A GUIDE TO THE COASTAL ISOPODS OF CALIFORNIA

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The order Isopoda is one of nine orders in the crustacean superorder Peracarida. Peracarids are the “marsupial crustaceans,” distinguished from the three other eumalacostracan superorders (Hoplocarida, Syncarida, Eucarida) by the following combination of characters: embryos brooded by females in a marsupium constructed by specialized thoracic coxal endites called oöstegites (except in Thermosbaenacea, which carry broods beneath the carapace); absence of caudal rami on the telson; maxilliped basis produced into an anteriorly directed bladelike endite; mandible with an articulated accessory process in adults, between the molar and incisor processes (the lacinia mobilis); carapace, when present, not fused with posterior pereonites and usually reduced in size; and, in most, young hatching as mancas, a pre-juvenile stage lacking the last pair of thoracopods. All peracarids undergo direct development with brooding, hence true larval forms do not occur in this superorder. About 25,000 species of peracarids have been described.

Isopods can be distinguished from other peracarids, and crustaceans in general, by the following combination of characteristics: (1) body usually flattened (except in Anthuridea and Phreatoicidea); (2) head (cephalon) compact, with unstalked compound eyes, two pairs of antennae (first pair minute in Oniscidea), and mouthparts comprising a pair of mandibles, two pairs of maxillae (maxillules and maxillae), and one pair of maxillipeds; (3) a long thorax of eight thoracomeres, the first (and also the second in Gnathiidea) fused with the head and bearing the maxillipeds, the remaining seven (called pereonites) being free and collectively comprising a body division called the pereon; (4) seven pairs of uniramous legs, or pereopods, all more or less alike (hence, “iso-pod”), except gnathiids which have only 5 pairs of walking legs; (5) appendages never chelate (i.e., the subterminal article, or propodus, is not modified into "hand" that works with the terminal article, or dactyl, as a true claw); (6) a relatively short abdomen (pleon) composed of six somites, or pleonites, at least one of which is always fused to the terminal anal plate (telson) to form a pleotelson; (7) six pairs of biramous pleonal appendages, including five pairs of platelike respiratory/natatory pleopods and a single pair of fanlike or sticklike, uniarticulate (unjointed) uropods; (8) heart located primarily in the pleon, and (9) biphasic molting (i.e., posterior half of body molts before anterior half). For illustrations of general isopod morphology see figures 1 - 8.

All isopods possess one of two fundamental morphologies, being "short-tailed" or "long-tailed" (Brusca and Wilson, 1991). In the more primitive, short-tailed isopods the telsonic region is very small, positioning the anus and uropods terminally or subterminally on the pleotelson (Phreatoicidea, Asellota, Microcerberidea, Oniscidea, Calabozoidea). The more highly derived, long-tailed isopods have the telsonic region greatly elongated, thus shifting the anus and uropods to a subterminal position on the pleotelson (Flabellifera, Anthuridea, Gnathiidea, Epicaridea, Valvifera).

Isopods can be sexed in several ways. If oöstegites, or a marsupium, are present, one is obviously examining a female. The openings of the oviducts in females (near the base of the

legs on the fifth pereonite) are difficult to observe. If oöstegites are absent, males can be distinguished by the presence of paired penes on the sternum of pereonite 7 (or pleonite 1) or appendices masculinae (sing. appendix masculina) on the endopods of the second pleopods. Absence of penes, appendices masculinae, and oöstegites indicates the specimen is either a nongravid female or a juvenile that has not yet developed secondary sexual features.

Isopods are a large, diverse order with ten named suborders, all but two (Phreatoicidea and Calabozoidea) of which occur in California. They are found in all seas and at all depths, in fresh and brackish waters, and on land (the Oniscidea). The approximately 10,000 species are more-or-less equally split between marine and terrestrial/freshwater environments. Several general guides to marine isopods of Pacific North and Middle America have been published. These include: Richardson (1905) (still a valuable reference, although obviously out-of-date), Schultz (1969), Brusca (1980) (keys to common Gulf of California species), Brusca and Iverson (1985) (the only summary treatment available for the tropical eastern Pacific region), Wetzer et al. (1997), and Light's Manual. Kensley and Schotte (1989) is also a very useful reference. Key citations to the original literature for the Pacific coast of California are provided in this chapter, and the history of Pacific isopodology (with a complete bibliography) can be found in Wetzer et al. (1997).

The California marine isopod fauna numbers 190 named species (eight of which are questionable species, nomen dubia or species inquirenda), representing thirty-six families in eight suborders. Although we have enumerated all species known from California waters (see list below), the keys treat only species occurring in the intertidal and supralittoral zones, plus the commonly encountered fish parasites of the family Cymothoidae. However, the coverage of the key includes the entire coastline of California and Oregon. At least fourteen species are thought to have been introduced to California's coastal zone: one cirolanid, four sphaeromatids, one asellotan, one epicaridean and seven oniscids.

In the sea, isopods compare in ecological importance to the related Amphipoda and Tanaidacea, notably as intermediate links in food chains. They typically predominate (numerically), along with tanaids, bivalves, and polychaetes, in soft bottom sediment samples from continental shelves. On some tropical coasts, isopods may constitute the majority of prey items consumed by rocky shore fishes. In the Arctic region, they are one of the primary food items of gray whales. Intertidal isopods are predominantly benthic and cryptic, living under rocks, in crevices, empty shells and worm tubes, and among sessile and sedentary organisms, such as algae, sponges, hydroids, ectoprocts, mussels, urchins, barnacles, and ascidians. Some burrow in natural substrates including mud, sand, soft rocks, and driftwood, and some burrowers, such as the *Limnoria* (the gribbles) and *Sphaeroma*, do extensive damage to pilings and wooden boats. In the tropics, some species of *Sphaeroma* burrow into mangroves, weakening the prop roots and causing them to break more easily, which typically stimulates the growth of multiple new rootlets, leading to the classic stairstep structure of red mangrove prop roots (Perry and Brusca, 1989). Several species are important scavengers on shore wrack or dead animals (e.g. *Ligia*, *Tylos*). Cirolanids, corallanids and tridentellids are voracious carnivores, functioning both as predators and scavengers. Epicarideans are all parasites on other crustaceans, cymothoids are all parasites on fishes, and aegids are "temporary parasites" on fishes. Some invertebrate parasites, notably acanthocephalans, use isopods as intermediate hosts.

Identification of isopods often requires dissection and microscopic examination of appendages and other structures using fine-pointed "jewelers" forceps under a binocular dissecting microscope. Dissected parts may be mounted on microscope slides in glycerin or a more permanent medium for observation under a compound microscope.

KEY TO THE SUBORDERS OF ISOPODA

1. With five pairs of pereopods (thoracomere 2 entirely fused to cephalon, with its appendages modified as pylopods and functioning as a second pair of maxillipeds; thoracomere 8 reduced, without legs); adult males with mandibles grossly enlarged, forceps-like, projecting in front of head; adult females without mandibles ..... Gnathiidea
- With seven pairs of pereopods (thoracomere 2 not fused with cephalon, with one pair of maxillipeds and seven pairs of pereopods); males without projecting, forceps-like mandibles; females with mandibles 2
2. Adults are obligate parasites on other crustaceans; bilateral symmetry reduced or lost in females; male a small bilaterally symmetrical symbiont living on the body of the female; antennae (antennae 2) vestigial; antennules (antennae 1) reduced to three or fewer articles; without maxillules (maxillae 1) ..... Epicaridea
- Not obligate parasites on other crustaceans; bilateral symmetry retained in both sexes; male not as above; antennae never vestigial; antennules variable; usually with maxillules 3
3. Body cylindrical or tubular in cross-section, but often appearing laterally compressed (amphipod-like) due to ventrally elongated abdominal pleura; with distinct row of filter setae along medial margin of maxilla (maxilla 2); penes located on coxae of male pereopod 7; apex of pleotelson curves dorsally; pleonite 5 elongate, markedly longer than any other pleonites (known only from Southern Hemisphere and India) ..... Phreatoicidea
- Body variable, but not appearing laterally compressed as above; without row of filter setae along medial margin of maxilla; penes on sternum of male pereonite 7 (or on sternum of pleonite 1); apex of pleotelson does not curve dorsally; pleonite 5 rarely elongate (markedly longer than other pleonites only in Limnoriidae) 4
4. Terrestrial; antennules vestigial, minute; pleon always of 5 free pleonites, plus the pleotelson ..... Oniscidea
- Aquatic; antennules normal, or if reduced not minute; pleon variable, with or without fused pleonites 5
5. Anus and articulating base of uropods positioned terminally (or subterminally) on pleotelson; uropods styliform 6
- Anus and articulating base of uropods positioned at base of pleotelson; uropods flattened .. 8
6. With lateral coxal plates; antenna peduncle 5-articulate; maxillipeds without coupling setae; penes of male arise from articulation between pereonite 7 and pleonite 1; mandible without palp; pleopodal exopods broad and opercular to the thick tumescent endopods; female pleopod 1 present ..... Calabozoidea
- Without lateral coxal plates (pereopodal coxae small); antenna peduncle 6-articulate; maxillipeds with or without coupling setae; penes of male arise on sternum of pereonite 7; mandible with palp; pleopods not as above; female pleopod 1 absent 7
7. Minute, usually less than 3 mm long; long and slender, length about 6 times width; antenna peduncle without a scale; antennule reduced, peduncle indistinguishable from flagellum;

maxilliped without coupling setae on endite; female pleopod 2 biramous; male pleopod 2 endopod not geniculate; interstitial ..... Microcerberidea

- Rarely minute, usually greater than 4 mm long; body not elongate (length less than 6 times width); antenna peduncle usually with a scale; antennule rarely reduced, peduncle and flagellum distinct; maxilliped almost always with coupling setae on endite; female pleopod 2 uniramous; male pleopod 2 endopod large and geniculate; rarely interstitial ..... Asellota

8. Body elongate, length usually more than 6 times width; uropodal exopod curving dorsally over pleotelson; coxae of maxillipeds fused to head (i.e. not freely articulating); mandible with lamina dentata in lieu of spine row and lacinia mobilis (lamina dentata, spine row and lacinia mobilis lacking in Paranthuridae); maxillule an elongate stylet with apical hooks or serrate margin; maxilla vestigial and fused with paragnath (or absent) .....Anthuridea
- Body not markedly elongate, length usually less than 4 times width; uropodal exopod not curving over pleotelson; coxae of maxillipeds not fused to head; mandible without lamina dentata; maxillule variable; maxilla well developed, never fused with paragnath 9

9. Uropods modified as a pair of ventral opercula covering the entire pleopodal chamber; males with penes arising on sternum of pleonite 1, or on articulation between pereonite 7 and pleonite 1; mandibular molar process a stout, flattened grinding structure ..... Valvifera
- Uropods not modified as ventral opercula covering pleopods, but positioned laterally; males with penes arising on sternum of pereonite 7; mandibular molar process usually a thin, bladelike, cutting structure, or absent (flattened only in Sphaeromatidae) .. Flabellifera

SUBORDER ANTHURIDEA

(Key references: Menzies, 1951A; Menzies and Barnard, 1959; Negoescu and Wägele, 1984; Poore, 1984; Kensley and Schotte, 1989; Cadien and Brusca, 1993; Wetzer and Brusca, 1997)

Anthurideans are long, slender, subcylindrical isopods, with a length usually 6-15 times the width. The pereonites are mostly longer than wide (in contrast to most isopods, in which the reverse is true), and the dorsum often bears distinctive ridges, grooves or chromatophore patterns. Distinct coxal plates are rarely evident. The pleonites are often fused in various combinations, and pleonite 6 usually has its line of fusion with the telson demarcated by a deep dorsal groove. The first antennae are short (except in males of some species), as are the second antennae. The mandibles lack a distinct lacinia mobilis or spine row, instead usually having a dentate lobe or plate (the "lamina dentata"). The outer ramus of the maxillule is a slender stylet with terminal spines; the maxillae are rudimentary. The maxillipeds are more-or-less fused to the head and lack coupling setae on the endites.

Anthurideans are thought to be primarily carnivores, feeding on small invertebrates. Most inhabit littoral or shallow shelf environments, although some deep benthic (and some freshwater) species are also known. Many are known to be protogynous sequential hermaphrodites, and males have not yet been reported for several species. Fewer than 600 species of anthurideans have been named, but many remain undescribed. Four families of Anthuridea are currently recognized, distinguished primarily by characters of the mouthparts and pleon: Hyssuridae, Antheluridae, Anthuridae, Paranthuridae – the latter two occur in California waters.

KEY TO INTERTIDAL SPECIES OF ANTHURIDEA
(figures 9-12)

1. Mouthparts stylet-like, adapted for piercing and sucking, forming a conelike structure; mandible usually with smooth incisor, no molar process or lamina dentata; pleonites 1-6 usually with distinct sutures.....PARANTHURIDAE 2
- Mouthparts adapted for cutting and chewing; mandible usually with molar process, lamina dentata and toothed incisor; all or most pleonites usually fused ..... ANTHURIDAE 3
2. Mandibular palp lacking; 6 pairs of pereopods; pleon little longer than pereonites 6+7 .... *Colanthura bruscai*
- Mandibular palp present; 7 pairs of pereopods; pleon shorter than pereonites 6+7 .... *Paranthura elegans*
3. Maxilliped of 4 articles (at least 3 free); no pigmentation pattern on pereonites .... *Cyathura munda*
- Maxilliped of 5 articles; pereonites 1–6 each with a rectangular outline of pigment, characteristically discontinuous on each segment, and segment 7 with posterior transverse pigmentation ..... *Mesanthura occidentalis*

SUBORDER ASELLOTA

(Key references: Richardson, 1905; Menzies, 1951A, B, 1952; Menzies and Pettit, 1956; Menzies and Barnard, 1959; Kussakin, 1962A, B, 1988; George and Strömberg, 1968; Thistle, 1979; Wilson, 1994, 1997; Wilson and Wägele, 1994)

Asellotans are easily recognized by the following combination of features: uropods terminal and styliform; pleonites 4-5, and often pleonite 3, fused to pleotelson, creating an enlarged terminal piece; pleonite 1, 2, or 3 forming an operculum over the more posterior pleopods; male pleopods 2 with specialized copulatory apparatus consisting of an enlarged protopod, a geniculate (knee-like) endopod, and typically a well-muscled exopod; pereonites without coxal plates.

The Asellota are one of the most diverse groups of isopods, comprising about 25% of all marine species. They are most successful and diverse in the deep sea. Thirty-eight species of Asellota, in nine families, are known from California waters; eighteen (in four families) occur in California's intertidal region.

KEY TO THE INTERTIDAL SPECIES OF ASELLOTA
(figures 13 – 30)

1. Eyes on lateral, peduncle-like projections; terminal article (dactylus) of pereopods 2-7 with two claws 2
- Eyes (if present) dorsolateral on head, not pedunculate; dactylus of pereopods 2-7 with two or three claws 3
2. Pleotelson somewhat pear-shaped; uropods greatly reduced, barely visible dorsally .....MUNNIDAE 4
- Pleotelson broad, shieldlike; uropods short but clearly visible in dorsal view... SANTIIDAE (only one species of this family, *Santia hirsuta*, is known from California)
3. Both pairs of antennae small, flagella lacking or rudimentary; antenna articles of peduncle dilated; uropods short, inserted in subterminal excavations of pleotelson, not extending much beyond its posterior margin, if at all .....JOEROPSIDIDAE 7
- Antennae, long with multiarticulate flagella (caution: often broken off); antenna articles of peduncle not dilated; uropods well developed.....JANIRIDAE 8

4. Uropods minute, without serrate distal margin; male first pleopods with apices tapering to tip ..... *Uromunna ubiquita*
- Uropods not minute, with serrate distal margin; male first pleopods with apices laterally expanded 5
5. Uropods without large acute spinelike protuberances on distal margin; dentate suburopodal shelf visible in dorsal view ..... *Munna halei*
- Uropods with large acute spinelike protuberances on distal margin; no dentate suburopodal shelf visible in dorsal view 6
6. Pleotelson broad (length about 0.8 times width); body stout (length about 1.7 times width) ..... *Munna stephenseni*
- Pleotelson narrow (length about 1.6 times width); body relatively elongate (length about 2.6 times width) ..... *Munna chromatocephala*
7. Pleotelson with five to seven spines on each lateral border..... *Joeropsis dubia dubia*
- Pleotelson with three spines on each lateral border..... *Joeropsis dubia paucispinis*
8. Eyes lacking 9
- Eyes present 10
9. Body not elongate, length less than 3 times width; not a minute interstitial species..... *Caecijaera horvathi*
- Body elongate, length about 6 times width; minute (< 2 mm long) interstitial species
- ..... *Caecianiropsis psammophila*
10. Propodus (next to last article) of first pereopod with conspicuous serrated margin on proximal third of ventral margin; basal three articles of maxillipedal palp as wide as endite ..... *Janiralata* 11
- Propodus of first pereopod with proximal third of inferior border smooth; maxillipedal palp with second and third articles much wider than endite..... *Ianiropsis* 12
11. Pleotelson with distinct, medially curved, spinelike posterolateral angles..... *Janiralata occidentalis*
- Pleotelson with posterolateral angles evenly curved, lacking distinct angles or spinelike processes ..... *Janiralata davisi*
12. Lateral borders of pleotelson with spinelike serrations 13
- Lateral borders of pleotelson spineless (fine setae may be present)..... 15
13. Pleotelson with four to seven spinelike serrations on each side; lateral apices of first male pleopod not directed abruptly posteriorly ..... *Ianiropsis analoga*
- Pleotelson with two to three spinelike serrations on each side; lateral apices of first male pleopod directed abruptly posteriorly 14
14. Pleotelson with two spinelike serrations on each side ..... *Ianiropsis epilittoralis*
- Pleotelson with three spinelike serrations on each side ..... *Ianiropsis tridens*
15. Uropods half or less length of pleotelson 16
- Uropods considerably exceeding half pleotelson length 17
16. Pleotelson with distinct posterolateral angles lateral to uropod insertions..... *Ianiropsis derjugini*
- Pleotelson lacking posterolateral angles lateral to uropod insertions ..... *Ianiropsis minuta*
17. Uropods exceeding length of pleotelson; lateral apices of first male pleopod bifurcate ..... *Ianiropsis montereyensis*
- Uropods not exceeding pleotelson length; lateral apices of first male pleopod not bifurcate ..... *Ianiropsis kincaidi*

SUBORDER EPICARIDEA

(Key references: Richardson, 1905; Muscatine, 1956; Shiino, 1964; Markham, 1974, 1975, 1977a,b, 1985; Sassaman et al., 1984)

Epicarideans are ectoparasites of other crustaceans (malacostracans, ostracods, copepods, and cirripeds). Females are usually greatly distorted, being little more than an egg sac in some species. Males are symmetrical, but minute and live on the body of the female. Eyes are usually present in males, but reduced or absent in females. The antennules (first antennae) are very reduced, usually of only two or three articles; a 3-articulate peduncle is generally apparent only in juvenile stages. The antennae (second antennae) are vestigial in adults. The mouthparts are reduced, forming a suctorial cone with a pair of piercing stylets formed from the mandibles; a mandibular palp is absent. The maxillules and maxillae are reduced or absent.

There are no good references for the Epicaridea as a whole, although Strömberg (1971) reviews the embryology (including several California species), and Jay (1989) cites several other papers containing general information. The California fauna is poorly known, both taxonomically and biologically. About 700 species of epicarideans have been described world-wide, in eleven families. Three of these families are represented in California waters by sixteen species, six of which occur in the intertidal region and are included in the key.

Species in the family Bopyridae retain complete, or nearly complete body segmentation, and usually have six or seven pereopods on one side but far fewer on the other side. The sides of the pleonites are often produced as large lateral plates (epimeres) that resemble pleopods. Adult bopyrids are parasites either on the abdomen or in the branchial chamber of decapod crustaceans. In branchial parasites, the female attaches ventrally to the host's branchiostegite, inducing a bulge in the host's carapace. Males are much smaller and usually found on the ventral side of the pleon of the female isopod. Females brood many small eggs in an oöstegial brood pouch, that hatch as a free-swimming epicaridium stage. The epicaridium attaches to an intermediate host, a calanoid copepod. Once on the copepod, the isopod molts into a microniscus stage, and then into the cryptoniscus stage. The cryptoniscus detaches from the copepod, is free-swimming, and eventually attaches to the definitive host. All species are probably sequential hermaphrodites. About 500 species have been described world-wide.

Species in the family Entoniscidae are internal parasites of crabs and shrimps. Females are usually modified beyond recognition, with the marsupium grossly inflated and in some cases extending dorsally over the head. Males and mancas, however, are less distorted with a flattened body, complete segmentation, and pereopods. Mature females are surrounded by a host response sheath, with an external communication to the environment via a small hole or furrow in the carapace of the hosts. Most are parasitic castrators, and in some cases entoniscids can feminize male hosts. Good references on the biology of this family include: Giard (1887), Giard and Bonnier (1887), Veillet (1945), and Reinhard (1956).

The following key is based mainly on adult females.

KEY TO INTERTIDAL SPECIES OF EPICARIDEA
(figures 31-35)

1. Female without segmentation, simply an egg sac; antennae and mouthparts absent

.....HEMIONISCIDAE
..... (one California species, *Hemioniscus balani*, parasitic in barnacles of the genus
.....*Balanus* and *Chthamalus*)

- Female with distinct or weak segmentation; not simply an egg sac; antennae and mouthparts present, although may be greatly reduced.....2

2. Body of female without indication of rigid exoskeleton, seemingly undifferentiated, but body divisions and segmentation present; pereonites expanded laterally into thin plates; maxillipeds are the only recognizable mouthparts; pereopods stubby or absent; endoparasites in body cavity of decapod crustaceans..... ENTONISCIDAE
(one California species, *Portunion conformis*, in body cavity of the crab *Hemigrapsus* spp.)

- Female distinctly segmented; pereonites not expanded laterally into thin plates; mouthparts rudimentary; pereopods prehensile, seven present on one side, but all except first may be absent on the other side; parasites of branchial cavity or on pleopods of decapod crustaceans .....BOPYRIDAE 3

3. Pleon with lateral plates (epimeres or pleural lamellae) elongate, those of female fringed with long, branched processes, those of male without such digitations; in branchial cavity of ghost shrimps of the genus *Callianassa* .....*Ione cornuta*

- Pleon in both sexes with pleural lamellae rudimentary or absent (caution: do not confuse lateral biramous pleopods with pleural lamellae) 4

4. Female pleopods not prominent, relatively short, not noticeable in dorsal view; in branchial chamber of the snapping shrimp *Synalpheus lockingtoni* and *Alpheopsis equidactylus* .....
.....*Bopyriscus calmani*

- Female pleopods prominent, long, visible in dorsal view 5

5. Pleopods biramous, with narrow branches arising from a peduncle or stem, extending laterally from narrow pleon; among pleopods of the mud shrimp *Upogebia pugettensis*.....
.....*Phyllodurus abdominalis*

- Pleopods biramous, lanceolate, not arising from a peduncle, extending posteriorly from pleon; in branchial chamber of the pelagic galatheid crab *Pleuroncodes planipes*.....
.....*Munidion pleuroncodis*

SUBORDER FLABELLIFERA

(Key references: Stimpson, 1857; Richardson, 1899, 1905, 1909; Holmes and Gay, 1909; Hatch, 1947; Menzies, 1951B, 1954A, B, 1957, 1962; Menzies and Barnard, 1959; Schultz, 1969; Brusca, 1978A, 1981, 1983A, 1989; Brusca and Ninos, 1978; Bowman et al., 1981; Bruce et al., 1982; Carlston and Iverson 1981; Delaney, 1982, 1984; Delaney and Brusca, 1985; Bruce, 1986, 1990, 1993; Cookson 1991; Harrison and Ellis, 1991; Brusca and Wilson, 1991; Brusca and France, 1992; Brusca et al., 1995; Wetzer and Brusca, 1997)

Flabellifera comprise a large paraphyletic assemblage of families defined more by the absence of certain features than by any unique attributes. The eyes are usually large and well-developed, but are reduced or absent in cave and deep-sea species. The mouthparts are usually robust, adapted for cutting and grinding, or occasionally for piercing. Both the maxillules and maxillae are biramous. The pereopods are usually subsimilar, but in Serolidae, and some Cirolanidae and Sphaeromatidae, the anterior pairs may be subchelate/prehensile. The pleon comprises 1-5 free segments, plus the pleotelson. The uropods arise laterally, usually forming a distinct tailfan with the pleotelson.

With over 3,000 described species, Flabellifera is the second largest isopod suborder, represented in California by seven families, three of which (Anuropidae, Excorallanidae, Serolidae) have not been reported north of Point Conception. Because of the great diversity of this suborder, it is more convenient to key the families first, and then the species in each family.

KEY TO CALIFORNIA FAMILIES OF FLABELLIFERA

1. Uropods greatly reduced, with very small, often clawlike exopod; body less than 4 mm long; burrowing in wood or algal holdfasts ..... LIMNORIIDAE
- Uropods not greatly reduced; body rarely less than 3 mm long; rarely burrowing in wood or algae (a few species of Sphaeromatidae burrow into coastal wood structures, but they are large animals) 2
2. Pleon composed of three or fewer dorsally visible free pleonites, plus the pleotelson 3
- Pleon composed of four or five dorsally visible free pleonites, plus the pleotelson 4
3. Pleon composed of three dorsally visible free (complete) pleonites, plus pleotelson; cephalon fused medially with first pereonite; body strongly depressed and expanded laterally; pereonite 7 tergite incomplete or absent; antennae set very close together; frontal lamina reduced to a small triangular plate visible only by pushing aside antennal bases; pleopods 1-3 small and natatory, basis elongated; pleopods 4-5 large, broadly ovate, suboperculiform ..... SEROLIDAE
- Pleon composed of one or two dorsally visible free (complete) pleonites plus pleotelson; cephalon not fused with first pereonite (except in *Ancinus* and *Bathycopea*); body convex dorsally, not strongly depressed; pereonite 7 tergite complete; antennae not set close together; frontal lamina large and distinct; pleopods subequal, of modest size, basis not elongated; pleopods 4-5 ovate but not operculiform ..... SPHAEROMATIDAE
4. All pereopods prehensile (dactyli longer than propodi); antennae reduced, without clear distinction between peduncle and flagellum; maxillipedal palp 2-articulate..... ..... CYMOTHOIDAE
- At least pereopods 4-7 ambulatory (dactyli not longer than propodi); antennae not as above, with clear distinction between peduncle and flagellum; maxillipedal palp of two to five articles 5
5. Pereopods 1-3 strongly prehensile (dactyli longer than propodi); maxillipeds and maxillules and maxillae with stout, curved, apical setae; lacinia and molar process of mandible reduced or absent; maxilla reduced to a single slender stylet ..... AEGIDAE
- Pereopods 1-3 weakly prehensile at best; maxillipeds without stout, curved setae; mandible with or without lacinia and molar process; maxilla not a slender stylet 6
6. Mandible with distinct lacinia and large bladelike molar process; mandibular incisor generally broad, 3-dentate; maxillule lateral (outer) lobe often with several (ten to fourteen) stout spines, never stylet-like or falcate; maxilla well-developed; pereopods 1-3 not prehensile (dactyli not longer than propodi) ..... . CIROLANIDAE
- Mandible with lacinia and molar process greatly reduced, vestigial, or absent; mandibular incisor narrow; maxillule lateral (outer) lobe simple and falcate; maxilla reduced; pereopods 1-3 weakly prehensile or ambulatory ..... CORALLANIDAE

FAMILY AEGIDAE

Aegids are cirolanid-like, with the smooth dorsal surface either vaulted or flattened. The maxillipedal palp is of two, three or five articles, the terminal ones with stout acute setae

("spines"). The mandible is elongate, with a narrow incisor and reduced or vestigial molar process. Coxal plates of pereonites 2-6 are large and distinct. Pereopods 1-3 are prehensile (i.e., the dactyli are as long or longer than the propodi and strongly curved); pereopods 4-7 are ambulatory. The family Aegidae comprises six genera. All are temporary parasites on marine fishes. Adults engorge themselves with food (presumably blood) from their hosts, then dislodge and sit on the bottom to digest their meal. Nine species, in two genera, have been reported from Pacific North America, six of which inhabit California waters. However, only a single species occurs in the intertidal zone, *Rocinela signata* (figure 36).

FAMILY CIROLANIDAE

Cirolanids have sleek symmetrical bodies, 2 to 6.5 times longer than wide, with well-developed coxal plates on pereonites 2-7. The mandible has a broad tridentate incisor and a spinose bladelike molar process. The maxillipedal palp typically is 5-articulate and the articles never have hooked or curved setae or spines. All pereopods are ambulatory, although legs 1-3 tend towards a grasping form, with well-developed dactyli. The uropods form a tail fan with the pleotelson.

Cirolanids are all carnivores, either predatory or scavenging. A number of species are known to attack sick or weakened fish, or fish trapped in fishing nets, and some are capable of stripping a fish to the bones in a matter of hours. Stepien and Brusca (1985) review this phenomenon and describe the behavior from Catalina Island (California). This large family includes fifty-five genera. Eight species (in six genera) are known from California waters, six of which occur intertidally.

KEY TO INTERTIDAL SPECIES OF CIROLANIDAE
(figures 37-42)

1. Antennule peduncle article 1 longer than articles 2 or 3; antennule article 2 arising at right angle to article 1; maxilliped endite barely reaching (or extending barely beyond) first palp article; maxilliped endite without coupling setae; antennae long, extending beyond pereonite 7; lateral margins of pleonite 5 not encompassed by pleonite 4 ..... *Eurydice* ..... (one species in California, *Eurydice caudata*)
- Antennule peduncle article 2 or 3 longest; antennule article 2 not arising at right angle to article 1; maxilliped endite extending well beyond first palp article, usually to distal margin of second palp article; maxilliped endite with coupling setae; antennae length variable; lateral margins of pleonite 5 variable..... 2
2. Antennule peduncle article 2 or 3 longest; clypeus projecting ventrally.....3
- Antennule peduncle article 3 always longer than 1 or 2; clypeus short, broad, flat, and sessile, not projecting ventrally..... *Cirolana* 4
3. Prominent rostral process, apically spatulate, separating antennules ..... *Excirolana* 5
- Without prominent rostral process..... *Eurylana* (one species, *E. arcuata*)
4. Uropodal rami without apical notch; rostrum meets but does not overlap frontal lamina; antennule peduncle articles 1 and 2 not fused ..... *Cirolana harfordi*
- Both uropodal rami with apical notch; rostrum overlaps frontal lamina; antennule peduncle articles 1 and 2 fused..... *Cirolana diminuta*
5. Pleotelson broadly rounded and crenulate posteriorly; antennule peduncle with articles 2 and 3 subequal in length ..... *Excirolana linguifrons*

- Pleotelson obtusely rounded and acuminate posteriorly; antennule peduncle with article 3 longer than article 2 .....*Excirolana chiltoni*

FAMILY CORALLANIDAE

Corallanids resemble cirolanids but are even more highly modified as predators. Characteristic features of the family include: very large eyes, absence of an endite on the maxilliped, large falcate apical setae on the lateral lobes of the maxillules (often tended by subapical accessory setae), vestigial uniramous maxillae, and frequently a heavily ornamented dorsum beset with setae, spines, tubercles or carinae (especially in males). There are always five free pleonites. The first three pairs of pereopods are often grasping (dactylus as long or longer than the propodus).

Corallanidae is a small group, with six genera and about seventy species. The family is largely confined to tropical and subtropical shallow-water marine habitats, although some brackish and fresh water species are known. Many species are common on coral reefs (hence the name). Because they are often found attached to large prey, such as fishes, rays, turtles or shrimps, they are sometimes called parasites, but they are actually predators. Two species in the large New World genus *Excorallana* occur in the California intertidal region. Both can be collected with night lights over rocky bottoms. *E. tricornis occidentalis*, at least in Costa Rican waters, has nocturnal mass-migrations into the water column, perhaps preying on other microcrustaceans (Guzman et al., 1988). Two species belonging to the closely related family Tridentellidae are easily mistaken for corallanids; *Tridentella glutacantha* and *T. quinicornis* both occur in shallow subtidal rocky regions of California's offshore islands.

KEY TO INTERTIDAL SPECIES OF CORALLANIDAE
(figures 43-44)

1. Head of male ornamented with three tubercles; pereonites 4-7 with row of tubercles on posterior margin; pleotelson not densely covered by setae .... *Excorallana tricornis occidentalis*
- Head of male not ornamented with tubercles; pereonites 4-7 without row of tubercles on posterior margin; pleotelson densely covered by setae ..... *Excorallana truncata*

FAMILY CYMOTHOIDAE

Cymothoids resemble cirolanids and corallanids, but are modified for a parasitic lifestyle – all are fish parasites. The definitive features of the family are that all seven pairs of pereopods are prehensile (with long, strongly recurved dactyli as long or longer than the propodi) and the maxillipedal endite lacks coupling setae. Overall, the mouth appendages are highly modified for the parasitic lifestyle. The maxillipeds are reduced to small palps of two or three articles, the maxillules are modified as slender uniarticulate stylets lying adjacent to one another to facilitate transfer the host's blood to the mouth, and the maxillae are reduced to small bilobed appendages. All of these mouth appendages bear stout, curved, terminal or subterminal spinelike setae that serve to hold the buccal region strongly affixed to the flesh of the host fish. All cymothoid species are probably protandric hermaphrodites, first maturing into males and later transforming into females (unless retained in the male stage by the presence of a female already in place on the host fish).

Cymothoids are parasites on marine or freshwater fishes, and they are commonly found on sport and commercial fishes, such as mullet, jacks, groupers, flounder, perch, anchovies, and many others. Although they are not intertidal species, they are often seen by sport fishers and researchers, hence we provide a key to the California species. Most species attach either epidermally, in the gill chamber, or in the buccal region. However, species in some genera actually burrow beneath the skin where they live in a pocket or capsule formed within the musculature of the host (e.g., *Artystone, Riggia, Ichthyoxenus, Ourozeuktes*). Aside from some localized damage, in most cases cymothoids do not appear to create a great hardship on their hosts. Host-parasite specificity varies between genera, being high in some (e.g., *Cymothoa, Idusa, Mothocya*) and low in others (e.g. *Anilocra, Nerocila, Livoneca, Elthusa*). The only known case of a parasite functionally replacing a host organ occurs in *Cymothoa exigua*, a species that sucks so much blood from its host fish's tongue that the tongue atrophies and is destroyed, but the isopod remains attached to the remaining tongue stub where the host uses it as a replacement tongue for food manipulation (Brusca and Gilligan, 1983). An extensive radiation of cymothoid genera and species has taken place in the freshwater rivers of the Amazon Basin, and to a lesser extent central Africa and southeast Asia. Forty-three nominate genera and over 400 species of cymothoids exist, but the taxonomy of this family is very poorly understood. Seven species, in five genera, are known from California waters.

KEY TO CALIFORNIA SPECIES OF CYMOTHOIDAE
(figures 45-51)

1. Posterior margin of cephalon trisinuate; pleon not immersed in pereon 2
- Posterior margin of cephalon not trisinuate; pleon partially immersed in pereon.....3
2. Cephalon not immersed in pereonite 1; uropods generally extend beyond posterior border of pleotelson, and clearly visible in dorsal view..... ..... *Nerocila* (one species in California, *N. acuminata*)
- Cephalon somewhat immersed in pereonite 1; uropods barely or not extending beyond posterior border of pleotelson, and typically held concealed under the pleotelson (not visible in dorsal view) ..... *Enispa* (one species in California, *E. convexa)*
3. Basal articles of antennules not expanded and touching 4
- Basal articles of antennules expanded and touching or nearly touching ..... *Ceratothoa* 5
4. Antennule longer than antenna ..... *Mothocya* (one species in California, *M. rosea*)
- Antennule shorter than antenna ..... *Elthusa* 6
5. Pereopods 4-7 not carinate; posterior margin of pleonite 5 smooth, not trisinuate; labrum with free margin wavy, with wide medial notch ..... *C. gilberti*
- Pereopods 4-7 carinate; posterior margin of pleonite 5 trisinuate (except in occasional males); labrum with free margin broadly excavate, without medial notch.....*C. gaudichaudii*
6. Pleotelson in adult female nearly twice as broad as long; eyes medium-size and widely separated; anterior border of head broadly rounded or truncate; antenna of 10-11 articles; juveniles with diffuse dark pigmentation on uropodal exopod and anterolateral areas of pleotelson ..... *E. vulgaris*
- Pleotelson in adult female about as broad as long; eyes large, close-set medially; anterior border of head strongly produced, apically blunt; antenna of 8-9 articles; juveniles with pigment granules concentrated in melanophores, lacking distinct color pattern ..... *E. californica*

FAMILY LIMNORIIDAE

Limnoriids are a cosmopolitan family of wood and algae-boring isopods (the marine gribbles), distinguished by their minute size (4 mm or less in length), wood/algae boring habits, and several unique anatomical features: the head is set off from the pereon and freely rotates, the mandible incisor process lacks teeth and instead forms a projecting rasp-and-file device used to work wood, the mandibular molar process is absent, the basis of the maxillipeds is elongated and waisted, and the uropods are greatly reduced, with a minute often clawlike exopod.

Over seventy species, in three genera (*Limnoria, Lynseia, Paralimnoria*) have been described. Four species are known from California waters, one of which is an algal borer (*L. algarum*) and can be most easily found in the holdfasts of large brown algae such as *Macrocystis*, *Egregia*, *Laminaria*, *Postelsia*, and *Nereocystis*. The others infest marine woods, such as pier pilings, docks, boats, driftwood, etc.

KEY TO INTERTIDAL SPECIES OF LIMNORIIDAE
(figures 52-55)

1. Incisor process of mandibles simple, lacking rasp or file; algal holdfast borers *Limnoria algarum*
- Incisor of right mandible with filelike ridges, that of left with rasplike sclerotized plates; wood borers 2
2. Dorsal surface of pleotelson with a median Y-shaped keel at base; lateral and posterior borders of pleotelson smooth ..... *Limnoria lignorum*
- Dorsal surface of pleotelson with symmetrically arranged tubercles anteriorly; lateral and posterior borders of pleotelson smooth or tuberculate 3
3. Four anterior tubercles on pleotelson; posterior and lateral margins of pleotelson not tuberculate ..... *Limnoria quadripunctata*
- Three anterior tubercles on pleotelson; posterior and lateral borders of pleotelson tuberculate ..... *Limnoria tripunctata*

FAMILY SEROLIDAE

Serolids are quickly recognized by their broadly ovate, very thin, flattened bodies with broadly expanded coxal plates. The head is deeply immersed in the pereon. Some species are quite large (to 80 mm). The mandible lacks a molar process, and the maxilliped lacks coupling setae on the endite. Pereonite 1 is fused dorsally with the cephalon and encompasses it laterally. Pereopod 1 of both sexes, and pereopod 2 of most adult males, are subchelate, with the dactylus folding back upon an inflated propodus.

Serolidae is a cold-water family, primarily Southern Hemisphere in distribution. Deep sea species often have reduced eyes, or are blind. They are carnivores, scavengers or omnivores. *Heteroserolis carinata*, which ranges from southern California to the Gulf of California, is the only California species (figure 56). It burrows just under the sediment surface, from the low intertidal zone to about 100 m depth.

FAMILY SPHAEROMATIDAE

Sphaeromatid isopods can be recognized by their compact, convex bodies, usually capable of rolling into a ball (conglobation); by their pleon which is consolidated into two or three divisions; and by their lateral uropods in which the endopod is rigidly fused to the basal article and the exopod (if present) is movable. In their ability to conglobate, sphaeromatids resemble certain terrestrial isopods, called pillbugs—a striking example of parallel evolution. Identification of genera and species is often difficult because of marked sexual dimorphism. Hence it is advisable, when making determinations, to have a representative sample including adults of both sexes. Twenty-five species of sphaeromatids, in ten genera, have been described from California waters, twelve of which occur intertidally and are included in the following key. Some workers place *Ancinus*, *Bathycopea* and *Tecticeps* in separate families, while others recognize various subfamilies. However, the relationships of the sphaeromatid genera have yet to be analyzed phylogenetically and such taxonomic opinions are based largely on intuition.

Sphaeromatids are primitive flabelliferans with herbivorous habits. The molar process of the mandible is a broad, ovate grinding structure used to chew algae or other plant material. Smaller species probably feed by scraping diatoms and detritus off sand grains. *Paracerceis sculpta*, a subtropical species that finds its way north to southern California, is unique in that it is possesses three distinct male morphs (designated alpha, beta and gamma males). Alpha males are large, with a distinct morphology typical of other members of the genus; beta males mimic females; gamma males mimic juveniles. The advantage of the beta and gamma males is thought to be in allowing them to sneak into the harem, protected by a single alpha male, to inseminate females (Shuster, 1992; Shuster and Wade, 1991; Shuster and Sassaman, 1997). In the Sea of Cortez, harems most commonly form in calcareous sponges; the natural history of California populations of *P. sculpta* has not been studied.

KEY TO INTERTIDAL SPECIES OF SPHAEROMATIDAE
(figures 57-70)

1. Pereopod 1 prehensile; uropod lacking exopod ..... *Ancinus* (one species in California, *A. granulatus*)
- Pereopod 1 ambulatory; uropod with exopod 2
2. Pleopods 4 and 5 lacking pleats ..... *Gnorimosphaeroma* 3
- Pleopods 4 and 5 with pleats on endopods 4
3. First article of peduncles of right and left antennae touching each other ..... *G. noblei*
- First article of peduncles of right and left antennae not touching each other ... *G. oregonense*
4. Pleopod 4 and 5 with branchial pleats on both rami 5
- Pleopod 4 and 5 with branchial pleats on endopods only 6
5. Uropods lamellar in females, endopod reduced and exopod elongate-cylindrical in males; ovigerous females with four pairs of oostegites ..... *Paracerceis* 7
- Uropods lamellar in both sexes; ovigerous females lacking oöstegites 8
6. Uropodal exopod with serrate outer margin ..... *Sphaeroma* 12
- Uropodal exopod with smooth or lightly crenulate outer margin ..... *Exosphaeroma* 13
7. Male uropods with spines; female pleotelson stout, with four tubercles ..... *P. cordata*
- Male uropods without spines; female pleotelson elongate, with three tubercles..... *P. sculpta*
8. Frontal margin of head produced as a quadrangular process; first two articles of antennules dilated ..... *Dynamenella dilatata*
- Frontal margin of head not produced; articles of antennules not dilated 9
9. Uropod rami with crenulate margin (at least in males) ..... *Paradella dianae*

- Uropod rami without crenulate margin 10
10. Pleotelson with many tubercles ..... *Dynamenella sheareri*
- Pleotelson without tubercles 11
11. Pleotelson with many ridges; uropod rami of similar length ..... *Dynamenella benedicti*
- Pleotelson smooth; uropod with exopod (outer ramus) longer than endopod (inner ramus) ..... *Dynamenella glabra*
12. Pleotelson with many rows of tubercles, posterior extremity without prominent transverse elevation ..... *S. walkeri*
- Pleotelson with two rows of tubercules, posterior extremity with prominent transverse elevation ..... *S. quoyanum*
13. Pleotelson and uropods relatively small; posterior margin of pleotelson rounded ..... *E. inornata*
- Pleotelson and uropods very large; posterior margin of pleotelson acuminate ..... *E. amplicauda*

SUBORDER GNATHIIDEA

(Key references: Monod, 1926; Menzies and Barnard, 1959; Menzies, 1962; Schultz, 1966; Brusca, 1989; Cohen and Poore, 1994; Wetzer and Brusca, 1997)

Gnathiids are quickly recognized by the presence of only six free pereonites and five pairs of pereopods, the first pereonite being fused to the cephalon (with its appendages functioning as a second pair of maxillipeds, or pylopods) and the seventh pereonite being greatly reduced and without legs. The pleon is abruptly narrower than the pereon, always with five free pleonites (plus the pleotelson). Adult males have broad flattened heads with grossly enlarged mandibles that project in the front. Females have small narrow heads and no mandibles at all. In both sexes the eyes are well developed and frequently on short processes (ocular lobes). The embryos are incubated internally, distending the entire body cavity and displacing the internal organs.

Gnathiids occur from the littoral zone to the deep sea, and they are often numerous in shallow soft-bottom benthic samples. Adults probably do not feed and are often found in association with sponges. Adults are benthic but the juvenile stage, called "praniza," is a temporary parasite on marine fishes. Praniza are good swimmers, whereas adults have only limited swimming capabilities. Females and juveniles cannot be identified, and the taxonomy of this suborder is based entirely on males. About ten genera and 125 species, in a single family (Gnathiidae), have been described worldwide. Eight species have been found in California waters, all but *G. steveni* (figure 71) being subtidal. Only two species have been reported from north of Point Conception, *Gnathia tridens* and *Caecognathia crenulatifrons*. For a key to all known California species see Wetzer and Brusca (1997).

SUBORDER MICROCERBERIDEA

(Key references: Lang, 1960; Wägele et al., 1995)

Being tiny (less than 2 mm in length) and cryptic, members of this suborder are overlooked by most collectors. Microcerberids resemble anthurid isopods in having an elongate body and subchelate first pereopods. However, they are most closely related to the Asellota, with which they share the terminal styliform uropods and many other features. An asellote species, *Caecianiropsis psammophila*, also lives interstitially in intertidal sands of central California and shows the same adaptations to this habitat as microcerberids *i.e.,* elongation, small size, and loss

of eyes and pigmentation. Only one species of microcerberid has been reported from California waters, *Coxicerberus abbotti* (formerly placed in the genus *Microcerberus*), known from the interstitial environment in the Monterey Bay area (figure 72).

SUBORDER VALVIFERA

(Key references: Stimpson, 1857; Benedict, 1898; Richardson, 1905; Menzies, 1950A; Miller and Lee, 1970; Menzies and Miller, 1972; Brusca and Wallerstein, 1977, 1979A, B; Kensley and Kaufman, 1978; Brusca, 1983B, 1984; Rafi and Laubitz, 1990; Poore and Lew Ton, 1993)

Valviferans are distinguished by the unique opercular uropods that form hinged doors ("valves") covering the pleopods. Additional features that aid in recognition are the well-developed coxal plates, often partly fused pleonites, absence of mandibular palps (except in the Southern Hemisphere family Hologna thidae), and the penes of males arising from pleonite 1, or on the articulation of pleonite 1 and pereonite 7 (rather than on the thorax, as in all other marine isopods).

Three families and thirty-four species are represented in California waters. *Mesidotea entomon*, an offshore circum-Arctic species, is reported to occur as far south as Pacific Grove (California) and is the only representative of the Chaetiliidae in California. Twenty-one species in the families Arcturidae and Idoteidae occur in California's intertidal region.

KEY TO INTERTIDAL SPECIES OF VALVIFERA
(figures 73-93)

1. Body narrow, subcylindrical; anterior four pereopods unlike posterior three, being smaller, setose, and nonambulatory; head fused with first pereonite, leaving 6 free pereonites ..... ARCTURIDAE: *Idarcturus* (one species in California, *I. hedgpethi*)
- Body dorsoventrally depressed; pereopods subsimilar and ambulatory; 7 free pereonites ..... I DOTEIDAE 2
2. Pleon composed of 3 complete pleonites and 1 incomplete pleonite (represented by a pair of lateral suture lines), plus pleotelson ..... *Cleantioides* (one species in California, *C. occidentalis*)
- Pleon with less than 3 complete pleonites 3
3. Pleon composed of a single segment, with or without incomplete suture lines 4
- Pleon composed of 2 complete pleonites and 1 incomplete pleonite ..... *Idotea* 6
4. Antenna with multiarticulate flagellum; pleon with 1 pair of incomplete suture lines 5
- Antenna with single clavate flagellar article; pleon usually without suture lines..... *Erichsonella* 15
5. Maxillipedal palp of 4 articles ..... *Colidotea* 16
- Maxillipedal palp of 3 articles ..... *Synidotea* 17
6. Maxillipedal palp of 4 articles 7
- Maxillipedal palp of 5 articles 9
7. Pleotelson posterior margin concave ..... *I. rufescens*
- Pleotelson posterior margin not concave 8
8. Pleotelson posterior margin with strong median process, triangular in shape and with rounded apex ..... *I. ochotensis*
- Pleotelson posterior margin without strong median process ..... *I. urotoma*
9. Eyes transversely (dorsoventrally) elongate; maxilliped with 1, 2 or 3 coupling setae

..... *I. stenops*
- Eyes not transversely elongate; maxilliped with 1 coupling seta 10
10. Posterior border of pleotelson strongly concave..... *I. resecata*
- Posterior border of pleotelson not concave..... 11
11. Pleonite one with acute lateral borders 12
- Pleonite one without acute lateral borders 13
12. Eyes reniform; anterior margin of pereonite one encompassing cephalon..... *I. wosnesenskii*
- Eyes retangular; anterior margin of pereonite one not encompassing cephalon .... *I. schmitti*
13. Pleotelson with median posterior projection 14
- Pleotelson without median posterior projection ..... *I. kirchanskii*
14. Eyes circular; pleotelson median posterior projection long ..... *I. aculeata*
- Eyes with straight anterior and convex posterior border; pleotelson median posterior projection short ..... *I. montereyensis*
15. Body not elongated (length about 3 times width) ..... *E. pseudoculata*
- Body elongate (length about 7.4 times width) ..... *E. crenulata*
16. Posterior margin of pleotelson rounded; body relatively stout (length about 2.6 times width); antenna not, or barely, reaching pereonite 2; body dark purple or dark red (fading to bluish-gray in alcohol); commensal on sea urchins (*Strongylocentrotus*)..... *C. rostrata*
- Posterior margin of pleotelson triangular-shaped; body elongate (length about 5.5 times width); antenna reaching pereonite 3 or 4; body brown to brownish-green; not commensal on sea urchins (usually in brown algae) ..... *C. findleyi*
17. Body smooth; head without preocular horns or other projections ..... *S. harfordi*
- Body with tuberculations, carinae or bumps; head with preocular horns or other processes... 18
18. Pereon lacking tubercles ..... *S. consolidata*
- Pereon with tubercles 19
19. Preocular horns project forward ..... *S. ritteri*
- Preocular horns project laterally 20
20. Lateral borders of first four pereonites acute; each pereonite with a transverse row of three pointed tubercles ..... *S. pettiboneae*
- Lateral borders of second, third and fourth pereonites blunt; pereonites with many small tubercles ..... *S. berolzheimeri*

SUBORDER ONISCIDEA (Terrestrial Isopods)

(Key references: Van Name, 1936, 1940, 1942; Mulaik and Mulaik, 1942; Schultz, 1970, 1972, 1984; Garthwaite et al., 1985, 1992; Taiti and Ferrara, 1986; Garthwaite 1988, 1992; Leistikow and Wägele, 1999)

The Oniscidea (formerly “Oniscoidea”) are the only group of crustaceans fully adapted to live on land. They are distinguished by: extreme reduction (1-3 articles) of the antennules; endopods of male pleopod 1 and/or 2 elongate, styliform, specialised as a copulatory apparatus; and, presence of a complex water-conducting system (Hoese, 1981, 1982A). In species best adapted to terrestrial life (e.g. Porcellionidae, Armadillidiidae, Armadillidae) the exopods of pleopods 1-2 or 1-5 bear respiratory structures, called pseudotracheae or "lungs." Terrestrial isopods possess general body morphologies correlated to their ecological strategies and behaviour, and can be grouped in three main categories (Schmalfuss, 1984): the runners, with an elongate, slightly convex body and long pereopods; the clingers, with a flat broad body and short strong pereopods; and the rollers, with a highly convex body able to roll up into a ball (pillbugs).

With over 4,000 described species, Oniscidea is the largest isopod suborder. They occur in any kind of terrestrial habitat, from littoral to high mountains, from forests to deserts. In California twenty-two species in nine families occur in littoral biotopes, but only species of *Ligia*, *Tylos*, *Littorophiloscia* and the Scyphacidae are typical inhabitants of the eulittoral zone.

KEY TO LITTORAL SPECIES OF ONISCIDEA
(figures 94-115)

The key and species list include all the strictly littoral oniscid species, some of which have wide distributions or have been introduced to North America, and some of which occur on both coasts.

1. Uropods ventral, hidden by pleotelson and not visible in dorsal view of the animal ..... TYLIDAE *Tylos punctatus*
- Uropods terminal, clearly visible in dorsal view 2
2. Flagellum of antenna with more than ten articles; eye with more than fifty ommatidia ..... LIGIIDAE 3
- Flagellum of antenna with two to seven articles; eye with less than thirty ommatidia, or eyes absent 6
3. Pleotelson with posterolateral projections; uropod with insertion of exopod and endopod at the same level ..... *Ligia* 4
- Pleotelson without posterolateral projections; uropod with insertion of exopod distinctly proximal to that of endopod ..... *Ligidium* 5
4. Distance between eyes equal to length of one eye; peduncle of uropod several times longer than broad ..... *Ligia occidentalis*
- Distance between eyes equal to twice length of one eye; peduncle of uropod about as broad as long ..... *Ligia pallasii*
5. Surface of body smooth and shiny; eye ovoid, far from posterior margin of cephalon; endopod of second male pleopod with rounded apex ..... *Ligidium gracile*
- Surface of body rough with sparse scales; eye subtriangular, almost reaching posterior margin of cephalon; endopod of second male pleopod with pointed apex..... *Ligidium latum*
6. Flagellum of antenna tapering to a point, with articles distinguishable only in micropreparations ..... TRICHONISCIDAE 7
- Flagellum of antenna with two to four clearly distinct articles 8
7. Flagellum of antenna of three minute articles; eye consisting of a single black ommatidium. ..... *Haplophthalmus danicus*
- Flagellum of antenna of six or seven minute articles; eyes lacking ..... *Brackenridgia heroldi*
8. Flagellum of antenna with four articles ..... SCYPHACIDAE (part) 9
- Flagellum of antenna with two or three articles 12
9. Uropods with peduncle subcylindrical, exopod inserted terminally and distinctly protruding from body outline ..... *Detonella papillicornis*
- Uropods with peduncle lamellar, exopod inserted on medial margin and not protruding from body outline 10
10. Body markedly convex and capable of rolling into a ball; cephalon with median lobe truncate ..... *Armadilloniscus lindahli*
- Body not markedly convex and incapable of rolling into a ball; cephalon with median lobe pointed 11

11. Penultimate article of peduncle of antenna with spurlike process on lateral margin; dorsal body surface of adult female covered with conspicuous tubercles; seventh male pereopod with a strong spine caudally directed and a rounded lobe on carpus ..... *Armadilloniscus coronacapitalis*
- Penultimate article of peduncle of antenna without spurlike process on lateral margin; dorsal body surface rough, with low, rounded tubercles; seventh male pereopod without spine and lobe on carpus ..... *Armadilloniscus holmesi*

12. Flagellum of antenna with three articles 13
- Flagellum of antenna with two articles 15

13. Cephalon with cone-shaped lateral lobes protruding frontwards; pleon not abruptly narrower than pereon ..... SCYPHACIDAE (part) *Alloniscus* 14
- Cephalon without cone-shaped lateral lobes; pleon abruptly narrower than pereon ..... PHILOSCIIDAE *Littorophiloscia richardsonae*

14. Peduncle of uropod with posterolateral margin produced, rounded ..... *Alloniscus mirabilis*
- Peduncle of uropod with posterolateral margin not produced, oblique ..... *Alloniscus perconvexus*

15. Body moderately convex, unable to roll into a ball; uropod subcylindrical, distictly protruding backwards compared with pleotelson tip 16
- Body very convex, able to roll into a ball; uropod flattened, reaching pleotelson tip 21

16. Dorsal surface of body covered with fine but distinct scales; first article of flagellum of antenna distinctly shorter than second ..... PLATYARTHRIDAE 17
- Dorsal surface of body with no distinctly visible scales; first article of flagellum of antenna as long or longer than second ..... PORCELLIONIDAE 18

17. Eyes with about ten ommatidia; pleotelson tip reaching distal margin of uropodal peduncle ..... *Niambia capensis*
- Eyes lacking; pleotelson much shorter than uropodal peduncle ..... *Platyarthrus aiasensis*

18. Cephalon with a V-shaped suprantennal line; pereonite 1 with regularly convex posterior margin ..... *Porcellionides floria*
- Cephalon with no suprantennal line; pereonite 1 with posterior margin concave at sides ..... *Porcellio* 19

19. Pleotelson with a rounded apex ..... *Porcellio dilatatus*
- Pleotelson with an acute apex 20

20. Dorsal surface of body granulated; posterior margin of first pereonite distinctly concave at sides ..... *Porcellio scaber*
- Dorsal surface of body smooth; posterior margin of first pereonite slightly concave at sides ..... *Porcellio laevis*

21. Cephalon with a triangular frontal scutellum; eyes with twenty to twenty-five ommatidia; posterolateral corner of first pereonite entire; uropod with large flattened exopod filling gap between pleotelson and fifth pleonite ..... ARMADILLIDIIDAE *Armadillidium vulgare*
- Cephalon with no triangular frontal scutellum; eyes with four to eight ommatidia; posterolateral corner of first pereonite cleft; uropod with large flattened peduncle filling gap between pleotelson and fifth pleonite, exopod minute inserted dorsally ..... ARMADILLIDAE *Venezillo microphthalmus*

LIST OF ALL CALIFORNIA MARINE ISOPODS
(commonly encountered junior synonyms and generic reassignments are provided)

SUBORDER ANTHURIDAE Monod, 1922

Family Antheluridae Poore and Lew Ton, 1988
Ananthura Barnard, 1925
Ananthura luna (Schultz, 1966). (Formerly placed in *Bathura*) Southern CA (Coronado, Tanner and Santa Monica Canyons; Santa Monica Bay). 78-1298 m.

Family Anthuridae Leach, 1814
Amakusanthura Nunomura, 1977
Amakusanthura californiensis (Schultz, 1964). (Formerly placed in *Apanthura*). Southern CA to northwestern Mexico. 80 m.
Cyathura Norman and Stebbing, 1886
Cyathura munda Menzies, 1951. Marin County, CA to northwestern Baja California and Gulf of California. Low intertidal to 132 m. Common in kelp holdfasts (e.g., *Egregia, Laminaria*) and surfgrass (*Phyllospadix*).
Haliophasma Haswell, 1881
Haliophasma geminatum Menzies and Barnard, 1959. (Formerly placed in *Silophasma*). Monterey, CA to central western Baja California. 9-512 m.
Mesanthura Barnard, 1914
Mesanthura occidentalis Menzies and Barnard, 1959. Point Conception, CA to Gulf of Nicoya, Costa Rica (including the Gulf of California). Intertidal to 20 m. On kelp and rocks.

Family Paranthuridae Menzies and Glynn, 1968
Califanthura Schultz, 1977
Califanthura squamosissima (Menzies, 1951). (Formerly placed in *Colanthura)*. Dillon Beach, CA to Oaxaca, Mexico (including the Gulf of California). Shallow subtidal to 142 m. Muddy or sandy sediments and kelp beds.
Colanthura Richardson, 1902
Colanthura bruscai Poore, 1984. San Clemente, CA to Costa Rica. Intertidal to 27 m.
Paranthura Bate and Westwood, 1868. = *Edanthura* Boone, 1923.
Paranthura algicola Nunomura, 1978. A questionable species, not distinguishable from published descriptions; possibly *P. elegans*. Reported by Nunomura (1978) from California (no specific locality provided).
Paranthura elegans Menzies, 1951. Marin County, CA to northwestern Baja California, and throughout the Gulf of California. Intertidal to 55 m. On algal mats, mud bottoms, pier pilings, rocky low intertidal.
Paranthura linearis *nomen nudum*. (Formerly placed in *Edanthura*.) Reported by Boone (1923) from Laguna Beach, CA.

SUBORDER ASELLOTA Latreille, 1803

Family Asellidae Rafinesque, 1815
Asellus Geoffroy, 1764
Asellus tomalensis Harford 1877. WA to central CA. Shallow, subtidal brackish water.

Family Dendrottiidae Vanhöffen, 1914
Acanthomunna Beddard, 1886
Acanthomunna tannerensis Schultz, 1966. Tanner Canyon, southern CA. Deep water.

Family Desmosomatidae Sars, 1897
Momedossa Hessler, 1970

Momedossa symmetrica (Schultz, 1966). (formerly placed in *Desmosoma)*. CA continental slope and submarine canyons. 469-2955 m.

Family Janiridae Sars, 1897
Caecianiropsis Menzies and Pettit, 1956

Caecianiropsis psammophila Menzies and Pettit, 1956. Marin to Monterey County, CA. Intertidal. Buried in sand.
Caecijaera Menzies, 1951

Caecijaera horvathi Menzies, 1951. HI and southern CA. Intertidal. Living inside burrows excavated in wood by *Limnoria* species.
Iais Bovallius, 1886

Iais californica (Richardson, 1904). (formerly placed in *Janiropsis*). Humboldt County to San Diego County, CA, southeast Australia, New Zealand. Shallow water. Usually found in bays and estuaries, commensal with the wood-boring isopod *Sphaeroma quoyanum*.
Ianiropsis Sars, 1897

Ianiropsis analoga Menzies, 1952. WA to Marin County, CA. Intertidal. Under rocks or on *Laminaria* holdfasts. Leach (1814) described *Janira maculosa* from Europe; Hatch (1947) misidentified specimens from WA as *J. maculosa* (Menzies, 1952). The specimens Hatch misidentified where a new species that Menzies (1952) later described as *Ianiropsis analoga*. Carvacho's (1981) distribution for *J. maculosa* (WA state) is based on Hatch (1947) and therefore incorrect.

Ianiropsis derjugini (Gurjanova, 1933). (formerly placed in *Janiropsis*). Komandorskie Islands, Bering Sea, to Monterey County, CA. Intertidal. Under rocks covered by algae.

Ianiropsis epilittoralis Menzies, 1952. Marin County to San Luis Obispo County, CA. Intertidal. On green filamentous algae in high intertidal.

Ianiropsis kincaidi (Richardson, 1904). (Formerly placed in *Janiropsis*) Komandorskie Islands, Bering Sea, to Monterey County, CA. Intertidal. = *Ianiropsis pugettensis* Hatch, 1947.

Ianiropsis magnocula Menzies, 1952. San Juan Island, WA to 3 miles off Russian River, CA. 20-57 m. Muddy substrate and on red and brown algae.

Ianiropsis minuta Menzies, 1952. Marin County, CA. Intertidal. Under rocks or sand.

Ianiropsis montereyensis Menzies, 1952. Marin to Monterey Counties, CA. Intertidal to shallow subtidal. Under rocks or in *Macrocystis* holdfasts.

Ianiropsis tridens Menzies, 1952. San Juan Island, WA to Monterey County, CA; northern Chile. Intertidal. On algae; occasionally found in sponges.
Janiralata Menzies, 1951

Janiralata davisi Menzies, 1951. Monterey County, CA. Intertidal.

Janiralata occidentalis (Walker, 1898). (formerly placed in *Janira*). San Juan County, WA to Orange County, CA. Intertidal. Under rocks.

Janiralata rajata Menzies, 1951. Monterey County, CA. 40 m. A poorly known species reported from egg cases of the ray, *Raja binoculata*.

Janiralata solasteri (Hatch, 1947). (formerly placed in *Janira*). AK to southern CA. 50-90 m.

Janiralata triangulata (Richardson, 1899). (formerly placed in *Ianthe*). Monterey Bay, CA. Shallow water.

Family Joeropsididae Nordenstam, 1933
Joeropsis Koehler, 1885

Joeropsis concava (Schultz, 1966). (formerly placed in *Jaeropsis)*. Central to southern CA, including San Diego. 60-221 m.

Joeropsis dubia dubia (Menzies, 1951). (formerly placed in *Jaeropsis)*. Marin County, CA to San Quintín, Baja California and Gulf of California. Low intertidal to 100 m. Found on algal holdfasts, bryozoans, tunicates, hydroids, barnacles and under rocks.

Joeropsis dubia paucispinis (Menzies, 1951). (formerly placed in *Jaeropsis)*. Marin County, CA. Intertidal to 116 m.

Joeropsis lobata (Richardson, 1899). (formerly placed in *Jaeropsis)*. Monterey Bay, CA. Shallow water.

Family Munnidae G. O. Sars, 1897
Munna Kroyer, 1839

Munna chromatocephala Menzies, 1952. Puget Sound, WA to central CA. Intertidal. Found on red algae and among incrusting organisms on rocks.

Munna halei Menzies, 1952. Tomales Bay to San Luis Obispo, CA. Intertidal. Found under rocks, in *Macrocystis* holdfast, and among spines of the purple sea urchin *Strongylocentrotus purpuratus*.

Munna magnifica Schultz, 1964. Off Santa Barbara, CA. 500m.

Munna spinifrons Menzies and Barnard, 1959. Point Conception (12 m) to Point Loma (145 m), CA.

Munna stephenseni Gurjanova, 1933. Bering Sea to central CA. Intertidal to 18 m.
Uromunna Menzies, 1962

Uromunna ubiquita (Menzies, 1952). (formerly placed in *Munna)*. Puget Sound to northwestern Baja California and Gulf of California. Intertidal to shallow subtidal. = *Munna minuta* Hansen in Hatch, 1947.

Family Munnopsidae Sars, 1869 (*sensu lato* Wilson, 1989)
Eurycope G. O. Sars, 1864

Eurycope californiensis Schultz, 1966. Santa Maria Basin to Newport Canyon, CA. 478-930 m.
Ilyarachna Sars, 1879

Ilyarachna acarina Menzies and Barnard, 1959. Southern CA (Santa Maria Basin to Point Loma). 73-1118 m.

Ilyarachna profunda Schultz, 1966. Southern CA (La Jolla Canyon). 461-1298 m.
Nannonisconus Schultz, 1966

Nannonisconus latipleonus Schultz, 1966. Central and southern CA. 465 m.

Family Paramunnidae Vanhöffen, 1914
Munnogonium George and Strömberg, 1968

Munnogonium erratum (Schultz, 1964). (formerly placed in *Austrosignum*). Santa Barbara Channel. 135 m.

Munnogonium tillerae (Menzies and Barnard, 1959). (formerly placed in *Austrosignum*). Central to southern CA. 5-150 m. = *Munnogonium waldronensis* George and Strömberg, 1968; = *Munnogonium erratum* (Schultz, 1964).
Paramunna G. O. Sars, 1866

Paramunna quadratifrons Iverson and Wilson, 1981. Tanner Bank, southern CA. 197m.

Pleurogonium G. O. Sars, 1863

Pleurogonium californiense Menzies, 1951. Throughout California, south at least to Point Loma. 90-154 m.

Family Santiidae Kussakin, 1982

Santia Sivertsen and Holthuis, 1980

Santia hirsuta (Menzies, 1951). (Formerly placed in *Antias*). Marin County, CA. Intertidal. Found in rock and sand between coralline and laminarian algal zones.

SUBORDER EPICARIDEA Latreille, 1831

Family Bopyridae Rafinesque, 1815

Aporobopyrus Nobili, 1906

Aporobopyrus muguensis Shiino, 1964. Bodega Bay, CA to central west Baja California. 10–12 m. In branchial chamber of porcelain crab *Pachycheles rudis*.

Aporobopyrus oviformis Shiino, 1934. Seto, Japan and Point Mugu, CA. 10–12 m. Found in branchial chamber of porcelain crab *Pachycheles pubescens* in CA.

Argeia Dana, 1853

Argeia pugettensis Dana, 1853. Bering Sea to southern CA, Japan and Korea. Branchial parasites on shrimps of the family Crangonidae. 32-188 m. = *Argeia pauperata* Stimpson, 1857; = *Argeia calmani* Bonnier, 1900; = *Argeia pingi* Yu, 1935.

Asymmetrione Codreanu, Codreanu and Pike, 1965

Asymmetrione ambodistorta Markham, 1985. Southern CA. 3 m. Infesting the hermit crab *Isocheles pilosus*.

Bopyrella Bonnier, 1900

Bopyriscus calmani (Richardson, 1905). (Formerly placed in *Bopyrella*). Southern and central CA. Intertidal to 9 m. On branchial chamber of the snapping shrimp *Synalpheus lockingtoni* and *Alpheopsis equidactylus*. = *Bopyrella macginitiei* Shiino, 1964.

Ione Latreille, 1817

Ione cornuta Bate, 1864. British Columbia to San Francisco, CA. Intertidal to shallow water. In branchial chamber of species of ghost shrimps of the genus *Callianassa* (found on *C. longimana* in the eastern Pacific and *C. japonica* in the western Pacific). = *Ione brevicauda* Bonier, 1900.

Munidion Hansen, 1897

Munidion pleuroncodis Markham, 1975. Central CA to (at least) central Mexico. Known to infest only the pelagic red galatheid *Pleuroncodes planipes*, which occurs in CA only during warm years when the host moves north from the tropical eastern Pacific. Offshore storms occasionally move *P. planipes* ashore where they are beached.

Phyllodurus Stimpson, 1857

Phyllodurus abdominalis Stimpson, 1857. Southern British Columbia, Canada to northwest Baja California. Intertidal. Among pleopods of mud shrimp *Upogebia pugettensis* (female is posterior to first pair of large pleopods, male roves).

Pseudione Kossmann, 1881

Pseudione galacanthae Hansen, 1897. British Columbia, Canada to Gulf of California. Offshore (> 50m). In branchial chamber of *Galacantha diomediae parvispina* and *Munnida quadrispina*.

Schizobopyrina Markham, 1985

Schizobopyrina striata (Nierstrasz and Brender à Brandis, 1929). (formerly placed in *Bopyrina*). Throughout CA and Baja California, including Gulf of California. Shallow water. Found on *Hippolytes californiensis* (in San Diego Bay) and on *Thor algicola* (in Gulf of California).

Stegophryxus Thompson, 1902

Stegophryxus hyphalus Markham, 1974. Carmel, CA to Baja California, Mexico. 69-319 m. Infesting *Parapagurodes laurentae* and *P. makarovi*.

Family Dajidae Sars, 1899

Holophryxus Richardson, 1905

Holophryxus alaskensis Richardson, 1905. Behm Canal, AK, to Santa Barbara Channel, CA. 44-700 m. On dorsal part of carapace of *Pasiphaea pacifica*. =*Holophryxus californiensis* Richardson, 1908; = *Hypodajus georgiensis* Nierstrasz and Brend à Brandis, 1931.

Family Entoniscidae Kossmann, 1882

Portunion Giard and Bonnier, 1886

Portunion conformis Muscatine, 1956. San Francisco to Marin County. Intertidal. In visceral cavity of *Hemigrapsus oregonensis* and *H. nudus*.

Family Liropsidae Bonnier, 1990

Cabirops Kossmann, 1884

Cabirops montereyensis Sassaman, 1985. Monterey Bay, CA. Shallow water. On marsupium of the isopod *Aporobopyrus muguensis*.

Faba Nierstrasz and Brender à Brandis, 1931

Faba setosa Nierstrasz and Brender à Brandis, 1931. Central CA. 300 m. On the shrimp, *Spirontocaris bispinosa*.

Hemioniscus Buchholz, 1866

Hemioniscus balani Buchholz, 1866. A European species apparently introduced throughout the world. In the eastern Pacific, reported from: British Columbia, Canada to Baja California, Mexico. Intertidal. On barnacles of the genus *Balanus* and *Chthamalus*. This species has also been assigned to *Cryptothir*, *Cryptothiria*, and *Cryptoniscus*.

SUBORDER FLABELLIFERA Sars, 1882

Family Aegidae Dana, 1853

Aega Leach, 1815

Aega (Aega) lecontii (Dana, 1854). (formerly placed in *Aegacylla*). Central and southern CA. Offshore. Taken from fish or from soft bottoms.

Aega (Rhamphion) microphthalma Dana, 1854. Monterey, CA. [*species inquirenda*; see Brusca, 1983A]

Aega (Rhamphion) plebia Hansen, 1897. Although no records exist for CA, this species is wide ranging, known from the Bering Strait to Peru and Tierra del Fuego. Only collected in deep water (688-2534 m) off oceanic islands. Taken from fish or from soft bottoms. = *A. magnoculis* Richardson, 1909.

Aega (Rhamphion) symmetrica Richardson, 1905. AK to central CA, possibly occurring in southern CA. 75 to 878 m. Taken from fish or from soft bottoms.

(Note: Pacific records of the Atlantic species *Aega tenuipes* are in error.)

Rocinela Leach, 1815

Rocinela angustata Richardson, 1904. Bering Sea, AK to central western Baja California. 30-2214 m. Taken from fish or from soft bottoms.

Rocinela belliceps (Stimpson, 1864). (Formerly placed in *Aega*). AK to Baja California, Clarion Island, and the Gulf of California (Mexico). Shallow subtidal to 284 m. Taken from fish or from soft bottoms. = *Rocinela alascensis* Richardson, 1898.

Rocinela laticauda Hansen, 1897. Rare. Known from only 2 records: Piedras Blancas Point (near San Simeon), CA and Acapulco (western Mexico). 120-906 m. Taken from fish or from soft bottoms.

Rocinela murilloi Brusca and Iverson, 1985. Point Sur, CA to Valparaiso, Chile. Very common at depths of 768 to 1866 m. Taken from fish or from soft bottoms.

Rocinela signata Schiödte and Meinert, 1879. Los Angeles, CA to Ecuador; also in tropical western Atlantic (Florida to Brazil). Intertidal to 68 m. Common. Taken from fish or from soft bottoms. = *Rocinela aries* Schiödte and Meinert, 1879.

Family Anuropidae Stebbing, 1893

Anuropus Beddard, 1886

Anuropus bathypelagicus Menzies and Dow, 1958. CA. Pelagic; probably a symbiont on jellyfish and salps.

Family Cirolanidae Dana, 1853

Cirolana Leach, 1818

Cirolana diminuta Menzies, 1962. Point Conception, CA to western Baja California and Gulf of California; Galapagos Islands. Intertidal to 50 m. Easily confused with the tropical *C. parva*.

Cirolana harfordi (Lockington, 1877). (formerly placed in *Aega*). Vancouver Is (Canada) to northwestern Baja California; single record from La Paz (Baja California Sur). Also reported from the coasts of Russia, Japan and Australia, where it has apparently been introduced. Intertidal to shallow subtidal. *C. harfordi* var. *spongicola* Stafford, 1912 is probably *C. diminuta*.

Eurydice Leach, 1815. = *Branchuropus* Moore, 1901; = *Helleria* Czerniavsky, 1868 (not *Helleria* Ebner, 1868); = *Pelagonice* Soika, 1955; = *Slabberina* Beneden, 1861.

Eurydice caudata Richardson, 1899. San Diego, CA to Gulf of Guayaquil (Ecuador), including all offshore islands of the tropical eastern Pacific. Intertidal to 160 m. =*E. branchuropus* Menzies and Barnard, 1959.

Eurylana Jansen, 1981

Eurylana arcuata (Hale, 1925). (formerly placed in *Cirolana*). San Francisco, New Zealand, Australia and western coast of South America. Intertidal to shallow subtidal. Probably introduced from New Zealand. =*Cirolana robusta* Menzies, 1962; =*Cirolana concinna* Hale, 1925, in Menzies, 1962 (misidentification).

Excirolana Richardson, 1912

Excirolana chiltoni (Richardson, 1905). (formerly placed in *Cirolana*). British Columbia to CA; Japan, Taiwan, Hong Kong. Intertidal. =*E. kincaidi* (Hatch, 1947); =*E. vancouverensis* (Fee, 1926); = *E. japonica* Richardson, 1912.

Excirolana linguifrons (Richardson, 1899). (Formerly placed in *Cirolana*). Monterey Bay to southern CA. Intertidal.

Metacirolana Kussakin, 1979

Metacirolana joanneae (Schultz, 1966). (Formerly placed in *Cirolana*). Submarine canyons and basins off central and southern CA. 218 m.

Natatolana Bruce, 1981

Natatolana californiensis (Schultz, 1966). (Formerly placed in *Cirolana*). Throughout the canyons and basins of southern CA; Gulf of California, Costa Rica, Peru-Chile Trench. Fine sand and mud bottoms. 40-2000 m (most common at 800-1200 m). =*Cirolana deminuta* Menzies and George, 1972.

Family Corallanidae Hansen, 1890

Excorallana Stebbing, 1904

Excorallana tricornis occidentalis Richardson, 1905. Southern CA to Panama. Intertidal to 138 m. On rocks, sandy beaches, and in mangrove habitats.

Excorallana truncata (Richardson, 1899). (Formerly placed in *Corallana*). Point Conception, CA to Galapagos Islands. Intertidal to 183 m. =*E. kathyae* Menzies, 1962.

Family Cymothoidae Leach, 1818

Ceratothoa Dana, 1853

Ceratothoa gaudichaudii (H. Milne Edwards, 1840). (Formerly placed in *Cymothoa*). Southern CA to Cape Horn, and around to southern Patagonia. Rare in southern CA. Found on many species of pelagic fishes.

Ceratothoa gilberti (Richardson, 1904). (Formerly placed in *Meinertia*). Southern CA to Mazatlán, Sinaloa, Mexico. Rare in southern CA; a tropical species. In the mouths of mullet (*Mugil cephalus* and *M. hospes*).

Elthusa Bruce, 1990

Elthusa californica (Schioedte and Meinert, 1884). (Formerly placed in *Livoneca*). Los Angeles, CA to Peru. Found on dwarf surfperch (*Micrometrus minimus*), shiner surfperch (*Cymatogaster aggregata*), surf smelt (*Hypomesus preitiosus*), topsmelt (*Atherinops affinis*), arrow goby (*Clevelandia ios*) and California killifish (*Fundulus parvipinnis*).

Elthusa vulgaris (Stimpson, 1857). (Formerly placed in *Livoneca*). Coos Bay, OR to Colombia; common from southern CA and Gulf of California to Costa Rica. 1 – 311 m. Found in gill chambers of a wide variety of fishes.

Enispa Bruce, 1990

Enispa convexa (Richardson, 1905). (Formerly placed in *Livoneca*). San Diego, CA to Gulf of Guayaquil, Ecuador. Rare in CA; a tropical species. Found in gill chambers of Pacific bumper (*Chloroscombrus orqueta*), pompanos (*Trachinotus rhodopus* or *T. paitensis*) and *Serranus* sp.

Mothocya Costa in Hope, 1851

Mothocya rosea Bruce, 1986. San Diego to Central America. Found in species of *Hyporhampus* (*H. rosea* and *H. snyderi*).

Nerocila Leach, 1818

Nerocila acuminata Schioedte and Meinert, 1881. Southern CA to Peru, including Gulf of California, HI, Las Tres Marías and Galapagos Islands. Parasite of many fish species. =*Nerocila californica* Schioedte and Meinert, 1881; *Pterisopodus bartschi* Boone, 1918. (Note: records of *Anilocra* from the E. Pacific are probably erroneous.)

Family Limnoriidae White, 1850

Limnoria Leach, 1814

Limnoria algarum Menzies, 1957. OR to southern CA. Intertidal to 15 m. On holdfasts of *Macrocystis*, *Egregia*, *Laminaria*, *Postelsia*, *Nereocystis*, *Sargassum* and *Pelagophycus*.

Limnoria lignorum (Rathke, 1799). (Formerly placed in *Cymothoa*). Temperate and boreal Northern Hemisphere distribution, it occurs from Kodiak Island, AK to Point Arena, CA in the Pacific coast. Intertidal to 20 m. Wood borer. *=Limnoria terebrans* Leach, 1813.

Limnoria quadripunctata Holthuis, 1949. Widespread cool temperate distribution; in CA it occurs from central to southern CA. Intertidal to 30 m. Wood borer.

Limnoria tripunctata Menzies, 1951. From various temperate and tropical locations, including the Caribbean; on the Pacific coast it occurs from San Francisco, CA to Mazatlán, Mexico. Intertidal to 7 m. Wood borer.

Family Serolidae Leach, 1814

Heteroserolis Nordenstam, 1933

Heteroserolis carinata (Lockington, 1877). (Formerly placed in *Serolis*). Southern CA to Baja California, and into the Gulf of California. Intertidal to 98 m. On soft bottoms.

Family Sphaeromatidae H. Milne Edwards, 1840

Ancinus H. Milne Edwards, 1840

Ancinus granulatus Holmes and Gay, 1909. Southern CA, from Santa Barbara to Mazatlán (Mexico), and throughout Gulf of California. Intertidal to 10 m. *=A. seticomvus* Trask, 1970. *Ancinus* and *Bathycopea* are placed in the family Ancinidae by Bruce (1993) and some other workers.

Bathycopea

Bathycopea daltonae (Menzies and Barnard, 1959). (Formerly in *Ancinus*). Monterey Bay to San Miguel Islands, CA. 19-20 m.

Clianella Boone, 1923

Clianella elegans Boone, 1923. *Nomen dubium*. La Jolla and San Pedro, CA.

Discerceis Richardson, 1906

Discerceis granulosa (Richardson, 1899). (Formerly placed in *Cilicaea*) Southern CA to Cedros Island, Baja California. Subtidal, to 37 m.

Dynamene Leach, 1814

Dynamene tuberculosa Richardson, 1899. Aleutian Islands, AK to southern CA. Shallow water.

Dynamenella Hansen, 1905

Dynamenella benedicti (Richardson, 1899). (Formerly placed in *Dynamene*). Monterey Bay, CA. Intertidal.

Dynamenella conica Boone, 1923. San Francisco to Monterey Bay. Intertidal. [*species inquirenda]*

Dynamenella dilatata (Richardson, 1899). (Formerly placed in *Dynamene*). Monterey Bay, CA. Intertidal.

Dynamenella glabra (Richardson, 1899). (Formerly placed in *Dynamene*). OR to San Diego, CA. Intertidal.

Dynamenella sheareri (Hatch, 1947). (Formerly placed in *Dynamene*). San Juan Archipelago, WA to southern CA. Intertidal to shallow subtidal.

Exosphaeroma Stebbing, 1900

Exosphaeroma amplicauda (Stimpson, 1857). (Formerly placed in *Sphaeroma*). AK to Los Angeles, CA. Intertidal.

Exosphaeroma aphrodita Boone, 1923. *Nomen dubium*. La Jolla, CA.

Exosphaeroma inornata Dow, 1958. Northern CA to Los Angeles. Intertidal and shallow subtidal. In holdfasts of kelp (*Macrocystis*). *=E. media* George and Strömberg, 1968.

Exosphaeroma octoncum (Richardson, 1897). (Formerly placed in *Sphaeroma*). Monterey to Marin County, CA. Shallow water.

Exosphaeroma rhomburum (Richardson, 1899). (Formerly placed in *Sphaeroma*). Monterey Bay, CA. Shallow water.

Gnorimosphaeroma Menzies, 1954

Gnorimosphaeroma insulare (Van Name, 1940). (Formerly placed in *Exosphaeroma*). Popof Island, AK to San Nicolas Island, off Los Angeles, CA. Fresh and brackish water. In shallow estuaries and lagoons along the coast. =*G. oregonensis lutea* Menzies, 1954; = *G . lutea* Menzies, 1954.

Gnorimosphaeroma noblei Menzies, 1954. Central CA. High intertidal. Under rocks.

Gnorimosphaeroma oregonense (Dana, 1853). (Formerly placed in *Sphaeroma*). AK to San Francisco Bay, CA. Intertidal to 24 m. Brackish to salt water.

Gnorimosphaeroma rayi Hoestlandt, 1969. Japan, Eastern Siberia, HI and Tomales Bay, CA. Shallow water. Probably introduced to CA together with Japanese oysters that were implanted at Tomales Bay.

Paracerceis Hansen, 1905. = *Sergiella* Pires, 1980.

Paracerceis cordata (Richardson, 1899). (Formerly placed in *Cilicaea*). Aleutian Islands to southern CA. Intertidal to shallow subtidal.

Paracerceis gilliana (Richardson, 1899). (Formerly placed in *Cilicaea*). Catalina Island, CA. 55-73 m.

Paracerceis sculpta (Holmes, 1904). (Formerly placed in *Dynamene*). Southern CA (San Clemente Island and San Diego) to Gulf of California and Michoacan (Mexico). Widely introduced around the world by oceanic shipping (e.g., Brazil, Hawaii, Atlantic coast of Europe, Mediterranean, Australia). Intertidal to shallow subtidal. Males with harems occurring in calcareous sponges.

Paradella dianae (Menzies, 1962). (Formerly placed in the genera *Dynamenopsis* and *Dynamenella*). Southern CA to Bahía de San Quintín, Baja California. Intertidal to shallow subtidal.

Sphaeroma Latreille, 1802

Sphaeroma quoyanum H. Milne Edwards, 1840. San Diego County to Humbolt County, CA; Australia; New Zealand. Intertidal to shallow subtidal. Wood, mud and soft rock borer. Probably introduced to western North America in the late 1800's on ships from Australia (see Rotramel, 1972; Carlton, 1979; Carlton and Iverson, 1981). =*S. pentodon* Richardson, 1904.

Sphaeroma walkeri Stebbing, 1905. A western Pacific and Indian Ocean species introduced to southern CA. According to Kensley and Schotte (1989), this is possibly a pantropical species (it also occurs in the Caribbean).

Tecticeps Richardson, 1897

Tecticeps convexus Richardson, 1899. OR border to Point Conception, CA. 9 m. Placed in the family Tecticipididae by Iverson (1982), Bruce (1993), and some other workers.

Family Tridentellidae, Bruce 1984

Tridentella Richardson, 1905. = *Smicrostoma* Hale, 1925.

Tridentella glutacantha Delaney and Brusca, 1985. Farallon Islands to southern CA. 128-360 m. Rocky bottoms.

Tridentella quinicornis Delaney and Brusca, 1985. Southern CA Channel Islands. 53 m. Rocky bottoms.

SUBORDER GNATHIIDEA Hansen, 1916

Family Gnathiidae Harger, 1880
Caecognathia Dollfus, 1901

Caecognathia crenulatifrons (Monod, 1926). (Formerly placed in *Gnathia*). On southern CA coastal shelf and slope, 9-1376 m; off Santa Cruz Island, 80-270 m; Santa Cruz Basin. Northern record is south of Monterey Bay, CA; southernmost record is off Punta Banderas (northern Baja California, Mexico).

Caecognathia sanctaecrucis (Schultz, 1972). (Formerly placed in *Gnathia*). Santa Maria Basin, Santa Cruz Canyon, Southern CA Bight. 218 m. = *G. hirsuta* Schultz, 1966; not *G. hirsutus* of G.O. Sars 1870.

Gnathia Leach, 1814

Gnathia clementensis Schultz, 1966. Known only from the type locality, San Clemente Canyon, CA. 162 m.

Gnathia coronadoensis Schultz, 1966. Known only from two specimens collected in Coronado Canyon. 344-812 m. In green mud and green mud with hydrogen sulfide.

Gnathia productatridens Menzies and Barnard, 1959. Point Conception to the Southern CA Bight. 20-164 m.

Gnathia steveni Menzies, 1962. Redondo Beach, CA, to northwestern Baja California. Intertidal.

Gnathia tridens Menzies and Barnard, 1959. Point Conception and San Clemente, 11-27 m. One record from Gulf of Alaska.

Gnathia trilobata Schultz, 1966. Coronado Canyon (812 m), La Jolla Canyon (976 m), and off Point Loma (98-153 m).

SUBORDER MICROCERBERIDEA Lang, 1960

Family Microcerberidae Karaman, 1933
Coxicerberus Wägele, Voelz and MacArthur, 1995

Coxicerberus abbotti (Lang, 1960). (Formerly placed in *Microcerberus*). Central CA. Interstitial; intertidal.

SUBORDER VALVIFERA Sars, 1882

Family Arcturidae Bate and Westwood, 1868
Idarcturus Barnard, 1914

Idarcturus allelomorphus Menzies and Barnard, 1959. Monterey to Point Loma, including Cortes and Tanner Banks. Mud bottoms. 12-92 m.

Idarcturus hedgpethi Menzies, 1951. Tomales Bay, CA. Low intertidal. On seaweeds and hydroids.

Microarcturus Nordenstam, 1933

Microarcturus tannerensis Schultz, 1966. Tanner Canyon, southern CA. 1298 m.

Neastacilla Tattersall, 1921

Neastacilla californica (Boone, 1918). (Formerly placed in *Astacilla*). Point Conception to Point Loma, CA, and isolated reports from the Gulf of California. Shallow water to 99 m. On seaweed.

Family Chaetiliidae Dana, 1853
Mesidotea Richardson, 1905. =*Saduria* Adams in White, 1852.

Mesidotea entomon (Linnaeus, 1767). (Formerly placed in *Oniscus*). Circumpolar, western coast of North America to Pacific Grove, CA; Stockholm, Germany, Labrador, Kara Sea. Intertidal in the northern part of its range, to 30 m in the south.

Family Holognathidae Thomson, 1904
Cleantioides Kensley and Kaufman, 1978

Cleantioides occidentalis (Richardson, 1899). (Formerly placed in *Cleantis*). Southern CA to Ecuador and Galapagos Islands. Intertidal to 50 m.

Family Idoteidae Fabricius, 1798
Colidotea Richardson, 1899

Colidotea findleyi Brusca and Wallerstein, 1977. San Diego (rare) to northwestern Baja California, with records from the northern Gulf of California. Intertidal to a depth of at least 1 m. Common on the brown algae *Sargassum*.

Colidotea rostrata (Benedict, 1898). (Formerly placed in *Idotea*). Northern CA (rare) to northwest coast of Baja California (Mexico). Intertidal. Commensal of sea urchin *Strongylocentrotus*.
Edotia Guerin-Meneville, 1844

Edotia sublittoralis Menzies and Barnard, 1959. Vancouver Island (British Columbia) to northwestern Baja California (Mexico); one record from Costa Rica. 15 to 46 m.
Erichsonella Richardson, 1900

Erichsonella crenulata Menzies, 1950. Southern CA (Orange County, CA). Intertidal to shallow subtidal. On eelgrass, *Zostera*.

Erichsonella pseudoculata Boone, 1923. Point Conception, CA to the Mexican border. Intertidal to 18 m.
Idotea Fabricius, 1799 (some researchers distinguish two genera within *Idotea*, *Idotea* sensu stricto and *Pentidotea*)

Idotea aculeata (Stafford, 1913). (Formerly placed in *Pentidotea*). Northwestern Canada to western coast of Baja California; scattered records from Gulf of California. Intertidal.

Idotea fewkesi Richardson, 1905. AK to southern CA. Shallow water.

Idotea kirchanskii Miller and Lee, 1970. OR to southern CA. Intertidal. On surfgrass, *Phyllospadix*.

Idotea metallica Bosc, 1802. A rare tropical species occasionally occurring in southern CA and Gulf of California during warm years; pelagic, attached to floating seaweed. Cosmotropical.

Idotea montereyensis (Maloney, 1933). (Formerly placed in *Pentidotea*). Northwestern Canada to northwestern Baja California. Intertidal. Common on surfgrass *Phyllospadix*. =*Idotea gracillima* (Dana) of Richardson, 1905 and Schultz, 1969.

Idotea ochotensis Brandt, 1851. AK to northern CA. Intertidal to 36 m.

Idotea resecata Stimpson, 1857. AK to southwest Baja California (Mexico). Intertidal. Frequently found living in kelp (e.g., *Macrocystis*, *Egregia*) and eelgrass (*Zostera*).

Idotea rufescens Fee, 1926. British Columbia to central western Baja California. Intertidal to 82 m. On algae. Possibly a synonym of *I. resecata*.

Idotea schmitti (Menzies, 1950). (Formerly placed in *Pentidotea*). Northwestern Canada to northwestern Baja California. Intertidal to shallow subtidal. =*Pentidotea whitei* Stimpson of Richardson, 1905.

Idotea stenops Benedict, 1898. AK to western Baja California; one record from the Gulf of California. Intertidal to shallow subtidal.

Idotea urotoma Stimpson, 1864. AK to western Baja California; scattered records from southern Gulf of California. Intertidal to shallow subtidal. =*Cleantis heathii* Richardson, 1899; = *Idotea rectilinea* Lockington, 1877.

Idotea wosnesenskii Brandt, 1851. AK to San Francisco; one anomalous record from La Paz (Baja California). Intertidal to shallow subtidal. =*Idotea hirtipes* Dana, 1853; = *Idotea oregonensis* Dana, 1853.

Synidotea Harger, 1878

Synidotea angulata Benedict, 1897. British Columbia to northern CA. 60- 76 m.

Synidotea berolzheimeri Menzies and Miller, 1972. Central CA, San Luis Obispo to Sonoma County. Intertidal. On hydroid, *Aglaophenia*.

Synidotea calcarea Schultz, 1966. Tanner and Santa Rosa Canyons. 54-813 m.

Synidotea consolidata (Stimpson, 1856). (Formerly placed in *Idotea*). Southern AK to central CA. Intertidal to 20 m. This species has been confused (in the literature) with the very similar circum-Arctic *Synidotea bicuspida* (Owen, 1839). =*Synidotea macginitiei* Maloney, 1933.

Synidotea harfordi Benedict, 1897. OR to southwestern Baja California; rare in Gulf of California; one record from Costa Rica. Introduced to Japan. Intertidal to shallow subtidal. Easily confused with *S. laticauda*; see Poore 1996 for distinctions.

Synidotea laticauda Benedict, 1897. San Francisco, CA. Shallow water; often found on floats in bays and estuaries. See Poore 1996 for diagnostic and biogeographic information.

Synidotea magnifica Menzies and Barnard, 1959. San Luis Obispo to northwestern Baja California (Mexico). 29 to 98 m.

Synidotea media Iverson, 1972. Point Soberanes to Santa Maria Basin, CA. 183 m.

Synidotea pettiboneae Hatch, 1947. British Columbia to central CA. Intertidal. On hydroids and bryozoans.

Synidotea ritteri Richardson, 1904. British Columbia to north of San Francisco. Intertidal.

Synisoma Collinge, 1917

Synisoma wetzerae Ormsby, 199l. One record from Catalina Island, southern CA (on rocks and brown algae, *Sargassum palmeri* and *Cystoseira neglecta*) and one record from Guaymas (Gulf of California). 13 m.

SUBORDER ONISCIDEA Latreille, 1829

Family Armadillidae Brandt and Ratzeburg, 1831

Cubaris Brandt, 1833

Cubaris affinis (Dana, 1854). *Nomen dubium*. (Formerly placed in *Spherillo*). California. This and the following species, which according to Budde-Lund (1904) are synonyms, are not included in the key since their original descriptions do not permit species recognition and type specimens are lost. Most probably they belong to the genus *Venezillo*.

Cubaris californica (Budde-Lund, 1885). *Nomen dubium*. (formerly placed in *Armadillo*). San Francisco and San Pedro, CA. =*Armadillo speciosus* Stuxberg, 1875, *nomen praeoccupatum*.

Venezillo Verhoeff, 1928

Venezillo microphthalmus (Arcangeli, 1932). (Formerly placed in *Armadillo*). Southern and central CA.

Family Armadillidiidae Brandt and Ratzeburg, 1831
Armadillidium Brandt, 1833
Armadillidium vulgare (Latreille, 1804). (Formerly placed in *Armadillo*). Cosmopolitan species of Mediterranean origin.

Family Ligiidae Brandt and Ratzeburg, 1831
Ligia Fabricius, 1798
Ligia occidentalis Dana, 1853. Oregon to Gulf of California, Mexico. Rocky shores.
Ligia pallasii Brandt, 1833. AK to Santa Cruz, CA. Rocky shores on open coast environments.
Ligidium Brandt, 1833
Ligidium gracile (Dana, 1856). (Formerly placed in *Styloniscus*). AK to CA. Riparian.
Ligidium latum Jackson, 1923. San Francisco Bay Area to Santa Barbara County, CA. Riparian.

Family Philosciidae Kinahan, 1857
Littorophiloscia Hatch, 1947
Littorophiloscia richardsonae (Holmes and Gay, 1909). (Formerly placed in *Philoscia*). Vancouver Island, Canada to Baja California, Mexico. Littoral species common in marshes, along bays and estuaries.

Family Platyarthridae Verhoeff, 1949
Niambia Budde-Lund, 1908
Niambia capensis (Dollfus, 1895). (Formerly placed in *Metoponorthus*). Introduced from southern Africa; widespread along the Pacific coast from southern WA to southern CA. Supralittoral and riparian. =*Porcellio littorina* Miller, 1936.
Platyarthrus Brandt, 1833
Platyarthrus aiasensis Legrand, 1953. This species has a western Mediterranean-Atlantic distribution; introduced to USA (known from southern CA and TX). A myrmecophile.

Family Porcellionidae Brandt and Ratzeburg, 1831
Porcellio Latreille, 1804
Porcellio dilatatus Brandt, 1833. Introduced from Europe. =*Porcellio spinicornis occidentalis* Miller, 1936.
Porcellio laevis Latreille, 1804. A cosmopolitan species of Mediterranean origin. Synanthropic.
Porcellio scaber Latreille, 1804. A cosmopolitan species of European origin. =*Porcellio scaber americanus* Arcangeli, 1932.
Porcellionides Miers, 1877
Porcellionides floria Garthwaite and Sassaman, 1985. Southern and western USA, Yucatan Peninsula (Caribbean Mexico), Baja California (Mexico), and Bahamas. This species is very similar to the cosmopolitan synanthropic *Porcellionides pruinosus* (Brandt, 1833), which is present in the USA but does not seem to occur on the Pacific coast (Garthwaite and Sassaman, 1985).

Family Scyphacidae Dana, 1852
Alloniscus Dana, 1856

Alloniscus mirabilis (Stuxberg, 1875). (Formerly placed in *Rhinoryctes*). From San Mateo County, CA to Magdalena Bay, Baja California, Mexico. A littoral halophilic species common on sandy beaches above high tide line, where it borrows in sand under driftwood. *=Alloniscus cornutus* Budde-Lund, 1885.

Alloniscus perconvexus Dana, 1856. WA to west Baja California. A littoral halophilic species common on sandy beaches above high tide line, where it borrows in sand under driftwood.

Armadilloniscus Uljanin, 1875

Armadilloniscus coronacapitalis Menzies, 1950. Marin County to San Miguel and Anacapa Islands, CA. A littoral halophilic species.

Armadilloniscus holmesi Arcangeli, 1933. British Columbia to west Baja California, Mexico. A littoral halophilic species found in marshes, bays and estuaries under rocks and driftwood. = *Actoniscus tuberculatus* Holmes and Gay, 1909, *nomen praeoccupatum*.

Armadilloniscus lindahli (Richardson, 1905). (Formerly placed in *Actoniscus*). Marin County, CA to Baja California, Mexico. A littoral halophilic species.

Detonella Lohmander, 1927

Detonella papillicornis (Richardson, 1904). (Formerly placed in *Trichoniscus*). Pacific coast, from Bering Island (Russia) and Alaska to San Francisco Bay, CA. A littoral halophilic species common under rocks above high tide line.

Family Trichoniscidae Sars, 1899

Brackenridgia Ulrich, 1902

Brackenridgia heroldi (Arcangeli, 1932). (Formerly placed in *Protrichoniscus*). Central and southern CA.

Haplophthalmus Schoebl, 1861

Haplophthalmus danicus Budde-Lund, 1885. A cosmopolitan species.

Family Tylidae Milne Edwards, 1840

Tylos Audouin, 1826

Tylos punctatus Holmes and Gay, 1909. Southern CA to Baja California and the Gulf of California. A littoral halophilic species restricted to sandy beaches where it burrows above the most recent high tide line during the day and is active on surface at night (Hays, 1977).

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Legends

Plate 1. **Isopoda**. Isopod anatomy in representative groups. 1, Cirolanidae. 2, Asellota. 3, Sphaeromatidae. 4, Idoteidae. 5, Generalized mouthparts. 6, Penes. 7, Pleon of Valvifera (ventral view). 8, Generalized pleopods. (after Van Name, 1936; Menzies and Frankenberg, 1966; Menzies and Glynn, 1968)

Plate 2. **Isopoda**. **Anthuridea**: 9, *Cyathura munda*, A, whole animal, B, detail of the head in lateral view. 10, *Colanthura bruscai*, pleon. 11, *Mesanthura occidentalis*. 12, *Paranthura elegans*. 13-15, **Asellota**: 13, *Caecianiropsis psammophila*. 14, *Caecijaera horvathi*. 15, *Janiralata davisi*, A, whole animal, B, maxilliped. (after Menzies, 1951A; Menzies and Petit, 1956; Menzies and Barnard, 1959; Poore, 1984; Wetzer and Brusca, 1997)

Plate 3. **Isopoda**. **Asellota**: 16, *Janiralata occidentalis*. 17, *Ianiropsis analoga*, A, whole animal, B, male first pleopods. 18, *Ianiropsis derjugini*. 19, *Ianiropsis epilittoralis*. 20, *Ianiropsis kincaidi*, A, whole animal, B, male first pleopods, C, detail of the distal part of the male first pleopods. (after Menzies, 1951A, 1952)

Plate 4. **Isopoda**. **Asellota**: 21, *Ianiropsis minuta*, A, whole animal, B, maxilliped. 22, *Ianiropsis montereyensis*, A, whole animal, B, male first pleopods, C, detail of the distal part of the male first pleopods. 23, *Ianiropsis tridens*. 24, *Joeropsis dubia dubia*, A, whole animal, B, detail of the lateral margin of the pleotelson. 25, *Joeropsis dubia paucispinis*, detail of pleotelson. (after Menzies, 1951A, 1952)

Plate 5. **Isopoda**. **Asellota**: 26, *Santia hirsuta*. 27, *Munna chromatocephala*, A, whole animal, B, uropod, C, male first pleopods. 28, *Munna halei*, A, uropod, B, whole animal. 29, *Munna stephenseni*, A, whole animal, B, uropod. 30, *Uromunna ubiquita*, A, whole animal, B, male first pleopods, C, uropod. (after Menzies, 1951A, 1952)

Plate 6. **Isopoda**. **Epicaridea**: 31, *Bopyriscus calmani*. 32, *Ione cornuta*. 33, *Munidion pleuroncondis*. 34, *Phyllodurus abdominalis*. (after Richardson, 1905; Markham, 1975; Sassaman et al., 1984)

Plate 7. **Isopoda**. **Epicaridea**: 35, *Portunion conformis*. 36-38, **Flabellifera**: 36, *Rocinela signata*. 37, *Cirolana diminuta*, A, postmanca, B, adult male. 38, *Cirolana harfordi*, A, male, B, a different male morphotype. (after Richardson, 1905 after Schiodte and Meinert; Muscatine, 1956; Brusca et al., 1995)

Plate 8. **Isopoda**. **Flabellifera**: 39, *Euryalana arcuata*. 40, *Eurydice caudata*. 41, *Excirolana linguifrons*, cephalon, pleotelson. 42, *Excirolana chiltoni*. 43, *Excorallana tricornis occidentalis*, A, whole animal in lateral view, B, whole animal in dorsal view. 44, *Excorallana truncata*. (after Richardson, 1899, 1905 after Hansen; Bruce and Jones, 1981; Jansen, 1981; Delaney, 1982, 1984; Brusca et al., 1995)

Plate 9. **Isopoda**. **Flabellifera**: 45, *Ceratothoa gaudichaudii*. 46, *Ceratothoa gilberti*. 47, *Enispa convexa*, A, whole animal in dorsal view, B, whole animal in lateral view. 48, *Mothocya rosea*, A, antenna 1, B, antenna 2, C, whole animal. (after Brusca, 1981; Bruce, 1986)

Plate 10. **Isopoda**. **Flabellifera**: 49, *Elthusa californica*. 50, *Elthusa vulgaris*. 51, *Nerocila acuminata*, A, acuminata form, female, B, acuminata form, male, C, aster form, female. 52, *Limnoria algarum*. (after Menzies, 1957; Brusca, 1981)

Plate 11. **Isopoda**. **Flabellifera**: 53, *Limnoria quadripunctata*, A, whole animal, B, mandible. 54, *Limnoria lignorum*, pleotelson. 55, *Limnoria tripunctata*, pleotelson. 56, *Heteroserolis carinata*. 57, *Ancinus granulatus*. (after Menzies, 1957; Trask, 1970; Wetzer and Brusca, 1997)

Plate 12. **Isopoda**. **Flabellifera**: 58, *Paradella dianae*. 59, *Dynamenella sheareri*. 60, *Dynamenella benedicti*, pleotelson. 61, *Dynamenella glabra*, pleotelson. 62, *Dynamenella dilatata*. 63, *Paracerceis cordata*. (after Richardson, 1899; Menzies, 1962; George and Strömberg, 1968; Schultz, 1969)

Plate 13. **Isopoda**. **Flabellifera**: 64, *Paracerceis sculpta*. 65, *Gnorimosphaeroma noblei*, A, whole animal, B, frontal view of cephalon. 66, *Gnorimosphaeroma oregonense*, A, frontal view of cephalon, B, whole animal. 67, *Exosphaeroma amplicauda*. (after Stimpson, 1857; Menzies, 1954A; Brusca, 1980)

Plate 14. **Isopoda**. **Flabellifera**: 68, *Exosphaeroma inornata*. 69, *Sphaeroma walkeri*. 70, *Sphaeroma quoyanum*, pleotelson. 71, **Gnathiidea**: 71, *Gnathia steveni*. 72, **Microcerberidea**: 72, *Coxicerberus abbotti*, A, antenna 1, B, whole animal. 73-74, **Valvifera**: 73, *Idarcturus hedgpethi*. 74, *Cleantioides occidentalis*. (after Richardson, 1905; Menzies, 1951A, 1962; Dow, 1958; Lang, 1960; Brusca and Wallerstein, 1979; Kensley and Schotte, 1989)

Plate 15. **Isopoda**. **Valvifera**: 75, *Colidotea rostrata*. 76*, Colidotea findleyi*, A, whole animal, B, maxilliped. 77, *Erichsonella crenulata*, A, dorsal view of cephalon, B, lateral view of cephalon, C, whole animal. 78, *Erichsonella pseudoculata*. 79, *Idotea aculeata*. 80, *Idotea kirchanskii*. (after Benedict, 1898; Stafford, 1913; Menzies, 1950A; Schultz, 1969; Miller and Lee, 1970; Brusca and Wallerstein, 1977)

Plate 16. **Isopoda**. **Valvifera**: 81, *Idotea montereyensis*. 82, *Idotea ochotensis*. 83, *Idotea resecata*. 84, *Idotea rufescens*. 85, *Idotea schmitti*. 86, *Idotea stenops*, A, maxilliped, B, whole animal. (after Richardson, 1905; Schultz, 1969; Rafi and Laubitz, 1990)

Plate 17. **Isopoda**. **Valvifera**: 87, *Idotea wosnesenskii*. 88, *Idotea urotoma*. 89, *Synidotea berolzheimeri*, A, maxilliped, B, whole animal. 90, *Synidotea consolidata*. 91, *Synidotea harfordi*. 92, *Synidotea pettiboneae*. 93, *Synidotea ritteri*. (after Menzies and Miller, 1972; Rafi and Laubitz, 1990)

Plate 18. **Isopoda**. **Oniscidea**: 94, *Tylos punctatus*, A, lateral view of whole animal, B, fourth and fifth pleonite and pleotelson. 95, *Ligia occidentalis*. 96, *Ligia pallasii*, A, cephalon and first pereonite, B, fifth pleonite, pleotelson and uropods. 97, *Ligidium gracile*, A, lateral view of cephalon and first pereonite, B, fifth pleonite, pleotelson and uropods, C, second male pleopod. 98, *Ligidium latum*, A, lateral view of cephalon and first pereonite, B, second male pleopod.

Plate 19. **Isopoda**. **Oniscidea**: 99, *Haplophthalmus danicus*. 100, *Brackenridgia heroldi*, cephalon and first pereonite.101, *Detonella papillicornis*. 102, *Armadilloniscus lindahli*, A, lateral view of whole animal, B, dorsal view of cephalon, C, fourth and fifth pleonite, pleotelson

and uropods. 103, *Armadilloniscus coronacapitalis*, A, female cephalon and first pereonite, B, male seventh pereopod.

Plate 20. **Isopoda**. **Oniscidea**: 104, *Armadilloniscus holmesi*, A, cephalon and first pereonite, B, male seventh pereopod. 105, *Alloniscus mirabilis*. 106, *Alloniscus perconvexus*, third-fifth pleonite, pleotelson and uropods. 107, *Littorophiloscia richardsonae*. 108, *Niambia capensis*. 109, *Platyarthrus aiasensis*, A, cephalon and first pereonite, B, pleon, pleotelson and uropods.

Plate 21. **Isopoda**. **Oniscidea**: 110, *Porcellionides floria*, frontal view of cephalon. 111, *Porcellio dilatatus*, A, cephalon and first pereonite, B, fourth and fifth pleonite, pleotelson and uropods. 112, *Porcellio scaber*, A, cephalon and first pereonite, B, fourth and fifth pleonite, pleotelson and uropods.113, *Porcellio laevis*, A, cephalon and first pereonite, B, fourth and fifth pleonite, pleotelson and uropods. 114, *Armadillidium vulgare*, A, lateral view of whole animal, B, frontal view of cephalon, C, fifth pleonite, pleotelson and uropods. 115, *Venezillo microphthalmus*, A, lateral view of whole animal, B, frontal view of cephalon, C, fifth pleonite, pleotelson and uropods (115C after Arcangeli, 1932).