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西太平洋浮游动物种类多样性

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摘要: 西太平洋区是全球海洋生物种源中心,许多类群的最高物种多样性都出现于该区域,因此,在该区开展种类多样性的研究不仅重要和必要,而且具有在跨国尺度上进行综合管理和相互合作的迫切性。本文在西太平洋的浮游动物样品鉴定分类、编目、文献资料整理和分析的基础上,记录和编入西太平洋10个浮游动物类群2,658种(含亚种),隶属于206科675属,其中水螅水母类99科251属697种,栉水母类12科22属59种,浮游软体动物14科35属86种,介形类8科89属416种,桡足类51科156属908种,糠虾类4科58属202种,磷虾类2科8属56种,十足类8科22属105种,毛颚类5科8属48种,被囊类5科26属81种。

关键词: 浮游动物, 西太平洋, 种类组成, 多样性

Zooplanktonic diversity in the western Pacific

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Abstract: The western Pacific region has been operating as a centre for the origin of marine biodiversity: the richest diversity of many marine taxa was found in these waters. Therefore, biodiversity research and conservation efforts in this area are necessary in order to promote the integrative and international management of this resource. The present work is a compilation of numbers of all the families, genera and species of major taxa of zooplankton known in the western Pacific Ocean(106°–150°E, 0°–44°N). In all, 2,658 zooplanktonic species (including subspecies) belonging to 206 families and 675 genera have been recorded from taxonomic identifications and literature, 99 families, 251 genera and 697 species belong to the Medusozoa, 12 families, 22 genera and 59 species to the Ctenophora, 14 families, 35 genera and 86 species to the pelagic Molluscs (Pteropoda and Heteropoda), 8 families, 89 genera and 416 species to the Ostracoda, 51 families, 156 genera and 908 species to the Copepoda, 4 families, 58 genera and 202 species to the Mysidacea, 2 families, 8 genera and 56 species to the Euphausiacea, 8 families, 22 genera and 105 species to the Decapoda, 5 families, 8 genera and 48 species to the Chaetognatha, 5 families, 26 genera and 81 species to the Tunicata.

Key words: zooplankton, western Pacific region, taxa composition, diversity

面对自然变化和人类活动引起的生物多样性丧失,人类正面临前所未有的紧迫感,1992年世界环发大会签署的《生物多样性公约》强调“保护生物多样性就是保护人类自己”。生物多样性的保护

需要全面、可信的物种和种类组成等基础资料,这很大程度上依赖于调查和文献资料分析获得的物种多样性研究成果。因此,《生物多样性公约》、《二十一世纪议程》、“物种2000”、国际生物多样性科学

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计划(DIVERSITAS)倡议开展生物多样性的基础研究。国际海洋生物普查(CoML)组织计划通过10年的努力,构建全球海洋生物物种编目数据库,以逐步实现全球海洋生物资源可持续利用的目标。

西太平洋区为全球海洋生物种源中心(Briggs, 2005; Allen, 2007),许多海洋生物类群的最高物种多样性都出现于该区域(Randall, 1998; Allen, 2002; Briggs, 2005; Jensen, 2006)。因此,在该区开展物种多样性的保护和研究不仅重要和必要(Allen, 2002; Carpentera & Springer, 2005),而且具有在跨国尺度上进行综合管理和相互合作需要的迫切性(Bellwood & Hughes, 2001)。我国在西太平洋区域开展海洋生物种类多样性的研究工作主要集中于中国海域,《中国海洋生物种类与分布》(黄宗国,1994)、《中国海洋生物种类与分布(增订版)》(黄宗国,2008)、《中国海洋生物名录》(刘瑞玉,2008)和《中国海洋生物种类与图集》(黄宗国和林茂,2011)等专著对我国海洋生物的种类进行了全面系统的总结。然而,在我国管辖海域以外的西太平洋洋区,尚未开展较为全面的海洋生物种类多样性文献资料收集整理和调查研究。发现新的生物种类,评估和保护海洋生物的多样性,研究气候变化和人类活动对海洋生态系统的影响,都需要有海洋生物的物种多样性的基础知识的支持。本文在分类研究和编目的基础上,对西太平洋浮游动物主要类群的种类多样性进行分析探讨,以期为今后更加深入地研究西北太平洋海洋生物种类组成、分布、起源、扩散、区系和地理学特点提供科学依据和参考。

1 研究范围

研究海域(106° – 150° E, 0° – 44° N)东西横跨经度约为 40° ,南北纵跨纬度约为 44° ,南达赤道线北部海区,北至白令海南端,在中国台湾岛东部海域、印度尼西亚、菲律宾、日本和韩国近海均有采样站位设置。

2 研究方法

组织浮游动物各类群分类学家对“国际黑潮十年联合调查(CSK)”(1965–1975年)、“中太平洋西部调查”(1978–1980年)、“中日副热带环流合作调查研究”(1995–1997年)、“南海中部海域环境资源综合调查”(1980–1982年)、“908专项”(2005–2009年)和相关

海区的调查所获的浮游动物样品进行鉴定,并分析数据;研究区浮游动物主要类群的系统分类工作参考《中国海洋生物种类与分布》(黄宗国,1994)、《中国海洋生物种类与分布(增订版)》(黄宗国,2008)、《中国海洋生物名录》(刘瑞玉,2008)、《中国海洋生物种类与图集》(黄宗国和林茂,2011)和“中国海及邻近西北太平洋海洋生物物种编目和分布图集研究报告”(2010)和相关文献资料(Kramp, 1959, 1961, 1968; Pousen, 1962, 1965, 1969, 1973; Totton, 1965; 张福绥, 1965, 1966; Park, 1968; Alvarino, 1971; 张金标, 1979; 张金标和许振祖, 1980; 陈瑞祥, 1982a, b; 陈柏云, 1982, 1985; 陈清潮等, 1983; 章淑珍和陈清潮, 1984; Ohtsuka, 1984, 1985, 1992; Bouillon *et al.*, 1986, 2006; Ohtsuka & Hiromi, 1987; 林茂, 1988, 1992; 林玉辉和连光山, 1988; 蔡秉及, 1989; 林茂和张金标, 1989, 1993; 戴燕玉, 1989, 1995, 1996, 2006; 孟凡等, 1990; 李钦亮和孟凡, 1990; 刘红斌等, 1990; 王春生, 1991; 张谷贤和陈清潮, 1991; 马兆党和宋庆云, 1992; 马兆党和孟凡, 1992, 1993; 李钦亮, 1992, 1993; 陈瑞祥和林景宏, 1993; Wong *et al.*, 1993; 林景宏和陈瑞祥, 1994; 邱书院, 1996; Mitsuo & Masaaki, 1997; 张金标和林茂, 1997; Randall, 1998; 杨关铭等, 1999; 戴燕玉等, 2000; 陈瑞祥等, 2000; 林景宏等, 2000; 黄凤鹏等, 2000; Kubota, 2003; 张金标等, 2003; 陈亚瞿等, 2003; 李纯厚等, 2004; 徐兆礼等, 2004, 2006a,b; Hsiao *et al.*, 2004; 徐兆礼, 2005a,b; 徐兆礼和张凤英, 2006; Yin, 2006; Lin & Lin, 2006; Kubota & Gravili, 2007; 徐兆礼和林茂, 2007; 胡剑等, 2008; 许振祖等, 2011),参照公认适用的海洋生物种类鉴定成果,甄别并删除可能同种异名和异种同名现象,确定种类学名和中文名,形成种类编目清单,分析西太平洋浮游动物主要类群的种类组成和多样性。

3 结果

记录和编入西太平洋10个主要浮游动物类群2,658种(含亚种),隶属于206科675属,其中水母类

林茂,王春光,王彦国,项鹏,王雨(2010)我国及邻近西北太平洋海洋生物分布图集编制研究报告.国家海洋局第三海洋研究所.

许振祖,黄加祺,林茂,郭东晖,王春光(2011)中国近海水螅虫总纲生态动物地理学研究.海峡两岸海洋生物多样性研讨会文集(待刊).

99科251属697种，栉水母类12科22属59种，浮游软体动物14科35属86种，介形类8科89属416种，桡足类51科156属908种，糠虾类4科58属202种，磷虾类2科8属56种，十足类8科22属105种，毛颚类5科8属48种和被囊类5科26属81种。

3.1 水母类(水螅水母类、立方水母类、十字水母类和钵水母类)

西太平洋区共记录水母类5纲99科251属697种，占所有记录种类数的26.2%。其中，育水母纲的筐水母亚纲4科10属20种，硬水母亚纲4科16属25种；水螅水母纲的花水母亚纲31科87属280种、兰卡水母亚纲1科3属3种，软水母亚纲16科39属161种，淡水水母亚纲1科7属9种，管水母亚纲15科40属99种；立方水母纲4科4属8种；十字水母纲3科5属10种；钵水母纲18科38属83种。主要种为：半口壮丽水母(*Aglaura hemistoma*)、宽膜棍手水母(*Rhopalonema velatum*)、爪室水母(*Chelophyes appendiculata*)、扭歪爪室水母(*C. contorta*)、尖角水母(*Eudoxoides mitra*)、方拟多面水母(*Abylopsis tetragona*)、小拟多面水母(*A. eschscholtzii*)、巴斯水母(*Bassia bassensis*)、大西洋五角水母(*Muggiaeae atlantica*)和拟细浅室水母(*Lensia subtiloides*)。

3.2 栒水母类

西太平洋区共记录栉水母类2纲7目12科22属59种，其中有触手纲6目(球栉水母目、美光水母目、兜水母目、带水母目、稳叶水母目和扁栉水母目)11科21属53种；无触手纲1目(瓜水母目)1科1属6种。主要种为：球型侧腕水母(*Pleurobrachia globosa*)和瓜水母(*Beroe cucumis*)。

3.3 浮游软体动物(异足类和翼足类)

西太平洋区浮游软体动物共记录3目14科35属86种，其中，原始腹足目4科9属30种，被壳目5科17属42种，裸体目5科9属14种。主要种为：强捲螺(*Agdina stimpsoni*)、明螺(*Atlanta peroni*)、蝴蝶螺(*Desmopterus papilio*)、玻杯螺(*Hyalocyliz striata*)、长吻龟螺(*Cavolinia longirostris*)、胖虎螺(*Linacima inflata*)、马蹄虎螺(*L. trochiformis*)、棒笔帽螺(*Creseis clava*)、尖笔帽螺(*C. acicula*)、芽笔帽螺(*C. virgula*)、拟翼管螺(*Firoloidea desmaresti*)和拟海若螺(*Paraclione longicaudata*)。

3.4 介形类

西太平洋区浮游介形类共记录1目2亚目8科89

属416种，占该海区所记录浮游动物总种类数的15.7%。其中海萤亚目4科59属242种；吸海萤亚目4科30属174种。主要种为：条纹始浮萤(*Archiconchoecia striata*)、肥胖吸海萤(*Halocypris brevirostris*)、圆形后浮萤(*Metaconchoecia rotundata*)、短形小浮萤(*M. curia*)、长拟浮萤(*Paraconchoecia oblonga*)、葱萤(*Porroecia porrecta*)、刺喙葱萤(*P. spinirostri*)和后圆真浮萤(*Euconchoecia maimai*)。

3.5 桡足类

西太平洋区浮游桡足类共记录7目51科156属908种，占该研究海区所记录浮游动物总种类数的34.2%。其中，哲水蚤目34科124属741种，隐水蚤目1科3属4种，剑水蚤目3科10属42种，奇水蚤目1科1属2种，猛水蚤目4科5属7种，歧口水蚤目7科15属101种，怪水蚤目1科2属18种。主要种为：奇桨剑水蚤(*Copilia mirabilis*)、狭额真哲水蚤(*Eucalanus subtenius*)、亚强次真哲水蚤(*Subeucalanus subcrassus*)、强次真哲水蚤(*S. crassus*)、帽形次真哲水蚤(*S. pileatus*)、小哲水蚤(*Nannocalanus minor*)、驼背隆哲水蚤(*Acrocalanus gibber*)、微刺哲水蚤(*Canthocalanus pauper*)、海洋真刺水蚤(*Euchaeta marina*)、平滑真刺水蚤(*E. plana*)、精致真刺水蚤(*E. concinna*)、长角海羽水蚤(*Haloptilus longicornis*)、丹氏厚壳水蚤(*Scolecithrix danae*)、缘齿厚壳水蚤(*S. nicobarica*)、长刺小厚壳水蚤(*Scolecithricella longispinosa*)、锥形宽水蚤(*Temora turbinata*)、异尾宽水蚤(*T. discaudata*)、丽隆水蚤(*Oncaeae venusta*)、瘦乳点水蚤(*Pleuromamma gracilis*)、拟长腹剑水蚤(*Oithona similis*)、小拟哲水蚤(*Paracalanus parvus*)、近缘大眼水蚤(*Corycaeus affinis*)、达氏宇哲水蚤(*Cosmocalanus darwini*)和中华哲水蚤(*Calanus sinicus*)。

3.6 糠虾类

西太平洋区共记录糠虾类4科58属202种，其中，疣背糠虾科3属10种，柄糠虾科1属3种，瓣眼糠虾科1属2种，糠虾科53属187种。主要种为：太平洋疣背糠虾(*Lophogaster pacificus*)、光背糠虾(*Paralophogaster glaber*)、东方原糠虾(*Promysis orientalis*)、园缺刻囊糠虾(*Gastrosaccus hibii*)、漂浮囊糠虾(*G. pelagicus*)、宽尾刺糠虾(*Acanthomysis laticauda*)、美丽拟节糠虾(*Hemisiriella pulchra*)、单节古糠虾(*Archaeomysis kokuboi*)、小红糠虾(*Erythrops*

minuta)、光臂拟双眼糠虾(*Euchaetomeropsis mero-lepis*)、汤氏节糠虾(*Siriella thompsoni*)和中华节糠虾(*S. sinensis*)。

3.7 磷虾类

磷虾类在西太平洋区共记录2科8属56种, 其中, 深磷虾科1属1种, 磷虾科7属55种。主要种为: 隆柱螯磷虾(*Stylocheron carinatum*)、近缘柱螯磷虾(*S. affine*)、柔嫩磷虾(*Euphausia tenera*)、小型磷虾(*E. nana*)、中华假磷虾(*Pseudeuphausia sinica*)、宽额假磷虾(*P. latifrons*)、太平洋磷虾(*Euphausia pacifica*)和三刺燧足磷虾(*Thysanopoda tricuspidata*)。

3.8 十足类

西太平洋区共记录十足类8科22属105种, 其中, 莹虾科1属9种, 樱虾科3属31种, 深对虾科2属10种, 对虾科1属2种, 玻璃虾科11属48种, 长额虾科2属2种, 小海虾科1属2种, 笛虾科1属1种。主要种为: 中型莹虾(*Lucifer intermedius*)、正型莹虾(*L. typus*)、刷状莹虾(*L. penicillifer*)和东方莹虾(*L. orientalis*)。

3.9 毛颚类

西太平洋区毛颚类仅记录了1纲1目5科8属48种, 其中: 铲虫科4属6种, 真虫科1属6种, 箭虫科1属33种, 镊虫科1属2种, 翼箭虫科1属1种。主要种为: 飞龙翼箭虫(*Pterosagitta draco*)、肥胖箭虫(*Sagitta enflata*)、百陶箭虫(*S. bedoti*)、太平洋箭虫(*S. pacifica*)、微型箭虫(*S. minima*)和拿卡箭虫(*S. nagae*)。

3.10 被囊类

西太平洋区被囊类共记录了2纲5科26属81种, 其中, 有尾纲2科11属35种, 海樽纲3科15属46种。主要种为: 小齿海樽(*Doliolum denticulatum*)、软拟海樽(*Dolioletta gegenbauri*)、双尾纽鳃樽(*Thalia democratica*)、双尾纽鳃樽东方亚种(*T. democratica orientalis*)、长尾住囊虫(*Oikopleura longicauda*)、异体住囊虫(*O. dioica*)和红住囊虫(*O. rufencens*)。

4 讨论

本文收录西太平洋区浮游动物类群2,658种(含亚种), 较以往我国所记录的1,852种多806种, 多了43.5%(黄宗国, 1994, 2008; 刘瑞玉, 2008; 黄宗国和林茂, 2011)。各种区系成分物种的增加是本文收

录物种增多的原因。在地理分布上, 分布于菲律宾、新几内亚、澳大利亚、马来群岛和斐济群岛等的物种, 如: 水母类的太平洋美螅水母(*Clytia pacifica*)、嵌合鞭棍水母(*Catostylus mosaicus*)、汤申鞭棍水母(*C. townsendi*)、巴尔克朗水母(*Crambione bartschi*)、鞭状克朗水母(*C. mastigophora*), 介形类的母弯喉萤(*Vargula matrix*)、假勇敢喜萤(*Philomedes pseudodothousae*)、扇喜萤(*P. ptyx*)、锯齿弯喉萤(*Vargula dentata*)、逃弯喉萤(*V. fugax*)和六弯喉萤(*V. hex*); 分布于日本、俄罗斯远东和白令海的物种, 如: 水母类的加迪美螅水母(*C. gardineri*), 浮游软体动物的日本龙骨螺(*Carinara japonica*)、软长角螺(*Clione limacina*)、美丽小角螺(*Paedoclione doliformis*)、十字鳃螺(*Crrucibranchae macrochira*), 介形类的小豌豆弯喉萤(*Vargula puppis*)、正规弯喉萤(*V. norvegica*)、东方正规弯喉萤(*V. norvegica orientalis*)、夜光海萤(*Cypridina noctiluca*)、麦氏喜萤(*Philomedes macandrei*)、多齿喜萤(*P. multidentata*)、箭喜萤(*P. sagittata*)、亚弓喜萤(*P. subarcuata*), 糠虾类的小尾小糠虾(*Mysidella nana*)、米染和糠虾(*Nipponomysis misakiensis*)、小型和糠虾(*N. ling-vura*)、窄细和糠虾(*N. tenuiculus*)、多节和糠虾(*N. toriumii*)、线形和糠虾(*N. takitai*)、奇异和糠虾(*N. imparis*), 桡足类的太平洋刺额水蚤(*Bradyidius pacificus*)、长伪哲水蚤(*Pseudocalanus elongatus*)、新氏伪哲水蚤(*P. newmani*)、千岛黄水蚤(*Xanthocalanus kurilensis*), 磷虾类的多眼臂磷虾(*Tessuarachion oculatus*), 十足类的细囊膜虾(*Hymenodora gracilis*)、圆状铲虫(*Spadella cephalopter*)、角状铲虫(*S. angulata*)、粗壮副铲虫(*Paraspadella gotoi*)、深层锄虫(*Heterokrohnia bathybria*)、大头住囊虫(*Sinisteroffia magnum*)、凶形纽鳃樽(*Cyclosalpa foxtoni*); 栖息于深海的物种, 如: 水母类的拟泳塔水母(*Nectodamas diomedae*)、波泳塔水母(*Nectopyramis thetis*)、浮泳塔水母(*N. natans*)、刺泳塔水母(*N. spinosa*), 桡足类的太平洋鹰嘴水蚤(*Aetideus pacificus*)、太平洋光水蚤(*Lucicutia pacifica*)、灾难琉哲水蚤(*Ryocalanus infelix*)、深海拟真刺水蚤(*Paraeuchaeta abyssalis*)、宽新异肢水蚤(*Neorhabdus latus*), 糠虾类的纤细颚糠虾(*Gnathophausia gracilis*)、长足颚糠虾(*G. longispina*)、刺尾柄糠虾(*Eucopia sculpticauda*)、异柄糠

虾(*E. grimaldii*)、磷虾类的北方深居虾(*Benthophilus borealis*)、十足类的大玻璃虾(*Pasiphaea amplidens*)、慢玻璃虾(*P. tarda*)、祈福扁虾(*Ephyrina benedicti*)、肩状扁虾(*E. ombango*)、微细异虾(*Heterogenys microphthalmus*)、棘尾膜虾(*Hymenodora acanthitelsonis*)、额膜虾(*H. frontalis*)、多孔膜虾(*Meningodora compsa*)、毛颚类的无齿深铲虫(*Bathyspadella edentata*)、被囊类的巨冠住囊虫(*Sinisteroffia scrippsi*)等。我国学者尚未对这些种类在西太平洋的分布进行分析研究。

表1是世界、西太平洋和中国海域所记录的浮游动物主要类群及其物种数的统计数据,总结和比较结果如下:西太平洋浮游动物主要类群的种类组成上,水母类697种,比以往我国学者所收录的多190种,多了37.5%;栉水母类59种,多45种,多了321.4%;浮游软体动物86种,多23种,多了36.5%;介形类416种,多183种,多了78.5%;桡足类908种,多181种,多了24.9%;糠虾类202种,多92种,多了83.6%;磷虾类56种,多7种,多了14.2%;十足类105种,多59种,多了128.3%;毛颚类48种,多7种,多了17.0%;被囊类81种,多19种,多了30.6%。

西太平洋浮游动物主要类群种数与世界浮游动物主要类群种数的比率在28.9%和65.6%之间,表明了西太平洋浮游动物种类的丰富与多样性,其中:栉水母类、磷虾类、浮游软体动物和被囊类比

率都在60%以上,分别为65.6%、65.1%、62.3%和60.4%;水母类和毛颚类分别为59.1%和51.6%,桡足类的比率为45.4%,糠虾类的比率为28.9%。

4 研究展望

西太平洋海域辽阔,为海洋生物提供了不同的栖息生境,并有相应性质的物种和区系,但目前区域内海洋浮游动物多样性的调查研究还缺乏系统的规划。展望未来,开展不同生境和类群的海洋浮游动物多样性调查研究和交流合作仍是今后开展区域内海洋生物多样性保护的首要工作基础。

(1)跨国和跨地区的合作。总结并列出已知种类的清单是生物多样性保护不可缺少的核心内容,是推动生物多样性研究和保护的工作基础,但海洋生物的分布多超过一个国家的管辖范围,目前的种类多样性研究仅局限于某一国家或地区,因此开展跨国跨地区的合作是满足生物多样性研究、保护和科学、可持续利用的需要。

(2)不同尺度的调查研究。浮游动物种类多样性体现在研究海域的差异性,就西太平洋区域范围而言,我们的工作也才刚起步,对西太平洋浮游动物种类多样性的了解和认识,我们要关注区域大尺度上的调查研究,掌握种类多样性现状和变化规律,同时也要关注区域内研究还不深入的类群和地区的种类多样性,总之,目前我们对西太平洋范围的

表1 世界、西太平洋和中国浮游动物主要类群及其种数

Table 1 Number of described species of major marine zooplankton groups in the world, western Pacific and China seas

类群(门、纲或目) Group (Phylum, Class or Order)	世界 World	西太平洋 western Pacific	中国海域 China seas
水母类 (水螅水母类、立方水母类、十字水母类和钵水母类) Medusozoa (Hydromedusae, Cubozoa, Staurozoa and Scyphozoa)	1,187	697	507
栉水母类 Ctenophora	90	59	14
浮游软体动物(翼足类、异足类) Pelagic molluscs (Pteropoda and Heteropoda)	138	86	63
介形类 Ostracoda	/	416	233
桡足类 Copepoda	2,000	908	727
糠虾类 Mysidacea	700	202	110
磷虾类 Euphausiacea	86	56	49
十足类 Decapoda	/	105	46
毛颚类 Chaetognatha	93	48	41
被囊类 Tunicata	134	81	62
总计 Total	/	2,658	1,852

/ 表示数据待确定

/ Listed in work but number undetermined

浮游生物多样性调查研究还缺乏系统规划,需要加强不同时空尺度的调查研究,才能获得有关浮游动物多样性和海洋环境关系之间更有科学价值的信息,探索种类多样性与环境之间的相关性。

(3)分类和多样性基础研究。加强对研究不足或空白类群的研究,重视种阶元以上不同分类类群为对象的分类多样性(taxonomic diversity)的比较,客观地揭示更多的种类多样性信息,在此基础上开展基于数理统计和模型的浮游动物种类多样性研究,以了解和预测浮游动物多样性未来可能的变化,促进浮游动物多样性的应用研究,推动浮游动物种类多样性研究向更深、更广的领域拓展。

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附录I 西太平洋区浮游动物主要类群的种类

Appendix I Summary of major groups of zooplankton, with numbers of families, genera and species in western Pacific region

<http://www.biodiversity-science.net/fileup/PDF/w2011-178-1.pdf>