Supporting Information. O'Brien, J.M., R.R.E. Stanley, N.W. Jeffery, S.G. Heaslip, C. DiBacco, Z. Wang. Modelling demersal fish and benthic invertebrate assemblages in support of marine conservation planning. Ecological Applications.

Appendix S1

Table S1. Characteristics of annual multispecies bottom trawl surveys in 4 regions of the Northwest Atlantic including survey timing, fishing vessel, gear characteristics, and fishing protocols. SGSL = Southern Gulf of St. Lawrence, NGSL = Northern Gulf of St. Lawrence, NL = Newfoundland & Labrador, and MAR = Maritimes. NM = nautical miles (1 NM = 1.85 km).

Region	Survey Timing	Fishing Vessel	Gear type	Codend liner mesh size (mm)	Tow Speed (kn)	Valid Tow Duration (min)	Standard Tow Distance (NM)
SGSL	Aug-Oct	CCGS *Teleost*	Western IIA box trawl	19	3.5	30 ± 10	1.75
NGSL	Jul-Sep	CCGS *Teleost*	Campelen 1800 shrimp trawl	12.7	3	15 ± 5	0.8
NL	Apr-Jun Sep-Dec	CCGS *Teleost*, CCGS *Wilfred Templeman*	Campelen 1800 shrimp trawl	12.7	3	15 ± 5	0.8
MAR	Feb-Apr Jun-Aug	CCGS *Alfred Needler* CCGS *Teleost*	Western IIA box trawl	19	3.5	30 ± 10	1.75

Table S2. List of fish and invertebrate taxa (phyla, taxa name, and taxonomic resolution) included in clustering analyses to identify predominant assemblage types in 4 regions of the Northwest Atlantic (NGSL, SGSL, NL, MAR). All taxa were recorded in > 1% of 4-km grid cells within study area boundaries for all regions indicated. NGSL = Northern Gulf of St. Lawrence, SGSL = Southern Gulf of St. Lawrence, NL = Newfoundland & Labrador, MAR = Maritimes.

Phylum	Taxa	Taxonomic resolution	Region
Annelida	*Aphrodita hastata*	species	NGSL, SGSL, MAR
Annelida	Polychaeta	class	NGSL, SGSL
Arthropoda	*Aega psora*	species	NGSL
Arthropoda	Amphipoda	order	SGSL
Arthropoda	*Anonyx* spp.	genus	NGSL
Arthropoda	*Arcoscalpellum michelottianum*	species	NGSL
Arthropoda	*Argis dentata*	species	NGSL, MAR
Arthropoda	*Atlantopandalus propinqvus*	species	NGSL, NL, MAR
Arthropoda	Balanidae	family	NGSL
Arthropoda	*Calocaris templemani*	species	NGSL
Arthropoda	*Cancer borealis*	species	MAR
Arthropoda	*Cancer irroratus*	species	SGSL, MAR
Arthropoda	*Chaceon quinquedens*	species	MAR
Arthropoda	*Chionoecetes opilio*	species	NGSL, SGSL, NL, MAR
Arthropoda	*Chirona hameri*	species	NGSL
Arthropoda	Cirripedia	subclass	SGSL
Arthropoda	*Crangon septemspinosa*	species	MAR
Arthropoda	*Epimeria loricata*	species	NGSL
Arthropoda	*Eualus fabricii*	species	NGSL
Arthropoda	*Eualus gaimardii*	species	NGSL
Arthropoda	*Eualus macilentus*	species	NGSL
Arthropoda	*Eusirus cuspidatus*	species	NGSL
Arthropoda	*Homarus americanus*	species	SGSL, MAR
Arthropoda	*Hyas araneus*	species	NGSL, SGSL, MAR

Arthropoda	*Hyas coarctatus*	species	NGSL, SGSL, MAR
Arthropoda	Isopoda	order	SGSL
Arthropoda	*Lebbeus groenlandicus*	species	NGSL
Arthropoda	*Lebbeus microceros*	species	NGSL
Arthropoda	*Lebbeus polaris*	species	NGSL, MAR
Arthropoda	*Lithodes maja*	species	NGSL, SGSL, MAR
Arthropoda	*Munidopsis curvirostra*	species	NGSL
Arthropoda	*Neohela monstrosa*	species	NGSL
Arthropoda	*Pagurus* spp.	genus	NGSL, SGSL
Arthropoda	*Pandalus borealis*	species	NGSL, NL, MAR
Arthropoda	*Pandalus montagui*	species	NGSL, NL, MAR
Arthropoda	*Paramphithoe hystrix*	species	NGSL
Arthropoda	*Pasiphaea multidentata*	species	MAR
Arthropoda	*Pontophilus norvegicus*	species	NGSL, MAR
Arthropoda	Pycnogonida	class	NGSL, SGSL
Arthropoda	*Rhachotropis aculeata*	species	NGSL
Arthropoda	*Sabinea sarsii*	species	NGSL
Arthropoda	*Sabinea septemcarinata*	species	NGSL
Arthropoda	*Sclerocrangon boreas*	species	NGSL, MAR
Arthropoda	*Sergestes arcticus*	species	MAR
Arthropoda	*Spirontocaris liljeborgii*	species	NGSL, MAR
Arthropoda	*Spirontocaris phippsii*	species	NGSL
Arthropoda	*Spirontocaris spinus*	species	NGSL, MAR
Arthropoda	*Stegocephalus inflatus*	species	NGSL
Brachiopoda	Brachiopoda	phylum	SGSL
Brachiopoda	*Hemithiris psittacea*	species	NGSL
Brachiopoda	*Terebratulina septentrionalis*	species	NGSL
Bryozoa	Bryozoa	phylum	NGSL, SGSL
Chordata	*Amblyraja jenseni*	species	NL

Chordata	*Amblyraja radiata*	species	NGSL, SGSL, NL, MAR
Chordata	*Ammodytes dubius*	species	NL, MAR
Chordata	*Ammodytes* spp.	genus	NGSL, SGSL
Chordata	*Anarhichas denticulatus*	species	NL
Chordata	*Anarhichas lupus*	species	NGSL, SGSL, NL, MAR
Chordata	*Anarhichas minor*	species	NGSL, NL
Chordata	*Anisarchus medius*	species	NGSL, SGSL
Chordata	*Antimora rostrata*	species	NL, MAR
Chordata	*Apristurus profundorum*	species	NL
Chordata	*Arctozenus risso*	species	NGSL, SGSL, MAR
Chordata	*Argentina silus*	species	NGSL, NL, MAR
Chordata	*Artediellus atlanticus*	species	SGSL, MAR
Chordata	*Artediellus* spp.	genus	NGSL
Chordata	*Artediellus uncinatus*	species	SGSL
Chordata	Ascidiacea	class	NGSL, SGSL
Chordata	*Aspidophoroides monopterygius*	species	NGSL, SGSL, NL, MAR
Chordata	*Aspidophoroides olrikii*	species	NGSL, SGSL, NL
Chordata	*Bathylagus euryops*	species	NL
Chordata	*Bathyraja spinicauda*	species	NGSL, NL
Chordata	*Boltenia ovifera*	species	SGSL, MAR
Chordata	*Boltenia* spp.	genus	NGSL
Chordata	*Boreogadus saida*	species	NGSL, NL
Chordata	*Brosme brosme*	species	MAR
Chordata	*Careproctus reinhardti*	species	NGSL, SGSL
Chordata	*Centroscyllium fabricii*	species	NGSL, NL, MAR
Chordata	*Chauliodus sloani*	species	NL, MAR
Chordata	*Chiasmodon niger*	species	NL
Chordata	*Citharichthys arctifrons*	species	MAR
Chordata	*Clupea harengus*	species	NL

Chordata	*Coryphaenoides rupestris*	species	NL, MAR
Chordata	*Cottunculus microps*	species	NGSL, NL
Chordata	*Cryptacanthodes maculatus*	species	NGSL, SGSL, NL, MAR
Chordata	*Cyclopterus lumpus*	species	NGSL, SGSL, NL, MAR
Chordata	*Cyclothone microdon*	species	NGSL
Chordata	*Dipturus laevis*	species	MAR
Chordata	*Enchelyopus cimbrius*	species	NGSL, SGSL, NL, MAR
Chordata	*Eumesogrammus praecisus*	species	NGSL, SGSL, NL
Chordata	*Eumicrotremus spinosus*	species	NGSL, SGSL, NL, MAR
Chordata	*Gadus morhua*	species	NGSL, SGSL, NL, MAR
Chordata	*Gadus ogac*	species	NGSL, SGSL
Chordata	*Gasterosteus aculeatus*	species	NGSL, SGSL
Chordata	*Glyptocephalus cynoglossus*	species	NGSL, SGSL, NL, MAR
Chordata	*Gymnelus viridis*	species	NGSL, SGSL, NL
Chordata	*Gymnocanthus tricuspis*	species	NGSL, SGSL, NL
Chordata	*Halocynthia pyriformis*	species	SGSL
Chordata	*Helicolenus dactylopterus*	species	MAR
Chordata	*Hemitripterus americanus*	species	NGSL, SGSL, NL, MAR
Chordata	*Hippoglossina oblonga*	species	MAR
Chordata	*Hippoglossoides platessoides*	species	NGSL, SGSL, NL, MAR
Chordata	*Hippoglossus hippoglossus*	species	NGSL, SGSL, NL, MAR
Chordata	*Icelus bicornis*	species	NGSL
Chordata	*Icelus spatula*	species	NGSL, SGSL, NL
Chordata	*Leptagonus decagonus*	species	NGSL, SGSL, NL, MAR
Chordata	*Leptoclinus maculatus*	species	NGSL, SGSL, NL, MAR
Chordata	*Leucoraja erinacea*	species	MAR
Chordata	*Leucoraja ocellata*	species	SGSL, MAR
Chordata	*Limanda ferruginea*	species	NGSL, SGSL, NL, MAR
Chordata	*Liparis gibbus*	species	NGSL, SGSL

Chordata	*Lophius americanus*	species	NGSL, NL, MAR
Chordata	*Lumpenus lampretaeformis*	species	NGSL, SGSL, NL, MAR
Chordata	*Lycenchelys paxillus*	species	NGSL
Chordata	*Lycenchelys verrillii*	species	NGSL
Chordata	*Lycodes esmarkii*	species	NGSL, NL
Chordata	*Lycodes lavalaei*	species	NGSL, SGSL, MAR
Chordata	*Lycodes polaris*	species	SGSL
Chordata	*Lycodes reticulatus*	species	NL
Chordata	*Lycodes terraenovae*	species	NGSL, MAR
Chordata	*Lycodes vahlii*	species	NGSL, SGSL, NL, MAR
Chordata	*Macrourus berglax*	species	NL
Chordata	*Malacoraja senta*	species	NGSL, SGSL, NL, MAR
Chordata	*Malacosteus niger*	species	NL
Chordata	*Melanogrammus aeglefinus*	species	NGSL, NL, MAR
Chordata	*Melanostigma atlanticum*	species	NGSL, SGSL, NL, MAR
Chordata	*Merluccius albidus*	species	MAR
Chordata	*Merluccius bilinearis*	species	NGSL, SGSL, NL, MAR
Chordata	*Micromesistius poutassou*	species	NL
Chordata	*Myoxocephalus aenaeus*	species	SGSL, MAR
Chordata	*Myoxocephalus octodecemspinosus*	species	SGSL, NL, MAR
Chordata	*Myoxocephalus scorpius*	species	NGSL, SGSL, NL, MAR
Chordata	*Myxine glutinosa*	species	NGSL, SGSL, NL, MAR
Chordata	*Nemichthys scolopaceus*	species	NL, MAR
Chordata	*Nezumia bairdii*	species	NGSL, SGSL, NL, MAR
Chordata	*Notacanthus chemnitzii*	species	NL
Chordata	*Paraliparis calidus*	species	NGSL
Chordata	*Paraliparis copei copei*	subspecies	NGSL
Chordata	*Peprilus triacanthus*	species	SGSL, MAR
Chordata	*Petromyzon marinus*	species	MAR

Chordata	*Phycis chesteri*	species	NGSL, SGSL, NL, MAR
Chordata	*Pollachius virens*	species	MAR
Chordata	*Polyacanthonotus rissoanus*	species	NL
Chordata	*Polyipnus clarus*	species	NGSL
Chordata	*Pseudopleuronectes americanus*	species	SGSL, MAR
Chordata	*Rajella fyllae*	species	NL
Chordata	*Reinhardtius hippoglossoides*	species	NGSL, SGSL, NL, MAR
Chordata	*Scophthalmus aquosus*	species	SGSL, MAR
Chordata	*Sebastes mentella*	species	NL, MAR
Chordata	*Sebastes* spp.	genus	NGSL, SGSL
Chordata	*Serrivomer beanii*	species	NL, MAR
Chordata	*Simenchelys parasitica*	species	NL
Chordata	*Squalus acanthias*	species	MAR
Chordata	*Stichaeus punctatus*	species	SGSL
Chordata	*Stomias boa*	species	NL, MAR
Chordata	*Synaphobranchus affinis*	species	MAR
Chordata	*Synaphobranchus kaupii*	species	NL
Chordata	*Tautogolabrus adspersus*	species	SGSL, MAR
Chordata	*Trachyrincus murrayi*	species	NL
Chordata	*Triglops murrayi*	species	NGSL, SGSL, MAR
Chordata	*Ulvaria subbifurcata*	species	MAR
Chordata	*Urophycis chuss*	species	MAR
Chordata	*Urophycis tenuis*	species	NGSL, SGSL, NL, MAR
Chordata	*Xenodermichthys copei*	species	NL
Chordata	*Zoarces americanus*	species	NL, SGSL, MAR
Cnidaria	*Actinauge cristata*	species	NGSL
Cnidaria	Actiniaria	order	SGSL
Cnidaria	*Actinostola callosa*	species	NGSL
Cnidaria	Alcyonacea	order	SGSL

Cnidaria	*Bolocera tuediae*	species	NGSL
Cnidaria	*Epizoanthus erdmanni*	species	NGSL
Cnidaria	*Flabellum alabastrum*	species	NGSL
Cnidaria	*Gersemia rubiformis*	species	NGSL, SGSL, MAR
Cnidaria	*Hormathia* spp.	genus	NGSL
Cnidaria	Hydrozoa	class	NGSL, SGSL
Cnidaria	*Liponema multicorne*	species	NGSL
Cnidaria	Nephtheidae	family	NGSL
Cnidaria	*Paragorgia arborea*	species	MAR
Cnidaria	Pennatulacea	order	NGSL, SGSL
Cnidaria	*Stephanauge nexilis*	species	NGSL
Cnidaria	*Stomphia coccinea*	species	NGSL
Cnidaria	*Urticina felina*	species	NGSL
Echinodermata	*Amphiura* spp.	genus	NGSL
Echinodermata	*Asterias forbesi*	species	MAR
Echinodermata	*Asterias rubens*	species	SGSL, MAR
Echinodermata	Asteriidae	family	NGSL
Echinodermata	*Brisaster fragilis*	species	NGSL, SGSL
Echinodermata	*Ceramaster granularis*	species	NGSL, MAR
Echinodermata	*Crossaster papposus*	species	NGSL, SGSL, MAR
Echinodermata	*Ctenodiscus crispatus*	species	NGSL, SGSL, MAR
Echinodermata	*Cucumaria frondosa*	species	NGSL, SGSL
Echinodermata	*Diplopteraster multipes*	species	NGSL, MAR
Echinodermata	*Echinarachnius parma*	species	NGSL, SGSL, MAR
Echinodermata	*Gorgonocephalus* spp.	genus	NGSL, SGSL
Echinodermata	*Henricia sanguinolenta*	species	MAR
Echinodermata	*Henricia* spp.	genus	NGSL, SGSL
Echinodermata	*Hippasteria phrygiana*	species	NGSL, SGSL, MAR
Echinodermata	*Leptasterias polaris*	species	MAR

Echinodermata	*Leptasterias* spp.	genus	SGSL
Echinodermata	*Ophiacantha* spp.	genus	NGSL
Echinodermata	*Ophiopholis aculeata*	species	NGSL
Echinodermata	*Ophioscolex glacialis*	species	NGSL
Echinodermata	*Ophiura sarsi*	species	MAR
Echinodermata	Ophiurida	order	SGSL
Echinodermata	Ophiuridae	family	NGSL
Echinodermata	Poraniidae	family	NGSL
Echinodermata	*Poraniomorpha hispida*	species	MAR
Echinodermata	*Pseudarchaster parelii*	species	NGSL, MAR
Echinodermata	*Psilaster andromeda*	species	NGSL, SGSL, MAR
Echinodermata	*Psolus fabricii*	species	SGSL
Echinodermata	*Psolus phantapus*	species	SGSL
Echinodermata	*Psolus* spp.	genus	NGSL
Echinodermata	*Pteraster militaris*	species	MAR
Echinodermata	*Pteraster* spp.	genus	NGSL, SGSL
Echinodermata	*Solaster endeca*	species	NGSL, SGSL, MAR
Echinodermata	*Strongylocentrotus droebachiensis*	species	MAR
Echinodermata	*Strongylocentrotus* spp.	genus	NGSL, SGSL
Mollusca	*Aporrhais* spp.	genus	NGSL, SGSL
Mollusca	*Arctica islandica*	species	SGSL, MAR
Mollusca	*Astarte* spp.	genus	NGSL, SGSL
Mollusca	*Bathypolypus bairdii*	species	NGSL, SGSL
Mollusca	*Boreotrophon clathratus*	species	NGSL
Mollusca	Buccinidae	family	NGSL, SGSL
Mollusca	*Buccinum undatum*	species	MAR
Mollusca	Cardiidae	family	NGSL, SGSL
Mollusca	Cephalaspidea	order	NGSL
Mollusca	*Chlamys islandica*	species	NGSL, SGSL, MAR

Mollusca	*Cuspidaria glacialis*	species	NGSL
Mollusca	*Cyrtodaria siliqua*	species	SGSL
Mollusca	*Doryteuthis pealeii*	species	MAR
Mollusca	*Euspira heros*	species	MAR
Mollusca	*Hiatella arctica*	species	SGSL
Mollusca	Hiatellidae	family	NGSL
Mollusca	*Macoma calcarea*	species	NGSL
Mollusca	*Margarites* spp.	genus	NGSL, SGSL
Mollusca	Mytilidae	family	NGSL, SGSL
Mollusca	Naticidae	family	NGSL, SGSL
Mollusca	*Neptunea lyrata*	species	MAR
Mollusca	*Nuculana* spp.	genus	SGSL
Mollusca	Nuculanida	order	NGSL
Mollusca	Nudibranchia	order	NGSL, SGSL
Mollusca	*Placopecten magellanicus*	species	SGSL, MAR
Mollusca	Polyplacophora	class	NGSL, SGSL
Mollusca	*Rossia* spp.	genus	NGSL, SGSL
Mollusca	*Scabrotrophon fabricii*	species	NGSL
Mollusca	*Semirossia tenera*	species	MAR
Mollusca	*Similipecten greenlandicus*	species	NGSL
Platyhelminthes	Platyhelminthes	phylum	NGSL
Porifera	*Biemna variantia*	species	SGSL
Porifera	*Halichondria panicea*	species	SGSL
Porifera	*Halichondria sitiens*	species	SGSL
Porifera	*Haliclona* spp.	genus	SGSL
Porifera	*Iophon* spp.	genus	SGSL
Porifera	*Mycale lingua*	species	SGSL
Porifera	*Phakellia* spp.	genus	SGSL
Porifera	*Polymastia* spp.	genus	SGSL

Porifera	Porifera	phylum	NGSL, SGSL
Porifera	*Suberites ficus*	species	SGSL
Porifera	*Tentorium semisuberites*	species	SGSL
Sipuncula	Sipuncula	phylum	NGSL, SGSL

Table S3. Comparison of cophenetic correlation coefficients (*c*) between dendrograms produced using 4 distance/similarity metrics and 7 hierarchical clustering methods on annual trawl survey catch composition data in 4 regions of the Northwest Atlantic: NGSL, SGSL, NL, and MAR (see Table S1 caption for regional abbreviations). Average = unweighted pair-group method using arithmetic averages (UPGMA), McQuitty's = weighted pair-group method using arithmetic averages (WPGMA), centroid = unweighted pair-group method using centroids (UPGMC), median = weighted pair-group method using centroids (WPGMC).

Clustering Method	Distance/Similarity Metric	Cophenetic Correlation (*c*)			
		NGSL	SGSL	NL	MAR
average	Jaccard	0.325	0.403	0.284	0.316
average	Soerensen	0.329	0.403	0.308	0.335
average	Gower	0.448	0.524	0.461	0.555
average	Simpson	**0.761**	**0.700**	**0.716**	**0.585**
Ward's	Simpson	0.703	0.557	0.672	0.529
McQuitty's	Simpson	0.476	0.573	0.648	0.514
centroid	Simpson	0.637	0.552	0.673	0.334
complete	Simpson	0.680	0.493	0.304	0.265
median	Simpson	0.623	0.437	0.373	0.410
single	Simpson	0.337	0.243	0.073	0.295

Bolded text indicates highest cophenetic correlations in each region

Table S4. Environmental data layers assembled for predictive modelling of spatial distributions of predominant assemblage types for demersal fish and benthic invertebrates in the Northwest Atlantic. For each variable, the summary statistics derived from the input data sources for each 4-km grid cell of the final rasters used in analyses, units of measure, year range of available data, native spatial resolution, and source(s) of input data are provided.

Variable	Summaries	Unit	Year range	Native spatial resolution	Source
Bottom temperature	Average mean (annual, spring, summer, fall, winter), min, max, range (annual)	°C	2007 – 2015	~ 3 – 5 arc-min	Wang et al. 2018
Sea surface temperature (SST)	Average mean (annual, spring, summer, fall, winter), min, max, range (annual)	°C	2007 – 2015	~ 3 – 5 arc-min	Wang et al. 2018
Bottom salinity	Average mean (annual, spring, summer, fall, winter), min, max, range (annual)	psu	2007 – 2015	~ 3 – 5 arc-min	Wang et al. 2018
Bottom shear stress	Average mean (annual)	N m^{-2}	2007 – 2015	~ 3 – 5 arc-min	Wang et al. 2018
Bottom current velocity N-S	Average mean, max (annual)	m s^{-1}	2007 – 2015	~ 3 – 5 arc-min	Wang et al. 2018
Bottom current velocity E-W	Average mean, max (annual)	m s^{-1}	2007 – 2015	~ 3 – 5 arc-min	Wang et al. 2018
Mixed layer depth (MLD)	Average mean (annual, summer)	m	2007 – 2015	~ 3 – 5 arc-min	Wang et al. 2018
Surface chlorophyll *a*	Average mean (annual, spring, summer, fall, winter), min, max, range (annual)	mg m^{-3}	2007 – 2011, 2012 – 2016	37.5 arc-sec	Fisheries and Oceans Canada 2021b
Primary production (PP)	Average mean, max (annual, spring/summer)	mg C m^{-2} d^{-1}	2007 – 2016	2.5 arc-min	Fisheries and Oceans Canada 2021a*
Depth	NA	m	NA	15 arc-sec, 30 arc-sec	CHS 2004, GEBCO 2014
Slope	NA	degrees	NA	15 arc-sec, 30 arc-sec	CHS 2004, GEBCO 2014
Aspect	NA	degrees	NA	15 arc-sec, 30 arc-sec	CHS 2004, GEBCO 2014
Bathymetric Position Index (BPI)	0.5 km, 1 km, 2 km, 5 km, 10 km, 20 km	NA	NA	15 arc-sec, 30 arc-sec	CHS 2004, GEBCO 2014
Dissolved oxygen (DO)	mean	mg l^{-1}	1898 – 2009	5 arc-min	Tyberghein et al. 2012
pH	mean	NA	1910 – 2007	5 arc-min	Tyberghein et al. 2012
Nitrate	mean	µmol l^{-1}	1928 – 2008	5 arc-min	Tyberghein et al. 2012
Phosphate	mean	µmol l^{-1}	1922 – 1986	5 arc-min	Tyberghein et al. 2012
Silicate	mean	µmol l^{-1}	1930 – 2008	5 arc-min	Tyberghein et al. 2012

*Depth-integrated net primary production provided by Remote Sensing Unit at the Bedford Institute of Oceanography, Dartmouth, NS. Estimated using data from multiple sources using methods described in Platt et al. 2008

Table S5. Final sets of environmental predictor variables included in random forest models classifying assemblage types in each of 4 regions of the Northwest Atlantic: NGSL, SGSL, NL, and MAR (see Table S1 caption for regional abbreviations). BPI = Bathymetric Position Index, SST = Sea Surface Temperature, √ = variable included in regional model. Pairwise correlations are ≤ 0.7 between all variables in a regional model.

Variable	NGSL	SGSL	NL	MAR
Aspect	√	√	√	√
BPI (0.5 km)			√	√
BPI (1 km)	√	√		
BPI (10 km)				√
BPI (20 km)	√	√	√	
Bottom current velocity E-W (max annual)			√	
Bottom current velocity E-W (mean annual)	√	√	√	
Bottom current velocity N-S (max annual)		√	√	
Bottom current velocity N-S (mean annual)	√	√		
Bottom salinity (max annual)				√
Bottom salinity (range annual)			√	
Bottom shear stress (mean annual)	√	√	√	√
Bottom temperature (max annual)	√	√	√	√
Bottom temperature (mean annual)		√		
Bottom temperature (min annual)	√	√	√	√
Chlorophyll *a* (min annual)			√	
Chlorophyll *a* (mean fall)			√	
Chlorophyll *a* (mean spring)			√	
Chlorophyll *a* (mean summer)			√	
Chlorophyll *a* (mean winter)	√		√	
Depth			√	√
Dissolved oxygen	√		√	√
Mixed layer depth (mean annual)	√	√	√	
Mixed layer depth (mean summer)		√		
pH	√		√	
Primary production (max spring/summer)	√	√	√	√
Primary production (mean annual)			√	
SST (max annual)	√			
SST (mean winter)		√		
SST (min annual)	√	√		
Slope	√	√	√	√

Table S6. Scientific name, common name, frequency of occurrence (Freq = % grid cells occupied) and indicator value (IndVal) for taxa characterizing predominant assemblages of demersal fish and benthic invertebrates in each of 4 regions of the Northwest Atlantic: NGSL, SGSL, NL, and MAR (see Table S1 caption for regional abbreviations). IndVal for all taxa listed are significant at $\alpha = 0.05$.

Assemblage	Taxa	Common name	Freq (%)	IndVal
NGSL				
Deep Channels	*Nezumia bairdii*	Marlin-spike Grenadier	93.3	0.793
	Myxine glutinosa	Northern Hagfish	93.1	0.707
	Brisaster fragilis	Heart Urchin	82.1	0.664
	Arctozenus risso	White (Spotted) Barracudina	93.2	0.647
	Malacoraja senta	Smooth Skate	92.1	0.507
	Reinhardtius hippoglossoides	Greenland Halibut (Turbot)	97.0	0.489
	Pennatulacea	Sea Pens	88.5	0.483
	Enchelyopus cimbrius	Fourbeard Rockling	88.0	0.472
	Lithodes maja	Northern Stone Crab	57.3	0.458
	Glyptocephalus cynoglossus	Witch Flounder	98.3	0.451
	Pandalus borealis	Northern Shrimp	99.2	0.435
	Melanostigma atlanticum	Atlantic Soft Pout	56.1	0.427
	Bolocera tuediae	Deeplet Sea Anemone	67.2	0.424
	Urophycis tenuis	White Hake	63.9	0.417
	Amblyraja radiata	Thorny Skate	94.8	0.405
	Sebastes spp.	Unseparated Redfishes	99.7	0.404
	Pontophilus norvegicus	Norwegian Shrimp	56.3	0.398
	Phycis chesteri	Longfin Hake	39.2	0.371
	Bathypolypus bairdii	North Atlantic Octopus	41.5	0.285
		Mean	**79.0**	**0.486**
		Max	**99.7**	**0.793**
Shallow Banks & Straits	*Triglops murrayi*	Moustache Sculpin	94.4	0.656
	Crossaster papposus	Spiny Sunstar	74.9	0.649
	Strongylocentrotus spp.	Sea Urchins	93.7	0.636
	Eumicrotremus spinosus	Atlantic Spiny Lumpsucker	70.7	0.594
	Spirontocaris spinus	Parrot Shrimp	62.7	0.573
	Eumesogrammus praecisus	Fourline Snakeblenny	66.9	0.559
	Pandalus montagui	Striped Pink (Aesop) Shrimp	98.3	0.507
	Myoxocephalus scorpius	Shorthorn Sculpin	64.8	0.489
	Hyas coarctatus	Arctic Lyre (Toad) Crab	72.5	0.475
	Argis dentata	Arctic Argid	68.3	0.474
	Lebbeus polaris	Polar Lebbeid shrimp	72.8	0.474
	Gadus morhua	Atlantic Cod	99.0	0.434
	Henricia spp.	Blood Stars	78.0	0.423
	Gersemia rubiformis	Sea Strawberry	58.5	0.405
	Sabinea septemcarinata	Sevenline Shrimp	55.1	0.404
	Asteriidae	Asterid Sea Stars	50.9	0.389
	Ophiopholis aculeata	Daisy Brittle Star	58.5	0.362
	Rhachotropis aculeata	Eusirid Amphipod	41.1	0.356

	Hyas araneus	Atlantic Lyre Crab	42.5	0.347
	Pteraster spp.	Pterasterid Cushion Stars	47.0	0.345
	Aspidophoroides monopterygius	Alligatorfish	62.4	0.341
	Gorgonocephalus spp.	Basket Stars	51.2	0.339
	Porifera	Sponges	86.4	0.332
	Chlamys islandica	Iceland Scallop	39.0	0.332
	Sclerocrangon boreas	Sculptured Shrimp	35.2	0.325
	Eualus fabricii	Arctic Eualid	35.2	0.312
	Lebbeus groenlandicus	Spiny Lebbeid Shrimp	32.8	0.310
	Lycodes lavalaei	Newfoundland Eelpout	45.6	0.300
	Stomphia coccinea	Swimming Anemone	46.3	0.298
	Polychaeta	Bristle Worms	72.1	0.297
	Boltenia spp.	Sea Potatoes	39.4	0.297
	Pagurus spp.	Hermit Crabs	39.4	0.297
	Anarhichas lupus	Atlantic Wolffish	48.4	0.265
	Ophiuridae	Ophiruid brittle stars	58.9	0.253
		Mean	**60.7**	**0.407**
		Max	**99.0**	**0.656**
Channel Heads & Slopes	*Lycodes vahlii*	Checker (Vahl's) Eelpout	68.4	0.507
	Ctenodiscus crispatus	Mud Star	85.0	0.396
	Chionoecetes opilio	Snow Crab	84.8	0.382
	Hippoglossoides platessoides	American Plaice	99.8	0.370
	Hippoglossus hippoglossus	Atlantic Halibut	54.4	0.347
	Lumpenus lampretaeformis	Snakeblenny	50.7	0.332
	Leptoclinus maculatus	Daubed Shanny	64.5	0.326
		Mean	**72.5**	**0.380**
		Max	**99.8**	**0.507**
SGSL				
Magdalen Shallows/ Chaleur Bay	*Gorgonocephalus* spp.	Basket Stars	80.3	0.419
	Buccinidae	Whelks	75.6	0.415
	Crossaster papposus	Spiny Sunstar	91.5	0.403
	Hyas coarctatus	Arctic Lyre (Toad) Crab	83.4	0.389
	Chionoecetes opilio	Snow Crab	97.4	0.385
	Strongylocentrotus spp.	Sea Urchins	90.2	0.383
	Pagurus spp.	Hermit Crabs	66.9	0.365
	Lycodes lavalaei	Newfoundland Eelpout	39.7	0.346
	Boltenia ovifera	Sea Potato	69.0	0.319
	Hippoglossoides platessoides	American Plaice	99.0	0.310
	Gadus morhua	Atlantic Cod	86.8	0.299
	Leptagonus decagonus	Atlantic Sea Poacher	32.2	0.281
	Leptoclinus maculatus	Daubed Shanny	60.0	0.272
	Icelus spatula	Spatulate Sculpin	32.5	0.261
		Mean	**71.8**	**0.346**
		Max	**99.0**	**0.419**
Inshore/ Magdalen Is.	*Limanda ferruginea*	Yellowtail Flounder	86.5	0.387
	Echinarachnius parma	Sand Dollar	71.6	0.343
	Cucumaria frondosa	Common Sea Cucumber	54.9	0.284

	Leptasterias spp.	Six-rayed Sea Stars	64.2	0.270
	Hyas araneus	Atlantic Lyre Crab	59.1	0.258
		Mean	**67.3**	**0.308**
		Max	**86.5**	**0.387**
Laurentian Channel	*Glyptocephalus cynoglossus*	Witch Flounder	97.7	0.826
	Sebastes spp.	Unseparated Redfishes	99.2	0.725
	Myxine glutinosa	Northern Hagfish	73.7	0.720
	Lithodes maja	Northern Stone Crab	69.2	0.680
	Amblyraja radiata	Thorny Skate	82.0	0.586
	Reinhardtius hippoglossoides	Greenland Halibut (Turbot)	82.7	0.576
	Nezumia bairdii	Marlin-spike Grenadier	57.9	0.576
	Pennatulacea	Sea Pens	69.2	0.570
	Malacoraja senta	Smooth Skate	60.2	0.562
	Hippasteria phrygiana	Horse Star	62.4	0.546
	Arctozenus risso	White (Spotted) Barracudina	57.9	0.546
	Urophycis tenuis	White Hake	86.5	0.413
	Melanostigma atlanticum	Atlantic Soft Pout	41.4	0.402
	Bathypolypus bairdii	North Atlantic Octopus	42.1	0.390
	Brisaster fragilis	Heart Urchin	36.8	0.364
	Hippoglossus hippoglossus	Atlantic Halibut	56.4	0.304
	Actiniaria	Sea Anemones	85.7	0.298
	Ctenodiscus crispatus	Mud Star	54.9	0.286
	Rossia spp.	Bobtail Squid	31.6	0.277
		Mean	**65.7**	**0.508**
		Max	**99.2**	**0.826**
Northumberland Strait/ St. George's Bay	*Homarus americanus*	American Lobster	60.5	0.558
	Cancer irroratus	Atlantic Rock Crab	70.2	0.556
	Scophthalmus aquosus	Brill (Windowpane) Flounder	4.70	0.533
	Gasterosteus aculeatus	Threespine Stickleback	11.2	0.527
	Pseudopleuronectes americanus	Winter Flounder	92.6	0.497
	Myoxocephalus octodecemspinosus	Longhorn Sculpin	60.5	0.374
	Tautogolabrus adspersus	Cunner	15.8	0.260
		Mean	**45.1**	**0.472**
		Max	**92.6**	**0.558**
NL				
Inner Shelf	*Boreogadus saida*	Polar Cod	67.6	0.464
	Icelus spatula	Spatulate Sculpin	49.6	0.390
	Pandalus montagui	Striped Pink (Aesop) Shrimp	84.4	0.354
	Chionoecetes opilio	Snow Crab	89.1	0.333
	Leptoclinus maculatus	Daubed Shanny	47.5	0.332
	Leptagonus decagonus	Atlantic Sea Poacher	47.8	0.270
	Lycodes reticulatus	Arctic Eelpout	52.1	0.266
		Mean	**62.6**	**0.344**
		Max	**89.1**	**0.464**
Outer Shelf	*Pandalus borealis*	Northern Shrimp	84.8	0.375
	Anarhichas lupus	Striped Atlantic Wolffish	58.3	0.282

	Amblyraja radiata	Thorny Skate	91.1	0.277
	Anarhichas minor	Spotted Wolffish	41.6	0.276
		Mean	**69.0**	**0.302**
		Max	**91.1**	**0.375**
Grand Banks	*Limanda ferruginea*	Yellowtail Flounder	95.5	0.839
	Ammodytes dubius	Northern Sand Lance	74.2	0.528
	Myoxocephalus octodecemspinosus	Longhorn Sculpin	35.9	0.313
		Mean	**68.5**	**0.560**
		Max	**95.5**	**0.839**
Slope	*Antimora rostrata*	Blue Antimora	89.6	0.825
	Coryphaenoides rupestris	Rock (Roundnose) Grenadier	83.3	0.789
	Synaphobranchus kaupii	Gray's Cutthroat Eel	94.5	0.659
	Macrourus berglax	Roughhead Grenadier	98.5	0.649
	Notacanthus chemnitzii	Spiny Eel	59.8	0.540
	Chauliodus sloani	Viperfish	58.4	0.500
	Stomias boa	Boa Dragonfish	69.9	0.497
	Bathylagus euryops	Goiter Blacksmelt	48.7	0.469
	Nezumia bairdii	Marlin-spike Grenadier	90.5	0.454
	Serrivomer beanii	Stout Sawpalate	46.2	0.424
	Reinhardtius hippoglossoides	Greenland Halibut (Turbot)	95.1	0.320
	Malacosteus niger	Spotlight Loosejaw	29.6	0.286
	Polyacanthonotus rissoanus	Shortspine Tapirfish	29.2	0.280
	Atlantopandalus propinqvus	Deep-sea Shrimp	37.5	0.272
	Anarhichas denticulatus	Northern Wolffish	44.7	0.269
	Chiasmodon niger	Black Swallower	30.3	0.265
		Mean	**62.9**	**0.469**
		Max	**74.1**	**0.825**
Laurentian Channel/ Shelf Break	*Urophycis tenuis*	White Hake	82.9	0.667
	Merluccius bilinearis	Silver Hake	75.3	0.642
	Myxine glutinosa	Northern Hagfish	66.5	0.555
	Argentina silus	Atlantic Argentine	46.9	0.414
	Lophius americanus	Monkfish	43.6	0.380
	Glyptocephalus cynoglossus	Witch Flounder	92.7	0.374
	Phycis chesteri	Longfin Hake	65.8	0.373
	Malacoraja senta	Smooth Skate	45.5	0.342
	Sebastes mentella	Beaked Redfish	93.1	0.328
	Enchelyopus cimbrius	Fourbeard Rockling	37.8	0.254
		Mean	**65.0**	**0.433**
		Max	**93.1**	**0.667**
MAR				
WSS/Outer BoF	*Urophycis chuss*	Squirrel (Red) Hake	59.1	0.331
	Pollachius virens	Pollock	59.2	0.293
	Merluccius bilinearis	Silver Hake	85.0	0.263
		Mean	**67.8**	**0.296**
		Max	**85.0**	**0.331**

WSS: Banks/ Inner BoF	*Placopecten magellanicus*	Atlantic Deep Sea Scallop	62.6	0.402
	Pseudopleuronectes americanus	Winter Flounder	56.2	0.400
	Leucoraja erinacea	Little Skate	47.9	0.377
	Myoxocephalus octodecemspinosus	Longhorn Sculpin	73.1	0.335
	Melanogrammus aeglefinus	Atlantic Haddock	90.7	0.318
	Limanda ferruginea	Yellowtail Flounder	67.4	0.282
	Homarus americanus	American Lobster	55.6	0.270
	Leucoraja ocellata	Winter Skate	45.1	0.261
	Hemitripterus americanus	Sea Raven	53.1	0.260
		Mean	**61.3**	**0.323**
		Max	**90.7**	**0.402**
ESS	*Lycodes vahlii*	Checker (Vahl's) Eelpout	40.2	0.310
	Pandalus borealis	Northern Shrimp	69.6	0.307
	Hippoglossoides platessoides	American Plaice	94.2	0.275
	Glyptocephalus cynoglossus	Witch Flounder	92.4	0.274
		Mean	**74.1**	**0.292**
		Max	**94.2**	**0.310**
ESS: Banks	*Strongylocentrotus droebachiensis*	Green Sea Urchin	79.8	0.516
	Ammodytes dubius	Northern Sand Lance	58.5	0.394
	Chionoecetes opilio	Snow Crab	81.8	0.331
	Echinarachnius parma	Sand Dollar	59.6	0.284
	Crossaster papposus	Spiny Sunstar	61.4	0.278
	Hyas coarctatus	Arctic Lyre (Toad) Crab	39.4	0.269
		Mean	**63.4**	**0.345**
		Max	**81.8**	**0.516**
Laurentian Channel/ Shelf Break	*Phycis chesteri*	Longfin Hake	85.0	0.502
	Sebastes mentella	Beaked Redfish	100	0.323
	Arctozenus risso	White (Spotted) Barracudina	58.8	0.298
	Urophycis tenuis	White Hake	77.8	0.283
		Mean	**80.4**	**0.352**
		Max	**100**	**0.502**
Slope	*Synaphobranchus affinis*	Cutthroat Eel	94.3	0.850
	Chauliodus sloani	Viperfish	74.3	0.703
	Serrivomer beanii	Stout Sawpalate	71.4	0.701
	Stomias boa	Boa Dragonfish	80.0	0.683
	Antimora rostrata	Blue Antimora	65.7	0.638
	Coryphaenoides rupestris	Rock (Roundnose) Grenadier	57.1	0.554
	Centroscyllium fabricii	Black Dogfish	68.6	0.517
	Nemichthys scolopaceus	Slender Snipe Eel	48.6	0.394
	Chaceon quinquedens	Red Deep Sea Crab	51.4	0.367
	Reinhardtius hippoglossoides	Greenland Halibut (Turbot)	80.0	0.299
	Nezumia bairdii	Marlin-spike Grenadier	65.7	0.298
		Mean	**68.8**	**0.546**
		Max	**94.3**	**0.850**

Table S7. Class-specific performance of random forest classifier for Maritimes region when hindcasting the expected assemblage type at sites (i.e., 4-km grid cells) with repeated measures in two time periods (2007 – 2011, 2012 – 2016) based on environmental conditions in those time periods. Sensitivity (true positive rate), specificity (true negative rate), precision, and prevalence calculated from the confusion matrix for both time periods combined are provided for each of the 6 predominant assemblage types in the region.

Assemblage	Sensitivity	Specificity	Precision	Prevalence
WSS/Outer BoF	0.655	0.905	0.685	0.239
WSS: Banks/Inner BoF	0.794	0.855	0.848	0.504
ESS	0.679	0.962	0.528	0.059
ESS: Banks	0.775	0.941	0.729	0.169
Laurentian Channel/Shelf Break	0.667	0.978	0.444	0.025
Slope	1.00	0.998	0.500	0.002

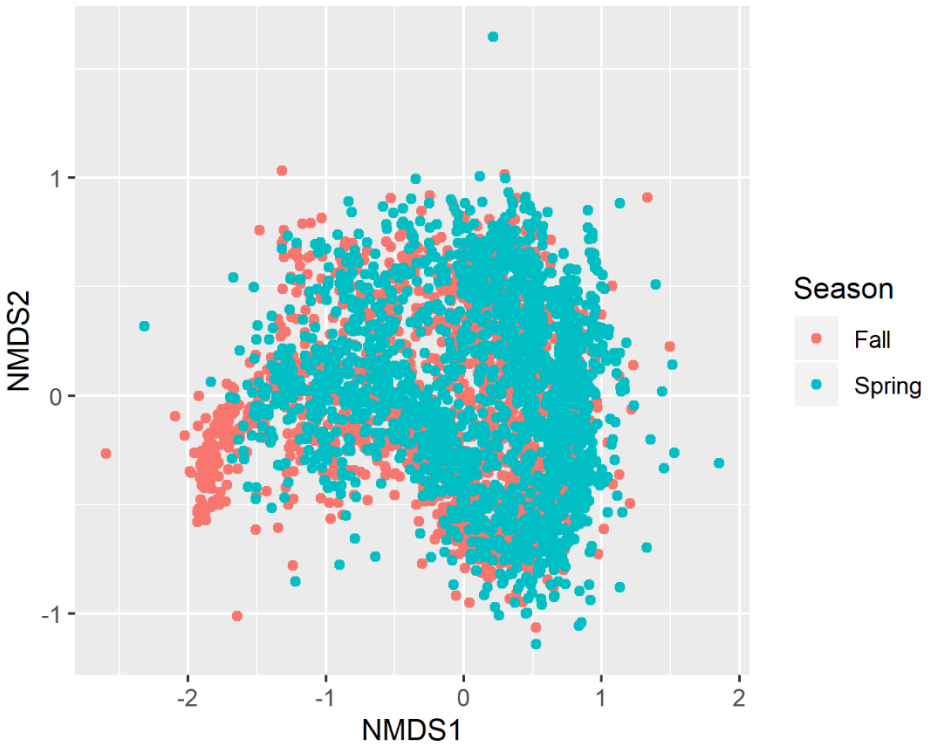

Figure S1. Non-metric multidimensional scaling ordination comparing community structure of demersal fish and benthic invertebrates between spring and fall bottom trawl surveys along Newfoundland and Labrador. Points represent community data aggregated to 4-km grid cells.

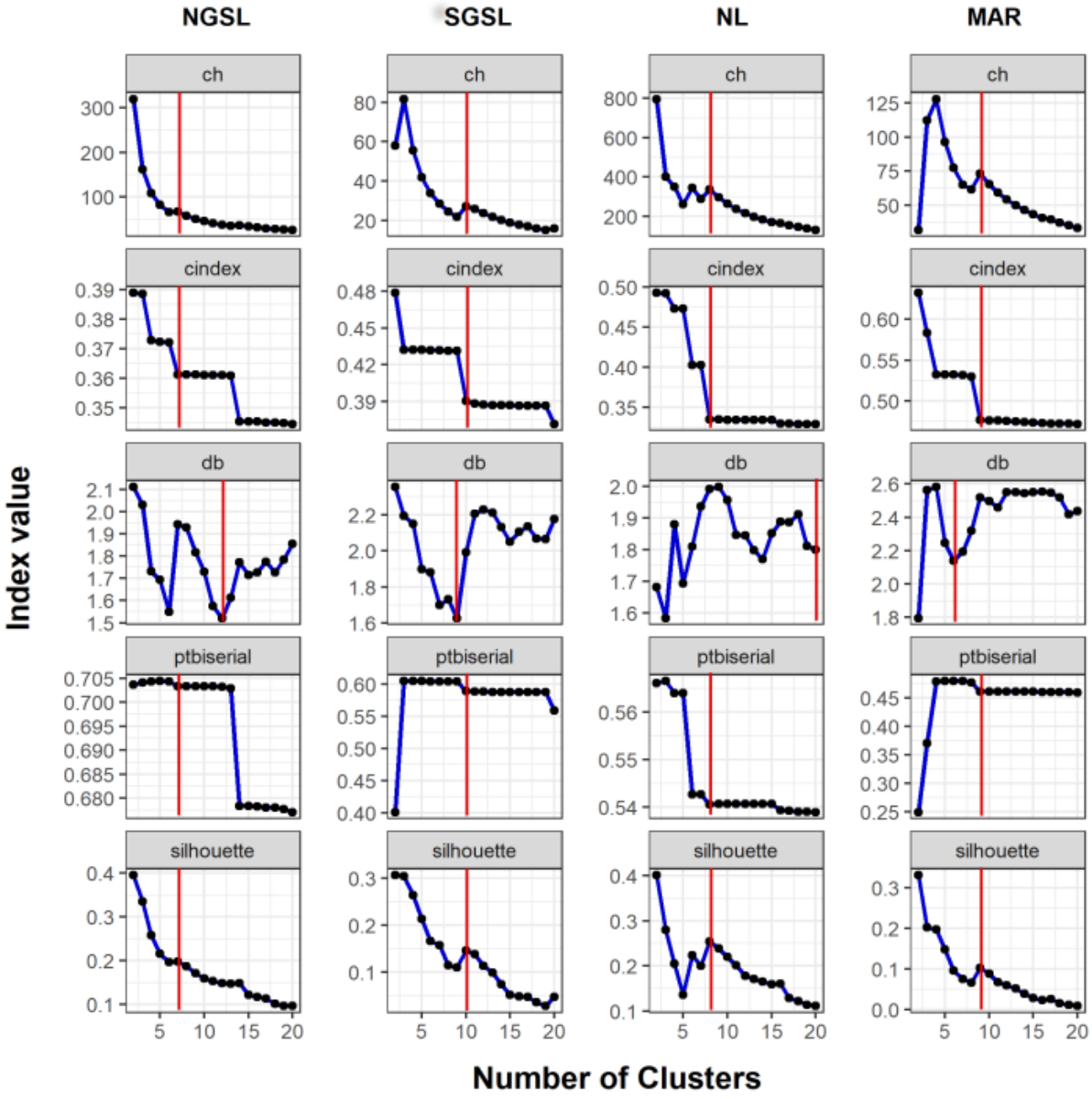

Figure S2. Value of various internal cluster validity indices for differing hierarchical clustering solutions (k = 2 – 20) grouping observations in dendrograms based on similarity of taxonomic composition in 4 regions of the Northwest Atlantic: NGSL, SGSL, NL, MAR (see Table S1 caption for regional abbreviations). ch = Calinski-Harabasz index, cindex = C index, db = Davies-Bouldin index, ptbiserial = Point-Biserial index, silhouette = Silhouette index. Red vertical lines indicate local optima for a given index.

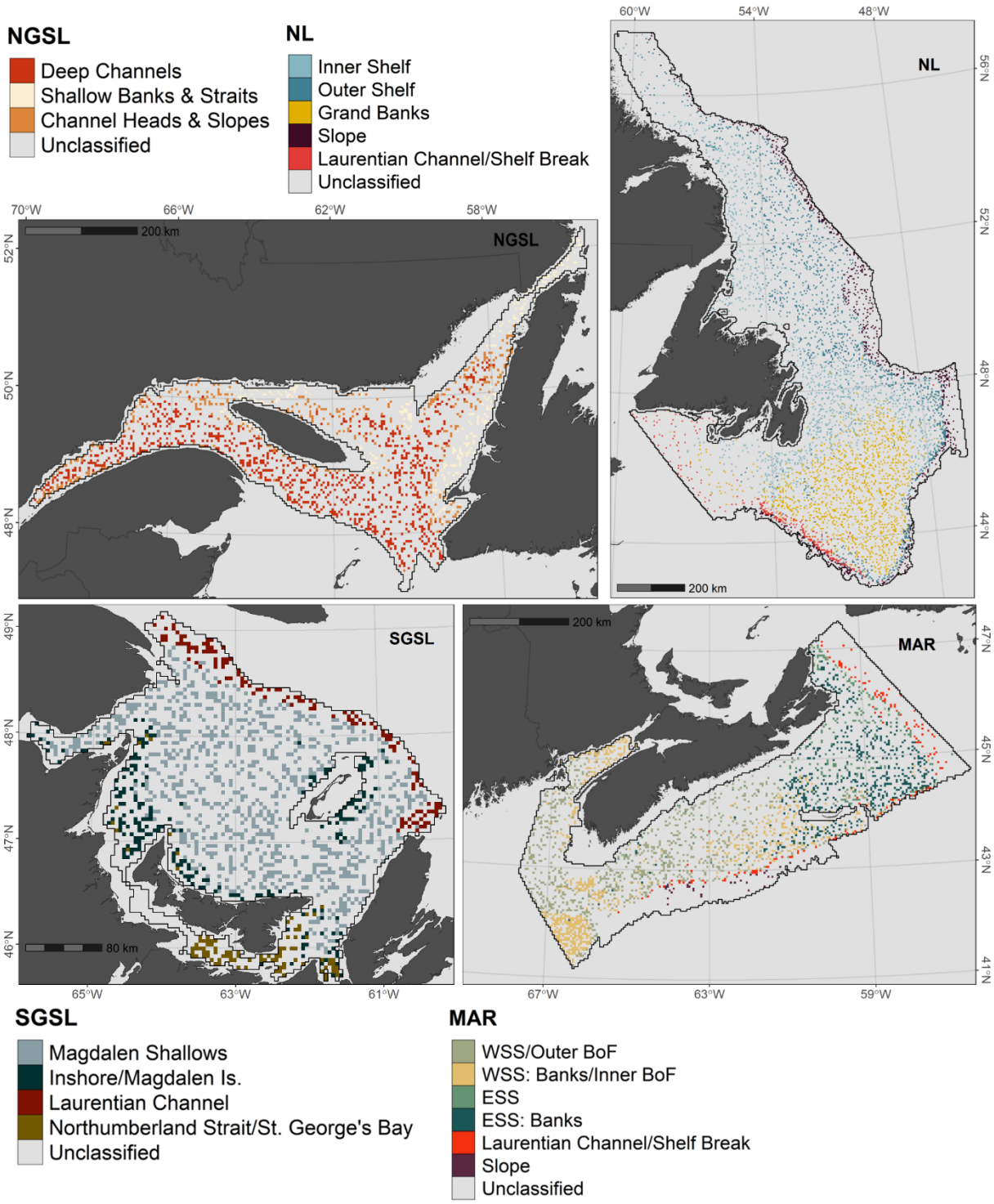

Figure S3. Distribution of predominant assemblages of demersal fish and benthic invertebrates in each of 4 regions of the Northwest Atlantic: NGSL, SGSL, NL, and MAR (see Table S1 caption for regional abbreviations). Colours identify groupings of 4-km grid cells with similar taxonomic composition based on hierarchical clustering of annual multispecies trawl survey data. Light grey indicates cells lacking survey data or that did not group with a major cluster.

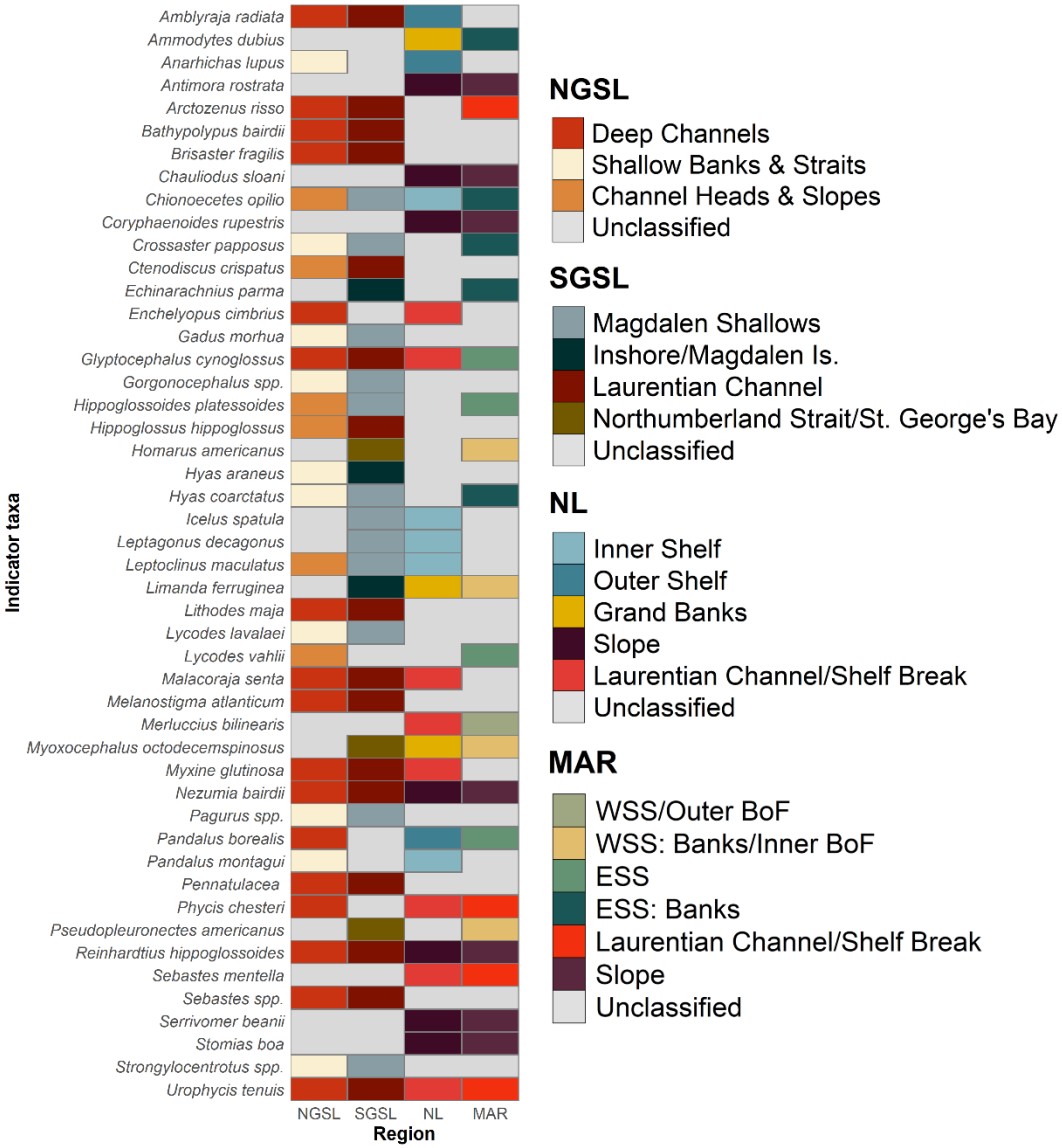

Figure S4. Indicator taxa identified as representative of predominant assemblage types of demersal fish and benthic invertebrates in 4 regions of the Northwest Atlantic: NGSL, SGSL, NL, and MAR (see Table S1 caption for regional abbreviations). Only taxa shared across multiple regions are shown. Cell colours indicate the regional assemblage type with which each taxa is associated.

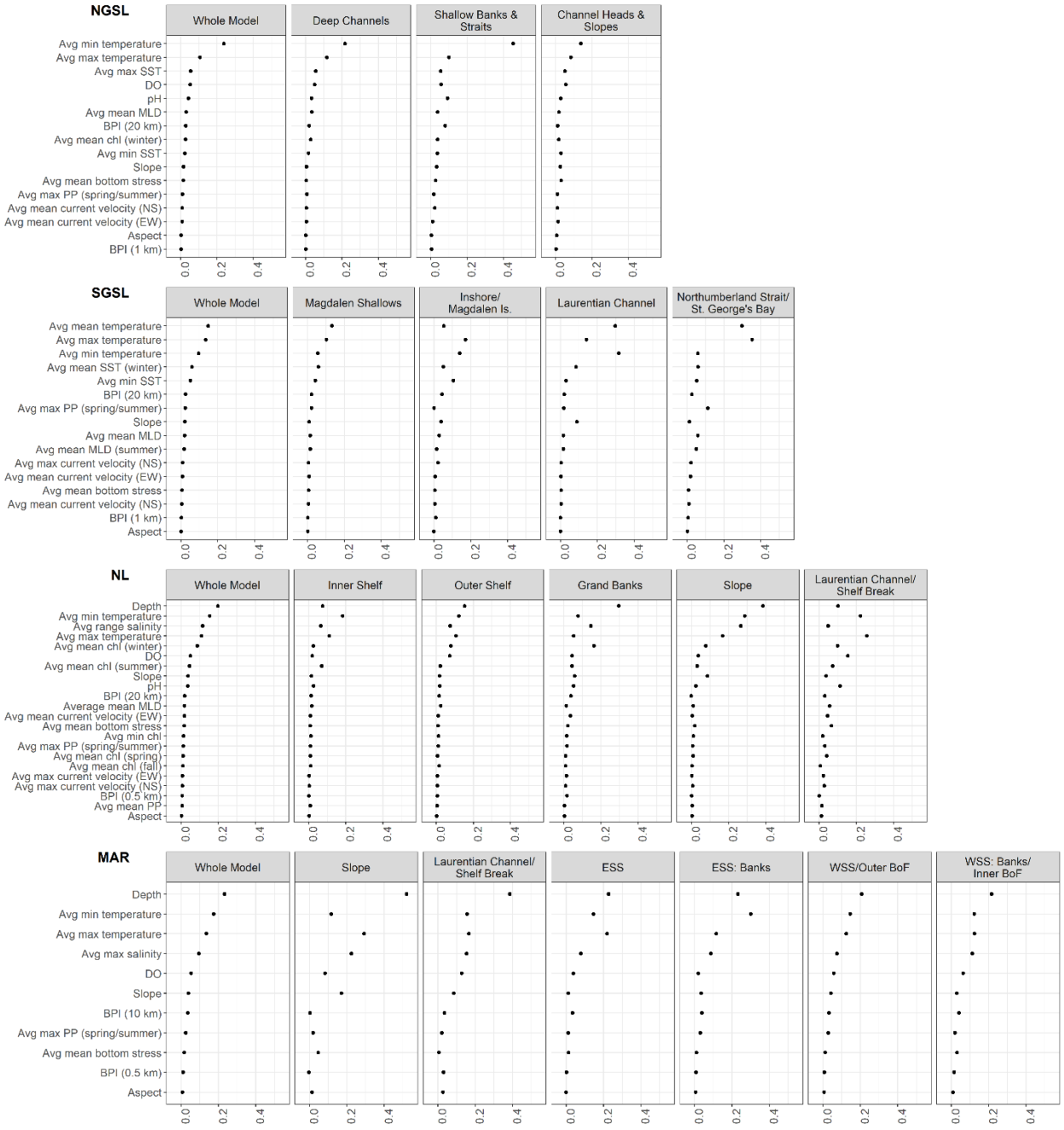

Figure S5. Class-specific variable importance plots indicating mean decrease in accuracy resulting from randomly permuting values of environmental predictors among observations used in the 4 regional random forest classifiers: NGSL, SGSL, NL, MAR (see Table S1 for regional abbreviations). Importance of variables to predictions for the whole model and for each assemblage type individually is indicated in separate panels. Variable summaries with prefix 'Avg' indicate averages across years with available data. Refer to Table S4 for details and data sources for individual variables.

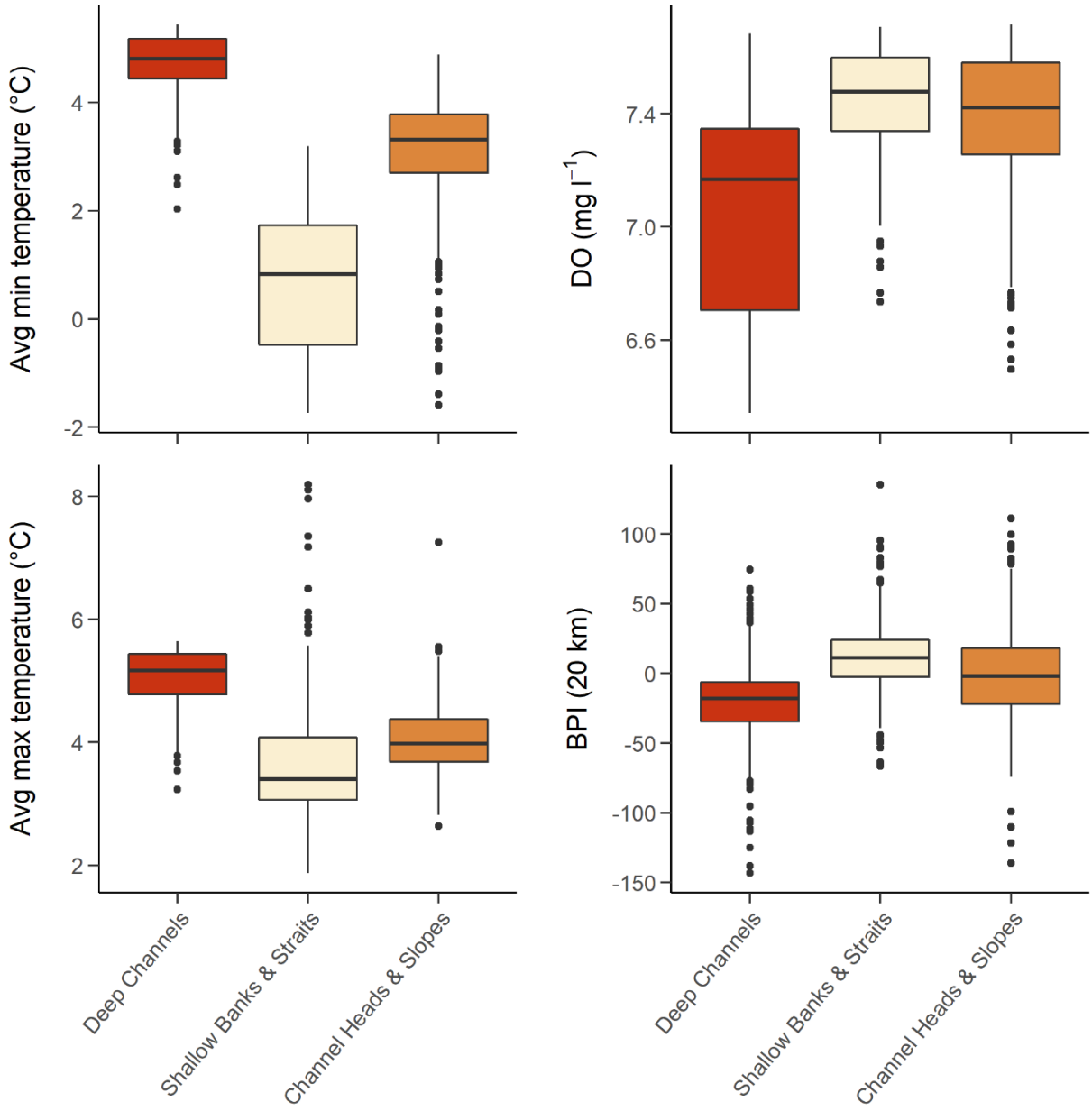

Figure S6. Characteristic environmental conditions occupied by the 3 predominant assemblage types in the Northern Gulf of St. Lawrence. Boxplots summarize the distribution of values for key environmental correlates with the spatial distribution of assemblages. Box lower edge, middle bar, and upper edge indicate the 25th, 50th, and 75th percentiles, respectively. Whiskers indicate most extreme values within 1.5 times the interquartile range of box edges. Individual points are outliers.

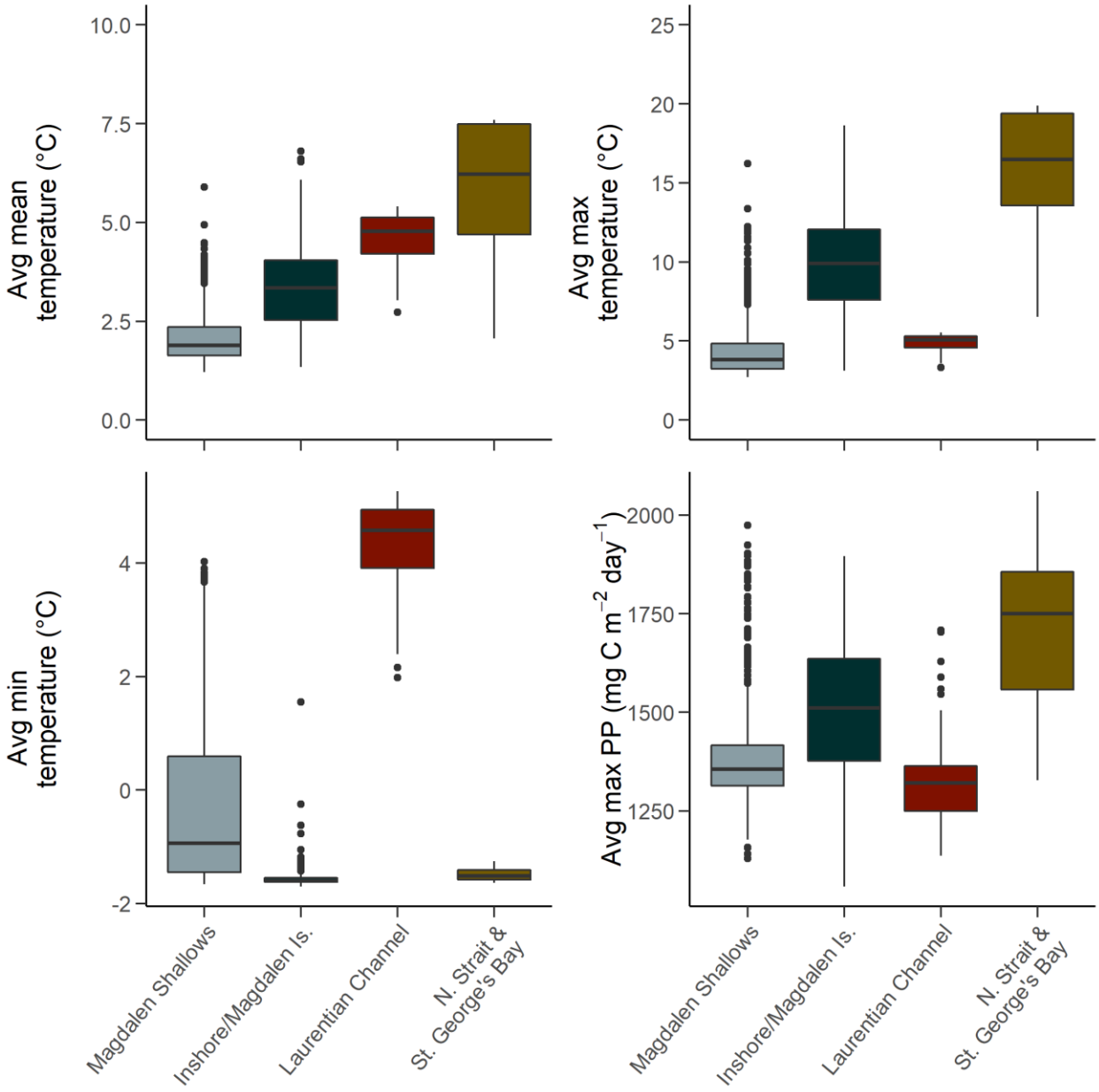

Figure S7. Characteristic environmental conditions occupied by the 4 predominant assemblage types in the Southern Gulf of St. Lawrence. Boxplots summarize the distribution of values for key environmental correlates with the spatial distribution of assemblages. Box lower edge, middle bar, and upper edge indicate the 25th, 50th, and 75th percentiles, respectively. Whiskers indicate most extreme values within 1.5 times the interquartile range of box edges. Individual points are outliers.

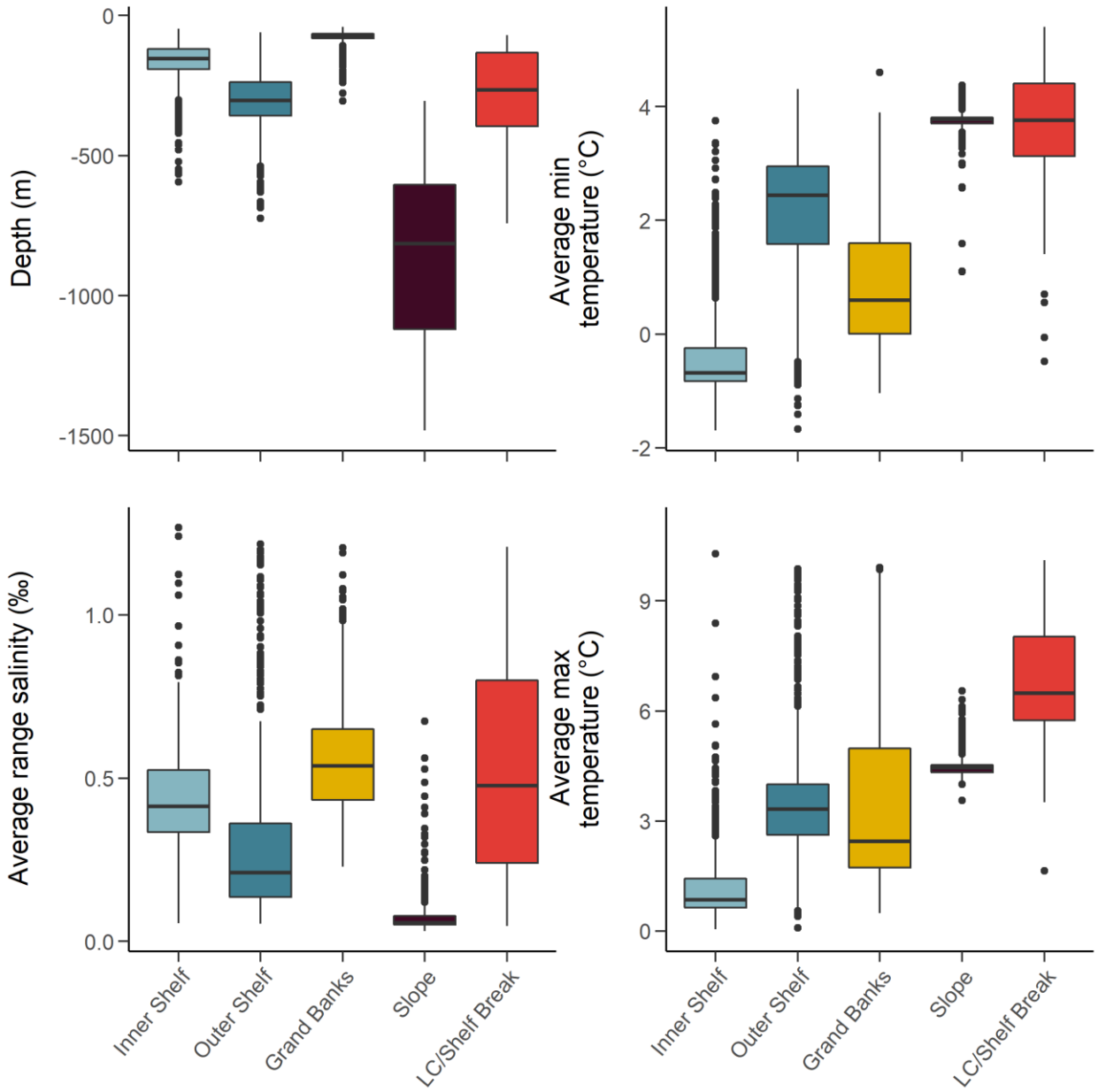

Figure S8. Characteristic environmental conditions occupied by the 5 predominant assemblage types in the Newfoundland & Labrador region. Boxplots summarize the distribution of values for key environmental correlates with the spatial distribution of assemblages. Box lower edge, middle bar, and upper edge indicate the 25th, 50th, and 75th percentiles, respectively. Whiskers indicate most extreme values within 1.5 times the interquartile range of box edges. Individual points are outliers.

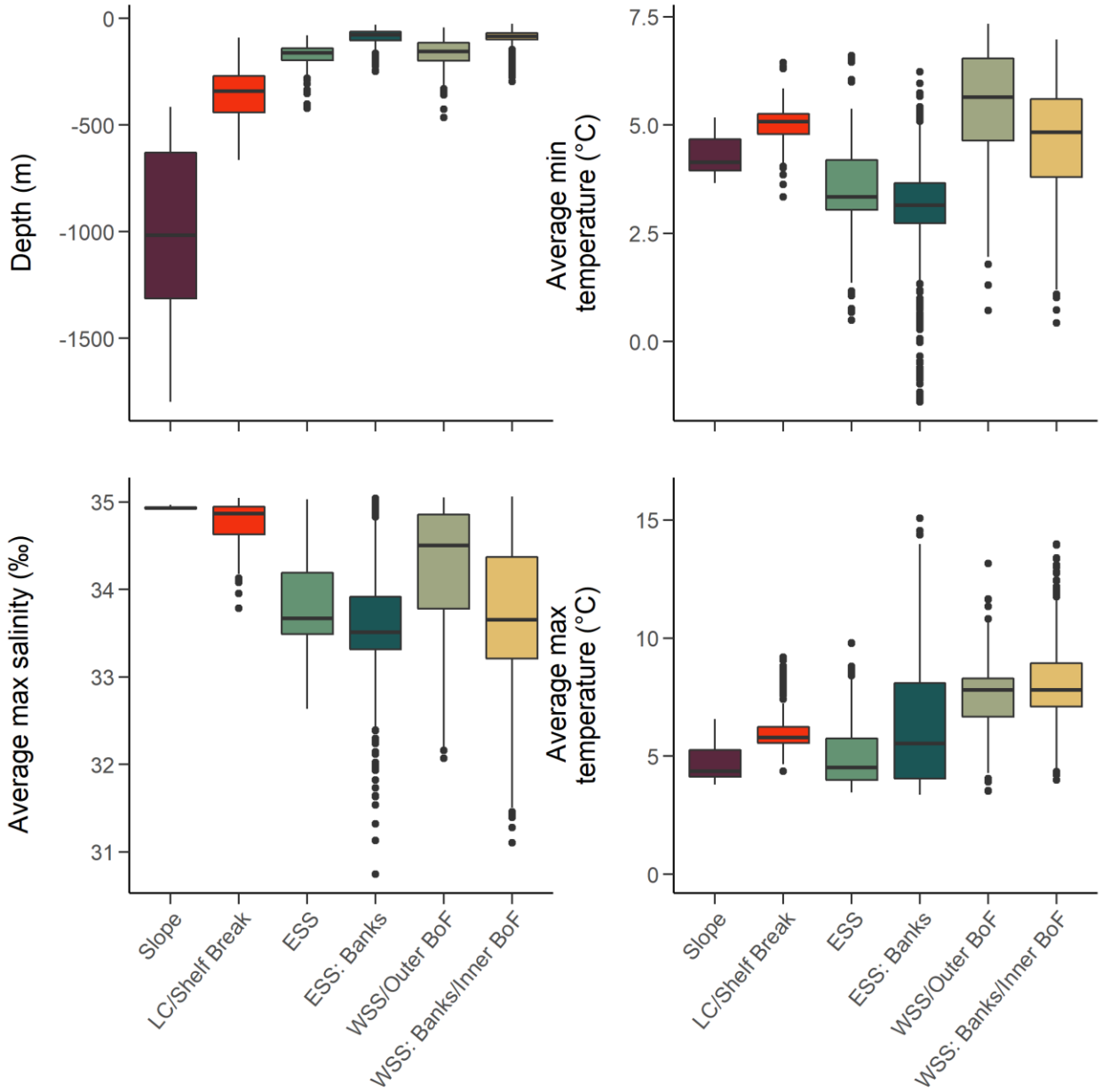

Figure S9. Characteristic environmental conditions occupied by the 6 predominant assemblage types in the Maritimes region. Boxplots summarize the distribution of values for key environmental correlates with the spatial distribution of assemblages. Box lower edge, middle bar, and upper edge indicate the 25th, 50th, and 75th percentiles, respectively. Whiskers indicate most extreme values within 1.5 times the interquartile range of box edges. Individual points are outliers.

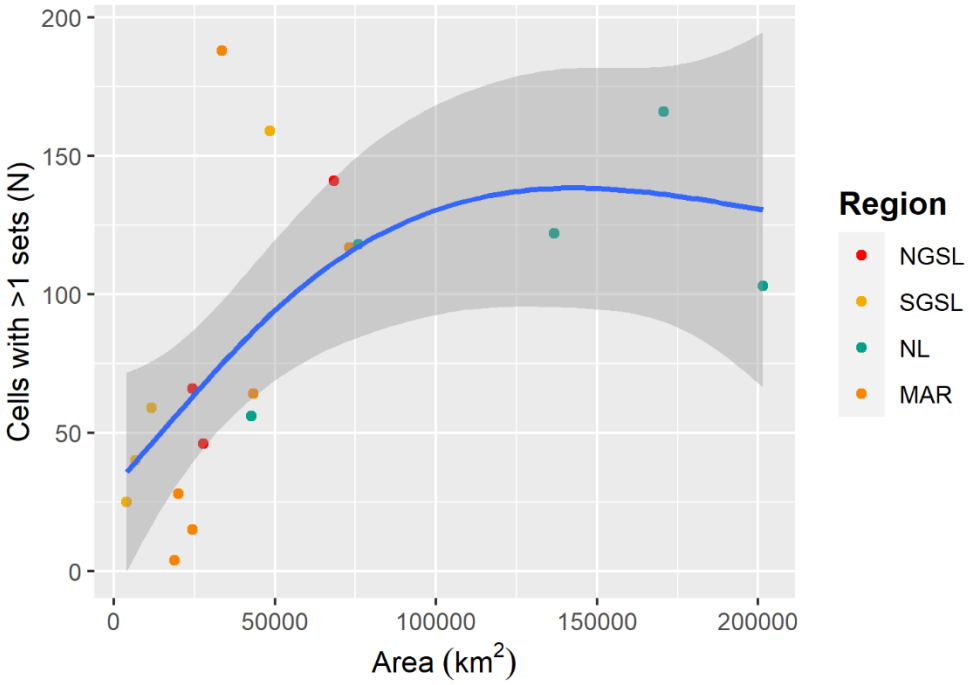

Figure S10. Frequency of grid cells with multiple trawl sets from across multiple years over the period 2007 to 2017 in each cluster (assemblage type) in relation to areal footprint of that cluster (km^2). Colours denote the region with which the cluster belongs (NGSL, SGSL, NL, MAR; see Table S1 caption for regional abbreviations). Blue line is a gam smoother with 95% CI in grey shade.

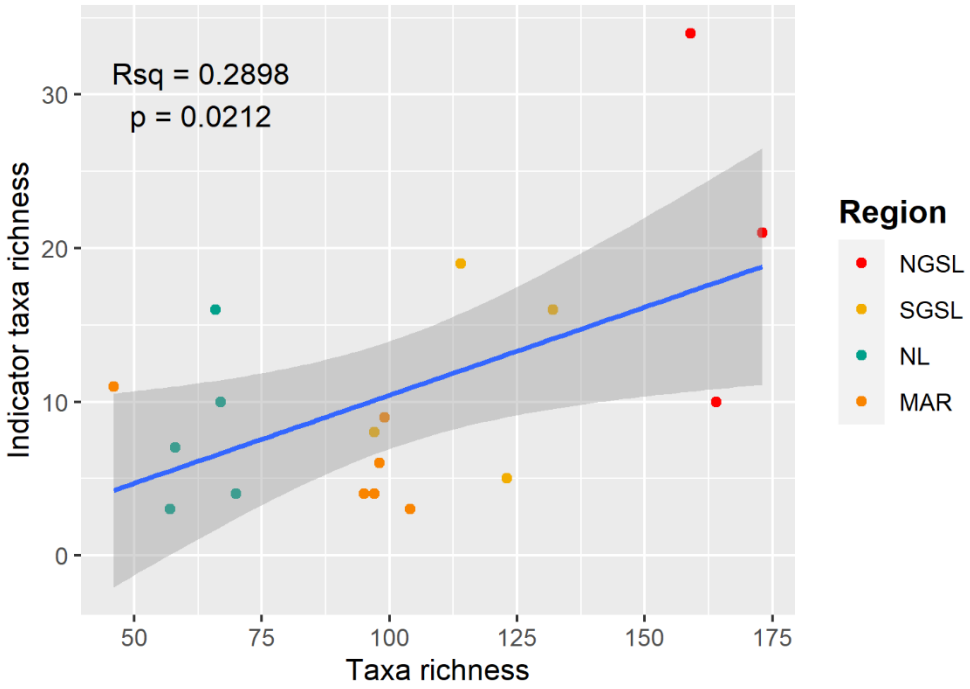

Figure S11. Relationship between number of indicator taxa characterizing a cluster (i.e., assemblage type) and the taxa richness associated with that assemblage. Colours denote the region with which the cluster belongs (NGSL, SGSL, NL, MAR; see Table S1 caption for regional abbreviations). Blue line is the linear regression relationship with 95% CI in grey shade.

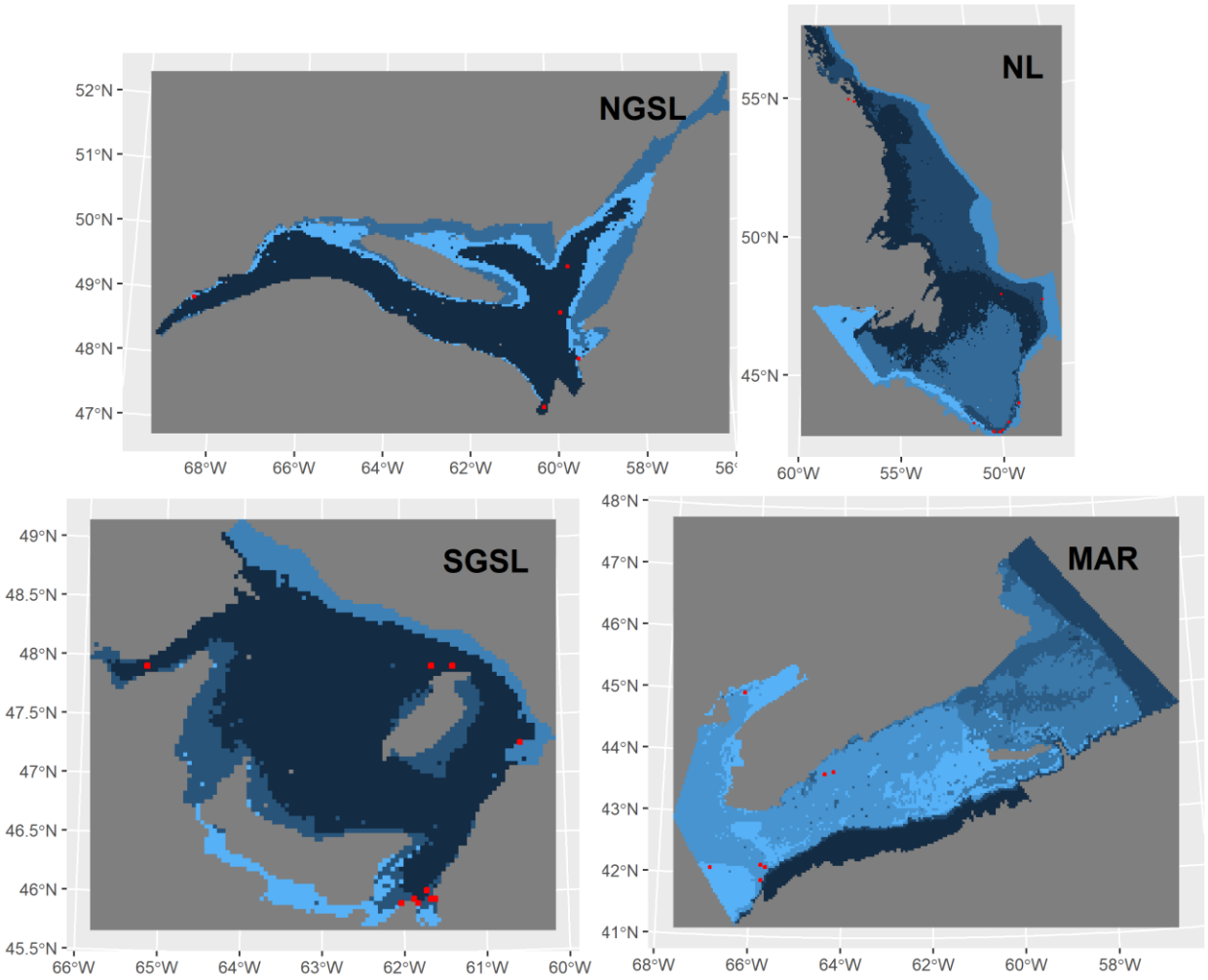

Figure S12. Spatial distribution of minor clusters (< 20 grid cells) with respect to the major assemblage types in each region (NGSL, SGSL, NL, MAR; see Table S1 caption for regional abbreviations). Grid cells belonging to minor clusters are highlighted in red. Blue tones indicate the predicted distribution of the major assemblage types in each region.

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