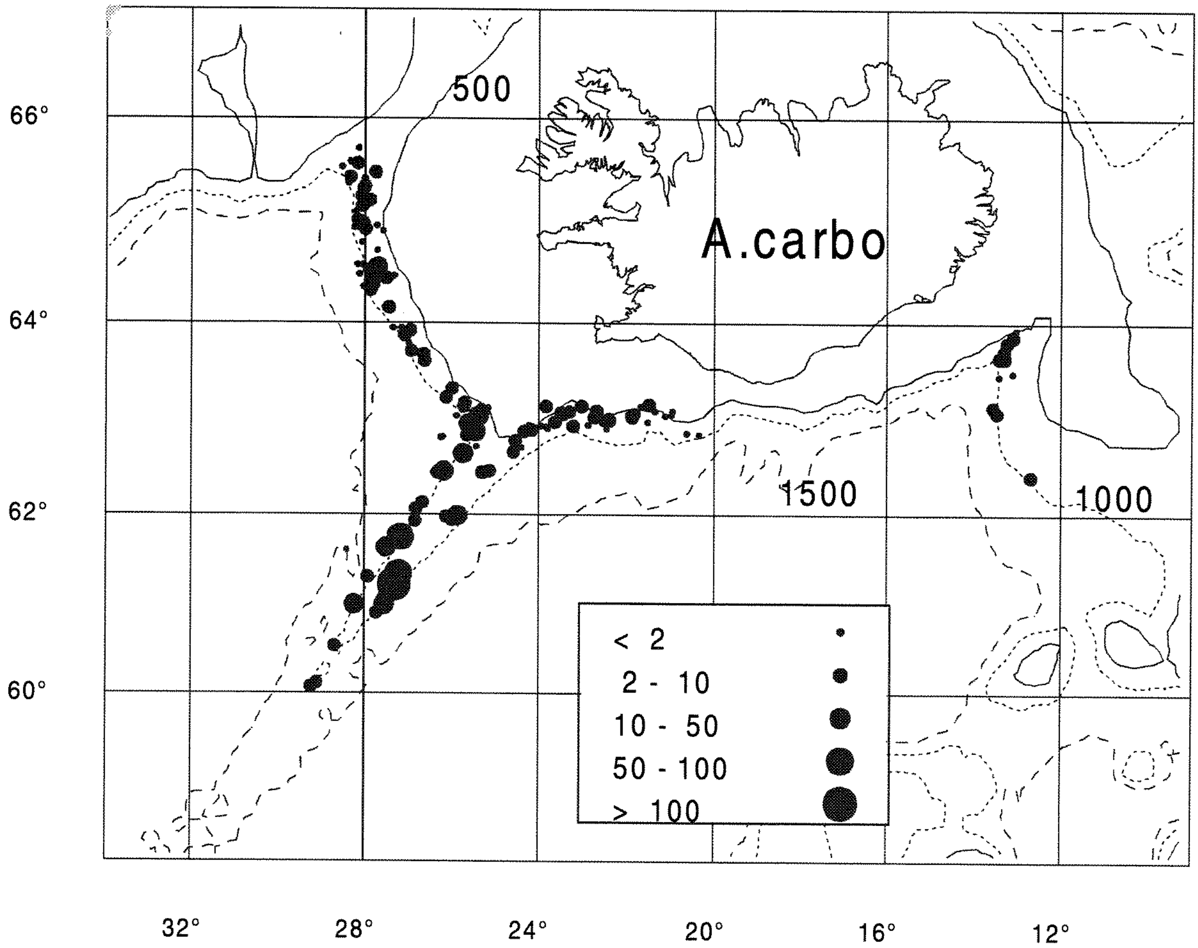



**Figure 5.11.136** *A. carbo.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

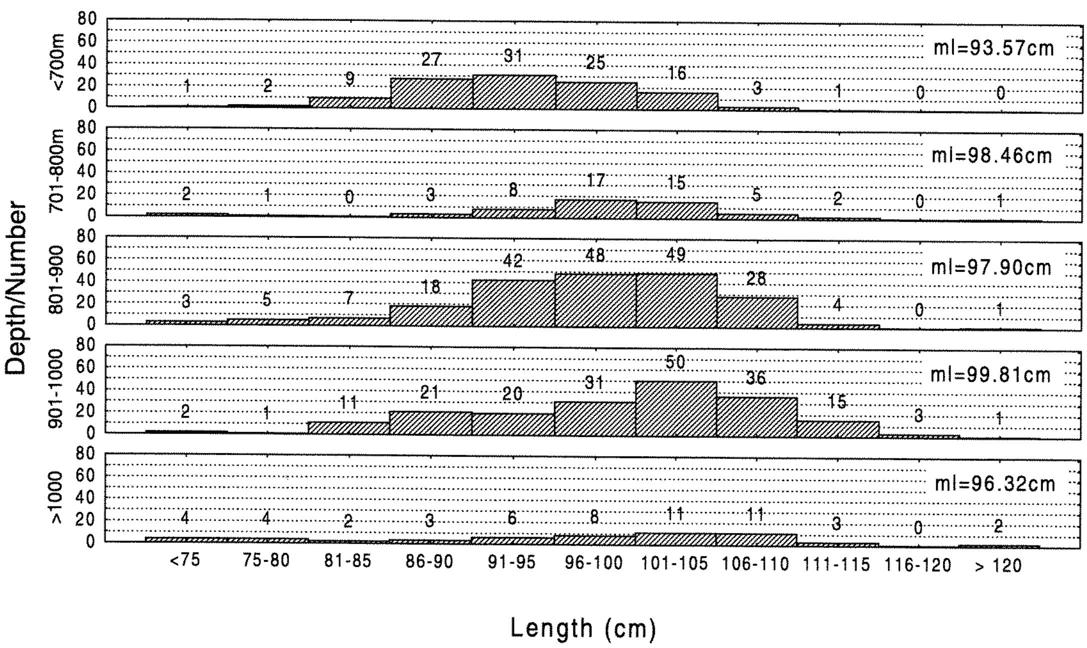


**Figure 5.11.137** *A. carbo.* Length and mean length (ml) by depth intervals and sex.

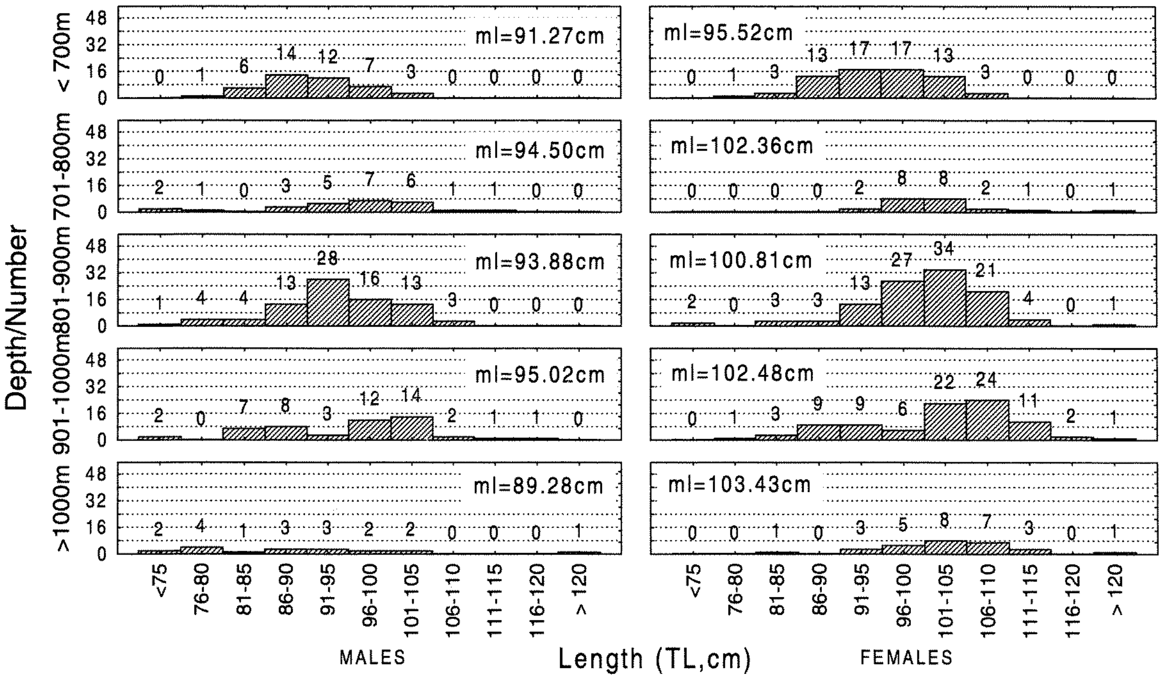



**Figure 5.11.138** *A. carbo.* Length distribution by sex.

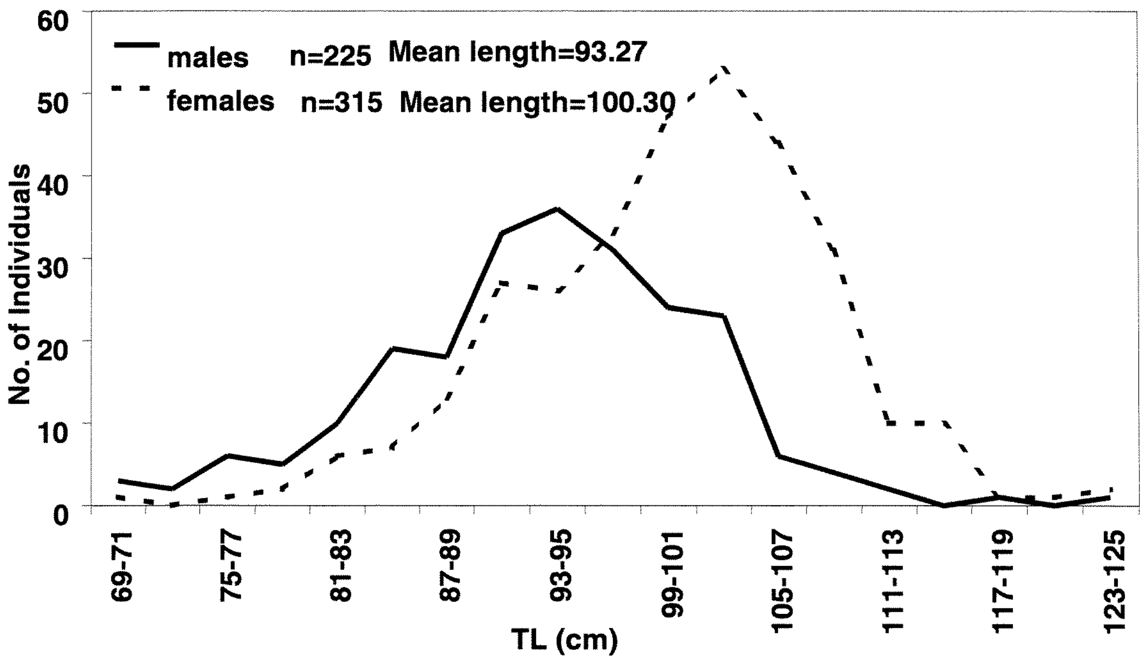


**Figure 5.11.139** *A. carbo.* Length-weight relationship by sex.

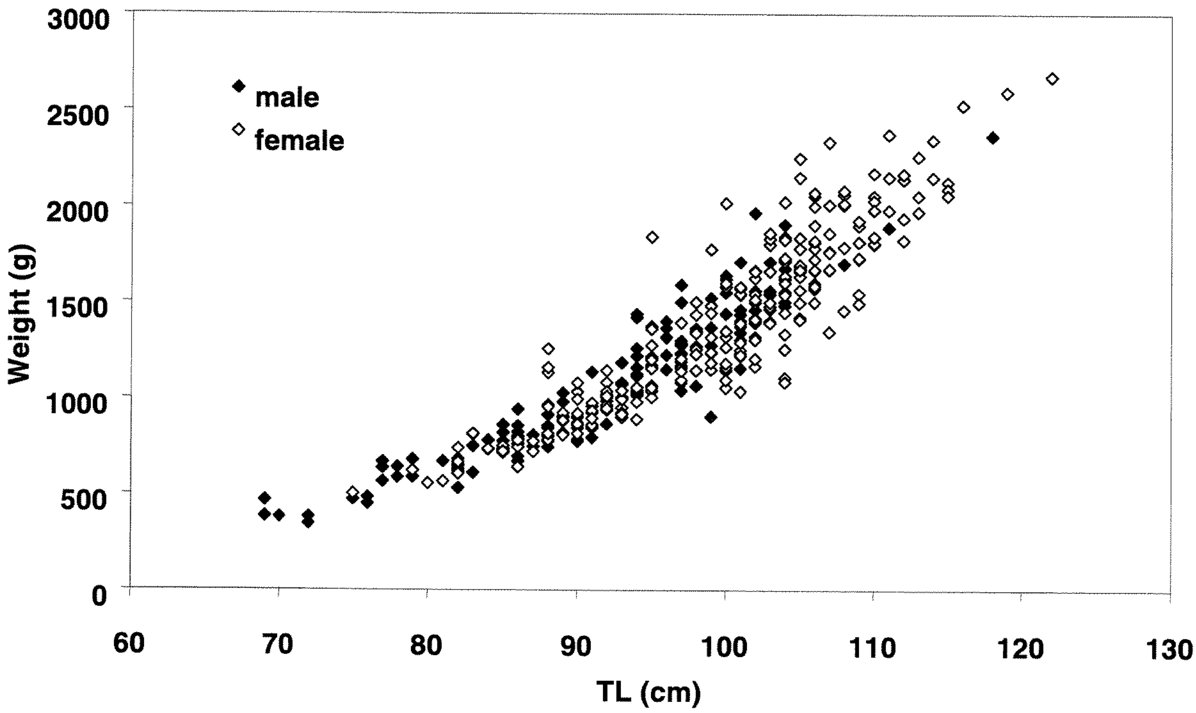



**Figure 5.11.140** *A. carbo.* Maturity stages by season (males: filled bars, females: open bars).

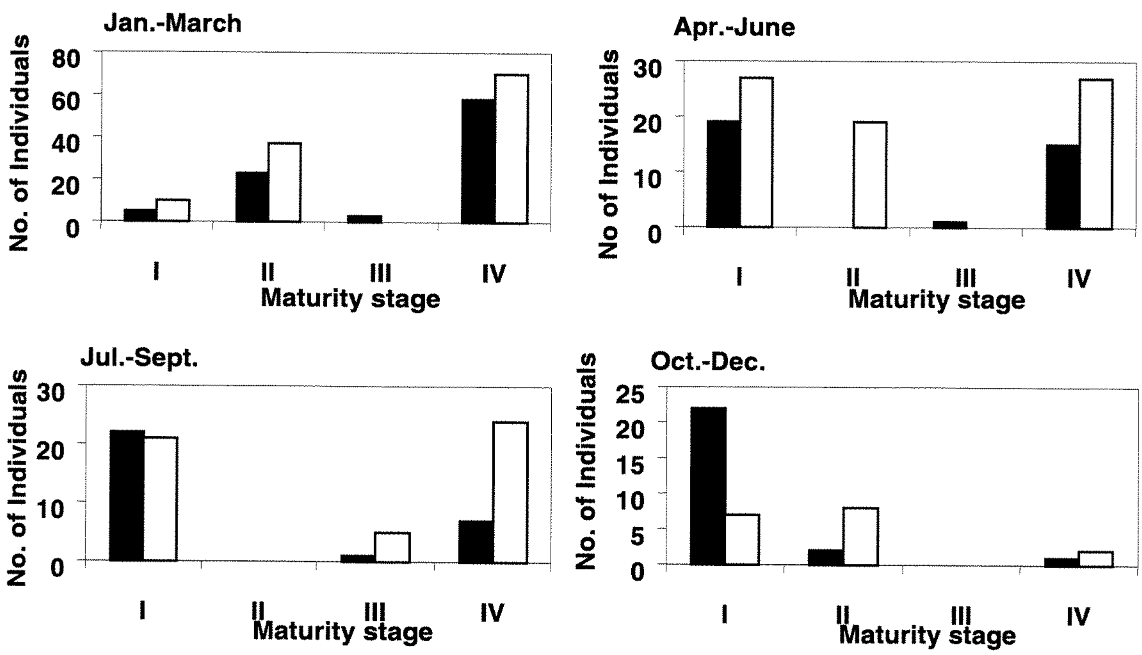


**Figure 5.11.141** *A. denticulatus.* Distribution and relative abundance in numbers.

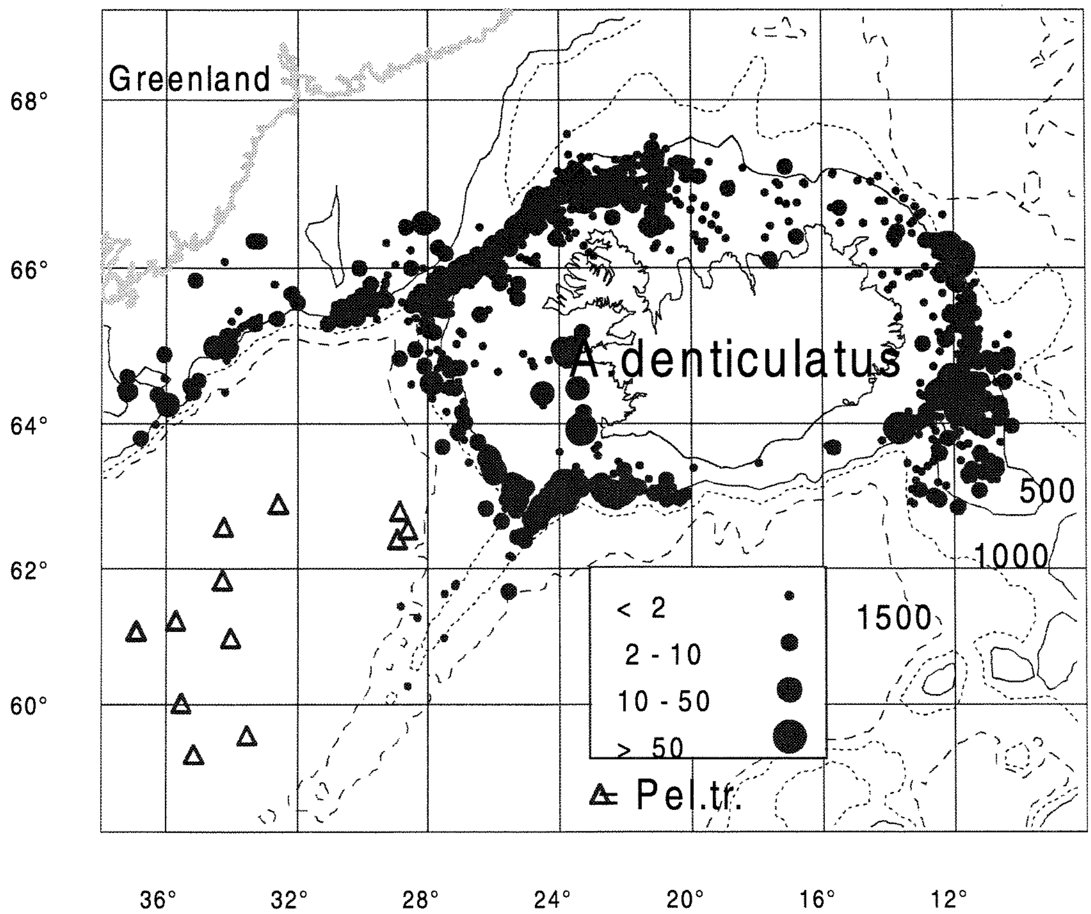



**Figure 5.11.142** *A. denticulatus.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

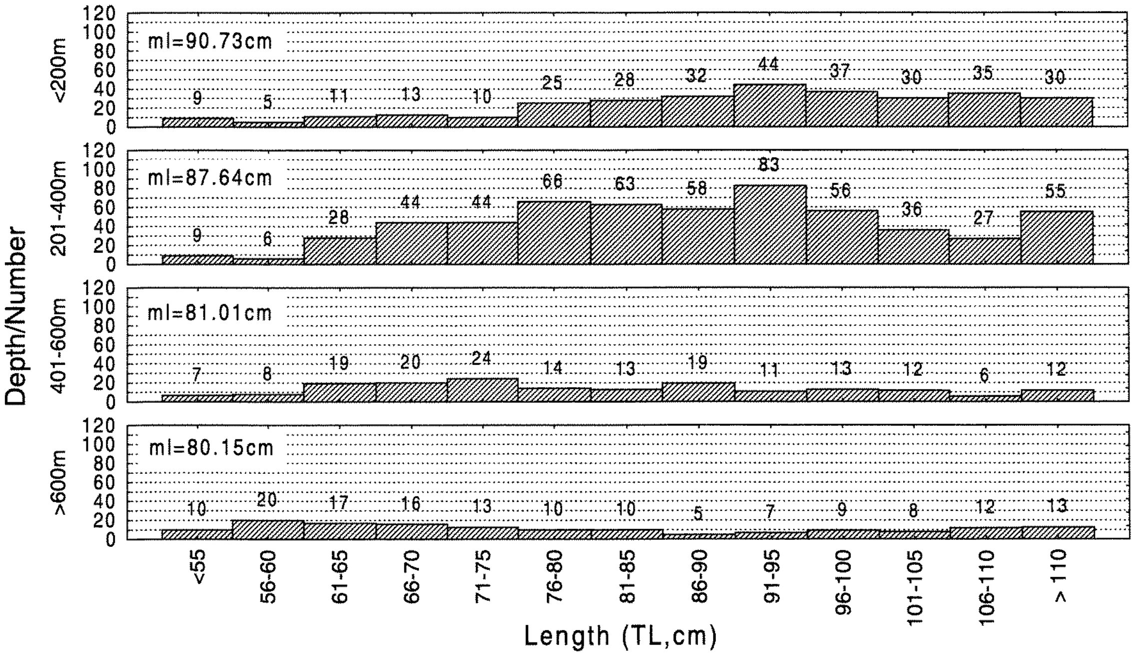


**Figure 5.11.143** *A. denticulatus.* Length and mean length (ml) by depth intervals and sex.

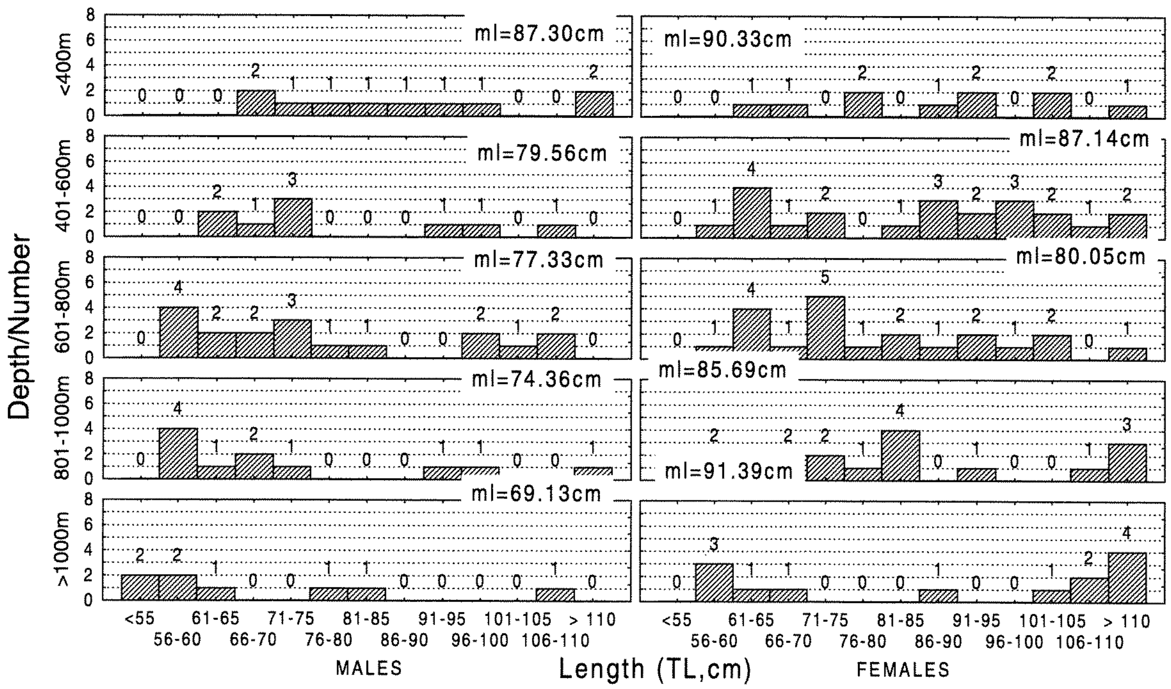



**Figure 5.11.144** *A. denticulatus.* Length distribution by sex.

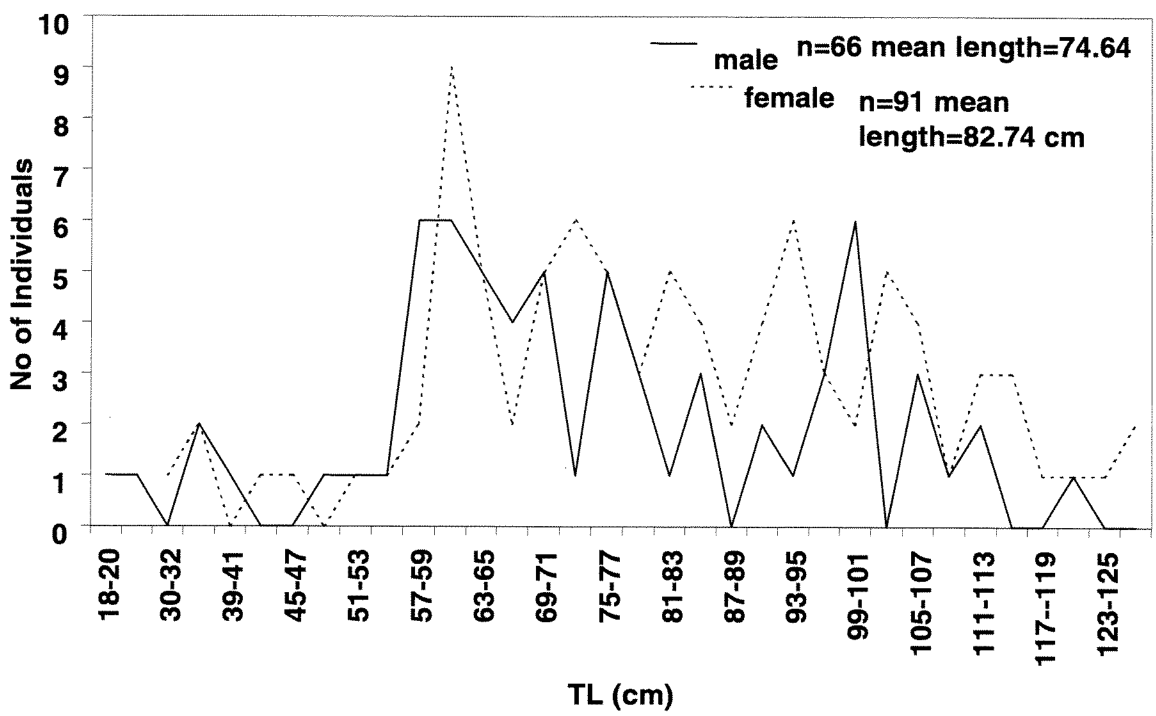


**Figure 5.11.145** *A. denticulatus.* Length-weight relationship by sex.

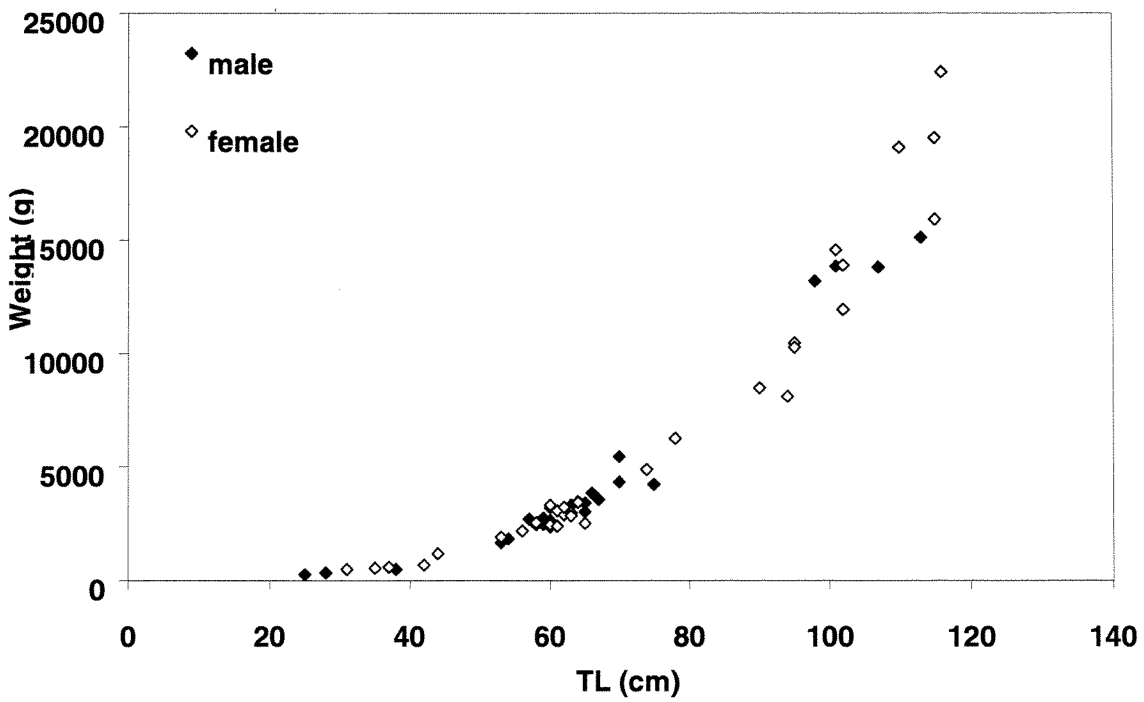



**Figure 5.11.146** *A. denticulatus.* Maturity stages by season (males: filled bars, females: open bars).

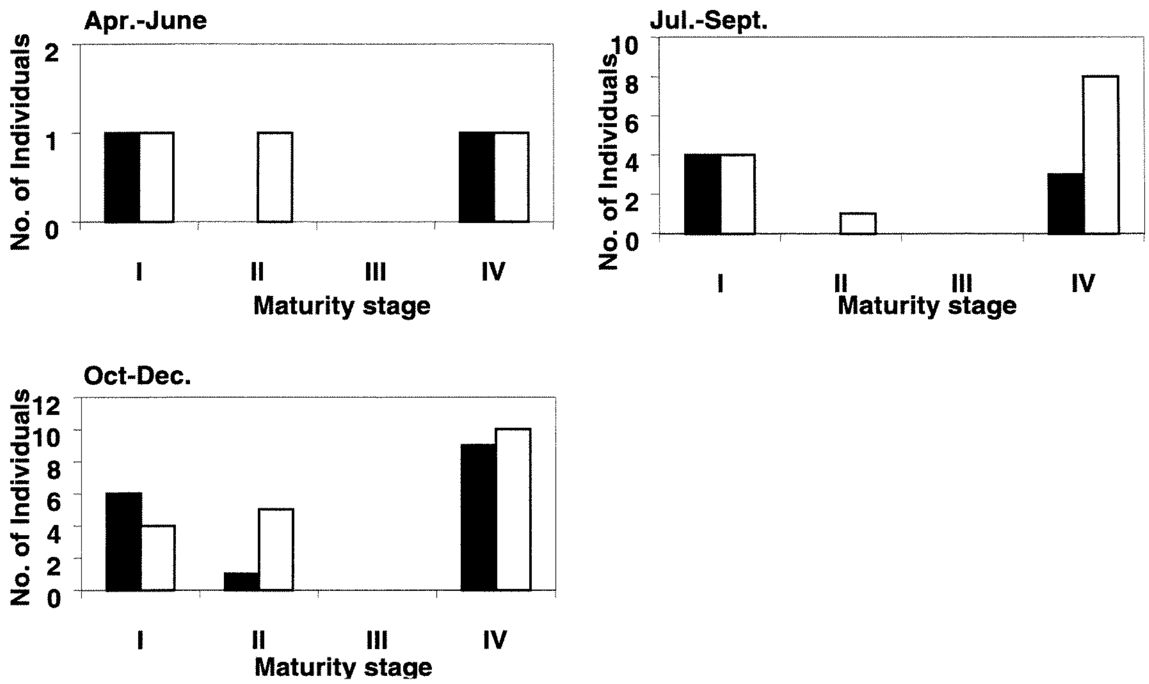


**Figure 5.11.147** *L. esmarki.* Distribution and relative abundance in numbers.

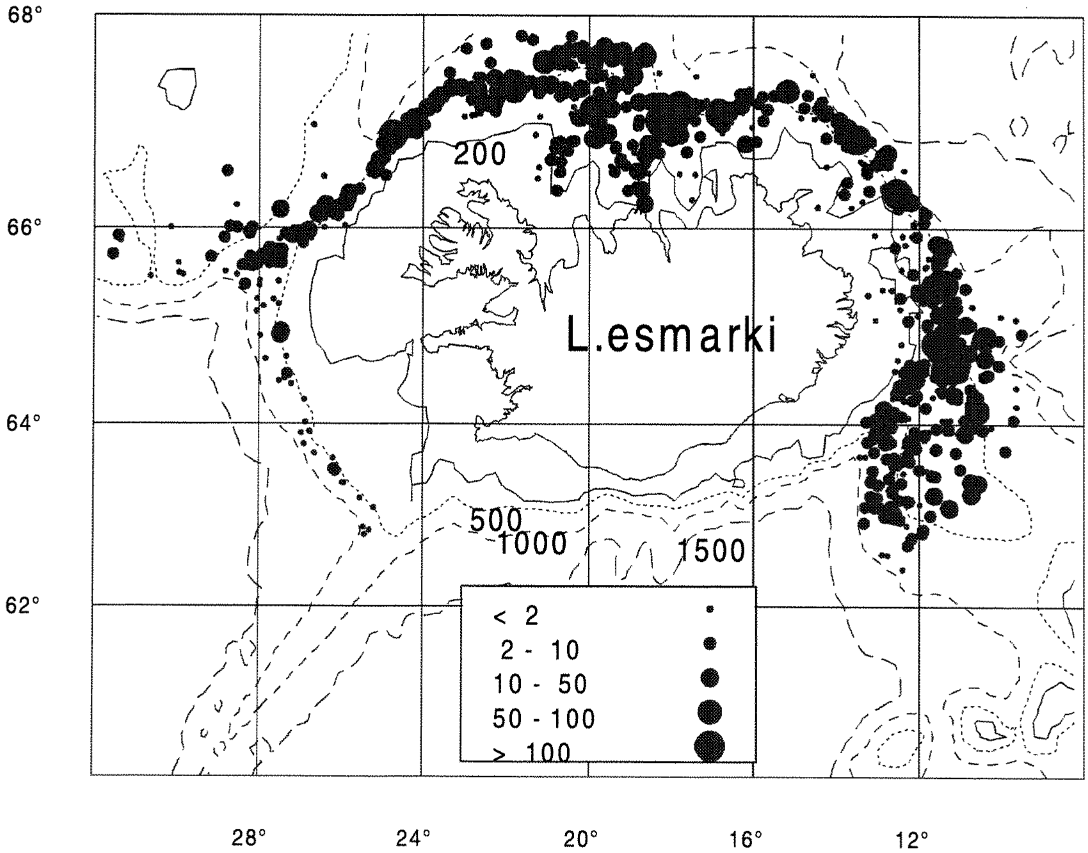



**Figure 5.11.148** *L. esmarki.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

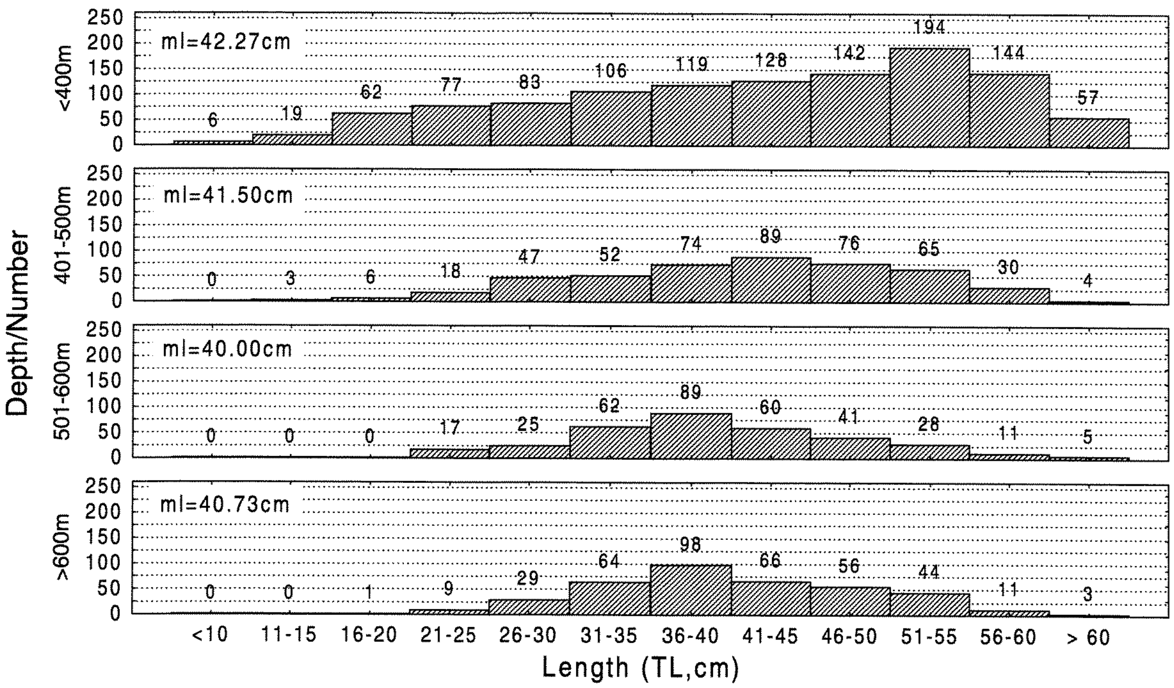


**Figure 5.11.149** *L. esmarki.* Length and mean length (ml) by depth intervals and sex.

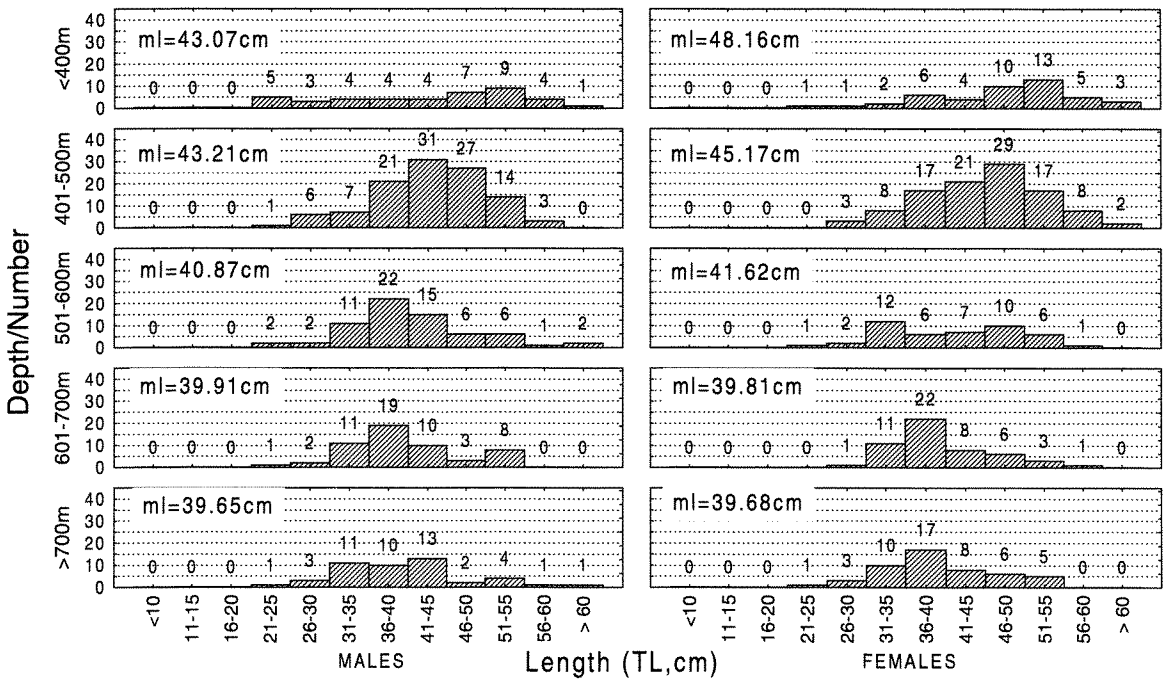



**Figure 5.11.150** *L. esmarki.* Length distribution by sex.

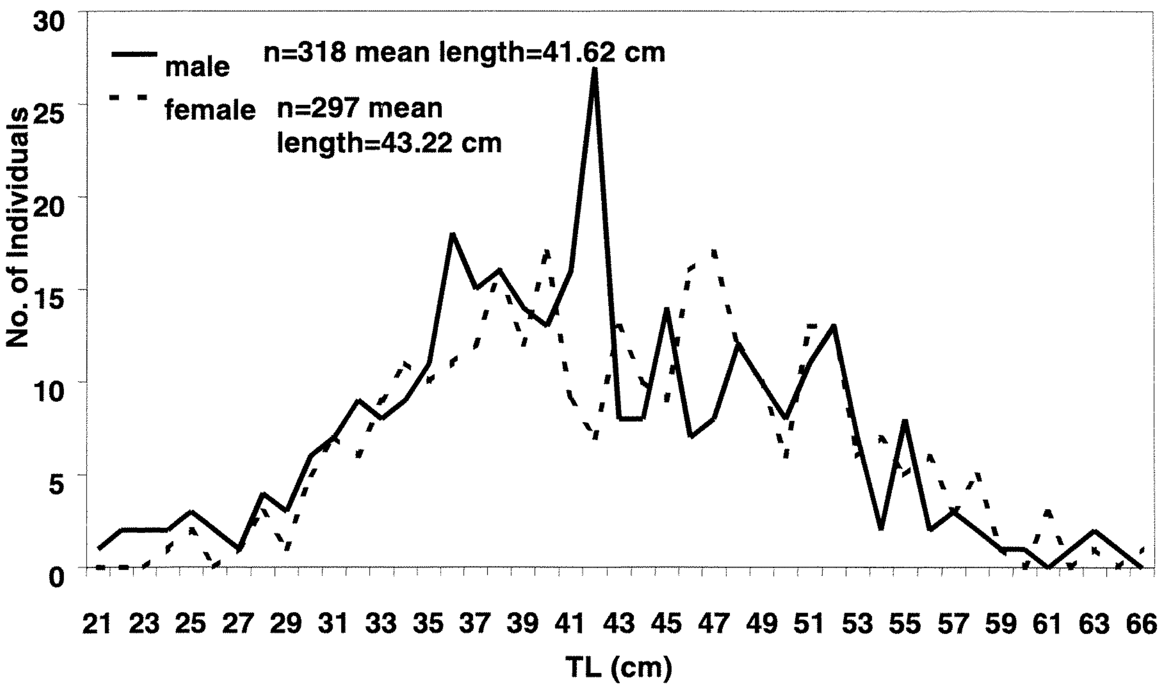


**Figure 5.11.151** *L. esmarki.* Length-weight relationship by sex.

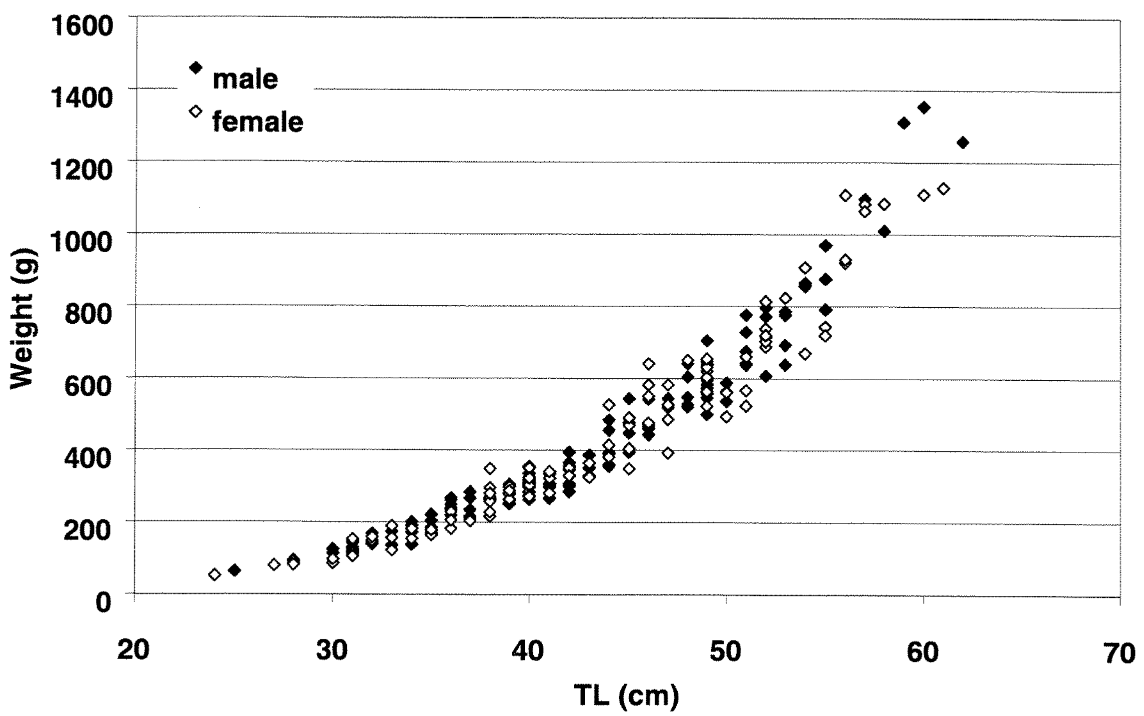



**Figure 5.11.152** *L. esmarki.* Maturity stages in October-December (males: filled bars, females: open bars).

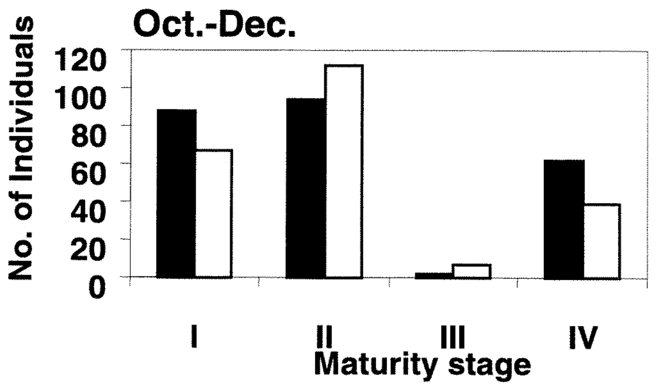


**Figure 5.11.153** *L. reticulatus.* Distribution and relative abundance in numbers.

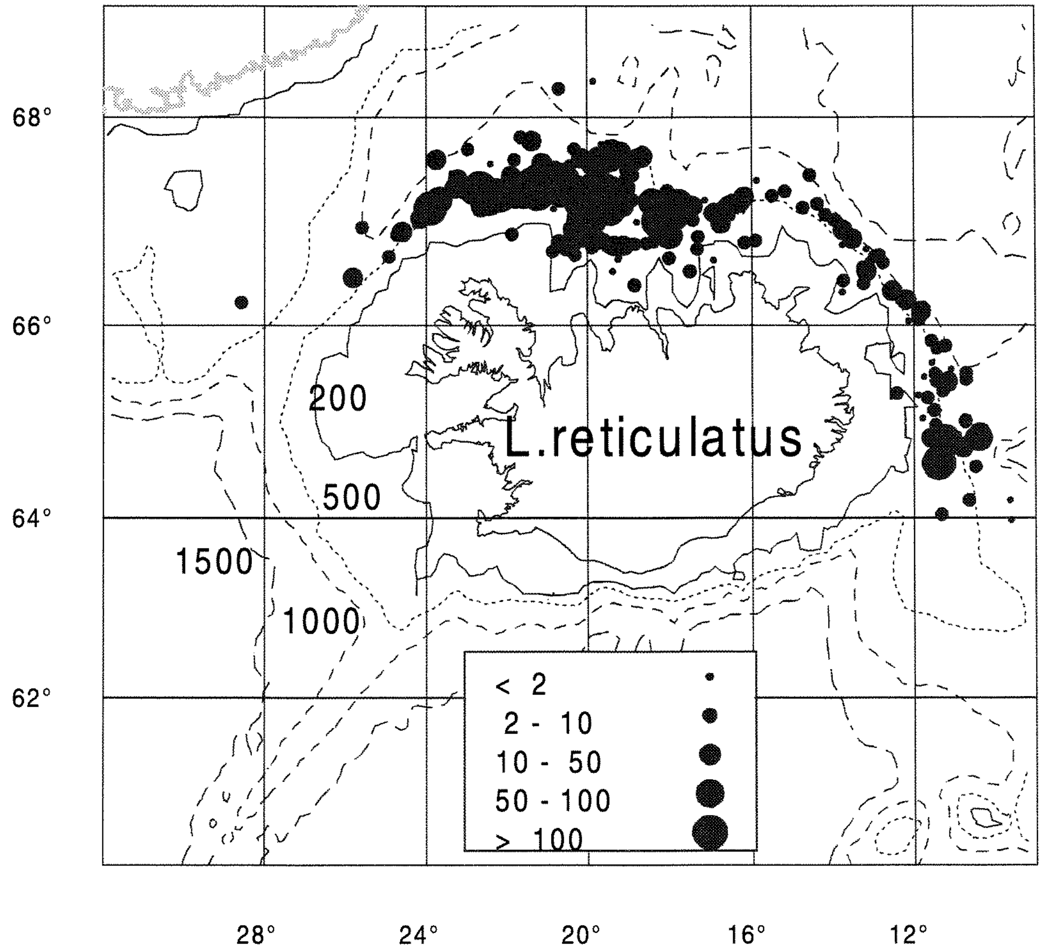



**Figure 5.11.154** *L. reticulatus.* Length-depth relationship and mean length (ml) by 100 m depth intervals.

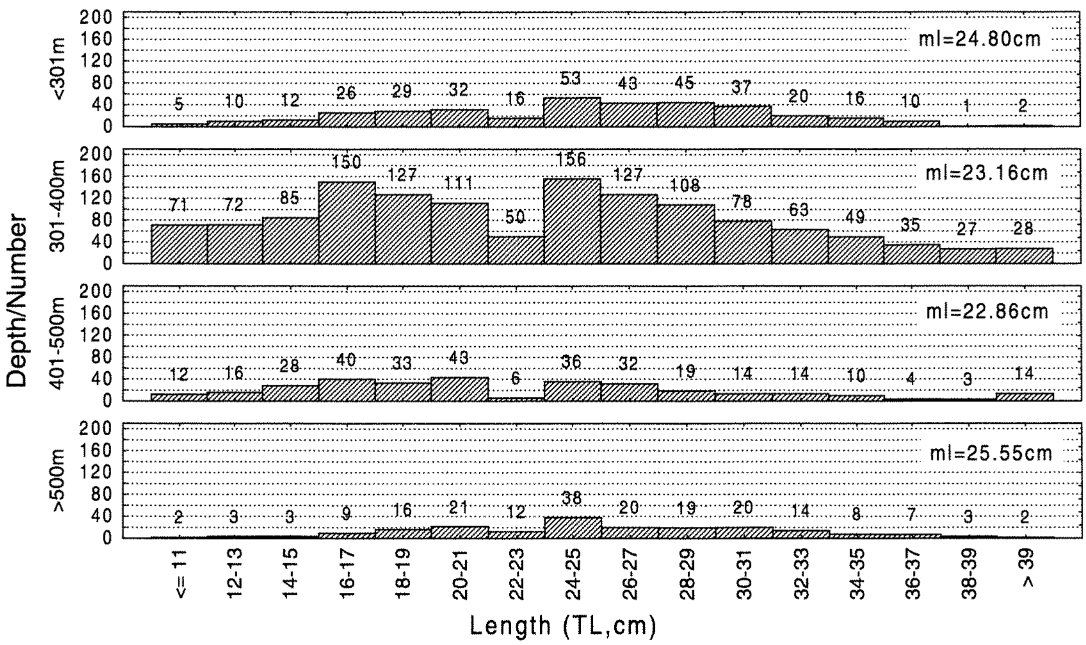


**Figure 5.11.155** *L. reticulatus.* Length and mean length (ml) by depth intervals and sex.

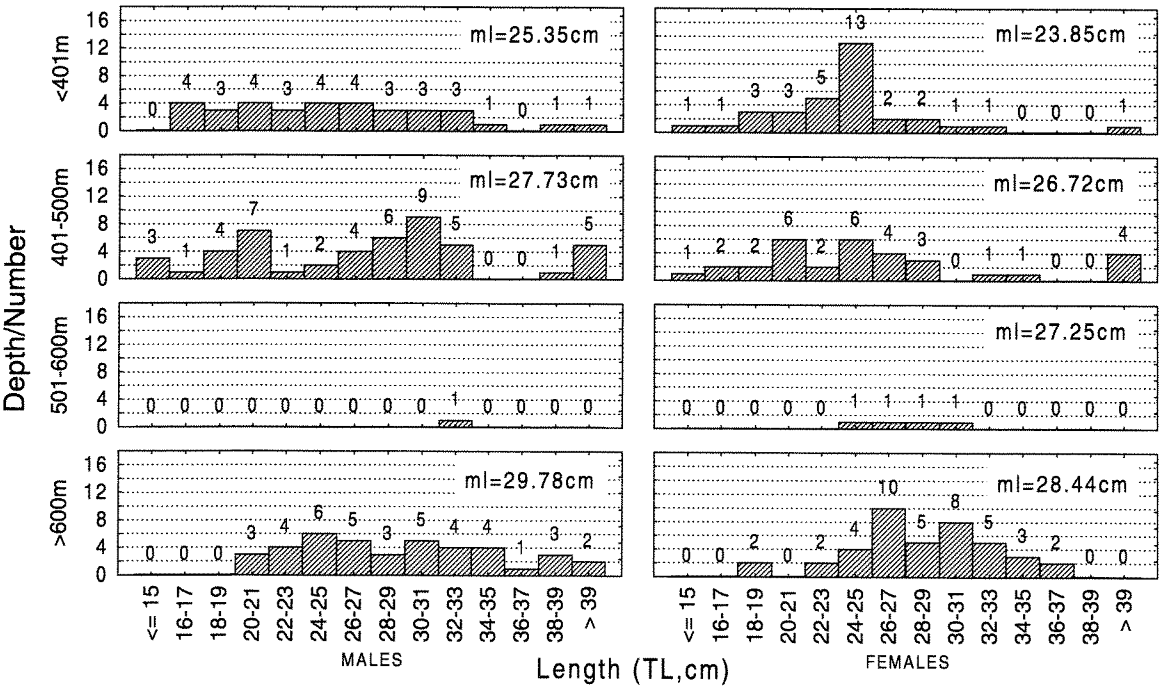



**Figure 5.11.156** *L. reticulatus.* Length distribution by sex.

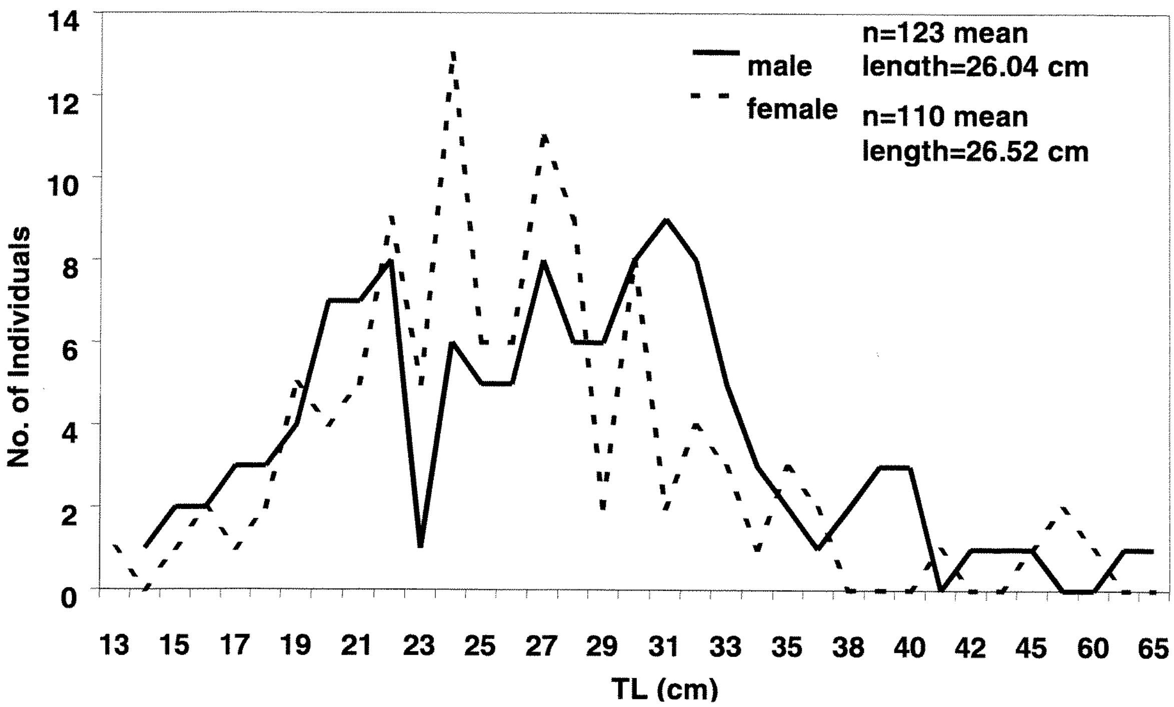


**Figure 5.11.157** *L. reticulatus.* Length-weight relationship by sex.

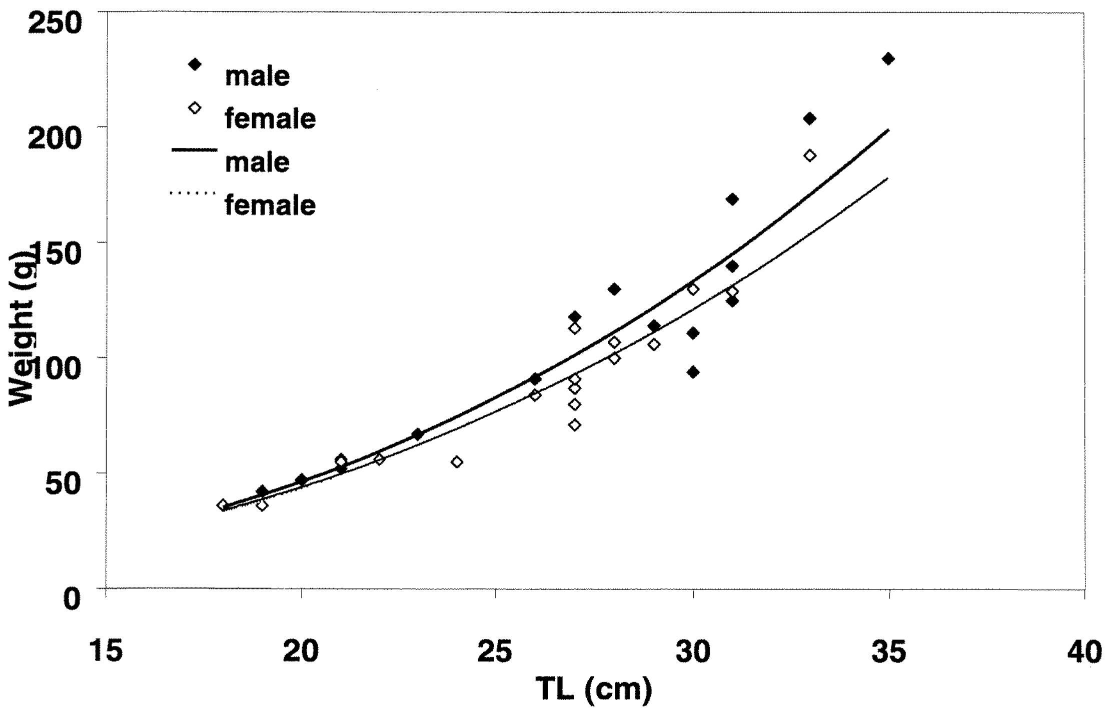



**Figure 5.11.158** *L. reticulatus.* Maturity stages in October-December (male: filled bars, females: open bars).

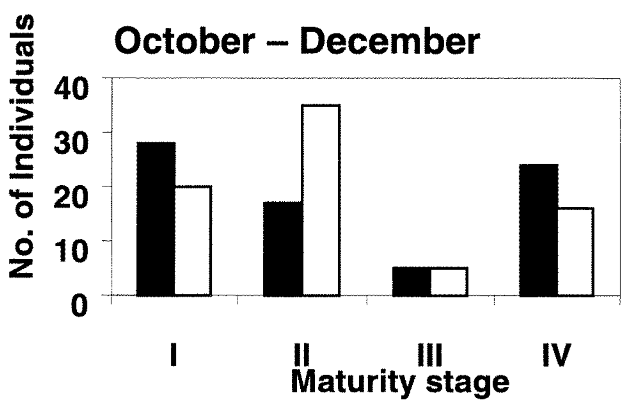


**Figure 5.11.159** *C. reinhardti.* Distribution and relative abundance in numbers.

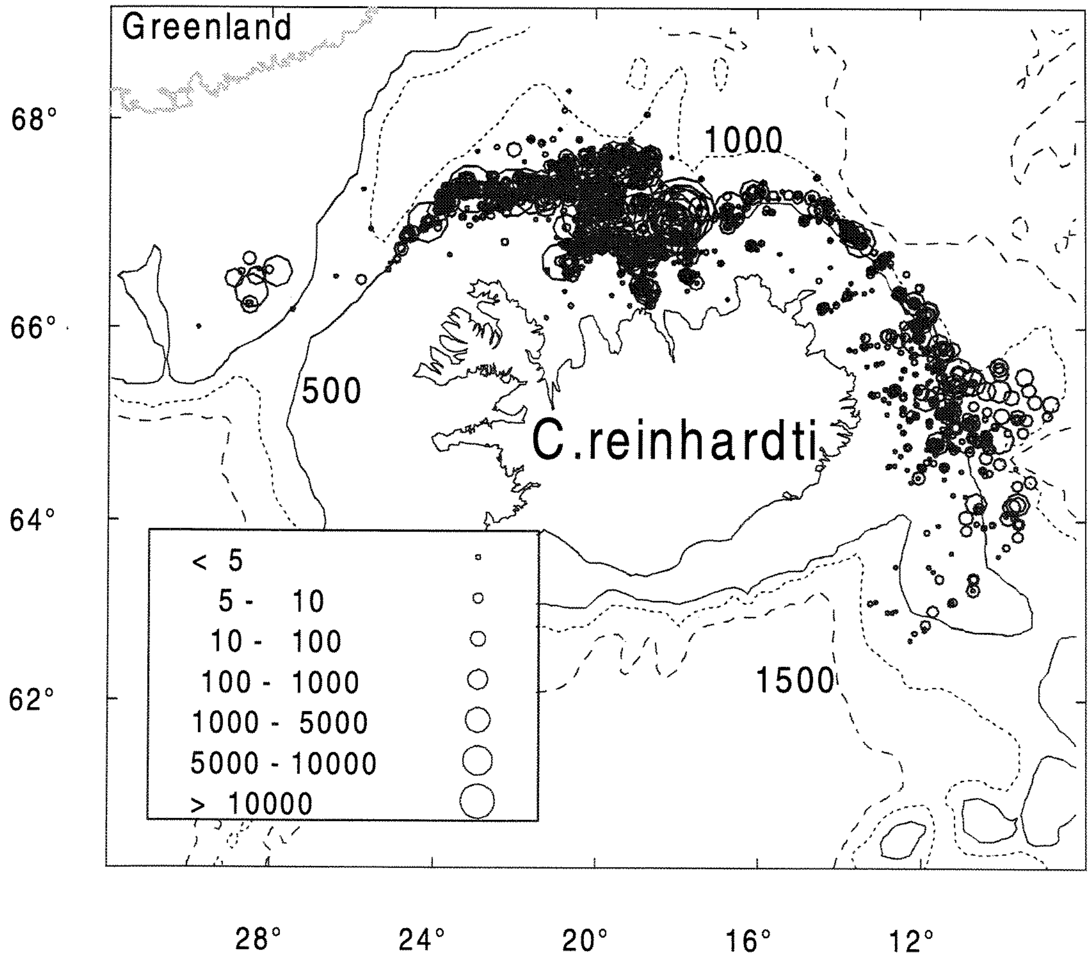



**Figure 5.11.160** *C. reinhardti.* Length-depth relationship and mean length (ml) by 200 m depth intervals.

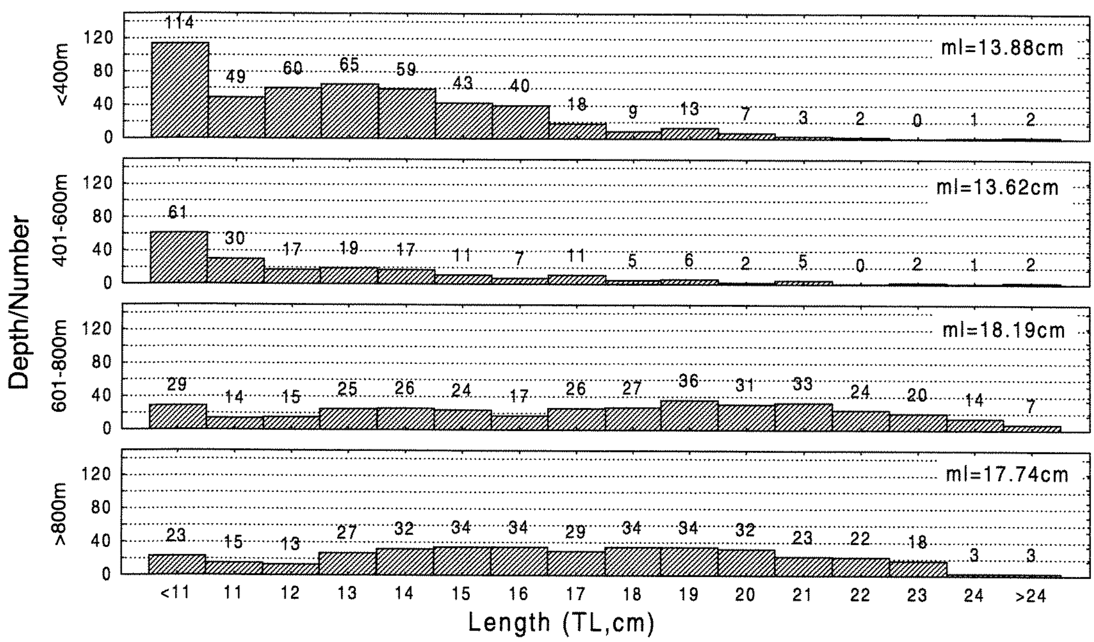


**Figure 5.11.161** *C. rèinhardti.* Length and mean length (ml) by depth intervals and sex.

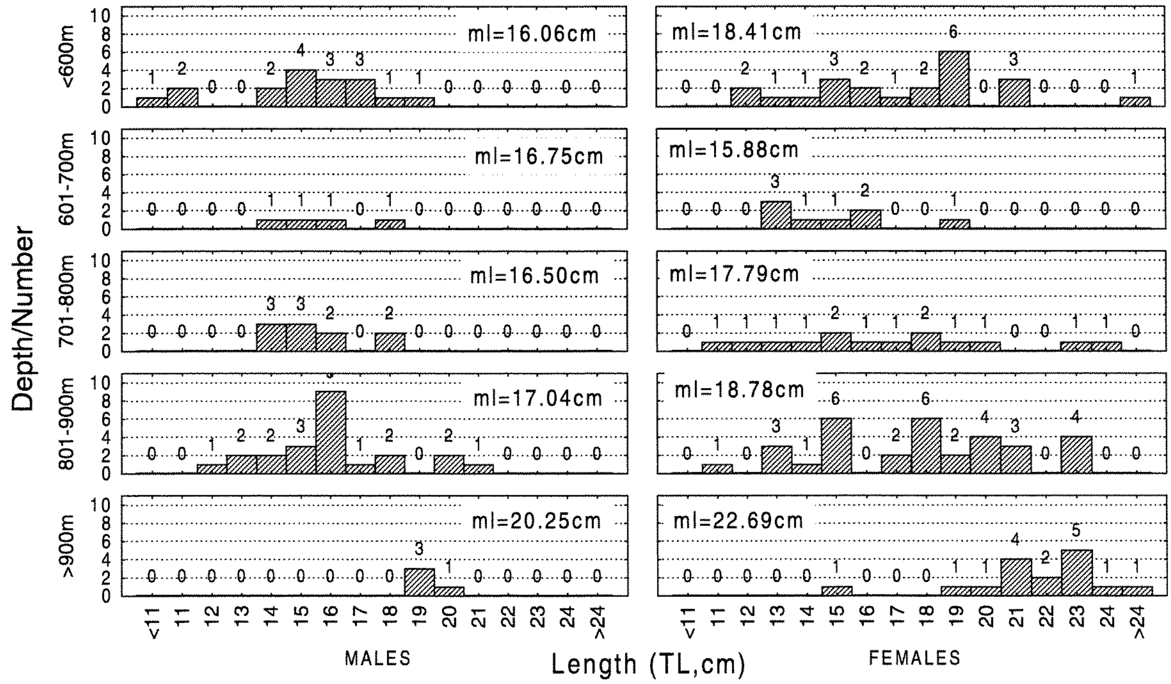



**Figure 5.11.162** *C. reinhardti.* Length distribution by sex.

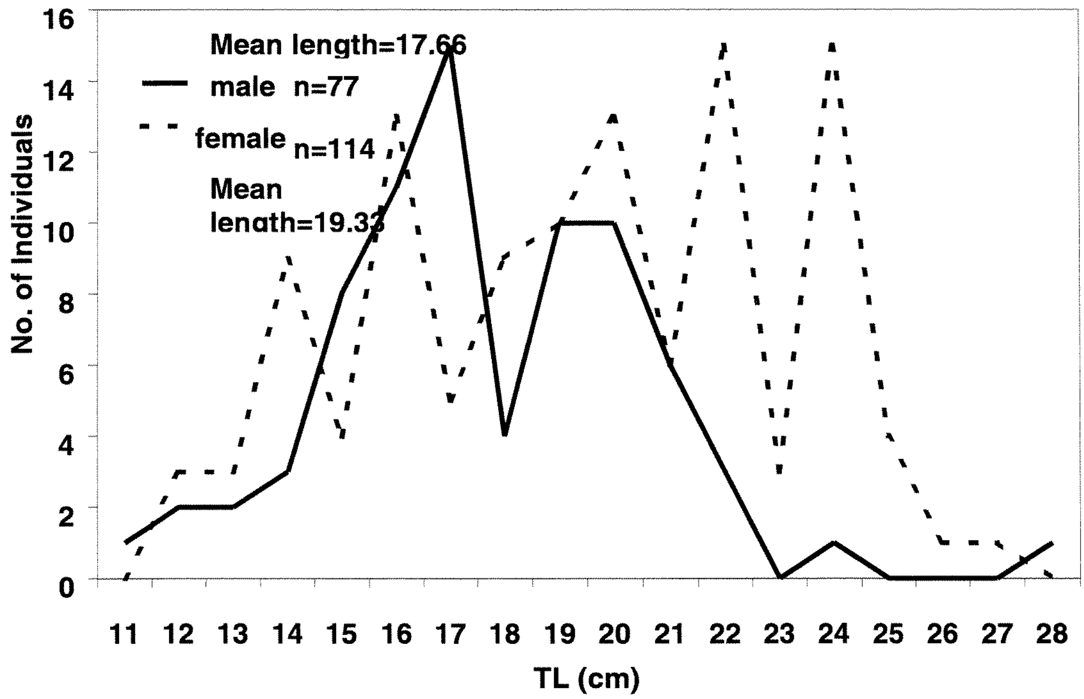


**Figure 5.11.163** *C. reinhardti.* Length-weight relationship by sex.

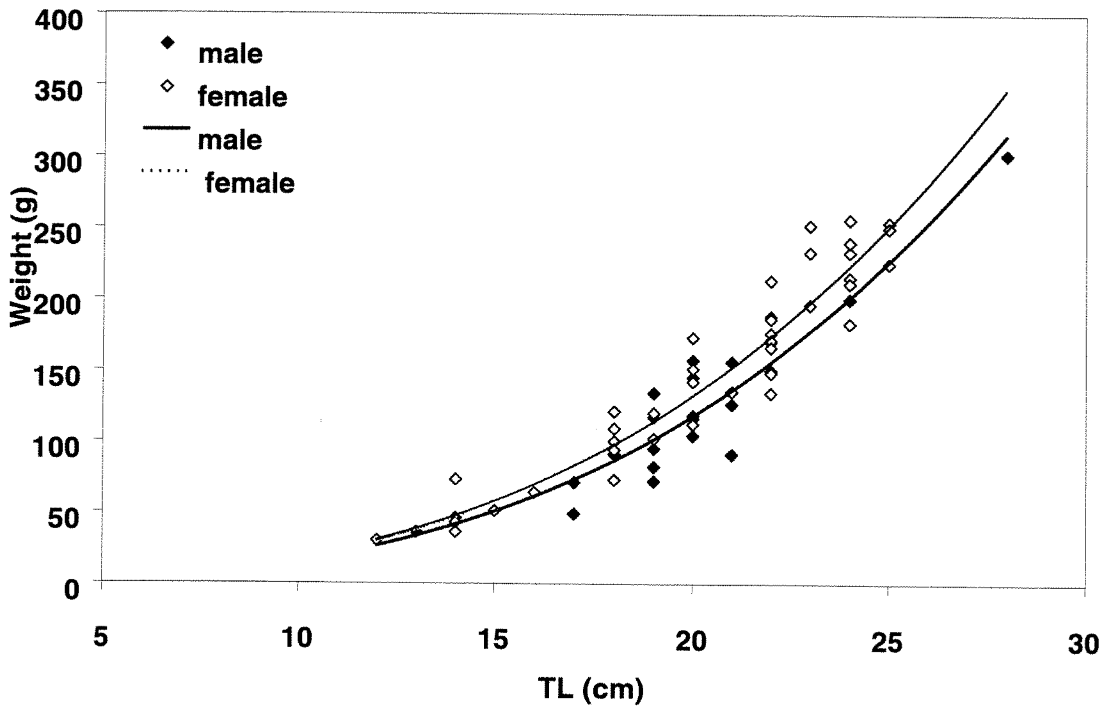
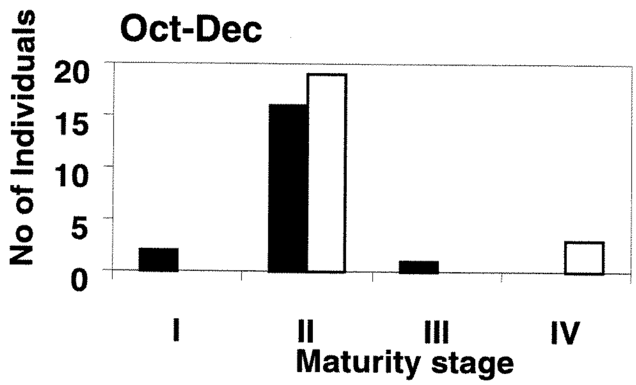



**Figure 5.11.164** *C. reinhardti.* Maturity stages in October-December (males: filled bars, females: open bars).



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75. Nytjastofnar sjávar 1999/2000. Aflahorfur fiskveiðiárið 2000/2001. *State of Marine Stocks in Icelandic Waters 1999/2000. Prospects for the Quota year 2000/2001. Reykjavík 2000*. 176 s.

76. **Jakob Magnússon, Jútta V. Magnússon, Klara B. Jakobsdóttir**: Djúpfiskarannsóknir. Framlag Íslands til rannsóknaverkefnisins EC FAIR PROJECT CT 95-0655 1996-1999. *Deep-Sea Fishes. Icelandic Contributions to the Deep Water Research Project. EC FAIR PROJECT CT 95-0655 1996-1999*. Reykjavík 2000. 164 s.

77. Þættir úr vistfræði sjávar 1999. *Environmental Conditions in Icelandic Waters 1999*. Reykjavík 2000. 31 s.

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