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Acanthomysis bowmani, a new species, and *A. aspera* Ii, Mysidacea newly reported from the Sacramento-San Joaquin Estuary, California (Crustacea: Mysidae)

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Abstract.—*Acanthomysis bowmani,* a new species is described and named. Geographical range is extended for *A. aspera* Ii (1964) to include the Sacramento-San Joaquin Estuary. Evidence indicates that both species were recently introduced into this estuarine system.

W. M. Tattersall (1932) reported five species of Mysidacea in San Francisco and San Pablo Bays. Distribution of one of these species, *Neomysis mercedis* Holmes, 1897 extends upstream into the Sacramento-San Joaquin Delta. *Neomysis mercedis,* an epibenthic species, shares this Delta with a recently described species, *Deltamysis holmquistae* Bowman & Orsi (1992). This paper discusses two species of *Acanthomysis* that have begun to appear in plankton samples collected since 1992, *A. bowmani,* a new species, first caught 8 July 1993, and *A. aspera* Ii (1964), first caught 5 August 1992.

Methods.—All samples were collected with a tow-net mounted in a frame constructed of steel pipe and towed for 10 minutes from the bottom to the surface in several steps depending on water depth. The mouth of the net was 0.3 m in diameter, bag length equaled 1.5 m, and mesh size was 505 μm.

Acanthomysis bowmani, new species
Figs. 2–4

Material examined.—All specimens from Suisun Bay, California (Fig. 1), J. J. Orsi, 11 Apr 1996. Holotype male, 11.6 mm total length (USNM 282745); Allotype, female, 12.5 mm (USNM 282746); Paratypes (USNM 282747) 7 males and 1 dissected male (7.7–11.8 mm), 4 females (10.5–11.8 mm), and 12 juveniles (3.5–8.1 mm).

Description.—Body slender, elongate. Carapace (Fig. 2A, B) with anterior margin produced into sharp triangular rostrum ventrally supported with distinct keel and 2 struts at base, posterior margin emarginate exposing somites 7 and 8, anterio- and posteriolateral lobes rounded. Narrow, nearly inconspicuous furrow encircles carapace about ⅓ the distance posterior from rostrum. Eyes prominent, stalked; short pigmented stripe near base of stalk dorsomedially; cornea large, kidney-shaped, dorsal margin scalloped, conspicuous ocular tooth on anterosuperior edge (Fig. 2A, B).

Antennular peduncle (Fig. 2C) stout, 3-segmented; combined length of segments 1 and 2 equal length of segment 3; segment 1 with group of 4 pinnate setae distolaterally; segments 2 and 3 without conspicuous setae; ventrolateral male lobe on segment 3 conspicuous, heavily setose with fine simple setae.

Antennal peduncle (Fig. 3A) 3-segmented; segments 1 and 3 subequal in length; segment 2 about 1.5 times longer than segment 1 or 3, with 3 stout naked and 1 pinnate setae distolaterally; segment 3 with 4

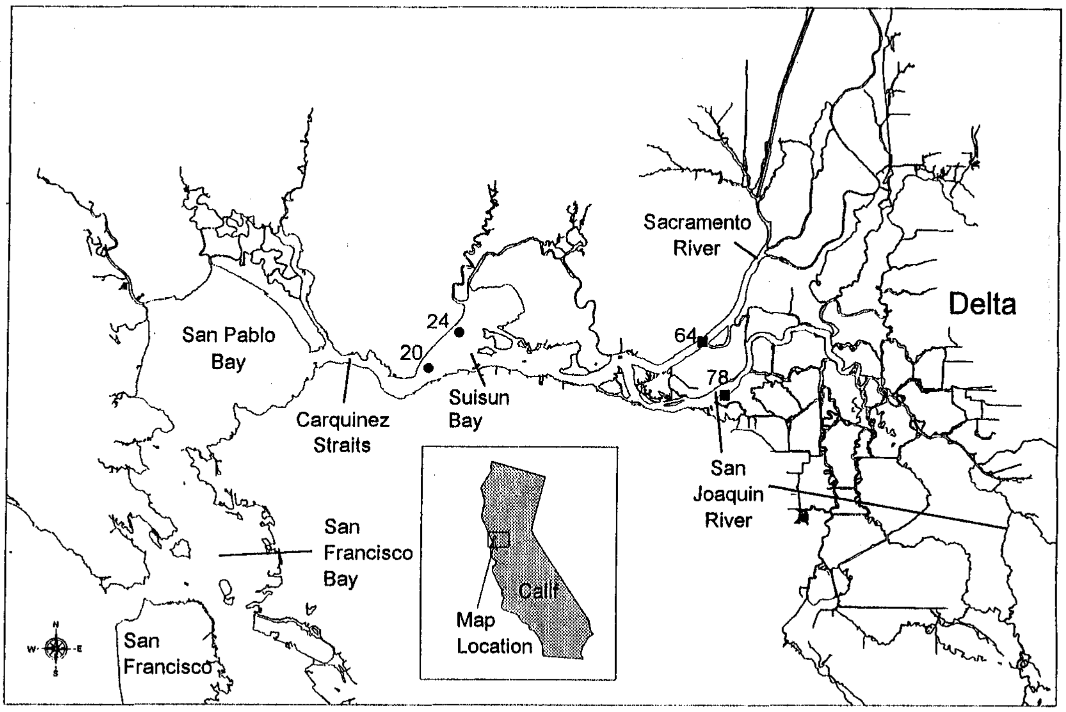

Fig. 1. Sacramento-San Joaquin Esturary with sampling stations of the California Department of Fish and Game. Stations 20 and 24 in Suisun Bay are where specimens of *Acanthomysis aspera* were first collected and stations 64 and 78 are where *A. bowmani* was first obtained.

stout naked and 2 pinnate setae distolaterally, 2 small pinnate setae ventrally. Antennal scale blade-like, setose all around, about 1.8 times longer than peduncle, lateral margin nearly straight, medial margin slighty convex near base, 8.4 times as long as wide near base, rounded articulated tip 0.05 times scale length.

Right and left mandibles (Fig. 3B) with bicuspid incisors, left lacinia mobilis with 3 robust cusps, right monocuspid; each mandible with 3 robust setose accessory blades; left molar with medial surface slightly papillose, base heavily papillose and armed with clump of short, stout setae; right molar basal surface armed with row of strong, tooth-like projections and clump of short, stout setae. Mandibular palp (Fig. 3C) 3-segmented, segment 1, inconspicuous; second proximal segment robust, triangular in cross section, 1.5 times longer than distal segment, lateral margin with stout, naked setae, medial margin with 4 widely separated, stout setae; distal segment lateral margin armed with spines furnished with lateral rows of spinules, medial margin with 6 widely spaced naked setae, terminating in single robust, naked spine.

Maxillule (Fig. 3D) typical of genus, outer lobe with hump-like process on anterior margin, posterior margin naked. Maxilla (Fig. 3E) exopod blade-like, 4 times as long as broad at greatest width; endopod 2-segmented, proximal segment with rectangular patch of minute papillae near lateral margin, distal segment margins setose. Labrum (Fig. 3F) and paragnaths (Fig. 3G) typical of genus.

Endopod of first (Fig. 3H) and second (Fig. 3I) thoracic limbs typical of genus. Endopod of third thoracic limb (Fig. 4A) with ischium 1.8 times longer than merus, ischium as long as carpo-propodus, carpopropodus 9-segmented, dactylus small

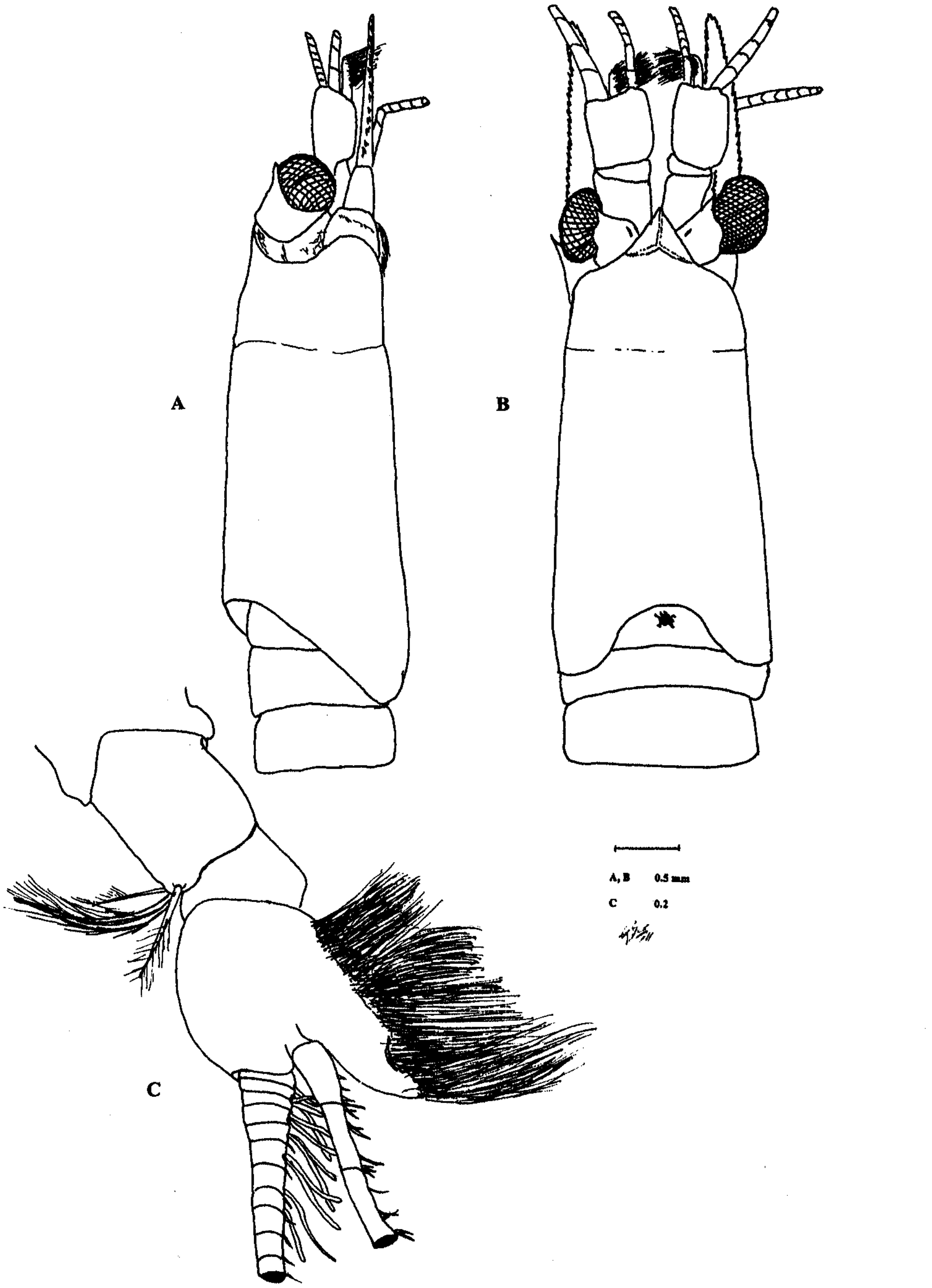

Fig. 2. *Acanthomysis bowmani,* new species: A. Anterior profile; B. Dorsal view; C. Antennule peduncle. Male, 11.6 mm.

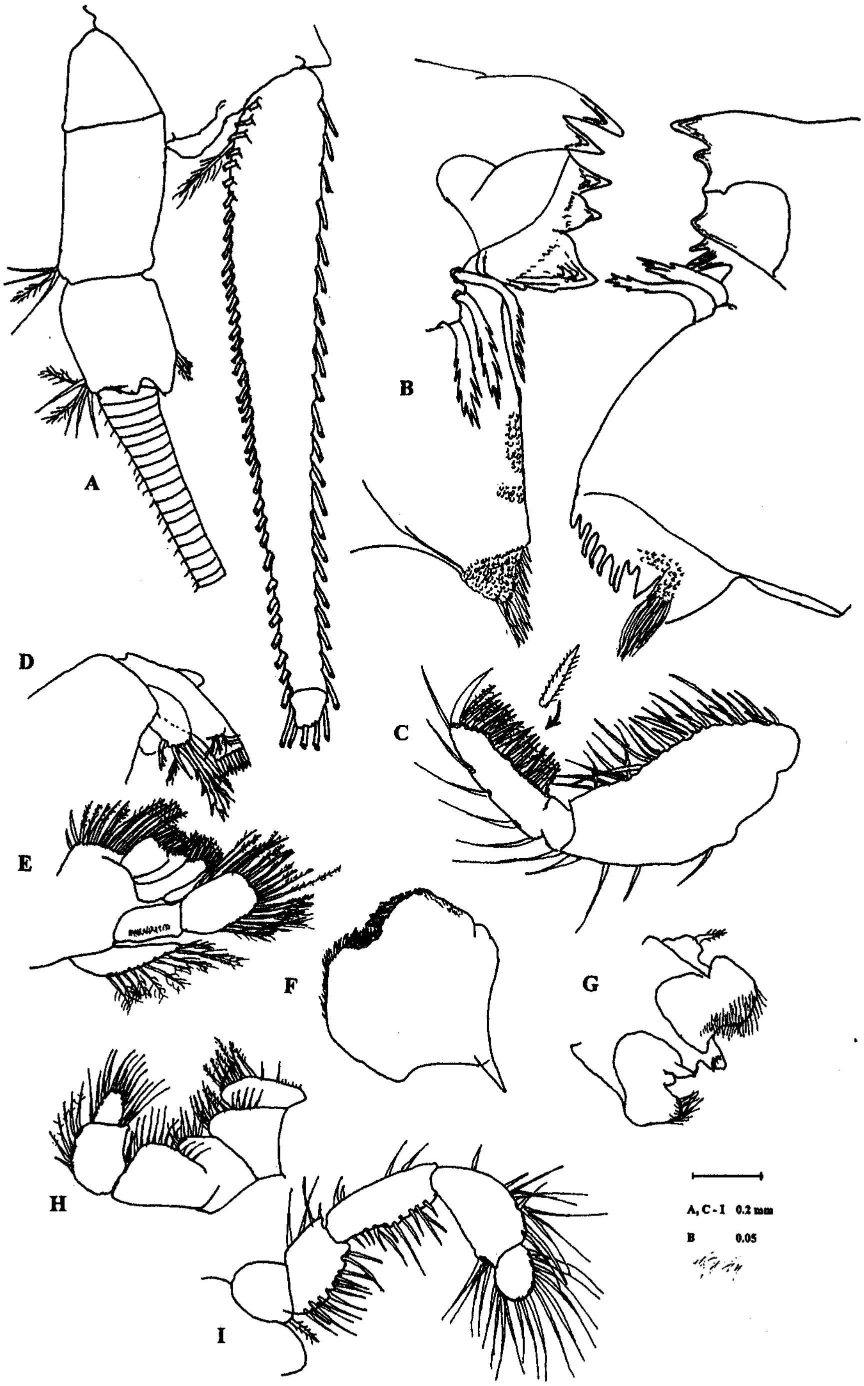

Fig. 3. *Acanthomysis bowmani,* new species: A. Antenna and antennal scale; B. Right and left mandibles; C. Mandibular palp; D. Maxillule; E. Maxilla; F. Labrum; G. Paragnaths; H. Endopod of 1st thoracic limb; I. Endopod of 2nd thoracic limb. Male, 11.6 mm.

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about 0.2 times length of strong terminal claw; exopod (Fig. 4B) about 2/3 length of endopod, 9-segmented. Structure of endopods and exopods of thoracic limbs 4 to 8 similar to 3.

Penis (Fig. 4C) robust, length about 1.7 times width, each with pair of terminal lobes containing an aggregate of naked setae, posterior margin with 7 naked setae around edge of an articulation and small plumose setae near base, anterior margin with 1 naked and 3 pinnate setae.

Male pleopods 1 to 3 and 5 rudimentary, unjointed; pleopod 1 smallest (Fig. 4D) and 5 longest (Fig. 4F); pleopod 4 biramous (Fig. 4E), endopod unjointed, exopod long, 2-segmented, segment 1 about 1.5 times longer than endopod and 1.2 times longer than segment 2 which terminates in 2 long, robust, spinulose nails, a long, robust seta and 1 minute spine.

Uropod (Fig. 4G) exopod blade-like, lateral margin slightly concave, medial margin slightly convex, about 1.4 times longer than endopod; endopod margins tapering distally, 2 distally directed spines along medial margin near statocyst ventrally.

Telson (Fig. 4H) linguiform, 2.4 times longer than width at base, each lateral margin with 3–4 spines near base, a space and 18–19 spines of equal length along distal 2/3, ultimate marginal spines 3.3 times longer than other marginal spines and as long as pair of terminal spines.

Remarks.—Close resemblance exists between *A. bowmani,* n. sp., and two species reported from the western Pacific Ocean by Ii (1964), *A. sinensis* and *A. longirostris* (Table 1). In addition to two subtle character variations, e.g., arrangement of the long spines on or near the apex of the telson and the difference in the number of distal telsonal marginal spines, the near equal length of the two segments that comprise the exopod of male fourth pleopod and a longer antennal scale separates *A. bowmani* from the other two species (Table 1). Presently *A. sinensis* is known only from the East China Sea off the mouth of the Yangtze River, while *A. longirostris* has a more cosmopolitan distribution in oriental waters. It has been reported from Ariake Bay, Japan, Port Kusan and Haejun Bay, Korea (Ii 1964, Jo & Ma 1996), and waters off the North China Coast (Shen et al. 1989).

To provide an additional taxonomic character and to ease total length measurements, the relationship between carapace length of *A. bowmani* (measured along the dorsal midline from rostral tip to posterior margin) and its total length (measured from rostral tip to posterior margin of telson) was determined using a least square linear regression. This relationship is described by the equation, total length = 3.69 (carapace length) − 0.07; with a sample size of 28 specimens, the correlation coefficient equaled 0.98.

Ecological notes.—*Acanthomysis bowmani* is most abundant in June and July in Suisun Bay (Fig. 1) at about 2.0‰S. Water temperature at which type specimens were collected was 16° C, specific conductivity equaled 340 μS/cm, <0.5‰S.

Etymology.—Named in honor of the late Dr. Thomas E. Bowman, curator of Crustacea U.S. National Museum of Natural History and our close colleague, who contributed greatly to the systematic knowledge of the Mysidacea.

Acanthomysis aspera Ii, 1964

Acanthomysis aspera, reported from coastal waters around Japan (Mauchline & Murano 1977), China (Shen et al. 1989) and Korea (Jo & Ma 1996) has begun to appear in collections from the western end of Suisun Bay, downstream of *A. bowmani* sampling locations (Fig. 1). This is the first record of the occurrence of this species in the eastern Pacific. Dr. Tom Bowman verified the identification of the specimens.

Synanthropic introductions.—Historical and biogeographic evidences strongly suggest that *A. bowmani* and *A. aspera* were introduced to the Sacramento-San Joaquin Estuary with the flushing of ship ballast wa-

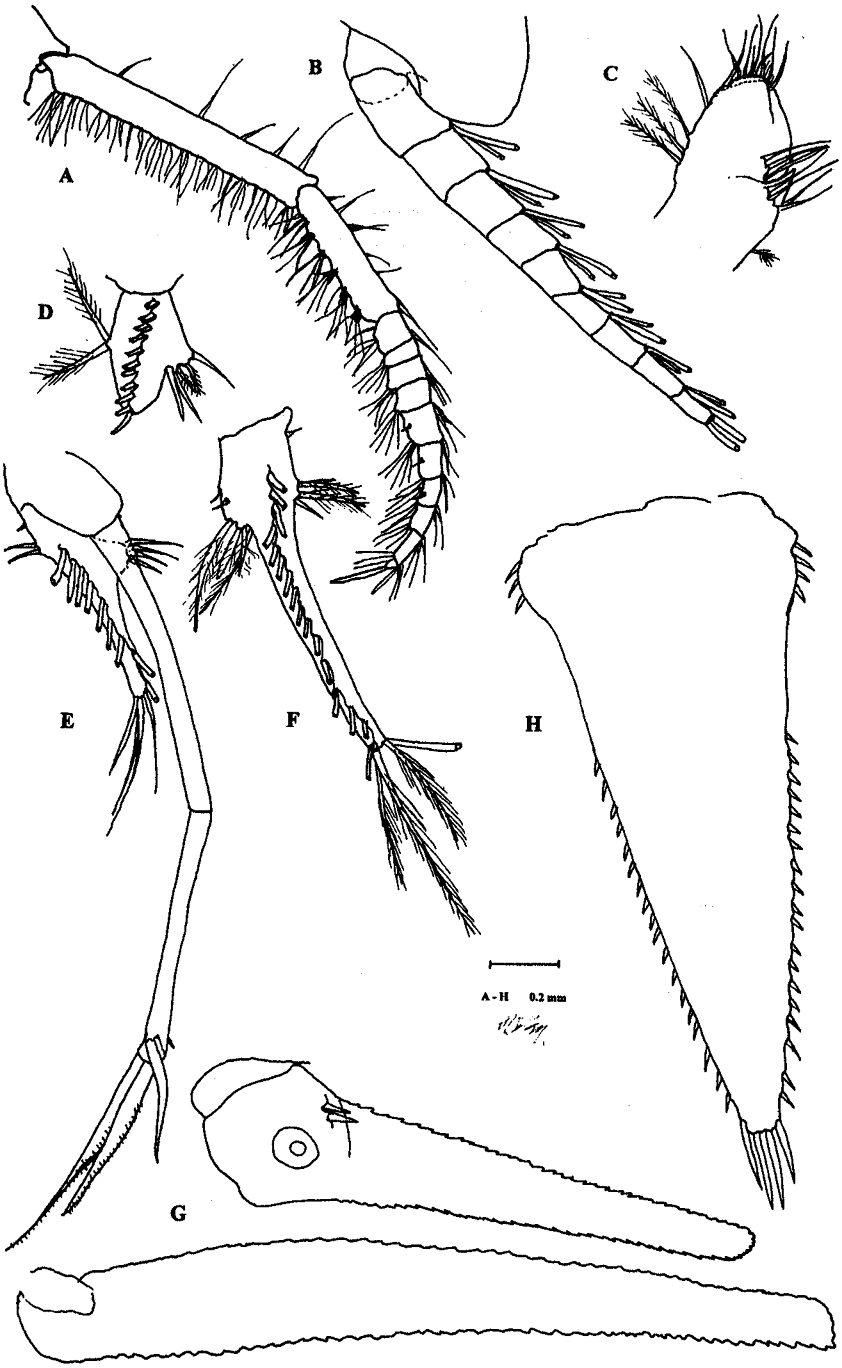

Fig. 4. *Acanthomysis bowmani,* new species, A. Endopod of 3rd thoracic limb; B. Exopod of 3rd thoracic limb; C. Penis; D. Pleopod 1; E. Pleopod 4; F. Pleopod 5; G. Uropod endopod (upper), exopod (lower); H. Telson. Male, 11.6 mm.

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Table 1.—Comparison of diagnostic characteristics of *Acanthomysis bowmani,* n. sp., taken from the waters of the Sacramento-San Joaquin Estuary, California, with those noted by Ii (1964) for *A. sinensis,* and *A. longirostris* from waters off the western Pacific Ocean.

Characters	*A. bowmani*	*A. sinensis*	*A. longirostris*
Rostrum	Reaches middle of antennular peduncle first segment	Reaches middle of antennular peduncle first segment	Long, reaches second joint of antennular peduncle
Eye stalk	Proximal half without spinules	Proximal half without spinules	Proximal half with spinules
Antennal scale	8.4× as long as broad	5.0× as long as broad	7.0× as long as broad
Carpopropodus	9 segments	10 segments	9–11 segments
4th pleopod of male	2-segmented, 1st 1.2× longer than 2nd	2-segmented, 1st 30× longer than 2nd	2-segmented, 1st 22× longer than 2nd
Uropod	Endopod with 2 spines near statocyst	Endopod with 2 spines near statocyst	Endopod with 2–3 spines near statocyst
Telson	3–4 basal marginal spines, 18–19 distal marginal spines	4 basal marginal spines, 13–14 distal marginal spines	3 basal marginal spines, 20 distal marginal spines
Apex of telson	Narrowly truncated, with 2 terminal spines and 2 long ultimate marginal spines	Broadly truncated, with 4 terminal spines	Narrowly truncated with 2 terminal spines
Distribution	Coastal	Offshore	Coastal

ter (Carlton 1979). *Acanthomysis aspera* has been reported from coastal regions of Japan (Ii 1964), China (Shen et al. 1989) and Korea (Jo & Ma 1996), while morphological characteristics of *A. bowmani* show very close affinity with congeneric species that also have only been reported from the western Pacific. Although the Sacramento-San Joaquin Estuary has been continuously and systematically surveyed for the past 25 years, neither species occurred in any samples taken at the same collecting sites and at similar times prior to 5 August 1992.

Other crustaceans foreign to the Sacramento-San Joaquin Estuary have been reported. Ferrari & Orsi (1984) found a copepod, *Limnoithona sinensis* Burckhardt, previously reported from the Yangtze River delta and described a new species, *Oithona davisae,* which is also common in the Western Pacific. Likewise, Bowman and Orsi (1992) suggest that *Deltamysis holmquistae* may also have been introduced.

A possible site of introduction of the *Acanthomysis* spp. is the Port of Oakland, since it receives a considerable amount of shipping from the Far East. Research on these exotic species is currently underway because they may have a detrimental affect on the endemic Mysidacea.

Acknowledgments

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Literature Cited

Bowman, T. E., & J. J. Orsi. 1992. *Deltamysis holmquistae,* a new genus and species of Mysidacea from the Sacramento-San Joaquin Estuary of California (Mysidae: Mysinae: Heteromysini).—Proceedings of the Biological Society of Washington 105:733–742.

Carlton, J. 1979. Introduced invertebrates of San Francisco Bay. Pp. 427–444 *in* T. Conomos, ed., San Francisco Bay: the urbanized estuary. Pacific Division, American Association for the

Advancement of Science, San Francisco, California, 493 pp.

Ferrari, F. D., & J. Orsi. 1984. *Oithona davisae*, new species, and *Limnoithona sinensis* (Burckhardt, 1912) (Copepoda: Oithonidae) from the Sacramento-San Joaquin Estuary, California.—Journal of Crustacean Biology, 4:106–126.

Ii, N. 1964. Fauna Japonica, Mysidacea (Crustacea). Biogeographical Society of Japan, Tokyo, 610 pp.

Jo, S.-G., & C.-W. Ma. 1996. Mysidacea (Crustacea from the West Coast of Korea.—Journal of the Korean Fishery Society, 29:805–827.

Mauchline, J., & M. Murano. 1977. World list of the Mysidacea, Crustacea.—Journal of the Tokyo University of Fisheries 64:39–88.

Shen, C. J., J. Y. Liu, & W. Shaowu. 1989. Mysidacea in waters off the North China Coast.—Studia Marina Sinica 30:189–227.

Tattersall, W. M. 1932. Contribution to a knowledge of the Mysidacea of California. II: the Mysidacea collected during the survey of San Francisco Bay by the U.S.S. *Albatross* in 1914.—University of California Publications in Zoology 37:315–347.