THE AMPHIPOD SUPERFAMILY LEUCOTHOIDEA ON THE PACIFIC COAST OF NORTH AMERICA. FAMILY PLEUSTIDAE: SUBFAMILY PLEUSTINAE. SYSTEMATICS AND BIOGEOGRAPHY.

By E. L. Bousfield¹ and E. A. Hendrycks²

ABSTRACT

Members of the subfamily Pleustinae Bousfield & Hendrycks, 1994 (family Pleustidae) are thick-bodied, carinated, and strongly rostrate, micro-carnivorous, benthic gammaridean amphipods that are endemic to North Pacific and Holarctic coastal shelf waters. The genus *Pleustes* Bate 1858, to which the 15 previously known world species and subspecies had been assigned, is herein subdivided into two genera, *Pleustes* with two subgenera *Pleustes* (*Pleustes*) Bate, and *Pleustes* (*Catapleustes*), new subgenus, and *Thorlaksonius*, new genus. In this systematic treatment, 12 species are newly described and keyed, all previous subspecies are rediagnosed and elevated to full species status, and the resulting 24 species and variations are reallocated to genus and subgenus, as follows:

(1) Pleustes (Pleustes) acutirostris, new species; P. (P.) gurjanovae, new species; P. (P.) lawrencianus, new species; P. (P.) obtusirostris Gurjanova, 1938; P. (P.) sibiricus Gurjanova, 1972; and P. (P.) tuberculatus Bate, 1858. "Pleustes" occidentalis (Stimpson, 1864) is considered a nomen nudum. Nomenclatural resolution of variation within the widespread holarctic species Pleustes (Pleustes) panoplus (Kroyer, 1838), which occcurs mainly outside the present study region, awaits further investigation.

(2) Pleustes (Catapleustes) constantinus, new species: P. (C.) victoriae, new species; P. (C.) angulatus Shoemaker, 1955; P. (C.) japonensis Gurjanova, 1972; and P. (C.) paradoxus Gurjanova, 1972.

(3) Thorlaksonius amchitkanus, new species; T. borealis, new species; T. brevirostris, new species; T. carinatus, new species; T. grandirostris, new species; T. subcarinatus, new species; and T. truncatus, new species. Rediagnosed species include the North American Pacific Thorlaksonius depressus (Alderman, 1936), T. platypus (Barnard & Given, 1960), and the Asiatic Pacific species T. incarinatus (Gurjanova, 1938), T. obesirostris (Bulycheva, 1952), and Thorlaksonius sp., originally treated by Nagata (1965) as a species of Pleustes, sens. lat.

Pleustinid amphipods probably originated in coastal waters of the boreal North Pacific region. From there the more advanced genus *Pleustes* has spread into colder and deeper waters of the high arctic and northern North Atlantic marine regions where it appears to be actively in the process of speciation.

INTRODUCTION

The gammaridean amphipod subfamily Pleustinae was established by Bousfield and Hendrycks (1994) to encompass a set of some 15 previously known, and about 12 undescribed, species and variants of heavy bodied, carinated, and strongly rostrate holarctic members of family Pleustidae. The purpose of this study is to describe, at the level of genus, subgenus, and species, the morphological, distributional, and ecological features of this fauna with special reference to those members occurring in North American Pacific coastal marine waters.

Previous studies on this fauna in the North Pacific region are quite limited. In North American waters, the first pleustinid record was that of Stimpson's enigmatic species, *Amphithonotus occidentalis* (1864), included by Stebbing (1906) as a species of *Pleustes*. Alderman (1936) described and figured *Pleustes depressus* from central California, later listed by Barnard (1975), Austin (1985), and Staude (1987) from Washington to California. Barnard & Given (1960) described and figured *Pleustes platypa* from central California, and Barnard (1969b) amplified the regional morphological variability and distribution of the species. Shoemaker (1955) figured *Pleustes angulatus* from the Pt. Barrow region of Alaska. More recently O'Clair (1977) listed *Pleustes* sp. from the *Laminaria* community at Amchitka I., and Slattery and Oliver (1987) provided notes on the ecology, life history and ecto-commensals of "*Pleustes tuberculatus*" from the Bering Sea coast of Alaska.

In the northwestern Pacific region, systematic work on pleustinids was somewhat more extensive. Although a number of variants of *Pleustes panoplus* (Kr.), had long been known from western arctic regions of Russia, Gurjanova (1938) first described *Pleustes cataphractus obtusirostris*, *P. c. typicus*,

¹ Royal British Columbia Museum, Victoria, B. C. Canada. V8V 1X4

² Canadian Museum of Nature, Ottawa, Ontario, Canada. K1P 6P4

and P. incarinatus from its far-eastern (Pacific) waters. Further records from the Okhotsk and Japan Sea regions were included in the larger compendium of Gurjanova (1951), to which Bulycheva (1952) added Pleustes obesirostris from Peter-the-Great Bay. In her further major revisionary study, Gurjanova (1972) amplified descriptions and summarized all pleustid records from Soviet far-eastern seas. She included the new subspecies Pleustes panoplus sibiricus, Pleustes cataphractus japonensis, the nominate subspecies P. c. cataphractus (Stimpson, 1853), and Pleustes angulatus paradoxus. Further regional distributional and ecological records were given by Tzvetkova and Kudrjaschov (1985). From coastal marine waters of Japan, Nagata (1960, 1965) recorded and figured Pleustes panoplus, to which records from Tomioka and Shijiki Bays were added by Hirayama (1988). All previous work on the systematics of the genus Pleustes (sens. lat.) had been updated and summarized by Barnard & Karaman (1991), a solid reference base on which the present study was brought to completion.

ACKNOWLEDGEMENTS

The present North American pleustinid material, comprising some 12 species in 3 genera and subgenera, was accumulated mainly as a result of NMNS field expeditions in the North American Pacific region, from southeastern Alaska to northern California, during the period 1955-1980. Pertinent station lists are detailed elsewhere (Bousfield, 1958, 1963, 1968; Bousfield & McAllister, 1963; and Bousfield & Jarrett, 1981). Other material, now in the research collections of the Canadian Museum of Nature, Ottawa, was provided mainly by C. E. O'Clair, Auke Bay, Alaska, C. P. Staude, Friday Harbor, Washington, and P. N. Slattery, Moss Landing, California. Full acknowledgement of assistance provided by institutions and colleagues in the field work and for provision of pleustid study material has been provided elsewhere (Bousfield & Hendrycks, 1994) and is again gratefully expressed here. The authors especially value the help of artist Susan Laurie-Bourque, Hull, Oue., in preparing the line illustrations, and Marjorie Bousfield, Montreal, Que., in translating some of the pertinent Russian literature. We thank Drs. C.-t. Shih, K. E. Conlan, and Diana Laubitz, CMN, for their commentary on earlier drafts of the text, and C. P. Staude, FHL, and P. Lambert, Royal British Columbia Museum, for all phases of editorial assistance in this issue .

SYSTEMATICS

An updated overview of gammaridean amphipod family Pleustidae and its subfamily composition has been provided recently by the authors (Bousfield and Hendrycks, 1994). The present study provides a detailed revision of the nominate subfamily Pleustinae, based mainly on material from the North American Pacific coastal marine region, and on new insights applied to the pertinent taxonomic literature.

PLEUSTINAE, Bousfield & Hendrycks, 1994 (Figs. 1, 2)

Pleustidae Stebbing, 1906: 310 (partim).—Gurjanova, 1951: 336 (part);—Gurjanova, 1972: 635 (part).—Barnard, 1969a: 421 (partim).—Barnard & Karaman, 1991: 644 (partim). Pleustinae Bousfield & Hendrycks, 1994: 39.

Type Genus. Pleustes (Pleustes) Bate, 1858: 362.

Genera and Subgenera: Pleustes (Catapleustes), new subgenus; Thorlaksonius, new genus.

Diagnosis: Body stout, broadest at peraeon segment 5. Peraeon, pleon and urosome variously carinate or toothed mid-dorsally and dorso-laterally. Urosome segment 2 dorsally occluded (or nearly so) by segments 1 & 3. Rostrum strongly developed, often sexually dimorphic (larger in male). Eyes large, roundish, protruding from head surface. Anterior head lobe acute; inferior antennal sinus shallow. Antennae medium, slender. Antenna 1 slightly longer than antenna 2; peduncular segments 2 and 3 short. Accessory flagellum lacking.

Mouthparts modified. Upper lip, median notch shallow, lobes slightly asymmetrical. Lower lip, inner lobes small, deep, outer lobes large, oblique, not widely separated. Mandible, molar very small, conical, apex pilose; spine-row long, blades numerous (14-30+), thick, pectinate; left lacinia 7-8 dentate, right lacinia lacking; incisor irregularly 8dentate; palp not elongate, stout, segment 3 often with basal cluster of "A" setae, or none. Maxilla 1, outer plate with 9 apical spines; inner plate small, with 1 subapical seta; palp segment 1 with prominent setose lateral wing; apex of segment 2, oblique, spinose. Maxilla 2, inner plate broadened, short, inner basal submarginal plumose seta(e) often present. Maxilliped, outer plate narrow, basically columnar (outer margin may be slightly convex), inner margin setose, apex rounded, spinose; inner plate short, broad, with stout apical and inner marginal spines; palp stout, apex of segment 3 rounded, slightly extending beyond base of dactyl, armed with pectinate spines; dactyl slender.

Coxal plates 1-4 very deep, broad, covering leg bases, often medially ribbed; hind cusps small or lacking; coxa 1 hatchet-shaped, covering lower head, but excavated beneath the eye; coxa 4 with posterior process. Gnathopods large, powerfully subchelate, subequal, not sexually dimorphic; basis slender, anterior margin setose; merus with acute postero-distal process; carpus short, hind lobe narrow, deep; propod, palm smoothly convex, lacking median tooth, posterior angle with well-developed "step-down" margin bearing 3(4) groups of stout spines; outer "s.-d." marginal spines often extend along palmar margin, distally largest; inner marginal spines few (3-5), subequal; hind margin short, bare.

Peraeopods 3 and 4 slender, anterior margin of basis setose, segment 4 longest, 5 shortest, dactyls medium short. Peraeopods 5-7 homopodous, stouter, and dactyls longer, than in peraeopods 3-4; coxae acute behind, laterally ridged;

bases slightly narrowed, vertically ribbed; basis of peraeopod 7 with proximal posterior tooth or cusp; segment 4 usually strongly overhanging segment 5 behind.

Pleon plates broad, deep, hind corners acute or produced, hind margins smooth or with basal cusp. Pleopods strong, rami subequal, peduncles long, marginally setose. Uropods 1-2, rami long, serially spinose marginally, apices acute; uropod 1, rami subequal, peduncle lacking distal ecdysial spine. Uropods 2 & 3, outer ramus markedly shorter than inner ramus. Uropod 3, inner ramus more than twice length of peduncle. Telson short, broad, keeled proximally, penicillate setae distal, apex subtruncate.

Coxal gills large, laminar or plate-like, smaller or pallet-like on peraeopods 2 & 6. Brood plates broad, normal.

Distributional Ecology: To date, members of this subfamily have been recorded only from high-salinity, summercold waters of the North Pacific, North Atlantic, and Arctic seas. Shallow-water species are associated with rocky coastlines where they frequently cling to large kelps and benthic algae, or to sponges and other colonial invertebrates. Many are beautifully maculated, in all colours from nearly pure white to almost black. Some mimic the shells of mitrellid snails (Carter & Behrens, 1980). The thick, heavily armoured bodies and slow rate of ecdysis (of larger instars of arctic species) render them attractive substrata for temporary settlement of barnacles and other fouling organisms (Slattery & Oliver, 1987).

Taxonomic commentary: The Pleustinae is a moderately advanced but very distinctive subfamily group. Apomorphic character states occur commonly in the mouthparts (vestigial mandibular molar, small columnar outer plate of the maxilliped), gnathopods (powerfully subchelate, smoothpalmed, with short, deeply lobate carpus), and peraeopods (modified coxae and bases of peraeopods 5-7). These are shared mainly with the Parapleustinae, Pleusirinae, and other advanced pleustid subfamilies (see Bousfield & Hendrycks, 1994). However, the strongly rostrate head and carinated body, weakly modified upper and lower lips, and strong spine-teeth of the inner plate of the maxillipeds are considered plesiomorphic with respect to other subfamilies. The sexually dimorphic rostrum and the dorso-laterally bicarinate urosome are apomorphies unique to the Pleustinae. However, these character states appear remarkably congruent with corresponding features of the enigmatic leucothoidean family Lafystiidae (Bousfield, 1987).

With subfamily Pleustinae, members of the *Pleustes* panoplus group of species are demonstrably more similar to the *Pleustes angulatus* group, than to members of the *P. platypus-depressus* group. The principal differences are summarized in the following key (p. 9), and in the dorsal body outlines (Fig.1). Hence the decision here to recognize, formally, the first two taxonomic groups as the subgenera *Pleustes* and *Catapleustes* within genus *Pleustes* (pp. 8 and 28), and the last group as a distinct full genus of its own, *Thorlaksonius* (p. 38).

Table I. Genera, Subgenera and Species of Pleustinae

Pleustes (Pleustes) panoplus (Kroyer)	Holarctic;
and variants	North Atlantic
P. (P.) acutirostris, new species	Can. Arctic
P. P.) tuberculatus Bate, 1858	Arctic
P. (P.) sibiricus Gurjanova, 1972	Siberian Sea
P. (P.) gurjanovae, new species	Siberian Arctic
P. (P.) lawrencianus, new species & var.	Bering Sea
P. (P.) obtusirostris Gurjanova, 1938	Okhotsk, Japan
P. (P.) occidentalis (Stimpson, 1864) *	Eastern Pacific
Pleustes (Catapleustes) victoriae, n. sp.	BC
P. (C.) constantinus, new species & var.	Bering Sea-BC
P. (C.) angulatus Shoemaker, 1955	Arctic Alaska
P. (C.) japonensis Gurjanova, 1972	Japan - Bering?
P. (C.) paradoxus Gurjanova, 1972	Okhotsk Sea
Thorlaksonius amchitkanus, new species	Bering Sea
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938)	Bering Sea Okhotsk - Japan
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960)	Bering Sea Okhotsk - Japan California
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species	Bering Sea Okhotsk - Japan California SE Alaska - BC
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species T. subcarinatus, new species	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR SE Alaska - BC
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species T. subcarinatus, new species T. depressus (Alderman, 1936)	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR SE Alaska - BC California
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species T. subcarinatus, new species T. depressus (Alderman, 1936) T. grandirostris, new species	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR SE Alaska - BC California BC - Oregon
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species T. subcarinatus, new species T. depressus (Alderman, 1936) T. grandirostris, new species T. obesirostris (Bulycheva, 1952)	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR SE Alaska - BC California BC - Oregon Japan Sea
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species T. subcarinatus, new species T. depressus (Alderman, 1936) T. grandirostris, new species T. obesirostris (Bulycheva, 1952) Thorlaksonius species (Nagata, 1960-65)	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR SE Alaska - BC California BC - Oregon Japan Sea Coasts of Japan
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species T. subcarinatus, new species T. depressus (Alderman, 1936) T. grandirostris, new species T. obesirostris (Bulycheva, 1952) Thorlaksonius species (Nagata, 1960-65) T. carinatus, new species	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR SE Alaska - BC California BC - Oregon Japan Sea Coasts of Japan SE Alaska - BC
Thorlaksonius amchitkanus, new species T. incarinatus (Gurjanova, 1938) T. platypus (Barnard & Given, 1960) T. borealis, new species T. brevirostris, new species T. subcarinatus, new species T. depressus (Alderman, 1936) T. grandirostris, new species T. obesirostris (Bulycheva, 1952) Thorlaksonius species (Nagata, 1960-65) T. carinatus, new species T. truncatus, new species & var.	Bering Sea Okhotsk - Japan California SE Alaska - BC SE Alaska - OR SE Alaska - BC California BC - Oregon Japan Sea Coasts of Japan SE Alaska - BC BC

* nomen nudum

TAXONOMIC FEATURES OF PLEUSTINIDS

In previous taxonomic treatments of pleustinid amphipods, characters of the external body surface and of the gnathopods have been utilized most frequently. These features tend to vary somewhat within species and populations, and between sexes and instars, but limits of variation for each can be established. Character states of peraeopods, uropods and telson have been less consistently employed, and those of the mouthparts, coxal gills and pleopods utilized little or not at all. Thus, for pragmatic reasons, and until a geographically broader series of specimens can be examined for each species, conspicuous external features are employed mainly here also.

The terminology of principal taxonomic features of the Pleustinae are illustrated in Figs. 1 & 2. With respect to external body features (Figs. 1, 2A), protruberances (teeth, tubercles, carinations) of the upper body surface (peraeon, pleon, and urosome) are localized longitudinally in a middorsal carina, and paired dorso-lateral carinae and midlateral ridges or carinae. In members of subgenus *Catapleustes*, the lateral carinae of coxae 5-7 may extend winglike from the body surface, and inferior lateral tubercles (carinae) may be present just above the mid-lateral ridge.

AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994



FIG. 1. Dorsal View of *Thorlaksonius* spp. A-B; *Pleustes (Pleustes)* spp. C-D; *Pleustes (Catapleustes)* spp. E-H.



FIG. 2. MORPHOLOGICAL TERMINOLOGY OF PLEUSTINAE A. Body - Lateral View B. Gnathopod 1 - Lateral View C. Gnathopod 2 - Lateral View

In the posterior pleon and urosomal segments 1 & 2, the mid-dorsal carinae are usually low, but the paired dorsolateral carinae are large, often tooth-like, or elongate (ridgelike or wing-like) and variously medially incised, often deeply so. Inferior-lateral teeth may extend onto pleon segments 1 -3 in *Catapleustes*. Urosome segment 2 is very short and lacks dorsal processes in all pleustinids. In subgenera of *Pleustes*, the hind margins of pleon plates 1-3 usually bear a proximal tooth or cusp.

In gammaridean amphipods, the posterior angle of the gnathopod propod demarcates the junction of the palmar margin with the posterior margin. In pleustinids, the posterior angle is armed with spines of various sizes and thicknesses which are grouped, usually in 3 clusters, on both inner and outer marginal faces of the propod. Prey organisms are presumably impaled on these spines when the dactyl is closed suddenly. These consist of a distal spine group (DSPG), a median spine group (MSPG) and a proximal spine group (PSPG) (rarely also a fourth small accessory proximal spine group). In species of Catapleustes and Thorlaksonius, the distal spine group extends along the outer margin of the palm. Its distal-most spine is the largest of the series, often much larger than the adjacent spine. The number of spines in each cluster, and the total number of major spines at the posterior angle are here considered to be taxonomic features that appear to be diagnostic of the species. Spine counts here represent a minimal number since minute, vestigial, or setose spines are not included.

In pleustinids also, the palmar angle has an elongated border of its own, here termed the "step-down" margin, that is usually sloped or angled differently to either the palmar or posterior margins. The angular change of slope between palmar and "step-down" margin may be gentle ($<30^{\circ}$), merging equally gently with the posterior margin. In most species of *Pleustes*, however, the angle of change is often large (>45°), usually larger in gnathopod 2, and occasionally nearly at right angles to the palmar margin.

When resting, the tip of the dactyl closes into a shallow cavity or dactyl-tip depression (D-TD) on the inner face of the propod, between the DSPG and the MSPG. The pit varies in size and shape, and its proximal border may be marked by a faint semi-circular line or ring on the surface of the propod. A second smaller accessory depression occurs between the inner median and proximal spine groups.

Other noteworthy features of the distal segments of the pleustinid gnathopod include the acute postero-distal process of the merus, the very narrow carpal lobe (larger in gnathopod 2), the short posterior margin of the propod (often less than 1/2 length of palmar margin), the median anteriorly submarginal facial setae of the propod, the short closely set palmar marginal setae, and the smooth, uniformly arcuate dactyl with its very short, and weakly differentiated unguis. The anterior margin of the basis of gnathopod 1 is lined with numerous medium-long setae, the clustering and location of which appears to have species-level significance. Features of the mouthparts are equally diagnostic, but are much less useful in pragmatic identification keys.

Pleustes Bate

Pleustes Bate, 1958: 362.—Stebbing, 1906: 309 .—Gurjanova, 1951: 635 (partim).—Barnard, 1969a: 425 (partim).—Gurjanova, 1972: 141 (partim).—Karaman & Barnard, 1979: 114 (partim).—Barnard & Karaman, 1991: 650 (partim).

Subgeneric content: *Pleustes (Pleustes)* Bate 1858: 362 (TYPE); *Pleustes (Catapleustes)*, new subgenus (p. 28).

Diagnosis: Body carinate, toothed or ridged mid-dorsally, dorso-laterally, and mid-laterally (occasionally inferior laterally) on some or all peraeonal, pleon, and urosomal segments. Pleon 3 with prominent pair of bilobate, dorso-lateral carinae. Urosome 3, paired dorso-lateral carinae elevated, acute behind. Rostrum large, basally broad, with median dorsal depression and paired dorso-lateral ridges that are proximally supra-orbital, distally often deflexed or downcurved, tip acute or less often truncate, slightly sexually dimorphic.

Antenna 1, peduncular segment 1 large, 2 & 3 relatively long. Mouthparts distinctive. Mandible, palp segment 3 with numerous (4-12) long simple setae arising basally on outer and inner faces (baso-facial or "A" setae). Maxilla 2, inner plate with stout inner marginal seta. Maxilliped, palp segment 2 equal to or longer than 3; inner plate broadened medially.

Coxal plates 1-4 very deep, often vertically ribbed, lower hind margin often incised. Gnathopods 1 & 2, propod, angle of "step-down" margin often large (> 45°), especially in gnathopod 2; distal-most group of spines at posterior angle variously (or not) ext ending along palmar margin; dactyl-tip depression often large, deep; accessory depression, smaller, less distinct.

Peraeopods 3-7 slender, seldom stout; segment 5 short, not strongly overhung posteriorly (<40%) by segment 4; dactyls medium to medium long. Peraeopods 5-7, coxae laterally ridged, often toothed or wing-like, usually acute and/or produced behind; bases, hind margins shallowly incised or straight, hind lobes narrowly rounded or subacute.

Pleon plates 1 & 2 (occ. 3) with acute basal posterior marginal cusps. Uropods ordinary. Telson short, little longer than wide, apex subtruncate. Coxal gills large, plate-like, little modified anteriorly.

Taxonomic commentary: The subgenera combined within genus *Pleustes* would appear, in balance, more closely similar to each other than to the genus *Thorlaksonius* (see Discussion, p. 63). Especially diagnostic are: the form of the rostrum (basally broad with lateral ridges, arising supraorbitally, not strongly sexually dimorphic); strongly carinate and toothed peraeon, pleon and coxae 5-7; generally slender peraeopods, somewhat stronger in peraeopods 5-7 than in peraeopods 3-4; and the baso-facially setose mandibular palp, among other differences.

The present taxonomic treatment departs from previous studies in two main procedures: (1) elevation, to species and

KEY TO GENERA AND SUBGENERA OF SUBFAMILY PLEUSTINAE

- 2. Coxae 1-4, lower hind margin sharply and deeply incised; peraeon segments 1-4 usually with mid-lateral carinae or teeth; gnathopod 2, propod, spines at posterior angle extending onto outer margin of palm and beyond corresponding inner marginal spines *Pleustes (Catapleustes)* n. subg. (p. 28)
 —Coxae 1-4, lower margin continuous, nearly straight throughout; peraeon segments 1-4 rarely bearing

subgeneric significance, characters earlier treated as of subspecific value only, and (2) utilization of new characters and new character states (mainly of mouthparts and gnathopods) in diagnoses at all levels. The need to reexamine type material, much of which is no longer available, especially where the original species descriptions and illustrations were limited, is urgent. However, general correlations between body carination, rostral form, and other superficial features (prominently treated in the literature) can be made with detailed characters of mouthparts, gnathopods and other seemingly more reliable taxonomic characters. A phyletically more satisfactory arrangement of all species, previously known or newly described herein, may then be attempted (see below, p. 62).

LEGEND FOR FIGURES

A1	-	antenna 1	MX1	- maxilla 1
A2	-	antenna 2	MX2	- maxilla 2
DACT	- 1	dactyl	MXPD	- maxilliped
EP1-3	-	pleon plates 1-3	OU PL	- outer plate
GN1	-	gnathopod 1	PLP	- palp
GN2	-	gnathopod 2	P3-7	- peraeopods 3-7
HD	-	head	RT	- right
IN PL	-	inner plate	Т	- telson
LFT	-	left	U1-3	- uropods 1-3
LL	-	lower lip	UROS	- urosome
MD	-	mandible	07	- male
			9	- female

Pleustes (Pleustes) Bate, new status

Pleustes Gurjanova, 1951: 435 (partim).—Barnard, 1969a: 425 (partim).—Gurjanova, 1972 (partim): 141.—Barnard & Karaman, 1991: 650.

Type Species: Amphithoe panopla Kroyer, 1838 (<u>non</u> Pleustes tuberculata Bate, 1858).

Species content: Pleustes (P.) panoplus (Kroyer, 1838: 270); Pleustes (P.) occidentalis (Stimpson, 1864: 158); Pleustes (P.) tuberculatus Bate, 1858: 362; Stephensen, 1938: 252; Gurjanova, 1972: 148, figs. 4B, 6; Pleustes (P.) obtusirostris Gurjanova, 1938: 313, fig. 38; Pleustes (P.) sibiricus Gurjanova, 1972: 150, figs. 7B, 8; Pleustes (P.) lawrencianus, new species (p. 23); Pleustes (P.) gurjanovae, new species (p. 22); Pleustes (P.) acutirostris, new species (p. 18).

Diagnosis: Body large at maturity (15-28 mm). Peraeon and pleon segments moderately to strongly carinate and/or toothed dorsally and mid-laterally; peraeon segments 1-4 usually not (or weakly) carinate mid-laterally (dorso-laterally), not inferior laterally, nor strongly laterally; pleon segment 3 usually lacking acute postero-lateral cusp. Head, rostrum usually strong, slender, tip acute or occasionally truncate, dorsal median depression shallow; lateral ridges arising fully supra-orbitally, lower margin straight or slightly concave.

Mandible: blade row with numerous (20-30+) blades; palp segment 3 with numerous (11-16+) baso-facial setae. Maxilla 1, palp segment 1, lateral process strongly developed. Maxilliped, outer plate usually with 2 apical spines.

Coxal plates 1-4 facially smooth or with faint vertical mid-rib only; lower margin appearing straight or slightly curved, hind corners squarish or rounded, not excavate or incised. Coxae 5-7, usually acute, produced behind, laterally ribbed, not toothed. and setose.

Gnathopods 1 & 2, propods, distal group of posterodistal spines not extending onto outer palmar margin, and not beyond corresponding inner marginal spines; dactyl-tip depression (between distal and penultimate spine groups) usually large angle of "step-down" margin steep, (usually >45° to line of palmar margin).

Peraeopods 5-7, segments usually little stronger and dactyls not noticeably longer than in peraeopods 3-4; bases, hind margins gently rounded or straight, rarely concave, hind lobes usually rounded.

Uropods relatively short; uropod 1 not longer than pleon segment 3 and urosome segments 1-3 combined. Telson typically short, squarish, slightly broadened distally.

Distributional Ecology: Component members tend to be Arctic and Holarctic, extending southwards into the North Atlantic and North Pacific regions approximately to the limit of summer-cold shelf waters, seldom at slope or abyssal depths. This situation contrasts with that of the subgenus *Catapleustes*, the 5 known species of which tend to occur deeply subtidally in northeastern and northwestern Pacific regions, and with the 12 known species of genus *Thorlaksonius* that occur mainly shallowly subtidally on both N. American and Asiatic coasts of the North Pacific region.

Taxonomic Commentary: Within subfamily Pleustinae, members of the subgenus *Pleustes* are morphologically much more similar to members of the *Catapleustes* subgroup than to those of the *Thorlaksonius* subgroup. Hence the decision to recognize *Thorlaksonius* as a separate full genus (p. 38).

Pleustes (Pleustes) panoplus (Kroyer)

Amphithoe panopla Kröyer, 1838: 270, fig. 9. Amphithonoptus cataphractus Stimpson, 1853: 52. Pleustes panoplus Sars, 1895: 344, pl. 121.—Stebbing, 1906: 310.—Gurjanova, 1951: 635, fig. 433.—Barnard & Karaman, 1991: 651, fig. 115A. Pleustes panopla J. L. Barnard, 1969a: 425, fig. 152b.

Pleustes panoplus panoplus Gurjanova, 1972: 147, fig. 4A (partim).

Diagnosis. Mature female (18-27 mm): Peraeon with mid-dorsal ridge, becoming carinated and weakly toothed on posterior 2 segments; dorso-lateral tubercles or teeth lacking on peraeon segments1-4, trace or very weak on peraeon 5-7; lateral margins weakly carinated or ridged. Pleon segments 1-3 with low mid-dorsal carina, and with dorso-lateral tubercles or teeth on each side, strongest on pleon 2, ridge-like on

pleon 3; pleon plates 1 & 2 each with proximal posterior marginal tooth. Urosome segments 1 and 3, paired dorsolateral ridges not strongly elevated.

Rostrum slender, arched, apex subacute, lower margin slightly concave. Eye medium, sub-ovate. Antenna 1, flagellum with 30-45 segments. Antenna 2 shorter, flagellum with 20-26 segments.

Mouthparts typical of genus. Mandibular palp segment 3 with cluster of 11-12 baso -facial setae; spine row with 25-30+ blades. Maxilliped, outer plate with 2 apical spines.

Coxa 1 regularly hatchet-shaped. Coxa 4, hind margin steeply sloped. Coxae 5-7 with shallow lateral ridge, acuminate behind. Gnathopod 1, basis, anterior margin strongly setose throughout; propod, angle of "step-down" margin medium (about 45°), dactyl-tip depression medium small; distal cluster of 3-4 short subequal spines, none enlarged. Normal or regular postero-distal spine (PDSP) formula: outer - 4:3:3; inner - 3:3:4, total of 20-21. Gnathopod 2, propod slightly deeper and shorter; PDSP formula: outer 3:3:4; inner 4:3:3, total of 20-21; total gnathopod spine count 40-42.

Peracopods 5-7, hind margin of bases nearly straight, very slightly convex; segment 4 weakly (\sim 30%) overhanging segment 5 posteriorly; dactyls relatively short, < 50% length of respective propods.

Uropod 2, outer ramus about 4/5 length of inner ramus. Uropod 3, inner ramus 3 X length of peduncle, and 1.7 X length of outer ramus.

Telson broadening distally, about as long as wide, apex broadly rounded

Sexual dimorphism inconspicuous. Males slightly smaller than females.

Colour: Body dark brown, whitish, or variegated with shades of brown; eye dark red (Sars, 1895; Stebbing, 1906).

Distribution: This species has been recorded widely throughout Arctic and North Atlantic regions. Figured specimens that rigorously match the type morphology have been recorded only from the eastern North Atlantic region, in coastal waters from Scandinavia to Iceland, in depths of 5-155 m.

Taxonomic Commentary: The present diagnosis is based mainly on the description and figures of Sars (1895), supplemented by notes from Stebbing (1906) and Gurjanova (1951) who examined material from the general region of the type locality, and adjacent waters. In addition, considerable morphological variation has been noted in material from various subregions throughout the holarctic range of this species. Five regional variants are treated immediately below. However, several records of *Pleustes panoplus* in previous literature can be attributed to other species, as noted elsewhere in the text. A full treatment of all records, in which pertinent material can be re-examined, is recommended by the authors.

KEY TO KNOWN SPECIES OF PLEUSTES (PLEUSTES)

1	 Rostrum, apex variously pointed or acute; peraeopods 3 - 7 slender, segments 4 and 5, length > 3X respective width; urosome 3, paired dorso-lateral carinae or "wings" acutely pointed behind; maxilliped, inner plate with 5-7 apical spines
2	 Peraeon segment 5 lacking elevated or posteriorly toothed mid-dorsal carination; gnathopods 1 & 2, spine count at posterior angle of propod high (>15)
3	a. Peraeon segments 6 & 7, mid-dorsal carinae low, not elevated, lacking posterior tooth; pleosome 3, paired lateral carinae not deeply incised medially and little elevated above mid-dorsal line; gnathopod 2 propod, spine count at posterior angle totals 18-22 <i>P. panoplus</i> complex (pp.10-17)Peraeon segments 6 & 7, mid-dorsal carinae elevated, each with posterior tooth; pleon segment 3, paired dorso-lateral carinations elevated well above mid-dorsal line, each with deep median notch; gnathopod 2, propod, spine count at posterior angle totals 15-19
4	A. Rostrum, apex very slender, nearly straight; peraeon segment 5 lacking dorso-lateral tooth; coxa 1 with 2 postero-distal cusps; gnathopod 2, propod, spine count at posterior angle totals 17-18
-	 Rostrum elongate, slender; peraeon segments 1-3 lacking dorso-lateral tooth; coxa 1 with 3 postero-distal cusps; coxa 4, hind margin vertical; gnathopod propods, spine count at posterior angle totals 14-15 <i>P. sibiricus</i> Gurjanova (p. 21) Rostrum thick, strongly down-curved; peraeon segments 1-3 each with prominent dorso-lateral tooth or tubercle; coxal 1, single postero-distal tooth very small or lacking; coxa 4, hind margin oblique; gnathopod propods, spine count at posterior angle totals 10-12 <i>P. gurjanovae</i>, n. sp. (p. 22)
6	. Peraeon segments 1-7 strongly carinated mid-dorsally; peraeon segments 1-4 each with trace of dorso- lateral tubercles; telson short, broad
7	. Rostrum elongate, 2-3 X depth, apex narrowly truncate; gnathopod propods, spine count at postero- distal angle totals 18-19 <i>P. lawrencianus</i> n. sp. (p. 23) –Rostrum medium-short, length about twice depth, apex deeply truncate; gnathopod propods, spine count at postero-distal angle totals 16-17 <i>P. lawrencianus</i> var. (p. 23)

Pleustes (Pleustes) panoplus variants

Subsequent to the original description and illustration of "Amphithoe" panopla Kroyer 1838 from Norwegian waters, several other species, subspecies, and varieties have been identified in the literature from various holarctic, Atlantic, and Pacific regions. None of these forms has previously been treated in full taxonomic fashion, particularly in details of mouthpart morphology, so that species status and precise phyletic inter-relationships are not yet determinable (Table, p. 12). Such treatment, involving reexamination of type and topotype material, might include several of the species and subspecies of *Pleustes* (sens. lat.) of Gurjanova (1972). That material, not readily available to us, is beyond the scope of this essentially North American Pacific regional study. However, information provided by previous authors, notably Stebbing (1906), Stephensen (1938), and Gurjanova (1938, 1951, 1972), is sufficient to establish, with reasonable degree of reliability, the generic and subgeneric status of their taxa. The correct identities of their species, however, are somewhat more problematical, and some species new to science may yet be formally recognized.

P. (Pleustes) panoplus, Variation 1 (Fig. 3)

Amphithonotus cataphractus Stimpson, 1853: 52 Pleustes cataphractus Stebbing, 1906: 310. Pleustes panoplus Holmes, 1905: 489, fig., pl. XXIX.— Shoemaker, 1930: 309.—Dunbar, 1954: 750? **non:** Pleustes cataphractus Stephensen, 1938: 252, fig. 28. —Slattery & Oliver, 1987: 360. Pleustes cataphractus cataphractus Gurjanova, 1972: 153. Pleustes panopla Shoemaker, 1955: fig. 14B.

Material Examined: "Prince" Stn. 13, Passamaquoddy Bay, Bay of Fundy, N. B., A. G. Huntsman, Biological Board of Canada, July 8, 1913. - 1 female br. II (16.0 mm) + slide mount, CMN Cat. No. NMCC1994-366 (selected from other material of that collection series, Acc: 51-15).

Diagnosis (Adult female, 12-16 mm): Body medium large, broad, strongly carinate dorsally and laterally (quiquecarinate); surface heavily pitted. Peraeonal segments 1-7 with median dorsal carina increasing in size and acumination posteriorly; small mid-lateral (dorso-lateral) posterior marginal teeth on peraeon segments 5-7; lateral margins (of all) sharply ridged. and posteriorly acuminate, posteriorly produced on segment 5-7; pleon segments 1-3 mid-dorsally carinate (decreasing posteriorly); pleon 1 & 2 each with paired dorsolateral teeth (very strong and acute in 2) and small lateral hind marginal teeth; pleon 3 with paired dorso-lateral ridges, slightly notched medially, hind margin smooth; urosome segments 1 and 3 with paired dorso-lateral carinae, medially notched in 1, elevated and wing-like in 3. Head, rostrum strong, concave above, distally deflexed and acute, lower margin slightly concave. Eyes rounded, bulging from sides of head. Antenna 1, flagellum 40+ segmented. Antenna 2, flagellum slightly shorter than in antenna 1, 28segmented.

Mandibular palp, segment 3 with cluster of 10-11 basofacial setae. Maxilliped, inner plate with 6-7 apical spines and 1 subapical marginal spine.

Coxal plates 1-4 very deep, lower corners rounded, hind corners with small cusp. Gnathopod 1, basis distally expanded, anterior margin medially heavily long-setose, distally bare; propod, hind margin > 1/2 palmar margin; spine groups at posterior angle each with elongate distal-most spine. Gnathopod 2, angle of "step-down" margin steep (60-70°), D-TD large, deep, distal-most spine of each cluster about twice size of adjacent spine.

Peraeopods 5-7, coxae strongly ridged laterally, acutely produced behind; bases straight or slightly convex behind, lower hind lobes rounded; segment 4 moderately (1/3) overhanging segment 5 posteriorly; dactyls medium (<1/2 propod).

Pleon plates 2 & 3, hind corners acuminate. Uropods 1 & 2, rami slender, inner ramus longer than peduncle. Uropod 3, inner ramus not extending as far posteriorly, margins 6-7 spinose; outer ramus about 60% length of inner ramus. Telson subquadrate, truncate, hind corners rounded.

Body colouration (fresh): "Colour very variable, generally dark reddish or brown, variegated and mottled with white. Some specimens were of a uniform deep purple, others pure white. Eyes yellowish or vermillion colored, with a black dot in the middle" (Stimpson, 1853).

Distributional Ecology: North American Atlantic coast, Labrador to the Gulf of Maine, subtidally to depths of more than 100 m. Not yet recorded from the St. Lawrence estuary or Saguenay fiord.

Behaviour: Stimpson (loc. cit) noted that the animal in motion "preserves an erect posture, like the isopods, with its tail bent up underneath. It seldom swims but makes powerful leaps by means of its well-developed caudal stylets. When disturbed it rolls itself up and remains quiescent, as if feigning death." In possessing a short urosome segment 2, members of the Pleustinae are morphologically similar to other amphipod groups such as talitroideans and oedicerotoideans with similar saltating behaviour.

Taxonomic Commentary: Stimpson (<u>loc. cit.</u>) did not figure his material, but gave a reasonably accurate and complete account of its external body features. His description applies closely to the description, figures and lateral view plate of Holmes (1905) based on material from the Grand Manan (type) locality. It is also applicable to material from nearby Passamaquoddy Bay examined above (see fig. 3). The material of Shoemaker (1930), from somewhat greater depths in the southwestern Gulf of St. Lawrence, contains three specimens (ROM collections) the largest of which (a 14.5 mm male) is similar to, but less strongly toothed than, the Gulf of Maine material.

Pleustes cataphractus Slattery & Oliver, 1987, is close to, but probably specifically distinct from, Stimpson's original species from Grand Manan in the Gulf of Maine (see p. 13). Further material is needed to establish its full identity, however.

TABLE OF LOCALITES OF P. (P.) PANOPLUS VAR.

TYPE	P. (P.) panoplus (Koyer) N. E. Atlantic
VAR. 1	P. (P.) cataphractus (Stimps) - N. W. Atlantic
VAR. 2	P. (P.) panoplus Gurjanova - Greenland Sea
VAR. 3	P. (P.) panoplus Shoemaker - Can. Arctic
VAR.4	P. (P.) cataphractus Slattery - N. Bering Sea & Oliver
VAR. 5	P. (P.) panoplus Slattery - N. Bering Sea

FIG. 3. *Pleustes (Pleustes) panoplus*, variation 1. FEMALE, br. II (16.0 mm). Bay of Fundy. (SEE PAGE 13 - OPPOSITE)





FIG. 4. *Pleustes panoplus* var. 2. (20.0 mm). Greenland Sea. (modified from Gurjanova, 1972, figs. 4 & 5).

Pleustes (Pleustes) panoplus, variation 2 (Fig. 4)

Pleustes panoplus panoplus Gurjanova, 1972: 147, figs.4A, 5. (partim).

Diagnosis (Female, 20 mm): Peraeon segments 1-7 with low mid-dorsal carination but lacking dorsal or dorsolateral teeth or tubercles; lateral ridges regular, not pronounced. Pleon segments 1-3 with low mid-dorsal carination; dorso-lateral teeth distinct, but not exceptional; pleon plates 2 & 3 each with single mid-lateral hind marginal tooth.

Rostrum slender, elongate, lower margin nearly straight, apex acute. Antenna 1, flagellum not clearly shown but estimated to be about 30-35 segments.

Coxal plates 1-4 deep, narrow, gently rounded below; coxa 1 asymmetrically hatchet-shaped, hind corner lacking cusp(?); coxa 4 with sloping posterior margin. Coxae 5-7, mid-lateral ridge acutely produced behind.

Gnathopod 1, anterior margin of basis strongly setose except near antero-distal corner; propod ovate, with long palmar margin (~2X posterior margin), angle of "stepdown" margin shallow, very gently merging with posterior margin. Gnathopod 2, posterior margin very short (1/2 palmar margin); "step-down" at posterior angle gentle (about 30°); dactyl-tip concavity unpronounced; distal group of 3-4 ordinary spines, largest not greatly larger than adjacent spine.

Peraeopods 5-7, hind margins of bases variable, from gently concave (peraeopod 5) to gently convex (peraeopod 7); segment 4 postero-distal lobe with about 1/3 overhang of segment 5.

Uropod 3, length of inner ramus about 3X peduncle and 1.5 X outer ramus. Telson short, little longer than wide, very slightly broadening distally, apex broadly rounded.

Distribution: A deep-water form of the northern part of the Greenland Sea, central Barents Sea, and off Nova Zemlya, in depths of 170-360 m (Gurjanova, 1972).

Taxonomic Commentary: Gurjanova's description and illustration of *Pleustes panoplus panoplus* from the northern part of the Greenland Sea (<u>loc. cit.</u>, p. 147, figs 4A, 5) is close to, but minor features distinct from, Kroyer's *P. panoplus*, as

figured and described by Sars (1895, p. 344, pl. 141), and Gurjanova (1951 p. 636, fig.433). Her material may yet be designated as a separate full species.

Pleustes (Pleustes) panoplus variation 3.

Material: Richmond Gulf, Hudson Bay, N. W. T., Canada, F. Johansen coll., Aug. 25, 1920 - 1 male (14.5 mm) + slide mount. Royal Ontario Museum collections, Toronto?

Diagnosis. Male (14.5 mm): Peraeon segments 1-7 with medium strong lateral ridges. Peraeon segments 5 & 6 with low mid-dorsal ridges and small dorso-lateral cusps. Peraeon 4 with slight mid-dorsal ridge posteriorly but no trace of dorso-lateral cusp. Pleon segments 1 & 2 with low middorsal carinae; pleon segment 1, dorso-lateral carina low; dorso-lateral process on pleon 2 subacute, not strongly elevated. Pleon segment 3, dorso-lateral ridge shallowly incised. Urosome 1, dorso-lateral ridge low, elevated barely above mid-dorsal line.

Mandibular palp with 7-9 baso-facial setae. Maxilliped, outer plate with 2 apical spines; inner plate with 8 apical and 2 sub-apical inner marginal spines.

Gnathopod 1, basis with median anterior marginal cluster of long setae; propod, angle of "step-down" margin strong (50-60°); PDSP formula: inner- 3:3:3-4.

Peraeopods 3-4, distal segments relatively short, dactyl about 40% length of segment 6. Peraeopods 5-7, bases, hind margins slightly convex, lower corners rounded; dactyls medium (< 1/2 segment 6).

Pleopod peduncles shorter than subequal rami (inner ramus slightly the shorter), outer margin strongly setose. Inner ramus basally with 5-6 slender, apically bifurcate clothespin spines. Uropod 3, inner ramus 2.5 X peduncle, 60% longer than outer ramus that bears 6-7 serial pairs of marginal spines. Telson slightly longer than wide, slightly broadening distally, apex truncate or shallowly convex.

Variations of Slattery & Oliver (1987).

Material from the southern Chukchi Sea, identified as *Pleustes panoplus* by Slattery & Oliver (1987, p. 362), was not accompanied by taxonomic information. Subsequent reidentification of this material, kindly provided by Dr. Slattery, reveals two distinct variations of the *P. pleustes* form.

Pleustes (Pleustes) panoplus variation 4 (Fig. 5)

Material: Icy Cape, Alaska, southern Chukchi Sea, trawl haul, 8 m., P. N. Slattery coll., July 23, 1984 -1 female, br. I. (16.0 mm) + slide mount, CMN Cat. No. NMCC1994-367;1 male (15.0 mm) + slide mount CMN Cat. No. NMCC1994-368; several other male and non-ovigerous female specimens present in this lot..

Diagnosis. Female ov. (16 mm); male (14.0 mm): Peraeon segments 1-7, mid-lateral ridge distinct, little produced posteriorly; mid-dorsal ridge very weak or lacking; peraeon segments 6 & 7 with very low mid-dorsal carinae and minute trace of dorso-lateral cusps. Pleon segments 1 & 2, dorsolateral processes low, not or barely extending above low mid-dorsal carinae. Pleon segment 3, and urosome segment 1, dorso-lateral ridge low, shallowly incised. Pleon 1 & 2, basal posterior marginal cusp strong. Rostrum relatively longer and narrower in male. Antenna 1, peduncular segment 2 relatively short, length <1/2 segment 1.

Maxilliped, inner plate with 7 apical spines, and 2 very unequal, subapical inner marginal spines.

Coxa 1, hind cusp small. Coxa 4 not very broad, hind slope steep (\sim 75⁰). Gnathopod 1, propodus, angle of "step-down" margin medium (\sim 30⁰); D-TD medium; PDSP formula: outer - 4:3:1; inner - 3:3:4-5, total of 18-19. Meral process minute. Gnathopod 2, angle of "step-down" margin medium (\sim 30-40⁰); D-TD large; PDSP formula: outer - 4:3:2; inner - 3:3:4-5, total of 19-20; meral process strong.

Peraeopods 3-7, segments normal, dactyls short (40% of respective segment 6).

Telson short, broadening distally, little longer than wide, apex subtruncate.

Pleustes (Pleustes) panoplus, variation 5 (Fig. 6)

Material: Off Wainwright, Alaska, southern Chukchi Sea, otter trawl, 30 m., P. N. Slattery Stn. AHTR9, July 21, 1984 - 1 female (16.0 mm) + slide mount, CMN Cat. No. NMCC1994-369; male (17.0 mm) + slide mount, CMN Cat. No. NMCC1994-370; several other males and females.

Diagnosis. Female, br. I (20.0 mm); male (17.0 mm): Peraeonal segments 1-7, mid-dorsal and mid-lateral ridges distinct, mid-dorsal carinae and dorso-lateral cusps distinct on peraeon segments 6 & 7. Pleon segments 1 & 2, middorsal carinae low but distinct; dorso-lateral cusps acute, that of 2 elevated above mid-dorsal line; pleon 3 and urosome 1, dorso-lateral carinae are deeply incised and elevated above mid-line. Urosome 3, dorsal ridge strongly elevated. Pleon plates 1 & 2 each with strong hind marginal cusp. Carinae and teeth relatively larger and stronger, and rostrum, slightly longer in male. Antenna 1, segment 2 relatively long.

Maxilliped inner plate with 8 unequal apical spines, and 2 nearly subequal subapical inner marginal spines.

Coxa 1, hind cusp distinct. Coxa 4 deep, hind margin steeply sloped (70-80°). Gnathopod 1, propod distinctly shallower than that of gnathopod 2. Hind margins regular, not short, length > 1/2 palmar margin. Gnathopod 1, angle of "step-down" margin medium (~ 30°); D-TD medium; PDSP formula: outer - 4:3:1; inner - 3:3:3+, total of 18-19; meral process medium long. Gnathopod 2, angle of "stepdown" margin large (~60°); D-TD large; PDSP formula: outer - 4:3:2+; inner - 3:3+:3+, total of 18-20; meral process strong, acute.

Peraeopods 3-7, segments slender, dactyls long (>1/2 respective segment 6).

Telson short, broadening distally, apex rounded.



FIG. 5. *Pleustes panoplus* var. 4 ^Q (16 mm) O^e (14 mm) Icy Cape, Alaska.



FIG. 6. *Pleustes panoplus* var. 5. 2(20.0 mm) of (17.0 mm) (off Wainwright, Alaska).

Pleustes acutirostris, new species (Figs. 1B, 7)

Pleustes panoplus Shoemaker, 1955: 40 (partim)?

Material Examined: Prince of Wales Strait, N.W.T., trawl #4, J. Wacasey, Arctic Biol. Stn., 24 July, 1962 - 1 female, br. II (19.0 mm) + slide mount, HOLOTYPE, CMN Cat. No. NMNS 1994-371; <u>Ibid</u>, trawl #10, July 26, 1962 -1 male (16.0 mm) + slide mount, female br. II, PARATYPES, CMN Cat. No. NMCC1994-372.

Diagnosis: Female br. II (19.0 mm). Peraeon segments 1-4 with low mid-dorsal carinae; peraeon segments 5-7, carinae low, increasing in size, not produced posteriorly; mid-lateral ridges distinct, sharply produced posteriorly; segments 6 & 7 each with medium strong dorso-lateral tooth. Pleon segments 1 & 2 with unproduced ridge-like mid-dorsal carinae, lower on 2; with increasingly large and strongly acute dorso-lateral processes and short ridged posterior marginal cusps. Pleon segment 3 with very low median carina and sharply bilobate ridged dorso-lateral carina but no posterior marginal cusp; hind corners of pleon plates 2 & 3 weakly acute, not produced. Urosome 1, mid-lateral carina elevated, ridge-like, deeply incised medially. Urosome 3, dorso-lateral tooth wing-like, postero-dorsally acute.

Head, rostrum slender, nearly straight, apex narrowly acute, median depression shallow. Antenna 1 & 2 subequal; flagellum of antenna 1 with about 40 very short segments; peduncle 4 of antenna 2 extending beyond peduncle 3 of antenna 1.

Mandible, palp segment 3 with 8-10 baso-facial setae; blade row with 25-30+ blades. Maxilla 1, palp segment 1, lateral lobe with about 6 short setae; apex medially oblique, with 6 spines and sub marginal curve-tipped setae. Maxilla 2, inner margin with weak non-plumose basal seta. Maxilliped, outer plate with 3-4 slender apical spines; inner plate very short, apex with 7 apical and 2 unequal inner marginal stout spines.

Coxal plates 1-4 very large and deep, lower margins slightly convex; hind corner of 2 & 3 each minutely doubly cuspate. Gnathopod 1, basis, anterior margin setose proximally and medially; propod, angle of "step-down" margin shallow (~30°), D-TD medium; normal or regular PDSP formula: outer -4:2:2; inner - 3:4:2, total of 17-19. Gnathopod 2, angle of "step-down" margin steep (60-70°); PDSP formula: outer 3:2:2; inner 3:4:3, total of 17-18; carpal lobe with some distally pectinate setae.

Peraeopods 3-7 medium slender, dactyls medium long ($\sim 1/2$ length of respective propods); segment 4 overhang (of segment 5) relatively short (<20%). Peraeopods 5-7, coxae strongly acute and produced behind; bases, hind margins slightly convex, lower hind lobes sharply rounded.

Uropods 1 & 2, inner ramus longer than peduncle. Uropod 3, length of outer ramus about 60% that of inner ramus which has 7-8 serial pairs of marginal spines. Telson nearly square, slightly broadened distally, apex subtruncate.

Coxal gills large, plate-like, smaller on peraeopod 6.

Etymology: From the Latin *acutus* - sharpened, and *rostrum* - beak, alluding to the very slender, acute tip of the rostrum.

Distribution: Western Canadian Arctic. The species may also have been included in the material of Shoemaker (1955) from the Pt. Barrow region of Alaska, but that material has not been re-examined.

Taxonomic Commentary: The slender straight rostrum, slender peraeopods, and lowgnathopod propodal spine count distinguish this species from *P. (P.) panoplus* (Kr.) and its variations.

Pleustes (Pleustes) tuberculatus Bate (Fig. 8)

Pleustes tuberculata Bate, 1858: 362.—Sars, 1895: 344.— Stebbing, 1906: 311.—Stephensen, 1938: 253. Pleustes panoplus tuberculatus Gurjanova, 1951: 637.— Gurjanova, 1972: 148, figs. 4B, 6. (Kara Sca).—Tzvetkova & Kudrjaschov, 1985.

Diagnosis: Peraeon segments 1-7 mid-dorsally ridged; segments 6-7 each with elevated dorsal and dorso-lateral carina or ridges, toothed weakly behind; segment 5 with weak dorsal carina and trace of dorso-lateral tooth. All peraeon segments with moderate mid-lateral ridges. Pleon segments 1-3 with low mid-dorsal carinae, but very stout, elevated or projecting dorso-lateral teeth, rounded and weakly bifid on 3; pleon plates 1 & 2 each with hind marginal cusp.

Head, rostrum regular, apex acute. Antenna 1, flagellum with about 40 segments. Antenna 2, flagellum distinctly shorter than in antenna 1, with about 20 segments.

Mouthparts not described.

Coxae 1-4 deep, narrow, not ridged medially, gently rounded below; coxa 1 with single hind marginal cusp; coxa 4 narrow, rectangular, hind margin almost perpendicular, sub-parallel to anterior margin. Coxae 5-7, lateral ridges prolonged and acute posteriorly.

Gnathopod 1, anterior margin of basis with single proximo-medial cluster of long setae; propod ovate, much less deep than in gnathopod 2; angle of "step-down" margin very shallow ($< 20^{\circ}$); D-TD very small; PDSP formula: outer - 3:2:1(?); inner - 3:3:4, total of 16-17. Gnathopod 2, propod deepest about mid point, angle of "step-down" margin very steep (nearly right-angled), D-TD very pronounced, with dist-al cluster of 4 spines, one of which is much (3X) longer than the adjacent spine; PDSP formula, total of 14; meral process very strong.

Peraeopods 5-7, hind margin of basis distinctly convex; segment 4, postero-distal process pronounced, overhanging about 40% length of segment 5.

FIG. 7. *Pleustes (Pleustes) acutirostris,* new species FEMALE ov. (19.0 mm). (SEE PAGE 19 - OPPOSITE)



AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994



FIG. 8. Pleustes tuberculatus (Bate) $\stackrel{Q}{\rightarrow}$ ov. (18.0 mm) Kara Sea (modified from Gurjanova, 1972, figs. 4, 6)

Uropod 2, rami markedly unequal. Uropod 3, inner ramus elongate, more than 4 times length of peduncle and twice length of the inner ramus. Telson sub-rectangular, longer than wide, apex rounded.

Distributional Ecology: Greenland Sea, Barents Sea, Kara Sea, and East Siberia to Sea of Japan, in depths of 25 -200m. The species is mentioned by Tzvetkova & Kudrjaschov (1985) as a subspecies of *panoplus* east of Nova Zemlya to the Sea of Japan.

Taxonomic Commentary: Bate's original Latin diagnosis of *Pleustes tuberculata* (1858, p. 362) has been translated by Stephensen (1938, <u>loc. cit.</u>) as follows (parentheses of present authors): "All the mesosome (peraeon) and the two anterior metasome (abdominal) segments have each a medio-dorsal tubercle (carinata or tooth). The 3 posterior mesosome (peraeon) and all the metasome (abdominal) segments are laterally (i.e. dorso-laterally) tuberculate. The side plates (coxarum) of all the mesosome segments and of the two anterior metasome segments with the hind margin tuberculate (toothed). The 3 posterior peraeopoda with 1st joint (the coxa) tuberculate. Uropod 3 has the inner ramus rather long." The meaning of the third sentence is somewhat

ambiguous. However, in the context of Bate's generic diagnosis of the anterior coxae (loc. cit.), the third sentence may be interpreted to mean "the lateral ridge of all peraeon segments and the lateral margin of the first two pleon segments toothed behind".

There seems little doubt that Bate's original description is best applicable to the subgenus *Pleustes*, as defined herewith (p. 9). His description does not fit the very strongly processiferous segments and distally emarginated coxae characterizing subgenus *Catapleustes*. The dorsal and midlateral body carination is much too strong to fit the genus *Thorlaksonius*. Moreover, although Bate did not provide locality data for his material, subsequent authors (e.g Sars, 1895; Stebbing, 1906) refer to *P. tuberculatus* as a species of the Arctic Ocean wherein species of *Catapleustes* are rare, and *Thorlaksonius* are totally lacking.

However, the precise species identification of *P. (P.)* tuberculatus Bate yet remains uncertain. Gurjanova (1972, p. 148, figs 4B, 6) has assigned the name tuberculatus to a species from the Kara Sea region having weakly toothed peraeonal and mid-dorsal pleonal segments and an abrupt "stepdown" margin at the postero-distal angle of the propod of gnathopod 2. This form is herewith accepted as most probably identical with Bate's original species.



FIG. 9. Pleustes (Pleustes) sibiricus Gurjanova 9 (28.0 mm) of (20.0 mm) New Siberian Islands. (modified from Gurjanova, 1972, figs. 7, 8)

Pleustes (Pleustes) sibiricus Gurjanova, new status (Fig. 9)

Pleustes panoplus sibiricus Gurjanova, 1972: 150, figs. 7B, 8.—Barnard & Karaman, 1991: 651.

Diagnosis (Female 20-28 mm): Peraeon segments 1-7 carinated and strongly toothed mid-dorsally, and strongly ridged mid-laterally. Peraeon segments 3-7 with prominent dorso-lateral tubercles or teeth (lacking on peraeon segments 1-3), posteriorly becoming strongly elevated. Pleon segments 1-3 with strongly toothed and elevated mid-dorsal and paired dorso-lateral carinae; pleon plates 2 & 3 each with posterior marginal tooth. Urosome segment 1, dorso-lateral carina long, deeply excavated. Urosome 3, dorso-lateral carina small, acute.

Rostrum long, slender, slightly down-curved, apex acute. Eyes relatively large, rounded. Antennae and mouthparts not described.

Coxal plates 1-4 deep, broad, lacking strong mid-rib; coxa 1, hind margin nearly straight, postero-distally with 2-3 small cusps; coxa 4 sub-rectangular, hind margin subparallel to anterior margin. Coxae 5-7 each with strong midlateral ridge, toothed behind. Gnathopod 1, anterior margin of basis armed medio-distally with relatively short setae; propod relatively slender and less deep that that of gnathopod 2; angle of "step-down" margin shallow ($<30^{\circ}$), D-TP small; PDSP formula: outer - 3:3:2; inner 1:1:1(?), total of 11-12. Gnathopod 2, propod deep, angle of "step-down" margin abrupt ($\sim 70^{\circ}$), dactyl-tip depression large; distal group of four spines ordinary, not enlarged; PDSP formula: outer -3:3:2; inner - 4:3:3, total of 18; meral process elongate.

Peraeopods 5-7, hind margin of basis gently convex; segment 4 posterior overhanging about 1/3 the length of segment 5; dactyls not described (presumably elongate).

Uropod 1, rami little longer than peduncle. Uropods 2 & 3, outer ramus little shorter than inner ramus. Telson little longer than wide, broadening distally, apex rounded.

Distribution: An arctic species of New Siberian and Laptev Seas, taken subtidally from the shore-line to depths of 35 m.

Taxonomic Commentary: Gurjanova's lateral view figure (1972) of the body, and detailed figures of the gnathopods and posterior peracopods of *Pleustes panoplus* sibiricus are clearly those of subgenus *Pleustes*.



FIG. 10. Pleustes (Pleustes) gurjanova: new species. 9 (23.0 mm). Dezhneva Basin (modified from Gurjanova, 1972, figs. 7 & 9)

Pleustes (Pleustes) gurjanovae, new species (Fig. 10)

Pleustes cataphractus cataphractus Gurjanova, 1972: 153, Figs. 7A, 9.—Barnard & Karaman, 1991: 650.

Diagnosis. Female (23.0 mm): Peraeon segments 1-7 strongly carinated and processiferous mid-dorsally, dorsolaterally, and with strong mid-lateral ridges that are acutely produced posteriorly. Pleon segments 1-3 with strongly elevated mid-dorsal and dorso-lateral processes; pleon plates 1 & 2 each with posterior marginal tooth. Urosome 1, dorsolateral process elevated, shallowly incised.

Rostrum large, deep, deflexed distally and slightly concave below, apex acute. Mouthparts and antennae not described.

Coxal plates 1-4 deep, with median ridge, lower margins gently convex. Coxa 1 asymmetrically hatchet-shaped, postero-distal cusp very small or lacking. Coxa 4, hind margin sloped, not vertical. Coxae 5-7 with projecting midlateral ridges, acuminate behind. Gnathopod 1, anterior margin of basis strongly setose except distally; propod distinctly smaller and less deep than in gnathopod 2; angle of "step-down" margin very gentle (<20°), D-TD medium; PDSP formula: outer -3:2:1; inner - 1:1:1(?), total of 9-10. Gnathopod 2, angle of "step-down" margin abrupt (about 60°), dactyl-tip depression distinct; distal-most spine of distal spine cluster is enlarged, nearly twice length of adjacent spine; PDSP formula: outer - 3:3:2; inner - 1:1:1(?), total of 11; meral process medium.

Peraeopods 5-7, hind margin of bases varying from slightly concave (in peraeopod 5) to slightly convex (in peraeopod 7); distal segments medium, not slender; segment 4, postero-distal "overhang" is about 40% of the length of segment 5; dactyls strong, stout, length of each > 1/2 respective propod.

Uropods 1 & 2, inner ramus longer than peduncle. Uropod 3, inner ramus about 3 X peduncle, and 1.6 X outer ramus. Telson sub-rectangular, hind margin rounded.

Distribution: Gurjanova (loc. cit.) gives several records from the Arctic coast of Russia, from the Barents Sea, Kara Sea, East Siberian Sea, via the Sea of Okhotsk, and the Bering Sea to the Kurile Islands and northern Sea of Japan, in depths of 0 - 200 m.

Taxonomic Commentary: This is the most strongly carinated and tuberculated species of the subgenus *Pleustes* yet described. It differs markedly from Stimpson's "cataphractus" variation of *P. panoplus* (Kr.) in character states provided in the key to species. The authors take pleasure, therefore, in naming this very distinctive species in honour of the late Eupraxie F. Gurjanova, who first described and figured it.

Pleustes (Pleustes) lawrencianus, new species (Figs. 1A, 11, 12)

Pleustes panoplus tuberculatus Slattery & Oliver, 1987.

Material Examined: Off South-east Cape, St. Lawrence I., Bering Sea, Alaska, 8 m., P. Slattery coll., 6 June, 198 - 1 female, br I (17.0 mm)+slide mount, HOLOTYPE, CMN Cat. No. NMCC1994-373. Off Cape Thompson, southern Chukchi Sea, 6 m., P. Slattery, July, 1984 - 1 male (25.0 mm), CMN Cat. No. NMCC1994-374. Off North Pt., Little Diomede I., Bering Sea, Alaska, P. Slattery coll., 15 July, 1984 - 1 - female (27.0 mm) + slide mount, PARATYPE (fig'd); Ibid. - 3 post-br. III females, ~100 immatures, CMN Cat. No. NMCC1994-375.

Diagnosis. Female, br. I (17.0 mm): Peraeon segments 1-4 each with medium-tall flange-like posteriorly unproduced carinate and very low dorso-lateral tubercle; peraeon segments 5-7 with increasingly large and posteriorly slightly produced mid-dorsal carinae, dorso-lateral posterior marginal teeth, and acutely produced lateral ridges. Pleon segments 1 & 2 with elevated, ridge-like mid-dorsal carinae, high on pleon 1, low on pleon 2, with increasingly large and strongly acute dorso-lateral processes and short, ridged, posterior marginal cusps. Pleon segment 3 with acute middorsal tooth and oblique, weakly incised dorso-lateral carina, but no posterior marginal cusp; hind corners of pleon plates 2 & 3 acuminate, lower margins spinose. Urosome 1, dorsolateral carina low, weakly notched; urosome 3, dorso-lateral tooth forming an elevated ridge.

Head, rostrum long, medium deep, straight, apex narrowly truncate, median depression shallow. Antennae 1 & 2 subequal in length; flagellum of antenna 1 with about 30 short segments; peduncle 4 of antenna 2 extending well past peduncle 3 of antenna 1; flagellum 25-segmented.

Mandible, palp segment 3 with 15+ long baso-facial setae; blade row with 26-30+ blades. Maxilla 1, palp segment 1, lateral lobe with 3-4 very short setae; apex sharply rounded and medially oblique, with 8 spines and 8 sub-marginal curved setae. Maxilla 2, inner plate broad, basal inner marginal seta long, stout, plumose. Maxilliped, outer plate with 2 stout apical spines; inner plate with 8 apical and 2 subequal inner marginal stout spines.

Coxal plates 1-4 large, deep, each with prominent vertical midrib; lower margins rounded, hind cusp minute. Gnathopod 2, propod distinctly larger and deeper than in gnathopod 1. Gnathopod 1, basis with median anterior marginal setae; propod, angle of "step-down" margin very gentle (<10°), D-TD medium; PDSP formula: outer -4:2:1(?), inner - 3:3:3, total of 17-18. Gnathopod 2, propod, angle of "step-down" margin steep (~60°), D-TD and accessory D-TD well demarcated; PDSP formula: outer - 4:2:2; inner - 3:3:4 (+2?), total of 20; meral process finely acute.

Peraeopods 3-7 relatively short, segments heavy, spinose. Peraeopods 3 & 4 distinctly shorter than peraeopods 5-7, dactyls short (~ 1/3 respective propods). Peraeopods 5-7, coxae strongly ridged and acute posteriorly; bases subequal, with gently convex hind margins and broadly rounded lower hind lobes; segment 4 postero-distally overhanging segment 5 by about 30%.

Uropods 1 & 2, inner ramus shorter than (or equal to) peduncle. Uropod 3, inner ramus relatively broad, with 6-7 serial pairs of marginal spines. Telson nearly square, slightly broadened distally, apex subtruncate.

Coxal gills large, plate-like, very slightly smaller on peraeopods 2 and 6.

Etymology: The species name alludes to the geographical type locality, near St. Lawrence Island, Bering Sea.

Distributional Ecology: Northern Bering Sea region: coast of Alaska to St. Lawrence Island. It is the only known species of the subgenus to penetrate N. American Pacific coastal waters.

Taxonomic Commentary: This species differs rather markedly from Pleustes tuberculatus, as figured and redescribed by Gurjanova (1972). The heavy, strongly toothed body, relatively short heavy peraeopods, and long, narrowly truncate rostrum are diagnostic of P. (P.) lawrencianus. It (and varietal form below) appears most closely similar to P. (P.) obtusirostris Gurjanova from the western Pacific coastal marine region (p. 27). Some larger (and presumably older) specimens were fouled lightly on peraeonal segments and leg bases by newly settled spat (larvae) of acorn barnacles (Balanus sp.) (Fig. 12). In these pleustinid specimens, some evidence of sexual dimorphism can be noted in the rostrum (longer, tip more broadly truncate in males) and in the mid-dorsal and dorso-lateral carinae (larger and more strongly elevated in males). A small midventral sternal process was noted on peraeon segment 3 of one male specimen (Fig. 12).

Pleustes (Pleustes) lawrencianus, variation 1. (Fig. 13)

Material Examined: St, Makarius Bay, Amchitka I., Alaska, C.E. O'Clair coll., 20 July, 1968 - 1 female br. I (11.0 mm) (fig.'d), CMN Cat. No. NMCC1994-376.

Diagnosis: This variation differs from the typical form above, mainly in the following features: Rostrum medium deep, apex broadly truncate; gnathopod 2, propodal PDSP count low (~17); peraeopods 5-7 heavy, bases subquadrate postero-distally, dactyls stout; dorso-lateral tubercles and carinae blunt-tipped; body size relatively small (11.0 mm).

FIG. 11. P. (Pleustes) lawrencianus, new species FEMALE (17 mm) HOLOTYPE (SEE PAGE 24)

FIG. 12. P. (Pleustes) lawrencianus, new species SPECIMENS FOULED BY NEWLY SETTLED CIRRIPEDES (SEE PAGE 25)

FIG. 13. P. (Pleustes) lawrencianus, variation 1 FEMALE br. II. (11.0 mm). (SEE PAGE 26)

AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994











FIG. 14. *Pleustes (Pleustes) obtusirostris* Gurjanova. 2 (16.0 mm). Japan & Okhotsk Seas (modified from Gurjanova, 1951, fig. 435).

Pleustes (Pleustes) obtusirostris Gurjanova, new status (Fig. 14)

Pleustes cataphractus obtusirostris Gurjanova, 1938: 313, Fig. 38.—Gurjanova, 1951: 638, Fig. 435.—Gurjanova, 1972: 143.—Kudrjaschov, 1972: 102.—Tzvetkova & Kudrjaschov, 1985: 4.—Barnard & Karaman, 1991: 650.

Diagnosis: Peraeon and pleon segments mid-laterally ridged but not unusually strongly carinate or toothed dorsally or dorso-laterally. Rostrum short, slightly down-curved towards sharply truncate apex. Antenna 1 distinctly longer than antenna 2, precise number of flagellar segments not discernible but probably > 30.

Gnathopod 1, propod distinctly smaller and more slender than in gnathopod 2. Gnathopod 1, propod, angle of "step-down" margin gentle ($\sim 30^{\circ}$), D-TD small; PDSP formula: outer - undeterminable; inner - 3:3:3(?). Gnathopod 2, propod, angle of "step-down" margin $\sim 45^{\circ}$, D-TD distinct; PDSP formula: outer undeterminable; inner - 2:4:2(?). Meral pr-cess ordinary.

Uropod 3, inner ramus with 5-6 pairs of marginal spines, length >2X peduncle, and nearly 2X length of inner ramus. Telson markedly longer than wide, slightly broadening distally, apex rounded.

Distribution: Recorded from the Okhotsk and Japan Seas, in depths from 0 - 80 m, on coralline algae.

Taxonomic Commentary: Gurjanova (1951, loc. cit.) has redescribed and refigured material described originally (1938) from depths of 0-80 m. in Siaukhu and Sudzukhe Bays in the Sea of Japan. Regretably, the original description of the species is limited, identity of the propods is reversed, and provides little information pertaining to the mouthparts and peraeopods. However, her figures clearly show that the lateral rostral margin dorsally overlaps the eye margin, a factor that places the species in the genus Pleustes (sens. lat.) and not in the genus Thorlaksonius where a truncate rostrum also occurs in some species (p. 38). The figures show also that the lower margins of coxae 1-2 are rounded (not incised), and that the anterior peraeon lacks dorsal and lateral carinae or tubercles, character states that place the species in subgenus Pleustes rather than in subgenus Catapleustes. Moreover, at the postero-distal angle of gnathopod 2, the marginal "step- down" angle is large, the dactyl-tip depression is distinct, and the postero-distal cluster of spines does not extend along the outer palmar margin, character states that also rule out possible placement in the subgenus Catapleustes.

In view of the dearth of species-critical detail in the previous descriptions, this species could not be included confidently in the phenetic analysis and construction of a phenogram of morphological relationships (pp. 63-64). A detailed study of further material, and comparison with Gurjanova's original type specimen, is a necessry prelude to establishing the true relationship of this enigmatic form.

Pleustes (Catapleustes), new subgenus

Pleustes (partim) Gurjanova, 1951: 635.—Gurjanova, 1972: 131.—Barnard and Karaman, 1991: 650.

Type species: *Pleustes angulatus angulatus* Shoemaker, 1955: 40, fig. 14B.

Component Species:

P. (C.) japonensis Gurjanova, 1972: 154, figs 10, 11.

P. (C.) paradoxus Gurjanova 1972: 156, figs. 13,14

P. (C.) victoriae, new species (p. 28)

P. (C.) constantinus, new species (p. 32).

Diagnosis: Body carinated (toothed) mid-dorsally on all segments of peraeon and pleon; weakly to strongly dorso-laterally on peraeon segments 1-7, pleon segments 1-3, and urosome segments 1 & 3; medium to strongly ridged or toothed laterally on peraeon segments 1-7, and toothed behind on pleon segments 1, 2, & usually 3, often toothed inferior laterally on peraeon and pleon segments. Head, rostrum large, long, basally broad, with deep median depression; apex narrowing, subtruncate, distally deflexed, lower margin concave. Antennae medium, flagella 20-40 segmented.

Mandible: blade row with relatively few (<20) blades; palp segment 3 with relatively few (4-6) baso-facial setae. Maxilla I, segment 1, lateral process moderately developed, weakly setose. Maxilla 2, plates small, with inner marginal basal plumose seta. Maxilliped, palp segment 3 with well developed medio-distal pectinate spines.

Coxal plates 1-4, lower margin appearing angular, lower hind margin deeply incised or scalloped, outer face with distinct vertical rib; coxa 4 usually also with 2 posterior horizontal ridges. Coxa 5 with strongly developed, winglike, lateral process.

Gnathopods 1 & 2, distal-most group of postero-distal spines of propod extending submarginally along outer palmar face and beyond corresponding group of 4 inner marginal spines; distal-most outer spine variously (20 - 50% +) larger than adjacent spine; dactyl-tip depression (D-TD) small, shallow; angle of "step-down" margin shallow (usually < 30°), hind margin appearing nearly continuous with palmar margin; meral process weak to medium.

Peraeopods 3-7 generally slender. Peraeopods 5-7 typically more robust, and dactyls markedly longer than in peraeopods 3-4; coxae strongly horizontally ribbed, rounded or acute behind; hind margins of bases straight or shallowly incised, lower hind lobes sub-acute, proximal tooth of peraeopod 7 strong.

Uropods 1-2 relatively long; inner ramus usually longer than respective peduncle. Uropod 1 often longer than pleon segment 3 and urosome segments 1-3 combined.

Telson short-rectangular, slightly broadening distally, apex subtruncate.

Coxal gills large, plate-like.

Etymology: A combining form of the Greek prefix "kata" of Stimpson's species name "cataphractus" and the generic root "Pleustes", refering to the sharply incised lower margins of the anterior coxal plates of this subgenus, not found in subgenus Pleustes.

Taxonomic commentary: Although closely similar to subgenus *Pleustes* in most character states, subgenus *Catapleustes* embodies some character states of the genus *Thorlaksonius* (see commentary in *Pleustes*). These latter encompass the distal outer palmar spines of the gnathopod propod that extend along the outer palmar margin, the gentle angle of the "step-down" propodal margin, as well as the generally weak dactyl-tip depression, the weakly setose mandibular palp, the relatively few mandibular blades, and relatively short uropod 3.

Pleustes (Catapleustes) victoriae, new species (Figs. 1E,1F, 15, 16C)

Material Examined:

BRITISH COLUMBIA: Queen Charlotte Islands: ELB Stn. H8b, Delkatla Slough, near Masset, Aug., 1957 - 2 subadult males.

Northern Vancouver Island: ELB Stn.V18, Kelsey Bay, wharf, LW, July, 1959 - 2 females (1 slide mount), 5 im. (dried spms); ELB Stn. V17, Boat Bay., LW, July, 1959 -1 female (br. I), 1 im.

Southern Vancouver Island: Off Victoria, outer harbour, B. C., C. Low coll., 8 June, 1981 - Female ,br. II (7.3 mm) + slide mount, HOLOTYPE, CMN Cat. No. NMCC1994-362. Malcolm Pt., N.W. tip Malcolm I.(50.1°N,127.1° W), surface tow, E. Black, C. Low coll., 11 Sept., 1980 - Male (6.3 mm) + slide mount, ALLOTYPE, CMN Cat. No. NMCC1994-363; <u>Ibid</u> -2 males, 6 females, CMN Cat. No. NMCC1994-380. Greens Creek Delta, Hawk Inlet, B.C., E. Black coll., 1981 - 1 im.; unstated locality, Victoria area, B. C., E. Black coll., 1981 - 4 females, 2 males.

Diagnosis: A generally plesiomorphic member of the subgenus having relatively weakly developed dorsal and dorso-lateral tubercles and weak peraeonal and coxal lateral processes.

Female, br. II (7.3 mm): Mid-dorsal tubercles directed vertically and slightly posteriorly, short and acute on peraeon 1-4 (1 not noticeably larger than 2), higher and more broadly ridge-like on peraeon segments 5-7, broadly carinate on pleon 1, and progressively lower, unevenly ridge-like on pleon 2 & 3; dorso-lateral tubercles faint on peraeon 1-4, small, acute posteriorly on peraeon 5-7, ridged and posteriorly acute on pleon 1 & 2 and protruding little above middorsal line on pleon 2, ridge-like and mid-dorsally excavate on pleon 3 and urosome 1, and wing-like, acute above on urosome 3; mid-lateral ridges extending narrowly from sides of peraeon 1-7, sharply acute behind, short-ridged and cuspate on hind margin of pleon 1 & 2, indistinct on pleon 3.

Head very broad; eyes large, protruding half-diameter

KEY TO SPECIES OF PLEUSTES (CATAPLEUSTES)

 Peraeon segments 1-7, mid-lateral ridges variously shelf-like, rounded or acute behind, not produced outwards as tooth-like processes; inferior lateral tubercles lacking; gnathopods 1 & 2, submarginal palmar spines few (3-6), extending not more than one-third along outer face of palm; distal spine usually distinctly larger (about 50% longer) than adjacent spine. Peraeon segments 1-7, mid-lateral ridges of peraeon segments 1-7 strongly produced outwards, tooth like; inferior lateral tubercles present on peraeon segments 1-7 and pleon 1-3; gnathopods 1 & 2, submarginal palmar spines numerous (8 -12), extending at least half way along outer face of palm; distal palmar spine about 20% longer than adjacent spine.
 2. Peraeon segments 1-4 with distinct dorso-lateral tubercles, each as tall as broadbasally; peraeon segments 1-7 with elevated mid-dorsal carinations, carinae about as broad as tall
 3. Mid-dorsal tooth of peraeon 1 not larger than on peraeon 2; coxa 5, lateral wing weak, extending outwards less than half its length; pleon 3 lacking distinct posterior marginal cusp; antenna 1, flagellum 30+ segmented
4. Coxal plates 2-5 each with small antero-proximal tubercle; head with distinct mid-lateral ridge; per- aeopods 5-7, basis lower hind corner sharply rounded

aeopods 5-7, basis lower hind corner sharply rounded P (C.) paradoxus Gurjanova (p. 36)
 —Coxal plates 2-5 lacking antero-proximal tubercles; head lacking distinct median ridge; peraeopods 5-7, basis, lower hind corner subacute P. (C.) angulatus Shoemaker (p. 35)

from lateral surface; rostrum large, slightly longer than its basal width and longer than head, distally down-curved, apex narrowly subtruncate. Antenna 1 the longer, flagellum about 30-segmented, not basally conjoint; antenna 2, peduncle 4 not reaching end of peduncle of antenna 1, flagellum about 22-segmented, not basally conjoint.

Coxae 1-4 broad, medium deep, lower margins relatively shallowly incised behind; coxa 1 not totally covering anterior head lobe, medial rib weakly developed; coxa 4, median and horizontal ribs indistinct, hind lobe strong, acute, covering about 40% of lower margin of coxa 5. Coxa 5, lateral wing medium strong.

Mouthparts regular. Mandible, apex of molar relatively broad but non-triturative; spine row with 15-17 thick blades; left lacinia 7-dentate; palp segments 2 & 3 subequal in length, segment 3 with 4-5 baso-facial setae. Maxilla 1, palp segment 1 with single outer marginal seta; palp segment 2 broad, with 6 apical and inner marginal spines. Maxilla 2, plates short, basal inner marginal plumose seta medium strong. Maxilliped, inner plate with 4-5 apical, and 2 subequal subapical inner marginal spines; outer plate columnar, with 3-4 slender apical spines; palp not exceptionally powerful, segment 3 with row of subapical pectinate spines.

Gnathopods 1 & 2, propods subovate, subequal, 2 deeper. Gnathopod 1, basis with small anterior marginal cluster of setae medially; propod with 3 clusters of median facial submarginal setae; angle of "step-down" margin shallow ($<20^{\circ}$); D-TD very weak; distal group of 6 spines, three of which extend onto outer palmar margin; PDSP formula: outer - 6:3:3; inner - 3-4:3:3, total of 21-22. Gnathopod 2, propod, angle of "step-down" margin shallow (20-30°); D-TD barely discernible; PDSP formula: outer - 5(6):3:3; inner - 3:3:4, total of 21-22, and a small group of 1-2 accessory proximal spines; meral process short.

Peraeopods 3-4 as stout as, but shorter than, peraeopods 5-7; dactyls short. Peraeopods 5-7 subequal in length; bases with median ridge, hind margins slightly concave, hind corners squarish; segment 4 overhang shallow, about 20% length of segment 5; dactyls long, about half length of respective segment 6.

Pleon plates 2 & 3, hind corners acuminate, not produced. Uropods 1 & 2, inner ramus slender, distinctly longer than peduncle. Uropod 3, inner ramus nearly twice length of outer ramus, margins with 8 serial pairs of spines.

Telson slightly broadening distally, longer than wide, apex subtruncate. Coxal gills on peraeopods 2-6 large, laminar.

Body colouration: orange (fide E. Black).

FIG. 15. Pleustes (Catapleustes) victoriae, n. sp. FEMALE ov. (7.3 mm) HOLOTYPE; MALE (6.3 mm) ALLOTYPE. (SEE PAGE 30)

FIG. 16. Pleustes (Catapleustes) spp. - lateral views. A.-P. (C.) constantinus, n. sp.; B.-P. (C.) constantinus var.; C.-P. (C.) victoriae, n. sp. (SEE PAGE 31)









Pleustes (Catapleustes) constantinus, new species (Figs. 1G, 16A, 17)

Material Examined: Constantine Harbor, Amchitka I., Alaska, from plankton pump samples, off dock, P. Slattery coll., 21 Sept., 1969-1 male (8.0 mm) + slide mount, HOLOTYPE, CMN Cat. No. NMCC1994-364; <u>Ibid.</u>- 3 males, PARATYPES, CMN Cat. No. NMCC1994-379.

Diagnosis: An advanced member of the *victoriae* subgroup having relatively strongly developed dorsal and dorsolateral tubercles and strong lateral coxal processes.

Male (8.0 mm): Mid-dorsal tubercles directed vertically and slightly posteriorly, tips acute, medium strong (height greater than basal width) on peraeon 1-4, very strong on peraeon 5 & 6, successively decreasing and basally broadening on peraeon 7 and pleon 1, unevenly ridge-like on pleon segments 2 & 3; dorso-lateral tubercles rounded, low, on peraeon 1-4, increasingly strong, tooth-like on peraeon 5-7, strongly elevated on pleon 1 & 2 (above mid-dorsal line) broadly ridge-like and dorsally incised on pleon 3 and urosome 1 small & postero-dorsally toothed on urosome 3; midlateral ridge extending broadly (more than half segment length) from sides of peraeon 1-7, hind corners acuminate; coxae 5-7 acute and produced be hind. Pleon plates 1-3, hind margin with basal cusp; inferior lateral tubercles lacking.

Head broad; eyes large, protruding nearly half-diameter from facial surface; rostrum very large, longer than its basal width and about 40% longer than head, apex narrowing, subtruncate, distally slightly downcurved. Antennae subequal, Antenna 1 slightly longer than antenna 2, flagellum about 22-segmented; antenna 2, flagellum with about 16 segments, basally conjoint.

Coxae 1-3 relatively narrow (> 2X width), median rib strong, lower margin deeply incised, hind corner acuminate; coxa 1 covering anterior head lobe; coxa 4, horizontal ribs distinct, hind process produced, covering nearly half lower margin of coxa 5. Coxa 5, lateral wing very strong, projecting outwards nearly equal to its length, apex sharply acute; coxae 6 & 7 laterally ridged and toothed behind.

Mouthparts reduced. Mandible, palp segment 3 with 6-7 inner marginal pectinate setae and 5 (3+2) baso-facial setae; blade row with 15-17 blades. Maxilliped, palp segment 3 with 3 stout medio-distal saw-tooth spines set close to base of dactyl; outer plate with 2 strong apical spines; inner plate with 5-6 longish apical spines and 2 stouter inner marginal spines.

Gnathopods strongly developed. Gnathopod 1, basis with a few short slender spines distally on anterior margin; propod, distal group of postero-distal spines relatively long, extending dactylward about half their length beyond palmar margin; angle of "step-down " margin very shallow, almost continuous with palmar margin; D-TD inconspicuous; PDSP formula: outer - 6:3:2; inner - 3-4:3:3, total of 20-21. Gnathopod 2, propod with 3 clusters of postero-distal spines; distal group of 6 lateral spines extending submarginally about 1/4 palmar margin, distal spine about 50% longer than the adjacent spine; angle of "step-down" margin shallow (~20°); D-TD very weak; PDSP formula: outer - 6:3:3; inner - 3:3:3, total of 21; meral process short, acute.

Peraeopods 5-7, hind lobes of bases shallowly concave behind, proximally very broadly rounded in peraeopods 5 & 6, strongly toothed and nearly square on peraeopod 7; segment 4 overhanging segment 5 by about 30% of its length; dactyls slightly more than half length of respective propods.

Pleon plates 2 & 3, lower margins nearly bare, with 1-2 short stout spines only, hind corners acuminate, slightly produced. Uropod 3, inner ramus slender, about 2 1/2 X length of peduncle, margins 6-spinose; inner ramus, margins 3-spinose.

Telson short, rectangular, broadening distally, apex gently convex, hind corners very broadly rounding. Coxal gills large, plate-like, smaller on peraeopod 6.

Adult Female: Unknown.

Etymology: The name "constantinus" alludes to the type locality of the species at Constantine Harbor, Aleutian Islands, Alaska.

Taxonomic Commentary: A closely similar variant of the Aleutian species was obtained at several stations along the mainland coast of British Columbia as follows:

Pleustes (Catapleustes) constantinus, variation 1 (Fig. 1H; 16B)

Material Examined: ELB Stn. H26, Cox Point, mouth of Rivers Inlet, B. C., 30 m. dredge, July 19, 1964 -1 male (7.5 mm.) + slide mount, (fig.'d), CMN Cat. No. NMCC1994-365. ELB Stn. H5, Hinks I., B.C., LW level, July, 1964 - 2 males, 6 subadult specimens. Unnamed locality near Victoria, B. C., E. Black SCUBA Stn. B10 506 009, 1981 - 1 imm male + slide mount. CMN collections.

Diagnosis: Male (7.5 mm). This variant is similar to P. (C.) constantinus, having strongly elevated dorso-lateral and dorsal tuberculations on peraeon and pleon, and strong outward projection of the lateral process of coxa 5. It differs in the following character states:

Head, rostrum relatively deep, and more strongly deflexed distally. Mid-dorsal carinae more narrow, and bent more strongly posteriorly than in the species type.

Mandible, segment 3 with 11-12 inner marginal pectinate setae and 4 (2 + 2) baso-facial setae. Maxilliped, palp segment 3 elongate, with 5 stout medio-distal saw-tooth spines; outer plate with 2 stout apical spines; inner plate with 5-6 stout apical spines and 3 inner marginal spines.

FIG. 17. *Pleustes constantinus,* new species. MALE ov. (8.0 mm) HOLOTYPE ; (SEE PAGE 33 - OPPOSITE).



Coxae 1 not quite covering anterior head lobe, lateral rib strong, lower margin with narrow, deep, posterior excavation; coxa 2, lower margin, anterior portion smoothly convex, posterior excavation deep, semi-circular. Coxae 5-7 more sharply acute posteriorly.

Gnathopods 1 & 2, propod, 5 postero-distal spines extend submarginally along 1/3 palmar margin, distal spine slightly (20%) longer than adjacent spine; basis (of gnathopod 1) with medium-length setae, clustered centrally along anterior margin; basis (of gnathopod 2) with several short setae along antero-distal margin; PDSP counts as in the *C. constantinus* type.

Peraeopods 5-6, hind margin of basis nearly straight, proximal corner sharply rounding; peraeopod 7, hind margin with shallow excavations above and below sub-median "hump", proximal corner raised and subacute; dactyls elongate, about 60% length of corresponding propods.

Female: Unknown.

Extralimital Species of Pleustes (Catapleustes)

Previously treated in literature accounts of Soviet fareastern and N. American western arctic pleustids are various forms that appear referable to subgenus *Catapleustes* of genus *Pleustes*. These include the highly ornamented species of *Pleustes* and varieties of *P. panoplus* described and figured by Gurjanova (1938, 1951, 1972) mainly from the sea of Japan and Kamchatka regions, and by Shoemaker (1955) from Pt. Barrow, Alaska. Full description and analysis of mouthparts, gnathopods, coxal gills, etc., are yet required for precise classification of all those forms. However, as outlined in the subgeneric summary (p. 28), the taxa diagnosed below appear to be valid full species that are referable to the present concept of *Catapleustes*.

Gurjanova (1951, p. 637, fig. 434) redescribed and refigured, as *Pleustes cataphractus*, a medium large (20 mm) species from moderate depths (27-30 m.) in the seas of Japan and Okhotsk . In its strongly ornamented peraeon and gently sloped "stepdown" of the posterior angles of the propods of both gnathopods, it differs markedly from Stimpson's original *cataphractus* from the N. American Atlantic coast. The scalloped lower margins of coxae 1-4, and horizontally ribbed outer surface of coxa 4, are features of subgenus *Catapleustes*. Although Shoemaker (1955, p. 40) likened this Gurjanova "variety" to his own "*angulata*", as indicated in the key to species (p. 29), a distinctly different species may be represented here. Similar material was found by Tzvetkova and Kudrjaschov (1985) in S. Sakhalin Bay.

Taxonomic and Distributional Commentary: As indicated in the phenetic analysis (p. 66) and key to species, the subgenus *Catapleustes* appears divisible into two major morphological subgroups, viz. the *C. angulatus* (TYPE) subgroup, and the *C. victoriae* subgroup. The former is more strongly dorsally and laterally carinate and tuberculate, and

generally more advanced phyletically. Within the victoriae subgroup, the species *japonensis* is considered slightly more advanced than *constantinus* or victoriae.

Pleustes (Catapleustes) japonensis Gurjanova, new status (Fig. 18)

Pleustes cataphractus japonensis Gurjanova, 1972: 154, figs. 10, 11.

Pleustes cataphractus Tzvetkova & Kudrjaschov, 1985: 2.

Diagnosis. Female (20 mm): Peraeon segments 1-7 each with strong mid-dorsal carinae, dorso-lateral tooth-like processes, and strong mid-lateral carinae, but inferior lateral tubercles lacking. Pleon segments 1 & 2 with small, low mid-dorsal carinae but strong dorso-lateral processes, bifid on pleon 2. Pleon 3 and urosome 1 each with strong paired bifid dorso-lateral carinae. Urosome 3 with single-toothed pair of dorso-lateral carinae. Pleon plates 1-3 each basally with posterior marginal tooth, hind corners acute, produced.

Head, rostrum very large, arcuate, concave between raised lateral margins, lower margin concave, apex acute. Eyes large, round. Antenna 1, flagellum with about 30 short segments. Antenna 2 shorter, flagellum with about 25 segments.

Mouthparts not described.

Coxae 1-4 ribbed medially but lacking proximal tubercles, hind corners conspicuously excavate (weakly in coxa 4). Coxae 5 with strong lateral tooth; coxae 6-7 laterally ribbed and toothed behind.

Gnathopods 1 & 2, propods subequal, slightly less deep in gnathopod 1, hind margin in gnathopd 2 very short and nearly vertical. Gnathopod 2, dactyl-tip depression of propod (at posterior angle) shallow but distinct; some 3-5 spines of distal group extend onto palmar margin, distal spine about 30% larger than adjacent spine. Gnathopod 1, propod PDSP formula: outer - 7:3:3; inner - undeterminable. Gnathopod 2, PDSP formula: outer - 7:3:3; inner - undeterminable.

Peraeopods 5-7, bases ribbed medially, hind margins straight, lower hind corners squared; distal segments relatively stout; postero-distal lobe of segment 4 overhanging about 30-40% of segment 5; dactyls strong, each 50-60% length of respective propod.

Uropod 3 rami relatively short, weakly spined, length of inner ramus only 2X peduncle and nearly twice outer ramus. Telson, length about 1.3X width, slightly narrowing distally, apex rounded.

Distributional Ecology: The species figured by Gurjanova (1972) is known from Peter-the-Great Bay and Possjet Bay in the Sea of Japan, from the lower intertidal zone to depths of 80 m. Specimens from a single station, 0.7-1 m in depth, off the west coast of S. Sakhalin, examined by Tzvetkova and Kudrjaschov (1985), are tentatively attributed to this form.



FIG. 18. Pleustes (Catapleustes) japonensis Gurjanova, new status 2 (20.0 mm). (modified from Gurjanova, 1972, figs. 10, 11). Japan Sea.

Taxonomic Commentary: Gurjanova (<u>loc. cit.</u>) described, under the name *P. cataphractus japonensis*, a medium-sized (20 mm), strongly carinated and tuberculate species from Peter-the-Great Bay in the northwestern Sea of Japan. Although details of the mouthparts and degree of lateral extension of coxa 5 have not been treated, this taxon is clearly amember of the *Catapleustes* subgenus of *Pleustes*, and clearly distinct from all other species known to date. Diagnostic features, as outlined in the key to known species, are the broadly shelved and laterally directed peraeonal margins, the broad, high, mid-dorsal carinations, and the strong dorso-lateral tubercles on peraeon segments 1-7, the strong mid-lateral hind cusps on pleon plates 1-3, and straight hind margin of the bases of peraeopods 5-7. The taxon is here elevated to full species status within subgenus *Catapleustes*.

Gurjanova (1972) has also included in the synonomy of *japonensis* material that she had previously described and illustrated as *P. cataphractus* (1938), and *P. cataphractus typicus* (1951). However, in the 1951 paper, her illustration of the presumably same 20 mm female differs in some feattures, especially in abdominal carination and gnathopod propodal PDSP counts, that might be considered specifically significant, but which we attribute to less careful execution of the early figures. However, formal recognition of other taxa in Gurjanova's material (1951) must await detailed comparison with other regional species, and with the type of P. (C.) japonensis.

Pleustes (Catapleustes) angulatus Shoemaker, new status (Fig. 19B)

Pleustes panopla angulata Shoemaker, 1955: 40, fig. 14B. Pleustes angulatus angulatus Gurjanova, 1972: 155, fig. 12. —Barnard & Karaman, 1991: 650, fig. 115 (part).

Diagnosis: Male (10.0 mm). Peraeon segments 1-7 and pleon segments 1-2 each with strong dorsal and dorso-lateral acute processes or teeth, tips directed posteriorly, and low inferior lateral tubercles or teeth. Peraeon segments 1-7, mid-lateral carinae subalate. Pleon segments 1 and urosome segment 3 with strong bifid dorso-lateral carinae. Urosome 3 with small tooth-like dorsolateral carinae. Pleon plates 1-3 each basally with a strong posterior margin tooth or cusp.

Head with mid-dorsal ridge. Rostrum deep, elongate (length 1.5X head), nearly straight, apex acute. Eye medium-large, round. Antennae subequal. Antenna 1, flagellum with about 22 segments. Antenna 2, flagellum with 16-18 segments.

Coxal plates 1-4 medially ribbed, lacking proximal low tubercles, hind corners strongly excavate. Coxae 5-7, median ridge produced laterally as strong tooth, hind margins of coxae 6 & 7 rounded.

Gnathopods 1 & 2, propod spination not shown in detail. Propods large, subovate, that of gnathopod 1 slightly more slender than in gnathopod 2; angle of "step-down" margin of both propods is gentle $(\sim 30^{\circ})$ although appearing slightly greater in gnathopod 2; about 6 distal spines extend onto outer palmar margin of both propods; meral process moderately produced in both gnathopods.

Peraeopods 3-4 & 5-7, distal segments relatively short, stout, dactyls medium strong. Peraeopods 5-7, bases with slightly concave hind margins and squared hind corners; segment 4 overhanging segment 5 behind by nearly 50%.

Uropod 2, inner ramus distinctly longer than outer ramus, and longer than peduncle. Uropod 3, outer ramus appearing relatively thick and about half length of inner Telson not described in detail. ramus.

Distributional Ecology: P. (C.) angulatus is known from 2 specimens, to 7 m. depth, off Pt. Barrow, Alaska.

Taxonomic Commentary: Despite the lack of information concerning mouthparts and gnathopods, the external morphology of P. (C.) angulatus is here regarded as distinctive at the full species level. Differences of external body ornamentation and of gnathopod palmar armature, have been detailed in the key to species (p. 29) and in the treatment of P. (C.) paradoxus (below). In P. (C). angulatus, the flagellum of antenna 1 has only 22 segments (vs. 30+ in paradoxus) the lateral process of coxa 7 is shorter, and the distal segments (4-6) of the peraeopods are relatively short and stout.

Shoemaker (loc. cit.) supported the contention of Sars (1895), that the spine groups arising from what is termed here the "step-down" margin, are posterior, rather than palmar, marginal in origin.

Pleustes (Catapleustes) paradoxus Gurjanova, new status (Fig. 19A)

Pleustes angulatus paradoxus Gurjanova, 1972: 156, Figs. 13, 14.-Barnard & Karaman, 1991: 650.

Diagnosis. Male (16.0 mm): Peraeon segments 1-7 and pleon segments 1-2, each with high, arched, acute middorsal and dorso-lateral tooth-like processes, and inferior lateral tubercles or small teeth. Median carinae of peraeon segments 1-7 form tooth-like projections. Pleon segment 3 and urosome segment 1 each with strongly bicuspate lateral carinae. Urosome segment 3 with pair of wing-like dorsolateral carinae. Pleon plates 1-3 each basally with strong posterior marginal tooth.

Head with strong mid-dorsal ridge. Rostrum large, deep, strongly arched, lateral margins dorsally elevated, lower margin concave, apex subacute. Eye medium, round. Antenna 1, flagellum with 35-40 small segments (estimated). Antenna 2, flagellum slightly shorter, flagellum of 20-25 short segments (estimated).

Mouthparts undescribed.

Coxal plates 1-4 strongly ribbed medially, lower hind corner strongly excavate, processes acute; coxae 2-4 each proximally with low rounded protruberance. Coxa 5 deep, broad, with low facial protruberance anteriorly, strong winglike mid-lateral ridge, and acutely produced hind margin. Coxae 6-7 rounded behind, median ridge extending laterally as very strong acute tooth.

Gnathopod 1, basis with proximal and distal groups of anterior marginal setae; propod more slender and with smaller "step-down" posterior angle ($\sim 20^{\circ}$) than in gnathopod 2 (~60°); dactyl-tip depression shallow but distinct; distal row of 11 spines at posterior angle extend about 2/3 length of outer palmar margin, distal spine only slightly larger than adjacent spine; propodal PDSP formula: outer - 9:3:2; inner - 2:2:2, total of 20. Gnathopod 2, distal row of 10 spines extending more than half way along outer palmar margin; propodal PDSP formula: outer- 8:2:4; inner - 3:1:0(?), total of 18(?); meral process strong.

Peraeopods 5-7, bases broadest proximally, medially ribbed, hind margins varying from slightly concave (peracopod 5), to slightly convex (peracopod 7), lower hind corners squarish; segment 4 slender, postero-distal process relatively short (distal segments and dactyls not shown).

Uropods and telson indistinctly shown. Uropods 1 & 2, rami appearing slender, inner ramus longer than peduncle. Uropod 3, rami long, slender, length of inner ramus about 1.5X outer ramus. Telson not shown dorsally.

Distributional Ecology: Type lot from Kasatka Bay, southeastern Iturup Ids, Okhotsk Sea, 414 m. in depth.

Taxonomic Commentary: As noted above, P. (C.) paradoxus is grossly similar to C. angulatus in form and armature of peraeonal mid-dorsal, dorso-lateral, and midlateral processes or carinae, and inferior lateral tubercles. Gurjanova (loc. cit., fig. 14) appears to have reversed labels on her enlargements of palmar margins of gnathopods 1 & 2, corrected here in fig. 19A, and in the text (above). In gnathopods of paradoxus, the outer palmar spines are much stouter, and extend 1/2 to 2/3 the length of the palmar margins, rather than $\sim 1/3$, as in angulatus. Moreover, the coxal plates of paradoxus are much more deeply and sharply incised postero-distally, and bear small proximal facial "knobs", lacking in angulatus. With respect to the form of the bases of peraeopods 5-7 of both species, the hind lobes are broad, with nearly straight hind margins and sharply squared lower hind corners, although the hind lobe of peraeopod 7 is illustrated as rounded by Gurjanova (above).



 FIG. 19A. Pleustes (Catapleustes) paradoxus Gurjanova. o" (16.0 mm) Iturup I. (modified from Gurjanova, 1972)
 FIG. 19B Pleustes (Catapleustes) angulatus Shoemaker, o" (10.0 mm). Pt. Barrow, Alaska. (modified from Shoemaker, 1955, fig. 14B)

Thorlaksonius, new genus

Pleustes (partim): Gurjanova, 1951: 435.—Barnard, 1969a: 425.—Gurjanova, 1972:141—Barnard & Karaman, 1991: 650.

Type species: *Thorlaksonius brevirostris*, new species (present designation).

Other Species: Thorlaksonius incarinatus (Gurjanova, 1938); T. amchitkanus, new species; T. borealis, new species; T. obesirostris (Bulycheva, 1952); T. depressus (Alderman, 1936); T. platypus (Barnard & Given, 1960); T. subcarinatus, new species; T. carinatus, new species; T. truncatus, new species; Thorlaksonius sp. (Nagata, 1960, 1965).

Diagnosis: Body small to medium in size, broad, heavy. Carinae relatively weak, variably on pleon and posterior peraeon, weak or lacking on urosome. Peraeon segments 1-4 totally lacking mid-dorsal, dorso-lateral, and mid- lateral teeth or carinae. Head, rostrum deep, blunt (apex deflexed, rounded, or truncate, seldom acute), mid-dorsally flat or slightly humped (not depressed), lateral ridges arising anteroorbitally; trending (often conspicously) to sexual dimorphism (longer and more slender in males). Antenna 1, peduncular segments 2 & 3 very short.

Coxae 1-4 large, deep, facially smooth or with slight mid-rib; lower margin nearly straight, never scalloped or incised behind; hind corner squarish. Coxae 5-6 with weak lateral ridge, acute posteriorly; coxa 7 variably ridged and toothed.

Mouthparts apomorphic. Mandible: palp segment 3 with 0-1 (rarely 3-5) baso-facial setae; spine row short (15-20 blades). Maxilla 1, palp segment 1, lateral shelf prominent, often strongly setose. Maxilla 2, inner plate, basal plumose seta very weak, usually lacking. Maxilliped, palp stout; outer plate small, slender, apex 2-4 spinose; inner plate with 6-9 apical and 2-3 subapical inner marginal spines.

Gnathopod 1, propod slightly more slender than 2; postero-distal spines in 3 groups, distal group extending submarginally along palmar margin (4-12 spines), distal spine often conspicuously enlarged; inner marginal spines few (3-4), subequal; angle of palmar "step-down" margin gentle, not abrupt (<45°); D-TD shallow, small; carpal hind lobes slender, well-developed; meral process strong.

Peraeopods 3 & 4 generally more slender and dactyls shorter than in peraeopods 5-7. Peraeopods 5-7, segments relatively short and stout; bases weakly ridged laterally, postero-distally rounded, hind margin convex (usually) or nearly straight; segment 4 usually strongly overhanging segment 5 behind.

Pleon plates 1-3, basal hind marginal cusps very weak or lacking. Urosome 1, lateral ridge low, shallowly incised. occasionally raised and prominent. Uropods 1 & 2, rami slender, serially spinose, inner ramus longer than peduncle. Uropod 3, inner ramus short, ~ 60% length of outer ramus, tips not exceeding rami of uropod 2. Telson relatively long, length up to 1.5 times width, slightly narrowing or little broadened distally.

Coxal gills often unequal in size; gill on peraeopod 2 often sublinear, gill on peraeopod 6 usually smaller than on peraeopod 5.

Etymology: The genus is named in honour of Dr. Neil F. Thorlakson, Bellevue, Washington who, with his wife, Pat, and family, has long been an active outdoorsman and supporter of biological research and resource conservation in the North American Pacific region.

Taxonomic and Biogeographical Commentary: As outlined in the key (p. 9), members of this genus are distinguished mainly by the dorso-ventral depth of the rostrum, the relatively weak dorsal body carinae, and the spinose palmar margins of the gnathopods. In addition, the mouthparts are relatively specialized. Many of the species are strikingly pigmented with disruptive patterns or warning colouration. Males are smaller and more slender, the rostrum typically much larger (longer), the eyes relatively larger, and the antennae relatively longer than in corresponding mature females.

The genus is boreal amphi-Pacific in distribution, with three-fourths of the known species endemic to the North America Pacific coastal marine region. They range southward mainly in shallow water, apparently to the limit of macro-algal substrata, and northward into the Bering Sea; not yet found in the Chukchi Sea or western arctic localities.

The species cluster into 3 major phyletic subgroups (p. 64), representatives of all three occurring along both Asiatic and North American coasts.

Thorlaksonius amchitkanus, new species (Fig. 20)

Material Examined: Cyril Cove, Amchitka I., Alaska, subtidal BCF dive buoys, C.E.O'Clair coll., 26 June, 1972. -1 female ov. (13.0 mm).+ slide mount, HOLOTYPE, CMN Cat. No. NMCC1994-351.

Diagnosis. Female ov.(13.0 mm): Body short, very deep, medium-large. Peraeon totally lacking dorso-lateral and mid-lateral carinae or teeth; pleon segments 1-3 lacking lateral carinae, teeth, and/or posterior cusps; mid-dorsal carinae low, ridge-like, posteriorly rounded on peraeon segments 6 & 7 and pleon segments 1 & 2, not elevated on pleon 3; small dorso-lateral tooth on pleon 2; medium, ridge-like dorso-lateral ridges on pleon 3 and urosome 1; urosome 3 with short, paired, dorso-lateral "wings". Head, rostrum slender, slightly longer than head, lower margin straight, apex slightly down-curved, acute. Antenna 1 slightly the longer, flagellum with 35-40 very short segments; antenna 2, peduncle 4 not reaching distal margin of peduncle 3 of antenna 1.

KEY TO SPECIES OF THORLAKSONIUS (FEMALES AND SUBADULTS)

i

 Pleon segment 3 and urosome segment 1 each with strong dorso-lateral carinae, elevated above level of mid-dorsal carina; gnathopod propods, distal-most palmar spine not enlarged, <50% longer than adjacent spine
 2. Rostrum elongate, slender, apex subacute; peraeon segments 5-7 lacking mid-dorsal and dorso-lateral carination or teeth; coxa 7 not laterally ridged, rounded behind
 3. Rostrum very long, about 50% longer than head; gnathopod propods each with 8 palmar outer marginal spines; uropod 3, inner ramus elongate, more than 2.5 X length peduncle . <i>T. incarinatus</i> Gurj. (p. 40) —Rostrum shorter, slightly longer than dorsal head margin; gnathopod propods with 4-5 spines along outer palmar margin; uropod 3, inner ramus about 2X length of peduncle <i>T. amchitkanus</i>, n. sp. (p. 38)
4. Rostrum, apex truncate; antenna 1, flagellum 35-40 segmented
5. Rostrum elongate, "duck-bill"-shaped, apex not deflexed, lower margin convex
 6. Coxa 5 with lateral ridge, toothed behind; gnathopod propods, distal palmar spine not enlarged, < 50% longer than adjacent spine
 7. Antenna 1, flagellum with 16- 20-segments; peraeon segments 6-7, and pleon segments 1 & 2, mid-dorsal carinae not toothed behind
8. Coxa 7, not laterally ridgedor toothed behind
 9. Antenna 2, flagellum with 16-18 segments; pleon plate 3, hind corner acute, not produced; mandible, palp segment 3 lacking facial setae. —Antenna 2, flagellum with ~25 segments; pleon plate 3 strongly produced behind; mandibular palp segment 3 with numeorus short facial setae. T. obesirostris Bulycheva (p. 45)
 10. Mid-dorsal carinae of peraeon segments 6-7 and pleon segments 1-2 strongly toothed behind; gnath-opods 1 & 2, propod slender, length 2X depth
 11. Peracon segments 6-7 with dorso-lateral teeth; rostrum short, blunt, lower margin straight; antenna 1, flagellum with 22 segments

Coxae 1-4 very deep, narrow; 2 & 3 with faint median rib, lower margins slightly convex, corners sharply rounded; coxa 1 not covering anterior head lobe, medial rib faint; coxa 4, hind lobe acute, extending half-way along lower margin of coxa 5. Coxae 5-7 short, deep, rounded behind, lacking postero-lateral ridges.

Mouthparts plesiomorphic. Mandible, blade row short, with 14-16 blades; molar relatively large, thumb-like, apex subacute; palp segment 3 with about 5 baso-facial setae, inner margin of segment 2 moderately strongly (18-20) setose. Maxilla 1, palp little broadened, apical spines and setae extend along medially oblique margin nearly to midpoint; segment 1, lateral process small, 1-setose. Maxilla 2, inner plate broadened, inner margin lacking plumose seta. Maxilliped, palp large, strong; inner plate tall, inner margin richly setose, apex with 2-3 long spines; inner plate relatively large, apex rounded, with 7-9 spines of various sizes (innermost short, stout) and 2 subapical marginal spines.

Gnathopods 1 & 2, propods subequal in size, 1 more slender, and inner face with 5 clusters of superior submarginal setae; carpal lobe relatively short. Gnathopod 1, basis, anterior margin lined with numerous short setae; angle of "step-down" margin ~ 30°; PDSP formula: outer - 8:3:3; inner - 4:3:4, total of 25; meral cusp small. Gnathopod 2, propod, angle of "step-down" margin similar, D-TD short, shallow; PDSP formula: outer - 8:3:4; inner - 3:4:5, total of 27; postero-distal spines extending submarginally less than one-third of palm, distal spine about 30% longer than adjacent spine; meral process medium strong.

Peraeopods 5-7, distal segments short, stout, powerful; bases enlarging posteriorly, hind margins straight; proximal cusp of basis of peraeopod 7 sharply acute; segment 4 posteriorly overhanging segment 5 by about 60-70% of its length; dactyls stout, powerful, about twice as large as those of peraeopods 3 & 4.

Pleon plates 1 & 2, hind margin sinuous, hind corner acute, produced in 2. Pleon plate 3, hind margin straight, hind corner squarish; lower margins finely spinose. Uropods 1 & 2, margins spinose, inner ramus little or not longer than peduncle, tips extending scarcely beyond tip of uropod 3. Uropod 3, inner ramus short, barely twice length of peduncle, only 50% longer than inner ramus, margins 6-7 spinose.

Telson short, broadest subapically, apex broadly rounded. Coxal gills pallet-like on peraeopods 2 - 3, plate-like on 4-6.

Etymology: The name "amchitkanus" alludes to the type locality of the species, in the outer islands of the Aleutian chain, Alaska.

Distributional Ecology: Known only from the type locality. The low body carinations and heavy structure of the posterior (clinging) peraeopods suggests that the species inhabits wave- and surf-exposed localities.

Taxonomic commentary: Although this species bears a few apomorphic specializations of the peraeopods, uropods, and telson, the overall body form and armature, and structure of the gnathopods and mouthparts is distinctly the most plesiomorphic of known N. American forms (see discussion analysis, p. 62). Its phyletically nearest relative appears to be T. incarinatus Gurjanova, a species occuring in subarcticboreal seas of the north-western Pacific region.

Thorlaksonius incarinatus (Gurjanova) (Fig. 21)

Pleustes incarinatus Gurjanova 1938: 314, fig. 29 (English summary: 396).—Gurjanova, 1951: 641, fig. 437.— Gurjanova, 1955: 186, Pl. XXXII, fig. 7.—Gurjanova, 1972: 142,143.

Diagnosis: Gurjanova (loc. cit.) has provided a reasonably complete and accurate description of external body features and details of gnathopods, uropod 3, and telson of this relatively small (7.0 mm) species. The diagnostic features are as follows:

Peraeon segments 1-7, mid-dorsal carinae feebly developed (on peraeon 6 & 7) or lacking, dorso-lateral teeth or carinae lacking; pleon segments with low mid-dorsal carinae and strong, ridge-like, medially indented, dorso-lateral carinae; pleon plates, hind marginal cusps lacking. Urosome 1 with strong paired dorso-lateral ridge.

Head, rostrum slender, elongate (about twice length of head), lower margin nearly straight, apex subacute. Eyes round, black. Antenna I slightly longer than antenna 2; flagellum of about 20 segments.

Coxae 1-4 deep, narrow, rounded below. Coxae 5-7 with weak lateral ridges and posterior teeth. Gnathopods 1 & 2 somewhat dissimilar in form; gnathopod 1, propod elongate, parallel-sided, inner surface with 5 clusters of anterior submarginal setae; angle of "step-down" margin shallow (~15°); PDSP formula: outer - 8:5:3; inner - 1:2:1(?), total of 20; distal group spread 1/3 along the outer margin, outer spine stout; posterior margin very short. Gnathopod 2, propod somewhat shorter and deeper, angle of "step-down" margin nearly 45°; PDSP formula: outer - 8:5:3; inner -1:2:2(?), total of 21; distal group extending along one-third of palmar margin, distal spine largest and heaviest; meral lobe large, acute.

Peraeopods 5-7, bases broad, hind margins nearly straight; segments 4 & 5 relatively short, broad, with moderate overhang of segment 5; dactyls strong (< 50% length of segment 6).

Uropods 1 & 2, rami longer than respective peduncles, tips extending beyond tips of uropod 3. Uropod 3, rami relatively long and slender; inner ramus slender, with 8 pairs of marginal spines, length nearly 3X peduncle and 1.6X outer ramus. Telson narrowing distally, length 1.3X width, apex squared.

Body colouration: All body segments marked by strong vertical striping.

FIG. 20. Thorlaksonius amchitkanus, new species. FEMALE ov.(13.0 mm) HOLOTYPE (SEE PAGE 41 - OPPOSITE)



.



FIG. 21. Thorlaksonius incarinatus (Gurjanova, 1972) 2 (7.0 mm). Okhotsk Sea. A-E - after Gurjanova, 1972 F - after Gurjanova, 1955.

Distribution: Seas of Okhotsk and Japan, in depths of 16 to 80 m., associated with the *Desmarestia* algal zone.

Taxonomic commentary: This species bears plesiomorphic character states similar to those of its Aleutian counterpart, *T. amchitkanus* (p. 38). The close phyletic relationship (phenogram, p. 62) suggests that character states of the mouthparts, etc., not diagnosed by Gurjanova (loc. cit.), may be similar to those of *T. amchitkanus*.

The original descriptions and figures of this long-rostrate species regretably provide little detail concerning the mouthparts. Presumably these bear plesiomorphic features similar to those of the closely related beringian species, *T. amchitkanus*. The lateral view figures of Gurjanova (1955, 1972) differ slightly in the size of the rostra, size and form of coxal plates, and degree of dorsal carination. Allocation of formal taxonomic significance to such differences may be justified but must await re-examination of the original material. Thorlaksonius borealis, new species (Figs. 22 & 23)

Pleustes platypa Barnard & Given, 1960: 42, Table I (partim)?—Barnard, 1969b: 207 (Table of variation - partim)?

Material Examined: 28 specimens at 10 localities, southeastern Alaska to Oregon.

S. E. ALASKA: ELB & DEM Stns., 1961: Prince William Sound: A96 (1 male); A151 (1 female); Alexander Archipelago, Stn. A175 (1 female).

BRITISH COLUMBIA: North-central coast, ELB Stns. H5 (2 males, 1 female), H33 (1 female), H30 (1 female). Vancouver I. ELB Stn. B27 (1 male). ELB Stn. P710, Cape Beale, 19 July, 1970 - 1 female (11.0 mm) + slide mount, HOLOTYPE, CMN Cat. No. NMCC1994-361; 2 other

FIGS. 22 & 23. *Thorlaksonius borealis*, new species. FEMALE ov. (11.0 mm) HOLOTYPE (SEE PAGES 43, 44).





females. Deer I., B. C., C. Low, E. Black coll., 10 m., 1980 - 15 im. specimens.

OREGON: ELB Stn. W60, Otter Rocks, Bedrock and algae, LW, Aug. 14, 1966 -1 Female br. II + slide mount. CMN.

Diagnosis: Female ov. (11.0 mm). Peraeon segments 1-5 totally lacking mid-dorsal, dorso-lateral, and mid-lateral teeth or carinae; mid-dorsal carina very low, ridge-like on peraeon segments 6 & 7 and pleon segments 1-2; dorsolateral teeth small posteriorly on peraeon 7 and pleon 1; medium, ridge-like dorso-lateral carinae on pleon 3 and urosome 1; lateral ridges, posterior teeth and cusps totally lacking on peraeon 1-7 and pleon 1-3.

Head, rostrum large, "duck-bill" shaped, slightly longer than deep, about equal in length to head, apex bluntly rounded, not deflexed. Antennae subequal; flagellum of antenna 1 with about 35 short segments. Antenna 2, peduncular segment 4 extending beyond peduncular segment 3 of antenna 1; flagellum of 26-28 short segments.

Mouthparts ordinary. Mandible, left and right sides with 18-20 blades; molar broadly triangular, apex blunt; palp segment 3 lacking baso-facial seta(e); inner margin of segment 2 strongly setose. Maxilla 1, palp not broadened, both left and right sides with 6-7 apical spines extending along medially obique margin; lateral lobe of segment 1 with 3-4 longish setae. Maxilla 2, inner plate broad, inner margin lacking plumose seta. Maxilliped, outer plate relatively tall, reaching distal end of palp segment 1, apex with 2 curved spines; inner plate short, apex with 6 unequal spines, innermost not basally stout.

Coxae 1-4 deep, broad, outer face of 2 & 3 with fine midrib, lower margin gently convex, hind corner nearly square; coxa 1 nearly covering anterior head lobe; coxa 4 moderately produced behind, length equal to about half width of coxa; coxae 5-7 each with strongly developed, slightly oblique, postero-lateral ridge, posteriorly acute in coxae 6 & 7, strongly produced in coxa 5; coxa 5 relatively shallow, length nearly twice depth.

Gnathopod 1 slightly less deep than gnathopod 2. Gnathopod 2, angle of "step-down" margin gentle (30°) , D-TD shallow, small; PDSP formula:outer - 8:3:2; inner -4:4:5, total of 26; distal group extending submarginally about one-fourth of palm, distal spine about 30% longer than adjacent spine; posterior margin nearly equal in length to palmar margin; meral process medium, acute. Gnathopod 2, angle of "step-down" margin greater (~45°); PDSP formula: outer - 8:4:2; inner - 4:4:4, total of 26; meral process large.

Peraeopods 5-7, bases large, increasing posteriorly, hind margin of peraeopod 5 slightly concave, of peraeopods 6 & 7 straight or slightly convex, hind lobes of all broadly rounded below; proximal cusp of basis of peraeopod 7 prominent, triangular; segment 4 posteriorly overhanging segment 5 by about half its length; dactyl stout, distinctly longer and heavier than those of peraeopods 3 & 4.

Pleon plates 2 & 3, hind corners acuminate, slightly produced, lower margins weakly spinose. Uropods 1 & 2

elongate, inner ramus distinctly longer than peduncle, tips extending well beyond tip of uropod 3. Uropod 3, inner ramus stout, about 2.5 times length of peduncle, margins 8spinose.

Telson relatively long, slightly expanded medio-distally, at level of penicillate setae, narrowing to broadly rounded apex. Coxal gills very large, narrowest on peraeopod 2, smallest on peraeopod 6.

Male (~7.5mm): Smaller and more slender, and rostrum relatively longer, than in female. Antenna 1, flagellum with 26 segments; aesthetascs numerous. Peraeopods 5-7, dactyls very long, >> than 1/2 length of weakly spinose segment 6. Uropods 1 & 2 slender, inner ramus > peduncle.

Etymology: From the Greek root "*boreo*", meaning northern, alluding to the northerly distribution of the species on the North American Pacific coast.

Taxonomic commentary: Thorlaksonius borealis is isolated phyletically from its nearest relatives, but "bridges" character states differences between all three major subgroups (p. 63). Its morphology approximates form 1 (Table I of Barnard & Given, 1960), and possibly also one of the variants listed by Barnard (1969b) in "Velero" material from the Point Conception region of California. This species entrains a number of plesiomorphic character states of the antennae, peraeopods, uropods and telson, but the mouthparts and coxal plates are relatively apomorphic. The species superficially resembles the *platypus-depressus* subgroup but the abdomen, especially pleon 3 and urosome, bears moderately well developed dorso-lateral ridges, reminiscent of those of the primitive *amchitkanus* group on the other.

Distributional ecology: Prince William Sound and Southeastern Alaska, through British Columbia to Oregon, mainly along surf-exposed, cold water, high salinity bedrock and algal shores.

> Thorlaksonius obesirostris (Bulycheva) (Figs. 24, 25)

Pleustes obesirostris Bulycheva, 1952: 215, fig. 16.— Gurjanova, 1972: 159, fig. 15.—Barnard & Karaman, 1991: 651.

Diagnosis: Body (7-10 mm). Mid-dorsal, dorso-lateral and mid-lateral teeth or carinae lacking on peraeon segments 1-7, weakly developed on pleon 1-3. Rostrum short, thick, deeper than long, apex blunt, deflexed, lateral margin not reaching eye. Eyes rather large, round, yellow-brown or bight cinnamon (in alcohol). Antenna 1, flagellum 14-15 segmented (part broken off?). Antenna 2, peduncular segment 4 slightly longer than 5; flagellum 21-22 segmented.

Mouthparts originally undescribed (figures of Bulycheva are small and species-diagnostic character states are not clear). Mandibular palp segment 3 bears a posterior marginal and facial brush of short setae (Gurjanova, fig. 15).



Fig. 24. Thorlaksonius obesirostris Bulycheva, 1952 Q (9 mm). Japan Sea. Peter the- Great Bay (modified from Bulycheva, 1952).



FIG. 25. Thorlaksonius obesirostris Bulycheva, 1952. Syntype Q (~10.0 mm). Japan Sea. (modified from Gurjanova, 1972, fig. 15).

Gnathopod 1, anterior marginal setae of basis located centrally; propod oval, palmar margin about 3/4 of its total length, with one stout cluster of antero-medial facial setae; distal spine group (DSPG) not extending onto palmar margin, distal-most spine very large, more than twice length of adjacent spine; angle of "step-down" margin very gentle; PDSP formula: outer - 2:3:2; inner - 0(?):3:1(?), total of 11(?). Gnathopod 2, propod similar but larger (inner facial setae not shown); angle of "step-down" margin sharp (45°); D-TD distinct; PDSP formula: outer - 4:1:1; inner - 1:1:1(?), total of 9; DSPG not extending onto palmar margin, distal spine more than twice length of adjacent spine(s).

Coxa 1 weakly hatchet-shaped. Coxa 2, lower hind border squarish. Peraeopods typical of the genus, hind margins of distal segments spinose.

Pleon plate 3, hind corner acute, produced. Uropod 3, outer ramus nearly twice length of inner ramus, and more than twice length of short peduncle. Telson longer than wide, narrowing slightly to rounded apex.

Distributional Ecology: Common in Peter-the-Great Bay (USSR coast, Sea of Japan), on reefs and in mature *Sargassum* and *Zostera*, at depths of 1-16 m. Tzvetkova & Kudrjaschov (1985) describe the species as abundant in the rocky shore kelp bed community and among fronds of *Sargassum*. The species occurs widely in the Seas of Japan and Okhotsk, and off the Kurile Islands and south Sakhalin.

Taxonomic commentary: The diagnosis (above) utilizes taxonomically critical information provided in the text accounts of Bulycheva (1952) and Gurjanova (1972), and is supplemented by the present authors' interpretation of figures. The armature of gnathopod propod posterior angle, setation of mandibular palp segment 3, and number of flagellar segments of antenna 1 relative to those of antenna 2, are anomalous to those character states in all other members of the genus *Thorlaksonius*. To clarify the accuracy and pertinency of these character states, detailed study of further material seems desirable.

Thorlaksonius depressus (Alderman) (Fig. 26)

Pleustes depressus Alderman, 1936: 56, figs. 14-18.—Barnard, 1954: 9.

Pleustes depressa J. L. Barnard, 1969b: 206, fig. 58c, Table (part).—Barnard, 1975 (Light's Manual): 348 (key), 362 (list).—Carter & Behrens, 1980: 376, fig. 1.—Staude, 1987: 379, fig. 18.65, Key.

Diagnosis: The following diagnosis is based on specieslevel character states provided in the taxonomic description and figures of Alderman (1936):

Female ov. (8.5 mm): Body medium, relatively slender. Low mid-dorsal and dorso-lateral carinae or teeth present on peraeon segments 6 & 7, and more strongly on pleon segments 1-3. Rostrum large, very deep, strongly deflexed to a broadly rounded or subtruncate apex. Antenna 1, flagellum 15-segmented. Antenna 2, flagellum 13-segmented.

Upper lip, epistomal process well marked, triangular, knife-like in front. Mandibular palp, length of segment 2 twice segment 1; segments 2 & 3 subequal in length. Maxilliped, inner plate half as long as outer. Other mouthpart structures probably much as in *grandirostris* and related members of the "duck-bill" subgroup of *Thorlaksonius*.

Coxae 1-4 deep, lower margins rounded. Coxa 4 not strongly produced behind. Coxa 5 posteriorly acute?

Gnathopod 1, propod twice as long as deep (wide) (angle) defined by a series of spines, distalmost palmar spine distinctly larger than adjacent spine. Gnathopod 2, propod deeper than in gnathopod 1, except that the posterior carpal lobe is larger and flattened cup-fashion over base of propod; angle of "step-down" margin very shallow, margin merging with posterior margin; D-TD barely discernible; at least 3 medium spines extend along outer palmar margin. PDSP formulae undeterminable.

Peraeopods 3-7 relatively short, segments stout. Peraeopod 4, dactyl stout, about 50% length of segment 6. Peraeopod 6, hind margin of basis nearly straight, posterior lobe rounded; segment 4 short, broad, hind lobe extending 50% length of segment 5; dactyl strong, length nearly 50% of segment 6.

Uropod 1, rami and peduncle subequal in length. Uropod 2, outer ramus 2/3 length of inner ramus. Uropod 3, outer ramus half as long as inner, and 50% longer than peduncle.

Telson flat, not constricted at base, rounded apically , length 40% greater than width.

Colour: light tan.

Length of specimens: 6.0 mm, 8.0 mm.

Distributional Ecology: In shallows along rocky shores, from Coos Bay, Oregon, to Carmel and La Jolla, California, in small numbers, variously associated with *Phyllospadix*, *Macrocystis*, and coralline algae. Two females, taken from kelp holdfasts, in 2 fathoms (about 4 m.) of water, at Moss Beach, San Mateo Co., California, July-August, 1933. Material similar to *T. depressus* was also listed by Barnard (1969b) from "Velero" Stns. 2280, and 1407.

Taxonomic Commentary: The weakly carinated body, large down-curved rostrum, short legs, and small size distinguish this species from all others known to date. Its combination of plesiomorphic and apomorphic character states relate it most closely to *Thorlaksonius platypus* and *T. grandirostris* (p. 54).

Thorlaksonius platypus (Barnard & Given) (Fig. 27)

Pleustes platypa Barnard & Given, 1960: 41, fig. 1.—J. L. Barnard, 1969b: 206, fig. 58a, Table (sample 1871 mainly) —Crane, 1969: 200, pl. 1?—Field, 1974: 439, Figs. 1-3? Pleustes platypus—Gurjanova, 1972: 142-143.—Barnard,

AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994





FIG. 26. Thorlaksonius depressus (Alderman). 2 (8.5 mm). Central California. (after Alderman, 1936, figs. 14-18).



FIG. 27. Thorlaksonius platypus (Barnard & Given). 2 (8.5 mm) Southern California. (after Barnard & Given, 1960, fig. 1).

Bowers, & Haderlie, 1980: 559?—Carter & Behrens, 1980: 376, fig. 1.—Barnard & Karaman, 1991: 651.

Material Examined: None identified in present lots.

Diagnosis: The following diagnosis is collated from the original figure and brief descriptive remarks of Barnard & Given (loc. cit.).

Female ov. (8.5 mm): Mid-dorsal carinae lacking ,or trace only, on peraeon segments 5 & 6, distinct on peraeon 7, medium to weak on pleon segments 1 & 2 respectively; dorso-lateral and lateral teeth lacking on all peraeonal seg-

ments, weakly developed on pleon segments 1 & 2. Dorsolateral ridges apparently lacking on pleon 3 and urosome 1.

Head, rostrum large, deep, "duck-bill" shaped, about 1.5X head length, slightly deflexed distally to bluntly rounded apex. Antenna 1, flagellum of 25-30 segments (estimated). Antenna 2, peduncular segment 4 extending well past peduncle of antenna 1; flagellum of 15-20 segments (estimated).

Barnard & Given (<u>loc. cit.</u>) referred to the mouthparts "as in *P. panopla* (Kroyer) (Sars, 1895, pl. 121)". However, in view of mouthpart distinctions between the genera *Thorlaksonius* and *Pleustes* (*Pleustes*), such does not seem likely, and the mouthparts remain, in effect, undescribed. Coxae 1-4 broad deep, lower corners sharply rounded. Coxa 5 hind margin steeply sloped, not strongly produced posteriorly. Coxae 5-6 hind corners subacute (facially not ridged?); coxa 7 apparently without lateral ridge or toothed behind.

Gnathopods unequal; gnathopod 1, propod smaller more slender than in gnathopod 2, hind margins of both very short; angle of "step down" margin very gentle, imperceptibly merging with hind margin; distal spines extend onto outer palmar margin, distal-most spine distinctly stronger than adjacent spine; PDSP formulae not accurately determinable; that of gnathopod 2 close to: outer - 8:3:2.

Peraeopods 5-7, bases broad, hind margins nearly straight; segment 4 ordinary, postero-distal lobe overhanging segment 5 by about 40% of its length; dactyls stronger than in peraeopods 3 & 4, about half the length of segment 6. Uropods 1 & 2, inner ramus longer than peduncle, serially about 10-spinose. Uropod 3, length of outer ramus about 60% that of the inner ramus. Telson slightly longer than wide, slightly broadening distally, apex rounded. Coxal gills, brood plates, pleopods also not described.

Distributional Ecology: Pt. Conception, Catalina I., and La Jolla, S. California, on various bottom types (*Phyllospadix, Chaetopterus*, etc.), in small numbers from the low water line to depths of more than 100 m.

Taxonomic commentary: Barnard (1969b, Table, p. 207) has listed a number of morphotypes (from "Velero" samples taken off the coast of southern California) that vary widely in type of rostrum, and dorsal carination of peraeon and pleonal segments. Variants of this species exhibit Batesian mimicry with mitrellid snails (Crane, 1969; Field, 1974; Carter & Behrens, 1980). Similar kinds of "variation" in the present material from British Columbia and adjacent coastal waters is here shown to have species-level taxonomic importance. Its possible applicability to Barnardian material awaits re-examination of the original "Velero" material in the Allan Hancock Foundation collections, and "mimicry" collections elsewhere (above).

Thorlaksonius brevirostris, new species (Figs. 28, 29)

Material Examined: A total of 235 specimens in 74 station lots were examined (number of specimens taken at each station given in parentheses).

S.E.ALASKA: ELB & DEM Stns., 1961: 14 lots (31 specimens): A6(1), A7(1), A27(1), A80(2), A91(2), A96(1), A131(1), A136(1), A147(6), A151(3), A168 (2).

ELB, KEC Stns., 1980: 6 lots (14 specimens): S5B7(10), S8F3(2); S18F3(1), S19B1(1), S20B5(1), S23F1(1). BRITISH COLUMBIA:

Queen Charlotte Islands: ELB Stns., 1957: 3 lots (6 specimens): E14a(3), W2(1), W4a(2).

North-central coast: ELB Stns., 1964: 11 lots, (82 speci-

mens): H1(1), H3(5), H7(11), H8(6), H10(4), H23(1), H29(3) H30(3), H33(14), H65 (31), H57(4).

Vancouver Island, north end, ELB Stns., 1959: 12 lots (83 specimens): O1(2), O5(3), O11(6), O13(2), O15(3), V5(5), V7(39), V10(1), V17(12), V46(6), N6(9), N16(1). ELB Stns., 1955: 1 lot (1 specimen).

TYPE LOT : Lady Ellen Point, north end of Vancouver I., B. C., ELB Stn. V7, LW, 7 Aug., 1959 - 1 female ov. (7.8 mm) + slide mount, HOLOTYPE, CMN Cat. No. NMCC 1994-352; male (7.0 mm), ALLOTYPE, CMN Cat. No. NMCC 1994-353; several males, females and immatures, PARATYPES, CMN Cat. No. NMCC1994-354.

Vancouver Islands, south end, ELB Stns.: 10 lots (43 specimens): 1955 -3 lots (31 specimens): G2(1), F1 (20), F2(10), F3(1); 1970 -2 lots (3 specimens): P702(2), P719 (1);1975 - 2 lots, (2 specimens): P3a(1), P17a(1);1976 -3 lots, (7 specimens): B4(1), B7(4), B27(2). Additional material from localities in southern Vancouver I.: E. Black, C. Low collns., (1980-81): -12 lots (21 specimens).

WASH.-OREGON, ELB Stns., 1966 - 5 lots (27 specimens): W30(2), W36(1), W40(1), W42(1), W60(22).

CALIFORNIA: Horseshoe Cove, Bodega Bay, CA. K. E. Conlan Stn. 06-2, July 6,1986 - 3 males, 5 females, 12 im.

Diagnosis: Female ov. (7.8 mm): Body small to medium. Peraeon segments 1-5 lacking dorsal and dorso-lateral teeth or carinae. Peraeon segments 6, 7, and pleon segments 1-3 with very low mid-dorsal ridge, not toothed behind. Pleon segments 1 & 2 with small dorso-lateral teeth. Pleon 3 and urosome 1 with low dorso-lateral ridges, not toothed behind. Pleon plates 1-3, hind corners acute, slightly produced, lacking hind marginal cusps.

Head, rostrum very short, about half length of head, strongly deflexed at subtruncate apex, lower margin slightly convex. Antennae subequal in length. Antenna 1 short, flagellum with 16-18 segments. Antenna 2, peduncle 4 extending beyond peduncle 3 of antenna 1, flagellum with 15-16 short segments.

Mouthparts generally apomorphic. Lower lip with medium separation of outer lobes. Mandible, molar conical, apex pilose; spine row with 18-19 blade-spines; palp segment 3 lacking baso-facial setae. Maxilla 1, palp, apex subacute, with 2 apical and 3-4 marginal spines; segment 1, lateral expansion with 1-2 setae. Maxilla 2, inner plate lacking proximal plumose seta. Maxilliped, palp segments heavy; outer plate with 2 apical curved spines; inner plate with 6 apical and 2 subapical inner marginal spines.

Coxal plates 1-4, hind corners squared. Coxa 4, posterior margin sloped at about 60° , hind lobe not strongly produced. Coxae 5 & 6 each with lateral ridge and short hind tooth. Coxa 7 smooth, without lateral ridge or hind tooth.

Gnathopod propods sub-ovate, unequal in size. Gnathopod 1, propod with 3 clusters of median facial setae; <u>PDSP formula: outer - 6:2:2; inner - 2:4:3, total of 19.</u> FIGS. 28, 29. *Thorlaksonius brevirostris*, new species FEMALE ov.(7.8 mm) HOLOTYPE; MALE (7.0 mm) ALLOTYPE. (SEE PAGES 50 AND 51)

AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994





Gnathopod 2, angle of "step-down" margin gentle, imperceptible, D-TD shallow; distal spines extend little onto outer palmar margin, distal-most much enlarged, > 2X adjacent spine; PDSP formula: outer - 6:3:2; inner - 3:3:2, total of 19-20; meral process large.

Peraeopods 5-7, bases, hind margins nearly straight; segment 4 somewhat broadened, postero-distal lobe overhanging about 50% length of segment 5; dactyls medium, length about half that of segment 6.

Uropods 1 & 2, inner ramus longer than peduncle, margins with 6-7 serially paired spines. Uropod 3, length of inner ramus about 2 1/2X peduncle and 1 1/2X inner ramus, margins 5-6 spinose. Telson, length about 1.4 X width, broadening slightly distally, apex rounded or subtruncate.

Coxal gills 2-3 sac-like, 4-6 large, plate-like.

Male (7.0 mm): Peraeon segment 7 with small dorsolateral tooth. Pleon segments 1-3, dorso-lateral teeth stronger than in female. Rostrum of medium length, less strongly deflexed apically, lower margin straight. Antenna 1 longer than antenna 2, flagellum with about 22 segments, basally conjoint.

Etymology: The name "brevirostris" alludes to the very short rostrum of the female.

Distributional Ecology: Widely distributed in shallow outer coastal waters of SE Alaska, British Columbia, Washington and Oregon, to central California, associated with laminarian holdfasts and *Phyllospadix*, from the LW level to depths of 35 m.

Taxonomic Commentary: This species is closely related to *T. subcarinatus*, and other members of the *depressusplatypus* subgroup. Its character states are mainly apomorphic.

Thorlaksonius subcarinatus, new species (Fig. 30)

Pleustes depressa Barnard, 1968b: 206, fig. 58c, Table I (part)?

Material Examined: A total of 118 specimens in 39 station lots were examined (number of specimens taken at each station given in parentheses).

S.E. ALASKA: ELB Stns., 11 lots (24 specimens): A3(1), A48(1), A71(1), A87(1), A92(3), A12(2), A131(1), A139(1), A174(4), A151(5); ELB & KEC Stns., 1980: S6B1(4). BRITISH COLUMBIA: Queen Charlotte Ids., ELB Stns, 1957: 9 lots (30 specimens): E14(2), E14a(1), E14b(5), E25(2), H11 (1), W8(2), W4a(5), W15b(1), N2a(9).

North-central coast: ELB Stns., 1964: 6 lots (31 specimens): H5(8), H33(1), H43(1), H47(4), H53(11), H65(6); ELB Stn., 1959 - N1(3).

Vancouver I., north end, ELB Stns., 1959: 2 lots (5 specimens): N11(4), V22(1); ELB Stn., 1955: G4 (7). Vancouver I., south end, ELB Stns., 1955 - 2 lots (13 specimens); ELB Stns, 1976 - 2 lots (5 specimens). **TYPE LOT:** Telegraph Bay, Cadborough Bay, Vancouver I., B.C. ELB Sta. F6, Aug. 9, 1955. - 1 female ov. (9.3 mm), HOLOTYPE, CMN Cat. No. NMCC1994-355; 1 male (5.0 mm), ALLOTYPE, CMN Cat. No. NMCC1994-356; several males, females, & im., CMN Cat. No. NMCC1994-357. WASH.-OREGON: ELB Stns., 1966: 2 lots (3 specimens). W40(1), W64(2). Mill Bay, K.E.Conlan Stn. 1, 1980- (1). E. Black coll., Pultney Pt., Malcolm I, 1980 - 1 female.

Diagnosis: Female ov. (9.3 mm). Body medium sized, relatively short and deep. Peraeon segments 1-5 totally lacking mid-dorsal dorso-lateral and lateral teeth or carinae; mid-dorsal carinae low, posteriorly elevated but not posteriorly toothed on peraeon 6 & 7 and pleon 1 & 2; pleon 3 and urosome 1 with dorso-lateral low ridges. Dorso-lateral teeth on peraeon segments 6 & 7 small, acute, on pleon segments 1 & 2 larger and basally ridged; pleon segment 1 with small posterior marginal tooth.

Head, rostrum very short, less than half length of head, much deeper than long, apex deflexed and truncate, lower margin nearly straight. Antenna 1 slightly the longer, flagellum with 20-25 segments. Antenna 2, peduncle 4 extending well beyond peduncle 3 of antenna 1, flagellum of 18-20 segments.

Coxae 1-4 deep, with facial mid-rib, lower margins slightly convex, hind corners with weak cusps; coxa 1 covering anterior head process; coxa 4, hind process long, more than half width of coxa 4, extending half-way along lower margin of coxa 5. Coxae 5-7 with weak, obliquely sloping, postero-lateral ridges, little produced but toothed behind; coxa 5 long, deep, length nearly twice depth.

Mouthparts unremarkable. Mandible, left and right sides with 16-18 blades; molar broadly triangular; palp segment 3 with 1 baso-facial seta, inner (posterior) margin of segment 2 strongly setose. Maxilla 1, apical spines and setae extending obliquely nearly to mid-point of slightly expanded segment 2; lateral process of segment 1 with 3-4 longish setae. Maxilla 2, inner plate slightly broadened, with 1 short plumose inner marginal seta. Maxilliped, outer plate short, apex 2-3 spinose; inner plate with six apical spines, innermost not basally broadened.

Gnathopod 1, propod more slender, less basally deep, than in gnathopod 2; angle of "step-down" margin gentle (~30°); PDSP formula: outer - 7:3:2; inner - 4:4:3-4, total of 23-24. Gnathopod 2, angle of "step-down" margin similarly gentle, D-TD small, shallow; distal spines extend about onethird along palmar margin, distal-most spine about twice length of adjacent spine; PDSP formula: outer - 8:4:3; inner - 4:4:3, total of 26; meral process large.

Peraeopods 5-7, hind margin of basis nearly straight; segment 4 posteriorly overhanging segment 5 by about half its length; dactyls long, slender, more than half the length of segment 6. Peraeopod 7, proximal process of basis blunt.

FIG. 30. *Thorlaksonius subcarinatus*, new species FEMALE (9.3 mm) HOLOTYPE; MALE (5.0 mm) ALLOTYPE. (SEE PAGE 53 - OPPOSITE)

AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994



Pleon plates 2 & 3, hind corners acute, produced, lower margins spinose. Uropods 1 & 2, inner ramus longer than peduncle, strongly serially spinose. Uropod 3, inner ramus more than twice length of peduncle, margins with about 8 spines. Telson sub-rectangular, slightly expanded distally, apex broadly rounded. Coxal gills very large, plate-like, subsimilar on peraeopods 4-6.

Male (5.0 mm): Body smaller, more slender; peraeonal mid-dorsal & dorso-lateral teeth stronger. Rostrum slightly longer than deep. Antennal flagella distinctly longer and with $\sim 10\%$ more segments than in female.

Etymology: The name "*subcarinatus*" alludes to the weakly carinated posterior segments of the peraeon and pleon of this species.

Distribution: Coastal waters of southeastern Alaska to British Columbia, Washington State (San Juan Islands), and Oregon, mainly on algae and rocky substrata, at depths of 0 - 25 m.

Taxonomic Commentary: The species is closely related to *T. brevirostris*, and to the "duck-bill" rostrate members of the *depressus-platypus* subgroup.

Thorlaksonius grandirostris, new species (Fig. 31)

Material Examined:

BRITISH COLUMBIA: Queen Charlotte Islands: ELB Stn. W15b, Two Mountain Bay, near Horn Rock, Tasu Sound, LW bedrock, Zostera, 9 Aug., 1957 - 1 female ov.(6.0 mm) HOLOTYPE, CMN Cat. No. NMCC1994-350; ELB Stn. W4a, Nesto Pt., Hippa I., LW, boulders, *Phyllospadix*, Aug. 11, 1957 - 1 female ov.(dried specimen) + slide mount. OREGON: K E Conlan Stn. 06-2, Sunset Bay, Coos Co., Oregon, LW, July 8, 1986 - 1 female ov. (6.0 mm) + slide mount, PARATYPE, CMN collections.

Diagnosis. Female ov. (6.0 mm): Body small to medium, relatively long, slender. Peraeon segments lacking lateral, dorso-lateral, and mid-dorsal carinae except for very weak dorso-lateral and mid-dorsal teeth on peraeon 7. Mid-dorsal carinae very low, ridge-like on pleon 1-3, small hind tooth on 1 & 2; dorso-lateral teeth on pleon 1 & 2 small, very low, ridge-like on pleon 3 and urosome 1; pleon 1-3 lacking postero-lateral cusps.

Head, rostrum very large, deep, "duck-billed", straight, nearly twice length of head, apex rounded. Antennae subequal; antenna 1, flagellum 18-20 segmented, bearing conspicuous aesthetascs. Antenna 2, peduncle 4 not extending beyond peduncle 3 of antenna 1; flagellum 14- segmented.

Mouthparts reduced. Mandible, left and right blade rows short, 15-16 blades on each side; molar short, thumb-like, apex subacute; left lacinia 8-9 dentate; palp segment 3 lacking baso-facial setae; segment 2, inner margin sparsely setose. Maxilla 1, palps slender, 4 short spines at rounded apices; lateral process of segment 1 small, 2-setose. Maxilla 2, plates small, inner plate little broadened, inner margin lacking plumose seta. Maxilliped, palp segments relatively short, weak; outer plate relatively broad, apex with 2 spines; inner plate very short, apex with 6 unequal spines, inner margin with 2 slender spines.

Coxae 1-4 medium large, broad, relatively shallow, smooth facially, lower margins of 2 & 3 gently convex, hind corners squarish; coxa 1 covering anterior head lobe; coxa 4, hind lobe weakly produced, rounded, extending about onequarter length of coxa 5. Coxae 5-7 short, deep, hind corners squarish, not produced or toothed, coxa 5 with weak, oblique, postero-lateral ridge.

Gnathopod 1, basis, anterior margin sparsely lined with setae, longish proximally; hind lobes of carpus relatively short, weakly setose. Gnathopod 1, propod ovate, smaller and more slender than in gnathopod 2; angle of "step-down" margin very gentle (~10°), nearly continuous with palmar margin; D-TD very shallow; a few distal spines extend submarginally along one-quarter of palm, distal spine enlarged, more than twice size of adjacent spine; PDSP formula: outer - 5:2:0; inner - 3:4:3, total of 17; hind margin gently convex, about 2/3 length of palm; meral process weak. Gnathopod 2, angle of "step-down" margin also very weak; distal spine of DSPG very large (> 2X adjacent spine); PDSP formula: outer - 6:2:1; inner - 3:3+:3, for total of 18+; meral process very weak.

Peraeopods 5-7, bases increasing posteriorly, hind margins straight or very slightly concave; proximal process of basis of peraeopod 7 large, triangular; segment 4 posteriorly overhanging segment 5 by about 40% of its length; dactyls medium, nearly 50% length of respective segment 6.

Pleon plates 2 & 3, hind corners acuminate, lower margins very weakly spinose. Uropods 1 & 2, inner ramus longer than peduncle, moderately serially spinose, tips extending distinctly beyond uropod 3. Urosome 2 nearly totally occluded dorsally. Uropod 3, outer ramus little more than twice length of peduncle, margins 6-spinose.

Telson subrectangular, margins subparallel, apex broadly sub-truncate. Coxal gills plate-like, markedly smallest on peraeopod 6.

Etymology: The name "grandirostris" alludes to the very large rostrum, a size that is relatively longer and deeper than in all other species known to date.

Distributional Ecology: Known only from outer coast localities of the Queen Charlotte Islands, B. C., and one locality in central California. The greatly enlarged rostrum would appear to fit this species for Batesian mimicry of mitrellid snails of similar body size.

FIG. 31. *Thorlaksonius grandirostris*, new species FEMALE ov. (6.0 mm) HOLOTYPE (SEE PAGE 55 - OPPOSITE)



AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994



FIG. 32. Thorlaksonius sp. 9 (to 13.0 mm). Japan. (modified from Nagata, 1965).

Taxonomic commentary: The species is the most advanced member of the essentially North American endemic *platypus- depressus* species complex (see Phenogram, p. 62).

Thorlaksonius sp. (Fig. 32).

Pleustes panoplus Nagata, 1960: 170, plate 14, figs. 46-49.—Nagata, 1965: 175, fig. 2.

Material Examined: None identified from the study region, and type material not examined.

Diagnosis. Female (up to 13 mm in length): Peraeon segments 5-7 and pleon segments 1 & 2 with prominent middorsal posteriorly toothed carinae. Dorso-lateral toothed carinae prominent on peraeon segment 7 and pleon 1 & 2, minutely toothed on peraeon segments 5 & 6. Low ridged dorso-lateral carinae on pleon segment 3 and urosome segment 1. Pleon plate 2, posterior margin with weakly toothed basal cusp.

Head, rostrum large, very deep, but short, not exceeding length of head, strongly deflexed at subtruncate apex, lower margin straight. Eyes large, black. Antenna 1, flagellum with 30-35 segments. Antenna 2 shorter, peduncular segment 4 exceeding segment 3 of antenna 1; flagellum about 20-segmented.

Mouthparts not described or figured by Nagata (loc. cit.); possibly similar to those of *T. truncatus* (p. 59).

Coxae 1-4 medium deep. Coxa 2 broadening distally, lower corners sharply rounded. Coxa 4 relatively narrow,

hind margin steeply sloped (~75⁰), little produced posteriorly. Coxae 5-7 with sharp lateral ridged, toothed behind.

Gnathopods 1 & 2 subsimilar in form; propods relatively large, but slender and elongate. Gnathopod 1, propod smaller than in gnathopod 2; palmar margin very oblique, merging gently with short posterior margin; distal-most spine group at posterior angle extending little onto outer palmar margin, distal spine elongate, about twice length of the adjacent spine. Gnathopod 2, propod, angle of "stepdown" margin gentle ($\sim 20^{\circ}$); PDSP formula: outer - 7:3:2 (?), other formulae undeterminable.

Peraeopods 3 & 4, distal segments slender. Peraeopods 5-7, bases relatively narrow, deeply posteriorly lobate, hind margins straight or slight concave. Peraeopods 6 & 7 apparently distinctly longer than peraeopod 5, segment 5-6 slender, segment 5 posteriorly overhanging by 40-50% of segment 5; dactyls slender, little larger than those of peraeopods 3 & 4.

Uropods 1 & 2, inner ramus longer than peduncle, margins serially spinose. Uropod 3, rami slender elongate; length of inner ramus about 3X peduncle and 1.5X outer ramus. Telson elongate, length 1.5X width, apex sharply rounded.

Distribution: Shallow waters of the Seto Inland Sea, Mutsu Bay to west coast of Kyushu, commonly in the *Zostera* belt near low water mark (Nagata, 1965).

Taxonomic Commentary: This distinctive species conforms essentially with the diagnosis of genus *Thorlaksonius*. Cluster analysis relates it, not very closely, to the *truncatus* subgroup (p. 62). However, the enlarged distal palmar spines of the gnathopods and deflexed form of the rostrum are more similar to the *subcarinatus-obesirostris* complex within the *depressus-platypus* subgroup. A more precise phyletic positioning within the genus awaits full re-examination of the original material.

Thorlaksonius carinatus, new species (fig. 33)

Material Examined:

S.E. ALASKA: ELB Stn. S6L2, NW end Hogan I., Imperial Passage, shallow dive, 0-16 m. sand, stone, hydroid clumps, July 28, 1980 -1 female (+slide mount).

BRITISH COLUMBIA: Queen Charlotte Ids., ELB Stn. E14c, Onward Pt., Skidegate Inlet, LW, fucoids, kelp, July 14, 1957 - 3 females ov., 1 female br. I.

Vancouver I., north end: ELB Stn. N22, Manson's Landing, Cortez I., boulders, kelp, LW, June 20,1959 - 1 female (small) + slide mount.

Vancouver I., south end: ELB Stn. P710b, Cape Beale, bedrock, boulders, LW, July 19, 1970 - 2 males (+ 1 slide mount); Stn. B17, Off Cape Beale, 40-45 m., sand and tubeworms, 30 May, 1977 - 1 female (11.0 mm) + slide mount, HOLOTYPE, CMN Cat. No. NMCC1994-360; ELB Stn. B8, Off Brady's Beach, 5-10 m. d, stones, algae, May 21, 1977 - 1 male (+ slide mount; specimen photographed).

Diagnosis.Female ov. (11.0 mm): Body medium large, elongate. Peraeon segments 1-4 lacking mid-dorsal, dorsolateral, and lateral carinae except for small mid-dorsal trace on peraeon 5. Mid-dorsal carinae low, posteriorly elevated on peraeon 5, moderately strongly elevated and slightly toothed behind on peraeon 6 and 7 and pleon 1, centrally rounded on pleon 2, and a low ridge on pleon 3; dorso-lateral teeth increasingly strong on peraeon 5-7, proximally ridged and distally produced (above median line) on pleon 1 & 2, dorso-lateral carinae of pleon 3 and urosome 1 moderately elevated, but unevenly ridged; lateral ridges of peraeon 5-7 with sharp posterior teeth. Pleon plates 1 & 2 with posterior marginal tooth; pleon plate 3 smooth behind. Head, rostrum stout, deep, slightly shorter than head; apex bluntly rounded or subtruncate. Antenna 1 slightly the longer, flagellum with 26-30 short segments; antenna 2, peduncle 4 not extending beyond peduncle 3 of antenna 1; flagellum 22-segmented.

Coxa 1-4 deep, lacking facial mid-rib; lower margins of 2 & 3 nearly straight, hind corners squarish; coxa 1 covering anterior head lobe; coxa 4, posterior process acute, extending along 1/3 of lower margin. Coxae 5-7 medium deep, with weakly expressed postero-lateral ridge, each with weak posterior tooth.

Mouthparts modified. Lower lip, inner lobes relatively broad. Mandible, blade row relatively short, 15-18 blades; molar small, apex blunt; palp segment 3 lacking baso-facial setae, segment 2 moderately setose medially. Maxilla 1, palps medium broad, 8-9 apical spines extending along oblique medial margin; segment 1, lateral process moderate, with 3 long outer marginal setae. Maxilla 2, inner plate broad, inner margin lacking plumose seta. Maxilliped, outer plate medium, apex with 3-4 slender spines; inner plate medium, apex with 8-9 closely crowded spines of various sizes and basal thicknesses.

Gnathopod 1 distinctly smaller and more slender than gnathopod 2; anterior margin of basis densely lined with longish setae; angle of "step-down" margin gentle; PDSP formula: outer - 10:4:2; inner - 4:4:6?, total of 30; meral process short. Gnathopod 2, propod, angle of "step-down" margin slightly stronger (~ 30°), tip of dactyl closing short of D-TD depression; distal spine group extends submarginally along 40% of palm, distal spine about twice as heavy and 50% longer than adjacent spine; hind margin short, about half length of palm; meral process short.

Peraeopods 5-7, bases increasing posteriorly, hind margins straight; proximal cusp of basis of peraeopod 7 weakly developed; segment 4 posteriorly overhanging segment 5 by about half its length; dactyls distinctly stronger than those of peraeopods 3 & 4, = 1/2 length of segment 6.

Pleon plates 2 & 3, hind corners acute, slightly produced, lower margins moderately spinose. Uropods 1 & 2 strongly spinose, inner ramus longer than peduncle, tips extending slightly beyond that of uropod 3. Uropod 3, inner ramus nearly 3X length of peduncle, and 1.6 X length of outer ramus; margins 7-8 spinose.

Telson linguiform, slightly broadening distally, apex broadly rounded.

Coxal gills medium, pallet-like on peraeopods 2 & 3, rounded, plate-like on 4-6.

Male (~6.5 mm): Rostrum larger than in female, and more strongly downcurved apically, lower margin shallowly concave. Antenna 1, flagellum with 26 segments, richly provided with aesthetascs. Peraeopods 5-7 distal segments slender, dactyls long (>1/2 segment 6).

Etymology: From the Latin root "*karina*" or keel, alluding to the relatively strong keel-shaped dorsal and dorso-lateral body ridges that demarcate this species.

Distributional Ecology: Sparsely occurring along the coasts of southeastern Alaska and Vancouver Island, B.C, in depths down to nearly 50 m. A member of the *T. truncatus* sub-group that is apparently amphi-Pacific in distribution.

Taxonomic Commentary: Thorlaksonius carinatus bears a number of apomorphic character states including a strongly carinatedbody dorsum, and coxal ridges, that relate it most closely to *T. truncatus* (see p. 59 and key, p. 39). Mouthpart structure, especially the apical spination of the maxilliped plates, is relatively plesiomorphic, however.

FIG. 33. *Thorlaksonius carinatus*, new species FEMALE ov. (11.0 mm) HOLOTYPE (SEE PAGE 58)



Thorlaksonius truncatus, new species (Figs. 34, 35)

Pleustes species, Bousfield, 1985: 32, fig. 2.

Material Examined:

BRITISH COLUMBIA: ELB Stn. B13, off Brady's Beach, 6-14 m., sand, stone, algae, 25 May, 1977 - 1 female ov. (10.5 mm) + slide mount, HOLOTYPE, CMN Cat. No. NMCC 1994-358; <u>Ibid</u>. - 1 male (8.7 mm) + slide mount, ALLO-TYPE, CMN Cat. No. NMCC1994-359; <u>Ibid</u>. - 3 females, CMN Cat. No. NMCC1994-378.

North-central coast: ELB Stns., July-August, 1964: H30 (2 females, 1 male); H45 (1 female).

Vancouver Island, south end, Berkeley Sound & outer coast: ELB Stn. P9, 1955 (Amphitrite Pt.) - 1 male; ELB Stn. B9a, 16 m., rock, sand, June 28, 1976 - 1 male (+ slide mount), 3 females; ELB Stn. B27, SW end Diana I., 8-10 m., sand, July 8, 1976 - 1 male. ELB Stn. B18, mouth Trevor Channel, 36-40 m., sand, shell, May 30, 1977 - 6 males, 1 female, 2 im.; Stn. B21b, off Brady's Beach, 10-20 m., sand, kelp, June 1, 1977 - 1 male, 4 females + 2 slide mounts. CMN collections.

Diagnosis. Female ov.(10.5 mm): Body medium large, elongate. Ridge-like carinae, raised and toothed posteriorly, on peraeon segments 5-7 and pleon 1, centrally raised on pleon 2, low on pleon 3; posteriorly acute dorso-lateral teeth on peraeon segments 6 & 7 and pleon 1, strongly elevated (above dorsal ridge) and produced on pleon 2; medially incised and ridge-like on pleon 3 and urosome 1; postero-lateral ridge and teeth on pereon 5-7, cuspate on pleon segments 1 & 2.

Head, rostrum massive, very deep, as long as head, lower margin straight, apex gently deflexed, truncate. Antenna 1 slightly the longer, flagellum about 35-segmented. Antenna 2, flagellum about 30-segmented.

Coxae 1-4 very large and deep, lower margins nearly straight, hind corners squarish; coxa 1 covering anterior head lobe; coxa 4 very large, hind process enlarged, extending posteriorly about half length of coxa 5; coxae 5-7, posterolateral ridge strong, oblique, acutely produced behind; coxa 5 very large, length about 1.5 times depth.

Mouthparts modified. Mandible, left and right spine rows with 19-20 blades; molar process narrow, tip bluntly rounded. Maxilla 1, left palp broadened, apical spines and setae extending obliquely to about mid-point of segment 2; segment 1, lateral process with 3-4 longish setae. Maxilla 2, outer plate little broadened, inner margin lacking plumose seta. Maxilliped, inner plate medium, apex 4-spinose; inner plate very short, broad, inner apical spine broadened at base, apex with 7 apical and 4-5 inner marginal spines.

Gnathopod 1, basis, anterior margin lined with short setae; propod, angle of "step-down" margin medium (~ 30°); PDSP formula: outer - 9:3:2; inner - 4:3:4, total of 25; meral process short. Gnathopod 2, palmar margin strongly convex; angle of "step-down" margin medium large (~ 45°), distal spines extending fully half way along outer palmar margin; D-TD medium; PDSP formula: outer - 9:4:2; inner - 3:4:1(?), total of 23; meral process short.

Peraeopods 5-7, bases increasing posteriorly, hind margins straight or slightly concave, proximal hind cusp of basis of peraeopod 7 relatively short, blunt; segment 4 strongly overhanging segment 5 posteriorly by about 60-70% of its length; dactyls slender, slightly longer than those of peraeopods 3 & 4, each about 50% length of its segment 6.

Pleon plates 2 & 3, hind corners acute, lower margins weakly spinose. Uropods 1 & 2, inner ramus longer than peduncle, tips extending well beyond uropod 3. Uropod 3, inner ramus elongate, nearly 3 X length of peduncle, margins 7-spinose. Telson subrectangular, slightly expanded distally, apex broadly rounded.

Coxal gills sublinear on peraeopods 2 & 3, plate-like on peraeopods 4-6.

Male (8.7 mm): Body relatively small, slender. Rostrum elongate, more than twice as long as deep, and about 1.5 X length of head, straight, lower margin gently convex, apex narrowly truncate. The eye appears relatively large and placed closer to the anterior head margin. The flagella of the antennae are relatively longer, and segments more numerous, than in the female.

Colour: Mottled rosy red; body segments of some individuals may have grayish white vertical stripes.

Etymology: The name *"truncatus"* alludes to the deep, apically squared or truncated rostrum of the female.

Distributional ecology: The species occurs along the outer coast of Vancouver I., in subtidal depths to about 30 m., on hard sand bottoms on which were deposited mats of laminarians and other kelp.

Taxonomic commentary: Material from the present series of stations exibits some degree of morphological and colour variation, as well as sexual dimorphism. Thus, a 13.5 mm female from B9 Second Beach differed slightly from the TYPE female in the maxilliped (outer plate with only 2 apical spines), uropod 3 (rami slightly longer and more spinose), and telson (distally slightly narrowing, apex more sharply rounded). These and other minor other differences are here considered to be within the range of size and individual variation for the species.

This species, and *T. carinatus*, are the most advanced of all species known to date (pp. 62-63), both of which are endemic to the North American Pacific coast.

FIG. 34. *Thorlaksonius truncatus*, new species. FEMALE ov. (10.5 mm) HOLOTYPE; MALE (8.7 mm) ALLOTYPE. (SEE PAGE 60)

FIG. 35.*Thorlaksonius truncatus*, new species, var. FEMALE (13.5 mm) VARIANT (SEE PAGE 61)





TAXONOMIC AND BIOGEOGRAPHIC DISCUSSION

The present study treats 24 species and 3 genera and subgenera within the holarctic subfamily Pleustinae. The foregoing diagnoses and descriptions have suggested phyletic relationships that are here developed more firmly on a numerical taxonomic basis. For this purpose, the character states of genera, subgenera, and species are phyletically ordered and analyzed, using a modification of the phenetic UPGMA system of Sneath and Sokal (1973) that employs an index of similarity termed the Plesio-Apomorphic (P.-A.) Index. This modification has been utilized previously in developing natural relationships within similar taxonomic units of the Ampeliscidae (Dickinson, 1982), various Corophioidea (Conlan, 1983), and Phoxocephalidae (Jarrett & Bousfield, 1994). The higher the P.-A. number, the more phyletically advanced is the species, the lower the number, the more primitive. A matrix of 15-20 characters, and corresponding 30-40 pairs of character state extremes, are considered in the analysis of relationships within species of *Ple-ustes* (Table III), *Catapleustes* (Table IV), and *Thorlaksonius* (Table III.). The number of characters employed is therefore about twice the number of corresponding taxa, a diversity level considered analytically significant within the pertinent literature (above). In demarcating the discontinuous condition of each character in these analyses, the plesiomorphic condition is coded as 0, the apomorphic condition as 2, and the intermediate condition as a value of 1.

The quality and number of characters and character

AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994

TABLE II. THORLAKSONIUS	CHARACTERS AND	CHARACTER STATES
-------------------------	----------------	------------------

CHARACTER	CHARACTER STATE				
		VALUE			
	Plesiomorphic	Intermediate	Apomorphic		
	0	1	2		
1. Rostrum shape	slender, straight below	thicker, straight below	short, deep, thick rounded below		
2. Peraeon 5-7 Mid-dorsal carinae	lacking	weak on 6-7	strong, 5-7		
3. Peraeon 5-7, dorso- lateral carinae	lacking	weak on 6-7	strong on 6-7		
4. Pleon 1-3, mid- dorsal carinae	weak, lacking	moderate	large, strong		
5. Pleon 1-3,dorso- lateral carinae	weak lacking	moderate	large, strong		
6. Coxa 7, hind margin7. Mandible, palp segment 3 number facial setae	rounded 4-5	acute 1-2	ridged, toothed setae lacking		
 Maxilla 1, palp spines Maxilliped, outer plate, number apical spines 	many subapical 4-5	few subapical 3	apical only 2		
10. Maxilliped, inner plate, total apical spines	10-11	9	7-8		
11. Antenna 1: number of flagellar segments	30-40+	19-29	14-17		
12. Antenna 2, length peduncle	long	medium	short		
13. Gnathopods 1 & 2; form of	normal; < 50%	mod. enlarged; 50% >	large:>2X adjacent		
distal palmar spines	adjacent spine	adjacent spine	adjacent spine		
14. Gnathopods 1 & 2: post- erior angle "step-down"	slight	moderate	strong		
15. Gnathopod 1: number of groups of med. facial setae	4-6	2-3	0-1		
16. Peraeopods 5-6: basis, hind margin	convex	straight	sl. concave		
17. Peraeopods 5-7, segment 4 post."overhang" segment 5	<45%	~50%	>50%		
18. Peraeopods 5-7, size of dactyls	small, < 50% segment 6	medium	large; > 50%		
19. Urosome 1, dorso-lateral carinae	weak, below mid-dorsal carinae	medium, level with md. carinae	strong,, elevated		
20. Telson, shape	narrowing distally	rectangular	slightly broadened		

states used here depends very significantly on the quality of descriptions and illustrations in the pertinent literature. Some proved to be of uneven quality and completeness, and did not always treat, in satisfactory or uniformly applicable detail, phyletically significant character states of gnathopods and peraeopods, and frequently not at all character states of mouthparts, antennal armature, gills, brood plates, pleopods, and or uropods 1 & 2. In the case of *Pleustes (Pleustes)*, and especially *Pleustes (Catapleustes)*, groups in which rela-

tively little material and few species were obtained from the field study region, and material from other sources was not readily available, such dependence was high. Thus, in analytical treatment of those groups, similarity correlations and coefficients may have less phyletic significance than had a full range of morphological characters been utilized.

With respect to overall relationships between genera and subgenera within subfamily Pleustinae, both plesiomorphic and advanced character states occur widely.

FIG. 37. PHENOGRAM OF SPECIES OF PLEUSTES (PLEUSTES)

In balance, however, members of the genus *Thorlaksonius* entrain the largest number of plesiomorphies of character states treated herein, especially of rostral form and body armature. The most primitive members of this genus are therefore considered closest to the hypothetical subfamily ancestral type (see Bousfield & Hendrycks, 1994). Similarly, members of the subgenus *Catapleustes* are considered to contain the most advanced forms of pleustinids, with members of the nominate subgenus *Pleustes* intermediate in phylogeny.

With respect to numerical taxonomic analysis of component species, the characters and characters states are provided in Tables II-IV and the correponding phenograms in Figures 36-38. Within the genus *Thorlaksonius*, the phenogram of species similarities (Fig. 36), based on a 20character analysis (Table II), suggests that the 12 recognized species form three basic subgroupings at 50-60% similarity level. These encompass a primitive and phyletically distant slender-rostrate *incarinatus* group (P.-A. indices of 11-13), an intermediate "duck-bill"-rostrate *platypus-depressus*

AMPHIPACIFICA VOL. I NO. 2 24 MAY 1994

CHARACTER	CHARACTER STATE		
	Di		
	Plesiomorphic	Intermediate	Apomorphic
	0		2
1. Rostrum shape	slender, straight below	thicker, curved	large, thick
2. Peraeon 1-7;	lacking	weak on 6-7	strong, 5-7
mid-dorsal carinae			
3. Peraeon 1-4, lateral tubercles	lacking	trace	present
4. Peraeon 5-7, dorso- lateral carinae	lacking	weak on 6-7	strong on 6-7
5. Peraeon 5-7, lateral carinae	lacking	weak	strong
6. Coxae 5-7, postlateral	weak	moderate	strong
7. Peraeopods 5-7 ; dactyls	short (1/4 seg 6)	medium	1 ong(1/3 seg. 6)
8. Pleon 1-3, mid- dorsal carinae	weak,	moderate	large, strong
9. Pleon 1-3, lat- eral carinae	weak, lacking	moderate	large, strong
10. Pleon plate 3: posterior marginal cusp	lacking	trace	distinct, acute
11. Gnathopods 1, basal : setation	heavy	medium	broken
12. Gnathopods 1 & 2: post- erior angle "step-down"	slight (45°)	moderate	strong ($\cong 90^{\circ}$)
13. Gnathopod 2: length of distal palmar spine	≅adjacent spine	1.5 X adjacent spine	2 X adjacent spine
14. Peraeopods 5-7: basis, hind margin	convex	straight	slightly concave
15. Peraeopods 5-7, segment 4	1/4 segment 5	1/3 segment 5	1/2 segment 5
6. Uropod 3, inner ramus	long (3/4)	medium (2/3)	short (3/5)
7. Telson shape	tapering to apex	medium	short, broad

TABLE III. PLEUSTES (PLEUSTES) CHARACTERS AND CHARACTER STATES

group (P.-A. indices of 13-24), and an advanced truncaterostrate *truncatus* sub-group (P.-A. indices of 21-26). Biogeographically, the genus *Thorlaksonius* is endemic to the North Pacific region. Members of the primitive group are the most northern, and are confined to the summer-cold waters of the Bering, Okhotsk, and Japan seas. The intermediate group consists of relatively closely related forms (63-76% similarity, except for the relatively primitive *T. borealis*), that are mainly endemic to the North American coastal region. The advanced group contains a *truncatuscarinatus* species pair in the eastern boreal Pacific that is relatively distantly related (63% similarity) to a carinated but yet unnamed species in the boreal western Pacific.

Within subgenus *Pleustes*, the phenogram of species similarities (Fig. 37), based on a 17-character matrix (Table III), clusters the 10 recognized species and varietal complexes into two main subgroups at the 50-60% similarity level. These encompass a primitive, weakly carinate *panoplus* group (P.-A. indices of 4-17) and an advanced, strongly carinated *tuberculatus group* (P. A. indices of 20-24). Members within each species complex are relatively closely related (73-85% similarity). Biogeographically, the subgenus

Pleustes is essentially holarctic and high arctic in distribution, extending southward in the western (N. American) N. Atlantic region, via the cold Labrador Current, to the Gulf of Maine and in the western (Asiatic) Pacific, via cold Oyashio surface waters. The most advanced species occur in the western Bering Sea, the Sea of Okhotsk and the northern Sea of Japan. Only one species (*P. panoplus*) is known from the eastern North Atlantic and no species has yet been recorded from the eastern North Pacific south of the Bering Sea.

Within subgenus *Catapleustes*, based on a matrix of 15 characters and corresponding character states (Table IV), the relatively small complex of 5 recognized species can be clustered into three main subgroups at 50-70% similarity

levels (Fig. 38). These consist of a primitive, less strongly carinated and spinose *constantinus* subgroup of two North America Pacific and Beringian species (P. A. indices of 11-15), the slightly more advanced and more strongly carinated *P. (C.) japonensis* in the western N. Pacific (P. A. index of 14), and a highly advanced, strongly carinated and spinose *paradoxus-angulatus* pair of species in colder waters of the Chukchi-Bering-Okhotsk marine region. As in the genus *Thorlaksonius*, no members have yet been recorded from outside the North Pacific and immediately adjacent waters. *Catapleustes* co-occurs regionally with *Thorlaksonius*, but in deeper waters.

Ecologically, pleustinid species form a relatively small

CILADAOTED

	VALUE		
	Plesiomorphic	Intermediate	Apomorphic
	0	1	2
1. Rostrum shape	slender, straight below	thicker, slightly curved below	large, thick, distinctly arcuate below
2. Antenna 1, number flagellar segments	35-45	26-34	15-25
3. Peraeon 1-7; dorso-lateral carinae	very weak or lacking	weak (ht < width)	strong (height>width)
4. Peraeon 1-4, supra-lateral tubercles	lacking	trace	present
5. Peraeon 1-7, mid-lateral processes	rounded ridge	intermediate	acute, tooth-like
6. Peraeopod 5, coxal process	sub-triangular	acute, blade-like	
7. Coxa 4 lower marginal excavation	shallow	intermediate	wide, deep
8. Coxae 1- 5, proximal tubercles	absent	trace	present
9. Pleon 1-3, mid-lateral teeth or processes	weak, lacking	moderate	large, strong
10. Peraeopods 5-7; dactyls	short (1/4 seg 6)	medium	1 ong (1/2 seg. 6)
 Peraeopods 5-7: basis, hind margin 	convex	straight	slightly concave
12. Gnathopod 2: number of palmar outer marginal spines	many (8-10)	intermediate	few (4 - 5)
13. Gnathopod 2: length of distal palmar spine	≅ adjacent spine	intermediate size	1.5 X adjacent spine
14. Uropod 3, inner ramus relative to outer ramus	long (3/4)	medium (2/3)	short (3/5)
15. Telson shape	tapering to apex (L > W)	$\begin{array}{c} medium \\ (L \cong W) \end{array}$	short, apex broad

TABLE IV. PLEUSTES (CATAPLEUSTES) CHARACTERS AND CHARACTER STATES

and inconspicuous part of regional pleustid faunas and total hard-bottom amphipod communities as a whole. As a specialized group of micro-predators, and micro-carnivores, they occupy niches on open stony bottoms and on the fronds of marine grasses and kelp, that would seem highly vulnerable to fish predation. However, low-level populations are apparently maintained there, despite such presumed predation pressure, by factors not yet fully understood. These factors may include, variously within the genera and subgenera, heavily spinose and sharply toothed body armature that resists manipulation by small-mouthed predators, and Batesian mimicry of other hard-shelled invertebtrates of similar size that are presumably less attractive to larger predators (as noted by Crane, 1969; Field, 1974; and Carter & Behrens, 1980). Other factors may encompass protective

body coloration that, on the one hand, may be classically cryptic, phaneric, or camouflaging or, on the other hand, may be proaposematic or warning of the presence of body compounds (e..g. terpenes) that are noxious, unpalatable, or otherwise harmful to potential fish predators (Williams & Anderson, 1987).

In summary, the subfamily Pleustinae (including the morphologically most primitive and most advanced species) may be considered essentially endemic to coastal shelf waters of the North Pacific Ocean. A morphologically intermediate element, containing the type genus and species, has pentrated arctic shelf waters, in both directions from the Pacific, into arctic-subarctic regions of the North Atlantic Ocean where it may be actively in the process of speciation.

LITERATURE CITED

- Alderman, A. L., 1936. Some new and little known amphipods of California. Univ. Calif. Publ. Zool. 41(7): 53-74, 51 figs.
- Austin, W. C., 1985. An Annotated Checklist of Marine Invertebrates in the Cold Temperate Northeast Pacific. Publ. Khyotan Mar. Lab., Cowichan Bay, B. C. Vols. I-III: 1-682.
- Barnard, J. L., 1954. Marine Amphipoda of Oregon. Oregon State Monogr., Stud. in Zool. 8: 1-103, 33 pls.
- , 1969a. The families and genera of marine gammaridean Amphipoda. U.S. Natl. Mus. Bull. 271: 1-535.
 - _____, 1969b. Gammaridean Amphipoda of the rocky intertidal of California: Monterey Bay to La Jolla. U.S. Natl. Mus. Bull. 258:1-230, figs. 1-173.
 - , 1975. Amphipoda: Gammaridea. pp. 313-366, pls. 70-85. <u>In</u> R. I. Smith & J. T. Carlton (eds). Light's Manual: Intertidal Invertebrates of the Central California Coast, 3rd edition. Univ., California Press, Berkeley, CA. 716 pp.
 - , D. Bowers, & E. C. Haderlie, 1980. Chapter 22: Amphipoda. The amphipods and allies. pp. 559-556. <u>in</u> R. H. Morris, D. P. Abbott, & E. C. Haderlie (eds). Intertidal Invertebrates of California. Stanford Univ. Press. Stanford, California.
 - , & R. R. Given, 1960. Common pleustid amphipods of southern California, with a projected revision of the family. Pac. Nat. 1(17): 37-48.
 - , & G. S. Karaman, 1991. The Families and Genera of Marine Gammaridean Amphipoda (Except Marine Gammaroids) Parts 1 & 2: 1-866. 133 figs., 7 maps.
- Bate, C. S., 1858. On some new genera and species of Crustacea Amphipoda. Ann. Mag. Nat. Hist. (Ser. 3) 1: 361-362.
- Bousfield, E. L., 1958 Ecological investigations on shore invertebrates of the Pacific coast of Canada, 1955. Bull. Natl. Mus. Canada, 147: 104-115.
 - , 1963. Investigations on sea-shore invertebrates of the Pacific coast of Canada, 1957 and 1959.
 I. Station list. Bull. Natl. Mus. Can. 185: 72-89.
 - -, 1968. Studies on littoral marine invertebrates of the Pacific coast of Canada, 1964. I. Station list. Natl. Mus. Can. Bull. 223: 49-57.
 - , 1985. Mysterious insects of the sea. Rotunda, 18 (3): 30-36.
 - Canada. Can. Bull. Fish. Aqu. Sci. 217: 1-37.

 - , & D. E. McAllister, 1962. Station list of the National Museum Marine Biological Expedition

to south-eastern Alaska and Prince William Sound. Natl. Mus. Can. Bull.183: 76-103.

- -, & E. A. Hendrycks, 1994. A Revision of the Family Pleustidae (Crustacea: Amphipoda:Leucothoidea) Part I. Systematics and Biogeography of Component Subfamilies. Amphipacifica I(1): 17-57.
- Bulycheva, A. I, 1952. New species of amphipods (Amphipoda: Gammaridea) from the Sea of Japan (in Russian). Trud. Zool. Inst. Akad. Nauk, SSSR. 12:195-251.
- Carter, J. W. & D. W. Behrens, 1980. Gastropod mimicry by another pleustid amphipod in central California. The Veliger 22: 376-377, 1 fig.

Conlan, K. E., 1983. The amphipod superfamily Corophioidea in the northeastern Pacific region. 3. Family Isaeidae: systematics and distributional ecology. Natl. Mus. Natur. Sci., Publ. Natur. Sci. 4: 1-75.

- Crane, J. M., 1969. Mimicry of the gastropod Mitrella carinata by the amphipod Pleustes platypa. The Veliger 12: 200, pl. 36.
- Dickinson, J. J., 1982. The systematics and distributional ecology of the family Ampeliscidae (Amphipoda: Gammaridea) in the northeastern Pacific region. I. The genus *Ampelisca*. Publ. Biol. Oceanogr., Natl. Mus. Can. 10: 1-39, 21 figs. 3 tables.
- Dunbar, M. J., 1954. The amphipod Crustacea of Ungava Bay, Canadian eastern Arctic. Jour. Fish. Res. Bd. Canada, 11: 709-798.
- Field, L. H., 1974. A description and experimental analysis of Batesian mimicry between a marine gastropod and an amphipod. Pac. Sci. 28(4): 439-447.
- Gurjanova, E. F., 1938. Amphipoda Gammaroidea of Siaukua Bay and Sudzukhe Bay (Japan Sea). Rept. Hydrobiol Expd. Zool. Inst. Acad. Sci. USSR in 1934. 1: 241-404, 59 figs., (In Russian)
 - -, 1951. Bokoplavyi Morei SSSR, i sopredelnyk vod. Opred. Faune SSSR, Izd. Zool. Inst. Akad. Nauk. No. 41, 1029 pp.

 - , 1972. New species of amphipods (Amphipoda, Gammaridea) from the northern part of the Pacific Ocean. Trud. Zool. Inst. Akad. Nauk SSSR 52: 129-200, figs. 1-43 (in Russian).
- Hirayama, A. 1988. Taxonomic Studies on the Shallow-Water Gammaridean Amphipoda of West Kyushu, Japan. VIII. Pleustidae, Podoceridae, Priscomilitaridae, Stenothoidae, Synopiidae, and Urothoidae. Publ. Seto Mar.Biol. Lab. 33(1/3): 39-7.
- Holmes, S. J., 1905. The Amphipoda of southern New England. U.S. Bur. Fish. Bull, 24: 459-529, pls. 1-13.
- Jarrett, N. E., & E. L. Bousfield, 1994. The Amphipod Superfamily Phoxocephaloidea on the Pacific Coast of North America. Family Phoxocephalidae. Part I. Metharpiniinae, New Subfamily. Amphipacifica I(1): 58-140.

- Karaman, G. S., & J. L. Barnard, 1979. Classificatory revisions in gammaridean Amphipoda (Crustacea), Part 1. Proc. Biol. Soc. Wash. 92(1): 106-165.
- Kroyer, H., 1838. Gronlands amfipoder beskrevne af Henrik Kroyer Kongel. Danske Vidensk. Selsk.Naturvid. Math. Afhandl. 7: 229-326, pls. 1-4.
 - ———, 1842. Une Nordiske slaegter og Arter af Amfipodernes Orden, henorende til Familien Gammarina (Forelobigt Uddrag af et Storre Arbejde). Naturh. Tidsskr. 4: 141-166.
- Kudrjaschov, V. A., 1972. K faune i ekologii bokoplavov (Amphipoda-Gammaridea) prilivo-otlivnoi zony Kuril'skikh ostrovov (Litoral'o-vov Iturup, Urup, Simuschir, Paramuschir. Uchenye Zapiski Dvgu 60: 79-116.
- Nagata, K., 1960. Preliminary notes on benthic gammaridean Amphipoda from the *Zostera* region of Mihara Bay, Seto Inland Sea, Japan. Publ. Seto Mar. Biol. Lab. 8: 163-182, 2 figs., pls. 13-17.
- O'Clair, C. E., 1977. Marine Invertebrates in Rocky Intertidal Communities. The Environment of Amchitka Island, Alaska, 1977. Tech. Information Center, NOAA, Auk Bay, Alaska. Ch. 18: 395-449.
- Sars, G. O., 1895. Amphipoda. An account of the Crustacea of Norway with short descriptions and figures of all the species. Christiana and Copenhagen. vol. I. Amphipoda. pp. i-viii, 1-711, pls. 1-240, 8 suppl. pls.
- Shoemaker, C. R., 1930. The Amphipoda of the Cheticamp Expedition of 1917. Contr. Can. Biol. & Fish. n. s. 5(10): 1-141, figs. 1-54.

_, 1955. Amphipoda collected at the Arc-

tic Laboratory, Office of Naval Research, Point Barrow, Alaska, by G. E. MacGinitie. Smithson. Misc. Coll. 128(1): 1-78, 20 figs.

- Slattery, P. N., and J. S. Oliver, 1987. Barnacle settlement on *Pleustes panopla tuberculata* (Amphipoda) in the Chukchi Sea. J. Crustacean Biol. 7(2): 358-363.
- Sneath, P. H. A., and R. R. Sokal, 1973. Numerical Taxonomy. W.H. Freeman and Company, San Francisco. 573 pp.

Staude, C. P. 1987. Gammaridean Amphipoda. in Kozlof, E. N. Marine Invertebrates of the Pacific Northwest. Univ. Wash. Press. Seattle. 18: 346-391.

- Stebbing, T. R. R., 1906. Amphipoda I: Gammaridea. Das Tierreich, 21: 1-806 figs. 1-127.
- Stephensen, A. 1938. The Amphipoda of Northern Norway and Spitzbergen with adjacent waters. Tromso Mus. Skr. 3: 141-278, figs. 20-31.
- Stimpson, W., 1853. Synopsis of the Marine Invertebrata of Grand Manan: or the Region about the mouth of the Bay of Fundy, New Brunswick. Smiths. Contr. Knowl. 6: 5-66, pl. 1-3.
- ______, 1864. Descriptions of new species of marine Invertebrata from Puget Sound, collected by the naturalists of the Northwest Boundary Commis sion, A. H. Campbell, Esq., Commisioner. Proc. Acad. Nat. Sci., Philad. v. 16: 153-165.
- Tzvetkova, N. L., & V. A. Kudrjaschov, 1985. Eological Studies on the fauna of South . Sakhalin. Acad. Naul. Trud., 1985: 1-45.(?)
- Williams, D. E., & R. J. Andersen, 1987. Terpenoid metabolites from skin extracts of the dendronotid nudibranch *Tochuina tetraquetra*. Can. Jour. Chem. 65(9): 2244-2247.

Bousfield, E. L. and Hendrycks, E A. 1994. "The amphipod superfamily Leucothoidea on the Pacific coast of North America. Family Pleustidae: subfamily Pleustinae. Systematics and biogeography." *Amphipacifica : journal of systematic biology* 1(2), 3–69.

View This Item Online: <u>https://www.biodiversitylibrary.org/item/216835</u> Permalink: <u>https://www.biodiversitylibrary.org/partpdf/214922</u>

Holding Institution World Amphipoda Database

Sponsored by IMLS LG-70-15-0138-15

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder. Rights Holder: Amphipacifica Research Publications License: <u>http://creativecommons.org/licenses/by-nc-sa/4.0/</u> Rights: <u>https://biodiversitylibrary.org/permissions</u>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at https://www.biodiversitylibrary.org.