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Shallow water sea slugs (Gastropoda: Heterobranchia) from the northwestern coast of the Sea of Japan, north of Peter the Great Bay, Russia

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The coast of northern Primorye region, north of Peter the Great Bay has been sparsely studied in regards to its molluscan fauna, with just a few works reviewing the distribution of local mollusks. This work presents a survey of the shallow water heterobranch sea slugs currently occurring around Kievka Bay to Oprichnik Bay, Russia. Thirty-nine species of sea slugs were found in this study and the new species *Cadlina olgae* sp. nov., described herein. Most (24) of the species occurring in the area have widespread ranges in the northern Pacific Ocean. The eight species are endemic for the Sea of Japan and adjacent part of the Sea of Okhotsk. Seven other occur also in northern Atlantic and Arctic waters. Thirteen found species are not known from Peter the Great Bay but known from adjacent northern Pacific waters. The finding of a previously undescribed species emphasizes the need of further surveys, particularly in subtidal and deeper waters, in order to improve the knowledge on this neglected fauna in Primorye.

1 **Shallow water sea slugs (Gastropoda: Heterobranchia) from the northwestern coast**
2 **of the Sea of Japan, north of Peter the Great Bay, Russia**

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9 ABSTRACT

10 The coast of northern Primorye region, north of Peter the Great Bay has been sparsely
11 studied in regards to its molluscan fauna, with just a few works reviewing the distribution of
12 local mollusks. This work presents a survey of the shallow water heterobranch sea slugs
13 currently occurring around Kievka Bay to Oprichnik Bay, Russia. Thirty-eight species of sea
14 slugs were found in this study and the new species *Cadlina olgae* sp. nov., described herein.

15 Most (24) of the species occurring in the area have widespread ranges in the northern
16 Pacific Ocean. Eight species are endemic for the Sea of Japan and the adjacent part of the Sea of
17 Okhotsk. Seven others also occur in northern Atlantic and Arctic waters. Thirteen species not
18 known from Peter the Great Bay but known from adjacent northern Pacific waters. The finding
19 of a previously undescribed species emphasizes the need for further surveys, particularly in
20 subtidal and deeper waters, in order to improve the knowledge on this neglected fauna.

21 INTRODUCTION

22 The Heterobranch sea slugs of Russian Far East have been sparsely studied; the best-
23 studied area is Peter the Great Bay, the southernmost Russian shore in Asia, although the fauna
24 of this bay has not been studied until first half of the 20th century. The studies in this area
25 revealed a number of species, many of them were new for the Russian fauna, and a number of
26 new taxa were described (e.g. Volodchenko, 1941; Minichev, 1970, 1971; Minichev et al., 1971;
27 Slavoshevskaya, 1971; Martynov, 1992, 1998a, 2002, 2003; Chernyshev, 2008, 2014; Chaban &
28 Chernyshev, 2009, 2014; Chernyshev & Chaban, 2010; Martynov et al., 2015). However, the
29 coastline located north off Peter the Great Bay remains almost totally unattended by

30 malacologists besides a few new species descriptions (Vloldchenko, 1941; Martynov, 2002).
31 More recently, we have reported several new species for Sea of Japan and the Russian fauna
32 from Rudnaya and Vladimir Bays (Chichvarkhin et al., 2015; 2016a, b; Breslau et al., 2016;
33 Ekimova et al., 2016).

34 The present study provides records of sea slugs found in shallow waters (above 30 m
35 depth) between Kievka Bay (42.85°N) and Oprichnik Bay (44,45°N), Primorskiy Krai, Russia.
36 The coast of this area consists of rocky formations with sparse sandy beaches and a quite narrow
37 intertidal zone. Rocky platforms and boulder fields are common; however, some sheltered areas
38 have open sandy beaches, usually exposed to strong surf (e.g. Rudnaya, Kievka Bays). The goal
39 of this preliminary study is to contribute to the knowledge of the molluscan fauna in Russian Far
40 East, particularly providing a tool useful for identification of live animals in the field.

41 MATERIALS AND METHODS

42 The material examined was collected during the summers of 2012–2016 in several
43 locations between Kievka and Oprichnik Bays (Fig. 1) of the northwestern Sea of Japan,
44 Primorskiy Krai, Russia. All the collecting was made manually by SCUBA diving, mostly on
45 rocky walls, platforms, and the pinnacles. Four specimens of *Cadlina laevis* collected in the
46 White Sea Biological Station, Moscow University, White Sea, Russia were also examined. The
47 specimens were deposited in the collections of the Museum of A.V. Zhirmunsky Institute of
48 Marine Biology, Russian Academy of Sciences (MIMB) and Zoological Museum, Moscow State
49 University (ZMMU).

50 Field study permits were not required for this study and none of the species studied herein
51 are currently under legal protection. All the collected specimens were preserved in 95% ethanol.
52 Photography was performed with a Nikon D300 or D810 cameras with a Nikkor 105/2.8G lens
53 in appropriate Sea&Sea housings with Sea&Sea YS-D1 strobes when used underwater. All sizes
54 given are living measurements, radular features were examined after carbon coating by field
55 emission scanning electron microscope Zeiss Sigma using a ETSE detector at EHT 10 kV. Color
56 plates were composed with Adobe Photoshop software and original colors of the images were
57 not modified.

58 In order to characterize genetically and barcode the new species of *Cadlina*, DNA
59 extraction was performed using DNEasy kit (Qiagen). Folmer's universal COI (Folmer et al.,

60 1994), and 16S rRNA gene fragment primers (Palumbi, 1996) were used to amplify the region of
61 interest for three specimens of *Cadlina olgae* sp.n. and two specimens in *C. laevis*. For two
62 specimens of *Limacina helicina*, the COI fragment was amplified only. The master mix (for each
63 sample) was prepared using 34.75 mL H₂O, 5.00 mL PCR Buffer (Evrogen, Moscow), 5.00 mL
64 25 mM MgCl₂, 1.00 mL 40 mM dNTPs, 1.00 mL 10 mM primer 1, 1.00 mL primer 2, 0.25 mL 5
65 mg/mL Taq, and 1.00 mL extracted DNA. Reaction conditions were an initial denaturation for 3
66 min at 95 C, 39 cycles of 1) denaturation for 45 sec at 94°C, 2) annealing for 45 sec at 50°C, and
67 3) elongation for 2 min at 72°C, and a final elongation for 10 min at 72°C. PCR products yielding
68 bands of appropriate size (approximately 695 bp in COI, and 421 in 16S) were purified using the
69 Montage PCR Cleanup Kit (Millipore). Cleaned PCR samples were quantified using a NanoDrop
70 3000 Spectrophotometer (Thermo Scientific). Sequencing was conducted by Sanger ddNTP
71 termination method using BrightDye chemistry (Nimagen) and ABI 3500 Genetic Analyser
72 (Applied Biosystems). The sequences were assembled and edited using BioEdit (Hall, 1999).
73 BioEdit was also used to extract the consensus sequences The sequences used in this study are
74 listed in the Table 1, most of acquired from GenBank sequences were obtained by Johnson
75 (2010).

76 The electronic version of this article in Portable Document Format (PDF) will represent a
77 published work according to the International Commission on Zoological Nomenclature (ICZN),
78 and hence the new names contained in the electronic version are effectively published under that
79 Code from the electronic edition alone. This published work and the nomenclatural acts it
80 contains have been registered in ZooBank, the online registration system for the ICZN. The
81 ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information viewed
82 through any standard web browser by appending the LSID to the prefix <http://zoobank.org/>. The
83 LSID for this publication is: urn:lsid:zoobank.org:pub:02814E3B-C41F-4AA7-80B9-
84 D4DD2ED73FF2. The online version of this work is archived and available from the following
85 digital repositories: PeerJ, PubMed Central and CLOCKSS.

86 ABGD method (Puillandre et al., 2012) is based on pairwise distances, detecting the breaks
87 in the distribution referred to as the “barcode gap” (Hebert et al., 2003) without any prior species
88 hypothesis. It is commonly used for species delimitation analyses, including the latest works on
89 molluscan taxa (Jörger et al., 2012; Barco et al., 2013; Krug et al., 2013; Ekimova et al., 2015;
90 Katugin et al., 2015). The ABGD program is available at the web-site

91 <http://www.wabi.snv.jussieu.fr/public/abgd/abgdweb.html>. We analyzed COI and 16S alignments
92 using uncorrected *p*-distance. The other settings remained as default except the relative gap
93 width (X) was set to 0.9 for 16S dataset.

94 RESULTS

95 Systematics

96 Heterobranchia

97 Order Cephalaspidea P. Fischer, 1883

98 Superfamily Philinoidea Gray, 1850 (1815)

99 Family Aglajidae Pilsbry, 1895 (1847)

100 Genus *Melanochlamys* Cheeseman, 1881

101 **Type species** *Melanochlamys cylindrica* Cheeseman, 1881, by original designation.

102 1. *Melanochlamys ezoensis* (Baba, 1957) (Fig. 2A, B)

103 *Aglaja ezoensis* Baba, 1957:8-14.

104 *Aglaja nana* Steinberg & Jones, 1960.

105 *Philinopsis giglioli* – Gulbin, 1990 (part.), non Tapparone-Canefri, 1874.

106 *Melanochlamys diomedea* – Chaban & Martynov, 1998 (part.); Chaban & Martynov, 2006
107 (part.); Gulbin & Chaban, 2009; Chaban & Martynov, 2013a (part.); Martynov & Korshunova,
108 2011 (part.), Yavnov, 2012 (part.), non Bergh, 1893.

109 **Material examined.** 2 specimens, Rudnaya Bay, 2m, 10 Oct 2015, A. Chichvarkhin leg.

110 **Identification.** Body length up to 7 mm. Background grey with dotted dark pigmentation.

111 **Ecology.** Occurs on the surface of sandy bottom, partially burrowed into sand.

112 **Distribution.** Japan, Korea, Russia (Primorye) (Martynov & Korshunova, 2011; Cooke et
113 al., 2014).

114 2. *Melanochlamys chabanae* Breslau, Valdés & Chichvarkhin, 2016 (Fig. 2C, D)

115 Breslau, Valdes & Chichvarkhin, 2016.

116 ? *Melanochlamys diomedea* – Yavnov, 2012 (part.), non Bergh, 1893.

117 **Material examined.** 7 specimens, Vladimir Bay, May 2014, 1-8m, K. Dudka leg.

118 **Identification.** Superficially quite similar to sympatric *M. ezoensis* but adult individuals of
119 *M. chabanae* approaching 14 mm body length are 3-4 times larger. These species also possess
120 distinctive male reproductive system morphology (long penis, seminal bulb of approximately
121 same size as the prostate) and DNA sequences (Breslau et al. 2016).

122 **Ecology.** Occurs on the surface of sand bottom, partially immersed into sand mass.
123 Probably feeds on sand-dwelling mollusks.

124 **Distribution.** Known from Vladimir Bay and South Korea. May occur in the continental
125 shore of the Sea of Japan (Breslau et al., 2016).

126 **Superfamily Bulloidea Gray, 1827**

127 **Family Retusidae Thiele, 1925**

128 **Genus *Retusa* T. Brown, 1827**

129 **Type species** *Bulla obtusa* Montagu, 1803, by subsequent designation.

130 **3. *Retusa minima*** Yamakawa, 1911 (Fig. 2E, F)

131 Yamakawa, 1911:47, pl, 11, figs. 21-24.

132 *Coleophysis (Sulcoretusa) minima* Habe, 1964; Kuroda et al., 1971; Ito et al., 1986; Ito,
133 1990; Ishii, 199.

134 *Retusa (Sulcoretusa) minima* Ito, 1978.

135 *Sulcoretusa minima* Higo, Goto, 1993; Higo et al., 1999; Noseworthy et al., 2007.

136 *Cylichnina pertenuis* – Golikov & Scarlato, 1967 (part.), non Smith, 1875.

137 *Retusa (Cylichnina) succincta* – Minichev, 1971 (part.), non A. Adams, 1862.

138 *Tornatina truncata* – A. Adams, 1862; Kuroda & Habe, 1954, non *Bulla truncata* J.
139 Adams, 1800.

140 **Material examined.** 2 specimens, Kievka Bay, 2 m, 1 Jul 2015, A. Chichvarkhin leg.

141 **Identification.** Shell-bearing mollusk. Differs from other similar Cephalaspidea with
142 cylindrical shell shape and fine radial sculpture.

143 **Ecology.** Occurs on the surface of sand bottom, partially burrowed into sand.

144 **Distribution.** Previously known in Russia from Peter the Great Bay, also from Japan and
145 Korea (Chaban, Chernyshev, 2009; Martynov, Korshunova, 2011).

146 **Order Thecosomata Blainville, 1824**

147 **Superfamily Limacinoidea Gray, 1840**

148 **Family Limacinidae Gray, 1840**

149 **Genus *Limacina* Bosc, 1817**

150 **Type species** *Clio helicina* Phipps, 1774, by monotypy.

151 **4. *Limacina helicina ochotensis* Shkoldina, 1999** (Fig. 2G)

152 Shkoldina, 1999:299-305, figs. 2-3.

153 **Material examined.** 6 specimens, Senkina Shapka pinnacle, 5m, 5 May 2013, A.

154 Chichvarkhin & A. Semenov leg.

155 **Identification.** Quite distinctive shelled planktonic species. Shell size ranges <1 to 8 mm.

156 **Ecology.** These planktonic mollusks appear in Spring and completely disappear at the end
157 of May. Occur at the depths of 1-8 m at various sites. Rather rare. In summer time migrate to the
158 lower depth. Feed on planktonic Diatoms collected with bubble-like mucous veil.

159 **Distribution.** This subspecies is known from southern Sea of Okhotsk and Primorye shore
160 including Peter the Great Bay where reported very abundant at low depths in spring (Shkoldina,
161 1999a, b).

162 **Remark.** No polymorphism was detected in COI gene sequences of *L. helicina* from NW
163 Sea of Japan is similar to those from N. Atlantic, N. Pacific, and Arctic: maximum p-distance
164 between studied sequences (Table 1) of this species does not exceed 0.011 ± 0.004 . This suggests
165 identity of all these populations to a single species *L. helicina*.

166 **Order Gymnosomata Blainville, 1824**

167 **Superfamily Clionoidea Rafinesque, 1815**

168 **Family Clionidae Rafinesque, 1815**

169 **Genus *Clione* Pallas, 1774**

170 **Type species** *Clio limacina* Phipps, 1774, by monotypy.

171 **5. *Clione limacina* (Phipps, 1774)** (Fig. 2H)

172 *Clione limacina* Phipps, 1774:195-196.

173 *Clione dalli* Krause, 1855.

174 *Clione elegantissima*, Dall, 1871.

175 **Material examined.** 1 specimen, Klokovo Bay, 4m, 11 May 2014, A. Chichvarkhin leg.

176 **Identification.** Very distinctive planktonic shell-less species. The form from the Sea of
177 Japan differs by having a light caudal end of the body. Body size of adults 15-35 mm.

178 **Ecology.** These planktonic mollusks appear in spring and completely disappear at the end
179 of May. Occur at the depths of 1-8 m at various sites. Not abundant. In summer time migrate to
180 the lower depth. Obligated predator of planktonic *Limacina helicina*.

181 **Distribution.** Common in the Pacific, Atlantic and Arctic oceans (Martynov &
182 Korchunova, 2011; Lebedev et al., 2015).

183 **Order Runcinacea Burn, 1963**

184 **Superfamily Runcinoidea H. Adams & A. Adams, 1854**

185 **Family Runcinidae H. Adams & A. Adams, 1854**

186 **Genus *Runcinida* Burn, 1963**

187 **Type species** *Runcina elioti* Baba, 1937a, by subsequent designation.

188 **6. *Runcinida valentinae* Chernyshev, 2006 (Fig. 2I)**

189 **Material examined.** 6 specimens, south of Rudnaya Bay, Senkina Shapka pinnacle, 18m,
190 5 Jun 2013, A. Chichvarkhin leg.; 18 specimens, south of Rudnaya Bay, Senkina Shapka
191 Pinnacle, 18-19m, 15 May 2014, 18 m. A. Chichvarkhin leg.; 2 specimens, south of Rudnaya
192 Bay, Senkina Shapka pinnacle, 16-19m, 16 May 2015, A. Chichvarkhin leg.; 3 specimens
193 Kievka Bay, 1.2 m, A. Chichvarkhin leg.

194 **Material examined.** Holotype: south of Rudnaya Bay, Senkina Shapka pinnacle, 16-19m,
195 2 May 2016, A. Chichvarkhin leg.; Paratypes: 4 specimens, Rudnaya Bay, Senkina Shapka
196 pinnacle, 15 May 2014, A. Chichvarkhin leg.

197 **Identification.** Body brown with violet tinge. Dorsum with bright orange rim and orange
198 triangular or heart-shaped spot on third fore portion of the dorsum. Body length 2-6 mm.

199 Radula described and imaged in Chichvarkhin et al. (2015).

200 **Ecology.** Occurs at the depths of 16-20 m on rocky substrates in Senkina Shapka pinnacle.
201 In Kievka Bay lives at the depth of 0.5-3 m on calcareous red algae. Feeding presumably on
202 benthic bacteria or protists, reproduction unknown.

203 **Distribution.** Originally described from Kunashir Island, referred as *Runcina elioti* from
204 the northern Hokkaido (Nakano, 2004). Likely distributed along the Sea of Japan coast between
205 Amur river mouth and Peter the Great Bay, probably in the Korean peninsula (Chernyshev,
206 2006; Chichvarkhin et al., 2015).

207 **Order Sacoglossa Ihering, 1876**

208 **Superfamily Limapontioidea Gray, 1847**

209 **Family Limapontiidae Gray, 1847**

210 **Genus *Placida* Trinchese, 1876**

211 **Type species** *Calliopaea dendritica* Alder & Hancock, 1843, by monotypy.

212 **7. *Placida babai* Ev. Marcus, 1982** (Fig. 2J, K)

213 *Placida babai* Ev. Marcus, 1982:25, figs. 32, 33.

214 *Placida* sp. – Fan et al., 2013.

215 *Placida dendritica* – Martynov, 1998b; Martynov, 2006; Martynov & Korshunova, 2011;
216 Chernyshev, 2014, non Alder & Hancock, 1843.

217 *Placida dendritica* s. lato – Chaban & Martynov, 2013b.

218 *Hermaea dendritica* – Baba, 1937.

219 *Placida dendritica* – Baba, 1955; Baba, 1959; Bleakney, 1989, 1990; Hamatani in Okutani,
220 2000; Suzuki, 2000; Nakano, 2004; Trowbridge, Hirano & Hirano, 2008; Klochkova et al., 2010,
221 non Alder & Hancock, 1843.

222 *Placida* sp. – Baba, 1986.

223 **Material examined.** 1 specimen, 5 Jun 2012 Dva Brata Rocks, 4m, Chichvarkhin leg; 1
224 specimen, south of Oprichnik Bay, near Viking wreck site, on the rocks at sea surface level, ca.
225 100 m off shore, 6 Jun 2013, A. Chichvarkhin leg; 1 specimen, Vtoroy Is., Kievka Bay, 1 m, 3
226 Jul 2015, A. Chichvarkhin leg.

227 **Identification.** Body size reach 35 mm, usually smaller. background creamy white with
228 green network of fine dendrites of digestive gland. Oral tentacles absent.

229 **Ecology.** In Russian waters, feeds on mainly on *Bryopsis* green algae. A report about
230 feeding on *Ulva fenestrata* (Martynov & Korshunova, 2011) is likely due to a mistake.

231 **Distribution.** Confirmed from the Sea of Japan, Yellow Sea, and Pacific coast of Japan.
232 Probably possesses wider distribution, which can be clarified after taxonomical problem solution
233 concerned *P. babai* identity (Chichvarkhin et al. 2016).

234 **Remarks.** The species occurring in the Sea of Japan are rather distinct in morphology and
235 mitochondrial genes sequences from *P. dendritica* from the Atlantic. Therefore, this is a distinct
236 species. However, it is difficult to assign proper taxonomical name for this species because of
237 several unresolved taxonomical confusions (Chichvarkhin et al., 2016c).

238 **Order Pleurobranchomorpha Pelseneer, 1906**

239 **Superfamily Pleurobrancoidea Gray, 1827**

240 **Family Pleurobranchidae Gray, 1827**

241 **Genus *Berthella* Blainville, 1824**

242 **Type species** *Bulla plumula* Montagu, 1803 (type by monotypy)

243 **8. *Berthella californica* (Dall, 1900)** (Fig. 3A, H)

244 *Pleurobranchus californicus* Dall, 1900:92-93.

245 *Pleurobranchus chacei* Burch, 1944.

246 *Pleurobranchus californicus denticulatus* MacFarland, 1966.

247 **Material examined.** 1 specimen, Cherniye Skaly Cape, 20m, 5 Jun 2013, A. Chichvarkhin
248 leg.; 1 specimen, Skaly Is., Kievka Bay, 7m, 28 Jun 2015, A. Chichvarkhin leg.

249 **Identification.** White semi-translucent body with solid white dots and white rim around
250 notum. No oral tentacles, tube-like rhinophores, head lobe wide. Body size to 80 mm, the
251 specimens found in Primorye are max 45 mm. Gill covered by the right side of the notum.

252 **Ecology.** Occurs on the surface of rocky substrates at the depths of 10-30 m. Oviposits
253 white egg ribbons onto lower side of the boulders. Feeding unknown.

254 **Distribution.** A common species known from California along North American and the
255 Asian coast of Japan and Korea (Martynov & Korshunova, 2011).

256 **Order Nudibranchia Cuvier, 1817**

257 **Superfamily Onchidoridoidea Gray, 1827**

258 **Family Onchidorididae Gray, 1827**

259 **Genus *Onchidoris* Blainville, 1816**

260 **Type species** *Onchidoris leachii* Blainville, 1816, by monotypy.

261 **9. *Onchidoris muricata* (Müller, 1776)** (Fig. 3B–D)

262 *Doris muricata* Müller, 1776:229.

263 **Material examined.** 2 specimens, Kievka Bay, 6 m, 1 Jul 2015, A. Chichvarkhin leg.; 12
264 specimens, Senkina Shapka pinnacle, 16-18 m, 15 May 2015, A. Chichvarkhin leg.

265 **Identification.** Color creamy white, size to 15 mm. Notum covered with bud-like
266 (mushroom-like) tubercles.

267 **Ecology.** Feeds on a wide range of encrusting Bryozoans. In Senkina Shapka pinnacle
268 feeds exclusively on different bush-like *Bugula articulata*. Occurs at the depth of 5-20 m. An
269 ephemeral species that is abundant in May but totally disappeared in early autumn.

270 **Distribution.** Arctic and North Pacific species. Has been recently confirmed from the Sea
271 of Japan, far from its known distribution area (Chichvarkhin et al, 2016d).

272 **Genus *Knoutsodonta* Hallas & Gosliner, 2015**

273 **Type species** *Adalaria jannae* Millen, 1987, by original designation

274 **10. *Knoutsodonta jannae* (Millen, 1987)** (Fig. 3E, F)

275 *Adalaria jannae* Millen, 1987:2696-2702; Martynov, 2006; Martynov & Korshunova,
276 2011; Martynov, 2013.

277 ? *Adalaria derjuguni* Volodchenko, 1941.

278 **Material examined.** 1 specimen, Kievka Bay, 5m, 1 Jul 2015, A. Chichvarkhin leg.

279 **Identification.** Color creamy white to light brown, size to 12 mm. Notum covered with
280 finger-like tubercles. White round gland behind the gills.

281 **Ecology.** Occurs at 1-15 m depth under stones and on rocks. Feeds on encrusting
282 bryozoans.

283 **Distribution.** A common species known from California along North American and Asian
284 coast to Peter the Great Bay. May occur in Japan and Korea (Martynov & Korshunova, 2011).

285 **Family Goniodorididae H. Adams & A. Adams, 1854**

286 **Genus *Ancula* Lovén, 1846**

287 **Type species** *Polycera cristata* Alder, 1841, by monotypy.

288 **11. *Ancula gibbosa* (Risso, 1818)** (Fig. 3H)

289 *Tritonia gibbosa* Risso, 1818:

290 *Ancula pacifica* MacFarland, 1905.

291 *Polycera cristata* Alder, 1841.

292 **Material examined.** 2 specimens, north of Brynner Cape, Rudnaya Bay, 5-7 m, 10 May
293 2014, A. Chichvarkhin leg.

294 **Identification.** Body size to 15 mm, color white. Clearly distinguishable from other dorid
295 nudibranchs by the long papillae near oral tentacles and around the rhinophores (Martynov &
296 Korshunova, 2011).

297 **Ecology.** Occurs at 5-10 m. depth, feeds on bush-like bryozoans.

298 **Distribution.** North Pacific species.

299 **Superfamily Doridoidea Rafinesque, 1815**

300 **Family Cadlinidae Bergh, 1891**

301 **Genus *Cadlina* Bergh, 1879**

302 **Type species** *Doris laevis* Linnaeus, 1767, by monotypy.

303 **12. *Cadlina olgae* sp. nov.** (Fig. 3I, J; 4A–E)

304 urn:lsid:zoobank.org:act:758A5BFF-FDB9-4E19-8D0D-D054358ACE6F

305 *Cadlina laevis* – Martynov, 2006 (part.); Martynov & Korshunova, 2011 (part.), non
306 Linnaeus, 1767.

307 ? *Cadlina* spp. – Martynov, 2013 (part.).

308 **Type material.** Holotype: MIMB 33105 Senkina Shapka pinnacle, south of Rudnaya Bay,
309 16m, 10 Oct 2015, O. Krutichenko leg.; Paratype: MIMB33106 Senkina Shapka pinnacle, south
310 of Rudnaya Bay, 14 m, 6 May 2013, T. Antonkhina leg.

311 **Material examined.** 1 specimen, Senkina Shapka pinnacle, south of Rudnaya Bay, 16m, 10
312 Oct 2015, O. Krutichenko leg.; Dva Brata Rocks, south of Rudnaya Bay, 4 m, 16 May 2014, A.
313 Chichvarkhin leg.

314 **Diagnosis.** White semi-translucent oval shaped body with solid yellow dots, rather large
315 yellow glands near the edge of mantle, and yellow rim formed by numerous tiny dots around
316 notum. Oral tentacles short, triangular, folded at apex, rhinophores lamellar. Rachidian teeth with

317 2 bigger central and 4-6 smaller lateral denticles. Inner lateral teeth with equal number of
318 denticles on both sides. Body size to 25 mm.

319 **Description.** Body shape oval, rounded in juvenile specimens, lengths to 25 mm (14 mm in
320 holotype, 11 mm in paratype) in fully extended living specimens (Figs. 4D and E). Body with
321 uniformly white semi-translucent background, uniformly covered with small yellow dots on
322 elevated tubercles. 4 to 10 larger yellow sub-epidermal glands along each side of mantle; edge of
323 notum and foot covered with numerous tiny dots forming yellow rim, which looks solid without
324 magnification (but less intense than in *C. luteomarginata* MacFarland, 1966). Notum moderately
325 wide, wider than foot, contains no spicules. Rhinophores with 8-10 lamellae with few yellow
326 dots on top. Oral tentacles very short, triangular, folded distally. Gills in holotype with 5
327 branchial leaves, with yellow pigment on tips. Radula (Fig. 4) of 55-60 rows, in 30th row
328 12.1.1.1.12. Rachidian tooth with two central larger central denticles and 2-3 smaller lateral
329 denticles (Fig. 4A). First lateral teeth with bigger central denticle and four smaller denticles on
330 both sides. The other lateral teeth are similar, with 4-5 outer denticles and no inner denticles
331 (Fig. 4C).

332 Ampulla wide, long and convoluted in 2 folds. Prostate long, tubular with 1-2 loops, vas
333 deferens very narrow with one loop, it expands in wider muscular ejaculatory portion. Penis
334 narrow, bears an armature of very fine spines. Vagina wide and short, branched into a duct that
335 connects seminal receptacle and uterine duct. Uterine duct is long, not shorter than bursa
336 copulatrix. Seminal receptacle almost spherical, slightly smaller than oval bursa copulatrix. No
337 vagina extension near the entrance into copulatory bursa.

338 **Etymology.** After my wife and colleague Olga Chichvarkhina.

339 **Ecology.** Occurs at various depths on rocky substrates, feeding unknown.

340 **Distribution.** Probably has wider distribution in the Sea of Japan.

341 **Remarks.** This species differs from *Cadlina* sp. (Martynov, 1999) with larger rachidians and
342 fewer denticles in lateral teeth. Central denticles in the rachidian tooth of *C. olgae* are never split
343 in 2-3 secondary denticles. The invalid (unpublished) species "*Cadlina potini*" referred by
344 Martynov (1999) is more similar to *C. olgae* but possesses 6 outer denticles in first lateral teeth
345 (4 in *C. olgae*), the other lateral teeth possess 15 lateral denticles (4-5 in *C. olgae*). Both these
346 forms referred by Martynov, the radula possesses more rows with more teeth in each row. In *C.*

347 *laevis* (Linnaeus, 1767), rachidian teeth possess up to six equal denticles (unequal in *C. olgae*)
348 (Thompson, Brown, 1984). Examined specimens of *C. laevis* from the White Sea possess
349 rachidian tooth with 2-4 poorly developed smooth denticles; first lateral tooth is crowned with 3
350 denticles on inner side and 5-7 denticles on the outer side (Fig. 4 F, G), similar pattern is
351 observed in *C. sp.2* from Bering Sea (Fig. 4H) (4 denticles on both sides in *C. olgae*). *C.*
352 *japonica* Baba, 1937 clearly differs from *C. olgae* with: brownish pigment on the mantle, intense
353 yellow pigmentation of gills, small hook-shaped rachidian tooth divided in two lobe-like
354 denticles, and presence of small outermost lateral teeth (Baba, 1937b). *C. luteomarginata*
355 MacFarland, 1966 differs from *C. olgae* with solid yellow rim around the mantle, more intense
356 pigmentation on the tubercles, hook-shaped rachidian tooth with four small denticles, larger
357 central denticle on all lateral teeth, and 7-8 very small denticles on all lateral teeth (Rudman,
358 2001; Johnson, 2001). Reproductive system is typical to Far Eastern *C. laevis*-group species
359 described in Martynov (1999): it possesses rather polymorphic prostate and vas deferens
360 containing one to five loops, thus they unlikely can be served as species-specific traits. Female
361 reproductive system is similar to Martynov's (1999) "*C. potini*" (in *C. olgae* holotype is identical
362 with Fig. 83 in this work) with no vaginal duct extension near bursa copulatrix entrance. I
363 suppose, Martynov (1999) studied *C. olgae* but he mixed it with one or more species reporting
364 radula/reproductive combinations, that do not fully coincide with my specimens. Thus thorough
365 study of morphological variation in *Cadlina* needed to shed light onto the systematics of this
366 genus in the northwestern Sea of Japan.

367 Molecular COI sequences suggest an evidence that *Cadlina olgae* is a member of cryptic
368 species complex referred as *C. laevis*, which includes at least *C. olgae*, *C. laevis*, an undescribed
369 species candidate from Bering Sea, and *C. luteomarginata* with at least two sister species (Fig.
370 5). Although the p-distance between these species is relatively low, lowered level of divergence
371 is a characteristic for sibling species that descent during Pleistocene glaciations (Breslau et al
372 2016; Lindsay et al. 2016; Kleinberger et al. 2016; Hallas et al., 2016). Likely, this phenomenon
373 also occurs in amphiboreal species with direct development, e.g. *Cadlina* (Thompson, 1967)
374 whose speciation took place during recent dispersal from a refugia.

375 The resulted number of species identified in ABGD analysis of COI and 16S. Using
376 uncorrected distance matrices, the COI sequences showed a major barcode gap between a priori
377 genetic distance thresholds of 0.01 and 0.036 in COI (0.01 and 0.013 in 16S). Using a value of P

378 between this range (0.01 for both markers), the same 13 species were identified, and assignment
379 of individuals to the species matched the NJ tree topology (Fig. 5). Importantly, however, the
380 species identified are not polyphyletic. A series of species-specific diagnostic indels was found
381 in the 16S after position #240 (in *C. laevis* sequence): there is no insert in *C. olgae*, while a six-
382 base TTTTTA insert is present in *C. laevis* sequence, and eight-base insertion ATTTTSTA in *C.*
383 sp. 1 (Table 2). These indels are likely a conservative trait in *Cadlina* species because *C. luarna*
384 and *C. rumia* do not possess an insert as *C. olgae*, while three species (*C. japonica*, *C.*
385 *luteomarginata*, *C. aff. luteomarginata*) possess a four-base insert TTT(C)A, three others possess
386 one Thymine insert (*C. flavomaculata*, *C. modesta*, and *C. sparsa*), *C. pellucida* possesses four-
387 base TTTA insert, and *C. sp.2* possesses an insert of seven bases TTTTAAA. I suppose this
388 pattern has high phylogenetic weight, hence it is capable to adequately detect closely related
389 sibling species.

390 **Family Discodorididae Bergh, 1891**

391 **Genus *Diaulula* Bergh, 1878**

392 **Type species** *Diaulula sandiegensis* Cooper, J.G., 1863, by monotypy.

393 **13. *Diaulula odonoghuei* Steinberg, 1963** (Fig. 6A, B)

394 Steinberg, 1963:63-67.

395 *Peltodoris mauritana* – Baba, 1935, non Bergh, 1889.

396 *Archidoris tuberculata* – Volodchenko, 1941; Volodchenko in Ushakov, 1953 (non Cuvier,
397 1804).

398 *Doris echinata* – O'Donoghue, 1922 (non Lovén, 1846).

399 *Doridigitata maculata* – O'Donoghue, 1926 (non Garstang, 1896).

400 *Doris odonoghuei* – Behrens & Valdes, 2001.

401 *Diaulula sandiegensis* – Behrens, 1980 (part.); Martynov, 2006; Martynov, Korshunova,
402 2011; Martynov, 2013 non *Doris (Actinocyclus?) sandiegensis* Cooper, 1863.

403 **Material examined.** 1 specimen, Rudnaya Bay, Brynner Cape, 5-6m, 10 May 2014, A.
404 Chichvarkhin leg; 2 specimens, Senkina Shapka pinnacle, 12-16m, 12 May 2014, A.
405 Chichvarkhin leg; 1 specimen Dva Brata Rocks, 5-6m, 6 Jun 2013, leg. A. Chichvarkhin; 1
406 specimen, Kievka Bay, 5-6m, 29 Jun 2015, A. Chichvarkhin leg.

407 **Identification.** Creamy-yellowish body color with dark brown large spots. Notum covered
408 with numerous fine caryophyllidiae.

409 **Ecology.** Occurs at the depths of 1-30 m, feeds on *Adocia cinerea* and *Haliclona permolis*
410 sponges.

411 **Distribution.** South Korea, Japan, Russian Pacific, Kommander's Islands, to Alaska and
412 Northern California (Lindsay et al. 2016, in press).

413 **Remark.** This species had been referred to *D. sandiegensis* (J. G. Cooper, 1863) that
414 occurs in Pacific coast of North America, but our recent study has confirmed distinctiveness of
415 these species (Lindsay et al. 2016).

416 **Genus *Rostanga* Bergh, 1879**

417 **Type species** *Doris coccinea* Forbes, 1848, by monotypy.

418 **14. *Rostanga alisae* Martynov, 2003** (Fig. 6C, D)

419 Martynov, 2003:142-146, figs. 1-3.

420 **Material examined.** 2 specimens, Kievka Bay, 2 m, 29 Jun 2015, A. Chichvarkhin leg.

421 **Identification.** Very distinctive intense orange-red colored dorid nudibranch with
422 characteristic rosette-like rhinophores formed with vertical lamellae, notum covered with
423 numerous small caryophyllidiae. Body size to 16 mm.

424 **Ecology.** Occurs at 0-10 m depth, feeds on *Ophlitaspongia pennata* sponge.

425 **Distribution.** Northern continental shore of the Sea of Japan (Martynov & Korshunova,
426 2011).

427 **Superfamily Polyceroidea Alder & Hancock, 1845**

428 **Family Okadaidae Baba, 1930**

429 **Genus *Vayssierea* Risbec, 1928**

430 **Type species** *Vayssierea caledonica* Risbec, 1928, by original designation.

431 **15. *Vayssierea elegans* (Baba, 1930)** (Fig. 6E, F)

432 *Okadaia elegans* Baba, 1930:48-50, pl. 2, figs. 11-14.

433 *Okadaia tectocardia* Slavoshevskaya, 1971.

434 **Material examined.** 3 specimens, Kievka Bay, 1-2 m, 1-5 Jul 2015, A. Chichvarkhin leg.

435 **Identification.** Small red-colored mollusk with elongate body. Body smooth: gill, tentacles
436 or papillae on the notum are absent. Body size to 6 mm.

437 **Ecology.** Occurs at shallow depth of 0.1- 2 m under rocks or on algae. Feeds on
438 Spirorbidae tube worms.

439 **Distribution.** Known from Kievka and Peter the Great Bays in Russia, also from Japan
440 (Martynov & Korshunova, 2011).

441 **Family Polyceridae Alder & Hancock, 1845**

442 **Genus *Triopha* Bergh, 1880**

443 **Type species** *Triopha carpenteri* Stearns, 1873, by monotypy.

444 **16. *Triopha catalinae* (Cooper, 1863) (Fig. 6G)**

445 *Triopha catalinae* Cooper, 1863:59.

446 *Triopha carpenteri* Stearns, 1873.

447 *Triopha modesta* Bergh, 1880.

448 *Triopha scrippsiana* Cockerell, 1915.

449 *Triopha elioti* O'Donoghue, 1921.

450 *Triopha pacifica* Volodchenko, 1941.

451 **Material examined.** 2 specimens, Tretya Langou, 14m, 12 May 2014, A. Chichvarkhin
452 leg; 2 specimens, 8m, Dva Brata Rocks, 13 May 2014, A. Chichvarkhin leg; 1 specimen, Kievka
453 Bay, 7m, 29 Jun 2015, A. Chichvarkhin leg.; 2 specimens, Senkina Shapka Pinnacle, 17 m, 2 Jun
454 2016, A. Chichvarkhin leg.

455 **Identification.** Background body color varies bright white to light grey with orange
456 pigment on the gills tips and papillae located on notum edge, darker orange colored tubercles
457 scattered on notum. Body size to 15 cm.

458 **Ecology.** Occurs at 1-30 m depth, feeds on various bryozoans (Martynov, 1999).

459 **Distribution** A common species known from California along North American and Asian
460 coast to Japan and Korea (Martynov & Korshunova, 2011).

461 **Genus *Palio* Gray, 1857**

462 **Type species** *Polycera ocellata* Alder & Hancock, 1842, by monotypy.

463 **17. *Palio dubia* (Sars, 1829)** (Fig. 6H)

464 *Palio dubia* – Martynov, 2006; Martynov & Korshunova, 2011.

465 *Palio* sp. – Martynov, 2013.

466 **Material examined.** 1 specimen, Senkina Shapka pinnacle, 5 May 2013, 16m, A.
467 Chichvarkhin leg.

468 **Identification.** Background color grey, greenish-grey with numerous light tubercles.
469 Rhinophores lamellated, larger whitish tubercles behind the gills. Size to 15 mm.

470 **Ecology.** Occurs on 5-20 m depth, feeds on encrusting bryozoans.

471 **Distribution.** North Atlantic, White Sea, Barents Sea, North Pacific (Martynov &
472 Korshunova, 2011).

473 **Superfamily Tritonioidea Lamarck, 1809**

474 **Family Dendronotidae Allman, 1845**

475 **Genus *Dendronotus* Alder & Hancock, 1845**

476 **Type species** *Doris arborescens* O. F. Müller, 1776, by monotypy.

477 **18. *Dendronotus kamchaticus* Ekimova, Korshunova, Schepetov, Neretina, Sanamyan &**
478 **Martynov, 2015** (Fig. 7A, F)

479 *Dendronotus frondosus* – Martynov, 2006; Martynov, Korshunova, Sanamyan &
480 Sanamyan, 2010; Martynov & Korshunova, 2011:152-155 (part.), non Ascanius, 1774.

481 ? *Dendronotus robustus* – Yavnov, not Verrill, 1870

482 ? *Dendronotus primorjensis* Martynov, Korshunova & Sanamyan, 2015.

483 **Material examined.** 2 specimens, Rudnaya Bay, 8 May 2013, A. Chichvarkhin leg; 1
484 specimen, Rudnaya Bay, 10 Oct 2015, A. Chichvarkhin leg.

485 **Identification.** Oral veil with 4–6 lip papillae and branched appendages. Primary stalks of
486 veil appendages tall and slender, giving rise to numerous secondary branches with short tertiary
487 branches. Rhinophoral sheath divide into 5–6 crown papillae that about same length. Lateral
488 papillae (about one-third or one-half of sheath length) branches off sheath base and expanded
489 with secondary branches. Rhinophores bear 14–20 lamellae. Background color is transparent
490 white, with complex pattern of light, dark, and red-brown spots and stripes. On dorsal side spots

491 and stripes merge and form characteristic striped pattern. Lateral sides of body devoid of stripes
492 but covered with brown spots. Size to 25 mm.

493 **Ecology.** Occurs at 10-20 m depth on cnidarians.

494 **Distribution.** Described from Kamchatka, recently found in Rudnaya and Peter the Great
495 Bays. Probably possess wide distribution along Far Eastern shore (Ekimova et al., 2016).

496 **19. *Dendronotus frondosus* Ascanius, 1774** (Fig. 7B)

497 *Amphitrite frondosa* Ascanius, 1774: 155, pl. 2, fig. 2.

498 *Dendronotus primorjensis* Martynov, Korshunova & Sanamyan, 2015.

499 ? *Dendronotus frondosus* s.l. - Chernyshev, 2014.

500 **Material examined.** 1 specimen, Rudnaya Bay, 10 Oct 2015, A. Chichvarkhin leg.

501 **Identification.** Body slim elongate laterally compressed with 4-10 pairs of branched
502 papillae. Oral veil with 10–14 short lip papillae and 4–5 secondary branched appendages.
503 Rhinophoral sheaths with long stalk and five crown appendages. Lateral papillae moderate in
504 size with small secondary branches. Light to dark brown body with opaque golden groups of
505 dots. Size to 20 mm.

506 **Ecology.** Occurs at 1-20 m depth on cnidarians, mainly on *Obelia* sp.

507 **Distribution.** North Atlantic, Barents Sea, White Sea, the northern part of the Sea of Japan
508 (Ekimova et al., 2016).

509 **20. *Dendronotus dudkai* Ekimova, Schepetov, Chichvarkhina & Chichvarkhin, 2016** (Fig.
510 7C)

511 ? *Dendronotus frondosus* s.l. - Chernyshev, 2014:93.

512 ? *Dendronotus primorjensis* Martynov, Korshunova & Sanamyan, 2015.

513 **Material examined.** 1 specimen, Rudnaya Bay, 10 June 2012, A. Chichvarkhin leg.;5
514 specimens, Rudnaya Bay, 8 Oct 2013, A. Chichvarkhin leg.

515 **Identification.** Superficially similar to sympatric *D. frondosus* but possess perl-white
516 stripes along dorsal side. Oral veil small with 6–12 large, secondary branched cerata. Muscular
517 lips with 5–10 short lip papillae. Rhinophoral sheaths with long stalk and 4–5 crown secondary
518 branched appendages. Lateral papillae moderate in size with small secondary branches.

519 Rhinophores with 8–10 lamellae. 6–8 pairs of highly branched dorsolateral processes, size and
520 degree of branching decrease towards the tail. Size to 20 mm.

521 **Ecology.** Occurs at 10–20 m depth on *Obelia* cnidarians.

522 **Distribution.** This species has been detected just recently. It's confirmed distribution is
523 two locations in Peter the Great Bay, and Rudnaya Bay, but may have wider distribution.

524 **Remark.** Recently, *Dendronotus primorjensis* Martynov, Korshunova and Sanamyan,
525 2015 has been described from Peter the Great Bay where at least three *Dendronotus* species
526 occur. The description of the external morphology is quite brief and literally constitutes a
527 redescription of *D. kamchaticus* because of the absence of white pigment agglomerations
528 described for *D. primorjensis* is a characteristic of *D. kamchaticus*. However, described radula
529 conforms to diagnosis of all species in the *D. frondosus* species complex. The illustrated
530 holotype cannot be distinguished from *D. kamchaticus*, thus, *D. primorjensis* is probably a
531 synonym of *D. kamchaticus*. The location of the type specimens of *D. primorjensis* is unknown:
532 probably they do not exist because of their unavailability in referred collection, while the authors
533 refuse providing them for examination. Also, the authors cannot provide or publish *D.*
534 *primorjensis* nucleotide sequences that they refer as “distinct from the other *Dendronotus*
535 species”. Therefore, we suggest considering *D. primorjensis* as *nomen nudum* or a synonym of a
536 species of *D. kamchaticus* that is likely occurs at type locality of *D. primorjensis* (Ekimova et al.,
537 2016).

538 **21. *Dendronotus cf. albopunctatus* Robilliard, 1972 (Fig. 7D)**

539 Robilliard, 1972:421-432.

540 **Material examined.** Several specimens, about 2 cm long were photographed by Andrei
541 Shpatak and Andrei Nekrasov in Rudnaya Bay area.

542 **Identification.** Wide body with short papillae and solid white dots on small tubercles.

543 **Ecology.** Unknown.

544 **Distribution.** The species is known from northeastern Pacific only, never been confirmed
545 from Asian coast.

546 **Family Tritoniidae Lamarck, 1809**

547 **Genus *Tritonia* Cuvier, 1798**

548 **Type species** *Tritonia hombergii* Cuvier, 1803, by subsequent designation.

549 **22. *Dendronotus dalli* Bergh, 1879** (Fig. 7E)

550 Bergh, 1879:150, pl. 1, fig. 21, pl. 2, figs. 9-12, pl. 3, figs. 2-6.

551 *Dendronotus elegans* – Verrill, 1880.

552 **Material examined.** 1 specimen, 4 cm long was imaged by Andrei Shpatak in June, 2013
553 at Dva Brata Rocks <http://shpatak.livejournal.com/175711.html>.

554 **Identification.** Color varies: white, yellow, creamy to dark orange. Usually six pairs of
555 papillae with solid white pigmented tips.

556 **Ecology.** Occurs at 5 m deeper depths. Feeds on hydroids.

557 **Distribution.** A common species known from California along North American and Asian
558 coast to Sakhalin, Japan and Primorye.

559 **23. *Tritonia tetraquetra* (Pallas, 1788)** (Fig. 7G)

560 *Limax tetraquetra* Pallas, 1788, non *Tochuina tetraquetra* Bergh, 1879.

561 *Tritonia diomedea* Bergh, 1894.

562 *Tritonia primorjensis* Minichev, 1971.

563 **Material examined.** 1 specimen, Nevelsk, Sakhalin Is, 10 m, 22 Aug 2014, A.
564 Chichvarkhin leg.; 1 specimen, Kholmsk, Sakhalin Is, 7 m, 26 Aug 2014, A. Chichvarkhin leg.

565 **Identification.** Very distinctive orange-colored body with white plumage-like papillae.
566 Body size usually 20-50 mm but may grow to 300 mm.

567 **Ecology.** Occurs 1-2 m and deeper.

568 **Distribution.** Rare along continental shore of the Sea of Japan (Minichev, 1971). Very
569 common on its adjacent Sakhalin shore. Occurs also in all Russian Pacific seas and along
570 American coast to California (Martynov & Korshunova, 2011).

571 **Unassigned Cladobranchia**

572 **Family Proctonotidae Gray, 1853**

573 **Genus *Janolus* Bergh, 1884**

574 **Type species** *Janolus australis* Bergh, 1884, by monotypy.

575 **24. *Janolus fuscus* O'Donoghue, 1924** (Fig. 7H)

576 O'Donoghue, 1924:1-33.

577 **Material examined.** 1 specimen, Senkina Shapka pinnacle, 5 May 2013, 16 m, T.

578 Antokhina leg.; 1 specimen, Senkina Shapka pinnacle, 16 m, 14 May 2014, A. Chichvarkhin

579 leg.; 1 specimen, Senkina Shapka pinnacle, 18 m, 15 May 2015, A. Chichvarkhin leg.

580 **Identification.** Distinctive species with numerous long semitranslucent white body and
581 papillae with dark digestive gland inside and yellow circles below solid white tips. Brown line
582 along dorsum. Size to 35 mm.

583 **Ecology.** Associated with various bryozoan hosts. In Senkina Shapka, feeds on *Bugula*
584 *articulata* colonies only at the depths of 16-19 m.

585 **Distribution.** From Baja California to Alaska in America, also in Japan and Korea. In
586 Russia, known from Senkina Shapka site only (Chichvarkhin et al., 2016; Behrens & Hermosillo,
587 2005).

588 **Family Dironidae Eliot, 1910**

589 **Genus *Dirona* MacFarland, 1905**

590 **Type species** *Dirona picta* MacFarland, 1905, by subsequent designation.

591 **25. *Dirona pellucida* Volodchenko, 1941** (Fig. 7I)

592 Volodchenko, 1941:56, 65, pl. 1, fig. 6, pl. 2, fig. 6.

593 *Dirona akkeshiensis* Baba, 1957.

594 *Dirona aurantia* Hurst, 1966.

595 *Dirona albolineata* –Volodchenko, 1941, non Eliot in Cockerell & Eliot ex MacFarland,
596 1905.

597 *Dirona picta* –Volodchenko, 1941, non Eliot in Cockerell & Eliot ex MacFarland, 1905.

598 **Material examined.** 2 specimens, Rudnaya Bay, Brynnera Cape, 5 m, 6 May 2013, A.

599 Chichvarkhin leg.; 3 specimens, Senkina Shapka pinnacle, 15-18 m, 6 May 2013, A.

600 Chichvarkhin leg.; 2 specimens, Dva Brata rocks, 5 m, 6 May 2013, A. Chichvarkhin leg.; 2

601 specimens, Senkina Shapka pinnacle, 16 m, 15 May 2014, A. Chichvarkhin leg.; 1 specimen,

602 Dva Brata rocks, 7 m, 13 May 2014, A. Chichvarkhin leg.; 1 specimen, Senkina Shapka

603 pinnacle, 14 m, 15 May 2015, A. Chichvarkhin leg.; 1 specimen, Senkina Shapka pinnacle, 17

604 m, 10 Oct 2015, A. Chichvarkhin leg.; 4 specimens, Senkina Shapka pinnacle, 15-20 m, 2 Jun
605 2015, A. Chichvarkhin leg.

606 **Identification.** Semitranslucent pale yellow to intensive orange body and flattened
607 papillae. White dots scattered across the body, the tips of papillae white. No white rim around
608 foot. Size to 150 mm.

609 **Ecology.** Occurs on rocky substrates at various depths. Feeding unknown.

610 **Distribution.** A common species known from California along North American and Asian
611 coast to Japan and Korea (Martynov & Korshunova, 2011).

612 **Superfamily Flabellinoidea Bergh, 1889**

613 **Family Flabellinidae Bergh, 1889**

614 **Genus *Flabellina* Gray, 1833**

615 **Type species** *Doris affinis* Gmelin, 1791, by monotypy.

616 **26. *Flabellina* cf. *amabilis* (Hirano & Kuzirian, 1991) (Fig. 8A)**

617 *Flabellina amabilis* Hirano & Kuzirian, 1991:48-55, figs. 1-7.

618 "*Coryphella*" *amabilis* – Martynov, 2006; Martynov, 2013.

619 **Material examined.** 1 specimen, Tretya Langou Bay, 16 m, 4 May 2013, A. Chichvarkhin
620 leg.

621 **Identification.** Body white semitranslucent. Tiny white dots on oral tentacles, rhinophores,
622 and on cerata below cnidosacs. Cerata with pinky-red appendages of digestive gland.

623 **Ecology.** Found on sunken rope colonized with *Obelia* hydroids.

624 **Distribution.** Known from all Russian Pacific seas and Hokkaido shore in Japan
625 (Martynov & Korshunova, 2011).

626 **27. *Flabellina verrucosa* (Sars, 1829) (Fig. 8B, C)**

627 *Eolidia verrucosa* Sars, 1829:9-12, pl. 2. figs. 1-4.

628 ? *Coryphella longicauda* (sic!) – Volodchenko, 1941.

629 *Coryphella verrucosa* – Martynov, 2013; Martynov & Korshunova, 2011.

630 *Coryphella pseudoverrucosa* Martynov, Korshunova & Sanamyan, 2015.

631 **Material examined.** 2 specimens, Tretya Langou Bay, 15 m, 4 May 2013, A.
632 Chichvarkhin leg.

633 **Identification.** Body white. Cerata brownish-red, never bright red in studied area. White
634 solid stripe on oral tentacle and less solid pigmentation on the rhinophores. Cnidosacs smaller
635 than in similar *C. cf. nobilis*. White stripe on tail. Body size to 35 mm.

636 **Ecology.** In Rudnaya Bay vicinity found on *Obelia longissima* at 12-20 m depth.

637 **Distribution.** A common species known from all Far Eastern seas of Russia, North
638 America, Arctic and the northwestern Atlantic (Martynov & Korshunova, 2011; Behrens &
639 Hermosillo, 2005).

640 **28. *Flabellina cf. nobilis* Verrill, 1880** (Fig. 8D–F)

641 Verrill, 1880:380.

642 *Himatina nobilis* – Martynov, 2006; Martynov, 2013.

643 **Material examined.** 12 specimens, Tretya Langou Bay, 15-18 m, 15 May 2014, A.
644 Chichvarkhin leg.; 1 specimen, Tretya Langou Bay, 15 m, 15 May 2014, A. Chichvarkhin leg.; 1
645 specimen, Senkina Shapka Pinnacle, 9 m, 14 May 2014, A. Chichvarkhin leg.

646 **Identification.** Body wide, white. Cerata bright-red. Oral tentacle and the rhinophores are
647 heavily dusted with white pigment. Cnidosacs white, big. White stripe on tail. This is the biggest
648 local *Coryphela* species to 45 mm.

649 **Ecology.** Occurs on *Obelia cf. longissima* hydroids at 10-20 m depth.

650 **Distribution.** This species is found in Rudnaya Bay, distribution range unknown. *F.*
651 *nobilis* is known from the northern Atlantic. Similar forms were reported from the Arctic and
652 Pacific seas of Russia (Martynov & Korshunova, 2011), although they may represent several
653 sister species.

654 **29. *Flabellina trophina* (Bergh, 1890)** (Fig. 8G, H)

655 *Himatella fusca* O'Donoghue, 1921.

656 *Himatella trophina* Bergh, 1890: 1-75.

657 *Aeolis camtchatica* Volodchenko, 1941.

658 *Himatina trophina* – Martynov, 2013; Martynov & Korshunova, 2011.

659 **Material examined.** 4 specimens, Dva Brata rocks, 5 m, 6 Jun 2013, A. Chichvarkhin leg.;
660 2 specimens, Dva Brata rocks, 5 m, 16 May 2014, A. Chichvarkhin leg.

661 **Identification.** Body wide, white semi-translucent. Cerata in continuous rows, brownish,
662 never bright red. White solid stripes on oral tentacle and the rhinophores. Cnidosacs small, white.
663 White stripe on tail. Body size to 25 mm.

664 **Ecology.** Occurs on rocky walls at 3-6 m depth. Feeds on hydroids.

665 **Distribution.** The north Pacific seas (Martynov & Korshunova, 2011).

666 **Remarks.** Martynov (2006) synonymized *Cratena rubra* Volodchenko, 1941 and *C.*
667 *trophina*. However, monoserial radula described and drawn by Volodchenko is not specific for
668 Flabellinidae but characteristic for Tergipedidae. Type specimens of *C. rubra* were collected
669 from soft bottom at 20 m depth - this is unlikely habitat for *C. trophina*, which occurs at shallow
670 depths of 3-6 m on wave exposed rocks. While *Cuthona nana*, which settles on hermit crab
671 shells can easily occur there, moreover, this is the only red colored Tergipedid species known
672 from the Sea of Japan that reach described body length of 25 mm.

673 **30. *Flabellina athadona* Bergh, 1875** (Fig. 9A–E)

674 Bergh, 1875:635-638, pl. 13, figs. 1-13.

675 non *Coryphella athadona* – Volodchenko, 1941.

676 non *Coryphella athadona* (sic!) – Volodchenko, 1955.

677 *Coryphella athadona* – Martynov & Korshunova, 2011.

678 "*Coryphella*" *athadona* – Martynov, 2006; Martynov, 2013.

679 **Material examined.** 4 specimens, north of Brynner Cape, Rudnaya Bay, 8 m, 4-6 May
680 2013, A. Chichvarkhin leg.; 2 specimens, Tretya Langou Bay, 16 m, 4 May 2013, A.
681 Chichvarkhin leg.; 2 specimens, Dva Brata rocks, 6-8 m, 14 May 2014, A. Chichvarkhin leg.; 1
682 specimen, Rudnaya Bay, Brynner Cape, 7 m, 14 May 2015, A. Chichvarkhin leg.; 2 specimens,
683 Vladimir Bay 20 May 2014, K. Dudka leg.; egg masses, Olga Bay, 5 m, 1 Jun 2016, A.
684 Chichvarkhin leg.

685 **Identification.** Body yellowish-white. Cerata may be colored in various tans on yellow,
686 red and brown. Can be clearly identified with white triangle or X-shaped mark on head and oral
687 tentacles. White stripe on tail. Body size to 20 mm.

688 **Ecology.** Occurs various substrates at 0-15 m depth, most common on *Obelia longissima*.
689 Feeds on wide range of hydroids.

690 **Distribution.** A common species known from all Far Eastern seas of Russia (Martynov &
691 Korshunova, 2011).

692 **Superfamily Fionoidea Gray, 1857**

693 **Family Eubbranchidae Odhner, 1934**

694 **Genus *Eubbranchus* Forbes, 1838**

695 **Type species** *Eubbranchus tricolor* Forbes, 1838, by original designation.

696 **31. *Eubbranchus rupium* Møller, 1842** (Fig. 9F, G)

697 *Tergipes rupium* Møller, 1842: 78.

698 *Eubbranchus exiguus* – Roginskaya, 1962; Roginskaya, 1987, non Alder & Hancock, 1848.

699 *Nudibranchus rupium* – Martynov, 1998a, b; Martynov, 2006; Martynov & Korshunova,
700 2011; Yavnov, 2012; Martynov, 2013.

701 **Material examined.** 2 specimens, Dva Brata Rocks, 4 m, 10 Oct 2015, A. Chichvarkhin
702 leg.

703 **Identification** Body grey to olive with dark spots and white tiny dots in some specimens.
704 Digestive gland is visible as brown-green reticulate network. The rhinophores translucent, often
705 with white dots and brown ring in the middle point. Oral tentacles 2 times shorter than the
706 rhinophores. Anterior part of the foot with no appendages. Body size to 13 mm.

707 **Ecology.** Feeds on *Obelia longissima* and probably other hydroids at 0-20 m depth.

708 **Distribution.** Widely distributed in Far Eastern seas, Atlantic, and Arctic (Martynov &
709 Korshunova, 2011).

710 **32. *Eubbranchus misakiensis* Baba, 1960** (Fig. 9H, I)

711 *Aenigmastyletus alexeii* – Martynov, 1998a; Martynov & Korshunova, 2011; Chernyshev,
712 2014.

713 **Material examined.** 2 specimens, Vtoraya Langou Bay, 15 m, 16 May 2015, A.
714 Chichvarkhin leg.

715 **Identification.** Body slim, semi-translucent with clearly separated brownish spots.
716 Digestive gland visible as a brown-green reticulate network. The rhinophores translucent, often

717 with white 2.5-fold longer than oral tentacles. Cerata are swollen in middle part with appropriate
718 local extension of digestive gland. Fore part of the foot with no appendages. Body size to 18 mm.

719 **Ecology.** Occurs on *Obelia longissima* hydroids at 0-20 m depth.

720 **Distribution.** Likely, widely distributed in the Sea of Japan.

721 **Family Tergipedidae Bergh, 1889**

722 **Genus *Trinchesia* Ihering, 1979**

723 **Type species** *Doris caerulea* Montagu, 1804, by original designation.

724 **33. *Trinchesia ornata* (Baba, 1937) (Fig. 9J)**

725 *Cuthona (Hervia) ornata* Baba, 1937a:331-333, pl. 2, fig. 4, text-fig. 17.

726 **Material examined.** 1 specimen, Senkina Shapka pinnacle, 16 m, 15 May 2014, A.

727 Chichvarkhin leg.; 3 specimens, Senkina Shapka pinnacle, 17 m, 12 May 2015, A. Chichvarkhin

728 leg.; 1 specimen, Senkina Shapka pinnacle, 17 m, 10 Oct 2015, A. Chichvarkhin leg.

729 **Identification.** Body yellow to orange. Cerata, oral tentacles and proximal parts of the
730 rhinophores white with blue pigmentation in basal part. Body size to 15 mm.

731 **Ecology.** Occurs on various substrates at 2-20 m depth. Abundant on *Microporina*
732 *articulata* bryozoan colonies.

733 **Distribution.** Widely distributed species in the Sea of Japan and Japanese islands
734 (Martynov & Korshunova, 2011).

735 **34. *Triinchesia viridis* (Forbes, 1840) (Fig. 9K)**

736 *Montagua viridis* Forbes, 1840:106-107, pl. 2, fig. 18)

737 **Material examined.** 2 specimens, Dva Brata rocks, 4-6 m, 6 Jun 2013, A. Chichvarkhin
738 leg.

739 **Identification.** Body white. The rhinophores and oral tentacles are translucent, 2/3
740 proximal part of them is pigmented white. Cerata dusted with white pigment, with brownish-
741 green digestive gland appendages. Cnidosac is distinctive, white under translucent cap. Body
742 size to 15 mm.

743 **Ecology.** Found on algae covered with the hydroids.

744 **Distribution.** Widely distributed in the northern Pacific and the northern Atlantic
745 (Martynov & Korshunova, 2011).

746 **Genus *Cuthona* Alder & Hancock, 1855**

747 **Type species** *Eolis nana* Alder & Hancock, 1842, by monotypy.

748 **35. *Cuthona nana* (Alder & Hancock, 1842)** (Fig. 10A–G)

749 *Eolis nana* Alder et Hancock, 1842:31-36.

750 *Cratena rubra* Volodchenko, 1941.

751 *Precuthona divae* Marcus, 1961.

752 *Cuthona* sp. – Nakano, 2004.

753 *Cuthona hermitophilla* Martynov, Korshunova & Sanamyan, 2015.

754 non *Cuthona divae* – Nakano, 2004.

755 **Material examined.** 2 specimens, Rudnaya Bay, Brynner Cape, 6-8 m, 6 May 2013, A.

756 Chichvarkhin leg.; 5 specimens, Rudnaya Bay, Brynner Cape, 6-8 m, 13-16 May 2014, A.

757 Chichvarkhin leg.; 12 specimens, Rudnaya Bay, Brynner Cape, 6-8 m, 15 May 2015, A.

758 Chichvarkhin leg.; 2 specimens, Dva Brata rocks, 6-8 m, 15 May 2014, A. Chichvarkhin leg.; 3

759 specimens, Kievka Bay, 6-9 m, 29 Jun 2015, A. Chichvarkhin leg.; 2 specimens Rudnaya Bay,

760 Brynner Cape, 6-9 m, 30 May 2016, A. Chichvarkhin leg.; 1 specimen Senkina Shapka Pinnacle,

761 16 m, 2 Jun 2016, A. Chichvarkhin leg.

762 **Identification.** Body white semi-translucent. Rhinophores longer than oral tentacles lack

763 pigmentation. Cerata pink with white dots and white cnidosacks. Body length to 30 mm.

764 **Ecology.** Occurs at the depths of 2-20 m. Feeds on hydroids colonized hermit crabs' shells.

765 Oviposits on the same shells and hydroid colonies.

766 **Distribution.** Known from Vladimir Bay, Rudnaya Bay, and Kievka Bay (Chichvarkhin et

767 al., 2016b). Presumably reported from Bering Sea (Martynov & Korshunova, 2011; Martynov et

768 al., 2015). Also known from the NE Pacific and Atlantic (Chichvarkhin et al., 2016b).

769 **Remark.** *Cuthona hermithophila* has been described from Kievka Bay recently. We have

770 thoroughly investigated a population from there and few other populations. All of them are

771 nearly indistinguishable from nominative *C. nana* (Chichvarkhin et al, 2016b).

772 **Genus *Cuthonella* Bergh, 1884**

773 **Type species** *Cuthonella abyssicola* Bergh, 1884, by monotypy.

774 **36. *Cuthonella soboli* Martynov, 1992** (Fig. 11A–G)

775 Martynov, 1992:18-23, figs. 1-3.

776 *Cuthona* sp. – Baba, 1935a; Baba 1935b; ? Roginskaya, 1964.

777 *Cuthonella osyoro* – Baba, 1940; Martynov, 2006.

778 *Cuthona* cf. *punicea* – Nakano, 2004.

779 **Material examined.** 2 specimens, south of Oprichnik Bay, Viking wreck, 6-8 m, 6 June
780 2013, A. Chichvarkhin leg.; 5 specimens, Tretya Langou, 16-18 m, 6 June 2013, A.
781 Chichvarkhin leg.; 2 specimens, Brynner Cape, 4 m, 15 May 2014, A. Chichvarkhin leg.; 2
782 specimens, Dva Brata rocks, 6-8 m, 15 May 2014, A. Chichvarkhin leg.; 2 specimens, Vtoraya
783 Langou, 12-16 m, 16 May 2014, A. Chichvarkhin leg.; 1 specimen, Senkina Shapka pinnacle, 17
784 m, 15 May 2015, A. Chichvarkhin leg.; 4 specimens, Vladimir Bay 20 May 2014, K. Dudka leg.;
785 2 specimens, Kievka Bay, 7 m, 29 Jun 2015, A. Chichvarkhin leg.

786 **Identification.** Maximum body length 20 mm. Body uniformly. Rhinophores and oral
787 tentacles with white pigmentation. Coloration of the cerata varies. Color form from Vladivostok
788 possess brown cerata. Most common form possesses a dark brown colored digestive gland, a
789 white stripe along dorsal side of cerata and orange ring near the tips of cerata. Rare individuals
790 possess no orange pigment or white stripes. A form with orange colored digestive gland, orange
791 pigment with no white stripes is known from Vityaz Bay of the southwestern Peter-the-Great
792 Bay.

793 **Ecology.** Occurs on various substrates at 0-25 m depth where feeds on wide range of
794 hydrozoans, also fish eggs and presumably *Spyrorbis* sp. polychaete.

795 **Distribution.** Northern part of the Sea of Japan (Martynov & Korshunova, 2011).

796 **Superfamily Aeolidioidea Gray, 1827**

797 **Family Aeolididae Gray, 1827**

798 **Genus *Aeolidia* Cuvier, 1798**

799 **Type species** *Limax papillosus* Linnaeus, 1761, by subsequent designation.

800 **37. *Aeolidia papillosa* (Linnaeus, 1761) (Fig. 11H, I)**

801 *Limax papillosus* Linnaeus, 1761:508.

802 *Aeolidia papillosa* var. *pacifica* Volodchenko in Ushakov, 1953.

803 **Material examined.** 2 specimens, Senkina Shapka Pinnacle, 16 m, 13 May 2014, A.
804 Chichvarkhin leg.; 2 specimens, Brynner Cape, 6-8 m, 30 May 2016, A. Chichvarkhin leg.

805 **Identification.** Body, rhinophores, oral tentacles, and papillae brownish with with
806 numerous dots of white pigmentation. Body wide. Size to 70 mm.

807 **Ecology.** Feeds on *Metridium senile* hexacorals. Occurs on rocks and under stones at 1-20
808 m depth.

809 **Distribution.** A member of large amphiboreal cryptic species complex known as *A.*
810 *papillosa* (Kleinberger et al., 2016). The slugs from the Sea of Japan probably constitute a
811 distinct species.

812 **Family Facelinidae Bergh, 1889**

813 **Genus *Hermisenda* Bergh, 1879**

814 **Type species** *Cavolina crassicornis* Eschscholtz, 1831, by monotypy.

815 **38. *Hermisenda crassicornis* (Eschscholtz, 1831)** (Fig. 11J)

816 *Cavolina crassicornis* Eschscholtz, 1831:15, fig. 1.

817 *Aeolis (Flabellina?) opalescens* Cooper, 1863.

818 **Material examined.** 1 specimen, Vtoraya Langou Bay, 15 m, 7 May 2013, A.
819 Chichvarkhin leg.; 2 specimens, Vtoraya Langou Bay, 16 m, 16 May 2015, A. Chichvarkhin leg.

820 **Identification.** Body whitish, 30 mm max. Orange line with blue margins along central
821 part of the body. Orange markings on both lateral sides of the head. Long oral tentacles with blue
822 lines.

823 **Ecology.** A predator that feeds on aeolid nudibranches, mainly on *Flabellina athadona*.
824 Occurs at various depths of 1-15 m depths.

825 **Distribution.** North Pacific species, occurs from Mexico to Alaska, Sea of Japan, Kurile
826 Islands (Martynov & Korshunova 2011; Lindsay & Valdes, 2016).

827 **Remark.** Recently, Lindsay & Valdes (2016) hypothesized that *H. emurai* (Baba, 1937c)
828 inhabits the western Pacific including Russian waters, while *H. crassicornis* is a NE Pacific
829 species. Although they did not use any materials or data from there for making such a conclusion.
830 The slugs from the Russian waters possess character traits of the 'northeastern' *H. crassicornis*:

831 white longitudinal lines on their cerata, which are not arranged in distinct groups, overall
832 coloration brownish, not orange.

833

834 DISCUSSION

835 The present work updates the knowledge on the scarcely known marine fauna Primorye
836 region; from the 85 species of sea slugs recorded to inhabit Russian waters of the Sea of Japan
837 (Sirenko, 2013; Chichvarkhin et al., 2015, 2016a, 2016d; Martynov et al., 2015; Ekimova et al.,
838 2016), the 38 species were recorded in the surveyed region, accounting for about 46% of its sea
839 slug fauna. A large group of species (24) occurring in the area are widely distributed in the
840 northern Pacific Ocean. The eight species are endemic for the Sea of Japan and adjacent part of
841 the Sea of Okhotsk: *Cadlina olgae*, *Rostanga alisae*, *Melanochlamys chabanae*, *Runcinida*
842 *valentinae*, *Retusa minima*, *Cuthonella soboli*, *Dendronotus dudkai*, *Eubbranchus alexeii*. While
843 seven other species including *Cuthona nana*, *Eubbranchus rupium*, *Flabellina verrucosa*,
844 *Dendronotus frondosus*, *Palio dubia*, *Clione limacina*, and *Limacina helicina* occur also in
845 northern Atlantic and Arctic waters. Thirteen found species are unknown from Peter the Great
846 Bay but known from the Northern Pacific excluding *M. chabanae* and *R. valentinae*.
847 Interestingly, several species that are not recorded in the Peter the Great Bay were previously
848 found in the northern Hokkaido, including, e.g. *R. valentinae*, *J. fuscus*, and *O. muricata*. This
849 fact may detect an introgression pathway of northern species into the Sea of Japan along Kurile
850 Archipelago, Sakhalin, and Hokkaido. Most of studied 38 species can be clearly discriminated
851 using live body shape, size, and coloration, what makes their identification in the field faster and
852 easier. The only problematic group is the genus *Dendronotus*, three species of which (*D.*
853 *frondosus*, *D. dudkai*, and *D. kamchaticus*) are poorly distinguishable, hence molecular markers
854 or radula examination are preferred for their identification.

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865

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Figure 1

Surveyed area map

1 - Kievka Bay (42.84°N 133.65°E), 2 - Olga Bay (43.74°N 135.27°E), 3 - Vladimir Bay (43.91°N 135.50°E), 4 - Dva Brata, Senkina Shapka (44.33°N 135.84°E), 5- Rudnaya Bay, Brynner Cape (44.36°N 135.80°E), 6 - Tretya Langou, Kamenka Bay (44.42°N 135.94°E), 7 - Oprichnik Bay (44.45°N 136.00°E).



Figure 2

Heterobranchia of surveyed area

(A, B) *Melanochlamys yezoensis*, Rudnaya Bay. (C, D) *M. chabanae*, Vladimir Bay. (E, F) - *Retusa minima*, Kievka Bay. (G) - *Limacina helicina*, Rudnaya Bay. (H) - *Clione limacina*, Rudnaya Bay. (I) *Runcinida valentinae*, Senkina Shapka. (J) *Placida babai*, Dva Brata. (K) egg mass of *P. babai*, Nevelsk, Sakhalin.



Figure 3

Heterobranchia of surveyed area

(A) *Berthella californica*, Senkina Shapka. (B-D) *Onchidoris muricata*, Senkina Shapka. (E, F) - *Knoutsodonta jannae*, Kievka Bay. (G) *Ancula gibbosa*, Senkina Shapka. (H) *Berthella californica*, egg mass. (I, J) *Cadlina olgae*, Senkina Shapka.

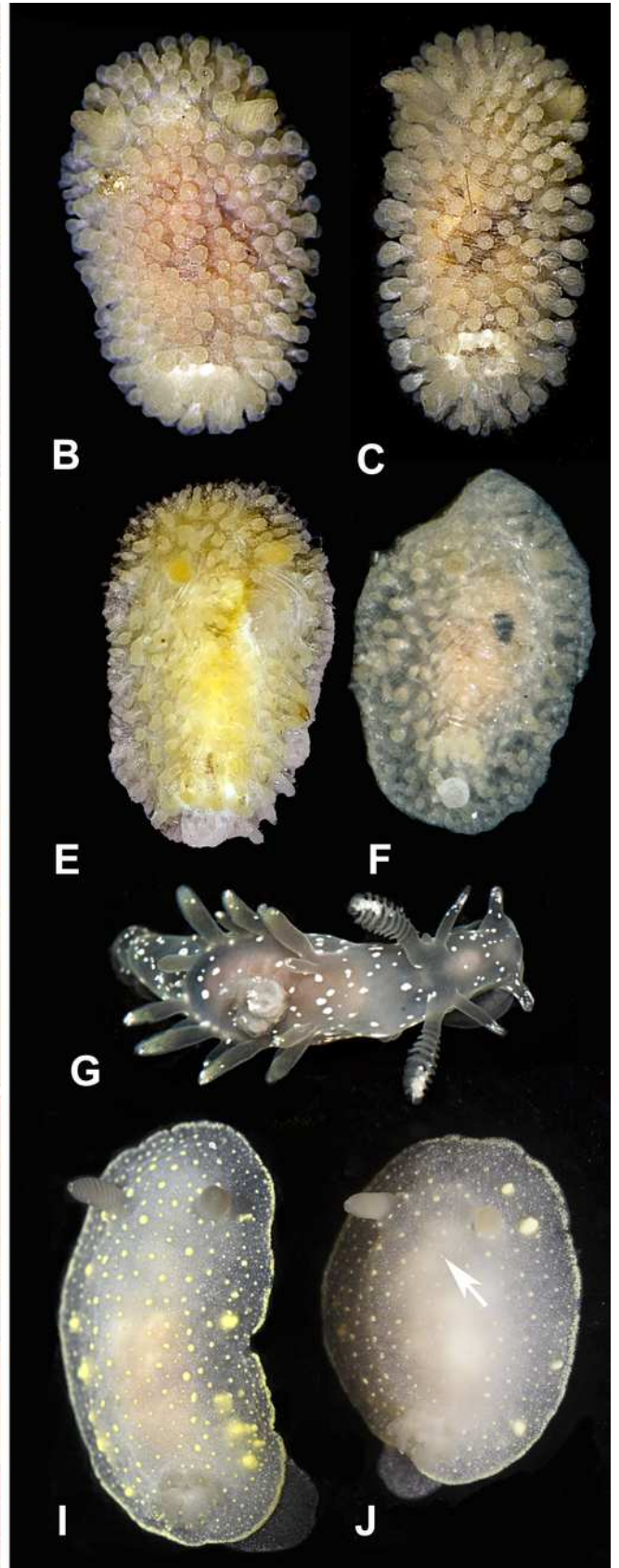


Figure 4

Radular and external morphology of *Cadlina* spp.

Cadlina olgae: A - rachidian and first marginal teeth of 29th and 30 th rows, scale 10 mkm; B - overview of radula rows, scale 50 mkm; C - 37-43th rows; D - holotype, scale 3 mm; E - paratype, scale 3 mm. *Cadlina laevis* (White Sea): F - rachidian and central lateral teeth, scale 10 mkm; G - rachidian tooth of 50th row, scale 10 mkm; *Cadlina* sp.1: H - rachidian and first marginal teeth of 29th and 30th rows, scale 10 mkm.

**Note: Auto Gamma Correction was used for the image. This only affects the reviewing manuscript. See original source image if needed for review.*

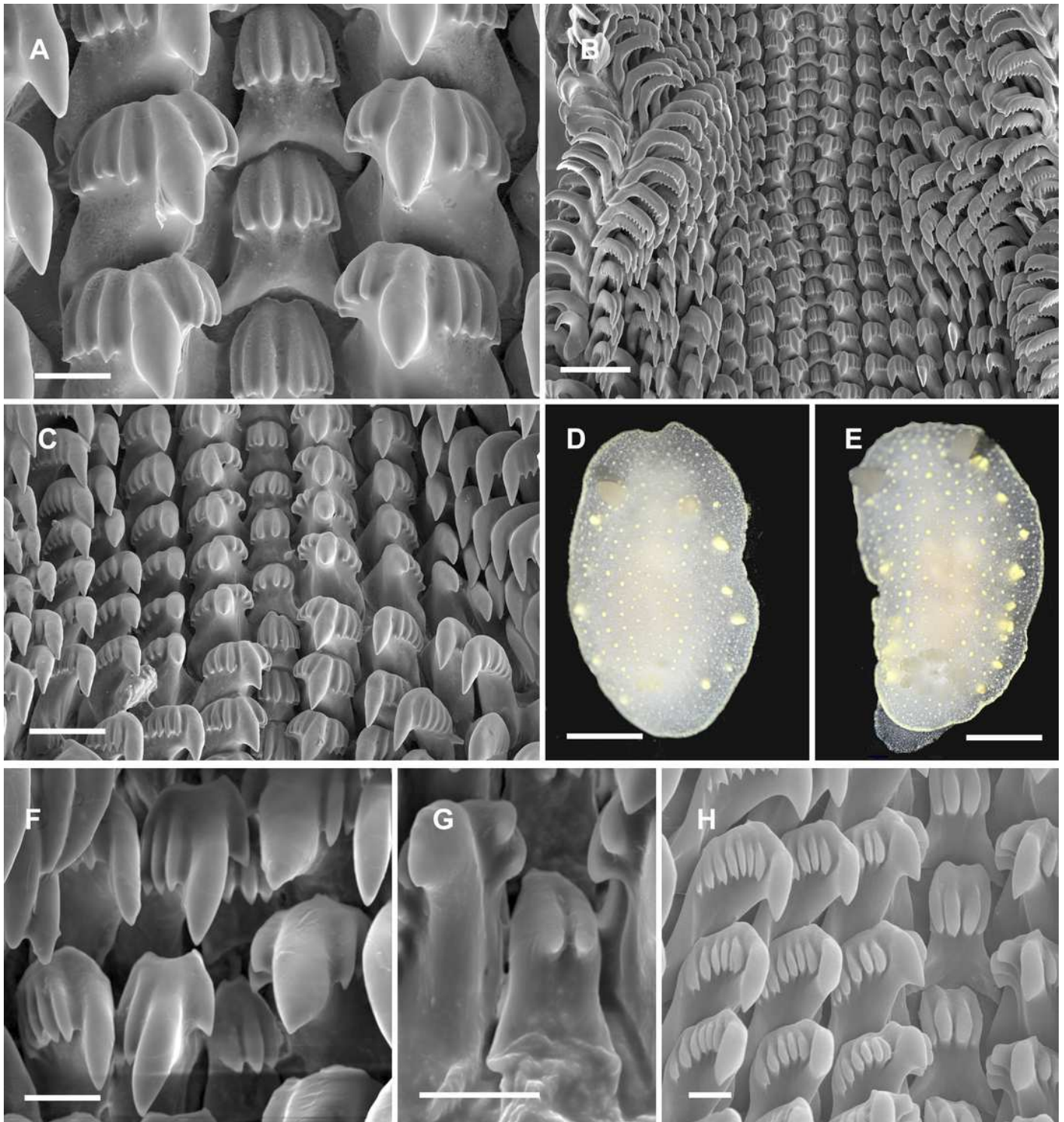


Figure 5

Cladistic species dilimitation in the genus *Cadlina*: Neighbour Joining tree. Bootstrap support (1000 pseudoreplicates) shown at the internodes.

A. COI. B. 16S.

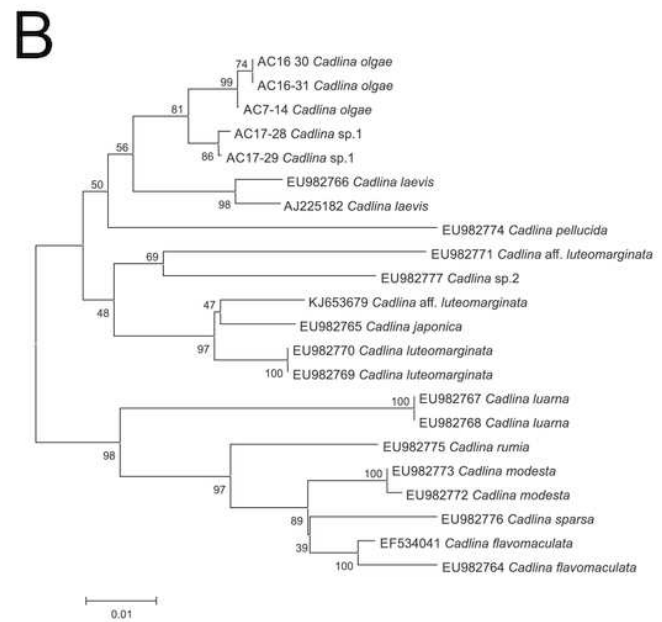
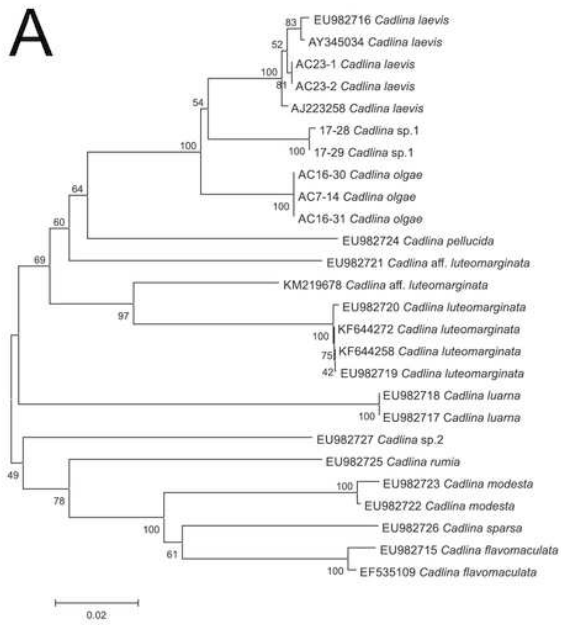


Figure 6

Heterobranchia of surveyed area

(A) *Diaulula odonoghuei*, Brynner Cape. (B) *D. odonoghuei* egg mass. (C, D) *Rostanga alisae*, Kievka Bay. (E, F) *Vayssierea elegans*, Kievka Bay. (G) *Triopha catalinae*, Oprichnik Bay. (H) *Palio dubia*, Klokovo Bay.

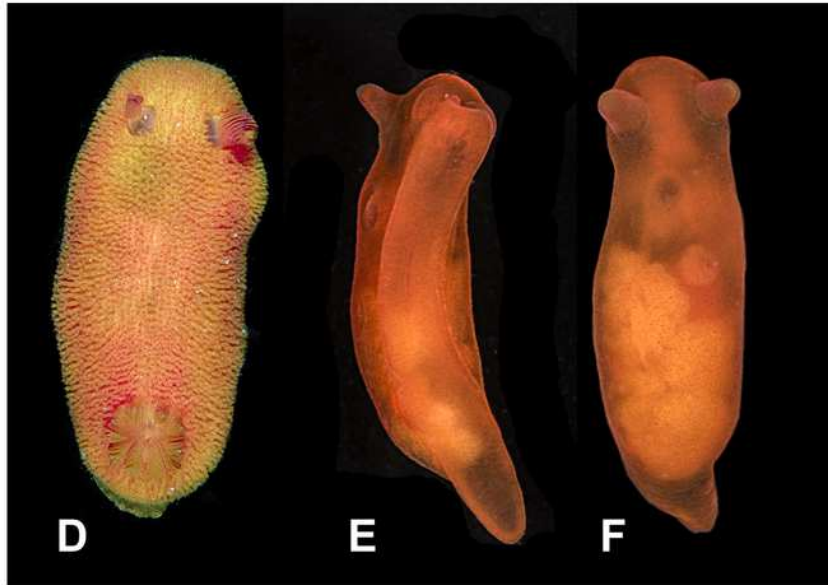
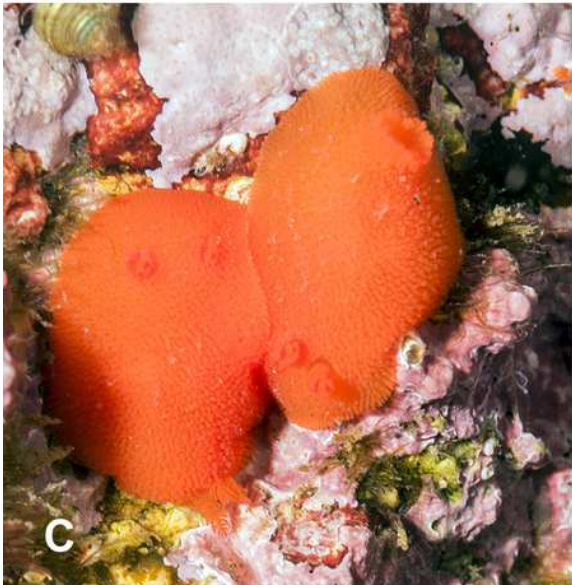
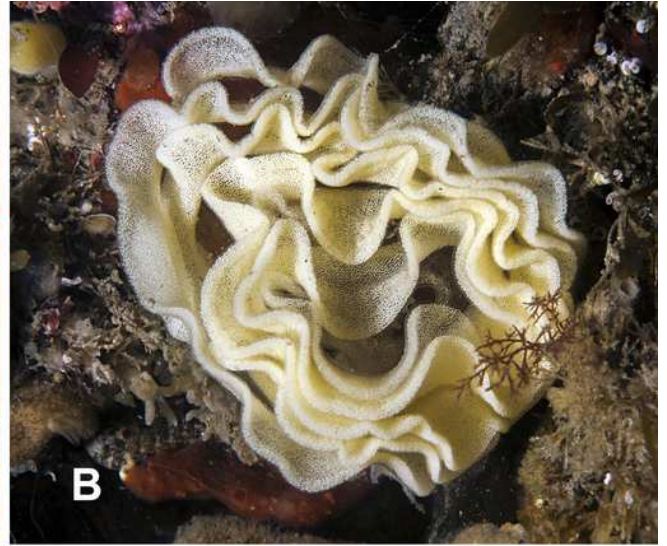


Figure 7

Heterobranchia of surveyed area

(A) *Dendronotus kamchaticus*, Rudnaya Bay. (B) *D. frondosus*, Rudnaya Bay. (C) *D. dudkai*, Rudnaya Bay. (D) *D. albopunctatus*, Rudnaya Bay. (E) *D. dallii*, Avacha Bay. (F) *D. kamchaticus* egg mass. (G) *Tritonia tetraquetra*, Nevelsk, Sakhalin (H) *Janolus fuscus*, Rudnaya Bay. (I) *Dirona pellucida*, Rudnaya Bay.



Figure 8

Heterobranchia of surveyed area

(A) *Flabellina* cf. *amabilis*, Klokovo Bay. (B, C) *F. verrucosa*, Klokovo Bay. (D, E, F) *F. cf. nobilis*, Klokovo Bay. (G, H) *F. trophina*, Dva Brata.

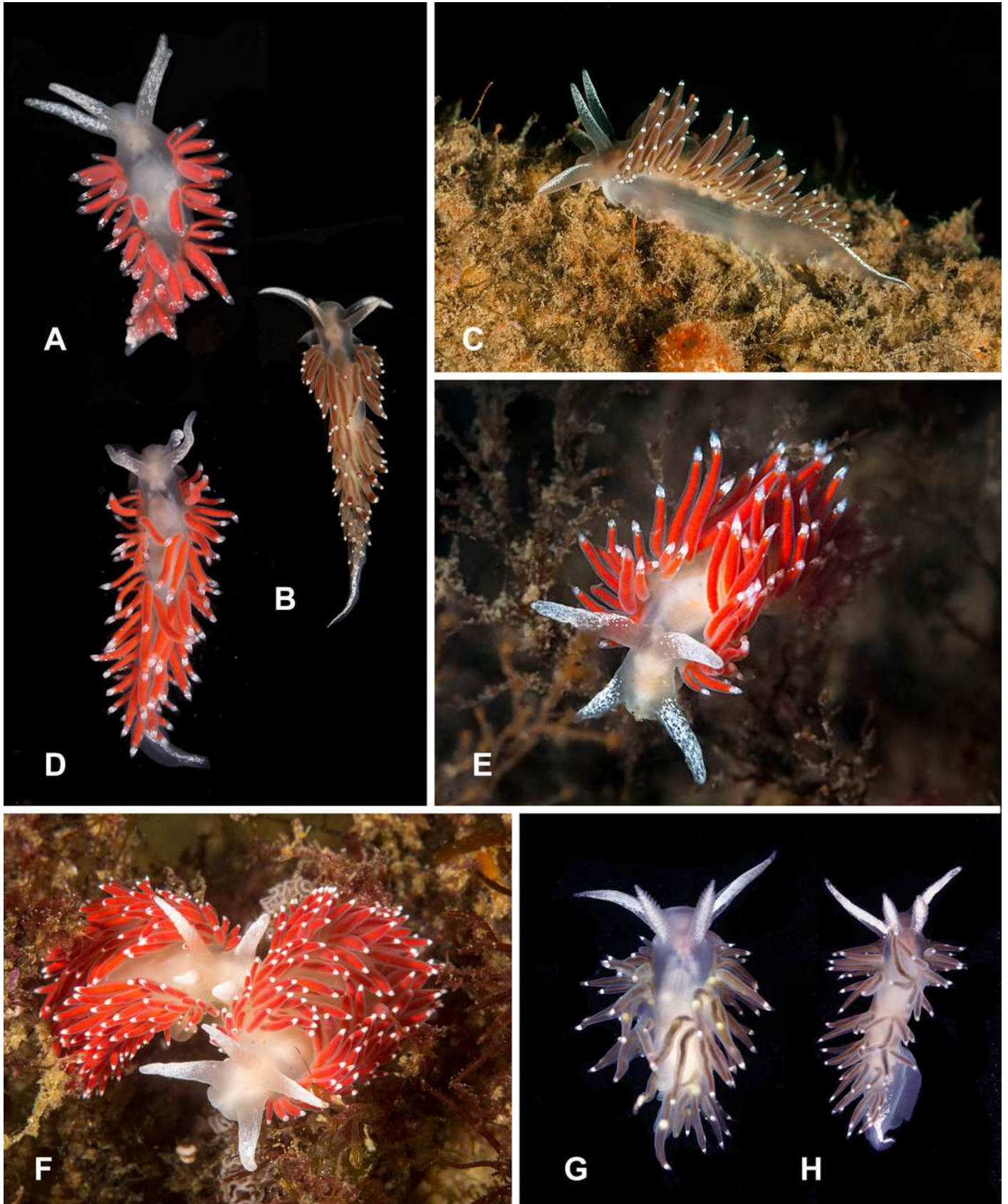


Figure 9

Heterobranchia of surveyed area

(A-E) *Flabellina athadona*, Dva Brata, Klokovo Bay; (F, G) *Eubranchius rupium*, Tretya Langou Bay; (H, I) *E. misakiensis*, Senkina Shapka. (J) *Trinchesia ornata*, Senkina Shapka. (K) *Trinchesia viridis*, Dva Brata.

*Note: Auto Gamma Correction was used for the image. This only affects the reviewing manuscript. See original source image if needed for review.

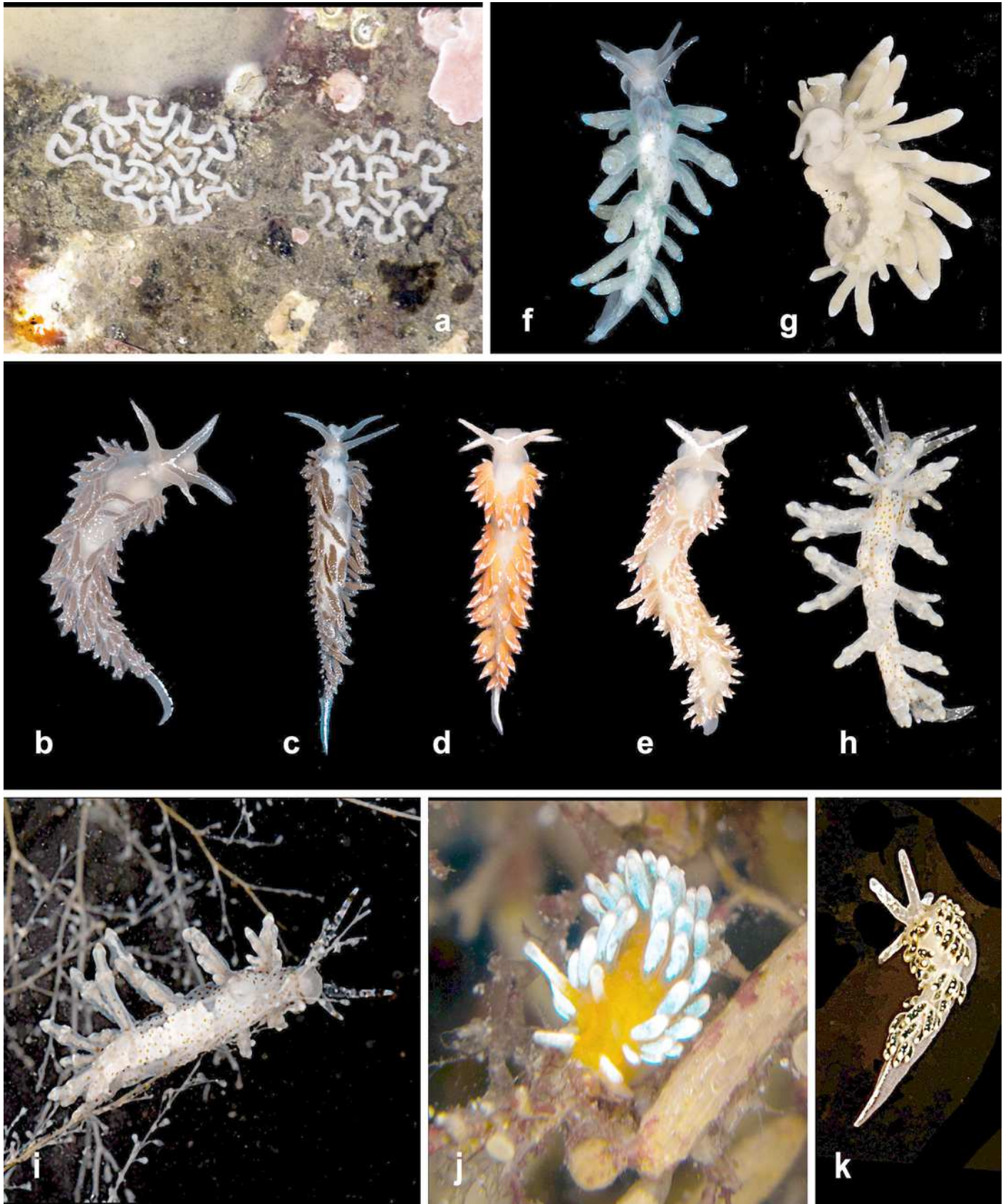


Figure 10

Heterobranchia of surveyed area

(A) *Cuthona nana* egg mass, Brynner Cape. (B, D-G) *C. nana* color forms, Brynner Cape. (C) *C. nana*, Kievka Bay.

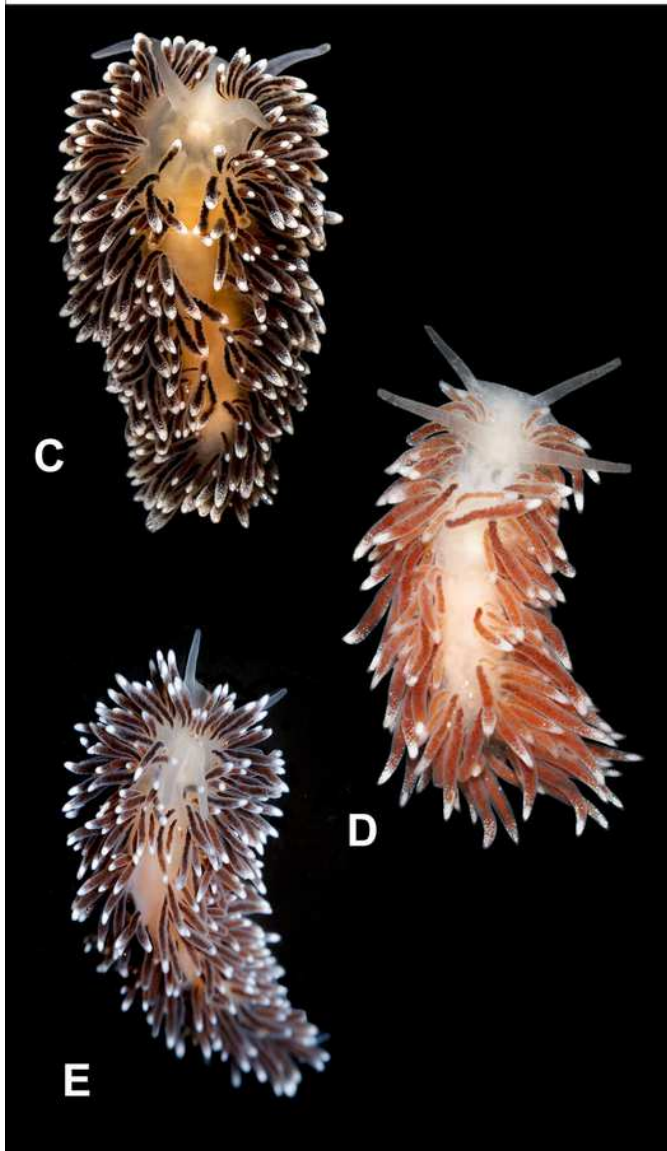


Figure 11

Heterobranchia of surveyed area

(A) *Cuthonella soboli*, Rudnaya Bay. (B) *C. soboli* egg mass, Rudnaya Bay. Color morphs of *C. soboli*: (C, D, F) Rudnaya Bay. (E) Vladimir Bay. (G) Vityaz Bay. (H) *Aeolidia papillosa* egg mass, Senkina Shapka. (I) *A. papillosa*, Senkina Shapka. (J) *Hermisenda crassicornis*, Klokovo Bay.

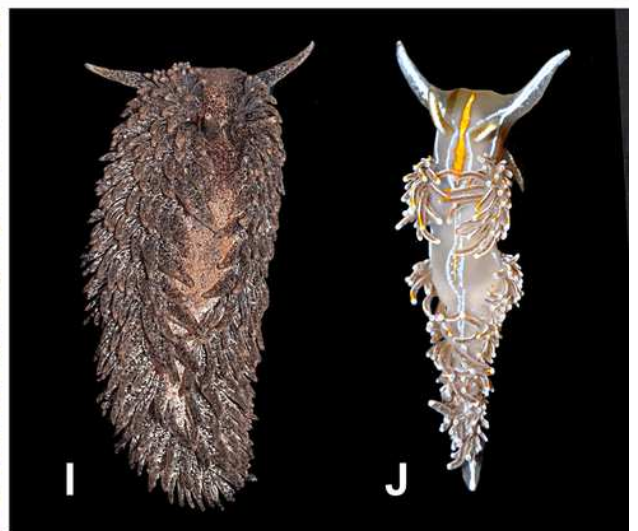
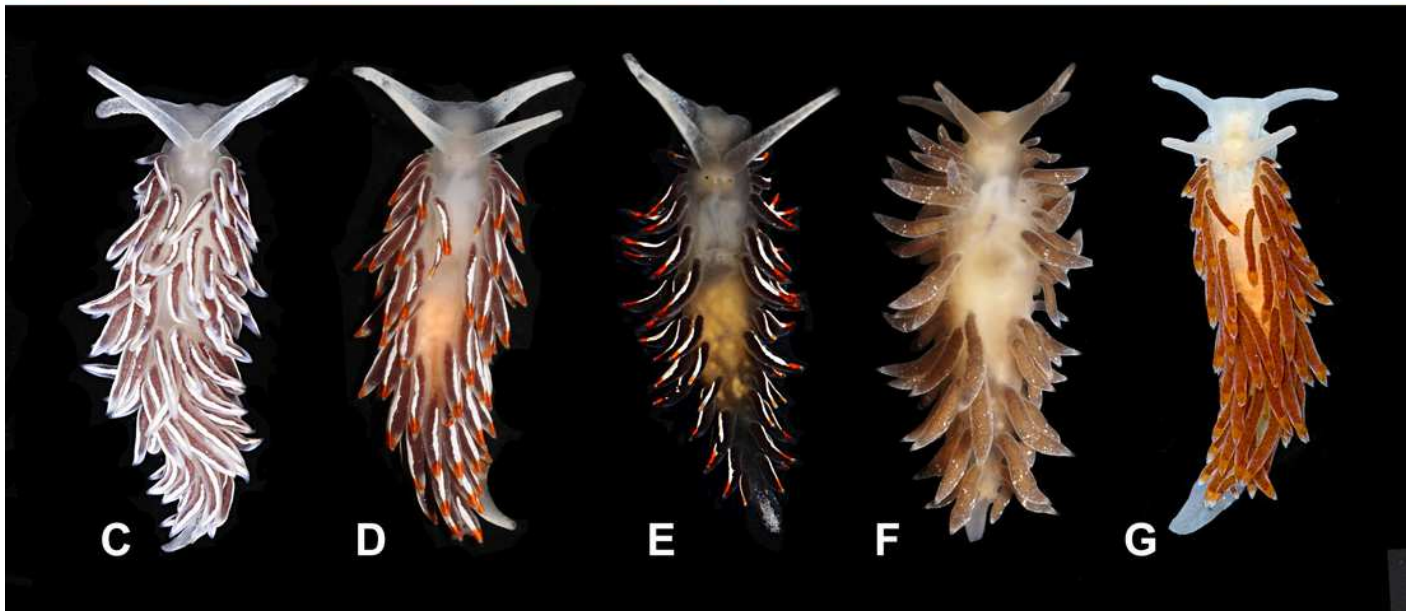
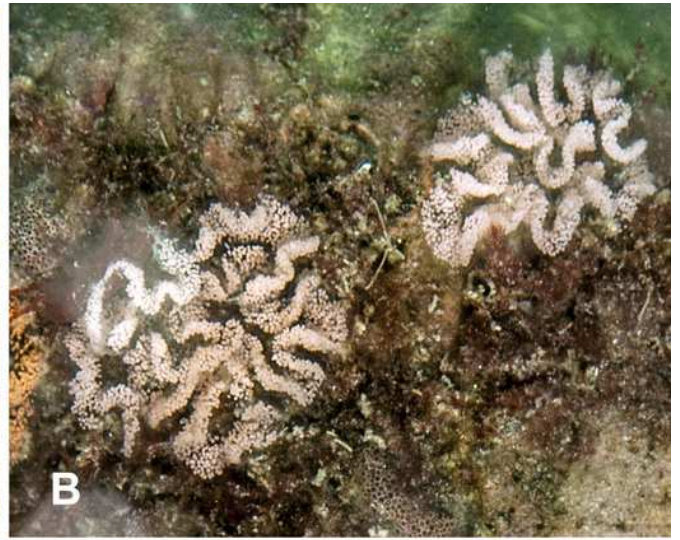


Table 1 (on next page)

Nucleotide sequences used in this study. Marked NCBI numbers indicate data obtained in this study.

Species	Location	Voucher#	COI NCBI#	16S NCBI#
<i>Cadlina laevis</i>	Mausunduer, Froya, Norway	CASIZ 182928	EU982716	EU982766
<i>C. laevis</i>	Kinkell Braes, Scotland	-	AY345034	-
<i>C. laevis</i>	Marstrand, Bohuslän, Sweden	-	AJ223258	AJ225182
<i>C. laevis</i>	White Sea	AC23-1	KX938359	-
<i>C. laevis</i>	White Sea	AC23-2	KX938360	-
<i>C. sp. 1</i>	Bering Sea	AC17-29	KX938362	KX938358
<i>C. sp. 1</i>	Bering Sea	AC17-28	KX938361	KX938357
<i>C. olgae</i>	Rudnaya Bay	AC16-30	KX610756	KX938355
<i>C. olgae</i>	Rudnaya Bay	AC7-14	KX610757	KX938354
<i>C. olgae</i>	Rudnaya Bay	AC16-31	KX610758	KX938356
<i>C. pellucida</i>	Ilha de Pesequeiro, Portugal	CASIZ 175448	EU982724	EU982774
<i>C. luteomarginata</i>	Canada: British Columbia, Bamfield	-	EU982720	EU982770
<i>C. luteomarginata</i>	Canada: British Columbia, Bamfield	10BCMOL- 00278	KF644272	-
<i>C. luteomarginata</i>	Canada: British Columbia, Bamfield	10BCMOL- 00358	KF644258	-
<i>C. luteomarginata</i>	Bamfield,, British Columbia, Canada	CASIZ 182929	EU982719	EU982769
<i>C. aff. luteomarginata</i>	Mendocino County, CA, USA	-	EU982721	EU982771
<i>C. aff. luteomarginata</i>	Canada: Parksville, Vancouver Island, British Columbia	CASIZ 188599A	KM219678	KJ653679
<i>C. luarna</i>	Punta Sabana, Costa Rica	CASIZ 175437	EU982718	EU982768
<i>C. luarna</i>	Costa Rica	-	EU982717	EU982767
<i>C. rumia</i>	Entrade al Parque, Bocas	CASIZ	EU982725	EU982775

	del Toro, Panama	175456		
<i>C. modesta</i>	Cayucos, California, USA	CASIZ 182930	EU982723	EU982773
<i>C. modesta</i>	Pillar Point, San Mateo County, California, USA	-	EU982722	EU982772
<i>C. sparsa</i>	La Jolla, San Diego County, California, USA	CASIZ 182932	EU982726	EU982776
<i>C. flavomaculata</i>	Palos Verdes, California, USA	AM C203860	EU982715	EF534041
<i>C. flavomaculata</i>	Point Loma, San Diego California, USA	CASIZ 182923	EF535109	EU982764
<i>C. japonica</i>	South Korea	CASIZ 182925	-	EU982765
<i>C. sp. 2</i>	Cape Peninsula, Cape Province, South Africa	CASIZ 175547	EU982727	EU982777
<i>Limacina helicina</i>	Rudnaya Bay	AC6-1	KX871888	-
<i>L. helicina</i>	Rudnaya Bay	AC6-3	KX871889	-
<i>L. helicina</i>	Antarctic Ocean	-	KC774084	-
<i>L. helicina</i>	Carribbean Sea, Yukatan, Belize	-	KC774083	-
<i>L. helicina</i>	Arctic Ocean	-	AB859536	-
<i>L. helicina</i>	Arctic Ocean: north of Europe	Ga56.2.1	FJ876924	-
<i>L. helicina</i>	Pacific Ocean: Prince Williams Sound	Ga56.1.1	FJ876923	-
<i>L. helicina</i>	Arctic ocean	-	AB859537	-

Table 2 (on next page)

Partial 16S sequences of the species in the genus *Cadlina* (positions #221-255 in *C. laevis*) with barcoding indels after position #240

1

<i>laevis</i> Norway	GCTTTACTAA-GTTGAAAAT--TTTTTA--TTTTCAAGA
<i>laevis</i> Sweden	GCTTTACTAAAGTTGAAAAT--TTTTTA--TTTTTAAGA
<i>olgae</i>	GCTTTACTAAAGTTGAAATT-----TTTTCAAGT
sp.1 Bering Sea	GCTTTACTAAAGTTGAAATTAATTTTTTA--TTTTCAAGT
sp.2 S. Africa	GCTTTGCTAAAGTTAAGAAT---TTTTAAATTCCTGAAT
<i>japonica</i>	GCTTTACTAAAAATGAGAGT---TTCTA--TTCTTAAGT
<i>luteomarginata</i>	GCTTCACTAAAGTTGAGAAT---TTTTA--TTCTTAAGT
aff. <i>luteomarginta</i>	GCTTTACTAAAGTTGAGAAT---TTTTA--TTCTTAAGT
<i>luarna</i>	GTTTTACTAAAAATTAATTG-----TTTTTAAGT
<i>pellucida</i>	GCTTTACTAAAGTTGAAAAT---TTTA--TTTTTAAAA
<i>rumia</i>	GCTTTACTAAAGTTGAATCT-----TTTTTAAGT
<i>flavomaculata</i>	GCTTTACTAAAAATGAATTCT-----TTTT-AAGT
<i>modesta</i>	GCTTTACTAAAAATGAATTCT-----TTTT-AAGT
<i>sparsa</i>	GCTTTACTAAAAATGAATTCT-----TTTT-AAGT

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