

Index of abundance for Gag (*Mycteroperca microlepis*) using combined data from fishery independent video surveys

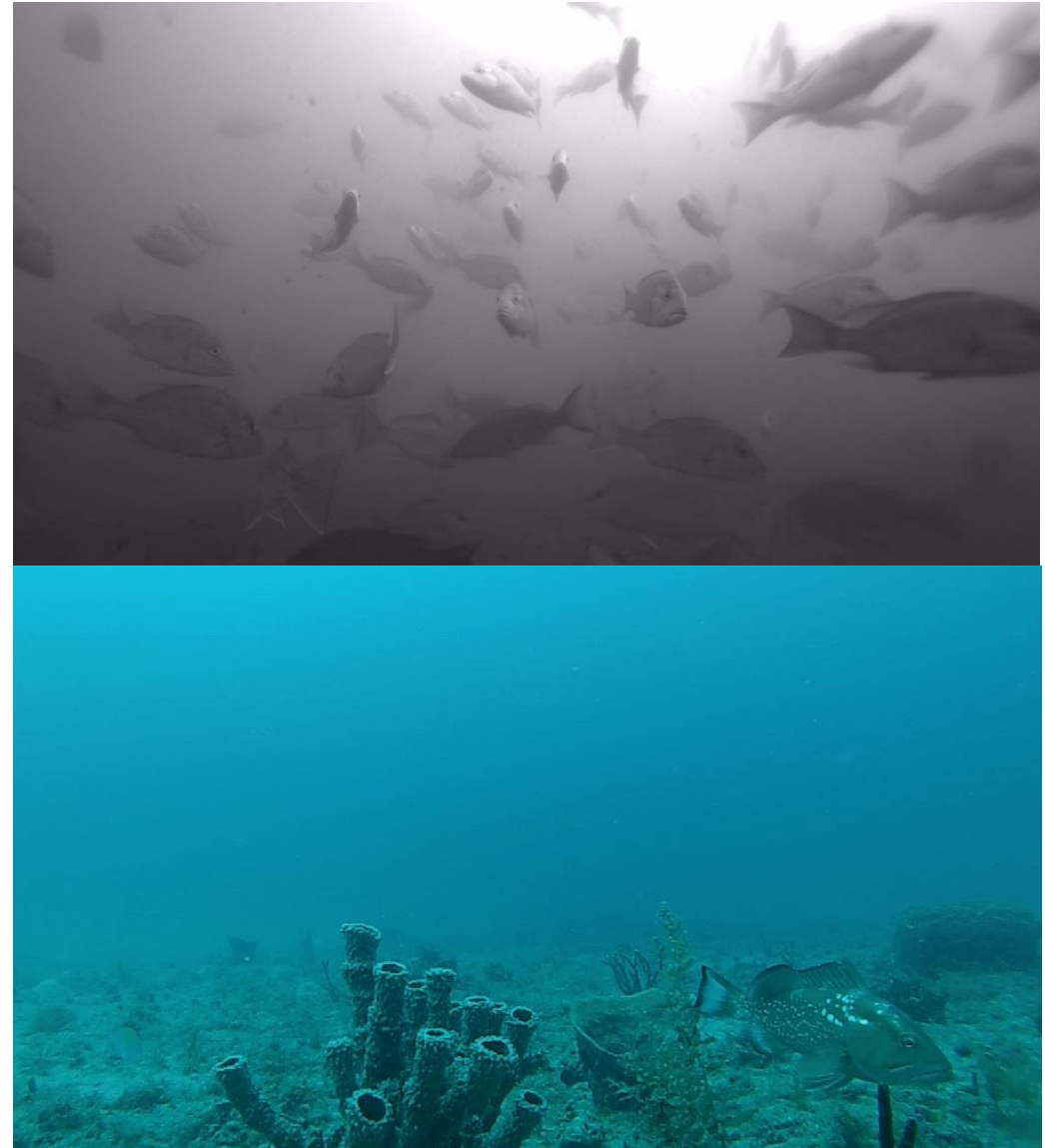
Justin Lewis¹, Heather Christiansen¹, Sean Keenan¹, Kate Overly², Matthew Campbell²,
Ted Switzer¹

¹Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission

²National Marine Fisheries Service, Southeast Fisheries Science Center

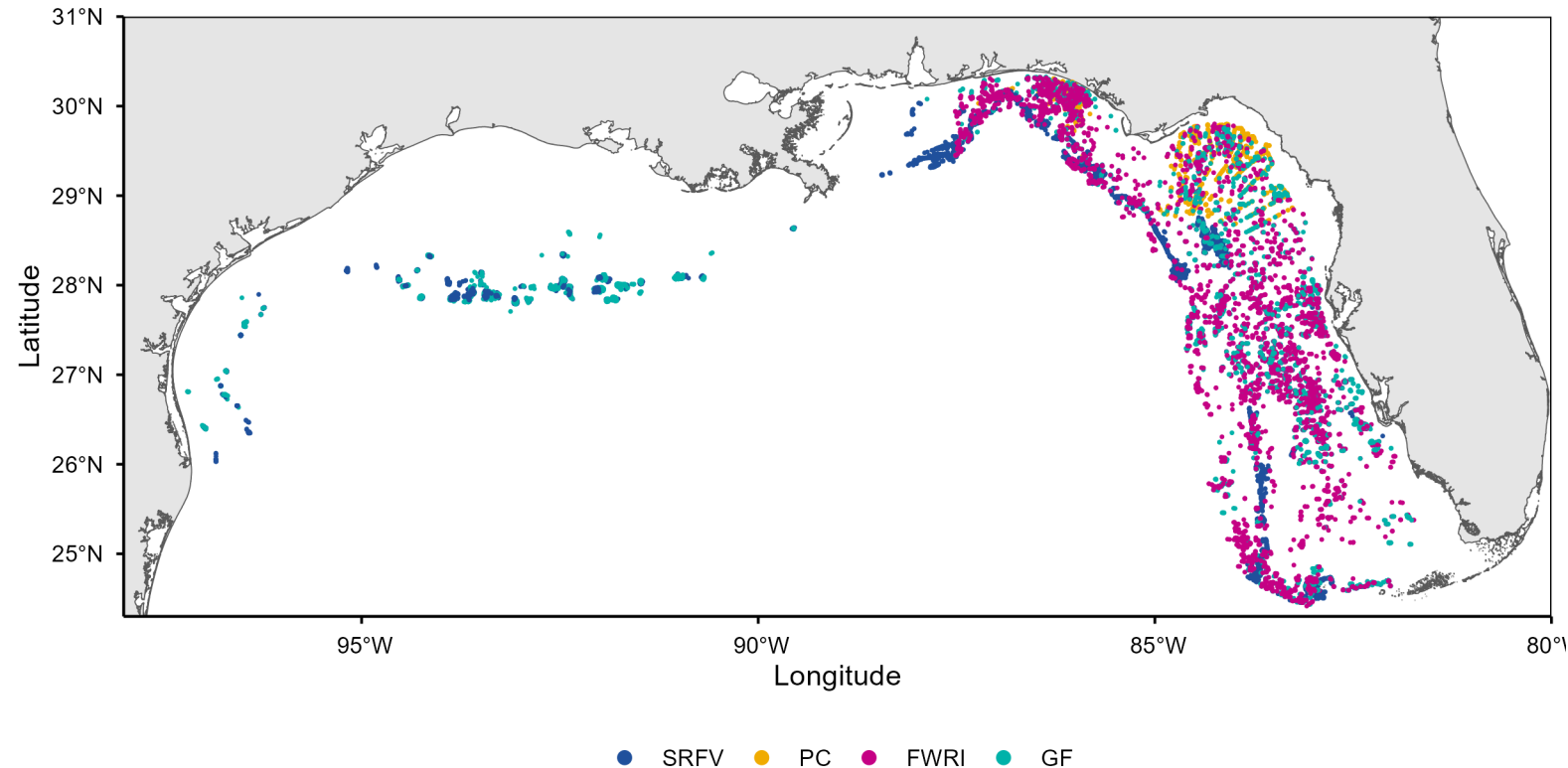
Stereo Baited Remote Underwater Video (S-BRUVs) Survey

- Fishery Independent
- Non-capture method of sampling
- Stereo-video imaging
 - Allow for measurements of select taxa
- Baited
- Video read for 20 minutes
 - MaxN = the maximum # seen of a species at one time
- Habitat metrics coded
 - e.g., sponge, rock, coral

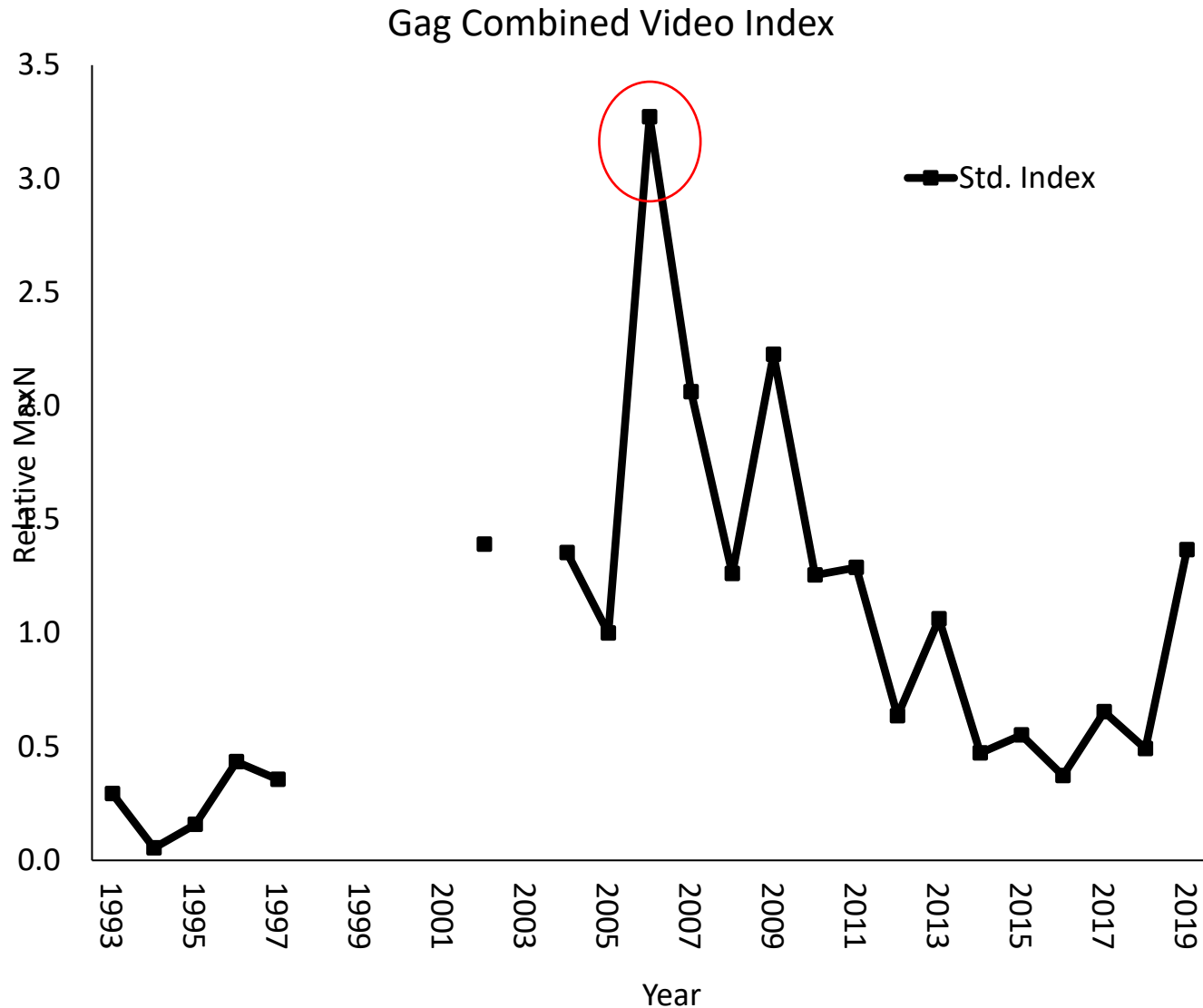


SBRUV Survey History

- Time series variation
 - **SFRV-NMFS Pascagoula (1993- 2019)**
 - **NMFS Panama City (2006-2019)**
 - **FWRI (2010-2013 zones 4,5)**
 - **FWRI (2014-2015 zones 4,5,9,10)**
 - **FWRI NFWF expansion (2016-2019)**
 - **G-FISHER (2020-2024)**
- SRFV: High relief, deep sites, soundings, multibeam data
- FWRI/PC: Sample locations determined from side-scan mapping efforts
- G-FISHER: unifies the three surveys, modifications to habitat targeting
- **SEDAR 72:**
 - **Eastern Gulf natural reef data from 1993 to 2019**
 - **CART-based habitat area weighted index (Thompson *et al.* 2022)**

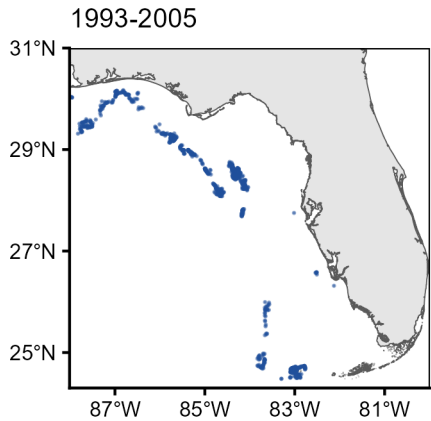


SEDAR72- Gulf Gag

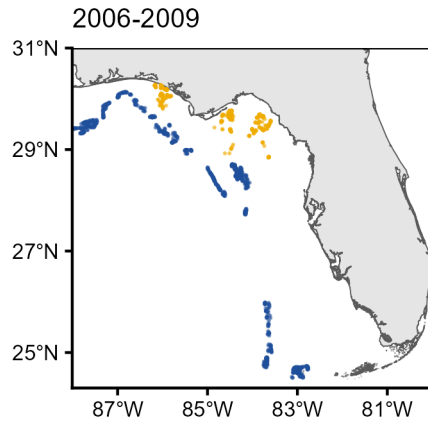


- Abundance peaked in 2006 coincided with PC survey
- Concerns that CART approach not effectively accounting differences in survey selectivity of Gag (1993-2009)

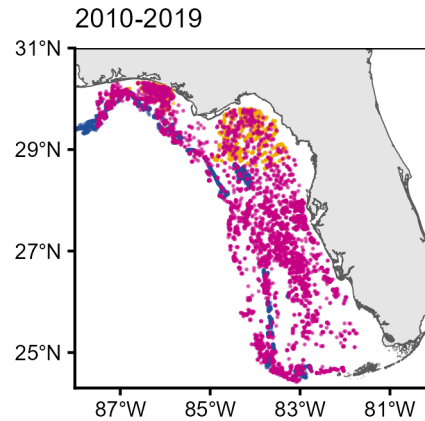
SEDAR72- Gulf Gag



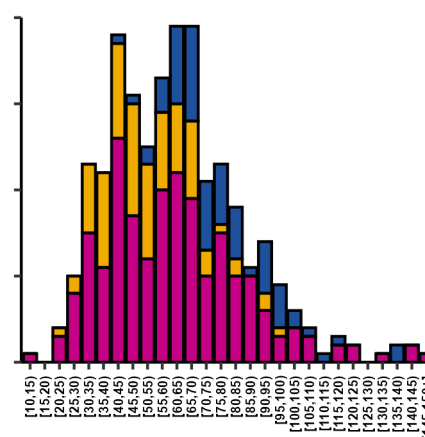
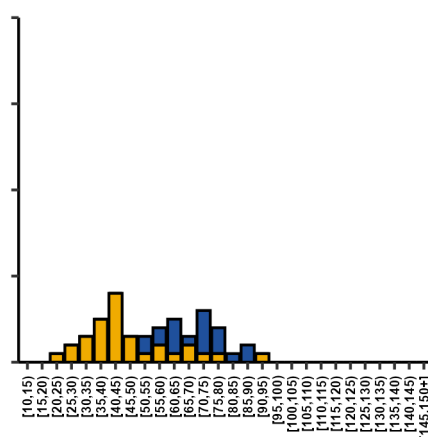
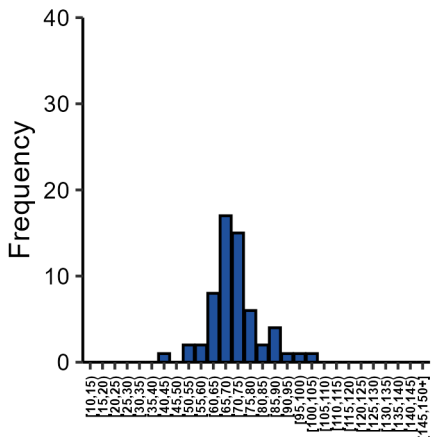
SRFV ~ 0.10



SRFV ~ 0.06
PC ~ 0.40

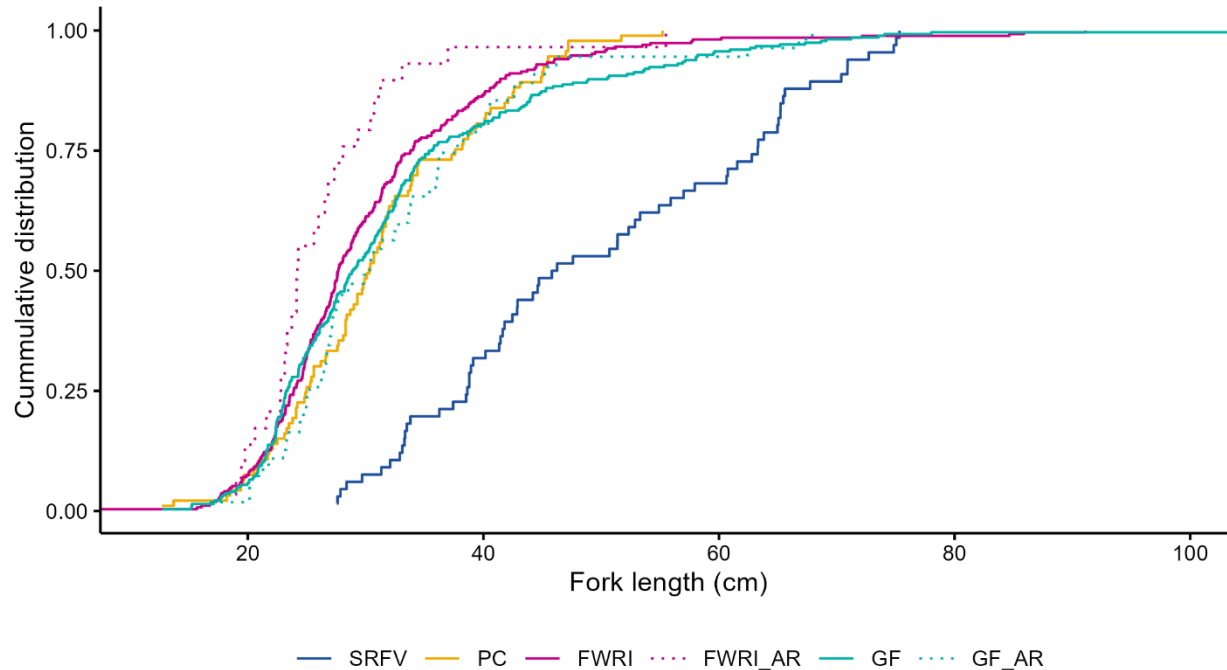
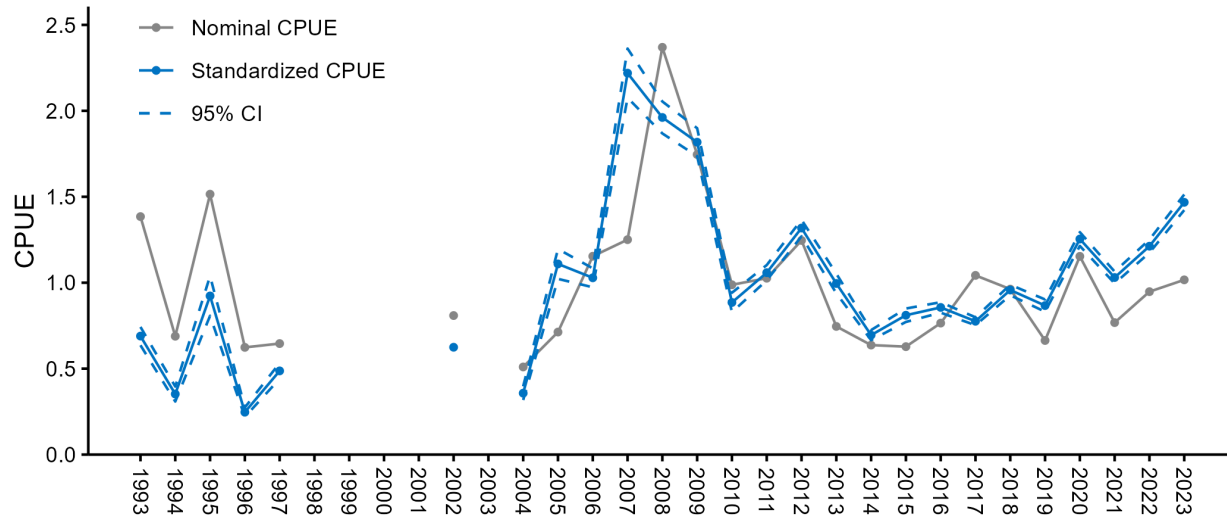


SRFV ~ 0.06
PC ~ 0.16
FWRI ~ 0.05



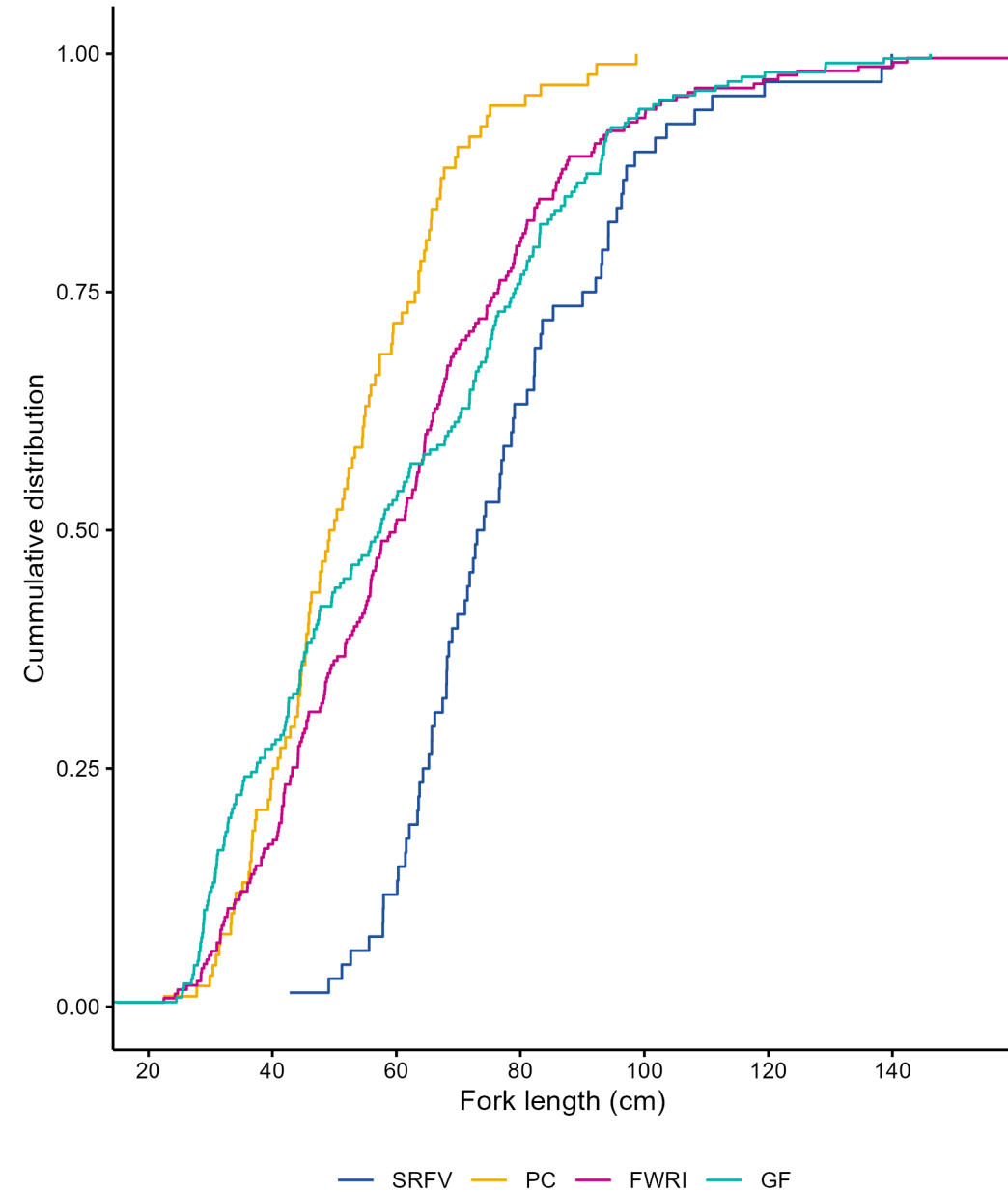
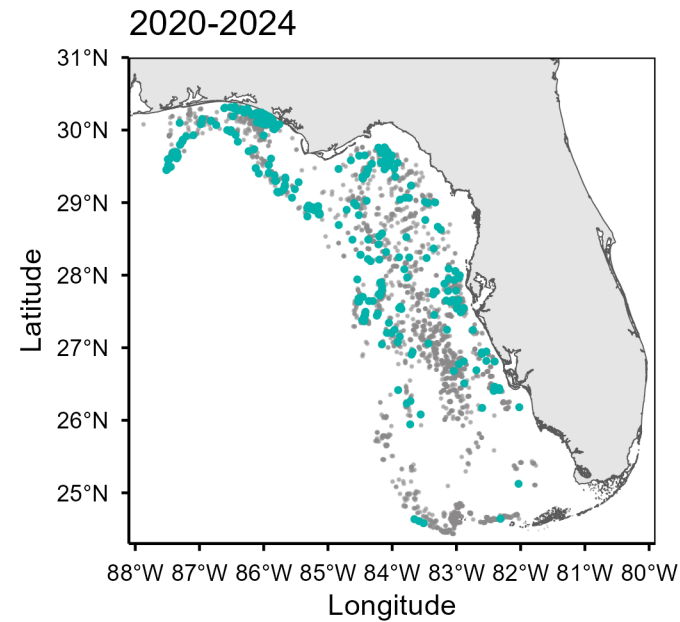
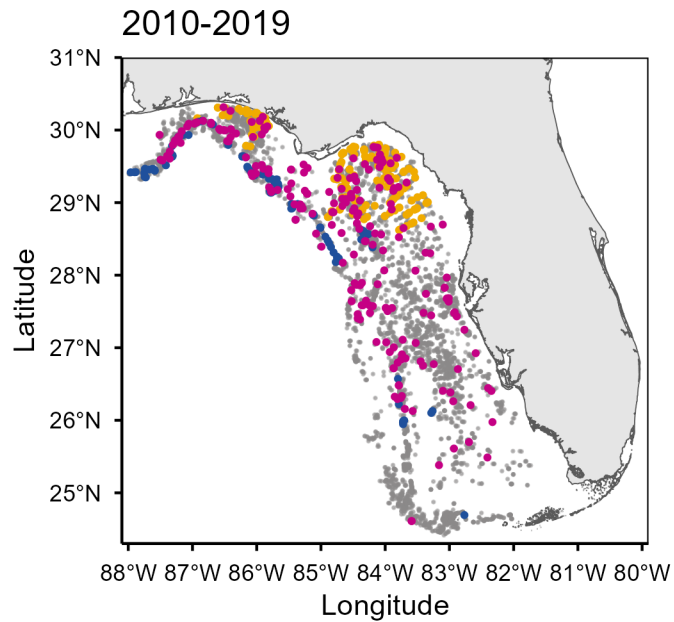
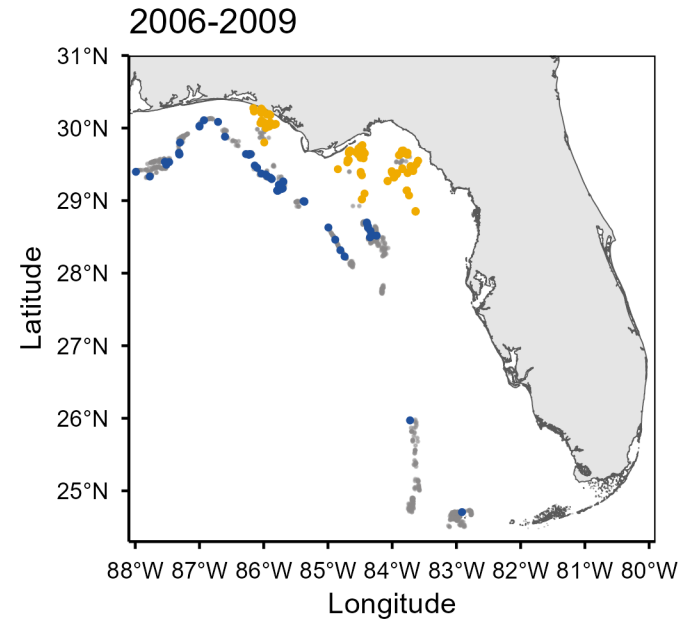
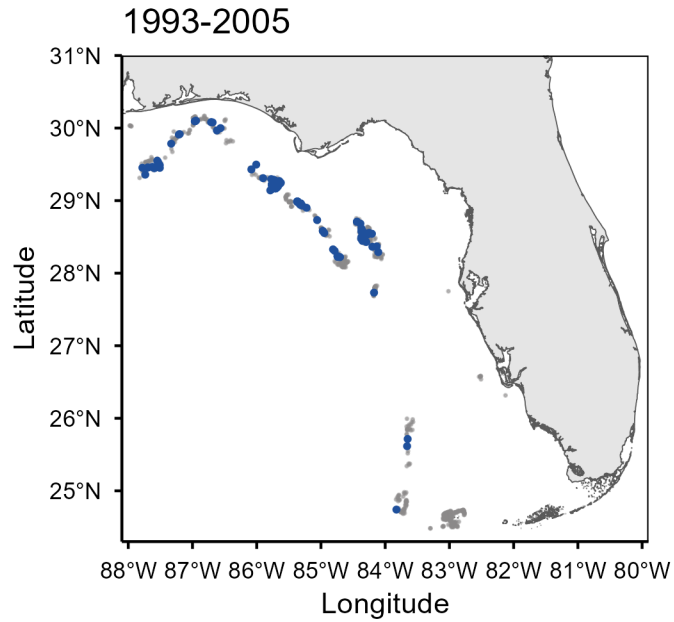
- Abundance peaked in 2006 coincided with PC survey
- Concerns that CART approach not effectively accounting differences in survey selectivity of Gag (1993-2009)
 - Spatial distribution
 - Encounter rate
 - Size composition
- Recommendations:
 - Use separate SRFV and PC indices
 - In future, evaluate inclusion of FWRI/GF

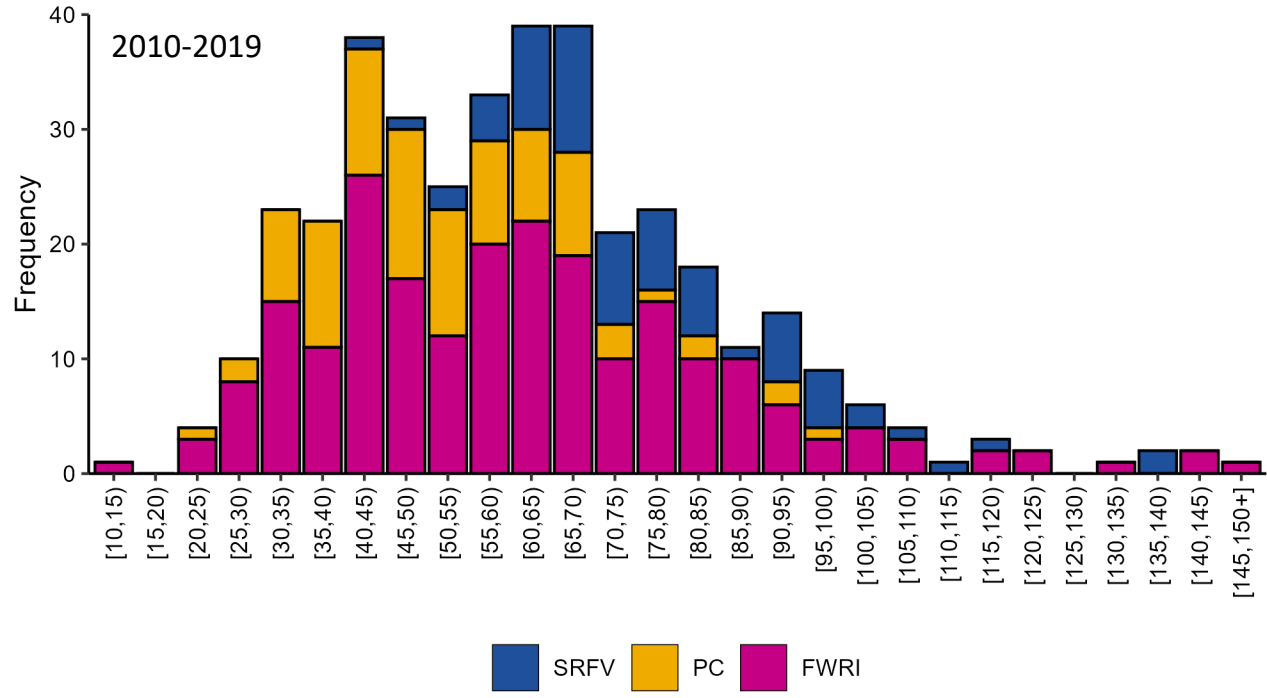
SEDAR94- Gulf Hogfish



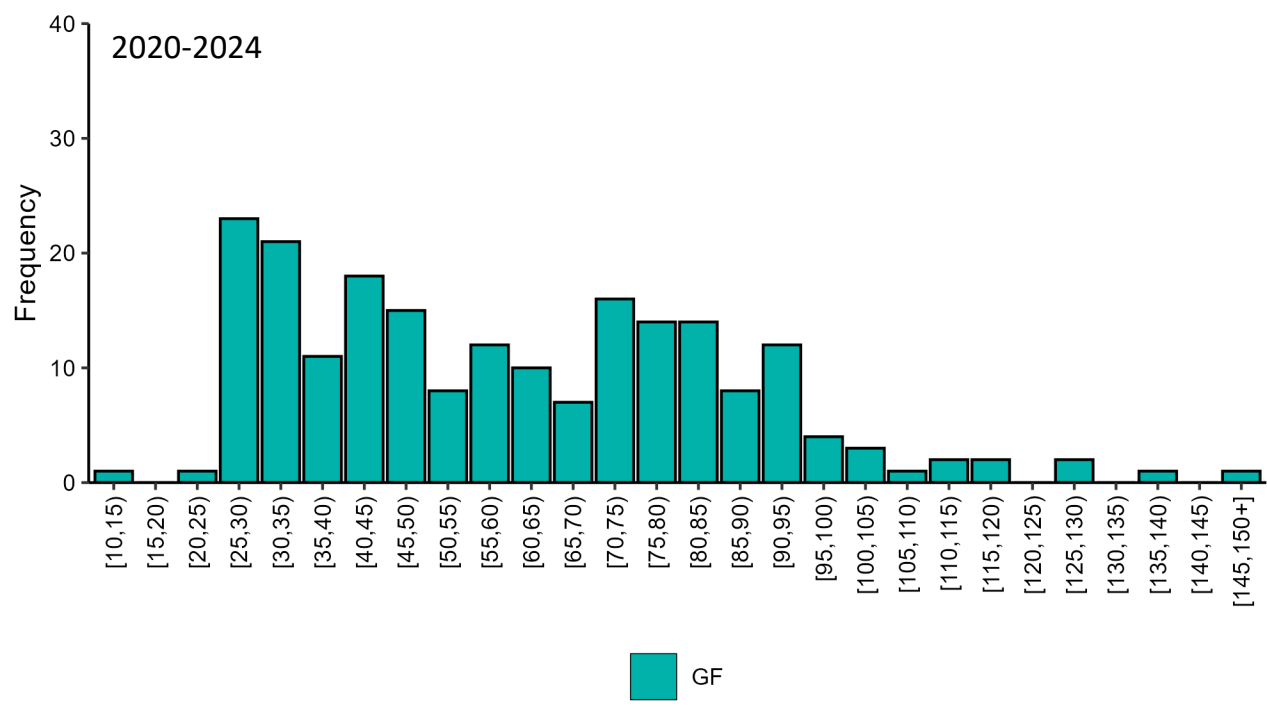
- Data workshop August 2025
- Similar pattern (and concerns) with index from full time series
- Index data working group recommended truncated time series
- Interim Gag also considered:
 - SEDAR 72 status quo use spatial subset of site data correspond to historic SRFV and PC survey domains
 - Modified CART approach generate separate inshore/offshore indices
 - Truncated time series (2010-2024)
- Truncated time series natural reefs deemed most appropriate for Gag

Interim- Gulf Gag



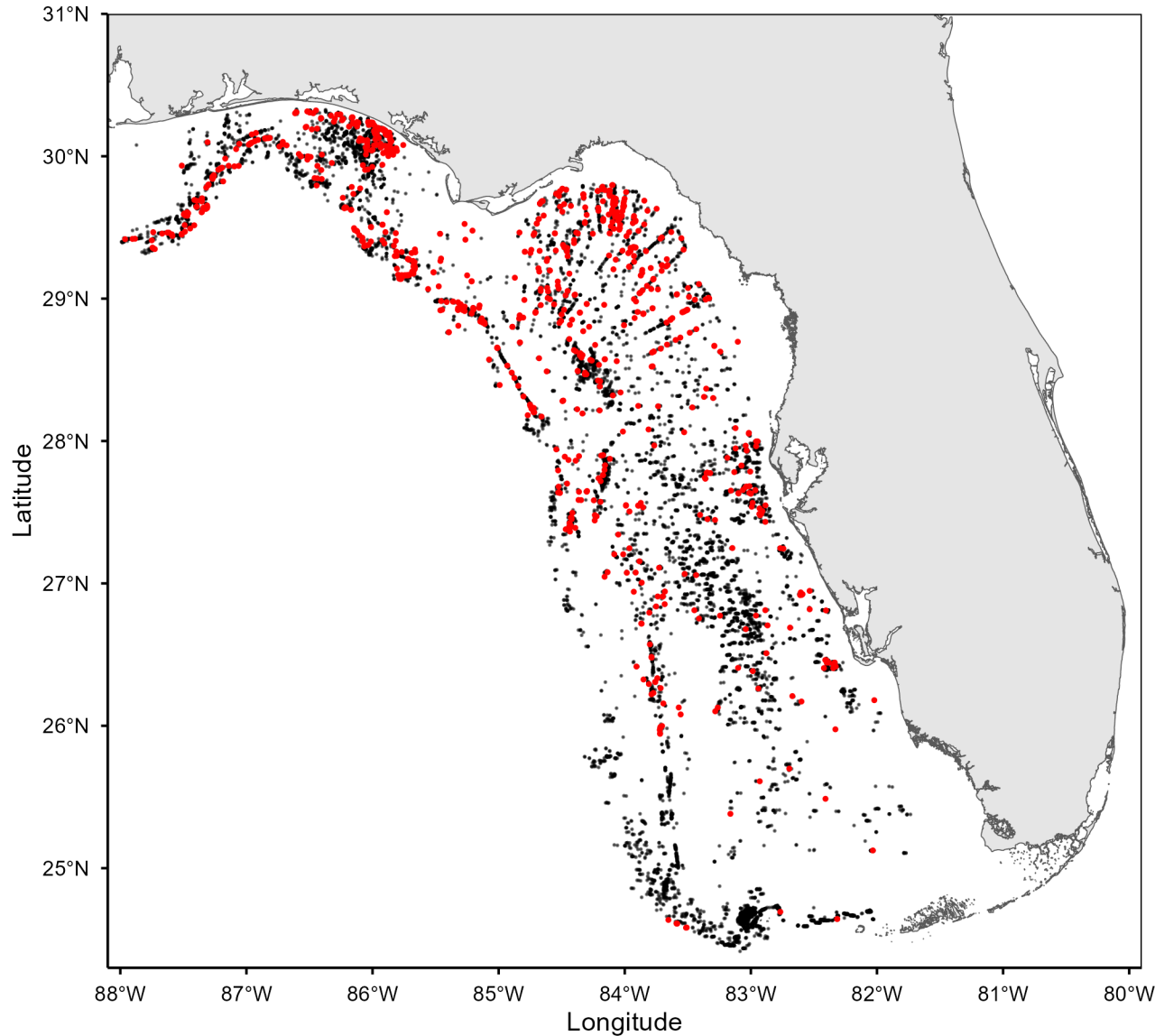


Year	SRFV		PC		FWRI		GF	
	Measures	Sites	Measures	Sites	Measures	Sites	Measures	Sites
2010	1	1	22	17	1	1		
2011	21	16	21	14	5	5		
2012	15	10	13	10	7	7		
2013	9	5	0	0	0	0		
2014	4	4	6	5	4	4		
2015	5	5	6	4	8	7		
2016	2	2	0	0	62	44		
2017	1	1	7	6	41	32		
2018	6	6	2	2	37	20		
2019	4	2	15	10	58	39		
2020							27	24
2021							36	32
2022							41	34
2023							47	34
2024							56	40



Gag presence/absence

Year	SRFV		PC		FWRI		GF	
	FO	Effort	FO	Effort	FO	Effort	FO	Effort
2010	19	221	46	138	1	49		
2011	34	337	42	150	12	211		
2012	25	281	16	148	12	214		
2013	14	163	11	86	3	183		
2014	11	230	23	169	11	338		
2015	12	152	9	155	10	378		
2016	6	205	16	158	54	719		
2017	9	221	21	147	40	622		
2018	7	213	10	76	29	694		
2019	11	285	25	94	56	899		
2020							33	764
2021							84	999
2022							87	936
2023							69	939
2024							71	1017



Analytical methods-Habitat Model

- *Thompson et al. 2022-Fisheries Research*
- Describe sites with Low, Medium, and High proportion positive
 - Strata * Year * Species
 - MacCall 1990
- Classification and Regression Trees (CART)
 - MaxN reduced to binary (P/A)
 - R package: partykit (Hothorn and Zeileis 2015)



PA ~ Latitude + Longitude + Depth + Geoform Code + Substrate Max Relief + Algae + Hard coral + Soft coral + Seagrass + Sponge + Relief + Rock + Artificial Structure

Analytical methods

- Negative binomial model
 - $\text{MaxN} = \text{Year} * \text{Hab} * \text{Survey}$
- Weighted model
 - First, estimate total reef area within each survey domain
 - Second, allocate area estimates of High, Medium, and Low habitats proportionally based on random sampling effort

Survey area weights

Gulf	SRFV	PC	FWRI (2010-2013)	FWRI (2014-2015)	FWRI (2016-2019)	GF
Total Universe Area (km2)	35462	22105	46286	63620	149053	149053
Area x Proportion of mapped with reef	6176	5124	9820	11597	29437	29437

Time Period Weighting Values

2010-2013	0.29	0.24	0.46	0	0	0
2014-2015	0.27	0.22	0	0.51	0	0
2016-2019	0.15	0.13	0	0	0.72	0
2020-2024	0	0	0	0	0	1.00

Survey habitat weights

Survey	Low	Medium	High
SRFV	0.74	0	0.26
PC	0.36	0.54	0.1
FWRI	0.39	0.45	0.16
G-FISHER	0.39	0.45	0.16

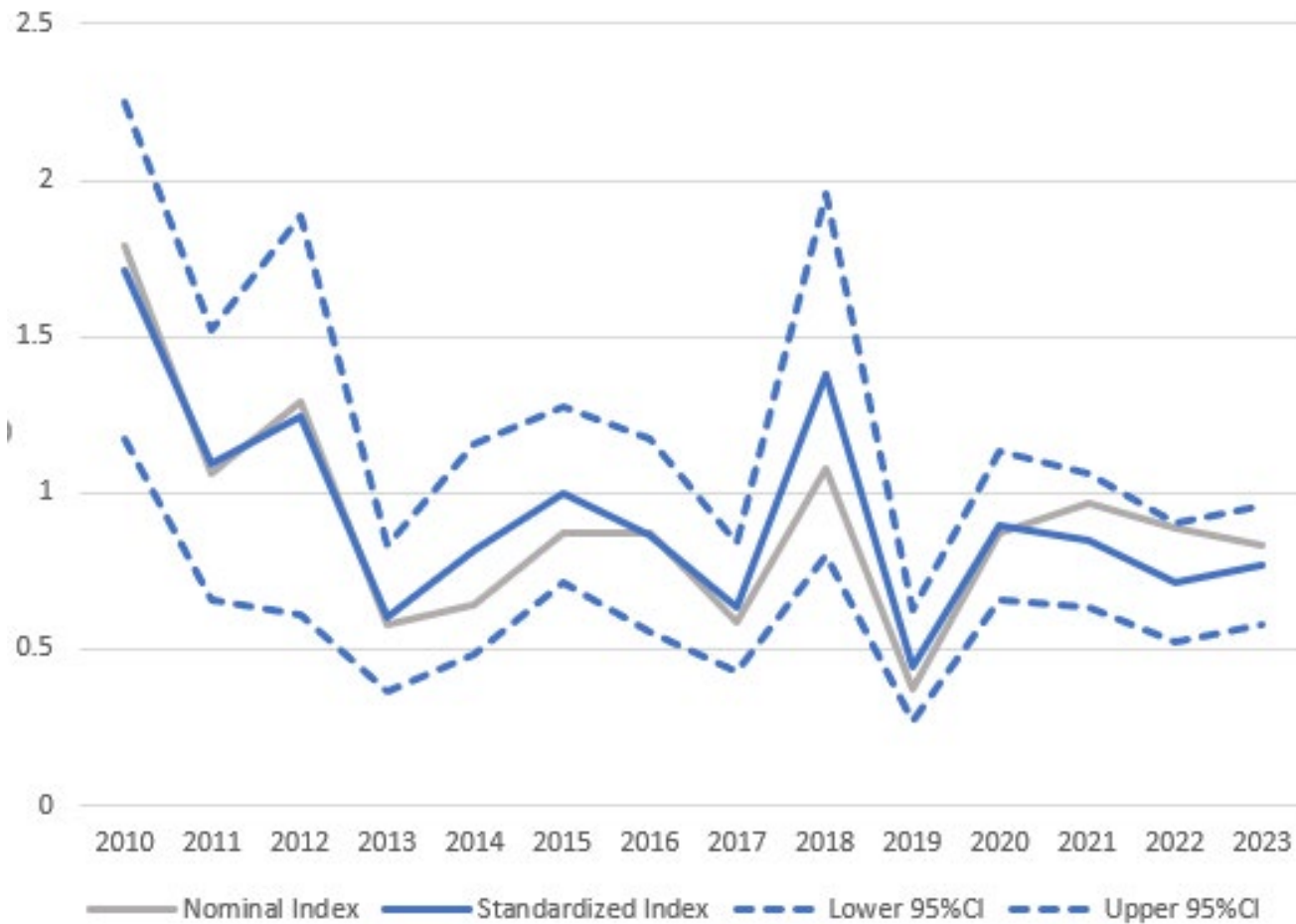
Survey effort by habitat category

Year	SRFV			PC			FWRI			GF		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
2010	161	0	60	55	69	14	24	25	0			
2011	232	0	105	28	100	22	133	78	0			
2012	219	0	62	27	108	13	139	75	0			
2013	109	0	54	17	54	15	109	74	0			
2014	177	0	53	39	113	17	185	130	23			
2015	121	0	31	74	74	7	143	177	58			
2016	151	0	54	94	53	11	258	334	127			
2017	162	0	59	65	68	14	200	293	129			
2018	170	0	43	35	32	9	222	329	143			
2019	202	0	83	37	47	10	256	416	227			
2020										325	354	85
2021										349	469	181
2022										297	383	256
2023										295	379	265
2024										337	419	261

Gag FO by survey habitat category

Year	SRFV			PC			FWRI			GF		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
2010	2	0	17	11	25	10	0	1	0			
2011	9	0	25	3	32	7	4	8	0			
2012	6	0	19	2	9	5	5	7	0			
2013	1	0	13	0	10	1	1	2	0			
2014	2	0	9	0	17	6	5	4	2			
2015	5	0	7	1	7	1	2	5	3			
2016	1	0	5	6	7	3	4	26	24			
2017	2	0	7	5	10	6	0	17	23			
2018	3	0	4	4	3	3	0	13	16			
2019	3	0	8	5	16	4	5	19	32			
2020										5	19	9
2021										11	32	41
2022										5	30	52
2023										3	21	45
2024										8	29	34

Index of Abundance

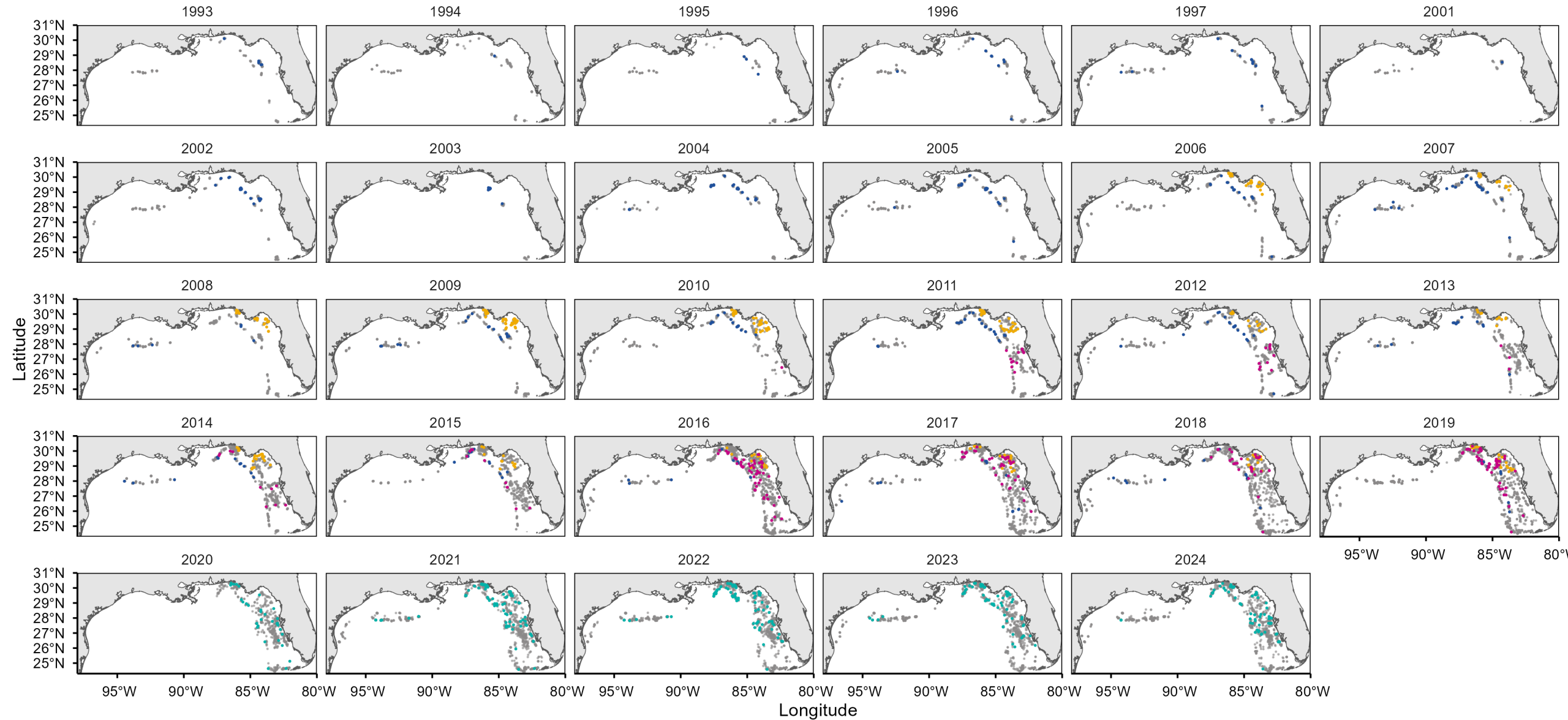


Year	FO	Effort	Nominal	Nominal CV	Index	Index CV
2010	66	408	2.3045	2.97	1.9882	0.21
2011	88	698	1.7890	3.54	1.7129	0.16
2012	53	643	1.0624	4.38	1.0901	0.20
2013	28	432	1.2923	8.39	1.2476	0.26
2014	45	737	0.5781	4.43	0.6005	0.20
2015	31	685	0.6434	7.96	0.8172	0.21
2016	76	1082	0.8690	4.26	0.9960	0.14
2017	70	990	0.8681	5.59	0.8626	0.18
2018	46	983	0.5829	5.66	0.6319	0.17
2019	92	1278	1.0806	5.61	1.3785	0.21
2020	33	764	0.3750	4.96	0.4476	0.20
2021	84	999	0.8750	3.95	0.8961	0.14
2022	87	936	0.9653	3.54	0.8509	0.13
2023	69	939	0.8840	4.83	0.7125	0.14
2024	71	1017	0.8306	4.71	0.7672	0.13

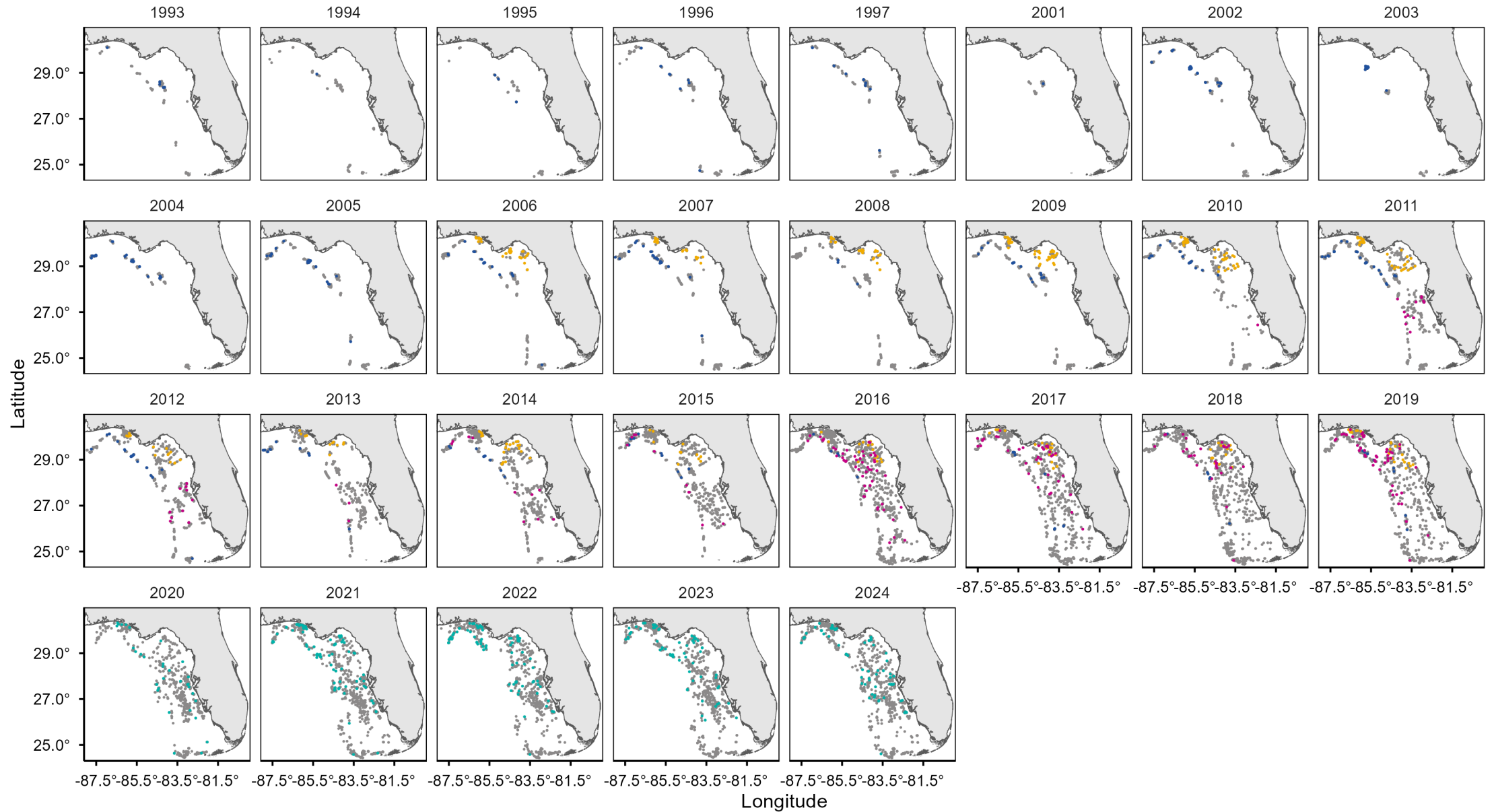
* 2020-2024 nominal CPUE consistently higher than index because of changes in survey strata (e.g., spatial and habitat strata) and optimal effort allocation (i.e., not random-stratified) with the G-FISHER program resulting in an over-representation of high-quality habitat.

Extra slides

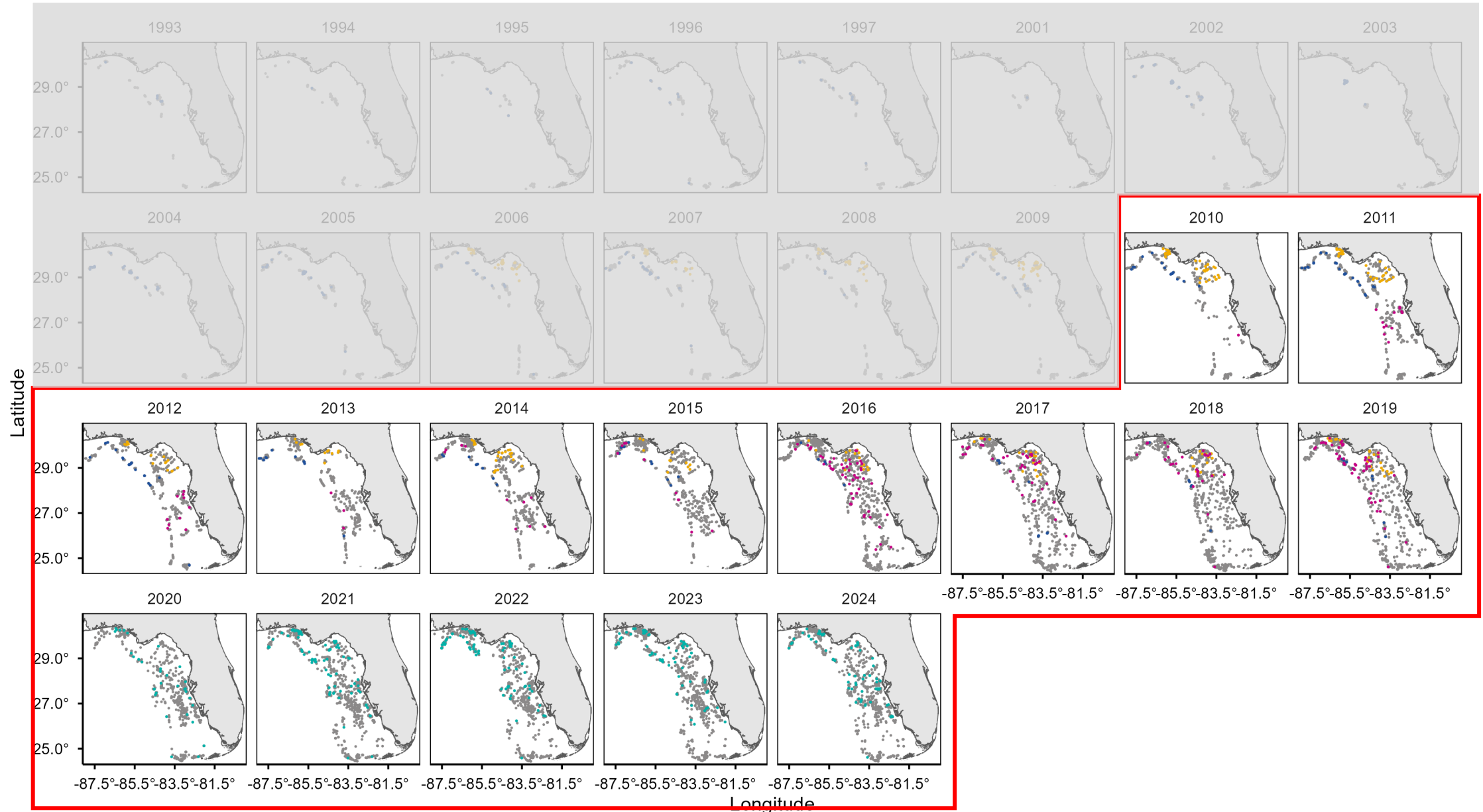
Gulf-wide Gag occurrence



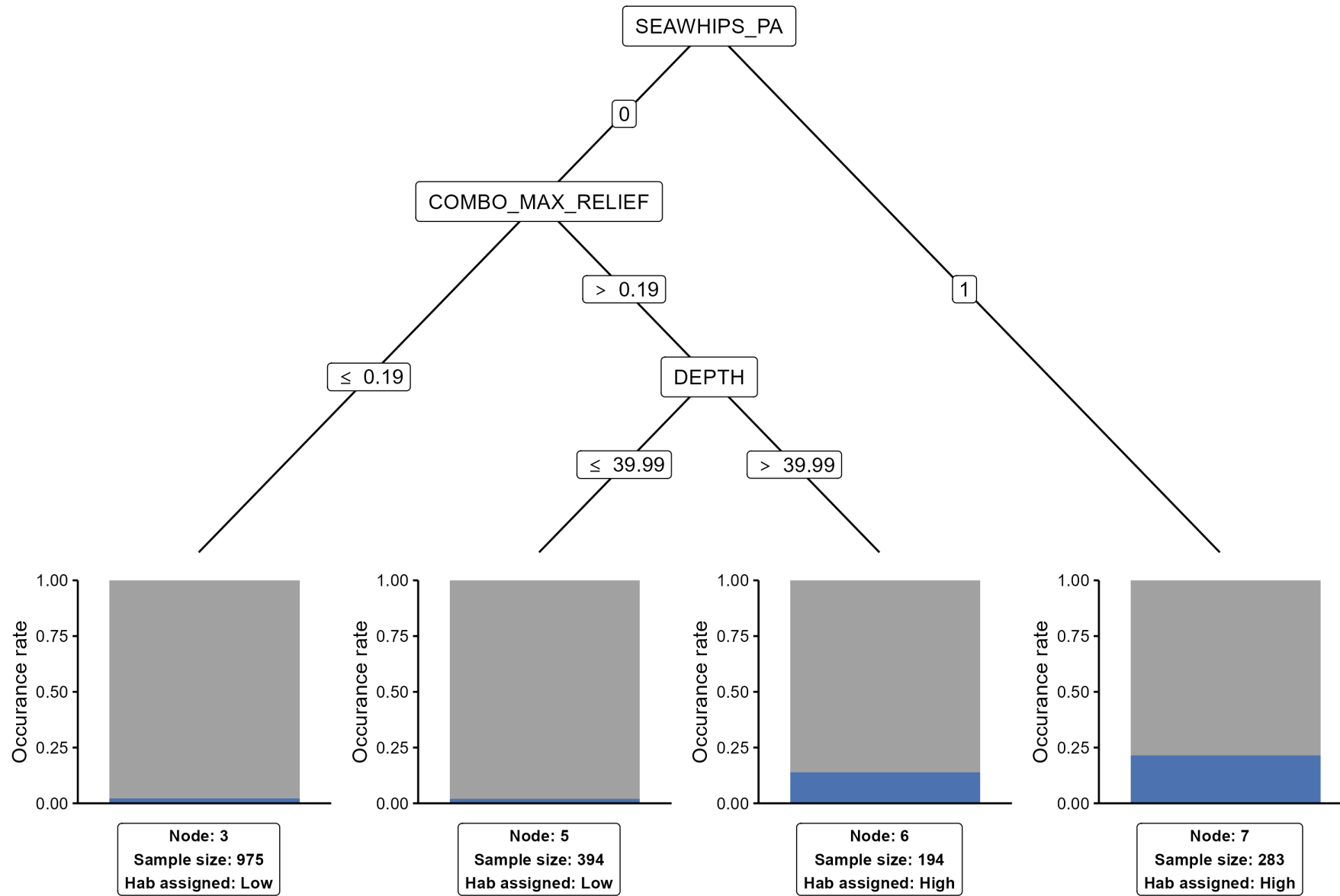
Gag occurrence (full time series)



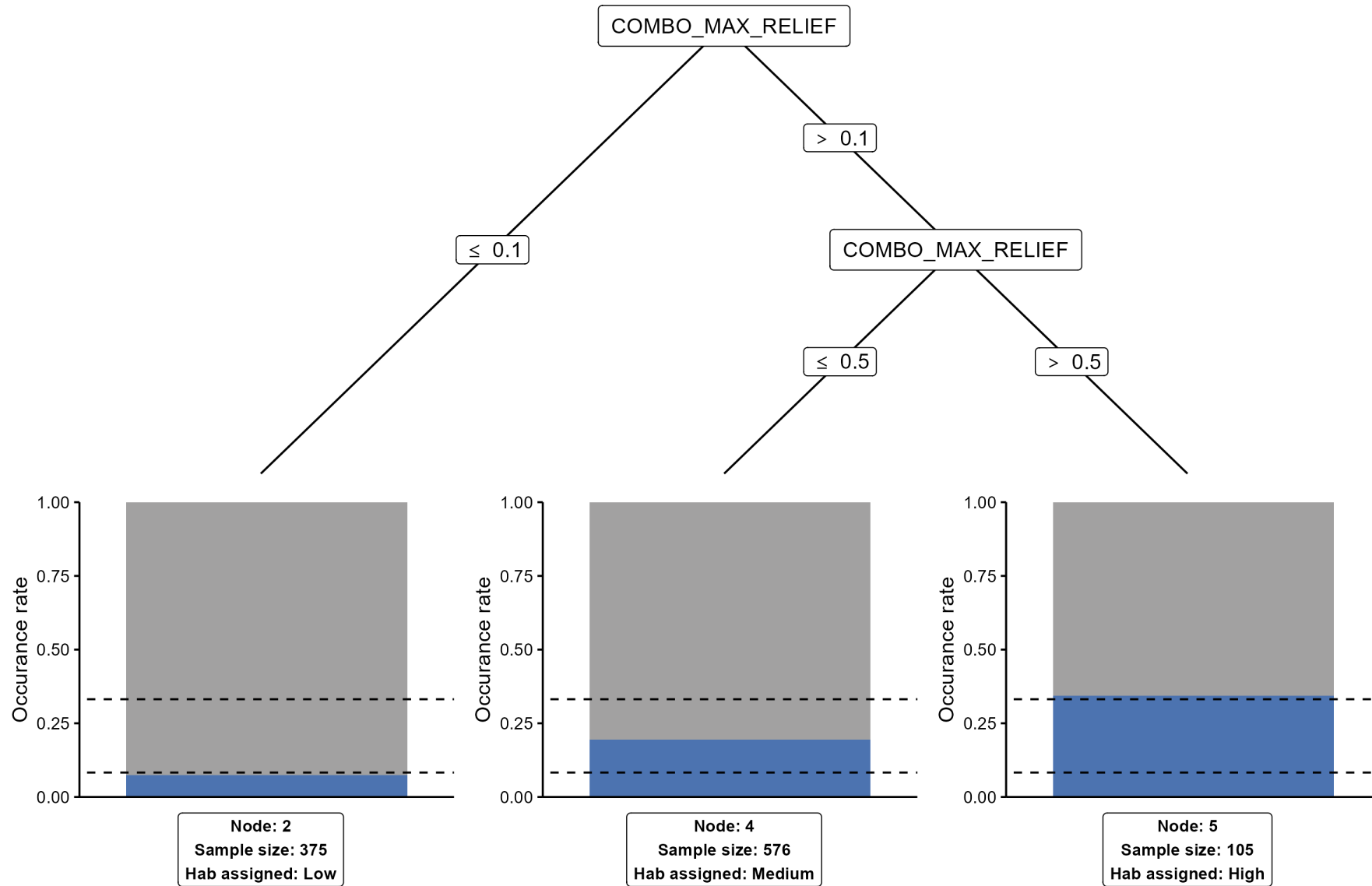
Gag occurrence (truncated time series)



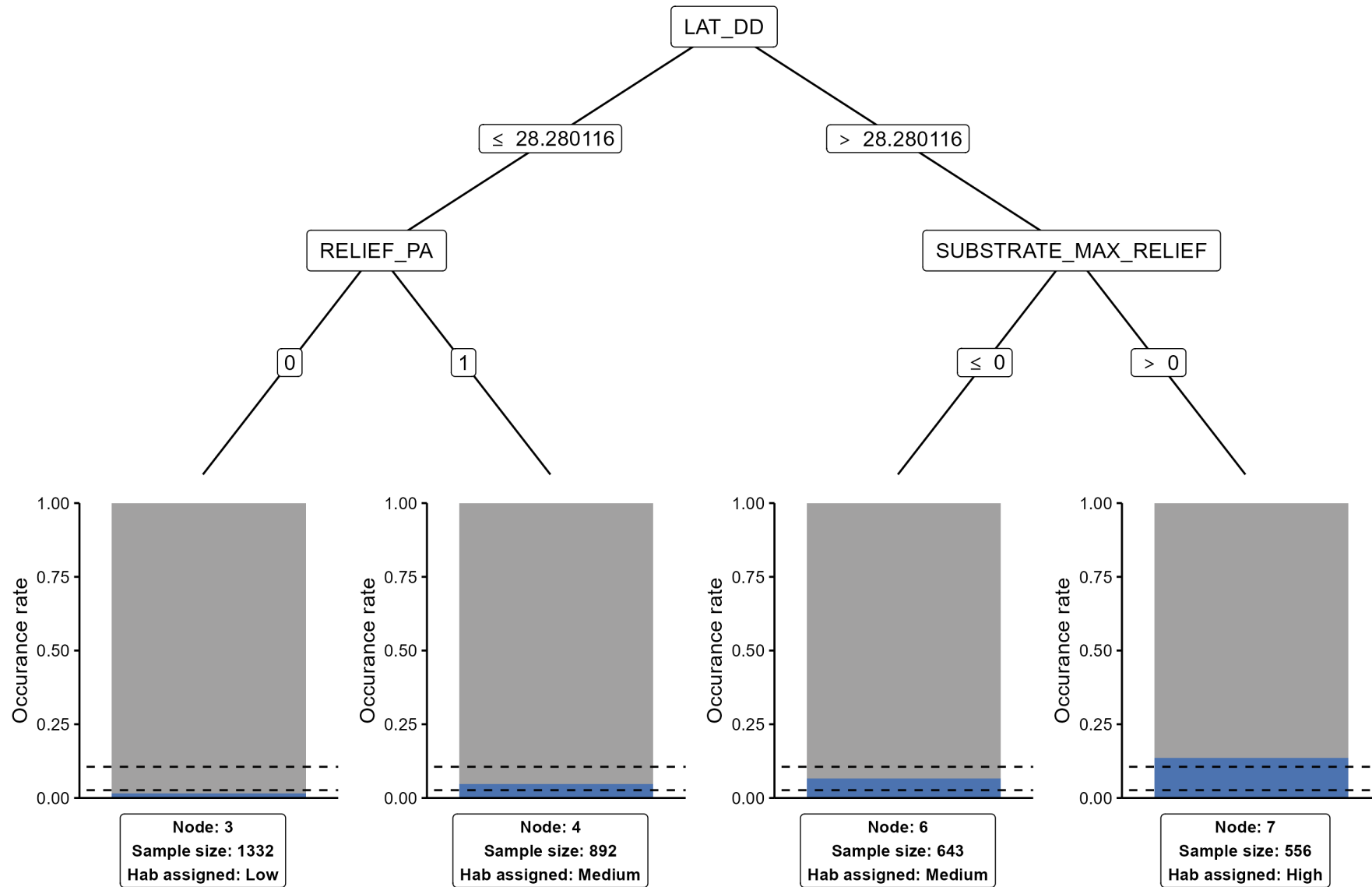
SRFV Final CART
Mycteroperca microlepis



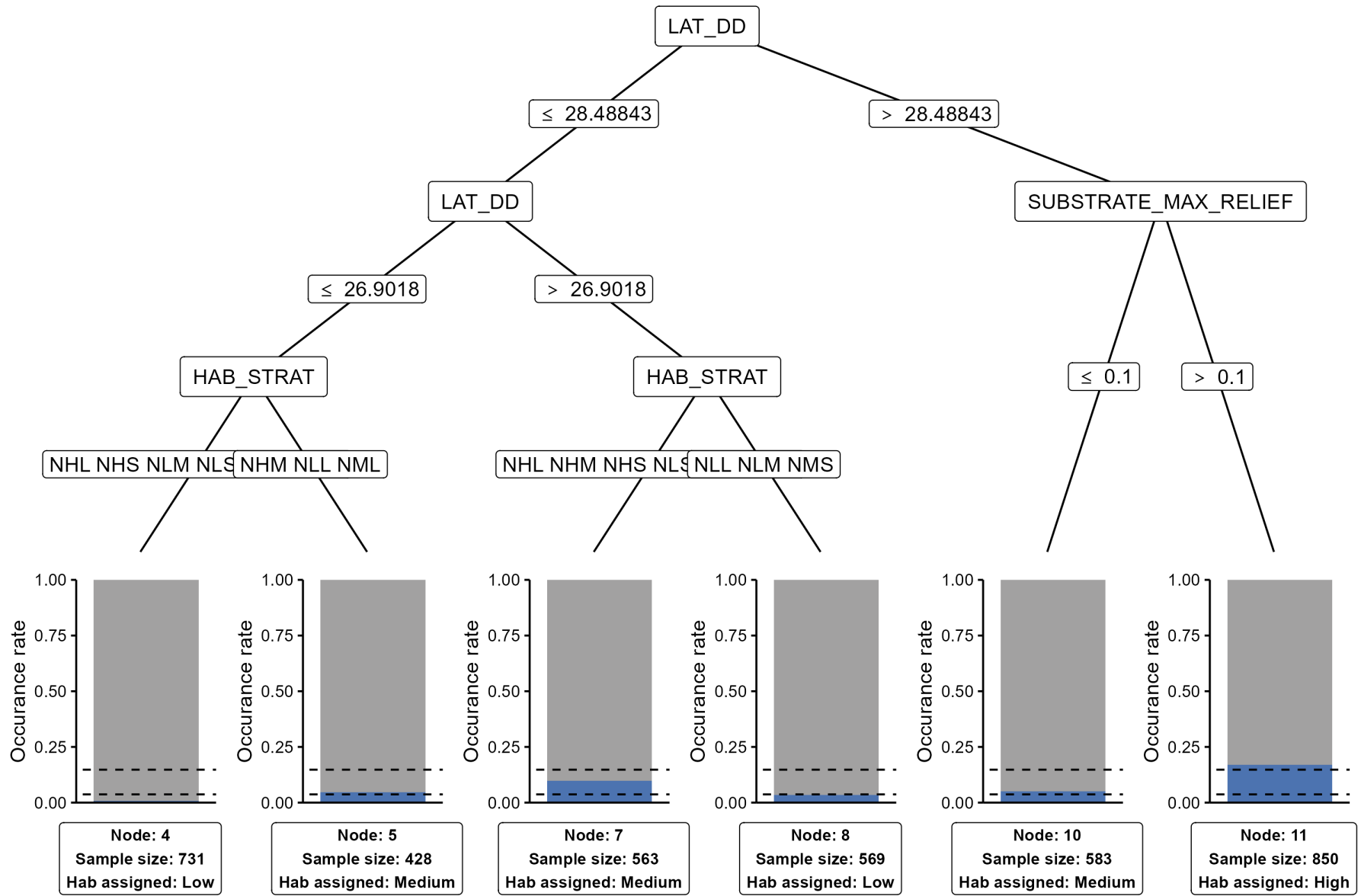
PC Final CART
Mycteroperca microlepis



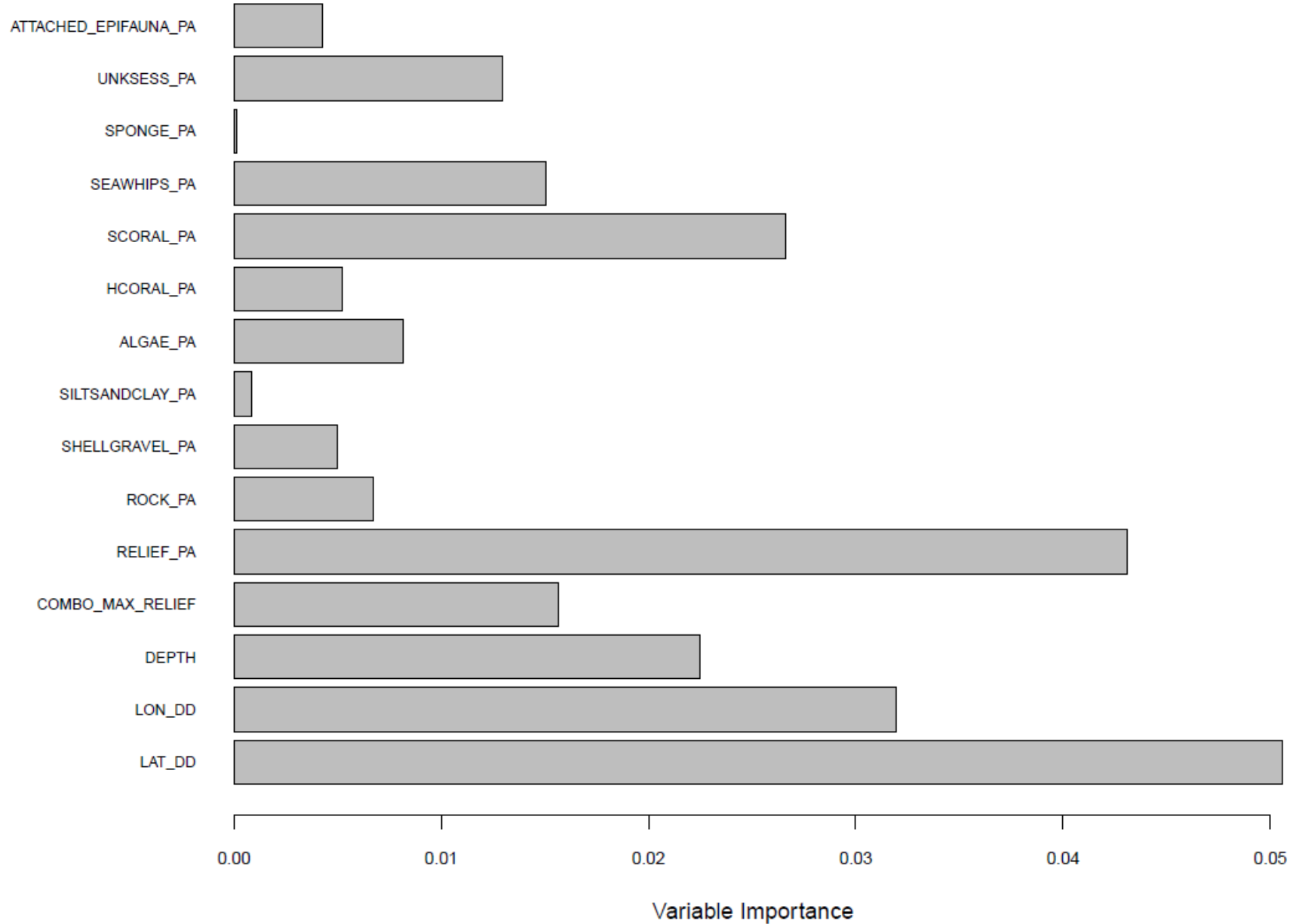
FWRI Final CART
Mycteroperca microlepis



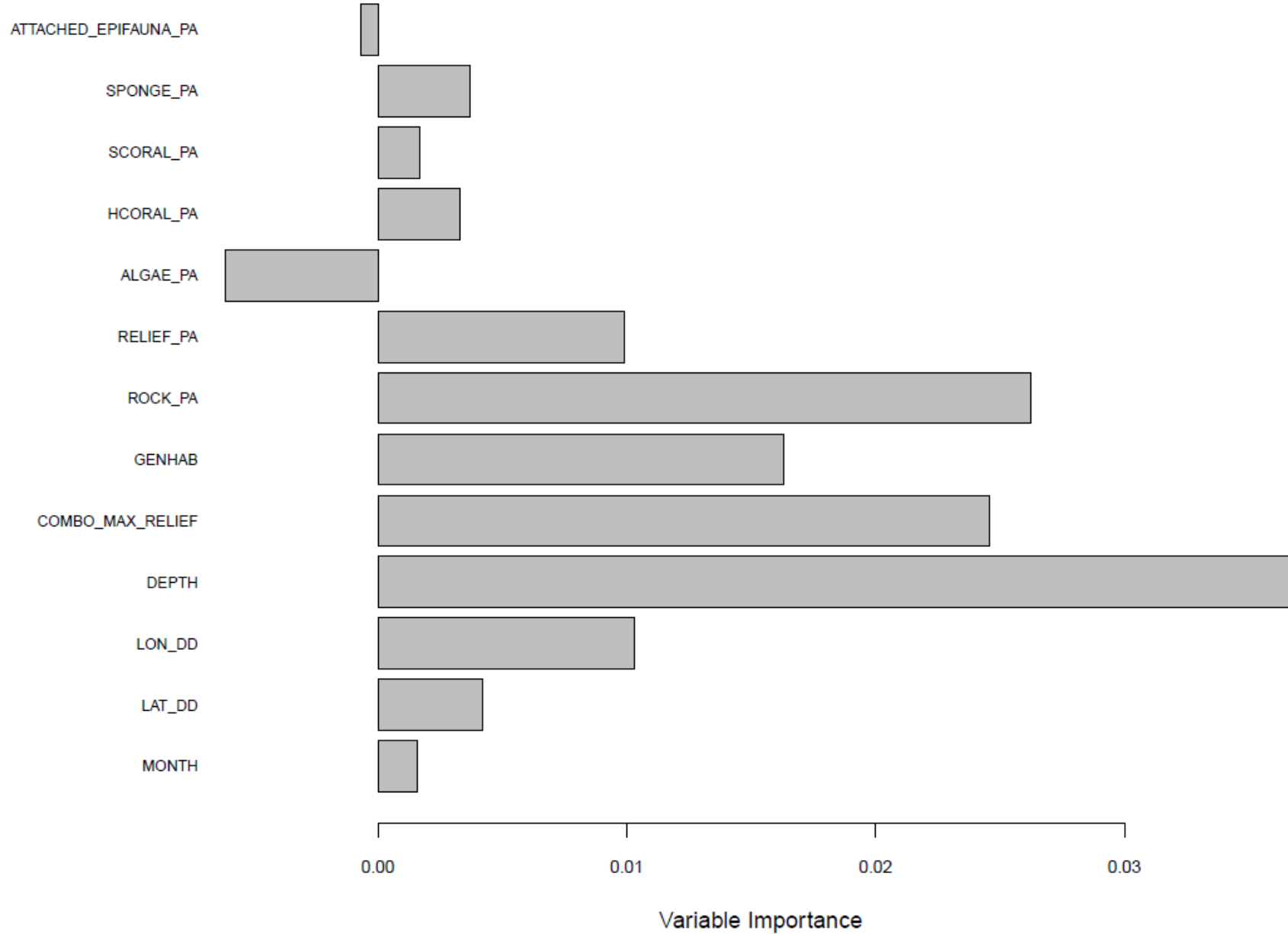
GF Final CART
Mycteroperca microlepis



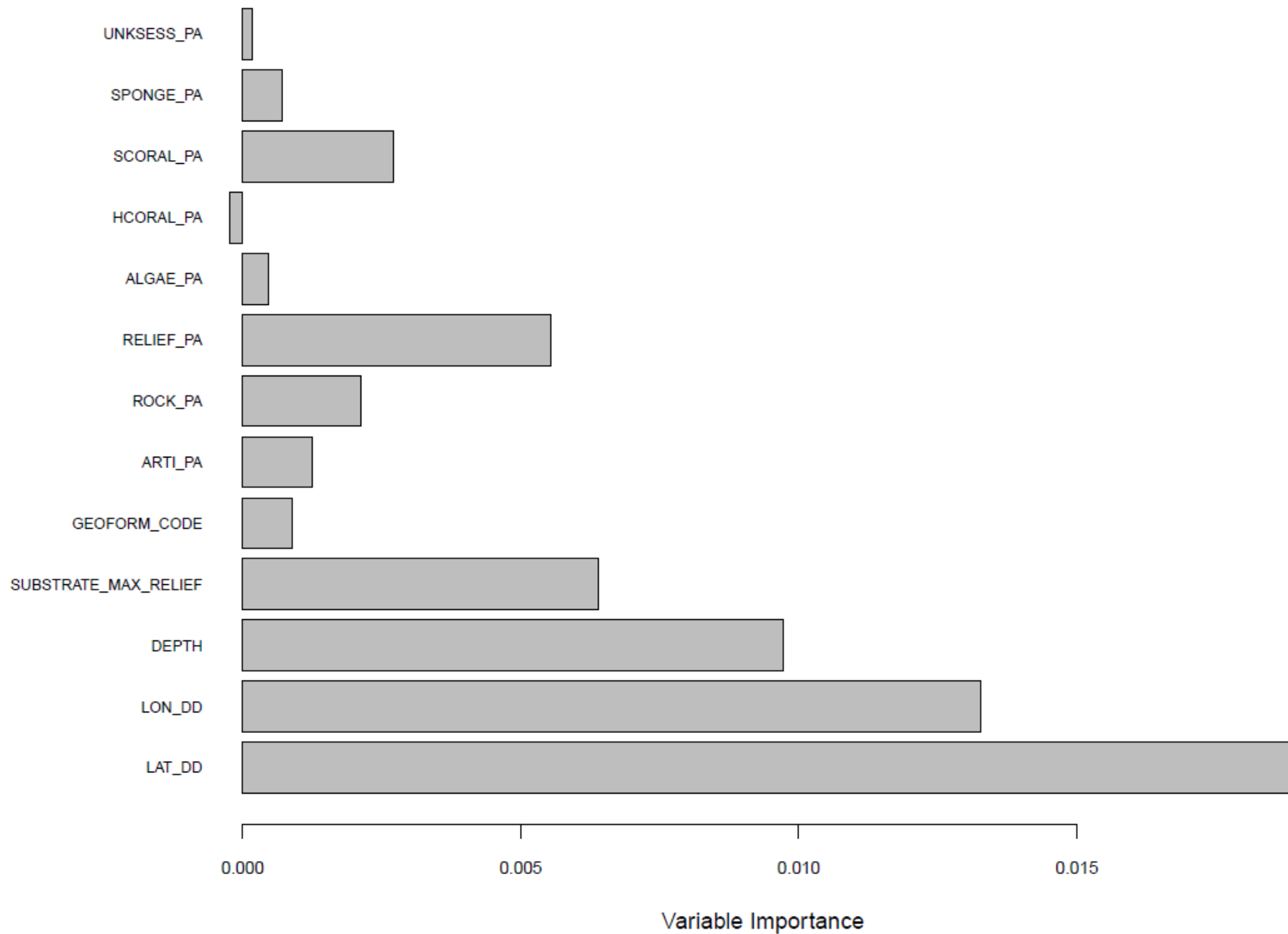
SRFV variable importance
Mycteroperca microlepis



PC variable importance
Mycteroperca microlepis



FWRI variable importance
Mycteroperca microlepis



GF variable importance
Mycteroperca microlepis

