

Adelasterias papillosa. Dredged at 35 fathoms; temperature 30° F.; February 20, 1948. *Promachocrinus kerguelensis*, *Sterechinus antarcticus*, *Leptychaster magnificus*, *Psilaster charcoti*, *Odontaster meridionalis*, *Odontaster validus*, *Acodontaster elongatus*, *Perknaster aurantiacus*, *Remaster gourdoni*, *Adelasterias papillosa*, *Ophiacantha disjuncta*, *Amphiura belgicae*, *Ophiomastus ludwigi*, *Ophiura serrata*, *Ophiura rouchi*, *Ophiurolepis gelida*, *Ophiurolepis martensi*, *Ophionotus victoriae*. Dredged at 40 fathoms; temperature 30° F.; February 22, 1948. *Promachocrinus kerguelensis*, *Sterechinus antarcticus*, *Odontaster validus*, *Cuenotaster involutus*, *Lysasterias perrieri*, *Ophionotus victoriae*. Dredged at 35-105 fathoms; temperature 30.2° F.; February 19, 1948. *Sterechinus antarcticus*. Dredged at 115 fathoms; temperature 30.2° F.; February 18, 1949. *Sterechinus antarcticus*, *Odontaster validus*.

Off Peter I Island; 30 fathoms; temperature 29.6° F.; February 15, 1948. *Psilaster charcoti*, *Ophionotus victoriae*. Same, 60 fathoms; February 15, 1948. *Ophionotus victoriae*.

Lat. 66° 35' S., long. 90° 40' E.; 150 fathoms; December 30, 1947. *Ophiacantha disjuncta*, *Ophiocten megaloplax*.

Lat. 65° 25' S., long. 101° 13' E.; 110 fathoms; temperature 30° F.; January 14, 1948. *Florometra mawsoni*, *Ophionotus victoriae*, *Ophiocten megaloplax*.

ZOOLOGY.—*A new genus and species of notodelphyoid copepod from Japan.*¹ PAUL L. ILLG, U. S. National Museum.

In the course of assembling a series of notodelphyoid copepods for revisionary studies, a fruitful source of material has been found in the yet unclassified collections of tunicates in the National Museum. The distinctive form here described has been selected for immediate treatment as a testimonial to the retiring curator of echinoderms, United States National Museum, Austin Hobart Clark. It is considered an appropriate token of Mr. Clark's significant connections with the United States Fish Commission steamer *Albatross*, the collecting vessel, and of his pioneer interest in the zoogeographic features of Japanese waters.

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Lat. 66° 31' S., long. 110° 26' E.; 100 fathoms; January 9, 1948. *Promachocrinus kerguelensis*, *Ophiosteira senoqui*, *Ophiocten megaloplax*.

It is interesting to compare the representation of the different classes of echinoderms (exclusive of the holothurians) in the Antarctic and the Arctic. The number of species in each region is as follows:

	Antarctic	Arctic
Crinoidea.....	24	3
Echinoidea.....	30	2
Asteroida.....	114	23
Ophiuroidea.....	50	12

This enumeration does not include the fauna of the subantarctic islands or the Magellanic region, which support many additional species mostly related to Antarctic types.

The strictly Antarctic species are almost wholly confined to the immediate vicinity of the Antarctic continent, while the majority of the Arctic species range for a greater or lesser distance southward in the north Atlantic, a few also in the north Pacific, and there is an isolated Arctic colony in the very cold water of the eastern part of the Seas of Okhotsk and Japan. A few Antarctic types range northward along the west coast of South and North America. Thus among the crinoids *Ptilocrinus* reaches British Columbia, *Ilycrinus* occurs off southeastern Alaska and westward to the Commander Islands, and *Florometra* extends northward to the Aleutian Islands, and south in the west Pacific to southern Japan.

The generic name here proposed is derived as an anagram of Mr. Clark's given name.

Family NOTODELPHYIDAE

Subfamily NOTODELPHYINAE Schellenberg, 1922

Ustina, n. gen.

The description below of the characters of the genotype and only species, *Ustina clarki*, n. sp., provides the generic definition.

Ustina clarki, n. sp.

Specimens examined.—23 females, 18 males, all adult; from branchial cavities of numerous specimens of a small species of solitary ascidian. *Albatross* station 3698, off Manazuru Zaki, N. 8°, W. 4.5 miles, inside Sagami Bay, Honshu Island, Japan, 153 fathoms, May 5, 1900.

Types.—Holotypic female, U.S.N.M. no. 91090; allotypic male no. 91091; paratypes no. 91092; all from the one known collection; scientific name of ascidian host not known.

Description.—FEMALE (Figs. 1, *a-o*): General aspect (Fig. 1, *a*) marked by the heavy chitinization of the body, with resultant characteristic rigidity of the major body units, and, in addition, an extremely notable compression of the metasome. The heavy body cuticle is densely set with perforating conical pores which reach from wide bases to much diminished surface apertures. There seem to be no structures projecting beyond the apertures. The metasome is 5-segmented. The fused cephalothoracic portion includes the somites of all the mouthparts. The segment of the first swimming legs is free and much shorter than the other thoracic segments. The somite of the fourth legs almost equals in bulk the remainder of the metasome by reason of its voluminous dorsal and posterior expansion to accommodate the characteristic incubatorium. The eggs are large and rather few in number. They form a compact mass which somewhat intrudes anteriorly into the third free somite.

The urosome (Fig. 1, *b*) is 5-segmented, somewhat elongate and cylindrical. The very short somite of the fifth legs is succeeded by three long, subequal segments and a very short, but highly characteristic, terminal segment. The anal somite bears a greatly enlarged ventral projection, pear-shaped in lateral view, wide and faintly bilobed from ventral aspect. This prominence is further marked by a very thick cuticle, densely set with the porelike structures described above. The caudal rami are widely spaced and project ventrolaterally from the sides of the segment.

An axis through the body measures over-all 2.2 mm. The separate lengths of the metasome and urosome, as measured along their major axes, are respectively 1.75 mm and 1.15 mm.

The head (cephalothorax) is triangular in side view. The ventral margin of the notal shield is markedly indented subapically at the point of emergence of the antennular bases. The notum is produced ventrally and posteriorly over the bases of the antennules as a wide-based, roughly triangular rostrum, with rounded apex.

The antennule (Fig. 1, *c*) is 8-segmented and densely setiferous. The base is more or less enveloped by the ample rostrum. The typical posture would appear to be that resulting from a sharp elbow bend of the third segment upon the second. The basal two segments are much the

widest, the six distal to the flexure taper gradually to the narrow tip which is about one-seventh the basal width of the first segment. The setation has not been depicted fully in the figure nor was an exact count attempted. All the segments are heavily chitinized and the setae are consistently long, slender and profusely plumose.

The antenna (Fig. 1, *d*) is 3-segmented. The basal segment is much the longest, almost equaling the combined lengths of the distal segments. It bears distally a well-developed, elongate, plumose seta. The two terminal segments are subequal. Segment 2 bears a short slender seta subapically. Segment 3 has the usual stout, curved, tapered hook, articulated on the distal surface. Set in relation to this terminal jointing are 5 setae. More proximally there is a trio of subequal setae which lie closely appressed to the surface. Still more proximal is a short slender seta. The basal segment bears a characteristic marginal row of very long, fine cilia.

The masticatory plate of the mandible (Fig. 1, *e*) is best presented by illustration. The mandibular palp (Fig. 1, *f*) shows some tendency to suppression of the endopodite. Some of the setae are stout, elongate and plumose, but several are reduced to relatively short and slender dimensions. The two segments are subequal. The basal segment bears 4 setae at the distal medial corner. The terminal segment bears 8 setae arranged across the truncate end and along the medial margin. The basipodite bears a relatively small subapical seta. The exopodite is a flattened, rigid plate with no remaining evidence of segmentation other than its 5 graduated, long, plumose setae.

The maxillule (Fig. 1, *g*) is ornamented with relatively long, profusely plumose setae. The principal endite of the coxopodite bears a row of nine stout, short, tapered setae. The next distal medial process (a second endite?) is directly prolonged as a sharply tapering, flattened seta, profusely set with marginal ciliation. The basipodite bears medially three long, graduated setae, all plumose. The shortest is proximal and equals about two-thirds the length of the distally placed longest. The middle seta is intermediate in length. The endopodite bears four long, plumose setae, two borne terminally and two on the medial margin. The exopodite is slightly more expanded than the endopodite and has three setae widely spaced along its somewhat truncate margin. The epipodite is set with a long plumose seta, directed basally and with a more distally placed, very short, sharply tapered auxiliary seta.

The maxilla (Fig. 1, *h*) is seemingly of primitive construction. It is 5-segmented; each segment bears one or more profusely ciliated, elongate setae. The basal segment bears a proximal trio of long setae, set more or less transversely to the main axis of the appendage on a well-developed protuberance. The next distal medial prominence bears a single long, plumose seta. The third prominence has a pair of equal, long, plumose setae. The terminal prominence of the segment bears two equal plumose setae; set at the base of these is a very short auxiliary seta. The second segment bears a pair of setae with an accompanying, basally placed, short auxiliary seta. The more proximal of the principal setae is equivalent in length to those of the basal segment. The distal seta is about two-thirds as long as the other, of about the same thickness; it is the homologue of the heavily developed claw that occurs in many closely related notodelphyoids. The third segment bears one plumose seta; the fourth segment is distinctively set with one long, plumose seta and a second, much shorter and slenderer seta. The terminal segment bears a distally arranged trio of plumose setae, one of which is equivalent in dimensions with the majority of the setae of the appendage, the remaining two shorter and slenderer by about one-third. All are plumose.

The maxilliped (Fig. 1, *i*) is a flat, unsegmented plate, preserving, however, indications of direct derivation from a 2-segmented condition. A distal pair of subequal, long, plumose setae is set on a well demarcated projection of the appendage. The medial margin bears two quartets of roughly equal, short, plumose setae.

The swimming legs are distinctive as indicated in the figures and in the following tabulation of arrangement of setae and spines. Setae are designated in Arabic numerals following designation of spines in Roman. The segments of each ramus are accounted for in order from the basal segment distally. First exopodite I-1; I-1; IV-3; first endopodite O-0; O-6. Second exopodite I-1; I-1; V-4; second endopodite O-1; O-8. Third exopodite I-1; I-1; IV-4; third endopodite O-1; O-8. Fourth exopodite I-1; I-1; IV-3; fourth endopodite O-1; O-7.

All the legs are heavily chitinized. None bears medial setae on the coxopodite. All bear a seta, variously developed, at the lateral edge of the basipodite. The endopodites are all 2-segmented. The lengths of the exopodites are graduated, the fourth being at least twice as long as the first. The elongation is mainly due to increased produc-

tion of the terminal segment of each exopodite.

In the first legs (Fig. 1, *j*) the rami are subequal. The lateral seta of the coxopodite is very long, stout and plumose. The basipodite bears medially a stout, curved, tapered spine which reaches to about the beginning of the distal third of the terminal segment of the endopodite. The setae of the terminal segment of the exopodite are short, exceeding the inner terminal spine by about half its length. The endopodite (Fig. 1, *k*) is highly distinctive; it is heavily chitinized. The elongate, terminal segment curves laterally and distally. The setae are all very long and profusely plumose.

In the second legs (Fig. 1, *l*) the endopodite reaches slightly beyond the second segment of the exopodite. The terminal exopodite segment is slightly shorter than the combined lengths of the two proximal segments. The third endopodite reaches just beyond the second segment of the third exopodite. The terminal segment of the latter exceeds the combined lengths of the proximal two segments by about one-third. In the fourth legs (Fig. 1, *m*) the endopodite does not quite reach to the distal margin of the second segment of the exopodite. The length of the distal segment of the exopodite exceeds the proximal segments by half again their combined lengths. The setae of these swimming legs are in the main very long and plumose. Notably excepted are the setae of the third and fourth exopodites. These are short and slender; their consistency approaches more or less that of the spines and they lack the usual plumose ciliation.

The fifth legs (Fig. 1, *n*) are much reduced. In general aspect they are reminiscent of those in *Botachus*. The basal portion is more or less coalesced with the substance of the somite. A plumose lateral seta is borne on a slightly elevated basal prominence. The free segment is short and narrow. It bears a medial subapical spine and a relatively short terminal seta. The basal plate and free segment are heavily chitinized. The terminal seta is seemingly lacking in ornamentation.

The caudal rami (Fig. 1, *o*) are flat, heavily chitinized plates. The armature consists of a long, terminal, articulated claw, a more proximal, short, heavy, spinelike claw, and 3 short setae.

MALE (Figs. 1, *p*, *q*): a more or less generalized notodelphyoid type, possibly tending somewhat to compression of the metasome. The integument is of normal aspect, lacking the marked sclerotization seen in the female. There are no cuticular pores detectable in the specimens seen. The meta-



FIG. 1.—*Ustina clarki*, n. sp. Female: a, Habit, lateral view; b, urosome, ventral view; c, antennule; d, antenna; e, masticatory plate of mandible; f, mandibular palp; g, maxillule; h, maxilla; i, maxilliped; j, first leg; k, first endopodite; l, second leg; m, fourth leg; n, fifth leg; o, caudal ramus. Male: p, First leg; q, fourth leg. The scale, referring only to the figure of the habit of the female, represents 0.5 mm. To avoid complication of detail the plumose ciliation of most setae depicted has been omitted; this detail can be supplied from the description.

some is 5-segmented, comparable, except for the lack of the inflated incubatory structures, to the tagmosis in the female. The urosome is 6-segmented, modified in its thoracic component by the complicated male reproductive structures. The first urosomal somite is short and bears at its posterior margin fifth legs entirely comparable with those in the female. The second segment is twice as long and bears the usual sixth leg lappets, each terminating in a prolongation bearing two subequal setae. The succeeding three segments are subequal; the first of these is half again as long as the combined lengths of the first two segments. The terminal somite is comparable to that in the female, heavily chitinized, but lacking the elaborately developed cuticular structure of the other sex.

None of the cephalic or thoracic appendages, other than the sexually modified sixth legs exhibits specialization toward copulatory prehension. The head appendages and maxillipeds are comparable to those in the female, although of smaller absolute dimensions and with somewhat less substantial structure. The swimming legs are not so modified as those in the female, retaining a more generalized aspect. The segmentation differs by the fact that the endopodites of the second, third and fourth legs preserve the basic 3-segmented condition. The ornamentation differs from that in the female in the following particulars: second endopodite O-1; O-2; O-6. Third endopodite O-1; O-2; O-6. Fourth exopodite I-1; I-1; IV-4; fourth endopodite O-1; O-2; O-5.

The first legs (Fig. 1, *p*) exhibit segmentation and ornamentation comparable to that in the female, but with over-all reduction in size and substance. The exopodites in the second through fourth legs exceed the endopodites by about the length of the terminal exopodite segments. These terminal segments in each case are shorter than the combined lengths of each two basal segments. The fourth leg (Fig. 1, *q*) is depicted to show the departure in configuration of segments and degree of ornamentation from the condition in the female.

The length of the male is 1.1 mm.

Remarks.—The copepod here described raises some difficulty when an attempt is made to place it in the scheme of classification of the notodelphoids. The existing generic definition most aptly accommodating its characteristics would be *Notopterophoroides* Schellenberg, 1922. However, when characters of the present species, those of *Botachus*, the species of *Notopterophorus*, *Pachy-*

pygus and the two species of *Notopterophoroides* are compared, it would seem as though a set of variations around a basic ground plan is discernible. Unifying characters would be: considerable similarity of antennule; general similarity of construction of mandibular palp; more or less graduated reduction in maxillular ornamentation, in structure of maxilla, and of maxilliped; individual but more or less consistent modifications of swimming legs; reduction of fifth legs; and great similarity of construction of urosome with markedly consistent modification of the anal somite and caudal rami. It seems supportable that here among the notodelphoids is still another series of related forms comparable to the groups varying around the *Notodelphys* mode and the *Doropygus* mode respectively. The present series exhibits characters (structure of antennule, for instance) which might be considered more primitive than those of *Doropygus*; others indisputably are more highly derived. By comparison with *Notodelphys* some of this group display a possibly more basic condition in having the somite of the first swimming legs a free segment. Since very probably there are yet undiscovered a considerable number of notodelphoids which might furnish elucidation of the so far seemingly random distribution of the basic characters, it seems best at the present level of knowledge to indicate supraspecific identity as strongly as possible. Accordingly separation is here recognized of all the aforementioned genera, and for the newly described form generic status is proposed. The species of *Notopterophoroides* seem to be rather arbitrarily united in the generic delimitation. Since Lang, 1949, by designation of *N. armadillo* Schellenberg as genotype has fixed the generic concept, the second species, *N. malacodermatus* Schellenberg, seems only questionably appropriately referable to the genus. However, until the discovery of other species and clarification of the characters of the latter species, it seems preferable to refrain from attempting further generic separation.

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