

# **Analysis of SEAMAP data for the entire GoM for years 2010 - 2022 and summer sampling months of June, July, and August**

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

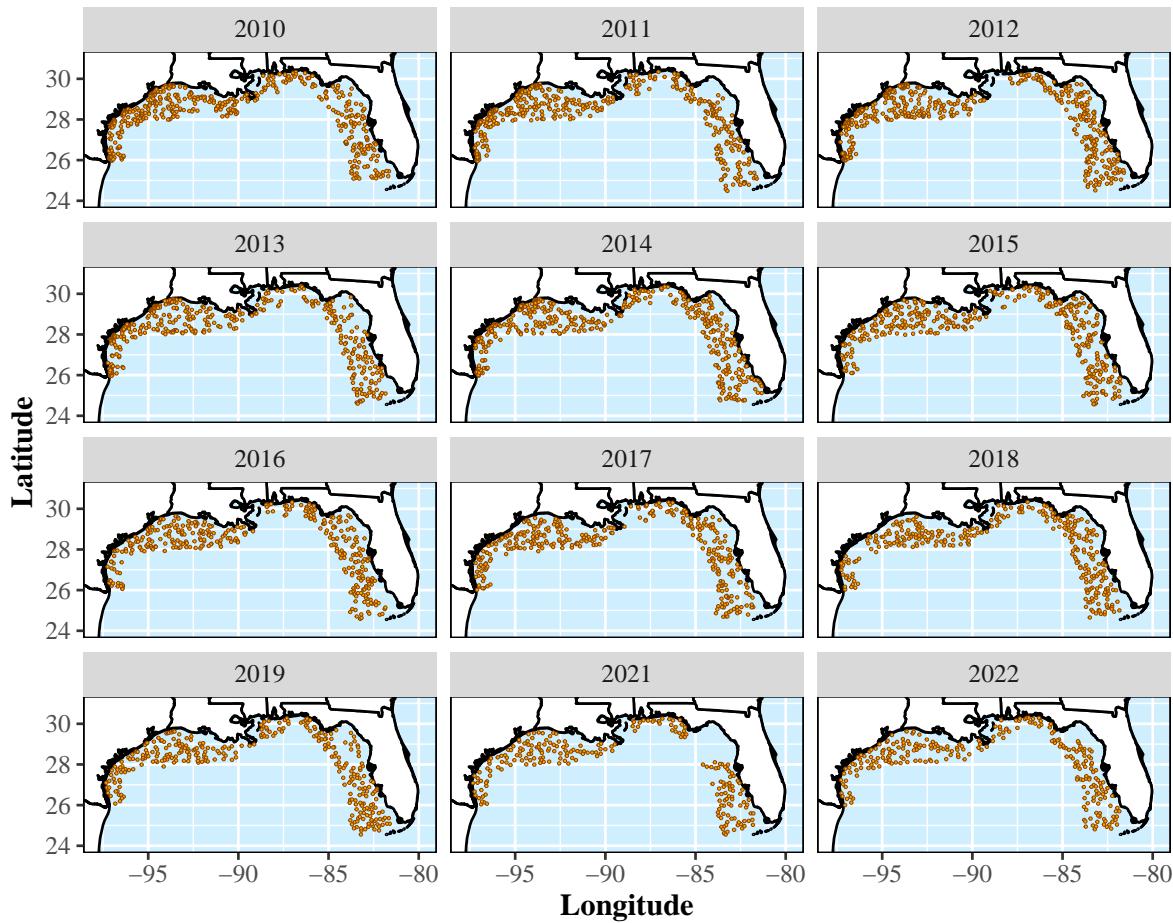
### **Analysis of SEAMAP Trawl Data**

**Data Subset: all GoM stations for summer trawls (June, July, August) in years 2010 - 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
2010	483	6; 8; 7
2011	405	6; 7
2012	494	6; 7
2013	389	7; 6
2014	437	6; 7
2015	367	6; 7
2016	338	6; 7
2017	330	6; 7
2018	305	6; 7
2019	312	6; 7
2021	224	6; 7
2022	253	6; 7; 8

**Trawl Stations for entire GoM  
2010 – 2022 June, July, August**



**Figure 1.** Trawl sampling locations for the entire GoM for each year of data collection for this subset of data (2010-2022 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 310 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.

**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	West shifted	East shifted
deep-water	7	0	0	0	0	0	0
subtropical	211	33	19	14	32	17	15
temperate	4	0	0	0	2	2	0
tropical	88	8	4	4	8	5	3

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

index	north	south	west	east
1	<i>Eucinostomus harengulus</i>	<i>Citharichthys spilopterus</i>	<i>Citharichthys spilopterus</i>	<i>Ophidion beani</i>
2	<i>Pomacanthus arcuatus</i>	<i>Echiophis intertinctus</i>	<i>Pomacanthus arcuatus</i>	<i>Porichthys plectrodon</i>
3	<i>Pronotogrammus martinicensis</i>	<i>Ophidion beani</i>	<i>Prionotus longispinosus</i>	<i>Prionotus roseus</i>
4	<i>Pterois volitans</i>	<i>Prionotus roseus</i>	<i>Pterois volitans</i>	
5			<i>Saurida normani</i>	

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

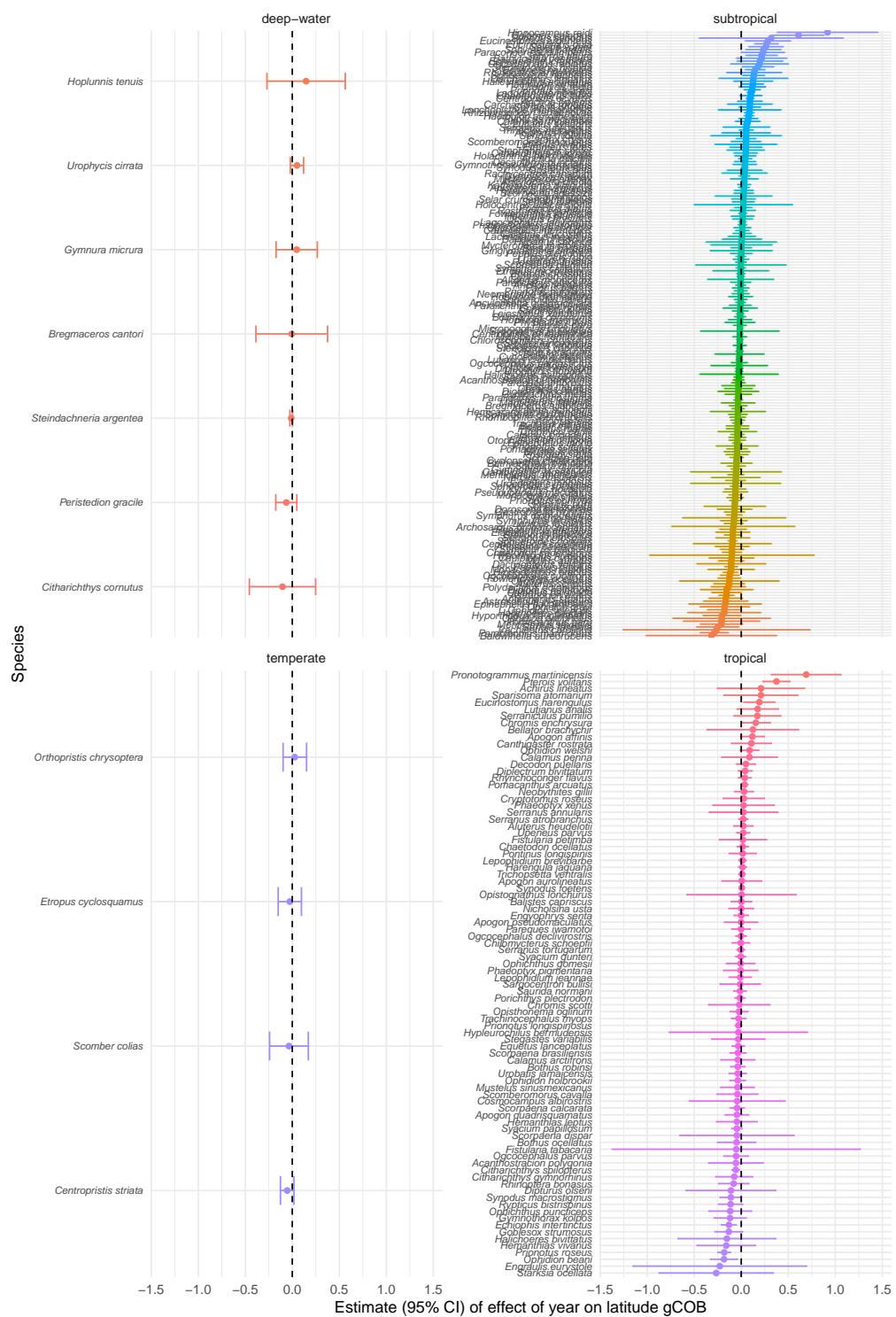
index	north	south	west	east
1	<i>Ancylosetta dilecta</i>	<i>Astrapogon alutus</i>	<i>Centropristes ocyurus</i>	<i>Anchoa lyolepis</i>
2	<i>Calamus calamus</i>	<i>Cyclopsetta chittendeni</i>	<i>Cyclopsetta chittendeni</i>	<i>Anchoa mitchilli</i>
3	<i>Centropristes ocyurus</i>	<i>Cynoscion arenarius</i>	<i>Decapterus punctatus</i>	<i>Astrapogon alutus</i>
4	<i>Echeneis naucrates</i>	<i>Fowlerichthys ocellatus</i>	<i>Echeneis naucrates</i>	<i>Etrumeus teres</i>
5	<i>Eucinostomus argenteus</i>	<i>Hippocampus erectus</i>	<i>Eucinostomus argenteus</i>	<i>Gymnothorax saxicola</i>
6	<i>Eucinostomus gula</i>	<i>Hyporthodus flavolimbatus</i>	<i>Eucinostomus gula</i>	<i>Hippocampus erectus</i>
7	<i>Haemulon aurolineatum</i>	<i>Ogcoccephalus cubifrons</i>	<i>Haemulon aurolineatum</i>	<i>Hyporthodus flavolimbatus</i>
8	<i>Haemulon striatum</i>	<i>Parablennius marmoreus</i>	<i>Lagodon rhomboides</i>	<i>Hyporthodus niveatus</i>
9	<i>Hippocampus reidi</i>	<i>Peprilus burti</i>	<i>Lutjanus synagris</i>	<i>Parablennius marmoreus</i>
10	<i>Lagodon rhombooides</i>	<i>Prionotus ophryas</i>	<i>Lutjanus vivanus</i>	<i>Peprilus alepidotus</i>
11	<i>Lutjanus synagris</i>	<i>Prionotus tribulus</i>	<i>Peprilus burti</i>	<i>Priacanthus arenatus</i>
12	<i>Prionotus stearnsi</i>	<i>Seriola fasciata</i>	<i>Rhizoprionodon terraenovae</i>	<i>Prionotus rubio</i>
13	<i>Rhizoprionodon terraenovae</i>	<i>Sphoeroides dorsalis</i>	<i>Selene vomer</i>	<i>Prionotus tribulus</i>
14	<i>Selene vomer</i>	<i>Sphoeroides spengleri</i>	<i>Seriola rivoliana</i>	<i>Rostroraja texana</i>
15	<i>Sphoeroides nephelus</i>		<i>Seriola zonata</i>	<i>Synodus intermedius</i>
16	<i>Sphyraena borealis</i>		<i>Sphoeroides nephelus</i>	
17	<i>Sphyraena tiburo</i>		<i>Sphyraena tiburo</i>	
18	<i>Stephanolepis hispida</i>			
19	<i>Synodus intermedius</i>			

**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>Etropus cyclosquamus</i>	
2			<i>Orthopristis chrysoptera</i>	

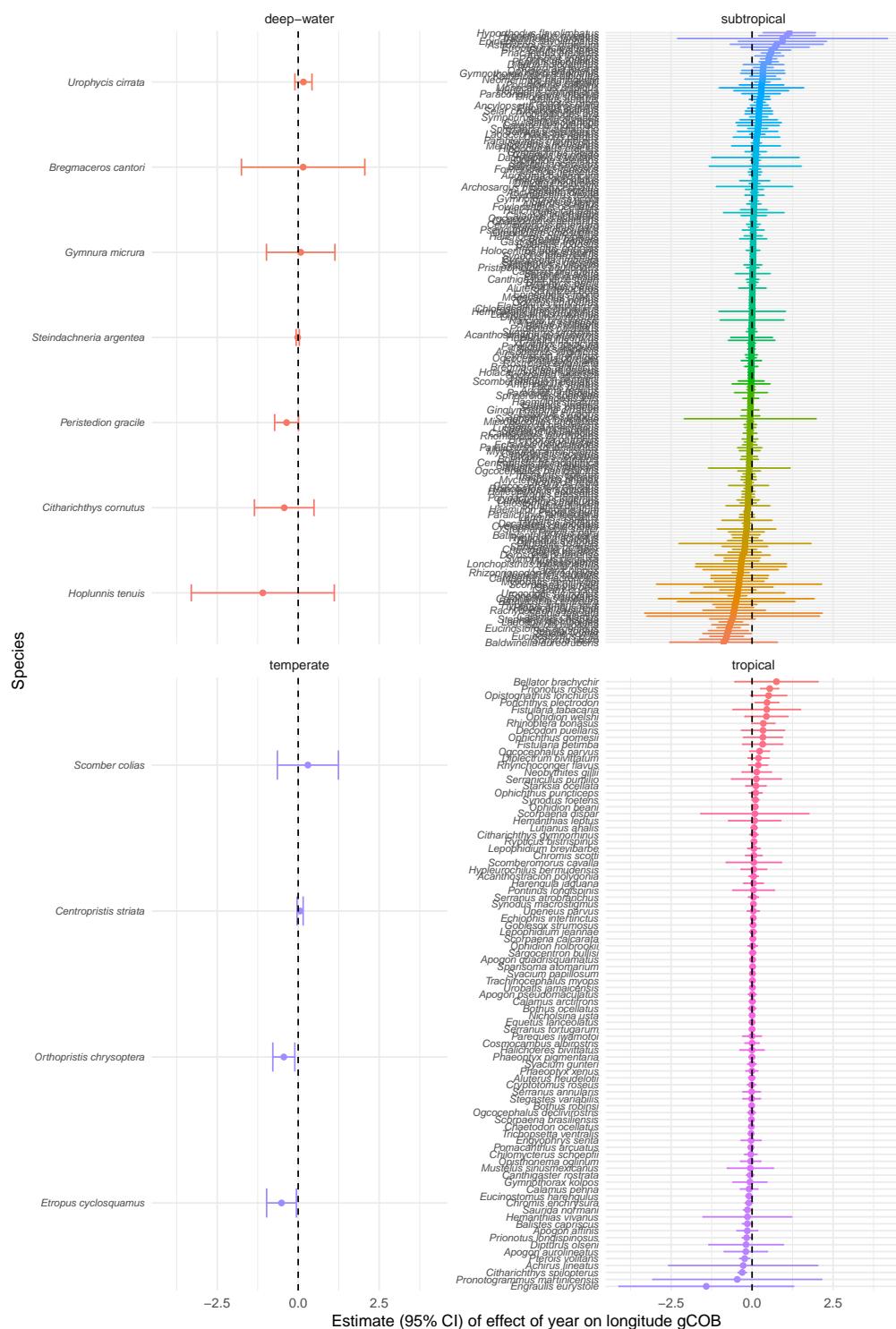
**NOTE:** None of the deepwater fish species in this data subset exhibited significant shifts in their latitude or longitude gCOBs.

2010–2022 June, July, & August  
all latitudinal trends in gCOBs



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

**2010–2022 June, July, & August  
all longitudinal trends in gCOBs**



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

**2010–2022 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.

**2010–2022 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.