

THE SYSTEMATICS OF THE PELAGIC SQUID
GENUS OCTOPOTEUTHIS RÜPPELL, 1844
(Cephalopoda: Teuthoidea) WITH EMPHASIS
ON SPECIES IN THE NORTH ATLANTIC

CENTRE FOR NEWFOUNDLAND STUDIES

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STEPHEN J. STEPHEN



**The Systematics of the Pelagic Squid Genus *Octopoteuthis*
Rüppell, 1844 (Cephalopoda: Teuthoidea) with Emphasis on
Species in the North Atlantic**

by



Stephen J. Stephen, B. Sc.

**A Thesis Presented to the School of Graduate Studies in
Partial Fulfillment of the Degree of Master of Science.**

**Memorial University of Newfoundland,
St. John's, Newfoundland
August 31, 1985**

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ISBN 0-315-43367-1

Dedication

To my parents, Joseph and Della Stephen

ABSTRACT

The systematics of the pelagic squid genus *Octopoteuthis* Rüppell, 1844 is reviewed. Four hundred and fifty-six specimens were examined from museum sources worldwide ranging in size from 1.3 mm - 240 mm dorsal mantle length (ML). Of the nine nominal species five are found to be invalid or considered *nomina dubia*. All species are found to bear photophores in a variety of body locations. Characters used to separate species include presence of one or two photophores on the posterior-ventral portion of the mantle; presence or absence of anterior eyelid photophores; presence or absence of an eyeball photophore; and presence or absence of accessory cusps (hooklets) on the arm hooks. Larval specimens (those less than approximately 25 mm ML and still bearing tentacles or remnants of them) could not be separated into species at present because of the late development of the characters defined above. Discriminant analysis run on morphometric data on each specimen supported the species separation proposed here. Geographic and vertical distribution is also discussed.

ACKNOWLEDGEMENTS

I extend my sincere thanks to my supervisor, F. A. Aldrich, who provided support in discussions and constructive criticisms during my research. I am indebted also to the other members of my supervisory committee, V. C. Barber and D. Larson whose guidance greatly improved this work.

I am especially thankful to those institutions and researchers who loaned me the four extant *Octopoteuthis* types (three holotypes and two syntypes: J. Knudsen, Zoologisk Museum, University of Copenhagen, Copenhagen; F. Naggs, British Museum (Natural History), London; and R. Brusca, Allen Hancock Foundation, Los Angeles. R. Janssen of the Senckenberg Institut, Frankfurt, F. D. R. kindly allowed me to reproduce Ruppell's unpublished manuscript illustrations of the holotype of *Octopoteuthis sicula* for which I am most grateful.

I am most grateful to all the individuals and institutions who have loaned additional collections of material used in this study: F. Naggs, British Museum (Natural History), London; T. Rowell, Invertebrate and Marine Plants Division, Fisheries and Oceans, Canada, Halifax, Nova Scotia; C. C. Lu, Museum of Victoria, Melbourne, Australia; D. Laubitz and J. M. Topping, National Museum Natural Sciences, National Museums of Canada, Ottawa; M. J. Dadswell and L. Linkletter, Biological Station, Fisheries and Oceans, Canada, St. Andrews, New Brunswick; M. Régeleveld, South African Museum, Cape Town, South Africa; F. G. Hochberg and P. H. Scott, Santa Barbara Museum of Natural History, Santa Barbara, California; H. G. Snyder, Scripps Institution of Oceanography, University of California, La Jolla, California; M. C. Mercer and E. Dawe, Biological Station, Fisheries and Oceans, Canada, St. John's, Newfoundland; C. Lea, Texas A and M University, College Station, Texas; C. F. E. Roper and M. J. Sweeney, United States National Museum of Natural History (USNMNH), (Smithsonian Institution), Washington, D. C.; J. Knudsen, Zoologisk Museum, University of Copenhagen, Copenhagen, Denmark; E. Willassen, Zoologisk

Museum, University of Bergen, Bergen, Norway; C. Warneke, Zoologisches Museum, University of Hamburg, Hamburg, F. D. R.; and H. Leta, Instituto Nacional de Pesca, Montevideo, Uruguay, David Heppell, Royal Scottish Museum, Edinburgh, Scotland.

Special thanks are extended to C. F. E. Roper and M. J. Sweeney, USNMNH, who provided specimens and workspace for me while on a Short-Term Visitor's Appointment visit there in December of 1983.

I am indebted to several people who, through personal discussions and correspondence, provided invaluable assistance to this project including: R. B. Toll, University of the South, Sewanee, Tennessee; G. L. and N. A. Voss, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami; C. F. E. Roper and M. J. Sweeney, USNMNH.

During the course of this project over one hundred individuals, museums, and institutions were contacted in the search for specimens and information. Nearly ninety per cent of them replied to my queries and when they themselves did not have material available, they kindly offered suggestions as to others who might. This work could not have been carried out had it not been for their helpfulness. To all of them goes my deepest appreciation.

Finally, I would like to thank my wife Kay without whose untiring support, encouragement, patience and understanding I would never have been able to complete this thesis.

This project was funded by two Memorial University Fellowships, and a Memorial University Bursary. The Short-Term Visitor's Appointment to Washington D. C. was partially founded by a grant from the USNMNH.

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Chapter 1

INTRODUCTION

The squid family Octopoteuthidae Berry, 1912 is comprised of two genera, *Octopoteuthis* Rüppell, 1844 and *Taningia* Joubin, 1931. The genus *Octopoteuthis* is represented by nine nominal species presently known to occur circumglobally. All species appear to be mesopelagic as adults (Lu and Clarke, 1975; Lu and Roper, 1979; Young, 1978, 1981; Young and Roper, 1977).

Many of the earliest species descriptions were very brief with few or no illustrations. This made it very difficult to separate species. *Octopoteuthis* adults and larger juveniles differ considerably in appearance from the larvae and smaller juveniles (25-30mm). Also adults and larger juveniles bear distinct photophore patterns and numbers which were neither recognized nor recorded in the earliest species. The loss of many of the species holotypes precluded their re-examination to verify the presence or absence of characters. As a result, considerable confusion has developed in species separation because of inadequate original descriptions, descriptions of species based on larval or juvenile specimens, loss of type material, and the continued addition of new species without clarification of the status of previous ones.

These problems became apparent when the writer was preparing an annotated checklist/key to cephalopods of the Canadian Atlantic for the Huntsman Marine Laboratory, St. Andrews, N. B. (Stephen, 1982, MS). At that time none of the *Octopoteuthis* specimens examined could be assigned to any of the three species reported, in the literature, to occur in the Western North Atlantic. Correspondence with several cephalopod systematists failed to indicate any means to accurately identify specimens of *Octopoteuthis*.

After being accepted to the Masters degree program at Memorial University the writer proposed a project to carry out a systematic revision of the genus *Octopoteuthis* in the North Atlantic. Discussion with my supervisor, Dr. F. A. Aldrich, and correspondence with Dr. C. F. E. Roper, United States National Museum and Dr. G. L. Voss and Mrs. N. A. Voss, Rosenstiel School of Marine and Atmospheric Science, University of Miami, reinforced my idea for the project.

Such a revision required the examination of the largest possible number of specimens from the widest possible distributional range. Since *Octopoteuthis* specimens are caught infrequently, it was necessary to obtain specimens from several institutions. To enable the revision to be comprehensive for the genus, specimens representing Atlantic, Indian and Pacific Ocean species were obtained.

Chapter 2

HISTORICAL RESUME

Rüppell described the first octopoteuthid in 1844 from a young specimen collected off Messina, Italy. He named it *Octopoteuthis sicula*. Krohn (1845), expanded Rüppell's brief description and provided the first illustrations of the species, which showed total dorsal and ventral views, the head and the hooks. In the paper Krohn changed the generic spelling to *Octopodoteuthis* following Rüppell's suggestion: "*Nach Rüppell's Vorschlage nenne ich das Genus wozu die beschriebene Species gehört, Octopodoteuthis*" (p. 49). In 1847, Krohn again changed the generic name to *Verania* after examining a well-preserved specimen which bore small tentacles. He placed his *Verania* in a family Onychoteuthiden, along with the genus *Enoploteuthis* d'Orbigny, 1839.

In 1849, Gray placed *Octopodoteuthis sicula* in his new family Onychoteuthidae. Verany (1851) made *Verania* a subgenus of *Onychoteuthis* Lichtenstein, 1818. Along with a description and a narrative of Rüppell's and Krohn's accounts of the species, Verany provided a ventral view of the gladius. For the next few years the genus was placed in the Onychoteuthidae but the generic spelling varied: *Veranya* (Fischer, 1837; Kefenstein, 1866; Pelseneer, 1894; and Tiberi, 1880) and *Verania* (Tryon, 1879; and Weiss, 1889). Pfeffer (1884) used the name *Octopoteuthis sicula*. Woodward (1871) in his "A Manual of the Mollusca" included *Octopodoteuthis* and *Verania* as synonyms of *Enoploteuthis*.

Verrill (1882) included *Verania* in the family Teuthidae Gray, 1849. He assigned the genus a non-supportable characteristic, however, when he listed it as having: "Tentacular club with hooks, ..." (p.280). In 1885, Verrill described a new species, *Ancistrocheirus megaptera*.

Hoyle (1886 a,b) reduced Gray's Onychoteuthidae to a subfamily of Onychii, Steenstrup 1861. The two species were listed as *Verania sicula* and *Anisrocheirus megaptera*.

Appellöf (1889) gave a detailed description of a larval *Octopoteuthis* and provided some detailed illustrations of the arms, tentacular club, internal viscera, digestive system and optic ganglia. His illustrations clearly showed the photophores on the ink sac and at the ends of the arms although he did not recognize them as such. During the same year Ernest Weiss examined and illustrated a specimen with a mantle length of 7 mm. Weiss misinterpreted the arm tip photophores as hectocotylized or modified portions of the arm of male cephalopods used in spermatophore transfer.

Goodrich, in his 1892 paper, provided a table of chief characters of recent oegopsid cephalopods. His diagnosis of *Verania* was:

"Arms with 2 rows of hooks. Tentacles short, suckers few. Pen slender, cartilaginous. Fins somewhat rounded, terminal." (p.320).

In the 1896 Monograph by Jatta, the author placed *Veranya sicula* in the Onychii, reviewing the findings of most of the earlier workers who had looked at it. He was the first to illustrate the radula.

In 1899, Ficalbi verified the 1844 date of Rüppell's description of *Octopoteuthis sicula* thereby validating the correct authority for the species. He also reproduced Rüppell's paper in its entirety, ensuring a larger audience for what had first appeared as a letter from Rüppell to one "m. le Coco".

Pfeffer, in his 1900 "Synopsis der oegopsiden Cephalopoden" assigned *Octopodoteuthis* to his family Enopteuthidae. Hoyle (1904) maintained Pfeffer's classification and used the following as a diagnosis of the genus:

"Tentacles absent in the adult; in the young shorter than the arms and with but few suckers on the club; body stumpy and rounded behind; suckers extending to the tips of the arms." (p.11)

Most authors continued to adopt Pfeffer's classification for the next few years (Hoyle, 1909, 1910; Massy, 1909; Pfeffer, 1908; Thiele, 1921).

In 1910, Chun used the spelling *Octopodoteuthis* and created a new family Veranyidae for it based on its generic synonym *Veranya*. Chun's diagnosis was:

"Body gelatinous, without luminous organs. Arms with 2 rows of hooks. Tentacles small, deciduous. Club with a small number of biserial suckers. Six buccal pillars; 4th arms attached ventrally. Radula with 5 transverse rows of teeth. Funnel cartilage wide, with a shallow pit which widens posteriorly. Gladius as in *Loligo*." (p.112)

Berry renamed the family Octopodoteuthidae in his July, 1912 paper on Japanese squids. It was not until November of that year that he explained his reasons for the change. He pointed out that Chun's Veranyidae was unacceptable because: "*Verania* is an exact synonym of *Octopoteuthis*" (p.845). Therefore, Veranyidae should be replaced by Octopoteuthidae or Octopodoteuthidae (if Krohn's emendation could be accepted). Several authors, however, continued to use Veranyidae as the family name (Chun, 1913; Murray and Hjort, 1912; Naef, 1916; Percy, 1965; and Voss, 1962; 1967).

In Pfeffer's 1912 work *Die Cephalopoden der Plankton-Expedition* he called the group Octopodoteuthinae making it a subfamily of the Enopoteuthidae. He also included therein Verrill's *Ancistrocheirus megaptera* by creating a new genus for it, called *Octopodoteuthopsis*.

Several authors, however, continued to use Pfeffer's classification (Joubin, 1920; Robson, 1924; Sasaki, 1916, 1929). Berry (1920a) continued to use the family Octopodoteuthidae but he did include Pfeffer's *Octopodoteuthopsis* in it. Berry's classification was used by the largest number of researchers (Akimushkin, 1963; Bouxin and Legendre 1936; Degner, 1925; Johnson, 1934; Joubin, 1931; Naef, 1921, 1923; Silas, 1968; Thiele, 1935; and Voss, 1956, 1960, 1963).

Naef (1923), in his great monograph on the cephalopods, added two new species of *Octopodoteuthis* to the list. Both his *O. persica* and *O. indica* were based on larval specimens first described by Chun in 1910. Joubin (1931), named the next species *Octopodoteuthis danae* based on a specimen collected by the

DANA expedition near Bermuda. He described the specimen as having 4 pairs of photophores on the body; at the tips of the ventral arms, at the ventral base of each eye socket, on the posterior ventrum of the mantle, and on the recti abdominalis muscles adjacent to the inksac.

In 1948, Robson added a sixth species by his description of *Octopodoteuthis nielseni*, illustrating the funnel organ and a portion of the radula. Robson also questioned Pfeffer's separation of *Octopodoteuthis* and *Octopodoteuthopsis*. He combined these two genera into a single genus *Octopodoteuthis*.

Adam (1952), described a specimen which he identified as *Octopoteuthis sicula*. It bore two pairs of photophores, which he described as ocular and abdominal in their location. He provided illustrations of arm hooks bearing accessory cusps, subordinate to the main median hook, and a radula with nine rows of teeth. He also gave a good synopsis of the work of previous authors and agreed with Robson's consolidation of Pfeffer's adoption of two genera. In 1956(a & b), Voss described a specimen which he identified as *Octopodoteuthopsis megaptera* (Verrill, 1885) and placed in the family Octopodoteuthidae. He found three pairs of light organs; one pair on the recti abdominalis muscles, a second pair on the posterior ventrum of the mantle, and a third pair of ocular photophores. Voss maintained that *Octopodoteuthis* and *Octopodoteuthopsis* were distinct genera. Adam (1960), upon re-examining his 1952 specimens plus one other found the paired ventral mantle photophores similar to the ones described by Voss in his specimen of *O. megaptera*. Adam also listed the family to which they were to be assigned as Octopoteuthidae as did Clarke (1966), and Mercer (1968).

Several authors returned to Rüppell's original generic designation *Octopoteuthis* for the species *O. sicula* (Adam, 1952, 1960; Clarke, 1966; Mercer, 1968; Muus, 1963; Pearcy, 1965; Rancurel, 1970; and Voss, 1963).

In 1963, Akimushkin added the seventh species, *Octopodoteuthis longiptera*,

collected from a sperm whale (*Physeter catodon*) stomach. He compared *O. sicula* with his new species based on fin, mantle and funnel measurements, locking cartilage shape, and terminal swellings at the tips of the arms. The description of his species was brief and made no mention of photophores. No illustrations were provided.

Roper, Young and Voss (1969), offered a final solution to the problem of generic and familial spellings. The genera *Verania* (*Veranya*), *Octopodoteuthis* (*Octopoteuthis*, an incorrect spelling) and *Octopodoteuthopsis* were made synonyms of Rüppell's *Octopoteuthis*. Berry's Octopoteuthidae was selected as the valid family name.

Young (1972), added an eighth species, *Octopoteuthis deletron*, to the genus. He provided a detailed description of it including information on its ontogeny. He was also the first to describe serial photophores along the course of the axial nerves in the arms. A thorough discussion of the eight nominal species was included. Several species were eliminated or considered *nomina dubia*. *O. persica* was transferred to the species *Taningia danae* based on the specimen's distinct swellings on the tips of arms L and RII and its extremely broad fins. Young ignored *O. indica* because its small size did not permit adequate comparison with other species. He termed *O. longiptera* a *nomen dubium* because of its inadequate original description and the loss of the holotype which prevented its re-examination. He identified three species, *O. megaptera*, *O. danae*, and *O. sp A*, from the Atlantic and separated them using photophore patterns, hook structure and tail length. He suggested that one of the species was probably a synonym of *O. sicula*. In the Pacific, Young listed two species, his *O. deletron* and Robson's *O. nielsenii*.

Lipka (1975), described brachial photophores from Western Atlantic specimens he identified as *O. megaptera*. His discussion reviewed much of Young's 1972 findings.

In 1980, Clarke named the ninth nominal species, *O. rugosa*, based on a complete female specimen collected from a sperm whale stomach. He reported that he found no light organs in his new species and that Young's suggestion that they were present in all members of the genus was incorrect. Clarke reviewed Young's examination of the genus. Roper, Sweeney and Clarke (1985) also discussed *rugosa* in their work on Antarctic cephalopods.

Nesis (1982), recognized only seven identifiable *Octopoteuthis* species in a key to species of the genus; *O. dzhelton*, *O. sp. A*, *O. danae*, *O. megaptera*, *O. sicula*, *O. nielsenii*, and *O. rugosa*. He commented that Akimushkin's *O. longiptera* was not included because of an extremely incomplete original description.

It is in this confusing state that we find ourselves at the beginning of this current review and, hopefully, rearrangement of the genus, with reference to the Atlantic specimens.

Chapter 3

MATERIALS AND METHODS

The bulk of specimens used in this study were obtained on loan from various institutions. Additional material was examined while on a Short-Term Visitors Appointment to the United States National Museum of Natural History (Smithsonian Institution), Washington, D. C.. The following abbreviations are used to indicate the institutions from which specimens were borrowed:

BMNH - British Museum (Natural History),
London.

CSI - CSIRO (Commonwealth Scientific and
Industrial Research Organization)

IMPD - Invertebrates and Marine Plants
Division, Fisheries and Oceans,
Canada, Halifax, N. S.

INAP - Instituto Nacional de Pesca,
Montevideo, Uruguay.

MUV - Museum of Victoria (formerly
National Museum of Victoria),
Melbourne, Australia.

NMC - National Museum of Natural History,
National Museums of Canada, Ottawa,
Ontario.

RSM - Royal Scottish Museum, Edinburgh,
Scotland.

SABS - Biological Station, Fisheries and
Oceans, Canada, St. Andrews, New

Brunswick.

- SAM - South African Museum, Cape Town,
South Africa.
- SBM - Santa Barbara Museum, Santa Barbara,
California.
- SIO - Scripps Institute of Oceanography,
University of California, La Jolla,
California.
- SJBS - Biological Station, Fisheries and
Oceans, Canada, St. John's, Newfoundland.
- TAMU - Texas A & M University, College
Station, Texas.
- USC - Allan Hancock Foundation, University of
Southern California, Los Angeles.
- USNM - United States National Museum of
Natural History, Washington, D. C.
- ZMUC - Zoologisk Museum, University of Copenhagen,
Copenhagen, Denmark.
- ZMUB - Zoologisk Museum, University of Bergen,
Bergen, Norway.
- ZMUH - Zoologisches Museum der Universitat
Hamburg, Hamburg, Federal Republic of
Germany.

In reference to ships the following designations apply:

- ABM - R/V ALABAMA
- ADO - R/V ANTON DOHRN
- ADM - R/V ADMIRAL KING
- AFR - R/V AFRICANA

AGA - R/V A. AGASSIZ

ALM - R/V ALAMINOS

ALA - R/V ALASKA

ALB - R/V ALBATROSS

ARC - R/V ARCTURUS

ARG - R/V ARGUS

ATC - R/V A. T. CAMERON

ATL - R/V ATLANTIS II

BAC - R/V BACHT

BEL - R/V BELOGORSK

CLA - R/V T. CLARKE

CLI - R/V CLIMAX

COU - R/V COURAGEOUS

CRO - R/V T. CROMWELL

DAN - R/V DANA

DEL - R/V DELAWARE II

DIS - R/V DISCOVERY

DSJ - R/V DAVID STARR JORDAN

GAD - R/V GADUS

HAL - R/V HALCYON

HMA - R/V HAKUREI MARU

HUB - R/V C. L. HUBBS

ILL - R/V ILLOVD

JOA - R/V JOAST

JWS - R/V J. W. SCOGGAN

KMA - R/V KAIYA MARU

LHA - R/V LADY HAMMOND

MNA - R/V MEIRINE NAUDE

MSA - R/V MICHAEL SARS

PEN - R/V PENALBA

SAN - R/V SANDS

SMI - R/V H. M. SMITH

SOE - R/V SOELA

SPE - R/V SPENCER

SPR - R/V SPRIGHTLY

SWA - R/V SWAN

TAI - R/V TAIT

VEL - R/V VELERO

WAS - R/V T. WASHINGTON

WHE - R/V WALTHER HERWIG

WIG - R/V WIGWAM

In reference to program the following designations apply:

EAS - R/V EASTROPAC plankton sampling program at
SCRIPPS

Gear employed in capturing the *Octopoteuthis* spp. reported herein are designated
as follows:

BONG - Bongo
 BT - Beam Trawl
 COBB - Cobb Midwater Trawl
 E300 - 3 metre Ring Trawl
 EMT - Engels Midwater Trawl
 IKMT - Issacs-Kidd Midwater Trawl
 MOC - Multiple Opening-closing
 Net Environmental Sensing
 System
 MOT - Monsoon Midwater Trawl
 MWT - Midwater Trawl
 NAN - Nanaimo Midwater Trawl
 OTT - Otter Trawl
 RMT - Rectangular Midwater Trawl
 S150 - 1.5 metre Stramin Net
 S200 - 2.0 metre Stramin Net
 TUCK - Tucker Trawl
 mw - metres of wire out

Measurements and counts are those recommended by Roper and Voss (1983). All measurements were taken by means of a steel centimeter rule or metric calipers, and are presented in millimeters (mm). The following abbreviations are the data categories measured or computed. The definitions of some of the actual measurements are inherent in the definition of the indices. Figures 3-1, 3-2 and 3-3 illustrate where the measurements were taken on each specimen.

Figure 3-1: Generalized drawing of a squid of
the genus *Octopoteuthis* (dorsal view)
showing dimensions and structures measured
in review of proposed diagnostic characters.

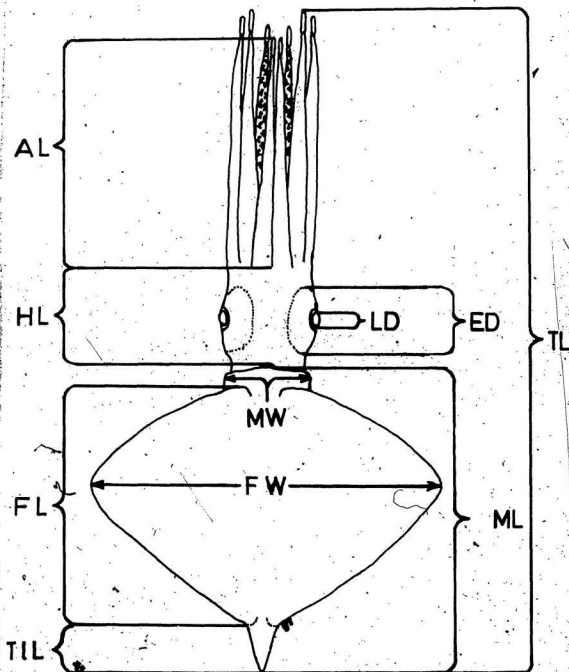


Figure 3-2: Generalized drawing of a squid of the genus *Octopoteuthis* (ventral view) showing position of photophores. ATP - arm tip photophore; AP - arm photophore; AEP - anterior eyelid photophore; VHP - ventral head photophore; VP - visceral photophore; PVMP - posterior ventral mantle photophore.

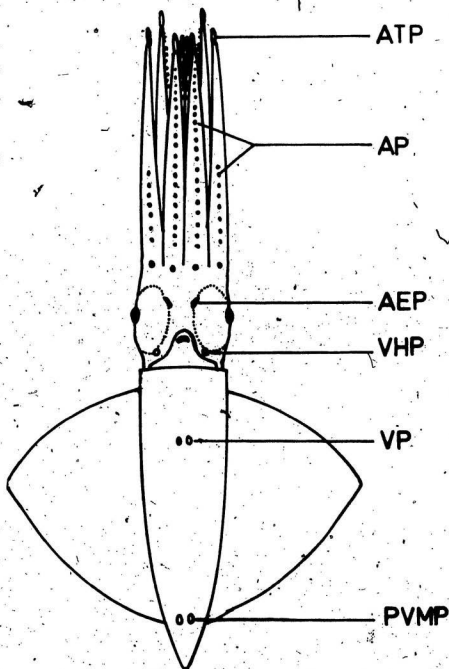
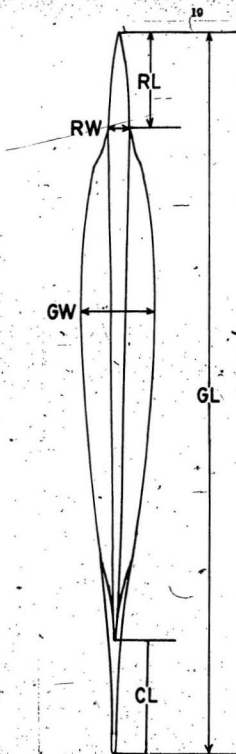


Figure 3-3: Generalized drawing of the gladius of Young's *Octopoteuthis* sp A showing cross sectional configurations and the axes of which measurements were taken.



- AF - Arm Formula: comparative length of arms expressed in decreasing order.
- HC - Arm Hook Count: number of hooks on each designated arm.
- AL - Arm Length (I, II, III, IV).
- ALI - Arm Length Index: length of arm measured from the first basal (proximal-most) hook to the tip of the arm as a percentage of mantle length. (Arm I, dorsal; II, dorso-lateral; III, ventro-lateral; IV ventral)
- ED - Eye Diameter.
- EDI - Eye Diameter Index: greatest diameter of eye as a percentage of mantle length.
- FL - Fin Length.
- FLI - Fin Length Index: greatest length of fin (excluding tail) as a percentage of mantle length.
- FW - Fin Width.
- FWI - Fin Width Index: greatest width (dorsally) across both fins as a percentage of mantle length.
- GL - Gladius Length: dorsal length of gladius along midline.
- GLI - Gladius Length Index: length of gladius as a percentage of mantle length.
- GW - Gladius Width.

- GWI - Gladius Width Index: greatest width of gladius as a percentage of gladius length.
- HL - Head Length.
- HLI - Head Length Index: dorsal length of head measured from point of fusion of dorsal arms to anterior tip of nuchal locking cartilage as a percentage of mantle length.
- HW - Head Width.
- HWI - Head Width Index: greatest width of head at level of eyes as a percentage of mantle length.
- LD - Lens Diameter.
- LDI - Lens Diameter Index: diameter of eye lens as a percentage of mantle length.
- ML - Mantle Length: dorsal mantle length measured from anterior-most point of mantle to posterior apex of mantle.
- MW - Mantle Width.
- MWI - Mantle Width Index: greatest straight-line (dorsal) width of mantle as a percentage of mantle length.
- RL - Rachis Length.
- RLI - Rachis Length Index: length of free rachis measured from anterior end of gladius to point where anterior end of valve joins rachis, as a percentage of gladius length.
- RW - Rachis Width.

- RWI - Rachis Width Index: width of rachis measured at point where anterior edge of vane meets rachis as a percentage of gladius length.
- TIL - Tail Length.
- TILI - Tail Length Index: portion of the mantle measured from the posterior edge of fins to the distal tip of mantle as a percentage of mantle length.
- TtL - Tentacle Length.
- TtLI - Tentacle Length Index: total length of tentacular stalk and club as a percentage of mantle length.
- TL - Total Length: measured from the tip of club (or longest arm in juveniles and adults) to posterior-most point of mantle.

Photophore numbers and placement were determined by minor microscope dissection. Axial nerve photophores were uncovered by making an incision along the length of all arms and by examining them using a dissecting microscope. Due to the extreme difficulty in determining arm photophore numbers without causing some damage to intact arms, specimens were X-rayed in an attempt to see if arm photophores could be seen on the film and counted. No photophores were visible on the film so after several attempts the procedure was abandoned.

The gladius was extracted for examination using the method described by Toll (1932), which requires displacement of viscera from the left side to the animal's right, slicing through the stellate ganglion thereby permitting easy removal of the gladius from the shell sac. The gladius thus acquired was stained by use of methylene blue and required measurements were taken with vernier calipers. Beaks and radula were removed for examination by excising the

complete buccal mass from the squid and then soaking the mass in a 10 percent solution of potassium hydroxide. The potassium hydroxide digested adhering tissue and after rinsing in distilled water the beaks were measured using Vernier calipers. The radula was photographed using a WILD Photomat MPS 55 dissecting scope/camera combination.

A number of additional characters were looked at including; funnel locking cartilage, nuchal cartilage and funnel organ sculpturing, and the number and type of brachial armature (ie. hooks and sucker counts).

Statistical analysis of the morphometrics was done using SAS software package (SAS, 1982) on the Memorial University VMS (DIGITAL) computing system. Initially, it was planned to analyze all morphometric and meristic variables but the loss of the arm tips of the majority of the specimens precluded the use of arm and total lengths, hook and sucker counts and axial photophore counts. Thus, only the following measurements were analysed statistically in individual species; mantle width, fin length, fin width, head length, head width, tail length, eye diameter, and lens diameter. Additional measurements analysed in larvae included tentacle length, and arm lengths.

Indices (means, maximum and minimum values) were calculated for the larvae, and individual species. The species indices were generated for size ranges of 25 mm ML intervals. Larval indices were generated for size ranges of 5 mm ML intervals.

Means comparisons, using the general linear models (GLM) procedure, were carried out on juvenile and maturing animals separated into 5 species defined by photophore position and number and hook structure. Each variable was analysed separately in individual GLM procedures. During each procedure the defined variable was compared for all species simultaneously. Each GLM indicated which means differed significantly (at the .05 per cent level) between species.

Discriminant analysis was then run on the same morphometrics using the discriminant analysis (DISCRIM) procedure. The procedure classified specimens into one of the 5 defined species based on analysis of the morphometrics. It also reclassified any observations that appeared to be misclassified originally and listed the number of observations and per cents classified into species. After the first DISCRIM procedure was completed it was found that one of the defined species *O. sp A* had very low numbers (5) and was not being treated with full matrix ranking. A second DISCRIM procedure was therefore run without the species.

Chapter 4

RESULTS

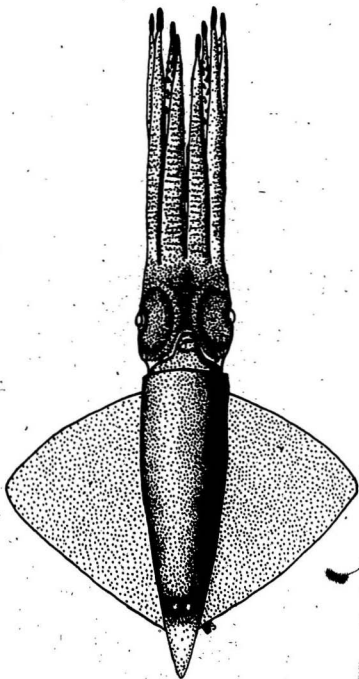
4.1. GENERAL MORPHOLOGY

Specimens of the genus *Octopoteuthis*, like other decapod squids, bear eight arms and two tentacles. The paired tentacles common to most squids are retained only during the larval period. By the time the animals have reached a dorsal mantle length of 25-30 mm, the tentacles are autotomized, the stumps being gradually resorbed. As adults the animals have large rhomboidal fins extending almost the total length of the mantle. Fin width is usually greater than mantle length (See Fig 4-1).

The mantle is conical, tapering gradually posteriorad. It is composed of layers of muscles internally and a gelatinous outer layer which contains ammonium and is thought to aid the animal in maintaining buoyancy (Clarke *et al.*, 1969; Clarke *et al.*, 1979; Denton and Gilpin-Brown, 1973). Both the gelatinous and muscular layers are heavily pigmented giving preserved specimens a rich purple-red colour. In mature females (of all species) the gelatinous layer at the anterior end of the mantle, near the funnel, becomes rugose.

The arms are nearly equal in length to the mantle and bear biserial hooks and suckers. These hooks, numbering around 40-60 per arm, are formed by the modified chitinous rings of the original arm suckers. A few (6-15) suckers remain near the distal end of each arm. The arms also have a gelatinous outer layer

Figure 4-1: Drawing of a Generalized Adult squid of
the genus *Octopoteuthis* (ventral view).
(Scale = 10mm)



although most specimens lose much of this during capture. The gelatinous layer is not pigmented but underlying it on arms III and IV on most specimens is a layer of chromatophores arranged in parallel rows running across each arm. This has been previously noted only in *Octopoteuthis deletron* Young, 1972; and *O. rugosa* Clarke, 1980.

Each species bears a number of *photophores* found in various locations on the body; ventrally on the posterior portion of the mantle, ventrally overlying the ink sac, one anteriorly on the tissue of the eyelid and another postero-laterally to the eye between the eyelid and the olfactory papillae (and in some, on the eyeball as well), at the proximal base of each of the arms, and in a series paralleling the axial nerves of the ventral and two lateral pairs of arms. Elongate photophores are also found on the distal tips of each arm. Almost all of these photophores are situated in such a way that light they emit is directed ventrally (Young and Roper, 1977). The high incidence of arm tip loss eliminated the use of axial photophore counts as a possible aid in species identification.

The head is also covered by a gelatinous layer of tissue. The eyes are large, their diameter almost equal to the head length. There are two "olfactory" papillae, ventrally situated on the head, one on either side of the funnel. The funnel extends almost to the midpoint of the eye. The funnel locking apparatus is of a modified, simple, straight type which generally widens posteriorly. The funnel organ consists of an inverted V-shaped dorsal pad and two oval ventral pads. There is a papilla on a small ridge at the apex of the dorsal pad and longer ridges running partway down each side of the V. There was no discernable difference in the sculpturing of the funnel locking cartilage, the nuchal cartilage or the funnel organ in any of the species of *Octopoteuthis* examined.

Sexual maturity, in both sexes, seems to occur at a varying size range starting at around 80.0 mm mantle length (ML). *Gravid females* have very large nidamental (85 mm in a 215 mm ML female) and oviducal glands. The mature eggs are slightly oval and about 2 mm in diameter. In *mature males* the penis is

very large extending, in some specimens examined, beyond the mantle cavity opening. Unlike the males of other teuthoid squids, those of *Octopoteuthis* lack a hectocotylus (the modified arm tip(s) used in spermatophore transfer).

The *radula* is composed of seven rows of teeth, one median row and three lateral rows to either side.

The *gladii* in the genus have been inaccurately described in the past. Most illustrations and descriptions were based on very small specimens and were drawn with little or no detail (Jatta, 1896; Adams and Adams, 1858). Structurally the gladius consists of a short free rachis, and wide vanes that join together posteriorly to form a conus (see Fig 4-2).

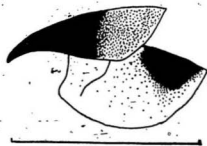
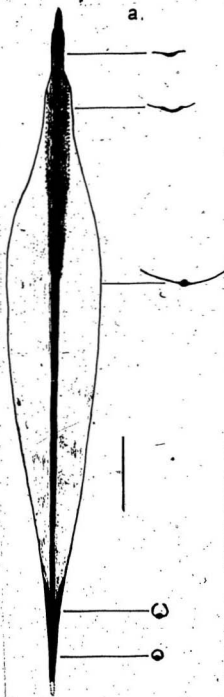
As stated earlier in this section, *larvae* differ from juveniles and adults in several ways. Fig 4-3 shows the ontogenetic development of three larvae from 5.0 to 10.9 mm ML. They bear very wide fins, like the adults, but the fin length is less than half that of the mantle. Photophores are not present in the larval forms to the degree they are in the postlarval and adult configuration. An exception to this generalization is the case of the photophores found at the distal termination of the arms.

A total of 455 specimens of *Octopoteuthis* were examined representing collections from the North and South Atlantic, the NE Pacific, the Indian Ocean, the SW Pacific in the vicinity of Australia and from the Mediterranean Sea. Sizes of specimens ranged from larvae of 1.7mm ML to the largest adult of 240mm ML.

Of the nine nominal species described only four still have extant types; *Octopoteuthis danae*, *O. nielsenii*, *O. deletron*, and *O. rugosa*. Only the *O. deletron* and *O. rugosa* holotypes are adult animals. Both the syntypes of *O. nielsenii* and the holotype of *O. danae* are juveniles.

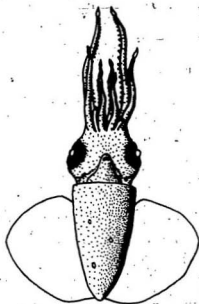
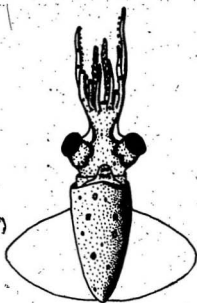
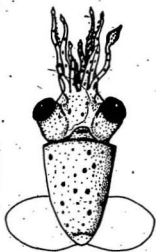
The following sections deal with each nominal species separately, giving

Figure 4-2: Drawings of (a.) the gladius and (b.)
beaks of *Octopoteuthis deletron* Young, 1972,
and (c.) arm hooks (with and without cusps).
(Scale = 10mm)



c.

Figure 4-3: Drawings of larval squid of the genus *Octopoteuthis* showing ontogenetic changes in general morphology (Scale=2 mm).



information on the type specimen(s) followed by a full description of each species listing characters of the species along with specific comments on the type(s). Where no type specimens exist the original description is given. Only two of the original nine nominal species could be clearly distinguished, *danae* and [*deletron*]. Three other species, temporarily designated as A, B, and C could be identified using the same criteria. To attempt to stabilize the systematics of the genus *Octopoteuthis* species B and C were used as the bases to redescribe the two oldest species, *sicula* and *megaptera* respectively. The reasoning for each choice will be discussed in the appropriate section below.

4.2. *Octopoteuthis sicula* Rüppell, 1844

SYNONYMY.

- as *Octopoteuthis sicula* Rüppell, 1844; Pfeffer, 1884
- Ficalbi, 1899; Degner, 1925; Adam, 1952, 1960; Clarke, 1966, 1980; Young, 1972; Nesis, 1982
- as *Octopodoteuthis sicula* Krohn, 1845; Pfeffer, 1900;
- Hoyle, 1909; Pfeffer, 1908; Thiele 1921, 1935; Chun, 1910; Naef 1921, 1923;
- as *Verania sicula* Krohn, 1847; Tryon, 1879; Verrill, 1882; Hoyle, 1886 a, b; Weiss, 1889; Goodrich, 1892;
- as *Octopodoteuthis sicula* Gray, 1849
- as *Onychoteuthis* (*Verania*) *sicula* Verany, 1851
- as *Veranya sicula* Keferstein, 1866; Tiberi, 1880; Fischer, 1887; Pelseneer, 1894; Jatta, 1896;
- as a synonym of *Enoploteuthis* in Woodward, 1871

Type: Juvenile, 44 mm ML, not extant.

Type Locality: From off Messina, Italy, 27 February 1844.

Material examined: see Appendices I and II.

DESCRIPTION.-Translated from Rüppell, 1844.

Finally, however, our honourable friend Dr. Krohn who is preparing the publication of a new genus of cephalopod, he recently uncovered, which I also collected and observed alive, permitted me the opportunity

to give a short note calling it to the attention of Sicilian malacologists. This genus that is decreed to be called

Octopoteuthis.

combines the characteristics of the species *Octopus*, *Loligo*, and *Enoplateuthis*. In it, the head, the mouth of which is surrounded by eight tentacles equal in length and equipped with a double longitudinal set of little hooks, rests on a visceral sac which is conical, funnel-shaped and supported by a very thin horny layer and which has on its dorsal side for two-thirds of its length towards the apex, a large fin-like subcordiform membrane.

We call this species

Octopoteuthi siculiana

Octopoteuthis sicula

This has under the head a small, fleshy prolongation, thirty pairs of tiny hooks in alternate rows above each tentacle. The live animal is a translucent rosy colour, the ends of the tentacles a deep red.

In the dead animal the chromatophores produce many yellowish-red spots over the whole surface. The total length of the body and the tentacles is from 2.5 inches and the maximum transverse breadth of the fin is from 15 lines. (a line = one 12th of an inch)

DESCRIPTION.-*O. sicula*, an Atlantic and Mediterranean species, closely resembles *Octopoteuthis danae* although it does bear characters that separate the two.

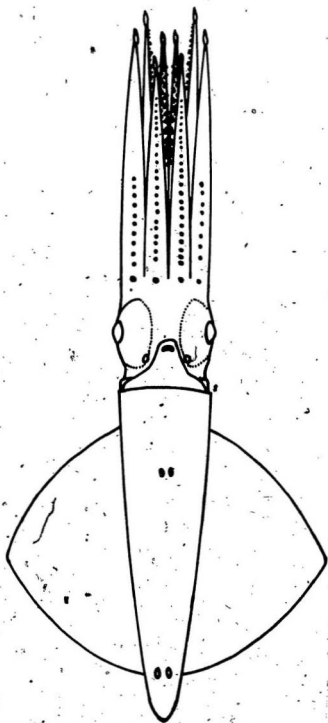
The mantle is conical and covered with a gelatinous layer. The tail length is approximately 14 per cent of the ML.

As in other species the fins are large and muscular. Fin length is 75 per cent of the ML while the fin width is 115 per cent of ML.

The head itself is robust with thick outer gelatinous layer.

Figure 4-4: Photograph of Rüppell's original unpublished illustration of the holotype of *Octopoteuthis sicula*. (Courtesy of Ronald Janssen, Curator of Invertebrates, Senckenberg Institut, Frankfurt, F. D. R.).

Figure 4-5: Drawing of *Octopoteuthis
sicula* Rüppell, 1844 showing
photophore patterning.



The *funnel* is large and extends about half-way along the length of the head.

The *arms* have hooks which bear accessory cusps unlike the closely related species *Octopoteuthis danae*. The arm formula was $\text{II} > \text{III} > \text{IV} > \text{I}$ in a 215 mm ML female.

A pair of *photophores* is found ventrally on the posterior portion of the mantle. There is a pair of photophores located ventrally adjacent to the ink sac, and a single photophore at the postero-ventral position of each eye. The arms III and IV each have a series of axial photophores (43 and 25 respectively in a 215 mm ML female). (See Fig 4-5)

The *gladius* has a short, free rachis with RLI and RWI of 10 and 2 percent respectively. The rachis begins to form a dorsal keel about 1/3 of the way down its length. Anteriorly the vanes taper down to the rachis in a series of three gradual contractions. The vanes ($\text{GWI} = 12$ percent) begin to curl ventrally about 85 percent of the way down the gladius. The vanes which form the secondary conus ($\text{CLI} = 2$ percent) do not begin to fuse until the vanes have run together for a distance greater than the conus length. (See Fig 4-6)

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower *beak* is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is obtuse. The upper beak has a greatly curved rostrum and the jaw angle is acute.

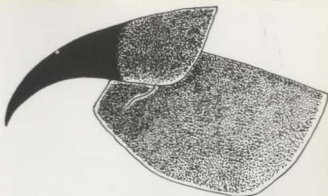
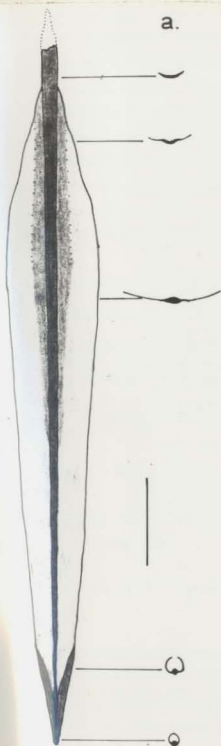
DISCUSSION. The type specimen of *sicula* could not be traced; however Ruppell's original unpublished illustrations (see Fig 4-4) of the specimen were located at the library of the Senckenberg Institute in Frankfurt, Germany.

The illustrations give no indications of the photophore pattern of the specimen so little could be determined except the animal's basic habitus.

Figure 4-6: Drawings of (a.) gladius (with cross sections), (b.) beaks and a photograph of (c.) portion of radula from specimens of *Octopoteuthis sicula* Rüppell, 1844.
(Scale = 10 mm)

A single specimen collected from Mexico - description of the specimen

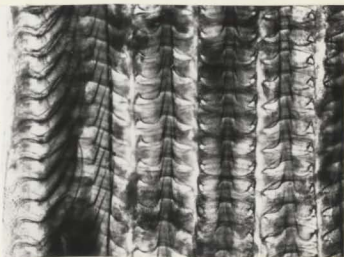
a.



b.



c.



A single specimen collected from Messina, Italy was examined from the collections of the Royal Scottish Museum. It is a 28.3 mm ML animal bearing a pair of abdominal photophores. The hooks have all been dissolved away during preservation but it appears by the intact hook sheathing that accessory cusps were probably present. No photophores were visible on the eyeball or the anterior portion of the eyelid. The species B listed above bears paired abdominal photophores, no eyeball or eyelid photophores and hooks with accessory cusps. The similarity of the characters and the distribution of B throughout the North Atlantic including the Mauritanian subprovince associated with the Mediterranean subprovince (Backus and Craddock (1977) and Backus *et al.* (1977)) imply that species B is most probably Ruppell's *sicula*.

4.3. *Octopoteuthis megaptera* (Verrill, 1885)

SYNONYMY:-

as *Octopoteuthis megaptera* Clarke, 1966, 1980; Young, 1972; Lipka, 1975; Nesis, 1982

as *Ancistrocheirus megaptera* Verrill, 1885; Hoyle 1886

a, b:-

as *Octopodoteuthopsis megaptera* Pfeffer, 1912; Berry 1920

a; Voss 1956 a, b; 3

Holotype: Juvenile, 44 mm ML, not extant.

Type Locality: ALBATROSS, Sta 2235, 39° 12'N, 72° 03'W, 1500 mw, 09:49, 13 September 1884.

Material examined: Holotype not located. For other material see Appendices I and

II.

ORIGINAL DESCRIPTION:-

"*Ancistrocheirus megaptera* Verrill, sp. nov. Body small, rather short, with an acute posterior end, extending a little beyond the posterior border of the fin. Fins very large, thick and strong, attached nearly the entire length of the body, and together forming a broad,

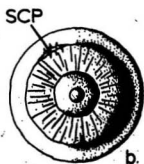
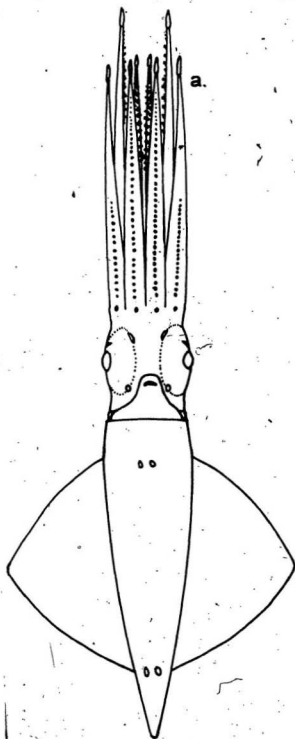
rhombic figure, with the outer angles behind the middle; anteriorly the attachment of the fin does not reach quite to the edge of the mantle, and the front edge forms a slightly rounded lobe in front of the attachment; posteriorly the fins are nearly united, across the back, but leave the acute, posterior tip of the body free for a short distance. The front edge of the mantle recedes in a broad curve ventrally, but has slightly prominent lateral lobes and a broad obtuse dorsal angle, which extends farther forward than the lateral does. The head is rather large, with large eyes, furnished with thin free lids. The siphon is rather large, with two small dorsal bristles. The connective cartilages on its base are rather small, ear-shaped, such as in *Ommastrephes*. The arms are rather large, not very unequal in size, the dorsal ones slightly smaller than the others; all are unusually rounded and most of them, in our specimen, have lost their tips. They all bear two alternating rows of small prominent sharp claws, which are not very closely arranged. The inner face is not separated by a distinct margin. The tentacular arms are wanting. Color, in alcohol, orange-brown, due to numerous purple and brown specks scattered pretty uniformly over the surface, both above and below; the outer portions of the fins appear to have been transparent; the surface of the body appears to have been entirely smooth and destitute of tubercles, although the specimen is so much injured as to make this a little uncertain. Length of the body to front edge of mantle, 44 mm; length of free caudal portion, 6 mm; length of the attachment of fin, 34 mm; from front margin of fin to mantle edge, 3.5 mm; breadth across fins, 56 mm; length of head, from dorsal cartilage to base of dorsal arms, 19 mm; length of dorsal arms, 24 mm; diameter at base, 3.5 mm; diameter of lateral arms, 4 mm. A single mutilated specimen (No. 40,128) was taken at station 2235, 707 fathoms, 1884. This species closely resembles *A. veranyi*, recorded from the Indian Ocean, but it apparently differs from the latter by having larger fins and in being destitute of the rows of tubercles on the mantle; the arms also appear to differ in their proportions."

DESCRIPTION.—The *mantle* is broadly conical with the tail making up approximately 14 per cent of ML in maturing adults.

The *fins* are large, their length being 71 per cent of ML while fin width equals about 91 per cent of ML.

The *head* bears large eyes whose diameter nearly equals total head length.

Figure 4-7: Drawing of *Octopoteuthis megaptera* (ventral view) showing photophore patterning. EP - eye photophore. (Scale = 10 mm)



The *funnel* projects about half-way along the length of the head. The dorsal pad of the funnel organ is an inverted V-shape with ridges running down each arm and a small papilla at the apex of the V.

The *arms* have hooks with accessory cusps. In a 113 mm ML female hook and sucker counts were as follows: LI - 50 hooks, 10 suckers; LIII - 53 hooks, 10 suckers; RII - 68 hooks, 12 suckers.

There are paired *photophores* on the ventral portion of the mantle. Paired photophores are also found adjacent to the ink sac. Single photophores are located at the anterior end of each eyelid. A crescent-shaped photophore is found on each eyeball, in an antero-dorsal position, at the junction of the iris and the sclera. These eye photophores are easily seen in specimens as small as 30 mm ML and are creamy white in colour (see Fig 4-7).

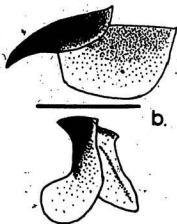
The *gladius*, like those of other species, is quite delicate (see Fig 4-8). There appears to be little or no free rachis with very narrow anterior vane extensions running right up to the anterior tip of the gladius. The RLI and the RWI of the anteriormost portion of the gladius is 11.3 and .7 percent respectively. The rachis begins to form a dorsal keel about 1/3 of the way along its length. The vanes (GWI = 9.66 percent) begin to curl ventrally about one third of the way down the gladius. The fused portion of the vanes which form the secondary conus (CLI = 7.3) do not begin until the vanes have run together for a distance equal to the conus length.

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower *beak* is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is obtuse. The upper beak has a curved rostrum and the jaw angle is slightly acute.

DISCUSSION.-Although Verrill provided good morphometric measurements

Figure 4-8: Generalized diagram of (a.) gladius (with cross sections), (b.) beaks from specimens of *Octopoteuthis megaptera*.

a.



he gave no indication of the presence of photophores or the structure of the hooks of his new species. With the holotype lost there can be no way of determining these characteristics. Four identifiable species of *Octopoteuthis* occur in the Northwest Atlantic, and with the exception of Young's *O. sp A* all have been collected near the type locality of *O. megaptera*. The long standing use of the species names *sicula*, *megaptera* and *danae* and the real need to stabilize the systematics of the genus warrant retention of *megaptera* as a valid species. Since *sp C*, listed earlier, remains the only species of the three in the area without a name it will be designated as *megaptera*.

4.4. *Octopoteuthis indica* (Naef, 1923)

SYNONYMY.

as *Octopodoteuthis indica* Naef, 1923

as *Octopoteuthis indica* Young, 1972; Clarke, 1980

Holotype: Larva, 3.8 mm ML, not located.

Type Locality: VALDIVIA, Sta 102, 13° 2'N, 46° 41'W, vertical net, 0-1800 m, 1898-1899.

Material Examined: Holotype not located and no additional material found.

ORIGINAL DESCRIPTION.-Translated from Naef:

"...the larva described by Chun (1910, Plate XVII, Figures 3, 4, 9) from the Agulhas Current differs from the Mediterranean specimens. The stage of development is similar but the arm apparatus is markedly less developed. There are much fewer suckers and terminal swellings are absent, even on the second pair, which is the longest. On the other hand, the tentacles are relatively strong. These are obviously two different species and I propose the name *Octopodoteuthis indica* nov. spec. for this larva. It is significant that this larva already has a buccal funnel consisting of 6 parts at a dorsal mantle length of 3.8 mm."

DISCUSSION.- The holotype of this species could not be located so character examination was limited to the brief translated description and the few

illustrations in Chun's monograph. Since none of the photophore patterns or the hook structure could be determined and basing species on larval specimens is at best risky *Octopoteuthis indica* should be considered a *nomen dubium*.

4.5. *Octopoteuthis persica* (Naef, 1923)

SYNONYMY.-Translated from Naef:

as *Octopodoteuthis persica* Naef, 1923

as *Octopoteuthis persica* Young, 1972

Holotype: Larva, 4.7 mm ML, not located.

Type Locality: VALDIVIA, Sta 271, 34° 31'S 26° 0'E, vertical net, 0-1200 m, 1898-1899.

Material Examined: Holotype not traced. No additional material found.

ORIGINAL DESCRIPTION.-

"The oldest stage described by Chun (Plate XVII, Figures 1, 2, 7, 8) probably belongs to a third species. Although it is larger and more developed, it shows no evidence of conversion of suckers into hooks. I name this form *Octopodoteuthis persica*. ...The young *O. persica* has a mantle length of only 4.7 mm, compared with 6.5 mm of the specimen of *O. sicula* described below. The fins of the specimen of *O. persica*, however, are much larger, occupying 2/3 of the mantle length and their span is more than 1.5 times that of the mantle length. On the other hand, the arm apparatus of *O. persica* is even less developed than that of the stage described above: the third and fourth arms are still shorter than the first, and terminal swellings are only present on the second pair. All these differences are so marked that they cannot belong to the same species.

Discussion.-The specimen Naef described as a new species *persica* appears from all evidence to be a larval specimen of *Taningia danae* Joubin, 1931. Naef's description and Chun's illustration of the terminal swellings of arms II is indicative of *Taningia* and not *Octopoteuthis*. This agrees with the findings of Clarke, 1980 and Young, 1972. *O. persica* must therefore be considered a *nomen dubium*.

4.6. *Octopoteuthis danae* (Joubin, 1931)

SYNONYMY.-

as *Octopodoteuthis danae* Joubin, 1931

as *Octopoteuthis danae* Young, 1972; Clarke, 1980;
Nesis, 1982

Holotype: Juvenile female, 32 mm ML, in good condition in Zoologisk Museum, University of Copenhagen, Copenhagen. (See Fig 4-9)

Type Locality: DANA Sta 1341 V, 33° 15'N, 68° 20'W, 1500 mw, S-200, 19:30, 14 May 1922

Material Examined: Holotype and additional material (See Appendices I and II).

DESCRIPTION. The *mantle* is conical in shape and somewhat gelatinous ending in a blunt point. The mantle projects beyond the posterior portion of the fins and forms a tail averaging about 16 per cent (18.7 per cent in the holotype) of the mantle length.

The *fins* are large, rhomboidal and their length is 77 per cent (71 per cent in the holotype) of the mantle length. Their posterior ends follow along the lateral edge of the tail in the form of narrow strips while the anterior edge of the fins form free lobes.

The *head* is large with the eyes occupying almost its total length. The olfactory papilla lies posteriorly on the head, lateral to the base of the funnel. The head is encased in a thick gelatinous layer.

The *funnel* extends nearly to the midpoint of the eyeball. The funnel locking cartilage is a modified simple straight type. The actual shape is like an elongate raindrop. The funnel organ is in three parts: a dorsal inverted V-shaped pad; and two ventral oval-shaped pads. The dorsal pad has a papilla resting on a

Figure 4-9: Photograph of the Holotype of *Octopoteuthis danae* (Joubin, 1931).



short anterior ridge. Other ridges run about halfway down each shoulder of the V. The sculpturing of the funnel organ can be highly variable. A funnel valve is present.

The *arms* are very brittle and are almost always broken distally. This makes determination of the arm formula difficult. In mature specimens they appear subequal. Larger specimens may have 50+ hooks and 6-10 suckers per arm. The hooks are alternating arranged in two rows and are enclosed in fleshy sheaths. The hooks have no accessory cusps. The distal arm tips are bare of hooks or suckers. At each arm tip there is a distinct swelling containing the subcutaneous elongate distal photophores. In the holotype only arms IV still intact. They are 19.0 and 20.0 mm long (right and left respectively). Each ventral arm bears about 45 hooks basally and approximately 9 suckers near each distal tip.

There are paired *photophores* on the ventrum of the mantle, another pair on the muscoli recti abdominalis and a third pair on the ventral portion of the head near the olfactory papilla. There were no photophores on the eyeball or at the anterior of the eye orbit. There are approximately 24 photophores located along the axial nerve of each ventral arm. Photophores were found at the base of arm pairs II and III but none were found at the base of the dorsal arms. (See Fig 4-10)

The *gladius* has a short free rachis with RLI and RWI equal to 10 and 2 percent respectively. The rachis begins to form a dorsal keel about 1/3 of the way down its length. Anteriorly the vanes taper down to the rachis in a series of three gradual contractions with the final contraction before the free rachis being barely visible (see Fig 4-11). The vanes are widest at about the midpoint of the gladius (GWI = 6 percent) and begin to curl ventrally about 85 percent of the way down the gladius. The vanes do not begin to fuse until the vanes have run together for a distance greater than the conus length (CLI = 11 percent).

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid

**Figure 4-10: Drawing of *Octopoteuthis danae*
(Joubin, 1931) showing photophore patterning.**

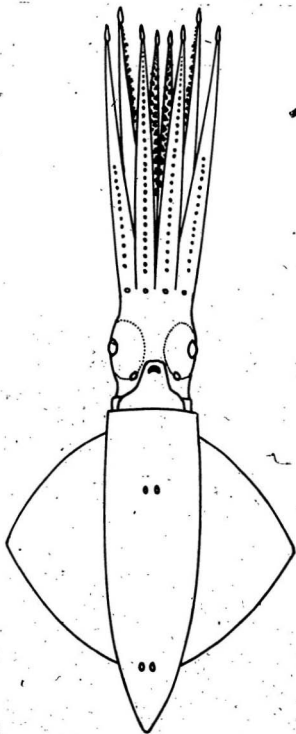
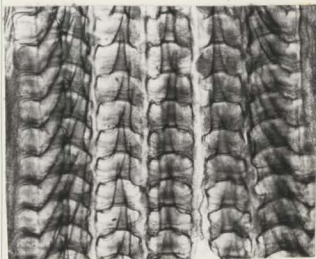
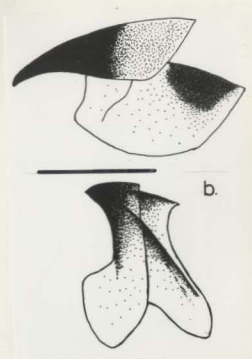
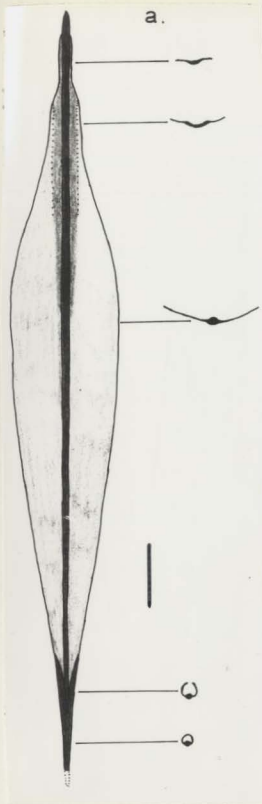


Figure 4-11: Drawings of (a.) a gladius (with cross sections), (b.) beaks and a photograph of (c.) portion of radula from specimens of *Octopoteuthis danae* (Joubin, 1931) (Scale = 10mm)



second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower beak is about $1/3$ the length of the wing. The rostral edge is almost straight and the jaw angle is slightly obtuse. The upper beak has a curved rostrum and the jaw angle is acute.

4.7. *Octopoteuthis nielseni* (Robson, 1948)

SYNONYMY.

as *Octopodoteuthis nielseni* Robson, 1948

as *Octopoteuthis nielseni* Young, 1972; Clarke, 1980;

Nesis, 1982

Syntypes: Two juveniles, 26 mm ML (Robson, 1948) in extremely dehydrated condition, deposited in the British Museum (natural History), BM 1947.7.7.10.

Type Locality: ARCTURUS, Sta 74, 4° 50'N, 87° 00'W, near Cocos Island, Pacific Ocean, 0-727 and 0-909 m, open tow net, 14:30, 2 June 1925.

Material Examined: Syntypes.

ORIGINAL DESCRIPTION.

Dorsal length of mantle	..... 26 (?) mm
Maximum width of mantle	..... 12+ mm
Maximum length of fins	..... 22 mm
Total width of fins	..... 34 mm
Length of head (mantle edge to base of dorsal arms)	..... 9 mm
Width of head	..... 11 mm
Length of third arms	..... 36+ mm

In *O. nielseni* the suckers and hooks are arranged in a zig-zag about the median furrow. So much damage has been done to the arms that it is not easy to say how many hooks there were. On one arm there are at least 20 pairs.

The hooks are, as in *sicula*, sheathed in fleshy casings and are upright and columnar. The fins are 84% of the body-length and their total

span is 130% of the mantle-length (both figures are the same as in *sicula*). The cephalic component of the adhesive-organ is not like that of *sicula* as shown in Pfeffer's fig. 9, pl. 12 (1912); there is a far wider and less distinctly channelled groove. Unlike those of *sicula* the arms are rounded and have neither the "Schwimmsaume" nor the "Schutzsaume." ... The funnel organ is not like that of *sicula* figured by Jatta (1896) though it is a little more like that shown by Sasaki (1929). The radula is quite unlike that of *sicula* (Jatta, 1896, pl. 13, fig. 8) in its rhachidian tooth, with an extraordinary small base and square admedian tooth.

The general shape and the form of the fins are not particularly different from those of *sicula* (e.g. as given by Pfeffer and Sasaki). The adhesive-organ, radula and the entire lack of membranes on the arms (which cannot be due to damage) are, however, features which preclude our ranking it with *sicula*. The adhesive organ is of uncertain importance. Another point of diagnostic value is the great length of the third arms.

sicula. Jatta. Longest arms 25 mm. Pfeffer. Longest arms equal mantle. Sasaki. Longest arms slightly shorter than mantle.

nielsenii. Longest arms 36 mm., mantle 26 mm.

DISCUSSION.- The syntypes were borrowed from the British Museum (natural History) but were so severely dehydrated that no measurements or meristics could possibly be taken. The lack of knowledge about the photophore patterns and hook configuration of the syntypes inhibits any attempt to validate the species. The species C listed above has been assigned to *Octopoteuthis megaptera*, but appears to be found circum-globally. Future comparison of Atlantic and East Indian Ocean/West Pacific material may discern enough difference in characteristics to separate species C into two species the Pacific one being *nielsenii*. Until that time *nielsenii* must be considered a *nomen dubium*.

4.8. *Octopoteuthis longiptera* (Akimushkin, 1963)

SYNONYMY.-

as *Octopodoteuthis longiptera* Akimushkin, 1963

as *Octopoteuthis longiptera* Young, 1972; Clark, 1980;

Nesis, 1982

Holotype: Adult, 590 mm ML, not extant (K. N. Nesis, personal communication).

Type Locality: From Sperm whale stomach, 20° S, 25° W.

Material Examined: None available.

DESCRIPTION.-Akimushkin's original description is as follows.

* ...head and arms had traces of a jellylike tissue which apparently covered the body of the live animal and had been partially digested.

Mantle, conical, 3 times as long as wide ($c/l=33\%$). Dorsal margin of mantle protruding markedly forward to form an acute angle. Ventral incision inconspicuous. Fins long, extending from anterior margin of mantle (excluding the dorsal protuberance) along entire lateral surface to posterior end of mantle, where they narrow markedly to form a narrow border. Fins oval with the longer axis situated along the body, 36% longer than wide, 92% of the mantle length measured with the dorsal protuberance.

Head large but narrower than the mantle ($o/c=70\%$). Eyes very large, convex but not stalked. Nuchal folds absent. Tuberculus olfactorius fairly long but thin and inconspicuous. Infundibular funnel of medium depth.

Funnel very long, terminally protruding beyond anterior margin of eyeball, though the eyes of this species are not small. Infundibular cartilage large, subtriangular, with narrow anterior and wide, obtuse posterior end. Central pit of infundibular cartilage deep, wide, pyriform.

Buccal membrane with 6 apices and 7 rays. Two dorsal pairs of buccal darts attached dorsad to suckers of corresponding arms, two ventral ones - ventrad.

Arms of medium length ($l/L=47\%$). The tips of all but the second and third arms had been cut off, so their length is unknown. The second, however, is much longer than the third. Swimming carinae destroyed or absent. Fragments of protective membrane show that these were well developed on the base of the arms (where they covered the hooks completely) and probably had an undulate margin. All arms bear two dense rows of large hooks. Terminally the hooks diminish in size and the rows fuse into one zigzag line. Terminal part (7-8%) of arms covered with minute suckers disposed at first in a straight row but as the arm widens form a zigzag pattern and terminally reappear in a straight row. The terminal swellings of the arms, typical of the genus *Octopoteuthis*, are almost imperceptible in our specimen; on the other hand, the tips of the preserved arms are somewhat compressed laterally.

Tentacles totally absent, without even a trace of their site of attachment. Beak with ventral mandible of highly characteristic form. Total length of specimen 590 mm.

DISCUSSION.-Although Akimushkin described the largest *Octopoteuthis* specimen ever recorded in the literature the diagnosis of his new species lacked any good characters to separate his species with any others. Coupled with the fact that the holotype is no longer extant this species must be considered a *nomen dubium*. This agrees with the observations of Young, 1972; Clarke, 1980 and even Nesis, 1982.

4.9. *Octopoteuthis deletron* Young, 1972

SYNONYMY.-

as *Octopoteuthis deletron* Young, 1972

as *Octopoteuthis sicula* Percy, 1965; Okutani and McGowan, 1969

Holotype: Male, 109 mm ML, extant and in good condition, deposited in the Allan Hancock Foundation, Los Angeles, California, Catalogue No. C-type#3.

Type Locality: VELERO, Sta 8716, 33° 15'N, 118° 37'W, 950 mw, IKMT, 7 June 1963.

Material Examined: Holotype and one paratype plus additional material. (See Appendices I and II)

DESCRIPTION.—The holotype of *O. deletron* is in the best condition of any of the existing species types (see Fig 4-12). It is a maturing male (100 mm ML) with several complete arms. The holotype has undergone some shrinkage (10-15 per cent) in most body measurements (see Table 4-1).

Table 4-1: Variation in body measurements in the holotype of *Octopus teuthis deletron* after 15 years of preservation.

BODY LENGTH	PRESENT MEASUREMENT (mm)	ORIGINAL MEASUREMENT (Young, 1972) (mm)
ML	100.0	109.0
MW	30.0	37.0
FL	80.0	94.0
FW	96.0	104.0
HW	29.3	33.0
TTL	8.0	13.0

The *mantle* is conical with the posterior apex appearing very blunt due to ventral curving of the tail. The tail averages about 16 per cent of the mantle length in adults (8 per cent in the holotype).

The *fins* are large as in other species. Posteriorly, they appear to end short of the mantle but actually continue as reduced narrow strips along each lateral edge of the tail. The fin length averages 75.6 per cent (80 per cent in the holotype) of the mantle length.

The head is fairly large and the eyes extend almost the entire length of the head.

The funnel is fairly long extending almost to the midpoint of the head. The funnel locking cartilage is a modified simple straight form which posteriorly curves slightly and flares. As in other *Octopoteuthis* species, the dorsal pad of the funnel organ is an inverted V-shape with short ridges on the arms and a prominent papilla on a ridge at the apex. The ventral pads of the organ are oval.

There are two complete arms in the holotype, the ventral right (IV) and the ventral-lateral left (III). The second right arm (II) is regenerating but this will be discussed in a later section. Each arm has gelatinous aboral keels. The arms bear two rows of small hooks protected by fleshy sheaths. There are two distinct, small accessory cusps on each hook. There are 3-11 small suckers at the distal end of each arms (just before the distal elongate photophore).

There is a single photophore on the ventrum of the mantle (a character shared with only one other *Octopoteuthis* species). Paired photophores are found lying ventrally on the ink sac, and two ventrally, one on each side of the head near the olfactory papillae. Single photophores are found near the anterior medial margin of each eye and are obliquely orientated. The third and fourth arm pairs each have a series of photophores lying near the axial nerve. The basal photophore in each series is larger than those following it and is somewhat isolated from the others. In the holotype the arms IV bear about 25 photophores and arms III bear about 2 photophores. Arms II bear just the basal photophore while arms I lack any of the series. All four arm pairs bear the distal elongate photophores. (See Fig 4-13)

The gladius has a short free rachis with RLI and RWI equal to 4.6 and 1.6 percent respectively (see Fig 4-14). The rachis begins to form a dorsal keel about 1/3 of the way down its length. Anteriorly the vanes taper down to the rachis in a series of three gradual contractions with the final contraction before the free

Figure 4-12: Photograph of the Holotype of *Octopoteuthis*
deletron Young, 1972.



Figure 4-13: Drawing of *Octopoteuthis deletron*
Young, 1972 showing photophore patterning.
(Scale = 10mm)

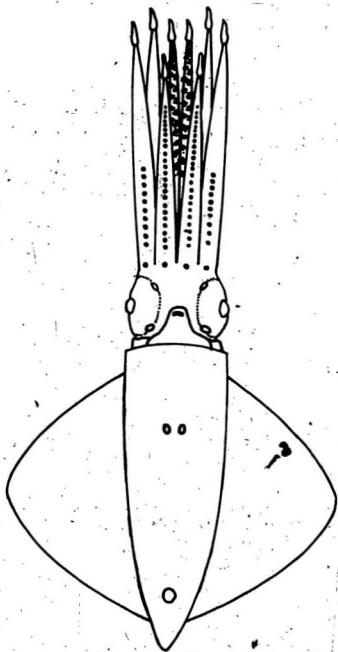
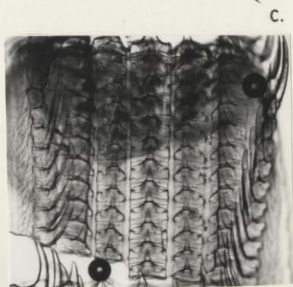
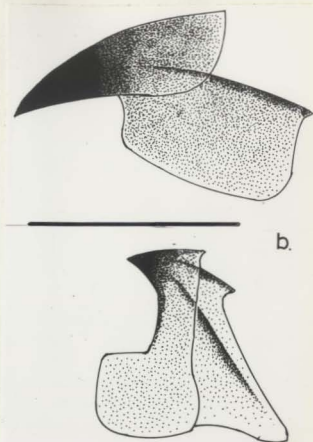
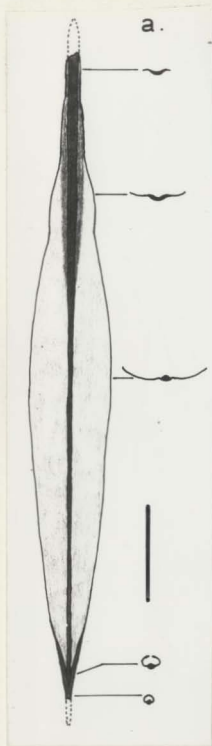


Figure 4-14: Drawings of (a.) a gladius (with cross sections), (b.) beaks and photograph of (c.) portion of radula from specimens of *Octopoteuthis dyletron* Young, 1972
(Scale = 10mm)



rachis being barely visible. The vanes are widest about halfway down the gladius (GWI = 6.9 percent) and begin to curl ventrally about 85 percent of the way down the gladius. The vanes do not begin to fuse until the vanes have run together for a distance greater than the conus length (CLI = 5 percent).

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower *beak* is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is obtuse. The upper beak has a curved rostrum and the jaw angle is acute.

4.10. *Octopoteuthis rugosa* Clarke, 1980

SYNONYMY.-

as *Octopoteuthis rugosa* Clarke, 1980, Nesis, 1982; Toll, 1982; Roper, Sweeney, and Clarke, 1985

Holotype: Mature female, 160 mm ML, in fair condition in the British Museum (natural History), BM 1973.100. Three paratypes also extant.

Type Locality: From sperm whale stomach, Donkergat, South Africa, 29 September 1963.

Material Examined: The holotype and a paratype (see Appendices I and II)

DESCRIPTION.-The holotype and a paratype of *Octopoteuthis rugosa* were examined. The holotype is a large mature female (see Fig 4-15) and the paratype is a male, both collected from a whale stomach.

The *mantle* is large and conical, tapering posteriorly into a large tail. Although there is a considerable amount of digestion of the outer epithelium, the structure of the mantle can still be determined. There is found, both at the anterior and the posterior ends of the mantle, an outer gelatinous covering. In

Figure 4-15: Photograph of the holotype of
Octopoteuthis rugosa Clarke, 1980
(arrows = 15 mm).



the holotype, the gelatinous layer at the anterior end bears longitudinal grooves. The rugose *mantle*, for which the species was named, is a secondary sex character, as Clarke suspected. It is found in all fully mature female *Octopoteuthis* and is not species specific.

The *fins* are about 80 per cent of the ML in the holotype and 85 per cent in the paratype. The posterior end of the fins forms small lateral ridges on the tail of each specimen. The tail makes up about 16 per cent of the ML.

The *head* is large, with the eye diameter nearly equal to head length.

The *funnel* reaches nearly to the midpoint of the eye. The funnel locking cartilage is simple and straight but modified so that the posterior portion flares out slightly. The funnel organ has been dissolved in both specimens so that distinguishing characters have been obliterated.

There are only two intact *arms* in the holotype (arms III) and one in the paratype (right arm IV). Almost all of the hooks and suckers were lost from the arms so no accurate count could be taken.

In Clarke's (1980) description of his new species *O. rugosa* he expressly stated that he could find no *photophores*. Careful examination of both the holotype and the paratype revealed a number of photophores on both (although neither animal bore a complete set). There are paired photophores on the postero-ventral side of both mantles (see Fig 4-16 for those of the female holotype), a pair of photophores on the recti abdominis muscles of the male, and eye orbit photophores on both. There were 12 photophores located along the axial nerves of arms III of the holotype and about 40 in the arms IV of the paratype. The condition of all but a few of these photophores was admittedly very poor but they are clearly demonstrable. It is not surprising that these organs, obviously missed by Clarke (1980), are in poor shape since these specimens were secured after having undergone partial digestion in a sperm whale stomach.



Figure 4-16: Photograph of the posterior ventral portion of the mantle of the holotype of *Octopoteuthis rugosa* Clarke, 1980 showing the paired photophores (arrows = 15 mm).

DISCUSSION.-Clarke separates *rugosa* from other *Octopoteuthis* species by (1) lack of photophores on the mantle wall and ink sac, (2) a rugose mantle in females and (3) lateral pigment bands on the ventral arms (first described in *O. deletron* by Young in 1972 is common to all species). Examination of Clarke's specimens show that photophores are present. The rugose mantle is found in all sexually mature female *Octopoteuthis* and the lateral pigment bands are present in all species. Thus there appear to be no characters by which *rugosa* can be identified as a distinct species and, as a result, it should be considered a *nomen dubium*.

4.11. *Octopoteuthis* sp A

DESCRIPTION.-Young (1972) first used this designation for a species of *Octopoteuthis* found in the Atlantic that, like his *O. deletron*, bore a single ventral abdominal photophore on the mantle. (See Fig 4-17)

The mantle is conical with the tail portion averaging about 15 per cent of total mantle length. Like the other species of the genus, the mantle bears a gelatinous outer layer.

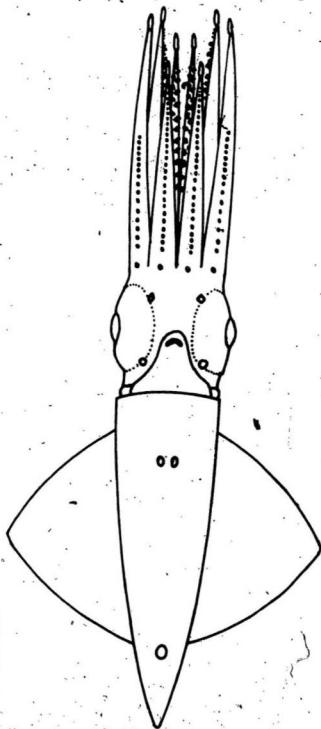
The fins are large and muscular, their length 77 per cent and their width about 104 per cent of ML.

The head is large (37 per cent of ML) with the eye diameter almost equal to its total length.

The funnel is relatively long, reaching nearly to the midpoint of the head. The inverted V-shaped dorsal pad of the funnel organ is, as in other species, highly variable in form. It generally has a small papilla on the apex of the dorsal pad with small to high ridges running down each arm.

The arms have hooks (65-70 per arm in an 84 mm ML specimen) which lack accessory cusps. The arms also bear several small pairs of suckers distally (7-10 in an 84 mm ML specimen).

Figure 4-17: Drawing of Young's
Octopoteuthis sp A showing
photophore patterning.



There is a single photophore found ventrally on the posterior portion of the mantle. As in all species there are paired photophores lying ventrally adjacent to the ink sac and at the posterior portion of the eye orbit. There is also a pair of anterior eyeball photophores as in *O. deletron*. These eyeball photophores are almost square. There are serial photophores along arms III and IV.

The *gladius* is fragile with the free portion of the rachis (RLI = 13.6 percent) being wider (RWI = 3 percent) than in other *Octopoteuthis* species. The vanes (GWI = 8.6 percent) are very thin and appear to taper posteriorly. In effect the two vanes begin to curl ventrally about two-thirds of the way down the gladius until they touch and fuse, forming a long secondary conus (CLI = 15.9 percent), posteriorly. (See Fig 4-18)

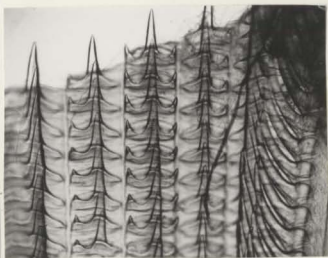
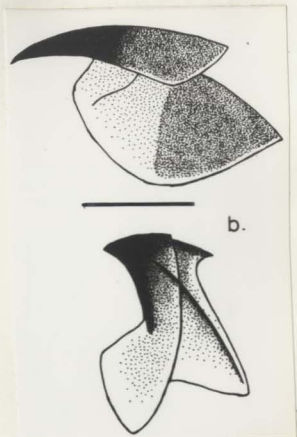
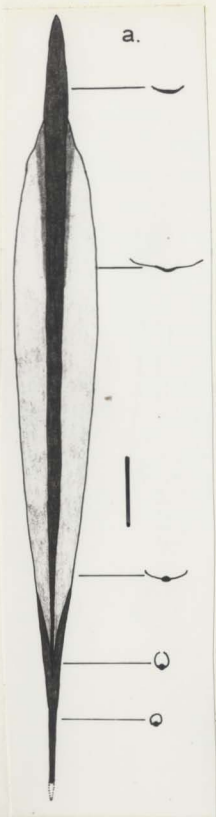
The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small as in other species. The rostrum of the lower beak is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is almost ninety degrees. The upper beak has a slightly curved rostrum and the jaw angle is acute.

4.12. Statistical Analysis of Morphometric Data

The summary of indices for each species are presented below in a series of tables 4-3 to 4-7. Each index is handled in 25 mm ML intervals for the entire size range available for each species. Larval indices (see Table 4-2) are handled in 5 mm ML intervals although they cannot yet be identified to species. The arm length indices and the tentacular length indices are not presented for the individual species because of the very high percentage of loss of arms and total loss of tentacles in juveniles and adults.

The means comparisons of each variable gave an indication of differences between species presented in tables 4-8 through 4-15.

Figure 4-18: Drawings of (a.) gladius (with cross sections), (b.) beaks and photograph of (c.) portion of radula from specimens of *Octopoteuthis* sp A (Scale = 10mm)



**Table 4-2: Summary of indices for selected
5 mm increment series of *Octopoteuthis*
spp larvae.**

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 4-10 mm						
HWI	35	0.48	0.26	0.69	0.01	0.09
FLI	73	0.68	0.00	1.33	0.02	0.18
FWI	67	1.41	0.29	2.56	0.04	0.36
HLI	38	0.48	0.34	0.65	0.01	0.08
HWI	34	0.57	0.40	0.69	0.01	0.08
TLI	73	0.00	0.00	0.21	0.00	0.03
EDI	35	0.20	0.06	0.33	0.01	0.04
LDI	33	0.07	0.04	0.10	0.00	0.01
TLI	13	0.56	0.35	0.77	0.04	0.13
TLI	12	2.06	1.69	2.70	0.08	0.26
ALI I	73	0.02	0.00	0.78	0.01	0.12
ALI II	2	1.08	1.02	1.14	0.06	0.09
ALI III	2	0.93	0.88	0.98	0.05	0.07
ALI IV	2	0.50	0.45	0.55	0.05	0.07
ML = 11-15 mm						
HWI	16	0.41	0.30	0.50	0.01	0.06
FLI	25	0.78	0.58	1.25	0.03	0.13
FWI	25	1.29	0.46	2.00	0.06	0.32
HLI	16	0.41	0.30	0.53	0.02	0.07
HWI	16	0.48	0.39	0.55	0.01	0.05
TLI	25	0.02	0.00	0.14	0.01	0.04
EDI	16	0.18	0.10	0.25	0.01	0.04
LDI	16	0.06	0.04	0.09	0.00	0.01
TLI	0					
TLI	9	1.95	0.25	2.51	0.23	0.69
ALI I	25	0.08	0.00	0.72	0.05	0.23
ALI II	3	1.06	0.93	1.12	0.06	0.11
ALI III	6	0.78	0.75	0.93	0.05	0.12
ALI IV	6	0.63	0.08	0.79	0.11	0.28
ML = 16-20 mm						
HWI	9	0.39	0.31	0.51	0.02	0.06
FLI	15	0.77	0.42	1.06	0.03	0.13
FWI	15	1.33	0.59	1.76	0.06	0.25
HLI	10	0.38	0.27	0.45	0.02	0.05
HWI	10	0.41	0.26	0.50	0.02	0.07
TLI	15	0.05	0.00	0.19	0.01	0.06
EDI	10	0.19	0.15	0.25	0.01	0.03
LDI	10	0.06	0.04	0.08	0.00	0.01
TLI	0					
TLI	5	2.22	2.07	2.44	0.06	0.14
ALI I	15	0.18	0.00	0.79	0.08	0.31
ALI II	2	0.83	0.78	0.87	0.05	0.07
ALI III	2	0.67	0.67	0.68	0.00	0.01
ALI IV	3	0.54	0.49	0.60	0.03	0.05

Table 4-2, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
HL = 21-25 aa						
MWI	3	0.31	0.23	0.38	0.05	0.08
FLI	4	0.44	0.37	0.74	0.09	0.18
FWI	4	1.16	0.74	1.40	0.14	0.29
HLI	3	0.32	0.23	0.36	0.04	0.08
MWI	3	0.35	0.26	0.41	0.05	0.08
FLI	4	0.05	0.00	0.12	0.03	0.06
EDI	3	0.17	0.10	0.21	0.04	0.06
LDI	3	0.05	0.04	0.06	0.01	0.01
T&LI	0					
TLI	3	1.93	1.63	2.21	0.17	0.29
ALI I	4	0.34	0.00	0.69	0.19	0.39
ALI II	2	0.81	0.71	0.90	0.09	0.13
ALI III	1	0.40	0.40	0.40		
ALI IV	2	0.56	0.53	0.59	0.03	0.04

Table 4-3: Summary of indices for selected series *Octopoteuthis sicula* representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE ML = 25-50 mm	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
MWI	25	0.33	0.25	0.44	0.01	0.05
FLI	31	0.73	0.61	0.89	0.01	0.06
FWI	31	1.20	1.04	1.45	0.02	0.11
HLI	25	0.43	0.24	0.55	0.01	0.06
MWI	25	0.34	0.27	0.49	0.01	0.05
TILI	31	0.13	0.08	0.18	0.00	0.03
EDI	25	0.23	0.14	0.32	0.01	0.04
LDI	24	0.08	0.04	0.11	0.00	0.02
ML = 51-75 mm						
MWI	7	0.29	0.27	0.31	0.01	0.02
FLI	10	0.76	0.71	0.84	0.01	0.04
FWI	7	1.12	1.00	1.30	0.03	0.09
HLI	7	0.40	0.35	0.49	0.02	0.05
MWI	7	0.34	0.27	0.38	0.01	0.04
TILI	10	0.18	0.10	0.31	0.02	0.07
EDI	7	0.25	0.22	0.27	0.01	0.02
LDI	7	0.09	0.07	0.10	0.00	0.01
ML = 76-100 mm						
MWI	5	0.32	0.26	0.39	0.02	0.05
FLI	6	0.81	0.71	0.95	0.04	0.11
FWI	6	1.13	1.00	1.34	0.05	0.13
HLI	6	0.35	0.32	0.40	0.01	0.03
MWI	5	0.32	0.25	0.39	0.03	0.06
TILI	6	0.14	0.00	0.23	0.03	0.08
EDI	6	0.25	0.23	0.28	0.01	0.02
LDI	5	0.08	0.08	0.09	0.00	0.01
ML = 101-125 mm						
MWI	4	0.26	0.22	0.30	0.02	0.04
FLI	12	0.75	0.64	0.85	0.02	0.06
FWI	12	0.99	0.90	1.15	0.02	0.07
HLI	5	0.29	0.27	0.35	0.01	0.03
MWI	5	0.27	0.22	0.30	0.01	0.03
TILI	12	0.14	0.09	0.23	0.01	0.04
EDI	5	0.21	0.18	0.22	0.01	0.02
LDI	5	0.07	0.07	0.07	0.00	0.00
ML = 126-150 mm						
MWI	2	0.28	0.23	0.33	0.05	0.07
FLI	3	0.77	0.73	0.84	0.04	0.08
FWI	3	1.00	0.92	1.08	0.04	0.08
HLI	2	0.28	0.27	0.29	0.01	0.01
MWI	2	0.24	0.23	0.28	0.03	0.04
TILI	3	0.12	0.00	0.20	0.06	0.11
EDI	2	0.20	0.19	0.21	0.01	0.01
LDI	2	0.07	0.07	0.07	0.00	0.00

Table 4-3, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
HL = 151-175 mm						
MWI	0	.	.	.	.	.
FLI	1	0.81	0.81	0.81	.	.
FWI	1	1.03	1.03	1.03	.	.
HLI	0	.	.	.	.	.
MWI	0	.	.	.	.	.
TILI	1	0.15	0.15	0.15	.	.
EDI	0	.	.	.	.	.
LPI	0	.	.	.	.	.
HL = 176-200 mm						
MWI	0	.	.	.	.	.
FLI	2	0.80	0.79	0.82	0.02	0.02
FWI	2	0.98	0.92	1.03	0.05	0.07
HLI	0	.	.	.	.	.
MWI	0	.	.	.	.	.
TILI	2	0.19	0.17	0.22	0.03	0.04
EDI	0	.	.	.	.	.
LPI	0	.	.	.	.	.
HL = 201-225 mm						
MWI	1	0.25	0.25	0.25	.	.
FLI	1	0.75	0.75	0.75	.	.
FWI	1	0.87	0.87	0.87	.	.
HLI	1	0.29	0.29	0.29	.	.
MWI	1	0.24	0.24	0.24	.	.
TILI	1	0.22	0.22	0.22	.	.
EDI	1	0.14	0.14	0.14	.	.
LPI	1	0.06	0.06	0.06	.	.

Table 4-4: Summary of indices for selected series of *Octopoteuthis megaptera* representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 25-50 mm						
MWI	27	0.32	0.26	0.38	0.01	0.04
FLI	35	0.72	0.65	0.86	0.01	0.05
FWI	35	1.12	0.74	1.33	0.02	0.11
HLI	26	0.43	0.29	0.71	0.02	0.09
HWI	27	0.34	0.22	0.41	0.01	0.04
TILI	35	0.16	0.00	0.28	0.01	0.05
EDI	27	0.23	0.09	0.33	0.01	0.05
LDI	25	0.07	0.02	0.11	0.00	0.02
ML = 51-75 mm						
MWI	10	0.30	0.23	0.36	0.01	0.04
FLI	11	0.71	0.62	0.78	0.01	0.05
FWI	11	1.02	0.84	1.22	0.03	0.10
HLI	10	0.39	0.31	0.48	0.02	0.06
HWI	10	0.32	0.26	0.38	0.01	0.04
TILI	11	0.19	0.06	0.26	0.02	0.06
EDI	10	0.25	0.20	0.31	0.01	0.04
LDI	10	0.08	0.05	0.10	0.00	0.01
ML = 76-100 mm						
MWI	11	0.28	0.24	0.33	0.01	0.03
FLI	13	0.72	0.63	0.77	0.01	0.04
FWI	12	0.95	0.88	1.05	0.02	0.06
HLI	11	0.37	0.31	0.43	0.01	0.04
HWI	11	0.29	0.21	0.34	0.02	0.05
TILI	13	0.21	0.15	0.29	0.01	0.04
EDI	11	0.24	0.18	0.27	0.01	0.03
LDI	11	0.08	0.06	0.09	0.00	0.01
ML = 101-125 mm						
MWI	7	0.31	0.20	0.49	0.06	0.12
FLI	12	0.68	0.60	0.76	0.01	0.05
FWI	12	0.91	0.77	1.04	0.02	0.08
HLI	7	0.35	0.27	0.40	0.02	0.05
HWI	7	0.27	0.22	0.35	0.02	0.04
TILI	12	0.22	0.13	0.29	0.01	0.04
EDI	8	0.20	0.18	0.23	0.01	0.02
LDI	8	0.06	0.06	0.07	0.00	0.01
ML = 126-150 mm						
MWI	5	0.27	0.21	0.30	0.02	0.04
FLI	8	0.73	0.67	0.85	0.02	0.05
FWI	6	0.95	0.88	1.00	0.02	0.05
HLI	5	0.32	0.24	0.38	0.02	0.05
HWI	5	0.24	0.20	0.26	0.01	0.02
TILI	8	0.19	0.12	0.26	0.02	0.05
EDI	5	0.18	0.14	0.20	0.01	0.02
LDI	5	0.06	0.04	0.08	0.01	0.01

Table 4-4, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
HL = 151-175 mm						
HWI	3	0.25	0.22	0.28	0.02	0.03
FLI	5	0.71	0.66	0.79	0.02	0.06
FWI	5	0.87	0.78	1.00	0.04	0.09
HLI	3	0.29	0.27	0.33	0.02	0.03
HWI	3	0.24	0.23	0.25	0.01	0.01
TILI	5	0.22	0.14	0.26	0.02	0.05
EDI	3	0.13	0.06	0.18	0.04	0.07
LDI	3	0.06	0.06	0.07	0.00	0.01
HL = 176-200 mm						
HWI	1	0.24	0.24	0.24		
FLI	1	0.64	0.64	0.64		
FWI	1	0.81	0.81	0.81		
HLI	1	0.33	0.33	0.33		
HWI	1	0.21	0.21	0.21		
TILI	1	0.25	0.25	0.25		
EDI	1	0.16	0.16	0.16		
LDI	1	0.06	0.06	0.06		

Table 4-5: Summary of indices for selected series of *Octopoteuthis danae* (Joubin, 1931) representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
HL = 25-50 mm						
MWI	7	0.34	0.31	0.36	0.01	0.02
FLI	10	0.74	0.63	0.81	0.02	0.05
FWI	10	1.25	1.09	1.49	0.03	0.10
HLI	7	0.43	0.39	0.49	0.01	0.04
MWI	7	0.38	0.36	0.41	0.01	0.02
TILI	10	0.12	0.00	0.23	0.03	0.09
EDI	7	0.25	0.21	0.30	0.01	0.03
LDI	6	0.09	0.08	0.11	0.00	0.01
HL = 51-75 mm						
MWI	12	0.33	0.22	0.40	0.01	0.05
FLI	18	0.79	0.67	1.09	0.03	0.11
FWI	18	1.12	1.02	1.25	0.01	0.06
HLI	14	0.35	0.32	0.42	0.01	0.03
MWI	11	0.35	0.28	0.50	0.02	0.07
TILI	18	0.14	0.00	0.23	0.02	0.07
EDI	13	0.24	0.22	0.30	0.01	0.02
LDI	13	0.09	0.08	0.10	0.00	0.01
HL = 76-100 mm						
MWI	2	0.31	0.29	0.33	0.02	0.03
FLI	2	0.70	0.69	0.71	0.01	0.01
FWI	2	1.05	1.02	1.08	0.03	0.04
HLI	2	0.32	0.30	0.34	0.02	0.02
MWI	2	0.36	0.33	0.38	0.03	0.04
TILI	2	0.16	0.12	0.21	0.05	0.06
EDI	2	0.23	0.22	0.24	0.01	0.02
LDI	2	0.09	0.08	0.09	0.00	0.00
HL = 101-125 mm						
MWI	1	0.25	0.25	0.25		
FLI	2	0.83	0.74	0.92	0.09	0.13
FWI	2	1.09	0.95	1.22	0.14	0.19
HLI	1	0.31	0.31	0.31		
MWI	1	0.24	0.24	0.24		
TILI	2	0.09	0.00	0.18	0.09	0.12
EDI	1	0.21	0.21	0.21		
LDI	1	0.08	0.08	0.08		

Table 4-8: Summary of indices for selected series of *Octopoteuthis deletron* Young, 1972 representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
HL = 25-50 mm						
MWI	3	0.31	0.28	0.33	0.02	0.03
FLI	14	0.79	0.72	0.94	0.02	0.06
FWI	14	1.19	1.09	1.30	0.02	0.06
HLI	3	0.37	0.26	0.43	0.06	0.10
HWI	3	0.31	0.29	0.33	0.01	0.02
TILI	14	0.07	0.00	0.15	0.01	0.05
EDI	3	0.24	0.21	0.28	0.02	0.03
LDI	3	0.08	0.07	0.09	0.01	0.01
HL = 51-75 mm						
MWI	2	0.34	0.33	0.35	0.01	0.01
FLI	4	0.74	0.69	0.82	0.03	0.06
FWI	4	1.14	1.06	1.25	0.04	0.08
HLI	2	0.33	0.32	0.35	0.02	0.03
HWI	2	0.32	0.24	0.41	0.08	0.12
TILI	4	0.11	0.07	0.17	0.02	0.04
EDI	1	0.26	0.26	0.26	.	.
LDI	1	0.09	0.09	0.09	.	.
HL = 76-100 mm						
MWI	3	0.30	0.26	0.33	0.02	0.04
FLI	3	0.81	0.80	0.82	0.01	0.01
FWI	3	1.01	0.96	1.05	0.03	0.05
HLI	3	0.32	0.23	0.39	0.05	0.08
HWI	3	0.30	0.28	0.34	0.02	0.03
TILI	3	0.08	0.06	0.08	0.01	0.01
EDI	3	0.21	0.20	0.22	0.01	0.01
LDI	3	0.08	0.07	0.08	0.00	0.01
HL = 101-125 mm						
MWI	1	0.27	0.27	0.27	.	.
FLI	1	0.71	0.71	0.71	.	.
FWI	1	1.07	1.07	1.07	.	.
HLI	1	0.30	0.30	0.30	.	.
HWI	1	0.28	0.28	0.28	.	.
TILI	1	0.17	0.17	0.17	.	.
EDI	1	0.22	0.22	0.22	.	.
LDI	1	0.08	0.08	0.08	.	.
HL = 126-150 mm						
MWI	0	.	.	.	.	.
FLI	3	0.76	0.73	0.81	0.03	0.04
FWI	3	0.86	0.83	0.89	0.02	0.03
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	3	0.18	0.16	0.23	0.02	0.04
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.

Table 4-6, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
HL = 151-175 aa						
MWI	0	.	.	.	.	.
FLI	1	0.76	0.76	0.76	.	.
FMI	1	0.88	0.88	0.88	.	.
HLI	0	.	.	.	.	.
HMI	0	.	.	.	.	.
TILI	1	0.16	0.16	0.16	.	.
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.
HL = 176-200 aa						
MWI	1	0.27	0.27	0.27	.	.
FLI	1	0.69	0.69	0.69	.	.
FMI	1	0.84	0.84	0.84	.	.
HLI	1	0.21	0.21	0.21	.	.
HMI	1	0.27	0.27	0.27	.	.
TILI	1	0.16	0.16	0.16	.	.
EDI	1	0.15	0.15	0.15	.	.
LDI	1	0.06	0.06	0.06	.	.

Table 4-7: Summary of indices for selected series of *Octopoteuthis* sp A Young, 1972 representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML 25-50 mm						
MWI	1	0.27	0.27	0.27	.	.
FLI	1	0.87	0.87	0.87	.	.
FWI	1	1.26	1.26	1.26	.	.
HLI	1	0.52	0.52	0.52	.	.
HWI	1	0.32	0.32	0.32	.	.
TILI	1	0.19	0.19	0.19	.	.
EDI	1	0.24	0.24	0.24	.	.
LDI	1	0.07	0.07	0.07	.	.
ML 51-75 mm						
MWI	2	0.28	0.24	0.30	0.02	0.03
FLI	3	0.76	0.70	0.83	0.04	0.07
FWI	3	1.11	0.99	1.30	0.10	0.17
HLI	2	0.42	0.41	0.43	0.01	0.01
HWI	2	0.29	0.25	0.33	0.04	0.04
TILI	3	0.15	0.11	0.21	0.03	0.05
EDI	2	0.22	0.21	0.23	0.01	0.01
LDI	2	0.07	0.07	0.07	0.00	0.00
ML 76-100 mm						
MWI	0	.	.	.	.	.
FLI	4	0.76	0.69	0.86	0.04	0.07
FWI	4	1.00	0.88	1.10	0.04	0.09
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	4	0.15	0.08	0.20	0.03	0.05
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.
ML 101-125 mm						
MWI	2	0.28	0.24	0.31	0.03	0.05
FLI	3	0.71	0.69	0.76	0.02	0.04
FWI	3	0.91	0.85	0.95	0.03	0.05
HLI	2	0.38	0.35	0.41	0.03	0.04
HWI	2	0.32	0.26	0.38	0.06	0.08
TILI	3	0.20	0.15	0.24	0.03	0.05
EDI	2	0.25	0.24	0.26	0.01	0.02
LDI	2	0.10	0.09	0.10	0.01	0.01
ML 126-150 mm						
MWI	0	.	.	.	.	.
FLI	1	0.75	0.75	0.75	.	.
FWI	1	0.94	0.94	0.94	.	.
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	1	0.14	0.14	0.14	.	.
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.

Table 4-7, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
HL 151-175 mm						
MWI	1	0.26	0.26	0.26		
FLI	3	0.74	0.73	0.76	0.01	-0.02
FWI	3	0.87	0.82	0.92	0.03	0.05
HLI	2	0.34	0.33	0.34	0.00	0.01
MWI	1	0.20	0.20	0.20		
TILI	3	0.14	0.12	0.16	0.01	0.02
EDI	1	0.18	0.18	0.18		
LDI	1	0.05	0.05	0.05		
HL 176-200 mm						
MWI	0					
FLI	1		0.74	0.74		
FWI	1	0.90	0.90	0.90		
HLI	0					
MWI	0					
TILI	1	0.14	0.14	0.14		
EDI	0					
LDI	0					

**Table 4-8: Means comparisons of mantle width
between five species of *Octopoteuthis*.**

ALPHA=.05 CONFIDENCE=.95 DF=154 MSE=770.993
CRITICAL VALUE OF STUDENTIZED RANGE=3.904

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE - SP A	-29.880	4.136	38.153	
DANAE - DELETRON	-16.531	11.136	38.804	
DANAE - MEGAPTERA	5.290	21.806	38.322	
DANAE - SICULA	14.577	32.062	49.548	***
SP A - DANAE	-38.153	-4.136	29.880	
SP A - DELETRON	-32.580	7.000	46.580	
SP A - MEGAPTERA	-15.101	17.669	50.439	
SP A - SICULA	-5.343	27.926	41.195	
DELETRON - DANAE	-38.804	-11.136	16.531	
DELETRON - SP A	-46.580	-7.000	32.580	
DELETRON - MEGAPTERA	-13.450	10.669	36.789	
DELETRON - SICULA	-5.817	20.926	47.669	
MEGAPTERA - DANAE	-38.322	-21.806	-5.290	***
MEGAPTERA - SP A	-50.439	-17.669	15.101	
MEGAPTERA - DELETRON	-36.789	-10.669	15.450	
MEGAPTERA - MEGAPTERA	-4.659	10.257	25.172	
SICULA - DANAE	-49.548	-32.062	-14.577	***
SICULA - SP A	-61.195	-27.926	5.343	
SICULA - DELETRON	-47.669	-20.926	5.817	
SICULA - MEGAPTERA	-25.172	-10.257	4.659	

**Table 4-9: Means comparisons of fin length
between five species of *Octopoteuthis*.**

ALPHA=.05 CONFIDENCE=0.95 DF=248 MSE=836.576
CRITICAL VALUE OF STUDENTIZED RANGE=3.886

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE	- SP A	-16.433	7.519	31.471	
DANAE	- MEGAPTERA	18.467	31.857	45.248	***
DANAE	- DELETRON	18.007	35.944	53.880	***
DANAE	- SICULA	22.991	36.332	49.673	***
SP A	- DANAE	-31.471	-7.519	16.433	
SP A	- MEGAPTERA	0.307	24.338	48.370	***
SP A	- DELETRON	1.593	28.425	55.256	***
SP A	- SICULA	4.809	28.813	52.817	***
MEGAPTERA	- DANAE	-45.248	-31.857	-18.467	***
MEGAPTERA	- SP A	-48.370	-24.338	-0.307	***
MEGAPTERA	- DELETRON	-13.956	4.086	22.129	
MEGAPTERA	- SICULA	-9.009	4.475	17.958	
DELETRON	- DANAE	-53.880	-35.944	-18.007	***
DELETRON	- SP A	-55.256	-28.425	-1.593	***
DELETRON	- MEGAPTERA	-22.129	-4.086	13.956	
DELETRON	- SICULA	-17.618	0.388	18.395	
SICULA	- DANAE	-49.673	-36.332	-22.991	***
SICULA	- SP A	-52.817	-28.813	-4.809	***
SICULA	- MEGAPTERA	-17.958	-4.475	9.009	
SICULA	- DELETRON	-18.395	-0.388	17.618	

**Table 4-10: Means comparisons of fin width
between five species of *Octopoteuthis*.**

ALPHA=.05 CONFIDENCE=0.95 DF=244 MSE=627.639
CRITICAL VALUE OF STUDENTIZED RANGE=3.887

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY ***

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE	- SP A	-14.295	6.476	27.248	
DANAE	- MEGAPTERA	20.976	32.749	44.521	***
DANAE	- DELETRON	19.333	34.901	50.469	***
DANAE	- SICULA	23.692	35.289	46.887	***
SP A	- DANAE	-27.248	-6.476	14.295	
SP A	- MEGAPTERA	5.380	26.272	47.165	***
SP A	- DELETRON	5.181	28.425	51.668	***
SP A	- SICULA	8.019	28.813	49.607	***
MEGAPTERA	- DANAE	-44.521	-32.749	-20.976	***
MEGAPTERA	- SP A	-47.165	-26.272	-5.380	***
MEGAPTERA	- DELETRON	-13.577	2.152	17.882	
MEGAPTERA	- SICULA	-9.272	2.541	14.354	
DELETRON	- DANAE	-50.469	-34.901	-19.333	***
DELETRON	- SP A	-51.668	-28.425	-5.181	***
DELETRON	- MEGAPTERA	-17.882	-2.152	13.577	
DELETRON	- SICULA	-15.210	0.388	15.987	
SICULA	- DANAE	-46.887	-35.289	-23.692	***
SICULA	- SP A	-49.607	-28.813	-8.019	***
SICULA	- MEGAPTERA	-14.354	-2.541	9.272	
SICULA	- DELETRON	-15.987	-0.388	15.210	

**Table 4-11: Means comparisons of head length
between five species of *Octopoteuthis*.**

ALPHA=.05 CONFIDENCE=0.95 DF=158 MSE=660.67
CRITICAL VALUE OF STUDENTIZED RANGE=3.903

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
SP A	- DANAE	-18.261	11.039	40.339	
SP A	- DELETRON	-16.455	18.560	53.455	
SP A	- MEGAPTERA	0.937	29.267	57.596	***
SP A	- SICULA	8.648	37.346	66.043	***
DANAE	- SP A	-40.339	-11.039	18.261	
DANAE	- DELETRON	-17.894	7.461	32.816	
DANAE	- MEGAPTERA	3.274	18.228	33.181	***
DANAE	- SICULA	10.668	26.307	41.946	***
DELETRON	- SP A	-53.455	-18.500	16.455	
DELETRON	- DANAE	-32.816	-7.461	17.894	
DELETRON	- MEGAPTERA	-13.461	10.767	34.994	
DELETRON	- SICULA	-5.810	18.846	43.502	
MEGAPTERA	- SP A	-57.596	-29.267	-0.937	***
MEGAPTERA	- DANAE	-33.181	-18.228	-3.274	***
MEGAPTERA	- DELETRON	-34.994	-10.767	13.461	
MEGAPTERA	- SICULA	-8.656	8.079	21.815	
SICULA	- SP A	-66.043	-37.346	-8.648	***
SICULA	- DANAE	-41.946	-26.307	-10.668	***
SICULA	- DELETRON	-43.502	-18.846	-5.810	
SICULA	- MEGAPTERA	-21.815	-8.079	5.656	

**Table 4-12: Means comparisons of head width
between five species of *Octopoteuthis*.**

ALPHA=.05/CONFIDENCE=0.95 DF=154 MSE=454.214
CRITICAL VALUE OF STUDENTIZED RANGE=3.904

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE	- SP A	-28.332	3.003	34.338	
DANAE	- DELETRON	-15.483	10.003	35.489	
DANAE	- MEGAPTERA	5.926	21.183	36.440	
DANAE	- SICULA	13.587	29.622	45.657	***
SP A	- DANAE	-34.338	-3.003	28.332	
SP A	- DELETRON	-29.460	7.000	43.460	
SP A	- MEGAPTERA	-12.028	18.180	48.389	
SP A	- SICULA	-3.989	26.619	57.228	
DELETRON	- DANAE	-35.489	-10.003	15.483	
DELETRON	- SP A	-43.460	-7.000	29.460	
DELETRON	- MEGAPTERA	-12.907	11.180	35.268	
DELETRON	- SICULA	-4.969	19.619	44.207	
MEGAPTERA	- DANAE	-36.440	-21.183	-5.926	***
MEGAPTERA	- SP A	-48.389	-18.180	12.028	
MEGAPTERA	- DELETRON	-35.268	-11.180	12.907	
MEGAPTERA	- SICULA	-5.265	8.439	22.142	
SICULA	- DANAE	-45.657	-29.622	-13.587	***
SICULA	- SP A	-57.228	-26.619	3.989	
SICULA	- DELETRON	-44.207	-19.619	4.969	
SICULA	- MEGAPTERA	-22.142	-8.439	5.265	

**Table 4-13: Means comparisons of tail length
between five species of *Octopoteuthis*.**

ALPHA=.05 CONFIDENCE=0.95 DF=240 MSE=815.755
CRITICAL VALUE OF STUDENTIZED RANGE=3.886

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE	- SP A	-16.133	7.519	31.171	
DANAE	- MEGAPTERA	18.635	31.857	45.080	***
DANAE	- DELETRON	18.232	35.944	53.655	***
DANAE	- SICULA	23.158	36.332	49.506	***
SP A	- DANAE	-31.171	-7.519	16.133	
SP A	- MEGAPTERA	0.608	24.338	48.069	***
SP A	- DELETRON	1.929	28.425	54.920	***
SP A	- SICULA	5.109	28.813	52.516	***
MEGAPTERA	- DANAE	-45.080	-31.857	-18.635	***
MEGAPTERA	- SP A	-48.069	-24.338	-0.608	***
MEGAPTERA	- DELETRON	-13.730	4.006	21.903	
MEGAPTERA	- SICULA	-8.840	4.475	17.789	
DELETRON	- DANAE	-53.655	-35.944	-18.232	***
DELETRON	- SP A	-54.920	-28.425	-1.929	***
DELETRON	- MEGAPTERA	-21.903	-4.006	13.730	
DELETRON	- SICULA	-17.392	0.388	18.169	
SICULA	- DANAE	-49.506	-36.332	-23.158	***
SICULA	- SP A	-52.516	-28.813	-5.109	***
SICULA	- MEGAPTERA	-17.789	-4.475	8.840	
SICULA	- DELETRON	-18.169	-0.388	17.392	

Table 4-14: Means comparisons of eye diameter
between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=157 MSE=485.462
CRITICAL VALUE OF STUDENTIZED RANGE=3.903

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE	- SP A	-30.524	1.403	33.329	
DANAE	- DELETRON	-21.102	5.903	32.908	
DANAE	- MEGAPTERA	3.538	18.814	34.091	***
DANAE	- SICULA	11.188	27.249	43.309	***
SP A	- DANAE	-33.329	-1.403	30.524	
SP A	- DELETRON	-33.582	4.500	42.582	
SP A	- MEGAPTERA	-13.481	17.411	48.304	
SP A	- SICULA	-5.442	25.846	57.133	
DELETRON	- DANAE	-32.908	-5.903	21.102	
DELETRON	- SP A	-42.582	-4.500	33.582	
DELETRON	- MEGAPTERA	-12.843	12.911	38.685	
DELETRON	- SICULA	-4.900	21.346	47.592	
MEGAPTERA	- DANAE	-34.091	-18.814	-3.538	***
MEGAPTERA	- SP A	-48.304	-17.411	13.481	
MEGAPTERA	- DELETRON	-38.685	-12.911	12.843	
MEGAPTERA	- SICULA	-5.457	8.435	22.326	
SICULA	- DANAE	-43.309	-27.249	-11.188	***
SICULA	- SP A	-57.133	-25.846	5.442	
SICULA	- DELETRON	-47.592	-21.346	4.900	
SICULA	- MEGAPTERA	-22.326	-8.435	5.457	

**Table 4-15: Means comparisons of lens diameter
between five species of *Octopoteuthis*.**

ALPHA=.05 CONFIDENCE=.95 DF=148 MSE=689.211
CRITICAL VALUE OF STUDENTIZED RANGE=3.906

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT
SP A	- DELETRON	-33.712	4.500	42.712
SP A	- DANAE	-25.824	4.600	39.024
SP A	- MEGAPTERA	-14.752	16.292	47.335
SP A	- SICULA	-3.436	26.035	57.505
DELETRON	- SP A	-42.712	-4.500	33.712
DELETRON	- DANAE	-25.455	2.100	29.655
DELETRON	- MEGAPTERA	-14.125	11.792	37.709
DELETRON	- SICULA	-4.891	21.535	47.961
DANAE	- SP A	-39.024	-4.600	25.824
DANAE	- DELETRON	-29.655	-2.100	25.455
DANAE	- MEGAPTERA	-6.520	9.692	25.904
DANAE	- SICULA	2.420	19.435	36.449
MEGAPTERA	- SP A	-47.335	-16.292	14.752
MEGAPTERA	- DELETRON	-37.709	-11.792	14.125
MEGAPTERA	- DANAE	-25.904	-9.692	6.520
MEGAPTERA	- SICULA	-4.466	9.743	23.952
SICULA	- SP A	-57.505	-26.035	5.436
SICULA	- DELETRON	-47.961	-21.535	4.891
SICULA	- DANAE	-36.449	-19.435	-2.420
SICULA	- MEGAPTERA	-23.952	-9.743	4.466

The first DISCRIM procedure produced a table giving the number of observations and the percents classified into species (see Table 4-16(a)). Based on the analysis 73.7 per cent of the initial species assignments appeared correct. After removal one of the species with a very low sample number (*O. sp A*) the analysis recognized 78.1 per cent of the initial assignments correct (see Table 4-16.

(b))

Table 4-16: Discriminant analysis of species designation of (a.) five species of the genus *Octopoteuthis* and (b.) four species of the genus after removal of *O. sp A*.

NUMBER OF OBSERVATIONS AND PERCENTS CLASSIFIED INTO SPECIES:						
FROM SPECIES	DANAE	DELETRON	MEGAPTERA	SICULA	SP A	TOTAL
UNKNOWN	4 13.33	1 3.33	5 16.67	14 46.67	6 20.00	30 100.00
DANAE	19 82.61	0 0.00	0 0.00	2 8.70	2 8.70	23 100.00
DELETRON	1 11.11	7 77.78	0 0.00	1 11.11	0 0.00	9 100.00
MEGAPTERA	5 8.93	3 5.36	30 53.57	8 14.29	10 17.86	56 100.00
SICULA	10 22.22	0 0.00	1 2.22	32 71.11	2 4.44	45 100.00
SP A	0 0.00	0 0.00	1 16.67	0 0.00	5 83.33	6 100.00
TOTAL PERCENT	39 23.08	11 6.51	37 21.89	57 33.73	25 14.79	169 100.00
PRIORS	0.2000	0.2000	0.2000	0.2000	0.2000	

NUMBER OF OBSERVATIONS AND PERCENTS CLASSIFIED INTO SPECIES:					
FROM SPECIES	DANAE	DELETRON	MEGAPTERA	SICULA	TOTAL
UNKNOWN	4 11.11	1 2.78	15 41.67	16 44.44	36 100.00
DANAE	20 86.96	0 0.00	0 0.00	3 13.04	23 100.00
DELETRON	1 11.11	7 77.78	0 0.00	1 11.11	9 100.00
MEGAPTERA	5 8.93	3 5.36	40 71.43	8 14.29	56 100.00
SICULA	10 22.22	0 0.00	2 4.44	33 73.33	45 100.00
TOTAL PERCENT	40 23.67	11 6.51	57 33.73	61 36.09	169 100.00
PRIORS	0.2500	0.2500	0.2500	0.2500	

4.13. Arm Regeneration in *Octopoteuthis*

Individuals of *Octopoteuthis* have very brittle arms, the tips of which are almost always lost when specimens are collected by standard gear types. This is particularly true of juveniles and adults. Arms commonly remain intact however when whole specimens are collected from the stomachs of large predators, due to the manner of their being ingested whole.

Arm length ratios are commonly used as systematic characteristics (Roper and Voss, 1983). It was during the examination of complete arms on the specimens that arm regeneration was discovered. In all, 15 of the specimens examined showed evidence of one or more arms regenerating; including the holotype of *Octopoteuthis deletron* (see Fig. 4-19).

Arm and tentacle regeneration has been found in a number of different cephalopods (Adam, 1937; Aldrich and Aldrich, 1968; Lange, 1920; and Murata *et al.*, 1981). A search of the pertinent literature revealed only one reference to this phenomenon in the genus *Octopoteuthis*. Rancurel, in his 1970 paper included but a single line with regards to regeneration, namely:

"Sur l'échantillon no.21, les trois bras droits supérieurs ont été rompus, antérieurement à la capture, et ont commencé à régénérer sur une longueur de 2 à 3 mm."

Regeneration is easily identifiable by several means (see Figs 4-19 and 4-20). First, the regenerated portions generally appear narrower than the basal (undamaged) portion of the arms (Fig 4-19 b). Second, the normally encountered alternating pattern in the arm hooks is interrupted and there will be two or even three hooks produced in one row before another hook appears in the opposite row.

The arm and its accessory structure appear to have the ability to regenerate, including the hooks, the distal suckers, the spindle-shaped distal photophores and the photophores along the axial nerve. Injury or loss at any point along the arm can lead to regeneration of the missing portion or structures.

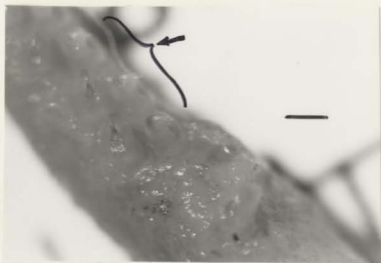


Figure 4-10: Photograph showing regeneration of arm RIII in the holotype of *Octopoteuthis deletron* Young, 1972. (Scale = 1 mm)




Figure 4-20: Photographs showing regeneration of arms in specimens of *Octopoteuthis* (a.) arm pair with one arm regenerating, (b.) diameter difference between basal and regenerating portion (Scale = 1 mm).

a.



b.

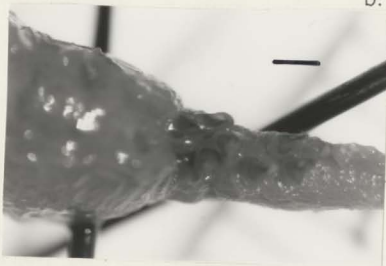


Figure 4-21: Photographs showing arm regeneration in *Octopoleuthis* (a.) regenerating arm showing reformed spindle-shaped photophore at tip, (b.) change in armature patterning on regenerating arm. (Scale in mm)



Chapter 5

Discussion

5.1. Species Validity

In the past several authors have attempted to clarify the status of the 9 nominal species. Young (1972) discussed the then 8 nominal species and considered the most important characters to be the presence of 1 or 2 ventral abdominal photophores, tail length, and presence or absence of accessory cusps on the arm hooks. He considered *Octopoteuthis persica* and *O. indica* to be *nomina dubia* because their small size precluded accurate identification. He also believed that *O. persica* was really the young of *Taningia danae* based on the distinct swellings at the tips of arms II. Young questioned the validity of *O. longiptera* because the limited number of characters, used by Akimushkin, did not clearly separate it from other species. Although Young was unable to identify characters essential for a definition of *O. nielsenii* he considered that it was a valid species. He thus considered the following species valid: *O. danae*, *O. megaptera*, and his *O. sp A* in the Atlantic, and *O. deletron* and *O. nielsenii* in the Pacific. He suggested that one of the three Atlantic species, probably *O. danae*, was a synonym of *O. sicula*.

Clarke (1980) agreed with Young's opinions on *O. persica* and *O. indica* but he considered *O. longiptera* to be a valid species based on its size being considerably larger than that of any previous specimens captured. He also questioned Young's assumption that all *Octopoteuthis* species bear photophores. Clarke expressed some doubt on the distinction between *O. sicula*, *O. megaptera* and his new species *O. rugosa*, basing his opinion, at least in part, on incomplete

data with respect to photophores in the two species. On the matter of photophores Clarke is, at best, inconsistent.

Nesis (1983) produced a key to the genus *Octopoteuthis* and listed only seven species: *O. danae*, *O. deletron*, *O. sicula*, *O. megaptera*, *O. rugosa*, *O. nielseni*, and *O. sp. A*. He made note that *O. longiptera* was lacking in good diagnostic characters.

The present study supports the validity of only four of the nine nominal species plus Young's as yet unnamed sp. A (see Table 5-1). In addition, one other species is described here. Examination of specimens available have supported Young's assumption that all individuals greater than 20-25 mm ML bear photophores other than those at the arm tips. All species discussed below are determined by a combination of three photophore groups (ventral abdominal, anterior eyelid, and eyeball) and the presence or absence of accessory cusps on the arm hooks.

It should be noted that although all attempts were made to obtain representative specimens from all oceans several major areas were little, if at all represented. These include the Northwestern Pacific, Southeastern Pacific and Indian Oceans. The large Russian and Japanese collections of this genus (literature reports and personal communication - Yu. Froeman, K. N. Nesis and T. Okutani) may possibly contain additional species and their re-examination based on this study's results will certainly improve our knowledge.

Young and Roper (1977) observed live specimens of what they identified as *Octopoteuthis nielseni* and reported five small additional mantle photophores: one, located laterally, on either side of the mantle at the same level as the pair lying on the ventrum of the ink sac; a single photophore lying centrally and just anterior to the ventral abdominal pair; and one to each side of the single centre one and lying laterally. None of these five photophores could be found on any of the specimens examined in this study. Young also has been unable to find these

Table 5-1: Checklist of all names proposed for *Octopoteuthis* and their validity after this revision.

<u>Taxon</u>	<u>Validity after this Revision</u>
FAMILIES:	
Veranyidae Chun, 1910	Invalid
Octopodoteuthidae Berry, July, 1912	Invalid
Octopoteuthidae Berry, November, 1912	Valid
GENERA:	
<u>Octopoteuthis</u> Rüppell, 1844	Valid
<u>Octopodoteuthis</u> Krohn, 1845	Invalid
<u>Verania</u> Krohn, 1847	Invalid
<u>Veranya</u> Keferstein, 1866	Invalid
<u>Octopodoteuthopsis</u> Pfeffer, 1912	Invalid
SPECIES (listed with the valid generic name):	
<u>Octopoteuthis sicula</u> Rüppell, 1844	Valid
<u>O. megaptera</u> Verrill, 1885	Valid
<u>O. persica</u> Naef, 1923	Invalid
<u>O. indica</u> Naef, 1923	Invalid
<u>O. danae</u> Joubin, 1931	Valid
<u>O. neilseni</u> Robson, 1948	Invalid
<u>O. longiptera</u> Akimushkin, 1963	Invalid
<u>O. deleton</u> Young, 1972	Valid
<u>O. rugosa</u> Clarke, 1980	Invalid
<u>O. sp A</u>	Valid

photophores in any preserved specimens he has examined (personal communication). With the extremely dehydrated condition of the Robson's syntypes identification of characters is impossible.

All specimens collected in the eastern Pacific and originally thought to be *Octopoteuthis nielsenii* have been found to bear eyeball and anterior eyelid photophores, paired abdominal photophores and cusps on their hooks. Based on those characters used in this study it would seem that the specimens examined, from the Pacific, are the same as those specimens described as species C, from the Atlantic, above and classified as *Octopoteuthis megaptera*. As more squid families are examined it becomes apparent that species squid have distribution patterns reflecting the geographic patterns of Backus and Craddock, 1977 and others. It may turn out that *Octopoteuthis nielsenii* may represent a valid Pacific form similar to the Atlantic *megaptera* but this remains questionable at the present time. *O. nielsenii* must at present be considered a *nomen dubium*.

Originally it had been planned to obtain Mediterranean specimens in an attempt to clarify the identity of the type species *O. sicula*. Although over one hundred institutes and museums were contacted worldwide only a handful of Mediterranean specimens were obtained. These were all very young animals and only one specimen, from the type locality, had a discernable photophore pattern.

Naef's *Octopoteuthis indica* was a larval specimen and no taxonomically useful characters could be attributed to it. His second species *Octopoteuthis persica* is actually a larval *Taningia danae* as both Young and Clarke had supposed. The two species named by Naef in 1923, and first described by Chun in 1910 as *Octopodoteuthis* sp., must then be considered *nomina dubia*.

The holotypes of Verrill's *Octopoteuthis megaptera* and Akimushkin's *O. longiptera* have been lost and no photophore pattern has ever been described for either. To maintain *longiptera* as valid on the basis of a few body measurements seems to be unjustifiable. There is absolutely no way to ascertain if it could be applied to any valid species so it seems wise to name *longiptera* a *nomen dubium*.

As revealed in the results of this study both the holotype and paratype of *Octopoteuthis rugosa* were found to be characterized by widely distributed photophores. Specifically they are to be found on the posterior ventrum of the mantle, the posterior ventrum of the eyelid, along the axial nerves of at least the ventral arms and lying ventral to the ink sac and dorsal to the muscoli recti abdominalis. Unfortunately, because of partial digestion, it could not be determined if the specimens bore either the anterior eyelid or eyeball photophores. The complete photophore pattern was therefore unobtainable so *O. rugosa* can neither be placed within an existing species nor stand alone as a valid species. It must then be considered a *nomina dubium*.

The International Code of Zoological Nomenclature (International Commission for Zoological Nomenclature 1985) rules that changes in species validity, like those proposed above, are only legal if presented in a recognized publication (Article 11(a)). As a thesis is not a recognized publication (Article 9(11)) a manuscript is now in preparation for publication which includes the above changes as well as a name for species A, all in accordance with the code.

5.2. An Artificial Key to the Species of *Octopoteuthis*

- 1 a. A single photophore located ventrally and superficially on the posterior portion of the mantle at the muscle-gelatinous layers interface. 2
- 1 b. A pair of photophores located ventrally on the posterior portion of the mantle at the muscle-gelatinous layers interface 3
- 2 a. Accessory cusps present on arm hooks even in young stages (20-25 mm ML); species found in the eastern Pacific *O. deletron*
- 2 b. Accessory cusps absent on arm hooks even in young stages (20-25 mm ML); species found primarily in the North Atlantic *O. sp A*

- 3 a. Single crescent-shaped photophore present on each eyeball; anterior eyelid photophore present *O. megaptera*
- 3 b. Single crescent-shaped photophore absent on each eyeball; anterior eyelid photophore absent 4
- 4 a. Accessory cusps present on arm hooks even in young stages (20-25 mm ML) *O. sicula*
- 4 b. Accessory cusps absent on arm hooks even in young stages (20-25 mm ML) *O. danae*

Table 5-2 below lists the characters and character states of the five valid species.

Table 5-2: Characters and character state distribution of the five valid species of *Octopoteuthis*

Species	Abdominal Photophores	Eye Photophores	Accessory Hook Cusps	Eyelid. Photophores
<u><i>O. danae</i></u>	2	absent	absent	absent
<u><i>O. deletion</i></u>	1	absent	present	present
<u><i>O. sp A</i></u>	1	absent	absent	present
<u><i>O. sicula</i></u>	2	absent	present	absent
<u><i>O. megaptera</i></u>	2	present	present	present

5.3. Distribution

The distribution of the genus *Octopoteuthis* appears to be extremely widespread ranging from sub-Arctic to Antarctic waters. Most collections are from offshore locations but captures are recorded near continents where the continental shelf is very close to shore.

Of the 285 juvenile and maturing specimens (identified and unidentified) which had depth data, 194 (64.8 per cent) were collected in the first 500 metres of water and a total of 250 (80.6 per cent) in the first 1000 metres.

The following sections describe the geographic and vertical distribution of each of the five species described above. The zoogeographic terms used for pelagic faunal regions in the Atlantic are those defined by Backus and Craddock (1977) and Backus *et al.* (1977).

Because of the problem of identifying *Octopoteuthis* larvae to species they are discussed as a group on their own. Unfortunately because of the large number of sources of specimens some data were unobtainable, particularly time of collection. This hindered somewhat the examination of vertical migration.

5.3.1. *Octopoteuthis sicula*

Geographic Distribution.—Found primarily in the western North Atlantic in the slope water province of the North Atlantic temperate region (see Fig 5-1). Also located in Gulf of Mexico and northern Sargasso Sea of the North Atlantic subtropical region and the Caribbean Sea and Amazonian provinces of the Atlantic tropical region. Two specimens were collected, one from off of west Africa in the Northern Mauritanian upwelling province and the second from the Indian Ocean.

Vertical Distribution.—Of the 78 specimens of the species only 62 individuals had depth capture data available. All specimens were collected in the top 1000 metres of water at depths ranging between 24 and 1000m (see Fig 5-2). Nearly 81 percent of them were collected in the first 500 metres. Twenty-three animals were collected in the first 100 metres of water (17 from 2 tows). All known night captures (16) were found in the first 500 metres. Of the seven known daytime captures the deepest was collected from gear fishing at 800 metres.

**Figure 5-1: Map showing distribution of the
Octopoteuthis sicula Rüppell, 1844**

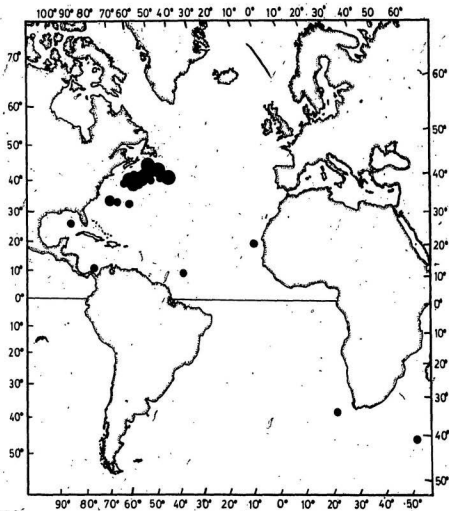
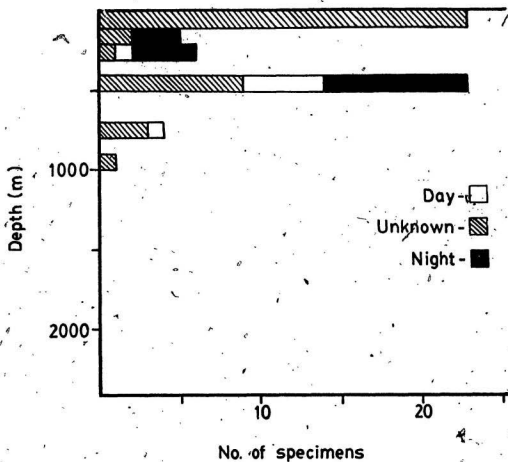


Figure 5-2: Vertical distribution of
Octopoteuthis sicula Rüppell,
1844.

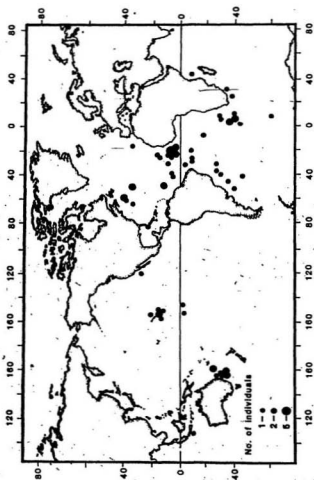


5.3.2. *Octopoteuthis megaptera*

Geographical Distribution.-A very widespread species found throughout the Atlantic between 45° N and 50° S including: the slope water and Mediterranean outflow provinces of the North Atlantic temperate region; the Straits of Florida, Amazonian and Guinean provinces of the the Atlantic tropical region; the South Atlantic subtropical sea and off the coast of South Africa. Also found throughout the Indian Ocean and off Eastern Australia in the western Pacific. (See Fig 5-3)

Vertical Distribution.-Fifty-seven specimens of *megaptera* were collected from gear fished from 25-4046-metres. MOCNESS captures were from 100 and 250 metres (see Fig 5-4). Eighty-eight percent of all captures were from the first 1000 metres (70 percent in the first 500 metres). All nighttime captures were in the first 1000 metres. The only known twilight capture was from a gear fished at 1000 metres.

Figure 5-3: Map showing distribution of
Octopoteuthis megaptera (Verrill,
1885)



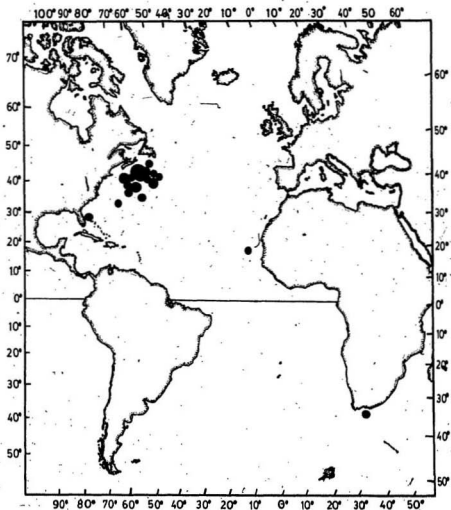
**Figure 5-4: Vertical distribution of
Octopoteuthis megaptera (Verrill,
1885)**

5.3.3. *Octopoteuthis danae*

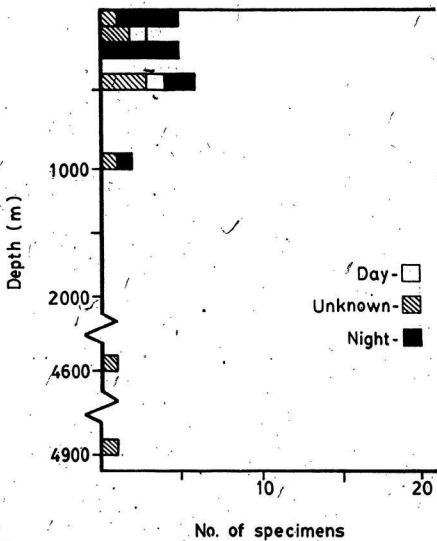
Geographic Distribution.-*Octopoteuthis danae* appears to be a Northwest Atlantic species collected between 35° and 45° N (see Fig 5-5). It is primarily found in the slope water of the North Atlantic temperate region. Several specimens have also been collected in the North Sargasso Sea province of the North Atlantic subtropical region. Single specimens have been collected from off west Africa in the southern Mauritanian upwelling and from off South Africa. Two additional specimens were collected from off Eastern Australia. The identification of the Australian specimens is doubtful.

Vertical Distribution.-Of the 33 individuals identified as *danae* only 21 had depth data available. Captures ranged from 100-4850 metres with 15 (60 per cent) of the captures coming from the first 500 metres (see Fig 5-6). There were 12 known nighttime captures, all above 1000 metres, with 11 of them in the top 500 metres. The two recorded daytime captures were from 200 and 500 metres respectively. The deepest capture using a MOCNESS closing net was at night while fishing at 441 metres depth.

Figure 5-5: Map showing distribution of
Octopoteuthis danae Joubin, 1931.



**Figure 5-8: Vertical distribution of
Octopoteuthis danae Joubin,
1931.**



5.3.4. *Octopoteuthis deletron*

Geographic Distribution.-*Octopoteuthis deletron* is found in the eastern Pacific primarily off California, Washington and Oregon 30° to 40° N and 118° to 128° W (see Fig 5-7).

Vertical Distribution.-A total of 29 specimens (18 with depth data) of *deletron* were collected from gear fished at depths of 274-5500 metres (see Fig 5-8). Seven were caught above 1000 metres and 14 were caught above 2000 metres. Of the remaining six specimens, three were collected from gear fished down to 2300 metres and the remaining three were collected from gear fished at 3000, 4500, and 5500 metres respectively. Six of the seven known night captures were from 2000 metres or above.

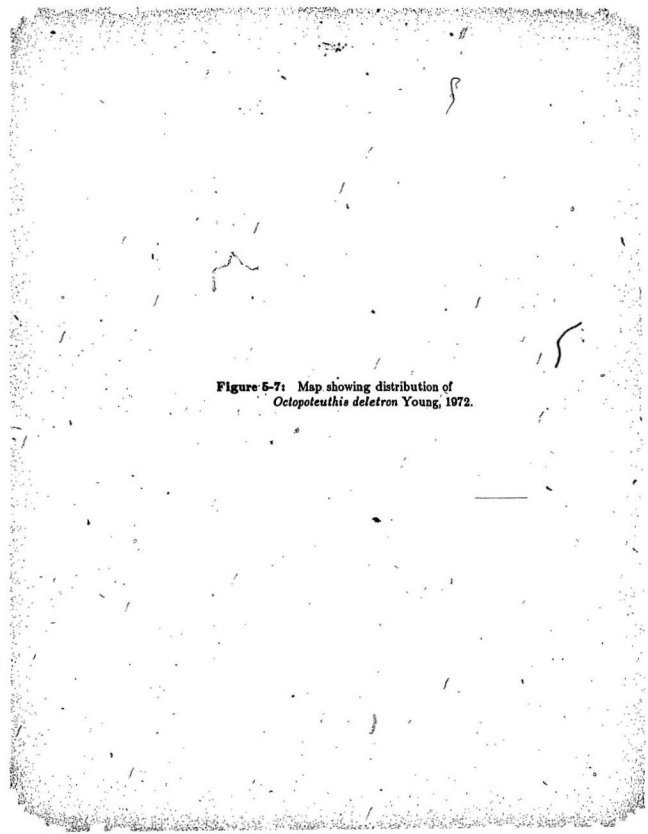


Figure 5-7: Map showing distribution of
Octopoteuthis deletron Young, 1972.

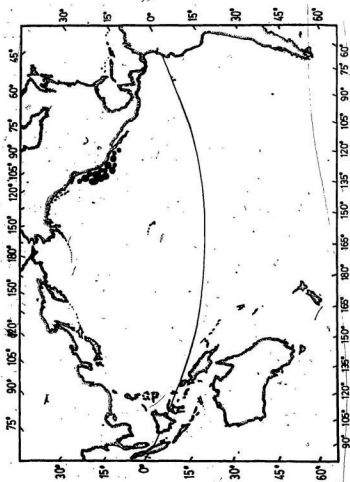
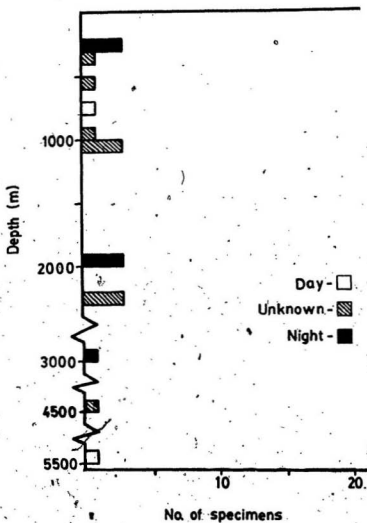


Figure 5-8: Vertical distribution of
Octopoteuthis deletron Young,
1972.

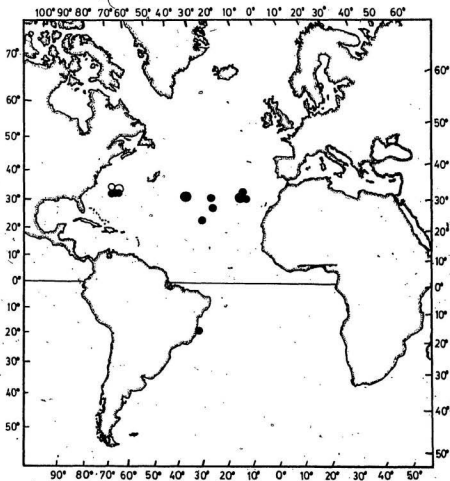


5.3.5. *Octopoteuthis* sp A

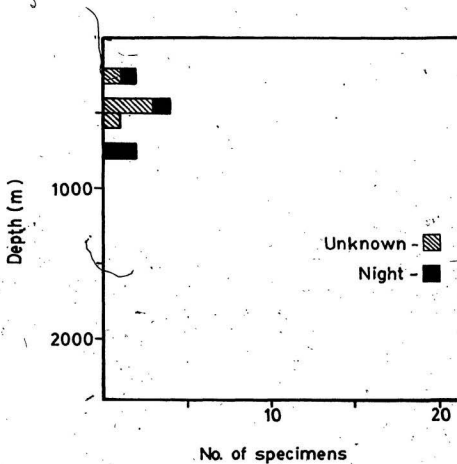
Geographical Distribution.-*O. sp A* is primarily distributed in the North Atlantic between 20° and 40° N in the north and south Sargasso Sea provinces of the Atlantic subtropical region (see Fig 5-9). Other specimens were collected from the northern and southern Mauritanian upwelling provinces of the North African subtropical sea. A single specimen was collected from off South America in the South Atlantic subtropical sea.

Vertical Distribution.-Only nine specimens of *sp A* had depth data available (see Fig 5-10). Six of the specimens were collected from 500 metres or less and all nine were collected from 800 metres or less. There were four known nighttime captures; one from 300, one from 500 and two from the 800 metre depth.

Figure 5-9: Map showing distribution of
Young's *Octopoteuthis* sp A.



**Figure 5-10: Vertical distribution of
Young *Octopoteuthis* sp. A.**



5.4. Larval Distribution

Geographical Distribution.-In all, a total of 146 larval specimens were examined representing collections from the Atlantic, Indian, and Pacific Oceans and the Mediterranean Sea. The adult characters normally used to separate species (photophore patterns and number and the presence or absence of accessory cusps on arm hooks) do not develop early enough to be useful for species identification in larvae. At present no other characters have been identified that can accurately separate larval *Octopoteuthis* into species. All specimens discussed will, therefore, be referred to as *Octopoteuthis* spp.

The largest number of specimens examined, totalling 108, came from the Atlantic. Of these, 105 were from the North Atlantic and a single specimen came from off the western coast of South Africa (see Fig 5-11). Atlantic specimens were collected in all months except December and January with highest catches in March, April and June (see Fig 5-12).

Only 40 other specimens were examined, 6 and 29 from the Pacific and Indian Oceans respectively, and 5 from the Mediterranean Sea. To supplement the sparse data the literature was searched for information on additional larvae (Mediterranean - Degner 1925, Issel 1925; Pacific - Okutani and McGowan 1969; and the Atlantic - Cairns, 1976, Massy 1909).

An attempt was made to compare these monthly distributions with those of mature and maturing adult specimens (ie. those showing evidence of gametes) of various species to aid in larval identification. All species of *Octopoteuthis*, however, seem to have a prolonged period of maturity that can span six to eight months of the year.

Vertical Distribution.-Captures of specimens occurred using a variety of gear types fishing at depths of 23-3500 m (see Fig. 5-13). Only 13 specimens lacked gear depth information (8 of those were from a single MOCNESS station).

Figure 5-11: Map of distribution of
Octopoteuthis spp larvae.

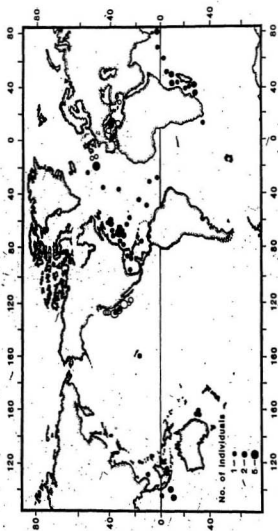
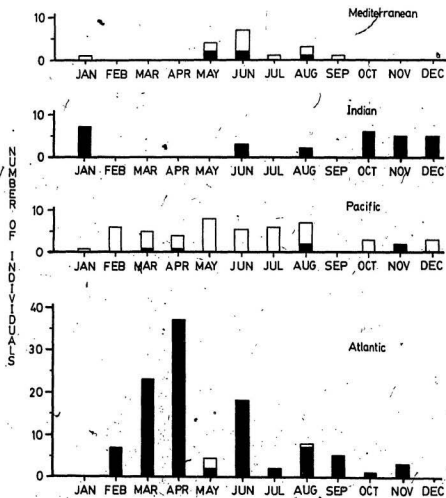


Figure 5-12: Monthly distribution of
Octopoteuthis spp larvae
based on catch data.



Of the 133 specimens with depth data 71 percent were collected in the first 500 m of depth and 90 percent in the first 1000 m (all gears combined).

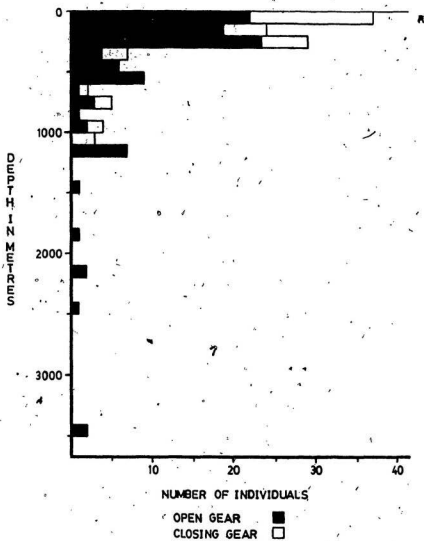
Daytime captures of larvae ranged from 55-1200 m for closing nets (55-1500 m for all gears). Of the 31 known daytime captures 16 were collected in the first 500 m and 15 in the next 1000 m. Night-time captures ranged from 50-1000 m for closing nets (50-3500 m for all gears). Fifty-four larvae were nighttime captures with 40 of those collected in the top 500 m. The heaviest nighttime concentration (31 individuals) was distributed between 100-400 m.

Although not closely looked at, size of individual animals (ML) did not seem to restrict vertical distribution. One daytime catch using a MOCNESS at 1050 m yielded a pair of larvae with MLs of 5.8 and 15.5 respectively. Two separate nighttime trawls in comparison, one at 23 and another at 50 m, yielded specimens of 16.8 and 1.9 mm ML.

Some of the present observations seem to agree with those of Roper and Young (1975). They reported day and night trawl catches of 60 and 81 percent respectively, of larvae of *Octopoteuthis deletron* Young, 1972 in the first 500 m of water. The remainder of their specimens were collected in the next 700 m. In comparison, only 4 specimens out of 146 reported on in this paper came from gear fished at depths greater than 1200 m. These deepwater records are probably the result of catches while the nets were being set.

Roper and Young also found that nighttime vertical distribution (near surface to 500 m) of *Octopoteuthis deletron* larvae encompassed and spread beyond their daytime distribution (200-400 m). *O. deletron* larvae were also absent from the upper 200 m of water. Unlike Roper and Young's observations however, a substantial number of larvae (one third of all day-time catches) were found to inhabit the top 200 metres. There also did not appear to be any substantial difference between day and nighttime range distribution (55-1200 and 50-1000 m respectively) when looking at results from closing gear.

**Figure 5-13: Vertical distribution of
Octopoteuthis spp larvae.**



5.5. Gladius

Toll (1982) looked at the structure of the gladius in most of the teuthoid squids and found it to be quite distinctive between families, some genera and sometimes even species specific. Due to a shortage of available specimens he was unable to determine the full structure of the gladius of the genus *Octopoteuthis* but he did report Clarke's 1980 comment that at least *O. rugosa* had a conus. The present study has verified the presence of what Toll (1982) calls a secondary conus in all species of *Octopoteuthis*. This secondary conus is formed by the ventral fusion of the vanes of the gladius. The species of *Octopoteuthis* appear to have very different gladii but because of the small number examined (1-3) from each species inter- and intraspecific variability cannot be measured at this time. Examination should certainly be focussed in this area in any future studies in this genus.

5.6. Arm Loss and Regeneration

The loss of arms (at least the distal portion of them) is extremely common in the genus *Octopoteuthis*. So common in fact, that it is quite unusual to collect a specimen having more than one or two complete arms. Very few other groups of teuthoid squids, even the smallest species, undergo such loss during capture. Evidence that arm loss occurs during capture is supported by the frequent collection of detached arm tips with and without accompanying specimens (personal observation). The other valid genus in the family Octopoteuthidae, *Taningia*, rarely has incomplete arms, unlike the case in *Octopoteuthis*.

The causes of such arm loss may be several but one of the most probable reasons is due to the presence of photophores on all the arm tips and the behavioural and ecological consequences thereof. In an environment where available light levels are very low, such as is the case of the midwater depths usually inhabited by *Octopoteuthis*, any sources of light, no matter how faint, may serve as lures for prey or signals for species recognition. It may also

inadvertently attract predators to the animal and result in capture of the individual squid if some alternative action could not take place. The autotomy of one or several arms would leave a predator busy and allow the squid a chance to escape relatively unharmed (much like some lizards that lose their tails when attacked). Of course, loss of parts of arms to predation may not be excluded.

Such action would be detrimental to the individual animal if no means were available to replace the lost parts. Arm regeneration would appear to be the natural physiological response to such a situation.

Lange (1920) was the first to study regeneration of cephalopods (primarily octopods) in detail. She noted that there was wound healing in teuthoids but that the occasional case of regeneration is by what she labels "compensatory regulation". She stated that lost arms were replaced and not repaired "by developing that rudimentary buccal arm which was correlated to the lost arms". The "replaced arm" differs from the original in length and in that it occupies a position nearer the buccal membrane.

Aldrich and Aldrich (1968) disagreed with Lange in respect to the process of arm and tentacle regeneration of at least some of the teuthoids. Their examination of a specimen of *Architeuthis dux* Steenstrup, and review of the literature on regeneration in other species (*Loligo pealei* and *Illex illecebrosus* (Verrill, 1881); *Architeuthis harvii* (Verrill, 1882); and *Sepioteuthis lessoniana* (Adam, 1937)) revealed that regeneration was certainly more complicated than Lange supposed.

Murata *et al.* (1981) looked at tentacle and arm regeneration in *Ommastrephes bartramii* (Lesueur). They found regenerated portions to be generally shorter and suckers on those portions to be smaller, fewer in number, and irregular in configuration. Percentages of captured squids with evidence of regeneration ranged from 0-17.1 per cent over a three year sampling period.

The last two papers above corroborate the present findings of the degree of complexity that can occur in teuthoid arm (and tentacle) regeneration. The percentage of regeneration in *Ommastrephes bartrami* is approximately equal to the nearly 15 per cent found in the *Octopoteuthis* specimens examined here. It would certainly seem that regeneration is much more common in teuthoids than had previously been thought.

5.7. Photophores and Bioluminescence

It is surprising in a squid genus like *Octopoteuthis*, which bears many photophores, that the discovery of their bioluminescent function took so long. Nearly fifty years after *O. sicula* was first described Chun (1910) was one of the first researchers to suggest that the outgrowths located near the ink sac were photophores. In 1912 Pfeffer proposed two other possible photophore sites; at the distal extremities of the arm tips and on the ventral sides of the eye (lid?). Berry (1920a and b) tentatively listed the genus as being bioluminescent. In 1923 Naef accepted the presence of the arm tip photophores but doubted the nature of those organs lying ventrally against the ink sac.

Okada (1927) carried out the first histological study of the three supposed photophore groups. His conclusion was that the only photophores in *Octopoteuthis* were those located at the arm tips. In 1929 Pierantoni carried out a similar examination and appeared to be totally unaware of the work done two years earlier by Okada. Pierantoni found *Octopoteuthis* to be a luminescent species. In the same year, in Japan, Sasaki described arm tip photophores from specimens of *Octopoteuthis* specimens from Japan.

In 1931, Joubin described his new species *Octopodoteuthis danae* as having four pairs of photophores but was unable to conduct histological studies on them because of the poor condition of the specimen and its tissues.

Harvey (1952) in his classic text on bioluminescence listed *Octopodoteuthis*

and *Octopodoteuthopsis* as bioluminescent species. Both Adam (1952, 1980) and Voss (1956a) described photophores in specimens they described as *Octopoteuthis sicula* and *O. megaptera* respectively. Young (1972) was the first to find brachial photophores along the axial nerves of his new species *O. deletron*. In 1975 Lipka described brachial photophores from *Octopoteuthis* specimens in the North Atlantic.

Herring (1977) discussed bioluminescence in fish and cephalopods and presented a list of all known cephalopods bearing photophores including *Octopoteuthis*. Herring (1978a and b) again listed luminescent cephalopods and presented a table showing photophore distribution in each family.

Nearly all the photophores in *Octopoteuthis* species are directed ventrally (Young and Roper, 1977). During observations on live specimens of *Octopoteuthis nielseni* Young and Roper (1977) found that the squid could countershade themselves by using their body photophores to match the intensity of the level of light coming from an overhead light. The animals tested turned their photophores on in response to overhead illumination and reduced or turned them off when overhead light was extinguished.

5.8. Ecological and Economic Importance

While specimens of the genus *Octopoteuthis* are relatively rare in collections they have been collected from the stomachs of a large number of fish and cetacean species. Clarke (1980) has found members of the genus to account for up to 24 per cent of the buccal masses taken from sperm whale stomachs from off Durban, South Africa. Table 5-3 provides a list of predators from which *Octopoteuthis* specimens (or their beaks) have been collected and the literature reference.

It is obvious from the table that *Octopoteuthis* must play an important role as food for these predators. It should also be noted that the largest specimens we

Table 5-3: Predators from which *Octopoteuthis* specimens have been collected

PREDATOR	AUTHORITY
CETACEANS	
<i>Physeter catodon</i> - Sperm whale	Akimushkin, 1963; Clarke, 1966; Clarke, 1980; Clarke and MacLeod, 1976; Clarke, MacLeod and Paliza, 1976; Okutani and Sasaki, 1978; Okutani <i>et al.</i> , 1976.
<i>Hyperoodon ampullatus</i> - Northern bottle- nosed whale	Clarke and Kristensen, 1980.
<i>Tursiops truncatus</i> - Bottle-nosed dolphin	Clarke, 1966; Rancurel, 1964.
FISH	
<i>Thunnus alalunga</i> - Albacore tuna	Bouxin and Legendre, 1932.
<i>Thunnus thynnus</i> - Blue-fin tuna	Data from specimens examined.
<i>Alepisaurus ferox</i> -	Rancurel, 1970.
<i>Prionace glauca</i> - Blue shark	Clarke and Stevens, 1976.

have representing the genus generally come from the stomachs of large predators (Clarke, 1980). Indeed, the largest specimen examined in this study (240 mm ML) came from the stomach of a blue-fin tuna collected in South African waters.

The genus has little commercial value at present and the high ammonium content in its tissues would certainly detract from its palatability. Tomiyama and Hibiya (1978) however listed it as being landed for use as food in Japan.

5.9. Statistical Analysis

Morphometrics have been used in taxonomic study since the late 1800's. Great emphasis has been placed on indices (ie. body measurements as a proportion of some standard body measure, most often the length of the mantle measured on the dorsum from the anterior-most point of the mantle to the posterior apex of the mantle, the mantle length) as a means to differentiate between cephalopod species. Roper and Voss (1983) call for an even greater emphasis. Little has been written however on the statistical testing of these indices and usually nothing is done other than to present their means, ranges and standard deviations.

Several authors have discussed the pros and cons of analysing derived variables, such as indices (ie. ratios), versus original measurements (Atchley *et al.*, 1976; Blackwith and Reyment, 1971; Green, 1979; Marr, 1955; and Sokal and Rolf 1969, 1973). For the most part they considered the use of ratios to be statistically poor in morphometric analyses and recommended methods such as the analysis of covariance (ANCOVA) of the original measurements. One of the main reasons for the problem is that indices change with growth and it is sometimes difficult to get specimens of equal size.

N. Voss (1985) has managed to get around this problem and retain the use of indices by summarizing them, for selected series, over an entire available size range. This method is certainly good when applied to a large and diverse sample size but it still does not statistically test the data.

A few cephalopod workers have used statistical analyses in their work. Cohen, in her 1976 paper on the systematics of western North Atlantic species of *Loligo*, used ANCOVA in her analysis. The ANCOVA allowed analysis of the factors of sex and geographic location simultaneously and eliminated the need to have samples of equal size.

The discriminant analysis used in this present review of the genus *Octopoteuthis* ran ANCONVAs on the raw measurements of selected parameters of each of the species and recommended changes in classification based on those analyses. The growth factor was neutralized by making ML the independent variable and running all ANCOVAs against it. The discriminant analysis was, in fact, testing the usefulness of morphometrics to distinguish a priori species based the characters defined above.

The initial discriminant analysis presented an a posteriori classification including a list of what it considered as 'misclassified specimens' and a table indicating the percentages of specimens classified into each a priori species. First results indicated an average of 73.7 per cent of classified specimens as correct. One species, *O. sp A*, had a very small sample population (5) with complete variable data. As a result the covariance matrix was not of full value (ie. the analysis did not use two of the variables, eye diameter and lens diameter, of the species). *O. sp A* was therefore removed from the second discriminant analysis to see if the classification could be improved.

The second discriminant analysis resulted in an improved classification average of 78.1 percent of the original identifications correct. The overall result suggests that there is a good correlation between body measurements and the a priori defined species. One of the four species, *Octopoteuthis danae* had the highest correct classification of nearly 87 percent. The other three species *deletron*, *sicula* and *megaptera* had lower classification percentages of 77.8, 73.3 and 71.4 per cent respectively.

Based on the a priori species classification it would be expected that *sicula* would be closest to *danae* in morphometrics since they differ only by the presence or absence of accessory cusps on the arm hooks. This is supported by the high percentage of *sicula* specimens (22.2 percent) that are placed into *O. danae* by the analysis.

The discovery that morphometrics appear to be useful in separating species in this genus is surprising in a group of squids that is generally very gelatinous. The specimens examined for this study were fixed for varying durations in formalin and preserved in a variety of alcohol types (70% ethanol, 50 % isopropanol) which would be expected to produce varying shrinkage results. Certainly with the very small number of specimens (169) with complete morphometric data the measurements seem to be species specific.

5.10. Conclusions

From this study I conclude that:

1. There are 5 valid species of *Octopoteuthis*; 4 in the North Atlantic *sicula*, *megaptera*, *danae*, and sp A and 2 in the Pacific *deletron* and *megaptera*.

2. Species of *Octopoteuthis* may be separated using photophore patterns and hook structure making obvious therefore that intact complete specimens are necessary for proper analysis.

3. Morphometric data alone are not sufficient criteria on which to base species differentiation.

4. Discriminant analysis is encouraged as a proper statistical means to test morphometrics in a systematic paper such as this. The rate of success achieved in its use here exceeded all expectations and this technique should be used in cephalopod systematics where morphometrics and resultant indices are so heavily relied upon.

5. With the co-occurrence of 4 species in the North Atlantic and two in the Pacific one would expect that further close analysis of the two species presently recognized in the Pacific, supplemented by additional collections, would indicate multiple octopoteuthid fauna there as well.

Chapter 6

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APPENDIX 1

This following appendix lists the collection and catalogue data for each specimen by species. See materials and methods for museum, gear and collector abbreviations.

Octopoteuthis sticula

SPECIM	SEX	MATUR	ABDOMINAL PHOTOPHORE-2	NAUSEN	ANTERIOR EYE ORBIT	PHOTOPHORE-3	ETERNAL PHOTOPHORE-3	DEPTH	DEAR	DAY	NON	YEAR	MUS	CURTOS	DATE
9	F			49.0	ARG	6	41 47 -N	100	ERT	10	NOV	1980	SAB	2177	
10	F		96.0	HA	48-4	42 56 -N	37 15 -W	500	ERT	10	NOV	1980	SAB	2177	
11	F		123.0	HA	65-5	44 23 -N	57 15 -W	500	ERT	20	NOV	1979	SAB	2177	
12	F		100.0	HA	65-5	44 23 -N	57 15 -W	500	ERT	20	NOV	1979	SAB	2177	
13	F		102.0	HA	65-5	44 23 -N	57 15 -W	500	ERT	20	NOV	1979	SAB	2177	
14	F		100.0	HA	51-5	43 38 -N	54 30 -W	500	ERT	21	NOV	1979	SAB	2177	
15	F		130.0	HA	51-5	43 38 -N	54 30 -W	500	ERT	21	NOV	1979	SAB	2177	
16	F		130.0	HA	51-5	43 38 -N	54 30 -W	500	ERT	21	NOV	1979	SAB	2177	
17	F		130.0	HA	51-5	43 38 -N	54 30 -W	500	ERT	21	NOV	1979	SAB	2177	
18	F		111.0	HA	55-5	42 34 -N	61 49 -W	500	ERT	29	NOV	1980	MHC	92474	
22	F		77.0	LHA	13-3	39 00 44N	62 00 04W	300	ERT	18	NOV	1979	MHC	92474	
24	F		68.0	LHA	14	38 59 50N	62 13 08W	300	ERT	7	FEB	1982	MHC	92485	
28	F		75.0	LHA	14	38 59 50N	62 13 08W	300	ERT	8	FEB	1982	MHC	92485	
29	F		100.0	LHA	70-2	42 42 -N	61 25 -W	100	ERT	8	FEB	1982	MHC	92485	
32	F		100.0	LHA	70-2	42 42 -N	61 25 -W	100	ERT	25	NOV	1979	MHC	92485	
33	F		20.0	LHA	13-1	39 00 85W	62 00 20W	50	ERT	7	FEB	1982	MHC	92482	
34	F		54.0	CJ1	11	40 18 -S	153 34 48E	150	ERT	22	APR	1982	NOV	F51081	
37	F		72.0	ANT	3/103	43 30 -S	149 01 -E	150	ERT	18	JUN	1982	NOV	F51077	
38	F		42.0	OCE	78-2	20 28 -N	18 01 -W	200	MHC	21	JUL	1982	TANU	F31075	
40	F		26.0	OCE	78-2	20 28 -N	18 01 -W	200	MHC	05	NOV	1978	TANU		
80	F		26.0	OCE	1808	26 14 48	95 31 04W	210	MHC	27	FEB	1981	TANU		
106	F		37.0	OCE	131-3	34 32 -N	75 40 -W	150	MHC	21	FEB	1979	TANU		
107	F		31.0	OCE	131-3	34 32 -N	75 40 -W	150	MHC	21	FEB	1979	TANU		
108	F		240.0	AFR	41037	33 35 -S	17 10 -E	490	MHC	11	SEP	19743	TANU		
143	F		35.0	REP	7	8 28 -N	84 13 -W	145	MHC	27	JUL	1982	SM	7462	
146	F		28.0	OAD	25	41 37 24N	52 00 -W	100	T	24	MAY	1982	SAB		
147	F		38.0	OAD	26	41 38 12N	52 00 -W	100	T	29	MAY	1982	SAB		
148	F		38.0	OAD	26	41 38 12N	52 00 -W	100	T	29	MAY	1982	SAB		
149	F		38.0	OAD	26	41 38 12N	52 00 -W	100	T	29	MAY	1982	SAB		
150	F		36.0	OAD	26	41 38 12N	52 00 -W	100	T	29	MAY	1982	SAB		
151	F		36.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
157	F		47.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
158	F		36.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
159	F		32.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
161	F		32.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
162	F		34.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
163	F		39.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
164	F		40.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
165	F		35.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
167	F		34.0	OAD	32	41 17 18N	48 11 34W	100	T	30	MAY	1982	SAB		
168	F		44.0	CNA	1520	38 54 -N	69 32 -W	35	ERT	30	APR	1971	USNM	00814462	
241	F		178.0	NEL	12-18	32 09 -N	64 11 -W	250	ERT	24	AUG	1971	USNM	00728875	

Octopoteuthis sicula

ABDOMINAL PHOTOPHORE-2				ANTERIOR EYE ORBIT PHOTOPHORE-0				EYEBALL PHOTOPHORE-0				ACCESSORY HOOK CUSP-1			
SPECNO	SEX	MATUR	HAIRLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	NUS	CATNO	
341	M <td>2</td> <td>170-0</td> <td>DEL</td> <td>12-01</td> <td>44 11</td> <td>44 11</td> <td>0</td> <td>750</td> <td>ENT</td> <td>24</td> <td>AUG</td> <td>1971</td> <td>USNH</td> <td>00228825</td>	2	170-0	DEL	12-01	44 11	44 11	0	750	ENT	24	AUG	1971	USNH	00228825
343	M <td>2</td> <td>341-0</td> <td>JOA</td> <td>10-4</td> <td>32 18</td> <td>44 12</td> <td>0</td> <td>ENT</td> <td>2</td> <td>JUN</td> <td>1970</td> <td>USNH</td> <td>00224831</td>	2	341-0	JOA	10-4	32 18	44 12	0	ENT	2	JUN	1970	USNH	00224831	
348	M <td>2</td> <td>311-0</td> <td>SAM</td> <td>10-4</td> <td>32 18</td> <td>44 12</td> <td>0</td> <td>ENT</td> <td>2</td> <td>JUN</td> <td>1970</td> <td>USNH</td> <td>00228033</td>	2	311-0	SAM	10-4	32 18	44 12	0	ENT	2	JUN	1970	USNH	00228033	
349	F <td>2</td> <td>321-0</td> <td>ALB</td> <td>7-5</td> <td>42 40</td> <td>42 40</td> <td>0</td> <td>ENT</td> <td>3</td> <td>FEB</td> <td>1982</td> <td>USNH</td> <td>00220314</td>	2	321-0	ALB	7-5	42 40	42 40	0	ENT	3	FEB	1982	USNH	00220314	
352	F <td>2</td> <td>321-0</td> <td>ALB</td> <td>7-5</td> <td>42 40</td> <td>42 40</td> <td>0</td> <td>ENT</td> <td>3</td> <td>FEB</td> <td>1982</td> <td>USNH</td> <td>00220314</td>	2	321-0	ALB	7-5	42 40	42 40	0	ENT	3	FEB	1982	USNH	00220314	
354	M <td>2</td> <td>72-0</td> <td>LHA</td> <td>1-4</td> <td>42 40</td> <td>42 57</td> <td>0</td> <td>750</td> <td>ENT</td> <td>3</td> <td>FEB</td> <td>1982</td> <td>IMFD</td> <td>IMFD</td>	2	72-0	LHA	1-4	42 40	42 57	0	750	ENT	3	FEB	1982	IMFD	IMFD
341	M <td>2</td> <td>105-0</td> <td>HNA</td> <td>20-5</td> <td>42 15</td> <td>43 07</td> <td>0</td> <td>500</td> <td>NMT</td> <td>25</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>IMFD</td>	2	105-0	HNA	20-5	42 15	43 07	0	500	NMT	25	NOV	1979	IMFD	IMFD
342	F <td>2</td> <td>115-0</td> <td>HNA</td> <td>20-5</td> <td>42 15</td> <td>43 07</td> <td>0</td> <td>500</td> <td>NMT</td> <td>25</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>IMFD</td>	2	115-0	HNA	20-5	42 15	43 07	0	500	NMT	25	NOV	1979	IMFD	IMFD
343	M <td>2</td> <td>115-0</td> <td>HNA</td> <td>20-5</td> <td>42 15</td> <td>43 07</td> <td>0</td> <td>500</td> <td>NMT</td> <td>25</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>IMFD</td>	2	115-0	HNA	20-5	42 15	43 07	0	500	NMT	25	NOV	1979	IMFD	IMFD
344	M <td>2</td> <td>125-0</td> <td>HNA</td> <td>20-5</td> <td>42 15</td> <td>43 07</td> <td>0</td> <td>500</td> <td>NMT</td> <td>25</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>IMFD</td>	2	125-0	HNA	20-5	42 15	43 07	0	500	NMT	25	NOV	1979	IMFD	IMFD
345	M <td>2</td> <td>111-0</td> <td>HNA</td> <td>20-5</td> <td>42 15</td> <td>43 07</td> <td>0</td> <td>500</td> <td>NMT</td> <td>25</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>IMFD</td>	2	111-0	HNA	20-5	42 15	43 07	0	500	NMT	25	NOV	1979	IMFD	IMFD
346	M <td>2</td> <td>57-0</td> <td>HNA</td> <td>20-5</td> <td>42 15</td> <td>43 07</td> <td>0</td> <td>500</td> <td>NMT</td> <td>25</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>IMFD</td>	2	57-0	HNA	20-5	42 15	43 07	0	500	NMT	25	NOV	1979	IMFD	IMFD
347	M <td>2</td> <td>185-0</td> <td>HNA</td> <td>20-5</td> <td>42 15</td> <td>43 07</td> <td>0</td> <td>500</td> <td>NMT</td> <td>25</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>IMFD</td>	2	185-0	HNA	20-5	42 15	43 07	0	500	NMT	25	NOV	1979	IMFD	IMFD
373	F <td>2</td> <td>125-0</td> <td>HNA</td> <td>50-5</td> <td>43 37</td> <td>59 37</td> <td>0</td> <td>500</td> <td>ENT</td> <td>19</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>M2299</td>	2	125-0	HNA	50-5	43 37	59 37	0	500	ENT	19	NOV	1979	IMFD	M2299
375	M <td>2</td> <td>125-0</td> <td>HNA</td> <td>50-5</td> <td>43 37</td> <td>59 37</td> <td>0</td> <td>500</td> <td>ENT</td> <td>19</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>M2299</td>	2	125-0	HNA	50-5	43 37	59 37	0	500	ENT	19	NOV	1979	IMFD	M2299
376	M <td>2</td> <td>117-0</td> <td>HNA</td> <td>50-5</td> <td>43 37</td> <td>59 37</td> <td>0</td> <td>500</td> <td>ENT</td> <td>19</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>M2299</td>	2	117-0	HNA	50-5	43 37	59 37	0	500	ENT	19	NOV	1979	IMFD	M2299
377	M <td>2</td> <td>117-0</td> <td>HNA</td> <td>50-5</td> <td>43 37</td> <td>59 37</td> <td>0</td> <td>500</td> <td>ENT</td> <td>19</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>M2299</td>	2	117-0	HNA	50-5	43 37	59 37	0	500	ENT	19	NOV	1979	IMFD	M2299
389	F <td>2</td> <td>132-0</td> <td>HNA</td> <td>20-5</td> <td>42 16</td> <td>43 05</td> <td>0</td> <td>500</td> <td>ENT</td> <td>19</td> <td>NOV</td> <td>1979</td> <td>IMFD</td> <td>M2299</td>	2	132-0	HNA	20-5	42 16	43 05	0	500	ENT	19	NOV	1979	IMFD	M2299
456	F <td>2</td> <td>28-3</td> <td>HNA</td> <td>40-5</td> <td>38 11</td> <td>15 33</td> <td>E</td> <td>500</td> <td>ENT</td> <td>19</td> <td>NOV</td> <td>1979</td> <td>REN</td> <td>1905.180.9</td>	2	28-3	HNA	40-5	38 11	15 33	E	500	ENT	19	NOV	1979	REN	1905.180.9
			28.3			38 11	15 33	E	500	ENT	19	NOV	1979	REN	1905.180.9

Octopoteuthis sicula ??

ABDOMINAL PHOTOPHORE-2				ANTERIOR EYE ORBIT PHOTOPHORE-0				EYEBALL PHOTOPHORE-9				ACCESSORY HOOK CUSP-1			
SPECNO	SEX	MATUR	HAIRLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	NUS	CATNO	
42	F	3	220	MAL	7	38 33	141 43	1050	7	4	AUG	1982	MUV	F31079	

Octopoteuthis megaptera

ABDOMINAL PHOTOPHORE-2				ANTERIOR EYE ORBIT PHOTOPHORE-1				EYEBALL PHOTOPHORE-1				ACCESSORY HOOK 'CUSP'-1			
SPECNO	SEX	MATUR	'HAIRLEN	COLL	STAT	LAT	LONG	'DEPTH	GEAR	'DAY	MON	YEAR	MUS	CATNO	
5	F	2	51-0	AKS	35-4	38 11	45 11	0	ENT	10	NOV	1980	SABS	2177	
7	F	2	55-0	HNA	22-4	42 16	41 28	0	ENT	18	NOV	1979	SABS	2177	
8	M	2	101-0	HNA	22-4	42 16	41 28	0	ENT	18	NOV	1979	SABS	2177	
25	M	2	37-0	BEL	79-2	40 53	48 N	300	ENT	15	MAY	1977	NHC	94.08	
30	M	2	41-0	CB1	11	40 18	149 01	0	ENT	18	JAN	1982	MUV	F31077	
38	M	2	41-0	CB1	11	40 18	149 01	0	ENT	18	JAN	1982	MUV	F31077	
43	F	2	37-0	SOE	7	38 08	36 S	130 14	00E	20	NOV	1979	MUV	F31075	
44	M	2	37-0	COU	7	36 04	132 50	0	ENT	3	DEC	1979	MUV	F31071	

Octopoteuthis megaptera

SPECNO	SEX	MATR	MAILIN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	ACCUSO	NOOK	CUSP	SE-1	CATNO
45	F		42-0	SPR	0	33 04	208	154 06	54E	0	7	22	SEP	1979	HUV	F51082	
46	F		74-0	SPR	0	33 04	208	154 06	54E	0	7	22	SEP	1979	HUV	F51082	
47	F		74-0	SPR	0	33 04	208	154 06	54E	0	7	22	SEP	1979	HUV	F51082	
48	F		74-0	SPR	0	33 04	208	154 06	54E	0	7	22	SEP	1979	HUV	F51082	
49	F		41-0	SOC	81/4	37 37	248	150 15	24E	150	TGP	19	NOV	1980	HUV	F51074	
50	F		49-0	TAI	19	37 37	248	150 15	24E	150	TGP	19	NOV	1980	HUV	F51074	
51	F		68-0	WHE	4	37 22	--	13 42	--	0	7	19	JAN	1968	ZNHU	7	F51080
52	F		132-0	WHE	13	37 22	--	13 42	--	0	7	19	JAN	1968	ZNHU	7	F51080
53	F		132-0	WHE	13	37 22	--	13 42	--	0	7	19	JAN	1968	ZNHU	7	F51080
54	F		113-0	WHE	4	43 5	--	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
55	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
56	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
57	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
58	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
59	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
60	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
61	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
62	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
63	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
64	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
65	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
66	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
67	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
68	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
69	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
70	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
71	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
72	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
73	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
74	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
75	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
76	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
77	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
78	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
79	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
80	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
81	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
82	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
83	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
84	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
85	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
86	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
87	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
88	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
89	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
90	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
91	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
92	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
93	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
94	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
95	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
96	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
97	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
98	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
99	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
100	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
101	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
102	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
103	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
104	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
105	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
106	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
107	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
108	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
109	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
110	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
111	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
112	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
113	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
114	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
115	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
116	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
117	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
118	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
119	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
120	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
121	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
122	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
123	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
124	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
125	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
126	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
127	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
128	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
129	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
130	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
131	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
132	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
133	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
134	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
135	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
136	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
137	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968	ZNHU	7	F51080
138	F		100-0	WHE	17	4	43 5	35 39	--	0	7	5	FEB	1968			

Octopoteuthis megaptera

ABDOMINAL PHOTOPHORE-2				ANTERIOR EYE ORBIT PHOTOPHORE-1				EYEBALL PHOTOPHORE-1				ACCESSORY HOOK CUSPS-1			
SPEEDNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
233	F		38.0		482-1	34	24	104	ENT	13	APR	1971	USNH		
234	F		82.0		419-1	34	25	112	ENT	28	MAR	1971	USNH		
235	F		59.0		419-1	34	25	112	ENT	28	MAR	1971	USNH		
236	F		75.0		419-1	34	25	112	ENT	28	MAR	1971	USNH		
237	F		75.0		419-1	34	25	112	ENT	28	MAR	1971	USNH		
238	F		39.0		419-1	34	25	112	ENT	28	MAR	1971	USNH		
239	F		39.0		419-1	34	25	112	ENT	28	MAR	1971	USNH		
240	F		110.0		489-1	37	22	105	ENT	17	APR	1971	USNH		
241	F		110.0		489-1	37	22	105	ENT	17	APR	1971	USNH		
242	F		131.0		487-2	5	30	140	ENT	9	APR	1971	USNH	00730482	
243	F		111.0		394-6	3	24	300	ENT	3	JAN	1970	ZMUC		
244	F		111.0		394-6	3	24	300	ENT	3	JAN	1970	ZMUC		
245	F		51.0		380-4	9	08	1000	ENT	30	AUG	1971	ZMUC		
246	F		51.0		380-4	9	08	1000	ENT	30	AUG	1971	ZMUC		
247	F		49.0		372-9	12	11	400	ENT	18	DEC	1971	ZMUC		

Octopoteuthis megaptera

ABDOMINAL PHOTOPHORE-2				ANTERIOR EYE ORBIT PHOTOPHORE-1				EYEBALL PHOTOPHORE-9				ACCESSORY HOOK CUSPS-1			
SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
137	F		128		481	40	49	247	OTT	1	OCT	1969	SM	40834	
138	F		150		481	40	49	247	OTT	1	OCT	1969	SM	40834	
247	F		150		481	40	49	247	OTT	1	OCT	1969	SM	40834	
270	F		113		ATL	2086	18 29	155	ICRT	24	NOV	1970	USNH	00814310	
271	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
272	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
273	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
274	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
275	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
276	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
277	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
278	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
279	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
280	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
281	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
282	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
283	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
284	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
285	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
286	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
287	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
288	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
289	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
290	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
291	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
292	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
293	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
294	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
295	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
296	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
297	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
298	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
299	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
300	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
301	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
302	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
303	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
304	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
305	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
306	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
307	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
308	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
309	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
310	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
311	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
312	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
313	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
314	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
315	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
316	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
317	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
318	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
319	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
320	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
321	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
322	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
323	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
324	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
325	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
326	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
327	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
328	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
329	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
330	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
331	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
332	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
333	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
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335	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
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337	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
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343	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
344	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
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346	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
347	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
348	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
349	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
350	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
351	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
352	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
353	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
354	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
355	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
356	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
357	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
358	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
359	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
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361	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
362	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
363	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
364	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
365	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
366	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
367	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
368	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
369	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
370	F		143		CHD	32-38	30 59	122	COBS	25	JUL	1967	USNH	00814408	
371	F		143		CHD	32-38	30 59	122							

ABDOMINAL PHOTOPHORE-2				ANTERIOR EYE ORBIT PHOTOPHORE-1				EYEBALL PHOTOPHORE-1				ACCESSORY HOOK CUSPS-0			
SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
1	M	2	59		HWA	22-2	42 14 --N	61 30 --W	100	ENT	18	NOV	1979	SABS 2177	

ABDOMINAL PHOTOPHORE-2				ANTERIOR EYE ORBIT PHOTOPHORE-1				EYEBALL PHOTOPHORE-1				ACCESSORY HOOK CUSPS-1			
SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
71	F	2	0		BHC	188	9 41 --S	27 39	-W	21	MAY	1966	ZMNH	17	
231	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
232	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
233	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
234	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
235	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
236	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
237	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
238	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
239	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
240	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
241	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
242	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
243	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
244	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
245	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
246	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
247	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
248	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
249	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
250	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
251	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
252	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
253	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
254	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
255	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
256	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
257	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
258	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
259	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
260	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
261	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
262	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
263	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
264	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
265	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
266	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
267	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
268	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
269	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
270	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
271	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
272	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
273	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
274	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
275	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
276	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
277	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
278	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
279	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
280	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
281	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
282	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
283	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
284	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
285	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
286	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
287	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
288	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
289	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
290	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
291	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
292	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
293	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
294	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
295	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
296	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
297	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
298	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
299	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	
300	F	2	0		BHC	343-2	40 18	59 12	ENT	21	MAY	1966	ZMNH	17	

Octopoteuthis deletron

SPECNO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	NUS	CATNO
144	F		73	T	T	34 20 -N	120 -W	0	T	4	AUG	1965	SEN	46000
172	F		41	T	T	MO RI N	PA CI FIC	0	T	12	APR	1968	CJBS	7
183	F		47	NV		40 35 13N	125 52 30W	3000	T	21	MAY	1964	SIO	44-51
184	F		54	NV	44115	18 02 14N	124 11 02W	5500	T	24	MAY	1964	SIO	44-53
185	F		57	SVZ	T	17 28 -N	109 18 -W	370	IKHT	15	APR	1957	SIO	7
187	F		41	ALA	T	32 10 -N	117 14 -W	274	MUT	31	JAN	1970	SIO	7
188	F		144	ALA	T	32 10 -N	117 14 -W	274	MUT	31	JAN	1970	SIO	7
189	F		172	MAS		38 20 30N	124 04 03W	4500	IKHT	14	JUN	1962	SIO	67-117
192	F		134	HUB	377	32 43 -N	117 37 -W	1043	IKHT	3	NOV	1951	SIO	7
193	F		144	HUB	11-19	34 33 -N	122 12 -W	2250	IKHT	12	JUN	1962	SIO	7
194	F		144	HUB	44-11	32 11 -N	117 21 -W	2000	IKHT	7	DEC	1964	SIO	7
199	F		27	NV	90-14	30 11 -N	124 57 -W	240	IKHT	5	SEN	1970	SIO	74-25
201	F		40	AVA	2	CAT ISLAND	LA BIGHT	0	T	9	DEC	1968	SIO	7
202	F		40	DAV	2	CAT ISLAND	LA BIGHT	0	T	9	DEC	1968	SIO	7
204	F		32	BSJ	2	CAT ISLAND	LA BIGHT	0	T	9	DEC	1968	SIO	7
205	F		31	BSJ	2	CAT ISLAND	LA BIGHT	0	T	9	DEC	1968	SIO	7
206	F		29	NV	44111	32 05 -N	117 37 -W	2000	MMD	12	DEC	1964	SIO	7
207	F		34	VEL	8025	35 14 -N	118 34 -W	563	IKHT	7	AUG	1965	USNM	0072483

Octopoteuthis deletron ??

SPECNO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	NUS	CATNO
139	F	3	161	T	3	T	T	15	T	10	APR	1973	SM	7

SPECNO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	NUS	CATNO
190	T	2	80	CHU	1	32 30 -N	117 27 -W	840	IKHT	1	NOV	1963	SIO	43-873

Oetopoteuthis sp. A

ABNORMAL PHOTOGRAPH-1				ANTERIOR EYE ORBIT PHOTOGRAPH-1				EYEBALL PHOTOGRAPH-0				ACCESSORY HOOK CUSPS-0			
SPECNO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
37	T	N	31	MHE	179	22 30 -N	18 48 -W	0	T	13	MAY	1964	ZHUN	T	
42	M	N	105	MHE	180	22 30 -N	20 08 -W	0	T	13	MAY	1964	ZHUN	T	
44	M	N	144	MHE	181	22 30 -N	20 08 -W	0	T	13	MAY	1964	ZHUN	T	
46	M	N	147	MHE	182	22 30 -N	20 08 -W	0	T	13	MAY	1964	ZHUN	T	
243	M	N	147	MHE	6	32 31 -N	16 54 -W	0	T	21	JAN	1948	ZHUN	T	
250	M	N	152	MHE	31-3	30 04 -S	5 22 -E	502	ERT	31	MAR	1971	USNH	T	
251	M	N	179	MHE	431-3	30 04 -S	5 22 -E	500	ERT	31	MAR	1971	USNH	T	
252	M	N	179	MHE	431-3	30 04 -S	5 22 -E	500	ERT	31	MAR	1971	USNH	T	
266	M	N	69	ALB	7-9-4	32 09 -N	63 45 -W	250	IKRT	22	AUG	1971	USNH	T	
277	M	N	84	ATL	2090	22 06 -N	32 45 -W	255	IKRT	7	SEP	1967	USNH	T	
290	M	N	116	DEL	17-79	32 08 -N	44 09 -W	450	ERT	23	AUG	1971	USNH	T	
292	M	N	122	DEL	17-79	32 08 -N	44 09 -W	450	ERT	23	AUG	1971	USNH	T	
307	M	N	93	VEL	11168	31 40 -N	120 04 -W	400	IKRT	31	JUL	1964	USNH	T	

Oetopoteuthis sp. A ??

ABNORMAL PHOTOGRAPH-1				ANTERIOR EYE ORBIT PHOTOGRAPH-1				EYEBALL PHOTOGRAPH-0				ACCESSORY HOOK CUSPS-0			
SPECKO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATHO	
294	M	3	128	DEL	12-80	32 19 -N	44 11 -W	750	ERT	24	AUG	1971	USNH	00728848	
295	M	3	128	DEL	12-87	32 04 -N	43 58 -W	1025	ERT	22	AUG	1971	USNH	00728847	
296	M	3	100	DEL	12-87	32 04 -N	43 58 -W	1025	ERT	22	AUG	1971	USNH	00728847	

Oetopoteuthis sp

ABNORMAL PHOTOGRAPH-0				ANTERIOR EYE ORBIT PHOTOGRAPH-0				EYEBALL PHOTOGRAPH-0				ACCESSORY HOOK CUSPS-0			
SPECKO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
53	T	N	32-54	DEL	2	38 11 -N	15 34 -E	0	T	17	MAY	1977	ZHUN	2790	
62	T	N	38-0	DEL	27745	34-4	36 22 -N	100	NOC	23	MAY	1977	TAMU	T	
64	T	N	38-0	DEL	27745	34-4	36 22 -N	100	NOC	23	MAY	1977	TAMU	T	
154	T	N	19-8	DEL	34-4	36 22 -N	47 14 24W	100	NOC	24	APR	1977	TAMU	T	
209	T	N	22-0	DEL	33-0	41 22 13N	47 14 24W	1000	NNO	9	SEP	1970	SIO	T	
209	T	N	27-0	DEL	33-0	41 22 13N	47 14 24W	1000	NNO	9	SEP	1970	SIO	T	
249	T	N	35-0	ALB	7-15	32 21 -N	121 59 -W	4000	NNO	9	SEP	1969	USNH	00725942	
337	T	N	45-0	NNA	22-5	42 15 -N	41 21 -W	450	IKRT	8	SEP	1969	USNH	00725942	
391	T	N	34-0	DEL	23-6	41 31 -N	60 44 -W	500	PMT	14	NOV	1979	IMPB	T	
394	T	N	34-0	DEL	23-6	41 31 -N	60 44 -W	500	PMT	14	NOV	1979	IMPB	T	

Ocotopoteuthis sp

-----ABDOMINAL PHOTOPHORE-2 ANTERIOR EYE ORBIT PHOTOPHORE-9 EYEWALL PHOTOPHORE-0 ACCESSORY HOOK CUPS-1
 SPECNO SEX MATURE MANLEN COLL STAT LAT LONG DEPTH GEAR DAY MONTH YEAR MUS CATNO
 242- F 2 53 MNE 419-2 34 26 -S 14 43 -E 305 ENT 28 MAR 1971 USNR T

-----ABDOMINAL PHOTOPHORE-2 ANTERIOR EYE ORBIT PHOTOPHORE-9 EYEWALL PHOTOPHORE-0 ACCESSORY HOOK CUPS-0
 SPECNO SEX MATURE MANLEN COLL STAT LAT LONG DEPTH GEAR DAY MONTH YEAR MUS CATNO
 27 F 44 ARD 49 43 38 -N 57 35 -W 300 ENT 17 NOV 1980 MNC 92481
 136 F 146 VEL 3 10 17 -N 57 46 -W 1000 HNT 24 FEB 1982 SMH 51337
 153 F 145 UAD 11 7 7 200 SPUT 24 FEB 1982 SBR 7091127
 166 F 83 EAS 12240 11 09 -N 111 57 -W 300 MAR 1982 EIO T
 215 F 70 MNE 490-1 7 0 ENT 18 MAR 1982 EIO T
 216 F 46 MNE 490-1 7 0 ENT 18 MAR 1982 EIO T
 278 F 84 ATL 2045 20 07 -N 18 15 -W 200 ENT 12 NOV 1976 USNR 00814604

-----ABDOMINAL PHOTOPHORE-2 ANTERIOR EYE ORBIT PHOTOPHORE-9 EYEWALL PHOTOPHORE-1 ACCESSORY HOOK CUPS-1
 SPECNO SEX MATURE MANLEN COLL STAT LAT LONG DEPTH GEAR DAY MONTH YEAR MUS CATNO
 21 F 80-0 MEL 22-5 46 16 -N 52 00 -W 500 ENT 24 MAR 1981 MNC 92082
 123 F 215-0 871 2008 3 41 -S 7 29 -E 0 FBS 14 MAY 1984 SMH 7897
 225 F 102-0 CRO 9 208 3 41 -S 7 29 -E 0 FBS 14 MAY 1984 SMH 7897
 227 F 163-0 WHE 474-7 7 9 23 SEP 1970 USNR 00814604
 297 F 163-0 WHE 474-7 7 9 23 SEP 1970 USNR 00814604

-----ABDOMINAL PHOTOPHORE-1 ANTERIOR EYE ORBIT PHOTOPHORE-1 EYEWALL PHOTOPHORE-1 ACCESSORY HOOK CUPS-1
 SPECNO SEX MATURE MANLEN COLL STAT LAT LONG DEPTH GEAR DAY MONTH YEAR MUS CATNO
 292 F 2 35 A DEL 12-72 32 25 -N 44 14 -W 760 ENT 23 AUG 1971 USNR 00728651

-----ABDOMINAL PHOTOPHORE-2 ANTERIOR EYE ORBIT PHOTOPHORE-1 EYEWALL PHOTOPHORE-0 ACCESSORY HOOK CUPS-0
 SPECNO SEX MATURE MANLEN COLL STAT LAT LONG DEPTH GEAR DAY MONTH YEAR MUS CATNO
 3 M 70 MEL 49-4 42 02 -N 56 15 -W 300 ENT 10 APR 1979 SABS 2177
 187 F 44 CRO 32-37 20 37 -N 138 12 -W 123 COBR 15 JUL 1967 USNR 00814601
 387 F 36 DAL 237 3 18 -S 45 18 -E 4780 12 MAR 1951 ZNUC T
 402 F 36 DAL 237 3 18 -S 45 18 -E 4780 12 MAR 1951 ZNUC T

Oetopsethis sp

ABDOMINAL PHOTOPHORE-0		ANTERIOR EYE ORBIT PHOTOPHORE-0		LAT		LONG		DEPTH		GEAR		DAY		ACCESSORY HOOK CURPS-1	
SPECNO	SEX	MATUR	MALEN	COLL	STAT									MUS	CATNO
62	F	2	27.3	DCE	112-3	34 33	N-N	75 37	-W	100	NOC	12	AUG	1978	TAMU
67	F	2	29.0	WNO	90-60	31 26	N	120 18	-W	1000	NOC	13	APR	1977	TAMU
181	F	2	32.0	T	90-60	31 26	N	120 18	-W	1000	NOC	13	APR	1977	TAMU
182	F	2	33.0	T	90-60	31 26	N	120 18	-W	1000	NOC	13	APR	1977	TAMU
229	F	2	30.0	CR0	44-17	11 53	N-N	98 40	-W	750	T	18	OCT	1969	USNM
274	F	2	125.0	HNA	59-5	43 37	N-N	144 48	-W	500	ENT	11	NOV	1979	INPD
374	F	2	93.0	REL	51	43 38	12N	54 32	-W	200	ENT	11	APR	1979	INPD

ABDOMINAL PHOTOPHORE-0		ANTERIOR EYE ORBIT PHOTOPHORE-0		LAT		LONG		DEPTH		GEAR		DAY		ACCESSORY HOOK CURPS-0	
SPECNO	SEX	MATUR	MALEN	COLL	STAT									MUS	CATNO
156	F	2	37	GAD	32	41 17	18N	48 11	34W	100	T	30	MAY	1982	5JBS

ABDOMINAL PHOTOPHORE-0		ANTERIOR EYE ORBIT PHOTOPHORE-1		LAT		LONG		DEPTH		GEAR		DAY		ACCESSORY HOOK CURPS-0	
SPECNO	SEX	MATUR	MALEN	COLL	STAT									MUS	CATNO
299	M	3	135	WNE	442-3	7	T	0	T	T	T	T	T	1971	USNM

ABDOMINAL PHOTOPHORE-0		ANTERIOR EYE ORBIT PHOTOPHORE-1		LAT		LONG		DEPTH		GEAR		DAY		ACCESSORY HOOK CURPS-1	
SPECNO	SEX	MATUR	MALEN	COLL	STAT									MUS	CATNO
305	F	2	51	ORE	3250	29 14	N-N	87 40	-W	0	NMT	26	APR	1961	USNM
306	M	2	43	ORE	3250	29 14	N-N	87 40	-W	800	NMT	26	APR	1961	USNM

ABDOMINAL PHOTOPHORE-0		ANTERIOR EYE ORBIT PHOTOPHORE-9		LAT		LONG		DEPTH		GEAR		DAY		ACCESSORY HOOK CURPS-1	
SPECNO	SEX	MATUR	MALEN	COLL	STAT									MUS	CATNO
293	M	3	175	DEL	12-72	32 25	N-N	63 14	-W	760	ENT	23	AUG	1971	USNM

ABDOMINAL PHOTOPHORE-0		ANTERIOR EYE ORBIT PHOTOPHORE-9		LAT		LONG		DEPTH		GEAR		DAY		ACCESSORY HOOK CURPS-0	
SPECNO	SEX	MATUR	MALEN	COLL	STAT									MUS	CATNO
24	F	2	40	LNA	27-3	39 56	03N	61 06	37W	300	ENT	17	FEB	1982	NKC
218	M	3	120	WNE	494-7	7	T	0	T	0	ENT	17	APR	1971	USNM

Ocotopocathia sp

ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-9				EYESALL PHOTOPHORE-9				ACCESSORY HOOK CUPS-1			
SPECNO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
20	F	2	165	HNA	18-2	41 28 -N	42 21 -N	100	MUT	24	NOV	1979	MNC	92112	
226	F	2	148	MRE	486-7	7	7	0	ENT	24	NOV	1979	MNC	92112	
227	F	2	133	MRE	486-7	7	7	0	ENT	24	NOV	1979	MNC	92112	
232	F	2	78	MRE	402-2	7	7	0	ENT	24	MAR	1971	USNR	92112	
233	F	2	40	MRE	402-2	7	7	0	ENT	24	MAR	1971	USNR	92112	
248	F	2	183	MRE	402-2	7	7	0	ENT	24	MAR	1971	USNR	92112	
288	F	2	165	MNT	4442	39 46 -N	71 28 -N	1016	DTT	14	NOV	1979	USNR	002130504	

ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-0				EYESALL PHOTOPHORE-0				ACCESSORY HOOK CUPS-0			
SPECNO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MIN	YEAR	MUS	CATNO	
430	F	1	2.4	DAN	3748	11 11	-S	41 57	-E	500	5200	6 JAN	1920	ZNUC	
431	F	1	9.9	DAN	3910	5 28	-N	80 00	-E	600	NOV	1929	ZNUC	7	
432	F	1	10.7	DAN	3910	5 28	-N	80 00	-E	600	NOV	1929	ZNUC	7	
433	F	1	8.4	THD	44	49 17	-N	14 03	-M	300	JUN	1906	ZNUC	7	
434	F	1	15.7	THD	89	51 34	-N	11 50	-M	1200	JUN	1906	ZNUC	7	
435	F	1	19.8	THD	89	51 34	-N	11 50	-M	1200	JUN	1906	ZNUC	7	
436	F	1	13.0	THD	89	51 34	-N	11 50	-M	1200	JUN	1906	ZNUC	7	
437	F	1	7.2	DAN	1367	48 35	-N	12 03	-M	300	MAY	1904	ZNUC	7	
440	F	1	21.0	THD	199	39 22	-N	10 49	-E	0	AUG	1910	ZNUC	7	
441	F	1	7.7	THD	62	50 35	-M	12 41	-M	300	JUN	1904	ZNUC	7	
443	F	1	9.0	DAN	1292	17 43	-N	14 35	-E	300	JUN	1904	ZNUC	7	
445	F	1	9.0	DAN	1292	17 43	-N	14 35	-E	300	JUN	1904	ZNUC	7	
446	F	1	2.7	DAN	4124	37 24	-N	2 58	-E	150	APR	1922	ZNUC	7	
447	F	1	7.7	DAN	3918	56 48	-N	20 21	-M	1800	JUN	1938	ZNUC	7	
448	F	1	2.5	DAN	3759	23 40	-S	43 02	-E	100	JUN	1930	ZNUC	7	
449	F	1	2.5	DAN	3759	23 40	-S	43 02	-E	100	JUN	1930	ZNUC	7	
450	F	1	1.8	DAN	3759	23 40	-S	43 02	-E	100	JUN	1930	ZNUC	7	
451	F	1	1.7	DAN	3860	2 57	-S	99 34	-E	250	DEC	1929	ZNUC	7	
452	F	1	3.4	DAN	3860	2 57	-S	99 34	-E	250	DEC	1929	ZNUC	7	
453	F	1	1.4	DAN	3860	2 57	-S	99 34	-E	250	DEC	1929	ZNUC	7	
454	F	1	1.4	DAN	3860	2 57	-S	99 34	-E	250	DEC	1929	ZNUC	7	

-----ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-0				EYESALL PHOTOPHORE-0				ACCESSORY HOOK CUPS-1			
SPECNO	SEX	MATUR	MALEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MIN	YEAR	MUS	CATNO	
100	F	1	14.0	OCE	7975	8 58	-N	21 41	-M	140	NOV	1978	YAMU	40970	
342	F	1	17.0	ALB	1274	32 31	-N	63 41	-M	320	SEP	1969	YAMU	00727532	
426	F	1	12.5	DAN	1245	19 35	-N	73 27	-M	600	FEB	1922	ZNUC	7	

Octopoteuthis sp

ABNORMAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-0				EYEBALL PHOTOPHORE-0				ACCESSORY HOOK CUSPS-0				
SPECNO	SEX	MATUR	HANLEN	COLL	STAT	LAT.	LONG.	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO		
40	F	1	14.8	SPR	20	35 01	-S	152 47	-E	23	NOV	1979	NUV	F51078		
41	F	1	16.3	SPR	20	35 01	-S	152 47	-E	23	NOV	1979	NUV	F51078		
51	F	1	15.5	F	7	38 11	-E	134 34	-E	0			ZUB	2990		
52	F	1	18.1	F	7	38 11	-E	134 34	-E	0			ZUB	2990		
55	F	1	18.1	APP	7	38 11	-E	134 34	-E	0			ZUB	2990		
55	F	1	3.8	MSA	53	34 59	-N	33 01	-N	200	JUN	1916	ZUB	1458A		
73	F	1	10.3	DCE	103-1	24 45	-N	79 44	-N	150	AUG	1978	TANU	7		
74	F	1	8.8	DCE	103-1	24 45	-N	79 44	-N	150	AUG	1978	TANU	7		
81	F	1	9.0	KNO	24-4	34 13	-N	71 25	-N	1200	FEB	1981	TANU	7		
87	F	1	13.4	DCE	90-1	29 56	-N	80 05	-N	390	AUG	1978	TANU	7		
88	F	1	22.0	KNO	34-4	34 37	-N	66 41	-N	0	NOC	24	APR	1977	TANU	7
89	F	1	8.0	KNO	34-4	34 37	-N	66 41	-N	0	NOC	24	APR	1977	TANU	7
91	F	1	9.2	KNO	34-4	34 37	-N	66 41	-N	0	NOC	24	APR	1977	TANU	7
92	F	1	6.1	KNO	34-4	34 37	-N	66 41	-N	0	NOC	24	APR	1977	TANU	7
93	F	1	3.2	KNO	34-4	34 37	-N	66 41	-N	0	NOC	24	APR	1977	TANU	7
94	F	1	5.3	KNO	34-4	34 37	-N	66 41	-N	0	NOC	24	APR	1977	TANU	7
98	F	1	4.7	KNO	35-4	34 35	-N	66 41	-N	0	NOC	24	APR	1977	TANU	7
101	F	1	10.0	DCE	7880	2 30	-N	19 22	-N	1000	AUG	1978	TANU	7		
102	F	1	17.0	DCE	104-0	24 42	-N	79 31	-N	350	NOC	8	AUG	1978	TANU	7
104	F	1	8.4	DCE	136-0	30 08	-N	79 40	-N	1050	NOC	12	AUG	1978	TANU	7
105	F	1	5.8	DCE	113-3	34 22	-N	75 41	-N	1050	NOC	12	AUG	1978	TANU	7
111	F	1	10.1	ATL	1019	25 13	-N	86 13	-N	700	NET	23	JUL	1969	TANU	7
112	F	1	6.3	ALA	10-19	22 51	-N	86 13	-N	400	NET	23	JUL	1969	TANU	7
113	F	1	4.3	ALA	10-19	22 51	-N	86 13	-N	400	NET	23	JUL	1969	TANU	7
113	F	1	11.2	DSF	02680	35 30	-S	18 52	-E	111	SONG	22	DEC	1977	SAN	4-262
179	F	1	14.0	F	347	7	19	37	-N	730	TKT	29	APR	1968	SAN	5447
249	F	1	14.0	SAN	4-178	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
253	F	1	4.0	DIS	7	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
254	F	1	4.0	DIS	7	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
254	F	1	20.0	SAN	6-178	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
257	F	1	19.0	TRI	2-4	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
259	F	1	9.0	SAN	4-7-8	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
260	F	1	10.0	SAN	7-30N	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
261	F	1	6.0	DIS	8281	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
264	F	1	3.0	DIS	8281	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
264	F	1	14.0	DIS	8281	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
265	F	1	15.0	DIS	81-28	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
268	F	1	17.0	DIS	81-28	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
287	F	1	6.0	DIS	81-16	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
303	F	1	7.0	SAN	4-7-8	31 37	30N	43 58	48U	140	RHT	20	MAR	1973	USNM	00724517
309	F	1	10.0	WES	7	30	-N	120	-N	155	TKT	25	AUG	1972	USNM	00724517
310	F	1	10.0	SAN	6-14A	32 20	-N	43 51	-N	35	TKT	28	APR	1964	USNM	00726874
311	F	1	9.0	SAN	6-14A	32 20	-N	43 51	-N	35	TKT	28	APR	1964	USNM	00726874

Octopoteuthis sp

SPECIES	SEX	MATURE	MANLEN	PHOTOPHORE-O	ANTERIOR EYE	ORBIT	PHOTOPHORE-O	EXTERNAL	PHOTOPHORE-O	DEPTH	GEAR	DAY	MOON	YEAR	MUS	CATNO
312	7	1	11.0	SAN	6-14A	32 20	N	43 51	N	55	IKOT	28	APR	1964	USNH	00724974
313	7	1	7.0	SAN	9-11B	32 03	N	44 05	N	410	IKOT	19	APR	1970	USNH	00724968
314	7	1	8.0	SAN	13-21	32 26	N	44 12	N	243	IKOT	3	SEP	1973	USNH	00724980
315	7	1	8.0	SAN	13-21	32 26	N	44 12	N	243	IKOT	3	SEP	1973	USNH	00724980
316	7	1	7.0	SAN	9-16A	31 45	N	43 34	N	250	IKOT	19	MAR	1970	USNH	00724969
317	7	1	9.0	SAN	12-36	32 22	N	44 11	N	222	IKOT	8	SEP	1971	USNH	00724931
318	7	1	9.0	SAN	13-21	31 41	N	43 41	N	462	IKOT	7	APR	1969	USNH	00728054
319	7	1	7.0	SAN	6-14C	32 18	N	43 50	N	140	IKOT	28	APR	1969	USNH	00724970
320	7	1	7.0	SAN	6-14C	32 18	N	43 50	N	140	IKOT	28	APR	1969	USNH	00724970
321	7	1	9.0	SAN	10-8A	32 03	N	44 25	N	90	IKOT	3	JUN	1970	USNH	00724960
322	7	1	10.0	SAN	6-12A	32 05	N	43 42	N	50	IKOT	27	APR	1969	USNH	00724961
323	7	1	10.0	SAN	6-26A	32 20	N	43 53	N	56	IKOT	28	APR	1969	USNH	00724972
324	7	1	10.0	SAN	13-0	32 20	N	43 51	N	94	IKOT	28	APR	1969	USNH	00724977
325	7	1	10.0	SAN	6-14B	32 20	N	43 51	N	58	IKOT	38	APR	1969	USNH	00724977
326	7	1	8.0	SAN	6-14B	32 20	N	43 51	N	260	IKOT	30	APR	1969	USNH	00724977
327	7	1	9.0	SAN	6-26A	32 18	N	43 35	N	260	IKOT	30	APR	1969	USNH	00724977
328	7	1	8.0	SAN	13-14	31 51	N	43 47	N	208	IKOT	24	FEB	1972	USNH	00728024
329	7	1	8.0	SAN	13-14	31 51	N	43 47	N	208	IKOT	24	FEB	1972	USNH	00728024
330	7	1	10.0	SAN	9-22B	32 17	N	43 36	N	90	IKOT	23	MAR	1970	USNH	00724978
331	7	1	10.0	SAN	9-24B	31 53	N	43 35	N	0	IKOT	22	MAY	1970	USNH	00724972
332	7	1	7.0	SAN	8-13P	32 13	N	43 44	N	175	IKOT	28	APR	1969	USNH	00724979
333	7	1	7.0	D15	81-20	31 47	42N	43 37	18M	25	ENT	14	MAR	1973	USNH	00724976
335	7	1	8.0	SAN	6-13P	32 13	N	43 44	N	175	IKOT	28	APR	1969	USNH	00724979
336	7	1	6.0	SAN	6-13P	32 13	N	43 44	N	175	IKOT	28	APR	1969	USNH	00724979
337	7	1	3.0	SAN	6-13P	31 57	N	43 37	N	1800	IKOT	27	APR	1969	USNH	00724979
338	7	1	27.0	SAN	6-13P	31 57	N	43 37	N	1800	IKOT	27	APR	1969	USNH	00724979
339	7	1	19.0	WES	7	30	N	130	N	250	ENT	5	AUG	1972	USNH	00728014
340	7	1	9.0	BEL	37-3	41 44	N	57 38	N	200	ENT	5	APR	1979	INF9	00729911
341	7	1	9.0	THO	74	49 23	N	12 13	N	260	7330	10	JUN	1966	ZHUC	00728024
342	7	1	6.0	DAN	29A2	24 33	S	38 26	E	190	5200	14	JAN	1930	ZHUC	00728024
404	7	1	15.0	THO	80	51 34	N	11 50	N	1200	7	16	JUN	1966	ZHUC	00728024
406	7	1	14.5	THO	80	51 34	N	11 50	N	1200	7	16	JUN	1966	ZHUC	00728024
407	7	1	20.1	DAN	3202	47 34	N	38 39	N	150	5200	30	MAY	1930	ZHUC	00728024
408	7	1	4.0	DAN	4119	40 13	N	12 06	E	460	5200	30	MAY	1930	ZHUC	00728024
410	7	1	4.0	DAN	4119	40 13	N	12 06	E	460	5200	30	MAY	1930	ZHUC	00728024
411	7	1	11.4	DAN	3487	7 14	N	115 23	N	300	5200	9	APR	1929	ZHUC	00728024
413	7	1	5.9	DAN	3915	4 4	N	12 08	E	300	5200	30	APR	1929	ZHUC	00728024
414	7	1	6.3	DAN	3544	25 19	S	34 13	E	450	5200	19	JAN	1930	ZHUC	00728024
415	7	1	2.7	DAN	3520	1 12	S	43 19	E	160	5200	9	DEC	1929	ZHUC	00728024
416	7	1	9.5	DAN	3924	5 01	S	54 46	E	1000	5300	14	DEC	1929	ZHUC	00728024
417	7	1	9.5	DAN	3924	5 01	S	54 46	E	1000	5300	14	DEC	1929	ZHUC	00728024
418	7	1	10.8	DAN	3539	11 35	S	49 45	E	300	5200	20	DEC	1929	ZHUC	00728024
420	7	1	1.9	DAN	846	28 32	N	56 38	N	50	5200	2	DEC	1929	ZHUC	00728024
422	7	1	1.4	DAN	3897	9 24	N	118 35	30E	350	5200	14	AUG	1929	ZHUC	00728024
423	7	1	7.3	DAN	3968	4 28	N	82 13	E	460	5200	32	NOV	1929	ZHUC	00728024
425	7	1	2.2	DAN	4124	37 24	N	2 58	E	250	5200	3	JUN	1930	ZHUC	00728024
427	7	1	7.2	DAN	3948	11 11	S	41 57	E	500	5200	4	JUN	1930	ZHUC	00728024
428	7	1	6.1	DAN	3948	11 11	S	41 57	E	500	5200	4	JUN	1930	ZHUC	00728024
429	7	1	6.1	DAN	3948	11 11	S	41 57	E	500	5200	4	JUN	1930	ZHUC	00728024

Octopoteuthis sp.

-----ABDOMINAL PHOTOPHONE-2				ANTERIOR EYE ORBIT PHOTOPHONE-0				EYEBALL PHOTOPHONE-0				ACCESSORY HOOK CURPS-0			
SPECNO	SEX	MATUR	MANEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
72	F	1	15.5	OCE	113-3	34 22	N 75 41	M 1050	MOC	12	AUG	1978	TARU		
77	F	1	19.0	KNO	9	39 42	N 67 23	M 790	IKRT	29	AUG	1975	TARU		
113	F	1	17.0	ATL	2730	11 00	N 41 31	M 475	IKRT	18	SEP	1973	TARU		
412	F	1	9.2	DM	3756	21 13	E 42 31	M 500	2200	10	JAN	1950	ENOC		

-----ABDOMINAL PHOTOPHONE-2				ANTERIOR EYE ORBIT PHOTOPHONE-0				EYEBALL PHOTOPHONE-0				ACCESSORY HOOK CURPS-1			
SPECNO	SEX	MATUR	MANEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO	
343	F	1	16	D15	81-10	31 51	24N 43 49	18W 800	RRT	14	MAR	1973	USNM	-00729504	
346	M	1	26	D15	81-53	32 12	24N 64 17	18W 205	RRT	26	MAR	1973	USNM	-00730038	

APPENDIX 2

The following appendix includes the specimen morphometric and meristic data for each species listed. In the case of the measurements all 0.0 are missing data (except those in larval ie. < 25 mm ML specimens). The abdominal photophore (abdphot) column the numbers used equal the number of photophores present 2 or 1 (or 0 in larvae). In the other meristics (anteye, eyebal, and hook) 9 = missing data, 0 = absent, and 1 = present. See materials and methods chapter for definition of abbreviations.

Octopoteuthis sicula

-----ABDOMINAL PHOTOPHORE-2-----			ANTERIOR EYE ORBIT PHOTOPHORE-0			EYEBALL PHOTOPHORE-0			ACCESSORY HOOK CUSPS-1		
SPECNO	MMANID	FINLEN	FINWID	HOLEN	HNWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN
341	0.0	178.0	178.0	0.0	0.0	24.0	0.0	0.0	0	0	0.0
342	0.0	42.0	42.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
343	0.0	27.0	27.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
344	0.0	34.0	34.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
351	0.0	29.0	40.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
352	0.0	29.0	40.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
353	0.0	54.0	82.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
354	0.0	54.0	82.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
361	0.0	85.0	112.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
362	0.0	89.0	113.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
363	0.0	37.0	34.0	0.0	0.0	8.0	0.0	0.0	0	0	0.0
364	0.0	37.0	34.0	0.0	0.0	8.0	0.0	0.0	0	0	0.0
365	0.0	90.0	128.0	0.0	0.0	22.0	0.0	0.0	0	0	0.0
366	0.0	43.0	59.0	0.0	0.0	11.0	0.0	0.0	0	0	0.0
372	0.0	31.0	17.0	0.0	0.0	20.0	0.0	0.0	0	0	0.0
373	0.0	92.0	127.0	0.0	0.0	20.0	0.0	0.0	0	0	0.0
374	0.0	84.0	112.0	0.0	0.0	23.0	0.0	0.0	0	0	0.0
377	0.0	80.0	108.0	0.0	0.0	13.0	0.0	0.0	0	0	0.0
389	23.2	95.0	130.0	27.2	24.8	17.0	17.8	4.3	0	0	0.0
425	4.2	111.0	141.0	22.2	21.2	21.0	21.0	2.1	0	0	0.0
456	13.0	21.7	35.0	22.9	22.0	2.9	6.5	2.1	0	0	53.0

Octopoteuthis sicula ??

-----ABDOMINAL PHOTOPHORE-2-----			ANTERIOR EYE ORBIT PHOTOPHORE-0			EYEBALL PHOTOPHORE-0			ACCESSORY HOOK CUSPS-1		
SPECNO	MMANID	FINLEN	FINWID	HOLEN	HNWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN
42	65	170	230	73.5	40	44	35.5	0	0	0	0
244	0	130	145	3.0	0	21	0.0	0	0	0	0

Octopoteuthis megaptera

-----ABDOMINAL PHOTOPHORE-2-----			ANTERIOR EYE ORBIT PHOTOPHORE-1			EYEBALL PHOTOPHORE-1			ACCESSORY HOOK CUSPS-1		
SPECNO	MMANID	FINLEN	FINWID	HOLEN	HNWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN
5	20.0	38.0	51.0	23.0	21.0	14.0	13.5	5.0	0	0	157.0
7	14.0	40.0	67.0	22.0	18.5	11.0	13.5	4.5	0	0	0.0
25	11.3	26.0	45.0	15.2	11.7	6.0	7.7	3.1	0	0	0.0
38	16.0	35.0	54.0	23.5	16.0	6.0	14.0	4.2	0	0	0.0
39	12.2	31.0	52.0	19.7	12.1	7.0	8.1	0.0	0	0	0.0
43	13.0	38.0	43.0	11.7	14.4	6.0	8.8	3.0	0	0	0.0
44	12.5	30.0	45.0	14.0	14.0	6.0	8.5	2.1	0	0	0.0

ANTERIOR EYE ORBIT PHOTOGRAPH-1	ETREAL PHOTOGRAPH-1	EFFEIAN	LENDIAN	ATTEHT	LETENT	TOILET
45	14.0	32.0	44.0	12.0	15.0	7.0
46	23.0	37.0	75.0	25.0	35.0	17.0
47	25.0	38.0	45.0	25.0	35.0	17.0
48	13.0	26.0	45.0	15.0	15.0	7.0
49	13.0	35.0	25.0	15.0	15.0	7.0
50	13.0	35.0	25.0	15.0	15.0	7.0
51	20.0	45.0	45.0	25.0	35.0	17.0
52	20.0	45.0	45.0	25.0	35.0	17.0
53	20.0	45.0	45.0	25.0	35.0	17.0
54	20.0	45.0	45.0	25.0	35.0	17.0
55	20.0	45.0	45.0	25.0	35.0	17.0
56	20.0	45.0	45.0	25.0	35.0	17.0
57	20.0	45.0	45.0	25.0	35.0	17.0
58	20.0	45.0	45.0	25.0	35.0	17.0
59	20.0	45.0	45.0	25.0	35.0	17.0
60	20.0	45.0	45.0	25.0	35.0	17.0
61	20.0	45.0	45.0	25.0	35.0	17.0
62	20.0	45.0	45.0	25.0	35.0	17.0
63	20.0	45.0	45.0	25.0	35.0	17.0
64	20.0	45.0	45.0	25.0	35.0	17.0
65	20.0	45.0	45.0	25.0	35.0	17.0
66	20.0	45.0	45.0	25.0	35.0	17.0
67	20.0	45.0	45.0	25.0	35.0	17.0
68	20.0	45.0	45.0	25.0	35.0	17.0
69	20.0	45.0	45.0	25.0	35.0	17.0
70	20.0	45.0	45.0	25.0	35.0	17.0
71	20.0	45.0	45.0	25.0	35.0	17.0
72	20.0	45.0	45.0	25.0	35.0	17.0
73	20.0	45.0	45.0	25.0	35.0	17.0
74	20.0	45.0	45.0	25.0	35.0	17.0
75	20.0	45.0	45.0	25.0	35.0	17.0
76	20.0	45.0	45.0	25.0	35.0	17.0
77	20.0	45.0	45.0	25.0	35.0	17.0
78	20.0	45.0	45.0	25.0	35.0	17.0
79	20.0	45.0	45.0	25.0	35.0	17.0
80	20.0	45.0	45.0	25.0	35.0	17.0
81	20.0	45.0	45.0	25.0	35.0	17.0
82	20.0	45.0	45.0	25.0	35.0	17.0
83	20.0	45.0	45.0	25.0	35.0	17.0
84	20.0	45.0	45.0	25.0	35.0	17.0
85	20.0	45.0	45.0	25.0	35.0	17.0
86	20.0	45.0	45.0	25.0	35.0	17.0
87	20.0	45.0	45.0	25.0	35.0	17.0
88	20.0	45.0	45.0	25.0	35.0	17.0
89	20.0	45.0	45.0	25.0	35.0	17.0
90	20.0	45.0	45.0	25.0	35.0	17.0
91	20.0	45.0	45.0	25.0	35.0	17.0
92	20.0	45.0	45.0	25.0	35.0	17.0
93	20.0	45.0	45.0	25.0	35.0	17.0
94	20.0	45.0	45.0	25.0	35.0	17.0
95	20.0	45.0	45.0	25.0	35.0	17.0
96	20.0	45.0	45.0	25.0	35.0	17.0
97	20.0	45.0	45.0	25.0	35.0	17.0
98	20.0	45.0	45.0	25.0	35.0	17.0
99	20.0	45.0	45.0	25.0	35.0	17.0
100	20.0	45.0	45.0	25.0	35.0	17.0

Octopoteuthis sp. A

STPCQ	MANU	FINEN	FINUN	FINEN	HOWD	TAILLEN	EYEDIAN	LEUSDIAN	RTTENT	LTFTENT	TOTLEN
78.5	57		14.0	9.8	7.3	2.3				0.0	
42	32.0	55	18.6	27.0	21.5	4.7	27.0	4.5	0	0	23.0
44	20.0	55							0		
49	28.5	60	99	40.8	30.0	24	27.8	10.0	0	0	
243	17.2	47	70	28.5	16.5	14	15.5		0	0	
200	39.8	113	125	51.9	31.0	28	26.0	7.8	0	0	0.0
205	3.0	45	89	16.0	10.0	13	10.0	0.0	0	0	
235	0.0	45	89	16.0	10.0	13	10.0	0.0	0	0	
264	0.0	52	68	0.0	0.0	10	0.0	0.0	0	0	0.0
277	0.0	58	74	0.0	0.0	14	0.0	0.0	0	0	0.0
290	0.0	80	104	0.0	0.0	17	0.0	0.0	0	0	0.0
305	0.0	80	104	0.0	0.0	17	0.0	0.0	0	0	0.0
327	0.0	180	102	0.0	0.0	27	0.0	0.0	0	0	0.0

Octopoteuthis sp. A ??

-----ANTONIMAL PHOTOPHORE=1									
ANTERIOR EYE ORBIT PHOTOPHORE=4									
EYEBALL PHOTOPHORE=6* ACCESSORY NODUS GUSP=0									
TOTAL									
	FIMINJ	HOLEN	NOMID	TRAILLEN	EYEDIAM	LENSDIAM	RITENT	LFTENT	
MAMMID	0	161	0	0	24	0	0	0	0
SPECKO	0	127	0	0	0	0	0	0	0
294	0	181	0	0	0	0	0	0	0
276	0	181	0	0	20	0	0	0	0
276	0	181	0	0	0	0	0	0	0

Octopoteuthis sp

ABDOMINAL PHOTOGRAPH-0	ANTERIOR EYE ORBIT PHOTOGRAPH-0	EVERALL PHOTOGRAPH-0	ACCESSORY NOOK CUPS-0	TOILEN							
SPECNO	RAMMID	FIMLEN	FIMIND	HOLEN	HOMID	TAILLEN	ETEDIAN	LENSDIAN	RITENT	LFTENT	TOILEN
53	0-0	39-2	43-0	0-0	0-0	0-0	0-0	1-0	0-0	0-0	0-0
54	0-0	29-4	45-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
55	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
56	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
57	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
58	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
59	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
60	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
61	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
62	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
63	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
64	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
65	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
66	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
67	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
68	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
69	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
70	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
71	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
72	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
73	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
74	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
75	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
76	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
77	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
78	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
79	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
80	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
81	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
82	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
83	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
84	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
85	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
86	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
87	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
88	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
89	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
90	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
91	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
92	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
93	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
94	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
95	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
96	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
97	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
98	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
99	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0
100	0-0	35-4	43-4	0-0	10-3	8-9	0-0	4-6	0-0	0-0	49-0

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-----ABDOMINAL PHOTOPHORE-2-----									
SPECHO	MANIID	FINLEN	FINIID	HOLEN	HOWID	TAILLEN	ETEDIAN	LENSDIAM	TOTLEN
242	0	38	40	21	0	13	13.8	4.8	115
-----ABDOMINAL PHOTOPHORE-2-----									
ANTERIOR EYE ORBIT PHOTOPHORE-9									
SPECHO	MANIID	FINLEN	FINIID	HOLEN	HOWID	TAILLEN	ETEDIAN	LENSDIAM	TOTLEN
27	14	38	37	19.5	0.0	7	30.0	0.0	0.0
126	49	103	144	53.4	55.2	27	32.7	14.3	280.4
153	19	31	74	25.7	21.0	7	14.0	4.8	0.0
176	0	39	105	0.0	0.0	18	0.0	0.0	0.0
210	0	31	85	0.0	0.0	8	0.0	0.0	0.0
216	0	50	111	0.0	0.0	0	0.0	0.0	0.0
214	0	40	48	0.0	0.0	0	0.0	0.0	0.0
279	0	54	84	0.0	0.0	14	0.0	0.0	0.0
-----ABDOMINAL PHOTOPHORE-2-----									
ANTERIOR EYE ORBIT PHOTOPHORE-9									
SPECHO	MANIID	FINLEN	FINIID	HOLEN	HOWID	TAILLEN	ETEDIAN	LENSDIAM	TOTLEN
21	28	40.0	84	0.0	0.0	14.0	0	0.0	0.0
123	40	145.0	190	77.2	54.5	40.0	31	0.5	483.2
125	0	84.5	119	39.2	43.0	15.4	27	0.0	0.0
226	0	111.0	142	0.0	0.0	25.0	0	0.0	0.0
229	0	123.0	163	0.0	0.0	25.0	0	0.0	0.0
-----ABDOMINAL PHOTOPHORE-1-----									
ANTERIOR EYE ORBIT PHOTOPHORE-1									
SPECHO	MANIID	FINLEN	FINIID	HOLEN	HOWID	TAILLEN	ETEDIAN	LENSDIAM	TOTLEN
292	0	26	44	0	0	3	0	0	0
-----ABDOMINAL PHOTOPHORE-2-----									
ANTERIOR EYE ORBIT PHOTOPHORE-1									
SPECHO	MANIID	FINLEN	FINIID	HOLEN	HOWID	TAILLEN	ETEDIAN	LENSDIAM	TOTLEN
3	20.5	33	77	27.5	22.0	14	15.3	5.4	0
189	0.0	82	90	0.0	0.0	17	0.0	0.0	140.5
227	0.0	27	45	0.0	0.0	9	0.0	0.0	0.0
402	11.0	26	41	12.8	11.7	2	0.0	2.5	71.8

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ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-0				EYEBALL PHOTOPHORE-0				ACCESSORY HOOK CUSPS-1			
SPECNO	MANWID	FINLEN	FINWID	FINWID	HOLEN	HWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN			
75	11	23.0	35.6	11.1	10.1	4	4.5	1.7	0	0	0	64.9			
92	6	14.5	25.1	9.5	7.1	2	4.6	1.2	0	0	0	41.5			
182	0	21.0	33.0	0.0	0.0	0	0.0	0.0	0	0	0	0.0			
279	0	23.0	34.0	0.0	0.0	0	0.0	0.0	0	0	0	0.0			
374	0	90.0	120.0	0.0	0.0	19	0.0	0.0	0	0	0	0.0			
386	27	73.0	94.0	32.0	29.0	10	20.6	7.5	0	0	0	0.0			

ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-0				EYEBALL PHOTOPHORE-1				ACCESSORY HOOK CUSPS-0			
SPECNO	MANWID	FINLEN	FINWID	HOLEN	HWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN				
156	14	24	40	15.3	14.7	8.4	3.5	2	0	0	0	0			

ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-1				EYEBALL PHOTOPHORE-0				ACCESSORY HOOK CUSPS-0			
SPECNO	MANWID	FINLEN	FINWID	HOLEN	HWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN				
299	0	125	155	0	0	0	0	0	0	0	0	0			

ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-1				EYEBALL PHOTOPHORE-0				ACCESSORY HOOK CUSPS-1			
SPECNO	MANWID	FINLEN	FINWID	HOLEN	HWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN				
305	0	36	54	0	0	10	0	0	0	0	0	0			
306	0	32	57	0	1.0	7	0	0	0	0	0	0			

ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-9				EYEBALL PHOTOPHORE-0				ACCESSORY HOOK CUSPS-1			
SPECNO	MANWID	FINLEN	FINWID	HOLEN	HWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN				
293	0	140	182	0	0	26	0	0	0	0	0	0			

ABDOMINAL PHOTOPHORE-0				ANTERIOR EYE ORBIT PHOTOPHORE-9				EYEBALL PHOTOPHORE-9				ACCESSORY HOOK CUSPS-0			
SPECNO	MANWID	FINLEN	FINWID	HOLEN	HWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN				
26	15	43	67	23	15	12	16	0.0	0	0	0	0			
210	0	92	135	0	0	24	0.0	0.0	0	0	0	0			

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-----ABDOMINAL PHOTOPHORE-0 ANTERIOR EYE ORBIT PHOTOPHORE-9 EVERALL PHOTOPHORE-2 ACCESSORY HOOK CUSPS-1-----

SPECNO	MMWID	FINLEN	FINWID	HULEN	HULWID	TAILLEN	EYEDIAM	LENSDIAM	RTENT	LTENT	TOTLEN
20	35	137	184	52.2	37.8	30	24.5	0	0	0	0
226	0	115	143	0.0	0.0	18	0.0	0	0	0	0
227	0	46	58	0.0	0.0	0	0.0	0	0	0	0
232	0	42	50	0.0	0.0	7	0.0	0	0	0	0
235	31	130	162	0.0	0.0	34	0.0	0	0	0	0
248	0	138	172	0.0	0.0	34	0.0	0	0	0	0
288	0	140	163	0.0	0.0	25	0.0	0	0	0	0

-----ABDOMINAL PHOTOPHORE-0 ANTERIOR EYE ORBIT PHOTOPHORE-0 EVERALL PHOTOPHORE-0 ACCESSORY HOOK CUSPS-0-----

SPECNO	MMWID	FINLEN	FINWID	HULEN	HULWID	TAILLEN	EYEDIAM	RTENT	LTENT	TOTLEN
420	1.2	4.1	0.0	0.0	2.3	0.0	0.7	1.5	1.5	5.9
431	4.1	7.0	0.0	5.3	4.9	0.0	1.7	0.0	0.0	0.0
432	4.3	7.0	12.5	4.8	4.0	0.0	1.6	0.0	0.0	0.0
433	4.3	7.0	12.5	4.8	4.0	0.0	1.6	0.0	0.0	0.0
434	5.5	5.8	10.0	4.0	5.4	0.0	1.8	0.0	5.5	18.3
435	3.5	2.2	5.4	2.4	3.3	9.0	1.0	0.0	3.0	10.5
436	8.0	12.0	17.0	7.9	7.8	1.2	4.0	0.0	0.0	48.3
437	5.3	2.2	5.4	2.4	3.3	9.0	1.0	0.0	3.0	10.5
438	5.3	2.2	5.4	2.4	3.3	9.0	1.0	0.0	3.0	10.5
439	3.0	2.7	8.0	5.0	7.1	0.0	3.2	0.0	4.0	32.5
440	3.6	5.4	11.0	4.0	4.3	0.0	1.0	0.0	4.1	12.1
441	1.1	2.0	7.8	15.5	4.8	0.0	1.3	3.1	3.1	34.3
442	1.1	2.0	7.8	15.5	4.8	0.0	1.3	3.1	3.1	34.3
443	4.5	3.5	7.7	2.6	2.8	0.0	1.7	4.8	0.0	13.4
444	2.6	3.5	7.7	2.6	2.8	0.0	1.7	4.8	0.0	13.4
445	2.6	3.5	7.7	2.6	2.8	0.0	1.7	4.8	0.0	13.4
446	1.4	0.0	0.0	1.3	1.2	0.0	0.3	0.8	0.8	0.0
447	3.1	4.5	8.8	3.3	3.6	0.0	1.5	0.0	0.0	0.0
448	2.8	1.2	2.4	1.8	2.8	0.0	1.0	4.2	4.0	4.0
449	1.4	0.0	0.0	1.0	2.1	0.0	0.2	2.3	2.3	5.8
450	0.0	0.0	0.0	0.0	0.9	0.0	0.3	1.0	1.9	3.6
451	0.0	0.0	0.0	0.0	1.1	0.0	0.3	1.0	1.9	3.6
452	0.0	0.0	0.0	0.0	0.7	1.0	0.0	0.3	0.0	0.0
453	0.0	0.0	0.0	0.0	1.4	1.5	0.0	2.0	2.0	5.8
454	0.0	0.0	0.0	1.0	1.3	0.0	0.3	1.5	1.5	3.9

-----ABDOMINAL PHOTOPHORE-0 ANTERIOR EYE ORBIT PHOTOPHORE-0 EVERALL PHOTOPHORE-0 ACCESSORY HOOK CUSPS-1-----

SPECNO	MMWID	FINLEN	FINWID	HULEN	HULWID	TAILLEN	EYEDIAM	RTENT	LTENT	TOTLEN
100	4.2	10.0	12.2	6.0	5.6	2.2	2.2	0.0	0	0
134	0.0	4.6	9.2	4.2	4.0	2.3	2.3	0	0	0
210	2.2	10.0	12.2	6.0	5.6	2.2	2.2	0	0	0
426	5.3	10.0	18.8	6.2	6.3	2.1	2.1	0	0	0

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ABDOMINAL PHOTOPHORE-2		ANTERIOR EYE ORBIT PHOTOPHORE-0		EYEBALL PHOTOPHORE-0		ACCESSORY HOOD CUSPS-0			
SPECNO	MM/ID	FINLEN	FIN/ID	HOLEN	HOWID	TAILLEN	EYEDIAM	RTTENT	LFTTENT
72	5.8	11.9	21.7	4.8	4.4	0	2.7	0	0
112	5.3	13.2	19.8	4.1	4.9	0	3.0	0	0
412	4.2	7.6	13.5	4.0	5.3	0	1.7	0	0

ABDOMINAL PHOTOPHORE-2		ANTERIOR EYE ORBIT PHOTOPHORE-0		EYEBALL PHOTOPHORE-0		ACCESSORY HOOD CUSPS-1			
SPECNO	MM/ID	FINLEN	FIN/ID	HOLEN	HOWID	TAILLEN	EYEDIAM	RTTENT	LFTENT
344	0	13	23	0	0	1	0	0	0
346	0	21	34	0	0	3	0	0	0



