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DEC 23 1991

Chapter 6

Caridean and Stenopodid Shrimp of the Galápagos Islands

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1. Introduction

At least 65 species of caridean and stenopodid shrimp live in the waters of the Galápagos Islands. These animals can be common, and often are a food source for fishes, birds or cephalopods. Many engage in mutualistic or commensal relationships with other animals. These shrimp, however, often go unnoticed because of cryptic coloration, small size (1 cm or less in total length), nocturnal activity patterns, or inaccessible habitats.

Much information on deep-sea species of the area comes from trawling by the U.S. Fisheries Steamer *Albatross* in 1889–92 (Faxon, 1893, 1895). Both benthic and pelagic species were taken. Since 1895, there are less than 10 additional records of species living in midwater habitats or deeper than 200 m near these islands because of lack of collecting activity in deep water.

The most extensive collections of decapods from the Galápagos were made by the *Velero III* under the sponsorship of Captain G. Allan Hancock in 1931–1939. Animals were taken at 257 stations from the intertidal zone to 300 fathoms (554 m) by hand, dredge, trawl, and dip net. Sampling was conducted among algae, coral, and rocks as well as on sand and mud.

The collections of the *Velero III* were sent to the University of Southern California and the Smithsonian Institution for study. The Brachyura and Porcellanidae of the islands were identified and recorded in the works by Garth (1939, 1946; see also Chapter 5, this volume) and Haig (1960; see also Chapter 7, this volume). Other decapods, particularly the shrimp, need further study. Most of the caridean shrimp taken by the *Velero III* at the Galápagos Islands were examined by Waldo L. Schmitt of the U.S. National Museum of Natural History (Smithsonian

Institution). Dr. Schmitt, who participated in the expeditions, made color notes on living specimens for many species. Unfortunately, he had only partially sorted the specimens to species, and died before publishing anything on the collection.

L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie examined the palaemonid shrimp of the Hancock Galápagos expeditions during his study of the holdings of the U.S. National Museum. Most of the records of this family in the Galápagos are contained in his works (1951, 1952a). Goy (1987) described a stenopodid shrimp from the collections. Records of some of the snapping shrimp (Alpheidae) from the collections were included in the work by Kim and Abele (1988).

Part of the collections of the *Velero III* remained at the University of Southern California, where they form part of the collection of the Allan Hancock Foundation (AHF). (Portions of the collection currently are being moved to the Los Angeles County Museum of Natural History). During preparation of a work on caridean shrimp of the Gulf of California (Wicksten, 1983) and routine cataloguing of AHF specimens, I examined all of the carideans from the Galápagos Islands. During visits in 1980 and 1987 to the USNM, I identified many of the carideans from the collections of the *Velero III*, but did not completely examine the specimens of the families Pasiphaeidae, Hippolytidae and Alpheidae. Records in this chapter include some published previously by me (Wicksten 1978, 1983, 1989a, 1989b) as well as unpublished records from the catalogues of the USNM and AHF. I also have examined specimens from the Galápagos Islands in the collections of the California Academy of Sciences (CAS).

Other accounts of carideans from the Galápagos are contained in expedition reports and species descriptions. Short accounts of collections can be found in the works of Schmitt (1924), Sivertsen (1933), Hult (1939) and Holthuis (1978). De Ridder (1980) studied the natural history of species of *Veleronia* of the Galápagos. De Ridder and Holthuis (1979) and Bruce (1978) described new species from the islands. Paul Humann of Hollywood, Florida has observed and photographed subtidal marine life of the Galápagos (Humann, 1986).

Most records of carideans and decapods come from intertidal and shallow subtidal habitats. Deeper subtidal areas have been sampled mostly by trawls and dredges. It is likely that species living in caves, under rocks, or in narrow crevices are underrepresented in collections or have not yet been collected. Almost no collections have been made in surf-swept or very steep areas, or near Islas Darwin, Wolf, Pinta, and Marchena.

2. Nearshore and Freshwater Species

A list of species living at 50 m or less is provided in Table 2. Records are taken from the published literature as well as from unpublished records of the institutions indicated in the references. Notes are provided for first records and range extensions of species at the Galápagos Islands. Station numbers refer to those of the *Velero III*, as published by Fraser (1943).

Kim and Abele (1988) described eight new species of *Alpheus* that included records from the Galápagos Islands. This work did not include comparisons to material previously reported from the Galápagos. Some of these eight species may have been identified previously as *A. leviusculus* or *A. armillatus* (Sivertsen, 1933;

Table 1. Biogeographic Affinities of Caridean and Stenopodid Shrimp from the Galápagos Islands^a

Region	No. of species	% of total
TEP	27	46
TIP	10	17
CAR-WA	7	11
CP	4	7
G	4	7
TC	3	5
Other or unknown	4	7

^aAbbreviations: TEP = tropical eastern Pacific, TIP = tropical Indo-Pacific, TC = tropical cosmopolitan, CP = Chilean Province, CAR-WA = Caribbean-western Atlantic, G = known only from Galápagos Islands.

Wicksten, 1983). The absence of comparative information in the descriptions of Kim and Abele (1988) rendered them unusable for the present study. Species of *Alpheus* are notably polymorphic, and often have extensive ranges. (See Banner and Banner, 1982, for a discussion of variation in *Alpheus*.) I have provided records, therefore, of species of *Alpheus* examined by me prior to 1988 or which belong to species described before 1988. The task of comparing the remaining alpheid from the Galápagos with specimens from other areas of the eastern and western Pacific as well as the Atlantic side of the Panamic land mass will require extensive time and the use of numerical taxonomic methods or other techniques of species discrimination.

Most of the species taken in the Galápagos Archipelago have wide ranges. Only four (*Palaemonella asymmetrica*, *Pontonides sympathes*, *Typton crosslandi* and *Philocheras lapillus*) are known only from the islands, but these are small animals that easily could be overlooked by collectors and may occur elsewhere in the eastern Pacific. *Palaemon gladiator* is known only from the Galápagos and Clipperton Island. Kim and Abele (1988) elevated *Alpheus strenuus galapagensis* Sivertsen, 1933 to a distinct species, *A. galapagensis*, but did not compare specimens from the islands with an extensive series of specimens from the western Pacific. Whether or not the Galápagos population is sufficiently distinct to warrant designation as a separate species remains in doubt.

3. Biogeographic Affinities

The biogeographic affinities of the shallow-water caridean and stenopodidean shrimp are given in Table 1. Most of the shallow species of the Galápagos (27 species, or 46%), including two freshwater species, occur in the tropical eastern Pacific or nearby river drainages from western Mexico south to the Galápagos or the coasts of Colombia, Ecuador, or northern Peru. Ten species (*Harpiliopsis depressus*, *Fennera chacei*, *Alpheus lottini*, *A. leviusculus*, *Alpheus pacificus*, *A. strenuus*, *A. splendidus*, *Neoalpheopsis euryone*, *Synalpheus nobili* and *S. biunguiculatus*, 17%) live in both the eastern Pacific and tropical Indo-West Pacific. *Alpheus sulcatus* lives in the Indo-Pacific and eastern Pacific as well as the eastern

Table 2. Species Occurrences, Notes, and References for Stenopodid and Caridean Shrimp of the Galápagos Islands^a

Infraorder STENOPODIDEA
 Family STENOPODIDAE
Microprosthema emmiltum Goy, 1987; loc. 16, Goy 1987, TEP.

Infraorder CARIDEA
 Family ATYIDAE, loc. 11, near Darwin Research Station, 25 Jan. 1964; 27 Jan. 1964, D. Cavagnaro and R. Schuster, CAS, TEP?
 Family PALAEMONIDAE
Brachycarpus biunguiculatus (Lucas, 1849); locs. 4, 5, 6, 7, 10, 13, 14, 15, 17, 21, 22; Holthuis, 1952a, TC.
Macrobrachium hancocki Holthuis, 1952; loc. 15; Holthuis, 1952a, TEP.
Macrobrachium americanum Bate, 1868; locs. 11, 15; Holthuis, 1952a, TEP.
Palaemon ritleri Holmes, 1895; locs. 4, 5, 8, 10, 11, 12, 16; Holthuis, 1952a, TEP.
Palaemon gladiator Holthuis, 1952; locs. 4, 6, 12, 22; Holthuis, 1952a, TEP.
Palaemonella holmesi (Nobili, 1907); loc. 6; Holthuis, 1951, TEP.
Palaemonella asymmetrica Holthuis, 1951; locs. 4, 7, 11, 14, 15, 17; Holthuis, 1951, G.
Periclimenes infraspinis (Rathbun, 1902); locs. 10, 11, 19, 20; Holthuis, 1951, TEP.
Periclimenes veleronis Holthuis, 1951; loc. 5; "Albermarle ls.," 22 May 1932, Zaca, CAS, TEP.
Harpiliopsis depressus (Stimpson, 1860); locs. 4, 6, 11, 13, 14, 20; Holthuis, 1951, 1979, TEP.
Periclimenaeus pacificus Holthuis, 1951; loc. 8; Holthuis, 1951, TEP.
Pontonia margarita Smith, 1869, loc. 4; Holthuis, 1951, CAR-WA.
Typton serratus Holthuis, 1951; loc. 6; Holthuis, 1951, TEP.
Typton crosslandi Bruce, 1978; loc. 19; Bruce, 1978, G.
Fennera chacei Holthuis, 1951; loc. 3; Wicksten, 1989a, TIP.
Pseudocoutierea elegans Holthuis, 1951; loc. 3; Holthuis 1951, TEP.
Veleronia serratifrons Holthuis, 1951; loc. 20; Holthuis, 1951, TEP.
Veleronia laevifrons Holthuis, 1951; locs. 8, 20; Holthuis, 1951; S. James Bay, 5 Feb. 1974, G. Wellington, CAS, TEP.
Pontonides sympathes de Ridder and Holthuis, 1979; locs. 9, 15; de Ridder and Holthuis, 1979, G.
Gnathophyllum panamensis Faxon, 1893; loc. 4, 5, 7, 8, 10, 16, 17, 19, 20, 22; Sivertsen, 1933; Wicksten 1983, Punta Espinosa, Isla Fernandina, 18 Sept. 1974, G. Wellington, AHF, Bahía Gardner sta. 27-33, 30-33, Bahía Cartago sta. 73-33, 800-38, 76-33; Bahía James sta. 10-33; S. Seymour sta. 360-35; Bahía Sullivan sta. 795-38 USNM, TEP.

Family BRESILIIDAE
Discias serrifer Rathbun, 1902; locs. 5,6; Kensley, 1983, CP.

Family PANDALIDAE
Plesionika mexicana Chace, 1937; locs. 6, 7; Wicksten, 1983, Bahía Sullivan sta. 795-38, USNM, TEP.

Family RHYNCHOCINETIDAE
Rhynchocinetes typus H. Milne-Edwards, 1837; locs. 6, 15, 17, 22; Tagus Cove (juv.) Holthuis, 1979, N. of Tagus Hill, Isla Isabela sta. 154-34; off Bahía Stephens, Isla San Cristobal sta. 171-34; Post Office Bay, 5 Feb. 1933, USNM, Isla Isabela, Isla Fernandina-P. Humann, 1986; pers. comm, CP.

Family HIPPOLYTIDAE
Trachycaris restrictus (A. Milne-Edwards, 1878); loc. 20; Off Bahía Gardner sta. 201-34, USNM, CAR-WA.
Latreutes antiborealis Holthuis, 1952; locs. 7, 10, 11, 14, 15, 17, 20; Wicksten, 1983; S. Seymour ls., sta. 87-83; Isla San Cristobal, sta. 41-33; Bahía Sullivan sta. 177-34, Off Post Office Bay sta. 197-34, USNM, TEP.
Hippolyte williamsi Schmitt, 1924; locs. 5, 10, 11, 12, 14, 21; "Eden", Schmitt 1924; N. Shore Isla Española, 11 Feb. 1967, V. Walters, CAS; Bahía Cartago, sta. 187-34; S. Seymour Is. sta. 87-33, Bahía Academy, 4 Feb. 1933, USNM, TEP.
Lysmata intermedia (Kingsley, 1878); loc. 17; Sivertsen, 1933, CAR-WA.
Lysmata galapagensis Schmitt, 1924; locs. 4, 5, 6, 7, 10, 12, 13, 14, 16, 20; NE of Eden, Schmitt, 1924; Bahía Darwin sta. 101-33, Bahía Cartago sta. 73-33, N. Tagus Cove sta. 154-34, Bahía Sullivan sta.

Table 2. (continued)

- 343-35, S. Seymour Is. sta. 86-33, Isla Pinzón sta. 80-33, Isla Santa Fé sta. 811-38, Black Beach sta. 162-34, Bahía Gardner sta. 30-33 USNM, TEP.
- Lysmata californica* (Stimpson, 1866); locs. 5, 6, 11, 13, 14, 16, 17, 19, 20, 21; Bahía Cartago sta. 76-33, Tagus Cove, 15 Jan. 1934, Bahía Academy sta. 314-35, Isla Pinzón sta. 80-33, Isla Santa Fé sta. 811-38, 313-35, Black Beach sta. 162-34, Post Office Bay 5 Feb. 1933, Bahía Gardner sta. 359-35, Isla Onslow sta. 804-38, USNM, Gordon Rocks, sta. 315-35, AHF, TEP.
- Family PROCESSIDAE
- Ambidexter swifti* Abele, 1972; locs. 4, 10, 13; Bahía Darwin sta. 94-33, S. Seymour Is. sta. 87-33, Isla Pinzón sta. 80-33, USNM, TEP.
- Ambidexter panamensis* Abele, 1972; loc. 20; Wicksten, 1983, TEP.
- Processa peruviana* Wicksten, 1983; locs. 1, 5, 6, 7, 14, 17, 20, 21; Isla Wolf sta. 143-34, Bahía Cartago sta. 185-34, Tagus Cove sta. 156-34, Bahía Sullivan sta. 178-34, S. Seymour Is. sta. 87-33, Isla Santa Fé sta. 810-38, Post Office Bay sta. 198-34, Bahía Gardner sta. 201-34, N. of Isla Española sta. 814-38, USNM, TEP.
- Family CRANGONIDAE
- Philocheras lapillus* Wicksten, 1989; locs. 5, 6, 15, 20; Wicksten, 1989b, G.
- Family ALPHEIDAE
- Neolpheopsis euryone* (de Man, 1910); locs. 4, 5, 10, 11, 20; Wicksten, 1983, TIP.
- Alpheopsis* sp.; loc. 4; Bahía Darwin sta. 101-33 USNM, TEP?.
- Salmoneus ortmanni* (Rankin, 1898); locs. 17, 20; Gordon Rocks, sta. 315-34, Post Office Bay, sta. 167-34, Bahía Gardner sta. 27-33 USNM, CAR-WA.
- Salmoneus serratidigitus* (Coutière, 1896); locs. 5, 6, 9, 16, 19, 20; Bahía Darwin sta. 101-33, Bahía Cartago sta. 800-38, Black Beach sta. 166-34, Bahía Gardner sta. 27-33, Isla Onslow sta. 804-38 USNM, TEP.
- Automate dolichognatha* de Man, 1888; locs. 5, 11, 14, 20; Wicksten, 1981; Bahía Cartago sta. 76-33, Isla Sante Fe sta. 46-33, USNM, TC.
- Synalpheus nobilii* Coutière, 1909; loc. 11; "Eden", Schmitt, 1924; Albermarle Pt., Isla Isabela (Wicksten, 1983), TIP.
- Synalpheus biunguiculatus* (Stimpson, 1860); locs. 14, 20; Wicksten, 1983, TIP.
- Synalpheus digueti* Coutière, 1909; loc.; Gordon Rocks, Isla Santa Cruz sta. 315-34, AHF, TEP.
- Pomagnathus corallinus* Chace, 1937; locs. 5, 19, 20; Wicksten, 1983; Isla Onslow sta. 194-34, 804-38 USNM, TEP.
- Alpheus inca* Wicksten and Méndez, 1981; Gordon Rocks, Isla Santa Cruz sta. 315-35 USNM, CP.
- Alpheus bellimanus* Lockington, 1877; locs. 5, 7, 11, 12, 14, 16, 17; Kim and Abele 1988, Bahía Sullivan sta. 341-35 USNM, TEP.
- Alpheus splendidus* Coutière, 1897; loc. 10; S. Seymour Is. sta. 87-33 USNM, TIP.
- Alpheus websteri* Kingsley, 1880; locs. 10, 14; Wicksten, 1983, CAR-WA.
- Alpheus normanni* Kingsley, 1878; loc. 20; Bahía Gardner sta. 358-35 AHF, CAR-WA.
- Alpheus lottini* Guérin, 1830; locs. 4, 5, 10, 11, 13, 14; Holthuis, 1979, Kim and Abele 1988; Bahía Cartago sta. 800-38, Bahía Academy, no date, Karl Kubler; Isla Isabela sta. Sante Fé sta. 811-38 AHF, S. Seymour sta. 789-38, Albermarle Pt., Isla Isabela sta. 69-33, Isla Pinzón sta. 80-33, Isla Pinzón sta. 80-33, Isla Santa Fé sta. 811-38 USNM, TIP.
- Alpheus malleator* Dana, 1852; locs. 4, 5, 6, 7, 9, 10, 11, 14, 16, 19, 20; Wicksten, 1983; Bahía Darwin sta. 97-33, Bahía Cartago sta. 73-33; Tagus Cove sta. 152-34, SE of Isla Daphne Major sta. 789-38, Bahía Sullivan sta. 343-35; W. coast Isla Santiago sta. 333-35, Isla Bartolomé sta. 344-35, S. Seymour Is. sta. 789-38, Bahía Academy sta. 168-34, Isla Sante Fé sta. 48-33, Black Beach sta. 33-33, Isla Onslow sta. 804-38, Bahía Gardner sta. 31-33 USNM, CAR-WA.
- Alpheus saxidomus* Holthuis, 1980; locs. 4, 6, 7, 19, 20; Bahía Darwin, 22 Feb. 1933, Tagus Cove sta. 152-34, Albermarle Pt., Isla Isabela sta. 69-33, Tagus Cove sta. 152-34, Sullivan Bay sta. 180-34, Isla Onslow sta. 804-38, Isla Gardner sta. 357-35 USNM, TEP.
- Alpheus paracrinitus* Miers, 1881; locs. 4, 5, 7, 10, 11, 14, 16, 20; Wicksten, 1983; Kim and Abele 1988, TC.
- Alpheus sulcatus* Kingsley, 1878; locs. 4, 5, 10, 11, 16, 17, 20, 22; Sivertsen, 1933; Kim and Abele 1988, Punta Espinosa, Isla Fernadina 18 Sept. 1974, G. M. Wellington AHF; Bahía Darwin sta.

Table 2. (continued)

101-33, Bahía Cartago sta. 73-33, S. Seymour Is. sta. 789-38, Black Beach sta. 33-33, Bahía Gardner sta. 27-33, USNM, TC except CAR-WA.
<i>Alpheus levisculus</i> Dana, 1852; locs. 12, 20; Bahía Conway sta. 82-33, AHF, Bahía Academy, no date, CAS, TIP.
<i>Alpheus strenuus</i> Dana, 1852; loc. 17; Silvertsen, 1933, TIP
<i>Alpheus pacificus</i> Dana, 1852; loc. 20; Kim and Abele, 1988, TIP.
<i>Alpheus</i> cf. <i>armillatus</i> Milne-Edwards, 1837; loc. 22; Punta Espinosa, Isla Ferndandina 18 Sept. 1974, G. M. Wellington, AHF, TEP?.
<i>Alpheus chilensis</i> Coutière, 1902; "Eden", off Isla Santa Cruz, Schmitt, 1924, CP.

^aKey to collection sites (loc): 1, Isla Wolf; 2, Isla Pinta; 3, Isla Marchena; 4, Bahía Darwin, Isla Genovesa; 5, Bahía Cartago, Isla Isabela; 6, Tagus Cove, Isla Isabela; 7, Bahía Sullivan, Isla Santiago; 8, Bahía James, Isla Santiago; 9, Isla Daphne; 10, Isla Seymour; 11, Bahía Academy, Isla Santa Cruz; 12, Bahía Conway, Isla Santa Cruz; 13, Isla Pinzón; 14, Isla Santa Fé; 15, Isla San Cristobal; 16, Black Beach, Isla Floreana; 17, Post Office Bay, Isla Floreana; 18, Cormorant Bay, Isla Floreana; 19, Isla Onslow; 20, Isla and Bahía Gardner; 21, Isla Española; 22, Isla Ferndina.

Atlantic. *Brachycarpus biunguiculatus*, *Automate dolichognatha*, and *Alpheus paracrinitus* (5%) are cosmopolitan in tropical areas (Wicksten, 1983, 1989; Banner and Banner, 1985). Three species (*Alpheus chilensis*, *Rhynchocinetes typus*, and *Alpheus inca*) reach their northern range limits in the Galápagos, and usually are found along the coast of Peru and Chile (Méndez, 1981). *Discias serrifer* has been collected at the Galápagos and the Juan Fernandez Islands (Kensley, 1983). *Pontonia margarita*, *Lysmata intermedia*, *Trachycaris restrictus*, *Salmoneus ortmanni*, *Alpheus malleator*, *A. normanni*, and *A. websteri* (11%) are found both in the Caribbean and in the eastern Pacific, while *Latreutes antiborealis* and *Phillocheras lapillus* are sibling species of the Caribbean and western Atlantic *L. parvulus* and *P. gorei* (Holthuis, 1952b; Wicksten, 1983, 1989b). The distributions of the caridean and stenopodid shrimp suggest that the Galápagos Islands have been populated by long-distance dispersal, and that insufficient time has passed for evolution of distinct insular species. The relatively young geologic age of the islands (perhaps 3.3 million years, Hall, 1983) indicates that they were populated during or after the closing of the Panamic seaway between the Caribbean and eastern Pacific (about 2–5 million years ago).

Only three species of freshwater shrimp are known from the islands. *Macrobrachium americanum* has been found in pools at Academy Bay, Isla Santa Cruz. *Macrobrachium hancocki* has been collected at Freshwater Bay, Isla San Cristobal, upstream of the bay proper. Both species of *Macrobrachium* also are widely distributed on the west coast of South America (Holthuis, 1952a). Individuals of *Macrobrachium* can disperse across salt water during floods, and have been found at other offshore islands of the eastern Pacific, including Isla Cocos (Wicksten, 1989a). Shrimp of the family Atyidae have been collected in a swamp near Academy Bay. Species of this family live in streams on the mainland coast of South and Central America.

4. Habitats

Tidepools and shallow rocky areas of the Galápagos contain many common carideans. The small translucent species of *Palaemon* are abundant. *Hippolyte*

williamsi usually lives among algae, which it matches in color. *Alpheus sulcatus*, *A. malleator*, *Synalpheus digueti*, and other snapping shrimp usually live in burrows in sand under rocks, among algal holdfasts, or in cracks. *Lysmata galapagensis* tends to hide under rocks by day and forages at night.

Shallow subtidal rocky areas also have abundant carideans. *Brachycarpus biunguiculatus*, species of *Palaemonella*, *Periclimenes inraspinis*, and *Gnathophyllum panamense* can be found. *Trachycaris restrictus* and *Latreutes antiborealis* may escape notice because of their small size and cryptic coloration, which matches pieces of debris, shell chips, or sand. Species of *Alpheus* and related alpheids are common in holes, under rocks, and in crevices among algae or corals.

During daylight hours, carideans and stenopodids may hide in caves and then emerge to forage at night. Species of *Lysmata* are particularly common in caves. *Lysmata californica* and other species often associate with moray eels (family Muraenidae), which they clean in a symbiotic relationship (Limbaugh, 1961). *Rhynchocinetes typus* also often is a cave-dweller, as is the stenopodid *Microprosthema emilltum*. Patches of branched corals (*Pocillopora* spp.) harbor symbiotic carideans. *Alpheus lottini*, a colorful species with stripes of red, orange, black and/or white, is common among corals. It feeds on small invertebrates and algae among the coral branches, but also may ingest coral mucus and tissue (Castro, 1971). *Fennera chacei* and *Harpiliopsus depressa* cling to the branches. The latter species feeds on coral mucus, zooxanthellae, and algal spores (Barry, 1965; in Castro, 1971). These shrimp have mouthparts specially modified for feeding on mucus and fine particles, as well as short dactyls that grip the coral firmly during daylight hours. (See Patton, 1974, and Bruce, 1976, for reviews of shrimp of coral reefs.) Another commensal species, *Synalpheus charon*, has not been reported yet from the Galápagos, but is common among corals elsewhere in the tropical eastern Pacific and may also be found at the islands with further collecting (Wicksten, 1983).

Species of the family Palaemonidae include symbionts of larger invertebrates. *Pontonides galapagensis* lives on black corals (*Antipathes galapagensis*) (de Ridder and Holthuis, 1979). Species of *Typton* are found in sponges (Holthuis, 1951), as are species of *Discias* (family Bresiliidae, Kensley, 1983). *Veleronia serratifrons* and *V. laevifrons* live on a gorgonian, *Muricea appressa* (de Ridder, 1980). *Pontonia margarita* lives on pelecypods (Holthuis, 1951).

Although sandy coasts are not common in the Galápagos, these areas are rich in species of the family Penaeidae (order Decapoda, infraorder Penaeidea), which have not yet been studied in the islands. Common carideans of sandy areas include *Processa peruviana*, *Plesionika mexicana*, *Philocheras lapillus*, and species of *Ambidexter*.

5. Offshore and Deep Benthic Species

There are few records of shrimp or other crustaceans from deeper areas of the Galápagos. Two species, *Encantada spinoculata* (Caridea: Bresiliidae) and *Spongicoloides galapagensis* (Stenopodidea: Spongicolidae) probably inhabit rocky areas. Each is known only from a single specimen. The bresiliid was collected at

55–92 m east of Jervis Island (Wicksten, 1989d), and the stenopodid was trawled off Isla Santa Cruz at 717 m (Goy, 1980). Both are of phylogenetic and biogeographic interest. *Encantada spinocolata* is related to deep-sea hydrothermal vent shrimp (*Alvinocaris* and *Rimicaris* spp.), but lives at a much lesser depth and has pigmented eyes. *Spongicoloides galapagensis* is the only eastern Pacific species of this genus, whose species often live in association with deep-sea hexactinellid sponges.

It is likely that species of the families Pasiphaeidae and Oplophoridae are abundant in mesopelagic habitats near the Galápagos, as they are elsewhere in the eastern Pacific. The only species of these two caridean families reported from the islands are *Pasiphaea americana* Faxon, at 478–1017 m; and *Acanthephyra faxoni* Calman, taken at 738 m (Méndez, 1981; USNM unpublished data for *Velero III* sta. 812–38). *Nematocarcinus agassizii* Faxon (family Nematocarcinidae) has been taken at 247–1883 m (Méndez, 1981). These species range widely in the deeper parts of the tropical eastern Pacific.

Two deep benthic species have been reported from the Galápagos: *Glyphocrangon loricata* Faxon at 605–769 m, and *Pontophilus gracilis occidentalis* Faxon at approximately 1700–2100 m (Méndez, 1981; Wicksten, 1989c). The former species reaches its northern range limit in the Galápagos; the latter ranges from southern California to Chile. Both of these species probably crawl and dig in muddy bottoms.

Although they have not been reported from the islands, species of the family Pandalidae probably also live in deeper areas near there. Species of *Heterocarpus* are common on lower continental shelves and continental slopes along the coasts of central and South America, as well as in the Indo-Pacific region. Species of *Plesionika* and *Stylopandalus* also have been collected in benthic or pelagic habitats from southern California to Peru (AHF, unpublished records).

6. Faunal Recruitment

Carideans and stenopodids have planktonic larval stages which evidently have little difficulty crossing the distance between the mainland of southern and central America and offshore islands such as the Galápagos. Certain carideans, including species of *Lysmata* and *Hippolyte*, may have been transported to the islands while clinging to floating algae or debris. The presence of commensals of branched corals (*Pocillopora* spp.) also suggests recruitment from the tropical Indo-West Pacific, although whether this was directly from the western Pacific or by way of previously established populations in the eastern Pacific is uncertain. The mixture of cold and warmer currents in the Galápagos has enabled elements of the Peru–Chilean fauna to become established in the islands.

At present, it is impossible to compare the caridean and stenopodid fauna of the Galápagos with that of comparable mainland areas of central or South America. Biases in collecting, lack of sampling, uncertain identifications, or natural fluctuations in biotas prevent biologists from knowing with any certainty whether a species is consistently present or absent in a particular area. The species composition of the Galápagos on the whole is similar to that obtained by the Hancock expeditions at sites in the southern Gulf of California, western Mexico and the

coasts of Panama and Ecuador. However, because the specimens have not been completely catalogued by station nor even fully identified, a station-by-station comparison is not possible.

Taxonomic problems hamper further understanding of the distributions of eastern Pacific carideans, in particular the family Alpheidae. The range of polymorphism among wide-ranging Indo-Pacific species is not known, nor have eastern Pacific populations been carefully compared with their western Pacific counterparts. Larval histories, color patterns, commensal associations and habitat requirements for most species of the area are unknown. The biology of caridean shrimp could provide many topics for study by visiting or resident scientists and their students at the islands.

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