Southern California Association of Marine Invertebrate Taxonomists

3720 Stephen White Drive
San Pedro, California 90731

February 1990 Vol. 8, No. 10

NEXT MEETING: Photis Workshop

GUEST SPEAKERS: SCAMIT Members

DATE: Monday, 12 March 1990, 9:30 AM

LOCATION: Cabrillo Marine Museum
3720 Stephen White Drive
San Pedro, CA 90731

MINUTES FROM MEETING ON FEBRUARY 12, 1990

Pagurid Meeting: Ms. Janet Haig, Allan Hancock Foundation, University of Southern California, hosted the pagurid meeting. Several problems concerning pagurid identification were discussed. Ms. Haig agreed with us that several corrections and additions, listed in the previous newsletter, need to be made to the key (Haig, J. 1977. A preliminary key to the hermit crabs of California. Proc. Taxonomic Standardization Program, So. Calif. Coastal Water Research Project, Vol. 5, No. 2, pp. 13-22). Don Cadien, Los Angeles County Sanitation Districts, agreed to rewrite this key, and Dean Pasko, Pt. Loma/City of San Diego, and Mas Dojiri, Hyperion Treatment Plant, plan to illustrate the characters included in the key. Many of these illustrations will be gleaned from the literature, but a few, by necessity, will be original. When completed, the illustrated key to the species of California hermit crabs will be distributed to SCAMIT members. SCAMIT gratefully acknowledges Janet Haig for hosting the meeting and for her helpful suggestions on the key.

Lists of synonymies and references for hermit crabs of southern California compiled by Carol Paquette, Marine Biological

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Consultants, are attached to this newsletter. Apparently, the printer copied only every other page of the handout provided in the previous newsletter; therefore, the correct version is included herein.

Photis Workshop: SCAMIT members planning to attend the next workshop on Photis at Cabrillo Marine Museum on 12 March 1990 are encouraged to bring their specimens of Photis and microscopes with them. Although a few microscopes will be provided at the workshop, there will not be enough for all the participants.

SCAMIT Cladistic Workshop: Dr. J. Kirk Fitzhugh, American Museum of Natural History, presented a seminar entitled "Cladistics and Polychaete Systematics: Truth or Consequences" at the Natural History Museum of Los Angeles County on 16 February. Attached to this newsletter are definitions of some common terms used in cladistics, and a short note on HENNIG86, a PC-DOS program for phylogenetic analysis.

Election of New SCAMIT Officers: Nominations for new SCAMIT officers have been received and ballots, including candidate biographies, are enclosed herein. Please vote for the candidate of your choice for each office and mail your completed ballots to the Vice-President at the address provided on the ballot.

Light's Manual Update: "Text corrections and addenda for adding to 3rd printing" of Light's Manual, Intertidal Invertebrates of the Central California Coast, edited by Ralph Smith and James Carlton is available from Ralph Smith.

8th Annual SCAMIT Picnic: This year's picnic will be held at Area 7 (northern end of the park), Doheny State Beach, on Saturday, 18 August 1990. The picnic chairman will be providing more details in an upcoming newsletter.

SCAMIT pagurids, 8 Jan 90 meeting

Pagurid species of southern California

Family Diogenidae
- *Isocheles* Stimpson 1858
  - *Isocheles pilosus* (Holmes) 1900
    - *Holopagurus pilosus* Holmes 1900
- *Paguristes* Dana 1851
  - *Paguristes bakeri* Holmes 1900
  - *Paguristes parvus* Holmes 1900
  - *Paguristes turgidus* (Stimpson) 1857
    - *Clibanarius turgidus* Stimpson 1857
    - *Eupagurus turgidus*: Stimpson 1859
    - *Pagurus turgidus*: Williamson 1915
    - *Paguristes turgides*: Gordan 1956
  - *Paguristes ulreyi* Schmitt 1921
    - *Paguristes occator* Glassell 1937
  - *Paguristes* sp.1 Haig

Family Paguridae
- *Discorsopagurus* McLaughlin 1974
  - *Discorsopagurus schmitti* (Stevens) 1925
    - *Pylopagurus schmitti* Stevens 1925
- *Pagurus* Fabricius 1775
  - *Pagurus aleuticus* (Benedict) 1892
    - *Eupagurus aleuticus* Benedict 1892
    - *Pagurus ochotensis aleuticus*: Makarov
  - *Pagurus armatus* (Dana) 1851
    - *Bernhardus armatus* Dana 1851
    - *Eupagurus armatus*: Stimpson 1857
    - *Eupagurus ochotensis*: Stimpson 1858
    - *Eupagurus alaskensis*: Harrington and Griffin 1897
    - *Pagurus ochotensis*: Holmes 1900
  - *Pagurus beringanus* (Benedict) 1892
    - *Eupagurus beringanus* Benedict 1892
    - *Eupagurus newcombei* Benedict 1892
    - *Pagurus newcombei*: Holmes 1900
  - *Pagurus capillatus* (Benedict) 1892
    - *Eupagurus pubescens*: Stimpson 1858
    - *Eupagurus capillatus* Benedict 1892
    - *Eupagurus trigonochirus*: Balss 1913
    - *Pagurus setosus*: Stevens 1925
    - *Pagurus* sp. [2]: McLaughlin 1963
  - *Pagurus caurinus* Hart 1971
    - *Pagurus setosus*: Hart 1940
  - *Pagurus granosimanus* (Stimpson) 1858
    - *Eupagurus granosimanus* Stimpson 1858
  - *Pagurus hemphilli* (Benedict) 1892
    - *Eupagurus hemphilli* Benedict 1892

Pagurus hirsutiusculus hirsutiusculus (Dana) 1851
Pagurus mertensii Brandt 1851
Bernhardus hirsutiusculus Dana 1851
Eupagurus mertensii: Stimpson 1857
Eupagurus hirsutiusculus: Stimpson 1857
Pagurus samuelis: Rathbun 1904
Pagurus hirsutiusculus venturensis Coffin 1957
Pagurus ochotensis Brandt 1851
Cancer bernhardus: Herbst 1791
Pagurus bernhardus
var. B. *granulato-denticulata* Brandt 1851
var. C. *spinimana* or sp. *ochotensis* Brandt 1851
Eupagurus bernhardus: Stimpson 1857
Eupagurus ochotensis: Stimpson 1858
Eupagurus alaskensis Benedict 1892
Pagurus alaskensis: Rathbun 1899
Eupagurus ortmanni Balss 1911
Pagurus alascensis: Balss 1911
Eupagurus spinimanus: Terao 1913
Pagurus ochatensis: Williamson 1915
Pagurus quaylei Hart 1971
Pagurus redondoensis Wicksten 1982
Pagurus sp. 3 Haig
Pagurus samuelis (Stimpson) 1857
Eupagurus samuelis Stimpson 1857
Pagurus setosus (Benedict) 1892
Eupagurus setosus Benedict 1892
Pagurus spilocarpus Haig 1977
Pagurus sp. 1 Haig
Pagurus tanneri (Benedict) 1892
Eupagurus tanneri Benedict 1892
Pagurus sp. 2 (Haig MS)
Pagurus sp. 4 (Hart MS)
Parapagurodes McLaughlin and Haig 1973
Parapagurodes laurentae McLaughlin and Haig 1973
?*Pagurus* [sp]: Menzies and Miller 1954
Parapagurodes makarovi McLaughlin and Haig 1973
Eupagurus mertensii: Benedict 1892
Parapagurus mertensii: Holmes 1900
Pylopagurus A. Milne Edwards and Bouvier 1891
Pylopagurus holmesi Schmitt 1921
Enallopaguropsis McLaughlin 1981
Enallopaguropsis guatemoci (Glassell) 1937
Pylopagurus guatemoci Glassell 1937
Haigia McLaughlin 1981
Haigia diegensis (Scanland and Hopkins) 1969
Pylopagurus diegensis Scanland and Hopkins 1969
Phimochirus McLaughlin 1981
Phimochirus californiensis (Benedict) 1892
Eupagurus californiensis Benedict 1892
Pagurus californiensis: Schmitt 1921
Pylopagurus californiensis: Haig, Hopkins and Scanland 1970

Orthopagurus Stevens 1927
Orthopagurus minimus (Holmes) 1900
Pagurus minimus Holmes 1900
Eupagurus "minimus": Alcock 1905
Parapagurus minimus: Hilton 1918
Pylopagurus minimus: Schmitt 1921

Family Parapaguridae
Parapagurus Smith 1879
Parapagurus pilosimanus benedicti de Saint Laurent 1972
Parapagurus armatus: Reinhard 1944
Sympagurus Smith 1883
Sympagurus haigae (de Saint Laurent) 1972
Parapagurus haigae de Saint Laurent 1972

SCAMIT pagurids, 8 Jan 90 meeting

Pagurid species of southern California

Family Diogenidae

Isocheles Stimpson 1858

Isocheles pilosus (Holmes) 1900

San Francisco, CA, to Estero de Punta Banda, outer Baja
Intertidal to 55 m, on sand.
Ref: Holmes 1900: description.
Rathbun 1910: distribution.
Schmitt, 1921: description and plate figure.
Forest 1964: Discussion; illustration of *I. pacificus* Bouvier.
Haig, Hopkins and Scanland 1970: discussion and key for Baja Calif.
Haig 1977a: key.
Wicksten 1977: artificial key.
Scanland unpublished: (as *Holopagurus*) description, key and diagrammatic illustrations.

Paguristes Dana 1851

Paguristes bakeri Holmes 1900

San Francisco, CA, to Gulf of California.
Shallow water to 232 m.
Ref: Holmes 1900: ?
Rathbun 1910: distribution.
Schmitt 1921: description and plate figures.
Glassell 1937: discussion.
Haig, Hopkins and Scanland 1970: discussion and key.
Haig 1977a: key.
Scanland unpublished: description, key and diagrammatic illustrations.

Paguristes parvus Holmes 1900

Catalina Island and San Pedro, CA, to northern outer Baja California.
3 to 6 m, rocky areas.
Ref: Holmes 1900: ?
Rathbun 1910: distribution.
Schmitt 1921: description, diagrammatic illustration and plate figure.
Haig, Hopkins and Scanland 1970: discussion and key.
Haig 1977a: key.
Wicksten 1977: artificial key.
Scanland unpublished: description, key and diagrammatic illustration.

Paguristes turgidus (Stimpson) 1857

Chukchi Sea and British Columbia to San Diego, CA.
Subtidal to 465 m.
Ref: Stimpson 1857: description (as *Clibanarius*)
Rathbun 1910: distribution.
Schmitt 1921: description and plate figures.
Stevens 1925: description, key and illustrations (whole body).
Hart 1971: range extension.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Hart 1982: description and illustration (whole body).
Kozloff 1987: key.
Scanland unpublished: description, key and diagrammatic illustration.

Paguristes ulreyi Schmitt 1921
British Columbia to Gulf of California.
10 to 60 m.
Ref: Schmitt 1921: description and plate figures.
Haig, Hopkins and Scanland 1970: discussion and key.
Hart 1971: range extension.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Hart 1982: description and illustration (whole body).
Kozloff 1987: key.
Scanland unpublished: description, key and diagrammatic illustration.
Paguristes sp.1 Haig
Ref: Haig 1977a: key.

Family Paguridae
Discorsopagurus McLaughlin 1974
Discorsopagurus schmitti (Stevens) 1925
Puget Sound and Arcata, CA
22 to 77 m.
Ref: Stevens 1925: (as *Pylopagurus*) description, key, illustrations and distribution.
McLaughlin 1974: description, key, illustrations and distribution.
Hart 1982: description and illustration (whole body).
Enallopaguropsis McLaughlin 1981a (description also in McLaughlin 1981b)
Enallopaguropsis guatemoci (Glassell) 1937
Outer coast of Baja California.
83 m.
Ref: Glassell 1937: description (as *Pylopagurus).*
Walton 1954: description (as *Pylopagurus*), key and illustration of major manus.
Haig 1977a: (as *Pylopagurus*) key.
McLaughlin 1981a: reassignment.
Haigia McLaughlin 1981a
Haigia diegensis (Scanland and Hopkins) 1969
Santa Catalina Island, CA, to Coronados Islands, Baja Calif.
3 to 20 m, rocky bottom.
Ref: Scanland and Hopkins 1969: description (as *Pylopagurus*) and illustration (anterior) and key.
Haig, Hopkins and Scanland 1970: discussion (as *Pylopagurus*) and key.
Haig 1977a: (as *Pylopagurus*) key.
Wicksten 1977: artificial key.
McLaughlin 1981a: reassignment.

Orthopagurus Stevens 1927

Orthopagurus minimus (Holmes) 1900

British Columbia to San Diego, CA.

11 to 64 m.

Ref: Holmes 1900: (as *Pagurus*)
Rathbun 1910: (as *Pagurus*) distribution.
Schmitt 1921: (as *Pylopagurus*) description and plate figures.
Stevens 1927: description of species and new genus, keys and plates (whole body).
Makarov 1938: description.
Hart 1971: range extension.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Kozloff 1987: key.
Scanland unpublished: (as *Pylopagurus*) description and key.

Pagurus Fabricius 1775

Pagurus aleuticus (Benedict) 1892

Bering Sea to Oregon.

14 to 435 m.

Ref: Benedict 1892: description (as *Eupagurus*).
Benedict 1901: description, illustration (whole body) and key.
Rathbun 1910: distribution and short description.
Stevens 1925: description, key and illustration (whole body).
Makarov 1938: description (as *P. ochotensis aleuticus*) and figure (comparison of dactyls w/ *P. ochotensis*).
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Hart 1982: description and illustration (whole body).
Kozloff 1987: key.

Pagurus armatus (Dana) 1851

Unalaska, Alaska, to San Diego, CA.

10 to 146 m.

Ref: Stimpson 1857: discussion (as *Eupagurus*).
Stimpson 1858: (as *Eupagurus ochotensis*, in part)
Holmes 1900: (as *P. ochotensis*)
Rathbun 1910: (as *P. ochotensis*) distribution.
Makarov 1938: description.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Hart 1982: description and illustration (whole body).
Kozloff 1987: key.

Pagurus beringanus (Benedict) 1892
Bering Sea to Monterey, CA.
Intertidal to 82 m.
Ref: Benedict 1892: description (as *Eupagurus*).
Benedict 1892: description (as *E. newcombei*).
Rathbun 1910: distribution.
Schmitt 1921: description and illustration (whole body).
Stevens 1925: description, key and illustration (whole body).
Makarov 1938: description.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Kozloff 1987: key.
Scanland unpublished: description, key and diagrammatic illustration

Pagurus capillatus (Benedict) 1892
Arctic Ocean to Kamchatka and California.
4 to 439 m.
Ref: Benedict 1892: description (as *Eupagurus*).
Rathbun 1910: distribution.
Schmitt 1921: description and illustrations (chela and anterior body).
Stevens 1925: (as *P. setosus*) description, key and illustration (whole body).
Makarov 1938: description.
Hart 1971: range extension.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Kozloff 1987: key and illustration (whole body).

Pagurus caurinus Hart 1971
Kodiak, Alaska, to British Columbia.
Littoral to 126 m, rock crevices or kelp holdfasts.
Ref: Hart 1971: description and illustrations (incl. whole body).
Haig 1977a: key.
Wicksten 1977: artificial key.
Kozloff 1987: key.

Pagurus granosimanus (Stimpson) 1858
Unalaska to Ensenada, Baja Calif.
Littoral to 32 m
Ref: Rathbun 1910: short description and distribution.
Schmitt 1921: description and illustration (whole body).
Stevens 1925: description, key and illustration (whole body).
Makarov 1938: description.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Kozloff 1987: key and illustration (whole body).
Scanland unpublished: description, key and diagrammatic illustration.

Pagurus hemphilli (Benedict) 1892
British Columbia to Monterey, CA.
Intertidal to ?
Ref: Benedict 1892: description (as *Eupagurus*).
Rathbun 1910: distribution.
Schmitt 1921: description and illustration (whole body).
Hart 1971: range extension.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Kozloff 1987: key.

Pagurus hirsutiusculus hirsutiusculus (Dana) 1851
Pribilof Islands to San Diego, CA, and Japan.
Intertidal to 110 fm.
Ref: Stimpson 1857: discussion (as ?*Eupagurus mertensii*)
Stimpson 1858: (as *Eupagurus*) synonymies.
Rathbun 1910: distribution and short description.
Schmitt 1921: description and illustration (whole body) and plate.
Stevens 1925: description, key and illustration (whole body).
Makarov 1938: description.
Coffin 1957: plate figure.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Kozloff 1987: key and illustration (whole body).
Scanland unpublished: description, key and diagrammatic illustration.

Pagurus hirsutiusculus venturensis Coffin 1957
Monterey, CA, to San Diego, CA.
Depth ?
Ref: Coffin 1957, Description and plate figure.
Haig 1977a: key.

Pagurus ochotensis Brandt 1851
Siberia to San Diego, CA.
Subtidal to 249 m.
Ref: Stimpson 1857: (as *Eupagurus bernhardus*) discussion.
Stimpson 1858: (as *Eupagurus*) synonymies.
Benedict 1901: description, illustration (whole body) and key.
Benedict 1901: description (as *P. alaskensis*), illustration (whole body) and key.
Schmitt 1921: description and illustration (whole body).
Stevens 1925: description, key and illustration (whole body).
Stevens 1925: (as *P. alaskensis*) description, key and illustrations.
Makarov 1938: description and comparison w/ *P. armatus*.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Hart 1982: description and illustration (whole body).
Kozloff 1987: key.
not Rathbun 1910.

Pagurus quaylei Hart 1971

British Columbia to Bahia San Quintin, Baja Calif.
2 to 97 m, gravel.
Ref: Hart 1971: description and illustrations (incl. whole body).
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Kozloff 1987: key.

Pagurus redondoensis Wicksten 1982

Redondo Beach and Santa Catalina Island to San Onofre, CA.
0 to 50 m, sheltered subtidal, among rocks or on sand near rocks.
Ref: Haig 1977a: (as *P.* sp. 3) key.
Wicksten 1977: (as *P.* sp. 3) artificial key.
Wicksten 1982: description and illustrations.

Pagurus samuelis (Stimpson) 1857

British Columbia to outer Baja California (Rathbun's report from Sitka, Alaska, is a misidentification of *P. hirsutiusculus*).
High intertidal to ?
Ref: Stimpson 1957: description (as *Eupagurus*).
Stimpson 1858: (as *Eupagurus*) description (in Latin). Schmitt 1921, description, illustration (whole body male and female) and plate figures.
Rathbun 1910: distribution.
Makarov 1938, description.
Hart 1971: range extension.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Wicksten 1977: artificial key.
Hart 1982: description and illustrations (whole body) (correction: Fig. 48c is merus of left chela).
Kozloff 1987: key.
Scanland unpublished: description, key and diagrammatic illustration.

Pagurus setosus (Benedict) 1892

Kodiak, Alaska, to Santa Cruz Island, CA.
9 to 480 m.
Ref: Benedict 1892: description (as *Eupagurus*).
Rathbun 1910: distribution and short description.
Schmitt 1921: description and illustration (whole body).
Makarov 1938: description and illustration (whole body).
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Kozloff 1987: key.
not Stevens 1925.

Pagurus spilocarpus Haig 1977

Zuma Beach, CA, to Punta Abreojos, Baja Calif.
Low tide to 71 m.
Ref: Haig 1977a: (as *P.* sp. 1) key.
Haig 1977b: description and illustrations.
Wicksten 1977: (as *P.* sp. 1)

Pagurus tanneri (Benedict) 1892
Pribilof Islands, Alaska, to San Simeon, CA.
87 to 1120 m.
Ref: Benedict 1892: description (as *Eupagurus*).
Rathbun 1910: distribution.
Schmitt 1921: description and illustration (whole body).
Makarov 1938: description.
Hart 1971: range extension.
McLaughlin 1974: description, key and illustrations.
Haig 1977a: key.
Kozloff 1987: key and illustration (whole body).

Pagurus sp. 2 (Haig MS)
Southern Baja Calif.
106 to 116 m.
Ref: is this *P.* sp.2 of Haig, Hopkins and Scanland 1970?
Haig 1977a: key.
Wicksten 1977: artificial key.

Pagurus sp. 4 (Hart MS)
Ref: Haig 1977a: key.

Parapagurodes McLaughlin and Haig 1973

Parapagurodes laurentae McLaughlin and Haig 1973
Southern Calif. and Channel Isl. to Gulf of California.
16 to 475 m.
Ref: McLaughlin and Haig 1973: description, illustration and key.
Haig 1977a: key.

Parapagurodes makarovi McLaughlin and Haig 1973
Monterey, CA, to outer Baja Calif.
75 to 574 m. (LACoSan 61 m)
Ref: Holmes 1900: ? (as *Parapagurus mertensii*)
Makarov 1938: description (as *Parapagurus mertensii*, in part) and discussion.
McLaughlin and Haig 1973: description, illustrations and key.
Haig 1977a: key.

Phimochirus McLaughlin 1981a

Phimochirus californiensis (Benedict) 1892
Santa Catalina Island and Monterey, CA, to Panama and Galapagos Isl.
Littoral to 129 m.
Ref: Benedict 1892: description (as *Eupagurus*).
Benedict 1892: (as *E. mexicanus*) description.
Rathbun 1910: (as *Pagurus*) distribution.
Schmitt 1921: (as *Pagurus*) description and illustrations (whole body and anterior).
Glassell 1937: (as *Pagurus*) discussion.
Haig, Hopkins and Scanland 1970: description (as *Pylopagurus*) and key.
Haig 1977a: (as *Pylopagurus*) key.
Wicksten 1977: artificial key.
McLaughlin 1981a: reassignment.
McLaughlin 1981b: description and plates (chelae).
Scanland unpublished: (as *Pagurus*) description, key and diagrammatic illustration.

Pylopagurus A. Milne Edwards and Bouvier 1891 (redescription in McLaughlin 1981a)
Pylopagurus holmesi Schmitt 1921
Channel Islands and San Pedro to Gulf of California.
2 to 460 m.
Ref: Schmitt 1921: description and illustrations (chela).
Walton 1954: description, illustration (whole body) and key.
Haig 1977a: key.
McLaughlin 1981a: assignment retained.
Scanland unpublished: description and key.

Family Parapaguridae
Parapagurus Smith 1879
Parapagurus pilosimanus benedicti de Saint Laurent 1972
Alaska to Gulf of Panama
750 to 1902 m.
Ref: de Saint Laurent 1972: short description and distribution.
McLaughlin 1974: description, key and illustrations.
Haig 1977a. key.
Kozloff 1987: key.
Sympagurus Smith 1883
Sympagurus haigae (de Saint Laurent) 1972
California (AHF sta. 993-39) to Gulf of Panama.
225 to 255 m.
Ref: de Saint Laurent 1972: (as *Parapagurus*) description, illustrations and distribution (incorrectly stated as Gulf of California).
Haig 1977: (as *Parapagurus*) key.
Lemaitre 1989: reassignment.

References:

Benedict, J.E., 1892, Preliminary description of thirty-seven new species of hermit crabs of the genus *Eupagurus* in the U.S. National Museum, Proc. U.S. Nat. Mus., Vol. 15.

Benedict, J.E., 1901, the hermit crabs of the *Pagurus bernhardus* type, Proc. U.S. Nat. Mus, Vol. 23, No. 1216.

Coffin, H.G., 1957, A new southern form of "*Pagurus hirsutiusculus*" (Dana) (Crustacea, Decapoda), Walla Walla Coll. Publ. Biol. Sci., No. 21.

de Saint Laurent, M. 1972. Sur the famille des Parapaguridae Smith, 1882. Description de *Typhlopagurus foresti* gen. nov., sp. nov., et de quinze espece ou sous-espece nouvelles de *Parapagurus* Smith (Crustacea, Decapoda), Bijdragen Tot De Dierkunde, 42(2):97-123.

Forest, J., 1964, Sur un nouveau genre de Diogenidae (Crustacea Paguridea) de l'Atlantique sud-Americain, *Loxopagurus* gen. nov., etabli pour *Pagurus loxochelis* Moreira, Zoologische Mededelingen, Vol. 39.

Glassell, S.A., 1937, Hermit crabs from the Gulf of California and the west coast of Lower California, The Templeton Crocker Expedition, XI, Zoologica, Vol. 22, No. 16.

Haig, J., Hopkins, T.S. and Scanland, T.B., 1970, The shallow water anomuran crab fauna of southwestern Baja California, Mexico, Trans. San Diego Soc. Nat. Hist., Vol. 16, No. 2.

Haig, J., 1977b, Description of a new hermit crab (Family Paguridae) from southern California and Mexico, Proc. Biol. Soc. Wash, Vol. 90, No. 3.

Haig, J., 1977a, A preliminary key to the hermit crabs of California, Proc. Taxonomic Standardization Program, So. Calif. Coastal Research Project, Vol. 5, No. 2, pp. 13-22.

Hart, J.F.L, 1971, New distribution records of reptant decapod Crustacea, including descriptions of three new species of *Pagurus*, from the waters of adjacent to British Columbia, Journ. Fish. Res. Bd. Canada, Vol. 28, No. 10.

Hart, J.F.L., 1982, Crabs and their relatives of British Columbia, British Columbia Provincial Museum Handbook No. 40.

Holmes, S.J. 1900, Synopsis of California stalk-eyed Crustacea, Occ. Pap. Calif. Acad. Sci., Vol. 7.

Kozloff, E.N., 1987, Marine invertebrates of the Pacific Northwest, Univ. Wash. Press.

Lemaitre, R., 1989, Revision of the genus *Parapagurus* (Anomura: Paguroidea: Parapaguridae), including redescriptions of the Western Atlantic species, Zoologische Verhandelingen, No. 253.

Makarov, V.V., 1938. Fauna of U.S.S.R., Crustacea, Anomura, Zoologicheskii Institut Akademii Nauk SSSR, Vol. 10, No. 3.

McLaughlin, P.A. and Haig, J., 1973, On the status of *Pagurus mertensii* Brandt, with descriptions of a new genus and two new species from California (Crustacea: Decapoda: Paguridae), Bull. So. Calif. Acad. Sci., Vol. 72, No. 3.

McLaughlin, P.A., 1974. The hermit crabs (Crustacea, Decapoda, Paguridea) of Northwestern North America, Zoologische Verhandelingen, No. 130.

McLaughlin, P.A., 1981a, Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species, Part I, Ten new genera of the Paguridae and a redescription of *Tomopagurus* A. Milne Edwards and Bouvier, Bull. Marine Sci., Vol. 32, No. 1.

McLaughlin, P.A., 1981b, Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part II. *Rhodochirus* McLaughlin and *Phimochirus* McLaughlin, Bull. Marine Sci., Vol. 31, No. 2.

Rathbun, M.J., 1910. Decapod crustaceans of the northwest coast of North America, Harriman Alaska Series, Vol. 10, Crustaceans, pp. 1-210.

Scanland, T.B., unpublished, A key to the Paguridae of San Diego County.

Scanland, T.B. and Hopkins, T.S., 1969, A new species of hermit crab, *Pylopagurus diegensis* (Decapoda: Anomura), with a key for the genus in the Eastern Pacific, Pacific Science, Vol. 23, No. 2.

Schmitt, W.L., 1921, The marine decapod Crustacea of California, U.C. Publ. in Zoology, Vol. 3.

Stevens, B.A., 1925, Hermit crabs of Friday Harbor, Washington, Publ. Puget Sound Biol. Sta., Vol. 3, No. 68.

Stevens, B.A., 1927, *Orthopagurus*, a new genus of Paguridae from the Pacific coast, Publ. Puget Sound Biol. Sta., Vol. 5.

Stimpson, W., 1857, On the Crustacea of Echinodermata of the Pacific shores of North America, Part 1, Crustacea, Journ. Boston Soc. Nat. Hist., Vol. 6, No. 4.

Stimpson, W., 1858, Prodromus descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit, Part 7, Proc. Acad. Nat. Sci. Philadelphia.

Walton, B.C., 1950, Some new and rare Pacific pagurids, Journ. Washington Acad. Sci., Vol. 40, No. 6.

Walton, B.C., 1954, The genus *Pylopagurus* (Crustacea: Anomura) in the Pacific with descriptions of two new species, Allan Hancock Pacific Expeditions, Vol. 18, No.2.

Wicksten, M.K., 1977, Artificial key to shallow-water hermit crabs of California, Proc. Taxonomic Standardization Program, So. Calif. Coastal Water Research Project, Vol. 5, No. 2, pp. 23-28.

Wicksten, M.K., 1982, *Pagurus redondoensis*, a new species of hermit crab from southern California (Anomura: Paguridae), Journ. Crustacean Biology, Vol. 2, No. 4.

SOME CLADISTIC TERMS

APOMORPHY (or APOMORPHIC): a derived or "advanced" character state, a state which shows a less general distribution among taxa; cf. plesiomorphy.

CHARACTER STATE: any of the conditions or expressions of a particular character. For example, "hair" is a character for which there might be three different states: blonde, red, brunette.

CHARACTER STATE POLARITY: the nature of states of a character in terms of being plesiomorphic or apomorphic; cf. out-group comparison.

CLADE: a branch on a cladogram, comprising a monophyletic group of taxa; e.g., the Order Amphinomida is a clade containing the Amphinomidae and Euphrosinidae, defined by the presence of calcareous setae.

CLADISTICS (or CLADISM): a systematic method for discovering internested groupings or relationships of organisms in terms of synapomorphy.

CLADOGRAM: a branching diagram which graphically represents the distribution of characters and/or character states among a group of taxa.

CONVERGENCE: the putative independent acquisition in two or more taxa or clades of an apomorphic character state, each being derived from two different plesiomorphic states; cf. homoplasy.

HOMOPLASY: the occurrence of a character state more than once on a cladogram, usually attributed to either parallel or convergent evolution.

MONOPHYLY: a group (two or more species or higher taxa) hypothesized as being derived from a single, common ancestor and which contains all descendants. Evidence for monophyly is based on the presence of at least one character state acting as a synapomorphy.

OUT-GROUP COMPARISON: a procedure for determining plesiomorphic and apomorphic conditions of character states by comparison of the taxa under study (the ingroup) to their sister-group (the outgroup). In such a comparison, states present in the out- and ingroup are considered plesiomorphic (the generality or distribution of that state is such that it cannot provide evidence of relationship within the ingroup), whereas a state found only in the ingroup is apomorphic.

PARALLELISM: the putative independent acquisition in two or more taxa or clades of an apomorphic character state from the same plesiomorphic state; *cf.* homoplasy.

PARAPHYLY: a group (two or more species or higher taxa) hypothesized as being derived from a single, common ancestor and which contains *some but not all* descendants. By definition, a paraphyletic group is defined on the basis of symplesiomorphy. For example, the Serpulidae is paraphyletic if the Spirorbidae is maintained, the former being defined by the plesiomorphic occurrence of an uncoiled calcareous tube.

PARSIMONY: "the economy of explanation." The formulation of hypotheses which minimize the number of *ad hoc* assumptions. In cladistics this entails the construction of cladograms requiring the fewest number of homoplasious (*cf.* homoplasy) character state changes.

PLESIOMORPHY (or PLESIOMORPHIC): a "primitive" character state, a state which shows a more general distribution among taxa; *cf.* apomorphy.

POLYPHYLY: a group (two or more species or higher taxa) in which the hypothesized most recent common ancestor for the group is assigned to some other group. Thus, a polyphyletic group is usually defined by an homoplasious character; a claim of polyphyly is contingent upon identifying all other taxa which must be included in the group to effect monophyly. For example, the claim that the Polychaeta are polyphyletic is only true if it can be shown that there is some other taxon which must be included in the Polychaeta, say pogonophorans, which would result in the group being monophyletic.

REVERSAL: a character state change on a cladogram from an apomorphic state to a plesiomorphic state.

SISTER GROUP: a term denoting an exclusive relationship among two or more taxa relative to a third. For example, the Onuphidae and Eunicidae are sister taxa relative to the Nereididae.

SYMPLESIOMORPHY: a *shared* plesiomorphic state.

SYNAPOMORPHY: an apomorphic state shared by at least two taxa, which forms the basis for cladogram construction.

SELECTED REFERENCES (not exhaustive!)

Cracraft, J. & N. Eldredge (eds.). 1979. Phylogenetic Analysis and Paleontology. New York: Columbia University Press, 233 pp.

Eldredge, N. & J. Cracraft. 1980. Phylogenetic Patterns and the Evolutionary Process. New York: Columbia University Press, 349 pp.

Humphries, C.J. & V.A. Funk. 1984. Chapter 17: Cladistic Methodology. *In* V.H. Heywood & D.M. Moore (eds.) Current Concepts in Plant Taxonomy, pp. 323-362. Systematics Association Special Volume No. 25. London: Academic Press.

Nelson, G. & N. Platnick. 1981. Systematics and Biogeography: Cladistics and Vicariance. New York: Columbia University Press, 567 pp.

Rieppel, O.C. 1988. Fundamentals of Comparative Biology. Boston: Birkhäuser Verlag, 202 pp.

Schoch, R.M. 1986. Phylogeny Reconstruction in Paleontology. New York: Van Nostrand Reinhold Co.

Wiley, E.O. 1981. Phylogenetics: The Theory and Practice of Phylogenetic Systematics. New York: J. Wiley & Sons, 439 pp.

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