

The Taxonomy, Ecology, and Distribution of Northern California Isopods of the Genus *Idothea* with the Description of a New Species¹

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INTRODUCTION

The usual small isopod collection contains numerous idotheid species and a very few species belonging to other groups. These are often species belonging to parasitic genera such as *Cymothoa* or destructive boring forms like *Limnoria* and *Sphaeroma*. Doubtless the large size and frequent great abundance of idotheid individuals accounts largely for their dominance in collections. However, insofar as the California coast is concerned, one who attempts to classify idotheid species meets with many difficulties. For example, males of one species have been known for many years under a name differing from that applied to the females, varieties of a single species have been known under different names, and certain species have been incorrectly named and confused with other species. Since many of the inadequacies in the classification can be traced to an originally poor description it is the purpose of this paper to correct earlier errors and to provide a simpler and more satisfactory classification of the species known to occur on the California coast. In certain instances it has been found impossible to solve, with the available material, a particularly difficult taxonomic problem and in such cases the problem is merely stated and discussed to a limited extent for the benefit of future workers.

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Since the morphology and location of the frontal projections of the idotheid head appear not to have been mentioned hitherto in the descriptions of American species, it has been thought desirable to illustrate those structures and to discuss in a synoptic way their specific significance in the classification of the various species. The discussions of the ecology and distribution of the species are only attempts to bring together what is now known about them. It is anticipated that patterns of distribution and ecology will be altered somewhat when other areas are studied more extensively. This applies particularly to more southern localities where relatively little is known concerning the isopod fauna.

Dr. Melville Hatch, University of Washington; Dr. Frank Pitelka, University of California; and Dr. John Mohr, University of Southern California have all assisted the writer through the loan and gift of numerous specimens from Washington; Monterey, California; and southern California. To these persons I tender my most sincere thanks. Special thanks are due Dr. Fenner A. Chace, Jr., Curator, Division of Marine Invertebrates, United States National Museum for the loan of specimens and for providing essential information about certain types.

GENERIC STATUS

Genus *Idothea* Fabricius, 1799.

Idothea FABRICIUS, 1799, emended from RICHARDSON (1905a, p. 356).

Pentidotea RICHARDSON, 1905a, restricted.

The genus *Pentidotea* Richardson, so far as I can determine, differs from *Idothea* Fabricius only in that the maxillipedal palp consists of five separate articles and not four as in *Idothea*. Since it has been shown that very small specimens of *Pentidotea resicata* (Stimpson), the genotype of *Pentidotea*, have a maxillipedal palp consisting of but four separate articles (Menzies and Waidzunas, 1948, p. 109) it seems essential that *Pentidotea* be considered a subgenus of *Idothea*. I believe that this arrangement not only expresses phylogenetic relationships more clearly but also removes *Pentidotea* from a list of genera differing from *Idothea* in much more essential characteristics. The generic diagnosis given by Richardson (1905a, p. 356) for *Idothea* can be

made to include *Pentidotea* simply by adding to the second sentence the words, "or five articles."

GENERIC DIAGNOSIS: Flagellum of second antenna multi-articulate. Maxillipeds with a palp composed of four or five articles. Epimera of all the segments (somites) of thorax (peraeon), with the exception of the first, distinctly separated from the somites. Abdomen (pleon) composed of three segments, with a suture line on either side at the base of the terminal segment, indicating perhaps another partly coalesced segment. Includes the subgenera *Idothea* and *Pentidotea*.

STRUCTURAL CHARACTERISTICS USED IN IDOTHEID TAXONOMY

No special structure can be singled out as an absolutely reliable specific characteristic for the identification of a species and in most instances a composite of characteristics is needed to distinguish one species from another. Interestingly enough certain features quite reliable in distinguishing one species from another may be totally unreliable in separating two other species. Early taxonomic researches in general employed too few characteristics in distinguishing various species. For example, in Richardson's monograph (1905a, pp. 356-376) one characteristic, the shape of the terminal segment of the body or telson, is used excessively in distinguishing twelve species of isopods (*Idothea* and *Pentidotea*). The keys, and the descriptive material as well, for that reason remain seriously wanting in diagnostic details. The main characteristic used by Richardson in separating groups of species, that of general body shape, is a very variable taxonomic character. Thus *Idothea fewkesi* is separated from *Idothea ochotensis* primarily because the body of *I. fewkesi* is "slender, linear, filiform," while that of *I. ochotensis* is "oblong-ovate." In reality it is very doubtful whether the two are specifically distinct. *Idothea gracillima* (Richardson, *non* Dana) is classified by Richardson as the slender, linear, filiform type, although ovigerous specimens of that species are far more oblong-ovate than filiform. The very limited use of the telson outline as a specific characteristic is illustrated in a paper by Menzies and Waidzunus (1949) wherein the generally concave posterior margin of the telson of *I. (P.) resecata* is shown to be subject to considerable developmental

variation. Richardson (1905a, p. 357, fig. 385) illustrates considerable variation in the posterior margin of the telson of *Idothea gracillima* (Richardson, *non* Dana). The above examples illustrate the need for a more comprehensive treatment of the species avoiding the use of vague terms such as oblongovate, slender, and filiform. Other numerous examples are available and researchers on the Pacific coast marine isopods in general appear to have added little to the taxonomy of the species subsequent to Richardson's monograph.

In view of the above considerations it seems desirable to discuss the external morphology of the idotheid isopod and to emphasize particular features which have proven useful in the identification of the various species.

The cephalon (head): The oral appendages, including the mandibles and maxillae, in general, appear to be very constant intergenerically and thus to be of little use in specific determination. The maxilliped, on the other hand, although generally showing little or no obvious specific differences, does differ in the number of coupling hooks present on the endognath. In *I. (P.) stenops* two coupling hooks are present on each endognath while that structure in all of the other species investigated has but one coupling hook. Long setae present on the outer border of the maxillipedal palp articles are characteristically present in *I. (I.) fewkesi*. This is in contrast to the short setae present on that appendage in most species. The antennae, although presenting some excellent generic characteristics, appear relatively constant within the genus. The frontal area of the cephalon between the supra-antennal line (frontal margin of the head) and the mandibles has a number of projections or laminae which vary in size, shape, and relationship to one another in various species while remaining relatively constant for a single species. In order dorso-ventrally these structures are (1) the frontal process; (2) the clypeus, which has (a) a frontal lamina (number 1) which is a dorsal extension of the clypeus and (b) a frontal lamina (number 2) which is a ventral extension of the clypeus; and (3) the labrum. These features are illustrated in text figure 1, A-C, for the species *I. (P.) wosnesenskii*. An excellent comparative account of frontal protuberances in various isopod groups with particular reference to the Onis-

coidea is given by Vandel (1943, pp. 31–59, figs. 12–18). In idotheid species the frontal process may bifurcate at the tip as in *I. (P.) stenops* and to a limited extent in *I. (P.) aculeata*, be blunt as in *I. (I.) urotoma*, or be pointed as in the majority of the species. The frontal lamina 1 may be medially concave as in *I. (I.) urotoma*; evenly rounded as in *I. (P.) montereyensis*, *I. (P.) resecata*, and *I. (I.) rufescens*; or it may be triangulate in other species, e.g., *I. (P.) schmitti* and *I. (P.) aculeata*. A frontal lamina 2 that extends forward beyond frontal lamina 1 appears in *I. (P.) wosnesenskii* and *I. (P.) schmitti*, but not in *I. (P.) montereyensis*, *I. (I.) fewkesi*, and *I. (I.) rufescens*. The shape and direction of the eye with reference to the body axis is a very useful specific character in certain instances. It is transversely elongate in *I. (P.) stenops*, pyriform in *I. (P.) resecata*, and circular in *I. (P.) aculeata*.

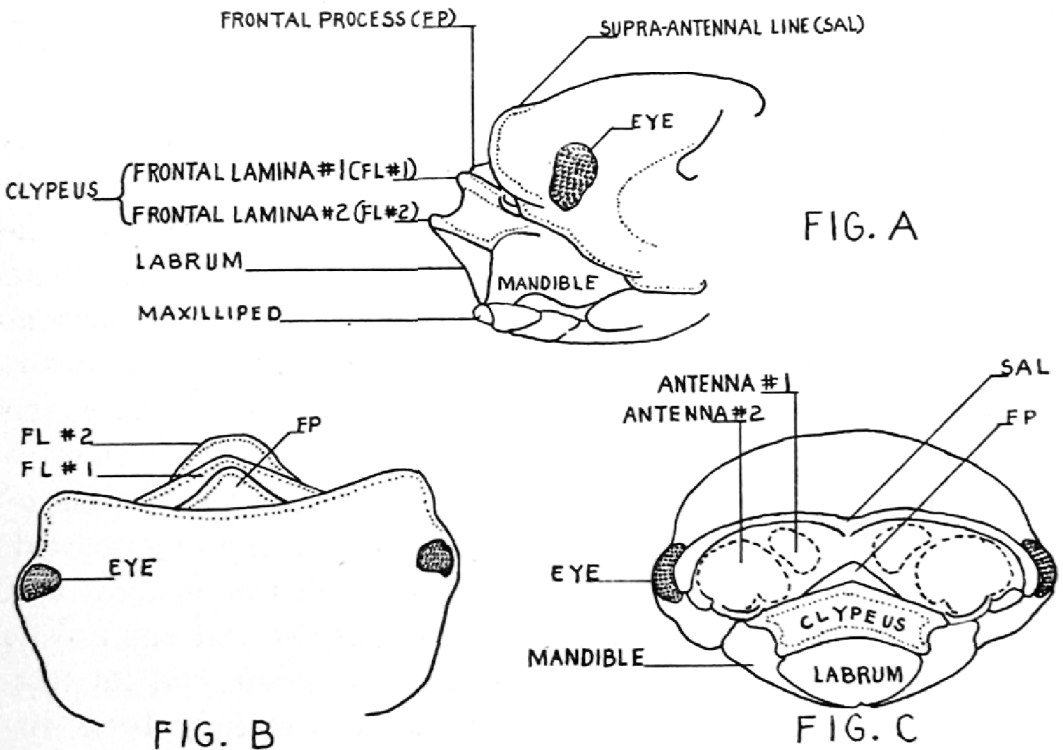


Figure 1. Terminology of cephalic structures of idotheid isopod *Idothea (Pentidotea) wosnesenskii* (Brandt). A. lateral view; B. dorsal view; C. frontal view.

The peraeon (thorax): The morphology of the peraeopods (legs) changes considerably in the number and size of the setae of certain segments in the course of development and is there-

fore of limited use as a specific characteristic. In certain cases, however, particularly in distinguishing the young of *I. (I.) rufescens* from those of *I. (P.) resecata*, the peraeopods are of decided value. Other characteristics of these two species are of relatively little use in separating the young of each species. The length of the epimeral plates compared with the length of the somites at the lateral borders has been used recently in distinguishing several idotheid species (Hatch, 1947, pp. 216-219). It is of particular importance to note that at the second, third, and fourth somites it is largely a matter of personal opinion whether an epimeral plate covers the entire border of its somite or not, because the limits of the borders are difficult to define exactly. Thus it is very difficult in the species *I. (P.) aculeata* and *I. (P.) schmitti* to say with certainty just where the lateral border commences and the posterior border ceases. This is true as well in *I. (P.) wosnesenskii*, *I. (P.) stenops*, and *I. (I.) rufescens*. In certain other species the lateral borders of these somites are well defined, e.g., *I. (P.) montereyensis*, and in such cases the comparative characteristic remains quite useful. Perhaps a more valuable character is the expression of the epimeral length in relationship to the length of the somite along the mid-line, although even here one meets a number of intraspecific variables. The shape of an epimeral plate appears fairly constant and one can distinguish specimens of *I. (P.) schmitti* from specimens of *I. (P.) aculeata* in that the postero-lateral angles of the seventh epimeral plates are sharp and acute in the latter and evenly rounded in the former.

The pleon (abdomen): The shape of the lateral borders of the first pleon somite when viewed dorsally serves to distinguish certain species. In *I. (P.) stenops* that border is straight and wide while in *I. (P.) wosnesenskii* it is narrow and acute. The configuration of the posterior border of the telson and its relative usefulness in distinguishing species has already been discussed. The penis, pleopods, and uropods of the species investigated show few or no specific differences.

Subgenus **Idothea**.

This subgenus as far as northern California is concerned contains but three species, *Idothea (Idothea) urotoma* Stimpson,

I. (I.) fewkesi Richardson, and *I. (I.) rufescens* Fee. The species *Stenosoma gracillimum* Dana (1854, p. 175) is in my opinion a *species inquirenda*, while the species given that name by Richardson (1905a, pp. 356-358) apparently is a synonym of *Idothea (Pentidotea) montereyensis* Maloney. *Idothea rectilinea* Lockington (1877, p. 36) should also be placed in *species inquirenda* status, while the species listed under that name by Richardson (1905a, pp. 360-362) is a synonym of *I. (I.) urotoma* Stimpson, being the female of that species.

KEY TO THE NORTHERN CALIFORNIA SPECIES OF THE SUBGENUS IDOTHEA

1. Frontal process apically blunt, frontal lamina 1 with a pronounced median concavity.....*I. (I.) urotoma* Stimpson
- Frontal process apically blunt or pointed, frontal lamina 1 semi-circular, lacking a median concavity.....2
2. Posterior margin of telson concave in outline. Epimeral plates of peraeon somites five and six occupying entire lateral margins of those somites. Frontal process apically blunt.....*I. (I.) rufescens* Fee
- Posterior margin of telson with a pronounced median projection. Epimeral plates of peraeon somites five and six occupying only three-fourths of the lateral margins of those somites. Frontal process apically pointed.....*I. (I.) fewkesi* Richardson

***Idothea (Idothea) fewkesi* Richardson, 1905.**

(Plate 1, figures A-I).

Idothea fewkesi RICHARDSON, 1905a, pp. 359-360, figs. 387-388.—Fee, 1926, pp. 17-18 (29-30).—? GURJANOVA, 1936, pp. 258-259.—HATCH, 1947, p. 218.

This species appears very closely related to a number of described species, some of which may prove to be synonyms; indeed, *I. (I.) fewkesi* may be found to be a synonym of one of the earlier described species. None of these related species, with the exception of *I. (I.) fewkesi*, is really adequately known and at present the species remain distinguished from one another only by very vague and unreliable descriptive terms. The species *I. (I.) fewkesi* is described adequately and is recognizable as constituting one of the members of the northern California isopod fauna. For that reason it seems best to retain the name until certain taxonomic knots can be thoroughly untied. It will suffice here

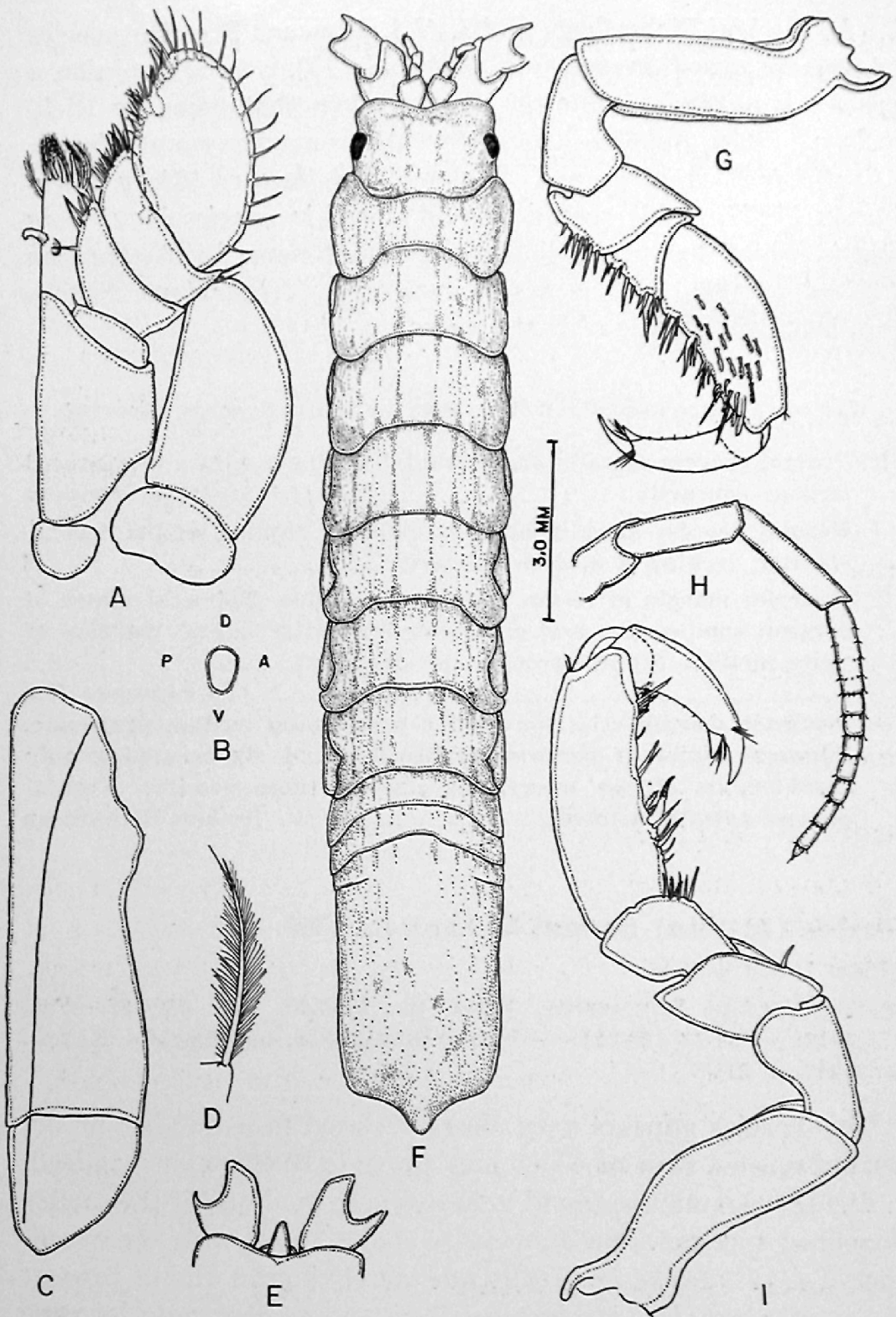


Plate 1. *Idothea (Idothea) fewkesi* Richardson. Figure A. maxilliped; B. eye, lateral view; D = dorsal, V = ventral, P = posterior, A = anterior; C. uropod; D. plumose setae at outer distal angle of uropodal basal segment, inner surface; E. cephalon, dorsal view, first antennae removed; F. male, dorsal view; G. first pereopod; H. second antenna; I. seventh pereopod.

to provide what are believed to be adequate figures and a diagnosis to permit the recognition of this species as it was originally described.

DIAGNOSIS: Supra-antennal line with a distinct median emargination; frontal process elongate, narrow, and pointed; frontal lamina 1 shorter than the frontal process, broadly convex in outline; apex of frontal lamina 2 not extending beyond frontal lamina 1. Lateral margins of cephalon sub-parallel. Eyes large, bulging and nearly rectangular in shape. Maxillipedal endognath with a single coupling hook; last palp article with a conspicuous fringe of long setae on outer border. Pleotelson elongate, with a distinct elongate median projection on posterior margin.

LOCATION OF TYPE: Museum of Comparative Zoology, Cambridge, Massachusetts; Cat. No. 6730, two specimens.

TYPE LOCALITY: Santa Barbara, California.

MEASUREMENTS OF TYPE: Length 42 mm., width 7.5 mm.

MEASUREMENTS OF SPECIMENS OTHER THAN TYPE: Figured male, length 19.2 mm., width (at second peraeon somite) 3.0 mm.; large male, length 39.0 mm., width 5.5 mm.; large ovigerous female, length 24.0 mm., width 5.0 mm.

ECOLOGY: Most of the specimens examined from northern California localities were collected at a depth of 25–35 feet and a very few were collected from the surface. It appears that as far as northern California localities are concerned the species is typically sub-intertidal. A number of ovigerous female specimens were collected in waters off Dillon Beach during the months of July and October, 1947.

SPECIMENS EXAMINED: A total of 41 male and 60 female specimens were examined from localities in northern California, Oregon, and Washington.

The species *Idothea (I.) ochotensis* Brandt appears to be very closely related to *I. (I.) fewkesi*. Some specimens identified by Richardson as *I. (I.) ochotensis* from the Bering Islands which the writer has examined differ only very slightly from specimens of *I. (I.) fewkesi* taken in northern California. The northern California specimens have telsons with distinct postero-lateral angles and a posterior median projection that is blunt at the

apex. The Bering Islands specimens differ, so far as I can determine, only in having less distinct postero-lateral telson angles and a more pointed posterior median telsonic projection. Such differences do not appear to merit consideration as specific differences, although they may very well be of considerable subspecific importance.

Although *I. (I.) fewkesi* is certainly a California species, Fee records it at Departure Bay, British Columbia, without any mention of *I. (I.) ochotensis*, a species previously recorded from areas near there. Gurjanova not only recorded *I. (I.) fewkesi* as a component of the Alaskan fauna but *I. (I.) ochotensis* as well and further described a species which is, in my opinion, doubtfully distinct from *I. (I.) ochotensis*, placing Richardson's 1899 and 1900 records for that species in synonymy with her new but inadequately described *I. (I.) aleutica*.

It appears clear that the species related to *I. (I.) ochotensis* and *I. (I.) fewkesi*, presented in the following list, are very poorly distinguished from one another and are in need of careful study and redescription before their validity can be either questioned or substantiated.

1. *Idothea (I.) aleutica* Gurjanova, 1933 pp. 91-92, 103, figs. 9-10, type locality, Komandor Islands. Range, Aleutian Islands to northwestern coast of North America.

2. *Idothea (I.) derjugini* Gurjanova, 1933, pp. 91, 103, figs. 7-8, Japanese Sea and southern part of Okhotsk Sea.

3. *Idothea (I.) fewkesi* Richardson, 1905a, pp. 359-360, figs. 387-388. See synonyms listed in this paper for this species.

4. *Idothea (I.) ochotensis* Brandt, 1851, pp. 145-146, pl. VI. Type locality and range, Okhotsk Sea to northern California. See also: Richardson, 1905a, pp. 366-367, figs. 396-397, and synonyms, 1905b, pp. 216; Gurjanova, 1933, pp. 93-94, 104, fig. 13; Hatch, 1947, p. 219 (references only, not the specimens recorded by Dr. Hatch which are specimens of *I. (P.) montereyensis* Maloney, see p. 185 in this paper).

***Idothea (Idothea) urotoma* Stimpson, 1864.**

(Plate 2, figures A-J).

Idothea urotoma STIMPSON, 1864, p. 155.—MIERS, 1883, p. 34.—RICHARDSON, 1899a, p. 845; —1899b, p. 264; —1900a, p. 226.

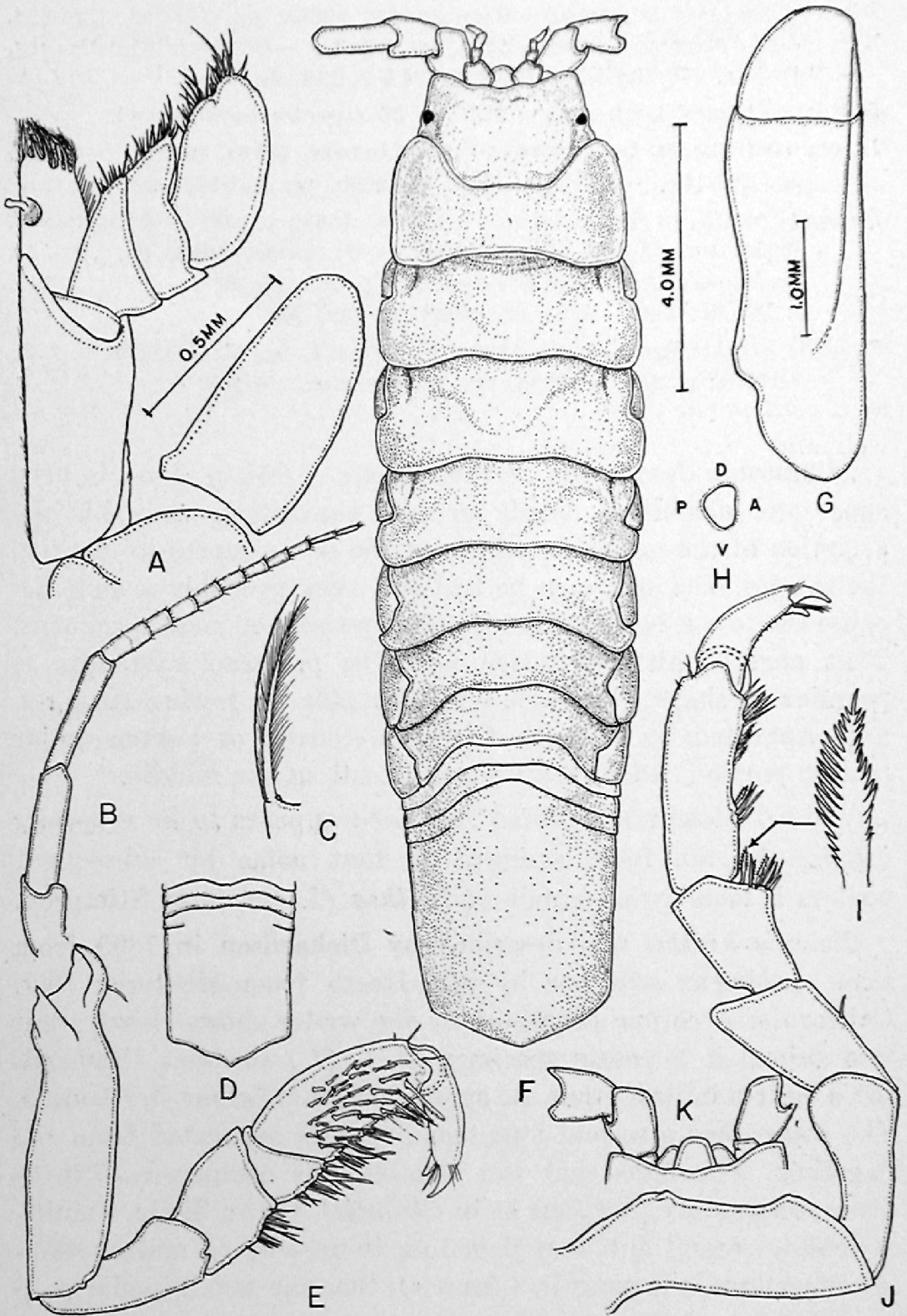


Plate 2. *Idothea (Idothea) wrotoma* Stimpson. Figure A. maxilliped; B. second antenna; C. plumose seta at outer distal angle of uropodal basal segment, inner surface; D. telson, male; E. first pereopod; F. adult female, dorsal surface; G. uropod; H. eye, lateral view; I. apex of spinulate seta of seventh pereopod; J. seventh pereopod; K. cephalon, dorsal view.

- Idothea urotoma* STIMPSON.—RICHARDSON, 1905a, pp. 358-359, fig. 386.
—JOHNSON AND SNOOK, 1935, pp. 289-290. —RICKETS AND CALVIN,
1939, p. 155, fig. 74. —HATCH, 1947, p. 218, fig. 94.
- Idotea rectilinea* LOCKINGTON, 1877, p. 36 (*species inquirenda*).
- Idotea rectilineata* LOCKINGTON, —RICHARDSON, 1899a, p. 845; —1899b,
pp. 264-265; —1900a, p. 226; —1900b, pp. 131-133, fig. 5.
- Idothea rectilinea* LOCKINGTON. —MIERS, 1883, p. 34. —RICHARDSON,
1905a, pp. 360-362, figs. 389-391. —STAFFORD, 1912, pp. 124-127,
fig. 7. —JOHNSON AND SNOOK, 1935, p. 289, fig. 243. —LIGHT, 1941,
p. 88, fig. 560. —HEWATT, 1946, p. 199, 204.
- Cleantis heathii* RICHARDSON, 1899a, pp. 851-852, fig. 25; —1899b, p. 272;
—1900a, p. 229, —1905a, pp. 407-408, figs. 457-458.

Stimpson's description of this species (1864, p. 155) is very short and elucidates mostly generic characters. Only his description of the posterior margin of the telson serves to identify the species. The specimen he had was very probably a male because the telson he describes is characteristic of male specimens. That part of his description is, "The posterior extremity is peculiar in shape, the angle on either side projecting strongly, and separated by a notch from the convex or subtriangular middle portion, which bears a small tooth at the middle."

While Lockington's *Idotea rectilinea* appears to be a *species inquirenda*, the form assigned to that name by subsequent writers is merely the female of *Idothea (I.) urotoma* Stimpson.

Cleantis heathii was described by Richardson in 1899 from some specimens sent her by Mr. Heath from Monterey Bay, California. A cotype examined by the writer shows clearly that this animal is a young specimen of *I. (I.) urotoma*. Richardson's figures indicate that the species does not belong in *Cleantis*. The cotype has a second antennal peduncle separated from the flagellum. The facts that the pleotelson is composed of three distinct segments (not four as in *Cleantis*), that a distinct multi-articulate second antennal flagellum is present (a multi-articulate flagellum is lacking in *Cleantis*), that the maxillipedal palp is composed of four articles (five articles in *Cleantis*), seem sufficient evidence that the species does not belong in *Cleantis*.

It is perhaps pertinent to remark here that young specimens of *Idothea* and *Pentidotea* have a second antennal flagellum composed of fewer segments than have adult specimens.

DIAGNOSIS: Supra-antennal line with a slight median emargination on either side of which is a small convexity. Frontal process elongate, apex blunt; frontal lamina 1 medially not exceeding the length of frontal process and having produced sides and a deep median concavity; frontal lamina 2 not visible in dorsal view. Lateral margins of cephalon converging anteriorly. Eyes small and quadrangular in shape. Maxilliped with a single coupling hook, last segment of palp lacking long setae on outer border. Posterior border of pleotelson triangular; in female specimens the postero-lateral borders are usually not irregular while in male specimens the first half of each postero-lateral border is slightly concave and the postero-medial part is convex and provided with a distinct but minute median tooth. Conspicuous, short, posteriorly projecting, postero-lateral angles are formed on the telsons of some male specimens.

TYPE LOCALITY: Puget Sound, Washington.

LOCATION AND NUMBER OF THE TYPE: The types appear to have been lost.

MEASUREMENTS OF TYPE: None given.

MEASUREMENTS OF SPECIMENS OTHER THAN THE TYPE: Figured ovigerous female, length 16.2 mm., width 4.0 mm.; large male, length 8.7 mm., width 1.8 mm.

ECOLOGY: From all of the records examined and from collections made in northern California it appears that the species is most abundant in the mid-intertidal zone of exposed rocky coast localities. Hewatt records it as a subtidal species at Santa Cruz Island. There is one record in the Pacific Marine Station collections of a specimen from a protected bay locality at Nick's Cove, Tomales Bay, Marin County, California. Most of the specimens were found on the under surface of rocks encrusted with bryozoa. Ovigerous specimens were collected during the months of April, May, and July.

GEOGRAPHIC RANGE: Puget Sound to Ensenada, Lower California, and the Channel Islands, Catalina Harbor and Santa Cruz Island.

SPECIMENS EXAMINED: A total of eight male and nine female specimens were examined from localities in Marin County, California.

Idothea (Idothea) rufescens, Fee, 1926.

(Plate 3, figures A-F).

Idothea rufescens FEE, 1926, p. 18 (30), pl. 1, fig. 12.—HATCH, 1947, p. 219, fig. 12.—MENZIES AND WAIDZUNAS, 1948, p. 111.

Fee's very brief description and semi-diagrammatic illustration of this species leave much to be desired. From the original description alone it is apparent that *I. (I.) rufescens* can be distinguished from *I. (P.) resecata* by two features only, viz., a four-segmented maxillipedal palp and a red or white color. Adult specimens of *I. (P.) resecata* have a five-segmented maxillipedal palp and are usually green in color. Menzies and Waidzunas placed *I. (I.) rufescens* in synonymy with *I. (P.) resecata* when they found young specimens of *I. (P.) resecata* to have a maxillipedal palp consisting of only four articles. These authors were further aware of the extreme color variation exhibited particularly by certain idotheid species. Although attempts to procure Fee's types have failed, by good fortune two female specimens were collected which may be Fee's species. Dr. Melville Hatch kindly loaned some specimens which he had identified as *I. (I.) rufescens*. Interestingly enough some of the specimens sent by Dr. Hatch were green in color, although they are doubtless identical with the red specimens I had collected. In most respects the specimens, including some ovigerous and therefore adult females, fit the description of *I. (I.) rufescens*; however, the epimeral plates at the fifth and seventh perion somites are of a different shape from those figured by Fee, being more rectangular than triangular. The posterior margins of those somites are medially convex and not concave as Fee indicates. Young specimens of the species identified as *I. (I.) rufescens* differ from young specimens of *I. (P.) resecata* in having ovoid eyes, an apically blunt frontal process, and peraeopods of a decidedly different structure. The eyes of *I. (P.) resecata* are pyriform and the frontal process apically pointed. The carpal segment of the seventh peraeopod of *I. (P.) rufescens* is considerably shortened as compared with that of *I. (P.) resecata* and the

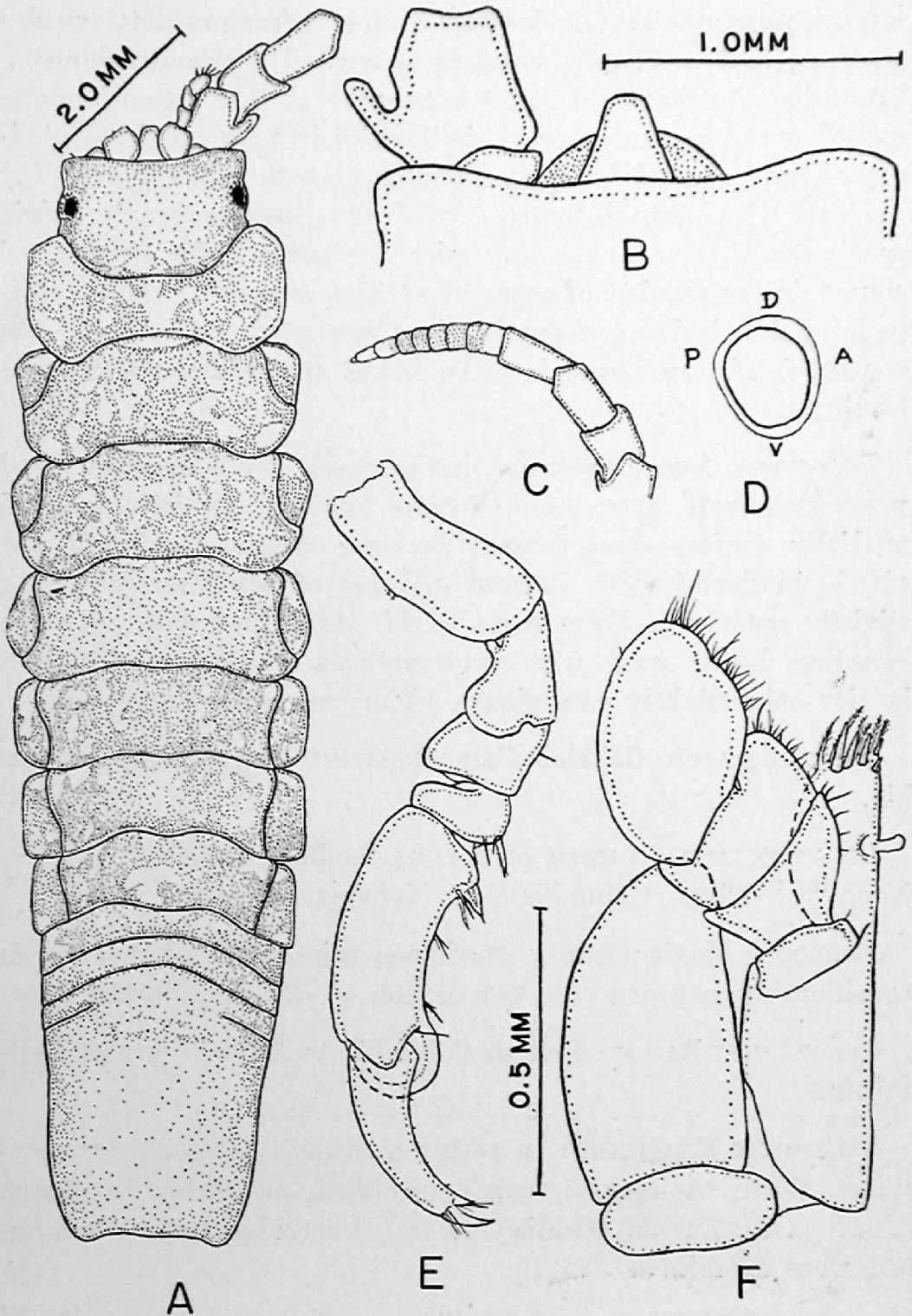


Plate 3. *Idothea (Idothea) rufescens* Fee. Figure A. female, dorsal view; B. cephalon, dorsal view, first antennae removed; C. second antenna; D. eye, lateral view; E. seventh pereopod; F. maxilliped.

largest propodal seta is located at the infero-proximal angle; whereas, that of *I. (P.) resecata* is located a considerable distance distal to that angle. This is a very real difference when one considers the generally great similarities in peraeopod morphology of two "related" species. Compare plate 7, figure E of *I. (P.) aculeata* with plate 8, figure C of *I. (P.) montereyensis*. Adult specimens of the two species under discussion differ further, of course, in the number of separate articles composing the maxillipedal palp. Judging from Marin County material alone, the species *I. (I.) rufescens* is to be found at exposed rocky coast localities.

DIAGNOSIS: Supra-antennal line very slightly concave, frontal process elongate, apex blunt; frontal lamina 1 semicircular and medially shorter than frontal process; frontal lamina 2 not visible in dorsal view. Lateral margins of cephalon diverging slightly anteriorly. Eyes large, ovoid. Maxilliped with only one coupling hook; palp with four articles. Posterior pleotelson border only slightly emarginate. Color red, white, or green.

TYPE LOCALITY: Gabriola Pass, Departure Bay, British Columbia.

LOCATION AND NUMBER OF TYPE: Pacific Biological Station, Nanaimo, British Columbia (?). Number not given.

ECOLOGY: Marin County specimens were collected in an area considerably exposed to wave action at the laminarian zone.

GEOGRAPHIC RANGE: British Columbia to Marin County, California.

SPECIMENS EXAMINED: In addition to the two specimens mentioned above, the several female specimens mentioned by Hatch (1947, p. 219) from Whidbey Island, Partridge Bay, Washington, were examined.

Subgenus **Pentidotea.**

The subgenus *Pentidotea* is represented in northern California by six species, *Idothea (Pentidotea) resecata* Stimpson, *I. (P.) stenops* Benedict, *I. (P.) wosnesenskii* (Brandt), *I. (P.) aculeata* Stafford, *I. (P.) montereyensis* Maloney, and *I. (P.)*

schmitti Menzies (= *Pentidotea whitei* Richardson, 1905a, non Stimpson, 1864, p. 155).

KEY TO THE NORTHERN CALIFORNIA SPECIES OF THE SUBGENUS PENTIDOTEA

1. Apex of frontal process entire. Maxilliped with one coupling hook. Eyes not markedly transversely elongate, length along body axis one-half or greater than one-half the width..... 2
- Apex of frontal process with a median notch..... 6
2. Frontal process blunt or widely angulate, not extending beyond frontal lamina 1. Frontal lamina 1 triangulate in dorsal view.....3
- A narrow, pointed frontal process exceeds considerably the forward extent of a semicircular frontal lamina 1..... 5
3. Postero-lateral margin of epimeral plate of seventh peraeon somite evenly convex, not acute. Eyes somewhat pyriform.....
..... *I. (P.) schmitti* Menzies
- Postero-lateral margin of epimeral plate of seventh peraeon somite acute. Eyes reniform or oval..... 4
4. First pleon somite with acute lateral borders. Eyes reniform.....
..... *I. (P.) wosnesenskii* (Brandt)
- First pleon somite with wide lateral borders. Eyes circular.....
..... *I. (P.) aculeata* (Stafford)
5. Telson posterior margin deeply concave, postero-lateral angles acute, each angle with a small but noticeable dorsal carina. Specimens usually found on *Zostera* sp.....*I. (P.) resecata* (Stimpson)
- Telson posterior margin usually convex, with a small but distinct median tooth; when concave then only slightly so and lacking acute postero-lateral angles and lacking any dorsal carina above each angle. Specimens usually found on *Phyllospadix* sp.....
..... *I. (P.) montereyensis* (Maloney)
6. Maxilliped with two coupling hooks. Eyes transversely elongate
..... *I. (P.) stenops* (Benedict)
- Maxilliped with one coupling hook. Eyes oval.....
..... Some adult specimens of *I. (P.) aculeata* (Stafford)

***Idothea (Pentidotea) stenops* (Benedict, 1898).**

(Plate 4, figures A-E; plate 9; figures A-B).

Idotea stenops BENEDICT, 1898, pp. 54-55, fig. 13.—RICHARDSON, 1899a, p. 846;—1899b, p. 266;—1900a, p. 227; 1904a, p. 219;—1904b, p. 663.

Pentidotea stenops (BENEDICT),—RICHARDSON, 1905a, pp. 375-376, figs. 407-408.—RICKETTS AND CALVIN, 1939, p. 128, fig. 63.—LIGHT, 1941, pp. 88, 92.—HATCH, 1947, p. 217, fig. 91.

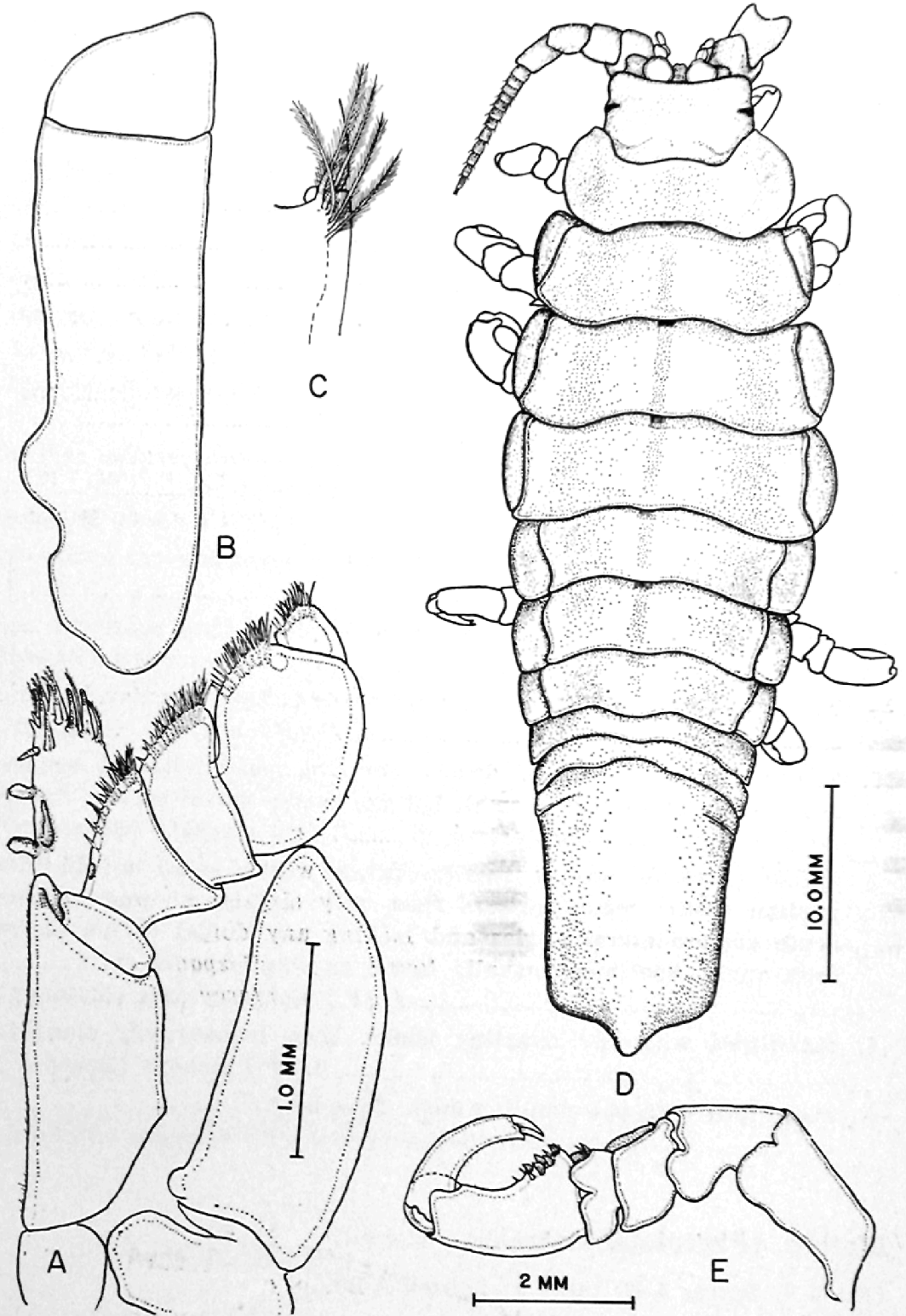


Plate 4. *Idothea (Pentidotea) stenops* (Benedict). Figure A. Maxilliped; B. uropod; C. plumose setae at outer distal angle of uropodal basal segment, inner surface; D. male, dorsal view; E. seventh pereopod.

No difficult synonymy is encountered for this species, the original description and figures of the species being quite adequate for subsequent recognition.

DIAGNOSIS: Supra-antennal line slightly concave; frontal process elongate, apex notched, and exceeding the forward extent of frontal lamina 1; frontal lamina 1 triangulate; frontal lamina 2 not visible in dorsal view. Eyes transversely elongate and narrow. Maxilliped with two coupling hooks. First pleon somite with lateral borders straight, not acutely pointed. Telson with sharply rounded postero-lateral angles and a produced posterior median projection.

Specimens of this species normally attain a size larger than that known for any other species of *Idothea* (*sensu lato*) occurring on the Pacific coast of North America.

TYPE LOCALITY: Monterey, California.

LOCATION AND NUMBER OF THE TYPE: Type in United States National Museum collections, Cat. No. 2276.

MEASUREMENTS OF TYPE: Not given.

MEASUREMENTS OF SPECIMENS OTHER THAN THE TYPE: Figured male, length 53.0 mm, width 15.0 mm, large ovigerous female, length 42.3 mm, width 14.2 mm.

ECOLOGY: Some of the specimens examined were collected from the lowest intertidal reaches of exposed rocky coast localities. A considerable number of specimens were taken from the stomachs of the fish *Hexagrammos* sp. One ovigerous specimen was collected during the month of June.

GEOGRAPHIC RANGE: Coos Bay, Oregon (Hatch, 1947, p. 217) to Monterey Bay, California. Hatch's Alaskan record for this species giving Richardson (1909, p. 109) as a reference is probably incorrect in that Richardson records three species on that page none of which is *I. (P.) stenops*.

SPECIMENS EXAMINED: A total of eight male, three female, and four young specimens were examined from northern California localities.

***Idothea* (*Pentidotea*) *schmitti* Menzies, new species.**

(Plate 5, figures A-F; Plate 9, figures G-H).

Idotea Whitei STIMPSON, 1864, p. 155 (*species inquirenda*).

Idotea whitei STIMPSON.—MIERS, 1883, pp. 42-43.—RICHARDSON, 1899a, pp. 846-847;—1899b, p. 266;—1900a, p. 227.

Pentidotea whitei STIMPSON.—RICHARDSON, 1905a, pp. 373-374, figs. 405-406;—1909, p. 109.—GURJANOVA, 1936, p. 260.—RICKETTS AND CALVIN, 1939, p. 128.—HATCH, 1947, p. 217, fig. 92.

Stimpson's description of *Idothea whitei* is much too incomplete and general for his species to be identifiable today. Miers' concept of what Stimpson's species was like fits the description of two species *I. (P.) whitei* (of Richardson) and *I. (P.) aculeata* Stafford. Richardson's description and figures (1905) definitely set the pattern for subsequent reference to the species; however, it should be noted that her concept of *I. (P.) whitei* can scarcely represent Stimpson's concept of the species. Stimpson writes: "Body slender—outer antennae nearly two-thirds as long as the body,—(abdomen) slightly narrowing posteriorly, with the extremity rounded, truncate, and bluntly acuminate at the middle.—it is allied to *I. Wosnesenskii*, but is very much more elongated." (1864, p. 155). Such a description applies much better to the form of *I. (P.) montereyensis* Maloney than that of *I. whitei* (of Richardson). The body of Richardson's *I. whitei* is not narrow but fairly broad, being very similar to that of *I. (P.) wosnesenskii*. In *I. (P.) montereyensis* the body is indeed narrow in comparison to that of *I. (P.) wosnesenskii*. The second antennae of Richardson's *I. whitei* do not nearly approach two-thirds the body length, while such is more nearly the case in certain specimens of *I. (P.) montereyensis*. The telson is bluntly acuminate at the middle in both species as it is also in *I. (I.) fewkesi* which species perhaps might also be identified with Stimpson's *I. whitei*. Whether one prefers to recognize Stimpson's species or not it appears clear that the form he described is not the same as the one which Richardson called *I. whitei* and that Richardson's species is in reality a species new to science. It is with considerable pleasure that I name this species in honor of Dr. Waldo L. Schmitt, Head Curator, Department of Zoology, United States National Museum, who has contributed greatly to science not only through his very valuable pub-

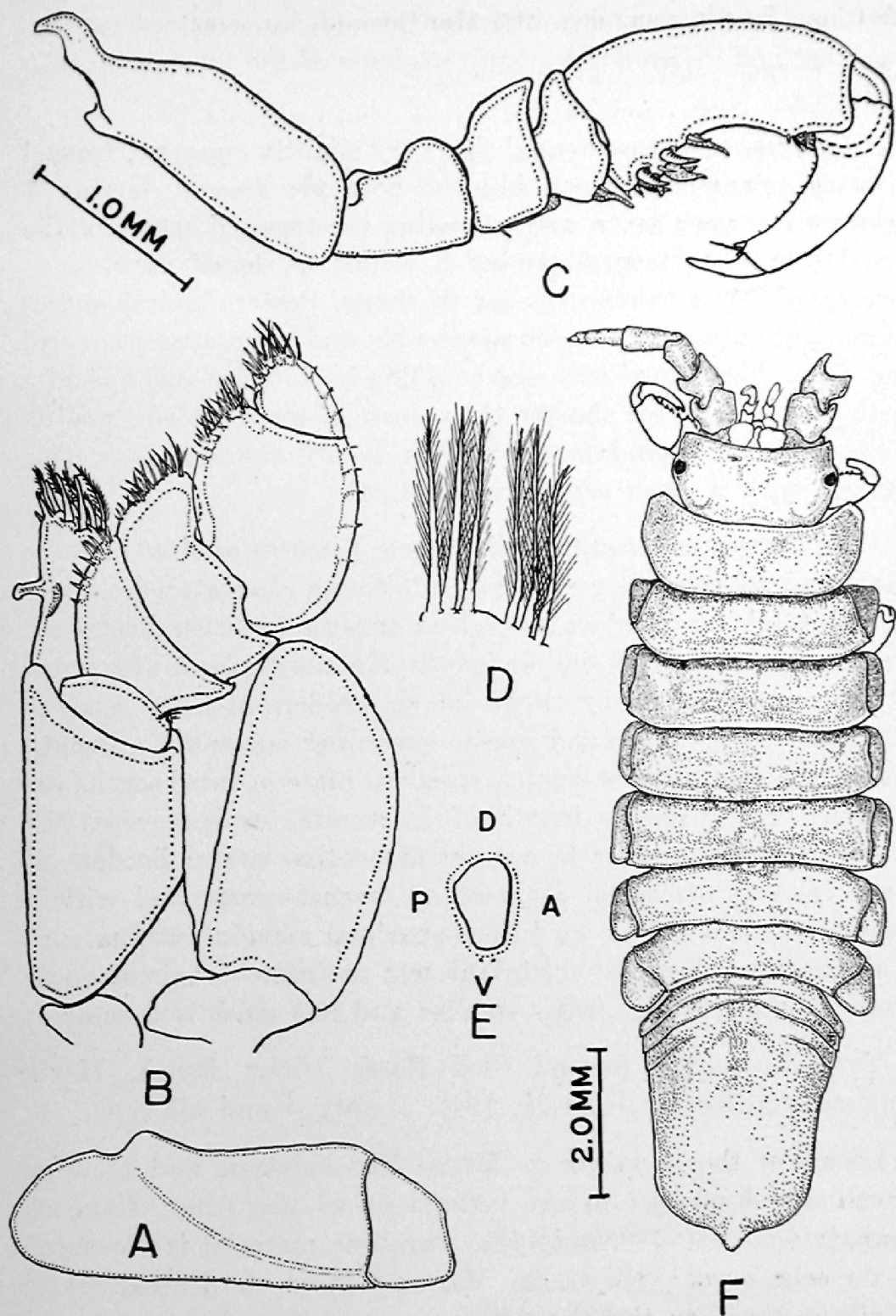


Plate 5. *Idothea (Pentidotea) schmitti* Menzies. Figure A. uropod; B. maxilliped; C. seventh pereopod; D. plumose setae at outer distal angle of uropodal basal segment, inner surface; E. eye, lateral view; F. holotype, dorsal view.

lications on the crustacea but also through his constant encouragement and assistance to many students of the marine invertebrates.

DIAGNOSIS: Supra-antennal line very slightly concave; frontal process triangulate, apex bluntly pointed; frontal lamina 1 triangulate, apex acute, and exceeding the forward extent of the frontal process; frontal lamina 2 visible in dorsal view, apex truncated. Eyes subrectangular in shape. Postero-lateral angles of epimeral plates of peraeon somites six and seven evenly curved, not acute. Maxilliped with one coupling hook. First pleon somite with lateral margins shorter than those of second pleon somite. Telson with postero-lateral margins evenly rounded, posterior margin with a short acute median tooth.

DESCRIPTION (diagnostic and generic features omitted): Body short and robust. Color generally pink with characteristic white patches on dorsum and on uropods at articulation with pleotelson. Peraeon somites all of similar length. Epimeral plates of somites 4 to 7 appear to occupy entire lateral borders of those somites. Epimeral plates of second somite exceeding one-half the length (along midline) of that somite, epimeral plate of third somite exceeding two-thirds the length of its somite; in both cases the epimeral plates appear to occupy the entire lateral borders of their somites. Propodal segment of seventh peraeopod with a cluster of strong setae on infero-proximal margin, carpus with a single, large, heavily chitinized seta at infero-proximal angle which is bordered by many smaller and less chitinized setae.

TYPE LOCALITY: Second Sled Road, Dillon Beach, Marin County, California, June 28, 1946. Holotype and allotype.

LOCATION AND NUMBER OF TYPE: The holotype and allotype have been deposited in the collections of the Allan Hancock Foundation, Nos. 462 and 462a. Paratype material is deposited in the collections of the Pacific Marine Station, the United States National Museum, and the Allan Hancock Foundation.

MEASUREMENTS OF TYPES: Holotype female, length 13.5 mm., width 4.0 mm. Allotype length 30.0 mm., width 8.0 mm.

ECOLOGY: Most specimens examined were collected from rocky coast localities, generally at the laminarian zone. A few speci-

mens were taken from the surface at a night light near the channel entrance to Tomales Bay, Marin County, California. Two ovigerous specimens were collected during the month of February.

GEOGRAPHIC RANGE: Bering Sea to Monterey Bay, California.

SPECIMENS COLLECTED: A total of eight male and four female specimens that had been collected from various localities in northern California were examined.

***Idothea (Pentidotea) wosnesenskii* (Brandt, 1851).**

(Plate 6, figures A-K; Plate 9, figures E-F).

Idotea Wosnesenskii BRANDT, 1851, p. 146.

Idotea wosnesenskii BRANDT.—STIMPSON, 1857b, p. 504.—BATE, 1866, p. 281.—MIERS, 1883, p. 40.—RICHARDSON, 1899a, p. 846;—1899b, p. 265;—1900a, p. 227;—1904a, p. 218 or 216;—1904b, p. 663;—1905b, p. 216.

Idotea media DANA, 1854, p. 175.—BATE, 1866, p. 282. (taken from RICHARDSON, 1905a, p. 370). (Probably *species inquirenda*.)

Idotea hirtipes DANA, 1852, (1853), p. 704, pl. 46, fig. 6.

Idotea Oregonensis DANA, 1854, p. 175, new name for *I. hirtipes* DANA, 1852.

Pentidotea wosnesenskii BRANDT.—RICHARDSON, 1905a, pp. 370-373, figs. 402-404;—1909, p. 109.—FEE, 1927, pp. 19-20.—JOHNSON AND SNGOK, 1935, p. 290, fig. 246.—GUBERLET, 1936, pp. 340-341, 1 pl.—GURJANOVA, 1936, p. 259-260.—RICKETTS AND CALVIN, 1939, p. 126, fig. 62.—LIGHT, 1941, p. 87, 88, figs. 55a, 56a-b.—HATCH, 1947, pp. 216-217, figs. 88-89, 162 (var *exlinae* Hatch).

Brandt's original description is today recognizable and thus few difficulties in synonymy are encountered.

Dana's *I. media*, which he considered related to *I. oregonensis*, should be considered a *species inquirenda* in that the description is hardly more than generic. It applies equally well to a number of known species, such as, *I. (P.) montereyensis* Maloney, *I. (P.) stenops* Benedict, and *I. (P.) schmitti* Menzies.

DIAGNOSIS: Supra-antennal line evenly concave; frontal process wide, with a blunt evenly rounded apex, and is shorter than frontal lamina 1; frontal lamina 1 wider than frontal process and triangulate in shape; frontal lamina 2 visible in dorsal view, triangulate, apex blunt. Eyes reniform, with convex edge

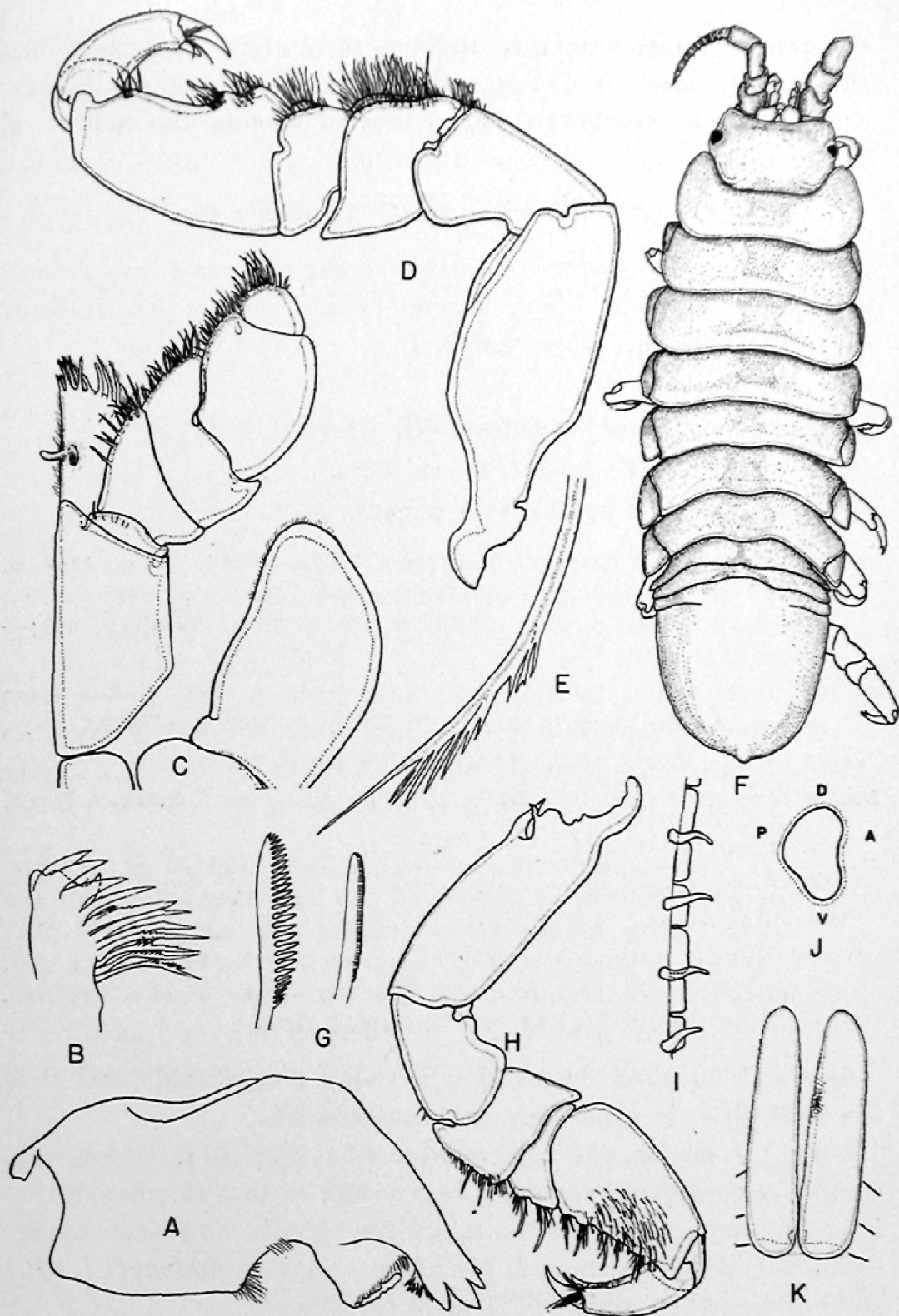


Plate 6. *Idothea (Pentidotea) wosnesenskii* Brandt. Figure A. left mandible; B. lacinoid seta and setal row of right mandible; C. maxilliped; D. seventh pereopod, male; E. the most proximal seta in setal row of right mandible; F. male, dorsal view; G. comb-like setae of first pereopod; H. first pereopod; I. setae and scale-like structures of inferior margin of dactyl of first pereopod; J. eye, lateral view; K. penis.

directed posteriorly. Maxilliped with a single coupling hook. Epimeral plates of seventh peraeon somite with acute postero-lateral edges. First pleon somite with acute lateral edges. Telson with an evenly rounded posterior margin having no suggestion of postero-lateral angles and having a minute median tooth.

TYPE LOCALITY: No exact location is given for the species in the original description although the following areas are noted: "Ochotskischen Meere, ferner bei den Inseln Attu, Atcha, St. Paul, Kadjak, Sitcha, und an der Nord-Californischen Kuste."

LOCATION AND NUMBER OF TYPE: These data are not known to the writer.

MEASUREMENTS OF TYPE: Not given.

MEASUREMENTS OF SPECIMENS OTHER THAN THE TYPE: Figured male, length 23.0 mm., width 6.0 mm.; large male, length 36.4 mm., width 9.6 mm.; large ovigerous female, length 25.0 mm., width 7.9 mm.

ECOLOGY: Specimens of this species were collected mostly from the mid-intertidal zones of the protected and open rocky coast. One specimen was taken in a surface plankton haul at the mid channel entrance to Tomales Bay, another was collected on rocks near Marshalls, Tomales Bay. Such bay occurrences are, however, unusual and not typical of the species' ecology. The species is commonly a member of the *Mytilus* bed biotope, although specimens were collected on the alga *Ulva* outside of the *Mytilus* biotope and less frequently on other species of algae in the middle and upper intertidal zones. Ovigerous specimens were noticed in July.

GEOGRAPHIC RANGE: Okhotsk Sea to Estero Bay, San Luis Obispo County, California.

***Idothea (Pentidotea) aculeata* Stafford, 1913.**

(Plate 7, figures A-G; Plate 9, figures I-J).

(Text figure 2).

Pentidotea aculeatus STAFFORD, 1913a, p. 165.

Pentidotea aculeata STAFFORD, 1913b, pp. 185-188, figs. 8-10.—JOHNSON AND SNOOK, 1935, p. 290, fig. 245.—HEWATT, 1946, p. 199.

This species is one of the best originally described and figured species in the genus. The young differ somewhat from the adults and the following diagnosis applies primarily to young specimens, although it is applicable to adults as well.

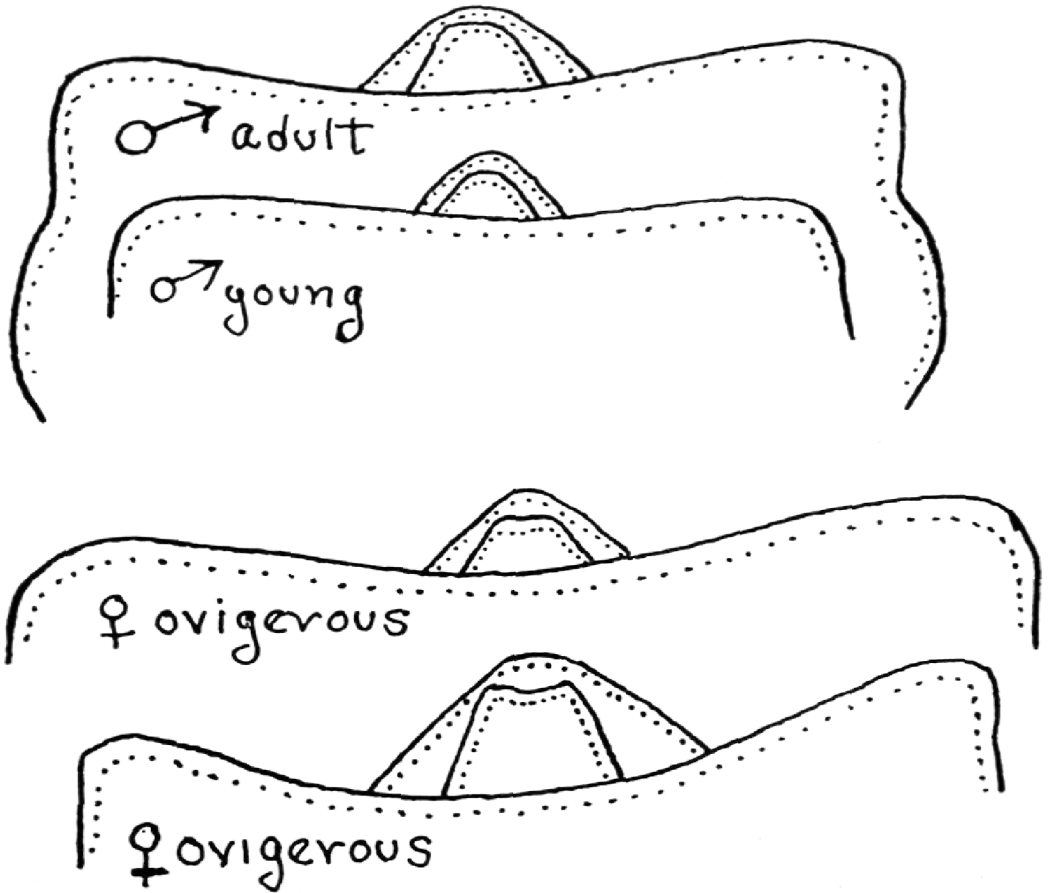


Figure 2. *Idothea (P.) aculeata* Stafford. Variations in the form of the frontal process. All specimens taken from the subintertidal at La Jolla, California.

DIAGNOSIS: Supra-antennal line concave; frontal process broadly triangulate with apex bluntly acuminate and often somewhat concave, frontal process shorter than frontal lamina 1; frontal lamina 1 broadly triangulate; frontal lamina 2 not visible in dorsal view. Eyes almost circular. Maxilliped with a single coupling hook. Epimeral plate of peraeon somites six and seven with acute postero-lateral angles. First pleon somite with long straight lateral borders. Telson elongate, with slightly concave postero-lateral borders and a large, elongate, bluntly pointed, median posterior projection the base of which nearly covers the median one-third of the posterior margin of the telson.

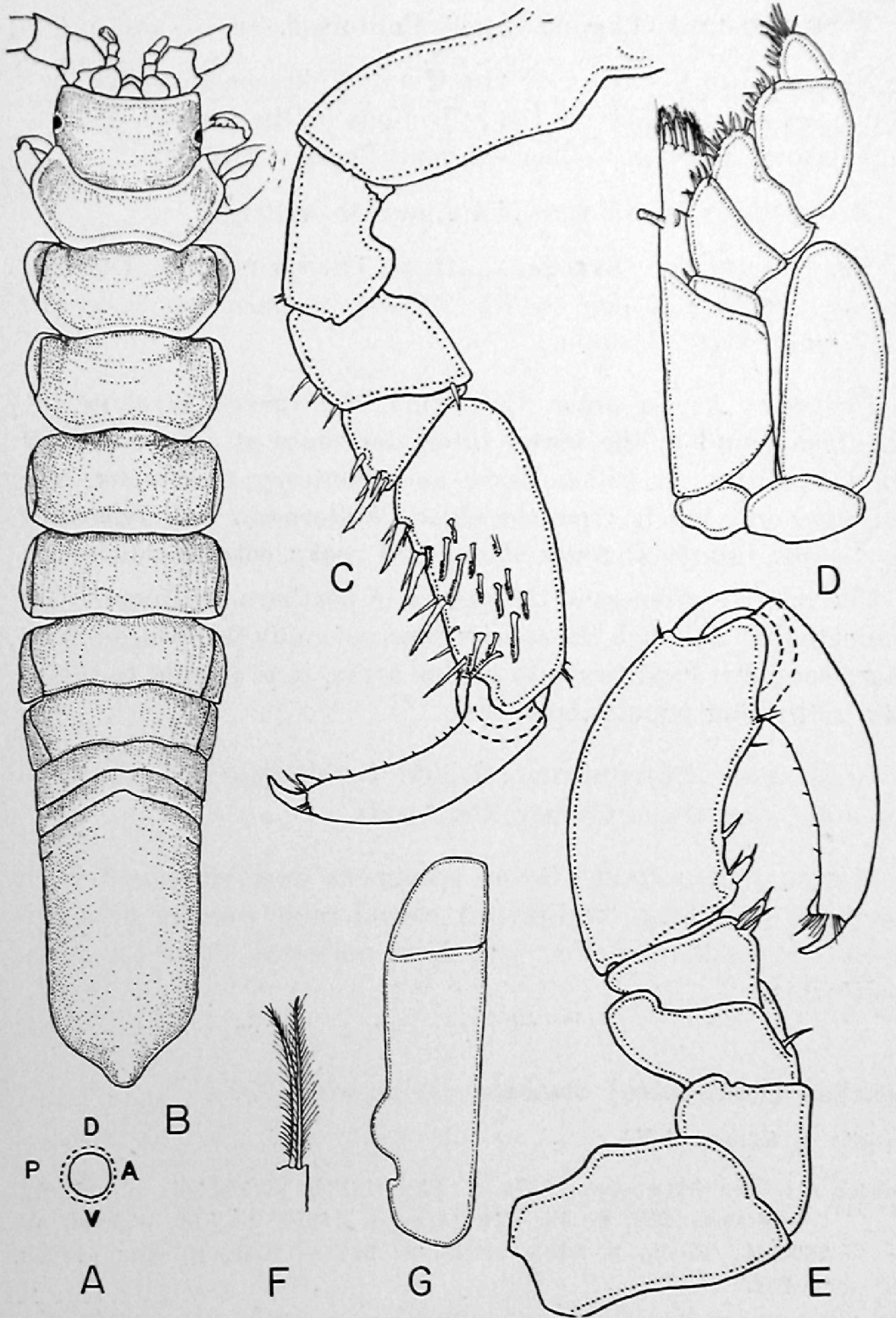


Plate 7. *Idothea (Pentidotea) aculeata* Stafford. Figure A. eye, lateral view; B, young female, dorsal view; C. first peraeopod; D. maxilliped; E. first peraeopod; F. plumose setae at outer distal angle of uropodal basal segment, inner surface; G. uropod.

TYPE LOCALITY: Laguna Beach, California.

NUMBER AND LOCATION OF THE TYPE: Unknown to writer, but the types are probably in the collections of the Laguna Marine Laboratory, Pomona College, Laguna Beach, California.

MEASUREMENTS OF TYPE: Not known to writer.

MEASUREMENTS OF SPECIMENS OTHER THAN THE TYPE: Figured female, length 13.0 mm., width 2.2 mm.; mature female, length 16.7 mm., width 3.0 mm.

ECOLOGY: At La Jolla, California, the species is abundant on algae found in the lowest intertidal zones at exposed rocky coast localities. At Dillon Beach and Monterey, specimens were collected only rarely from the algae *Phyllospadix* and *Bossea* at the lowest intertidal zones at exposed rocky coast localities.

The relative rareness of the species in northern California may indicate that although the species is occasionally introduced from more southern localities into colder areas, it is unable to maintain a thriving population there.

GEOGRAPHIC DISTRIBUTION: Dillon Beach, Marin County, to La Jolla, San Diego County, California.

MATERIAL EXAMINED: Seven specimens were examined from northern California localities. A considerable number of specimens were examined that had been collected from La Jolla, California.

***Idothea* (*Pentidotea*) *resecata* (Stimpson, 1857).**

(Plate 8, figures A-F).

Idotea resecata STIMPSON, 1857a, p. 88;—1857b, p. 504-505, pl. 22, fig. 7;—MIERS, 1853, p. 45.—RICHARDSON, 1899a, p. 844;—1899a, pp. 263-264; 1900a, p. 226;—1904a, p. 216;—1904b, p. 661;—1905b, p. 216.

Pentidotea resecata (STIMPSON).—RICHARDSON, 1905a, pp. 369-370, figs. 400-401.—SEARLE, 1914, p. 364.—HALE, 1924, p. 220.—FEE, 1926, p. 19.—JOHNSON AND SNOOK, 1935, p. 290, fig. 244.—GUBERLET, 1936, pp. 338-339, 1 pl.—RICKETTS AND CALVIN, 1939, p. 155, fig. 73.—LIGHT, 1941, pp. 87-92, fig. 56c.—HEWATT, 1946, p. 201.—HATCH, 1947, p. 218, fig. 93.—MENZIES AND WAIDZUNAS, 1948, pp. 107-113, figs. 1-20.

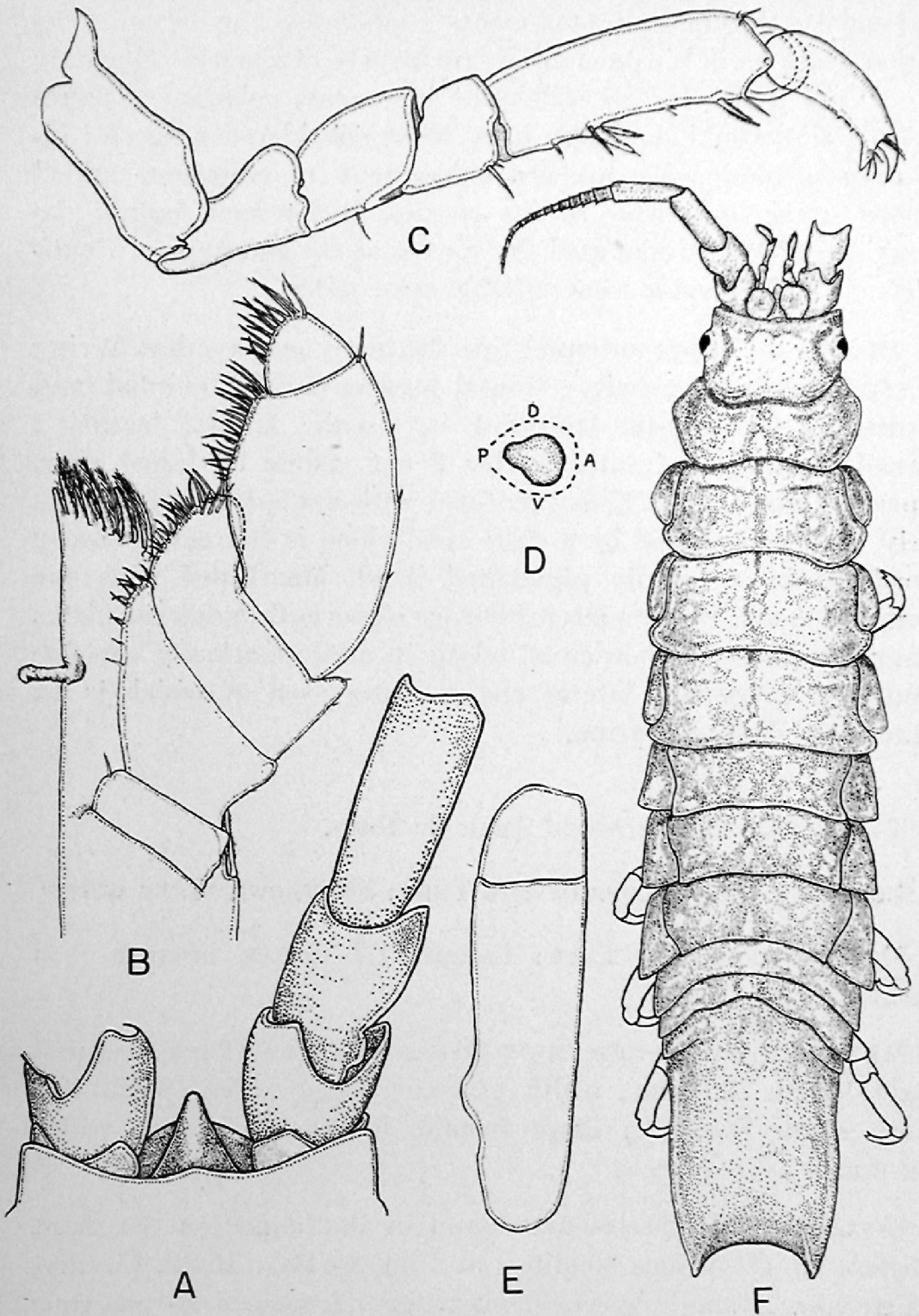


Plate 8. *Idothea (Pentidotea) resecata* (Stimpson). Figure A. cephalon, dorsal view, first antenna removed; B. maxilliped; C. seventh pereopod; D. eye, lateral view; E. uropod; F. male, dorsal view.

Stimpson's original description is recognizable as valid today primarily through his statements concerning the telson. The other features in his description are largely of generic value only and were it not for his somewhat inaccurate subsequent figure his species would doubtless have to be considered a *species inquirenda* today. Researchers subsequent to Stimpson added little to the knowledge of the species. Richardson figured the maxilliped, Hale designated the species as the genotype of *Pentidotea*, and Fee made some reliable color notes.

DIAGNOSIS: Supra-antennal line distinctly concave but having a small median convexity; frontal process narrow, pointed, and exceeding the frontal lamina 1 in length; frontal lamina 1 broadly rounded; frontal lamina 2 not visible in dorsal view, apex minutely cleft. Eyes pyriform with apex directed posteriorly. Eye surrounded by a clear area which is characteristically bordered by a heavily pigmented band. Maxilliped with one coupling hook. Postero-lateral border of seventh epimeral plates angulate. Posterior border of telson in adult markedly concave and with projecting lateral angles above each of which is an anteriorly directed carina.

TYPE LOCALITY: Strait of Juan de Fuca.

LOCATION AND NUMBER OF THE TYPE: Not known to the writer.

MEASUREMENTS OF TYPE: Length 1.7 inches, breadth 0.33 inches.

MEASUREMENTS OF SPECIMENS OTHER THAN THE TYPE: Figured male, length 22.5 mm., width 4.0 mm.; large male, length, 40.0 mm., width 7.0 mm.; large female, length, 16.5 mm., width 3.0 mm.

ECOLOGY: This species was found in abundance on the plant *Zostera* sp. at various localities in Tomales Bay, Marin County, California. A single specimen was taken from a crab pot rope one mile north west of Dillon Beach in Bodega Bay. Some specimens loaned by the University of California were found in off-shore kelp beds at Monterey Bay, California. Richardson records the species from the open ocean off southern California. The species appears in spite of these records to be predominantly

an inhabitant of fairly quiet bay localities. Specimens were occasionally taken at the surface at a night light near the channel entrance to Tomales Bay. Ovigerous specimens were taken in July.

GEOGRAPHIC RANGE: Karta Bay, southeast Alaska to southern California.

MATERIAL EXAMINED: A total of 9 male, 4 female, and 21 juvenile specimens collected at various localities in Washington and northern California have been examined.

***Idothea* (*Pentidotea*) *montereyensis* Maloney, 1933.**

(Plate 10, figures A-K; Plate 9, figures C-D).

Pentidotea montereyensis MALONEY, 1933, pp. 146-147, fig. 2.

Stenosoma gracillimum DANA, 1854, p. 175 (*species inquirenda*).—STIMPSON, 1857b, p. 505.

Idotea gracillima DANA.—MIERS, 1883, p. 35.—RICHARDSON, 1899a, p. 844;—1899b, p. 264;—1900a, p. 226;—1904a, pp. 216-218;—1904b, pp. 661-663, figs. 2-3.—1905a, pp. 356-358, figs. 384-385.

Idothea ochotensis HATCH, 1947, p. 219 (not *I. ochotensis* of Brandt or Richardson).

Maloney described this species apparently unaware that specimens identical with it had been known previously under a different name because he makes no mention of synonyms in his description.

Dana described *Stenosoma gracillimum* so very incompletely that one wonders how it was possible for Richardson to assign any form to Dana's species. Certainly Dana's description is applicable to several of the species known during that time. A comparison of Richardson's specimens with paratypes of Maloney's species shows them to be identical. The specimens reported by Hatch as *Idothea ochotensis* belong, as an examination of his specimens indicated, to this species.

DIAGNOSIS: Supra-antennal line slightly concave; frontal process narrow, elongate, pointed, and exceeding the length of frontal lamina 1; frontal lamina 1 wide, semi-circular in outline; frontal lamina 2 not visible in dorsal view. Eyes about as long as wide, having an almost straight anterior border and a convex posterior border. Maxilliped with one coupling hook.

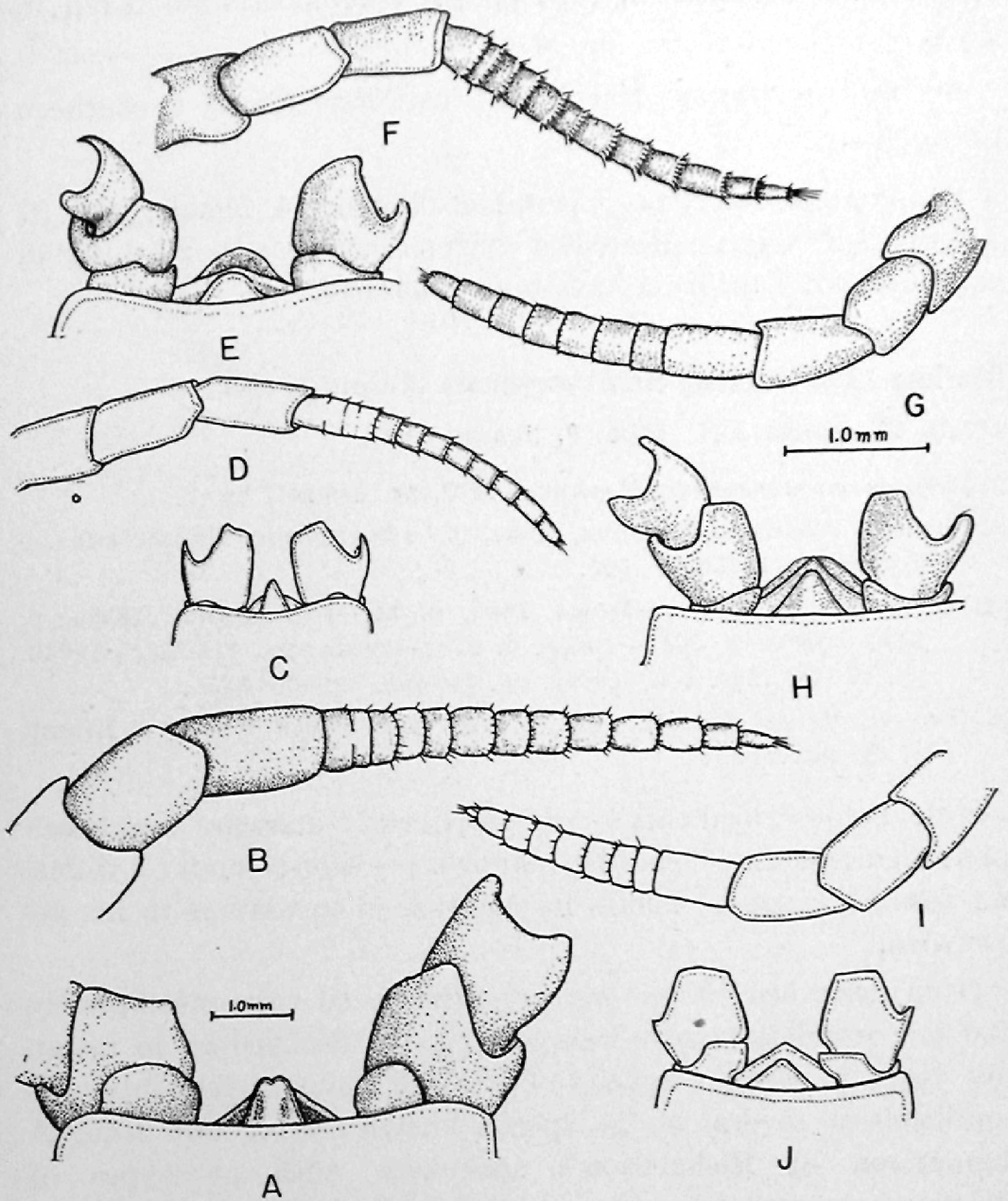


Plate 9. *Idothea (P.) stenops* Benedict. Figure A. cephalon, dorsal view, first antennae removed; B. second antenna. *Idothea (P.) montereyensis* Maloney. Figure C. cephalon; D. second antenna. *Idothea (P.) wosnesenskii* Brandt. Figure E. cephalon; F. second antenna. *Idothea (P.) schmitti* Menzies. G. second antenna; H. cephalon. *Idothea (P.) aculeata* Stafford. I. second antenna; J. cephalon.

Postero-lateral angle of seventh epimeral plates acute. First pleon somite with straight wide lateral borders. Posterior margin of telson slightly convex, postero-lateral margins evenly rounded, apex with a small tooth. In some, probably injured specimens, the posterior margin of the telson is truncate.

TYPE LOCALITY: Monterey Bay, California.

LOCATION AND NUMBER OF TYPE: United States National Museum, Cat. No. 66414.

MEASUREMENTS OF TYPE: Male, length 12.5 mm., width 3.75 mm.

MEASUREMENTS OF SPECIMENS OTHER THAN TYPE: Figured ovigerous female, length 13.2 mm., width 3.5 mm.; figured male, length 14.3 mm., width 2.0 mm.

ECOLOGY: Most specimens were collected at the lowest intertidal zone of exposed rocky coast localities on the eelgrass, *Phyllospadix* sp., although some were taken on other kinds of marine algae such as *Laminaria* and *Egregia*. Individuals collected from *Phyllospadix* were generally a light green in color, whereas those collected from *Laminaria* were usually dull purple-green in color. Specimens were frequently taken in tide pool plankton hauls and one specimen was collected in a surface plankton haul near the channel entrance to Tomales Bay. A considerable number were taken from fish stomachs. Ovigerous specimens were found during the months of August, October, and November.

GEOGRAPHIC RANGE: Seabeck, West Seattle, Washington, to Estero Bay, San Luis Obispo County, California. Both localities constitute extensions of the known range of this species.

SPECIMENS EXAMINED: A total of 113 male, 123 female, 39 juvenile specimens which had been collected at various localities from Washington to northern California were examined.

THE COMPOSITION AND DISTRIBUTION OF THE NORTHERN CALIFORNIA IDOTHEID FAUNA

Twelve species belonging to the genus *Idothea* (*sensu lato*) are known from the Pacific Coast of North America. Four of the

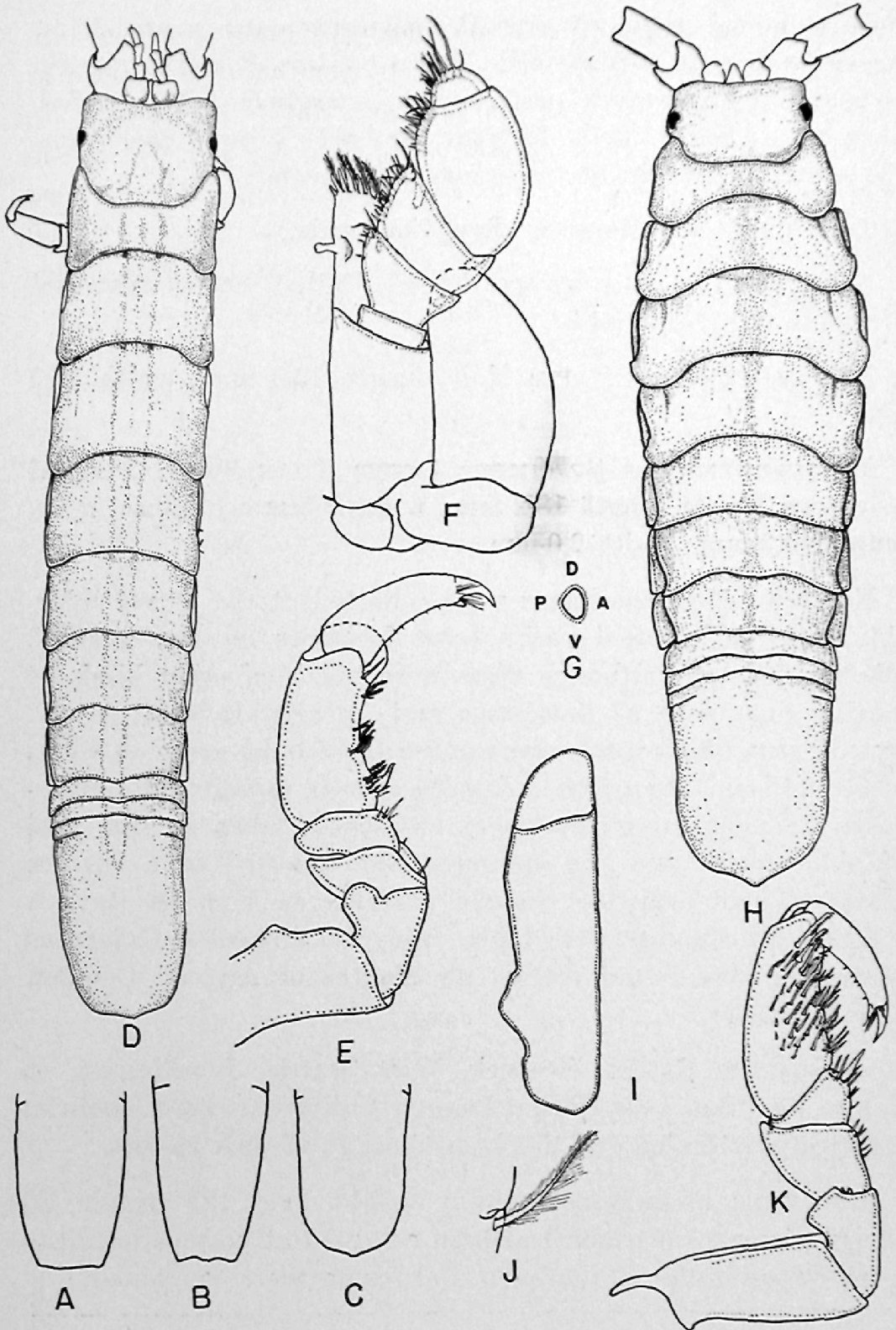


Plate 10. *Idothea (Pentidotea) montereyensis* Maloney. Figure A. telson, male; B. telson, female; C. telson, male; D. male, dorsal view; E. seventh peraeopod; F. maxilliped; G. eye, lateral view; H. female, dorsal view; I. uropod; J. plumose seta at outer distal angle of uropodal basal segment, inner surface; K. first peraeopod.

twelve do not appear to be specifically distinct from one another, at least as far as one can tell from the descriptions at present available. These four species are *Idothea* (*I.*) *ochotensis*, *I. (I.) aleutica*, *I. (I.) derjugini*, and *I. (I.) fewkesi*. The northern California fauna contains nine species including at least one of the above mentioned four. That species I prefer to call *I. (I.) fewkesi* for reasons mentioned earlier in this paper. One of the species known in the northern California fauna, *I. (P.) aculeata*, has not been reported north of California although it is a major component of the isopod fauna south of Point Conception. Four species, *I. (P.) schmitti*, *I. (P.) stenops*, *I. (P.) wosnesenskii*, and *I. (I.) rufescens* (excluding the three troublesome species, *I. (I.) ochotensis*, *I. (I.) aleutica*, and *I. (I.) derjugini* from the discussion) have not been recorded south of Monterey, California. Three species, *I. (I.) fewkesi*, *I. (P.) schmitti*, and *I. (P.) wosnesenskii* have similar recorded distributions along the entire Pacific Coast as far south as Monterey, California.

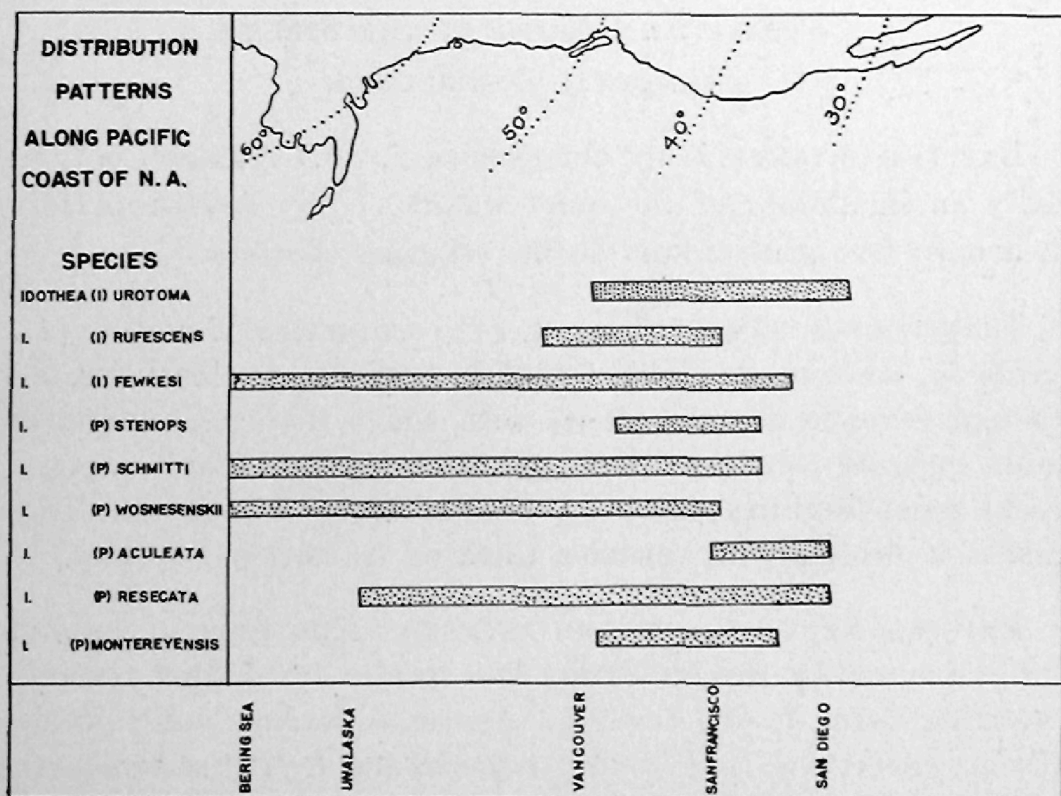


Figure 3. Distribution patterns of *Idothea* species along the Pacific Coast of North America.

It is of particular interest to note that almost all of the species belonging to *Idothea* (*sensu lato*) which have thus far been recorded from the Pacific Coast to North America are represented in the northern California fauna. Such a relationship does not obtain in the case of most genera belonging to the family Idotheidae. One genus, *Mesidotea*, has thus far not been reported south of Oregon. The genera *Cleantis*, *Eusymerus*, and *Colidotea*, on the other hand, have not been reported north of Point Conception, California. The genus *Synidotea*, which is represented in localities north of Washington by perhaps eight species, has but a single known species south of Point Conception, California. That species is *Synidotea harfordi* Benedict. The genus *Idothea* (*sensu lato*) is thus of further interest in having a relatively large number of species which are able to cross an oceanographic barrier which appears to impose very real limits to a rather considerable number of species and genera. The patterns of geographic distribution of the species considered in this report are summarized in text figure 3, p. 189.

COMPARATIVE ECOLOGY OF THE SPECIES HORIZONTAL DISTRIBUTION

BAY INHABITANTS: Only one species, *I. (P.) resecata*, is typically an inhabitant of the quiet waters of bay localities. Here it is most frequently found on the eel-grass, *Zostera*.

TRANSITIONAL: Two species, *I. (P.) wosnesenskii* and *I. (I.) urotoma*, were occasionally found in typical bay localities, although never in the abundance with which they were found at more exposed localities. Both species typically inhabit exposed rocky coast localities; however, their occurrence in bay localities makes it necessary to consider them as transitional species.

EXPOSED ROCKY COAST INHABITANTS: This type of habitat seems favored by the remaining five species (excluding the sub-intertidal form, *I. (I.) fewkesi*). As far as Marin County localities are concerned, *I. (P.) montereyensis* and *I. (P.) wosnesenskii* appear to be the dominant forms. *Idothea (P.) stenops* was collected only occasionally and *I. (I.) rufescens* and *I. (P.) aculeata* were found only rarely.

VERTICAL DISTRIBUTION

SUBINTERTIDAL SPECIES: Only one species, *I. (I.) fewkesi*, appears really to belong to this designation. It was taken in considerable numbers from a depth of 25–35 feet in Bodega Bay. An occasional record exists of this species being taken from the surface. No intertidal records are known, at least for Marin County; however, considering the relatively shallow habitat of the species an intertidal record would hardly be surprising.

TRANSITIONAL SPECIES: Here only one species, *I. (P.) stenops* need be mentioned, although certain others perhaps also belong to this designation. In areas from which that species was rarely taken intertidally it was found with surprising consistency in the stomachs of the sea-trout (*Hexagrammos* sp.) fished from the water beyond the lowest reaches of the minus one foot tide. One other species, *I. (P.) montereyensis*, also occurred in fish stomachs. Its great abundance in the intertidal zone in contrast to the scarcity of *I. (P.) stenops* makes this occurrence hardly unexpected.

INTERTIDAL SPECIES: It is to this classification that the majority of the species belong. Here they may be divided into two groups: those living in the upper intertidal, *Ulva-Mytilus* to *Egregia* zones; and those living in the lower *Phyllospadix-Laminaria* zones. Two species, *I. (P.) wosnesenskii* and *I. (I.) urotoma* belong in the first category. *Idothea (P.) wosnesenskii* was usually found in the *Mytilus* biotope; however, during unusual periods of abundance it was found also on the alga *Ulva* and other marine algae. In contrast to this, specimens of *I. (I.) urotoma* were encountered most frequently on the under surface of rocks encrusted by bryozoa. The remainder of the species, *I. (P.) montereyensis*, *I. (P.) aculeata*, *I. (P.) resecata*, *I. (P.) schmitti*, and *I. (I.) rufescens* were found on marine algae at the lowest reaches of the low tide.

Five species, *I. (P.) resecata*, *I. (P.) wosnesenskii*, *I. (P.) schmitti*, *I. (P.) montereyensis*, and *I. (I.) fewkesi*, were taken occasionally at the surface of the water in plankton hauls and with dip nets at night lights near the channel entrance to Tomales Bay, Marin County, California.

FORMS CONSIDERED SPECIES INQUIRENDAE IN THIS REPORT

Below is a list of species which I have preferred to place in a *species inquirendae* status. All are so very poorly described that the identification of any with a known form is in my opinion quite impossible; indeed, in certain instances the genus is even in doubt. These forms I consider essentially *nomina nuda*, because of the complete lack of limiting characteristics used in the original "descriptions." A description to be useful must limit the form to a single species. Any attempt to resurrect the following names supplanting better described forms merely because of date priority can meet only with failure simply because it is impossible for one to prove with certainty to which of the several species the names should apply. I do not mean to imply that I consider the term *species inquirenda* a synonym of *nomen nudum*; because I do not. I would have simply called the forms *nomina nuda* were it not for the multitude of objections that certainly have been raised against such a stand. To place them in *species inquirendae* status permits future workers to come to their own conclusions regarding the doubtful descriptions. The species concerned are: 1. *Idotea rectilinea* Lockington, 1877, p. 36. 2. *Idotea Whitei* Stimpson, 1864, p. 155, 3. *Idotea media* Dana, 1854, p. 175, and 4. *Stenosoma gracillimum* Dana, 1854, p. 175.

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