TRAWL CAUGHT SHRIMP IN THE SOUTHERN CALIFORNIA BIGHT
: a guide to field and laboratory identification

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Because they are prominent in many trawl catches several comprehensive regional treatments of shrimp exist. The most pertinent are Schmitt (1921), Word and Charwat (1976) and Butler (1980). Each of these had a slightly different focus, and none is adequate for all the shrimp recorded from the Southern California Bight. Martin & Zimmerman (1997) cover the northern portion of the Santa Barbara Channel, but treat only eleven species. Butler provides the most extended descriptions of the species covered, but treats the fauna of the Pacific Northwest and lacks many southern species. Word and Charwat focussed on the Bight, using the same sort of monitoring records we currently do. Nomenclatural changes have reduced the utility of their treatment, and although nearly all species are keyed, little supporting description is supplied. Schmitt likewise offers little detail in his descriptions of the species. Taxonomic changes have rendered many of his names obsolete as well. SCAMIT Taxonomic List Ed. 3 will provide the synonymies which allow older usages like Schmitt's to be related to current usage. Other resources are available for particular groups, especially the series of papers by Wicksten dealing with southern California families, genera, or species (Wicksten 1976, 1977, 1978a, b; 1979; 1980; 1981; 1983a; b; 1984; 1986; 1989a, b; 1990a, b; 1991, 1992, 1996a, b; Wicksten & Butler 1983; Wicksten & Hendrickx 1991). Live appearance of many shrimp is documented by color photographs in Jensen 1995. Butler 1980 gives color drawings of many species from depths inaccessible to diving photographers. Species which are normally found to the south, but have made incursions into the Southern California Bight during the current strong ENSO event require additional references (Chace 1937; Hendrickx 1990, 1995, 1996; Hendrickx & Navarrete 1996; Hendrickx & Wicksten 1989).

Because such a variety of information sources is available on this group, the necessity of precalibration of trawl shrimp identification in the Bight '98 regional sampling effort is great. With that goal in mind, new keys to shrimps known from the Bight which can be identified in the field have been prepared where necessary. Members of the Alpheidae and the Hippolytidae do not easily lend themselves to field separation because of size and/or use of small or obscure character states in their identification. Members of these families should always be returned to the lab for identification. Other groups such as the Crangonidae may or may not be field separable depending on the experience and expertise of the observer. In such intermediate groups it is particularly important to recognize your own limitations. A good rule of thumb for deciding if specimens should be returned to the lab for further identification is "if you have ANY doubts as to the identity of the animals, they should be returned to the lab for confirmation." Not just a few representatives, BUT ALL SUSPECT SPECIMENS. Even in cases where the observer has no doubt as to the identity of the animals, vouchers must still be taken for lab confirmation. These should be collected by each individual who participates in the field identifications for each species they have identified.

These requirements are not new, but they must be followed by <u>all</u> participants to avoid data compromise. If only one participant fails to identify, or identifies incorrectly, material which has been discarded prior to the discovery of the data deficiency, all data provided by other participants must be degraded to the level of the non-conforming group prior to analysis. This unfortunately occurred on several occasions during the 1994 regional monitoring effort, and the utility of resulting data was diminished. These concerns become even greater during Bight '98 because the number of groups involved is being increased, and along with the number of participants the possibilities for non-conformity.

The following families of shrimp are known from historic records to have occurred in the Bight - Alpheidae, Aristaeidae, Crangonidae, Glyphocrangonidae, Hippolytidae, Luciferidae, Ogyrididae,

Oplophoridae, Palaemonidae, Pandalidae, Pasiphaeidae, Penaeidae, Processidae, Sergestidae, Sicyoniidae, and Solenoceridae (less than half the 36 known families of shrimps). Of these sixteen families the Aristaeidae, Luciferidae, Oplophoridae, Pasiphaeidae and Sergestidae are all holopelagic shrimps and not part of the bottom trawl fauna.

For those interested in these animals a list of species reported from our area and useful references for their identification are provided below.

Aristaeidae

Bentheogennema burkenroadi Krygier & Wasmer 1975
has been taken from the surface to 1000m depths

Bentheogennema borealis (Rathbun 1902)
seldom reaches depths as shallow as 200m. These two species are keyed, described, and illustrated in Butler 1980. Should you reach Aristaeidae in the Key to Shrimp Families you should consult Butler for further information.

Luciferidae

Lucifer typus H. Milne Edwards 1837
known from as far north as the middle of the Baja peninsula, this species may range into Bight waters on the northward ENSO flow. See Hendrickx & Navarrete 1996

Oplophoridae - Species of *Acanthephyra*, *Systellaspis*, and *Hymenodora* are known to range into our geographic coverage area, but all from deeper than our maximum depths. It is very unlikely that they will stray into our depth range. Although not yet reported from Californian waters, the genus *Notostomus* has been recorded as far south as Oregon (Butler 1980). Animals keying to Oplophoridae should be examined with Butler in hand. He provides both generic and specific keys to local species, as well as good illustrations and descriptions.

Pasiphaeidae - most species listed in Word & Charwat and Hendrickx & Navarrete fall outside the geographic or bathymetric limits of our study area.

Pasiphaea pacifica Rathbun 1902
known throughout the bight, but generally taken in deeper trawls, although may surface at night (0-1076m). See Butler 1980

Pasiphaea chacei Yaldwyn 1962 from off Baja California to off Oregon, generally deeper than 300 m. Given the dislocations caused by the ENSO event, these are probably all below our depth range at this time. We should be aware of the characters to check to distinguish this from *P. pacifica*. See keys in Word & Charwat 1976 and Hendrickx & Navarrete 1996.

Sergestidae - Species in the genus *Sergia*, while taken from the surface to over 1000m depth, are from oceanic water masses found outside the Bight in the Eastern Pacific, and are not considered here. The single reported species of the genus *Petalidium* to occur off southern California is similarly oceanic, and not recorded from inshore waters of the Bight. Both genera are covered by Hendrickx & Navarrete 1996, who provide a key to the genera as well.

Sergestes similis Hanson 1903
ranges from the Gulf of California to the Gulf of Alaska and from the surface to 1200 m - the only member of the genus to occur in inshore waters of the Bight. Other

species may occur further offshore in the California Current or beyond (see Hendrickx & Navarrete 1996). The species is well described and illustrated by Butler 1980.

Of the remaining 11 families known from the area three are penaeoids (**Solenoceridae**, **Sicyoniidae**, and **Penaeidae**) all at one time considered to be subfamilies within the Penaeidae. If additional information on penaeoid biology or morphology is desired consult Dall et al (1990). A separate key is provided for benthic members of these families known to occur within the Bight plus a very similar species not yet known from the area (see attached key).

The eight benthic families of caridoid shrimp known from Southern California waters are all included in the family key. All members of the **Glyphocrangonidae** occur too deep to fall within our coverage. Distributional records are provided by Wicksten (1979), and a good illustrated key by Hendrickx (1995). All local members of the family **Ogyrididae** occur too shallowly to fall within our coverage. Although *Ogyrides alphaerostris* was reported from the area by Wicksten & Hendrickx (1991), the local species is still undescribed. Information on it should be sought from Jim Roney (LACEMD), who is in the process of describing these shrimp. We will probably see these small burrowing shrimp in our shallowest benthic samples, but not in our trawls.

Two of the six remaining families (Processidae and Palaemonidae) are represented by only a few species. The **Processidae** have only two local representatives, *Ambidexter panamensis* and *Processa peruviana*. *Ambidexter* has been reported only from shallow water in San Diego Bay, where it is taken both in infaunal samples and in seines. It is apparently a burrowing species, and may only be taken during night or crepuscular samplings over mud/algal bottoms. Given the dearth of records, the population in the bay may be quite localized. Abele (1972) describes the animal. If shallow water samples are taken in San Diego Bay we might get this species. *Processa peruviana* has only been taken once in local waters; off Palos Verdes in 1995. This animal is larger than *A. panamensis*, and was taken in the open sea, not in a bay, where it favors fine sand bottoms (Hendrickx 1995). It was taken at night, and may also be a burrower. Wicksten's original description (1983), supplemented by information in Hendrickx (1995), should allow identification of further specimens. Hendrickx also provides a key to separate these two genera. The normal range of the animal extends only as far north as the tip of Baja California, so occurrence in our area is undoubtedly related to ENSO transport.

Local **Palaemonidae** can be adequately field separated with the key of Word & Charwat (1976), which covers all species recorded to date. If you reach Palaemonidae in the family key, consult the above key. Members of the genus *Palaemon* occur only in shallow estuarine areas such as Huntington Harbor. Although an indigenous species exists (*Palaemon ritteri*), all recently caught *Palaemon* have been the introduced *P. macrodactylus*, which would key to the same place in Word & Charwat's key. Of the remaining four species in the key, two are commensals and not likely to be taken in a trawl sample. *Pontonia californiensis* is an endocommensal of tunicates, living within the branchial basket of the host. *Pseudocoutierea elegans* is an obligate commensal of muricid sea-fans, and may abandon a host caught in a trawl net and swim away. Specimens are usually taken from sea-fans collected by divers, but could also come from trawls which take sea-fans. The remaining species, *Palaemonella holmesi* and *Periclimenes infraspinus*, though rarely taken, could be caught in shallow water trawls within the Bight. *Palaemonetes hiltoni*, described from San Pedro by Schmitt in 1921 has not been seen since, and is no longer considered to occur in the Bight (Wicksten 1989). Under the current ENSO transport regime, we may refind it or other southern palaemonid species which have not yet been reported here. Wicksten's key (1989) to the family includes species not yet known from the Bight, and should be consulted for specimens which appear to key poorly or not at all in Word & Charwat 1976. Any specimens keying to the family should probably

be retained for laboratory verification. The two-volume monograph by Holthuis (1951, 1952) should provide information on species (such as *Palaemon macrodactylus*) not described in other works.

Members of the families **Alpheidae** and **Hippolytidae** should always be returned to the laboratory for identification, or for verification if large and characteristic enough for field ID. No specimens of these families should be discarded in the field. The sole exception to this rule is the hippolytid *Lysmata californica*. This species is large enough, and has a characteristic enough live appearance (see photograph in Jensen 1995) for reliable determination in the field. Voucher specimens should still be returned to the lab for verification, but large collections of *L. californica* can be returned to the sea. Although nearly all hippolytid species can be correctly determined with the key in Word and Charwat, we should use that in Wicksten (1990). California alpheids can be separated using the attached key, which includes undescribed species not in Wicksten (1984).

Species in the families **Crangonidae** and **Pandalidae** should be identifiable in the field in nearly all cases. Some damaged specimens and some very small juveniles may require laboratory confirmation, but few specimens should fall into these categories. New keys to both these families are presented here to incorporate taxonomic changes and new species records which render existing keys incomplete.

Resource Guide - Recommended Standard References for Bight '98 Trawl Shrimp Identification
F= field key, L= laboratory key, C= combined field and laboratory key

Trawl Shrimp Families - attached Family key (C) - all families below are included in the key

Alpheidae - LABORATORY ID ONLY, collect all specimens - attached Alpheid key (L)
Aristaeidae - all members excluded as holopelagic
Crangonidae - attached Crangonid key (C)
Glyphocrangonidae - all members excluded as outside depth limits
Hippolytidae - LABORATORY ID ONLY, collect all specimens - Wicksten 1990b key (L)
Luciferidae - all members excluded as holopelagic
Ogyrididae - all members excluded as outside depth limits
Oplophoridae - all members excluded as holopelagic
Palaemonidae - Word & Charwat 1976 key (F), Wicksten 1989a key (L)
Pandalidae - attached Pandalid key (C)
Pasiphaeidae - all members excluded as holopelagic
Penaeidae - attached Penaeoid key (C), Hendricks 1995 key (L)
Processidae - Hendrickx 1995 key (C)
Sergestidae - all members excluded as holopelagic
Sicyoniidae - attached Penaeoid key (C)
Solenoceridae - attached Penaeoid key (C)

List of Species Taken in Association with Monitoring Programs in the Southern California Bight at depths between 10-300 m

Suborder Penaeidea
- Superfamily Penaeoidea
  - Family Aristeidae
    - Bentheogennema burkenroadi Krygier & Wasmer 1975
  - Family Solenoceridae
    - Solenocera mutator Burkenroad 1938
  - Family Penaeidae
    - Metapenaeopsis mineri Burkenroad 1934
    - Penaeus californiensis Holmes 1900
  - Family Sicyoniidae
    - Sicyonia ingentis (Burkenroad 1938)
    - Sicyonia penicillata Lockington 1879
- Superfamily Sergestoidea
  - Family Sergestidae
    - Sergestes similis Hansen 1903

Suborder Caridea
- Superfamily Pasiphaeoidea
  - Family Pasiphaeidae
    - Pasiphaea pacifica Rathbun 1902
- Superfamily Pandaloidea
  - Family Pandalidae
    - Pandalopsis ampla Bate 1888
    - Pandalus danae Stimpson 1857
    - Pandalus jordani Rathbun 1902
    - Pandalus platyceros Brandt 1851
    - Pantomus affinis Chace 1937
    - Plesionika beebei Chace 1937
    - Plesionika trispinus Squires & Barragán 1976
- Superfamily Alpheoidea
  - Family Alpheidae
    - Alpheopsis equidactylus (Lockington 1877)
    - Alpheus bellimanus Lockington 1877
    - Alpheus californiensis Holmes 1900
    - Alpheus clamator Lockington 1877
    - Automate sp A SCAMIT 1995 §
    - Betaeus ensenadensis Glassell 1938
    - Betaeus harfordi (Kingsley 1878)
    - Betaeus harrimani Rathbun 1904
    - Betaeus longidactylus Lockington 1877
  - Family Hippolytidae
    - Eualus herdmani (Walker 1898)
    - Eualus lineatus Wicksten & Butler 1983
    - Heptacarpus brevirostris (Dana 1852)
    - Heptacarpus decorus (Rathbun 1902)
    - Heptacarpus fuscimaculatus Wicksten 1986
    - Heptacarpus flexus (Rathbun 1902)
    - Heptacarpus palpator (Owen 1839)
    - Heptacarpus sitchensis (Brandt 1851)
    - Heptacarpus stimpsoni Holthuis 1947
    - Heptacarpus taylori (Stimpson 1857)
    - Heptacarpus tenuissimus Holmes 1900
    - Heptacarpus tridens (Rathbun 1902)
    - Hippolyte californiensis Holmes 1895
    - Hippolyte clarki Chace 1951
    - Lysmata californica (Stimpson 1866)
    - Spirontocaris holmesi Holthuis 1947
    - Spirontocaris lamellicornis (Dana 1852)
    - Spirontocaris prionota (Stimpson 1864)
    - Spirontocaris sica Rathbun 1902
    - Spirontocaris snyderi Rathbun 1902
  - Family Ogyrididae
    - Ogyrides sp A Roney 1978 §
  - Family Processidae
    - Processa peruviana Wicksten 1983
- Superfamily Crangonoidea
  - Family Crangonidae
    - Crangon alaskensis Lockington 1877
    - Crangon alba Holmes 1900
    - Crangon handi Kuris & Carlton 1977
    - Crangon holmesi Rathbun 1902
    - Crangon nigricauda Stimpson 1856
    - Crangon nigromaculata Lockington 1877
    - Mesocrangon munitella (Walker 1898)
    - Metacrangon spinosissima (Rathbun 1902)
    - Neocrangon communis (Rathbun 1899)
    - Neocrangon resima (Rathbun 1902)
    - Neocrangon zacae (Chace 1937)
    - Rhynocrangon alata (Rathbun 1902)
- Superfamily Palaemonoidea
  - Family Palaemonidae
    - Pseudocoutierea elegans Holthuis 1951

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KEY TO SHRIMP FAMILIES RECORDED IN THE SOUTHERN CALIFORNIA BIGHT

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(based on Chace 1972, Burukovskii 1974, Dall et al 1990, and Hendrickx 1995)

1. Third legs chelate; pleura of second abdominal somite not overlapping that of first somite; . . . . . Suborder Dendrobranchiata 2
   Third legs not chelate; pleura of second abdominal somite overlapping that of first somite; . . . . . Suborder Eukyphida 7
2. Legs 4 and 5 well developed; gills numerous . . . . . Superfamily Penaeoidea 4
   Legs 4 and 5 reduced or absent; gills few (<9) . . . . . Superfamily Sergestoidea 3
3. Legs 4 and 5 absent; carapace elongated anteriorly by narrow "neck", eyes widely separated from mouthparts . . . . . Luciferidae
   Legs 4 and 5 reduced; carapace not elongated anteriorly, eyes just slightly anterior to mouthparts . . . . . Segestidae
4. Antennular flagellae subequal and originate distally on the 3rd segment; 5th leg lacks epipod 5
   Median(upper) flagellum much shorter than lateral (lower) and originates near base of 3rd segment; 5th leg with an epipod . . . . . Aristaeidae
5 Cervical sulcus reaching <⅔ the distance from the hepatic spine to the top of the carapace; postorbital spine absent;4th leg lacks epipod 6
   Cervical sulcus reaching the top of the carapace; postorbital spine present; 4th leg with an epipod . . . . . Solenoceridae
6. Third to 5th pleopods each with 2 rami; prosartema (eye brush) present on antennula; exopods present on 2nd and 3rd maxillipeds . . . . . Penaeidae
   Third to 5th pleopods each with a single ramus; prosartema absent; no exopods on 2nd and 3rd maxillipeds . . . . . Sicyoniidae
7. First leg subchelate 8
   First leg chelate or simple 9
8. Carpus of 2nd leg unsegmented . . . . . Crangonidae
   Carpus of 2nd leg multisegmented . . . . . Glyphocrangonidae
9. First and 2nd legs chelate; fingers of chelae with pectinate edges . . . . . Pasiphaeidae
   First and/or 2nd legs chelate; fingers without pectinate edges 10
10. Carpus of 2nd leg unsegmented; 1st leg with well-developed chela 11
    Carpus of 2nd leg multisegmented, **OR** 1st leg not chelate 12
11. Legs with exopods . . . . . Oplophoridae
    Legs lacking exopods . . . . . Palaemonidae
12. First legs with at least one well developed chela 13
    First legs with chelae very small or absent . . . . . Pandalidae
13. Rostrum edentate or dentate, but without subdistal tooth 14
    Rostrum with distal notch covered with bristles and forming subdistal dorsal tooth . . . . . Processidae
14. Eyes on long stalks, reaching nearly to end of antennular peduncle, and several times longer than eye diameter . . . . . Ogyrididae
    Eyestalks not unusually long, not or only slightly exceeding eye diameter 15
15. Eyes usually partially or entirely covered by carapace, incapable of free lateral movement; rostrum absent or spinelike . . . . . Alpheidae
    Eyes exposed and freely movable; rostrum well developed, toothed . . . . . Hippolytidae

KEY TO THE SO. CALIFORNIA BIGHT CRANGONID SHRIMP

Donald B. Cadien (CSDLAC), 20 March 1998

(based on Word & Charwat 1976, Kuris & Carlton 1977, Wicksten 1977, and Butler 1980)

1. Dactyls of 4th and 5th legs flattened; eyes partly concealed by carapace . . . . . *Argis* 2
   Dactyls of 4th and 5th legs not flattened; eyes not partly concealed 3

2. Carapace with 2 median dorsal spines posterior to rostral spine . . . . . *Argis californiensis*
   Carapace with 4 median dorsal spines posterior to rostral spine . . . . . *Argis levior*

3. Abdominal somites heavily sculptured; 3rd abdominal somite with rostrate posterior margin, 4th and 5th with posteriomedial spine . . . . . *Rhynocrangon alata*
   Abdominal somites weakly sculptured or unsculptured; 3rd abdominal somite not posteriorly produced, 4th and 5th somites lacking posteromedial spine (may be carinate) 4

4. Gastric region of carapace depressed 5
   Gastric region not depressed below general level of carapace 7

5. 1-2 spines ventrally on abdominal pleura . . . . . *Metacrangon spinosissima*
   Abdominal pleura without ventral spines 6

6. Carapace lacking lower submedian spine . . . . . *Metacrangon munita*
   Carapace with lower submedian spine . . . . . *Mesocrangon munitella*

7. Carapace with 1 median dorsal spine . . . . . *Crangon* 8
   Carapace with 2 median dorsal spines . . . . . *Neocrangon* 13

8. Sixth abdominal somite with bold lateral blue pigment spot(s) . . . . . *Crangon nigromaculata*
   Sixth abdominal somite lacking lateral pigment spot 9

9. Inner flagellum of antenna one distinctly longer than outer 10
   Inner and outer flagella of antenna one of equal length . . . . . *Crangon handi*

10. Sixth abdominal somite grooved ventrally 11
    Sixth abdominal somite not grooved ventrally 12

11. Spine of antennal scale extending well past end of blade . . . . . *Crangon alaskensis*
    Spine of antennal scale not or barely extending past end of blade . . . . . *Crangon nigricauda*

12. Ischium of 3rd maxilliped flattened and laterally flanged . . . . . *Crangon alba*
    Ischium of 3rd maxilliped not especially flattened and not flanged . . . . . *Crangon holmesi*

13. Third through fifth abdominal somites dorsally carinate . . . . . *Neocrangon communis*
    Abdominal somites not dorsally carinate 14

14. Rostrum bearing terminal "moustache" of setae projecting obliquely downward; rostrum variable, typically horizontal or slightly elevated . . . . . *Neocrangon zacae*
    Rostrum with lateral field of setae, but lacks "moustache"; rostrum variable, typically bearing a ventral blade, and strongly elevated above horizontal . . . . . *Neocrangon resima*

REVISED KEY TO THE PANDALIDAE OF CALIFORNIA

Donald B. Cadien (CSDLAC) - 20 Mar 1998

(modified from Burukovskii 1974, Wicksten 1978, Butler 1980, and Hendrickx 1996)

1. Rostrum articulated to front of carapace . . . . . *Pantomus affinis*
   Rostrum not articulated, integral to carapace 2

2. Third maxilliped with an exopod . . . . . *Plesionika* 3
   Third maxilliped lacking exopod 6

3. Second legs markedly unequal in length . . . . . *Plesionika mexicana*
   Second legs equal or subequal in length 4

4. Rostrum with 2-8 small spines dorsally near it's base; ventral spines (if present) very small and restricted to the distal half of the rostrum . . . . . *Plesionika sanctacatalinae*
   Rostrum with 10-14 well developed spines dorsally, and 12-18 spines ventrally on the rostrum; ventral spines not restricted to distal half of rostrum 5

5. Carpus of second legs with 8-9 segments; median carapace teeth near rostral base fixed . . . . . *Plesionika beebei*
   Carpus of second legs with 14-17 segments; 3 median carapace teeth at rostral base moveable . . . . . *Plesionika trispinus*

6. Discoid widening of inner margin of ischium of first leg prominent . . . . . *Pandalopsis ampla*
   No discoid widening of inner margin of ischium of first leg . . . . . *Pandalus* 7

7. Carapace, abdomen and legs a uniform translucent pink; third abdominal somite with dorsal carina forming a lobe on posterior margin . . . . . *Pandalus jordani*
   Carapace or abdomen with white lines,spots or flecks, or if uniform pink, with yellow bands on legs; third abdominal somite not carinated dorsally 8

8. Carapace with white lines and abdomen with white spots OR legs with yellow bands; dorsal spines confined to anterior half of carapace 9
   Carapace with scattered small black specks and minute red dots, abdomen with white lines dorsally and black lines laterally; dorsal spines extend to posterior half of carapace . . . . . *Pandalus danae*

9. Carapace and abdomen uniform translucent pink, legs 3-5 pink with yellow bands; sixth abdominal somite length $\geq$ 2X width . . . . . *Pandalus tridens*
   Carapace red with white lines, white spots on 1st and 5th abdominal somites, legs red and white banded; sixth abdominal somite length <2X width . . . . . *Pandalus platyceros*

REVISED KEY TO THE SO. CALIFORNIA BIGHT BENTHIC PENAEOID SHRIMP

D. B. Cadien (LACSD)- 12 March 1998 (modified 27May98)
(based on keys in Henrickx 1995, and Dall et al 1990)

1. Cervical sulcus reaching less than 2/3 the distance from the hepatic spine to the top of the carapace; postorbital spine absent; pereopod 4 lacks epipod 2
   Cervical sulcus reaching the top of the carapace; postorbital spine present; pereopod 4 bearing an epipod . . . . . Solenoceridae 3

2. Third to 5th pleopods biramous; prosartema (eye brush) present; exopods on 2nd and 3rd maxillipeds . . . . . Penaeidae 4
   Third to 5th pleopods uniramous; prosartema absent; exopods lacking on 2nd and 3rd maxillipeds . . . . . Sicyoniidae 6

3. Petasma of male with medial projection truncate and lateral projection acute and elongate (return to lab for identification) . . . . . *Solenocera florea**
   Petasma of male with medial projection elongate and triangular, lateral projection short and blunt (return to lab for identification) . . . . . *Solenocera mutator*

4. Rostrum dentate both dorsally and ventrally . . . . . *Penaeus* 5
   Rostrum dentate only dorsally . . . . . *Metapenaeopsis* 6

5. Gastrofrontal carina well defined, reaching to orbital margin . . . . . *Penaeus californiensis*
   Gastrofrontal carina often inconspicuous anteriorly, not reaching orbital margin . . . . . *Penaeus brevirostris**

6. Rostrum with 7-9 dorsal teeth, thelycum plate on sternite XIII of female lacking anteriorly directed spine . . . . . *Metapenaeopsis kishinouyei*#*
   Rostrum with 8-13 dorsal teeth, thelycum plate on sternite XIII of female bearing sharp anteriorly directed spine 7

7. Adult females with thelycum having a broad anteriomedially indented crest on sternite XIV (between 5th legs) . . . . . *Metapenaeopsis mineri#*
   Adult females with thelycum having a narrow anteriomedially cusped crest on sternite XIV (between 5th legs) . . . . . *Metapenaeopsis beebei*#*

8. Carapace bearing lateral "bulls-eye" marking or brown spot inside a larger light area in the posterior mid-portion of the carapace 9
   Carapace without brown spot or other pronounced marking on the posterior mid-portion of the carapace . . . . . *Sicyonia ingentis*

9. Anterior dorsal tooth of first abdominal segment sub-equal in size to posterior-most tooth of carapace dorsal carina . . . . . *Sicyonia penicillata*
   Anterior dorsal tooth of first abdominal segment much larger than posterior-most tooth of carapace dorsal carina . . . . . *Sicyonia disedwardsi**

*=not yet reported from area, but may range into it during strong ENSO events. Included for differentiation from closely related species known to occur in the southern California Bight.
#=adult males separable only on details of petasma structure (consult Hendrickx 1995)

REVISED KEY TO THE ALPHEIDAE OF CALIFORNIA

D. B. CADIEN (CSDLAC) - 23MAR 1998

(based on the key in Wicksten 1984)

1. Triangular movable plate articulated at posterolateral angle of sixth abdominal somite lateral to uropod base 2
   No triangular plate lateral to uropod base 9
2. Rostrum prominent, orbital hoods armed with spines . . . . . *Alphaeopsis equidactylus*
   Rostrum absent, carapace front without spines . . . . . *Betaeus* 3
3. Dactyls of walking legs slender and simple 4
   Dactyls of walking legs stout and bifid 6
4. Chelae of first legs with fingers > than palm; large male with fingers of chelipeds gaping . . . . . *Betaeus longidactylus*
   Chelae of first legs with fingers ≤ than palm; large male with fingers of chelipeds not gaping 5
5. Blade of antennal scale broad distally; fixed finger of first cheliped decreasing in width evenly to sharp curved tip . . . . . *Betaeus harrimani*
   Blade of antennal scale narrow distally; fixed finger of first cheliped truncate before sharp curved tip . . . . . *Betaeus ensenadensis*
6. Carapace front curved, not emarginate; commensal with sea urchins (*Strongylocentrotus* spp) . . . . . *Betaeus macginitieae*
   Carapace front emarginate; commensal with abalone or free living 7
7. Emargination of front shallow; telson with posterolateral spines small or missing; commensal with abalones (*Haliotis* spp) . . . . . *Betaeus harfordi*
   Emargination of front deep; telson with posterolateral spines well developed 8
8. Peduncle of first antenna less than ½ carapace length; merus of cheliped with lower inner ridge with long bristles, upper ridge ending in sharp tooth; chela with fingers subequal to palm; chela 3 times as long as wide . . . . . *Betaeus gracilis*
   Peduncle of first antenna ≃ carapace length; merus of cheliped with lower inner ridge usually tuberculate, upper ridge with tuft of hair; chela with fingers longer than palm; chela twice as long as wide . . . . . *Betaeus setosus*
9. Eyes partially or fully exposed dorsally 10
   Eyes fully covered by carapace dorsally 12
10. Eyes fully exposed dorsally, rostrum shorter than eyestalks . . . . . *Automate* 11
    Eyes partially exposed dorsally, rostrum much longer than eyestalks . . . . . *Salmoneus sp A*
11. Propodus of 3rd legs bearing spines on the posterior margin . . . . . *Automate dolichognatha*
    Propodus of 3rd legs setose, but lacking spines on posterior margin . . . . . *Automate sp A*
12. Legs lacking epipods; dactyls of legs 3-5 bifid . . . . . *Synalpheus lockingtoni*
    Legs with epipods; dactyls of legs 3-5 simple . . . . . *Alpheus* 13
13. Dactyl of major chela closing horizontally; merus of 3rd leg with prominent inferior spine . . . . . *Alpheus clamator*
    Dactyl of major chela closing vertically; merus of 3rd leg lacking prominent inferior spine 14
14. Orbital hoods spined; minor chela with prominent spine posterior to movable finger; movable finger flattened (lamellate) . . . . . *Alpheus bellimanus*
    Orbital hoods not spined; minor chela without prominent spine posterior to movable finger; movable finger not flattened . . . . . *Alpheus californiensis*