Supplementary Material

Table S1. Functional traits and modalities with corresponding abbreviations and associated ecosystem function. Definitions based on those provided by the Arctic Trait Base (Degen and Faulwetter 2019).

Trait	Modality	Definition	Abbreviation	Function
Adult Movement	Sessile	No movement	Sessile	Foraging ability, predatory avoidance, dispersal abilities
	Burrower	Burrows in sediments	Bur	
	Crawler	Move along sediment via legs or other appendages	Crawl	
	Swimmer	Moves above the sediment	Swim	
Body Size	Small	<10 mm	Sm	Energetic demand, ability to resistance predation
	Small-medium	10—50 mm	Sm-Med	
	Medium	50—100 mm	Med	
	Medium-large	100—300 mm	Med-Lg	
	Large	>300 mm	Lg	
Larval Development	Pelagic/Planktrophic	Larvae grow in the water column	Plank	Fecundity, development, and dispersion insights
	Pelagic/lecithotrophic	Larvae with yolk sac, pelagic period is short	Lecith	
	Benthic/direct	Larvae have benthic development	Direct	
Reproduction	Asexual	Budding & fission	Asex	Dispersal, continuous reproduction could allow for resilience, production
	Sexual: external	External fertilization (e.g., eggs & sperm released into water)	SexEx	
	Sexual: internal	Internal fertilization	SexIn	
	Sexual: brooding	Internal or external fertilization but eggs are brooded	SexBrod	
Bioturbation	Diffusive mixing	Random mixing of particles	Diffus	Impacts on biogeochemical cycles, food acquisition, resistance from disturbance
	Surface deposit	Deposition of particles at sediment surface (e.g., from defecation)	SurfD	
	Conveyer belt (upward)	Movement of sediment/particles from within sediment to the surface	CVbeltup	
	Conveyer belt (reverse)	Movement of sediment/particles from surface to deep within sediments	CVbeltrev	
	None	No bioturbation	Nobio	
Feeding Mode	Subsurface deposit	Feeds within the sediment	SubD	Method of resource acquisition, living position, growth requirements
	Suspension	Feeds on particles suspended in the water	Suspen	

	Surface deposit	Feeds on material from sediment surface	SurfD	
	Scavenger	Feeds on a variety of particles	Scav	
	Predator	Feeds on other organisms	Pred	
	Parasite	Uses host to obtain food	Para	
Living Habitat	Free living	Freely move within/on sediments	Free	Position in sediment, food acquisition, preferred environmental conditions
	Crevice dwelling	Tend to live in spaces between rocks	Crevice	
	Tube dwelling	Create tubes	Tube	
	Burrowing	Burrow within sediments	Bur	
	Epi/endo/phytic	Live on/in other organisms	Epi/Endo	
	Attached	Live attached to substrate	Attach	
Tolerance	Low	Species sensitive to changes in environment (e.g., organic enrichment, pollution, temperature, salinity changes)	Low	Species/taxa tolerance to disturbance (e.g., temperature, salinity, organic enrichment). Low indicating very sensitive and high indicated tolerant to conditions
	Medium	Species indifferent	Med	
	High	Species tolerant	High	

Table S2. Density (no. ind. 0.1m^{-2} ±SE) of species/taxa for major taxonomic groups (i.e., Amphipoda, Bivalvia, Gastropoda, Polychaeta, other) in historical versus contemporary samples.

Major Group	Species/Taxa	Historical Density (no. ind.m^{-2} ±SE)	Contemporary Density (no. ind.m^{-2} ±SE)
Amphipoda	*Aceroides (Aceroides) latipes*	0.12±0.09	0.30±0.14
	Bathymedon sp.	1.40±0.46	0.00±0.00
	Byblis gaimardii	0.67±0.40	0.09±0.07
	Hippomedon sp.	1.95±1.04	0.09±0.07
	Megamoera dentata	0.00±0.00	0.27±0.19
	Melita sp.	0.43±0.30	0.00±0.00
	Monocludes sp.	0.12±0.085	0.51±0.31
	Orchomenella minuta	0.00±0.00	0.75±0.23
	Paratryphosites abyssi	0.00±0.00	5.59±3.19
	Pontoporeia femorata	1.16±0.50	1.56±0.38
	Protomedeia sp.	0.73±0.73	0.00±0.00
	Quasimelita formosa	0.31±0.22	0.00±0.00
Bivalvia	*Axinopsida orbiculata*	0.00±0.00	1.97±1.18
	Ennucula sp.	1.59±0.44	0.99±0.24
	Macoma calcarea	12.13±2.37	14.11±2.78
	Megayoldia thraciaeformis	0.00±0.00	1.63±0.34
	Nuculana pernula	5.18±0.75	9.54±1.81
	Thyasira sp.	11.10±2.15	13.25 ± 2.71
	Yoldia hyperborea	0.37±0.16	1.50±0.31
	Yoldia sp.	2.44±0.60	0.00±0.00
Gastropoda	*Curtitoma incisula*	0.00±0.00	1.08±0.30
	Propebla rugulata	0.00±0.00	1.56±0.38
	Retusa obtusa	2.38±0.60	0.63±0.40
	Tachyrhynchus erosus	0.00±0.00	1.23±0.46

	Turridae sp.	1.10±0.34	0.00±0.00
Polychaeta	Ampharetidae sp. A	0.92±0.63	0.00±0.00
	Ampharete finmarchia	0.24±0.15	0.00±0.00
	Apistocranchus typicus	0.79±0.32	0.63±0.37
	Arcteobia anticostiensis	0.06±0.06	0.54±0.18
	Aricidae sp.	7.80±1.53	1.32±0.39
	Artacama proboscidae	1.77±0.84	0.00±0.00
	Bradabyssa villosa	1.28±0.75	0.60±0.27
	Capitellidae spp.	12.87±2.95	2.09±0.50
	Chaetozone sp.	13.29±1.99	5.39±1.27
	Cistenides hyperborea	15.92±9.15	0.27±0.12
	Cossura pygodactylata	465.73±64.87	28.56±6.88
	Dipolydora caulleryi	0.49±0.49	0.00±0.00
	Dorvilleidae spp.	30.12±6.07	1.82±1.46
	Dipolydora socialis	0.00±0.00	0.33±0.14
	Dysponetus pygmaeus	0.73±0.22	0.00±0.00
	Enipo canadensis	0.18±0.13	0.42±0.20
	Eteone flava	0.00±0.00	1.02±0.34
	Eteone longa	2.99±0.58	0.66±0.20
	Euchone incolor	3.29±1.71	0.72±0.40
	Goniada maculata	0.24±0.15	0.33±0.10
	Gyptis bruneli	16.40±1.66	2.24±0.73
	Lumbrineridae spp.	19.82±4.93	16.86±2.46
	Lysilla loveni	1.65±0.43	0.12±0.07
	Maldane glebifex	1.52±0.94	0.00±0.00
	Maldane sarsi	0.00±0.00	1.89±0.81
	Maldane sp. A	0.30±0.20	0.00±0.00
	Micronephtys neotana	18.41±1.93	6.04±0.81

	Nephtys ciliata	0.31±0.13	1.50±0.29
	Nereimyra aphroditoides	8.96±7.04	0.36±0.16
	Paradoneis lyra	0.00±0.00	0.99±0.45
	Paraonidae sp. A	0.55±0.38	0.00±0.00
	Pherusa plumosa	0.49±0.24	0.15±0.08
	Pholoe longa	0.55±0.31	3.07±1.52
	Pholoe minuta	0.96±0.10	0.96±0.41
	Prionospio steenstrupi	41.46±8.52	17.50±3.11
	Scalibregma inflatum	0.37±0.19	0.03±0.03
	Scoloplos armiger	1.77±0.99	2.22±0.71
	Sphaerodoridium minutum	1.65±0.63	0.18±0.08
	Spiochaetopterus typicus	0.12±0.09	0.42±0.15
	Syllides sp.	2.20±0.85	0.00±0.00
	Terebellides stroemii	3.35±0.68	0.57±0.16
	Terebellidae sp. B	0.85±0.40	0.00±0.00
Other	*Antalis entalis*	2.99±0.87	6.15±1.53
	Chaetognatha	0.12±0.09	0.18±0.07
	Ctenodiscus crispatus	0.18±0.10	0.45±0.13
	Cumacean spp.	5.24±1.45	3.01±0.80
	Echinoidea	0.55±0.21	0.06±0.04
	Nemertea spp.	10.49±1.76	4.80±1.25
	Ophiuridae	2.74±0.60	1.27±0.40
	Priapulus caudatus	0.00±0.00	0.30±0.17
	Sipunculidea sp.	2.44±0.56	0.48±0.15
	Tanaidacea	0.31±0.20	0.03±0.03

Note: to take a conservative approach, the following were grouped when considering "unique" species/taxa to historical and contemporary communities 1. *Maldane sarsi* and *Maldane* sp. A grouped as "*Maldane* sp." And 2. *Paradoneis lyra* and Paraonidae sp. A grouped as "Paraonidae sp."

Table S3. Abundance (total no. individuals) of species/taxa unique to historical and contemporary samples for major taxonomic groups (i.e., Amphipoda, Bivalvia, Gastropoda, Polychaeta, other).

Community	Species/Taxa	Major Group	Total abundance
Historical	Ampharetidae sp.	Polychaeta	38
	Amharete finmarchica	Polychaeta	10
	Dysponetus pygmaeus	Polychaeta	30
	Maldane glebifex	Polychaeta	63
	Dipolydora caulleryi	Polychaeta	20
	Syllides sp.	Polychaeta	90
	Terebellida sp. B	Polychaeta	35
	Artacama proboscidea	Polychaeta	73
	Yoldia sp.	Bivalvia	100
	Turridae sp.	Gastropoda	45
	Protomedeia sp.	Amphipoda	30
	Melita sp.	Amphipoda	18
	Quasimelita formosa	Amphipoda	13
	Bathymedon sp.	Amphipoda	58
Contemporary	*Axinopsida orbiculate*	Bivalvia	71
	Curtitoma incisula	Gastropoda	39
	Dipolydora socialis	Polychaeta	12
	Eteone flava	Polychaeta	37
	Megamoera dentata	Amphipoda	10
	Megayoldia thraciaeformis	Bivalvia	59
	Orchomenella minute	Amphipoda	27
	Paratryphosites abyssi	Amphipoda	201
	Priapulus caudatus	other	11
	Propebela rugulata	Gastropoda	23
	Trachyrhynchus erosus	Gastropoda	44

Table S4. Results of SIMPER analyses showing trait modalities contributing to ~50% of the dissimilarity between historical and contemporary communities for Placentia Bay, Newfoundland ordered from highest to lowest contribution. The cumulative percent of total expressed traits for influential modalities are also shown.

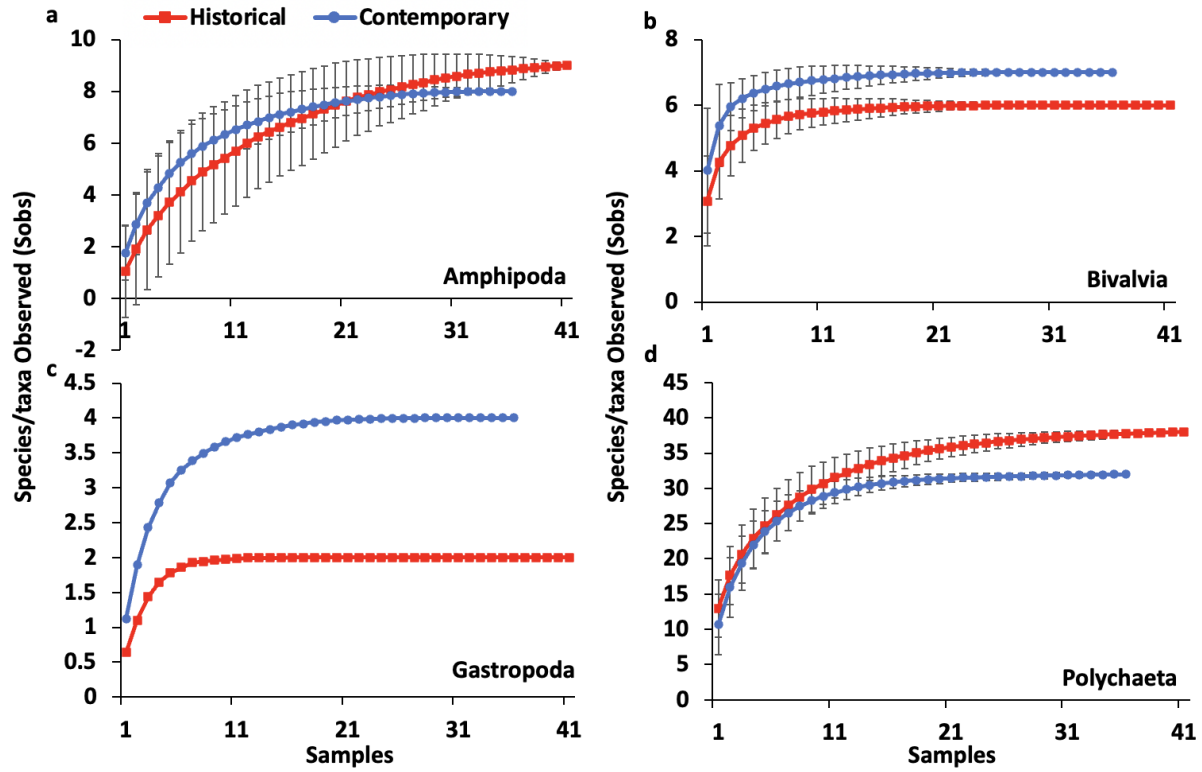| Modality (trait)	Dissimilarity (%)	Cumulative (%)
High (tolerance)	5.9	5.9
Small (body size)	5.7	11.6
Subsurface deposit (feeding mode)	5.6	17.2
Benthic/direct (larval development)	5.4	22.6
Surface deposit (bioturbator)	4.9	27.5
Sexual external (reproduction)	4.7	32.2
Burrower (adult movement)	4.7	36.9
Burrowing (living habitat)	2.6	39.5
Crawler (adult movement)	2.6	42.1
Medium (body size)	2.6	44.7
Medium-large (body-size)	2.5	47.2

Fig. S1. Species accumulation curve based on species/taxa observations ±SD for major groups including (a) Amphipoda, (b) Bivalvia, (c) Gastropoda, and (d) Polychaeta for historical and contemporary samples.
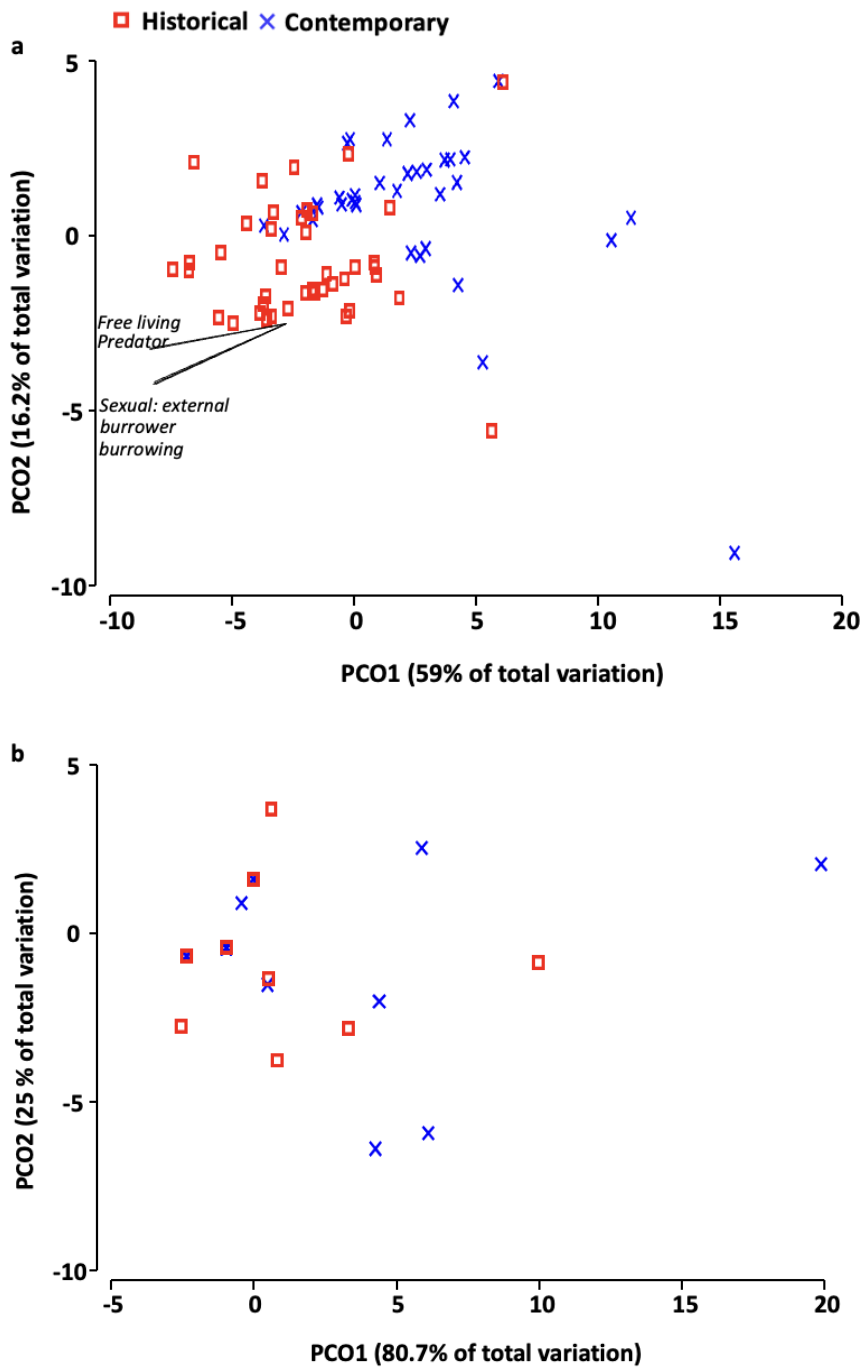
Fig. S2. Principal Coordinates Ordination (PCO) of functional traits for (a) expression of modalities based on Canberra similarity, and (b) presence/absence of modalities based on Sorensen resemblance. Differences between the historical versus contemporary communities were statistically significant (pseudo-$F_{1,\,75}$= 19.5 and PERMANOVA P= 0.0001). Modality vectors=Pearson correlation of ≥ 0.7.
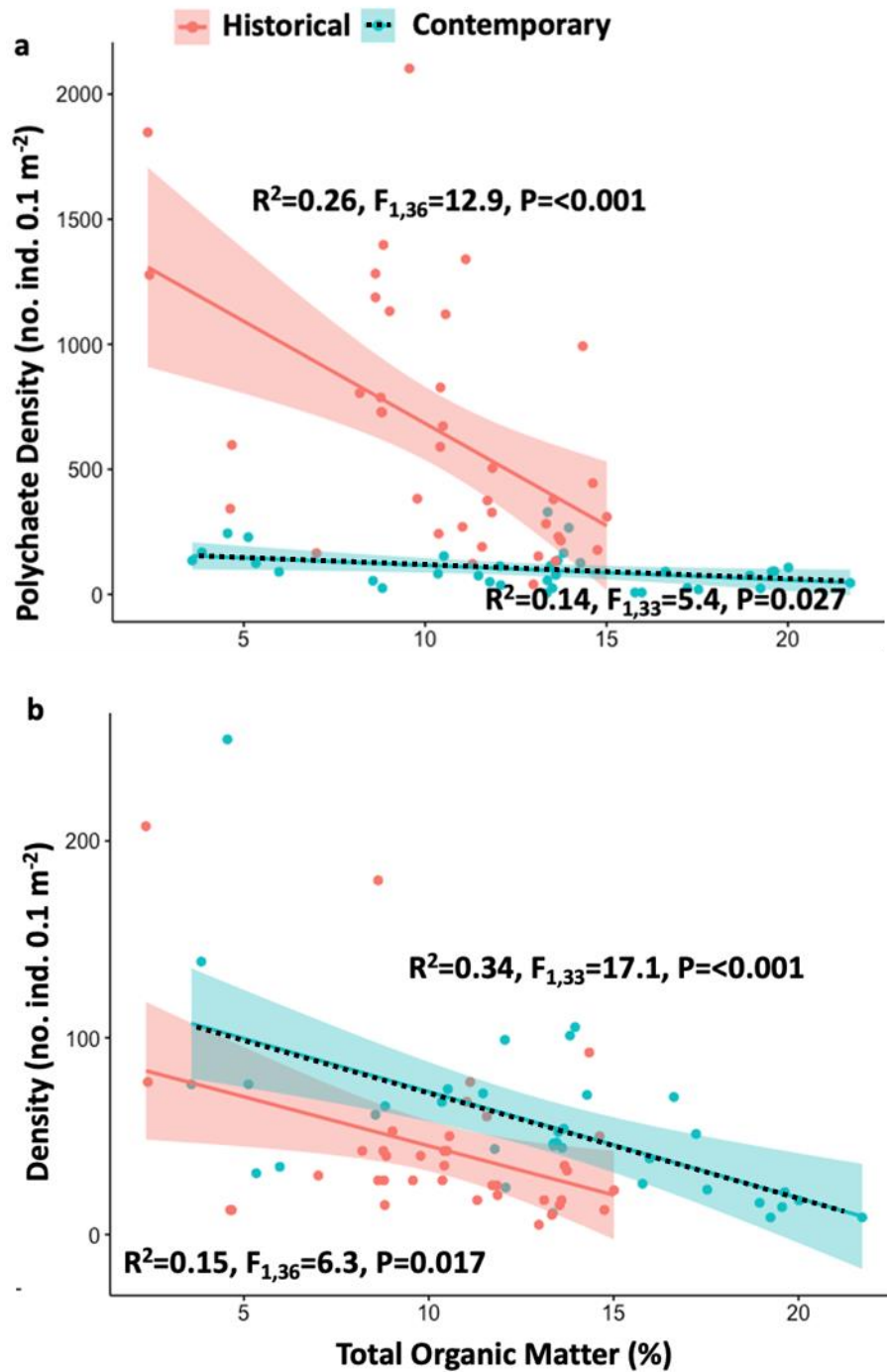
Fig. S3. Linear regression of density against total organic matter for (a) polychaetes (no. individuals $0.1m^{-2}$) and (b) major taxonomic groups excluding polychaetes (i.e., Amphipoda, Gastropoda, and Bivalvia combined). Historical=solid line and contemporary=dotted line.