

Table S1. List of 109 Brachyuran species and two outgroups used in this paper.

Species	Family	Length(bp)	Accession no.
<i>Chionoecetes pacificus</i>	Oregoniidae	15,341	AB735678
<i>Maja crispata</i>	Majidae	16,592	NC_035424
<i>Maja squinado</i>	Majidae	16,598	NC_035425
<i>Maguimithrax spinosissimus</i>	Mithracidae	15,817	NC_025518
<i>Chaceon</i> sp.	Geryonidae	16,126	KU507298
<i>Chaceon granulatus</i>	Geryonidae	16,135	NC_023476
<i>Ovalipes punctatus</i>	Ovalipidae	16,084	NC_042695
<i>Portunus trituberculatus</i>	Portunidae	16,026	NC_005037
<i>Portunus pelagicus</i>	Portunidae	16,157	NC_026209
<i>Portunus sanguinolentus</i>	Portunidae	16,024	NC_028225
<i>Callinectes sapidus</i>	Portunidae	16,263	NC_006281
<i>Charybdis japonica</i>	Portunidae	15,738	NC_013246
<i>Charybdis natator</i>	Portunidae	15,664	NC_036132
<i>Charybdis feriata</i>	Portunidae	15,660	NC_024632
<i>Charybdis bimaculata</i>	Portunidae	15,714	NC_037695
<i>Thalamita sima</i>	Portunidae	15,831	NC_039640
<i>Thalamita crenata</i>	Portunidae	15,787	NC_024438
<i>Scylla serrata</i>	Portunidae	15,775	NC_012565
<i>Scylla tranquebarica</i>	Portunidae	15,833	NC_012567
<i>Scylla paramamosai</i>	Portunidae	15,825	NC_012572
<i>Scylla olivace</i>	Portunidae	15,723	NC_012569
<i>Portunus gracilimanus</i>	Portunidae	15,990	NC_040124
<i>Monomia gladiator</i>	Portunidae	15,878	NC_037173
<i>Ashtoret lunaris</i>	Matutidae	15,807	NC_024435
<i>Matuta planipes</i>	Matutidae	15,760	NC_039351
<i>Pyrhila pisum</i>	Leucosiidae	15,516	NC_030047
<i>Pseudocarcinus gigas</i>	Menippidae	15,515	NC_006891
<i>Myomenippe fornasinii</i>	Menippidae	15,658	NC_024437
<i>Gandalfus yunohana</i>	Bythograeidae	15,567	NC_013713
<i>Gandalfus puia</i>	Bythograeidae	15,548	NC_027414
<i>Austinograea rodriguezensis</i>	Bythograeidae	15,611	NC_020312
<i>Austinograea alayseae</i>	Bythograeidae	15,620	NC_020314
<i>Segonzacia mesatlantica</i>	Bythograeidae	15,521	NC_035300
<i>Epixanthus frontalis</i>	Oziidae	15,993	NC_039110
<i>Leptodius sanguineus</i>	Xanthidae	15,480	NC_029726
<i>Atergatis integerrimus</i>	Xanthidae	15,924	NC_037172
<i>Atergatis floridus</i>	Xanthidae	16,180	NC_037201
<i>Etisus anaglyptus</i>	Xanthida	16,435	NC_042208
<i>Pilumnus vespertilio</i>	Pilumnidae	16,222	NC_039108
<i>Echinoecus nipponicus</i>	Pilumnidae	16,173	NC_039618

<i>Orithya sinica</i>	Orithyiidae	15,568	NC_039639
<i>Tubuca arcuata</i>	Ocypodidae	15,955	KX911977
<i>Tubuca paradussumieri</i>	Ocypodidae	15,614	MN072633
<i>Tubuca capricornis</i>	Ocypodidae	15,629	NC_039107
<i>Tubuca polita</i>	Ocypodidae	15,672	NC_039106
<i>Tubuca rosea</i>	Ocypodidae	15,643	MN072632
<i>Gelasimus borealis</i>	Ocypodidae	15,659	NC_038177
<i>Cranuca inversa</i>	Ocypodidae	15,677	NC_039111
<i>Austruca lactea</i>	Ocypodidae	15,659	NC_042401
<i>Ocypode ceratophthalmus</i>	Ocypodidae	15,564	NC_025324
<i>Ocypode cordimanus</i>	Ocypodidae	15,604	NC_029725
<i>Xenograpsus testudinatus</i>	Xenograpsidae	15,798	NC_013480
<i>Xenograpsus ngatama</i>	Xenograpsidae	16,106	NC_035951
<i>Chiromantes neglectum</i>	Sesarmidae	15,920	NC_031851
<i>Chiromantes dehaani</i>	Sesarmidae	15,917	NC_041212
<i>Chiromantes haematocheir</i>	Sesarmidae	15,899	NC_042142
<i>Metopaulias depressus</i>	Sesarmidae	15,765	NC_030535
<i>Clistocoeloma sinense</i>	Sesarmidae	15,706	NC_033866
<i>Episesarma lafondii</i>	Sesarmidae	15,640	MT193721
<i>Parasesarma eumolpe</i>	Sesarmidae	15,646	MT193720
<i>Parasesarma affine</i>	Sesarmidae	15,638	NC_039990
<i>Nanosesarma minutum</i>	Sesarmidae	15,637	NC_040977
<i>Parasesarma tripectinis</i>	Sesarmidae	15,612	NC_030046
<i>Parasesarma pictum</i>	Sesarmidae	15,611	NC_038066
<i>Gecarcoidea natalis</i>	Gecarcinidae	15,545	NC_039811
<i>Cardisoma carnifex</i>	Gecarcinidae	15,597	NC_039105
<i>Ilyoplax deschampsii</i>	Dotillidae	15,460	NC_020040
<i>Dotilla wichmanni</i>	Dotillidae	15,600	NC_038180
<i>Pachygrapsus crassipes</i>	Grapsidae	15,652	NC_021754
<i>Pachygrapsus marmoratus</i>	Grapsidae	15,406	NC_039109
<i>Grapsus tenuicrustatus</i>	Grapsidae	15,858	NC_029724
<i>Metopograpsus quadridentatus</i>	Grapsidae	15,517	NC_038178
<i>Metopograpsus frontalis</i>	Grapsidae	15,587	NC_042152
<i>Cyclograpsus granulatus</i>	Varunidae	16,300	NC_025571
<i>Pseudohelice subquadrata</i>	Varunidae	16,898	NC_042685
<i>Helicana wuana</i>	Varunidae	16,359	NC_034995
<i>Helice latimera</i>	Varunidae	16,246	NC_033865
<i>Helice tientsinensis</i>	Varunidae	16,212	NC_030197
<i>Cyclograpsus intermedius</i>	Varunidae	16,184	NC_050045
<i>Eriocheir hepuensis</i>	Varunidae	16,335	NC_011598
<i>Eriocheir sinensis</i>	Varunidae	16,354	NC_006992
<i>Eriocheir japonica</i>	Varunidae	16,352	NC_011597

<i>Neoeriocheir leptognathus</i>	Varunidae	16,143	NC_041211
<i>Hemigrapsus penicillatus</i>	Varunidae	16,486	NC_038202
<i>Hemigrapsus sanguineus</i>	Varunidae	16,275	NC_035307
<i>Metaplax longipes</i>	Varunidae	16,305	NC_040976
<i>Varuna litterata</i>	Varunidae	16,368	MT193719
<i>Varuna yui</i>	Varunidae	15,915	NC_037155
<i>Gaetice depressus</i>	Varunidae	16,288	NC_038179
<i>Macrophthalmus darwinensis</i>	Macrophthalminae	16,348	MF457408
<i>Macrophthalmus japonicus</i>	Macrophthalmidae	16,170	NC_030048
<i>Mictyris longicarpus</i>	Mictyridae	15,548	NC_025325
<i>Potamiscus motuoensis</i>	Potamidae	17,971	KY285013
<i>Geothelphusa</i> sp.	Potamidae	18,052	MG674171
<i>Geothelphusa dehaani</i>	Potamidae	18,197	NC_007379
<i>Huananpotamon lichuanense</i>	Potamidae	15,380	NC_031406
<i>Sinopotamon xiushuiense</i>	Potamidae	18,460	NC_029226
<i>Longpotamon yangtsekiense</i>	Potamidae	17,885	NC_036946
<i>Longpotamon kenliense</i>	Potamidae	18,499	NC_044413
<i>Sinopotamon yaanense</i>	Potamidae	17,126	NC_036947
<i>Somanniathelphusa boyangensis</i>	Gecarcinucidae	17,032	NC_032044
<i>Ranina ranina</i>	Raninidae	15,557	NC_023474
<i>Umalia orientalis</i>	Raninidae	15,466	NC_026688
<i>Lyreidus brevifrons</i>	Raninidae	16,112	NC_026721
<i>Homologenus malayensis</i>	Homolidae	15,793	NC_026080
<i>Homola orientalis</i>	Homolidae	16,084	KT182071
<i>Moloha majora</i>	Homolidae	15,903	NC_029361
<i>Latreillia valida</i>	Latreilliidae	15,097	MK204361
<i>Dynomene pilumnoides</i>	Dynomenidae	16,475	KT182070
<i>Pagurus nigrofascia</i>	Paguridae	15,392	NC_042412
<i>Pagurus gracilipes</i>	Paguridae	16,051	LC222534

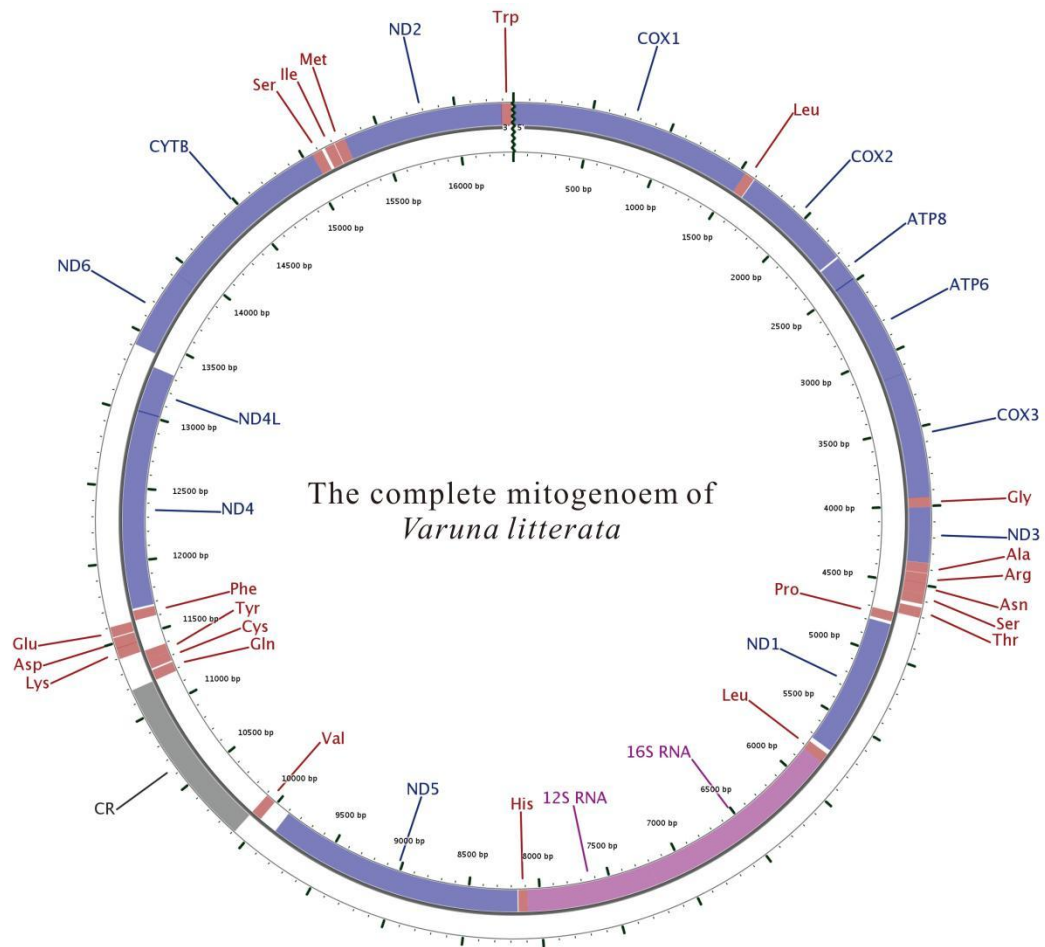


Fig. S1. Gene map of the *V. litterata* mitogenome.

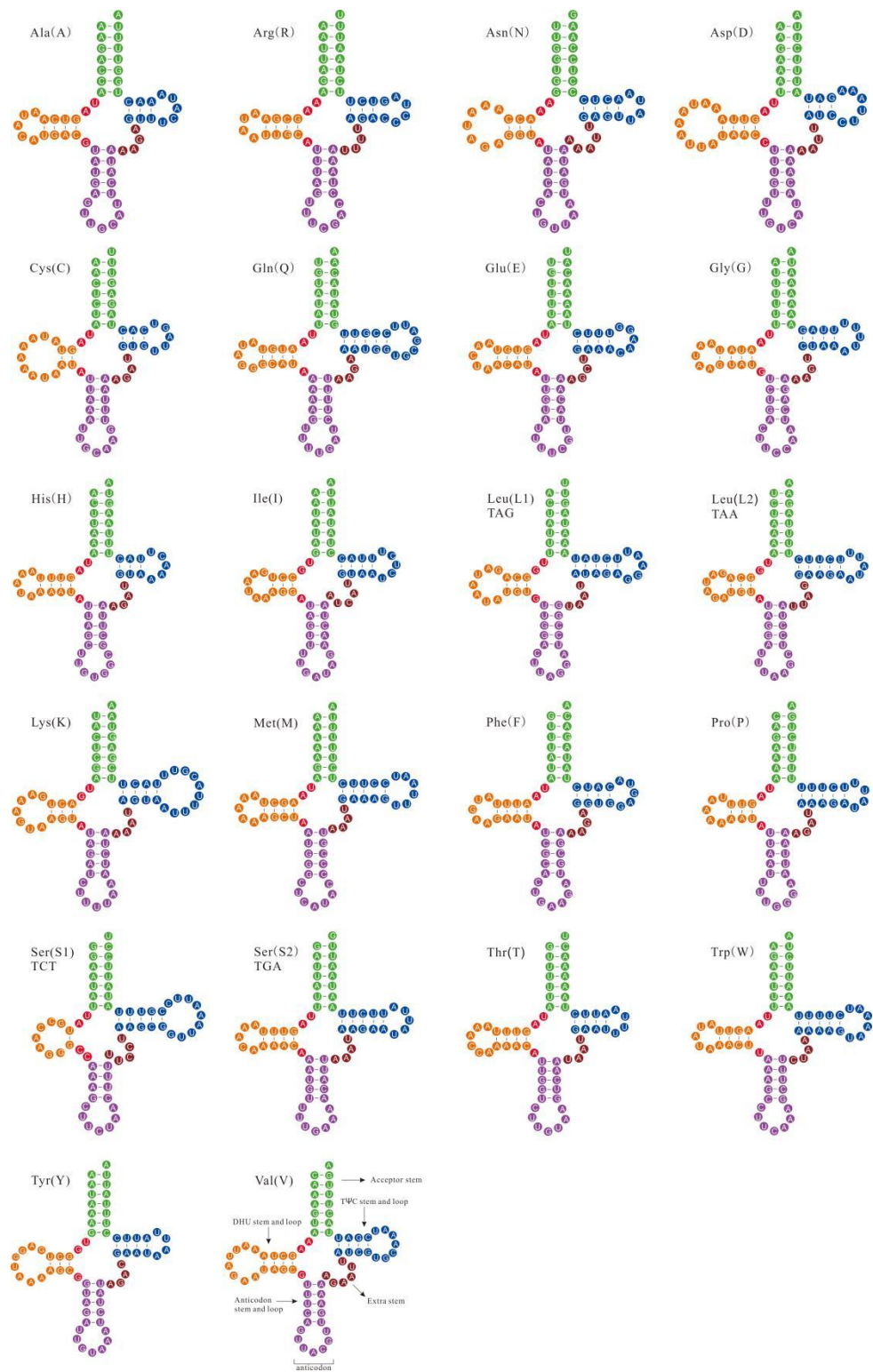


Fig. S2. Potential secondary structures of 22 inferred tRNAs in *V. litterata* mitogenome.

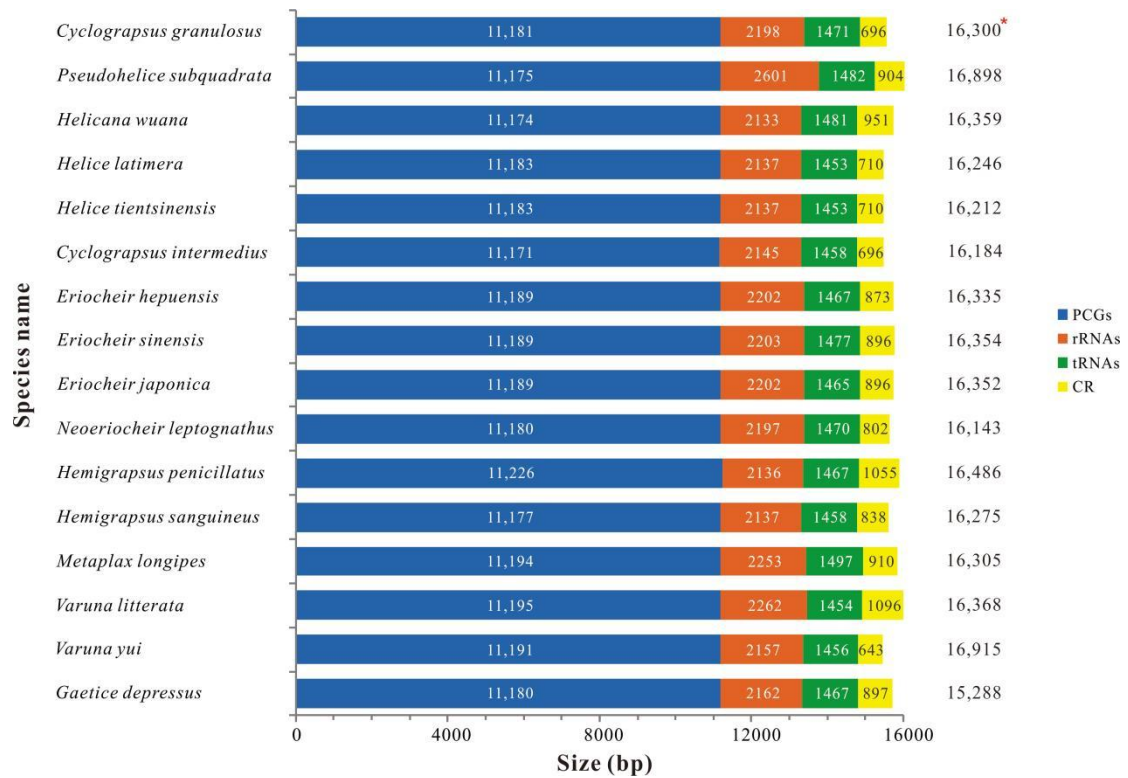


Fig. S3. The lengths of protein-coding genes (PCGs), rRNAs, tRNAs, and control regions among 16 Varunidae mitogenomes. The number marked with an asterisk indicates the total length of the mitogenome, including the intergenic spaces.

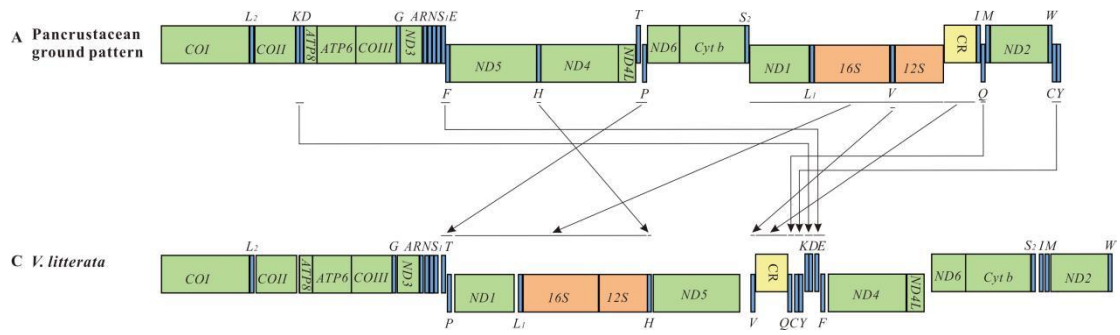


Fig. S4. Gene rearrangements in *V. litterata* mitogenome.

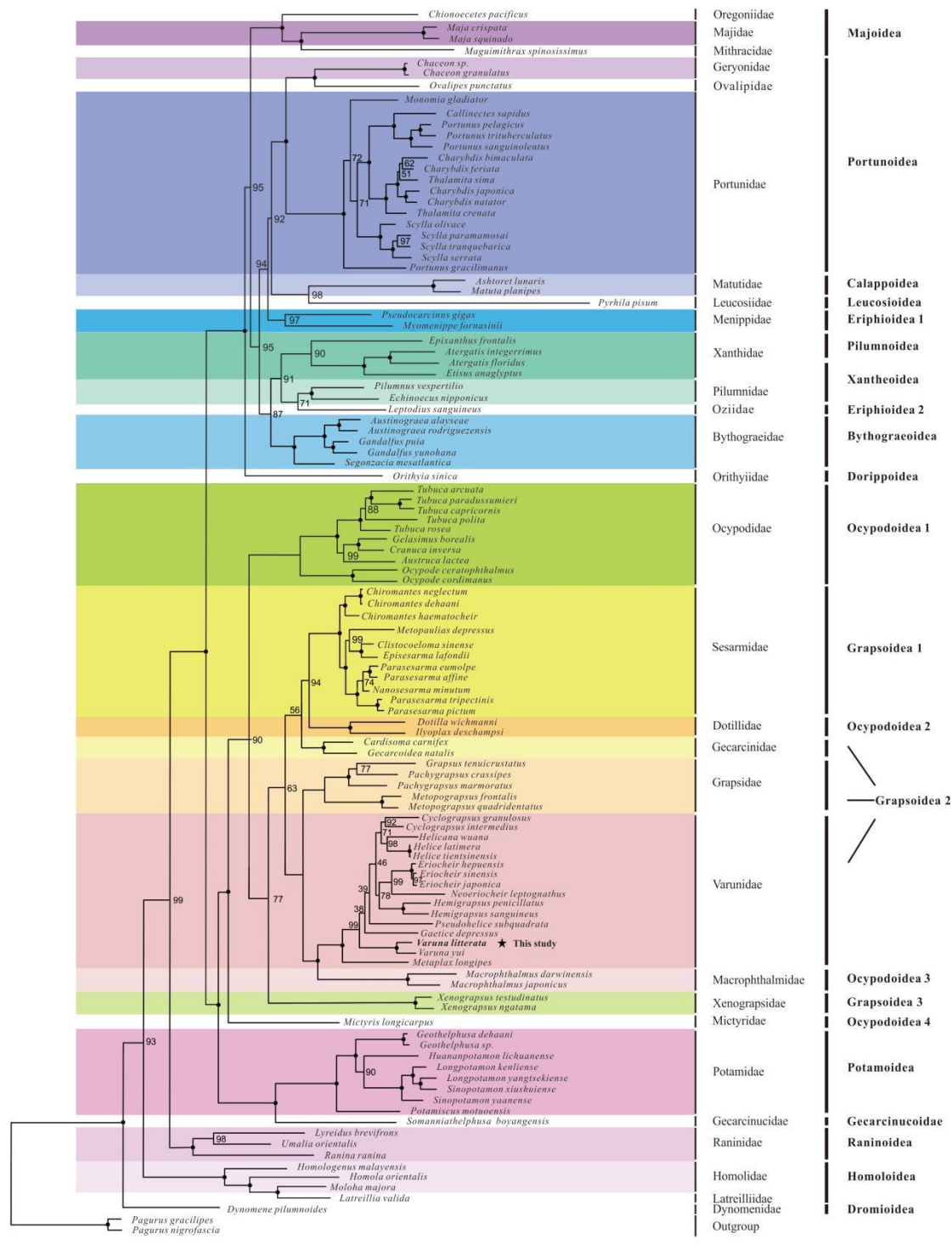


Fig. S5. Phylogenetic tree of Brachyuran species inferred from the amino acid sequences of 13 PCGs based on maximum likelihood (ML) analysis.

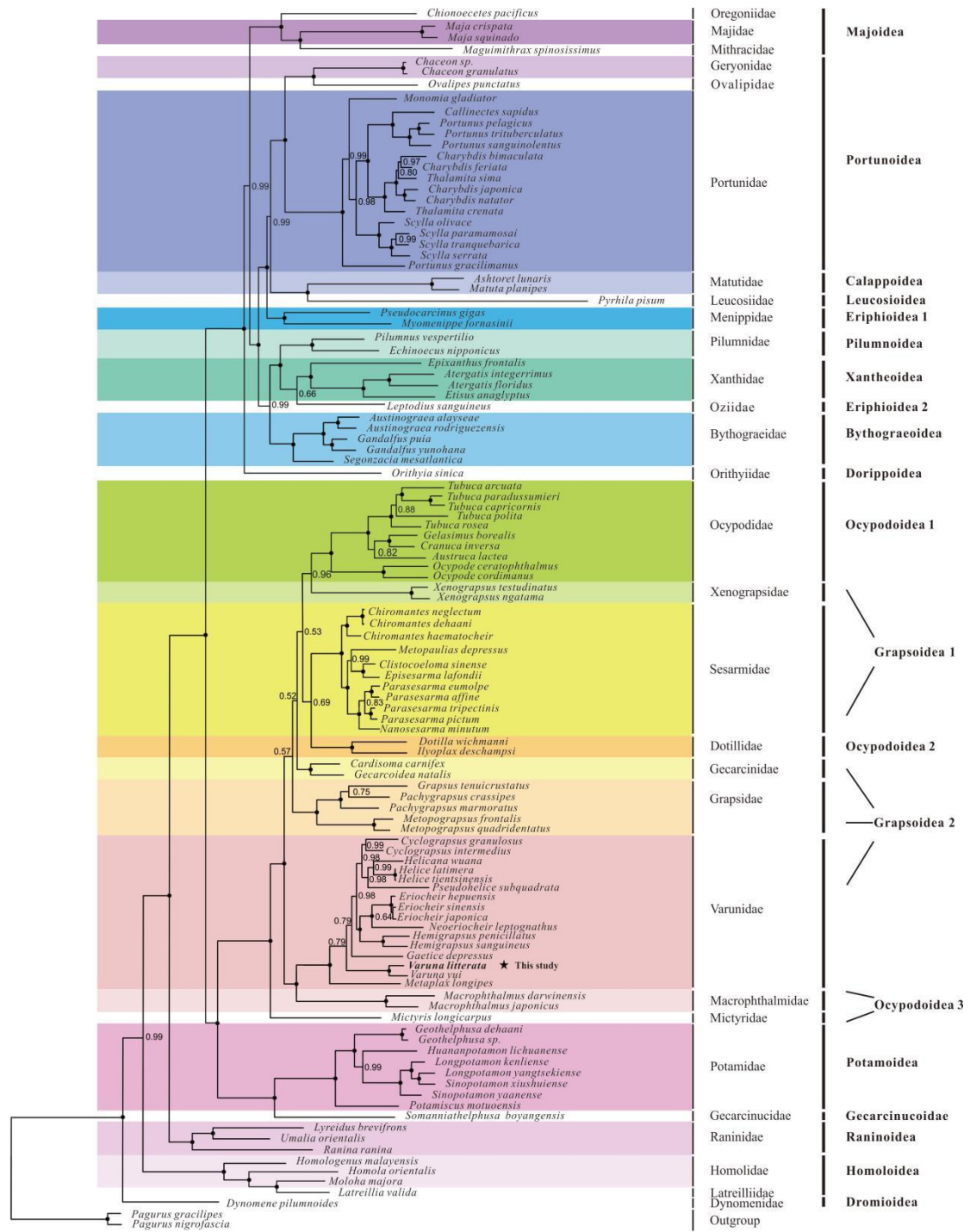


Fig. S6. Phylogenetic tree of Brachyuran species inferred from the amino acid sequences of 13 PCGs based on Bayesian inference (BI) analysis.