

The following supplement accompanies the article

Impact of multiple stressors on sea bed fauna in a warming Arctic

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Marine Ecology Progress Series 608: 1–12 (2019)

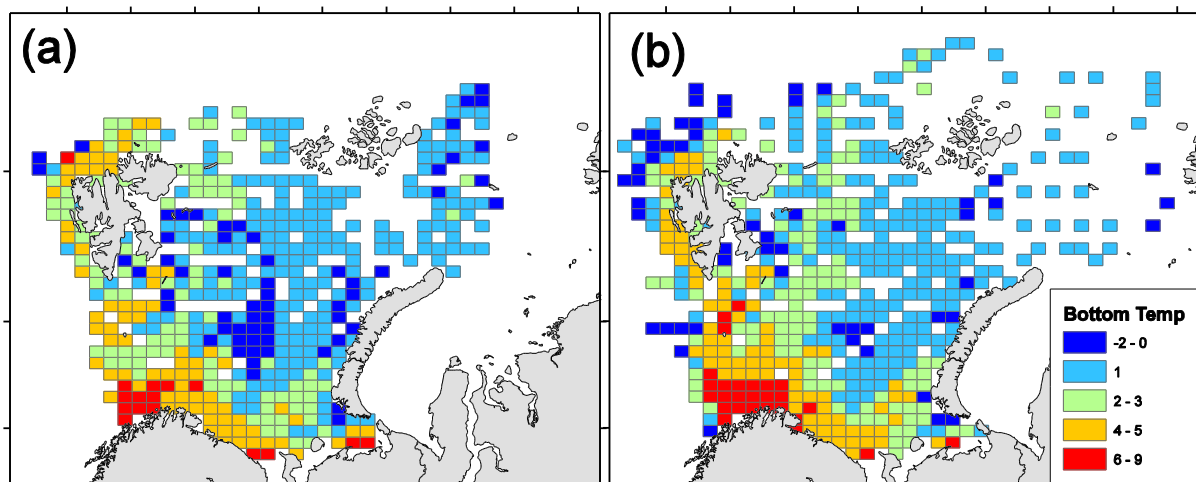


Figure S1. Mean bottom temperatures in August and September during a) 2009–2011 and b) 2012–2015 calculated for each grid cell (36*36 nautical mile).

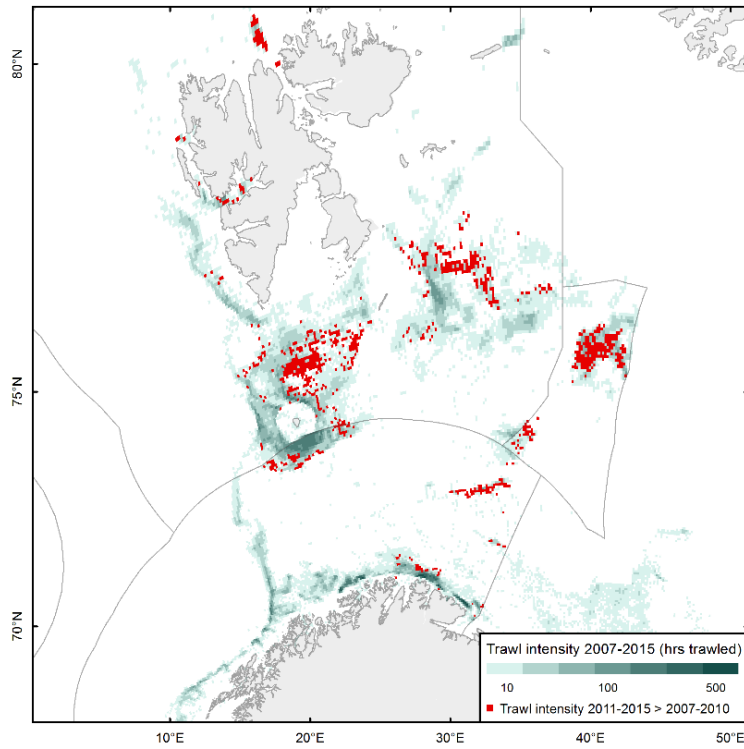


Figure S2. Bottom trawl intensity given as hours of trawling during 2007–2015. Grids trawled more intensively in 2011–2015 compared to during 2007–2013 are shown in red.

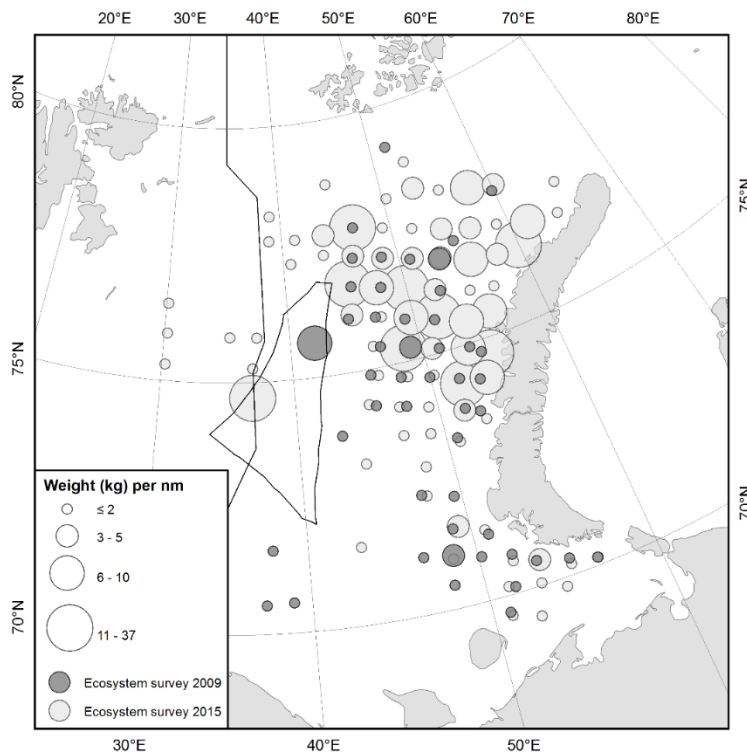


Figure S3. Distribution of snow crab (kg per nautical mile) in the Barents Sea in 2009 (dark grey) and 2015 (light grey).

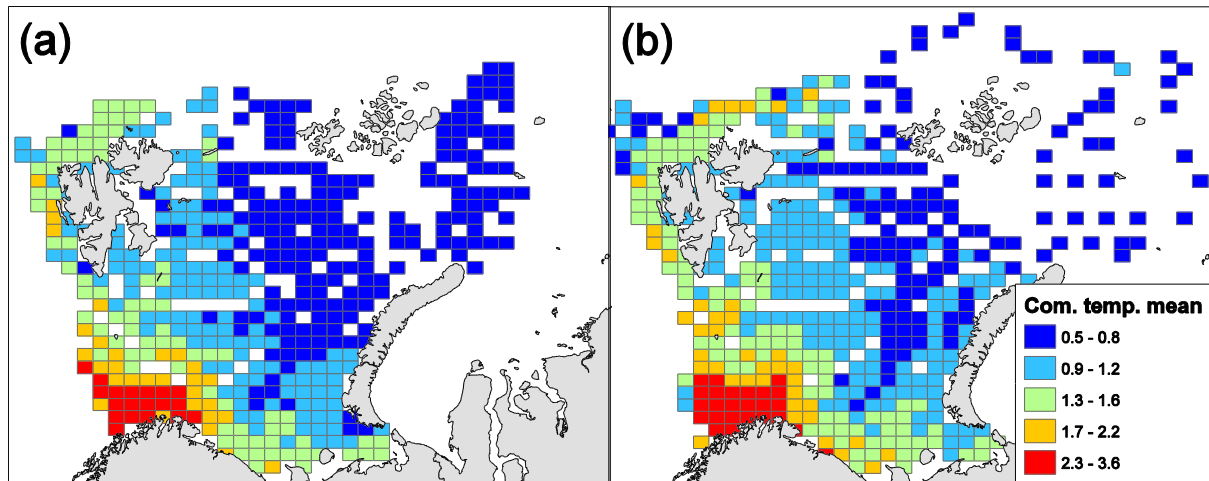


Figure S4.1 Benthic species mean community **temperature (°C) mean** (50th percentile) per 36*36 nautical mile grid for a) 2009–2011 and b) 2012–2015. Dominance of taxa with affinity to cold water are given in blue, while dominance of taxa with affinity to warm-water are given in red.

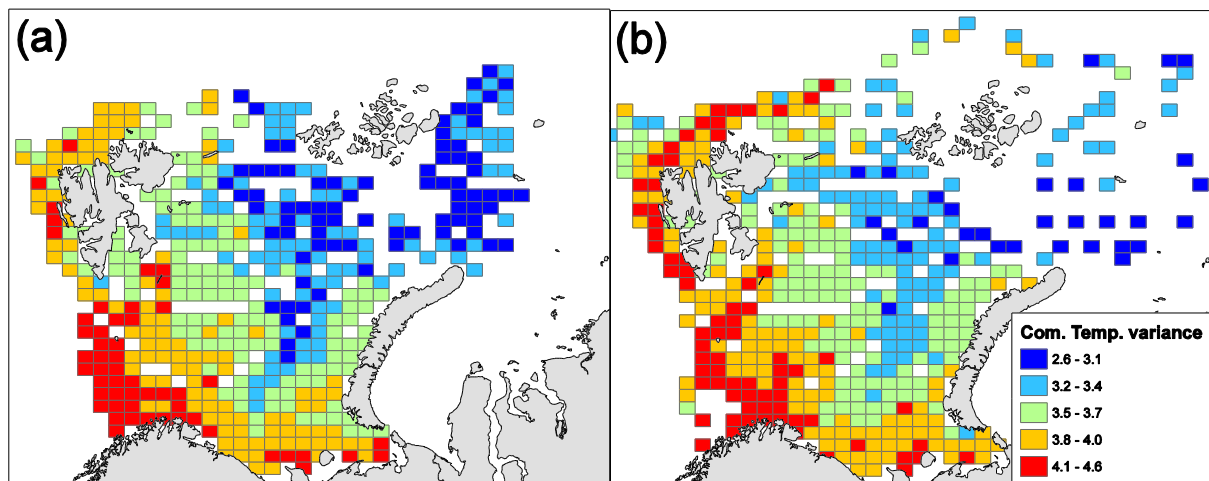


Figure S4.2 Benthic species mean community **temperature (°C) range** (10th–90th percentile range) per 36*36 nautical mile grid for (a) 2009–2011 and (b) 2012–2015. Dominance of taxa with broad tolerance to temperatures are given in red, while narrow tolerance is in blue.

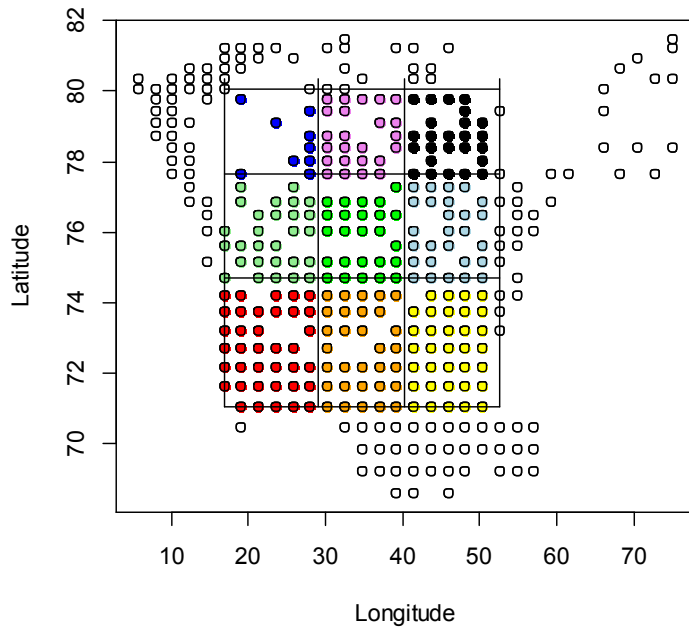


Figure S4.3 The rectangular grid of nine equally sized areas (blocks), where each area encompassing 35 grid cells, used to account for modelled spatial variability in community sensitivity.

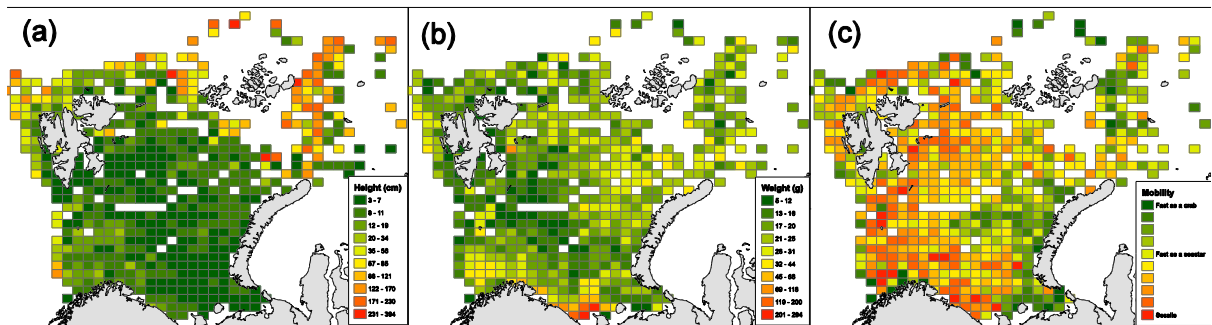


Figure S5: Benthic community mean (a) height (cm), (b) weight (g), and (c) mobility class (from “sessile” to “fast as a crab”) per 36*36 nautical mile grid.

Table S1. Megafauna taxa, data and traits sorted alphabetically after Phylum. Temp. mean (temperature mean given as the 50th percentile), Temp. range. (temperature range given as the 10th – 90th percentile range), Temp. sens. (given as the ranked value from sorting “Temp mean” and “Temp var”), Weight (g) (total biomass/total individuals), Height (adult height as measured in the field or from Hodgson 1987, REDLIST 2017 and MARBEFF 2017), Mob. (mobility given as 1 = as a crab, 2 as a sea star, 3 as a snail or no movement at all), Trawl vul. (given as the ranked value from “Height”, “Weight” and “Mob.”), Prey (as recorded from Pavlov & Sokolov 2003, Squires & Dawe 2003, Manushin *et al.*, 2016, Zakharov *et al.* 2016). Brac. = Brachiopoda, Bry. Bryozoa, Cni. Cnidaria, Cru. = Crustacea, Ech = Echinodermata, Moll. = Mollusca, Pol = Polychaeta, Por = Porifera, Pyc = Pycnogonida, Tun. = Tunicata.

Species name			Traits		Rank	Traits			Rank	Rank
Phylum	Group	Taxa	Temp. median	Temp. range	Temp. sens	Height (cm)	Weight (g)	Mob.	Trawl. vul	Prey avail.
Brac.	Rhynchonellata	Hemithiris psittacea	1.16	4.24	99	10	2.5	3	90	0
Brac.	Rhynchonellata	Macandrevia cranium	4.83	4.62	192	10	2.7	3	89	0
Bry.	Gymnolaemata	Alcyonidium disciforme	0.77	3.09	67	5	1.5	3	159	0
Cni.	Actiniaria	Anthosactis janmayeni	1.22	2.82	106	10	2.4	3	92	0
Cni.	Actiniaria	Bolocera tuediae	3.95	4.64	181	10	46.8	3	64	0
Cni.	Actiniaria	Cribrinopsis similis	2.11	2.68	137	10	33.2	3	68	0
Cni.	Actiniaria	Liponema multicornis	2.23	3.67	142	10	49.6	3	62	0
Cni.	Actiniaria	Metridium senile	1.74	3.69	123	10	163.7	3	56	0
Cni.	Actiniaria	Stomphia coccinea	2.28	4.58	143	10	38.2	3	66	0
Cni.	Actiniaria	Urticina felina	2.83	3.36	158	10	49.6	3	63	0
Cni.	Ceriantharia	Cerianthus lloydi	0.65	2.1	52	5	7.4	3	149	0
Cni.	Hydrozoa	Ptychogena lactea	1.01	1.96	85	10	7.4	2	78	0
Cni.	Octocorallia	Clavularia arctica	2.1	2.44	136	5	1.3	3	161	0
Cni.	Octocorallia	Isidella lofotensis	3.29	3.06	170	40	0.7	3	22	0
Cni.	Octocorallia	Paragorgia arborea	-0.41	NA	3	200	900	3	2	0
Cni.	Octocorallia	Umbellula encrinus	0.35	2.64	15	250	39.6	3	1	0
Cni.	Scleractinia	Caryophyllia smithii	4.61	0.94	189	5	4.4	3	153	0
Cru.	Amphipoda	Acanthonotozoma cristatum	-0.29	1.98	4	2	0.3	2	311	1
Cru.	Amphipoda	Acanthostepheia malmgreni	0.73	2.99	62	2	0.8	2	293	1
Cru.	Amphipoda	Ampelisca eschrichti	1.12	2.36	95	1	0.4	3	377	1
Cru.	Amphipoda	Arrhis phyllonyx	1.16	2.07	97	2	0.2	2	319	1
Cru.	Amphipoda	Byblis gaimardi	-0.06	0.45	9	2	0.2	2	317	0
Cru.	Amphipoda	Epimeria loricata	2.07	3.77	134	2	0.6	2	301	1
Cru.	Amphipoda	Eurythenes gryllus	-0.15	3.53	8	10	3.9	2	86	1
Cru.	Amphipoda	Eusirus cuspidatus	0.57	4.5	48	2	0.8	2	290	1
Cru.	Amphipoda	Eusirus holmi	0.19	2.39	10	2	1.8	2	259	1
Cru.	Amphipoda	Gammarus wilkitzkii	0.93	2.73	81	2	0.8	2	289	0
Cru.	Amphipoda	Leucothoe spinicarpa	0.3	1.38	12	2	0.6	2	297	1
Cru.	Amphipoda	Liljeborgia fissicornis	-0.17	3.14	7	2	1.1	2	281	1
Cru.	Amphipoda	Neochela monstrosa	1.57	6.03	121	2	0.9	2	285	0
Cru.	Amphipoda	Paramphithoe hystrix	0.82	3.77	72	2	0.7	2	294	1
Cru.	Amphipoda	Paroediceros lynceus	0.69	2.02	57	2	0.2	2	316	1
Cru.	Amphipoda	Phippsiella similis	-0.18	3.48	6	2	1.1	2	280	1
Cru.	Amphipoda	Rhachotropis aculeata	1.22	3.97	107	2	0.8	2	287	0
Cru.	Amphipoda	Tmetonyx cicada	3.18	4.79	166	2	0.2	2	315	1
Cru.	Anomura	Lithodes maja	4.93	3.99	193	10	133.3	1	57	0
Cru.	Anomura	Munida bamffica	5.14	3.06	195	10	5.6	1	82	0
Cru.	Anomura	Paralithodes camtschaticus	3.45	2.69	172	15	2031.4	1	41	0
Cru.	Brachyura	Chionoecetes opilio	0.42	2.1	24	12	55.7	1	51	1
Cru.	Brachyura	Geryon trispinosus	5.46	1.11	198	5	34.5	1	130	0
Cru.	Isopoda	Calathura brachiata	1.32	2.6	111	2	1.4	2	272	1
Cru.	Isopoda	Saduria sabini	0.43	2.31	26	5	3.3	2	154	0

Cru.	Mysidacea	Boreomysis arctica	-0.49	2.6	2	10	4.8	1	83	0
Cru.	Natantia	Atlantopandalus propinquus	3.12	6.15	163	30	2.2	1	29	0
Cru.	Natantia	Eusergestes arcticus	0.52	3.78	38	30	3.3	1	28	0
Cru.	Natantia	Hymenodora glacialis	-0.25	3.42	5	30	1.2	1	31	0
Cru.	Natantia	Lebbeus polaris	0.77	4.23	69	5	2.6	1	155	0
Cru.	Natantia	Pandalus montagui	3.59	5.52	174	50	2.3	1	17	1
Cru.	Natantia	Pontophilus norvegicus	3.18	3.65	168	3	1.8	1	209	0
Cru.	Natantia	Sabinea septemcarinata	0.7	3.26	59	3	3.3	1	204	1
Cru.	Natantia	Sclerocrangon boreas	1.35	4.15	112	3	5.8	1	196	1
Cru.	Natantia	Sclerocrangon ferox	0.46	2.27	31	4	8.2	1	182	1
Ech.	Asteroidea	Asterias rubens	2.73	4.65	153	5	12.3	2	139	0
Ech.	Asteroidea	Bathybiaster vexillifer	0.44	2.89	30	3	28.3	2	190	0
Ech.	Asteroidea	Ceramaster granularis	4.21	4.77	185	2	4.4	2	236	0
Ech.	Asteroidea	Crossaster papposus	0.69	3.87	58	5	16.7	2	133	0
Ech.	Asteroidea	Crossaster squamatus	2.37	2.61	144	2	1	2	284	0
Ech.	Asteroidea	Ctenodiscus crispatus	0.87	3.54	77	2	3	2	251	0
Ech.	Asteroidea	Hippasteria phrygiana	3.44	4.29	171	5	59.6	2	127	0
Ech.	Asteroidea	Hymenaster pellucidus	0.49	3.5	35	2	3.9	2	244	0
Ech.	Asteroidea	Icasterias panopla	0.57	2.4	46	5	43.8	2	128	0
Ech.	Asteroidea	Korethraster hispidus	0.96	4.91	83	2	1.7	2	263	0
Ech.	Asteroidea	Leptasterias groenlandica	0.87	3.93	76	2	3.8	2	245	0
Ech.	Asteroidea	Leptychaster arcticus	4.2	4.1	184	2	2	2	257	0
Ech.	Asteroidea	Lophaster furcifer	0.46	2.68	33	2	23.8	2	216	0
Ech.	Asteroidea	Pedicellaster typicus	4.29	3.93	186	2	11.5	2	222	0
Ech.	Asteroidea	Pontaster tenuispinus	0.66	3.78	54	2	4.2	2	239	0
Ech.	Asteroidea	Poraniomorpha hispida	3.17	5.44	165	2	163.5	2	214	0
Ech.	Asteroidea	Poraniomorpha tumida	0.44	2.27	29	2	13.1	2	221	0
Ech.	Asteroidea	Pseudarchaster parelii	4.51	2.9	187	2	3.2	2	248	0
Ech.	Asteroidea	Psilaster andromeda	0.36	2.52	17	2	19	2	219	0
Ech.	Asteroidea	Pteraster militaris	0.77	3.87	68	2	11.3	2	223	0
Ech.	Asteroidea	Pteraster obscurus	1.38	3.34	116	2	9.8	2	224	0
Ech.	Asteroidea	Pteraster pulvillus	2.19	4.61	141	2	3.7	2	247	0
Ech.	Asteroidea	Solaster endeca	0.4	3.2	21	4	73.4	2	174	0
Ech.	Asteroidea	Solaster syrtensis	0.32	4.11	14	5	170	2	126	0
Ech.	Asteroidea	Stephanasterias albula	3.6	3.11	175	1	0.5	2	375	0
Ech.	Asteroidea	Stichastrella rosea	5.75	2.76	200	3	10.2	2	195	0
Ech.	Asteroidea	Tremaster mirabilis	1.9	0	128	3	69.6	2	187	0
Ech.	Asteroidea	Tylaster willei	0.44	1.03	28	3	60.7	2	188	0
Ech.	Asteroidea	Urasterias linckii	0.55	2.91	44	5	41.4	2	129	0
Ech.	Crinoidea	Heliometra glacialis	0.46	2.3	32	40	13.6	3	20	0
Ech.	Crinoidea	Poliometra proluxa	0.55	4.14	43	40	8.4	3	21	0
Ech.	Echinoidea	Brisaster fragilis	3.58	2.77	173	3	25.7	2	191	0
Ech.	Echinoidea	Echinus acutus	4.69	2.03	190	10	33.9	2	67	0
Ech.	Echinoidea	Echinus esculentus	4.98	2.3	194	10	109.4	2	58	0
Ech.	Echinoidea	Spatangus purpureus	5.2	4.67	196	3	11.6	2	194	0
Ech.	Holothuroidea	Cucumaria frondosa	3.15	3.4	164	15	359.5	2	42	0
Ech.	Holothuroidea	Ekmania barthi	1.13	2.81	96	1	5.5	2	328	1
Ech.	Holothuroidea	Epyrgus scaber	0.41	2.71	22	1	3.7	1	336	1
Ech.	Holothuroidea	Parastichopus tremulus	5.51	2.44	199	8	91.1	2	106	0
Ech.	Holothuroidea	Pentamera calcigera	0.77	0.94	66	1	4.3	2	334	0
Ech.	Ophiuroidea	Gorgonocephalus arcticus	0.4	2.18	19	40	215.7	3	18	0
Ech.	Ophiuroidea	Ophiacantha bidentata	0.55	2.82	45	2	1.1	2	279	0
Ech.	Ophiuroidea	Ophiocten sericeum	0.53	3.65	39	2	0.4	2	309	0
Ech.	Ophiuroidea	Ophiopholis aculeata	1.03	4.07	88	2	1.9	2	258	0
Ech.	Ophiuroidea	Ophiopleura borealis	0.37	1.38	18	2	3.9	2	241	0
Ech.	Ophiuroidea	Ophioscolex glacialis	0.6	2.64	50	2	4.3	2	238	0
Ech.	Ophiuroidea	Ophiura robusta	0.82	4.13	71	2	1.4	2	270	0
Ech.	Ophiuroidea	Ophiura sarsi	1.21	3.89	104	2	1.4	2	271	1

Echi	Echiura	Hamingia arctica	1.21	3.98	105	1	11.4	3	323	0
Mol.	Bivalvia	Arctica islandica	3.03	0.02	161	1	6.8	2	325	1
Mol.	Bivalvia	Arctina greenlandica	2.79	1.76	156	2	0.5	2	303	1
Mol.	Bivalvia	Astarte borealis	1.46	4.13	118	2	7.1	2	226	0
Mol.	Bivalvia	Astarte crenata	0.9	3.95	79	2	3.7	2	246	0
Mol.	Bivalvia	Bathyarca glacialis	1.74	4.32	124	2	1.4	2	273	1
Mol.	Bivalvia	Chlamys islandica	1.28	3.87	110	4	56.4	2	176	0
Mol.	Bivalvia	Clinocardium ciliatum	0.65	3.17	53	1	9.8	2	324	1
Mol.	Bivalvia	Cuspidaria arctica	0.43	2.13	25	2	1.4	2	269	0
Mol.	Bivalvia	Cuspidaria glacialis	0.85	2.8	74	2	1	2	283	0
Mol.	Bivalvia	Delectopecten vitreus	2.47	6.63	145	2	0.8	2	288	0
Mol.	Bivalvia	Hiatella arctica	0.63	4.47	51	2	4.3	3	237	1
Mol.	Bivalvia	Karnekipia sulcatum	3.7	4.35	178	2	5.3	2	230	0
Mol.	Bivalvia	Macoma calcarea	0.57	4.13	47	2	2.8	2	253	1
Mol.	Bivalvia	Modiolus modiolus	0.93	6.21	80	3	1.4	3	210	0
Mol.	Bivalvia	Nuculana pernula	0.41	3.75	23	1	0.6	2	374	0
Mol.	Bivalvia	Serripes groenlandicus	1.19	4.64	101	2	21	3	217	1
Mol.	Bivalvia	Similipecten groenlandicus	0.5	2.87	36	2	0.3	2	310	0
Mol.	Bivalvia	Yoldia hyperborea	0.88	3.2	78	1	2.7	3	342	1
Mol.	Cephalopoda	Bathypolypus arcticus	1.03	3.75	87	50	28.4	1	12	0
Mol.	Cephalopoda	Cirroteuthis muelleri	-0.53	3.56	1	50	151	1	9	0
Mol.	Cephalopoda	Gonatus fabricii	1.84	4.09	126	50	9.7	1	4	0
Mol.	Cephalopoda	Rossia palpebrosa	0.67	3.34	55	20	13.1	1	39	0
Mol.	Gastropoda	Aeolidia papillosa	1.49	3.63	119	2	2.2	2	255	0
Mol.	Gastropoda	Boreoscala greenlandica	0.72	3.04	61	2	3.2	2	249	0
Mol.	Gastropoda	Buccinum angulosum	0.4	2.54	20	5	13.6	2	137	0
Mol.	Gastropoda	Buccinum ciliatum	0.35	4.07	16	3	3.9	2	200	0
Mol.	Gastropoda	Buccinum cyaneum	1.49	2.51	120	7	29.8	2	110	0
Mol.	Gastropoda	Buccinum elatior	1.12	3.72	94	5	7.8	2	148	0
Mol.	Gastropoda	Buccinum finmarchianum	2.59	4.57	149	3	3.5	2	203	0
Mol.	Gastropoda	Buccinum fragile	0.58	3.29	49	5	8.1	2	147	0
Mol.	Gastropoda	Buccinum glaciale	1.26	3.92	109	7	12.7	2	111	0
Mol.	Gastropoda	Buccinum hydrophanum	0.53	2.73	41	5	7.1	2	150	0
Mol.	Gastropoda	Buccinum micropoma	0.77	2.84	65	3	3.7	2	202	0
Mol.	Gastropoda	Buccinum polare	2.06	4.29	133	6	14.6	2	117	0
Mol.	Gastropoda	Buccinum undatum	1.16	3.9	98	5	11	2	141	0
Mol.	Gastropoda	Bulbus smithi	2.73	4.2	154	4	11	2	181	0
Mol.	Gastropoda	Cadlina laevis	2.72	4.57	151	2	0.5	2	302	0
Mol.	Gastropoda	Capulacmaea radiata	0.5	3.31	37	1	0.8	2	372	0
Mol.	Gastropoda	Colga villosa	2.82	6.48	157	1	0.7	2	373	0
Mol.	Gastropoda	Colus altus	0.53	2.26	40	4	5.1	2	184	0
Mol.	Gastropoda	Colus holboelli	2.12	3.89	138	5	10.4	2	143	0
Mol.	Gastropoda	Colus islandicus	0.84	3.82	73	7	12.9	2	110	0
Mol.	Gastropoda	Colus pubescens	1.08	2.86	91	4	5.1	2	185	0
Mol.	Gastropoda	Colus sabini	0.47	2.86	34	5	9.1	2	144	0
Mol.	Gastropoda	Colus turgidulus	0.44	1.97	27	8	15.8	2	107	0
Mol.	Gastropoda	Cryptonatica affinis	1.2	3.96	102	2	4.6	2	234	1
Mol.	Gastropoda	Limneria undata	1.02	3.89	86	2	0.8	2	292	0
Mol.	Gastropoda	Lunatia pallida	0.76	3.14	64	2	1.8	2	260	0
Mol.	Gastropoda	Neptunea communis	1.95	4.03	131	14	30.9	2	47	0
Mol.	Gastropoda	Neptunea denselirata	0.68	3.19	56	13	24	2	49	0
Mol.	Gastropoda	Neptunea despecta	3	2.94	160	10	19.4	2	72	0
Mol.	Gastropoda	Neptunea ventricosa	1.83	4.42	125	15	50.2	2	44	0
Mol.	Gastropoda	Puncturella noachina	2.73	5.68	155	2	1.2	2	275	0
Mol.	Gastropoda	Pyrulofuslus deformis	0.97	1.85	84	13	24.2	2	48	0
Mol.	Gastropoda	Volutopsis norvegicus	0.8	3.02	70	11	19.3	2	53	0
Pol.	Erantia	Laetmonice filicornis	5.2	4.19	197	1	3.7	2	337	0
Pol.	Sedentaria	Brada inhabilis	0.86	3.37	75	1	2.5	2	345	0

Pol.	Sedentaria	Maldane sarsi	1.38	3.34	114	1	1.5	3	361	0
Pol.	Sedentaria	Pherusa plumosa	0.71	2.61	60	1	0.9	2	371	0
Pol.	Sedentaria	Polyphysia crassa	1.19	2.54	100	1	1.3	2	363	0
Por.	Demospongia	Antho dichotoma	3.99	2.41	182	25	3.8	3	33	0
Por.	Demospongia	Asbestopluma pennatula	2.12	4.56	140	15	22.8	3	45	0
Por.	Demospongia	Asconema foliatum	1.93	3.78	129	20	56.7	3	37	0
Por.	Demospongia	Chondrocladia gigantea	0.95	4.23	82	30	23.6	3	26	0
Por.	Demospongia	Craniella cranium	2.04	3.18	132	5	14.8	3	136	0
Por.	Demospongia	Geodia barretti	3.66	5.87	176	30	2802.1	3	24	0
Por.	Demospongia	Geodia macandrewii	4.53	4.66	188	30	6072	3	23	0
Por.	Demospongia	Hamacantha implicans	1.63	2.9	122	5	1176.5	3	124	0
Por.	Demospongia	Iophon piceus	3.21	1.45	169	10	1.9	3	95	0
Por.	Demospongia	Radiella grimaldi	1.11	3.66	92	4	12.6	3	180	0
Por.	Demospongia	Radiella hemisphaericum	3.85	3.7	180	4	5.7	3	183	0
Por.	Demospongia	Stryphnus ponderosus	4.77	7.36	191	50	149.6	3	10	0
Por.	Demospongia	Stylocordyla borealis	1.86	4.56	127	15	135.4	3	43	0
Por.	Demospongia	Tedania suctoria	3.71	5.01	179	3	37.4	3	189	0
Por.	Demospongia	Tentorium semisuberites	2.12	4.61	139	2	54.9	3	215	0
Por.	Demospongia	Thenea muricata	2.57	5.18	147	5	15.6	3	135	0
Pyc.	Pantopoda	Boreonymphon abyssorum	0.73	2.75	63	6	0.8	2	120	0
Pyc.	Pantopoda	Boreonymphon ossiansarsi	1.2	3.6	103	6	1	2	119	0
Pyc.	Pantopoda	Colossendeis angusta	0.31	3.47	13	10	0.6	2	100	0
Pyc.	Pantopoda	Colossendeis proboscidea	0.53	3.91	42	15	6.5	2	46	0
Pyc.	Pantopoda	Nymphon brevistre	2.58	3.75	148	5	0.4	2	171	0
Pyc.	Pantopoda	Nymphon elegans	1.03	3.97	89	5	0.3	2	173	0
Pyc.	Pantopoda	Nymphon gracilipes	1.12	2.88	93	5	0.4	2	172	0
Pyc.	Pantopoda	Nymphon grossipes	1.94	4.05	130	5	0.4	2	170	0
Pyc.	Pantopoda	Nymphon hirtipes	1.07	3.48	90	5	0.5	2	168	0
Pyc.	Pantopoda	Nymphon hirtum	1.37	3.55	113	5	0.5	2	169	0
Pyc.	Pantopoda	Nymphon spinosum	1.44	4.43	117	7	2.4	2	113	0
Pyc.	Pantopoda	Nymphon stroemi	1.38	3.63	115	7	3.5	2	112	0
Pyc.	Pantopoda	Pycnogonum litorale	3.67	2.65	177	5	0.6	2	166	0
Tun.	Ascidacea	Boltenia echinata	2.65	4.18	150	5	8.7	3	145	0
Tun.	Ascidacea	Botryllus schlosseri	1.24	4.28	108	5	0.6	3	164	0
Tun.	Ascidacea	Ciona intestinalis	0.29	1.89	11	25	20	3	32	0
Tun.	Ascidacea	Cnemidocarpa rhizopus	2.99	1.22	159	5	5.8	3	151	0
Tun.	Ascidacea	Dendrodoa aggregata	2.08	5.58	135	5	2.1	3	157	0
Tun.	Ascidacea	Eudistoma vitreum	2.73	4.63	152	5	1.4	3	160	0
Tun.	Ascidacea	Halocynthia pyriformis	3.06	4.55	162	11	35.8	3	52	0
Tun.	Ascidacea	Kukenthalia borealis	2.56	4.63	146	3	0.5	3	212	0
Tun.	Ascidacea	Microcosmus glacialis	3.18	6.1	167	4	0.9	3	186	0
Tun.	Ascidacea	Pelonaia corrugata	4.13	0.83	183	1	3.9	3	334	0

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