CEPHALOPODS IN GREENLAND WATERS

A FIELD GUIDE

Technical report no. 58, 2004
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CEPHALOPODS IN GREENLAND WATERS

A FIELD GUIDE

by

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SIULEQUTSIUSSAQ

Una najoqqutassiaq Kalaallit Nunaata imartaani amikoqatigiiaat immikkoortissinnaanissaannut iluaqutissiatut suliaavoq. Amikut ukiut ingerlanerani annikitsuinnarmik misissuiffigineqartarsimapput, taamaattumillu amikoqatigiiaat assigiinngitsut allartorsimanerat aammalu paasissutissat siaruarsimanerinut tunngassuteqartut tamakkiisutut isigineqarsinnaanatik. Amikut Kalaallit Nunaata imartaani uumassuseqarnermut sunniuteqartarnerinut tunngatillugu maannakkut ilisimasanik tunngaveqartumik allaaserisaq aammalu aalisarneqarsinnaanerinut periarfissaasinnaasunut tunngassuteqartoq uani atuarneqarsinnaapput:
Frandsen and Wieland 2004, Cephalopods in Greenland Waters. Technical report no. 57, Pinngortitaleriffik, Greenland Institute of Natural Resources.

INTRODUKTION

Det primære mål med denne felt-manual er at lette artsbestemmelsen af de blæksprutter, der er mest almindelige i grønlandsk farvand. I tidens løb er blæksprutterne kun blevet undersøgt i begrænset omfang, og listen af arter samt deres udbredelse og levested skal derfor ikke betragtes som fuldstændig. En introduktion til blæksprutternes økologiske rolle i grønlandsk farvand og deres mulige fiskeripotentiale findes i: Frandsen and Wieland 2004, Cephalopods in Greenland Waters. Technical report no. 57, Pinngortitaleriffik, Greenland Institute of Natural Resources.

INTRODUCTION

The aim of this field guide is to facilitate species determination of the most common cephalopods in Greenland waters. The topic has received relatively little attention in the past and the list of species as well as their distribution and habitat should therefore be regarded as guidelines only. For an introduction to the ecological role of cephalopods in Greenland waters and their potential as fishery resource please see: Frandsen and Wieland 2004, Cephalopods in Greenland Waters. Technical report no. 57, Pinngortitaleriffik, Greenland Institute of Natural Resources.

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GENERAL CHARACTERISTICS OF CEPHALOPODS

The Cephalopoda is an ancient and very successful group of molluscs. They have a well defined head with image-forming eyes, 8-10 arms surrounding the mouth, a funnel, and a horny beak*. The internal organs are enclosed in a fold of the body called the mantle. In most cephalopods the mantle contains strong muscles that can expel water from the mantle cavity through the funnel and thereby provide the driving force for locomotion.
In cephalopods with 10 arms, two of the arms are modified to be contractible grasping device. Each tentacle consists of a proximal stalk – usually free of suckers – and a distal club armed with suckers and/or hooks (Fig. 1). In order to differentiate between the arms, they are numbered in pairs starting from the dorsal side (Fig.2)

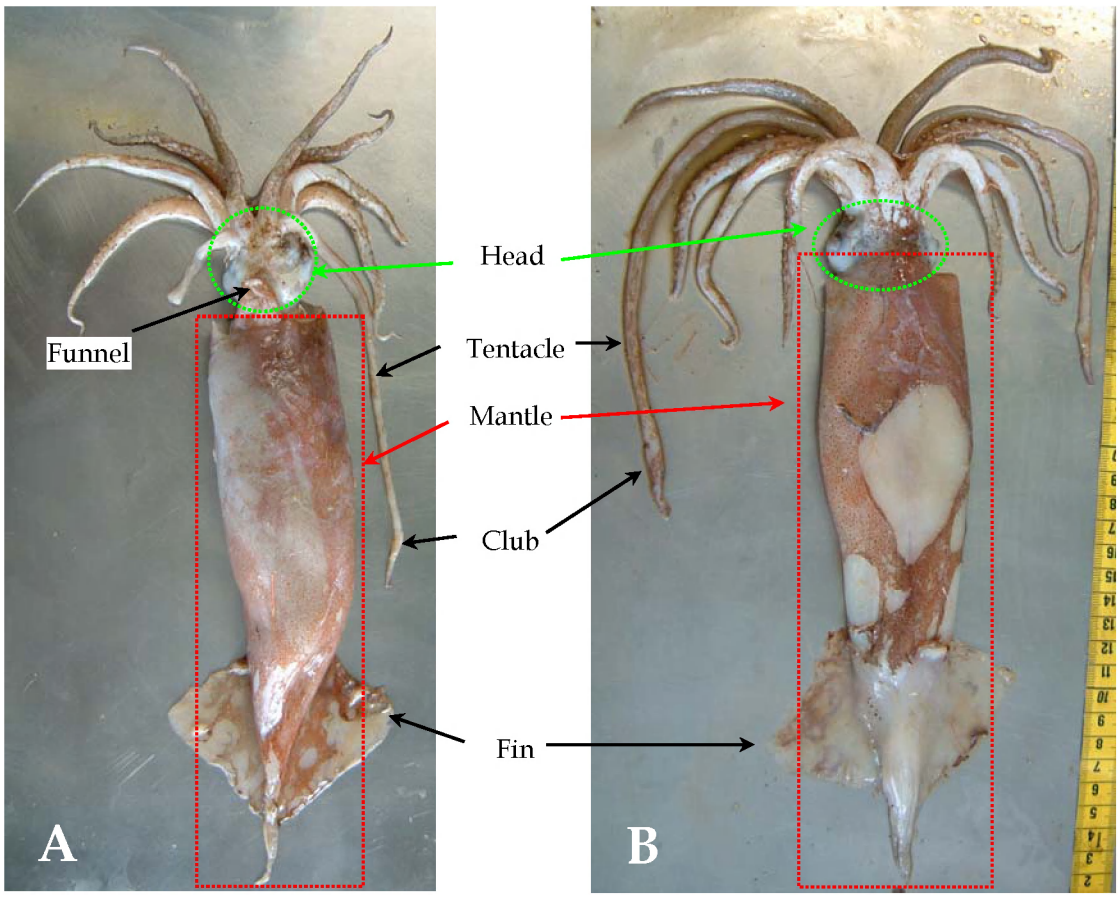


Fig. 1. Ventral (A) and dorsal (B) view of *Gonatus fabricii*. The funnel is located on the ventral side of the animal.

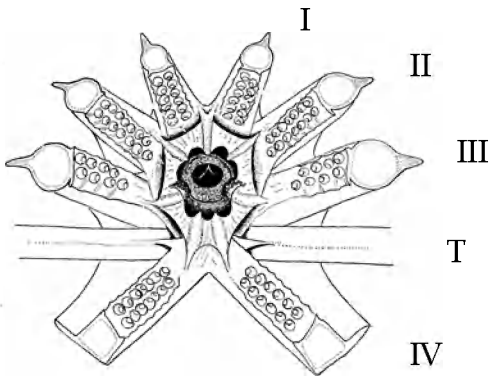


Fig. 2. Arm-pairs are numbered from the dorsal side of the animal. Squids, bobtail squids and cuttlefish have a pair of tentacles (T) between 3rd and 4th pair of arms (after Muus 1959)

* Several of these general morfological features do not apply to the family Nautilidae. Nautilidae are geographically limited to the tropical Indo-West Pacific.

WORKING WITH CEPH'S

Size

Length

In squids and bobtail squids, dorsal mantle length is a frequently used measurement of size. Due to gear damage of the tissue and the texture of the animals, this measurement will contain some degree of error. In this field guide, mantle length is used as an indication of size range of the different species (Fig. 3).

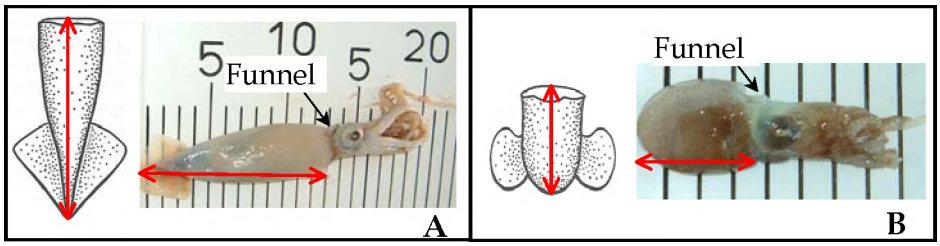


Fig. 3. Ventral (drawing) and lateral (picture) view of squid (A) and bobtail squid (B). Red arrows indicate mantle length. (drawings are from Nesis 1987)

For species that have a pen (a chitinous string positioned dorsally in the mantle), pen length is a more precise measurement (fig 4). The pen can usually be removed by tearing or slitting the dorsal side of mantle.

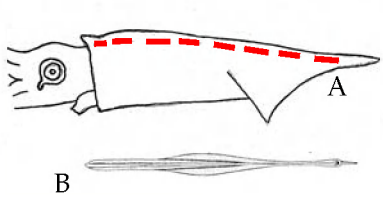


Fig 4. Lateral view of squid (A) and ventral view of pen (B). Dotted red line indicate position of pen. (B is from Muus 1959)

In octopods, mantle and head is fused dorsally and they have no pen. Total length: posterior end of mantle to tip of longest arm (Fig. 5), is therefore often used as a rough size estimate.

Fig 5. Dorsal view of octopus with red arrow indicating total length of the animal.

Weight

Total weight of the animal is a useful measure of size. Furthermore, weight of digestive gland may be used to determine condition of the animal.

Sex and maturity

A distinct sexual dimorphism is uncommon in cephalopods and dissection is therefore most often needed for sex determination. Cephalopods have a single gonad located in the posterior end of the body (App 1, fig 1A-2A). In males, sperm is rolled together in a spermatophor which is deposited on the female, where it fuses with the tissue. For this purpose one arm of the male has been modified – the ligula in incirrate octopods is the most obvious example of this. The female has 1 or 2 oviducts that eventually terminate near the mantle opening.

Determination of maturity differ between species and for a thorough guide to this, please consult: Lipinski 1979, Universal maturity scale for commercially important squids (Cephalopoda: Teuthoidae). ICNAF Res. Doc. 79/II/38, p 53-64.

Preservation of specimens

Cephalopods are well preserved when frozen. The degradation is fast and the specimens should be frozen as soon as possible after capture.

FEATURES OF THE FIELD GUIDE

Species determination

The field guide is primarily based on external characters that do not require a dissection of the specimens. As far as possible, the structural features of the immature and mature specimens of both sexes are taken into consideration. Unfortunately, identification of immature specimens as well as female octopods is often extremely difficult and sometimes practically impossible, so they may key only to genus or subgenus.

Distribution

Maps of distribution are based on findings in one shrimp survey conducted by Greenland Institute of Natural Resources (indicated by red crosses ✚) and descriptive information from the literature (indicated by green colouring ▇) (e.g. Collins 2002, Kristensen 1981, Maddison et al. 2004, Muus 1959, Muus 1962, Muus 2002, Nesis 1987, Okutani 2001, Roper et al. 1984, Wood and Day 1998-2004). Maps are in geodetic datum: WGS 84 and projection: UTM zone 24.

Please note:

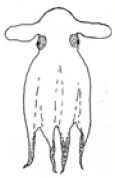
- Colour of cephalopods is not a useful characteristic in species determination. Furthermore the skin is often damaged by the fishing gear revealing the white muscles.
- The tentacles of squids and bobtail squids are often damaged or torn off during capture. Remains of the tentacles are usually visible at the base of the arms.

CEPHALOPOD SPECIES IN GREENLAND WATERS

Based on external characters, cephalopods represented in Greenland waters can be divided into four groups: cirrate octopods, incirrate octopods, squids and bobtail squids.

8 ARMS

Mouth and base of arms of incirrate octopod. Note the web connecting the arms.



Cirrate octopods, Cirrata → Page 8-10

The cirrate octopods have a gelatinous texture resembling that of jellyfish. They have paddle-like fins are supported by a cartilage structure and they have series of thread-like cirri along the side of the arms. The 8 arms are connected by a fragile web that is often damaged by the gear.

Incirrate octopods, Incirrata → Page 11-13

The incirrate octopods have a sac-like body with no lateral fins. They have 8 arms only (no tentacles) with bases connected by a membranous web.

8 ARMS + 2 TENTACLES

Mouth, and base of arms and tentacles of squid.

Squids, Teuthida → Page 14-18

The squids have an elongate, torpedo like body with postero-lateral fins and 8 arms + 2 tentacles. Groups of suckers and/or hooks forms a club at the end of each tentacle.

Bobtail squids, Sepiolida → Page 19-22

The bobtail squid have a broad sac-like body with lateral fins that in the Greenland species are round and flap-like. Like squids, bobtail squid have 8 arms + 2 tentacles with distal clubs.

Cirrate octopods, Cirrata

The web is very fragile and is most often damaged by the gear !

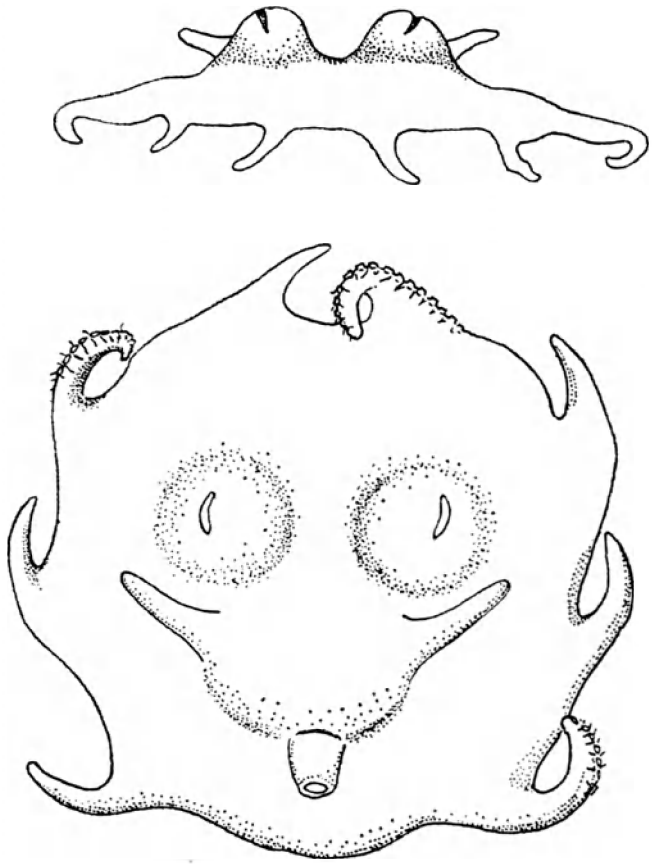


Fig.20. *Opisthoteuthis* sp. seen from front (A) and from above (B). (A+B from Muus 1959).

SHELL OF CIRRATE OCTOPODS

Supporting the lateral fins, cirrate octopods have an internal shell of cartilage-like consistency. The shape of the shell is used in species determination. The illustration shows a dorsal view of a stained, U-formed shell from *Opisthoteuthis* sp. (Illustration from Maddison et al 2004)

Opisthoteuthis sp.

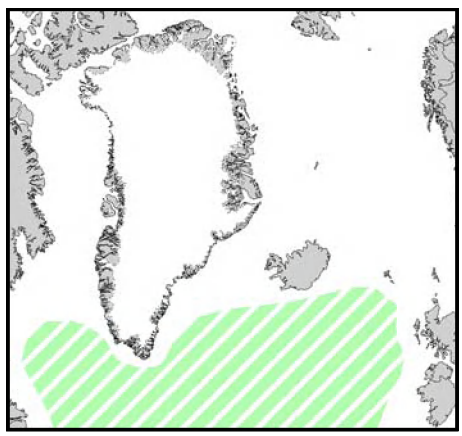
Size: Total length ≤ 25 cm

Characteristics: Tissue is gelatinous, cirri (see box on page 9) are short to moderate and the fins are small.
The genus is the most compressed of all cephalopods giving them a flattened appearance. Eyes are large – often 50% of head width. The internal shell is U-shaped (see box).

Similar species: Differ from *Cirroteuthis mülleri* and *Stauroteuthis syrtensis* in the flattened shape of body and the absence of a secondary web (see box on page 10).

Habitat: Primarily benthic and found from 800-1500 m

Distribution:



The northern distribution of the genus is based on very few specimens.

The web is very fragile and is most often damaged by the gear !

Photo: Martin Collins

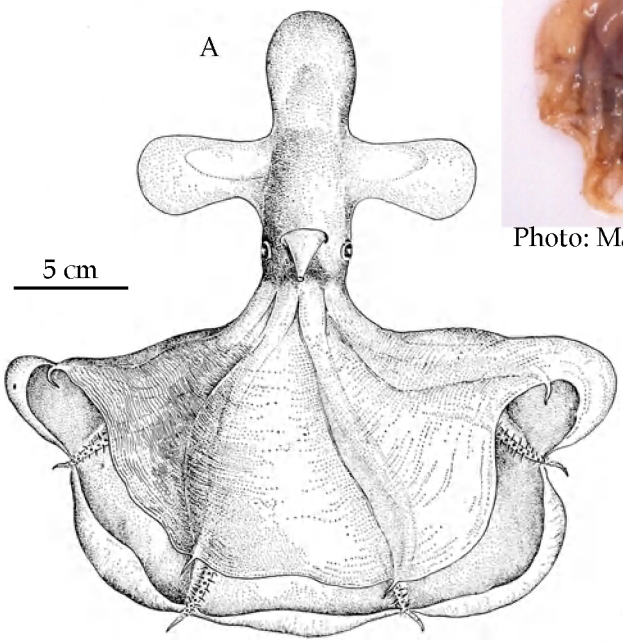


Fig. 18. Ventral (A) and dorsal (B) view of *Cirroteuthis mülleri*. (A from Muus 1959)

Cirroteuthis mülleri

Size: Total length ≤ 35 cm

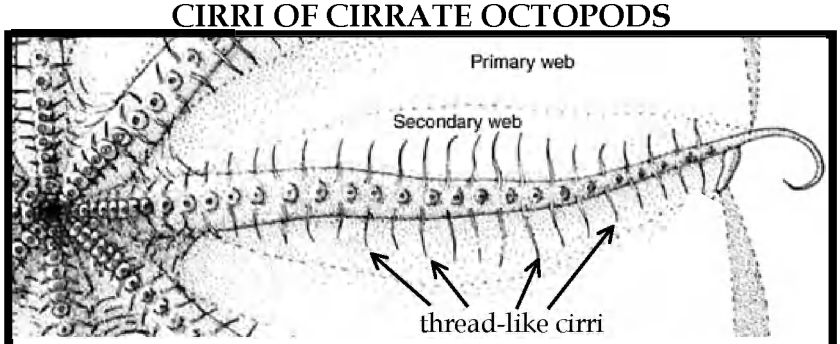
Characteristics: Tissue is gelatinous. Cirri (see box) are very long and fins are large. Eyes are small, their diameter about 10 % of head width.

Similar species: Differ from *Opisthoteutis* sp. in having an elongate body and a secondary web (see box on page 10). Differ from *Stauroteuthis syrtensis* in having a saddle-shaped shell (see box on page 8) and smaller eyes.

Habitat: Bentho-pelagic octopus found at deep-sea from 500-5000 m.

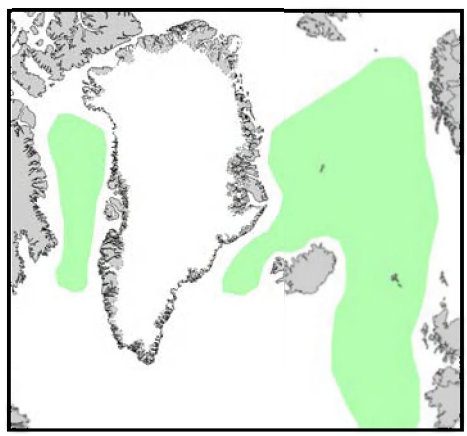
Synonyms:
Sciadephorus mülleri

CIRRI OF CIRRATE OCTOPODS



The cirrate octopods differ from other species of cephalopods in having one series of suckers down the midline of each arm and a series of cirri along each side of each arm. (Illustration from Maddison et al 2004)

Distribution:



Stauroteuthis syrtensis

The web is very fragile and is most often damaged by the gear !

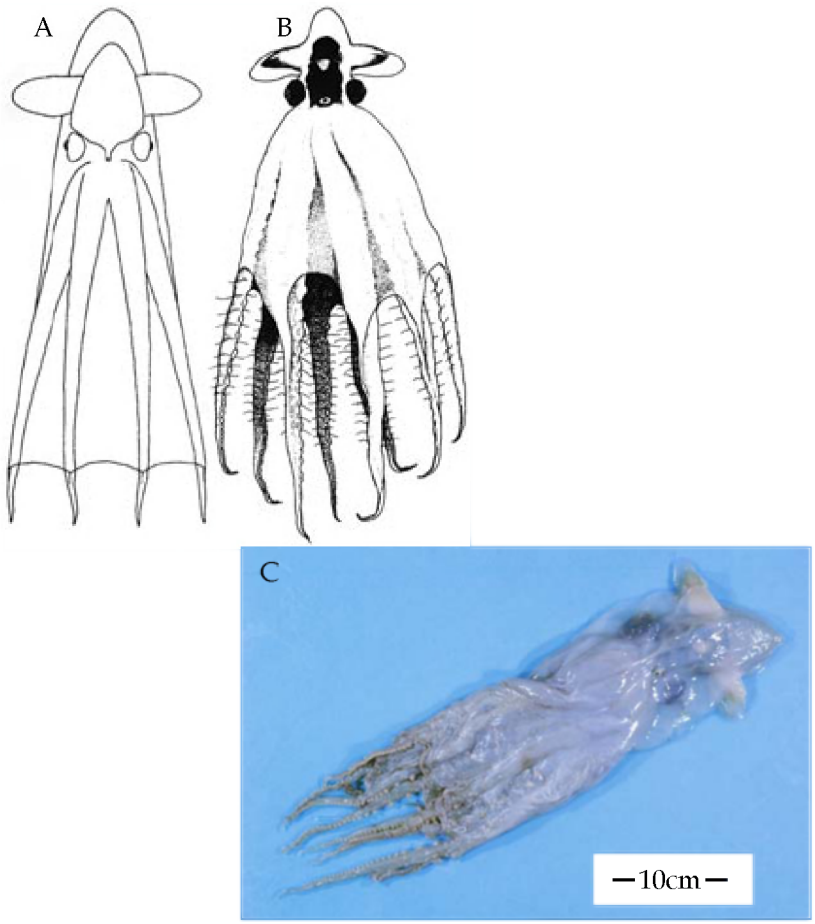


Photo: Martin Collins

Fig. 19. Ventral view of *Stauroteuthis syrtensis* (A-C).(A+B from Maddison et al 2004).

Size: Total length ≤ 50 cm

Characteristics: Tissue is gelatinous. Cirri (see box on page 9) are very long. Anterior-posterior elongation of body pronounced.

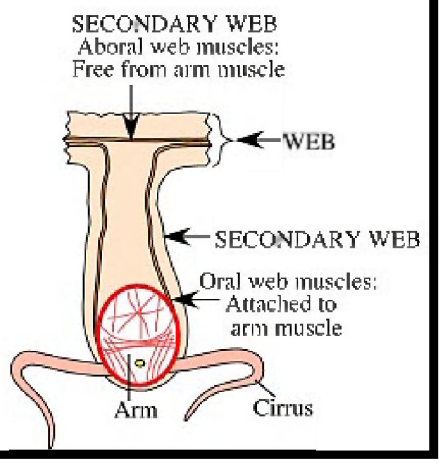
Similar species: Differ from *Opisthoteutis* sp. in having an Elongate body and a secondary web (see box). The species differ from *Cirroteuthis mülleri* in having a simple U-shaped shell (see box on page 8) and bigger eyes (≥ 20% of head width).

Habitat: 400-2500 m

Synonyms:
Cirroteuthis syrtensis
Chunioteuthis ebersbachii

SECONDARY WEB OF CIRRATE OCTOPODS

A characteristic feature of some species of cirrate octopods is the presence of a secondary web. This is a membranous structure distancing the arm from the regular web. The secondary web increases the motility of the arm. Illustration shows a cross section of arm and web. (From Maddison et al 2004).



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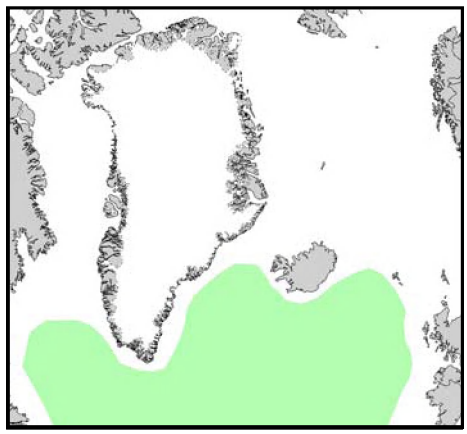
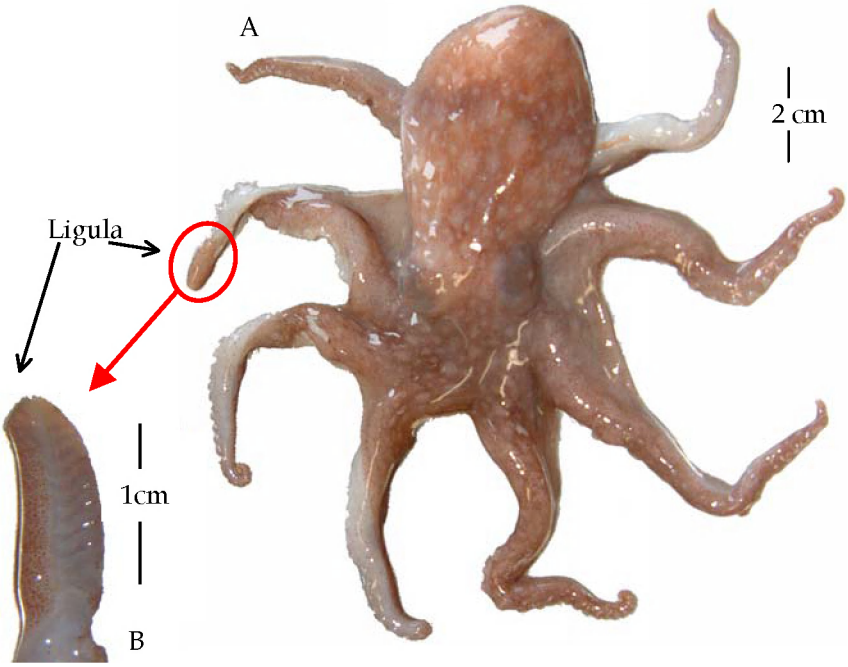
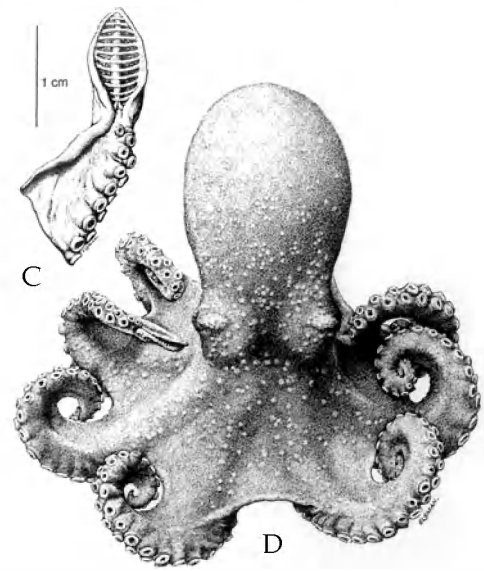
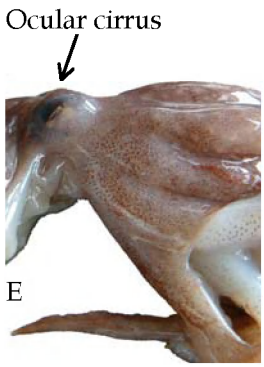


Incirrate octopods, Incirrata







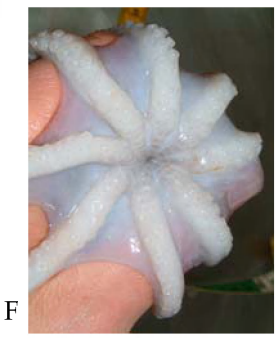


Fig.15. Dorsal view of male (A+D) *Bathypolypus arcticus*. In larger males, the tip of the 3rd right arm is a spoon-shaped ligula (B+C) with curled up sides. Lateral view (E) shows position of ocular cirrus. In the investigated specimens, the inside of the web is without pigmentation (F). (C+D from Muus 2002)

Bathypolypus arcticus

Size: Total length ≤ 20 cm

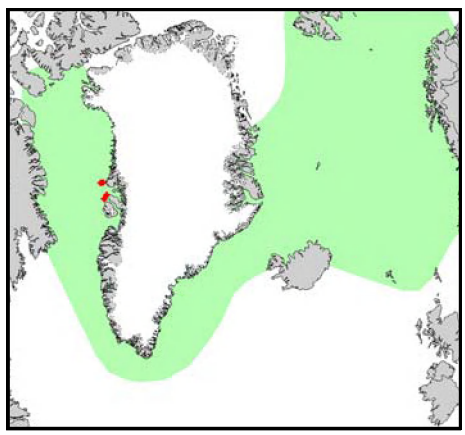
Characteristics: Skin is smooth or papillated with minute warts often in a stellate pattern on small light spots. Above each eye, a crowd of warts forms a cirrus.

Similar species: Differ from *B. bairdii* and *B.pugniger* in having an egg-shaped body with a slight constriction behind the head. Eye-balls are smaller (diameter < 33% of mantle length). The ligula has 11-17 transverse ridges.

Habitat: Benthic octopus found at depths from 15-1600 m.

Synonyms:
Octopus arcticus, O. grönlandicus, O. piscatorum, Polypus piscatorum, P. faeroensis, Bathypolypus faeroensis, Benthoctopus piscatorum, B. sasakii

Distribution:



Bathypolypus bairdii

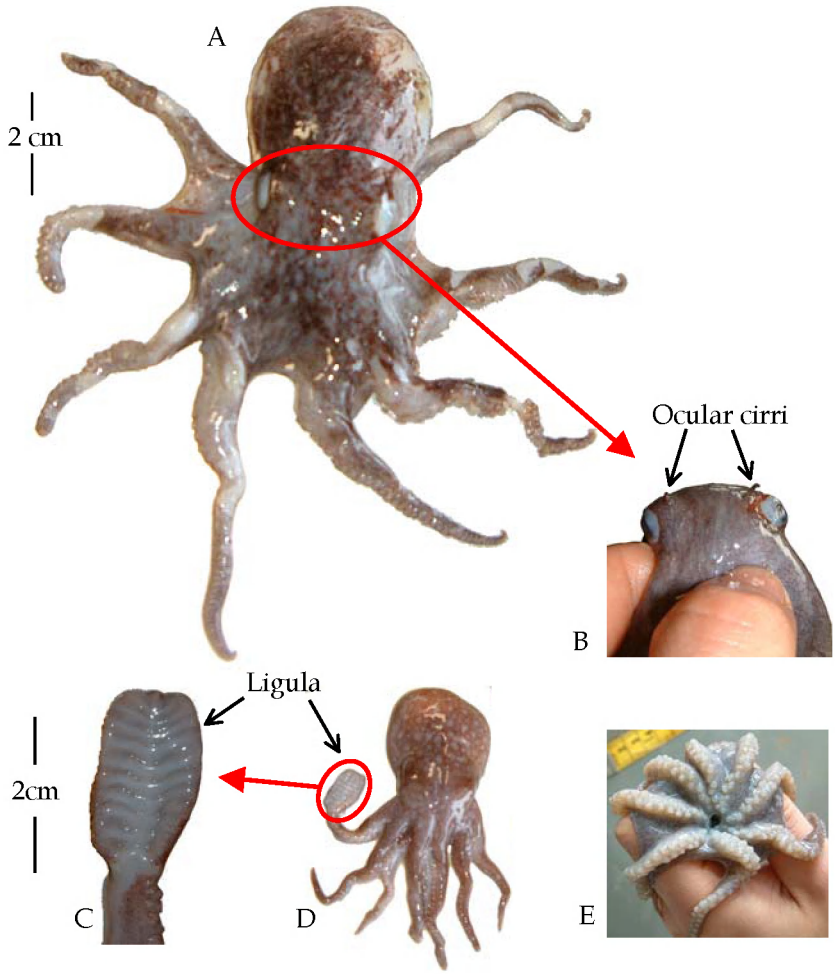


Fig.16. *Bathypolypus bairdii* Female in dorsal view (A) and male in dorsal (D) and lateral view (F). In larger males, the tip of the 3rd right arm is a spoon-shaped ligula (C+G). In the investigated specimens, the inside of the web is pigmented (E). Anterior view shows location of cirri above each eye (B). (F+G from Muus 2002)

<u>Size</u>: Total length ≤ 20 cm

<u>Characteristics</u>: Square-bodied, with papillated skin. The head is broad, with large eyes, each with an erectile pointed ocular cirrus.

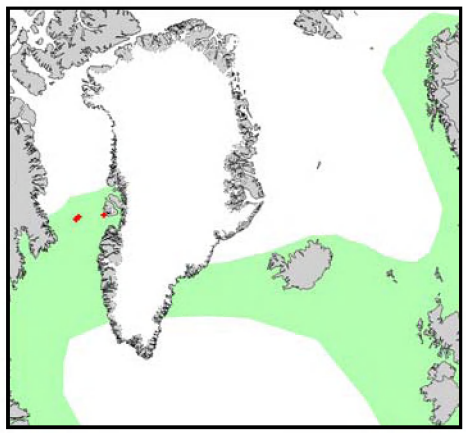
<u>Similar species</u>: Differ from *B.arcticus* in having a more compact body and bigger eye-balls (30-45 % of mantle length)

Only males with ligula can be separated from *B. pugniger*. Ligula is spoon-shaped with 7-11 transverse ridges.

<u>Habitat</u>:
20-1100m

<u>Synonyms</u>:
Bathypolypus proschi, B. arcticus, Benthoctopus piscatorum, Octopus piscatorum, O. obesus, O. lentus, O. arcticus Polypus arcticus, P. lentus

<u>Distribution</u>:



Bathypolypus pugniger

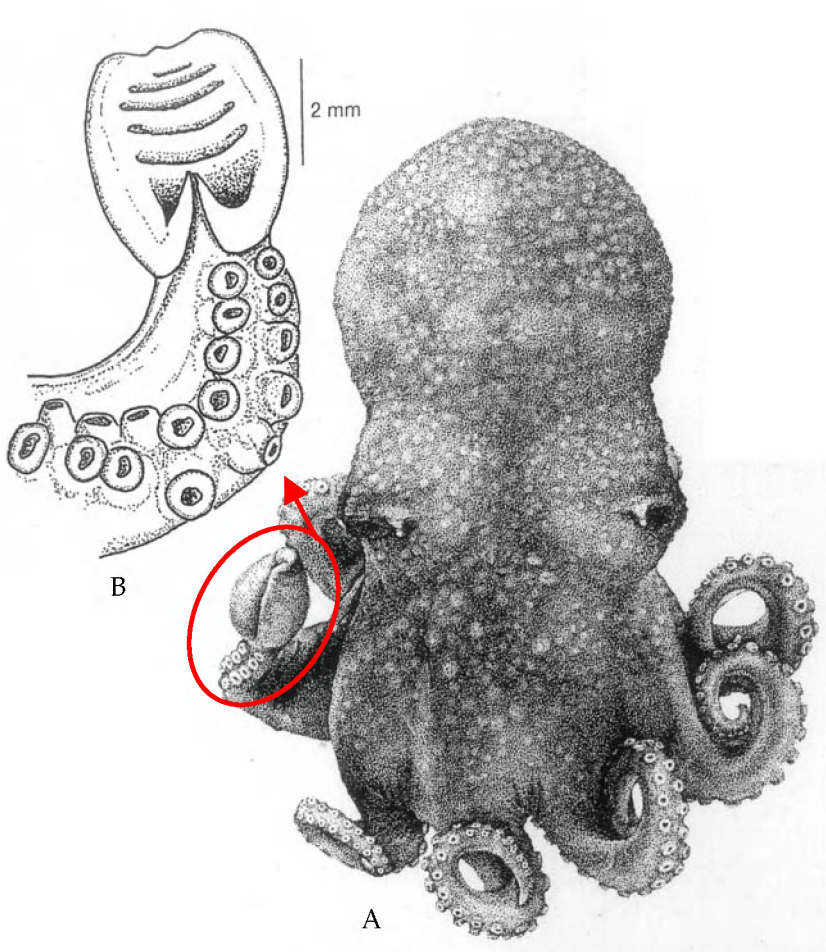


Fig.17. *Bathypolypus pugniger* male, dorsal view (A). In larger males, the tip of the 3rd right arm is a ligula (B). (from Muus 2002).

Size: Total length ≤ 15 cm

Characteristics: Square-bodied, with papillated skin. The head is broad, with large eyes, each with an ocular cirrus.

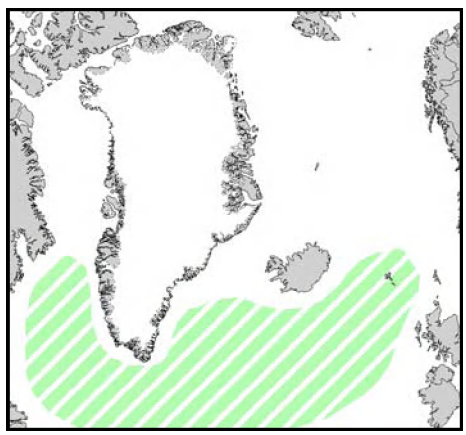
Similar species: Differ from *B.arcticus* in having a more compact body and bigger eye-balls (30-45 % of mantle length)

Only males with ligula can be separated from *B.bairdii*. Ligula is short and broad with curled up sides and has 4-6 transverse ridges.

Habitat:
200-1000m

Synonyms:
Bathypolypus arcticus

Distribution:



Distribution of *B. Pugniger* is largely unknown

Squids, Teuthida

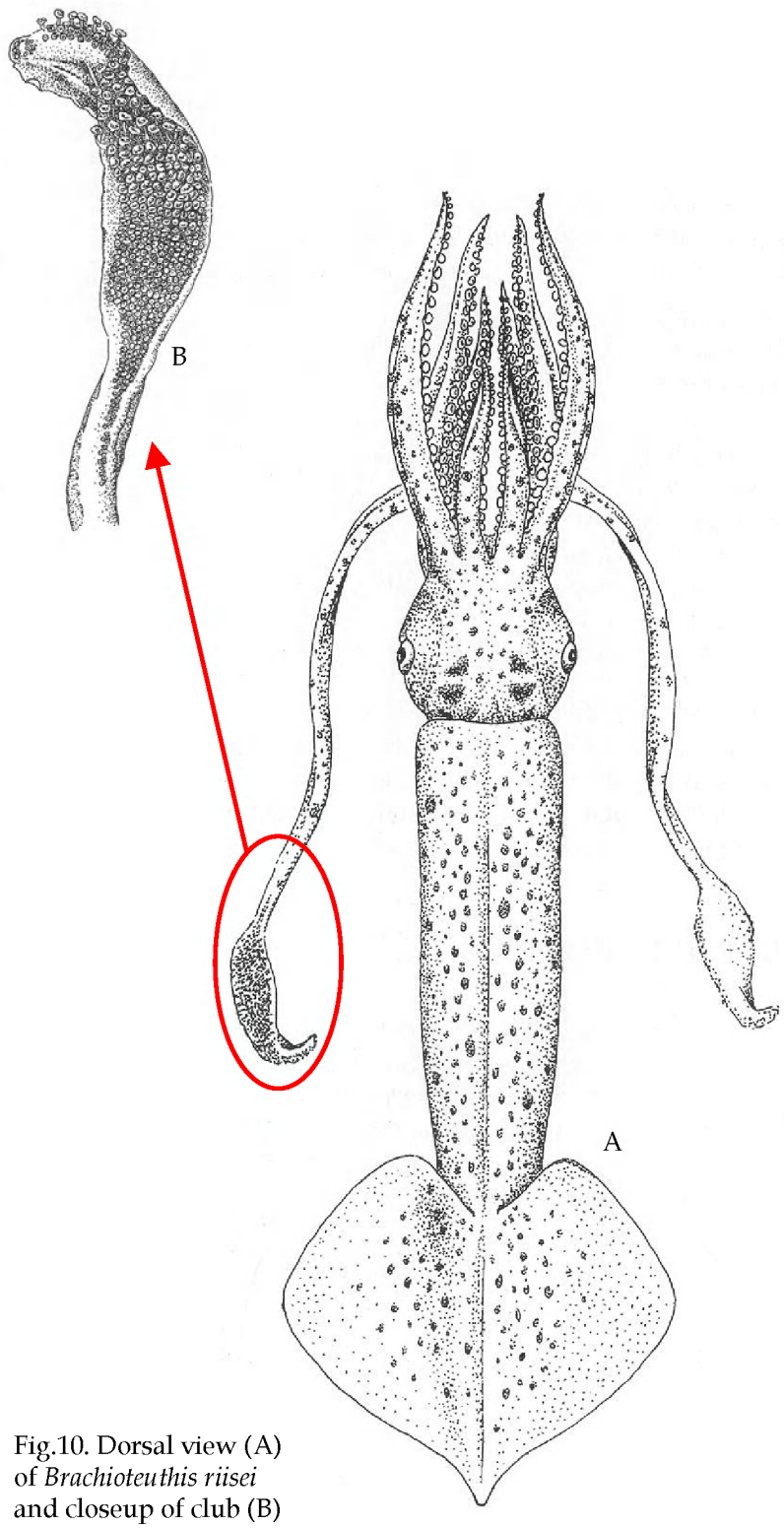


Fig.10. Dorsal view (A) of *Brachioteuthis riisei* and closeup of club (B) (From Guerra 1992).

Brachioteutis riisei

Size: Mantle ≤ 8 cm

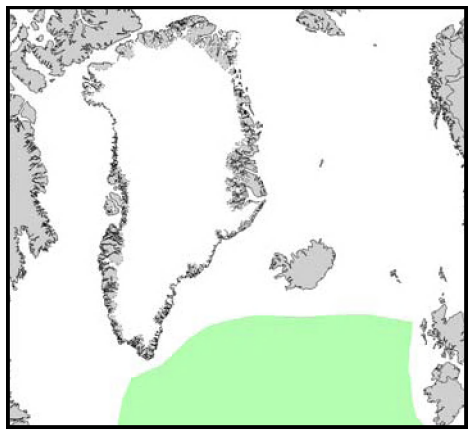
Characteristics: Small squid with elongate mantle. Fin widely heart shaped and clubs with numerous minute suckers on proximal part.

Similar species: Differs from the other Greenlandic squids in having well defined clubs without hooks, small eyes and heart shaped fin.

Habitat: Pelagic squid found from the surface down to 3000 m.

Synonyms:
Entomopsis velaini
Entomopsis clouei
Entomopsis aluei
Tracheloteuthis riisei
Verrillida gracilis
Verrilliola nympha
Brachioteuthis nympha
Brachioteuthis velaini

Distribution:



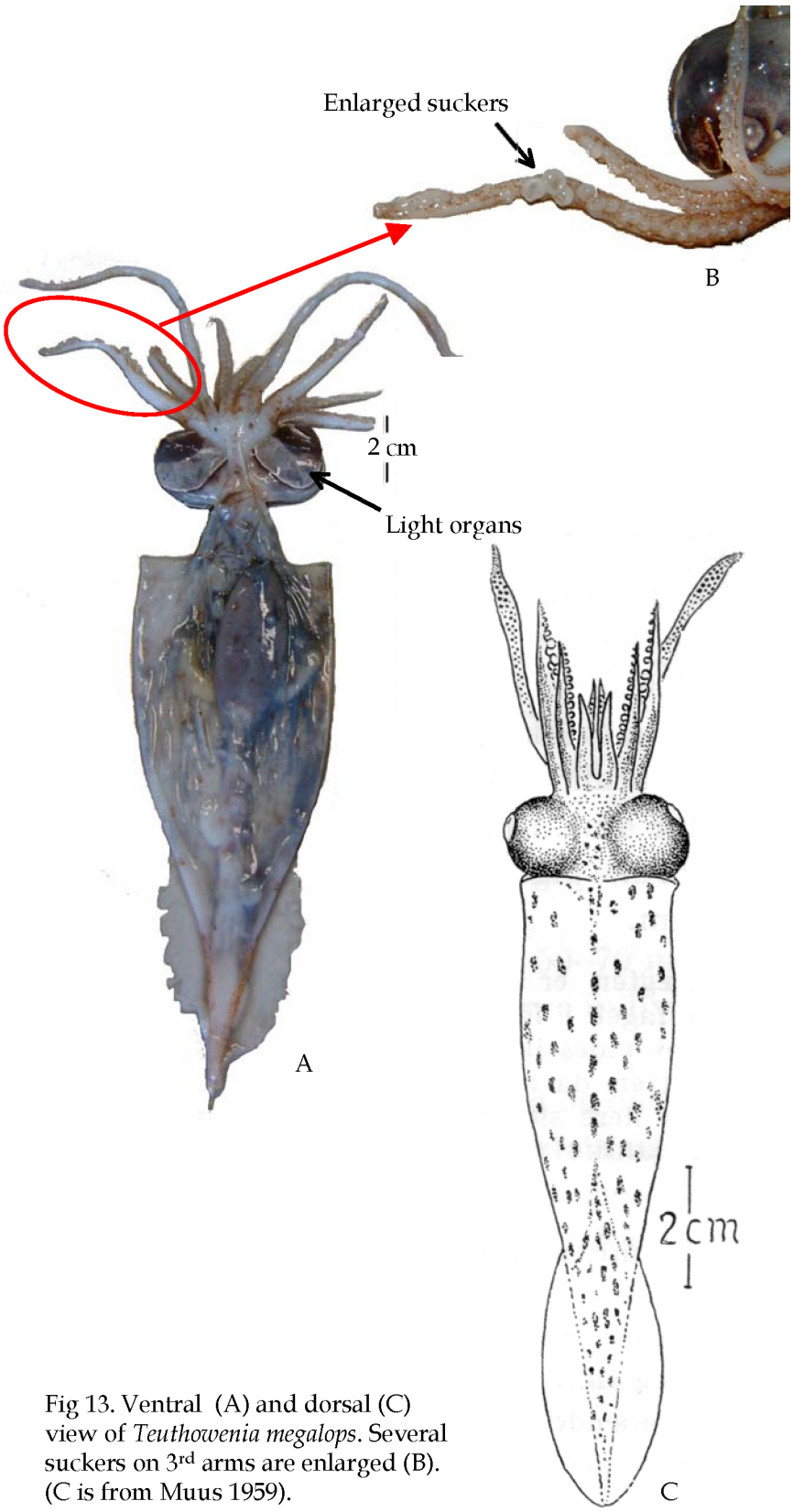


Fig 13. Ventral (A) and dorsal (C) view of *Teuthowenia megalops*. Several suckers on 3rd arms are enlarged (B). (C is from Muus 1959).

Teuthowenia megalops

Size: Mantle length ≤ 40 cm.

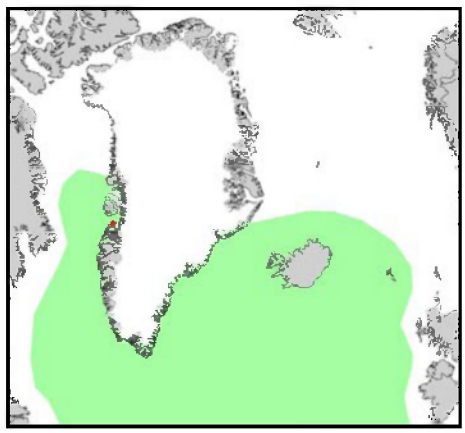
Characteristics: Mantle is thin and eyes are very big and look aside. Large light organs on ventral side of eyes. Several suckers on 2nd and 3rd arms are considerably enlarged.

Similar species: Differs from the *Todarodes* sp., *Gonatus* sp. and *Brachioteutis* sp. in that the mantle is fused with the dorsal side of the head and with the funnel.

Habitat: pelagic squid caught at depths from 50-1000 m.

Synonyms:
Verrilliteuthis megalops
Megalocranchia megalops
Desmoteuthis megalops
Desmoteuthis hyperborea
Desmoteuthis tenera
Desmoteuthis thori

Distribution:



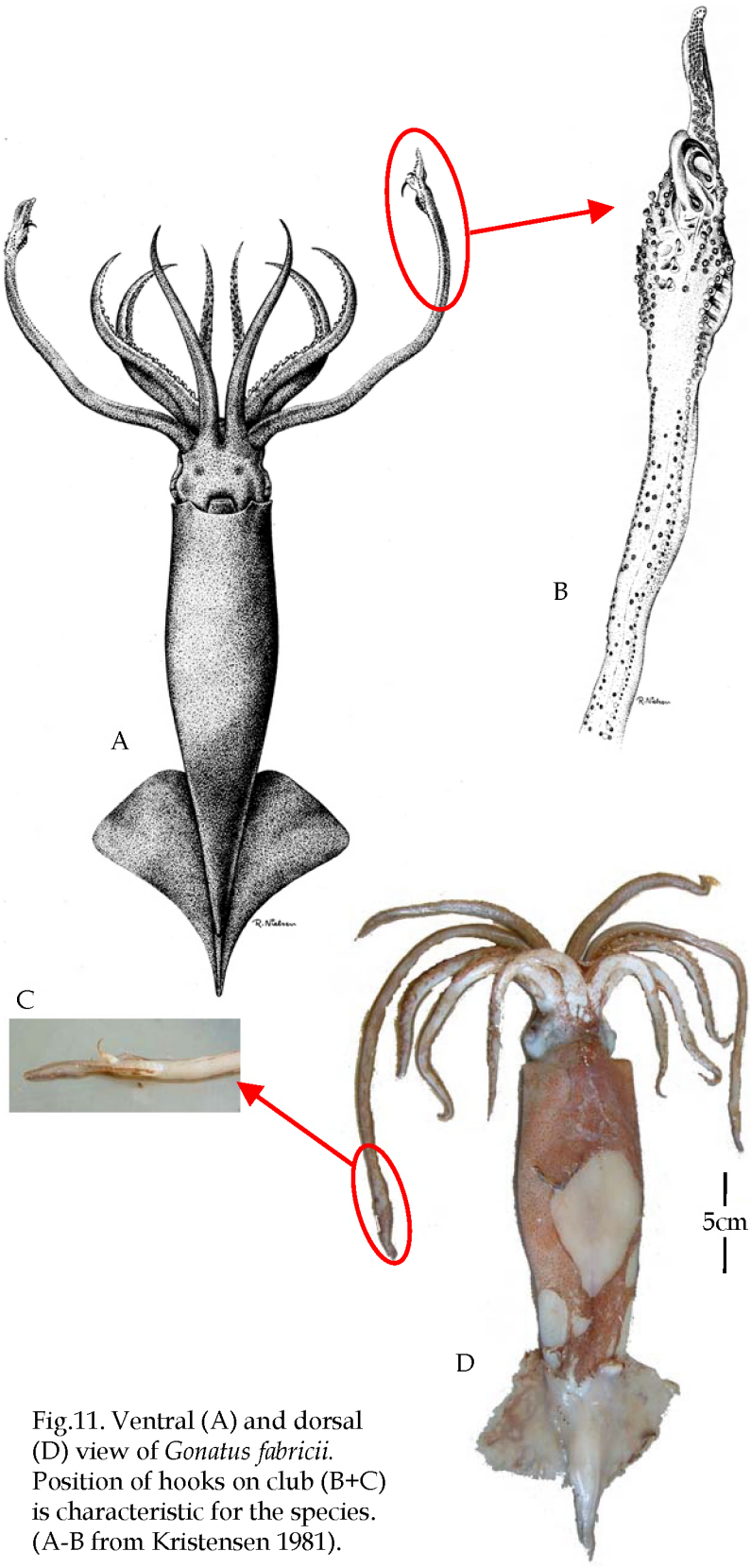


Fig.11. Ventral (A) and dorsal (D) view of *Gonatus fabricii*. Position of hooks on club (B+C) is characteristic for the species. (A-B from Kristensen 1981).

Gonatus fabricii

Size: Mantle length ≤ 35 cm.

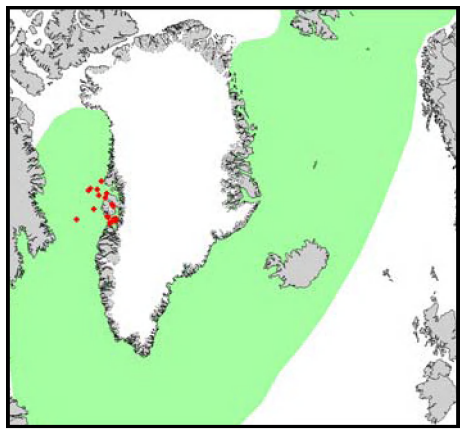
Characteristics: Mantle narrow, slightly wider at the middle. On larger animals, the inner 2 rows of suckers on arms I-III are replaced by hooks.

Similar species: Differs from *G. steenstrupi* in that the largest hook on club is followed distally by another large hook and proximally by 3 small ones. This can be seen in specimens larger than 4-5 cm (mantle length).

Habitat: Oceanic squid found at depths ranging from 50-2000 m

Synonyms:
Onychoteuthis fabricii
Gonatus (Gonatus) fabricii

Distribution:



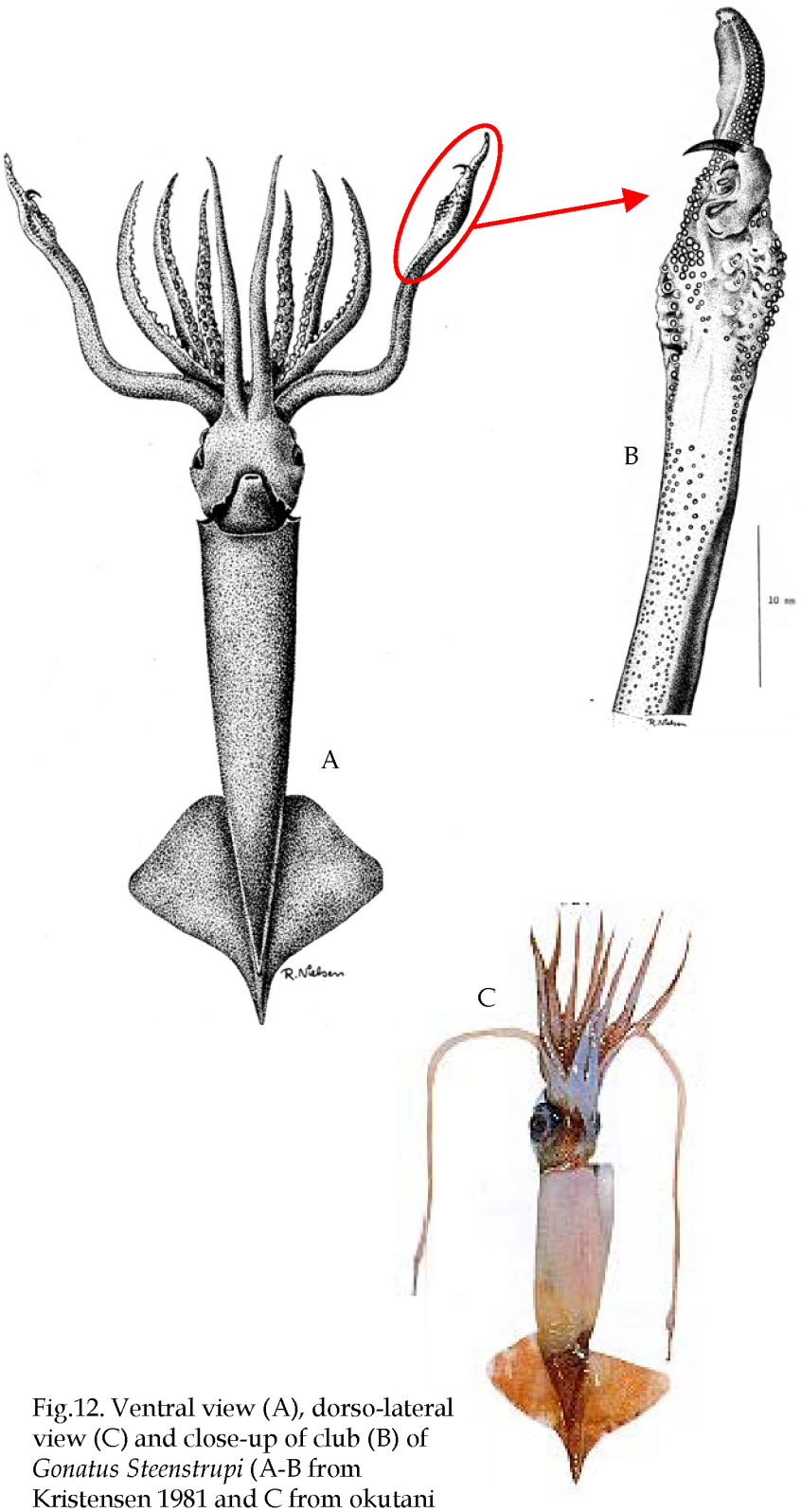


Fig.12. Ventral view (A), dorso-lateral view (C) and close-up of club (B) of *Gonatus Steenstrupi* (A-B from Kristensen 1981 and C from okutani 2001).

Gonatus steenstrupi

Size: Mantle length ≤ 13 (19 cm?)

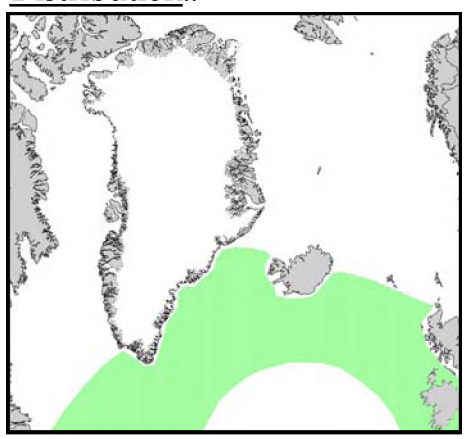
Characteristics: Mantle long, slender and conical. On larger animals, the inner two rows of suckers on arms I-III are replaced by hooks.

Similar species: Differ from *G. fabricii* in having 1 large hook on club followed proximally by 4-5 smaller hooks. This can be seen in specimens larger than 4-5 cm (mantle length).

Habitat: Oceanic squid found from the surface down to about 1000 m

Synonyms:
Gonatus fabricii
Gonatus (Gonatus) steenstrupi

Distribution:.



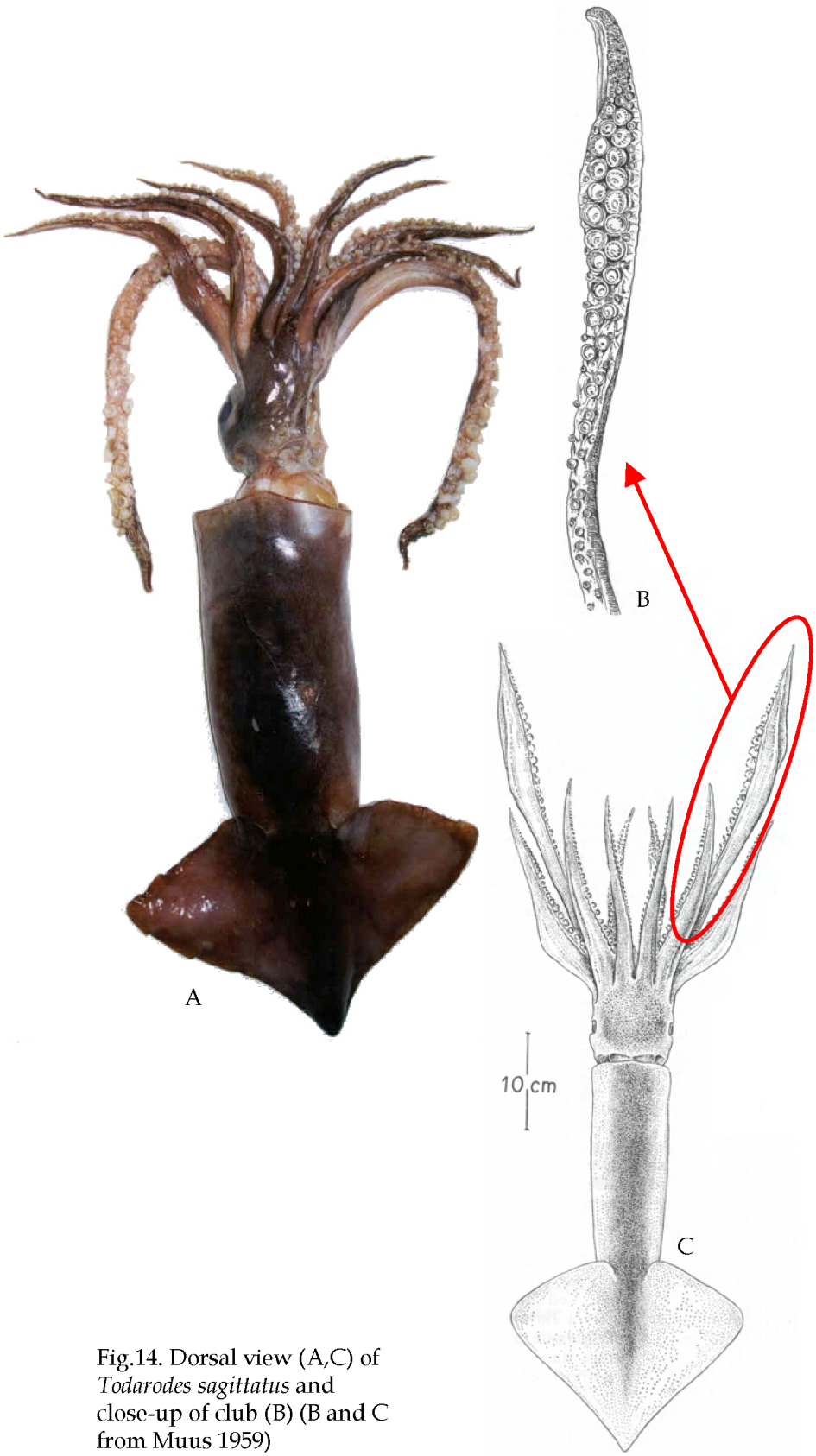


Fig.14. Dorsal view (A,C) of *Todarodes sagittatus* and close-up of club (B) (B and C from Muus 1959)

Todarodes sagittatus

Size: Mantle length ≤ 75 cm.

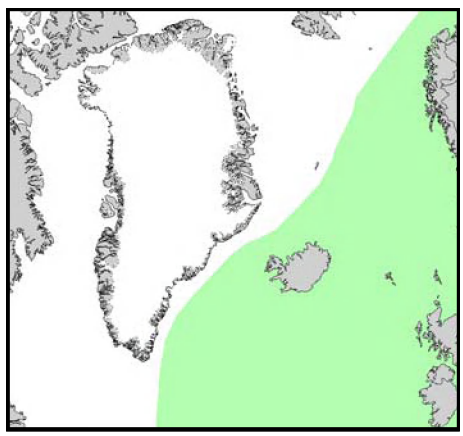
Characteristics: Slender squid with thick, muscular mantle. Fin heart-shaped, extended posteriorly into small tail.

Similar species: Differs from *Gonatus* sp. in not having distinct distal clubs on the tentacles.

Habitat: Oceanic squid occurring from the surface down to 2500 m

Synonyms:
Ommatostrephes sagittatus
Loligo todarus
Todarodes sagittatus sagittatus
Loligo sagittatus
Ommastrephes sagittatus

Distribution:



Bobtail squid, Sepiolidae

Only the genus *Rossia* is represented in Greenland waters. The specimens can be identified to species level from the arrangement of suckers on the clubs only (dissection microscope needed!).

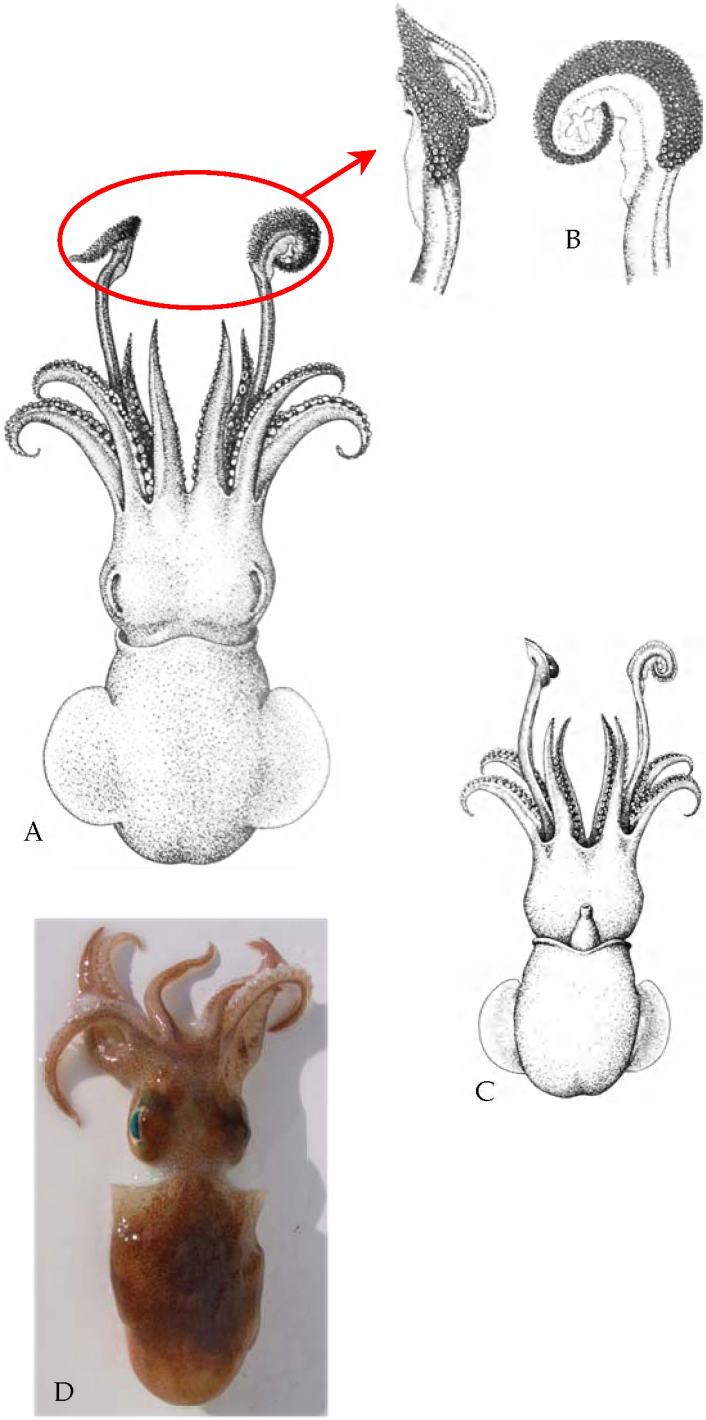


Fig.9. Dorsal (A,D) and ventral (C) view of *Rossia macrosoma* and close-up of club (B) (A-C from Guerra 1992).

Rossia macrosoma

Size: Mantle length ≤ 8 cm, rarely 10 cm

Characteristics: Anterior edges of fins do not reach the anterior edge of mantle. Skin smooth.

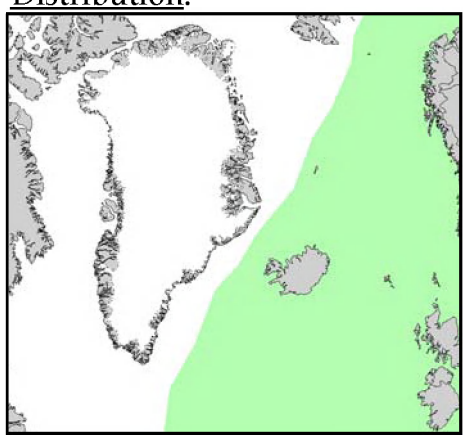
Similar species: Differ from the other species of *Rossia* in having smooth skin and approximately 10 rows of suckers on the well defined clubs.

Dissection microscope needed!

Habitat: Demersal species found on depths from 30 to 600 m.

Synonyms:
Sepiola macrosoma

Distribution:



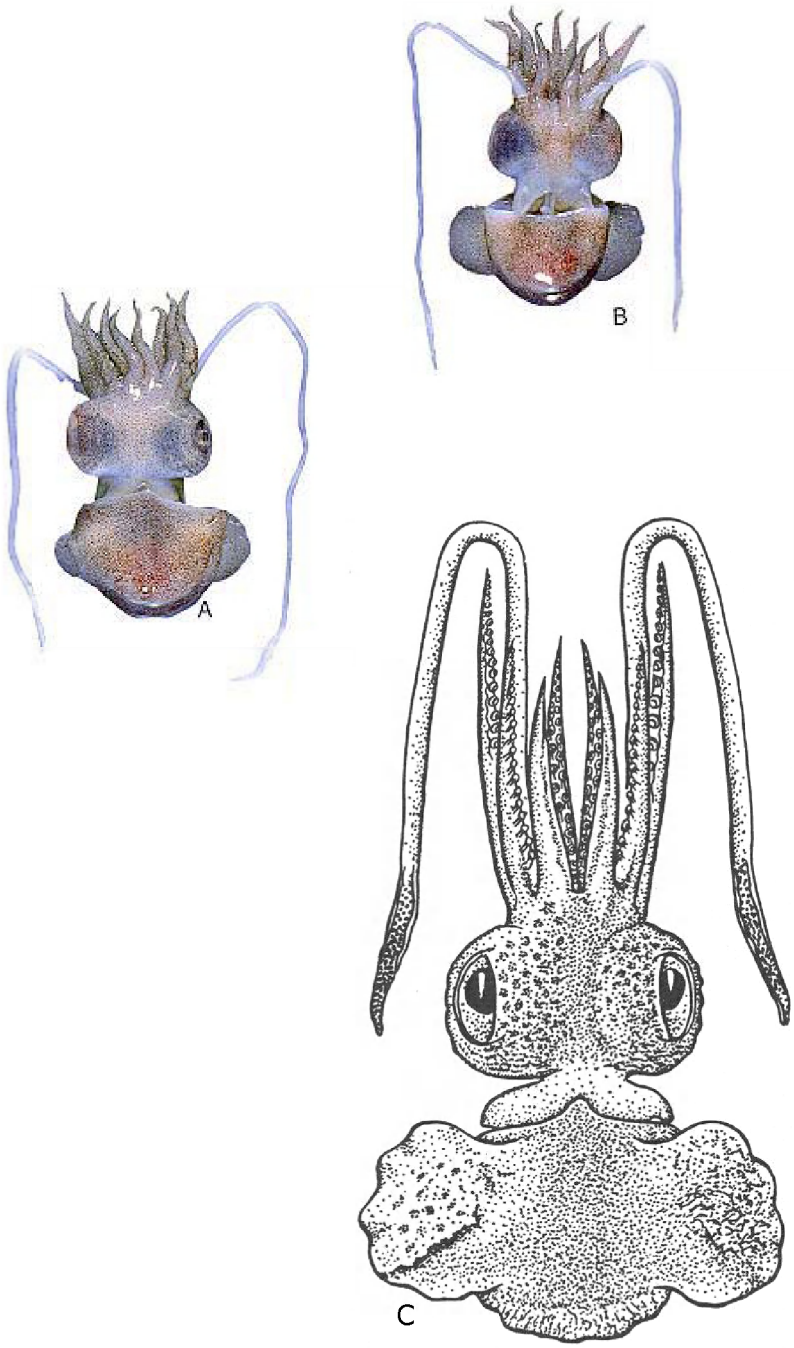


Fig.7. *Rossia megaptera* in dorsal view (A+C) and ventral (B) view (C is from Nesis 1987 and A+B are from Okutani 2001).

Rossia megaptera

Size: Mantle length ≤ 8 cm rarely 10 cm.

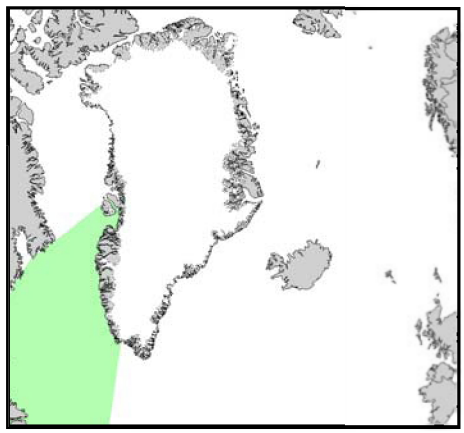
Characteristics: Anterior edges of fins extend beyond anterior edge of mantle. Body consistency is fairly soft and eyes are large.

Similar species: Differ from the other species of *Rossia* in that tentacle clubs are long but not expanded. The clubs are heavily crowded with minute suckers arranged in 8 or more rows.

Dissection microscope needed!

Habitat: Benthic species found at 628 m (only 1 depth record)

Distribution:



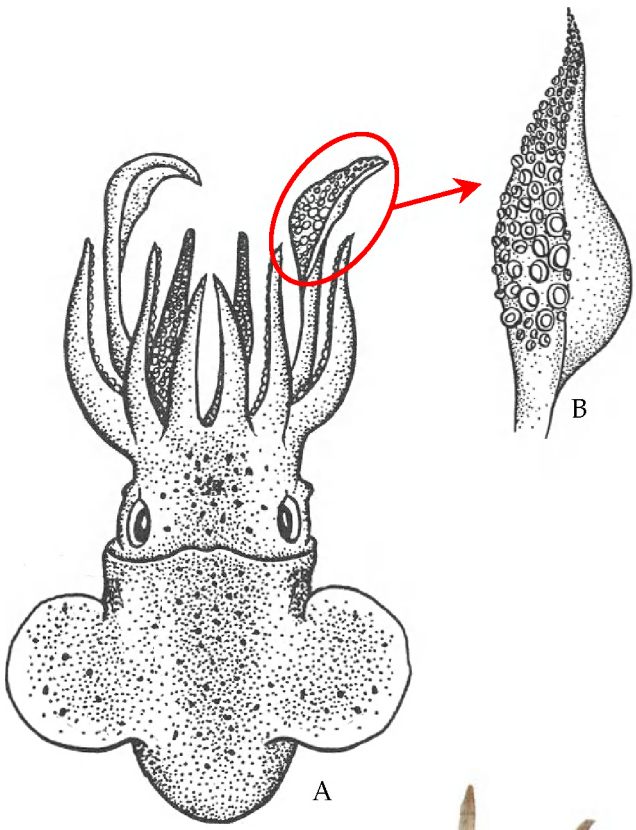


Fig.8. Dorsal view (A,C) of *Rossia moelleri* and close-up of club (B) (A and B are modified from Nesis 1987).

Rossia moelleri

Size: Mantle length ≤ 7 cm

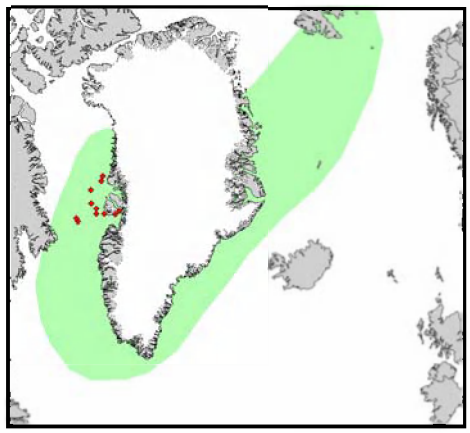
Characteristics: Skin smooth, body, slightly gelatinous.

Similar species: Differ from the other species of *Rossia* in having club suckers of very different sizes - considerably larger in proximal part of club than in distal part. In proximal part of club, suckers are arranged in 4 rows; in distal part, in 6 rows.

Dissection microscope needed!

Habitat: Found between 20 and 700m but it usually occurs deeper than 50 m

Distribution:



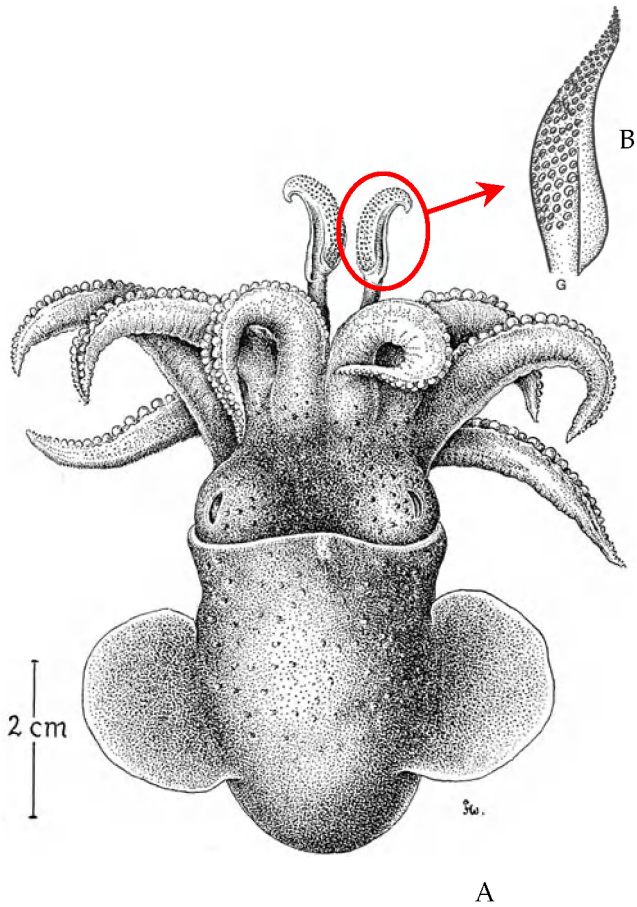


Fig.6. Dorsal view (A) and close-up of club (B) of *Rossia palpebrosa* (A from Muus 1959, B from Nesis 1987).

Rossia palpebrosa

Size: Mantle length ≤ 5 cm

Characteristics: Dorsal side of head and mantle beset by small rounded papillae whose number, size and distribution vary greatly and may be small and poorly visible.

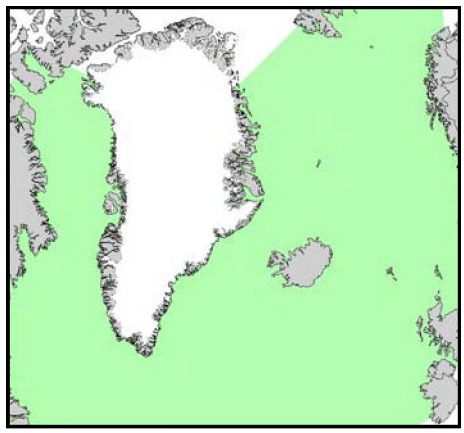
Similar species: Differ from the other species of *Rossia* in having club suckers arranged in 7-10 rows. All club suckers are of similar size.

Dissection microscope needed!

Habitat: Benthic species found at depths from 10-1250 m – mostly at 100-500 m.

Synonyms:
Rossia glaucopis
Rossia hyatti

Distribution:



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APPENDIX 1

INTERNAL ORGANS

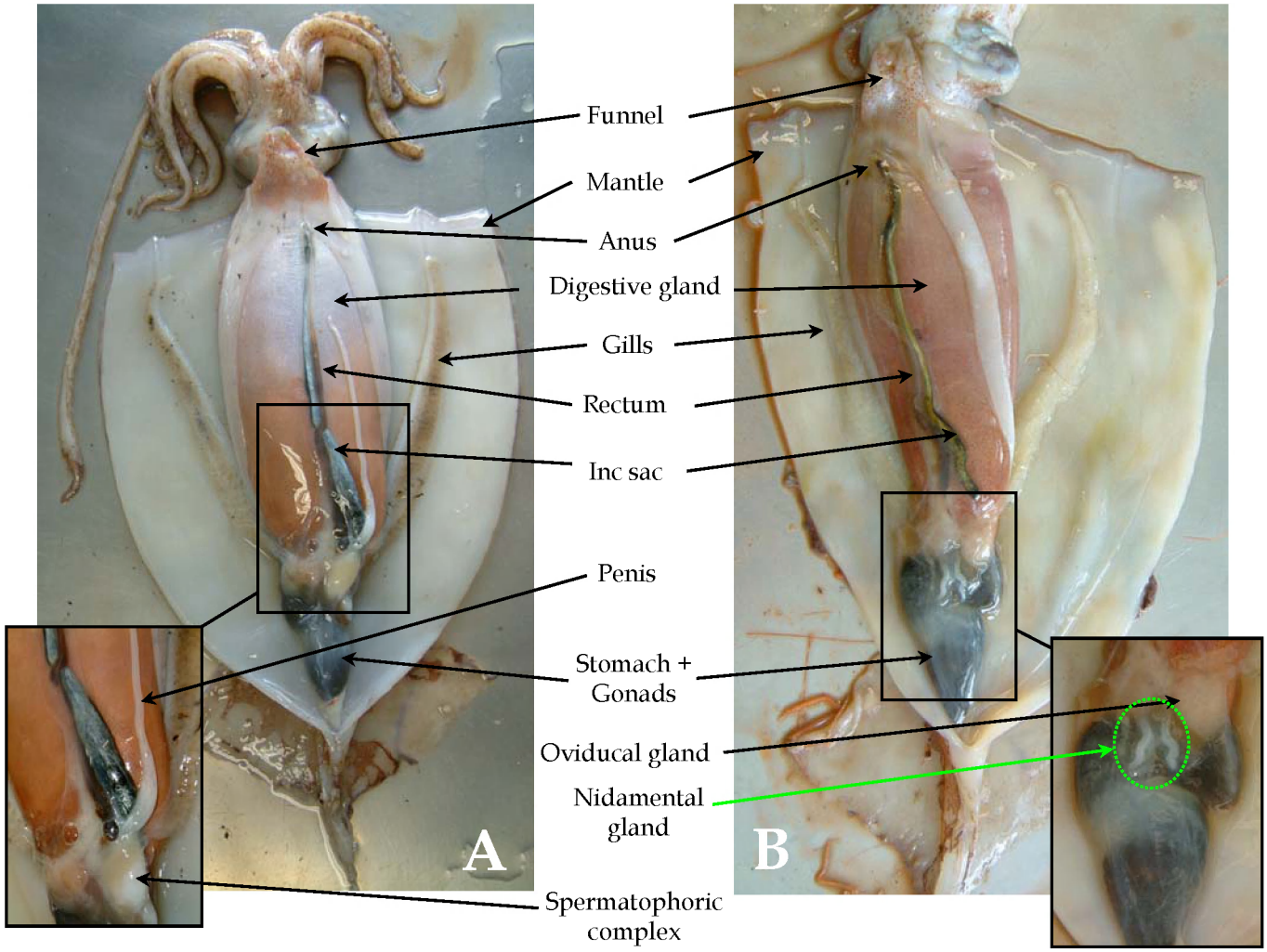

Fig.1. Ventral view of male (A) and female (B) *Gonatus fabricii* (squid). In *Gonatus*, the digestive gland is extremely large and has a high lipid content. Mature males have a well developed penis but yunger males can be difficult to distinguish from females. With some practice, the nidamental glands of females can be recognized in very small individuals.

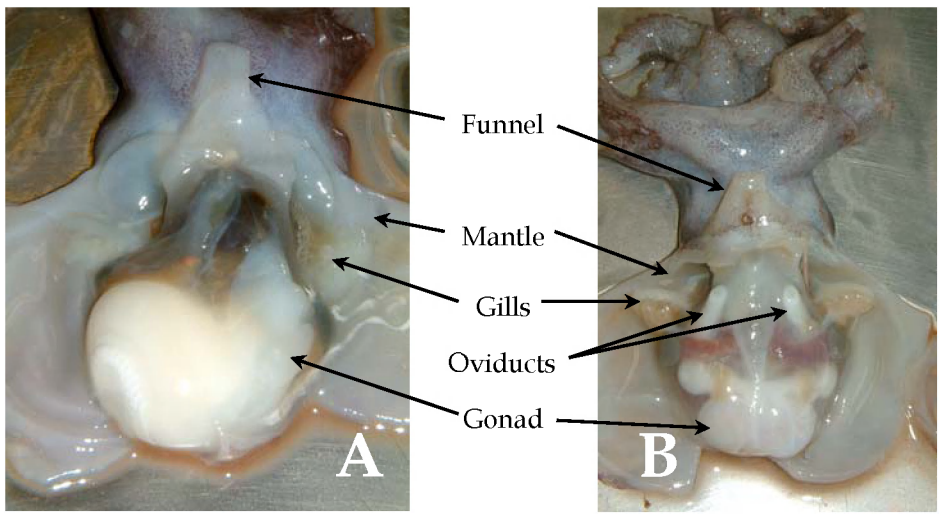

Fig.2. Ventral view of male (A) and female (B) *Bathypolypus* sp. (octopus).