

SUPPLEMENTAL FIGURES AND TABLES

Figure S1. Species distribution of positive catches for primary groundfish species (those occurring in > 5% of tows) from Northwest Fisheries Science Center (NWFS) bottom trawl survey tows conducted 2003 through 2015. Red lines represent cut points for dividing the survey area into four separate geographic groups. See Table S1 for frequency of occurrence for each species.

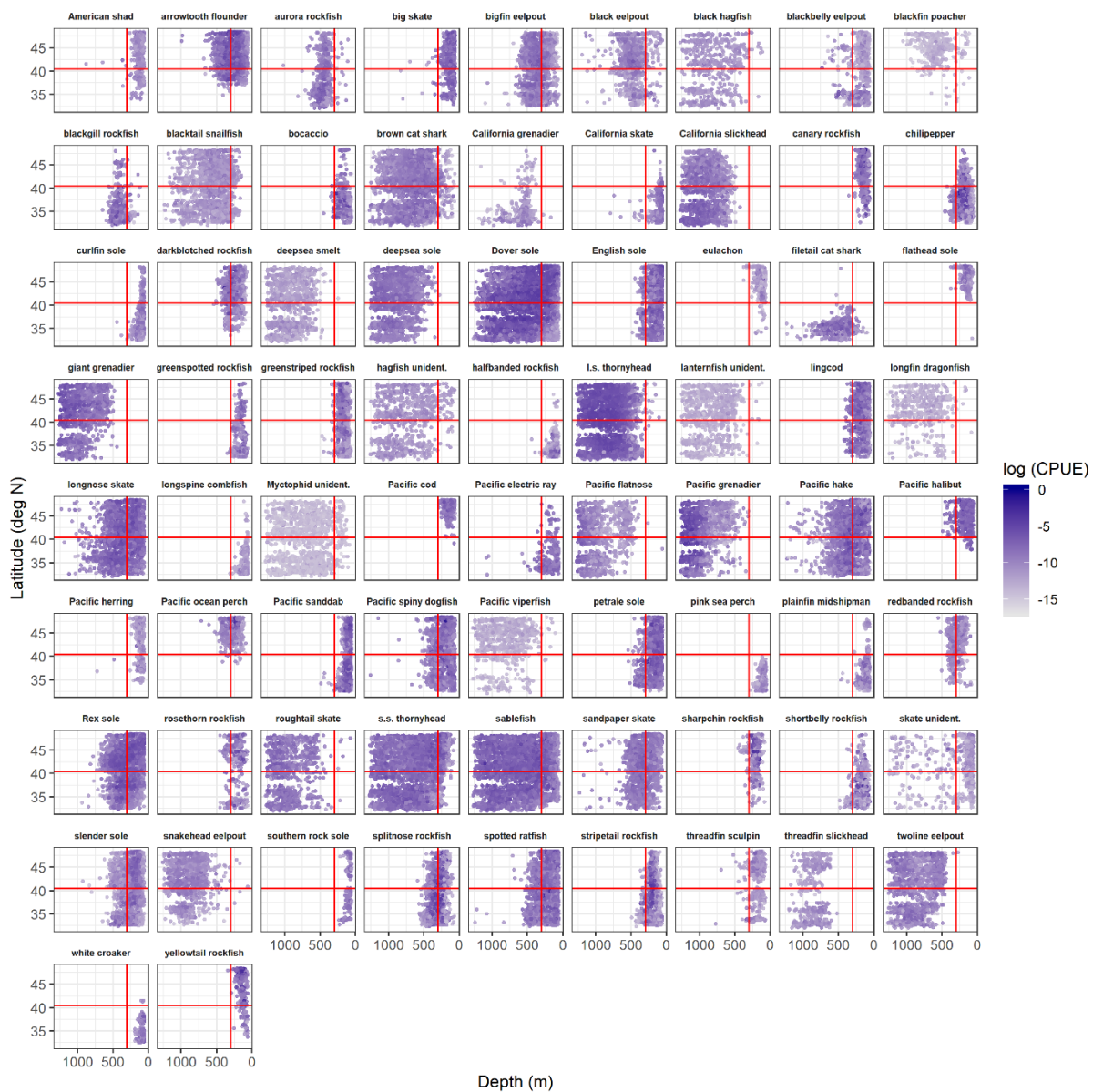


Figure S2. Temperature-depth correlation plots for each geographic group. A linear correlation is indicated by solid line. Correlation coefficients are shown for each geographic group.

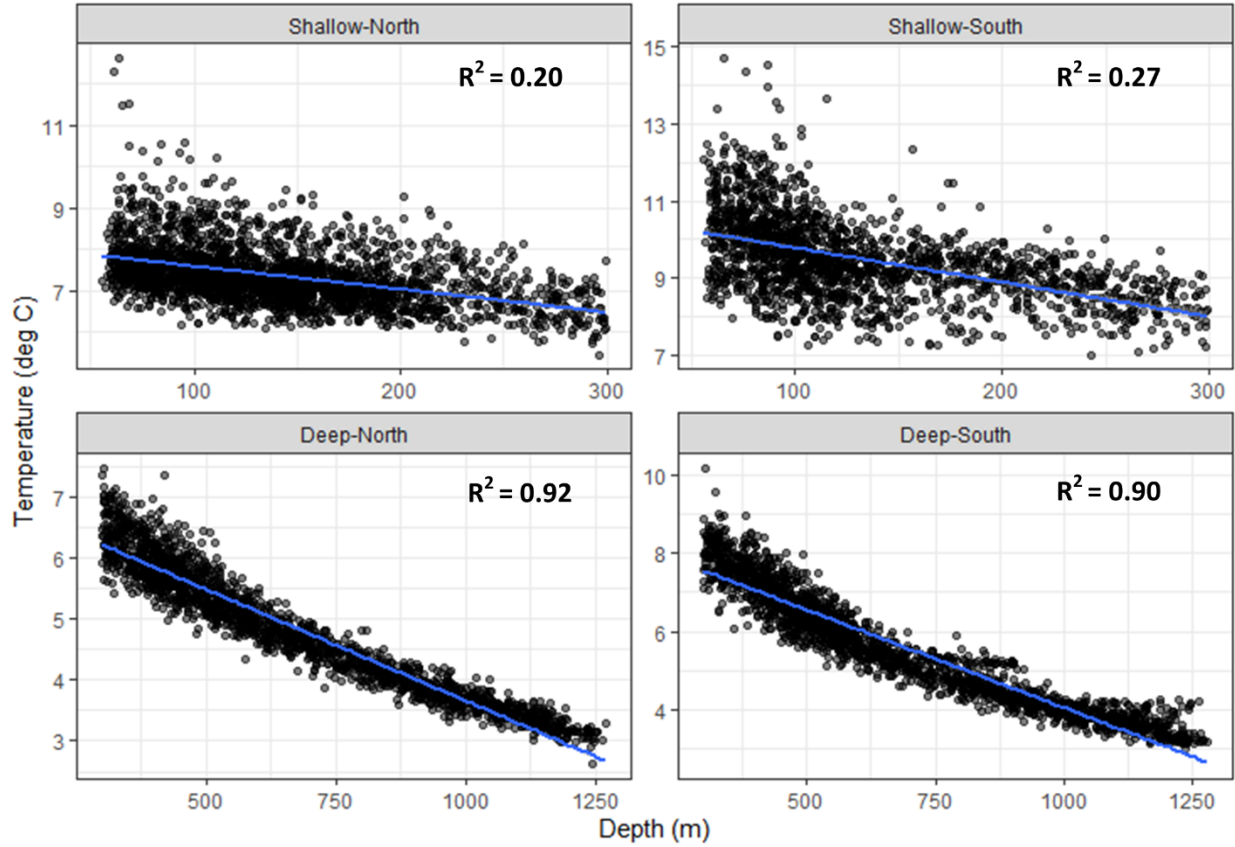


Figure S3. Model diagnostic plots for GLMMs predicting groundfish species density (species tow^{-1}) in the Shallow-North and Shallow-South geographic groups.

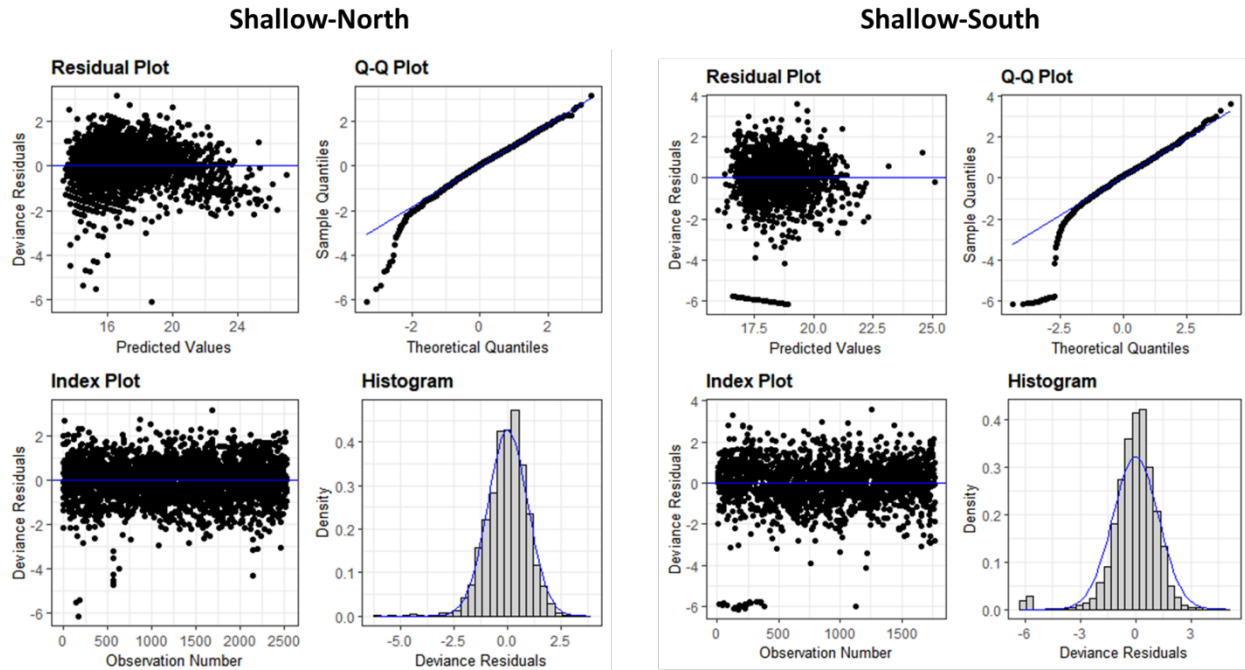


Figure S4. Model diagnostic plots for GLMMs predicting groundfish species density (species tow^{-1}) in the Deep-North and Deep-South geographic groups.

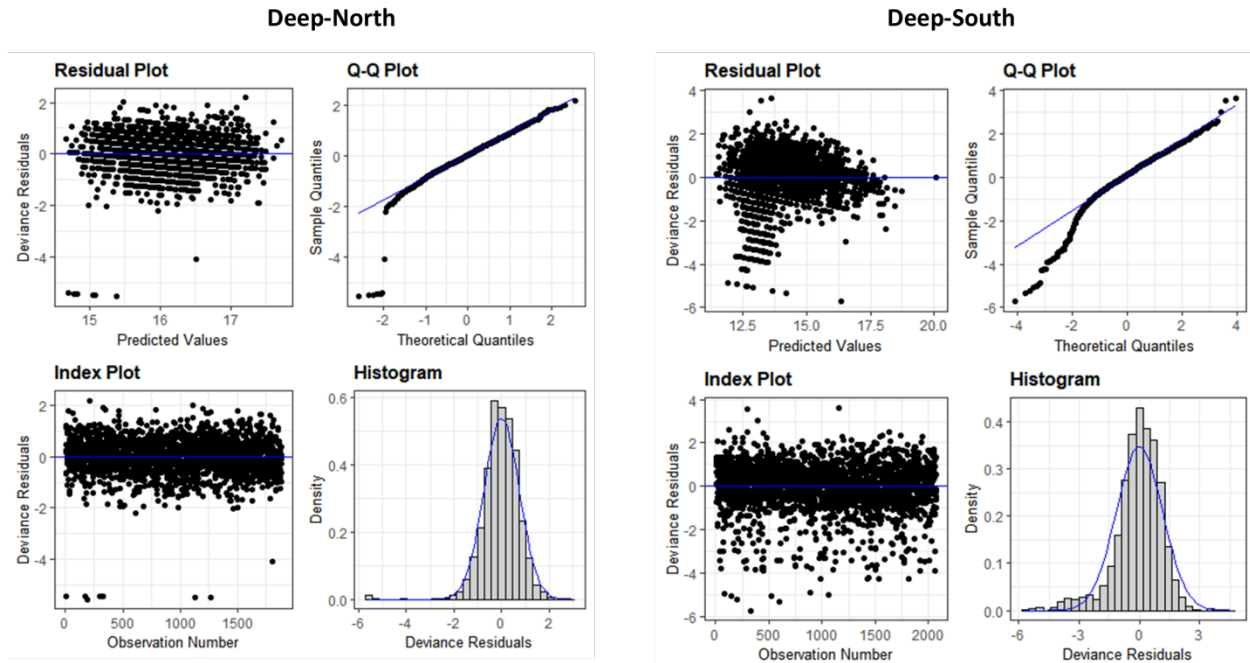


Figure S5. Model diagnostic plots for GLMMs predicting groundfish biomass (CPUE; kg ha^{-1}) in the Shallow-North and Shallow-South geographic groups.

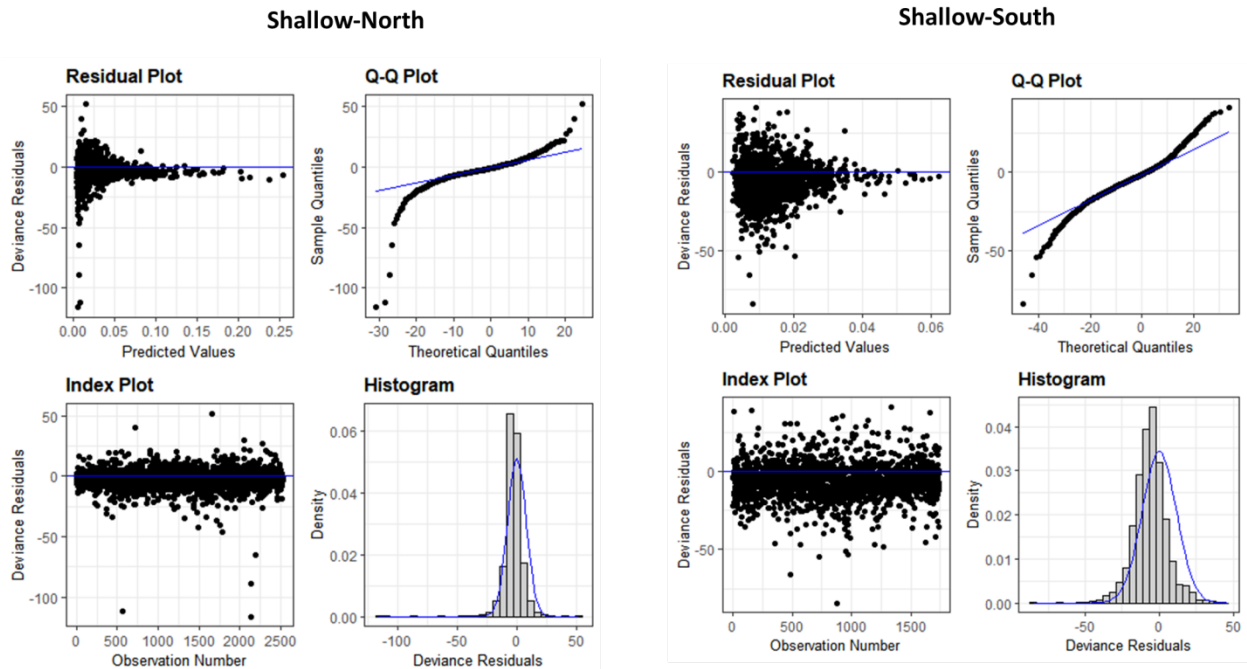


Figure S6. Model diagnostic plots for GLMMs predicting groundfish biomass (CPUE; kg ha⁻¹) in the Deep-North and Deep-South geographic groups.

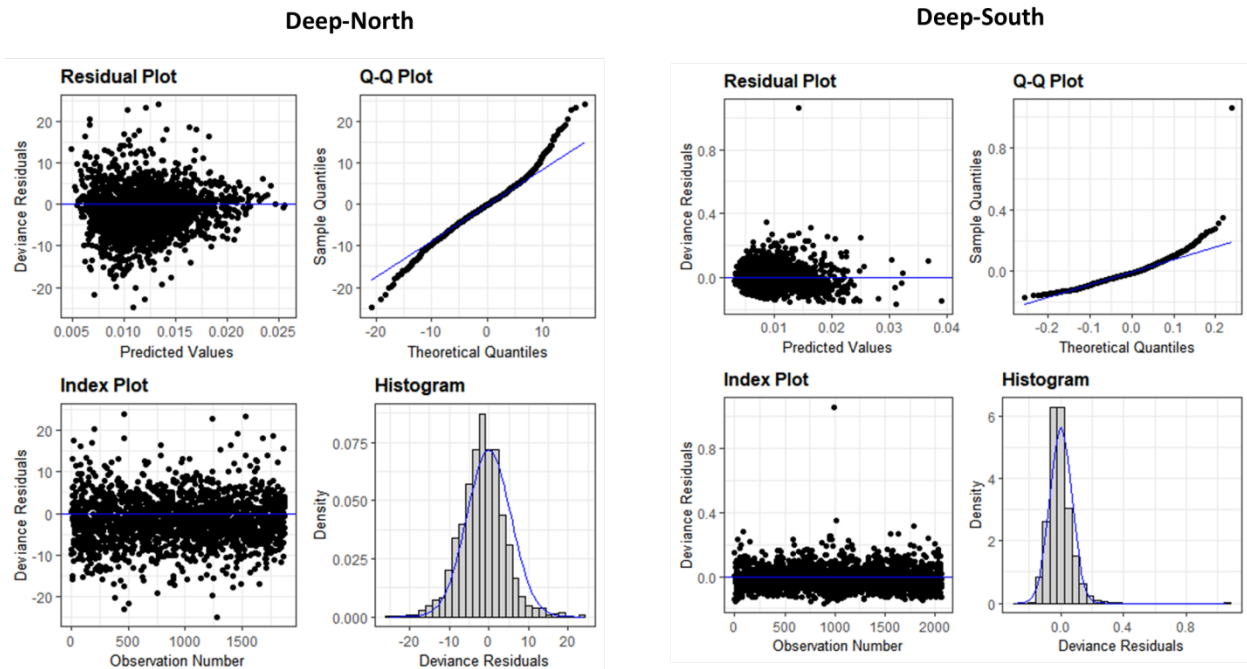


Figure S7. Distribution of groundfish species density (species tow⁻¹) by geographic group. Each box plot is comprised of mean species density across all years.

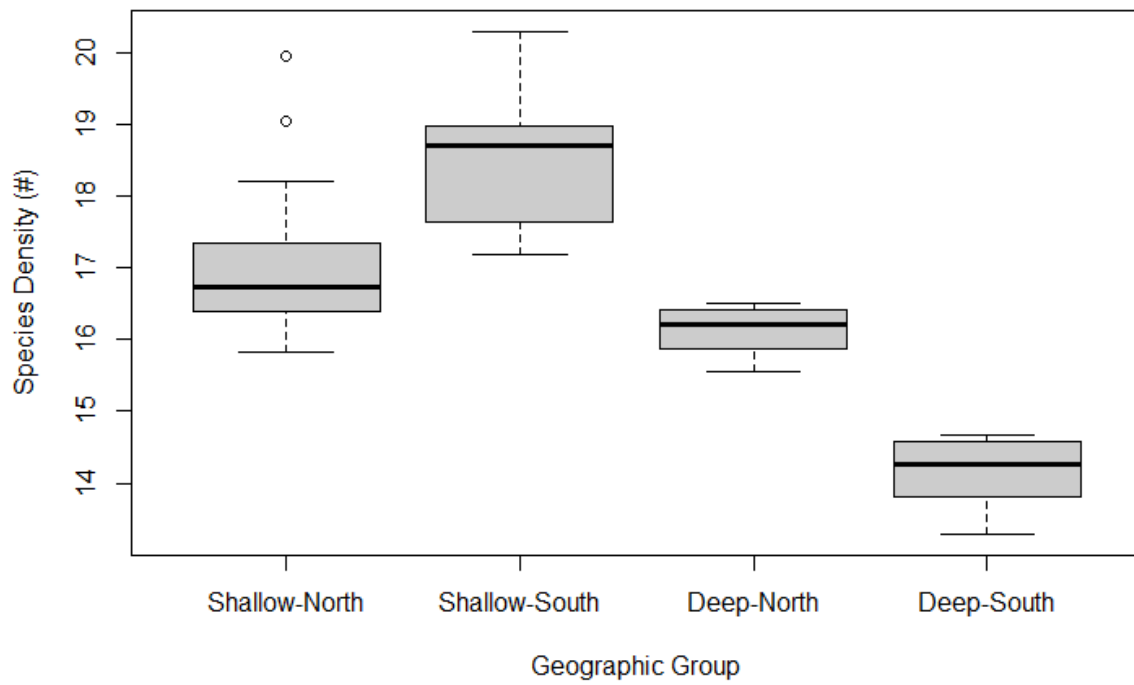


Figure S8. Distribution of groundfish biomass (CPUE; kg ha⁻¹) by geographic group. Each box plot is comprised of mean biomass across all years.

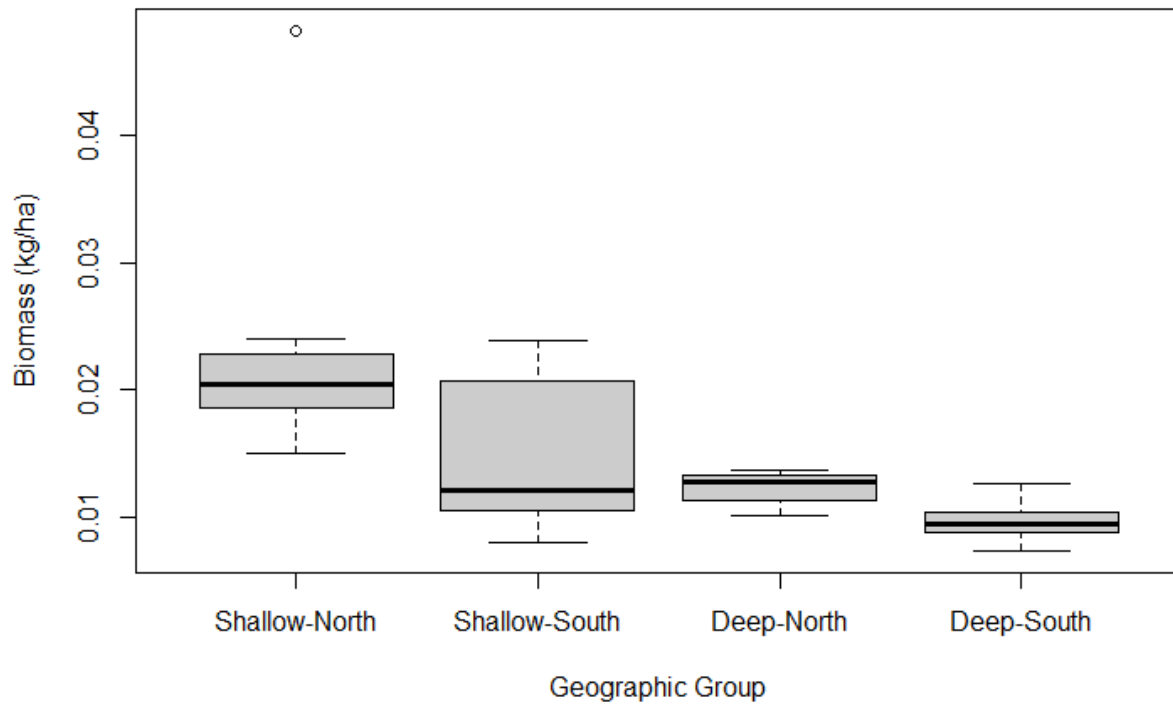


Figure S9. Cluster analysis of MRPP means for species composition across geographic groups.

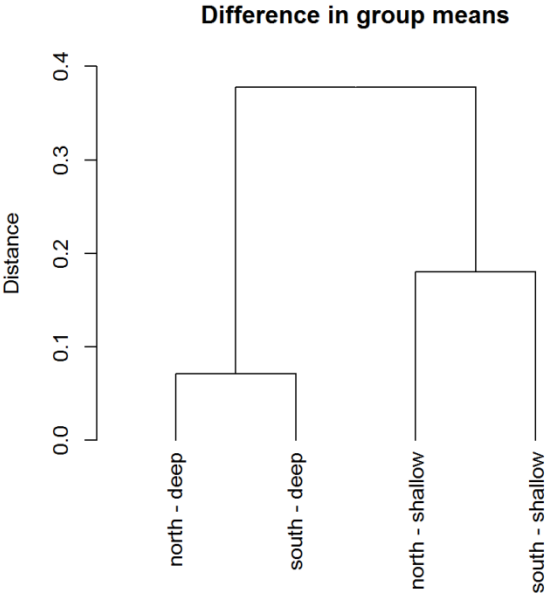


Figure S10. 3-dimensional NMDS plot showing ordination of fish composition data for all tows (Stress = 0.19). Color overlay indicates the geographic group corresponding to each tow.

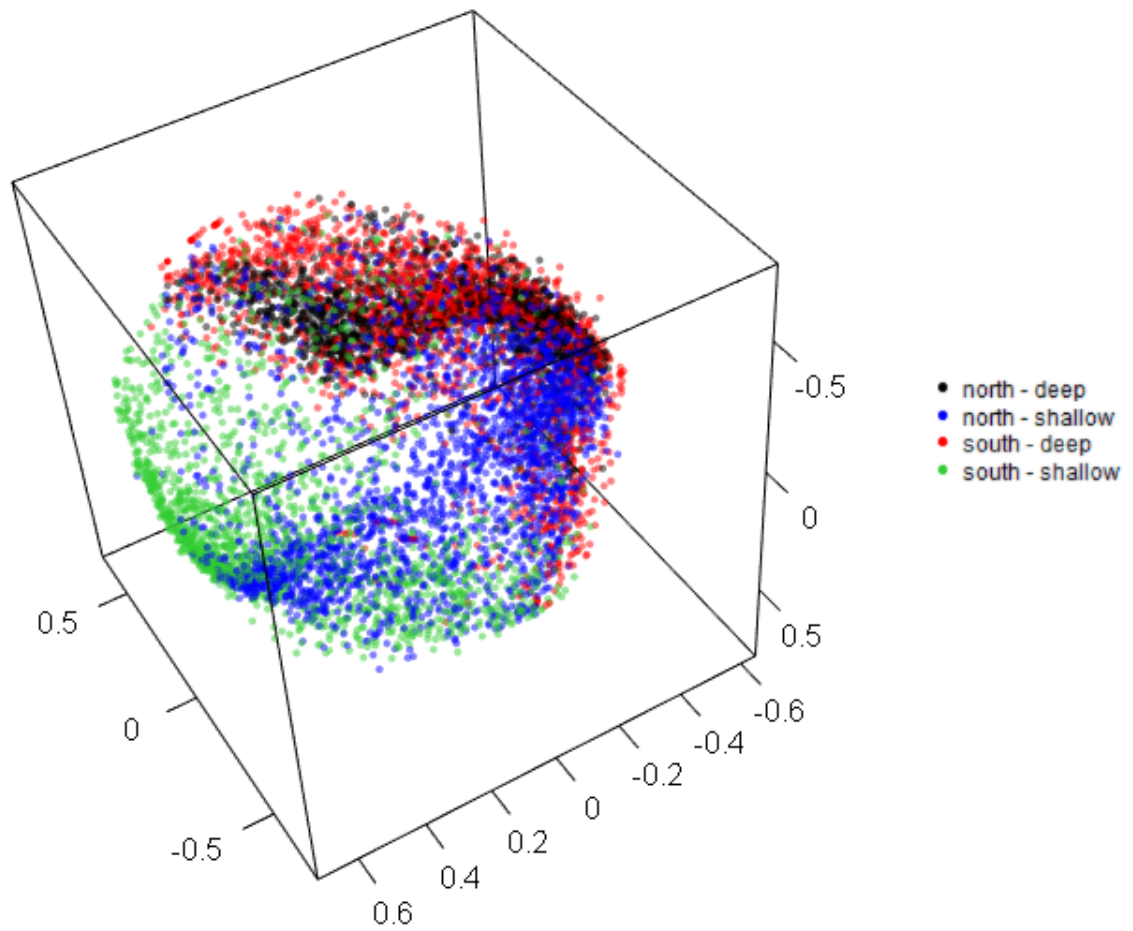


Table S1. Table of species occurrences for each geographic group. Values represent the number of tows from 2003-2015 that contained a record of the species; N = the total number of tows in each geographic group.

Name	Species	Shallow-North	Shallow-South	Deep-North	Deep-South
American shad	<i>Alosa sapidissima</i>	504	191	4	1
Arrowtooth flounder	<i>Atheresthes stomias</i>	2076	225	593	80
Aurora rockfish	<i>Sebastes aurora</i>	10	10	436	660
Big skate	<i>Beringraja binoculata</i>	934	377	8	7
Bigfin eelpout	<i>Lycodes cortezianus</i>	586	242	769	648
Black eelpout	<i>Lycodes diapterus</i>	91	30	840	454
black hagfish	<i>Eptatretus dean</i>	9	1	310	228
blackbelly eelpout	<i>Lycodes pacificus</i>	1034	560	47	57
blackfin poacher	<i>Bathyagonus nigripinnis</i>	22	5	453	22
blackgill rockfish	<i>Sebastes melanostomus</i>	4	51	44	361
blacktail snailfish	<i>Careproctus melanurus</i>	71	57	895	884
Bocaccio	<i>Sebastes paucispinis</i>	57	465	1	12
brown cat shark	<i>Apristurus brunneus</i>	70	57	1420	1348
California grenadier	<i>Nezumia stelgidolepis</i>	0	2	45	438
California skate	<i>Raja inornata</i>	43	830	0	14
California slickhead	<i>Alepocephalus tenebrosus</i>	0	0	790	993
canary rockfish	<i>Sebastes pinniger</i>	508	121	0	1
Chilipepper	<i>Sebastes goodei</i>	210	890	0	69
curlfin sole	<i>Pleuronichthys decurrens</i>	236	693	0	3
darkblotched rockfish	<i>Sebastes crameri</i>	973	177	254	63
deepsea smelt	Bathylagidae	1	0	616	530
deepsea sole	<i>Embassichthys bathybius</i>	1	0	1084	729
Dover sole	<i>Microstomus pacificus</i>	2384	1156	1606	1750
English sole	<i>Parophrys vetulus</i>	1819	1447	50	65
Eulachon	<i>Thaleichthys pacificus</i>	570	19	4	0
filetail cat shark	<i>Parmaturus xaniurus</i>	0	48	2	757
flathead sole	<i>Hippoglossoides elassodon</i>	633	1	11	0
giant grenadier	<i>Albatrossia pectoralis</i>	0	0	859	526
greenspotted rockfish	<i>Sebastes chlorostictus</i>	121	335	0	4
greenstriped rockfish	<i>Sebastes elongatus</i>	1369	764	5	12
hagfish unident	Myxinidae	51	7	435	372
halfbanded rockfish	<i>Sebastes babcocki</i>	9	641	0	3
longspine. thornyhead	<i>Sebastolobus altivelis</i>	12	1	1460	1524
lanternfish unident	<i>Lampanyctus</i> sp.	7	1	643	358
Lingcod	<i>Ophiodon elongatus</i>	1654	1035	31	45
longfin dragonfish	<i>Tactostoma macropus</i>	5	1	387	111
longnose skate	<i>Raja rhina</i>	2026	1122	791	998
longspine combfish	<i>Zaniolepis latipinnis</i>	11	786	0	1
Myctophid unident	Myctophidae	56	41	687	723
Pacific cod	<i>Gadus macrocephalus</i>	456	1	0	0
Pacific electric ray	<i>Tetronarce californica</i>	31	388	2	40
Pacific flatnose	<i>Antimora microlepis</i>	1	1	616	557

Pacific grenadier	<i>Coryphaenoides acrolepis</i>	0	0	996	613
Pacific hake	<i>Merluccius productus</i>	1492	967	834	1045
Pacific halibut	<i>Hippoglossus stenolepis</i>	623	19	43	1
Pacific herring	<i>Clupea pallasii</i>	308	335	0	2
Pacific ocean perch	<i>Sebastes alutus</i>	384	5	222	4
Pacific sanddab	<i>Citharichthys sordidus</i>	1300	1380	0	7
Pacific spiny dogfish	<i>Squalus suckleyi</i>	1326	863	167	145
Pacific viperfish	<i>Chauliodus macouni</i>	7	2	695	191
petrale sole	<i>Eopsetta jordani</i>	2131	1266	35	102
pink sea perch	<i>Zalemnius rosaceus</i>	0	943	0	0
plainfin midshipman	<i>Porichthys notatus</i>	95	1023	0	4
redbanded rockfish	<i>Sebastes babcocki</i>	364	48	192	71
Rex sole	<i>Glyptocephalus zachirus</i>	2421	1188	879	684
rosethorn rockfish	<i>Sebastes helvomaculatus</i>	408	123	98	31
rougthead skate	<i>Bathyraja trachura</i>	5	1	567	482
shortspine thornyhead	<i>Sebastolobus alascanus</i>	531	85	1778	1829
Sablefish	<i>Anoplopoma fimbria</i>	1414	600	1809	1577
sandpaper skate	<i>Bathyraja interrupta</i>	1291	250	617	508
sharpchin rockfish	<i>Sebastes zacentrus</i>	417	82	39	5
shortbelly rockfish	<i>Sebastes jordani</i>	91	638	5	43
skate unident	Rajidae	247	204	110	81
slender sole	<i>Lyopsetta exilis</i>	2150	1045	544	430
snakehead eelpout	<i>Lycenchelys crotalinus</i>	3	2	874	374
southern rock sole	<i>Lepidopsetta bilineata</i>	215	205	0	0
splitnose rockfish	<i>Sebastes diploproa</i>	591	351	297	512
spotted ratfish	<i>Hydrolagus colliei</i>	2112	1324	237	427
stripetail rockfish	<i>Sebastes saxicola</i>	586	1089	6	109
threadfin sculpin	<i>Icelinus filamentosus</i>	622	155	18	18
threadfin slickhead	<i>Talismania bifurcata</i>	0	0	194	269
twoline eelpout	<i>Bothrocara brunneum</i>	1	0	862	625
white croaker	<i>Genyonemus lineatus</i>	3	474	0	0
yellowtail rockfish	<i>Sebastes flavidus</i>	491	59	1	0
Sponges		371(14.6%)	310 (17.3%)	824 (43.5%)	696 (33.3%)
Corals		88(3.5%)	69 (3.9%)	308 (16.3%)	212 (10.1%)
Seapens		528 (20.8%)	386 (21.6%)	636 (33.6%)	493 (23.6%)
N		2533	1788	1893	2093

Table S2. Summary table of species density (species tow⁻¹) and groundfish biomass (CPUE; kg ha⁻¹) by year across the NWFSC bottom trawl survey time series.

	Species Density					Groundfish Biomass				
	year	mean	SD	min	max	mean	SD	min	max	
Coast-wide	2003	17.14	4.51	0	33	0.025	0.074	0.000	1.380	
	2004	16.86	5.16	0	36	0.018	0.033	0.000	0.530	
	2005	16.34	4.82	0	29	0.015	0.029	0.000	0.473	
	2006	16.12	4.40	0	30	0.014	0.025	0.000	0.421	
	2007	15.89	3.62	0	30	0.013	0.015	0.000	0.135	
	2008	15.80	4.04	0	29	0.012	0.011	0.000	0.084	
	2009	15.81	4.15	0	31	0.012	0.017	0.000	0.276	
	2010	16.46	4.26	0	32	0.012	0.013	0.000	0.160	
	2011	16.39	4.45	0	31	0.014	0.032	0.000	0.621	
	2012	16.25	4.52	1	37	0.015	0.026	0.000	0.314	
	2013	16.78	4.23	4	33	0.016	0.019	0.000	0.159	
	2014	17.02	4.60	1	31	0.017	0.042	0.000	0.950	
	2015	17.42	4.61	2	31	0.015	0.029	0.000	0.530	
		Mean	16.48	4.44	0	37	0.015	0.031	<0.001	1.380
	Sh-N	2003	19.04	4.17	0	33	0.048	0.121	0.004	1.380
2004		17.34	4.45	0	29	0.023	0.027	0.001	0.308	
2005		17.01	3.72	6	27	0.020	0.027	0.001	0.261	
2006		15.94	4.64	1	26	0.020	0.038	0.000	0.421	
2007		16.39	3.64	6	30	0.019	0.019	0.002	0.135	
2008		15.82	3.83	5	26	0.015	0.013	0.002	0.084	
2009		16.37	3.95	7	26	0.015	0.017	0.001	0.166	
2010		17.24	4.01	6	30	0.016	0.016	0.000	0.114	
2011		16.74	4.79	6	31	0.022	0.053	0.001	0.621	
2012		16.52	4.37	7	27	0.023	0.042	0.000	0.314	
2013		16.41	4.12	8	26	0.019	0.026	0.002	0.159	
2014		18.21	4.76	2	29	0.022	0.031	0.000	0.246	
2015		19.95	4.26	7	31	0.024	0.047	0.002	0.530	
		Mean	17.15	4.38	0	33	0.022	0.045	<0.001	1.38
D-N		2003	16.46	2.79	0	25	0.010	0.009	0.002	0.061
	2004	16.32	3.56	0	27	0.011	0.008	0.003	0.047	
	2005	16.42	3.26	0	25	0.010	0.007	0.002	0.037	
	2006	16.50	2.78	9	25	0.013	0.016	0.001	0.126	
	2007	15.71	2.57	8	23	0.012	0.007	0.002	0.040	
	2008	16.30	2.32	10	24	0.013	0.008	0.002	0.053	
	2009	15.55	2.75	8	23	0.011	0.007	0.002	0.050	
	2010	15.88	3.09	0	24	0.012	0.010	0.002	0.079	
	2011	16.44	3.06	0	24	0.013	0.009	0.001	0.074	
	2012	15.99	2.70	8	22	0.014	0.013	0.002	0.122	
	2013	16.22	3.00	9	23	0.013	0.011	0.002	0.102	
	2014	16.09	2.49	10	24	0.013	0.012	0.002	0.090	
	2015	15.75	2.78	3	23	0.014	0.013	0.003	0.122	
		Mean	16.13	2.85	0	27	0.012	0.010	0.001	0.126
	Sh-S	2003	17.64	5.70	0	31	0.024	0.058	0.001	0.385

	2004	18.71	6.81	0	36	0.023	0.056	0.001	0.530
	2005	17.18	7.13	0	29	0.023	0.051	0.001	0.473
	2006	18.32	4.41	0	30	0.013	0.021	0.000	0.171
	2007	17.37	3.93	6	27	0.012	0.019	0.000	0.131
	2008	17.95	4.52	4	29	0.010	0.014	0.000	0.079
	2009	17.61	4.23	8	31	0.008	0.016	0.000	0.149
	2010	18.71	4.63	6	32	0.008	0.016	0.000	0.160
	2011	18.97	3.93	0	30	0.011	0.020	0.000	0.195
	2012	19.51	4.09	11	37	0.012	0.020	0.000	0.148
	2013	20.30	3.81	11	33	0.018	0.020	0.001	0.141
	2014	19.91	4.03	9	31	0.021	0.079	0.001	0.950
	2015	18.98	4.64	7	30	0.011	0.020	0.000	0.179
	Mean	18.55	4.91	0	37	0.015	0.037	<0.001	0.950
D-S	2003	14.67	4.45	0	22	0.012	0.012	0.000	0.059
	2004	14.58	4.27	0	25	0.009	0.008	0.000	0.044
	2005	14.58	4.27	0	28	0.007	0.005	0.000	0.030
	2006	14.43	4.45	0	25	0.009	0.007	0.000	0.050
	2007	14.33	3.62	0	21	0.009	0.007	0.000	0.043
	2008	13.70	4.03	0	23	0.009	0.008	0.000	0.038
	2009	13.75	4.42	0	23	0.013	0.023	0.000	0.276
	2010	14.10	3.78	2	29	0.009	0.008	0.000	0.043
	2011	13.81	4.05	1	22	0.009	0.007	0.000	0.038
	2012	13.28	4.49	1	24	0.010	0.009	0.000	0.054
	2013	14.27	3.82	4	24	0.011	0.009	0.000	0.053
	2014	13.97	4.14	1	23	0.010	0.010	0.000	0.071
	2015	14.65	3.91	2	25	0.010	0.009	0.000	0.064
	Mean	14.16	4.14	0	29	0.010	0.010	<0.001	0.276

Table S3. Vector correlations to NMDS ordination axes

Shallow - North				
	Axis 1	Axis 2	r2	p-val
Depth	-0.055	-0.998	0.551	0.001
Temp	-0.009	1.000	0.207	0.001
Sponges	0.794	-0.609	0.011	0.001
Seapens	-0.246	0.969	0.003	0.009
Corals	-0.202	0.979	0.002	0.127
Shallow - South				
	Axis 1	Axis 4	r2	p-val
Depth	-0.605	-0.796	0.318	0.001
Temp	0.806	0.591	0.114	0.001
Sponges	0.479	-0.878	0.049	0.001
Seapens	-0.650	0.760	0.003	0.082
Corals	0.791	-0.611	0.001	0.541
Deep - North				
	Axis 1	Axis 3	r2	p-val
Depth	-1.00	0.04	0.87	0.001
Temp	1.00	-0.03	0.86	0.001
Sponges	0.54	0.84	0.03	0.001
Seapens	0.03	0.99	0.00	0.05
Corals	-0.45	-0.89	0.00	0.500
Deep - South				
	Axis 1	Axis 2	r2	p-val
Depth	-0.981	0.196	0.736	0.001
Temp	0.991	-0.133	0.625	0.001
Sponges	0.741	0.672	0.012	0.001
Seapens	0.946	-0.323	0.001	0.354
Corals	-0.784	-0.621	0.003	0.029