

Revision of  
*Onuphis*, *Nothria*, and *Paradiopatra*  
(Polychaeta: Onuphidae)  
Based upon Type Material

KRISTIAN FAUCHALD

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## ABSTRACT

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# Contents

	<i>Page</i>
Introduction .....	1
Acknowledgments .....	2
Brief Historical Review .....	2
Notes on Some Morphological Features .....	3
The <i>Onuphis-Nothria-Paradiopatra</i> Complex .....	7
Key to the Genera of the Complex .....	10
<i>Kinbergonuphis</i> , new genus .....	10
Key to the Species of <i>Kinbergonuphis</i> .....	11
<i>Kinbergonuphis tenuis</i> (Hansen, 1882), new combination .....	13
<i>Kinbergonuphis abyssalis</i> (Fauchald, 1968), new combination .....	14
<i>Kinbergonuphis arctica</i> (Annenkova, 1946), new combination .....	15
<i>Kinbergonuphis atlantisa</i> (Hartman, 1965), new combination .....	16
<i>Kinbergonuphis cedroensis</i> (Fauchald, 1968), new combination .....	16
<i>Kinbergonuphis difficilis</i> (Fauchald, 1982), new combination .....	18
<i>Kinbergonuphis dorsalis</i> (Ehlers, 1897), new combination .....	18
<i>Kinbergonuphis fragilis</i> (Kinberg, 1865), new combination .....	19
<i>Kinbergonuphis geminata</i> (Fauchald, 1980), new combination .....	20
<i>Kinbergonuphis gorgonensis</i> (Monroe, 1933), new combination .....	21
<i>Kinbergonuphis heterouncinata</i> (Hartmann-Schröder, 1965), new combination .....	21
<i>Kinbergonuphis investigatoris</i> (Fauvel, 1932), new combination .....	22
<i>Kinbergonuphis jenneri</i> (Gardiner, 1976), new combination .....	22
<i>Kinbergonuphis lineata</i> (Fauchald, 1980), new combination .....	23
<i>Kinbergonuphis microcephala</i> (Hartman, 1944), new combination .....	24
<i>Kinbergonuphis mixta</i> (Fauchald and Hancock, 1981), new combination .....	24
<i>Kinbergonuphis multidentata</i> (Hartmann-Schröder, 1960), new combination .....	25
<i>Kinbergonuphis nannognathus</i> (Chamberlin, 1919), new combination .....	25
<i>Kinbergonuphis notialis</i> (Monro, 1930), new combination .....	26
<i>Kinbergonuphis oligobranchiata</i> (Orensanz, 1974), new combination .....	26
<i>Kinbergonuphis orensanzi</i> (Fauchald, 1982), new combination .....	27
<i>Kinbergonuphis paradiopatra</i> (Hartman, 1944), new status, new combination .....	28
<i>Kinbergonuphis pigmentata</i> (Fauchald, 1968), new combination .....	28
<i>Kinbergonuphis proalopus</i> (Chamberlin, 1919), new combination .....	29
<i>Kinbergonuphis pseudodibranchiata</i> (Gallardo, 1968), new combination .....	31
<i>Kinbergonuphis pulchra</i> (Fauchald, 1980), new combination .....	31
<i>Kinbergonuphis pygidialis</i> (Fauchald, 1968), new combination .....	31



<i>Kinbergonuphis rubescens</i> (Augener, 1906), new combination .....	32
<i>Kinbergonuphis simoni</i> (Santos, Day, and Rice, 1981), new combination .....	32
<i>Kinbergonuphis taeniata</i> (Paxton, 1979), new combination .....	34
<i>Kinbergonuphis tenuisetis</i> (McIntosh, 1885), new combination .....	35
<i>Kinbergonuphis vermillionensis</i> (Fauchald, 1968), new combination ..	35
<i>Kinbergonuphis virgata</i> (Fauchald, 1980), new combination .....	36
<i>Onuphis</i> Audouin and Milne Edwards, 1833, emended .....	36
Key to the Species of <i>Onuphis</i> .....	37
<i>Onuphis eremita</i> Audouin and Milne Edwards, 1833 .....	39
<i>Onuphis eremita oculata</i> Hartman, 1951 .....	40
<i>Onuphis eremita parva</i> Berkeley and Berkeley, 1941 .....	41
<i>Onuphis acapulcensis</i> Rioja, 1944 .....	41
<i>Onuphis aucklandensis</i> Augener, 1924 .....	42
<i>Onuphis basipicta</i> Willey, 1905 .....	43
<i>Onuphis branchiata</i> Treadwell, 1931 .....	44
<i>Onuphis chinensis</i> Uschakov and Wu, 1962 .....	44
<i>Onuphis dibranchiata</i> Willey, 1905 .....	44
<i>Onuphis elegans</i> (Johnson, 1901) .....	45
<i>Onuphis farallonensis</i> Hobson, 1971 .....	45
<i>Onuphis fukianensis</i> Uschakov and Wu, 1962 .....	47
<i>Onuphis geophiliformis</i> (Moore, 1903), new combination .....	47
<i>Onuphis holobranchiata</i> Marenzeller, 1879 .....	48
<i>Onuphis iridescens</i> (Johnson, 1901) .....	49
<i>Onuphis mexicana</i> (Fauchald, 1968), new combination .....	49
<i>Onuphis opalina</i> (Verrill, 1873) .....	50
<i>Onuphis pallida</i> (Moore, 1911), new combination .....	51
<i>Onuphis rullieriana</i> (Amoureux, 1977), new combination .....	51
<i>Onuphis shirikishinaiensis</i> (Imajima, 1960), new combination .....	53
<i>Onuphis similis</i> (Fauchald, 1968), new combination .....	53
<i>Onuphis vexillaria</i> Moore, 1911 .....	54
<i>Onuphis vibex</i> (Fauchald, 1972), new combination .....	55
<i>Mooreonuphis</i> , new genus .....	55
Key to the Species of <i>Mooreonuphis</i> .....	56
<i>Mooreonuphis nebulosa</i> (Moore, 1911), new combination .....	56
<i>Mooreonuphis cirrata</i> (Hartman, 1944), new combination .....	58
<i>Mooreonuphis dangrigae</i> (Fauchald, 1980), new combination .....	58
<i>Mooreonuphis guadalupensis</i> (Fauchald, 1968), new combination ....	59
<i>Mooreonuphis intermedia</i> (Kinberg, 1865), new combination .....	60
<i>Mooreonuphis litoralis</i> (Monro, 1933), new combination .....	60
<i>Mooreonuphis microbranchiata</i> (Fauchald, 1968), new combination ..	61
<i>Mooreonuphis pallidula</i> (Hartman, 1965), new combination .....	62
<i>Mooreonuphis peruana</i> (Hartman, 1944), new combination .....	62
<i>Mooreonuphis stigmatidis</i> (Treadwell, 1922), new combination .....	63
<i>Mooreonuphis veleronis</i> (Fauchald, 1980), new combination .....	63
<i>Sarsonuphis</i> , new genus .....	64
Key to the Species of <i>Sarsonuphis</i> .....	65

<i>Sarsonuphis quadricuspis</i> (M. Sars, 1872), new combination .....	66
<i>Sarsonuphis armandi</i> (McIntosh, 1885), new combination .....	68
<i>Sarsonuphis bihanica</i> (Intes and Le Loeuff, 1975), new combination .....	68
<i>Sarsonuphis ehlersi</i> (McIntosh, 1885), new combination .....	70
<i>Sarsonuphis fiordica</i> (Fauchald, 1974), new combination .....	70
<i>Sarsonuphis fragosa</i> (Ehlers, 1887), new combination .....	70
<i>Sarsonuphis furcatoseta</i> (Monro, 1937), new combination .....	72
<i>Sarsonuphis hartmanae</i> (Kirkegaard, 1980), new combination .....	73
<i>Sarsonuphis hispanica</i> (Amoureux, 1972), new combination .....	74
<i>Sarsonuphis iberica</i> (Hartmann-Schröder, 1975), new combination ..	74
<i>Sarsonuphis lepta</i> (Chamberlin, 1919), new combination .....	75
<i>Sarsonuphis litabanchia</i> (Chamberlin, 1919), new combination ....	75
<i>Sarsonuphis pachyctmema</i> (Chamberlin, 1919), new combination ....	75
<i>Sarsonuphis papillata</i> (Kucheruk, 1979), new combination .....	76
<i>Sarsonuphis parva</i> (Moore, 1911), new combination .....	76
<i>Sarsonuphis paucibranchis</i> (Ehlers, 1908), new combination .....	77
<i>Sarsonuphis pauli</i> (Annenkova, 1952), new combination .....	78
<i>Sarsonuphis socia</i> (Chamberlin, 1919), new combination .....	78
<i>Sarsonuphis striata</i> (Uschakov, 1950), new combination .....	78
<i>Sarsonuphis willemoesii</i> (McIntosh, 1885), new combination .....	79
<i>Paradiopatra</i> Ehlers, 1887, emended .....	79
Key to the Species of <i>Paradiopatra</i> .....	80
<i>Paradiopatra glutinatrix</i> Ehlers, 1887, new combination .....	81
<i>Paradiopatra abranchiata</i> (McIntosh, 1885), new combination .....	81
<i>Paradiopatra abyssia</i> (Kucheruk, 1978), new combination .....	83
<i>Paradiopatra africana</i> (Augener, 1918), new combination .....	83
<i>Paradiopatra cirrobranchiata</i> (Moore, 1903), new combination .....	83
<i>Paradiopatra cobra</i> (Chamberlin, 1919), new combination .....	84
<i>Paradiopatra crassisetosa</i> (Chamberlin, 1919), new combination ....	85
<i>Paradiopatra hiatidentata</i> (Moore, 1911), new combination .....	85
<i>Paradiopatra pourtalesii</i> (Ehlers, 1879) .....	86
<i>Paradiopatra pycnbranchiata</i> (McIntosh, 1885) .....	87
<i>Paradiopatra solenotecton</i> (Chamberlin, 1919), new combination ....	87
<i>Nothria</i> Malmgren, 1866, emended .....	88
Key to the Species of <i>Nothria</i> .....	89
<i>Nothria conchylega</i> (M. Sars, 1835) .....	89
<i>Nothria anoculata</i> Orensanz, 1974, new status .....	90
<i>Nothria britannica</i> (McIntosh, 1903), new combination .....	91
<i>Nothria hawaiiensis</i> Pettibone, 1970 .....	93
<i>Nothria hyperborea</i> (Hansen, 1878), new combination .....	93
<i>Nothria mannarensis</i> Rangarajan and Mahadevan, 1961 .....	95
<i>Nothria occidentalis</i> Fauchald, 1968, new status .....	95
<i>Nothria textor</i> Hartman and Fauchald, 1971 .....	95
Species of the <i>Onuphis-Nothria-Paradiopatra</i> Complex Referable to	
Other Taxa .....	96
<i>Onuphis</i> ( <i>Onuphis</i> ) <i>amoureuxi</i> Intes and Le Loeuff, 1975 .....	96

<i>Onuphis brevicirris</i> Hartmann-Schröder, 1959 .....	97
<i>Nothria conchyphila</i> Verrill, 1885 .....	97
<i>Tradopia maculata</i> Baird, 1869 .....	99
<i>Nothria minuta</i> McIntosh, 1885 .....	99
<i>Onuphis pectinata</i> Knox and Hicks, 1973 .....	99
<i>Onuphis quinquedens</i> Day, 1951 .....	100
<i>Onuphis setosa</i> Kinberg, 1865 .....	100
<i>Onuphis tenuissima</i> Grube, 1868 .....	101
<i>Onuphis zebra</i> Berkeley and Berkeley, 1939 .....	101
Variability of Selected Morphological Features .....	102
Literature Cited .....	105



# Revision of *Onuphis*, *Nothria*, and *Paradiopatra* (Polychaeta: Onuphidae) Based upon Type Material

*Kristian Fauchald*

## Introduction

The generic complex *Onuphis-Nothria-Paradiopatra* is currently a conglomerate of a number of disparate species (Kucheruk, 1978:88). Recent revisions (Pettibone, 1970; Kucheruk, 1978; Paxton, 1979) have clarified certain morphological patterns, but two main sources of confusion have persisted. Firstly, most primary descriptions are inadequate and inconsistent. Secondly, a lack of understanding of the stability of morphological features used in taxonomic analysis has led to varying species concepts. The present revision attempts to alleviate both problems.

One hundred thirty two species have been named primarily or secondarily in *Onuphis*, *Nothria*, or *Paradiopatra*. Part or all of the type material of 97 of these were examined; another 23 species previously had been moved to other genera or synonymized with other species after examination of type materials by various authors; the types are missing for 3; finally, the whereabouts of the types of 11 species remain unknown. All but one of the latter 14 species can be referred to a genus

based on the original description or on earlier revisions of the type material.

All specimens were carefully examined and various variable features tabulated. Descriptions were standardized and modernized as much as possible, depending on the condition of the material. Figures of the anterior ends in lateral view were prepared for most species. All those species for which 5 or more specimens were available are accompanied with a table of summary statistics.

In descriptions of polychaetes, the range of variable features (e.g., the start of the branchiae, the number of branchial filaments) is often given. The value of this information can easily be augmented by the use of simple statistics (means, standard deviations) to demonstrate more clearly the variability to be expected for a given character within a taxon. Such analysis was undertaken for all species where the material consisted of five or more specimens. In a final section some general comments on the variability of the species are given.

Because of the incomplete original descriptions of many species, the generic designations *Onuphis*, *Nothria*, and *Paradiopatra* have been unsatisfactory. Updated descriptions and illustrations made it possible to group the species of the complex into six genera. Using cladistic techniques it was also

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*Kristian Fauchald, Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.*

possible to arrange the species in patterns suggesting relationships within and among the genera.

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### Brief Historical Review

The first two described species of onuphids, *Onuphis eremita* Audouin and Milne Edwards 1833, and *O. conchylega* Sars 1835 (= *Nothria con-*

*chylega*) have formed two separate foci within *Onuphis*. The following major characters were used in the original definition of the genus: short frontal palps, peristomial cirri present, and branchiae either as simple filaments or branched in a pectinate arrangement.

Onuphids are tubicolous and both early descriptions contain reference to the structure of the tubes. Most onuphids, such as *O. eremita*, have long tubes with cylindrical cross-sections covered with sand, small shell fragments or mud particles; but some species, including *O. conchylega*, have short flattened tubes covered with large shell fragments. The original concept of *Onuphis* also included forms with quill-shaped tubes not covered by foreign materials now generally referred to the genus *Hyalinoecia*.

When Johnston (1865:136) created *Northia* to include *Nereis tubicola* Müller, 1776, and *Onuphis conchylega* Sars, 1835, he did not mention the structure of the tube in his definition of the new genus, but noted that both species were tubicolous. He did, however, specify that his new genus could be separated from *Onuphis* on the branchial arrangement: "From the absence of pectinate branchiae, which are present in *Onuphis*, I have placed the following species in a new genus, the character of which is borrowed principally from Oersted."

Malmgren (1866:66) named *O. conchylega* as genotype for Johnston's genus and corrected the spelling of the generic name to *Nothria* on the assumption that Johnston's spelling was an error. He also removed *tubicola* to a new genus: *Hyalinoecia*. Malmgren did not give a new definition of *Nothria*, but referred to Johnston's original definition. Most subsequent authors have called the genus *Nothria* with *conchylega* as type-species and with Malmgren as the author of the genus. *Northia* is actually preoccupied in the combination *Northia* Gray, 1847, in Mollusca as pointed out by Baird (1869:360), Verrill (1873:98), and Pettibone (1970:252). Johnston's original spelling was last used by Johnson (1901) in describing two species, *Northia elegans* and *N. iridescens* from the northwestern coasts of the United States and Canada

and by Moore (1903) in describing *Northia geophiliformis* from Japan.

Abranchiate species, otherwise obviously related to *Onuphis*, were discovered in deep-water material and described, especially by McIntosh (1885). They were accommodated in *Nothria* by an expansion of the generic definition to include abbranchiate forms.

Saint-Joseph (1888:193) pointed out that the generic separation based on branchial structure was weak, since other features, such as the setal structures did not conform to the generic separation; he referred all species to *Onuphis*. This approach was followed by, among others, Chamberlin (1919), Fauvel (1923), and Monro (1933). Recently, Hobson (1971) by implication used the Saint-Joseph's generic concept and later (in Banse and Hobson, 1974:83) specifically stated that *Nothria* was to be included in *Onuphis*.

Hartman (1944b:66) found that *Onuphis* was clearly separable from *Nothria* only in that "the former has some branchiae that are branched whereas in *Nothria* the branchiae are simple filaments, where present." She went on to state: "Although this difference may have no phylogenetic significance, it is herein recognized for convenience." This approach was followed by Fauchald (1968, 1972, 1977a). Other authors, such as Pettibone (1963, 1967) and Fauchald (1980), compromised and recognized *Nothria* as a subgenus of *Onuphis*.

Pettibone (1970:251) emended *Nothria*, basing its separation from *Onuphis* not on the branchial structure, but on the structure of the anterior parapodia. These are enlarged and rotated anteriorly and inwards in *Nothria* (and the related *Paradiopatra*) and not so modified in *Onuphis*. Pettibone also emended *Paradiopatra* to include a series of *Nothria*-like species that lacked the distinctly foliose presetal lobes in anterior parapodia present in *Nothria*. Orensanz (1974) and Kucheruk (1978) have defined the three genera in a similar fashion.

### Notes on Some Morphological Features

In all species, the anterior part of the body is cylindrical. The median and posterior parts of

the body can have one of three different body shapes. Some species have cylindrical bodies, with just a very slight dorsal flattening. These species usually have poorly developed branchiae and fit rather closely to all sides of the tubes. In a very large group of species, the parapodia project dorsally from the juncture of the curved convex ventral surface and the flattened dorsal surface, so that the bodies have semicircular cross-sections. Most species with well-developed, pectinate branchiae have this body form. A third body form is present in *Nothria* and allied forms with flattened tubes. In these species the median and posterior parts of the body have ovate cross-sections with convex dorsal and ventral surfaces and parapodia projecting laterally. These forms usually have poorly developed branchiae.

All species in the complex have short, ovoid or inflated triangular frontal palps, previously called antennae (see Haffner, 1959, and Paxton, 1979). The five occipital antennae form a crescent over the posterior half of the prostomium. In most *Nothria* and *Paradiopatra*, the two outer lateral antennae are located forward and medially, so that the occipital antennae and the two frontal antennae form a closed circle when viewed from the dorsal side. Eyes, if present, usually consist of a large pair between the bases of the outer and inner lateral occipital antennae. More rarely a pair of small black eyespots are on the dorsal surface near the bases of the frontal antennae as well.

The ceratophores of the occipital antennae may be short (i.e., not projecting beyond the anterior margin of the prostomium) or they may be long (i.e., projecting well beyond the anterior margin of the prostomium). The outer lateral ceratostyles may be shorter than the ceratophores, but usually the styles are distinctly longer than the ceratophores in all occipital antennae. The absolute lengths of the inner lateral and median antennae vary greatly within each species, but the relationship between the length of the inner lateral and median occipital antennae is usually maintained. Small specimens usually have longer

antennae than larger specimens of the same species relative to the total length of the body.

The ceratophores may be smooth or have from a few to many rings. Within each species, the structure of the ceratophores is stable. The inner lateral ceratophores have the highest number of rings in nearly all species. The most common number of rings ranges from 3 to 5; deviations, either in the direction of smooth ceratophores or to more numerous rings, are rare. The rings are definite structural entities and usually show up well under the stereomicroscope, if illuminated from the side. Various wrinkles and other contraction phenomena may also be present, but they can be confused with the rings only in poorly preserved material.

The first several parapodia are always different in structure from those further back. The anterior parapodia have projecting muscular neuropodia supported by one or more internal acicula. Pre-setal lobes are present in most species as low folds covering the bases of the setae; in *Nothria* they are raised as distinct, foliose, or auricular lappets. Acicular lobes are usually rounded; postsetal lobes are subulate or digitiform in all species. Setae usually emerge into two distinct bundles, one dorsal and posterior to the acicula and the other ventral and anterior to the acicula. The rudimentary notopodia, referred to as dorsal cirri, are supported internally by slender, pliable acicula; they are subulate or slightly inflated basally. Cirriform or subulate ventral cirri are present in the first several setigers and resemble the corresponding dorsal cirri, but they are usually shorter and are never supported by acicula. The ventral cirri are replaced by glandular ventral pads. A single transitional setiger, in which the ventral cirrus is shorter than in the anteriormost setigers but lacking glands as in the next following setigers, sometimes can be recognized. The number of anterior setigers with parapodial structure as described above varies from one species to the next; most frequently 3 to 5 pairs are present. A reduction to only 2 such setigers or an increase to 6 or more are rarer conditions.

Parapodia of setiger 1 are always rotated for-

ward so that the morphological anterior surfaces face each other. The second pair of parapodia may be somewhat rotated, but the following parapodia are oriented with the morphological anterior surface facing anteriorly. The first two pairs of parapodia are usually distinctly ventral to the other parapodia; further back the parapodia are attached either fully laterally or dorsolaterally.

Median and posterior parapodia are simpler than the anterior ones. Their bases are shortened and the pre- and postsetal lobes usually are reduced to folds covering the bases of the setae. Digitiform postsetal lobes are continued through a varying, apparently species-specific number of setigers, but insufficient material has been investigated to confirm this possibility. Dorsal cirri are present in all setigers; they are usually slender and thread-like in posterior setigers, while retaining the same length.

The first and sometimes the second, pair of parapodia may be enlarged. The enlargement has two basic components. First, an increase in the muscle mass in the neuropodium may lead to an increase in the length of the corresponding segment to give space for muscle insertion. Thus, in forms with enlarged parapodia, the first (or first and second) segment is distinctly longer and more massive than more posterior segments. Second, the parapodia may be longer and in some species the first parapodia may project well beyond the tip of the prostomium. The two components appear partially independent of each other in that increased muscle mass may be present without a corresponding increase in length of the parapodium.

Development of the branchiae is extremely variable: a number of otherwise unrelated forms lack branchiae. In other forms simple, strap-like or pectinate branchiae may be present. A survey within the *Onuphis-Nothria-Paradiopatra* complex, in other onuphids and eunicids, indicates that branchiae beginning on setigers 5 to 10 and with a moderate number of branchial filaments in a pectinate arrangement must be considered the plesiomorph condition in the group. Any deviation from this condition must be considered apo-



morph. Both the site of the start of the branchiae and the number of branchial filaments appear to be conservative characters. The simple, strap-like branchiae appear to differ morphologically from the other branchiae; a confirmation of this suggestion awaits further study.

All species have simple limbate setae, pectinate setae, pseudocompound hooks in a few anterior setigers, acicula, and at least one additional kind of hook. Some species have compound spinigers. Limbate setae are most numerous in anterior setigers, but usually are present in all setigers. The limbation, a fraying of bundles of the fine hollow cylinders of which the setae consist, is variable, so the limbation may appear distinct or only poorly developed. In some cases the fraying has proceeded so far that the setae appear pilose or as if they have serrated cutting edges (cf. Fauchald, 1968:19, 39). The degree of fraying may be an artifact of wear or fixation and may be of little taxonomic value.

The small pectinate setae are usually located in the upper part of the setal bundles. Most species have a few, flattened pectinate setae with the distal pectinate edge at either an oblique or a right angle (transverse) with the long axis of the seta. The pectinate setae of species here referred to *Nothria* and *Paradiopatra* are always distally transverse and the outside edges are curved up forming an open scoop. Scoop-shaped pectinate setae are nearly always present in large numbers in anteromedian setigers and may totally dominate the setal fascicles. Comparison with other onuphid genera and with eunicids indicate that the flattened small form must be plesiomorph, the scoop-shaped form is, consequently, apomorph.

The pseudocompound hooks may have blunt-ending or pointed hoods. Most taxa have blunt-hooded hooks, the pointed ones being characteristic of only certain species. The appendage of the hooks may be distally falcate (unidentate), bidentate or tridentate. Considering occurrence within the whole family, it appears that the tridentate condition is plesiomorph and that any deviation from this condition must be considered apomorph.

Falcate hooks are usually simply worn bi- or tridentate hooks. With one exception (p. 16), falcate hooks never occur alone, and hooks that have yet to emerge from the setal fascicles show the basic bi- or tridentate condition. The evolutionary loss of the third tooth in the hooks may have taken place only once; however, considering the distribution of bidentate hooks, it appears more likely that the loss has happened more than once. The "hinge" is usually distinct, but the hooks cannot flex around it; in large species the hinge may become very indistinct or be lost completely. Pseudocompound hooks are usually present in the first 3 to 5 setigers, that is, usually those in setigers that have modified anterior parapodia. The co-occurrence of modified parapodia and pseudocompound hooks is here considered plesiomorph; any deviations are apomorph. The most common deviation is an increase in the number of setigers with pseudocompound hooks.

Large, tridentate hooks may be present in a number of anterior setigers, varying from 2 or 3 up to about 20 setigers; the large hooks usually start in setigers 3–5, so a careful examination of setigers 4 and 5 will usually reveal their presence. The large hooks have the lower and median teeth strongly beaked with the distal tooth smaller than the median tooth. In the pseudocompound hooks, on the other hand, the distal tooth is always better developed than the other teeth. The large hooks resemble those that appear in postlarval onuphids; their presence in adults may be a paedomorphic feature, and their scattered occurrence in the group may be less puzzling than would otherwise be the case.

Pseudocompound and large hooks are limited to anterior setigers. Further back in the body either subacicular or intrafascicular hooks may be found. Both kinds are large and bidentate. The subacicular hooks originate at, or slightly above, the origin of the acicula, but they emerge ventral to the acicular tip. The hooks thus form a distinct angle with the acicula. The subacicular hooks are circular in cross-section and usually barely emerge from their setal sacs. The intrafascicular hooks also originate at or near the origin



TABLE 1.—Survey of character-states of selected morphological features

<i>Feature</i>	<i>Plesiomorph condition</i>	<i>Apomorph condition</i>
1. Total number of setigers	Indeterminate (>100)	Determinate (<50)
2. Length of tube	Twice body length	Barely longer than body
3. Length of ceratophores	Prostomial length	<Prostomium
4. Rings on the ceratophores	3–8	(a) absent (b) >10
5. Number of cirriform ventral cirri	3–5	(a) 2 or less (b) more than 5
6. Foliose presetal lobes	Absent	Present
7. Number of setigers with pseudocompound hooks	3–5	(a) 2 or less (b) more than 5
8. Agreement between 5 and 7	Yes	No
9. Number of teeth in pseudocompound hooks	3	(a) 1 or 2 alone (b) 1 or 2 with 3
10. Hoods on the pseudocompound hooks	Short, blunt	Long, pointed
11. First parapodium	Not enlarged	Enlarged
12. Branchiae	Present	Absent
13. Start of branchiae	On or after setiger 5 but before setiger 10	(a) on or before setiger 4 (b) after setiger 10
14. Number of branchial filaments	2 or more	Single
15. Compound spinigers	Absent	Present
16. Large hooks	Absent	Present
17. Subacicular hooks (absence implies presence of intrafascicular hooks)	Present	Absent
18. Pectinate setae	Flat	Scoop-shaped

of the acicula, but they run parallel to the acicula in the middle of the parapodia and emerge with the acicula from the tip of the setal lobes. The intrafascicular hooks are flattened in cross-section and emerge for at least half their length from their setal sacs.

The acicula emerge from the end of the setal lobe as short, tapering bent spines. They are frayed and appear pilose in most species.

The tubes of most species are considerably longer than the length of the animal. They are circular in cross-section and consist of a strong, pliable inner lining covered with sand grains, shell fragments, or plant fragments. Some selection of particles apparently takes place, since the tubes are usually covered with larger particles than the mean particle size in the surrounding medium. The particles are usually closely fitted, but with little obvious orientation. Some species

have rather more ornate tubes, selecting very large particles and orienting these with the flat or concave sides against the tubes so that the tubes become flattened in cross-section. Some species of *Paradiopatra* build such tubes but best known are perhaps the shortened tubes of *Nothria* spp., sensu stricto, where large shell-fragments are closely oriented and trimmed to form very neat tubes. Species of *Nothria*, sensu stricto, are capable of transporting their tubes around. Other species apparently cannot move their tubes; when they move from one location to another, they may abandon their tubes and build new ones. Long tubes covered with unoriented material is here considered plesiomorph, deviations from this pattern, especially in the direction of shortened, flattened tubes, are considered apomorph.

The number of segments in adults of most onuphids is greater than 100, except in small

TABLE 2.—Character-states of selected onuphid genera (P = plesiomorph; A, a, and b = various apomorphs; features are numbered as in Table 1)

Genus	1. No. of setigers	2. Length of tube	3. Length of ceratophore	6. Foliose presetal lobes	9. No. of teeth in pseudo- compound hooks	10. Hood on pseudo- compound hooks	11. First para- podium	13. Start of branchiae	15. Compound spinigers	17. Subacicular hooks	18. Pectinate setae
<i>Kinbergonuphis</i>	P	P	P	P	P/b	P	P	P/A	P	P	P
<i>Onuphis</i>	P	P	A	P	P/b	P	P	a	P	P	P
<i>Mooreonuphis</i>	P	P	P	P	b	P	P	P/b	A	P	P
<i>Sarsonuphis</i>	P	P	P	P	P/a	A	P	P/A	P	P	P
<i>Paradiopatra</i>	P/A	P	P	P	P/a	P	P/A	P/A	P	A	A
<i>Nothria</i>	A	A	P	A	P/b	P	A	a	P	A	A

species. Species of *Nothria*, sensu stricto, and a few others usually have less than 50 setigers, even when they are not particularly small-bodied, and the number of segments appears reasonably constant within each species. Indeterminate, large numbers of segments is the plesiomorph condition; the short-bodied condition apomorph.

Tables 1 and 2 give surveys of the character-states for 18 selected characters used in comparison among the different taxa. Comparisons were made with other genera of Onuphidae and with the genera of Euncidae, the family most closely resembling the Onuphidae in the superfamily Eunicea. The characters appear adequate to distinguish and characterize genera; however, radiation within each genus has followed different lines, leading to unresolved dichotomies and trichotomies using the standardized character-set only.

The synonymy for each species includes only references to articles treating the types or other parts of the original material of that species.

### The *Onuphis*-*Nothria*-*Paradiopatra* Complex

The distribution of character-states of morphological features among species indicates that six genera can be recognized in the complex. *Nothria*, *Onuphis*, and *Paradiopatra* are here restricted and partially emended. Three new genera, *Kinbergonuphis*, *Mooreonuphis*, and *Sarsonuphis* are proposed.

All six genera can be separated from other onuphids by having short frontal palps and peristomial cirri; branchiae, if present, are in the form of single filaments or, if more filaments are present, these are in a pectinate arrangement (not spiralled). Only one anterior segment is distinctly enlarged. A key to other genera can be found in Kucheruk (1978).

Table 2 shows the character-states of selected morphological features for the different genera. Note that only characters where at least one-half of the genera had a defined character-state have been included. Figure 1 depicts the relationship between the genera in the form of a cladogram. Clearly, *Paradiopatra* and *Nothria* are more closely related to each other than either is to the remaining genera. *Sarsonuphis* and *Mooreonuphis* are characterized by the possession of unique kinds of setae not present in the other genera. *Onuphis* contains a series of forms with very long, strongly ringed ceratophores and branchiae present on or before setiger 4. *Kinbergonuphis* is characterized more by an absence of apomorphic character-states than by anything else; this genus may contain disparate elements.

The six genera are defined on morphological grounds. A survey of the geographic distribution and depths of type localities revealed some interesting patterns (Figure 2). These data show the fraction of these total number of species of the six genera of onuphids that were originally recorded from a particular geographical region at the depth range noted. For example, nearly 60% of

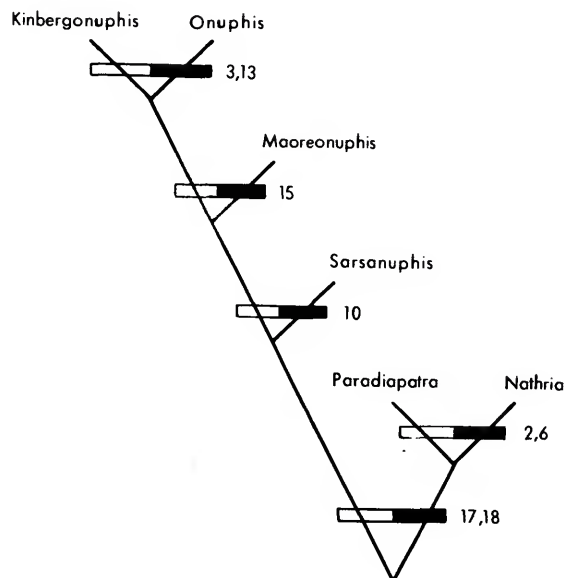


FIGURE 1.—Cladogram showing the relations among selected onuphid genera (character-numbers are explained in Table 1; black bar = apomorph state, white bar = plesiomorph state).

all species of these six genera described from intertidal areas belong to *Kinbergonuphis*, and nearly 60% of all species described from the western Atlantic Ocean belong to the same genus. This analysis can be partially interpreted as follows: *Kinbergonuphis* is found in world-wide areas, but appears focused in shallow water in the western Atlantic Ocean. *Onuphis* is relatively best represented in shelf depths in the western Pacific Ocean; no species of this genus has been described from truly cold regions. *Sarsanuphis* is a deep-water genus best represented in the eastern Atlantic and Indian oceans. *Mooreonuphis* is found in the Americas in intertidal and shelf regions. *Nothria* and *Paradiopatra* are found in all parts of the world; *Paradiopatra* is best represented in deep water, and *Nothria* does not show a clear depth preference.

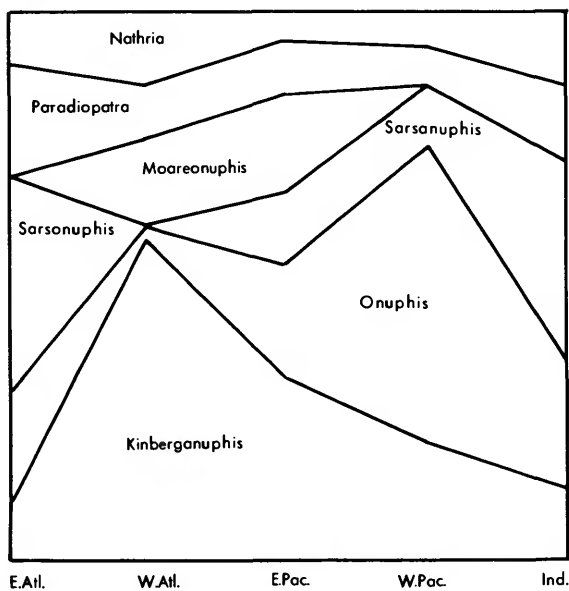
A converse analysis confirms the picture proposed above (Figure 3). Nearly half of the species treated in this paper were described from the eastern Pacific Ocean and most of the genera have slightly less than half of their species de-

scribed from this area; exceptions are *Mooreonuphis* and *Nothria*. The former has nearly three-quarters of its species described from the eastern Pacific Ocean, the latter is poorly represented in this part of the world. In the western Pacific Ocean, *Onuphis* is considerably better represented than anticipated from the first analysis. About 10% of the species were originally described from the eastern Atlantic Ocean. *Kinbergonuphis* is poorly represented in this region. *Sarsanuphis*, on the other hand, is much better represented than expected. Both predictions confirm the first analysis. In the western Atlantic Ocean, *Kinbergonuphis* and *Mooreonuphis* are better represented than expected; again as anticipated, *Nothria* is also well represented, but the numbers of species in the latter genus are so few that calculations are rather meaningless. The absence of *Sarsanuphis* is noticeable, since a rather considerable number of species of this genus were described from the eastern Pacific Ocean. The western Atlantic and the eastern Pacific have not had a deep water connection for sometime; the two sides of the Atlantic are in obvious deep-water connection. In the Indian Ocean, *Sarsanuphis* is better represented than anticipated.

The converse depth-distribution pattern reveals that in the intertidal *Kinbergonuphis* is much better represented than anticipated, *Onuphis* and *Sarsanuphis* are underrepresented. Again all these observations confirm predictions made in the first analysis. In shelf regions, *Onuphis* and *Nothria* are much better represented than expected and *Paradiopatra* is underrepresented. *Sarsanuphis* is rather better represented than anticipated, in that of all members of this genus, nearly one-third were described from shelf-depths. In deep water, *Onuphis* is distinctly underrepresented; *Sarsanuphis* and *Paradiopatra* are extremely well represented.

The converse analysis adds nothing to our understanding of the distribution of *Mooreonuphis*. The absence of any type material of *Sarsanuphis* in the western Atlantic Ocean does not imply that the genus is entirely missing. The analysis above is meaningful only if one basic assumption holds true, i.e., that, by now, sufficient collections

a. Geographical distribution



b. Depth distribution

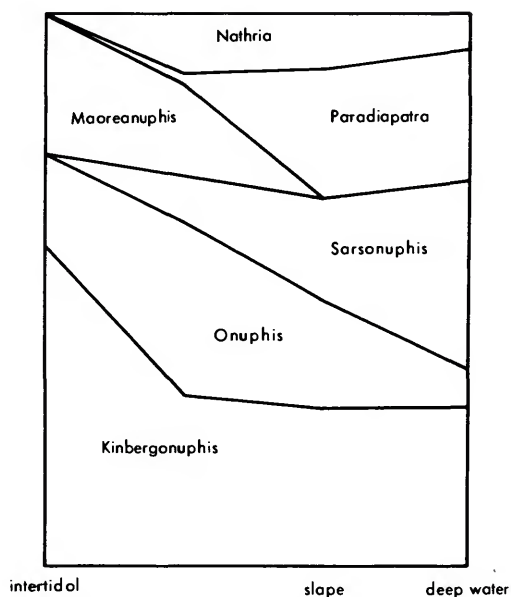
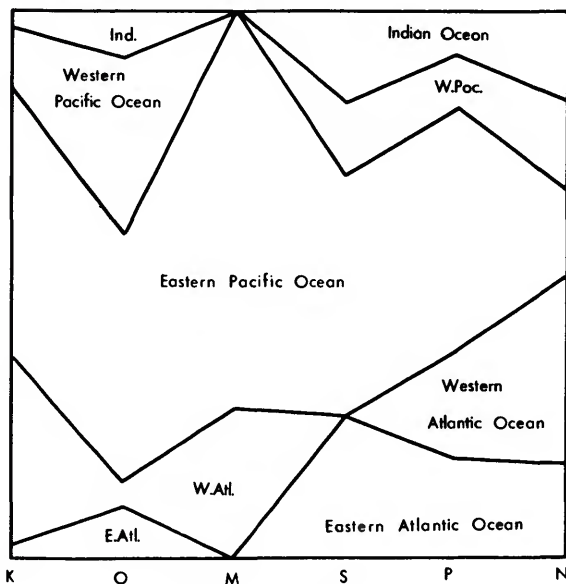


FIGURE 2.—Geographical and depth distribution of type localities for selected onuphid genera based on the total number of species described from each region.

a. Geographical distribution



b. Depth distribution

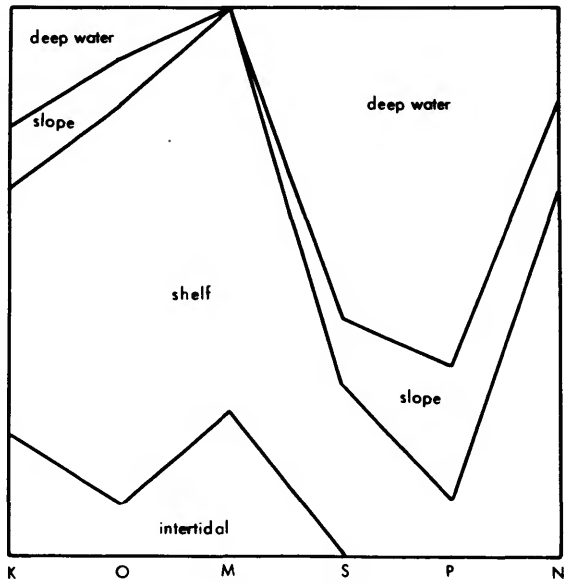


FIGURE 3.—Geographical and depth distribution of type localities for selected onuphid genera based on the total number of species referred to each genus ( $K$  = *Kinbergonuphis*;  $O$  = *Onuphis*;  $M$  = *Mooreanuphis*;  $S$  = *Sarsonuphis*;  $P$  = *Paradiopatra*;  $N$  = *Nothria*).

have been made in all parts of the world, so that the type locality for any given species, in some sense, represents a center for its distribution and, in another sense, that the sampling has been sufficient to generalize about the distribution of different genera. There are valid practical reasons why one would want to anticipate which genera should be represented in any given collection. Thus, if an unknown collection came from, say,

Indonesia, a search of the literature could profitably focus on the genus *Onuphis* and minimize search for species of *Mooreonuphis*. If a collection were known to originate from truly deep water, a search could most profitably start with *Sarsonuphis* and *Paradiopatra*, since members of these two genera make up a sizable fraction of all species known from deep water.

### Key to the Genera of the Complex

1. Subacicular hooks absent, intrafascicular hooks present, pectinate setae scoop-shaped ..... 2
- Subacicular hooks present, intrafascicular hooks absent, pectinate setae flat ..... 3
2. Foliose presetal lobes in anterior parapodia, body relatively short, with a limited number of setigers ..... **Nothria**
- Foliose presetal lobes absent, body long, usually with an indeterminate number of segments ..... **Paradiopatra**
3. Pseudocompound hooks with long, pointed hooks ..... **Sarsonuphis**, new genus
- Pseudocompound hooks with short, truncated hooks ..... 4
4. Compound spinigers present in some anterior setigers ..... **Mooreonuphis**, new genus
- Compound spinigers absent ..... 5
5. Occipital ceratophores longer than the length of the prostomium ..... **Onuphis**
- Occipital ceratophores as long as, or shorter than, the length of the prostomium ..... **Kinbergonuphis**, new genus

### ***Kinbergonuphis*, new genus**

DIAGNOSIS.—Onuphids with an indeterminate number of segments and long cylindrical tubes. Frontal palps short, peristomial cirri present. Occipital ceratophores as long as or shorter than length of prostomium; outer lateral ceratostyle as long as or longer than its ceratophore. Ceratophores with 10 or fewer rings, sometimes smooth. Ventral cirri cirriform in 2 or more setigers. Tridentate pseudocompound hooks always present (one exception), simple falcate or bidentate pseudocompound hooks frequently present; all pseudocompound hooks with short, blunt hoods. Branchiae, if present, usually from setiger 6 (22

of 26 species); if branchiae start later, always single filaments. Compound spinigers absent, large hooks may be present, subacicular hooks always present, pectinate setae flat.

TYPE-SPECIES.—*Onuphis tenuis* Hansen, 1882.

GENDER.—Feminine.

ETYMOLOGY.—Named in honor of the Swedish polychaete expert Johan Gustaf Hjalmar Kinberg, combines his last name with the name of the first described genus in the group, *Onuphis*.

REMARKS.—Thirty-two species belong to this genus, making it the largest of the genera in the *Onuphis-Nothria-Paradiopatra* complex. Cladistic analysis of the species appears confusing, and a number of unresolved dichotomies and trichoto-



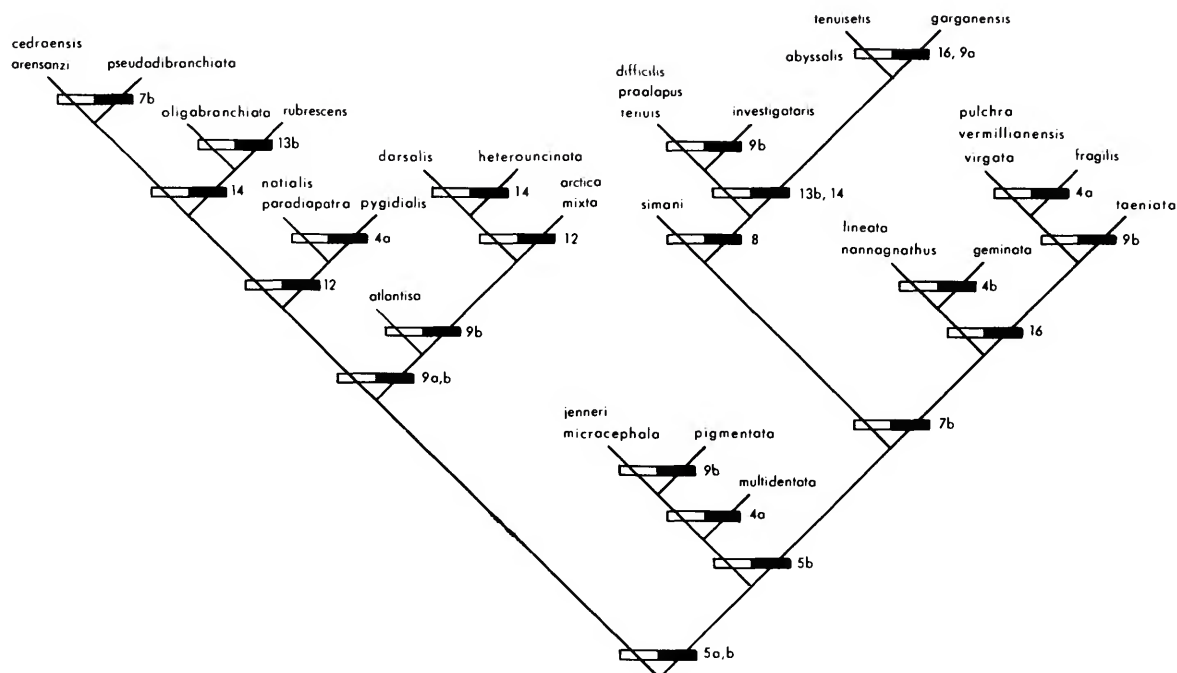


FIGURE 4.—Cladogram showing relations among species of *Kinbergonuphis* (character-numbers are explained in Table 1, black bar = apomorph state, white bar = plesiomorph state).

mies are present (Figure 4). The reason is that the set of characters used in the analysis was selected for the whole generic complex, rather than for this genus in particular. Apparently, radiation after the separation of the genus has only partially

followed parallel lines in the different genera.

Species of *Kinbergonuphis* have been described from worldwide areas, but the largest number are found in shallow water in the Americas, on both the Atlantic and Pacific oceans.

#### Key to the Species of *Kinbergonuphis*

1. Branchia absent ..... 2  
Simple strap-like, or pectinate branchiae present ..... 8
2. All pseudocompound hooks tridentate ..... 3  
At least some uni- or bidentate pseudocompound hooks present ..... 6
3. Pseudocompound hooks in 5 setigers, subacicular hooks first present from setiger 17 ..... ***K. pygidialis***  
Pseudocompound hooks in 3 or 4 setigers, subacicular hooks from setigers 12–14 ..... 4
4. Eyes present ..... 5  
Eyes absent ..... ***K. oligobranchiata*** (in part)
5. Subacicular hooks first present from setigers 10–14 (usually from 12–13, range 10–14) ..... ***K. paradiopatra***  
Subacicular hooks first present from setigers 14–16 (usually from 15, range 14–16) ..... ***K. notialis***

6. All pseudocompound hooks distally falcate and entire (unidentate) . . . . . ***K. atlantisa***  
     At least some pseudocompound hooks bi- and/or tridentate . . . . . 7
7. Subacicular hooks from setiger 5 . . . . . ***K. arctica***  
     Subacicular hooks from setiger 11 . . . . . ***K. mixta***
8. All branchiae simple and straplike . . . . . 9  
     Two or more branchial filaments present in some setigers . . . . . 14
9. Branchiae first present on setiger 6 or 7 . . . . . 10  
     Branchiae first present after setiger 10 . . . . . 12
10. All pseudocompound hooks tridentate . . . . ***K. oligobranchiata*** (in part)  
     At least some bidentate pseudocompound hooks present . . . . . 11
11. Cirriform ventral cirri on 3 setigers, subacicular hooks from setiger 8 . . .  
     . . . . . ***K. abyssalis***  
     Cirriform ventral cirri on 4 setigers, subacicular hooks from setiger  
     12 . . . . . ***K. heterouncinata***
12. Large hooks present in setigers 3–5 . . . . . ***K. gorgonensis***  
     Large hooks absent . . . . . 13
13. Cirriform ventral cirri on 5 setigers, subacicular hooks from setiger  
     14 . . . . . ***K. rubescens***  
     Cirriform ventral cirri on 7 setigers, subacicular hooks from setiger  
     20 . . . . . ***K. tenuisetis***
14. Large hooks present at least in setigers 4–8 . . . . . 15  
     Large hooks absent . . . . . 25
15. At least some bidentate pseudocompound hooks present . . . . . 16  
     All pseudocompound hooks tridentate . . . . . 17
16. Cirriform ventral cirri on 2 setigers only . . . . . ***K. pigmentata***  
     Cirriform ventral cirri on at least 4 setigers . . . . . ***K. taeniata***
17. Cirriform ventral cirri on 2 setigers . . . . . 18  
     Cirriform ventral cirri on at least 6 setigers . . . . . 19
18. Eyes present, subacicular hooks from setiger 26 . . . . ***K. microcephala***  
     Eyes absent, subacicular hooks from setigers 30–35 . . . . ***K. jenneri***
19. Cirriform ventral cirri on 11–13 setigers . . . . . ***K. virgata***  
     Cirriform ventral cirri on 6–9 setigers . . . . . 20
20. Pseudocompound hooks in no more than 6 or 7 setigers . . . . . 21  
     Pseudocompound hooks in 8 setigers . . . . . ***K. vermillionensis***
21. Ceratophores smooth . . . . . ***K. fragilis***  
     Ceratophores distinctly ringed . . . . . 22
22. Large hooks present to setigers 6–8 . . . . . 23  
     Large hooks present at least to setiger 15 . . . . . 24
23. Ceratophores with 3 or 4 rings . . . . . ***K. orensanzi***  
     Ceratophores with 7 or 8 rings . . . . . ***K. difficilis***
24. Ceratophores with 3 rings, pseudocompound hooks in 5 setigers . . . . .  
     . . . . . ***K. simoni***  
     Ceratophores with 4 or 5 rings, pseudocompound hooks in 6 setigers . . .  
     . . . . . ***K. pulchra***
25. Some pseudocompound hooks uni- or bidentate . . . . . 26

- All pseudocompound hooks tridentate ..... 28
26. Cirriform ventral cirri in maximally 7 setigers ..... 27  
Cirriform ventral cirri in 9 setigers ..... *K. geminata*
27. One or two branchial filaments present ..... *K. dorsalis*  
Up to 10 branchial filaments present ..... *K. investigatoris*
28. Subacicular hooks first present before setiger 15 ..... 29  
Subacicular hooks first present after setiger 19 ..... 32
29. Subacicular hooks from setiger 9 ..... *K. multidentata*  
Subacicular hooks from setiger 14 ..... *K. cedroensis*
30. Subacicular hooks from setiger 10 ..... *K. pseudodibranchiata*  
Subacicular hooks from setigers 14–15 ..... 31
31. Pseudocompound hooks in 5 setigers ..... *K. tenuis*  
Pseudocompound hooks in 7 setigers ..... *K. lineata*
32. Cirriform postsetal lobes in at least 50 setigers ..... *K. nannognathus*  
Cirriform postsetal lobes in less than 40 setigers ..... *K. proalopus*

***Kinbergonuphis tenuis* (Hansen, 1882),  
new combination**

FIGURE 5c

*Onuphis tenuis* Hansen, 1882b:10.—Augener, 1934:140.

**MATERIAL.**—Lectotype, 1 paralectotype, RNHL 1395, Atlantic Ocean off Rio de Janeiro, Brazil, coll. E. van Beneden.

**REMARKS.**—The original material now consists of one specimen in good condition with 114 setigers, one dissected anterior end, and a number of median and posterior fragments in good state of preservation. When examined by Augener, the material consisted of 6 specimens. One of the labels associated with the material is in Armauer Hansen's handwriting. The most complete specimen is herein selected as lectotype.

The lectotype, an incomplete specimen with 114 setigers, is 31.5 mm long and 1 mm wide, with parapodia; it has been confined in a tube and the body is essentially cylindrical and the parapodia closely appressed to the body. The remnants of a fragile, thin tube are present.

The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 8 in the lectotype and setiger 5 in the other specimen, the median antenna reaches setiger 5 in the lectotype and setiger 3 in the other specimen. The ceratophores have 6 rings. Branchiae are present

from setiger 6 and have maximally 4 filaments; they are present on the last setiger of the lectotype. All branchiae appear branched, even the first one has 2 filaments and the other branchiae have up to 4 filaments. Ventral cirri are cirriform on 7 setigers on the lectotype and on 9 setigers in the other specimen. Postsetal lobes are digitate in the first 18 setigers in the lectotype, their distribution could not be determined in the other specimen. Tridentate pseudocompound hooks with short, blunt hoods are present in the first 5 setigers in both specimens. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 14 in the lectotype; the origin could not be determined in the other specimen. Each of the flat pectinate setae is distally slightly oblique and has about 14 teeth. The maxillary formula is 1+1, 7+8, 6+0, 7–8+7–8, and 1+1 according to Augener, who indicated that he had problems counting the number of teeth, especially on maxilla IV.

*K. tenuis* differs from most other species of *Kinbergonuphis* by the large number of cirriform ventral cirri. It is known from the southwestern Atlantic Ocean off Brazil and Uruguay (Orensanz, 1974:89).

G. A. Hansen usually referred to himself as G. Armauer Hansen and used his middle name (in one Norwegian tradition) not as a second first

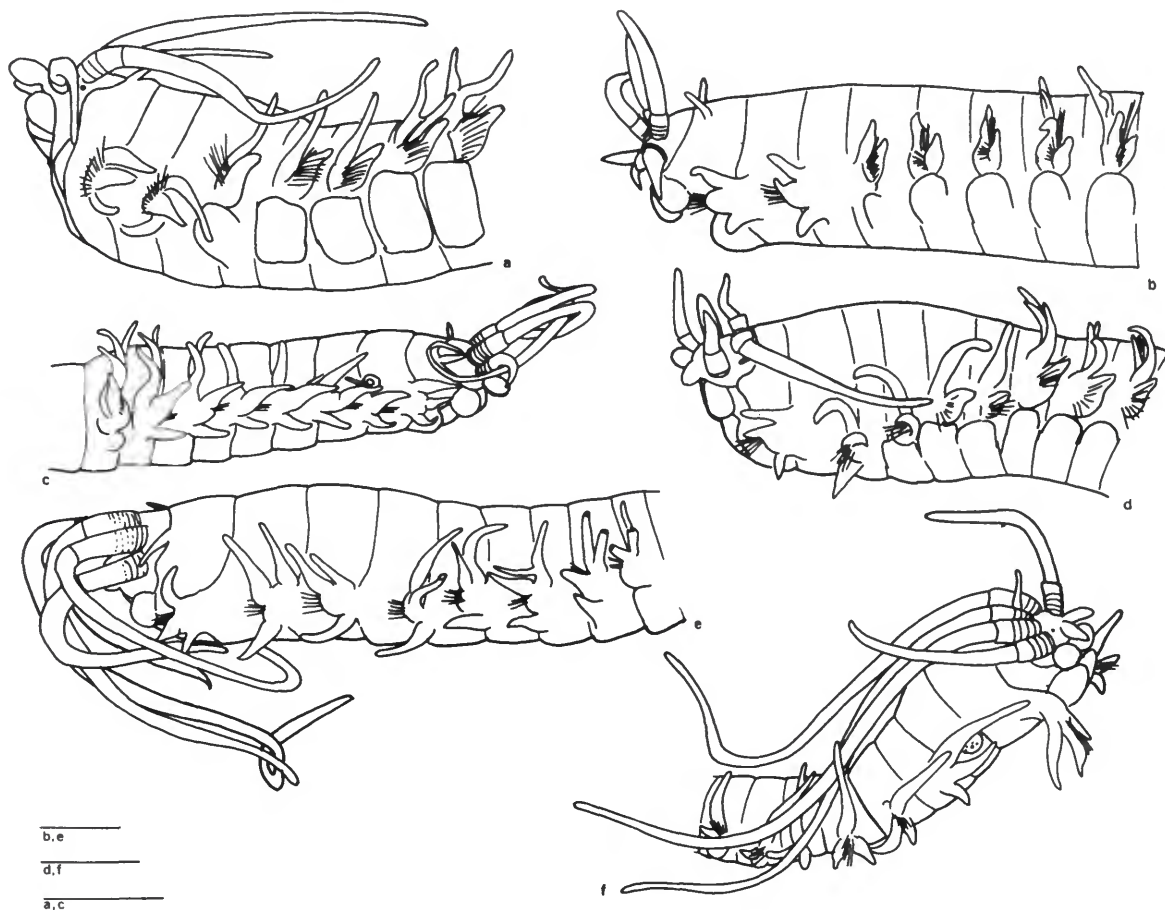


FIGURE 5.—Anterior ends of species of *Kinbergonuphis* in lateral view: a, *K. microcephala* (Hartman, 1944); b, *K. jenneri* (Gardiner, 1976); c, *K. tenuis* (Hansen, 1882); d, *K. pigmentata* (Fauchald, 1968); e, *K. proalopus* (Chamberlin, 1919) based on holotype of *Onuphis profundus*; f, *K. gorgonensis* (Monro, 1933). (All scales = 1 mm.)

name, but as part of his last name. In contemporaneous Norwegian writing, he was always referred to as Dr. G. Armauer Hansen. He is better known as Director of the Leprosy Institute in Bergen and as the discoverer of the causative agent of that disease, than for his descriptions of polychaetes.

***Kinbergonuphis abyssalis* (Fauchald, 1968),  
new combination**

FIGURE 6d

*Nothria abyssalis* Fauchald, 1968:19–20, pl. 4a–f; 1972:123.

**MATERIAL.**—Holotype, AFH Poly 350, Pacific Ocean off Baja California, from 22°38.6'N, 110°06.5'W to 22°38.6'N, 110°01.0'W, 2604 to 2713 m, deep diving dredge, silty clay, 26 Mar 1959, coll. Robert H. Parker (Station P-42-59).

**REMARKS.**—The holotype is an anterior fragment of 89 setigers that is 47 mm long and 1.5 mm wide with parapodia. The outer lateral occipital antennae reach setiger 1; the inner lateral antennae reach setiger 6 and the median antennae reaches setiger 3. The ceratophores have 5 to 7 rings. Branchiae are present from setiger 7 to the end of the fragment; each is short and strap-

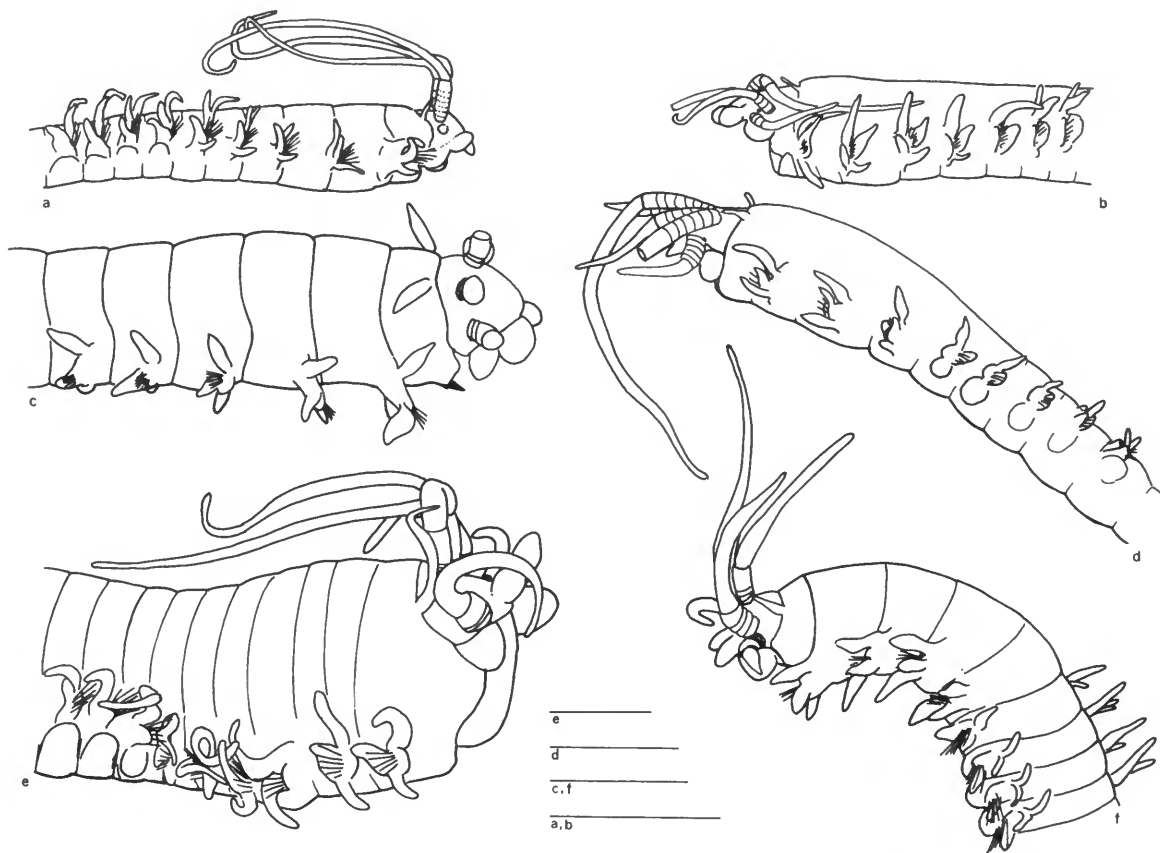


FIGURE 6.—Anterior ends of species of *Kinbergonuphis* in lateral view: a, *K. pseudodibranchiata* (Gallardo, 1968); b, *K. cedroensis* (Fauchald, 1968); c, *K. oligobranchiata* (Orensanz, 1974); d, *K. abyssalis* (Fauchald, 1968); e, *K. rubescens* (Augener, 1906); f, *K. heterouncinata* (Hartmann-Schröder, 1965). (All scales = 1 mm.)

like. Ventral cirri are digitate in the first 3 setigers, and digitate postsetal lobes are distinct in the first 6 setigers. Bi- and tridentate pseudocompounds hooks with short blunt hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 8. Each of the flat pectinate setae is distally oblique and has 15 teeth. The maxillary formula is 1+1, 9+8, 8+0, 4+4, and 1+1 according to Fauchald (1968:19–20).

*K. abyssalis* is characterized by having simple branchiae and both bi- and tridentate pseudo-compound hooks. The species is known only through its original record.

### ***Kinbergonuphis arctica* (Annenkova, 1946), new combination**

*Onuphis*(?) *arctica* Annenkova, 1946:186–188, fig. 3a–f.

**REMARKS.**—The type and only reported specimen was not available; it was requested from the collections of the Academy of Sciences, Moskva. The following comments are based on Annenkova's description and illustrations. The type was a short anterior fragment. The median occipital antenna reaches setiger 5, and the ceratophores have 6 rings. Branchiae are absent in the 10 setigers present. Ventral cirri are cirriform in the first 3 setigers. Uni-, bi-, and tridentate pseudo-



compound hooks are present in the first 5 setigers. Large hooks are absent and compound spinigers are presumed to be absent. Subacicular hooks are present from setiger 5. Each of the flat pectinate setae is distally oblique and has about 15 teeth. The illustration of the compound setae from the fifth setiger and the subacicular hooks given by Annenkova suggest that the specimen may have been a juvenile.

*Kinbergonuphis arctica* is poorly known and is here believed to be a juvenile. It is known only from its original record from Ostrov Genryetty in the Arctic Ocean.

***Kinbergonuphis atlantisa* (Hartman, 1965),  
new combination**

FIGURE 7q, TABLE 3

*Nothria atlantisa* Hartman, 1965:102–104, pl. 17a–c.

**MATERIAL**.—Holotype, AHF Poly 746, and 76 paratypes, AHF Poly 747, Atlantic Ocean off New England, east upper end of Block Canyon, 39°58'24"N, 70°40'18"W, 300 m, 28 Aug 1962, coll. H. L. Sanders, station Slope 2.

**REMARKS**.—All specimens are incomplete. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 3 and the median antenna reaches setiger 2. The ceratophores have 4 rings. Branchiae are absent. Ventral cirri are cirriform in the first 3 setigers; postsetal lobes are distinct in 7 or 8 setigers. Unidentate falcate pseudocompound hooks are present in the first 3 setigers. Compound spinigers

and large hooks are absent. The subacicular hooks are present from setiger 9. Each of the flat pectinate setae is distally oblique and has about 12 teeth. The maxillary formula is 1+1, 10+10, 6+0, 4+5, and 1+1.

*Kinbergonuphis atlantisa* is primarily characterized by the absence of branchiae, combined with unidentate, falcate pseudocompound hooks. The variability indicated in Table 3 is wholly due to the presence of two different size-classes of individuals. All juveniles, recognizable by their narrow bodies, have cirriform ventral cirri and pseudocompound hooks on 2 setigers. Further, the occipital antennae are relatively longer in the juveniles than in the adults, and the ceratophores have fewer articulations. Even with this mixed population, the species is extremely narrowly characterized as can be seen by the low standard deviations. *K. atlantisa* is known from deep shelf and slope areas off the central and north Atlantic coast of the United States. Additional material has been collected in various benthic investigations and will be reported upon in another publication, where the suggested allometries will be more fully explored.

***Kinbergonuphis cedroensis* (Fauchald, 1968),  
new combination**

FIGURE 6b

*Onuphis cedroensis* Fauchald, 1968:31–34, pl. 8a–g.

**MATERIAL**.—Holotype, AHF Poly 359, Pacific Ocean off Baja California, 8½ miles [13.7 km]

TABLE 3.—Summary statistics for the original material of *Kinbergonuphis atlantisa*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antenna:					
Outer lateral reach setiger	1–2	1.01	0.01	0.99	75
Inner lateral reach setiger	2–4	3.04	0.44	14.47	52
Median reaches setiger	1–3	2.03	0.35	17.24	66
Maximum number of rings	2–4	3.92	0.35	8.93	77
Cirriform ventral cirri to setiger	2–3	2.87	0.34	11.85	77
Number of setigers with pseudocompound hooks	2–3	2.87	0.34	11.85	77
Subacicular hooks first present on setiger	8–10	9.08	0.31	3.41	77

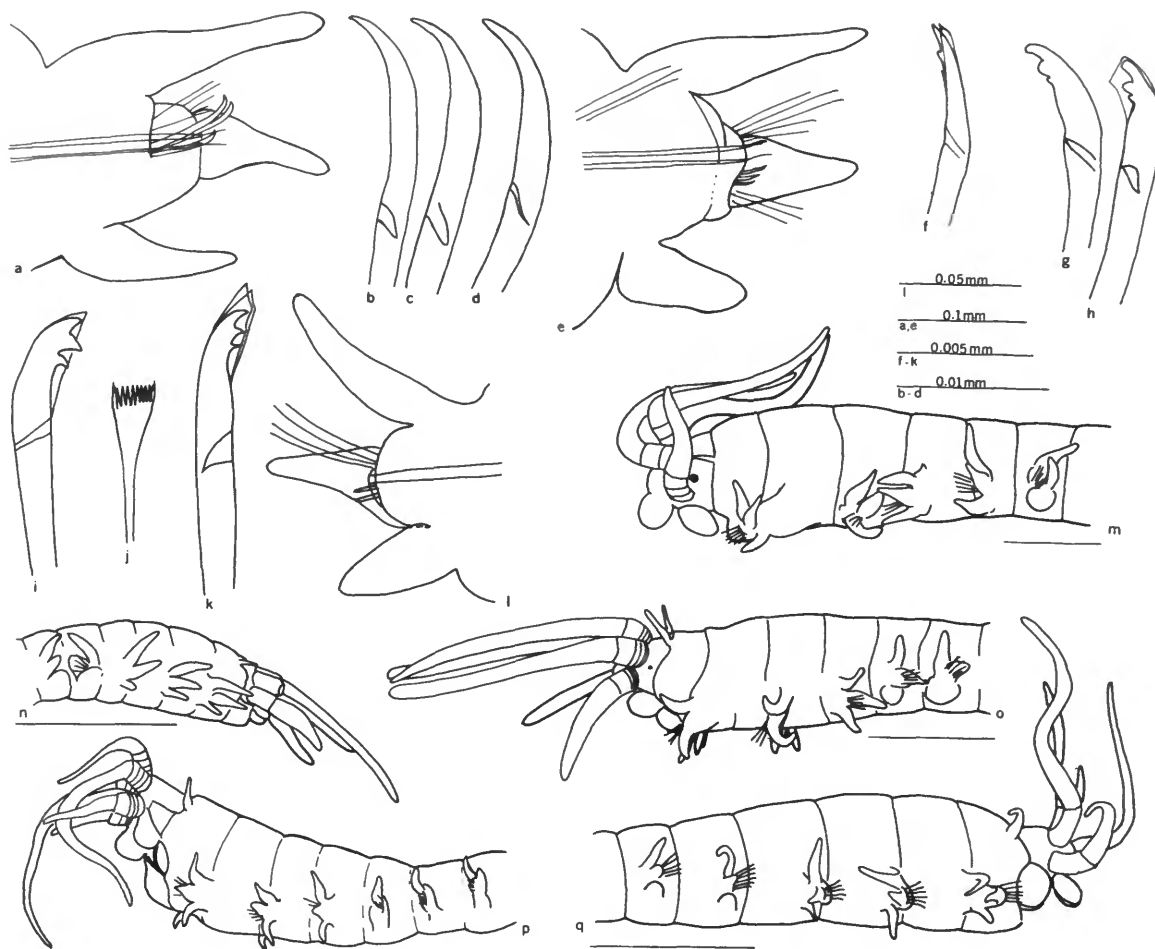


FIGURE 7.—Species of *Kinbergonuphis*. *K. dorsalis* (Ehlers, 1897): a, parapodium 3, anterior view; b–d, pseudocompound hooks of parapodium 3 (b is dorsalmost, d is ventralmost); e, parapodium 5, anterior view; f–h, pseudocompound hooks of parapodium 5 (f is dorsalmost, h is ventralmost). *K. paradiopatra* (Hartman, 1944): i, k, pseudocompound hooks of parapodium 3; j, pectinate seta, median parapodium; l, parapodium 3, anterior view. Anterior ends of *Kinbergonuphis* in lateral view: m, *K. notialis* (Monro, 1930); n, *K. pygidialis* (Fauchald, 1968); o, *K. paradiopatra* (Hartman, 1944); p, *K. mixta* (Fauchald and Hancock, 1981); q, *K. atlantisa* (Hartman, 1965). (All scales = 1 mm, except those indicated.)

south of Isla Cedros, from 27°55'20"N, 115°21'32"W to 27°54'58"N, 115°21'05"W, 95–100 m fine green-gray mud, small shells, 27 Feb 1941, *Velero* Station 1256–41.

REMARKS.—The holotype is an anterior fragment with 33 setigers that is 9 mm long and 1.0 mm wide, with parapodia. The outer lateral oc-

cipital antennae reach setiger 2, the inner lateral ones are now both broken; they were reported to reach setiger 4 by Fauchald (1968:31); the median antenna reaches setiger 5. The ceratophores have 3 or 4 rings each. Branchiae are first present from setiger 6; the maximum number of branchial filaments is 6. Cirriform ventral cirri are

present in the first 4 setigers, and the postsetal lobes are digitiform in the first 14 setigers. Tridentate pseudocompound hooks are present in the first 3 setigers; large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 14. The flat pectinate setae are distally oblique; each has 10 teeth. The maxillary formula reported by Fauchald (1968:32) is 1+1, 8+8, 10+0, 5+6, and 1+1.

*Kinbergonuphis cedroensis* is separable from similar species only on details in distribution of setae and cirri. It is known only from its original record in the Pacific Ocean off Mexico.

***Kinbergonuphis difficilis* (Fauchald, 1982),  
new combination**

FIGURE 8a

*Onuphis* (*Onuphis*) *difficilis* Fauchald, 1982:203–205, fig. 1, table 1.

*Onuphis setosa*—Orensanz, 1974:89 [in part; not Kinberg, 1865:560].

**MATERIAL.**—Holotype, MNHNM I 1382; 1 paratype, MNHNM; 1 paratype, USNM 69917; all Atlantic Ocean off Uruguay, 34°51'S, 54°04.5'W, 39 m, 14 Apr 1965, A. Knipovich, station 263.

**REMARKS.**—The holotype is an incomplete specimen with 50 setigers and is 16.5 mm long and 1.7 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the

inner lateral antenna reach setiger 7, and the median antennae reaches setiger 4. The occipital ceratophores have 7 basal rings. Branchiae are present from setiger 6 to the end of the specimens (up to 200 setigers); all branchiae are branched and have up to 6 filaments. Ventral cirri are cirriform in the first 8 setigers; postsetal lobes are digitiform in the first 17 setigers. Tridentate pseudocompound hooks are present in the first 5 setigers; the distal tooth is very long and slender and projects well beyond the hood in all pseudocompound hooks. The hoods are short and blunt. Large hooks are present in setigers 3 to 8. Bidentate subacicular hooks are present from setiger 18. The maxillary formula is 1+1, 9+9, 11+0, 9+8, and 1+1. The tubes have a soft inner lining with considerable tensile strength and are covered with loose, unsorted detrital particles.

The relationship between *K. difficilis* and related taxa was indicated by Fauchald (1982, table 1) and is indicated in the key to species above. *Kinbergonuphis difficilis* is known from a single locality at the mouth of Rio La Plata, Atlantic Ocean.

***Kinbergonuphis dorsalis* (Ehlers, 1897),  
new combination**

FIGURE 7a–h

*Diopatra dorsalis* Ehlers, 1897:71–74, pl. 5: figs 108–118.



FIGURE 8.—Anterior ends of species of *Kinbergonuphis* in lateral view: a, *K. difficilis* (Fauchald, 1982); b, *K. orensanzii* (Fauchald, 1982). (Both scales = 1 mm.)

**MATERIAL.**—Holotype, ZMH V-4806, Pacific Ocean off Chile, Strait of Magellan, Punta Arenas, intertidal, September and 10 October 1892, Michaelsen's stations 71–72.

**REMARKS.**—The type is a complete specimen with 166 setigers. The outer lateral occipital antennae reach setiger 1; the inner lateral antennae reach setiger 4, the median antenna reaches setiger 3. The ceratophores have 4 rings. Branchiae are first present from setiger 6 and are present in all except the last few setigers. Between setigers 11 and 63, 2 branchial filaments are present; all other branchiae are simple and strap-like. Ventral cirri (Figure 7a,e) are cirriform in the first 5 setigers, and the postsetal lobes are distinct to about setiger 18. Pseudocompound hooks are present in 5 setigers; they are either simple and falcate or tridentate. All hooks are simple and falcate in setigers 1–4 (Figure 7b–d) and all hooks are tridentate in setiger 5 (Figure 7f–h). Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 14. Each of the flat pectinate setae is distally transverse and has about 18 teeth.

Hartmann-Schröder (1962:114) redescribed this species based on fresh material collected near the type-locality. Her description differs from the above in some respects. She found cirriform ventral cirri on 6 setigers rather than on 5, and the maximal number of branchial filaments were 3, rather than 2. She also reported subacicular hooks present from setiger 18, rather than from 14, and only 13, rather than 18 teeth in the pectinate setae. Most of these differences are minor, and it is assumed that they do not change the status of the species.

*Kinbergonuphis dorsalis* is differentiated from all other species of *Kinbergonuphis* by the presence of falcate pseudocompound hooks in the first 4 setigers and tridentate hooks in the fifth, the last segment with such hooks. It is known from intertidal and shallow water areas in southern Chile along the Pacific coastline.

***Kinbergonuphis fragilis* (Kinberg, 1865),  
new combination**

FIGURE 9d

*Onuphis fragilis* Kinberg, 1865:561; 1910:40, pl. 15: fig. 11—Augener, 1931:298.—Fauchald, 1980:808. [Not Orensanz, 1974:94].

**MATERIAL.**—Holotype, NRS 465, Atlantic Ocean, S. of La Plata.

**REMARKS.**—The type material consists of one anterior fragment and a series of short, poorly preserved mid-sections. The anterior end consists of 47 setigers and is 7 mm long and 0.75 mm wide with parapodia. The occipital ceratostyles are missing; the ceratophores are smooth. Branchiae are first present from setiger 6; they are bifid in the last segments present in the fragment. Ventral cirri are cirriform in the first 7 setigers; the distribution of digitate postsetal lobes could not be determined. Tridentate pseudocompound hooks are present in the first 6 setigers, and a single large hook is present from setiger 4 to setiger 12. Compound spinigers were not seen and do not appear to have been present. Subacicular hooks are first present from about setiger 25. The structure of the pectinate setae is unknown. The maxillary formula, assuming Kinberg's illustrations (1910, pl. 15: fig. 11E) to be accurate, is 1+1, 7+6, 6+0, 10+9, and 1+1. The count is questionable for maxilla IV.

As indicated by Fauchald (1980:808), Augener's (1931:298) account of the type material is confused. The anterior end present in the type lot fits very well with Kinberg's original description but not at all with Augener's account. Orensanz (1974) appears to have based his identification on Augener's account and to have applied Kinberg's name erroneously to a different species. Without access to Orensanz' material, it cannot be decided which species he had.

*Kinbergonuphis fragilis* appears characterized by having at least one more anterior modified segment than usual in the genus, by having large hooks in some anterior setigers, and smooth rather than ringed ceratophores. It is known only from

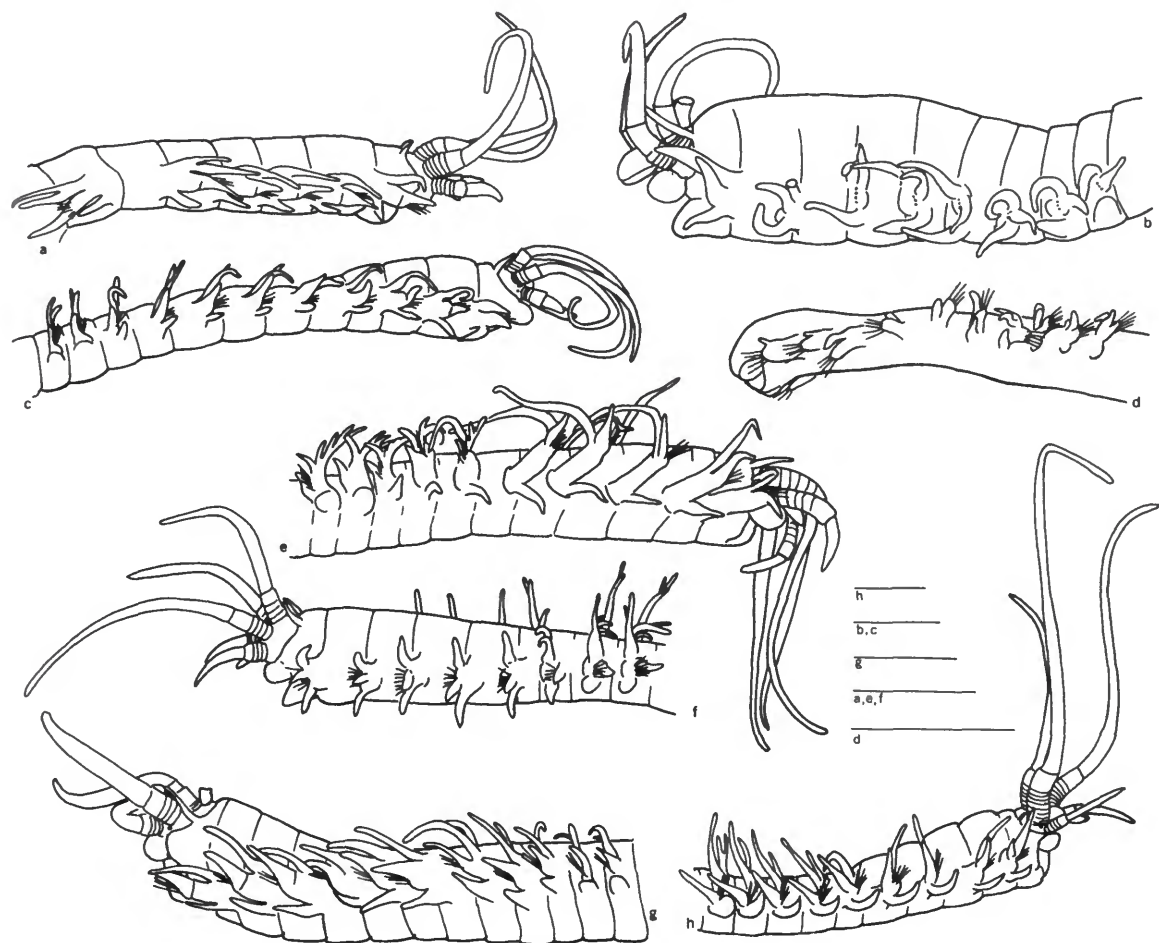


FIGURE 9.—Anterior ends of species of *Kinbergonuphis* in lateral view: a, *K. virgata* (Fauchald, 1980); b, *K. tenuisetis* (McIntosh, 1885); c, *K. pulchra* (Fauchald, 1980); d, *K. fragilis* (Kinberg, 1865); e, *K. geminata* (Fauchald, 1980); f, *K. lineata* (Fauchald, 1980); g, *K. vermillionensis* (Fauchald, 1968); h, *K. taeniata* (Paxton, 1979). (All scales = 1 mm.)

the type locality; extensions from this distribution are difficult to assess because of the confusion created by the erroneous interpretation of the type material.

***Kinbergonuphis geminata* (Fauchald, 1980),  
new combination**

FIGURE 9e

*Onuphis* (*Onuphis*) *geminata* Fauchald, 1980:810–813, figs. 3, 4, table 4.

**MATERIAL.**—Holotype, USNM 61239; 2 paratypes, USNM 61240; all Gulf of Mexico off Belize, halfway between Colson Point and Salt Creek, Dangriga district, 1 m, *Thalassia*, fine sand, almost mud, 16 May 1977, coll. M. L. Jones, station CB-40A.

**REMARKS.**—The holotype is an anterior fragment consisting of 81 setigers, is 32 mm long and 1.1 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2; the inner lateral and median antennae reach setiger 6. The



ceratophores have maximally 10 rings. Branchiae are first present from setiger 6; the maximum number of branchial filaments is 8 or 9. The branchial stem is very short in median setigers so that the long branchial filaments appear to arise as a tuft on either side of the dorsum. Ventral cirri are cirriform in the first 9 setigers; postsetal lobes are distinct in all setigers present. Pseudocompound hooks are present in the first 7 setigers; most of the hooks are tridentate, but a single bidentate hook is present in each fascicle. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 23. Each of the flat pectinate setae is distally oblique and has about 12 teeth in median and posterior setigers. In anterior setigers, distally transverse pectinate setae with about 8 teeth each are present. The maxillary formula is 1+1, 7+8, 6+0, 6+7, and 1+1 according to Fauchald (1980:812).

*Kinbergonuphis geminata* is characterized by the presence of numerous rings on the occipital ceratophores and by having cirriform ventral cirri in 9 setigers and pseudocompound hooks present in 7. It is known from one locality on the mainland coast of Belize.

***Kinbergonuphis gorgonensis* (Monro, 1933),  
new combination**

FIGURE 5f

*Onuphis gorgonensis* Monro, 1933:80–82, fig. 34a–f.  
*Nothria gorgonensis*.—Fauchald, 1977b:37.

**MATERIAL.**—Holotype, BMNH 1932.12.24. 422, Pacific Ocean off Panama, off Isla Gorgona, fine sand and shell, 36.5 m, 10 Aug 1924, coll. C. Crossland.

**REMARKS.**—The incomplete holotype consists of 55 setigers; it is 16.5 mm long and 1.5 mm wide, with parapodia. Originally described as having yellow patches with transverse dark brown and black lines, the specimen now has a dark brownish base color with distinct, nearly black, narrow, clearly defined intersegmental lines. Two pairs of eyes are present. A small black eyespot is near the base of the frontal antennae on either

side, and a larger, more diffuse eyespot is between the bases of the inner and outer lateral occipital antennae on either side. The outer lateral occipital antennae reach setiger 2, the inner lateral and median antennae reach setiger 11. The ceratophores have maximally 6 rings. Simple, strap-like branchiae are present from setiger 22 to the last segment of the fragment. Ventral cirri are cirriform in the first 6 setigers, the last cirrus being much shorter and blunter than the others. Postsetal lobes are distinct in the first 30 setigers. Bidentate, slender pseudocompound hooks with blunt hoods are present in the first 3 setigers; large hooks are present in setigers 3–5. Compound spinigers are absent. Subacicular hooks are first present from setiger 18. Most setae are broken; pectinate setae were not seen. The specimen had been deeply dissected frontally, the maxillary apparatus is missing. The maxillary formula is 1+1, 7+6, 7+0, 8+10, and 1+1, according to Monro (1933:81).

*Kinbergonuphis gorgonensis* is distinguished from congeners by the posterior appearance of the simple, strap-like branchiae, by having bidentate pseudocompound hooks and by the presence of large hooks. It is known only through its original record.

***Kinbergonuphis heterouncinata* (Hartmann-Schröder, 1965), new combination**

FIGURE 6f

*Nothria heterouncinata* Hartmann-Schröder, 1965:161–164, figs. 132–134.

**MATERIAL.**—Holotype, ZMH P-14289, Pacific Ocean off Chile, off Isla de Chiloe, 42°16'S, 74°15'W, 44 m, fine sand with algae and polychaete tubes, very little detritus, 18 Mar 1960, coll. G. Hartmann-Schröder and G. Hartmann.

**REMARKS.**—The holotype is an incomplete specimen with 25 setigers that is 7.2 mm long and 0.75 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1; the inner lateral antennae reach setiger 4, the median antennae reaches setiger 2. The ceratophores have 3 or

4 rings. Simple strap-like branchiae are present from setiger 6 to the end of the fragment. Ventral cirri are cirriform in the first 4 setigers and postsetal lobes are digitiform in the first 13 setigers. Bi- and tridentate pseudocompound hooks with blunt hoods are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 12. Each of the pectinate setae is distally transverse and has about 10 teeth. The maxillary formula is 1+1, 7+8, 8+0, 8+11, and 1+1, according to Hartmann-Schröder (1965:163).

*Kinbergonuphis heterouncinata* is differentiated primarily by the structure of the branchiae and the presence of both bi- and tridentate pseudocompound hooks. It is known only through its original record.

***Kinbergonuphis investigatoris* (Fauvel, 1932),  
new combination**

*Onuphis investigatoris* Fauvel, 1932:147–148, fig. 21, pl. 6: figs. 1–6.

REMARKS.—The type material, presumably deposited in the Indian Museum, Calcutta, was not available for examination. The following remarks assume that Fauvel's description and illustrations are accurate.

The inner lateral occipital antennae reach setiger 15; the median antennae reaches setiger 7. The ceratophores are short and ringed. Branchiae are present from setigers 5 or 6 and have maximally 10 filaments. Ventral cirri are cirriform on the first 6 or 7 setigers, and postsetal lobes are distinct on the first 12–15 setigers. Bi- and tridentate pseudocompound hooks are present in the first 5 or 6 setigers. Large hooks and compound spinigers are presumably absent. The setiger upon which the subacicular hooks appear is not known, hooks are known to be present in mid-body segments. The structure of the pectinate setae is unknown. The maxillary formula is 1+1, 9+9, 10+0, 7+12, and 1+1. Fauvel (1932:148) indicated that maxilla III was symmetrical with 10 teeth on either side. This must be a lapsus cal-

ami: except in rare abnormal cases, maxilla III is always asymmetrical in onuphids, and Fauvel would certainly have commented on such a unique feature.

*K. investigatoris* is known from deep water in the Arabian Sea. It is characterized by having one more segment than normal involved in the head-formation and in having both bi- and tridentate pseudocompound hooks.

***Kinbergonuphis jenneri* (Gardiner, 1976)  
new combination**

FIGURE 5b, TABLE 4

*Onuphis jenneri* Gardiner, 1975 [1976]:192–193, figs. 24a–t.

MATERIAL.—Holotype, USNM 53002, 3 paratypes, USNM 53003 and 53004, Atlantic Ocean, North Carolina, Banks Channel, Wrightsville Beach, intertidal, muddy sand, 8 Mar 1974, coll. S. Gardiner; paratype, USNM 53006, Atlantic Ocean, North Carolina, Banks Channel, Wrightsville Beach, intertidal, muddy sand, March 1973, coll. S. Gardiner; paratype, USNM 53007, Atlantic Ocean, North Carolina, Pivers Island, Beaufort, intertidal sand, July 1972, coll. C. Jenner; 3 paratypes, USNM 53010, Atlantic Ocean North Carolina, Bogue Sound, Morehead City, intertidal, clean sand, 16 Aug 1974; 2 paratypes, USNM 53008, Atlantic Ocean, South Carolina, north of Myrtle Beach, intertidal, sand, 2 Aug 1973, coll. Doll D. Dowds; 2 paratypes, USNM 53005, Atlantic Ocean, South Carolina, Horry County, intertidal, 14 Jun 1975, coll. C. Jenner.

REMARKS.—The holotype is an incomplete specimen of 328 setigers that is 227.0 mm long and 4.20 mm wide, with parapodia. The outer lateral occipital antennae reach the peristomium; the inner lateral antennae reach setiger 3, the median antenna reaches to about the middle of setiger 1. The ceratophores have 4 rings in most cases. Branchiae are present from setiger 6 on all but one specimen, which has the first branchia on setiger 5; the maximum number of branchial filaments is 6, again, with the exception of one individual that has 5 as the maximal number.

TABLE 4.—Summary statistics for the original material of *Kinbergonuphis jenneri*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			13
Inner lateral reach setigers	2-4	3.0	0.41	13.67	13
Median reaches setigers	1-3	1.45	0.66	45.52	13
Maximum number of rings	4-5	4.08	0.28	6.86	13
Branchiae:					
First present from setiger	5-6	5.92	0.28	4.73	13
Maximum number of filaments	5-6	5.92	0.28	4.73	13
Cirriiform ventral cirri	2	Invariant			13
reach setiger					
Numbers of setigers with pseudocompound hooks	3	Invariant			13
Large hooks:					
First present from setiger	4	Invariant			13
Last present on setigers	25-36	30.23	3.03	10.02	13
Subacicular hooks first present from setiger	26-37	31.23	3.03	9.70	13

Ventral cirri are cirriiform on the first 2 setigers; postsetal lobes are digitiform in all setigers. Tridentate pseudocompound hooks are present in the first 3 setigers and large hooks are present from setiger 5 to about setiger 30 (range: 25-36). Compound spinigers are absent. Subacicular hooks are first present from the first setiger behind the last large hook; that is, on the average, from setiger 31 (range: 26-37). Each of the flat pectinate setae is distally transverse and has about 15 teeth. The maxillary formula of one dissected individual is 1+1, 12+12, 13+0, 12+13, and 1+1. The tubes have a thin, flimsy lining and are covered with a thin sand layer.

*Kinbergonuphis jenneri*, *K. microcephala*, and *K. pigmentata* are characterized by having only 2 setigers with cirriiform ventral cirri and large hooks present in a large number of setigers. *K. pigmentata* has both bi- and tridentate pseudocompound hooks; the other two species have only tridentate ones. *K. jenneri* and *K. microcephala* can be separated on a number of features as indicated by Gardiner (1975 [1976]:192). *K. jenneri* has subacicular hooks from about setiger 31, *K. microcephala* has such hooks from setiger 26; maxilla II has nearly twice as many teeth in *K. jenneri* as in

*K. microcephala*, and, perhaps most characteristically, *K. microcephala* has eyes while *K. jenneri* lacks eyes. *K. jenneri* is known from a series of intertidal sandy localities along the southeastern United States.

#### ***Kinbergonuphis lineata* (Fauchald, 1980), new combination**

FIGURE 9f

*Onuphis striata* Hartmann-Schröder, 1965:164-167, figs. 135-137 [homonym, not *O. parva striata* Uschakov, 1950:193].

*Onuphis (Onuphis) lineata* Fauchald, 1980:813.

**MATERIAL.**—Holotype, ZMH P-14293, Pacific Ocean off Chile, off Punta Lavapie, 37°08.7'S, 73°38.6'W, 58 m, fine sand with rocks and dead algae, dredge and grab, 10 Mar 1960, coll. G. Hartmann-Schröder and G. Hartmann.

**REMARKS.**—As indicated by Fauchald (1980), *Onuphis striata* is preoccupied by Uschakov (1950:193) and had to be replaced. The holotype is a complete specimen with 99 fully formed setigers and, in addition, a tail end of about 30 setigers that is in recent regeneration. The outer occipital antennae reach setiger 1; the inner lat-

eral antennae reach setiger 7, and the median antenna reaches setiger 5. The ceratophores have 4 or 5 rings. Branchiae are present from setiger 6 and continue through at least setiger 99; the setigers of the regenerating posterior end lacks branchiae. Where best developed each branchia has 7 filaments. Ventral cirri are cirriform in 6 setigers; postsetal lobes are distinct in the first 50 setigers. Tridentate pseudocompound hooks with blunt hoods are present in the first 7 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 15. Each of the flat pectinate setae is distally transverse and has about 8 marginal teeth. The maxillary formula is 1+1, 6+6, 5+0, 5+7, and 1+1 according to Hartmann-Schröder (1965: 166).

*Kinbergonuphis lineata* differs from its congeners basically in having one extra segment with cirriform ventral cirri and two extra segments with pseudocompound hooks. It is known only through its original records.

***Kinbergonuphis microcephala*  
(Hartman, 1944),  
new combination**

FIGURE 5a

*Onuphis microcephala* Hartman, 1944b:78-80, pl. 3: figs. 67-75, pl. 18: fig. 339.—Fauchald, 1968:36.—Gardiner, 1975 [1976]:191.

**MATERIAL.**—Holotype, AHF Poly 736 (previously listed as type AHF 40), Pacific Ocean, Golfo de California, Punta Cholla, intertidal, coll. S. A. Glassell.

**REMARKS.**—The holotype is a complete specimen with about 250 setigers, is 120 mm long and about 3 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2; the inner lateral antennae reach about setiger 7 and the median antenna reaches setiger 4. The ceratophores have 4 rings. Branchiae are first present from setiger 6; the maximum number of branchial filaments is 7. Branchiae are absent on the second half of the body. Ventral cirri are cirriform

in the first 2 setigers; postsetal lobes are digitiform in the first 10 setigers. Tridentate pseudocompound hooks are present in the first 3 setigers; large hooks are present from setiger 4 to setiger 25. Compound spinigers are absent. Subacicular hooks are first present from setiger 26. Each of the flat pectinate setae is distally transverse and has about 10 teeth. The maxillary formula is 1+1, 9+8, 9+0, 6+9, and 1+1. The tube is soft with a pliable inner lining and a thin cover of sand.

*Kinbergonuphis microcephala* closely resembles *K. jenneri* and *K. pigmentata*. *K. microcephala* is known from Golfo de California in intertidal sands.

***Kinbergonuphis mixta* (Fauchald and  
Hancock, 1981), new combination**

FIGURE 7p

*Nothria mixta* Fauchald and Hancock, 1981:30-31, pl. 7a-f.

**MATERIAL.**—Holotype, AHF Poly 1151; 2 paratypes, AHF Poly 1152; all Pacific Ocean off Oregon, from 44°39.4'N, 126°59.1'W to 44°39.8'N, 126°59.2'W, 2800 m, 10 Feb 1965, coll. A. J. Carey, station AD 139, NAD 24.

**REMARKS.**—The largest paratype and largest specimen available has 72 setigers and is 30 mm long and 1 mm wide. The outer lateral occipital antennae reach setiger 2 as does the median antenna; the inner lateral antennae reach setiger 3. The ceratophores have 4 rings, of which the basal 3 are very much shorter than the distal one. Branchiae are absent. Ventral cirri are cirriform in the first 3 setigers; postsetal lobes are distinct in the first 8 or 9 setigers. Bi- and tridentate pseudocompound hooks are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 11. Each of the flat pectinate setae is distally slightly oblique and has about 20 teeth. The maxillary apparatus is unknown.

*Kinbergonuphis mixta* is characterized primarily by having both bi- and tridentate pseudocompound hooks and lacking branchiae. It is known from a single deep-water locality off central Oregon.



***Kinbergonuphis multidentata* (Hartmann-Schröder, 1960), new combination**

*Onuphis multidentata* Hartmann-Schröder, 1960:24–26, figs. 50–55.

**MATERIAL.**—Holotype, ZMH P-15270, Pacific Ocean off Peru, near Pucusama, near Lima, 3–4 m dredged in sharp-edged rocks and gravel, 30 Dec 1950, coll. Maria and Hans-Wilhelm Koepcke.

**REMARKS.**—The holotype originally was described as an incomplete specimen with about 95 setigers in two pieces that together measured 44 mm in length and 2.5 mm in width, with parapodia. The anterior end of the specimen is now in very poor condition so no illustration could be made and most of the prostomial features can no longer be recognized. The summary description given here is basically an interpretation of Hartmann-Schröder's text and figures supplemented with what observations could be made on the holotype.

The inner lateral occipital antennae reach setiger 3; the median antenna is very short and does not reach beyond the first peristomial ring; the outer lateral antennae appear to be of about the same length as the median one. The ceratophores are irregularly wrinkled, but no distinct rings can be recognized. Branchiae are first present from setiger 6 and are present on the last of the segments in the fragment. The maximum number of branchial filaments is 10. Ventral cirri are cirriform in the first 2 setigers, and from setiger 4 the ventral cirri are replaced by glandular pads; the cirri on setiger 3 are distinctly intermediate in structure between those of the first 2 setigers and the pads. Postsetal lobes are distinct in all setigers present. Tridentate pseudocompound hooks with blunt hoods are present in the first 3 setigers; there are two types of hooks as evidenced by shafts of two distinctly different thicknesses. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 9. Each of the flat pectinate setae is distally oblique and has between 10 and 15 coarse teeth. The maxillary formula is 1+1, 10+8, 8+0,

9+11, and 1+1 according to Hartmann-Schröder (1960:26).

*Kinbergonuphis multidentata* resembles *K. jenneri*, *K. microcephala*, and *K. pigmentata*, in that it has only 2 segments with distinctly cirriform ventral cirri; it differs from all three in that it lacks large hooks and the ceratophores are smooth rather than ringed. *K. multidentata* is known only through its original record.

***Kinbergonuphis nannognathus* (Chamberlin, 1919), new combination**

*Onuphis nannognathus* Chamberlin, 1919:270–274, pl. 43: figs. 8–11, pl. 44: figs. 1–5.—Fauchald, 1972:131.

**MATERIAL.**—Holotype, USNM 19755, Pacific Ocean, Golfo de California, 23°59'N, 108°40'W, 1811 m, light brown mud, *Albatross* station 3431.

**REMARKS.**—The holotype is an anterior fragment with 119 setigers; it has been frontally dissected and no reasonable figure can be given. The inner lateral and median occipital antennae reach setiger 16. The ceratophores have 5 to 8 rings. Branchiae are present from setiger 5 to the end of the fragment; where best developed each branchia has 8 filaments. Ventral cirri are cirriform on the first 7 setigers and postsetal lobes are distinct in all setigers. Tridentate pseudocompound hooks with blunt hoods are present in 6 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 21 (erroneously reported as setiger 18 by Fauchald, 1972:131). Each of the flat pectinate setae is distally transverse and has 14 teeth. The maxillary formula can be reconstructed only partially from information given by Chamberlin (1919:273–274) (?=+1, ?+10, ?+0, ?+9, and ?+1) in that he only gave information concerning the dentition of the right-hand side; the maxillae presently are missing.

*Kinbergonuphis nannognathus* can be differentiated from congeners by the increase in the number of setigers involved in the head-formation and the very long inner lateral and median occipital antennae. It is known only through its original record.



TABLE 5.—Summary statistics for the original material of *Kinbergonuphis notialis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			4
Inner lateral reach setiger	3-4	3.33	0.58	17.42	3
Median reaches setiger	3				1
Maximum number of rings	3	Invariant			4
Cirriiform ventral cirri	3-4	3.75	0.50	13.33	4
reach setiger					
Last setiger with	3-4	3.75	0.50	13.33	4
pseudocompound hooks					
Subacicular hooks first	14-16	14.75	0.96	6.51	4
present from setiger					

***Kinbergonuphis notialis* (Monro, 1930),  
new combination**

FIGURE 7m, TABLE 5

*Onuphis notialis* Monro, 1930:129-131, fig. 48a-h.

**MATERIAL.**—Three syntypes, BMNH 1930.10.8.1366-67, Antarctic Ocean, Antarctic Peninsula, off Clarence Island, 61°25'30"S, 53°46'00"W, 342 m, rock, dredged, 23 Feb 1927, *Discovery* station 170; syntype, BMNH ZK 1930.10.8.1331, Antarctic Ocean, off South Shetland Islands, Bransfield Strait, 63°17'20"S, 59°48'15"W, 200 m, mud, stones and gravel, dredged, 2 Mar 1927, *Discovery* station 175.

**REMARKS.**—All 4 syntypes have wide, dark brown bands across the dorsum of the anterior 35-40 setigers. Eyes are present. The best preserved specimen is 18.75 mm long, with 36 setigers, and is 1.5 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1; the inner lateral and median antennae reach setigers 3-4. The ceratophores have 3 rings. Branchiae are absent. Ventral cirri are cirriiform in the first 3 or 4 setigers; postsetal lobes are distinct in the first 12 or 13 setigers. Tridentate pseudocompound hooks are present in the first 3 or 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setigers 14-16. Each of the flat pectinate setae is distally oblique and has about 10 teeth. The maxillary

formula is 1+1, 5+9, 6+0, 8+10, and 1+1, according to Monro (1930:129, fig. 48g). The tubes consist of an extremely tough, flaky, pergamentous material; they are not covered with foreign material and fit the animals extremely closely.

*Kinbergonuphis notialis* is a relatively small species characterized by lacking branchiae and by its unusually sturdy tube. It is known from Antarctic waters.

***Kinbergonuphis oligobranchiata* (Orensanz,  
1974), new combination**

FIGURE 6c, TABLE 6

*Onuphis oligobranchiata* Orensanz, 1974:93-94, pl. 6.

**MATERIAL.**—Holotype and 4 paratypes: MACN 27475, Atlantic Ocean off Argentina 38°46'S, 54°53'W, 900 m, *Hero* station 11; 3 specimens: MACN 27476, Atlantic Ocean off Argentina, 37°44'S, 54°53'W, 700 m, *Hero* station 13; 1 specimen: MACN 27474, Atlantic Ocean off Argentina, 37°41'S, 54°48'W, 700 m, *Hero* station 14.

**REMARKS.**—All specimens are small, soft, and incomplete posteriorly. The holotype is an incomplete specimen with 27 setigers that is 11 mm long and 1.1 mm wide with parapodia. A single outer lateral occipital antenna is present on each of 2 specimens; in both cases it reaches to setiger 1; all other ceratostyles are either completely

TABLE 6.—Summary statistics for the original material of *Kinbergonuphis oligobranchiata*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			2
Inner lateral reach setiger	—				
Median reaches setiger	—				
Maximum number of rings	2–3	2.57	0.53	20.62	7
Branchiae:					
First present from setiger*	6–7	6.50	0.58	8.92	4
Maximum number of filaments	1	Invariant			4
Cirriiform ventral cirri to setiger	3	Invariant			5
Number of setigers with pseudocompound hooks	2–3	2.83	0.41	14.49	5
Subacicular hooks first present from setiger	10–16	12.33	2.34	18.98	6

\* 3 specimens, including the holotype, completely lack branchiae.

absent or are incomplete distally. The ceratophores are short, distally inflated and have basally either 2 or 3 rings. The median ceratophore is smaller and narrower than those of the inner lateral ones. The holotype lacks branchiae completely, as do 2 additional specimens; in 4 specimens single branchial filaments are present from either setiger 6 or 7; 2 specimens are in so bad a condition that the beginning of the branchiae cannot be determined. Because of the poor state of preservation of the material, the termination of the branchiae could not be precisely determined; it appears to be near setiger 18. Ventral cirri are cirriiform in the first 3 setigers and the postsetal lobes are digitiform in about the first 10 setigers. Tridentate pseudocompound hooks are present in 2 or 3 anterior setigers; compound spinigers and large hooks are absent. Two specimens have subacicular hooks from setigers 11–12. The other 4 specimens, for which this character could be measured, have hooks from setigers 14–16. In the specimens with subacicular hooks starting early, the hooks differ in structure from those in the specimens where they start further back. Each pectinate setae is flat, distally transverse, and has 12 to 14 coarse teeth.

All specimens are small, translucent and, sub-

jectively, have a juvenile look. It is here suggested that in adult specimens the subacicular hooks start at setigers 14–16. The smallest specimen has only 2 setigers with pseudocompound hooks and subacicular hooks from setiger 10. It appears probable that adult specimens will be shown to have 3 setigers with pseudocompound hooks. The lack of branchiae in nearly half of the original material may be a larval character; because of the small size of the specimens, it is probable that adult specimens will be shown to have at least branched branchiae, if not fully pectinate ones.

*Kinbergonuphis oligobranchiata* is poorly defined, because of the apparent juvenile nature of the type material and its poor state of preservation. *K. oligobranchiata* is known only from the original records in slope depths off Argentina.

***Kinbergonuphis orensanzi* (Fauchald, 1982),  
new combination**

FIGURE 8b

*Onuphis* (*Onuphis*) *orensanzi* Fauchald, 1982:205–208, fig. 2, tables 1, 2.

*Onuphis setosa*.—Orensanz, 1974:89 [in part: not Kinberg, 1865:560].

MATERIAL.—Holotype, MNHN I 1380, 129

paratypes, USNM 69918, Atlantic Ocean off Uruguay, 34°51'S, 52°35'W, 83 m, 12 Apr 1965, coll. A. Knipovich, station 250; 15 paratypes, MNHNM I 1383, Atlantic Ocean off Uruguay, 35°20.8'S, 52°50.4'W, 130 m, 14 Apr 1965, coll. A. Knipovich, station 260.

REMARKS.—The holotype is a complete specimen with 153 setigers, is 33.15 mm long and 2.5 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2; the inner lateral antennae reach setiger 5, and the median antenna reaches setiger 3. The ceratophores have up to 4 rings. Branchiae are present from setiger 6 to setiger 92 and have up to 3 filaments. Ventral cirri are cirriform on the first 5 setigers; postsetal lobes are digitiform on the first 10 setigers. Tridentate pseudocompound hooks with short, blunt hoods are present in the first 3–5 setigers. Large hooks are present in setigers 3 to 6. Compound spinigers are absent. Bidentate subacicular hooks are present from setigers 12 or 13. Each of the flat pectinate setae is distally oblique and has 10 teeth. The maxillary formula is 1+1, 5+5, 7+0, 4+6–7, and 1+1. Tubes have a thin inner lining and are covered with a thin layer of sediment.

The variability of this species was indicated by Fauchald (1982, table 2). The problem of the identity of Kinberg's *Onuphis setosa* was discussed by Fauchald (1982:203). *K. orensanzi* is known from the type-locality in the Atlantic Ocean in the mouth of Rio La Plata.

***Kinbergonuphis paradiopatra* (Hartman, 1944),  
new status, new combination**

FIGURE 7 *i-l, o*, TABLE 7

*Nothria stigmatis paradiopatra* Hartman, 1944b:91 [no illustration].

MATERIAL.—Holotype, AHF Poly 742, 24 paratypes, AHF, Poly 743, 1 additional specimen in the type lot is an unidentifiable onuphid, Pacific Ocean, California, Cypress Point, Monterey, intertidal, 11 Nov 1932.

REMARKS.—The species was described, as a

subspecies of *Nothria stigmatis* in a very brief note, essentially only pointing to the lack of branchiae. The holotype is an incomplete specimen with 87 setigers that is 32.2 mm long and 1.4 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1; the inner lateral and median antennae reach setiger 3. The ceratophores have 4 rings. Ventral cirri (Figure 7*l*) are cirriform on the first 3 setigers; postsetal lobes are distinct in the 12 first setigers. Tridentate pseudocompound hooks (Figure 7*i,k*) with blunt hoods are present in the first 3 setigers. The hooks have shafts of two different thicknesses. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 13. Each of the flat pectinate setae (Figure 7*j*) is distally transverse and has about 10 teeth. The maxillary apparatus is unknown.

Some variability is present in the material as indicated in Table 7. The length of the inner lateral and median occipital antennae vary a great deal. Most of the specimens are light rose-colored and lack color patterns, but in some specimens a broad, dark band is present across the peristomium.

Hartman (1944) associated this species with *Nothria stigmatis* (see *Mooreonuphis stigmatis*, p. 63), from which it clearly differs in that it lacks compound spinigers. It appears most closely related to *K. notialis* from which it can be separated on the distribution of subacicular hooks; these hooks are present from setigers 10–14, usually from 12–13 in *K. paradiopatra* and from setigers 14–16 in *K. notialis* (Table 5). *K. paradiopatra* is known only from the type locality in central California.

***Kinbergonuphis pigmentata* (Fauchald, 1968),  
new combination**

FIGURE 5*d*

*Onuphis pigmentata* Fauchald, 1968:38–39, pl. 9*f-n*.

MATERIAL.—Holotype, AHF Poly 362; paratype AHF Poly 363; both Pacific Ocean, Baja

TABLE 7.—Summary statistics for the original material of *Kinbergonuphis paradiopatra*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1-3	1.17	0.48	41.03	24
Inner lateral reach setiger	2-7	4.13	1.36	32.93	23
Median reaches setiger	1-7	3.70	1.36	36.76	23
Maximum number of rings	2-4	3.88	0.44	11.34	25
Cirriiform ventral cirri reaches setiger	3	Invariant			25
Last setiger with * pseudocompound hooks	2-3*	2.96	0.20	6.76	25
First subacicular hook on setiger	10-14	12.64	1.04	8.23	25

\* Invariant at 3, except for a single juvenile specimen.

California, Bahía de San Quintín, intertidal, mud-flats, 7 Apr 1950, coll. D. J. Reish.

REMARKS.—The holotype is an anterior fragment of 101 setigers, is about 30 mm long and 3.5 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 4, and the median antenna reaches setiger 2. The ceratophores have 3 or 4 poorly marked basal rings. Branchiae are present from setiger 6; even the first one has 2 filaments and where best developed, each branchia has 7 filaments. The holotype has the full complement of filaments on the last segment present. Ventral cirri are cirriiform in the first 2 setigers; postsetal lobes are digitiform in about the first 20 setigers. Bi- and tridentate pseudocompound hooks with blunt hoods are present in the first 4 setigers, not in 3 as originally stated (Fauchald, 1968:39). Large hooks are present from setigers 4 through setiger 24. Compound spinigers are absent. Subacicular hooks are first present from setiger 25. Each of the flat pectinate setae is distally oblique and has about 15 teeth. The maxillary formula is 1+1, 10+6, 11+0, 6+10, and 1+1 according to Fauchald (1968:39).

*Kinbergonuphis pigmentata* resembles *K. jenneri* and *K. microcephala*; it differs from both in that it has both bi- and tridentate pseudocompound hooks; the 2 other species have only tridentate

hooks. *K. pigmentata* is known from one locality off the west coast of Mexico.

### *Kinbergonuphis proalopus* (Chamberlin, 1919), new combination

FIGURE 5e, TABLE 8

*Onuphis proalopus* Chamberlin 1919:265-269, pl. 40: figs. 3-8, pl. 41: figs. 1-10.\*

*Onuphis profundus* Fauchald, 1968:40; 1972:133.

MATERIAL.—Holotype, *Onuphis proalopus*, USNM 19426, Pacific Ocean off Peru, off Punta Aguja, 5°47'S, 81°24'W, 976 m, dark brown volcanic mud, 12 Nov 1904, *Albatross* station 4653; holotype, *Onuphis profundus*, AHF Poly 364 and 7 paratypes, AHF Poly 365, Pacific Ocean off Baja, California, from 22°32.2'N, 109°43.0'W to 22°35.8'N, 109°47.9'W, 2766-2794 m, silty clay, deep diving dredge, 22 Mar 1959, coll. Robert H. Parker, station P-41-59.

REMARKS.—The holotype and only known specimen of *O. proalopus* has been dried out. It has been frontally dissected for its jaw-apparatus, so no meaningful illustration can be made. The morphological features were checked as carefully as possible. The material of *O. profundus* is in considerably better condition, and Figure 5e is based on its holotype. Below are given separate sum-

TABLE 8.—Summary statistics for *Kinbergonuphis proalopus* (based on the original material of *Onuphis profundus*, Fauchald, 1968:40; number in parentheses = calculated but statistically meaningless)

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antenna:					
Outer lateral reach setigers	3-5	3.67	1.15	31.34	3
Inner lateral reach setigers	10-15	(12.5)	(3.54)		2
Median reaches setigers	6-10	(8.0)	(2.83)		2
Maximum number of rings	5-7	5.88	0.99		8
Branchiae:					
First present from setiger	6-8	7.38	0.74	10.03	8
Maximum number of filaments	4	Invariant			8
Cirriiform ventral cirri to setiger	7	Invariant			8
Number of setigers with pseudocompound hooks	5-6	5.38	0.52	9.67	8
Subacicular hooks present from setiger	19-20	19.88	0.35	1.76	8

maries of the morphological features of the 2 taxa.

The type specimen of *O. proalopus* is incomplete and consists of 182 setigers, is 65 mm long and 1.6 mm wide, with parapodia. The outer lateral occipital antennae reaches setiger 1, the inner lateral antennae reach setiger 18, and the median antenna reaches setiger 4. The ceratophores have 6 or 7 rings. Branchiae are first present from setiger 6 and are present on the last setiger available; the maximal number of branchial filaments is 6. Ventral cirri are cirriiform in the first 7 setigers and postsetal lobes are distinct in about the first 15 setigers. Tridentate pseudocompound hooks with blunt hoods are present in the 5 first setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 21. Each of the flat pectinate setae is distally slightly oblique and has about 15 teeth. The maxillary formula (rewritten from Chamberlin, 1919:269) is 1+1, 8+10, 9+0, 7+10, and 1+1.

The holotype of *O. profundus* is an anterior fragment with 79 setigers that is about 64 mm long and 3.5 mm wide, with parapodia. The antennal styles have been lost on most specimens but appear to have had the following lengths: the inner

lateral styles are by far the longest and reach setigers 10-15; the median style reaches setigers 6-10. In both cases, where the inner lateral and median ones were present, the latter was clearly shorter than the former. The ceratophores have 5 to 7 poorly marked rings. Branchiae are present from setigers 6-8, most frequently from setiger 7 or 8; the maximum number of branchial filaments is 4. Ventral cirri are cirriiform in the first 7 setigers, and postsetal lobes are digitate in about 15 setigers. Tridentate pseudocompound hooks are present in the first 5 or 6 setigers; they were erroneously reported present in only 3 setigers in the original description (Fauchald, 1968:40). Large hooks and compound spinigers are absent. Subacicular hooks are present from setigers 19 or 20. Each of the flat pectinate setae is distally oblique and has about 15 teeth. The pectinate setae appear to be missing entirely before setiger 30. The maxillary formula according to Fauchald (1968:41) is 1+1, 8+9, 7+0, 8+7, and 1+1.

The differences between the type material of both species are minor and well within the range of variability established for other taxa in *Kinbergonuphis*.

Table 8 shows the variability of various features in the original material of *O. profundus*. As men-



tioned above, the interpretation of *O. proalopus* depends to a large extent on Chamberlin's original description. Since his observations cannot be confirmed on the holotype, they are not included in the table. *K. proalopus* is known from the eastern part of the Pacific Ocean in deep water.

***Kinbergonuphis pseudodibranchiata* (Gallardo, 1968), new combination**

FIGURE 6a

*Onuphis pseudodibranchiata* Gallardo, 1967 [1968]:76–77, pl. 26: figs. 5–10.

**MATERIAL.**—Holotype, AHF Poly 297, Pacific Ocean off Vietnam, Gulf of Nha Trang, 12°14'20"N, 109°12'10"E, 5 m, van Veen grab, fine sand with black decomposing organic matter, 1 Mar 1960, coll. V. A. Gallardo, station 186I.

**REMARKS.**—The holotype, an incomplete specimen with about 65 setigers, is 15 mm long and 7 mm wide, with parapodia. Both outer lateral occipital antennae, including the ceratophores, are missing; the inner lateral occipital antennae reach setiger 8; the median antenna reaches about setiger 10. Ceratophores are indistinctly ringed with about 7 rings. Branchiae are first present from setiger 4; with up to 3 branchial filaments. Ventral cirri are cirriform in 5 setigers; postsetal lobes are digitiform in the first 10 setigers. Tridentate pseudocompound hooks are present in 6 setigers; large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 10. Pectinate setae were not observed. The maxillary formula is unknown.

*Kinbergonuphis pseudodibranchiata* differs from most species in the genus by having the branchiae beginning setiger 4; they usually begin on setiger 6 in this genus. The species is otherwise characterized by the distribution of setae and cirri. *K. pseudodibranchiata* is known from several localities in the Gulf of Nha Trang, Vietnam.

***Kinbergonuphis pulchra* (Fauchald, 1980), new combination**

FIGURE 9c

*Onuphis (Onuphis) pulchra* Fauchald, 1980:814–819, figs. 5, 6, tables 5, 6.

**MATERIAL.**—Holotype, USNM 61241, 58 paratypes, USNM 61242, Gulf of Mexico off Belize, Carrie Bow Caye, sparse *Thalassia* just west of island, 1 m, 4 Apr 1976, coll. M. L. Jones, station CB-1.

**REMARKS.**—The holotype, a complete specimen with 250 setigers, is 70 mm long and 1.3 mm wide, with parapodia. The outer lateral occipital antennae reach the posterior edge of the peristomium, the inner lateral and median antennae reach setiger 5. The ceratophores have 4 or 5 rings. Branchiae are first present from setiger 6; the maximum number of branchial filaments is 4. Ventral cirri are cirriform through the first 9 setigers; postsetal lobes are distinct in about the first 50 setigers. Tridentate pseudocompound hooks are present in the first 6 setigers; large hooks are present from setiger 4 to about setigers 15–19. Compound spinigers are absent. Subacicular hooks are present from setigers 16–20. Each of the flat pectinate setae is distally transverse and has about 12 teeth. The maxillary formula is 1+1, 6–7+8, 8+0, 5–6+8, and 1+1 according to Fauchald (1980:818).

A table of the variability in the original material was given by Fauchald (1980, table 5). *K. pulchra* has one additional segment with pseudocompound hooks, large hooks are present, and the ventral cirri are cirriform on a larger number of segments than in most congeners. It is known from sandy flats near Carrie Bow Caye, Belize.

***Kinbergonuphis pygidialis* (Fauchald, 1968), new combination**

FIGURE 7n

*Nothria pygidialis* Fauchald, 1968:26–27, pl. 7f–m.

**MATERIAL.**—Holotype, AHF Poly 351, Pacific

Ocean, off Baja California, Isla Guadalupe, 2¼ miles [3.6 km] north of South Bluff, 28°54'00"N, 118°16'12"W, intertidal, rocky tidepools, *Eisenia* and *Codium*, 19 Dec 1949, *Velero* Station 1923–1949.

**REMARKS.**—The type, a complete specimen with 87 setigers, is about 15 mm long and 0.5 mm wide. The outer lateral occipital antennae reach setiger 3, the inner lateral antennae reach setiger 4, and the median antenna reaches setiger 7. The ceratophores are smooth. Branchiae are absent. Ventral cirri are cirriform in the first 3 setigers. Postsetal lobes are distinct in the first 9 setigers. Tridentate pseudocompound hooks are present in the first 5 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 17. Each of the flat pectinate setae is distally transverse and has 10 teeth. The maxillary formula is unknown.

*Kinbergonuphis pydidialis* lacks branchiae and the ceratophores are smooth. It is known only through the original record.

***Kinbergonuphis rubrescens* (Augener, 1906),  
new combination**

FIGURE 6e

*Onuphis rubrescens* Augener, 1906:139–141, pl. 4: figs. 76–83.

**MATERIAL.**—?Type, MCZ 2326, see "Remarks" below. The 2 original records are given as Nr. 241, depth 163 fm Lat., Cariacou N long. Cariacou W., and Nr. 218, depth 164 fm Lat., St. Lucia N. Long. St. Lucia W.

**REMARKS.**—This specimen may be part of the type material. The vial contains 3 handwritten labels (in addition to the label giving the MCZ number). These read: (1) "*Northia rubrescens* n. sp." This label is in an unknown handwriting, certainly not in Augener's writing. (2) "*Onuphis-Northia* not a valid genus. Treadwell." This label is in Treadwell's handwriting. (3) "This may be the type of *Onuphis rubrescens* Augener. No loc. or other data in bottle. Hartman 1937." This label is in Hartman's handwriting. The specimen is consistent with Augener's description of *K. rubrescens*

and is here assumed to be part of the original material.

The specimen is incomplete, with 112 setigers, and is 39.7 mm long and 4.2 mm wide, with parapodia; it has been frontally dissected and the maxillary apparatus is missing. The outer lateral occipital antennae reach setiger 3, the inner lateral antennae reach setiger 15, and the median antenna reaches setiger 14. The ceratophores are short and have at most 5 rings. Branchiae are present from setiger 13 to the end of the fragment; each is long, simple, and strap-like. Digitiform postsetal lobes are distinct to setiger 16, and ventral cirri are cirriform on the first 5 setigers. Tridentate pseudocompound hooks are present in the first 5 setigers; large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 14. Each flat pectinate setae is distally transverse and has about 15 teeth. The maxillary formula (according to Augener, 1906: 141) is 1+1, 8–9+8–9, 7–8+0, 6–10+6, and 1+1. A stiff, thick tube without any external covering of sand or any other foreign material is present in the same vial.

*Kinbergonuphis rubrescens* is distinguished from other members of the genus through the posterior appearance of the simple branchiae. *K. rubrescens* is known from slope depths in the Caribbean Sea.

***Kinbergonuphis simoni* (Santos, Day, and  
Rice, 1981), new combination**

FIGURE 10e, TABLE 9

*Onuphis simoni* Santos, Day, and Rice, 1981:663–668, fig. 1a–e.

**MATERIAL.**—Holotype, USNM 61098; 14 paratypes examined in detail, USNM 61099; all Atlantic Ocean, Gulf of Mexico, Old Tampa Bay by Courtney Campbell Causeway, intertidal, sand, 22 Feb 1980, coll. Santos, Lombard, and Churchill.

**REMARKS.**—The holotype is a complete specimen with 247 setigers and is about 52 mm long and 0.6 mm wide, with parapodia. The peristomium and anterior setigers have dark brown trans-

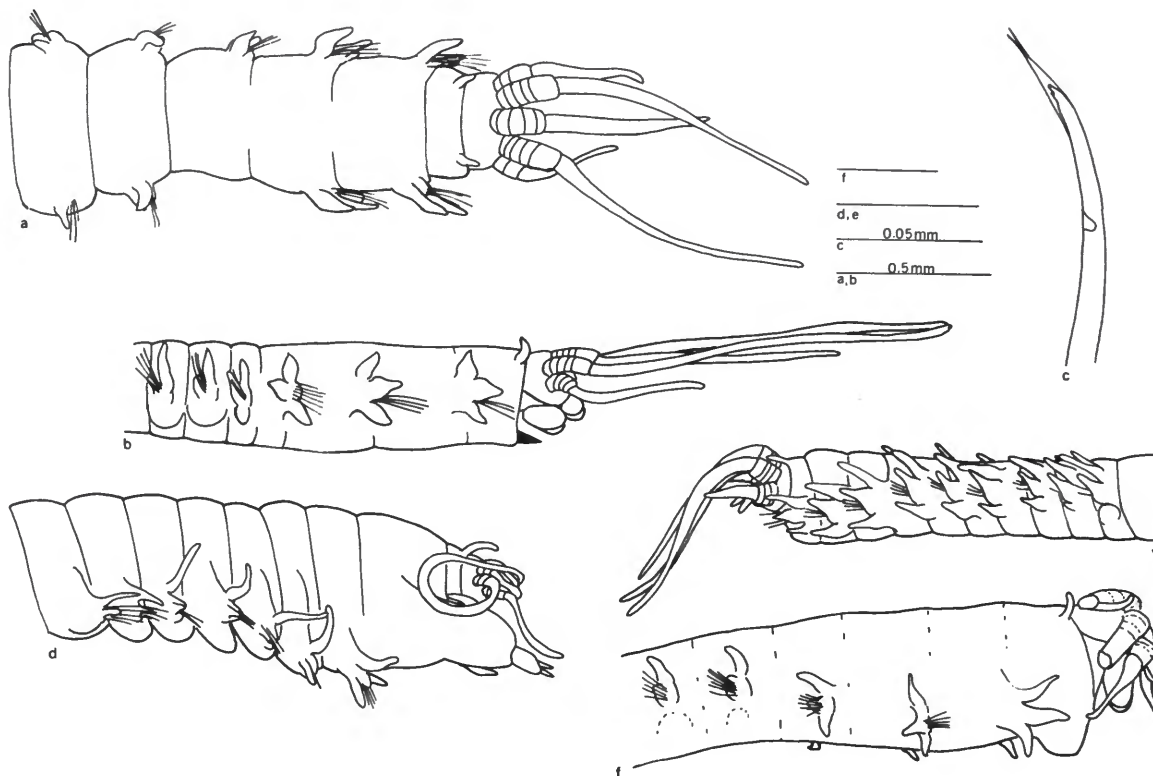


FIGURE 10—Anterior ends of species of *Onuphis*-*Nothria*-*Paradiopatra* complex: *a*, *Sarsonuphis fragosa* (Ehlers, 1887), dorsal view; *b*, lateral view; *c*, pseudocompound hook, second setiger; *d*, *Paradiopatra glutinatrix* Ehlers, 1887, lateral view; *e*, *Kinbergonuphis simoni* (Santos, Day, and Rice, 1981); lateral view; *f*, *Sarsonuphis iberica* (Hartmann-Schröder, 1975), lateral view. (All scales = 1 mm unless otherwise indicated.)

verse lines and patches, which fade rapidly posteriorly and which are absent posterior to setiger 25. The outer lateral occipital antennae reach setiger 1, the inner lateral ones reach setiger 7, and the median one reaches setiger 6 in most specimens. A juvenile has relatively longer occipital antennae as indicated in Table 9. The maximum number of rings on the ceratophores is 3, and the ceratophores are very short compared to the length of the prostomium. Branchiae are present from setigers 6 to 9, most commonly from either setiger 7 or 8 and the maximum number of branchial filaments is 4, the juvenile has maximally 2 branchial filaments. Ventral cirri are cirriform in the first 6–8 setigers and the postsetal

lobes are digitiform in the first 16–19 setigers. Tridentate pseudocompound hooks with short, blunt hoods are present in the first 5 setigers. Large hooks are present between setigers 4 and about setiger 16, varying with the beginning of the subacicular hooks. Compound spinigers are absent. Subacicular hooks are first present from about setiger 17; each of the flat pectinate setae is distally slightly oblique, nearly transverse and has about 10 teeth; they occur singly in the parapodia. The maxillary apparatus was not investigated in any of the specimens; it was given as 1+1, 10+11, 10+0, 5+9, and 1+1 by Santos, Day, and Rice (1981:666). The tubes are thin, flimsy, and sparsely covered with large sand gains.

TABLE 9.—Summary statistics for part of the type-material for *Kinbergonuphis simoni* (numbers in parentheses = calculated for adult specimens only)

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1–2	1.07	0.26	6.76	15
Inner lateral reach setiger	5–9 (7)	6.67 (6.50)	0.90 (0.65)	12.14 (6.51)	15 (14)
Median reaches setiger	5–7 (6)	5.33 (5.21)	0.62 (0.43)	7.15 (3.48)	15 (14)
Maximum number of rings	3	Invariant			
Branchiae:					
First present from setiger	6–9	7.50	1.22	20.00	14
Maximum number of filaments	4*	Invariant			14
Cirriiform ventral cirri to setiger	6–8	7.40	0.83	9.27	15
Number of setigers with pseudocompound hooks	5	Invariant			
Large hooks:					
First present from setiger	4	Invariant			15
Last present on setiger	12–17	15.93	1.39	12.08	15
Subacicular hooks first present from setiger	22–23	22.60	0.55	2.43	5

\* 2 in juvenile.

*Kinbergonuphis simoni* is rather more variable than most other members of the genus. The species differs from its congeners in combinations of various distributional features, such as, numbers of setigers with cirriiform ventral cirri and pseudocompound hooks. It is known from both sides of the Florida peninsula in shallow water and intertidal environments.

***Kinbergonuphis taeniata* (Paxton, 1979),  
new combination**

FIGURE 9*h*

*Onuphis taeniata* Paxton, 1979:284–288, figs. 43–55.

**MATERIAL.**—Paratypes, USNM 55950 and AHF Poly 1254, Pacific Ocean off Australia, Mackay, Queensland, town beach, ca. 21°09'S, 149°12'E, intertidal, sand, 5 Sep 1977, coll. H. and J. Paxton. The holotype is in the Australian Museum, Sydney, and other paratypes are in BMNH.

**REMARKS.**—One paratype (USNM 55950) is a

complete specimen with 172 setigers and is 54 mm long and 1.2 mm wide, with parapodia. The other paratype (AHF 1254) is incomplete, but generally of the same size. The notes are based on both specimens. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae reach setiger 11 or 14 and the median antenna reaches setigers 6 or 7. The inner lateral ceratophores, which are the longest, have 8 to 10 rings. Branchiae are first present from setiger 6; maximum number of branchial filaments is 4, and branchiae are absent on the last 15 setigers in the complete specimen. Ventral cirri are cirriiform in the first 8 or 9 setigers. Postsetal lobes are distinct in all setigers back to about setiger 120 in the complete specimen. Bi- and tridentate pseudocompound hooks with blunt hoods are present in the first 7 setigers; large hooks are present between setigers 4 and 10. Compound spinigers are absent. Subacicular hooks are present from setiger 37 or 42. Each of the flat pectinate setae is distally oblique and has about 10 teeth. The maxillary formula is 1+1, 9+8–9, 8–10+0,

5-6+9-10, and 1+1, according to Paxton (1979:285).

***Kinbergonuphis tenuisetis* (McIntosh, 1885),  
new combination**

FIGURE 7b

*Nothria tenuisetis* McIntosh, 1885:307-310, pl. 21A: figs. 24-26, pl. 40: figs. 8, 9.—Knox and Hicks, 1973:285.

**MATERIAL.**—Syntype, BMNH 1885.12.1.213, Pacific Ocean off New Zealand, off East Cape, North Island, 37°34'S, 179°22'E, 1274 m, gray ooze, *Challenger* station 169; syntype, BMNH 1885.12.1.214, Atlantic Ocean, Caribbean Sea, off Sombbrero and St. Thomas, 837 or 710 m, locality dubious.

**REMARKS.**—The specimen from the Caribbean Sea has been anteriorly dissected and is completely unidentifiable. No trace is left of the prostomium or the peristomium so the anterior features cannot be identified accurately. If the anteriormost structure present is the lower lip, then the branchiae start on setiger 7 and ventral cirri are cirriform in 5 setigers.

The following description is based on the specimen from New Zealand, which, while also frontally dissected, has been left reasonably intact. The sample contains several median and posterior fragments in addition to a single anterior fragment. The anterior fragment consists of 98 setigers and is 42.75 mm long and 2.5 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2, the sole remaining inner lateral antenna reaches setiger 6. The median style has been broken. The ceratophores have maximally 6 rings, of which the distal one is as long as the others put together. Branchiae are present from setiger 11 and continue to the end of the fragment. All are simple and strap-like on the anterior fragment, each is extremely long and flattened. Ventral cirri are cirriform in the first 7 setigers; postsetal lobes are distinct in the first 50 setigers. All setae are broken, with exception of the subacicular hooks. According to McIntosh (1885:308), the pseudocompound hooks should be tridentate

and blunt-hooded. They appear to have been present in 5 setigers. Large hooks and compound spinigers appear to have been absent. Subacicular hooks are first present from setiger 20. The structure of the pectinate setae is unknown; they cannot have been present in large numbers. Two sets of jaws were present in a small vial with the specimen from New Zealand; presumably these jaws are those of both the specimen from Sombbrero-St. Thomas and the New Zealand specimen. One set has been destroyed on the lefthand side and the maxillary formula can no longer be determined. The other has the following formula: 1+1, 7+8, 7+0, 7+10, and 1+1. It is impossible to decide to which specimen this set of maxillae belong.

Knox and Hicks (1973:285) reexamined the New Zealand specimen, but made no mention of the other specimen included in McIntosh' description. McIntosh did not specify which specimen was to be considered the type; thus the Caribbean specimen must be taken into account in a discussion of the species.

*Kinbergonuphis tenuisetis* is here identified with the specimen from New Zealand. If the interpretation of the fragmentary specimen from the Caribbean Sea is correct, the two specimens cannot belong to the same species. The Caribbean specimen cannot presently be assigned to any species from that area. Because of the poor condition of the types, *K. tenuisetis* remains poorly known; it appears characterized by long, strap-like branchiae starting at setiger 11. As accepted here, *K. tenuisetis* is known from the Pacific Ocean, near New Zealand, in deep water.

***Kinbergonuphis vermillionensis* (Fauchald,  
1968), new combination**

FIGURE 9g

*Onuphis vermillionensis* Fauchald, 1968:41-43, pl. 11.

**MATERIAL.**—Holotype, AHF Poly 366; 1 paratype, AHF Poly 367; both Pacific Ocean, Golfo de California, 29°21.0'N, 112°42.0'W, 129 m,



sand, rock dredge, 28 Apr 1959, coll. Robert H. Parker, station P-83-59.

**REMARKS.**—The anterior end of the holotype has disappeared since the original description was made. The paratype, which is an incomplete specimen with 83 setigers, is 27 mm long and 1.2 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral and median antennae reach setiger 3. The ceratophores have 4 or 5 rings. Branchiae are present from setiger 7; the maximum number of branchial filaments is 4. Branchiae are absent on the last 125 setigers of the holotype. Ventral cirri are cirriform in the first 9 setigers, but are relatively short in setigers 8 and 9. Postsetal lobes are distinct in the first 14 setigers. Tridentate pseudocompound hooks are present in 8 setigers and large hooks are present from setiger 4 through setiger 10. Compound spinigers are absent. Subacicular hooks are present from setiger 12. Each of the flat pectinate setae is distally oblique and has about 12 teeth. The maxillary formula is 1+1, 14+12, 8+0, 5+0, and 1+1 according to Fauchald (1968:42).

*Kinbergonuphis vermillionensis* has about 4 more modified anterior segments than usual; large hooks are present and the occipital antennae are short. It is known from the type locality near Isla Tiburon, Golfo de California.

***Kinbergonuphis virgata* (Fauchald, 1980),  
new combination**

FIGURE 9a

*Onuphis* (*Onuphis*) *virgata* Fauchald, 1980:819–821, fig. 7, tables 6, 7.

**MATERIAL.**—Holotype, USNM 61248, 4 paratypes, USNM 71249, Gulf of Mexico off Belize, halfway between Colson Point and Salt Creek, Dangriga district, bare sand, from 0.5 m to shore, fine sand, almost mud, 16 May 1977, coll. M. L. Jones, station CB-40B.

**REMARKS.**—The holotype, an incomplete specimen with 149 setigers, is 57 mm long and 0.7 mm wide, with parapodia. The outer lateral oc-

cipital antennae reach setiger 1; the inner lateral and median antennae reach setigers 3 or 4. The ceratophores have 4 or 5 rings. Branchiae are first present from setigers 5 to 7 and have up to 5 filaments. Ventral cirri are cirriform in the first 11 to 13 setigers. Postsetal lobes are distinct in at least 150 setigers (to the end of the fragments). Tridentate pseudocompound hooks are present in the first 7 setigers and large hooks are present from setiger 4 to setigers 21 or 22. Compound spinigers are absent. Subacicular hooks are present from setiger 22 or 23. Each of the flat pectinate setae is distally transverse and has about 8 teeth. The maxillary formula is 1+1, 7+9, 7+0, 5+9, and 1+1 according to Fauchald (1980:821).

*Kinbergonuphis virgata* has cirriform ventral cirri in 11–13 setigers and pseudocompound hooks in 7 setigers; thus more than the usual 3–5 anterior modified setigers are present. In addition, large hooks are present in some anterior setigers. A table showing variability in the types is given in Fauchald (1980, table 7). It is known from one locality on the mainland coast of Belize.

***Onuphis* Audouin and Milne Edwards, 1833,  
emended**

**DIAGNOSIS.**—Onuphids with an indeterminate number of setigers and long, cylindrical tubes; peristomial cirri present and frontal palps short. First parapodia not enlarged. Occipital ceratophores distinctly longer than the length of the prostomium, always ringed, usually with more than 10 rings. Outer lateral ceratostyles shorter than their ceratophores. Tridentate pseudocompound hooks always present, bidentate hooks sometimes present; all hooks short and blunt. Branchiae always present, either pectinate or as single filaments, usually first present before or on setiger 4 (19 of 22 species). Compound spinigers always absent, large hooks rarely present; subacicular hooks present. Pectinate setae flat.

**TYPE-SPECIES.**—*Onuphis eremita* Audouin and Milne Edwards, 1833, by monotypy.

**GENDER.**—Feminine.

**REMARKS.**—Most species of *Onuphis* have very

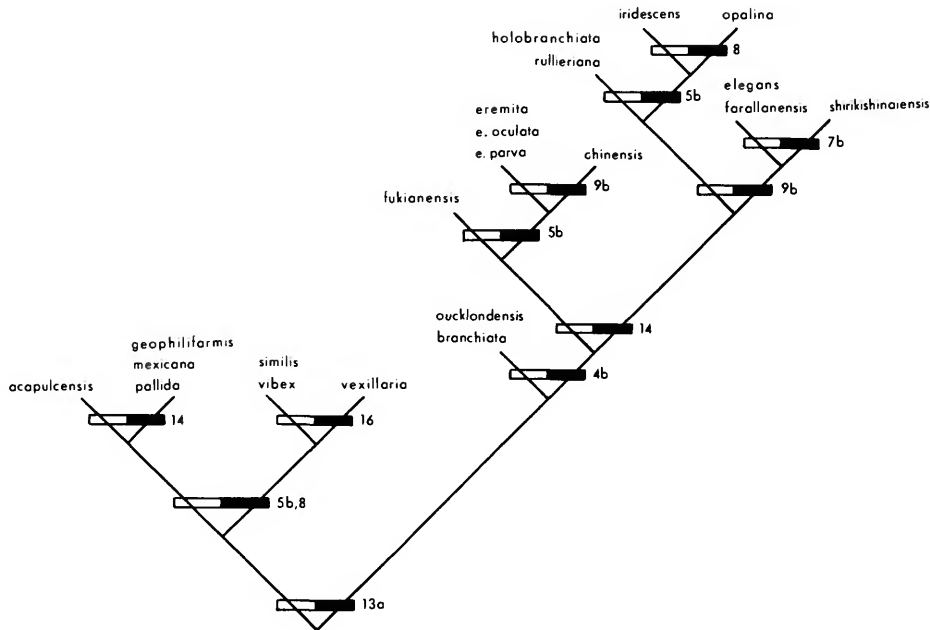


FIGURE 11.—Cladogram showing relations among species of *Onuphis* (character-numbers are explained in Table 1; black bar = apomorph state; white bar = plesiomorph state).

long, tapering dorsal cirri in the first setigers, giving them a distinctly ragged appearance. Most species of *Onuphis* were described from water shallower than 50 m. The genus is poorly represented in deep-water and in cold-water areas. It is relatively better represented in the western Pacific Ocean and in the Indian Ocean than the other genera in the *Onuphis*-*Nothria* complex. No species

have been described from either the Arctic or the Antarctic oceans. Cladistic analysis (Figure 11) of the 22 species in the genus, using the standard set of characters, leave a number of unresolved dichotomies and trichotomies. As in the case of *Kinbergonuphis*, it appears that some radiation has taken place since the origin of the genus, involving characters not included in the generalized set.

### Key to the Species of *Onuphis*

1. All branchiae simple and strap-like ..... 2  
    Branchiae at least bifid, usually pectinate ..... 13
2. Branchiae starting on setiger 1 ..... 3  
    Branchiae first present from setigers 4-6 ..... 9
3. All pseudocompound hooks tridentate ..... 4  
    Some bidentate pseudocompound hooks present ..... 7
4. Ventral cirri cirriform in 4 setigers ..... *O. holobranchiata*  
    Ventral cirri cirriform in 5-7 setigers ..... 5

5. Cirriform postsetal lobes distinct in first 10 setigers ..... *O. opalina*  
    Cirriform postsetal lobes distinct in first 12–16 setigers ..... 6
6. Cirriform postsetal lobes distinct in first 12 setigers ..... *O. rullieriana*  
    Cirriform postsetal lobes distinct in first 16 setigers ..... *O. iridescens*
7. Ventral cirri cirriiform in first 7 setigers, subacicular hooks first present  
    from setigers 13–14 ..... *O. shirikishinaiensis*  
    Ventral cirri cirriiform in first 5 setigers, subacicular hooks first present  
    from setigers 10 ..... 8
8. Most pseudocompound hooks bidentate, present in first 5 setigers  
    ..... *O. farallonensis*  
    Most pseudocompound hooks tridentate, present in first 4 setigers  
    ..... *O. elegans*
9. Pseudocompound hooks in first 3 or 4 setigers ..... 10  
    Pseudocompound hooks in first 5 setigers ..... 12
10. Subacicular hooks from setiger 16 ..... *O. pallida*  
    Subacicular hooks from setiger 8–12 ..... 11
11. Ventral cirri cirriiform in first 6 setigers; pseudocompound hooks in first  
    4 setigers; subacicular hooks from setigers 8 or 9 ..... *O. similis*  
    Ventral cirri cirriiform in first 4 or 5 setigers; pseudocompound hooks  
    in first 3 setigers; subacicular hooks from setigers 10–12 .....  
    ..... *O. geophiliformis*
12. Ventral cirri cirriiform in first 5 setigers; ceratophores vaguely ringed with  
    about 25 rings ..... *O. mexicana*  
    Ventral cirri cirriiform in first 6 setigers; ceratophores distinctly ringed  
    with maximally 12 rings ..... *O. vibex*
13. Branchiae from setigers 2–6 ..... 14  
    Branchiae from setiger 1 ..... 16
14. Large hooks present in setigers 6–9 ..... *O. vexillaria*  
    Large hooks absent ..... 15
15. Branchiae from setiger 2 ..... *O. aucklandensis*  
    Branchiae from setiger 6 ..... *O. acapulcensis*
16. Maximally 2 branchial filaments present ..... *O. dibranchiata*  
    At least 3 branchial filaments present ..... 17
17. Bidentate pseudocompound hooks present ..... 18  
    All pseudocompound hooks tridentate ..... 19
18. Pseudocompound hooks in first 3 setigers ..... *O. fukianensis*  
    Pseudocompound hooks in first 5 setigers ..... *O. chinensis*
19. Subacicular hooks present from setiger 20 ..... *O. branchiata*  
    Subacicular hooks present from 8–10 ..... 20
20. Pseudocompound hooks in first 4 setigers ..... *O. eremita parva*  
    Pseudocompound hooks in first 3 setigers ..... 21
21. Eyes present ..... *O. eremita oculata*  
    Eyes absent ..... *O. eremita* (including *basipicta*)

***Onuphis eremita* Audouin and Milne Edwards,  
1833**

FIGURE 12a, TABLE 10

*Onuphis eremita* Audouin and Milne Edwards, 1833:226–228, pl. 10: figs. 1–5.—Fauvel, 1919:385.

**MATERIAL.**—1 specimen, MNHNP, Atlantic Ocean off France, Ile de Re, approximately 42°12'N, 1°25'W, Plage du Martrai, 13 Aug 1920, identified by P. Fauvel. 2 specimens, MNHNP, Atlantic Ocean off France, Ile de Noirmoutier, approximately 46°58'N, 2°12'W, in intertidal sand, summer 1911, coll. Bioret, identified by P. Fauvel.

**REMARKS.**—The type of material of *O. eremita* is not present in the Paris Museum (J. Renaud-Mornant, in litt.). The types came from sandy areas near La Rochelle on the Atlantic coast of France. The present specimens are from similar environments. Ile de Re is immediately off La Rochelle. The two other specimens formed the

basis of Fauvel's (1919:385) description of the species. The comments below attempt to fill out and delimit the concept of the species as it was defined by the original authors and by the later revision by Fauvel.

The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setigers 7 to 9, and the median antenna setigers 4 to 6. The ceratophores are long and strongly ringed, with about 24 rings in the inner lateral ceratophores. The outer lateral ceratophores are distinctly longer than their styles. Branchiae are present from setiger 1 to the end of the fragments. The first 18–20 setigers have simple branchiae; thereafter, the number of branchial filaments increase rapidly to the maximum number, which is 6 in all 3 specimens. Ventral cirri are cirriform in the first 6 setigers; digitiform postsetal lobes are distinct in at least 60 setigers in all 3 specimens. A small interrampal papilla is present at the base of the dorsal cirri in setigers 4 to 10. Tridentate compound hooks with blunt hoods are

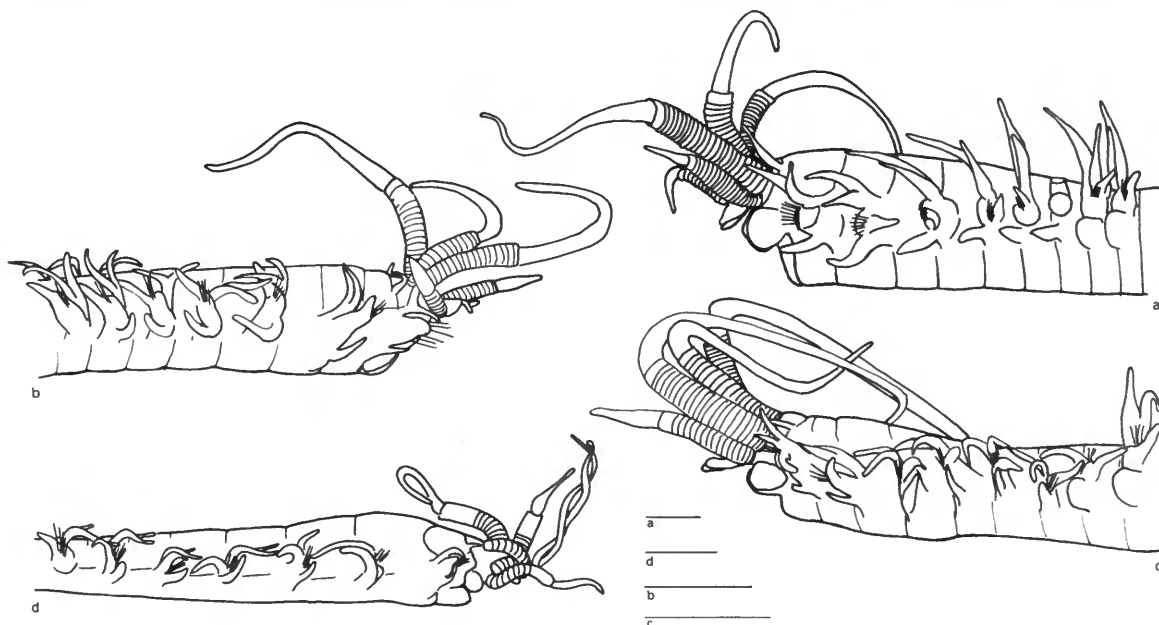


FIGURE 12.—Anterior ends of species of *Onuphis* in lateral view: a, *O. eremita* Audouin and Milne Edwards, 1833; b, *O. eremita oculata* Hartman, 1951; c, *O. eremita parva* Berkeley and Berkeley, 1941; d, *O. vibex* (Fauchald, 1972). (All scales = 1 mm.)

TABLE 10.—Summary statistics for *Onuphis eremita*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			3
Inner lateral reach setiger	7-9	7.67	1.15	14.99	3
Median reaches setiger	4-6	5.00	1.00	20.00	3
Maximum number of rings	23-25	24.00	1.00	4.17	3
Branchiae:					
First present from setiger	1	Invariant			3
Maximum number of filaments	6	Invariant			3
Cirriiform ventral cirri to setiger	6	Invariant			3
Last setiger with pseudocompound hooks	3	Invariant			3
Subacicular hooks first present from setiger	9-10	9.67	0.58	6.00	3

present in 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 9 or 10. Each of the flat pectinate setae is distally oblique and has about 15 teeth. The maxillary apparatus was not examined in any of these specimens. Fauvel (1923:415) gives the formula as 1+1, 6-7+8-9, 8-9+0, 4+9-10, and 1+1. The tubes were described by Audouin and Milne Edwards (1833:228) as cylindrical, thin-walled, and covered with sand grains.

*Onuphis eremita* differs from its congeners in having one or more segments with cirriiform ventral cirri than usual and in the large discrepancy between the number of segments with pseudocompound hooks and those with cirriiform ventral cirri. It is difficult to assess how widespread *O. eremita* might be, since it has been variably defined by different authors. It is certainly present in intertidal areas of western Europe.

#### *Onuphis eremita oculata* Hartman, 1951

FIGURE 12*b*, TABLE 11

*Onuphis eremita oculata* Hartman, 1951:52-54, pl. 14: figs. 1,2.

**MATERIAL.**—Holotype, AHF Poly 738, and 5 paratypes, AHF Poly 739, intertidal to shelf

depths, Gulf of Mexico, Alligator Point, Franklin Co., Florida.

**REMARKS.**—The holotype, a complete specimen with 215 setigers, is 52.5 mm long and 1.3 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 5, and the median antenna reaches setiger 3. The ceratophores have at least 15 rings. Outer lateral ceratophores are distinctly longer than their styles. Branchiae are present from the first setiger; maximally 6 branchial filaments are present. Ventral cirri are cirriiform in the first 6 setigers; digitiform postsetal lobes can be distinguished to about setiger 28. Interramal papillae are present from setiger 4 through setiger 10. Tridentate pseudocompound hooks with blunt hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present in setiger 10. Each of the flat pectinate setae is distally transverse and has about 10 teeth. The maxillary formula is 1+1, 8+9, 9+0, 6+11, and 1+1 according to Hartman (1951:54). Eyes are present between the outer and inner lateral occipital antennae.

*Onuphis eremita oculata* differs from the main form in having eyes and in having slightly shorter occipital antennae. It is known from Gulf of Mexico.



TABLE 11.—Summary statistics for the type material of *Onuphis eremita oculata*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			6
Inner lateral reach setiger	5-7	6.00	0.89	14.83	6
Median reaches setiger	3-4	3.60	0.55	15.28	5
Maximum number of rings	12-20	16.17	3.19	19.73	6
Branchiae:					
First present from setiger	1	Invariant			6
Maximum number of filaments	4-6	4.50	0.85	18.67	6
Cirriform ventral cirri to setiger	4-6	5.17	0.75	14.51	6
Last setiger with pseudocompound hook	3	Invariant			6
Subacicular hooks first present from setiger	10	Invariant			6

***Onuphis eremita parva* Berkeley and Berkeley,  
1941**

FIGURE 12c

*Onuphis eremita parva* Berkeley and Berkeley, 1941:35-36.—  
Pettibone, 1967:8.

**MATERIAL.**—Holotype, USNM 32886, and 1 paratype, USNM 32885, Pacific Ocean off California, Corona del Mar or vicinity, 22-31 m, coll. N. and G. MacGinitie.

**REMARKS.**—The holotype, an incomplete specimen with 50 setigers, is 15 mm long and 1.5 mm wide, with parapodia. The paratype is 17 mm long and 1.5 mm wide, including parapodia, and has 57 setigers. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae reach setiger 10, and the median antenna reaches setiger 7. The maximum number of rings on the ceratophores is 21. Outer lateral ceratophores are longer than their styles. Branchiae are first present from setiger 1; the branchiae are simple in the first 23 to 30 setigers; the maximum number of branchial filaments in the holotype and paratype is 4 and 5, respectively. Ventral cirri are cirriform in the first 6 setigers; digitiform postsetal lobes are distinct in the first 25 setigers; they are continued as low, but distinct, folds to about setiger 45. Interramal papillae are present in set-

tiger 4 through setiger 10. Tridentate pseudocompound hooks with blunt hoods are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 8. Each of the flat pectinate setae is distally transverse and has about 15 teeth. The maxillary formula is unknown.

*Onuphis eremita parva* differs from the stem species and from *O. eremita oculata* in having pseudocompound hooks in 4 rather than in 3 setigers. It was described and is known only from shallow water off southern California.

***Onuphis acapulcensis* Rioja, 1944**

*Onuphis acapulcensis* Rioja, 1944:139-143, figs. 1-11.

**REMARKS.**—The type material is no longer extant (Dr. Maria Elena Caso-Munoz, Universidad de México, in litt). The following remarks are based on the description and figures of Rioja (1944) recast in the format followed here.

Dark pigment bands are present across the peristomium and the first 5 or 6 setigers. The outer lateral occipital antennae reach setiger 2, the inner lateral and median antennae reach setiger 4. The ceratophores are long and have about 12 to 14 rings; the outer lateral ceratophore is clearly longer than its style. Branchiae are first

present from setiger 6; where best developed, at setigers 25–35, 12 branchial filaments are present. The branchiae are reduced towards the posterior end, but are present even on the last of the 480 setigers of the largest specimen described by Rioja. Ventral cirri are cirriform on the first 5 setigers. The number of digitiform postsetal lobes is unknown. Tridentate pseudocompound hooks with blunt hoods are present in the first 5 setigers. Compound spinigers and large hooks are absent. Subacicular hooks are first present from setigers 15–18. Each of the flat pectinate setae has 15–20 teeth and is distally oblique.

*Onuphis acapulcensis* differs from its congeners in the posterior appearance of the branchiae (setiger 6); in most species the branchiae start at or before setiger 4. It is known only from its original record near Acapulco on the Pacific coast of Mexico.

### *Onuphis aucklandensis* Augener, 1924

FIGURE 13f, TABLE 12

*Onuphis aucklandensis* Augener, 1924:418–422, fig. 11a–c.

**MATERIAL.**—Lectotype and 14 additional paralectotypes, Zoological Museum, Copenhagen, Pacific Ocean off New Zealand, Tiri Tiri, Auckland, 27 m, mud, 28 Dec 1914, coll. T. Mortensen.

**REMARKS.**—The lectotype, an incomplete specimen with 147 setigers, is 61.5 mm long and 2.8 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2; the inner lateral antennae reach as far back as setiger 15 in some specimens, and the median antenna may reach setiger 13; the median antennae are always shorter than the inner lateral ones even though the ranges of their lengths overlap widely. The ceratophores have about 8 rings. The outer lateral ceratophore is longer than its style. Branchiae always start on setiger 2 and continue posteriorly to the last setigers in the incomplete types; where best developed, each branchia has 5 filaments. The branchiae become simple posterior to setigers 100–110. Ventral cirri are cirriform on the first 7 setigers; postsetal lobes are digitiform to the last setigers present. Tridentate pseudocompound hooks are present in the first 5 setigers. Compound spinigers and large hooks are absent. Subacicular hooks are unusually thick and well developed; they are first present from setiger 15. Each of the flat pectinate setae is distally oblique and has about 15 teeth.

Knox and Hicks (1973:286) reported this species from New Zealand. Their description, not based on the types, differs in significant respects from the account given here. These authors in-

TABLE 12.—Summary statistics for the original material of *Onuphis aucklandensis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	2	Invariant			14
Inner lateral reach setiger	6–15	9.79	2.15	21.96	14
Median reaches setiger	5–13	7.27	2.19	30.12	14
Maximum number of rings	6–8	7.80	0.56	7.18	15
Branchiae:					
First present from setiger	2	Invariant			15
Maximum number of filaments	4–5	4.80	0.41	8.54	15
Cirriform ventral cirri to setiger	7–8	7.13	0.35	4.91	15
Last setiger with pseudocompound hooks	5	Invariant			15
Subacicular hooks first present from setiger	14–16	15.00	0.38	2.53	15

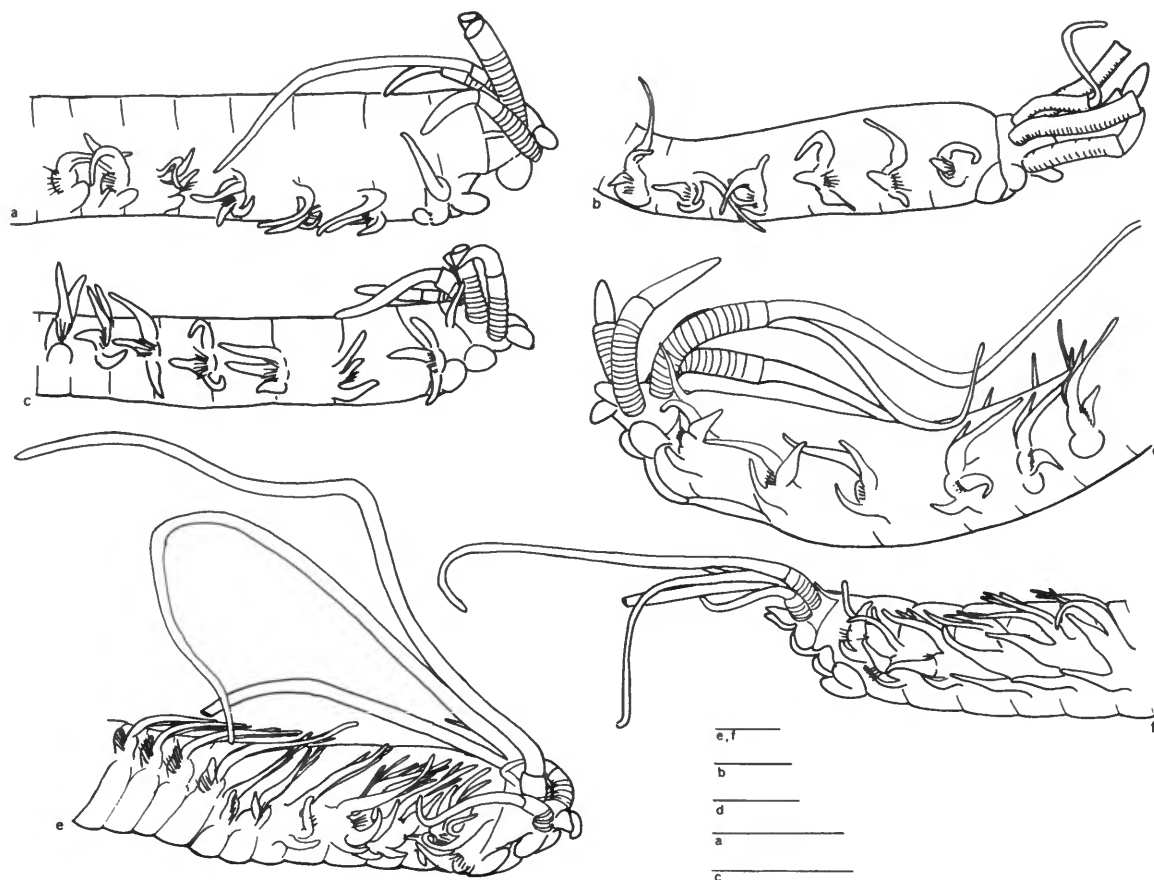


FIGURE 13.—Anterior ends of species of *Onuphis* in lateral view: a, *O. geophiliformis* (Moore, 1903); b, *O. mexicana* (Fauchald, 1968); c, *O. similis* (Fauchald, 1968); d, *O. pallida* (Moore, 1911); e, *O. branchiata* Treadwell, 1931; f, *O. aucklandensis* Augener, 1924. (All scales = 1 mm.)

indicated that both bi- and tridentate pseudocompound hooks were present and that the hooks were present in the first 6 setigers. The types have exclusively tridentate hooks present in only the first 5 setigers. Fauvel (1932:146, 1953:257) reported this species present in the Andaman Islands. His description does not agree with the type material, in that he reported both bi- and tridentate pseudocompound hooks present in only 3 setigers. The illustrations published by Fauvel (1953, fig. 127c-e) are copies of the original illustrations given by Augener (1924, fig. 11a-c) and are, thus, of the type material rather than of the specimens Fauvel had available from the And-

man Islands.

*Onuphis aucklandensis* differs from congeners in having fewer than the usual number of rings on the ceratophores (8 rings); the ventral cirri are cirriform on 7 rather than on 3 to 5 setigers, and the occipital antennae are long. It is known from New Zealand in shallow water.

### *Onuphis basipicta* Willey, 1905

*Onuphis basipicta* Willey, 1905:275-276, pl. 4: figs. 98-99.

REMARKS.—The type material was not available. It is not in BMNH; requests to the National

Museum of Sri Lanka gave no results. The following comments are based on the original description and figures. The occipital antennae have very long ceratophores. Willey describes the inner lateral ones as having nearly one-half the length of the antenna taken up by the ceratophores. The inner lateral antennae, which are the longest, reach setiger 10. Tridentate pseudocompound hooks are present in at least 2 setigers. Branchiae are present from setiger 1 and have up to 6 filaments where best developed. The species was named for the dark patches of pigment at the bases of the occipital antennae.

Fauvel (1932:146) synonymized *O. basipicta* with *O. eremita*, but did not examine the type material. Most features known for *O. basipicta* are certainly consistent with Fauvel's conclusion, but the length of the inner lateral ceratophores suggests that the proposed synonymy should be accepted only after an examination of Willey's material. *O. basipicta* was described from Sri Lanka in the Indian Ocean.

### *Onuphis branchiata* Treadwell, 1931

FIGURE 13e

*Onuphis branchiata* Treadwell, 1931:317-320, figs. 3a-g.

**MATERIAL.**—Holotype, USNM 19544, Pacific Ocean, the Philippine Islands, off Tayabas Light, Marinduque Island, 13°48'N, 121°43'E, 193 m, 24 Feb 1909, *Albatross* station D5369.

**REMARKS.**—The holotype, an anterior fragment of 100 setigers, is 36 mm long and 3.15 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral and median antennae are extremely long and reach setiger 25. The ceratophores have 6-8 rings. The outer lateral ceratophore is slightly longer than its style. Branchiae are present from setiger 1 to the end of the fragment; where best developed, each branchia has 5 filaments. Ventral cirri are cirriform in the first 6 setigers; digitiform postsetal lobes can be recognized to about setiger 40. Tridentate pseudocompound hooks with blunt hoods are present in the first 5 setigers. Large hooks and compound spinigers are absent. Subacicular

hooks are present from about setiger 20. Each of the flat pectinate setae is distally oblique and has about 20 teeth. The maxillary formula is 1+1, 8+9, 8+0, 6+6, and 1+1 according to Treadwell (1931:320).

*Onuphis branchiata* differs from other species of *Onuphis* in having cirriform ventral cirri in one more segment than usual and in having unusually long inner lateral and median occipital antennae. It is known only from its original record from the Philippine Islands.

### *Onuphis chinensis* Uschakov and Wu, 1962

*Onuphis chinensis* Uschakov and Wu, 1962b:118-119, 131-132, pl. 4a-g.

**REMARKS.**—The location of the type material is unknown; inquiries to both authors were without results, so the following comments are based on the original description and figure.

The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 7, and the median antenna reaches setiger 4. The ceratophores have about 12 articles. Outer lateral ceratophores are longer than their styles. Branchiae are present from setiger 1 and have 3 branchial filaments where best developed. Ventral cirri are cirriform in the first 6 setigers, and digitiform postsetal lobes are present in the first 10 setigers. Bi- and tridentate pseudocompound hooks with short hoods are present in the first 5 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setigers 10 to 12. The structure of the pectinate setae is unknown. The maxillary formula is 1+1, 8+9, 7+0, 7+10, and 1+1.

*Onuphis chinensis* was separated from the similar *O. eremita* by the absence of an interramal papilla that is present in the latter; it also has both bi- and tridentate pseudocompound hooks. *O. eremita* has only tridentate hooks. It has been reported from the Yellow Sea.

### *Onuphis dibranchiata* Willey, 1905

*Onuphis dibranchiata* Willey, 1905:277-278, pl. 4: fig. 100.

**REMARKS.**—The type was not available; it is



not in BMNH and requests to the National Museum, Sri Lanka, did not give any results. The following comments are based on Willey's original description and figures.

The occipital ceratophores have about 12 rings. The median antenna appears longer than the inner lateral ones. Branchiae are present from the first setiger and are simple on the first 17 setigers. Where best developed each branchia has 2 branchial filaments. The short-hooded pseudocompound hooks are both bi- and tridentate; two different size classes of hooks are present, or, alternatively, large hooks may be present.

Graveley (1927:74) reported this species from Krusadai Island and Fauvel (1953:254) repeated the same reports. Fauvel added that the pseudocompound hooks should be present in 3 to 5 setigers. It is not clear that Fauvel examined any specimens identified as *O. dibranchiata* or simply assumed that the hooks would be present in the usual number of setigers. Willey's original material apparently has never been reexamined.

*Onuphis dibranchiata* differs from most of its congeners in having both bi- and tridentate pseudocompound hooks; the maximum number of branchial filaments is also unusually low. It is known from Sri Lanka in the Indian Ocean.

### ***Onuphis elegans* (Johnson, 1901)**

*Northia elegans* Johnson, 1901:406–407, pl. 8: figs. 77–85.

*Onuphis elegans*.—Hobson, 1971:529.

**MATERIAL.**—Two syntypes, AHF Poly 740 and MCZ 1895, Pacific Ocean off Washington, Port Townsend region, Puget Sound, Columbia University Expedition.

**REMARKS.**—Both syntypes have been anteriorly dissected and cannot be fruitfully illustrated. Both are incomplete (the AHF specimen has 106 setigers and is 90 mm long and 9.1 mm wide, with parapodia; the MCZ specimen has 73 setigers, is 64.5 mm long and 5.1 mm wide, with parapodia). The occipital antennae (present on the MCZ specimen) are relatively short, the outer lateral antennae reach setiger 1, the inner lateral

antennae reach setiger 5, and the median antenna reaches setiger 2. The ceratophores have 11 rings. Outer lateral ceratophores are longer than their styles. Simple, strap-like branchiae are present from setiger 1 to the end of the fragments. Ventral cirri are cirriform on the first 5 setigers; digitiform postsetal lobes are present to setigers 12 or 13. Bi- and tridentate pseudocompound hooks are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 10. Each of the flat pectinate setae is distally transverse and has about 15 teeth. The maxillary formula of the two syntypes are, combined: 1+1, 6–7+5–7, 7–10+0, 6–7+5–8, and 1+1. The smaller syntype has the higher number of teeth, except on the unpaired maxilla III.

*Onuphis elegans* has simple, strap-like branchiae, both bi- and tridentate pseudocompound hooks and short occipital antennae. It is known from intertidal and shallow subtidal areas along the West Coast of the United States and British Columbia, Canada.

### ***Onuphis farallonensis* Hobson, 1971**

FIGURE 14c, TABLE 13

*Onuphis farallonensis* Hobson, 1971:531–533, fig. 2a–g.

**MATERIAL.**—Holotype, AHF Poly 982; 7 paratypes, AHF Poly 983 and 984, USNM 42026; all Pacific Ocean off California, northeast of Middle Farallon Island, 37°48'N, 122°59'W, 67 m, sand, 7 Aug 1938, *Velero* 887–38.

**REMARKS.**—Seven of the 8 specimens are remarkably uniform in structure as indicated in Table 13; the eighth specimen is a juvenile that clearly falls outside the pattern. The holotype, an incomplete specimen with 77 setigers, is 36.0 mm long and 2.1 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2, the length of the inner lateral antennae varies greatly, but, in any given specimen, the inner lateral antennae are always longer than the median antenna. The ceratophores have about 12 rings. Outer lateral ceratophores are longer than their



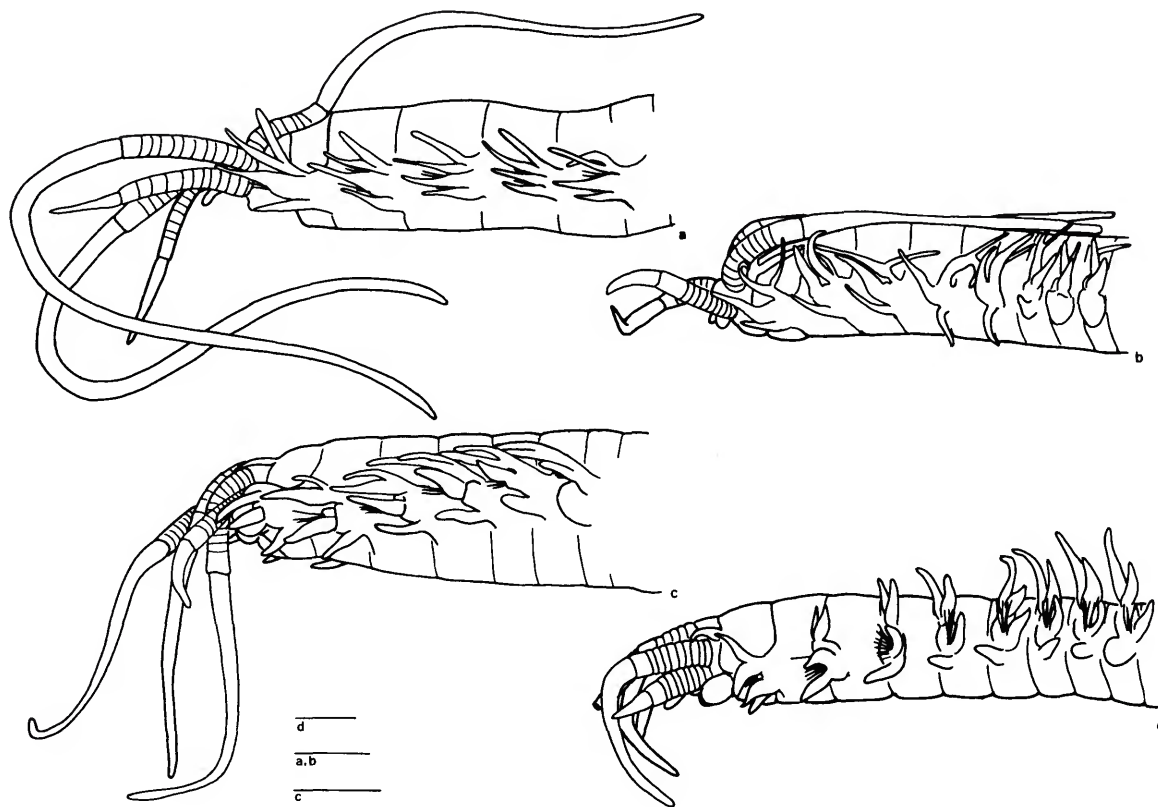


FIGURE 14.—Anterior ends of species of *Onuphis* in lateral view: a, *O. iridescens* (Johnson, 1901); b, *O. opalina* (Verrill, 1873); c, *O. farallonensis* Hobson, 1971; d, *O. shirikishinaensis* (Imajima, 1960). (All scales = 1 mm.)

styles. Branchiae are present from setiger 1, each is long and strap-like and has 1 filament. Ventral cirri are cirriform in the first 5 setigers; digitiform postsetal lobes could be recognized to about setiger 12. Bi- and tridentate pseudocompound hooks with blunt hoods are present in the first 5 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 10. Each of the flat pectinate setae is distally oblique and has about 15 teeth. The maxillary formula is 1+1, 9+10, 10+0, 6+11, and 1+1 according to Hobson (1971:533).

The juvenile specimen has branchiae from setiger 4; 4 cirriform ventral cirri and pseudocompound hooks are present in the first 4 setigers. In other respects it resembles the adult specimens.

The examination of the type material yielded rather less variability in some features than indicated in the original description. Thus, Hobson (1971:531) reported cirriform ventral cirri on 3 to 5 setigers; they are consistently present in the first 5 setigers in the adult specimens. Hobson (1971:531) reported pseudocompound hooks in 4 to 6 setigers; they are present in the first 5 setigers in the adults and in the first 4 setigers in the juvenile.

*Onuphis farallonensis* has strap-like branchiae and both bi- and tridentate pseudocompound hooks; in most respects it resembles its close congeners, *O. elegans* and *O. shirikishinaensis*. It is known from shallow water off central California.

TABLE 13.—Summary statistics for the type material of *Onuphis farallonensis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	2	Invariant			8
Inner lateral reach setiger	7–14	9.75	2.25	23.08	8
Median reaches setiger	5–7	6.00	0.71	11.83	5
Maximum number of rings	11–14	12.25	0.89	7.27	8
Branchiae:					
First present from setiger*	1	Invariant			7
Maximum number of filaments	1	Invariant			8
Cirriiform ventral cirri to setiger*	5	Invariant			7
Last setiger with pseudocompound hooks*	5	Invariant			7
Subacicular hooks first present from setiger	10	Invariant			7

\* A juvenile specimen has branchiae from setiger 4, cirriiform ventral cirri and pseudocompound hooks in four setigers.

### *Onuphis fukianensis* Uschakov and Wu, 1962

*Onuphis fukianensis* Uschakov and Wu, 1962a:93–94, 104, pl. 1e–k.

REMARKS.—The location of the type-specimen is unknown; inquiries to both authors were without results. The comments are based on the original description and illustrations.

The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 10, and the median antennae reaches setiger 6. The ceratophores are extremely long and have up to 40 rings. Outer lateral ceratophores are longer than their styles. Branchiae are first present from setiger 1 and are simple on the first 47 setigers; where best developed each branchia has 5 filaments. Ventral cirri are cirriiform in the first 5 setigers; the postsetal lobes were described as long and slender in anterior setigers and reduced in more posterior setigers. Pseudocompound hooks are present in the first 3 setigers; both bi- and tridentate hooks with blunt hoods are present. Uschakov and Wu (1962a, pl. 1i) illustrated a tridentate hook with a reduced proximal tooth. Large hooks and compound spinigers are presumably absent. Subacicular hooks are first present from setiger 10. The maxillary formula is 1+1,

7+7, 7+0, 8+7, and 1+1. Maxillae V were described as small, chitinized plates. Pectinate setae were not described.

*Onuphis fukianensis* has extremely long, ringed ceratophores and both bi- and tridentate pseudocompound hooks. The branchial distribution resembles the condition in *O. eremita* and related forms. *O. fukianensis* is known from shallow water off the Fukian Province, China, Pacific Ocean.

### *Onuphis geophiliformis* (Moore, 1903), new combination

FIGURE 13a, TABLE 14

*Northia geophiliformis* Moore, 1903:445–448, pl. 25: figs. 57–59.

MATERIAL.—Holotype, USNM 15711; 7 paratypes, USNM 5362; 12 paratypes, ANSP 971; all Pacific Ocean off Japan, North of Sendai Bay, 113 m, *Albatross* station 3771.

REMARKS.—All types are incomplete, a fragment with 82 setigers, measures 4.5 mm through the first 10 setigers and is maximally 1.3 mm wide, with parapodia. The outer lateral occipital antennae reach setigers 1 or 2; the styles have been lost from most of the inner and median

TABLE 14.—Summary statistics for the type material of *Onuphis geophiliformis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1-2	1.16	0.37	31.90	19
Inner lateral reach setiger	6-7	6.75	0.50	7.41	4
Median reaches setiger	5-7	6.00	0.53	8.91	8
Maximum number of rings	10-15	11.58	1.02	8.79	19
Branchiae:					
First present from setiger	3-6	5.05	0.76	15.03	20
Maximum number of filaments	1	Invariant			20
Cirriiform ventral cirri to setiger	4-5	4.95	0.22	4.52	20
Last setiger with pseudocompound hooks	3	Invariant			20
Subacicular hooks first present from setiger	10-12	10.75	0.72	6.66	20

antennae; those that remain reach setigers 5-7. The inner lateral ceratophores have about 11 rings. The outer lateral styles are distinctly shorter than their ceratophores. Branchiae are present from setigers 3-6; each branchia is simple and strap-like. Ventral cirri are cirriiform in the first 4 or 5 setigers, most usually in 5; postsetal lobes are digitiform in 10-12 setigers. Tridentate pseudocompound hooks are present in the first 3 setigers. Compound spinigers and large hooks are absent. Subacicular hooks are first present from setigers 10 to 12. Each of the flat pectinate setae is distally oblique and has about 15 teeth.

*Onuphis geophiliformis* is characterized by having simple, strap-like branchiae starting from setigers 5 or 6, rather than from setiger 1 as is usual in the genus. It was described from Japan.

#### ***Onuphis holobranchiata* Marenzeller, 1879**

*Onuphis holobranchiata* Marenzeller, 1879:132-134, pl. 4: fig. 1.

REMARKS.—The type specimen was not available for examination; it is not in the Zoological Museum, Vienna, where apparently most of Marenzeller's specimens are found. The remarks are based on Marenzeller's original description and illustrations. The median occipital antennae

reaches setiger 7, the inner lateral ones are said to be slightly shorter, i.e., reaching to about setiger 6; the outer lateral ones are less than half as long as the median one. If correct, the outer lateral antennae should reach to setigers 2 or 3. The inner lateral and median ceratophores have about 8 articles and the outer lateral ones 11 articles. The structure of the outer lateral occipital antennae is, thus, rather unique, in that they are considerably longer than usual and with longer ceratophores than those of the other occipital antennae. Branchiae are present from setiger 1; all are simple and strap-like. Ventral cirri are cirriiform in the first 4 setigers; digitiform postsetal lobes are distinct at least through setiger 33. Tridentate pseudocompound hooks with blunt hoods are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 8. The structure of the pectinate setae was not described. The maxillary formula was given as 1+1, 6+6, 7+0, 5+12, and 1+1.

*Onuphis holobranchiata* differs from its congeners in having simple strap-like branchiae and very long, well-developed outer lateral ceratophores. It was described from the Pacific Ocean off Japan.

***Onuphis iridescens* (Johnson, 1901)**

FIGURE 14a

*Nothia iridescens* Johnson, 1901:408, pl. 8: figs. 86, 87, pl. 9: figs. 88–92.

*Onuphis iridescens*.—Hobson, 1971:533.

**MATERIAL.**—Holotype, MCZ 1887, Pacific Ocean off British Columbia, Victoria, 1897, coll. W. A. Herdman.

**REMARKS.**—The holotype, an incomplete specimen with 51 setigers, is 30.7 mm long and 1.5 mm wide, with parapodia. It has at one time been dry and has been dissected dorsally for the maxillary apparatus. The occipital antennae are complete but have been badly folded; they are shown in Figure 14a, in their presumed stretched length. The outer lateral occipital antennae reach setiger 3, the inner lateral antennae reach setiger 13, and the median antenna reaches setiger 9. The ceratophores are long, cylindrical, and have 13 rings; the rings are not particularly distinct. Outer lateral ceratophores are distinctly longer than their styles. Simple, strap-like branchiae are present from the first setiger. Ventral cirri are cirriform through the first 6 setigers; digitiform postsetal lobes are distinct in the first 16 setigers.

Tridentate pseudocompound hooks are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 12. Each of the flat pectinate setae is distally transverse or slightly oblique and has about 15 teeth. The maxillary formula is 1+1, 7+8, 8+0, 5+10, and 1+1. The teeth on left maxilla IV are unusually long and slender. Fragments of a tube are present (the preserved shape of the holotype shows that it was preserved within a tube); the inner lining is thick and stiff and sparsely covered with sand grains. The relations between this and other similar species of *Onuphis* was extremely ably worked out by Hobson (1971:535). *O. iridescens* has been widely reported from the eastern Pacific Ocean in intertidal and shallow subtidal areas.

***Onuphis mexicana* (Fauchald, 1968),  
new combination**

FIGURE 13b, TABLE 15

*Nothia mexicana* Fauchald, 1968:25–26, pl. 7b–e.

**MATERIAL.**—Holotype, AHF Poly 354; 4 paratypes, AHF Poly 355; all Pacific Ocean off Baja California, from 22°32.2'N, 109°43.0'W to 22°35.8'N, 109°47.9'W, 2766–2794 m, silty clay,

TABLE 15.—Summary statistics for the original material of *Onuphis mexicana*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	2	Invariant			3
Inner lateral reach setiger		(broken in all specimens)			5
Median reaches setiger	3				1
Maximum number of rings	25	Invariant			5
Branchiae:					
First present from setiger	3–5	4.20	0.84	20.00	5
Maximum number of filaments	1	Invariant			5
Ventral cirri cirriform to setiger	5	Invariant			5
Last setiger with pseudocompound hooks	5	Invariant			5
Subacicular hooks first present from setiger	12–41	13.00	0.71	5.46	5

deep diving dredge, 22 Mar 1959, coll. R. H. Parker, station P-41-59.

REMARKS.—The holotype, an incomplete specimen with 136 setigers, is 66 mm long and 1.8 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2; the inner lateral antennae are broken in all 5 specimens; the median antenna reaches setiger 3 in the only specimen with this antenna intact. Fauchald (1972:127) reported that, in non-type material from western Mexico, the inner lateral antennae could reach setigers 10–11. The ceratophores are, characteristically, indistinctly ringed and are flared distally; the inner lateral ones have 25 rings and the outer lateral and median ones about 20 rings each. The outer lateral ceratophore is distinctly longer than its style. Simple, strap-like branchiae are first present from setigers 3–5, usually from setiger 4. Ventral cirri are cirriform in the first 5 setigers and digitiform postsetal lobes are present in about 13 setigers. Tridentate pseudocompound hooks with blunt hoods are present in the first 5 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setigers 12–14, usually from setiger 13. Each of the flat pectinate setae is distally oblique and has 13 to 15 teeth. The maxillary formula is 1+1, 6+6, 8+0, 7+9, and 1+1 according to Fauchald (1968:26).

*Onuphis mexicana* differs from its congeners in having simple branchiae and extremely long, indistinctly ringed ceratophores. It is known from deep water Pacific Ocean off Baja California.

### *Onuphis opalina* (Verrill, 1873)

FIGURE 14*b*, TABLE 16

*Nothria opalina* Verrill, 1873:102.

*Onuphis* (*Nothria*) *opalina*.—Pettibone, 1963:245, fig. 64*a–f*.

*Onuphis opalina*.—Hobson, 1971:537.

MATERIAL.—Fourteen syntypes, USNM 6134, Atlantic Ocean off New England, off Georges Bank, 200 m, 1872, Backe station 89–91*B*; 16 syntypes, USNM 16039, Atlantic Ocean off New England, Georges Bank, 273 m.

REMARKS.—None of the syntypes are complete, common measurements range from 15 mm for 50 segments up to 37.5 mm for 90 segments. The outer lateral occipital antennae usually reach setiger 2 (range 1–3), the inner lateral antennae reach usually setiger 10 (range 6–15), and the median antenna usually reaches setiger 7 (range 5–11). The inner lateral occipital antennae are always as long as or longer than the median one. The ceratophores are long and have about 12 rings. Outer lateral ceratophores are distinctly longer than the styles. Simple strap-like branchiae

TABLE 16.—Summary statistics for the type material of *Onuphis opalina*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1–3	2.0	0.27	13.50	29
Inner lateral reach setiger	6–15	9.96	2.57	25.80	26
Median reaches setiger	5–11	6.81	1.57	23.05	27
Maximum number of rings	12–13	12.00	0.24	2.00	29
Branchiae:					
First present from setiger	1	Invariant			29
Maximum number of filaments	1	Invariant			29
Cirriform ventral cirri					
present to setiger	6–7	6.10	0.31	5.08	29
Last setiger with					
pseudocompound hooks	4	Invariant			29
Subacicular hooks first					
present from setiger	12–15	13.30	0.66	4.96	29



are present from setiger 1 to the end of the fragments. Ventral cirri are usually cirriform in the first 6 setigers (range 6–7); digitiform postsetal lobes are present in about 10 setigers. Tridentate pseudocompound hooks with blunt hoods are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setigers 12–15, most frequently from either 13 or 14. Each of the flat pectinate setae is distally transverse and has about 12 teeth. The maxillary formula is 1+1, 9+8, 10+0, 5+5, and 1+1.

*Onuphis opalina* differs from its congeners in having simple branchiae, and ventral cirri in one more segment than usual. Hobson (1971:537) examined part of the original material, but apparently not the types; Pettibone (1963) examined the type material, as well as other material from New England. It is known from slope depths of the Atlantic Ocean off New England.

***Onuphis pallida* (Moore, 1911),  
new combination**

FIGURE 13d

*Nothria pallida* Moore, 1911:256–259, pl. 15: figs. 24–28, pl. 16: figs. 35–37.

**MATERIAL.**—Holotype, USNM 16844, Pacific Ocean off California, Point Loma Lighthouse N36°E, 13.4 miles (1000–1065 m), soft green mud, 14 Mar 1904, *Albatross* station 4352.

**REMARKS.**—The holotype, an incomplete specimen with 161 setigers, is about 80 mm long and 4.5 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae reach setiger 11, and the median antenna reaches setiger 6. The ceratophores are very long and have up to 18 rings. More than half the length of the outer lateral antenna is in its ceratophore. Simple, strap-like branchiae are present from setiger 4 to the end of the fragment. Ventral cirri are cirriform in the first 4 setigers; digitiform postsetal lobes are distinct in the first 12 setigers. Tridentate pseudocompound hooks

are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 16. Each of the flat pectinate setae is distally slightly oblique and has between 15 and 20 teeth. The maxillary formula is 1+1, 6+9, 7–8+0, 6–7+8, and 1+1 according to Moore (1911:258–259). The tubes are long, tough, and covered with a trim layer of silt particles.

*Onuphis pallida* differs from its congeners in having simple branchiae, very long ceratophores, and in its distribution of cirri and setae. It is known from southern California and western Mexico in deep water.

***Onuphis rullieriana* (Amoureux, 1977),  
new combination**

FIGURE 15f,g, TABLE 17

*Nothria rullieriana* Amoureux, 1977:399–402, fig. 1.

**MATERIAL.**—Five paratypes, MNHNP, AK 385, Atlantic Ocean, south of England, 48°39'03"N, 10°36'05"W, 1400 m, soft mud with some denser lumps, *Thalassa* 1973, station Z-451.

**REMARKS.**—The paratype illustrated is 28.2 mm long and 1.25 mm wide with parapodia and consists of 55 setigers. Other paratypes are of the same size. The outer lateral occipital antennae reach setiger 2 in most specimens; the inner lateral antennae reach setigers 5–14, usually setiger 9, and the median antenna reaches setigers 5–10, usually setiger 7. The ceratophores have up to 10 rings; the outer lateral ceratophores are distinctly longer than the styles, and the ceratophores reach well beyond the tip of the prostomium in all specimens. Branchiae are present from setiger 1 in all except 1 specimen in which they start at setiger 3; each branchia is simple and strap-like. Ventral cirri are cirriform in the first 5 or 6 setigers, postsetal lobes are distinctly digitiform in the first 12 setigers. Tridentate pseudocompound hooks with blunt hoods are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setigers 12–14. Each of the flat pectinate

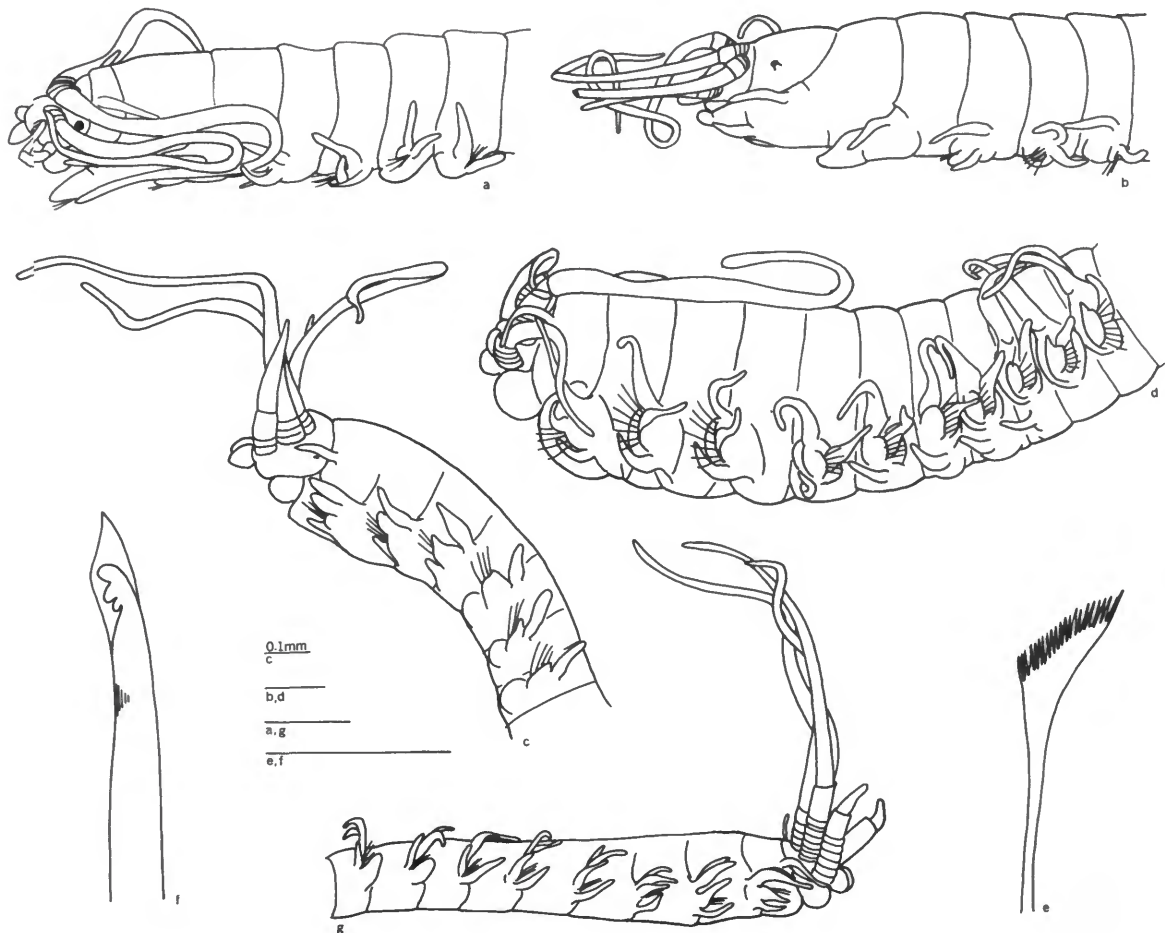


FIGURE 15.—Anterior ends of species of *Onuphis-Nothria-Paradiopatra* complex: a, *Nothria hyperborea* (Hansen, 1878), lateral view; b, *N. britannica* (McIntosh, 1903), lateral view; c, *Sarsonuphis bihanica* (Intes and Le Loeuff, 1975), lateral view; d, *Onuphis amoureuvi* Intes and Le Loeuff, 1975, lateral view; e, *O. amoureuvi*, pectinate seta, median parapodium, f, *O. rullieriana* (Amoureux, 1977), pseudocompound hook, second setiger; g, *O. rullieriana*, lateral view. (All scales = 1 mm unless otherwise indicated.)

setae is distally oblique and has about 15 teeth. The maxillary formula is 1+1, 6-8+8-9, 7-8+0, 7-9+9-11, and 1+1, according to Amoureux (1977:401).

*Onuphis rullieriana* is very similar to *O. iridescens* and *O. opalina*. All 3 species have branchiae from the first setiger, tridentate pseudocompound hooks in the first 4 setigers, and 5-7 setigers with

cirriform ventral cirri. One character that appears to separate them is the distribution of the digitiform postsetal lobes; such lobes are distinct in 10 setigers in *O. opalina*, in 12 setigers in *O. rullieriana*, and in 16 setigers in *O. iridescens*. The value of this character is debatable. *O. rullieriana* is known from slope depths and deep water in the eastern Atlantic Ocean off Britain.

TABLE 17.—Summary statistics for *Onuphis rullieriana*.

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1-2	1.75	0.50	14.29	4
Inner lateral reach setiger	5-14	9.00	3.81	42.33	5
Median reaches setiger	5-10	7.25	2.06	28.41	4
Maximum number of rings	10	Invariant			5
Branchiae:					
First present from setiger	1-3	1.40	0.89	63.57	5
Ventral cirri cirriform to setiger	5-6	5.40	0.55	10.19	5
Pseudocompound hooks present to setiger	4	Invariant			5
Subacicular hooks first present from setiger	12-14	13.00	0.71	5.46	5

***Onuphis shirikishinaiensis* (Imajima, 1960),  
new combination**

FIGURE 14d

*Nothria shirikishinaiensis* Imajima, 1960:55-58, figs. 1-14.

**MATERIAL.**—Two paratypes, USNM 58820, Pacific Ocean off Japan, Oma, Hokkaido, in sand in *Zostera*, May 1955, coll. M. Imajima. Holotype and other paratypes are in the National Museum, Tokyo.

**REMARKS.**—One of the paratypes, a complete specimen with 191 setigers, is 113.25 mm long and 2.55 mm wide, with parapodia. The outer lateral and median occipital antennae reach setiger 1, the latter may have been broken; the inner lateral antennae reach setiger 3. The ceratophores have up to 8 rings. Outer lateral ceratophores are distinctly longer than their styles. Simple strap-like branchiae are present from setiger 1; they are missing on the last 40 setigers on the complete specimen. Ventral cirri are cirriform in the first 7 setigers; digitiform postsetal lobes are distinct through setiger 30. Bi- and tridentate pseudocompound hooks with blunt hoods are present in the first 7 setigers. The first 3 or 4 have thick tridentate ones mainly; setigers 4-7 have slender bidentate hooks mainly. Large hooks and compound spinigers are absent. Subacicular

hooks are present from setigers 13 or 14. Each of the flat pectinate setae is distally transverse and has about 15 teeth. The maxillary formula is 1+1, 6+7, 6+0, 6-7+9, and 1+1 according to Imajima (1960:56).

*Onuphis shirikishinaiensis* has simple branchiae and both bi- and tridentate pseudocompound hooks; the distribution of the latter appears to be unique in the genus. The pectinate setae were illustrated as distally oblique in Imajima (1960, fig. 10); in the present paratypes the distal margin of these setae are distinctly transverse. It is known from intertidal areas to shelf depths off Japan.

***Onuphis similis* (Fauchald, 1968),  
new combination**

FIGURE 13c, TABLE 18

*Nothria similis* Fauchald, 1968:28-29, pl. 4g-i.

**MATERIAL.**—Holotype, AHF Poly 356; 3 paratypes, AHF Poly 357; all Pacific Ocean off Baja California, 5.5 miles (8.9 km) south of Islas San Benitos, from 28°12'35"N, 115°33'15"W, to 28°13'55"N, 115°35'05"W, 95-544 m, fine green and coarse gray sand, 2 hauls, 26 Feb 1941, *Velero* station 1251-41.

**REMARKS.**—The holotype is incomplete with

TABLE 18.—Summary statistics for the type material of *Onuphis similis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	2	Invariant			3
Inner lateral reach setiger	6–8	7.00	1.00	14.29	3
Median reaches setiger	5–7	5.67	1.15	20.28	3
Maximum number of rings	9–11	10.00	0.82	8.20	4
Branchiae:					
First present from setiger	6	Invariant			4
Number of filaments	1	Invariant			4
Cirriiform ventral cirri to setiger	6	Invariant			4
Number of setigers with pseudocompound hooks	4	Invariant			4
Subacicular hooks first present on setiger	8–9	8.75	0.50	5.71	4

77 setigers and is about 30 mm long and 1.5 mm wide with parapodia. The outer occipital antennae reach setiger 2, the inner lateral antennae reach setiger 7, and the median antenna reaches about setiger 6. The ceratophores have up to 10 rings. The outer lateral ceratophores are longer than the styles. Straplike branchiae are first present from setiger 6. Ventral cirri are cirriiform in the first 6 setigers, and the postsetal lobes are digitiform in the first 9 setigers. Tridentate pseudocompound hooks are present in the first 4 setigers. Compound spinigers and large hooks are absent. Subacicular hooks are first present from setigers 8 or 9. Each of the flat pectinate setae is distally oblique and has about 10 teeth. The maxillary formula is 1+1, 5+7, 7+0, 5+8 and 1+1, according to Fauchald (1968:28–29).

*Onuphis similis* is very similar to *O. geophiliformis*. Both have simple branchiae and similar distribution of various features. However, *O. similis* has pseudocompound hooks present in the first 4 setigers and subacicular hooks present from setigers 8 or 9, whereas *O. geophiliformis* has pseudocompound hooks in the first 3 setigers and subacicular hooks present from setigers 10–12. These numerical differences are minor, but cannot be disregarded without unwarranted assumptions about intermediate populations. The types of

both species were similar in size. *O. similis* is known from its original record only.

### *Onuphis vexillaria* Moore, 1911

*Onuphis vexillaria* Moore, 1911:266–269, pl. 17: figs. 69–76.

**MATERIAL.**—Holotype, USNM 19061, Pacific Ocean off California, Soledad Hill, Point La Jolla S50°E, 5.6 miles (442–510 m), soft green mud, 8 Mar 1940, *Albatross* station 4326.

**REMARKS.**—The anterior end has been dissected for the jaw-apparatus and is also badly folded, so no illustration can be given. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 9, and the median antenna reaches setiger 7. The ceratophores are long; each has 6 to 8 rings. The outer lateral ceratophore is distinctly longer than its style. Branchiae are first present from setiger 4 and are present at least through setiger 50 (last segment in the fragmentary holotype available). Where best developed, they are conspicuously pectinate and have 12 filaments. Ventral cirri are cirriiform in the first 8 setigers; postsetal lobes are distinct in about 30 setigers. Tridentate pseudocompound hooks with blunt hoods are present in the first 5 setigers. Large hooks are present from setiger 6 through setiger 8; compound spinigers

are absent. Subacicular hooks are first present from setiger 20. Each of the flat pectinate setae is distally oblique and has about 20 teeth. The maxillary formula is 1+1, 6+8-9, 7+0, 6+6, and 1+1 according to Moore (1911:269).

*Onuphis vexillaria* differs from its congeners in having relatively few rings on the ceratophores, in having large hooks in some anterior setigers, and in the distribution of setae and cirri. It was originally reported from slope depths in southern California.

***Onuphis vibex* (Fauchald, 1972),  
new combination**

FIGURE 12d

*Nothria vibex* Fauchald, 1972:128-130, pl. 25a-f.

**MATERIAL.**—Holotype, AHF Poly 1050; 1 paratype, AHF Poly 1051; both Pacific Ocean off Baja California, 29 miles (47 km) from Isla de la Natividad light, from 27°24'00"N, 115°12'15"W to 27°23'17"N, 115°13'45"W, 388-2466 m, green mud, forams, worms, crustaceans, 1 Jan 1961, *Velero* station 7231-61.

**REMARKS.**—The holotype, an incomplete specimen with 85 setigers, is 68.25 mm long and 1.25 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 4, and the median antenna reaches about setiger 3. The ceratophores are long and strongly ringed; the maximum number of rings is 12. Outer lateral ceratophores are longer than their styles. Simple, strap-like branchiae are present from setiger 4 to the end of the fragments. Ventral cirri are cirriform in the first 6 setigers, digitiform postsetal lobes are distinct in 8 or 9 setigers. Tridentate pseudocompound hooks with blunt hoods are present in the first 5 setigers. The lowermost tooth of some hooks is furcate. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 13. Each of the flat pectinate setae is distally oblique and has about 10 teeth. The maxillary formula is 1+1, 7+9, 8+0, 6+7; the fifth maxillae

were missing in the specimen examined by Fauchald (1972).

*Onuphis vibex* differs from most congeners by having simple branchiae beginning at setiger 4 and cirriform ventral cirri in 6 setigers. It is known from deep water off Baja California.

***Mooreonuphis*, new genus**

**DIAGNOSIS.**—Onuphids with large, indeterminate number of setigers and long, cylindrical tubes; peristomial cirri are present as are short frontal palps. First parapodia not enlarged. Ceratophores of occipital antennae no longer than the length of the prostomium, usually ringed, sometimes smooth. Ceratostyles of outer lateral occipital antennae longer than their ceratophores. Branchiae always present as single filaments or pectinate. Ventral cirri are cirriform in at least the first 3 or more setigers; foliose presetal lobes absent. Tridentate pseudocompound hooks always present, sometimes accompanied by bidentate ones; hoods always short and blunt. Compound spinigers always present; large hooks sometimes present. Pectinate setae flat.

**ETYMOLOGY.**—Named in honor of the eminent polychaetologist J. Percy Moore, the generic

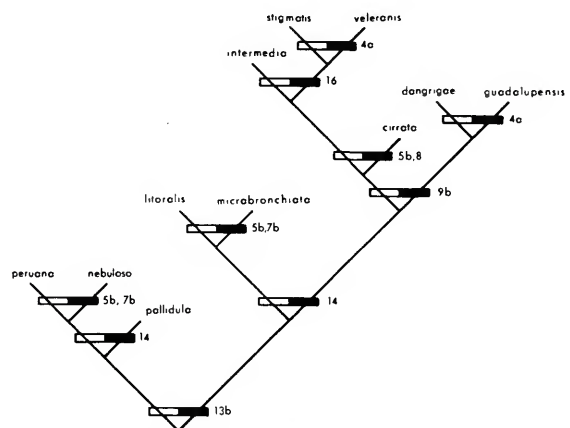


FIGURE 16.—Cladogram showing relations among species of *Mooreonuphis* (character-numbers are explained in Table 1; black bar = apomorph state, white bar = plesiomorph state).



name combines his last name with that of the earliest described genus in the family, *Onuphis*.

REMARKS.—All eleven species referred to *Mooreonuphis* were described from shelf-depths or intertidally in the Americas. Several species are highly

colored and have characteristic patterns of dark pigment on the anterior end. The relationship between the species is indicated in Figure 16.

TYPE-SPECIES.—*Onuphis nebulosa* Moore, 1911.

GENDER.—Feminine.

### Key to the Species of *Mooreonuphis*

1. Branchiae begin on setiger 6 or 7 ..... 2  
    Branchiae begin posterior to setiger 10 ..... 4
2. All branchiae simple ..... *M. pallidula* ..... 4  
    At least some branchiae pectinate ..... 3
3. Large hooks present in setigers 4–12 ..... *M. nebulosa* ..... 6  
    Large hooks absent ..... *M. peruana* ..... 5
4. Branchiae with 2 or 3 filaments ..... 5  
    All branchiae simple and strap-like ..... 6
5. Subacicular hooks present from setiger 13 ..... *M. litoralis* ..... 7  
    Subacicular hooks present from setiger 21 ..... *M. microbranchiata* ..... 8
6. Large hooks present in some anterior setigers (at least in setigers 4 and 5) ..... 7  
    Large hooks absent ..... 8
7. Branchiae begin on setiger 19 ..... *M. stigmatis* ..... 9  
    Branchiae begin on setigers 29 or 30 ..... *M. veleronis* ..... 10
8. All pseudocompound hooks tridentate ..... 9  
    Some bidentate pseudocompound hooks present ..... 10
9. Branchiae begin on setiger 17 ..... *M. cirrata* ..... 11  
    Branchiae begin on setiger 25 ..... *M. intermedia* ..... 12
10. Cirriform ventral cirri in the first 3 setigers, subacicular hooks from setiger 12 ..... *M. guadalupensis* ..... 13  
    Cirriform ventral cirri in the first 4 or 5 setigers; subacicular hooks from setigers 15–17 ..... *M. dangrigae* ..... 14

### *Mooreonuphis nebulosa* (Moore, 1911), new combination

FIGURE 17a

*Onuphis nebulosa*, Moore, 1911:269–273, pl. 17: figs. 58–68.

MATERIAL.—Holotype, USNM 16881; 2 paratypes, USNM 17062; all Pacific Ocean off California, off Point Pinos Lighthouse, S13°E, 8.3 miles (118–129 m), green mud, sand and gravel, 12 May 1904, *Albatross* station 4454.

REMARKS.—The holotype, an incomplete specimen with 81 setigers, is 23.4 mm long and 1.2

mm wide, with parapodia. The outer lateral occipital antennae reach setigers 1 or 2, the inner lateral antennae reach setigers 6, and the median antenna setiger 5 in the holotype and in one of the paratypes; they are slightly shorter in the other paratype. All ceratophores have 4 rings. Branchiae begin on setiger 6 (holotype) or 7 (paratypes); where best developed 4 branchial filaments are present. Ventral cirri are cirriform in the first 10 setigers in the holotype and in the first 9 in the two paratypes. Digitiform postsetal lobes are present in all setigers in all 3 specimens. Tridentate pseudocompound hooks with short

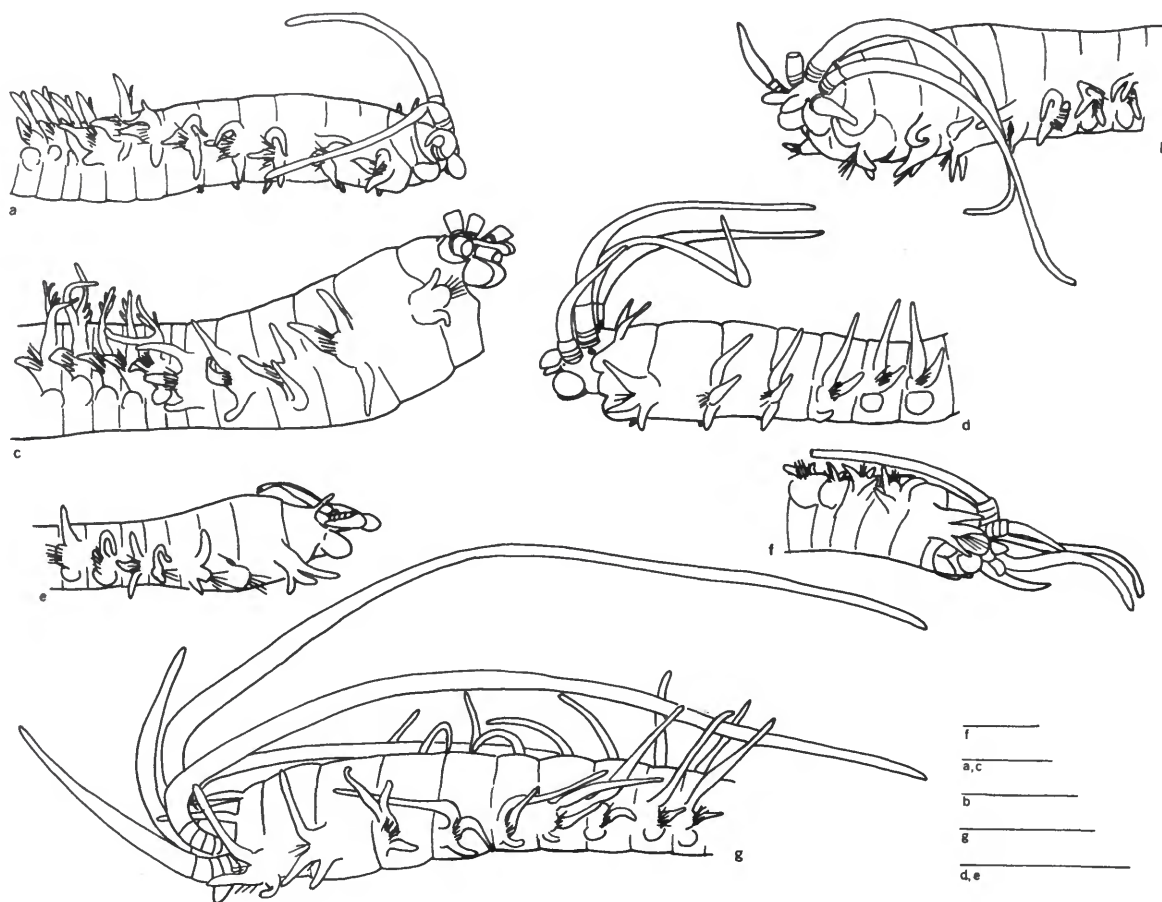


FIGURE 17.—Anterior ends of species of *Mooreonuphis* in lateral view: a, *M. nebulosa* (Moore, 1911); b, *M. pallidula* (Hartman, 1965); c, *M. peruana* (Hartman, 1944); d, *M. litoralis* (Monro, 1933); e, *M. intermedia* (Kinberg, 1865); f, *M. microbranchiata* (Fauchald, 1968); g, *M. cirrata* (Hartman, 1944). (All scales = 1 mm.)

blunt hoods are on the first 8 setigers in the holotype and on 7 setigers in the two paratypes. Large hooks are present from setiger 4 to setiger 15 in the holotype, and to setiger 12 in the two paratypes (as far as could be determined). Compound spinigers are present from setiger 7 through setiger 19 in the holotype and through setiger 17 or 18 in the two paratypes. Subacicular hooks are first present from the segment immediately posterior to the last setiger with compound spinigers, *i.e.*, from setigers 18–20 in the present

specimens. Each pectinate seta is distally narrow, transverse, and has about 10 teeth. The maxillary formula is 1+1, 10+10, 10+0, 6+8, and 1+1, according to Moore (1911:272–273).

*Mooreonuphis nebulosa* differs from most congeners in having a higher than usual number of modified anterior setigers, in having large hooks present in some anterior setigers, and in having distinctly pectinate branchiae present from setigers 6 or 7. It has been widely reported from both sides of the Americas, but may have been confused with a series of similar species.

***Mooreonuphis cirrata* (Hartman, 1944),  
new combination**

FIGURE 17g

*Nothria stigmatis cirrata* Hartman, 1944b:92-93, pl. 11: figs. 248-253.

*Nothria cirrata*.—Fauchald, 1968:20.

*Onuphis* (*Nothria*) *cirrata*.—Fauchald, 1980:806.

**MATERIAL.**—Holotype, AHF Poly 741, Pacific Ocean, Golfo de California, Puerto Refugio, Isla Angel de la Guarda, 29°32'33"N, 113°33'57"W, 20-40 m, sand and shell, 26 Jan 1940, *Velero* station 1048-40.

**REMARKS.**—The type, a complete specimen with 173 setigers, is 38.5 mm long and 1.6 mm wide, with parapodia. The outer lateral styles reach setiger 2, the inner lateral styles reach setiger 13, and the median style reaches setiger 10. The occipital ceratophores have 5 rings. Simple, strap-like branchiae are present from setiger 17 to setiger 155 leaving the posterior end abranchiate. Ventral cirri are cirriform in the first 6 setigers; digitiform postsetal lobes are distinct in the first 24 setigers. Tridentate pseudocompound hooks are present in the first 5 setigers. Large hooks are absent; compound spinigers are present from setiger 6 to setiger 16. Subacicular hooks are first present from setiger 17. Each of the flat pectinate seta is distally transverse and has about 20 teeth. The maxillary formula is 1+1, 6+7, 7+0, 6+8, and 1+1, according to Hartman (1944b:92-93).

The dorsal cirri and postsetal lobes are unusually long and slender in anterior setigers. The color pattern, consisting of dark bars and patches on the anterior end, is still distinct. It was described in detail by Hartman (1944b).

*Mooreonuphis cirrata* was indicated as a distinct species by Fauchald (1968:20); it can be differentiated from congeners by the late start of the simple, strap-like branchiae, by lacking large hooks, and by having all pseudocompound hooks tridentate. It has been reported from Golfo de California in shallow water.

***Mooreonuphis dangrigae* (Fauchald, 1980),  
new combination**

Figure 18b

*Onuphis* (*Nothria*) *dangrigae* Fauchald, 1980:802-806, figs. 1, 2, tables 2, 3.

**MATERIAL.**—Holotype, USNM 61224, Gulf of Mexico off Belize, Carrie Bow Caye, sand immediately behind inner reef crest at far side of flat, 1.5 m, 12 May 1977, coll. M. L. Jones; 9 paratypes, USNM 61225, Atlantic Ocean off Belize, Carrie Bow Caye, E of laboratory, sand areas mixed with coral rubble, just inside reef crest, 1 m, 5 Apr 1976, coll. M. L. Jones.

**REMARKS.**—The holotype, an incomplete specimen with 66 setigers, is 28 mm long and 1.5 mm wide, with parapodia. Complete specimens may have up to 130 setigers and be about twice the length of the holotype. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae reach setiger 9, and the median antenna reaches setiger 10. The ceratophores have 4 or 5 rings. Simple strap-like branchiae are first present from setigers 18-21. Ventral cirri are cirriform on the first 4 or 5 setigers; digitiform postsetal lobes are distinct in the first 45 setigers. Bi- and tridentate pseudocompound hooks with short, blunt hoods are present in the first 5 setigers. Large hooks are absent. Compound spinigers are present between setiger 6 and setigers 14-16. Subacicular hooks are first present from setigers 15-17, i.e., from the next setiger after the one with the last compound spinigers. Each of the flat pectinate setae is distally slightly oblique and has 12 teeth. The maxillary formula is 1 + 1, 8 + 7, 7 + 0, 7 + 8, and 1 + 1, according to Fauchald (1980:805). Additional material and a table showing the variability was given by Fauchald (1980:806).

*Mooreonuphis dangrigae* differs from most congeners in having simple strap-like branchiae beginning posteriorly (setigers 18-21) and both bi- and tridentate pseudocompound hooks. It differs from the closely similar *M. guadalupensis* in various dis-

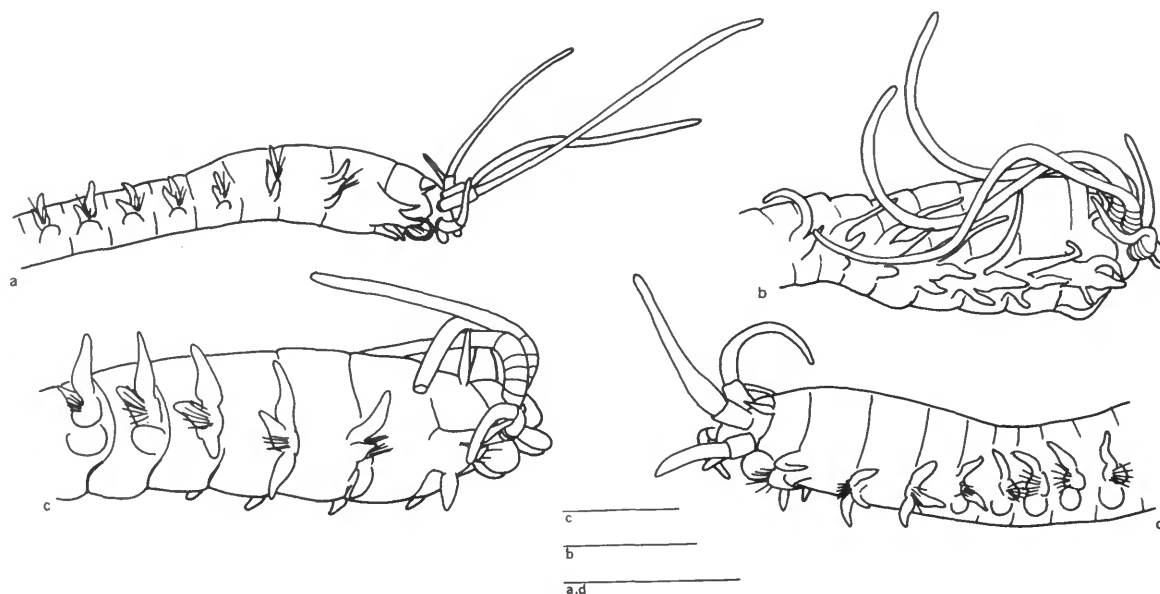


FIGURE 18.—Anterior ends of species of *Mooreonuphis* in lateral view: a, *M. veleronis* (Fauchald, 1980); b, *M. dangrigae* (Fauchald, 1980); c, *M. stigmatis* (Treadwell, 1922); d, *M. guadalupensis* (Fauchald, 1968). (All scales = 1 mm.)

tributional features. It is known only through its original record.

***Mooreonuphis guadalupensis* (Fauchald, 1968),  
new combination**

FIGURE 18d

*Nothria guadalupensis* Fauchald, 1968:22–24, pl. 6e–l.  
*Onuphis* (*Nothria*) *guadalupensis*.—Fauchald, 1980:806.

**MATERIAL.**—Holotype, AHF Poly 352; 3 paratypes, AHF Poly 353; all Pacific Ocean off Baja California, Melpomene Cove, Isla Guadalupe, 28°52'05"N, 118°19'05"W, rocky intertidal with *Eisenia*, 17 Dec 1949, *Velero* station 1912–49.

**REMARKS.**—The holotype, a complete specimen with about 100 setigers, is 21 mm long and 1.2 mm wide, with parapodia. Two other specimens are incomplete; the third paratype has been dissected and its anterior end can no longer be reconstructed. The outer lateral occipital antennae reach setiger 1, the inner lateral and median antennae reach setiger 3. The ceratophores are

smooth. Branchiae are present from setiger 22 in the holotype and from setiger 24 in the two paratypes; all branchiae are simple and strap-like. Ventral cirri are cirriform on the first 3 setigers; digitiform postsetal lobes are distinct through setiger 9 in the holotype and through setiger 12 in the two paratypes. Bi- and tridentate pseudocompound hooks with blunt hoods are present in 4 setigers. Large hooks are absent. Compound spinigers are present from setiger 4 to setiger 12 (holotype) or setigers 11 or 13 (paratypes). Subacicular hooks are present from setiger 13 in the holotype and from setigers 12 and 13 in the two paratypes. Each pectinate seta is distally transverse and has 6 to 8 teeth. The maxillary formula is 1+1, 8+7, 6+0, 5+8, and 1+1, according to Fauchald (1968:23).

*Mooreonuphis guadalupensis* has both bi- and tridentate pseudocompound hooks and simple branchiae starting on a late setiger. It is known only from intertidal areas on Isla Guadalupe off the coast of Baja California.

***Mooreonuphis intermedia* (Kinberg, 1865),  
new combination**

FIGURE 17c

*Onuphis intermedia* Kinberg, 1865:560; 1910:40, pl. 14: fig. 9.—Augener, 1931:296.

*Onuphis* (*Nothria*) *intermedia*.—Fauchald, 1980:806.

**MATERIAL.**—Holotype, NRS 461, Atlantic Ocean off the entrance to the harbor at Rio de Janeiro, 55–73 m.

**REMARKS.**—The holotype consists of an anterior end that is 9 mm long and about 1 mm wide with about 50 segments and 3 median fragments. The ceratostyles of the occipital antennae are all missing; the ceratophores have 4 or 5 rings. Simple, strap-like branchiae begin on about setiger 25 to the end of the anterior fragment. A median fragment present in the collection has 2 or 3 branchial filament per segment. This midpiece may not belong to the same species as the anterior end. Ventral cirri are cirriform in the first 5 setigers. Distribution of the digitiform postsetal lobes could not be determined. Tridentate pseudocompound hooks with short, blunt hoods are present in the first 3 setigers; one hook is clearly thicker than the others, but is otherwise similar. Large hooks are absent; a single compound spiniger is present in each parapodium from setiger 4 through setiger 13. Subacicular hooks are first present from setiger 13.

As remarked by Fauchald (1980:806), this species has been overlooked in the literature. Augener (1931:296) examined the type, but must have confused his notes, since his description differs clearly from both the original description and from the material present in the type-lot. The types and Kinberg's descriptions agree.

*Mooreonuphis intermedia* has simple branchiae starting on a posterior setiger, single compound spinigers in a number of anterior setigers, and it lacks large hooks. The holotype is rather poorly preserved and a number of important features remain poorly known. It is known from the western Atlantic Ocean off Brazil.

***Mooreonuphis litoralis* (Monro, 1933),  
new combination**

FIGURE 17d, TABLE 19

*Onuphis litoralis* Monro, 1933:78–80, fig. 33a–e.

**MATERIAL.**—Twelve syntypes, BMNH 1932.12.24.424–443, Pacific Ocean, Galapagos Islands, Conway Bay, Indefatigable Island, shore-pools, coll. C. Crossland.

**REMARKS.**—The only complete specimen has 99 setigers and is 27 mm long and 1.2 mm wide, with parapodia. Most specimens lack color patterns, but two specimens have transverse dark bars on the dorsum of the first 15 setigers. The outer lateral occipital antennae usually reach setiger 1 (range 1–2), the inner lateral and median antennae vary in length, but, on the average, reach setigers 8 and 7, respectively. The short ceratophores have about 5 rings. Branchiae usually begin at setiger 17 (range 16–19) and are present on all subsequent setigers, but are strongly reduced in the last 15 setigers in the only complete specimen. The maximum number of branchial filaments is usually 2 (range 1–2). Ventral cirri are cirriform in the first 4 setigers; digitiform postsetal lobes are present in the first 20–25 setigers. Tridentate pseudocompound hooks with short, blunt hoods are present in the first 4 setigers. Large hooks are found from setiger 3 (usually through setiger 5, range 4–6), and compound spinigers usually from setiger 5 (range 5–6) usually through about setigers 13 or 14 (range 12–15). Subacicular hooks are usually present from setiger 13 (range 12–16). Small slender pectinate setae are present in most setigers; each seta is distally transverse and has about 10 teeth. The maxillary formula is 1+1, 7+7, 7+0, 6+10, and 1+1 according to Monro (1933:79).

*Mooreonuphis litoralis* is differentiated by the posterior commencement of branchiae and the distribution of the large hooks. It is known only from the shelf depths of the eastern tropical Pacific Ocean.



TABLE 19.—Summary statistics for the type material of *Mooreonuphis litoralis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1-2	1.08	0.29	7.79	12
Inner lateral reach setiger	4-11	8.00	2.04	52.02	12
Median reaches setiger	4-11	7.45	1.86	46.44	11
Maximum number of rings	3-5	4.67	0.65	9.05	12
Branchiae:					
First present from setiger	16-19	17.25	0.87	4.39	12
Maximum number of filaments	1-2	1.92	0.29	9.14	12
Cirriiform ventral cirri to setiger	4	Invariant			12
Last pseudocompound hook on setiger	4	Invariant			12
Large hooks:					
First present on setiger	3	Invariant			12
Last present on setiger	4-6	5.00	0.43	3.70	12
Compound spinigers:					
First present on setiger	5-6	5.08	0.29	1.66	12
Last present on setiger	12-15	13.50	0.80	4.74	12
Subacicular hooks first present on setiger	12-16	13.25	1.29	12.56	12

***Mooreonuphis microbranchiata* (Fauchald,  
1968), new combination**

FIGURE 17f

*Onuphis microbranchiata* Fauchald, 1968:34-35, pl. 8h-q.

**MATERIAL.**—Holotype, AHF Poly 360; 1 paratype, AHF Poly 361; both Pacific Ocean off Baja, California, between Melpomene Cove and Inner Island, Isla de Guadalupe, 28°52'N, 118°19'W, 9-25 m, dredge, rock and sand, 18 Dec 1949, *Velero* station 1914-49.

**REMARKS.**—The holotype is without its anterior end and no further information can be given. It was described as having occipital antennae reaching setigers 4 or 5 with 3 rings on the ceratophores. Branchiae were present from setiger 13 with 2 or 3 very short, stubby branchial filaments. Ventral cirri were cirriiform on the first 7 setigers. The distribution of postsetal lobes was not specified. Tridentate pseudocompound hooks were present in the first 7 setigers. Large hooks and compound spinigers were present in setigers

4 to 11. Subacicular hooks were present from setiger 21.

The paratype is complete with 88 setigers and is 16.5 mm long and about 0.5 mm wide, with parapodia; it differs from the holotype and clearly belongs to another species. It has occipital antennae reaching setiger 3; the ceratophores have 4 rings. Cirriiform ventral cirri are present on the first 3 setigers and tridentate pseudocompound hooks are present in the first 4 setigers. Large hooks are absent. Compound spinigers are present in setigers 4-7. Subacicular hooks are present from setiger 13. Simple, strap-like branchiae are present from setiger 22. It appears most closely related to *M. cirrata* or *M. intermedia*, but differs from both in various distributional features; it is a juvenile and for that reason will not be further described.

*Mooreonuphis microbranchiata* is distinct as described; the number of modified anterior setigers and the late start of the structurally remarkable branchiae are characteristic and differentiates it from its congeners. It is known only through its original record.

***Mooreonuphis pallidula* (Hartman, 1965),  
new combination**

FIGURE 17*b*, TABLE 20

*Nothria pallidula* Hartman, 1965:105-106, pl. 17*d-h*.

**MATERIAL.**—Holotype, AHF Poly 748; 45 paratypes, AHF Poly 749; NW Atlantic Ocean, slope between upper ends of Atlantis and Block canyons, 40°01.8'N, 70°42'W, 200 m, 28 Aug 1962, coll. H. L. Sanders, station slope 2.

**REMARKS.**—The holotype has 59 setigers and is 16 mm long and about 2.1 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 10, and the median antenna reaches setiger 9; the length of the styles is somewhat variable, but the inner lateral ones are usually longer than the median one. The ceratophores have 4 rings. Branchiae begin on setiger 6; each is simple and strap-like. Ventral cirri are cirriform in the first 4 to 6 setigers, but by far the largest number of specimens have 5 pairs of cirriform cirri. Digitiform postsetal lobes are distinct to about setiger 30. Tridentate pseudocompound hooks are present in the first 5 setigers. Large hooks are absent. Com-

pound spinigers occur from setiger 6 to setiger 17-28, apparently related to the size of the specimens; they are found up to the beginning of the subacicular hooks, at setigers 18-29, mostly 21-22. Each pectinate seta is distally oblique and has 10 teeth. The maxillary formula is 1+1, 7+7, 9+0, 6+8, and 1+1.

*Mooreonuphis pallidula* differs from its congeners in having simple strap-like branchiae from setiger 6 and in having the subacicular hooks starting on a relatively posterior setiger. It is common in shelf and slope depths off the Atlantic coast of the United States.

***Mooreonuphis peruana* (Hartman, 1944),  
new combination**

FIGURE 17*c*

*Onuphis peruana* Hartman, 1944b:73-75, pl. 3; figs. 61-66.

**MATERIAL.**—Holotype, AHF Poly 737 (AHF 39 in old catalog), Pacific Ocean off Peru, Bahia de la Independencia, 14°17'30"S, 76°09'W, 33 m, rock, sand, and shell, 10 Feb 1938, *Velero* station 835-38.

**REMARKS.**—The holotype, in two fragments,

TABLE 20.—Summary statistic for the type material of *Mooreonuphis pallidula*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			46
Inner lateral reach setiger	6-14	9.84	2.07	43.55	38
Median reaches setiger	5-13	8.97	2.15	51.53	34
Maximum number of rings	4	Invariant			45
Branchiae:					
First present from setiger	6-7	6.02	0.15	0.37	46
Maximum number of filaments	1	Invariant			46
Cirriform ventral cirri present to setiger	4-6	5.00	0.21	0.88	46
Last pseudocompound hook on setiger	5	Invariant			46
Compound spinigers:					
First present on setiger	6	Invariant			46
Last present on setiger	17-28	20.5	2.01	19.69	46
Subacicular hooks first present on setiger	18-29	21.52	2.01	18.77	46

consists of 112 setigers; it is 49.5 mm long and 2.2 mm wide, with parapodia. All occipital styles have been lost, the ceratophores have 2 basal rings. Branchiae are present from setiger 6 to the end of the fragment; the first branchia has 3 filaments increasing to 8; the number is reduced to 5 in the last 10 segments. Ventral cirri are cirriform in the first 5 setigers; digitate postsetal lobes are distinct to about setiger 50. Tridentate pseudocompound hooks with short, blunt hoods are present in the first 5 setigers. Large hooks are absent; compound spinigers are present in setigers 6 to 20. Subacicular hooks are present from setiger 21. Each of the flat pectinate setae is distally oblique and has about 15 teeth. The maxillary formula is 1+1, 9+9, 9+0, 7+11, and 1+1, according to Hartman (1944b:75). Tubes are absent.

*Mooreonuphis peruana* differs from its congeners in having pectinate branchiae from about setiger 6 and lacking large hooks. Other species with branchiae starting that early either have simple branchiae or large hooks. It is known from shallow water in the tropical eastern Pacific Ocean.

***Mooreonuphis stigmatis* (Treadwell, 1922),  
new combination**

FIGURE 18c

*Onuphis stigmatis* Treadwell, 1922:176–178, figs. 22–34.  
*Onuphis* (*Nothria*) *stigmatis*.—Fauchald, 1980:806.

**MATERIAL.**—Holotype, AMNH 1383, Pacific Ocean off Washington, False Bay, San Juan Island, intertidal, sand.

**REMARKS.**—The holotype, an incomplete specimen with 114 setigers, is 61.8 mm long and 1.6 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 5, and the median antenna reaches setiger 3. The ceratophores have 5 rings. Simple strap-like branchiae begin on setiger 19 and continue to the end of the fragment. Ventral cirri are cirriform in the first 4 setigers; digitiform postsetal lobes are distinct in the first 17 setigers. Tridentate pseudocompound hooks with short,

blunt hoods are present in the first 3 setigers. Large hooks are present in setigers 4 and 5 only. Compound spinigers are present from setiger 4 to setiger 16. Subacicular hooks are first present from setiger 16. Each flat pectinate seta is distally transverse and has 15 teeth. The maxillary formula is 1+1, 6+6, 8+0, 6+10, and 1+1 according to Treadwell (1922:178). The ceratophores, the dorsal side of the peristomium, and each segment back to setiger 20 have remnants of transverse dark pigment bands.

*Mooreonuphis stigmatis* is characterized by simple branchiae starting on a posterior setiger and large hooks present in some anterior setigers. Fauchald (1980:806) demonstrated in a table the variability of non-type material collected from the type locality. *M. stigmatis* has been reported widely from both sides of the Americas, but has at least in part been confused with similar species. It is known to be present along the Pacific coast of the United States and Canada as far south as southern California in shallow water.

***Mooreonuphis veleronis* (Fauchald, 1980),  
new combination**

FIGURE 18a, TABLE 21

*Nothria stigmatis intermedia* Hartman, 1944b:93 [not *Onuphis intermedia* Kinberg, 1865:560].  
*Onuphis* (*Nothria*) *veleronis* Fauchald, 1980:807–808, table 2 [new name].

**MATERIAL.**—Holotype, AHF Poly 744; 5 paratypes, AHF Poly 745; all Pacific Ocean off California, northwest anchorage, San Clemente Island, 36 m, 12 Sep 1933.

**REMARKS.**—The holotype, an incomplete specimen, is 19 mm long and about 0.5 mm wide, with parapodia, consisting of about 60 setigers. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 6, and the median antenna reaches setiger 5. The ceratophores are smooth. Simple, strap-like branchiae begin on setiger 29 or 30. Ventral cirri are cirriform in the first 3 setigers; digitate postsetal lobes are distinct in about the first 5 setigers. Tridentate

TABLE 21.—Summary statistics for the type material of *Mooreonuphis veleronis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			6
Inner lateral reach setiger	5-7	6.17	0.75	9.12	6
Median reaches setiger	4-5	4.50	0.55	6.72	6
Maximum number of rings	0	Invariant			6
Branchiae:					
First present on setiger	29-30	29.60	0.55	1.02	6
Maximum number of filaments	1	Invariant			6
Ventral cirri cirriform to setiger	3	Invariant			6
Last pseudocompound hook on setiger	3	Invariant			6
Large hooks:					
First present on setiger	4	Invariant			6
Last present on setiger	6-8	7.00	1.10	17.29	6
Compound spinigers:					
First present on setiger	4	Invariant			6
Last present on setiger	11-13	12.17	0.98	7.89	6
Subacicular hooks first present on setiger	10-14	11.67	1.51	19.54	6

pseudocompound hooks are present in the first 3 setigers. A single large hook is present in each setiger between setiger 4 and 6 to 8. Compound spinigers are present in setigers 4-13. Subacicular hooks are present from setigers 10-14. Each flat pectinate seta is distally transverse and has about 12 teeth. The acicula are subdistally thickened in setigers 4 to 8.

*Mooreonuphis veleronis* differs from all congeners in having expanded acicula in setigers 4-8. It is known only through its original record.

### *Sarsonuphis*, new genus

DIAGNOSIS.—Onuphids with an indeterminate number of setigers, long, cylindrical tubes, peristomial cirri, and short frontal palps. Occipital ceratophores as long as or shorter than the prostomium, with a varying number of rings or smooth. Outer lateral occipital ceratostyle longer than its ceratophore. First parapodia not enlarged; foliose present lobes absent. Pseudocompound hooks bidentate; always with long, pointed hoods. Branchiae, if present, always pectinate.

Compound spinigers absent, large hooks rarely present, subacicular hooks present, pectinate setae flat.

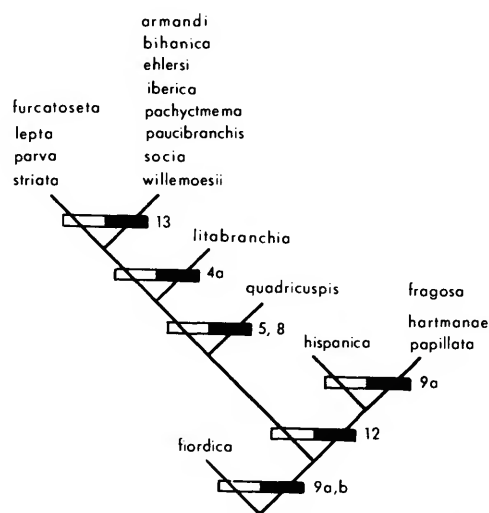


FIGURE 19.—Cladogram showing relations among species of *Sarsonuphis* (character-numbers are explained in Table 1; black bar = apomorph state; white bar = plesiomorph state).

TYPE-SPECIES.—*Onuphis quadricuspis* M. Sars, in G.O. Sars, 1872.

GENDER.—Feminine.

ETYMOLOGY.—Named in honor of Michael Sars, the eminent observer of invertebrates in Norwegian waters, the generic name combining his last name with *Onuphis*, the first described genus in the family.

REMARKS.—Twenty species are here referred to *Sarsonuphis*. Most species have been described from cold water, at either pole or from deep

water. An apparent geographic focus in the southern Indian Ocean may be spurious: several described deep-water species are extremely difficult to distinguish and may belong to the same species. The type material of several of them is in bad condition and more material from the type areas will be needed to determine the levels of variability to be expected in these species. The cladogram (Figure 19) shows that a number of unresolved dichotomies and trichotomies are present, as in *Onuphis* and *Kinbergonuphis*.

### Key to the Species of *Sarsonuphis*

1. Branchiae absent ..... 2  
Branchiae present ..... 6
2. Pseudocompound hooks distally unidentate ..... *S. hartmanae*  
Pseudocompound hooks bi- or tridentate ..... 3
3. All pseudocompound hooks tridentate ..... *S. fiordica*  
At least some pseudocompound hooks bidentate ..... 4
4. Pseudocompound hooks both bi- and tridentate ..... *S. hispanica*  
All pseudocompound hooks bidentate ..... 5
5. Cirriform ventral cirri on the first 4 setigers; subacicular hooks from setiger 9 ..... *S. fragosa*  
Cirriform ventral cirri on the first 3 setigers; subacicular hooks from setiger 11 ..... *S. papillata*
6. Branchiae present before setiger 10 ..... 7  
Branchiae first present after setiger 10 ..... 13
7. Branchiae present from setiger 3 ..... 8  
Branchiae not present before setiger 5 ..... 9
8. Maximally 7 branchial filaments; digitate postsetal lobes in the first 15 setigers ..... *S. parva*  
Maximally 18 branchial filaments present, digitate postsetal lobes in at least 75 setigers ..... *S. furcatoseta*
9. Ceratophores smooth ..... *S. litabbranchia*  
Ceratophores distinctly ringed ..... 10
10. Branchiae from setiger 5 ..... *S. pauli*  
Branchiae from setigers 6–8 ..... 11
11. Inner lateral and median occipital antennae of the same length ..... *S. striata*  
Inner lateral occipital antennae longer than the median one ..... 12
12. Large hooks in setigers 4–9 ..... *S. lepta*  
Large hooks absent ..... *S. quadricuspis*
13. Maximally 3 branchial filaments present ..... 14  
At least 4 branchial filaments present ..... 17



14. Ceratophores inflated, with up to 9 indistinct rings ..... *S. pachyctmema*  
 Ceratophores not inflated, with up to 6 distinct rings ..... 15
15. Ceratophores about as long as the length of the prostomium .....  
 ..... *S. paucibranchis*  
 Ceratophores about half as long as the length of the prostomium ..... 16
16. Branchiae present from setiger 12; each maxilla IV with 3 teeth .....  
 ..... *S. bihanica*  
 Branchiae present from setiger 16; each maxilla IV with 6 or 7 teeth ...  
 ..... *S. armandi*
17. Pseudocompound hooks in the first 3 setigers ..... 18  
 Pseudocompound hooks in the first 4 setigers ..... 19
18. Ceratophores with up to 9 articles ..... *S. socia*  
 Ceratophores with up to 5 articles ..... *S. ehlersi*
19. Subacicular hooks from setiger 10 ..... *S. iberica*  
 Subacicular hooks from setiger 16 ..... *S. willemoesii*

***Sarsonuphis quadricuspis* (M. Sars, 1872),  
 new combination**

FIGURE 20*e*, TABLE 22

*Onuphis quadricuspis* M. Sars, in G.O. Sars, 1872:407.—Biden-  
 kap, 1894:83.

**MATERIAL.**—Lectotype and 21 paralectotypes,  
 ZMO, Atlantic Ocean Norway, Oslofjord, Drø-  
 bak, 91–220 m, coll. M. Sars; 1 paralectotype,

ZMO, Atlantic Ocean, Norway, Oslofjord, Ås-  
 gårdstrand, 37–55 m, coll. M. Sars; 7 paralecto-  
 types, ZMO, Atlantic Ocean, Norway, Vestfjor-  
 den, Skråva, 546 m, coll. G.O. Sars.

**REMARKS.**—*S. quadricuspis* was described in a  
 paper issued by G.O. Sars based on his father's,  
 Michael Sars, descriptions and notes. Michael  
 Sars usually has been considered the author of  
 the species; no cause has been found to change  
 this tradition, but, since G.O. Sars is mentioned  
 as sole author of the paper, the double-reference

TABLE 22.—Summary statistics for the original material of *Sarsonuphis quadricuspis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			24
Inner lateral reach setiger	3–8	4.92	1.32	35.41	24
Median reaches setiger	2–5	2.77	0.97	33.97	22
Maximum number of rings	4–6	4.86	0.44	3.98	29
Branchiae:					
First present from setiger	6–10	7.42	1.27	21.74	26
Last present on setiger	35–62	44.50	6.31	89.47	22
Maximum number of filaments	1–4	3.29	0.71	15.32	28
Ventral cirri cirriform on setiger	2	Invariant			29
Last pseudocompound hooks on setiger	3	Invariant			29
First subacicular hook on setiger	9	Invariant			29

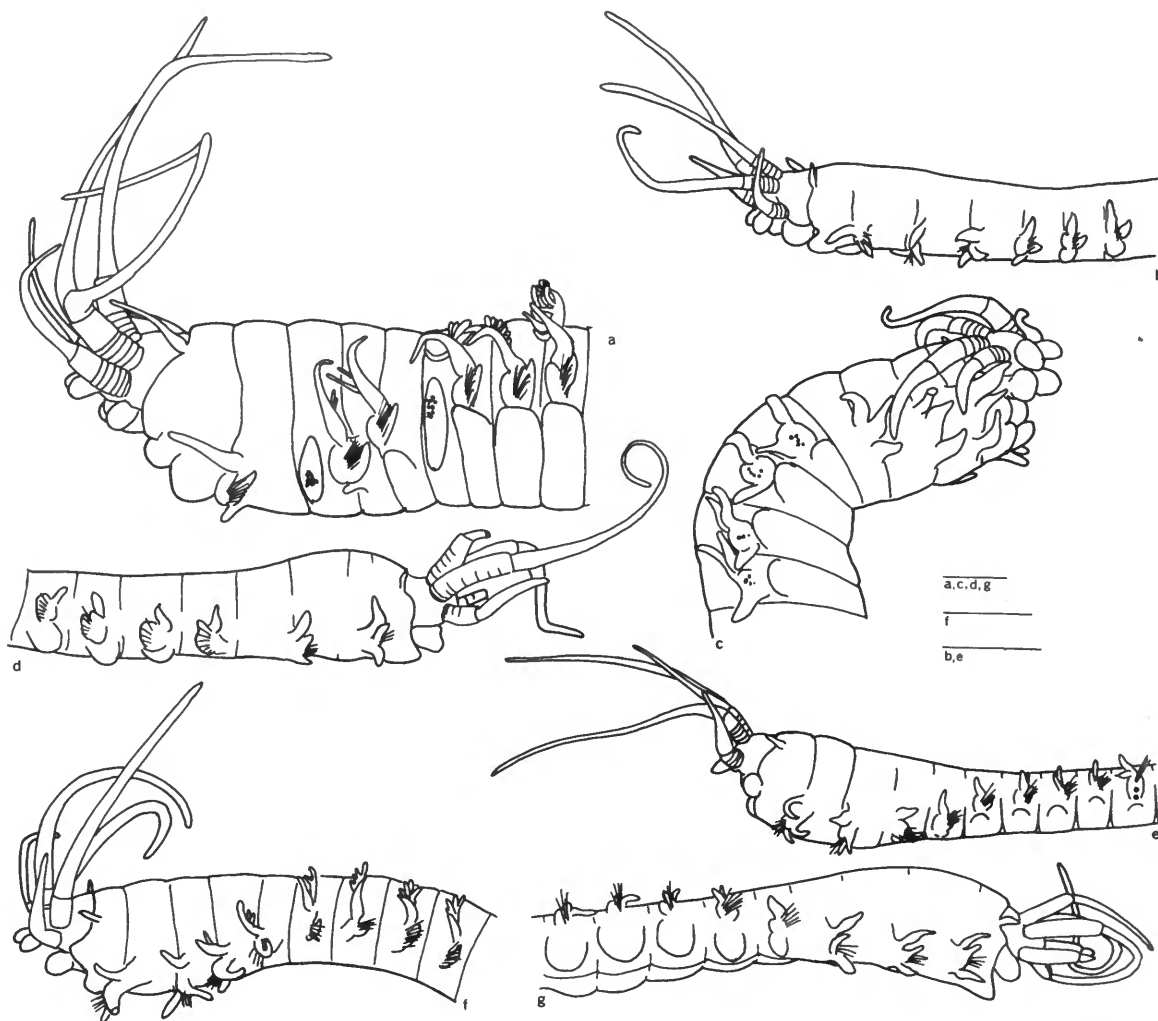


FIGURE 20.—Anterior ends of species of *Sarsonuphis* in lateral view: a, *S. furcatoseta* (Monro, 1937) some parapodia removed; b, *S. fiordica* (Fauchald, 1974); c, *S. striata* (Uschakov, 1950); d, *S. lepta* (Chamberlin, 1919); e, *S. quadricuspis* (M. Sars, 1872); f, *S. parva* (Moore, 1911); g, *S. litabanchia* (Chamberlin, 1919). (All scales = 1 mm.)

given above makes it easier to find the original description. As far as known the total original material was reexamined; in addition to 30 specimens of *S. quadricuspis*, the material also contained 7 specimens of *S. fiordica* described by Fauchald (1974). A lectotype and paralectotypes are herein designated for *S. quadricuspis*.

The lectotype is a complete female with large eggs in the body cavity. It is 72 mm long and 1.2 mm wide and consists of 177 setigers. The notes given are based on 29 of the 30 specimens examined. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach about setiger 5, and the median antenna reaches about

setiger 4; the ceratophores have 5 rings. Branchiae are present from setigers 6–10 in most specimens and are usually absent posterior to setiger 50; the maximum number of branchial filaments is 4 in most specimens. One juvenile had simple branchiae and another lacked branchiae altogether. Ventral cirri are distinctly cirriform in the first 2 setigers; on setiger 3 they are intermediate, but from setiger 4 on they are replaced by glandular pads. Digitiform postsetal lobes are distinct in the first 9 or 10 setigers. Bidentate pseudocompound hooks with long pointed hoods are present in the first 3 setigers. The two teeth are often small and barely distinct. The distal tooth narrows evenly distally. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 9 in all specimens; they are as large in the first setiger in which they occur as they are in later setigers. The pectinate setae are very small, thin and difficult to see; each is distally oblique and has about 15 teeth. The maxillary formula is 1+1, 7+7, 8+0, 7+8, and 1+1. The tubes are cylindrical, thick-walled mud-tubes and have a thick inner lining.

*Sarsonuphis quadricuspis* differs from most of its congeners by having cirriform ventral cirri in 2 anterior setigers only. It has been widely reported from cold water areas, especially in the Atlantic Ocean, but appears to have been confused with a number of similar species; its distribution cannot be precisely determined at this time.

***Sarsonuphis armandi* (McIntosh, 1885),  
new combination**

FIGURE 21a

*Nothria armandi* McIntosh, 1885:330–332, pl. 26A: figs. 8–10, pl. 41: figs. 11–13.

**MATERIAL.**—Holotype, BMNH 1885.12.1.225, Indian Ocean, south of Australia, 53°55'S, 108°35'E, 3549 m, diatom ooze, 3 Mar 1874, *Challenger* station 157.

**REMARKS.**—The holotype consists of a very large, stiff tube that has been opened from one end to the other; some short tube fragments and

fragments of other organisms, in addition to an anterior fragment of 10 setigers that has been cut from the rest of the body; posterior fragments are missing. The anterior end is 6.42 mm long and 1.4 mm wide. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 5, the median antenna is broken. The ceratophores have up to 5 rings. The branchial pattern could not be determined; according to McIntosh (1885:331–332) branchiae were present from setiger 16 with up to 2 branchial filaments. Ventral cirri are cirriform in the first 3 setigers; digitiform postsetal lobes appear to be present in the first 8 setigers only. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 9. Each of the flat pectinate seta is distally oblique and has about 15 teeth. The maxillary formula is 1+1, 10+10, 9+0, 6–7+7, and 1+1, according to McIntosh (1885:331).

The separation between *S. armandi* and several similar species, such as, *S. bihanica*, *S. ehlersi*, *S. iberica*, *S. paucibranchis*, *S. socia*, and *S. willemoesii*, is difficult and poses insoluble problems for the time being. *S. armandi* can be separated from other congeners by the late start of the branchiae. *S. armandi* is known from deep water in sub-Antarctic regions in the southern Indian Ocean.

***Sarsonuphis bihanica* (Intes and Le Loeuff,  
1975), new combination**

FIGURE 15c

*Onuphis bihanica* Intes and Le Loeuff, 1975:314, figs. 11a–h.

**MATERIAL.**—Paratype NMHNP AH 100, Eastern Atlantic Ocean off the Ivory Coast, 5°03.3'N, 4°05'W, 200 m, dredged, coll. A. Intes and P. Le Loeuff, 23 Nov 1966, station TD78.

**REMARKS.**—The paratype, an incomplete specimen with 36 setigers, is 4.8 mm long and 0.44 mm wide, with parapodia. A posterior fragment encased in a thin-walled tube is present in the vial; presumably, this is the posterior end of the same specimen. The outer lateral occipital an-

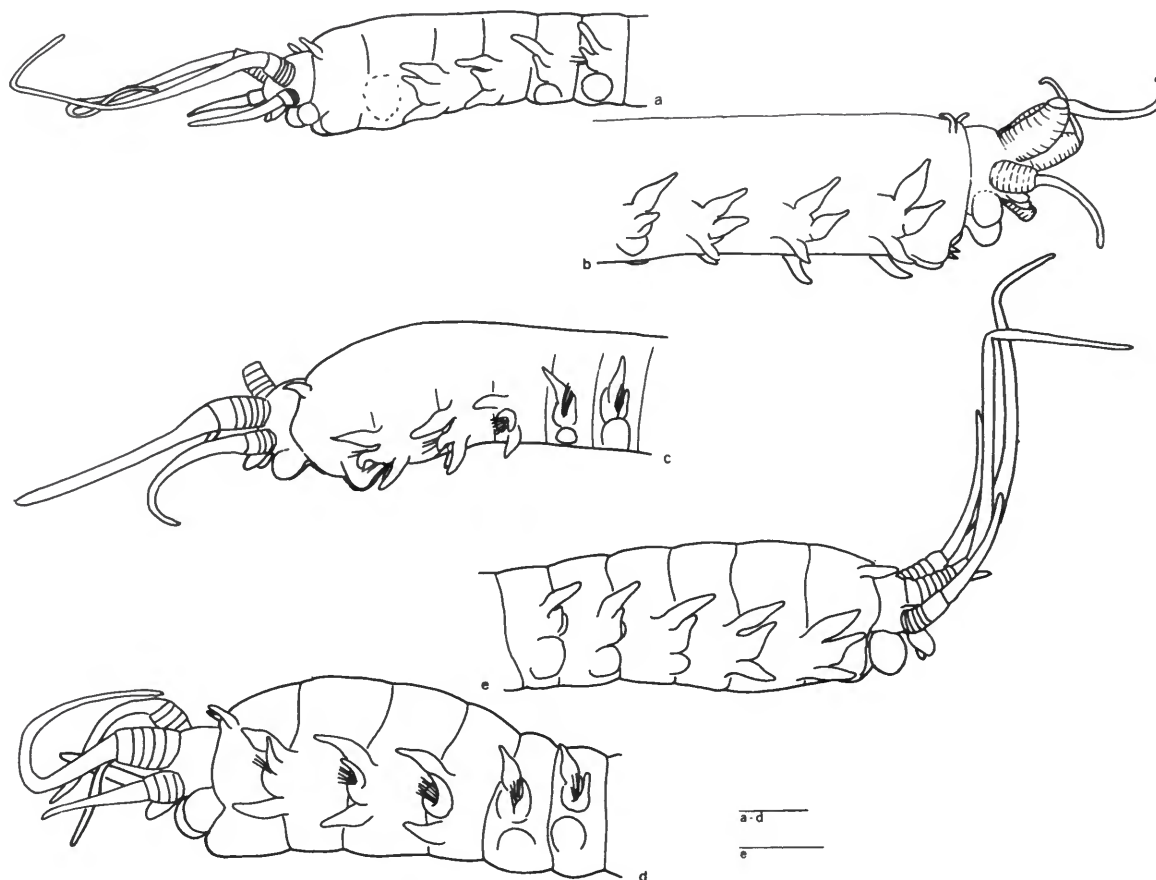


FIGURE 21.—Anterior ends of species of *Sarsonuphis* in lateral view: *a*, *S. armandi* (McIntosh, 1885) parapodium 1 missing; *b*, *S. pachyctmema* (Chamberlin, 1919); *c*, *S. socia* (Chamberlin, 1919); *d*, *S. ehlersi* (McIntosh, 1885); *e*, *S. paucibranchis* (Ehlers, 1908). (All scales = 1 mm.)

tenne reach setiger 2, the inner lateral antennae reach setiger 7, and the median antenna reaches setiger 7. The short ceratophores have 3 rings each. Branchiae are present from setiger 12 to the end of the fragment; most segments have only single branchial filaments, but in some of the posteriormost setigers, 2 filaments may be present in each branchia. Ventral cirri are cirriiform in the first 3 setigers; and digitiform postsetal lobes occur in about the first 5 setigers. Bidentate pseudocompound hooks with long pointed hoods are present in the first 3 setigers. Subacicular hooks are present from setiger 9. Large hooks and com-

pound spinigers are absent. Each of the pectinate setae is distally oblique and has 15 teeth. The maxillary formula is 1+1, 8+8, 6+0, 3+3, and 1+1, according to Intes and Le Loeuff (1975).

*Sarsonuphis bihanica* resembles *S. armandi* closely in most meristic characters, despite the great difference in size between the types of the two species. Branchiae are present from setiger 12 in *S. bihanica* and from setiger 16 in *S. armandi*. The jaws have more teeth on maxillary II to IV in *S. armandi* than in *S. bihanica*. *S. bihanica* is known from shelf depths of the tropical Atlantic Ocean off Africa.

***Sarsonuphis ehlersi* (McIntosh, 1885),  
new combination**

FIGURE 21*d*

*Nothria ehlersi* McIntosh, 1885:327–330, pl. 26A: figs. 5–7, pl. 35A: fig. 2, pl. 42: figs. 1–3.

**MATERIAL.**—Syntype, BMNH 1885.12.1.223, Pacific Ocean off Chile, 34°7'S, 73°56'W, 4050 m, gray mud, 17 Nov 1875, *Challenger* station 298; syntype, BMNH 1885.12.1.224, Pacific Ocean off Chile, 33°31'S, 74°43'W, 3888 m, gray mud, 14 Dec 1975, *Challenger* station 299.

**REMARKS.**—The specimen from station 298 is currently in the best condition. It is incomplete, consists of 89 setigers, and is 79 mm long and 2.3 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae reach setiger 4, and the median antenna reaches setiger 3. The ceratophores are barrel-shaped and have up to 5 rings. Branchiae are first present from setiger 17 and continue to setiger 73; where best developed, between setigers 23 and 42, each branchia has 4 filaments. Ventral cirri are cirriform in the first 3 setigers; digitiform postsetal lobes are distinct in about 7 setigers. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 13. Each of the flat pectinate setae is distally transverse and has about 18 teeth. The specimen from station 299 had been anteriorly dissected; in a vial with the sample was two sets of maxillae. The formulae are 1+1, 8+10, 13+0, 8+7, and 1+1 for one, and 1+1, 8+10, 12+0, 8+10, and 1+1 for the other. It is not possible to decide which set of maxillae belonged to what specimen.

*Sarsonuphis ehlersi* has pectinate branchiae limited to relatively few median setigers, but is otherwise very similar to several other deep-water species. It has been reported from the Pacific Ocean off Chile in deep water.

***Sarsonuphis fiordica* (Fauchald, 1974),  
new combination**

FIGURE 20*b*, TABLE 23

*Nothria fiordica* Fauchald, 1974:15–18, fig. 1a–f.

**MATERIAL.**—Holotype, ZMUB, 55040; 5 paratypes, AHF Poly 1120; all Atlantic Ocean, Norway, Ytre Samlafjord, southwest of Jonanes, 60°17'N, 06°13'10"E, 842–840 m, fine mud, 4 Jul 1956, Hardangerfjord Investigations station Z-25-56.

**REMARKS.**—The holotype, now incomplete, has 98 setigers and is 40 mm long and 1.1 mm wide, with parapodia. The last few segments reported by Fauchald (1974:16) have been lost. The outer lateral occipital antennae reach about midway on setiger 2; the inner lateral antennae reach setiger 3, and the median antenna reaches setiger 4. The ceratophores have about 4 rings. Branchiae are absent. Ventral cirri are cirriform in the first 4 setigers; digitiform postsetal lobes are distinct to about setiger 8. Tridentate pseudocompound hooks with long, pointed hoods are present in the first 2 setigers, not 4, as reported by Fauchald (1974:16). Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 16 in the holotype, but are more commonly present from setigers 14 or 15. One paratype has the jaw apparatus everted. The maxillary formula is 1+1, 5+6, 9+0, 6+8, and 1+1. Maxillae II and III may have 1 or 2 more teeth each, which could not be seen without damaging the specimen.

*Sarsonuphis fiordica* is unique in the genus in lacking branchiae, having tridentate rather than bidentate pseudocompound hooks, and in exhibiting only a limited cephalization. *S. fiordica* was described from Hardangerfjorden, western Norway, Atlantic Ocean, and has since been found in other fjords in Norway.

***Sarsonuphis fragosa* (Ehlers, 1887),  
new combination**

FIGURE 25*a–c*

*Diopatra* (*Paradiopatra*) *fragosa* Ehlers, 1887:75–76, pl. 20: figs. 7–14, pl. 21: figs. 1–4.—Pettibone, 1970:257.



TABLE 23.—Summary statistics for the type material of *Sarsonuphis fiordica*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1-2	1.50	0.55	20.17	6
Inner lateral reach setiger	3-7	5.20	1.48	42.12	5
Median reaches setiger	3-6	3.83	1.17	35.74	6
Maximum number of rings	4-5	4.33	0.52	6.24	6
Cirriiform ventral cirri present to setiger	4	Invariant			6
Pseudocompound hooks present to setiger	2	Invariant			6
Subacicular hooks first present from setiger	14-16	14.50	1.38	13.13	6

MATERIAL.—Syntype, MCZ 766, Atlantic Ocean, Caribbean Sea off Sand Key, 557 m (dried out), 17 Feb 1869; syntype, MCZ 656, Atlantic Ocean, Caribbean Sea off Marquesas, 606 m, 11 Feb 1869, *Blake*; syntype, MCZ 857, Atlantic Ocean, Caribbean Sea, off Bahia Honda, 792 m, *Blake*.

REMARKS.—The largest syntype (MCZ 766) is an incomplete specimen with 68 setigers, and is 28.5 mm long and about 1.0 mm wide, with parapodia. It has been dry and the width as measured is less than it was. The length of the occipital antennae could not be determined in this specimen. In another syntype (MCZ 857), the outer lateral occipital antennae reach setiger 2, the inner lateral and median antennae reach setiger 4. The ceratophores have 4 to 6 rings. Branchiae are absent. The first parapodia are not enlarged. Ventral cirri are cirriiform in the first 4 setigers; the distribution of digitiform postsetal lobes could not be determined. Bidentate pseudocompound hooks with long pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 9. Each of the pectinate setae is distally oblique and has about 15 teeth.

The syntypes from MCZ 656 are very soft, having been preserved in their tubes, but can be adequately illustrated. They differ from the other syntypes in that the inner lateral occipital anten-

nae reach setiger 6 and are distinctly longer than the median antenna, which reaches setiger 4. Postsetal lobes are digitiform in about the first 9 setigers. The maxillary formula of one of these specimens (as viewed through the body wall) is 1+1, 8+7, 7+0, 4+7, and 1+1. The tubes are slender and cylindrical with a distinct inner lining and they are covered with fine silt particles, large foraminiferan tests, and shell fragments arranged at right angles to the long axis of the tubes, especially dense near the opening of the tube. The tubes resemble closely those of *Diopatra ornata*.

Pettibone (1970:257) characterized the conditions of these syntypes as unsatisfactory and the species as doubtful. The types are certainly not in particularly good condition but they can be recognized and the additional original material makes it possible to characterize the species.

*Paradiopatra* was described as a subgenus of *Diopatra* to contain abranchiate forms that otherwise agreed with Ehlers (1887) concept of the genus. Two species were newly described in the subgenus, *fragosa* and *glutinatrix*. No type-species was designated for the subgenus. While *fragosa* has page priority over *glutinatrix*, Pettibone (1970:257), as first revisor, elevated *Paradiopatra* to a distinct genus and selected *Diopatra* (P.) *glutinatrix* as type-species, referring it to *Paradiopatra pycnobranchiata* (McIntosh, 1885).

Three other species of *Sarsonuphis* lack branchiae: *S. fiordica*, *S. hartmanae*, and *S. papillata*. *S.*

*fiordica* has tridentate pseudocompound hooks, *S. fragosa* and *S. papillata* have bidentate hooks, and *S. hartmanae* has simple falcate hooks. *S. papillata* has subacicular hooks starting at setigers 11 to 12 and cirriform ventral cirri in 3 setigers; *S. fragosa* has subacicular hooks starting at setiger 9, and the cirriform ventral cirri are in 4 setigers.

*S. fragosa* is known only through its original records from the slope depths of the Caribbean Sea.

***Sarsonuphis furcatoseta* (Monro, 1937),  
new combination**

FIGURE 20a, TABLE 24

*Onuphis furcatoseta* Monro, 1937:290–292, fig. 15a–f.

**MATERIAL.**—Ten syntypes, BMNH 1937.9.2.327–335, Indian Ocean off Arabian Peninsula, Gulf of Aden, 10°29'48"N, 45°01'48"E, soft brown mud, 186 m, trawled, 21 Sep 1933, John Murray Expedition station 16; 1 syntype, BMNH 1937.9.2.336, Indian Ocean off Arabian Peninsula, Gulf of Oman, from 25°34'12"N, 57°23'30"E to 25°33'00"N, 57°25'12"E, soft green mud, 196 m, trawled, 25 Nov 1933, John Murray Expedition station 70.

**REMARKS.**—All the syntypes are incomplete, a specimen with 85 setigers in 34 mm long and 2 mm wide, with parapodia. Most of the types have lost all occipital antennal styles; those that remain

show the following pattern: the outer lateral antennae reach setigers 1 to 3, the inner lateral antennae reach setiger 9, and the median antenna reaches setiger 8. The inner lateral and median antennae are present in only a single specimen and the outer lateral antennae in two specimens. The ceratophores have 6 rings; they are very distinct in the specimen from station 70 and rather indistinct in all specimens from station 16. Branchiae are present from setiger 3 and are present to the end of the longest fragment. The first branchia is bifid, all others are distinctly pectinate, with up to 18 slender, curling branchial filaments. The number of filaments decrease to about 10 posterior to setiger 60. Ventral cirri are cirriform in the first 3 setigers; the next several setigers have wide, transverse glandular pads replacing the ventral cirri. All ventral cirri are very small. Digitiform postsetal lobes are present in all 36 setigers in the specimen from station 70; they could not be clearly identified in the other specimens. Bidentate pseudocompound hooks with long pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setigers 9 or 10. Each of the flat pectinate setae is distally distinctly oblique and has about 15 coarse teeth. The maxillary formula is 1+1, 8+9, 8+0, 7+10, and 1+1, according to Monro (1937:292). One specimen from station 16 had been frontally dissected and the jaw apparatus was missing;

TABLE 24.—Summary statistics for the type material of *Sarsonuphis furcatoseta*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Maximum number of rings	5–6	5.88	0.35	2.08	6
Branchiae:					
First present from setiger	3	Invariant			
Maximum number of filaments	15–18	17.25	1.16	7.60	8
Ventral cirri cirriform to setiger	3	Invariant			11
Pseudocompound hooks present to setiger	3	Invariant			11
Subacicular hooks first present from setiger	9–10	9.27	0.47	2.38	11

presumably this is the specimen upon which Monro made his counts. Tubes are absent; they were described as mud-tubes by Monro.

All specimens from station 16 had remnants of transverse dark pigment bands across the dorsum of the first 10–15 setigers; this pigment pattern was absent on the specimen from station 70. There are some other differences in the specimens from station 16 and the one from station 70, but some of these may be due to the poor preservation of the material from station 16.

*Sarsonuphis furcatoseta* differs from its congeners mainly in the large number of branchial filaments. It is known from the northwestern Indian Ocean in shelf and slope depths.

***Sarsonuphis hartmanae* (Kirkegaard, 1980),  
new combination**

FIGURE 22

*Nothria hartmani* Kirkegaard, 1980:87–88, fig. 2a–d.

**MATERIAL.**—ZMC, holotype and 2 paratypes, northern Atlantic Ocean, 47°30'N, 9°34'W, 4250–4265 m, SMBA sledge, 29 April 1977, *Shackleton* station 1903/7; 2 paratypes, northern Atlantic Ocean, 47°36'N, 9°44'W, 4120–4165 m,

SMBA box dredge, 29 Apr 1977, *Shackleton* station 1903/2; ZMC, 1 paratype, northern Atlantic Ocean, 47°36'N, 9°45'W, 4165 m, anchor dredge, 29 Apr 1977, *Shackleton* station 1903/4; ZMC, 1 paratype, northern Atlantic Ocean, 47°31'N, 9°27'W, 4000–3820 m, Agassiz trawl, 29 Apr 1977, *Shackleton* station 1903/8.

**REMARKS.**—The total original material reported by Kirkegaard was examined. The holotype, an incomplete specimen with 23 setigers, is 12 mm long and about 2 mm wide, with parapodia. The largest specimen examined is 27 mm and consists of 43 setigers. The remarks are based on all the specimens. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 3 (rarely 2), and the median antenna reaches setiger 2 (rarely 3). The short ceratophores have 3 or 4 rings. In all specimens the median ceratophore has paired lateral projections and the inner lateral ceratophores have projections on the medial side. All projections are on the basal ceratophoral ring. Branchiae are absent. Ventral cirri are cirriform in the first 3 setigers and postsetal lobes are distinct in the first 8 to 10 setigers. Distally entire pseudocompound hooks with long, distally pointed hoods are present in the first 3 setigers. Compound spinigers and large hooks are absent. Subacicular hooks are

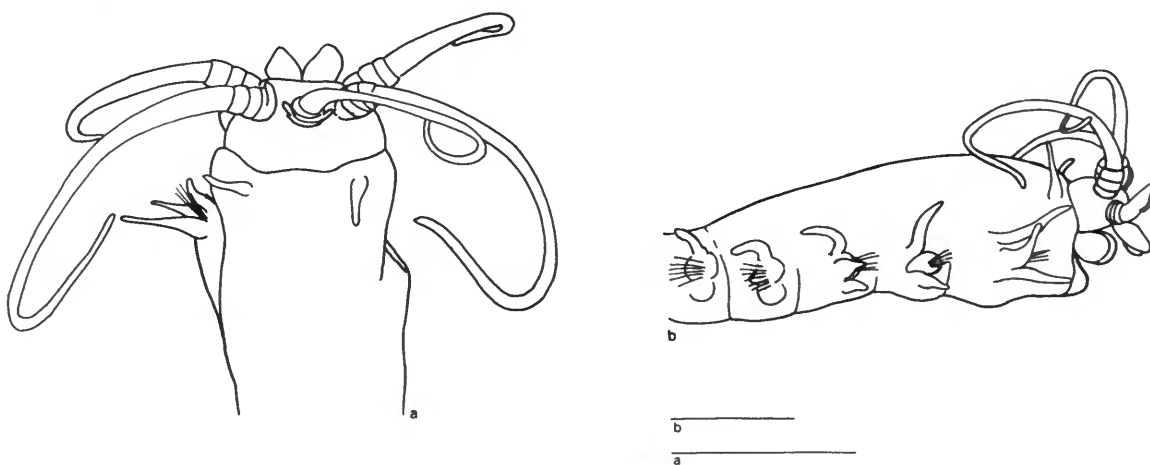


FIGURE 22.—*Sarsonuphis hartmanae* (Kirkegaard, 1980): a, anterior end, dorsal view; b, anterior end, lateral view. (Both scales = 1 mm.)

first present from setiger 11. Each of the flat pectinate setae is distally transverse and has about 20 somewhat irregular teeth. The maxillary formula is unknown.

The 7 specimens examined are remarkably uniform in structure; the only variability noted was in the length of the occipital antennae. Kirkegaard (1980:88) indicated that *Nothria* spp. Hartman (1965:106) and Hartman and Fauchald (1971:80) agreed with his species. *Nothria* spp. of these two papers actually include several different species, and only one specimen (from station II 2) agrees with Kirkegaard's species in that it lacks branchiae and has distally entire pseudocompound hooks with pointed hoods. Other specimens have branchiae and bidentate pseudocompound hooks; they belong to other, possibly undescribed, species of *Sarsonuphis*. Through a *lapsus calami*, Kirkegaard misspelled the specific name of the species; this has been corrected above.

*Sarsonuphis hartmanae* is known only from the northern Atlantic Ocean off Great Britain and may also be present on the New England coast in deep water.

***Sarsonuphis hispanica* (Amoureux, 1972),  
new combination**

*Nothria hispanica* Amoureux, 1972:76-77, figs. 2, 3.

REMARKS.—The type material is housed in Station Zoologique, Roscoff, France, but was not made available for study. The remarks are based on the original description and illustrations.

The anterior end was not described or illustrated. Branchiae are absent. Ventral cirri are cirriform in the first 3 setigers and transitional in setiger 4 to the glandular pads present in the rest of the segments. Digitiform postsetal lobes must be present in less than 15 setigers since parapodium 15 is illustrated without distinct postsetal lobes. Bi- and tridentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Compound spinigers and, presumably, large hooks are absent. Bidentate subacicular hooks are present from setiger 15. Each of the flat

pectinate setae is distally transverse and has about 15 teeth. The maxillary formula is 1+1, 7+9, 8+0, 9+8, and 1+? Tubes were not described.

*Sarsonuphis hispanica* is unique in the genus in that it combines presence of both bi- and tridentate pseudocompound hooks with an absence of branchiae. It is known from the Atlantic Ocean off Spain and France in slope depths.

***Sarsonuphis iberica* (Hartmann-Schröder,  
1975), new combination**

FIGURE 10f

*Onuphis* (*Onuphis*) *iberica* Hartmann-Schröder, 1975:63-65, figs. 26-31.

MATERIAL.—Paratype, ZMH P-13628, Atlantic Ocean, 42°17.2'N, 14°46.3'W, 5270 m, 11-12 Mar 1966, *Meteor* station 24, N 103.

REMARKS.—The paratype, an incomplete specimen with 28 setigers, is 18.75 mm long and 1.50 mm wide, with parapodia. The occipital antennae are long and slender; the ceratophores have 7 rings. Branchiae are first present from setiger 17, with 2 or 3 filaments present from the first branchia. The maximum number of branchial filaments is 4. Ventral cirri are cirriform in the first 3 setigers; the ventral cirri of setiger 4 is transitional, all other setigers have ventral glandular pads. Digitiform postsetal lobes are present in the first 8 setigers. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 10. Each flat pectinate setae is distally transverse and has about 20 fine teeth. The maxillary formula is 1+1, 9+11, and 8+0; teeth could not be discerned on maxilla IV and V, according to Hartmann-Schröder (1975:64), who indicated that they might be unidentate.

*Sarsonuphis iberica* resembles *S. willemoesii* closely, but differs in that the subacicular hooks start from setiger 10 rather than from 16 and in having more distinctly ringed ceratophores than *S. willemoesii*. *S. iberica* is known from deep water in the Atlantic Ocean off the Iberian Peninsula.



***Sarsonuphis lepta* (Chamberlin, 1919),  
new combination**

FIGURE 20d

*Onuphis lepta* Chamberlin, 1919:290–295, pl. 45: figs. 1–7, pl. 46: figs. 3–12.—Fauchald, 1972:125.

**MATERIAL.**—Holotype, USNM 19425, Pacific Ocean off Panama, 7°05'30"N, 79°40'W, 2311 m, hard bottom, *Albatross* station 3392.

**REMARKS.**—The holotype, an incomplete specimen with about 130 setigers, is 59.7 mm long and 1.2 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 6, and the median antenna reaches setiger 2. The ceratophores have up to 8 indistinct rings. Branchiae are first present from setiger 6 and continue to setiger 53. Some median branchiae are bifid, but most are simple and strap-like. Fauchald (1972:125) reported branchiae present from setigers 6–10 to setigers 50–57 in nontype material. Ventral cirri are cirriform in the first 3 setigers; digitate postsetal lobes are distinct in the first 20 setigers, but the specimen is poorly preserved and postsetal lobes may have been present further back. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks are present in setigers 4–9; compound spinigers are absent. Subacicular hooks are present from setiger 10. Each of the flat pectinate setae is distally transverse and has about 17 blunt teeth. The maxillary formula is 1+1, 11+11, 7–8+0, 6–7+0, and 1+1, according to Chamberlin (1919:294). The tubes have a tough inner lining and are covered with a well-organized layer of fine mud particles.

*Sarsonuphis lepta* can be differentiated from other species of *Sarsonuphis* by the poor development of the branchiae. It is known from deep water off the west coast of the Americas.

***Sarsonuphis litabbranchia* (Chamberlin, 1919),  
new combination**

FIGURE 20g

*Onuphis litabbranchia* Chamberlin, 1919:274–279, pl. 50: fig. 7, pl. 51: figs. 1–10.—Fauchald, 1972:130.

**MATERIAL.**—Two syntypes plus several tubes, MCZ 2324, 1 syntype plus several tubes, MCZ 2323, 1 median fragment plus tubes, USNM 20415, Pacific Ocean off Mexico, 14°46'N, 98°40'W, 3420 m, 10 Apr 1891, *Albatross* station 3415.

**REMARKS.**—The largest syntype (MCZ 2324), apparently the specimen described by Chamberlin, is incomplete with 60 setigers and is 49.5 mm long and 1.5 mm wide, with parapodia; several median fragments are present in the vial. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 5, and the median antenna reaches setiger 2. The ceratophores are smooth. Branchiae are first present from setiger 5; most are simple, but in the largest syntype some setigers posterior to setiger 22 have 2 or 3 filaments. Ventral cirri are cirriform in the first 3 setigers; digitiform postsetal lobes are distinct in the first 8 or 9 setigers. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setiger 12. The maxillary formula is 1+1, 8+8, 9+0, 4+7, and 1+1, according to Chamberlin (1919:278). The tubes have a thick, extremely tough inner lining and a thick, dense coat of silt particles as a cover. The other syntypes were preserved in their tubes and are now in poor condition, so no additional data can be collected.

*Sarsonuphis litabbranchia* differs from its congeners in having poorly developed branchiae and smooth occipital ceratophores. It is known only through its original record.

***Sarsonuphis pachyctmema* (Chamberlin, 1919),  
new combination**

FIGURE 21b

*Onuphis pachyctmema* Chamberlin, 1919:279–284, pl. 48: figs. 5–11, pl. 49: figs. 1–8, pl. 50: figs. 1–6.

**MATERIAL.**—Holotype and several tubes, USNM 19757, Pacific Ocean off Schura Bay,



Peru, 8°30'S, 85°30'W, 4313 m, 14 Nov 1904, *Albatross* station 4658.

REMARKS.—The holotype, an incomplete specimen with 85 setigers, is 85 mm long and 3 mm wide, with parapodia. Most of the occipital antennal styles have been lost; the median style reaches setiger 1, remnant of one of the outer lateral styles reaches setiger 1. The inflated ceratophores have about 9 rings. The branchiae are present from setiger 16 to setiger 60; the maximum number of branchial filaments is 3. Ventral cirri are cirriform in the first 3 setigers; digitiform postsetal lobes are distinct in the first 9 setigers. Bidentate pseudocompound hooks with pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 10. Each pectinate seta is flat, distally transverse, and has about 20 teeth. The maxillary formula is 1+1, 10+10, and 9+0; teeth were not specified on the remaining maxillae by Chamberlin (1919). The tubes are at least twice as long as the specimens; each has a tough inner lining and a trim cover of fine dark gray mud particles.

*Sarsonuphis pachyctmema* differs most markedly from its congeners in that the ceratophores are strongly inflated. It is known only from its type locality.

***Sarsonuphis papillata* (Kucheruk, 1979),  
new combination**

*Onuphis papillata* Kucheruk, 1979:1227–1228, fig. 1:1–8.

REMARKS.—The type material was not available; letters to the author gave no results. The following comments are based on the original description and figures. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 4, and the median antenna reaches setiger 2. The ceratophores have up to 4 rings. The inner lateral antennae have a pair of medially directed papillae on the 2 inner ceratophoral rings, and the median ceratophore has a pair of laterally directed papillae on the inner ring. Branchiae are absent. Ventral cirri are cir-

riform in the first 3 setigers; digitiform postsetal lobes are distinct in the first 5 setigers. Weakly bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setigers 11 or 12. The structure of the pectinate setae was not described. The structure of the maxillary apparatus was not described in detail, but was said to be of the type usual in the family.

*Sarsonuphis papillata* closely resembles *S. hartmanae* in lacking branchiae and in having papillate ceratophores. *S. papillata* has bidentate pseudocompound hooks; *S. hartmanae* has entire, falcate hooks. *S. papillata* is known from one locality in deep water in the Pacific Ocean off northern Chile.

***Sarsonuphis parva* (Moore, 1911),  
new combination**

FIGURE 20*f*, TABLE 25

*Onuphis parva* Moore, 1911:263–266, pl. 17: figs. 51–57, pl. 18: figs. 98–99.

MATERIAL.—Holotype, USNM 17356; 9 paratypes, USNM 17359; all Pacific Ocean off California, Point Pinos Lighthouse, 2°S, 2°W, 5 miles (95–107 m), green mud, 11 May 1904, *Albatross* station 4446.

REMARKS.—The holotype is complete and has 105 setigers. It is 30.7 mm long and 1 mm wide, with parapodia. The specimen was specified by Moore (1911:263) as the “type” and is here considered the holotype; the rest of the specimens were labeled “co-types” and are here considered paratypes.

The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 5. The median antenna is of about the same length. The median antenna is shorter than the inner lateral ones in most specimens. The ceratophores usually have 5 rings. Branchiae are first present from setigers 2–4, usually from setiger 3. Only the first branchia is simple, all others are branched. The maximum number of branchial filaments is

TABLE 25.—Summary statistics for the type material of *Sarsonuphis parva*

Character	Range (no.)	Mean	S.D.	C.D.	N
Occipital antennae:					
Outer lateral reach setiger	1-2	1.10	0.32	9.31	10
Inner lateral reach setiger	3-6	5.10	0.88	15.18	10
Median reaches setiger	3-6	4.38	1.06	25.65	8
Maximum number of rings	3-5	4.80	0.63	8.27	10
Branchiae:					
First present from setiger	2-4	3.10	0.57	10.48	10
Last present on setiger	29-37	31.25	2.66	22.64	8
Maximum number of filaments	5-7	6.60	0.84	10.69	10
Ventral cirri cirriform to setiger	3	Invariant			10
Last pseudocompound hooks on setiger	3	Invariant			10
First subacicular hook on setiger	9-10	9.30	0.48	2.48	10

7. The branchiae terminate, rather abruptly, at about setiger 31. Ventral cirri are cirriform on the first 3 setigers. Digitiform postsetal lobes are distinct in about 12 setigers. Bidentate pseudocompound hooks with extremely long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 9 or 10. Each flat pectinate seta is distally obliquely truncate and has about 10 teeth. The maxillary formula is 1+1, 8-9+9-10, 7-8+0, 5-6+7-8, and 1+1, according to Moore (1911:265). The tubes have a thin, flimsy inner lining and a thick coat of loose mud particles.

Five of the 10 type specimens were complete; the holotype is the largest with 105 setigers; other specimens had 93, 88, 88, and 72 setigers. Large ovate fecal pellets were present in most of the tubes; they consisted largely of diatom frustules.

*Sarsonuphis parva* differs from its congeners only in details of the distributional features, e.g., branchiae and ventral cirri. It is common in lower shelf depths along the west coasts of the Americas.

***Sarsonuphis paucibranchis* (Ehlers, 1908),  
new combination**

FIGURE 21c

*Diopatra paucibranchis* Ehlers, 1908:81-83, pl. 10: figs. 12-16, pl. 11: figs. 1-6.

**MATERIAL.**—Holotype, ZMB, 4524, Antarctic Ocean off Enderby Land, 63°16'S, 57°51'E, 4636 m, blue clay with rock fragments, 17 Dec 1898, *Valdivia* station 152.

**REMARKS.**—The holotype, an incomplete specimen with about 105 setigers, is 81 mm long and 1.5 mm wide with parapodia. The outer lateral and median occipital antennae reach setiger 1, the inner lateral antennae reach setiger 5. The ceratophores have up to 6 rings. Branchiae are present on setigers 17 to 36 with up to 2 branchial filaments. Ventral cirri are cirriform in the first 3 setigers; digitate postsetal lobes are present in the first 7 setigers. Bidentate pseudocompound hooks with long, pointed hoods occur in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 9. The pectinate setae are evenly expanded from the base to the tip and are relatively thick; each is distally transverse and has about 20 teeth. The maxillary formula is 1+1, 6+8, 9+0, 7+5, and 1+1 according to Ehlers (1908:82-83). The tube is long and has a thick mud wall, according to Ehlers (1908:83).

*Sarsonuphis paucibranchis* resembles *S. armandi* in having branchiae limited to a few median setigers and with a maximum of only 2 branchial filaments. The former has much longer ceratophores

than the latter. It has been reported from a single collection in the Antarctic Ocean.

***Sarsonuphis pauli* (Annenkova, 1952),  
new combination**

*Onuphis pauli* Annenkova, 1952:150–151, figs. 4, 5.

REMARKS.—The type material of this species was not available; letters to Leningrad and Moscow gave no results. The following comments are based on Annenkova's original description and figures. The inner lateral and median occipital antennae reach setigers 4 or 5; the ceratophores are strongly ringed, but the number of rings could not be determined. Branchiae are first present from setiger 5 and have up to 4 filaments. Bidentate pseudocompound hooks with long pointed hoods are present. The distribution of ventral cirri, pseudocompound hooks, postsetal lobes, subacicular hooks, as well as the presence of large hooks and compound spinigers, remain unknown. The maxillary formula is 1+1, 6+7, 5+0, 10+12, and 1+1.

*Sarsonuphis pauli* is assigned to this genus solely on the structure of the pseudocompound hooks; its relation to its congeners cannot be determined without an examination of the type. It is known from one locality in the shelf depths of the Chuckchi Sea, Arctic Ocean.

***Sarsonuphis socia* (Chamberlin, 1919),  
new combination**

FIGURE 21c

*Onuphis socia* Chamberlin, 1919:284–290, pl. 47: figs. 1–11, pl. 48: figs. 1–4.

MATERIAL.—Holotype, USNM 19427; 2 paratypes plus empty tubes, USNM 20417; all Pacific Ocean off Peru, Palominos Light House, 13°11'S, 78°18'W, 5178 m, fine dark brown infusorial mud, 21 Nov 1904, *Albatross* station 4672.

REMARKS.—The holotype has been frontally dissected for the maxillary apparatus, so one of the two paratypes is illustrated. The largest paratype is incomplete and is 48.3 mm long and 2.0

mm wide for 97 setigers with parapodia. The outer lateral occipital antennae reach about setiger 1, the inner lateral antennae reach setigers 5 or 6, the median antenna reaches setigers 2 or 3. The ceratophores have 8 or 9 articles. The branchiae are first present from setigers 17 or 18 and are missing posterior to setiger 50. Where best developed each branchia has 4 filaments, but the occurrence of the lateral filaments is irregular so that one segment with 4 filaments may abut one with just a single filament. Ventral cirri are cirriform in the first 3 setigers; digitiform postsetal lobes are distinct in the first 10 to 12 setigers. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 11. Each pectinate seta is flat, distally oblique, and has 18 to 20 teeth. The maxillary formula is 1+1, 13+13, 12+0, 9+11, and 1+1 according to Chamberlin (1919:289). The tubes have a tough inner lining and a dense, thick cover of silt-sized particles.

*Sarsonuphis socia* has few branchiated setigers and poorly developed branchiae, but it differs from similar species in having only 3 anterior setigers with pseudocompound hooks and cirriform ventral cirri; the other species have these features in 4 anterior setigers. It is known from its original record only.

***Sarsonuphis striata* (Uschakov, 1950),  
new combination**

FIGURE 20c

*Onuphis parva striata* Uschakov, 1950:193, fig. 25.—1955:236, figs. 74b, 77j.

*Onuphis striata*.—Fauchald, 1968:32.

MATERIAL.—One syntype, ZIANL, 1/25153, Pacific Ocean, off USSR, Sea of Okhotsk, off the coast of Kamtchatka, 51°39.9'N, 156°2'5"E, 97 m, sandy and clayey silt, 11 Jul 1932, coll. P.V. Uschakov, station 219.

REMARKS.—The syntype is a complete specimen with 110 setigers which currently is in two

pieces; it is 52.2 mm long and 1.7 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 2, the inner lateral and median antennae reach setiger 3. The ceratophores have 5 rings. Branchiae are present from setiger 6 through setiger 36; where best developed, between setigers 15 and 25, each branchia has 5 filaments. Ventral cirri are cirriform in the first 3 setigers; digitiform postsetal lobes are distinct in the first 10 setigers. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks begin on setiger 9. Each of the flat pectinate setae is distally oblique and has about 20 fine teeth. The maxillary formula is unknown. Tubes are now absent, but Uschakov (1955, fig. 74b) shows the animal emerging from a thick, smooth tube, presumably covered with fine silt particles. The state of preservation of the posterior end and the compressed nature of the median parapodia suggest that the tube must have been close fitting.

The pigment pattern, referred to in the name and shown in Uschakov's (1955) figure 74b is now partially faded, but apparently the prostomium and peristomium lacked dark pigment, whereas each segment between setiger 2 and setiger 20 had a wide dark band across the dorsum.

*Sarsonuphis striata* differs from its congeners in the short occipital antennae, in the distribution of branchiae, and in the color pattern of the anterior end. It is known from inshore areas in the northwest Pacific Ocean.

***Sarsonuphis willemoesii* (McIntosh, 1885),  
new combination**

*Nothria willemoesii* McIntosh, 1885:322-327, pl. 26A: figs. 1-4, pl. 35A: fig. 1, pl. 41: figs. 4-10.

**MATERIAL.**—Holotype, BMNH 1885.12.1.212, Pacific Ocean off Indonesia, off Amboina, dredged in 180 m, *Challenger* Expedition [no station reported].

**REMARKS.**—The holotype and only known specimen has been deeply dissected frontally and

the anterior part of the prostomium with the frontal antennae has been lost; thus neither measurements nor illustration can be of any value. The specimen is large consisting of about 75 setigers and is about 50 mm long. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae reach setiger 21, and the median antenna reaches setiger 12. The ceratophores are short and have about 6 evenly spaced rings. The ceratostyles are extremely slender. Branchiae are present from setiger 16 to the end of the fragment. Where best developed, at about setiger 40, each branchia is distinctly pectinate and has 4 filaments. Ventral cirri are cirriform in the first 4 setigers; digitiform postsetal lobes are distinct in all setigers present. Bidentate pseudocompound hooks with long, pointed hoods are present in the first 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks begin on setiger 16. Delicate pectinate setae are present in median setigers; each is flat, distally oblique and has about 25 teeth. The maxillary formula is 1+1, 10+10, 9+0, 11+12, and 1+1 according to McIntosh (1885:323).

A unique feature of this species is the presence of long, slender tapering dorsal cirri in all setigers; in median and posterior setigers (of those present) the dorsal cirri nearly meet across the dorsum.

*Sarsonuphis willemoesii* is characterized by the posterior location of the first branchiae and by the long, slender dorsal cirri and occipital antennae. It otherwise resembles *S. ehlersi* in most features. It is known only through its original record.

***Paradiopatra* Ehlers, 1887, emended**

**DIAGNOSIS.**—Onuphids with an indeterminate number of setigers, with long tubes, peristomial cirri, and short frontal palps. First parapodia distinctly enlarged in most species, auricular pre-setal lobes absent. Pseudocompound hooks bidentate in all but one species (*P. pourtalesii*), all with short, blunt hoods. Compound spinigers, large hooks and subacicular hooks absent. Intrafasci-



cular hooks present. Pectinate setae scoop-shaped. Branchiae, if present, pectinate or as single filaments.

**TYPE-SPECIES.**—*Diopatra* (*Paradiopatra*) *glutinatrix* Ehlers, 1887 (designated by Pettibone, 1970).

**REMARKS.**—*Paradiopatra* is here accepted largely as emended by Pettibone (1970). The key features in the present definition are the presence of intrafascicular hooks and scoop-shaped pectinate setae. Pettibone's definition emphasized the presence of the enlarged parapodia found in the type-species. Most species have enlarged first parapodia, but a few clearly related species do not; thus the emphasis of the definition has been shifted to the setal structures. *Paradiopatra* and *Nothria* are characterized by the presence of intrafascicular hooks and scoop-shaped pectinate setae. *Paradiopatra* lacks foliose presetal lobes in anterior setigers; *Nothria* has such lobes as emphasized by Pettibone (1970:251). *Paradiopatra* is currently known for 11 species. The relationship between the species is indicated in Figure 23.

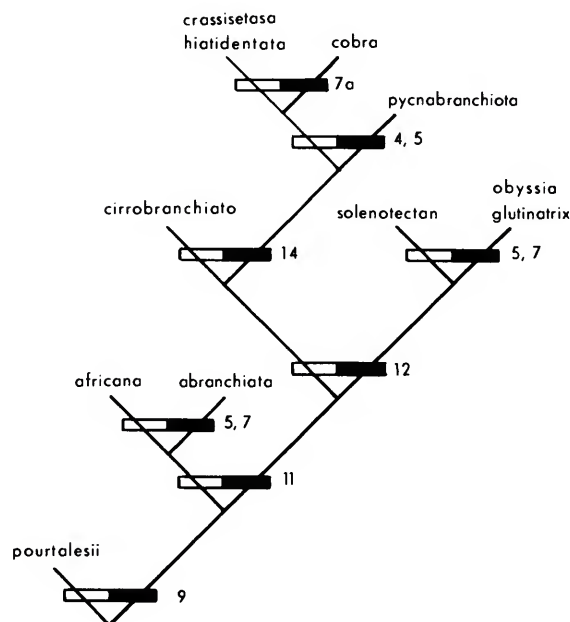


FIGURE 23.—Cladogram showing relations among species of *Paradiopatra* (character-numbers are explained in Table 1; black bar = apomorph state; white bar = plesiomorph state).

### Key to the Species of *Paradiopatra*

1. First parapodia not enlarged ..... 2  
First parapodia distinctly enlarged ..... 3
2. Simple branchiae present ..... *P. africana*  
Branchiae absent ..... *P. abbranchiata*
3. Branchiae present ..... 4  
Branchiae absent ..... 9
4. Branchiae with 2 or more filaments ..... 5  
Branchiae simple filaments ..... 6
5. Pseudocompound hooks tridentate ..... *P. pourtalesii*  
Pseudocompound hooks bidentate ..... *P. cirrobranchiata*
6. Intrafascicular hooks from setigers 4 or 5 ..... *P. crassisetosa*  
Intrafascicular hooks not present before setiger 10 ..... 7
7. Cirriform ventral cirri on the first 2 setigers, ceratophores smooth ..... *P. pyncnbranchiata*  
Cirriform ventral cirri on the first 3 setigers, ceratophores ringed ..... 8
8. Pseudocompound hooks on the first 3 setigers, intrafascicular hooks from setiger 12 ..... *P. hiatidentata*  
Pseudocompound hooks on the first 2 setigers, intrafascicular hooks from setiger 16 ..... *P. cobra*
9. Pseudocompound hooks in the first 2 setigers, intrafascicular hooks from setiger 7 or 8 ..... 10



- Pseudocompound hooks in the first 3 setigers, intrafascicular hooks from setiger 12 ..... *P. solenotecton*  
 10. Postsetal lobes reduced to low folds by setiger 20 ..... *P. abyssia*  
 Postsetal lobes digitiform at least through setiger 30 ..... *P. glutinatrix*

***Paradiopatra glutinatrix* Ehlers, 1887,  
new combination**

FIGURE 10d

*Diopatra* (*Paradiopatra*) *glutinatrix* Ehlers, 1887:76–78, pl. 18: figs. 10–15, pl. 19: figs. 1–5.

*Paradiopatra pycnobranchiata*.—Pettibone, 1970:258 [in part, not McIntosh, 1885].

**MATERIAL.**—Type, MCZ 767, Atlantic Ocean, Caribbean Sea, off the Sambos, 432 m, *Blake* (no data in vial; information on catalog card).

**REMARKS.**—The type is an incomplete specimen that consists of 28 setigers. It is 12.6 mm long and 2.2 mm wide, with parapodia. A shorter posterior fragment is also present in the vial. The specimen has been dried out and anteriorly dissected for the jaws, but is still in recognizable condition. The outer lateral occipital antennae reach setiger 2; the inner lateral and median antennae reach setiger 5. The ceratophores are very short and have about 2 rings. The first parapodia project well beyond the tip of the prostomium and are extremely muscular. Branchiae are absent. Ventral cirri are cirriform in the first 2 setigers; postsetal lobes appear to be present

in all setigers, including those of the posterior fragments, as short, digitiform lobes. Bidentate pseudocompound hooks with short, worn hoods are present in the first 2 setigers. Simple hooks and compound spinigers are absent. Subacicular hooks are absent; intrafascicular hooks are present from setiger 8. At about setiger 20, 5 pectinate setae are present in a setiger; each is distally scoop-shaped and has about 20 fine teeth. The maxillary formula is 1+1, 7+11, 8+0, 8+12, and 1+1, according to Ehlers. The tube is thick and rather soft, with a loose inner lining covered externally by white calcareous round foraminiferans and a few long, rod-shaped arenaceous foraminiferan tests.

***Paradiopatra abbranchiata* (McIntosh, 1885),  
new combination**

FIGURE 24c, TABLE 26

*Nothria abbranchiata* McIntosh, 1885:314–317, pl. 21A: fig. 27, pl. 22A: figs. 1–3, pl. 40: figs. 1–12.

**MATERIAL.**—Four syntypes, BMNH ZK 1885. 12.1.217 and 1921.5.1.1858, Antarctic Ocean,

TABLE 26.—Summary statistics for the type of *Paradiopatra abbranchiata*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1–2	1.25	0.50	20.00	4
Inner lateral reach setiger	8–11	10.00	1.41	19.88	4
Median reaches setiger	8–11	10.50	4.20	141.12	4
Maximum number of rings	5	Invariant			4
Ventral cirri cirriform to setiger	2	Invariant			4
Last pseudocompound hook on setiger	2	Invariant			4
First intrafascicular hook on setiger	9	Invariant			4

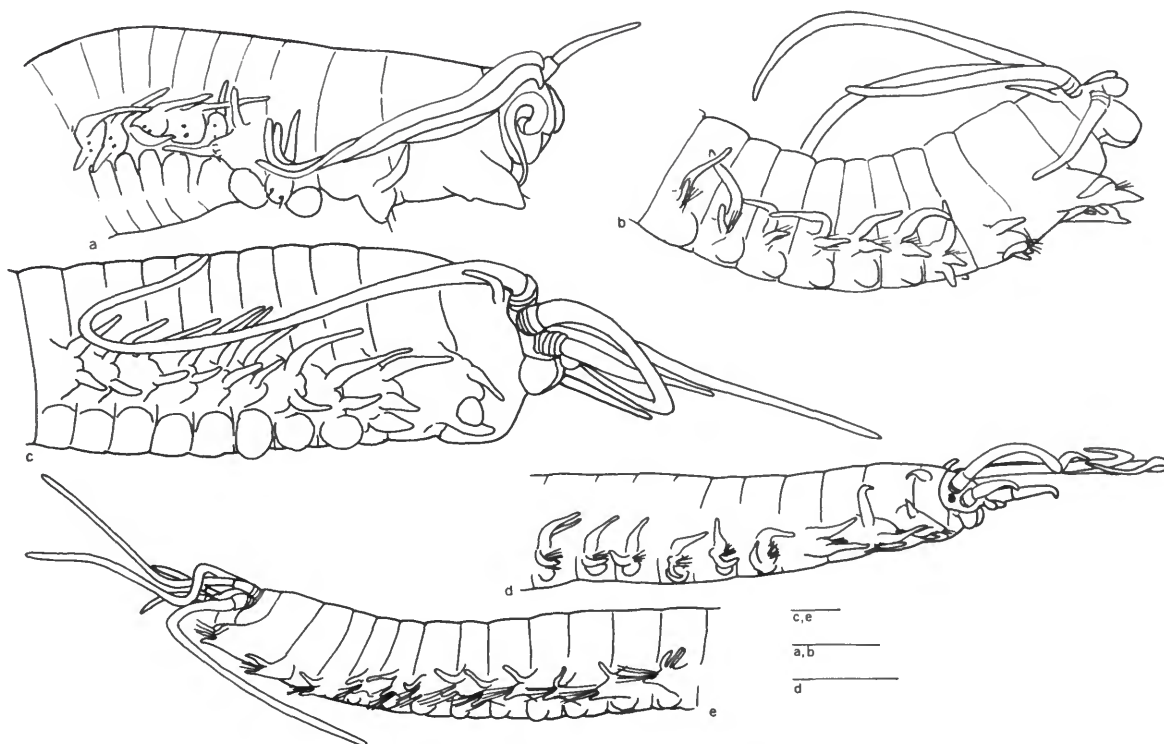


FIGURE 24.—Anterior ends of species of *Paradiopatra* in lateral view: a, *P. cobra* (Chamberlin, 1919); b, *P. cirrobranchiata* (Moore, 1903); c, *P. abbranchiata* (McIntosh, 1885); d, *P. africana* (Augener, 1918); e, *P. pourtalesi* (Ehlers, 1879). (All scales = 1 mm.)

62°26'S, 95°44'E, 3595 m, diatome ooze, 26 Feb 1874, *Challenger* station 156.

**REMARKS.**—All four specimens are short anterior fragments; a series of short median and posterior fragments are also present. The syntype illustrated is 15 mm long and 5.25 mm wide and consists of 18 setigers. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae vary in length but, on the average, reach setiger 10. The median antenna is extremely variable in length, but it is at least as long as the inner lateral ones in all specimens; on the average the median antenna reaches setiger 10. The ceratophores have up to 5 rings. Branchiae are absent. The first parapodia are not enlarged. Ventral cirri are cirriform on the first 2 setigers only; postsetal lobes are distinctly digitiform in all setigers present. Bidentate pseudocompound hooks

are present in the first 2 setigers; the hoods were fragmentary or absent. Large hooks and compound spinigers are absent. Subacicular hooks are absent. Intrafascicular hooks are present from setiger 9. Numerous pectinate setae are present in median and posterior setigers; each is distally scoop-shaped and has about 20 delicate teeth. All specimens had been dissected for the maxillary apparatus; the maxillary formula is 1+1, 8+8, 10+0, 8+8, and 1+1, based on the information in McIntosh (1885:315–316). A fragment of a tube present is very thick-walled, covered with fine clay particles, in which has been imbedded arenaceous foraminiferans.

*Paradiopatra abbranchiata* differs from its congeners in lacking branchiae and in lacking enlarged anterior parapodia. It is known through its original record only.

***Paradiopatra abyssia* (Kucheruk, 1978),  
new combination**

*Nothria abyssia* Kucheruk, 1978:101–103, fig. 4.

REMARKS.—The type material was not available for study; letters to the author did not give any results. The following comments are based on the original description and figure. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 5, and the median antenna reaches setiger 12. The short ceratophores have about 3 weakly defined rings. Branchiae are absent. Ventral cirri are cirriform in the first 2 setigers; postsetal lobes are completely reduced by setiger 20. Bidentate pseudocompound hooks are present in the first 2 setigers. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks begin on setiger 7 or 8. Pectinate setae are present from setiger 2; their structure was not described by Kucheruk.

The first parapodia are enlarged and directed forward, and extend beyond the tip of the postomium. As in most species with this character, the pseudocompound hooks are large and the hinge-line is poorly marked, especially in the first setiger; some of Kucheruk's (1978, fig. 4a–k) figures suggest that the hooks were worn and hoods and secondary teeth reduced. *P. abyssia* was described from deep water areas in the Pacific and Antarctic oceans.

***Paradiopatra africana* (Augener, 1918),  
new combination**

FIGURE 24d

*Onuphis africana* Augener, 1918:335–339, fig. 35, pl. 5: figs. 109–112, pl. 7: fig. 251.

MATERIAL.—Holotype, HSM V-920, Atlantic Ocean off Dahomey, Great Popo, coll. A. Hupfer, no date available.

REMARKS.—The holotype is an incomplete specimen with 37 setigers, 18 mm long, 0.75 mm wide with parapodia. The outer lateral occipital antennae reach setiger 1; both the inner lateral

and median occipital antennae reach setiger 9. The ceratophores have about 5 poorly marked rings. First parapodia are not enlarged. Branchiae are present from setiger 9; all are simple and are distinctly flattened near the bases. Ventral cirri are cirriform in the first 2 first setigers. In setiger 3 they have a somewhat transitional shape but are basically pad-shaped; all other parapodia have pads rather than ventral cirri. Digitiform postsetal lobes are distinct in the first 25 setigers. Bidentate pseudocompound hooks are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are absent. Intrafascicular hooks are present from setiger 35. Each pectinate seta is scoop-shaped and has about 20 delicate teeth. The maxillary formula is 1+1, 10+10, 9+0, 9–10+10, and 1+1, according to Augener (1918:339). The tube was described as flattened, similar to the tube of *Nothria conchylega*.

*Paradiopatra africana* has been considered to be closely related to *Nothria conchylega*, but differs clearly in lacking auricular presetal lobes in anterior setigers. It differs from most other species of *Paradiopatra* by the posterior start of the intrafascicular hooks, in most species these hooks start before setiger 20; in *P. africana* they are first present from setiger 35. *P. africana* is known from western Africa. Reports of this species from New Zealand and Ceylon appear to refer to other species.

***Paradiopatra cirrobranchiata* (Moore, 1903),  
new combination**

FIGURE 24b, TABLE 27

*Onuphis cirrobranchiata* Moore, 1903:451–453, pl. 25: figs. 60–63.

MATERIAL.—Holotype, USNM 15719; 3 paratypes USNM 5334; 2 paratypes, ANSP975: all Pacific Ocean off Japan, Suruga Bay, 306 m, *Albatross* station 3738.

REMARKS.—The holotype, a complete specimen with 55 setigers, is 35 mm long and 3 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 6 or 7, and the median antenna reaches setiger 9. The ceratophores have maxi-

TABLE 27.—Summary statistics for part of the original material of *Paradiopatra cirrobranchiata* (one paratype from USNM 5334 differs markedly and is not included in this table)

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			5
Inner lateral reach setiger	4–8	6.60	1.67	42.42	5
Median reaches setiger	5–12	9.00	2.94	96.30	4
Maximum number of rings	3	Invariant			5
Branchiae:					
First present from setiger	11–12	11.40	0.55	2.63	5
Maximum number of filaments	4–5	4.60	0.55	6.52	
Ventral cirri cirriform to setiger	2	Invariant			5
Pseudocompound hooks present to setiger	4	Invariant			5
Intrafascicular hooks present to setiger	5–6	5.40	0.55	5.56	5

mally 3 rings. First parapodia are enlarged. Branchiae are present from setiger 11 or 12; where best developed, each branchia has 5 filaments. Ventral cirri are cirriform in the first 2 setigers; digitiform postsetal lobes are distinct to the middle of the body at about setigers 25–30; the anteromedial ones are very long and slender. Bidentate pseudocompound hooks are present in the first 4 setigers. Large hooks, compound spinigers and subacicular hooks are absent. Intrafascicular hooks, compound spinigers and subacicular hooks are absent. Intrafascicular hooks are present from setiger 5 or 6. Each pectinate seta is scoop-shaped and has about 10 teeth along the margin. The maxillary formula is unknown.

One paratype (from USNM 5334) differs sharply from the others in that it has simple branchiae from setiger 8, pseudocompound hooks in the first 3 setigers and intrafascicular hooks from setiger 12. It does not appear to belong to any known species.

*Paradiopatra cirrobranchiata* differs from most of its congeners in having 4 setigers with pseudocompound hooks, most species have been setae in 2 setigers only. The branchiae are also unusually well developed. It has been reported from slope depths off Japan.

***Paradiopatra cobra* (Chamberlin, 1919),  
new combination**

FIGURE 24a

*Onuphis cobra* Chamberlin, 1919:300–305, pl. 52: figs. 1–8.  
*Paradiopatra pycnbranchiata*.—Pettibone, 1970:258 [part; not McIntosh, 1885].

**MATERIAL.**—Holotype, USNM 19745, Pacific Ocean off Panama, 4°56'N, 80°52'30"W, 3225 m, green mud, 6 Mar 1891, *Albatross* station 3381.

**REMARKS.**—The holotype is currently in three pieces, an anterior fragment of 19 setigers is 12.6 mm long and 3.3 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach about setiger 7, and the median antenna reaches setiger 8. The ceratophores have 3 or 4 rings. First parapodia are enlarged. Simple, strap-like branchiae are present from setiger 14. Ventral cirri are cirriform in the first 3 setigers; digitiform postsetal lobes are distinct in all setigers present. Bidentate pseudocompound hooks are present in the first 2 setigers; the hinge-line is extremely poorly marked, but visible in both setigers. Large hooks and compound spinigers and subacicular hooks are absent. Intrafascicular hooks are present from setiger 16. Each pectinate seta is scoop-shaped



and has about 15 teeth. The maxillary formula is 1+1, 10+9, 10+0, 9+0, and 1+1 according to Chamberlin (1919:304).

*Paradiopatra cobra* has the intrafascicular hooks and simple branchiae starting at a middle setiger. In other respects, it is differentiated from most congeners by having cirriform ventral cirri in one more setiger than the number of setigers with pseudocompound hooks. It has been reported from the Pacific Ocean in deep water only.

***Paradiopatra crassisetosa* (Chamberlin, 1919),  
new combination**

FIGURE 21d

*Onuphis crassisetosa* Chamberlin, 1919:295–300, pl. 42: figs. 1–6, pl. 43: figs. 1–8.

*Paradiopatra pycnbranchiata*.—Pettibone 1970:258 [part; not McIntosh, 1885].

**MATERIAL.**—Syntype, USNM 19424, Pacific Ocean off Panama 6°36'N, 81°45'W, 1057 m, green sand, 21 Oct 1904, *Albatross* St. 4621; syntype, USNM 19744, Pacific Ocean, off Galapagos Islands, 0°59'S, 88°58'30"W, 718 m, globigerina ooze, 28 Mar 1891, *Albatross* station 3401.

**REMARKS.**—The specimen from USNM 19424 (Figure 21d), consists of 34 setigers and is 19.5 mm long and 2.7 mm wide, with parapodia. It is incomplete. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 6, and the median antenna reaches setiger 10. The ceratophores have up to 4 indistinct rings. The first parapodia are enlarged. Simple, strap-like branchiae begin at setiger 14. Ventral cirri are cirriform in the first 2 or 3 setigers; digitiform postsetal lobes are present in at least 15 setigers, but neither specimen is in good enough condition to determine accurately the distribution of these lobes. Bidentate pseudocompound hooks are present in the first 2 or 3 setigers. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks begin on setiger 4 or 5. Each pectinate seta is distally scoop-shaped and has about 20 teeth. The maxillary formula is 1+1, 7+9, 8+0, 10+12, and 1+1 according to

Chamberlin. Chamberlin described the tubes as being hyaline with attached silicious sponge rods.

*Paradiopatra crassisetosa* is very similar to *P. pycnbranchiata*, from which it differs only in the distributional features of the setal components and in having vaguely ringed rather than smooth ceratophores. It is known from slope depths off Central America and the Galapagos Islands in the Pacific Ocean.

***Paradiopatra hiatidentata* (Moore, 1911),  
new combination**

FIGURE 25a

*Nothria hiatidentata* Moore, 1911:259–262, pl. 16: figs. 41–48, pl. 17: figs. 49–50.

*Paradiopatra pycnbranchiata*.—Pettibone, 1970:258 [part; not McIntosh, 1885].

**MATERIAL.**—Holotype, USNM 16876, Pacific Ocean off southern California, 32°32'40"N, 118°04'20"W, 1927 m, green mud, *Albatross* station 4387.

**REMARKS.**—The holotype, a complete specimen with 98 setigers, is 105 mm long and 6 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral and median antennae reach setiger 8. The ceratophores have up to 4 rings. The first parapodia are enlarged. Simple, strap-like branchiae are present from setiger 12. Ventral cirri are cirriform in the first 3 setigers; postsetal lobes are distinct in the first 14 setigers. Pseudocompound hooks are present in the first 3 setigers; they are either bidentate or unidentate. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks begin at about setiger 12. Each pectinate seta is distally scoop-shaped and has about 20 fine teeth. The maxillary formula is 1+1, 9+10, 9+0, 10+13, and 1+1, according to Moore (1911:262).

The presence of simple unidentate (falcate) in addition to bidentate pseudocompound hooks, differentiates *P. hiatidentata* from other similar species. It is widely known from deep water off southern California.



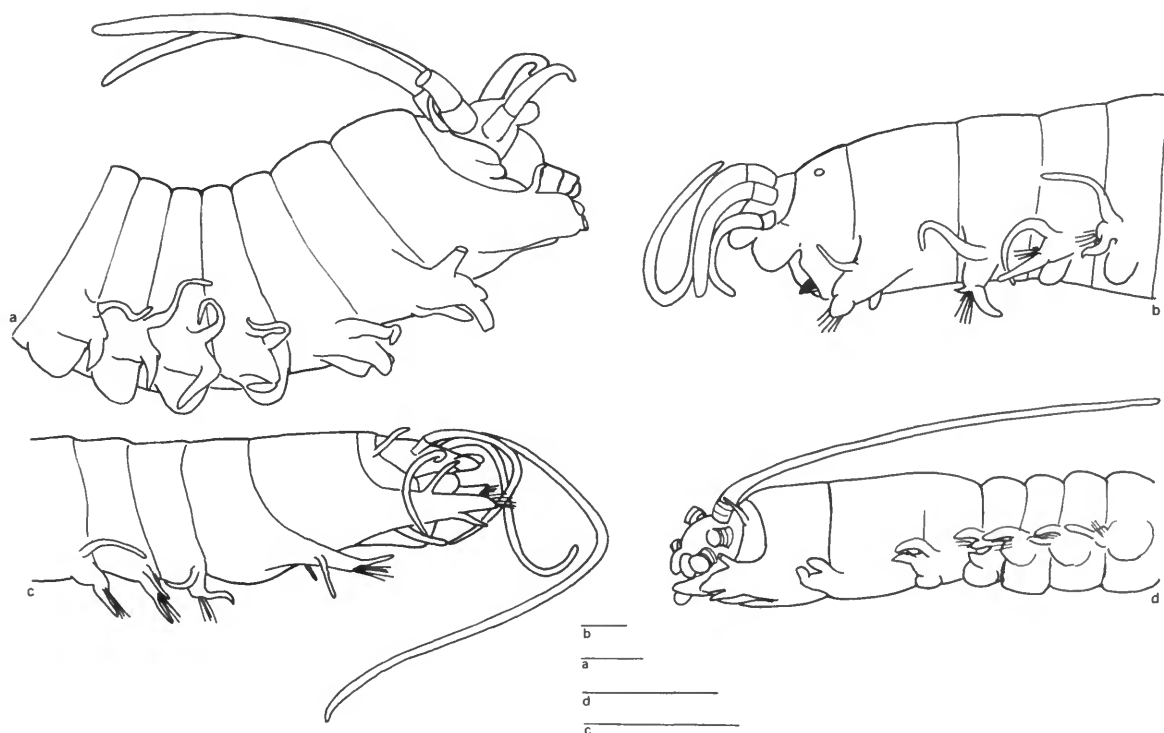


FIGURE 25.—Anterior ends of species of *Paradiopatra* in lateral view: a, *P. hiatidentata* (Moore, 1911); b, *P. pycnobranchiata* (McIntosh, 1885); c, *P. solenotecton* (Chamberlin, 1919); d, *P. crassisetosa* (Chamberlin, 1919). (All scales = 1 mm.)

### *Paradiopatra pourtalesii* (Ehlers, 1879)

FIGURE 24e

*Diopatra pourtalesii* Ehlers, 1879:273 [only tube described]; 1887:74–75, pl. 19: figs. 6–10, pl. 20: figs. 1–6.

*Paradiopatra pourtalesii*.—Pettibone, 1970:265–268, figs. 60a–d, 61a–k.

*Onuphis* (*Onuphis*) *pourtalesii*.—Fauchald, 1980:827.

**MATERIAL.**—Two syntypes, MCZ 687 and 801, 23°11'N, 82°23'W, 531 m, 18 Jan 1878, *Blake* station 16; one syntype, MCZ 874, off Florida, Sand Keys, 557 m, and off the Sambos, 435 m; one syntype, MCZ 815, off Cuba, 23°02.5'N, 83°11'W, 522 m, 1878, *Blake* station 21.

**REMARKS.**—At least two samples of the original material listed by Ehlers (1887) have not been recovered and some confusion on the labels makes certain of the localities somewhat dubious. Two

syntypes (MCZ 687, 801) are in separate vials, the locality given on the label for 687 reads “near Havana,” but gives the station as indicated above, the label for 801 reads “near Morro Light” and gives the same station data. Morro Light is at the entrance to Habana Harbor, essentially “near Havana.” The label of specimen 874 gives 2 localities on the same label. None of the currently examined specimens were specifically mentioned by Ehlers (1887). The original reference (1879) consists of a footnote detailing the structure of the tube; a complete description was given by Ehlers (1887).

The largest of the syntypes available is a mature female with large eggs in the body cavity. It is 19.5 mm long and 3 mm wide with parapodia and consists of 24 anterior setigers. The outer lateral occipital antennae reach setiger 1, the

inner lateral antennae reach setiger 10, and the median antenna reaches setiger 9. The short ceratophores have about 5 rings. The first parapodia are enlarged. Branchiae are present from setiger 12; the first 2 are simple, all others have 2 to 4 branchial filaments. The filaments are in a clearly pectinate arrangement. Ventral cirri are cirriform on the first 2 setigers only; digitiform postsetal lobes are distinct in all setigers. Tridentate pseudocompound hooks are present in the first 2 setigers. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks are present from setiger 9. Each pectinate seta is scoop-shaped and has about 20 delicate teeth; at least 10 pectinate setae are present in each parapodium. The maxillary formula is 1+1, 10+9, 9+0, 10+13, and 1+1. The tubes are flattened and have a strong, parchment-like inner lining sparsely covered with shell-fragments, or, where available, sponge spicules in well-defined patterns.

*Paradiopatra pourtalesii* differs from the other species of the genus in having tridentate, rather than bidentate pseudocompound hooks. It is known from slope depths in Caribbean region.

***Paradiopatra pycnbranchiata*  
(McIntosh, 1885)**

FIGURE 25b

*Nothria pycnbranchiata* McIntosh, 1885:317–320, figs. 74–76, pl. 22A: figs. 4, 5, pl. 40: figs. 13–15.

*Paradiopatra pycnbranchiata*.—Pettibone, 1970:258 [in part].

**MATERIAL.**—One paratype, USNM 4839, Pacific Ocean off Chile, 33°31'S, 94°31'W, 3931 m, blue mud, 14 Dec 1875, *Challenger* station 299. The holotype (not examined) is in the British Museum (Natural History).

**REMARKS.**—The anterior part of the paratype is nearly 40 mm long and 7.5 mm wide, with about 25 setigers. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae reach setiger 6, and the median antenna reaches setiger 5. The ceratophores are smooth, but are wrinkled when folded over. First parapodia are

somewhat enlarged. Branchiae are first present from setiger 17, but are irregularly present in the first new subsequent setigers. All branchiae have the same shape; each is short, simple, and digitiform. Ventral cirri are cirriform on the first 2 setigers; digitiform postsetal lobes are present on all setigers in the fragment. Bidentate pseudocompound hooks are present in the first 3 setigers. Compound spinigers, large hooks, and subacicular hooks are absent. Intrafascicular hooks are present from setiger 11. Each pectinate seta is distally scoop-shaped and has about 20 delicate teeth. Each parapodium has numerous pectinate setae. The maxillary formula is 1+1, 8–9+10, 9–10+0, 8–10+10–14, and 1+1 according to McIntosh's (1885, figs. 74–76) illustrations. Tubes are thick, stiff, and covered with a dense layer of clay particles.

*Paradiopatra pycnbranchiata* was redescribed by Pettibone (1970:258), who synonymized a number of other species with it. Considering the limited level of variability in the type material of species in the genus, it appears best to consider most species synonymized by Pettibone as still valid.

*Paradiopatra pycnbranchiata* has smooth ceratophores, and the branchiae, which start on a middle setiger, are simple. It has been reported from the Pacific Ocean off Chile and may be widespread, but its distribution cannot be determined at this point.

***Paradiopatra solenotecton* (Chamberlin, 1919),  
new combination**

FIGURE 25c, TABLE 28

*Paronuphis solenotecton* Chamberlin, 1919:306–310, pl. 39: figs. 3–8, pl. 40: figs. 1, 2.

*Nothria solenotecton*.—Hartman, 1965:103.—Fauchald, 1968:27.

**MATERIAL.**—Numerous syntypes, USNM 20005, 12 removed from their tubes and examined in detail, Pacific Ocean off Panama, 7°05'30"N, 79°40'W, 2311 m, hard substrate, 10 Mar 1891, *Albatross* station 3392.

TABLE 28.—Summary statistics for part of the original material of *Paradiopatra solenotecton*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			11
Inner lateral reach setiger	3-6	4.55	1.13	28.00	9
Median reaches setiger	4-6	5.22	0.83	13.20	9
Maximum number of rings	0	Invariant			9
Ventral cirri cirriform to setiger	3	Invariant			11
Pseudocompound hooks present to setiger	3	Invariant			11
Intrafascicular hooks present to setiger	12-13	12.09	0.30	0.74	11

REMARKS.—A large specimen has about 40 setigers and is about 25 mm long; all specimens examined had been damaged posteriorly and the total number of segments cannot be given; it appears to have been near 50 setigers in most instances. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 4 or 5, and the median antenna reaches setiger 5 or 6. The antennal styles are very fragile, so their length may have been underestimated. The ceratophores are very short and smooth. Branchiae are absent. The first setiger is expanded, and the first parapodia project beyond the tip of the prostomium. The parapodia are rotated so that the morphologically ventral side faces medially. The setae of the first and partially the second setiger are thicker and longer than those of the other parapodia, providing solid interior support for the expanded musculature. Ventral cirri are cirriform in the first 3 setigers; postsetal lobes are long, slender filaments in the first 10 to 12 setigers. Bidentate pseudocompound hooks are present in the first 3 setigers. Large hooks, compound spinigers and subacicular hooks are absent. Intrafascicular hooks are present from setiger 12. Each pectinate seta is distally scoop-shaped and has about 20 teeth. They are present in very large numbers in the anteriormost parapodia, with exception of the first 2, in which they are missing. The maxillary formula is 1+1, 8-9+9, 8-9+0, 10+12-13, and 1+1, according to Chamberlin (1919:309-310).

The short tubes have a pliable inner lining and

are covered with large sand grains and foraminiferan tests; the tubes appear to be only slightly longer than their contained specimens.

Peristomial cirri are present so this species cannot belong to *Paronuphis*, as pointed out by Hartman (1965:163). It has the setal array and expanded anterior parapodia of species in the *Nothria-Paradiopatra* group. It cannot, by definition, be a *Nothria* since it lacks auricular presetal lobes in the anterior setigers. It is clearly intermediate between species of *Paradiopatra* and *Nothria* and can be separated from its congeners by its lack of branchiae and by the short body and tube size. It may eventually prove to deserve separate generic standing.

#### *Nothria* Malmgren, 1866, emended

DIAGNOSIS.—Onuphids with short bodies, a limited number of segments, and short, flattened tubes. Peristomial cirri are present and the frontal palps short. First parapodia enlarged, with auricular presetal lobes in some anterior setigers. Ceratophores no longer than the prostomium, with few rings or smooth. Outer lateral ceratostyle distinctly longer than its ceratophore. Uni- or bidentate pseudocompound hooks present, hoods blunt. Branchiae, if present, nearly always as single filaments, rarely bifid. Compound spinigers, large hooks, and subacicular hooks absent. Intrafascicular hooks present, pectinate setae scoop-shaped.

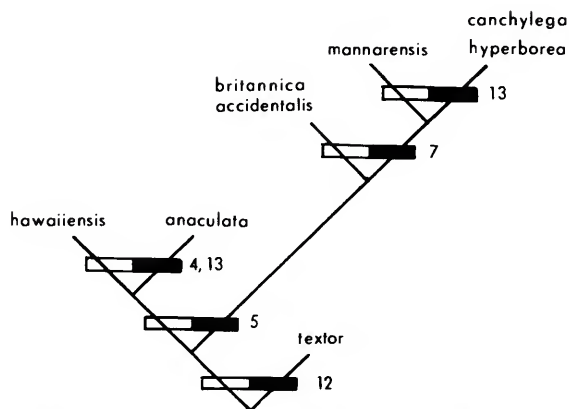


FIGURE 26.—Cladogram showing relation among species of *Nothria* (character-numbers are explained in Table 1; black bar = apomorph state; white bar = plesiomorph state).

TYPE-SPECIES.—*Onuphis conchylega* Sars, 1835, by original designation (see Pettibone, 1970).

REMARKS.—*Nothria* and *Paradiopatra* were redefined by Pettibone (1970). The above diagnosis follows her definition in most features, and specifically in the feature separating the two genera: *Nothria* has, *Paradiopatra* lacks auricular presetal lobes in anterior setigers. Two taxa (*anaculata* and *occidentalis*) described as subspecies of *conchylega* are here elevated to specific rank, since they differ from the stem species in exactly those features that are used to separate other species in this genus. Comments concerning the validity of the name *Nothria* were given above. Eight species are currently included in this genus. Figure 26 shows the relationships among the species.

### Key to the Species of *Nothria*

1. Pseudocompound hooks in the first 2 setigers ..... 2  
Pseudocompound hooks in the first 3 setigers ..... 6
2. Branchiae absent ..... *N. textor*  
Branchiae present ..... 3
3. Intrafascicular hooks from setiger 9 ..... *N. mannarensis*  
Intrafascicular hooks not present before setiger 12 ..... 4
4. Branchiae from setiger 9 or 10 ..... *N. hawaiiensis*  
Branchiae from setiger 11 or 12 ..... 5
5. Digitiform postsetal lobes in all setigers ..... *N. hyperborea*  
Digitiform postsetal lobes limited to first 14 or 15 setigers .....  
..... *N. conchylega*
6. Eyes absent ..... *N. anaculata*  
Eyes present ..... 7
7. Branchiae from setiger 8 ..... *N. occidentalis*  
Branchiae from setiger 9 or 10 ..... *N. britannica*

### *Nothria conchylega* (M. Sars, 1835)

FIGURE 23b, TABLE 29

*Onuphis conchylega* M. Sars, 1835:61–63, pl. 10: fig. 28a–e.  
*Onuphis eschrichtii* Oersted, 1843:172, fide Fauvel, 1914:127.  
*Onuphis jourdei* Marion 1883:44, fide Fauvel, 1923:415.  
*Nothria conchylega*.—Malmgren, 1866:66.  
*Nothria conchyphila* Verill, 1885a:524 [in part].

MATERIAL.—Lectotype and 14 additional

types, ZMO, Atlantic Ocean, Norway, Florø, 15–18 m, coll. M. Sars.

REMARKS.—The type locality of *O. conchylega* was identified by M. Sars (1835:61) in the following statement (translation by author): “One encounters this annelid in sandy bottoms not rarely in the Bergen Fjord, and near Florø in large numbers, commonly in 8–10 fathoms depth, in company with *Dentalium* and *Amphitrite*.” The

material examined is from the second of the two localities mentioned and was collected by M. Sars. It is here considered part of the type material; a lectotype is here selected for the species. The lectotype, a complete specimen with 45 setigers, is 26.5 mm long and 1.8 mm wide, with parapodia. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach about setiger 5, and the median antenna reaches setiger 7. With few exceptions, the median antenna is longer than the inner lateral ones. The ceratophores are short with 4 rings. A pair of large eyes occur between the bases of the outer and inner lateral occipital antennae rings. Simple, strap-like branchiae begin on setiger 11 or 12 and continue to near the posterior end of the animal. Ventral cirri are distinctly cirriform in the first 2 setigers, transitional in a third and distinctly pad-shaped from setiger 4. Postsetal lobes are distinct in the first 15 or 16 setigers. Auricular presetal lobes are present in the first 2 setigers, a small, digitiform presetal lobe is present in all remaining setigers. Bidentate pseudocompound hooks are present in the first 2 setigers; the hinge is indistinct. Worn hooks may appear unidentate. The hooks of the first setiger are very large compared to those of the second setiger. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks are present from setiger 12 or 13. Each pectinate seta is distally

scoop-shaped and has about 10 teeth. The maxillary formula is 1+1, 7-8+8, 7-8+0, 6-7+7-8, and 1+1, based on examination of two specimens. The tubes are only slightly longer than the specimens; each has a thick, clear inner lining and is covered by bivalve fragments or fragments of pectinariid tubes, etc. The fragments are arranged with the flat or concave side towards the lining so that the whole tube becomes flattened. Five additional specimens, in addition to those listed in Table 29 were cursorily examined and not removed from their tubes. They do not appear to differ from those examined in detail.

*Nothria conchylega*, as characterized here, can be separated from related taxa by various meristic features. In addition, it is an oculate form with a pair of large, black eyes between the outer and inner lateral occipital antennae. It has been reported from world-wide areas, both in shallow and deep water; it appears to have been confused with a variety of related taxa. The finding of flattened, short tubes has been considered adequate evidence for the presence of this species in an area; however, at least four other species have such tubes.

***Nothria anoculata* Orensanz, 1974, new status**

*Nothria conchylega anoculata* Orensanz, 1974:99-100, pl. 8.

REMARKS.—The types were not available for study, the following comments are based on the

TABLE 29.—Summary statistics for the type material of *Nothria conchylega*

Character	Range (no.)	Mean	S.D.	C. V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			15
Inner lateral reach setiger	1-8	5.0	1.06	22.47	14
Median reaches setiger	4-11	7.29	2.16	64.00	14
Maximum number of rings	4	Invariant			15
Branchiae:					
First present from setiger	11-13	11.60	0.63	3.42	15
Maximum number of filaments	1	Invariant			15
Ventral cirri cirriform to setiger	2	Invariant			15
Pseudocompound hooks present to setiger	2	Invariant			15
Intrafascicular hooks present from setiger	11-13	12.40	0.74	4.42	15



original description and illustration. The occipital antennae reach setigers 8 to 10 and have indistinctly ringed or smooth ceratophores. Simple, strap-like branchiae are first present from setigers 10 to 12. Ventral cirri are cirriform in the first 2 or 3 setigers; postsetal lobes are distinct in the first 8 to 12 setigers. Pseudocompound hooks are present in the first 3 setigers. The hooks are nearly simple, and uni- or bidentate in the first 2 setigers; the hinge is considerably more distinct in setiger 3 in which all the hooks are bidentate. Compound spinigers, large hooks, and subacicular hooks are absent. Intrafascicular hooks are first present from setigers 9 to 11. Each pectinate seta is distally scoop-shaped and has 14 coarse teeth. The maxillary formula is 1+1, 7-8+9, 7+0, 7+9, and 1+1, according to Orensanz (1974:99).

*Nothria an oculata* was originally differentiated from *N. conchylega* by the lack of eyes, but it can also be separated from other species of *Nothria* on distributional features of setae and branchiae. It is known from shallow water of the Atlantic Ocean off Argentina.

***Nothria britannica* (McIntosh, 1903),  
new combination**

FIGURE 15b, TABLE 30

*Onuphis britannica* McIntosh, 1903:555; 1910:404-407, pl. 51: figs. 6-6a, pl. 63: figs. 7-7d, pl. 65: fig. 13, pl. 75: fig. 5, pl. 84: figs. 3-3c.

**MATERIAL.**—Fourteen syntypes, BMNH 1921. 5.1.1687-90, North Atlantic Ocean, St. Magnus Bay, Shetland, dredged, 182 m, coll. J. Gwyn Jeffreys.

**REMARKS.**—The largest of the syntypes is an incomplete specimen with 26 setigers and is 28 mm long and 4.5 mm wide, with parapodia. The largest complete specimen studied has 36 setigers and is 15 mm long and 1.32 mm wide; other complete specimens have 28 and 35 setigers, respectively. Six of the 14 specimens were studied in detail.

The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach between setigers 6 to 9, usually 6, and the median antenna reaches between setigers 6-10, usually 7. The short ceratophores have usually 4 rings. Simple, strap-like branchiae are present from setiger 9 or 10. Ventral cirri are cirriform in the first 2 setigers; digitiform postsetal lobes are present in all setigers. Auricular presetal lobes are present and distinct in about the first 5 setigers. Bidentate pseudocompound hooks are present in the first 3 setigers; in the first setiger each hook has a poorly marked secondary tooth and the hinge is indistinct. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks are present from setiger 9 or 10. Pectinate setae

TABLE 30.—Summary statistics for *Nothria britannica*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			6
Inner lateral reach setiger	6-9	6.67	1.21	1.47	6
Median reaches setiger	6-10	7.75	1.71	2.92	4
Maximum number of rings	3-4	3.83	0.41	0.17	6
Branchiae:					
First present from setiger	9-10	9.17	0.41	0.17	6
Ventral cirri cirriform to setiger	2	Invariant			6
Pseudocompound hooks present to setiger	3	Invariant			6
Intrafascicular hooks from setiger	9-10	9.50	0.55	0.30	6

are present from setiger 2; each seta is distally scoop-shaped and has about 20 teeth. The maxillary formula is 1+1, 10+11-12, 10+0, 10-11+10-11, and 1+1, according to McIntosh (1910:405). The tube has thick, clear inner lining and is covered externally by large shell fragments arranged with the flat side against the tube. The tubes are only slightly longer than the contained animals.

*Nothria britannica* was considered a synonym of *N. conchylega* Sars by Fauvel (1923:415). *N. conchylega* has pseudocompound hooks in the first 2 setigers and branchiae first present from setigers 11 to 13 (Table 29). *N. britannica* has pseudocom-

pound hooks in the first 3 setigers and branchiae from setigers 9 or 10. *N. conchylega* has an auricular presetal lobe in each of the 2 first setigers and digitiform presetal lobes in the remaining setigers; *N. britannica* had auricular presetal lobes in the first 5 setigers and lack distinct presetal lobes in the remaining setigers. *N. britannica* resembles *N. occidentalis* in that it has pseudocompound hooks in the first 3 setigers and eyes are present. *N. britannica* has distinct digitiform postsetal lobes in all setigers, such lobes are present in only the first 14 setigers in *N. occidentalis*. Branchiae are present from setiger 8 in *N. occidentalis* and from setiger 9

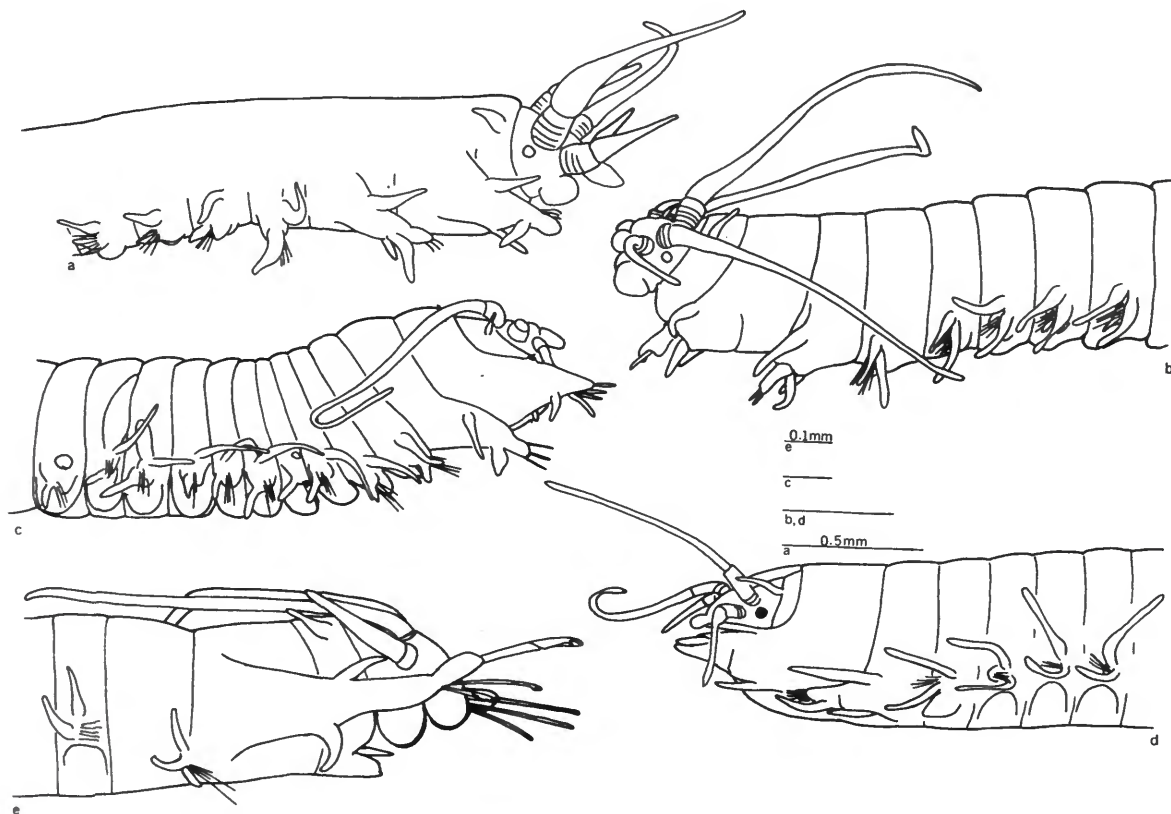


FIGURE 27.—Anterior ends of species of *Nothria* in lateral view: a, *N. mannarensis* Rangarajan and Mahadevan, 1961; b, *N. conchylega* (M. Sars, 1835); c, *N. hawaiiensis* Pettibone, 1970; d, *N. occidentalis* Fauchald, 1968; e, *N. textor* Hartman and Fauchald, 1971. (All scales = 1 mm unless otherwise indicated.)

TABLE 31.—Summary statistics for the original material of *Nothria hawaiiensis*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			9
Inner lateral reach setiger	5–11	7.80	2.17	60.37	6
Median reaches setiger	7–15	10.60	3.29	102.11	5
Maximum number of rings	5	Invariant			12
Branchiae:					
First present from setiger	9–11	9.50	0.67	4.73	12
Number of filaments	1	Invariant			12
Ventral cirri cirriform to setiger	3	Invariant			12
Pseudocompound hooks present to setiger	2	Invariant			12
Intrafascicular hooks from setiger	14–17	15.75	0.97	5.97	12

or 10 in *N. britannica*. *N. britannica* is known from the Shetland Islands in the North Atlantic Ocean.

### *Nothria hawaiiensis* Pettibone, 1970

FIGURE 27c, TABLE 31

*Nothria hawaiiensis* Pettibone, 1970:255–256, figs. 50–52.

**MATERIAL.**—Holotype, USNM 38051; 10 paratypes, USNM 5454; all Pacific Ocean off Hawaii, west coast of Hawaii Island, Kawaihae Light, S67°30' E10.0', 695–460 m, gray mud, foraminiferans, 11 Jul 1902, *Albatross* station 4041; Two paratypes, USNM 5433, Pacific Ocean off Hawaii, Kauai Island, Hanamaulu warehouse S30° W10.2' 726–681 m, coarse sand, foraminiferans, rocks, 21 Jun 1902, *Albatross* station 4022.

**REMARKS.**—One paratype from USNM 5454 had been dissected anteriorly and was not examined; the other 10 specimens, as well as the 2 from USNM 5433, were examined. The holotype, a complete specimen with 63 setigers, is 52.5 mm long and 6 mm wide. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setigers 5 to 9, and the median antenna reaches setigers 7 to 13. The ceratophores have 5 equal rings, where the distalmost is no longer than the others. Branchiae are present from setigers 9 to 10; the first one is about one-half the

length of the next following one. All branchiae are simple, inflated, and appear pustulate; they are easily dehiscent. Ventral cirri are from cirriform on the first 3 setigers; postsetal lobes are distinct in 16 setigers. Bidentate pseudocompound hooks with short, blunt hoods are present in the first 2 setigers. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks are present from setigers 14 to 17. Each pectinate seta is distally scoop-shaped and has 20 delicate teeth. Maxillary formula is 1+1, 7+7, 6+0, 8+6, and 1+1, according to Pettibone (1970:257). The flattened tubes have a thick, pliable inner lining and are covered with large shell fragments and coarse and gravel-sized particles.

*Nothria hawaiiensis* is characterized by the posterior appearance of the intrafascicular hooks. It is known from slope depths off Hawaii in the central Pacific Ocean.

### *Nothria hyperborea* (Hansen, 1878), new combination

FIGURE 15a, TABLE 32

*Onuphis hyperborea* Hansen, 1878:5, pl. 4: figs. 1–9; 1882a:32–33, pl. 4: figs. 5–13.

**MATERIAL.**—One lectotype, 2 paralectotypes,

TABLE 32.—Summary statistics for the original material of *Nothria hyperborea*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1-2	1.09	0.30	8.26	11
Inner lateral reach setiger	5-12	7.09	1.92	51.99	11
Median reaches setiger	3-14	8.11	3.06	115.46	9
Maximum number of rings	3	Invariant			11
Branchiae:					
First present from setiger	11-13	11.60	0.70	4.22	10
Number of filaments	1	Invariant*			11
Ventral cirri cirriform to setiger	2	Invariant			11
Pseudocompound hooks present to setiger	2	Invariant			11
Intrafascicular hooks present from setiger	13-15	14.60	0.70	3.36	10

\* One specimen has 3 branches on the left branchia of setiger 16.

ZMUB 2210, northern Atlantic Ocean, 62°44'N, 1°48'E, 753 m, clay, Norwegian North Atlantic Expedition station 18; 8 paralectotypes, ZMUB 2209, northern Atlantic Ocean, 64°36'N, 10°22'W, 547 m, sand and ooze, Norwegian North Atlantic Expedition station 48.

REMARKS.—One specimen from station 18 has been extensively dissected and is here designated as lectotype; it corresponds to the specimen illustrated in Hansen's (1878, 1882a) two articles. The comments are based on a summary of all type material.

A complete specimen consists of about 50 setigers and is 34 mm long and 2.7 mm wide, with parapodia. The outer lateral occipital antennae reach about setiger 1 (range 1-2), the inner lateral ones reach about setiger 7 (range 5-12), and the median antenna reaches about setiger 8 (range 3-14). In most specimens the median antenna is slightly longer than the inner lateral ones. The short ceratophores have 3 rings. The simple branchiae are first present from setigers 11 to 13. Ventral cirri are cirriform in the first 2 setigers and digitiform postsetal lobes are distinct in all setigers. The first parapodia are enlarged and directed anteriorly. Auricular presetal lobes are present in the first 2 setigers and short, tapering

presetal lobes are present in all setigers, but become increasingly reduced in posterior setigers. Bidentate pseudocompound hooks with short, blunt hoods are present in the first 2 setigers; the hinge is very poorly marked and the pseudocompound condition is indicated only by a subdistal swelling with a clear line running through it. Large hooks, compound setigers, and subacicular hooks are absent. Intrafascicular hooks are present from setigers 13 to 15. The pectinate setae are distally scoop-shaped; each has about 17 coarse teeth. They are first present from the second setiger and usually number about 10 in anteriomedian setigers. The maxillary formula is 1+1, 7+8, 8+0, 7+7, and 1+1. Tubes are flattened and are about as long as the contained specimens. Each tube has a thick, now rather brittle, inner lining and is covered externally by rounded sand grains in a single layer. The tubes from station 18 are covered with black, volcanic sand, those from station 48 with clear, nearly translucent sand grains, presumably reflecting local availability of suitably sized material.

*Nothria hyperborea* was considered synonymous with *N. conchylega* by Fauvel (1914:126). The two species are very similar, but can be separated by at least two features. *N. hyperborea* has intrafas-

cicular hooks from about setiger 14 and has digitiform postsetal lobes in all setigers; *N. conchylega* has intrafascicular hooks from about setiger 12 and digitiform postsetal lobes only in the first 14 to 15 setigers. The difference in tube construction may be important, but the availability to molluscan shell fragments in the two localities from which *N. hyperborea* has been taken is unknown. *N. hyperborea* is known from two localities in the northern Atlantic Ocean in the Norwegian Sea between Norway and Iceland.

***Nothria mannarensis* Rangarajan and Mahadevan, 1961**

FIGURE 27a

*Nothria mannarensis* Rangarajan and Mahadevan, 1961:179–185, figs. 1–17.—Achari, 1969:37.

**MATERIAL.**—Paratype, CMFRI T 89/2, Indian Ocean, Gulf of Manaar, opposite Pudumadam, 9°16'N, 79°01'E, 4 m, dredged, 25 Apr 1961.

**REMARKS.**—The paratype is a complete specimen with 23 setigers; the posterior end is abruptly narrowed and may be regenerating. The outer lateral occipital antennae reach setiger 1, the inner lateral antennae reach setiger 3, and the median antenna is broken. The ceratophores have 4 or 5 rings. Simple branchiae are present from setiger 8 to the posterior end. Ventral cirri are cirriform on the first 2 setigers; digitiform postsetal lobes are distinct in the first 15 setigers. Stout bidentate pseudocompound hooks are present in the first 2 setigers. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks begin on setiger 9. Each pectinate seta is scoop-shaped and has about 15 teeth. The maxillary formula is 1+1, 9+9, 6+0, 8+9, and 1+1, according to the original description. A tube is now missing; it was described as flattened and with a thick inner lining, covered with fragments of bivalves.

*Nothria mannarensis* differs from the other species of the genus in the distribution of setae and various soft parts. It is known only through its original record.

***Nothria occidentalis* Fauchald, 1968, new status**

FIGURE 27d

*Nothria conchylega occidentalis* Fauchald, 1968:20–21, pl. 5a–n.

**MATERIAL.**—Holotype, AHF Poly 358, Pacific Ocean, off Ensenada, Mexico, 4 miles (6.4 km) north of Islas Todos Santos, 31°53'20"N, 116°48'15"W, 75 m, shell, mud, gray sand, 24 Feb 1941, *Velero* station 1245–41.

**REMARKS.**—The holotype, an incomplete specimen with 26 setigers, is 10.5 mm long and 1.9 mm wide, with parapodia. The outer lateral occipital antennae reach the middle of the first setiger; the inner lateral antennae reach setiger 3, and the median antenna reaches setiger 9. The ceratophores are short and have 2 short basal rings and 1 long distal ring. Simple, strap-like branchiae are present from setiger 8. Ventral cirri are cirriform in the first 2 setigers; digitate postsetal lobes are distinct in the first 14 setigers. Auricular presetal lobes are present in the first 2 setigers. Simple falcate spines are present in the first setiger; the second and third setigers have bidentate pseudocompound hooks. Large hooks, compound spinigers and subacicular hooks are absent. Intrafascicular hooks are present from setiger 9. Pectinate setae are present from setiger 2 where they number 20; each seta is distally scoop-shaped and has about 10 teeth. The maxillary formula is unknown. The tubes are flattened and have a thick clear, inner lining covered externally by large shell-fragments arranged with the flat side against the tube.

*Nothria occidentalis* is separable from related species as indicated in the key. It is known from western Mexico and southern California, in shelf depths.

***Nothria textor* Hartman and Fauchald, 1971**

FIGURE 27e, TABLE 33

*Nothria textor* Hartman and Fauchald, 1971:78–80, pl. 10a–k.

**MATERIAL.**—Holotype, AHF Poly 688; 47 paratypes, Poly 689; all Atlantic Ocean east of



TABLE 33.—Summary statistics for part of the type material of *Nothria textor*

Character	Range (no.)	Mean	S.D.	C.V.	N
Occipital antennae:					
Outer lateral reach setiger	1	Invariant			5
Inner lateral reach setiger	1-6	3.33	1.63	79.79	6
Median reaches setiger	2-6	4.75	1.89	75.20	4
Maximum number of rings	0	Invariant			10
Cirriiform ventral cirri to setiger	2	Invariant			10
Pseudocompound hooks present to setiger	3	Invariant			10
Intrafascicular hooks present from setiger	6-8	7.50	0.71	6.72	10

Bermuda, from 32°19.4'N, 64°34.9'W to 32°19.0'N, 64°34.8'W, 1135-1153 m, 18 Aug 1966, coll. H. L. Sanders, station A 118.

REMARKS.—All type specimens are poorly preserved and none have more than about 15 recognizable segments. The species is extremely small, a ripe female was only about 2.5 mm long to 13 segments. The holotype is poorly preserved so the illustration was made of one of the paratypes. Ten specimens were examined in detail. The outer lateral antennae reach the middle of the enlarged first setiger; the inner lateral antennae and the median antennae vary greatly in length and may reach as far back as setiger 6. The ceratophores are short and smooth. Branchiae are absent (note, however, that the specimens examined are posteriorly incomplete and are often poorly preserved in the tubes). Auricular presetal lobes are present in the first setiger only. Ventral cirri are cirriiform in the first 2 setigers; digitiform postsetal lobes are distinct in about 8 setigers. Bidentate compound hooks are present in the first 3 setigers. These hooks are clearly and distinctly compound, rather than pseudocompound as is usual in the genus. Large hooks, compound spinigers, and subacicular hooks are absent. Intrafascicular hooks present from setigers 6 to 8. One very small individual had such hooks present from setiger 6, but the shape of these hooks more closely resembled the hooks present in postlarvae of other onuphids and were not the

shape of usual intrafascicular hooks. Each pectinate seta is distally scoop-shaped and has about 15 teeth. A large number of such setae are present in anterior setigers. The maxillary formula is 1+1, 8+13, 12+0, 10+9, and 1+1, according to Hartman and Fauchald (1971, pl. 10b). The tubes have a translucent inner lining and are covered externally by various shell fragments, mainly from pteropods. The fragments are attached with the flattened or concave surface against the lining, making the tubes appear flattened.

*Nothria textor* has extremely long, rather delicate first parapodia, projecting well beyond the prostomium. It also has compound, rather than pseudocompound anterior hooks, and it lacks branchiae. *N. textor* has been reported from various areas of the northwestern Atlantic Ocean.

#### Species of the *Onuphis-Nothria-Paradiopatra* Complex Referable to Other Taxa

##### *Onuphis (Onuphis) amoureuxi* Intes and Le Loeuff, 1975

FIGURE 15d, e

*Onuphis (Onuphis) amoureuxi* Intes and Le Loeuff, 1975:313-314, fig. 10b-g.

MATERIAL.—Paratype, MNHNP, Atlantic Ocean off Ivory Coast, 5°08.2'N, 4°05'W, 100 m, dredged, 23 Nov 1966, coll. A. Intes, *Reine Pokou*

station TD 77; paratype, MNHNP, Atlantic Ocean off Ivory Coast. 5°08.6'N, 4°09'W, 80 m, dredged, coll. A. Intes, *Reine Pokou* station TD 86.

REMARKS.—Of the two paratypes the largest (from TD 86) is 40 mm long and 12 mm wide, with parapodia, and consists of 54 setigers. The outer lateral occipital antennae reach setiger 2, the inner lateral antennae are missing on both specimens, and the median antenna reaches setiger 10. The ceratophores have up to 7 rings. Branchiae are present from setiger 10 to the end of the fragments; the maximum number of branchial filaments is 4. Ventral cirri are cirriform in the first 8 setigers; digitiform postsetal lobes are present in all setigers. Bidentate and unidentate pseudocompound hooks with long pointed hoods are present in the first 5 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 24 in one specimen and from setiger 28 in the other. Each pectinate seta is distally strongly oblique and has about 20 teeth.

A unique feature of these two specimens is the presence of a large pocket limited frontally by a large fold of tissue on setiger 7 through setiger 29. The setae are arranged in a single postsetal fascicle and the acicula emerge from a distinct rounded setal lobe in all setigers. These are features not present in any other taxon treated in this review, but resemble the condition in *Australonuphis* Paxton, 1979. The species does not appear, however, to belong to any known species in that genus and may differ from all other onuphids at the generic level.

### ***Onuphis brevicirris* Hartmann-Schröder, 1959**

FIGURE 28a

*Onuphis brevicirris* Hartmann-Schröder, 1959:155–158, figs. 138–145.

MATERIAL.—Holotype, HSM P-14290, Pacific Ocean off El Salvador, La Herradura, Estero Jaltepeque, station 4b.

REMARKS.—The specimen is as described by Hartmann-Schröder (1959). It is a juvenile and

the structure of the branchiae is the same as in juveniles of *Diopatra*. Comparison with juvenile specimens of *D. ornata* Moore from California indicate that the type may belong to this species, but valid specific identification is not possible since a number of species of *Diopatra* have very similar juveniles. The species is here considered invalid, since the type is an indeterminable juvenile of the genus *Diopatra*.

### ***Nothria conchyphila* Verrill, 1885**

*Nothria conchyphila* Verrill, 1885a:524–525, pl. 41:fig. 181 [in part]; 1885b:432.

*Nothria conchyphila*.—Hartman, 1944a:340 [in part].

*Onuphis* (*Nothria*) *conchyphila*.—Pettibone, 1963:246 [in part].

*Onuphis* (*Onuphis*) *quadricuspis*.—Pettibone, 1963:249 [in part].

REMARKS.—*N. conchyphila* was referred to *N. conchyphila* by Hartman (1944a) and to that species (as *Onuphis*) and to *O. quadricuspis* as well by Pettibone (1963:246, 249). The situation is confused, and despite the validity of the names to which it has been referred, it is important to clarify the use of the name (*N. conchyphila*), even if it is currently considered invalid.

Verrill (1885a:524) introduced the name in the following manner: “*Nothria conchyphila* V., which constructs flat, free tubes, about 2 inches long, out of broken bivalves, often occurs in vast numbers in the warm zone.” In addition, there is an illustration, Verrill (1885a, pl. 41, fig. 181) that is captioned “*Nothria conchyphila* V.” This illustration shows an anterior end with relatively long, strongly ringed ceratophores, branched branchiae from setiger 4 and with about 4 branchial filaments in the last setiger illustrated (setiger 7). The first parapodia are not shown as enlarged, nor are they directed forward. Verrill (1885a:525) reported that the collections were made by the *Albatross* in 1883, but gave no detailed locality information.

All known species that have short, flattened tubes covered with shell fragments also have enlarged first parapodia directed forward. They all have simple branchiae and short ceratophores

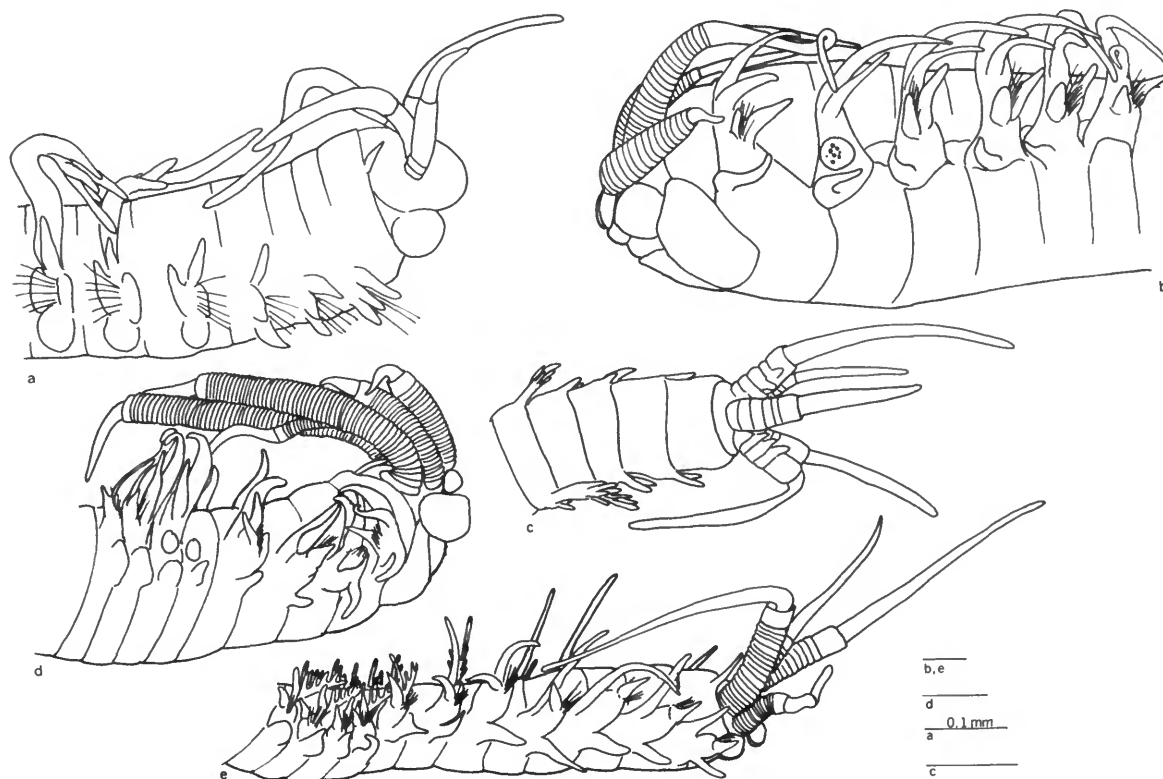


FIGURE 28.—Anterior ends of species of *Onuphis*–*Nothria* group in lateral view: a, *O. brevicirris* Hartmann-Schröder, 1959; b, *O. quinquedens* Day, 1951; c, *O. tenuissima* Grube, 1868; d, *Tradopia maculata* Baird, 1869; e, *O. zebra* Berkeley and Berkeley, 1939. (All scales = 1 mm unless otherwise indicated.)

with at most 4 or 5 short rings. Verrill's illustration cannot be of the specimens he described in the text.

Verrill (1885b) published another description of *N. conchyphila*. This time no mention was made of the tube, and the description could fit *Sarsonuphis* spp. rather than a species of *Nothria*, sensu stricto). Verrill (1885b:432) quotes his earlier paper from the same year and in addition refers to Verrill (1881, pl. 23: fig. 4). This paper (Verrill, 1881), the first in his projected series on New England annelids (cf. Hartman, 1944a), contains the first 12 plates of the series but with no accompanying description, and plate 23 (Verrill, 1881) was not among those issued. The text and the remaining plates were never issued by Verrill. All

completed plates of Verrill's series were finally issued by Hartman (1944a). Hartman's (1944a) plate 55, the same as Verrill's (1881) plate 23, contains as figure 4 the illustration that Verrill had issued in 1885 (1885a, pl. 41: fig. 181).

At least part of the material on which Verrill's species (1885b) is based, is present in the collections of the USNM. Nearly all specimens in this collection belong to *Nothria conchyphila* as this species is currently defined. The only specimen I have been able to find (USNM 13374) of the material referred to by Verrill (1885a), is a small specimen of *Diopatra cuprea* that could have been used for Verrill's plate (1885a, pl. 41: fig. 181). It fits the illustration well, but has the spiralled branchiae of a *Diopatra*.

*Nothria conchyphila* is thus in part a synonym of *Nothria conchylega* and is in part a synonym of *Diopatra cuprea*.

### ***Tradopia maculata* Baird, 1869**

FIGURE 28d

*Tradopia maculata* Baird, 1869:355–356.

**MATERIAL.**—Two syntypes, BMNH 1868.2.57.1, Indian Ocean, Madras, coll. F. Day, Esq.

**REMARKS.**—Both specimens are complete, with 470 and 487 setigers, respectively. The longest specimen is about 195 mm long and 3.6 mm wide, with parapodia. The anterior end is cylindrical, the median and posterior ends, posterior to setiger 7 or 8, are dorsally flattened and ventrally convex with the parapodia attached at the margins and directed dorsally. The inner lateral occipital antennae reach setiger 10, the median antenna reaches setiger 4, and the outer lateral antennae, which are shifted in position to arise between the frontal palps and the inner lateral occipital antennae, reach setiger 1 or 2. Two-thirds or more of the total length of all antennae is made up of the extremely strongly ringed ceratophores. The maximum number of rings is about 60. Dark, irregular pigment spots are scattered over the occipital antennae. Branchiae are present from setiger 1 to about 20 setigers from the posterior end. Where best developed each branchia is distinctly pectinate and has about 10 slender filaments. Ventral cirri are cirriform in the first 5 setigers; distinct, digitiform postsetal lobes are present in all setigers. The dorsal cirri of the anteromedian region are basally distinctly inflated. Tridentate pseudocompound hooks are present in the first 3 or 4 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 9 or 10. Each flat pectinate seta is distally oblique and has about 20 teeth. The maxillary formula is 1+1, 7+8, 9+0, 8+7, and 1+1, as observed in a specimen with everted jaw apparatus.

*Tradopia maculata* has not been reported since its original description; it was considered *Onuphis*

(?) incertae sedis by Fauvel (1953:281). *T. maculata* resembles *Onuphis quinquedens* Day (p. 100), *O. mariahirsuta* Paxton, and *O. gygis* Paxton in the structure of the anterior end; these species are here excluded from the genus *Onuphis*; their position will be clarified in a forthcoming study by Hannelore Paxton; therefore no taxonomic action is being taken here.

### ***Nothria minuta* McIntosh, 1885**

*Nothria minuta* McIntosh, 1885:334–335, pl. 21A: figs. 17, 18, pl. 40: fig. 4.

**MATERIAL.**—Holotype, BMNH 1885.12.1.227, Pacific Ocean, off New Zealand, 37°34'S, 179°22'E, 1260 m, gray ooze, 10 Jul 1874, *Challenger* station 169.

**REMARKS.**—The type and only known specimen is now in several pieces. The anterior end has been deeply dissected and no counts of segmentally arranged features could be made. McIntosh (1885, pl. 40: fig. 4) shows a small specimen of *Hyalinoecia*. This is consistent with the features that were observable in the type: peristomial cirri are absent; the first parapodia are somewhat enlarged (according to the illustration) and the setae of the first parapodia were described as large simple hooks. The specimen is abranchiate.

*Nothria minuta* is here considered an indeterminate species of *Hyalinoecia*.

### ***Onuphis pectinata* Knox and Hicks, 1973**

*Onuphis pectinata* Knox and Hicks, 1973:289–290, figs. 23–32.

**REMARKS.**—The type was not available for study; the following comments are based on the original description and illustrations. From intertidal waters of the Pacific Ocean off New Zealand. The outer lateral occipital antennae reach the peristomium; the inner lateral antennae reach setiger 5 and the median antenna reaches setiger 3. The ceratophores have up to 7 rings. Branchiae are present in all setigers; the first setiger has a pectinate branchia with 6 filaments; where best



developed the branchiae have about 11 filaments. The numbers of filaments decrease towards the posterior end. Ventral cirri are cirriform in the first 15 setigers; postsetal lobes are distinct in all setigers. Bidentate pseudocompound hooks are present in the first 6 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are first present from setigers 27–29. Each flat pectinate seta is distally oblique and has about 20 teeth. They are present from the first setiger. The maxillary formula is 1+1, 6–7+6, 8–9+0, 7+10, and 1+1.

The anterior end of this species appears to be extremely small, compared to the size and development of the first parapodia, which are unusually large compared to most species. It is very possible that the prostomium is newly regenerated after decapitation. For the time being, *O. pectinata* is considered as distinct, but of incertae sedis, in relation to described genera in the family.

### ***Onuphis quinquedens* Day, 1951**

FIGURE 28b

*Onuphis quinquedens* Day, 1951:40–42, figs. a–h.

*Onuphis (Onuphis) quinquedens*.—Day, 1967:422, fig. 17.13a–e.

**MATERIAL.**—Holotype, BMNH ZK 1961.16.34, Indian Ocean off Natal, Zululand, Umpangazi, intertidal, coll. J. H. Day, station G6V.

**REMARKS.**—The holotype is a very large specimen in several fragments. The anterior fragment consists of 112 setigers and is 72 mm long and 9 mm wide, with parapodia. The first part of the body, including approximately the first 6 setigers, is cylindrical; the remainder is strongly flattened dorsally and convex ventrally, with the parapodia attached marginally and directed dorsally. The occipital antennae have extremely long, strongly ringed, tapering ceratophores with up to 30 rings. The ceratostyles are relatively short. The outer lateral antennae reach setiger 1, the inner lateral antennae reach setiger 2, and the median antenna reaches setiger 3. The two peristomial cirri are placed laterally to a middorsal notch in the anterior peristomial margin. Branchiae are present

from setiger 1 to the end of the fragment; the first 8 pairs are simple filaments; the maximum number of filaments is 12; the branchiae are distinctly pectinate with the lateral filaments arranged neatly on the medial side of the stem. Ventral cirri are cirriform in the first 5 setigers; digitiform postsetal lobes are distinct to the end of the fragment. The first 15 setigers also have distinct presetal lobes; these are digitiform in the first 2 setigers, but become increasingly flattened and lobate. Bidentate pseudocompound hooks are present in the first 3 setigers. Large hooks and compound spinigers are absent. Subacicular hooks are present from setiger 10. Each flat pectinate seta is distally transverse and has about 25 fine teeth. The exposed jaw apparatus gives the following maxillary formula: 1+1, 5+6, 7+0, 7+8, and 1+1.

*Onuphis quinquedens* differs from other species of *Onuphis* in the structure of the anterior end, specifically in the structure of the occipital antennae. It is here considered to be incertae sedis. It is known only from the type locality.

### ***Onuphis setosa* Kinberg, 1865**

*Onuphis setosa* Kinberg, 1865:560; 1910:40, pl. 14: fig. 10.—Augener, 1931:297.

**REMARKS.**—The type material of *O. setosa* from the Atlantic Ocean off Rio La Plata, is not present in Riksmuseet, Stockholm, where the rest of Kinberg's material is deposited (Roy Oleröd, in litt.). It has been missing for some time, since Augener (1931:297) remarked that it was not present when he reviewed the four species of *Onuphis* described by Kinberg from southwestern Atlantic Ocean.

Kinberg's figure (1910, pl. 14: fig. 10) shows a species of the *Onuphis-Nothria* group with the outer lateral occipital antennae reaching setiger 1, the inner lateral antennae reaching setiger 4, and the median antenna perhaps reaching setiger 3. The ceratophores are short and are shown as having about 4 rings. Branchiae must start between setiger 10 and 20, since the latter is shown as having a single branchial filament. Ventral



cirri must be cirriform in less than the first 5 setigers, since Kinberg's figure of this setiger shows a rounded pad. The pseudocompound hooks are shown as bidentate and with short, blunt hoods. The everted jaw apparatus illustrated gives a maxillary formula of 1+1, 6+8, 10+0, 10+about 15, and 1+1.

Orensanz (1974:89) applied this name to material of two other species, *Kinbergonuphis difficilis* and *K. orensanzi*. Among their other features, branchiae are first present from setiger 6 and are clearly pectinate by setiger 20. Most of the pseudocompound hooks are tridentate, rather than bidentate, and the ventral cirri are cirriform in at least the first 5 setigers, except in juveniles. There is nothing in Kinberg's (1910) illustration or description to indicate that his specimen(s) was juvenile. Kinberg's name is here, temporarily, considered a nomen inquirenda. Unless fresh material that can be clearly associated with this species becomes available, the name should be considered a nomen oblitum. *O. setosa* was originally described from the shelf depths of the Atlantic Ocean off La Plata.

### ***Onuphis tenuissima* Grube, 1868**

FIGURE 28c

*Onuphis tenuissima* Grube, 1868:51.

*Hyalinoecia tenuissima*.—Grube, 1878:143.

**MATERIAL.**—Holotype and empty tubes, MPW 326, Cap, coll. Salmin; 1 paratype, ZMB 1841, Cap.

**REMARKS.**—The holotype is a complete specimen in good condition and the structure of the anterior end can be studied. The ceratophores of the occipital antennae are strongly ringed and the inner lateral antennae have lateral projections. Peristomial cirri are absent. The branchiae, of which there are about 10 pairs, are distinctly branched with the branches arranged in a spiral. The pseudocompound hooks are bidentate and have short, blunt hoods. The tubes are clear, stiff, and translucent with widely spaced rings and are distally covered with gooseneck barnacles.

The species clearly belongs to the genus *Epidiopatira*; the features observed are consistent with those of *E. hupferiana* Augener, 1918. This group of species is currently under study by Hannelore Paxton; therefore no taxonomic action is being taken herein.

### ***Onuphis zebra* Berkeley and Berkeley, 1939**

FIGURE 28e

*Onuphis zebra* Berkeley and Berkeley, 1939:337–338, figs. 9, 10.

**MATERIAL.**—Holotype, USNM 32898, Pacific Ocean off Baja California, Punta Gorda, 23°-04'N, 109°35'W, 26 m, 24 Apr 1937, coll. W. Williams.

**REMARKS.**—The holotype and only known specimen, is an anterior fragment of about 25 mm length consisting of 35 setigers. The outer lateral occipital antennae reach setiger 3, the inner lateral antennae reach setiger 8, and the median antenna reaches setiger 5. The ceratophores are long and strongly ringed with up to 15 rings. Branchiae are present from setiger 6; all are pectinate; where best developed 8 branchial filaments are present. The dorsal cirri are distinctly flattened in most segments and the thick branchial stems are basally slightly inflated. Neither of these features are well shown in Figure 24e, since they are best developed posterior to the setigers shown. Ventral cirri are cirriform in the first 10 setigers; digitiform postsetal lobes are distinct in all setigers. Tridentate pseudocompound hooks of two thicknesses are present in the first 5 setigers. Large hooks are absent. Compound spinigers are present as far as could be determined without destroying the specimen, from setiger 6 to the end of the fragment. Subacicular hooks are absent. Each pectinate setae is distally slightly oblique and has about 12 teeth.

The branchial structures are remarkably similar to those present in *Americonuphis* and in some *Australonuphis* (see Fauchald, 1973:22; Orensanz, 1974:100; and, especially, Paxton, 1979:270). It is here suggested that *O. zebra* be considered an

incertae sedis, probably more closely related to one of the above two other genera than to *Onuphis*.

### Variability of Selected Morphological Features

Most numerical information was measured in numbers of setigers rather than by absolute measurement. This has the advantages that most means represent setiger numbers and a variability indicated as one standard deviation more or less than the mean would convert directly into segment numbers or fractions of segment numbers. Thus, an estimate of the fidelity of any systematic character would be the fraction of species in which the character varied less than a selected amount. Because of the conversion, characters that vary one standard deviation or less appear to be most useful.

There are some drawbacks in this method of measuring variability. The initial measurement has a limited accuracy and if, for example, the inner lateral occipital antennae of a species normally reached to the groove between setigers 2 and 3, this length would sometimes be given as 2, sometimes as 3 and, because of the low value of the mean, the apparent variability could be very high, compared to the case where the mean was 20. This would be mitigated if metric measurements were used; however, the problems posed by contractions and twisting of specimens and body parts as fixation artifacts makes metric measurements inaccurate and extremely time-consuming to perform. The use of the setiger count, to a certain degree, lessens the effect of these problems. The coefficients of variability are sometimes enormous, sometimes very much smaller, for the same numerical range. This is due, of course, to the basic assumptions underlying the calculation of such coefficients. The same problem attaches to the standard deviations; but, because of the possibility of converting these into interpretable numbers, it appears preferable to use these latter, rather than the coefficients, in comparing fidelity of the characters.

Table 34 gives a summary of the statistics tables for all species for which adequate numbers

were available. Only about one-quarter of the species treated in this paper are included. The first column shows the numbers and percentages of species in which a given character is invariant; next column shows the numbers and percentages of species in which the character varies from the mean by a standard deviation of less than one; column 3 is the sum of columns 1 and 2 and, finally, column 4 is the total number of species for which numbers were available, and includes those where the character in question varied more than one standard deviation. This study covered the type material only; thus, the numbers represent a sample of a single population, in most cases. Each species, presumably, has a number of populations, each of which can be assumed to be slightly different from all other populations. Thus, the variability calculated here is probably minimal, compared to the total variability present in the species as a whole. This problem will be considered in a future study. A high fidelity feature is not necessarily useful as a taxonomic feature. In several cases, such characters vary so little among species that they are useless in discriminating among the species; a character with less fidelity can be much more useful.

The length of the outer lateral occipital antennae is a case in point. It shows high fidelity (88.46%). Since most species have these antennae reaching either setiger 1 or 2, the character is useless as a discriminant feature. The lengths of the inner lateral and median antennae vary greatly; therefore, these characters are useless in more than half of the taxa considered. However, the length of the inner lateral relative to the median antennae is much more conservative and *can* be used in a predictive sense in most taxa investigated. A method of scoring this character has been devised and the use of this statistic will be followed in a later study. The maximum number of rings on the ceratophores shows good fidelity (88.46%) and is an extremely useful feature.

The start of the branchiae and the maximal number of branchial filaments are features with high fidelity (90.48% and 95.00%, respectively). The branchiae sometimes start earlier on one side

TABLE 34.—Overall fidelity of systematic characters in the *Onuphis*–*Nothria* complex

Character	Invariant		S.D. <1		Invariant + S.D. <1		Total Species Examined (No.)
	(No.)	(%)	(No.)	(%)	(No.)	(%)	
Occipital antennae:							
Outer lateral length	18	69.23	5	19.23	23	88.46	26
Inner lateral length	0	0	8	33.33	8	33.33	24
Median length	1	4.17	9	37.50	10	41.67	24
Number of rings	9	34.62	14	53.85	23	88.46	26
Branchiae:							
Start at setiger	7	33.33	12	57.14	19	90.48	21
Filaments	12	60.00	7	35.00	19	95.00	20
Cirriform ventral cirri	20	71.43	8	28.57	28	100.00	28
Number of setigers with pseudocompound hooks	22	78.57	6	21.43	28	100.00	28
Large hooks:							
Start	4		0		4		4
End	0		2		2		4
Compound spinigers:							
Start	2		1		3		3
End	0		2		2		2
Subacicular or intrafascicular hooks	4	14.29	17	60.71	21	75.00	28

of the body than on the other. The number listed is the setiger on which the first trace of a branchia could be detected. There is no evidence to show that presence or absence of branchiae is a variable feature within any species treated in this paper. Similarly, there is no evidence to show that species with simple, strap-like branchiae may have varying numbers of branchial filaments. The numerical evidence demonstrates extremely high fidelity in this particular character state.

Obviously, the distribution of cirriform ventral cirri and the number of setigers with pseudocompound hooks are extremely predictable features since both have a value of 100%. The implication is that for an unknown species, both features could be used with confidence as a distinguishing feature. The number of observations of the distribution of large hooks and compound spinigers is too small to be particularly meaningful.

The start of the subacicular (intrafascicular) hooks is less well determined than most of the other features considered (75.00%), but even so,

for three-fourths of the species, the start of these features varies by less than one setiger in either direction from the mean. This feature is invariant for relatively few species. Considering the spread in means of this feature among species, it emerges as an extremely important discriminating character, despite its relatively low fidelity.

If the table is broken down to the generic level, some rather interesting features emerge. Most species of *Kinbergonuphis* have fewer invariant features than do species in the complex as a whole; in fact, species of *Kinbergonuphis* appear to be predictably more variable than most species of the group, except in the case of the occipital antennae. Four of six species of *Kinbergonuphis* show high fidelity in the length of the inner lateral and of the median occipital antennae compared to 8 of 24, for the group as a whole. Relatively few species of *Kinbergonuphis* were evaluated.

The genus *Onuphis* is well represented in the group of species for which measurements were

available. Most species in this genus appear to be highly predictable. For example, the following features show absolute predictability at one standard deviation: length of outer lateral antennae, start of branchiae, and number of branchial filaments, numbers of setigers with cirriform cirri and pseudocompound hooks and the start of the subacicular hooks. The only features measured that do not show such predictability are the lengths of the inner lateral and median occipital antennae and the number of rings on the ceratophores.

In *Sarsonuphis*, the number of rings on the ceratophores, and the number of cirriform ventral cirri and pseudocompound hooks are highly predictable, but the number of species analyzed is so low that there is a great margin for error. *Mooreonuphis* is rather less variable, in that a larger number of species show invariant features than show limited variation, and most species fall into either of the two categories; however, the number of species investigated is too low to allow unequivocal conclusions.

The genera *Nothria* and *Paradiopatra* were treated together, since these two genera appear more closely related to each other than to any other genus in the family. Each genus separately was too poorly represented to allow any kind of statement about the expected level of variability. The number of rings on the ceratophores, the numbers of setigers with ventral cirri and pseudocompound hooks are invariant in the species investigated. The start of the intrafascicular hooks also shows extremely limited variability. Only five of the total possible 18 species in these two

genera combined, have been analyzed, so again the numbers are of marginal validity.

In an attempt to explore further the pattern of variability, the variance to mean ratio was calculated for each one of the features measured. A pattern one might expect of the variance to mean ratio, would be that the ratio would be constant, i.e., that the variance varies directly with the mean. Biologically, this would imply that control of the development of each feature varies linearly along the length of the body. For example, the concentration of some controlling substance from the prostomium should decrease in linear fashion along the body. Another possibility might be that the variance increases relatively more rapidly than the mean, so that the ratio increases with increasing means. This would imply, for example, a curvilinear decrease of the concentration of whatever controlling substance is present. Because of the large number of invariant features, there are few comparable ratios for any given feature, and little can be said, except that each feature appears to have a different pattern and that neither of the two most logical patterns indicated above, appear to be represented. The lesson from this exercise is that numerical features appear to vary independently, and, thus, can be treated as independent characters in a systematic study. The numbers of specimens evaluated for each species is too small, in most cases, but future studies including larger numbers of specimens will use a larger panoply of analytic techniques and should allow firmer conclusions concerning the independence and fidelity of features used in taxonomic analyses.



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**Copy** must be typewritten, double-spaced, on one side of standard white bond paper, with 1¼" margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

**Front matter** (preceding the text) should include: **title page** with only title and author and no other information, **abstract page** with author/title/series/etc., following the established format, **table of contents** with indents reflecting the heads and structure of the paper.

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