

# **Analysis of SEAMAP data for the western GoM for all years (1983 - 2022) and summer sampling months of June, July, and August**

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## **Tropicalization of Gulf of Mexico Fish Communities**

### **Analysis of SEAMAP Trawl Data**

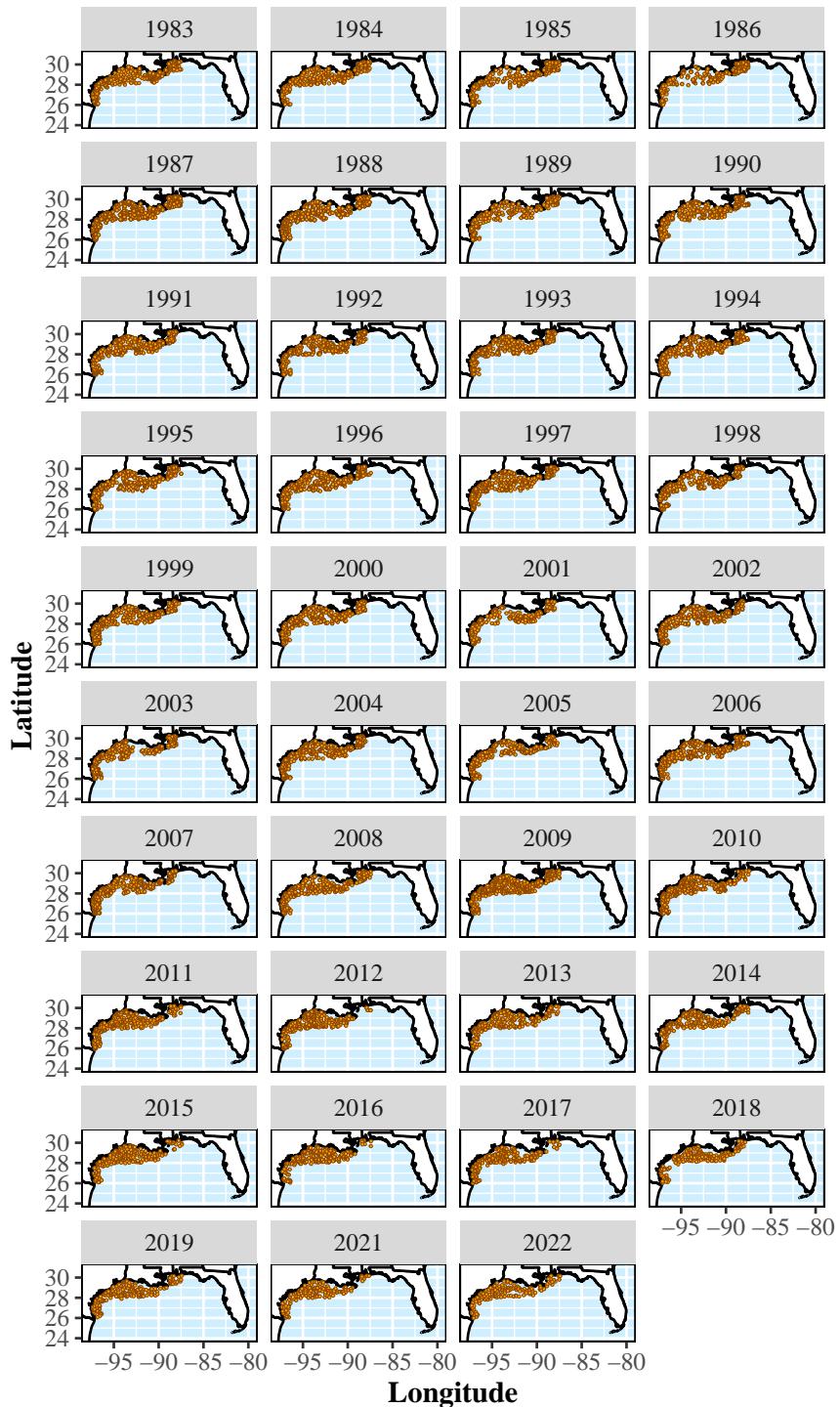
**Data Subset: western GoM stations for summer trawls (June, July, August) in years  
1983 - 2022**

**Table 1.** Number of trawl stations for each year of data and the fall months during which sampling took place (6 = June, 7 = July, 8 = August).

year	# of trawls	months
1983	381	8; 6; 7
1984	291	6; 7; 8
1985	404	6; 7; 8
1986	270	6; 7
1987	652	6; 7
1988	542	6; 7
1989	389	6; 7
1990	435	6; 7; 8
1991	418	6; 7
1992	407	7; 6
1993	444	8; 6; 7
1994	394	6; 7; 8
1995	370	6; 8; 7
1996	374	7; 6; 8
1997	371	6; 7; 8
1998	335	6; 7
1999	377	6; 7; 8
2000	377	6; 7
2001	269	7; 6
2002	372	6; 7
2003	303	6; 7
2004	363	6; 7
2005	300	6; 7; 8
2006	375	6; 7; 8
2007	353	6; 7; 8
2008	377	6; 8; 7
2009	476	6; 8; 7
2010	319	6; 8; 7
2011	265	6; 7
2012	293	6; 7
2013	250	7; 6
2014	259	6; 7
2015	188	6; 7
2016	179	6; 7
2017	178	6; 7
2018	149	6; 7
2019	166	6; 7
2021	127	6; 7
2022	133	6; 8

**Map of trawl stations**

**1983 – 2022 June, July, August Data  
for western GoM**



**Figure 1.** Trawl sampling locations for the western GoM for each year of data collection for this subset of data (1983-2022 summer sampling in months of June, July, and August).

There are 513 fish species that were caught in trawls in this subset of data.

Of those 513 fish species, only 294 of them had gCOB values for at least 5 years. For these fish species, linear models were constructed to test if their latitude and longitude gCOBs had shifted over time.

index	north	south	west	east
1	<i>Pareques acuminatus</i>	<i>Bellator brachypterus</i>	<i>Bellator brachypterus</i>	<i>Pareques acuminatus</i>
2	<i>Prionotus roseus</i>	<i>Citharichthys spilopterus</i>	<i>Citharichthys spilopterus</i>	<i>Prionotus roseus</i>
3	<i>Rypticus saponaceus</i>	<i>Diplectrum bivittatum</i>	<i>Diplectrum bivittatum</i>	<i>Rypticus saponaceus</i>
4		<i>Engyophrys senta</i>	<i>Echiophis punctifer</i>	
5		<i>Gobionellus hastatus</i>	<i>Engyophrys senta</i>	
6		<i>Gymnothorax kolpos</i>	<i>Gobioides broussonnetii</i>	
7		<i>Lepophidium brevibarbe</i>	<i>Gymnothorax kolpos</i>	
8		<i>Lepophidium jeannae</i>	<i>Lepophidium brevibarbe</i>	
9		<i>Neobythites gilli</i>	<i>Lepophidium jeannae</i>	
10		<i>Ogcocephalus declivirostris</i>	<i>Ogcocephalus declivirostris</i>	
11		<i>Ogcocephalus nasutus</i>	<i>Ogcocephalus nasutus</i>	
12		<i>Ophidion holbrookii</i>	<i>Ophidion holbrookii</i>	
13		<i>Ophidion welshi</i>	<i>Ophidion welshi</i>	
14		<i>Pontinus longispinis</i>	<i>Pontinus longispinis</i>	
15		<i>Porichthys pectorodon</i>	<i>Prionotus longispinosus</i>	
16		<i>Prionotus longispinosus</i>	<i>Rhynchoconger flavus</i>	
17		<i>Rhynchoconger flavus</i>	<i>Saurida normani</i>	
18		<i>Saurida normani</i>	<i>Scorpaena calcarata</i>	
19		<i>Serranus atrobranchus</i>	<i>Serranus atrobranchus</i>	
20		<i>Syacium gunteri</i>	<i>Syacium gunteri</i>	
21		<i>Trichopsetta ventralis</i>	<i>Synodus foetens</i>	
22			<i>Trichopsetta ventralis</i>	

**Table 2.** The number of fish species that have significantly shifted latitudinally or longitudinally based upon their gCOBs.

climate zone	n	significant latitude shift	North shifted	South shifted	significant longitude shift	W
deep-water	12	5	1	4	3	
subtropical	203	47	10	37	53	
temperate	5	0	0	0	1	
tropical	74	24	3	21	25	

**Table 3.** The tropical fish species that have significantly shifted their geographical center of biomass (gCOB) over time.

**Table 4.** The subtropical fish species that have significantly shifted their geographical center of biomass (gCOB) over time.

**Table 5.** The temperate fish species that have significantly shifted their geographical center of biomass (gCOB) over time.

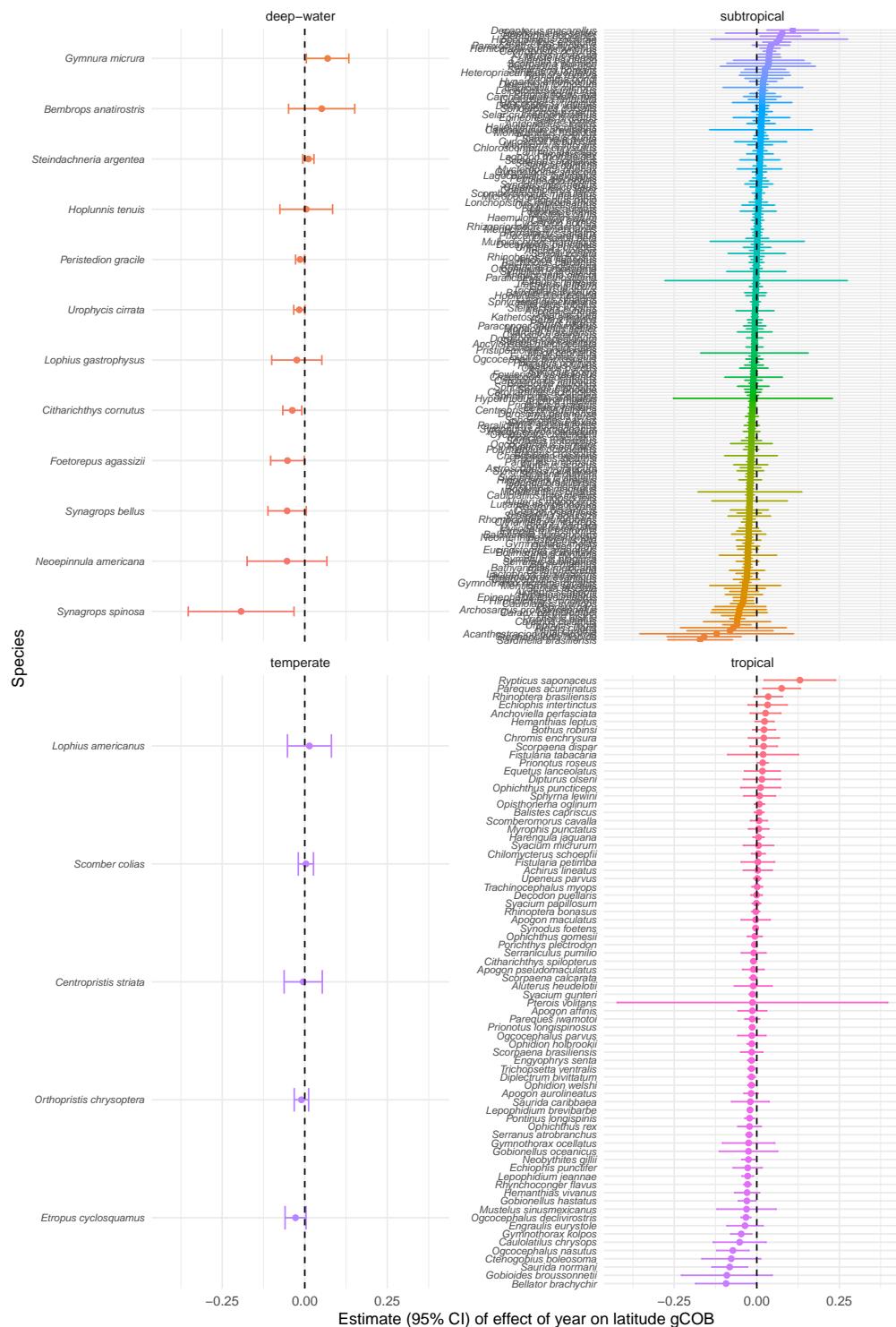
index	north	south	west	east
1			<i>Orthopristis chrysoptera</i>	

**Table 6.** The deep-water fish species that have significantly shifted their geographical center of biomass (gCOB) over time.

index	north	south	west	east
1	<i>Bembrops gobiooides</i>	<i>Ariopsis felis</i>	<i>Ancylopsetta quadrocellata</i>	<i>Centropristes ocyurus</i>
2	<i>Centropristes ocyurus</i>	<i>Bagre marinus</i>	<i>Archosargus probatocephalus</i>	<i>Decapterus macarellus</i>
3	<i>Decapterus macarellus</i>	<i>Bathygymnus mexicana</i>	<i>Ariopsis felis</i>	<i>Halieutichthys aculeatus</i>
4	<i>Diplectrum formosum</i>	<i>Bollmannia communis</i>	<i>Astroskopos y-graecum</i>	<i>Larimus fasciatus</i>
5	<i>Halieutichthys aculeatus</i>	<i>Bregmaceros atlanticus</i>	<i>Bagre marinus</i>	<i>Otophidium omostigma</i>
6	<i>Hemicarana amblyrhynchus</i>	<i>Brotula barbata</i>	<i>Bathygymnus mexicana</i>	<i>Paralichthys albigutta</i>
7	<i>Leiostomus xanthurus</i>	<i>Caulolatilus cyanops</i>	<i>Bollmannia communis</i>	<i>Rostroraja eglanteria</i>
8	<i>Paralichthys albigutta</i>	<i>Caulolatilus intermedius</i>	<i>Bregmaceros atlanticus</i>	<i>Sphoeroides dorsalis</i>
9	<i>Selene setapinnis</i>	<i>Centropristes philadelphica</i>	<i>Brotula barbata</i>	<i>Xyrichtys novacula</i>
10	<i>Xyrichtys novacula</i>	<i>Cyclosetta chittendeni</i>	<i>Caulolatilus intermedius</i>	
11		<i>Dorosoma petenense</i>	<i>Centropristes philadelphica</i>	
12		<i>Epinephelus flavolimbatus</i>	<i>Citharichthys macrops</i>	
13		<i>Etropus crossotus</i>	<i>Cyclosetta chittendeni</i>	
14		<i>Gymnachirus melas</i>	<i>Etropus crossotus</i>	
15		<i>Gymnachirus texae</i>	<i>Gymnachirus texae</i>	
16		<i>Gymnothorax nigromarginatus</i>	<i>Gymnothorax nigromarginatus</i>	
17		<i>Hirundichthys rondeletii</i>	<i>Hirundichthys rondeletii</i>	
18		<i>Histrio histrio</i>	<i>Histrio histrio</i>	
19		<i>Hoplunnis macrurus</i>	<i>Hoplunnis macrurus</i>	
20		<i>Lutjanus campechanus</i>	<i>Kathetostoma albigutta</i>	
21		<i>Neomerinthe hemingwayi</i>	<i>Lutjanus campechanus</i>	
22		<i>Pareques umbrosus</i>	<i>Neomerinthe hemingwayi</i>	
23		<i>Prionotus alatus</i>	<i>Ophidion grayi</i>	
24		<i>Prionotus paralatus</i>	<i>Paralichthys lethostigma</i>	
25		<i>Prionotus stearnsi</i>	<i>Pareques umbrosus</i>	
26		<i>Rhomboptiles aurorubens</i>	<i>Peprilus burti</i>	
27		<i>Rostroraja texana</i>	<i>Polydactylus octonemus</i>	
28		<i>Sardinella brasiliensis</i>	<i>Prionotus alatus</i>	
29		<i>Saurida brasiliensis</i>	<i>Prionotus paralatus</i>	
30		<i>Sphoeroides parvus</i>	<i>Prionotus stearnsi</i>	
31		<i>Squatina dumeril</i>	<i>Prionotus tribulus</i>	
32		<i>Stephanolepis hispida</i>	<i>Rhomboptiles aurorubens</i>	
33		<i>Syphurus civitatum</i>	<i>Rostroraja texana</i>	
34		<i>Syphurus diomedeanus</i>	<i>Sardinella brasiliensis</i>	
35		<i>Syphurus plagiura</i>	<i>Saurida brasiliensis</i>	
36		<i>Urophycis floridana</i>	<i>Sphoeroides parvus</i>	
37		<i>Urophycis regia</i>	<i>Squatina dumeril</i>	
38			<i>Stenotomus caprinus</i>	
39			<i>Stephanolepis hispida</i>	
40			<i>Syphurus civitatum</i>	
41			<i>Syphurus diomedeanus</i>	
42			<i>Syphurus plagiura</i>	
43			<i>Urophycis floridana</i>	
44			<i>Urophycis regia</i>	

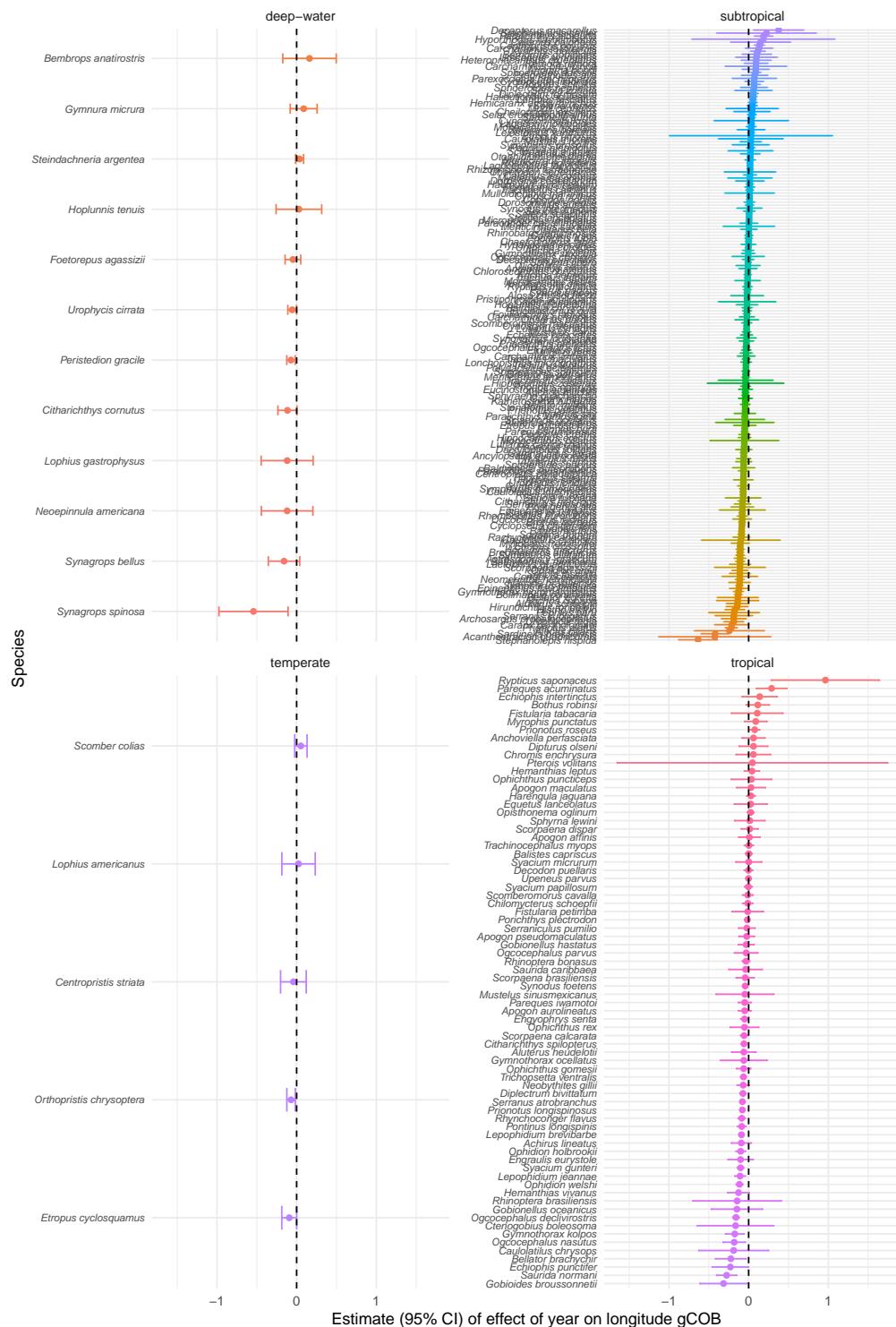
index	north	south	west	east
1	<i>Gymnura</i> <i>micrura</i>	<i>Citharichthys</i> <i>cornutus</i>	<i>Peristedion</i> <i>gracile</i>	
2		<i>Foetorepus</i> <i>agassizii</i>	<i>Synagrops</i> <i>spinosa</i>	
3		<i>Peristedion</i> <i>gracile</i>	<i>Urophycis</i> <i>cirrata</i>	
4		<i>Synagrops</i> <i>spinosa</i>		

**1983–2022 June, July, & August  
all latitudinal trends in gCOBs**



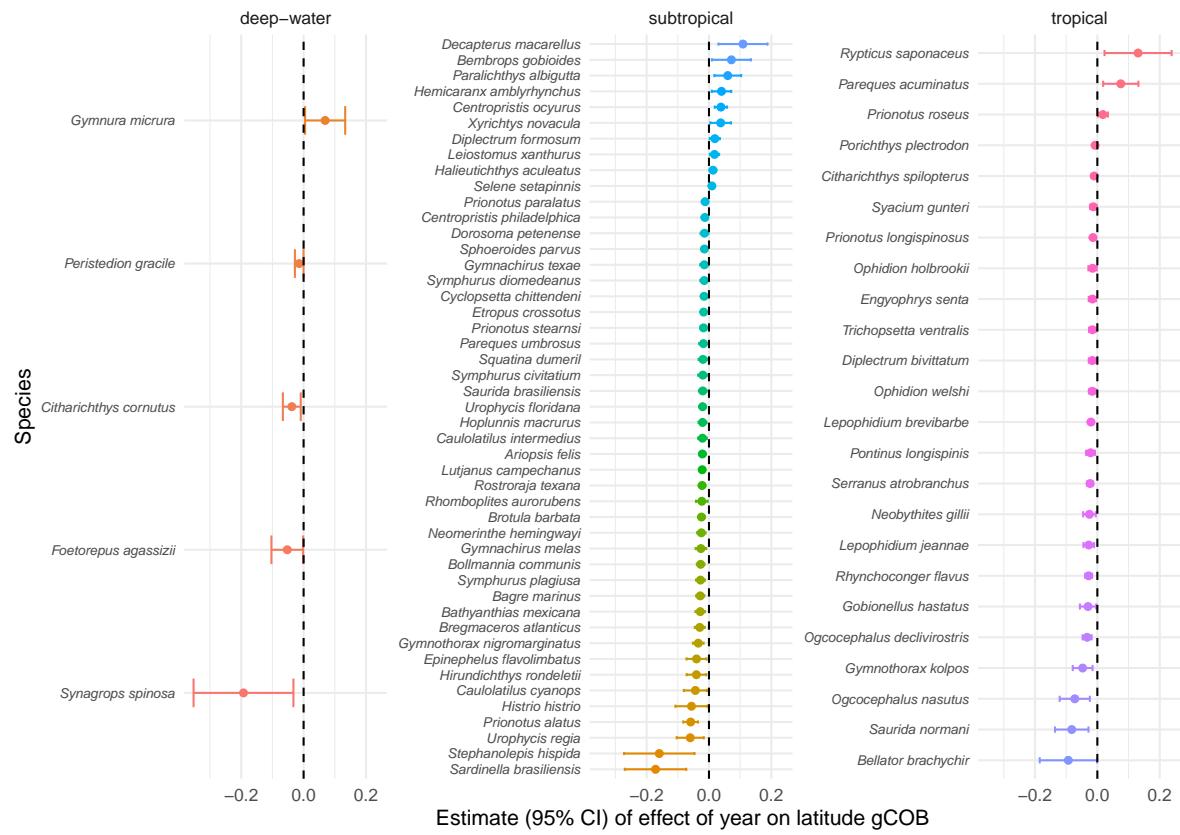
**Figure 2.** Latitudinal trends in gCOBs for fish species (deep-water, subtropical, temperate, tropical).

**1983–2022 June, July, & August  
all longitudinal trends in gCOBs**



**Figure 3.** Longitudinal trends in gCOBs for fish species (deep-water, subtropical, temperate, tropical).

**1983–2022 June, July, & August  
significant latitudinal shifts in gCOBs**



**Figure 4.** Latitudinal trends in gCOBs for fish species (deep-water, subtropical, tropical) with a significant shift over time. No temperate fish species exhibited a significant shift in latitude gCOB.

**1983–2022 June, July, & August  
significant longitudinal shifts in gCOBs**



**Figure 5.** Longitudinal trends in gCOBs for fish species (deep-water, subtropical, temperate, tropical) with a significant shift over time.