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## INTRODUCTION

The current review began as a series of in-house training documents. They were initially restricted to the fauna which had been encountered in the Southern California Bight (SCB). This is not a self-contained zoogeographic unit, and it was later decided to broaden the scope to include the entire Northeast Pacific (NEP). There are faunal connections between the biota of this region and that of adjacent regions to the west (Northwest Pacific), and to the North (fauna of the Bering Sea and Arctic), but the fauna of the NEP forms a natural zoogeographic unit. It ranges across several different marine climatic regions, and contains boreal, temperate, and tropical elements within its boundaries. The equator serves as a useful boundary to the south, not because of major climatic change north and south of it, but because of the equatorial currents that separate the waters above the equator from the waters to its south.

While much of the previous sampling in the NEP has hugged the coast in the past, there is an increasing focus on waters further offshore. Rather than restrict the coverage to a particular bathymetry it was decided to encompass the full depth variation between the shoreline and the middle of the North Pacific Basin. Intertidal forms, which are often excluded from treatments concentrating on benthic organisms, are here included as well. Although the concentration here is on the amphipods found on the sea-floor, pelagic forms are not excluded. It has proven very difficult to determine whether or not a given species lives exclusively off the bottom, lives part of its life on the bottom and the rest in the water column, or moves freely between the benthic and pelagic realms. Forms known primarily from collections with mid-water gear such as baited traps, Isaacs-Kidd Midwater trawls, and plankton nets are included here to provide a comprehensive treatment of the amphipod fauna of the NEP.

Freshwater forms, restricted to limnic, lacustrine, and hypogean environments along the coast of North America are not considered here. Terrestrial forms living in leaf litter and other moist habitats away from the seashore are also omitted. They form a natural unit different from the marine forms which are discussed in this volume, although some species occur in both fresh and saline waters. The only marine exclusions are those of the Hyperiidia. These occur in the region, but are not considered in this review. The hyperiids have been comprehensively treated in recent times by Vinogradov, Volkov and Semenova (1982). An English translation of this volume has been available since 1990. Although the hyperiids are now considered to nest within the gammaroids (Bousfield 2001) they are excluded as being clearly holopelagic.

Comprehensive treatment of the Ingolfiellida is even more recent (Vonk & Schramm 2003), but as current reports concern undescribed materials, they are included here. The ingolfiellid and traditional “gammaroid” amphipods in the marine and estuarine waters of the NEP are the subject of this treatment.

## **AMPHIPOD SUPERFAMILIES**

The higher level organization of the Order Amphipoda has long been a contentious issue. The fossil record, which helps elucidate the evolutionary history of many groups, is not really available for the amphipods. There are some fossil amphipods (analyzed by Bousfield 1982a, and summarized by Schram 1986), but not enough to provide much useful evidence as to the palaeohistory of the group. The order has long been divided into suborders on morphological grounds. This separation was into the major groups Gammaridea, Hyperidea, and Caprellidea, with Ingolfiellidea added in 1970 (Ruffo 1970). The value of at least one of these, the Caprellidea, has been recently challenged by several workers. In the recent revision of the Corophiida suborder of the Gammaridea (Myers & Lowry 2003), the caprelloids were included as a superfamily under the Infraorder Caprellida within the superorder Gammarida, a position followed below. Erection of a new suborder, the Senticaudata (Lowry and Myers 2013) further modified the existing scheme, reallocating many families to different placements based on their character analysis. Bousfield (2001) submerged the hyperiids into the gammarids based on morphological character continuity, and separated the gammarids into several informal groups which remain unnamed. The gammarids themselves have been distributed among several suborders by the research cited above. All these investigations have been based solely on morphological data.

Dr. J. L. Barnard thought at length about the evolution of the group, as evidenced in the structure of the extant species, but was just beginning to view some superfamilial groupings as appropriate and useful at the time of his death. His last major revisionary work (Barnard & Karaman 1991) retained an alphabetical treatment of the marine gammaridean amphipods (freshwater gammaroids were treated in Barnard & Barnard 1983). In their recent synthesis of the classification of the Crustacea, Martin & Davis (2001) chose to continue this tack, feeling that there was still too much controversy regarding the superfamily partition of the gammaroids. The superfamilial separation of the Hyperidea stems from Bowman & Gruner (1973) and continues in use with little or no modification (Vinogradov et al 1982[1996 translation], Martin & Davis 2001).

Phylogenetic studies based on molecular rather than morphological information are beginning to help clarify some previously obscure issues, but coverage remains low, and results require confirmation by other means (Englisch 2001, Englisch & Koeneman 2001, Englisch et al 2003)

At least 29 superfamily level taxa are represented in the amphipod fauna of the Northeast Pacific (NEP). Their organization above the superfamily level is murky, and has been so for many years. Recently efforts have been undertaken to find some order in the chaos. Bousfield (2001) suggested use of a series of Infraorders, an approach adopted here. Although they are outside the scope of this review, the families placed traditionally in the Hyperiidea are included below to provide a better overview of the phylogenetic hypotheses used here.

## **Higher Taxonomic Categories in the Order Amphipoda**

Those represented in the NEP **BOLDED**

[Based on Lowry & Myers 2013, and Bousfield 2001]

**Suborder Ingolfiellidea**

**Infraorder Ingolfiellida**

**I. Superfamily Ingolfielloidea**

**Suborder Senticaudata**

Infraorder Carangoliopsida

Parvorder Carangoliopsidira

Superfamily Carangolipsoidea

**Infraorder Talitrida**

**Parvorder Talitridira**

Superfamily Biancolinoidea

Superfamily Caspicoloidea

Superfamily Kurioida

**II. Superfamily Talitroidea**

**Infraorder Corophiida**

**Parvorder Corophiidira**

**III. Superfamily Aoroidea**

**IV. Superfamily Cheluroidea**

**V. Superfamily Chevalioidea**

**VI. Superfamily Corophioidea**

**Parvorder Caprellidira**

Superfamily Aetiopedesidae

**VII. Superfamily Caprelloidea**

Superfamily Isaeoidea

Superfamily Microtopoidea

**VIII. Superfamily Neomegamphoidea**

**IX. Superfamily Photoidea**

Superfamily Rakirooidea

**Infraorder Hadziida**

**X. Superfamily Hadzioidea**

**XI. Superfamily Callioppioidea**

**Infraorder Bogidiellida**

**Parvorder Bogidiellidria**

**XII. Superfamily Bogidielloidea**

**Infraorder Gammarida**

**Parvorder Crangonyctidira**

Superfamily Allocrangonyctoidea

**XIII. Superfamily Crangonyctoidea**

**Parvorder Gammaridira**

**XIV. Superfamily Gammaroidea**

**Suborder A (Bousfield's Natants)**

**Infraorder Lysianassida**

**XV. Superfamily Lysianassoidea**

**XVI. Superfamily Stegocephaloidea**

**Infraorder Synopiida**

**XVII. Superfamily Synopioidea**

- XVIII. Superfamily Pardaliscoidea**
- XIX. Superfamily Liljeborgioidea**
- Infraorder Physosomata\*
  - Superfamily Scinoidea\*
  - Superfamily Lanceoidea\*
- Infraorder Physocephalata\*
  - Superfamily Vibilioidea\*
  - Superfamily Phronimoidea\*
  - Superfamily Lycaeopsoidea\*
  - Superfamily Platysceloidea\*
- Infraorder Phoxocephaliida**
  - XX. Superfamily Phoxocephaloidea**
  - XXI. Superfamily Pontoporioidea**
- Suborder B (Bousfield's transitionals)**
  - Infraorder Eusirida**
    - XXII. Superfamily Eusiroidea**
    - XXIII. Superfamily Oedicerotoidea**
  - Infraorder Leucothoidea**
    - XXIV. Superfamily Leucothoidea**
    - XXV. Superfamily Stenothoidea**
    - XXVI. Superfamily Iphimedioidea**
  - Infraorder Dexaminida**
    - XXVII. Superfamily Dexaminoidea**
    - XXVIII. Superfamily Ampeliscoidea**
    - XXIX. Superfamily Melphidippoidea**

The polarity of this arrangement is still in dispute, and must await additional molecular work to provide clarity. In the absence of a comprehensive fossil record this is not surprising. Current morphological treatments provide a framework which will be revisited and revised many times in future. Some order does appear to be rising out of the chaos and uncertainty of previous organizational schemes, but much remains to be done.

Within each Infraorder, superfamily groups and families will be discussed in the order which best available cladistic analysis suggest follows a trend of increasing evolutionary development. Each group will be examined within the broad limits posed by the Northeast Pacific Ocean, defined as extending from the equator to the Aleutian Island Chain, and from the mid-point of the Pacific to the shores of North America. Species usually considered pelagic will be included (except the hyperiids), as the boundaries of their distributions within the water column are frequently unclear. Many such populations impinge on the benthic environment. The hyperiids, which are holoplanktonic, and only reach the bottom after death, will not be covered. Infraorders and Superfamilies traditionally considered to belong to this group are indicated by an asterisk (\*) above.

Index to Placement of amphipod Families (those marked with an asterisk are not recorded in the NEP; those only from freshwater (#), and those holoplanktonic (⌘) are excluded)

<b>Family</b>	<b>Infraorder</b>	<b>Superfamily</b>
Acanthogammaridae#	Gammarida	Gammaroidea
Acanthonotozomatidae*	Leucothoidea	Iphimedioidea
Acanthonotozomellidae	Leucothoidea	Iphimedioidea
Acidostomatidae	Lysianassida	Lysianassoidea
Aetiopedesidae*	Caprellida	Aetiopedesoidea
Alicellidae	Lysianassida	IS – “Alicellioidea”
Allocrangonyctidae#	Gammarida	Allocrangonyctoidea
Amaryllidae*	Lysianassida	Lysianassoidea
Amathillopsidae	Leucothoidea	Iphimedioidea
Ampeliscidae	Dexaminida	Ampeliscoidea
Amphiloichidae	Leucothoidea	Stenothoidea
Ampithoidae	Corophiida	Corophioidea
Anapronoidaeꜛ	Physocephalatida	Platyscelioidea
Anisogammaridae	Gammarida	Gammaroidea
Aoridae	Corophiida	Aoroidea
Archaeoscinidaeꜛ	Physosomatida	Scinoidea
Argissidae	Synopiida	Synopioidea
Aristiidae	Lysianassida	Lysianassoidea
Artesiidae#	Bogidiellida	Bogidielloidea
Austroniphargidae#	Gammarida	Crangonyctoidea
Baikalogammaridae#	Gammarida	Gammaroidea
Bateidae	Eusirida	Eusiroidea
Bathyporeiidae*	Gammarida	Gammaroidea
Behningiellidae*	Gammarida	Gammaroidea
Biancolinidae*	Talitrida	Biancolinioidea
Bogidiellidae	Bogidiellida	Bogidielloidea
Bolttsiidae*	Leucothoidea	Stenothoidea
Calliopiidae	Hadziida	Calliopioidea
Caprellidae	Caprellida	Caprelloidea
Caprogammaridae*	Caprellida	Caprelloidea
Carangoliopsidae*	Carangoliopsida	Carangoliopsoidea
Caspicolidae#	Talitrida	Caspicoloidea
Cebocarididae	Lysianassida	Lysianassoidea
Ceinidae*	Talitrida	Talitroidea
Cheidae*	Phoxocephalida	Phoxocephaloidea
Cheirocratidae*	Hadziida	Calliopioidea
Cheluridae	Corophiida	Cheluroidea
Chevaliidae	Corophiida	Chevalioidea
Chillagoeidae#	Gammarida	Crangonyctoidea
Chiltoniidae#	Talitrida	Talitroidea

<b>Family</b>	<b>Infraorder</b>	<b>Superfamily</b>
Chuneolidaeꜛ	Physosomatida	Lanceoidea
Clarenciidae*	Liljeborgida	Liljeborgoidea

Colomastigidae	Synopiida	Liljeborgoidea
Condukiidae*	Phoxocephalida	Phoxocephaloidea
Corophiidae	Corophiida	Corophioidea
Crangonyctidae#	Gammarida	Crangonyctoidea
Crangoweckeliidae#	Hadziida	Hadzioidea
Crymostygiidae#	Gammarida	Allocrangonyctoidea
Cressidae*	Leucothoidea	Stenothoidea
Cyamidae	Caprellida	Caprelloidea
Cyclocarididae	Lysianassida	Lysianassoidea
Cyphocarididae	Lysianassida	Lysianassoidea
Cyproideidae*	Leucothoidea	Stenothoidea
Cystosomatidaeæ	Physocephalatida	Vibilioidea
Dexaminidae	Dexaminida	Dexaminoidea
Diarellidaeæ	Physocephalatida	Phronimoidea
Didymocheliidae*	Leucothoidea	Leucothoidea
Dikwidae*	Leucothoidea	Iphimedioidea
Dogielinotidae	Talitrida	Talitroidea
Dulichidae	Caprellida	Caprelloidea
Dussartiellidae#	Gammarida	Allocrangonyctoidea
Endevouridae	Lysianassida	Lysianassoidea
Eophliantidae	Talitrida	Talitroidea
Epimeriidae	Leucothoidea	Iphimedioidea
Eriopisidae	Hadziida	Hadzioidea
Eusiridae	Eusirida	Eusiroidea
Eurytheneidae	Lysianassida	Lysianassoidea
Exoedicerotidae*	Eusirida	Oedicerotoidea
Falklandiellidae#	Gammarida	Gammaroidea
Gammaracanthidae#	Gammarida	Gammaroidea
Gammarellidae*	Gammarida	Gammaroidea
Gammaridae	Gammarida	Gammaroidea
Gammaroporeidae	Hadziida	Hadzioidea
Giniphargidae #	Gammarida	Crangonyctoidea
Hadziidae	Hadziida	Hadzioidea
Haustoriidae	Phoxocephalida	Pontoporeioidea
Hirondelleidae	Lysianassida	Lysianassoidea
Hornelliidae	Hadziida	Calliopioidea
Hyalellidae	Talitrida	Talitroidea
Hyalidae	Talitrida	Talitroidea
Hyperidaeæ	Physocephalatida	Phronimoidea
Hyperopsidae	Lysianassida	Lysianassoidea
Iciliidae*	incertae sedis	unknown
Ingolfiellidae	Ingolfiellida	Ingolfielloidea
<b>Family</b>	<b>Infraorder</b>	<b>Superfamily</b>
Ipanemidae*	Phoxocephalida	Phoxocephaloidea
Iphigenellidae #	Gammarida	Gammaroidea



Iphimediidae	Leucothoidea	Iphimedioidea
Isaeidae*	Caprellida	Isaeoidea
Ischyroceridae	Caprellida	Photoidea
Izinkalidae*	Lysianassida	Lysianassoidea
Kairosidae*	Carangoliopsida	Carangoliopsoidea
Kamakidae	Caprellida	Photoidea
Kergueleniolidae#	Gammarida	Allocrangonyctoidea
Kotumsaridae#	Gammarida	Crangonyctoidea
Kuriidae*	Talitrida	Kurioidea
Lanceolidae✕	Physosomatida	Lanceoidea
Laphystiidae	Leucothoidea	Leucothoidea
Laphystiopsidae	Leucothoidea	Leucothoidea
Lepechinellidae	Dexaminida	Dexaminoidea
Lepidopreeliidae	Lysianassida	Lysianassoidea
Leucothoidae	Leucothoidea	Leucothoidea
Liljeborgiidae	Synopiida	Liljeborgoidea
Luciobliviidae #	Gammarida	Gammaroidea
Lycaeidae✕	Physocephalatida	Platyscelioidea
Lycaeopsidae✕	Physocephalatida	Lycaeopsoidea
Lysianassidae	Lysianassida	Lysianassoidea
Macrohectopidae#	Gammarida	Gammaroidea
Maeridae	Hadziida	Hadzioidea
Maxillipiidae*	Leucothoidea	Leucothoidea
Megaleuropidae	Dexaminida	Melphippioidea
Melitidae	Hadziida	Hadzioidea
Melphidippidae	Dexaminida	Melphippioidea
Mesogammaridae	Gammarida	Gammaroidea
Metacrangonyctidae#	Hadziida	Hadzioidea
Metingolfiellidae*	Ingolfiellida	Ingolfielloidea
Microphasmidae✕	Physosomatida	Lanceoidea
Microprotopidae*	Caprellida	Microprotopoidea
Micruropidae#	Gammarida	Gammaroidea
Mimonectidae✕	Physosomatida	Scinoidea
Miramarassidae*	Leucothoidea	Iphimedioidea
Najnidae	Talitrida	Talitroidea
Neomegamphopidae	Caprellida	Neomegamphopoidea
Neoniphargidae#	Gammarida	Crangonyctoidea
Nihotungidae*	Leucothoidea	Stenothoidea
Niphargidae#	Gammarida	Crangonyctoidea
Nuuanuidae*	Hadziida	Hadzioidea
Ochlesiidae*	Leucothoidea	Iphimedioidea
Family	Infraorder	Superfamily
Oedicerotidae	Eusirida	Oedicerotoidea
Opisidae	Lysianassida	Lysianassoidea

OxycephalidaeꝞ	Physocephalatida	Platyscelioidea
Pachynidae	Lysianassida	Lysianassoidea
Pachyschesidae#	Gammarida	Gammaroidea
Pagetinidae*	Leucothoidea	Leucothoidea
Pallaseidae#	Gammarida	Gammaroidea
Paracalliopiidae*	Eusirida	Oedicerotoidea
Paracrangonyctidae#	Gammarida	Crangonyctoidea
Paragammaropsidae*	Caprellida	Aetiopedesoidea
Paraleptamphopidae#	Gammarida	Gammaroidea
Paramelitidae#	Gammarida	Crangonyctoidea
ParaphronimidaeꝞ	Physocephalatida	Vibilioidea
ParascelidaeꝞ	Physocephalatida	Platyscelioidea
Pardaliscidae	Synopiida	Pardaliscoidea
Perthiidae#	Gammarida	Crangonyctoidea
Phliantidae	Talitrida	Talitroidea
Photidae	Caprellida	Photoidea
Phoxocephalopsidae*	Phoxocephalida	Phoxocephaloidea
Phoxocephalidae	Phoxocephalida	Phoxocephaloidea
Phreatogammaridae*	Gammarida	Gammaroidea
PhronimidaeꝞ	Physocephalatida	Phronimoidea
PhrosinidaeꝞ	Physocephalatida	Phronimoidea
Platyischnopidae	Phoxocephalida	Phoxocephaloidea
PlatyscelidaeꝞ	Physocephalatida	Platyscelioidea
Pleustidae	Leucothoidea	Leucothoidea
Plioplateidae*	Talitrida	Talitroidea
Podoceridae	Caprellida	Caprelloidea
Podosiridae*	Leucothoidea	Iphimedioidea
Pontogammaridae#	Gammarida	Gammaroidea
Pontogeneidae	Hadziida	Calliopioidea
Pontoporeidae	Phoxocephalida	Pontoporeioidea
Podoprionidae *	Lysianassida	Lysianassoidea
Priscomilitariidae*	Caprellida	Neomegamphopoidea
PronoideaꝞ	Physocephalatida	Platyscelioidea
Prophliantidae	Dexaminida	Dexaminoidea
ProscinidaeꝞ	Physosomatida	Scinoidea
Pseudamphilochidae*	Leucothoidea	Stenothoidea
Pseudocrangonyctidae#	Gammarida	Crangonyctoidea
Pseudoniphargidae#	Gammarida	Allocrangonyctoidea
Rakiroidae*	Caprellida	Rakirooidea
Salentinellidae*	Bogidiellida	Bogidielloidea
Sandroidae#	Gammarida	Crangonyctoidea
ScinidaeꝞ	Physosomatida	Scinoidea
Family	Infraorder	Superfamily
Scopelocheiridae	Lysianassida	Lysianassoidea
Sebidae	Synopiida	Liljeborgoidea

Sensonatoridae#	Gammarida	Gammaroidea
Sicafodiidae*	Synopiida	Pardaliscoidea
Simnurothoidae*	Gammarida	Phoxocephaloidea
Sophrosynidae	Lysianassida	Lysianassoidea
Stegocephalidae	Lysianassida	Stegocephaloidea
Stenothoidae	Leucothoidea	Stenothoidea
Sternophysingidae#	Gammarida	Crangonyctoidea
Stilipedidae	Synopiida	Pardaliscoidea
Synopiidae	Synopiida	Synopioidea
Talitridae	Talitrida	Talitroidea
Temnophliantidae*	Talitrida	Talitroidea
Thaumatelsonidae*	Leucothoidea	Stenothoidea
Thoriellidae*	Lysianassida	Lysianassoidea
Trischizostomatidae*	Lysianassida	Lysianassoidea
Tulearidae*	Talitrida	Kurioidea
Typhlogammaridae#	Gammarida	Gammaroidea
Unciolidae	Corophiida	Aoroidea
Uristidae	Lysianassida	Lysianassoidea
Urohaustoriidae*	Phoxocephalida	Phoxocephaloidea
Uronyctidae#	Gammarida	Crangonyctoidea
Urothoidae	Phoxocephalida	Phoxocephaloidea
Valettiidae*	Lysianassida	IS – “Alicelloidea”
Valettiopsidae	Lysianassida	IS – “Alicelloidea”
Vibiliidaeæ	Physocephalatida	Vibilioidea
Vicmusiidae*	Leucothoidea	Iphimedioidea
Vitjazianidae	Synopiida	Pardaliscoidea
Wandinidae*	Lysianassida	Lysianassoidea
Zobrachoidae*	Phoxocephalida	Phoxocephaloidea