

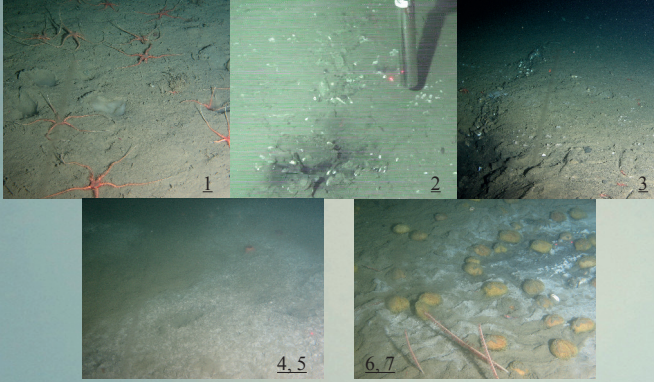
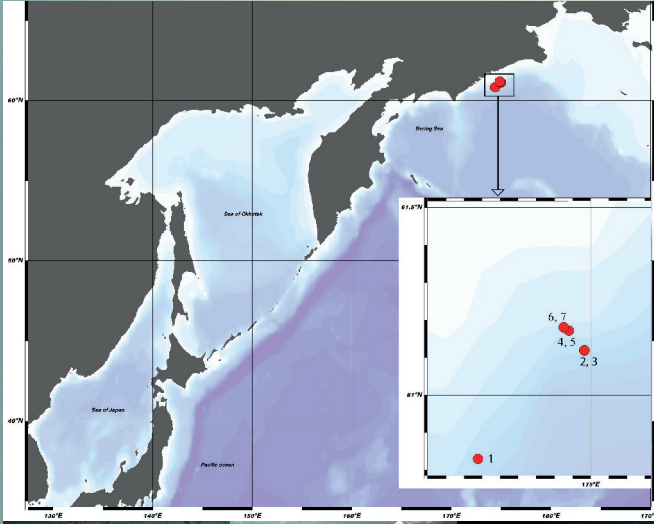
MEIOBENTHOS AT METHANE SEEPS ON THE KORYAK SLOPE OF THE BERING SEA

Portnova¹ D., Kiyashko² S., Saulenko^{2,3} A., Mordukhovich^{2,3} V.

¹Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, 117997, Russia

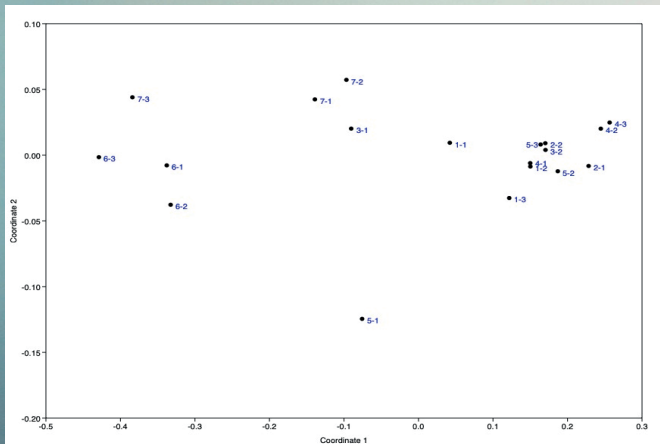
²A. V. Zhirmunsky National Scientific Center of Marine Biology, Far Eastern Branch, Russian Academy of Sciences, Vladivostok 690041, Russia

³Far Eastern Federal University, Vladivostok 690091, Russia



Abundance of the meiofauna taxa [ind./10 cm²]

Station	1 (background)		2 (periphery)		3 (periphery)		4 (periphery)		5 (seep)		6 (periphery)		7 (seep)	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
Nematoda	1711.0	168.0	1298.5	1028.5	1918.6	1122.2	5974.3	4221.8	365.1	166.1	1327.0	263.0	1610.0	626.0
Copepoda	28.6	4.1	8.7	5.6	23.6	16.1	15.5	5.3	4.6	2.3	59.7	26.5	61.4	21.2
Polychaeta	10.5	2.9	7.3	6.2	21.6	14.9	27.1	3.8	1.1	1.0	36.3	8.3	42.6	12.9
Neuphy	11.2	7.5	5.4	1.8	13.5	12.1	10.1	11.5	5.5	3.4	59.8	12.7	19.4	22.1
Hydrasoa	0.8	0.8	0.0	0.2	0.3	0.9	0.8	0.0	0.0	0.6	0.6	0.0	0.0	0.0
Ostracoda	0.7	0.3	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.2	0.3	0.2	0.3	0.3
Priapulida	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.2	0.3	0.3
Kinorhyncha	1.3	0.6	0.4	0.3	0.3	0.3	0.7	0.8	0.0	1.8	2.7	2.0	1.4	1.4
Bivalvia	1.3	1.2	0.4	0.3	0.3	0.3	1.5	1.4	0.0	0.6	1.0	0.2	0.3	0.3
Acarina	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.2	0.3	0.3
Ophiuroidea	0.0	0.0	0.1	0.2	0.4	0.6	1.1	0.6	0.4	0.3	0.2	0.3	0.0	0.0
Gastrotricha	0.7	0.6	0.1	0.2	1.2	1.4	0.4	0.3	0.2	0.3	2.2	2.5	0.2	0.3
Cumacea	0.0	0.0	0.0	0.0	0.9	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kamptozoa	0.0	0.0	1.8	3.2	1.1	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nemertea	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caudofoveata	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isopoda	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unidentified	0.7	0.6	0.0	0.0	0.2	0.3	1.5	1.7	0.0	1.8	1.8	2.9	5.1	5.1
Total	1767.4	156.7	1319.3	1047.6	1982.7	1137.4	6033.8	4223.6	376.9	163.4	1500.6	298.9	1739.2	648.2



nMDS scaling (Bray-Curtis, meiofauna taxa abundance)

Recently discovered methane seeps on the Koryak slope of the Bering Sea at depths 400-700 m are the northernmost chemosynthetic habitats (~61°N) known to date in the Pacific. In general, the identified communities can be divided into three types: (1) Communities of the first type are encountered at depths of 695-647 m surrounded by a background community of Ophiuroidea + Macrura Natantia. They are characterized by the development of numerous settlements of the symbiotic bivalve *Pliocardiina Calyplogena pacifica*. (2) Communities of the second type are encountered at depths of 429-417 m within the background community *Protopytilum/Asteronyx* + *Brisaster latifrons*. Among the specialized forms, *C. pacifica* is represented in a small amount. (3) Communities of the third type are noted at depths of 400-402 m within the community dominated by the anemone *Sagartiogeton cf. californicus* (Sagartiidae). Numerous and extensive seeps, often more than 1 m in size, are marked by widespread bacterial mats. Single calyplogens are present on the periphery of seeps. No apparent reaction of macrofauna to such seeps is observed. The aims of this study are: (1) to describe the meiofauna community composition at methane seeps and adjacent area; (2) to determine the composition of assemblages of the dominant meiofaunal taxon, the nematodes, and (3) to study the contribution of products of chemosynthetic origin to the nutrition of the dominant groups of meiofauna.

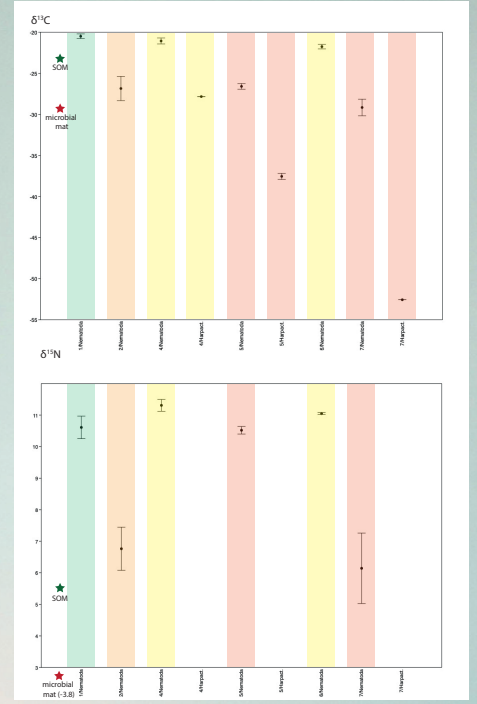
A total of 17 major meiofaunal taxa, excluding copepod nauplii, were recorded in the methane seeps: Nematoda, Copepoda, Polychaeta, Hydrozoa, Ostracoda, Priapulida, Kinorhyncha, Bivalvia, Acarina, Ophiuroidea, Gastrotricha, Cumacea, Kamptozoa, Nemertea, Caudofoveata, Isopoda with a strong dominance of Nematoda (more than 88% of total abundance). Meiofaunal abundances ranged between 347 ind./10 cm² (seep) and 5561 ind./10 cm² (periphery sediment). There were significant differences in the abundance of nematodes at different locations. The density of nematodes ranged from 336 ind./10 cm² (seep) to 5506 ind./10 cm² (periphery sediments). A total of 78 nematode genera were identified. Nematode dominant genus was *Daptonema*, subdominant genus was *Sabatieria*. Similarity and diversity analyses are done to compare the different locations.

A wide range of $\delta^{13}C$ and $\delta^{15}N$ values was found, with $\delta^{13}C$ values ranging from -31.9 to -20.2‰ and $\delta^{15}N$ values ranging from 7.2 to 11.2‰. The depleted isotopic signatures suggest that chemosynthetically derived organic matter is an important carbon source for nematodes at seeps and is also included in the diet of organisms from the periphery of seeps. (The study was supported by the Grant of the Russian Foundation for Basic Research no. 20-04-00919_a)

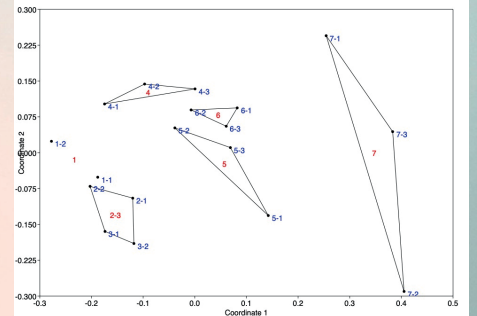
Average relative abundance of nematode genera [%]

Genus	Station						
	1	2	3	4	5	6	7
Acantholaimus	6.3	0.0	2.6	3.5	0.8	0.0	0.0
Acanthonchus	0.0	0.0	0.0	0.0	0.0	0.0	2.8
Aegialoalaimus	2.1	1.4	0.0	3.5	2.0	0.7	0.0
Amphimonhystera	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Anonchus	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Anoplostoma	0.0	0.0	0.0	1.2	0.0	1.5	0.0
Aponema	0.0	0.0	0.0	10.9	2.8	10.2	4.9
Campylolaimus	6.3	1.4	1.3	3.1	3.2	1.5	6.0
Crocconema	2.1	0.0	0.0	2.9	0.8	2.9	0.7
Daptonema	12.5	11.6	17.6	4.1	31.8	9.9	4.7
Desmodora	0.0	0.0	0.0	0.0	0.8	0.7	0.0
Desmodorella	0.0	0.0	0.0	1.2	1.6	1.1	1.4
Desmolaimus	0.0	2.9	0.0	1.2	0.0	0.7	2.1
Desmoscolex	14.6	13.8	11.8	29.6	14.7	11.9	3.0
Dichromadora	0.0	0.0	0.0	1.2	0.0	0.0	0.0
Didelata	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Diplopetites	0.0	4.3	0.0	0.0	0.0	1.5	0.0
Diplopetitoides	2.1	0.0	0.0	1.2	0.8	1.5	0.0
Diplopetilia	0.0	1.4	1.3	0.0	0.8	3.7	0.0
Dorylaimopsis	9.4	5.1	2.6	2.3	3.9	1.5	0.0
Euletherolaimus	0.0	0.0	2.0	1.2	1.6	1.5	8.4
Elzalia	4.2	0.0	1.3	3.9	7.1	17.1	2.8
Endeolophos	0.0	0.0	2.6	0.0	0.0	0.7	0.7
Ethmolaimus	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Gomphonchus	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Halalaimus	7.3	2.2	1.3	3.1	2.9	3.7	0.7
Leptolaimus	8.3	15.2	22.2	3.5	0.8	2.0	0.0
Linhomoeus	6.3	2.9	14.4	1.2	1.6	4.4	2.1
Longicyatholaimus	0.0	1.4	1.3	0.0	0.0	0.7	0.0
Marylynnia	0.0	1.4	0.0	0.0	0.0	0.0	9.1
Metacrocconema	0.0	0.0	0.0	1.2	11.0	0.0	49.7
Metalinhomoeus	0.0	0.0	0.0	0.0	0.0	0.0	6.3
Metaparacrocconema	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Metoncholaimus	0.0	0.0	0.0	0.0	0.0	0.8	0.0
Microalaimus	5.2	3.6	1.3	9.7	7.9	2.9	0.7
Molgolaimus	4.2	5.8	1.3	6.2	0.8	1.7	4.0
Moraxia	0.0	0.0	0.0	0.0	0.0	3.3	0.0
Nannolaimoides	0.0	0.0	0.0	0.0	0.0	0.0	7.0
Oncholaimus	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Parachromadorita	0.0	0.0	0.0	0.0	0.0	0.7	2.1
Paracrocconema	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Paracyatholaimus	0.0	0.0	0.0	1.3	0.8	0.8	2.8
Paralongicyatholaimus	0.0	0.0	0.0	0.0	0.0	0.0	4.9
Pierriella	0.0	0.0	0.0	4.7	0.0	1.5	1.4
Protrocha	0.0	0.0	0.0	1.2	0.0	5.1	0.0
Pselionema	0.0	1.4	0.0	2.3	1.3	0.7	0.0
Sabatieria	6.3	4.3	2.6	8.2	11.8	17.3	46.5
Setosabatieria	0.0	0.0	0.0	1.2	0.0	1.8	0.0
Sinanema	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Sphaerolaimus	0.0	1.4	0.0	0.0	0.8	1.5	0.0
Synonchiella	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Terschellingia	5.2	21.7	9.2	7.4	1.8	5.4	0.0
Thalassolaimus	2.1	1.4	0.0	0.0	0.8	0.0	0.0
Thalassomonhystera	0.0	0.0	0.0	0.0	0.0	1.5	0.0
Theristus	0.0	1.4	1.3	0.0	0.8	0.0	0.0
Viscosia	0.0	1.4	1.3	0.0	0.0	0.7	0.0
Desmolaimoides	4.2	0.0	0.0	0.0	1.6	0.0	0.0
Latronema	0.0	0.0	0.0	0.0	1.6	0.0	0.0
Minolaimus	2.1	0.0	0.0	0.0	0.8	0.0	0.0
Trochamus	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Oxyostoma	0.0	2.9	0.0	0.0	0.8	0.0	0.0
Lainella	0.0	0.0	0.0	0.0	2.4	0.0	0.0
Phaenocholaimus	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Wisneria	2.1	0.0	0.0	0.0	0.8	0.0	0.0
Spirinia	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Thalassironus	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Amphimonhystera	0.0	0.0	0.0	1.2	0.0	0.0	0.0
Karkinochromadora	0.0	0.0	0.0	1.2	0.0	0.0	0.0
Crocconema	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Halichoanlaimus	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Monhystera	4.2	0.0	0.0	0.0	0.0	0.0	0.0
Hapalaimus	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Dolicholaimus	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Prodesmodora	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Camaecolaimidae gen.sp.	0.0	2.1	0.0	0.0	0.0	0.0	0.0
Paramonhystera	0.0	4.3	1.9	1.2	5.9	0.0	0.0
Odontatoma	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Chromadoridae gen.sp.	2.1	0.0	0.0	0.0	0.0	0.0	0.0

Stable isotope signatures



nMDS scaling (Bray-Curtis, genera relative abundance)



ANOSIM pairwise comparisons

	1	2-3	5	4	7	6
1		0.405	0.199	0.203	0.5	0.194
2-3	0.405		0.059	0.03	0.029	0.028
5	0.199	0.059		0.2	0.103	0.101
4	0.203	0.03	0.2		0.1	0.106
7	0.5	0.029	0.103	0.1		0.1
6	0.194	0.028	0.101	0.106	0.1	