

Indices of abundance for Lane Snapper (*Lutjanus synagris*) using combined data from fishery independent video surveys

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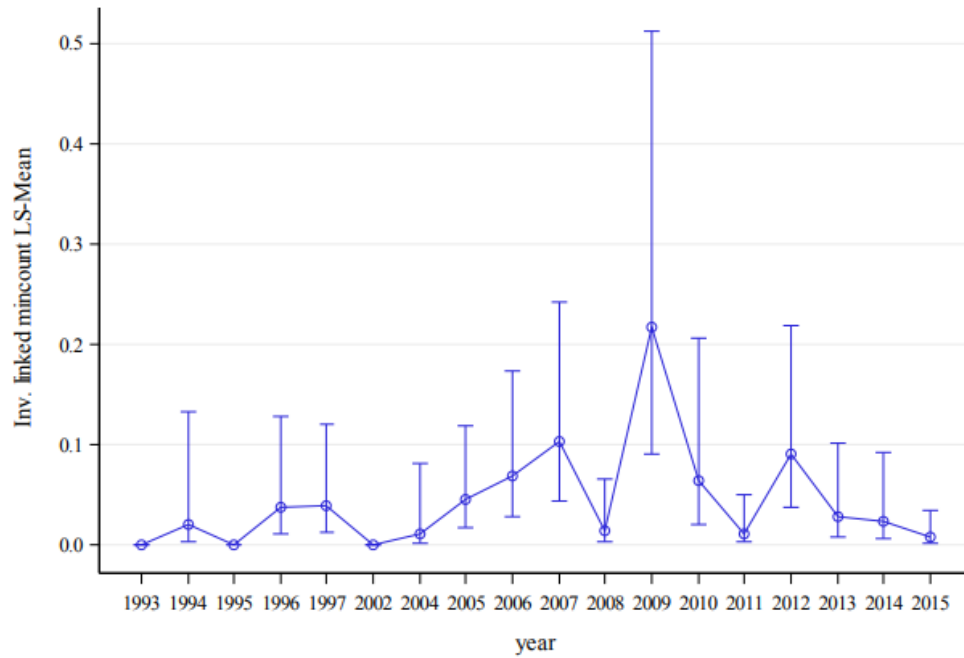
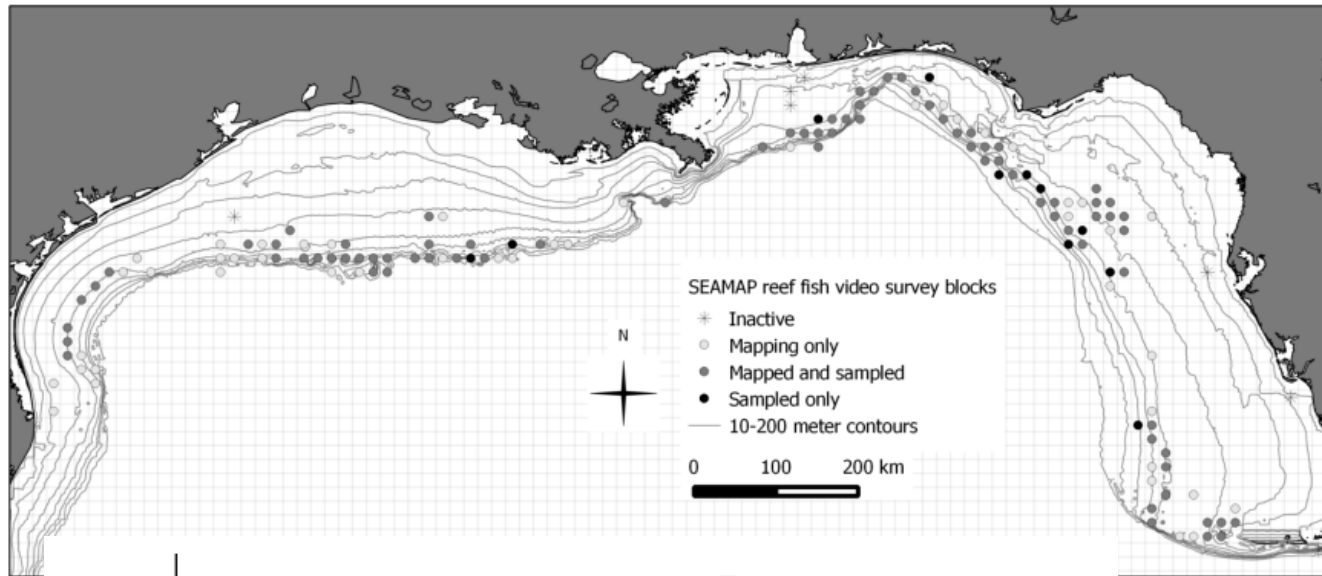
Stereo Baited Remote Underwater Video (S-BRUVs) Survey

- 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

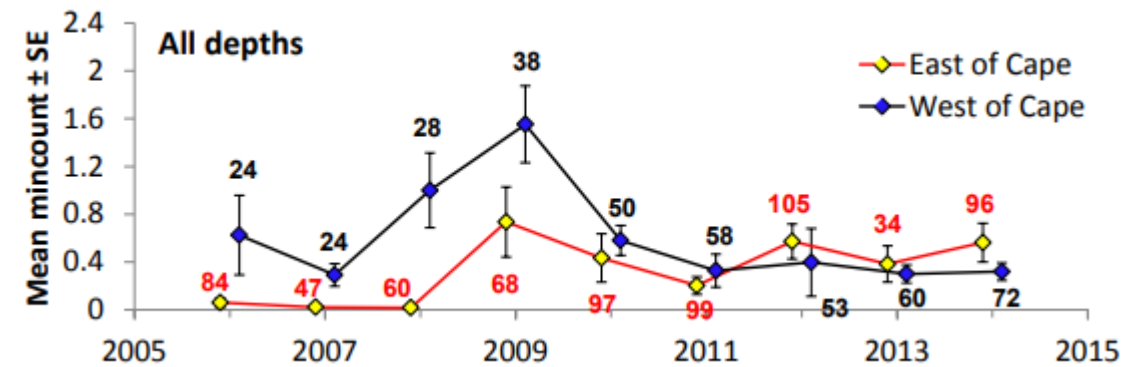
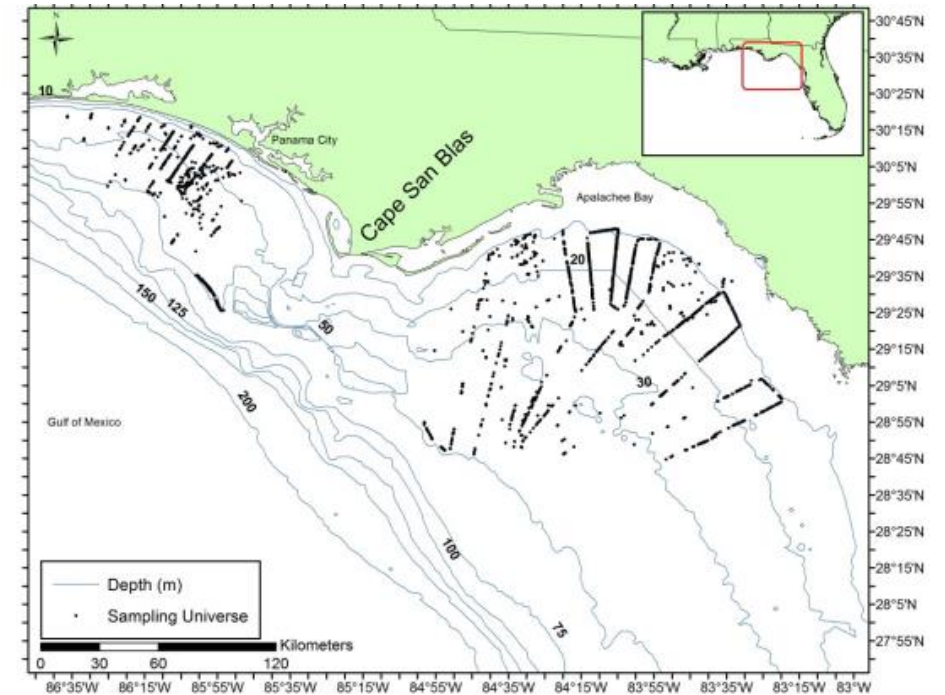


SEDAR49- Data limited Lane Snapper

SRFV-NMFS Pascagoula

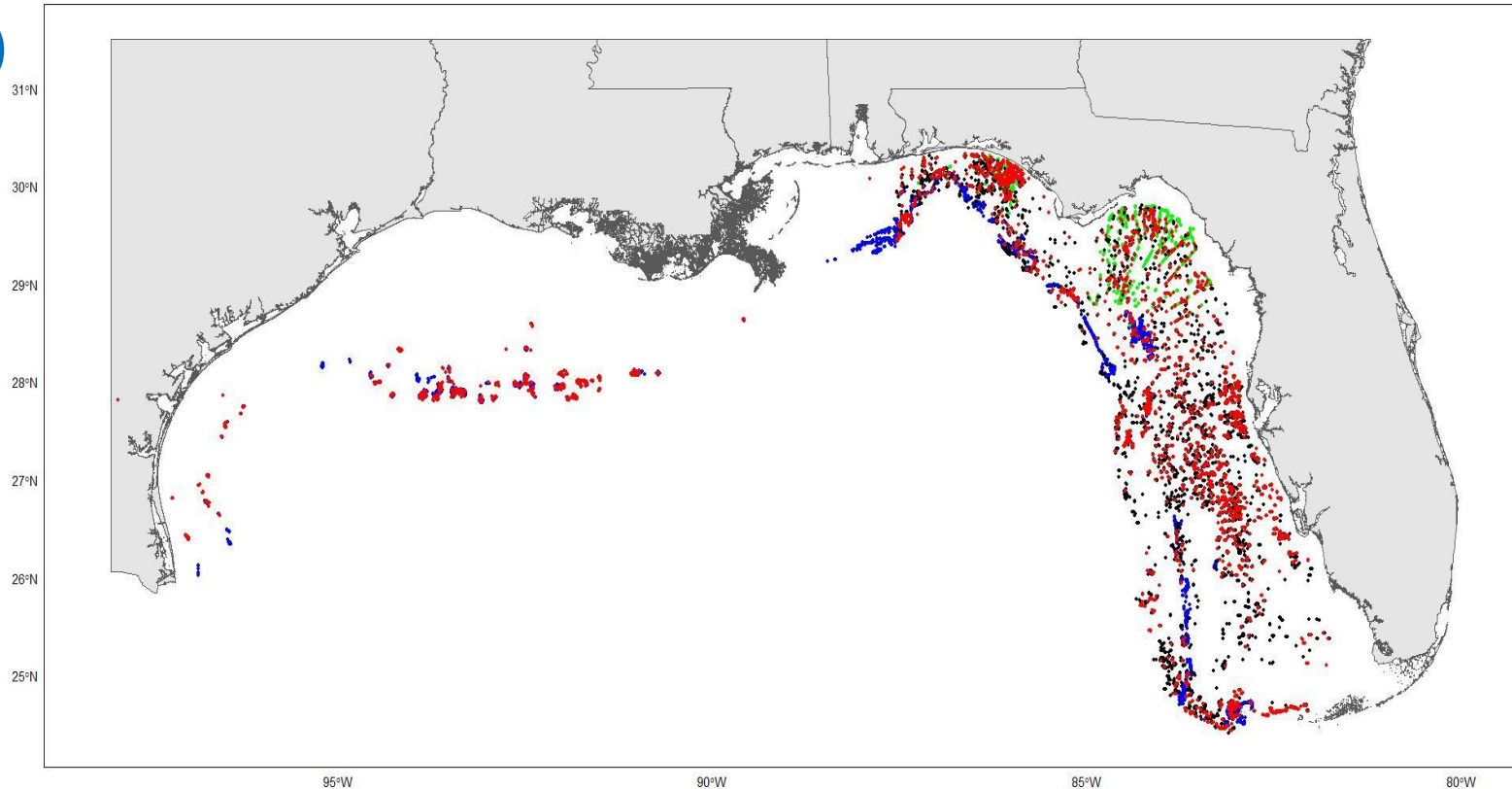


NMFS Panama City

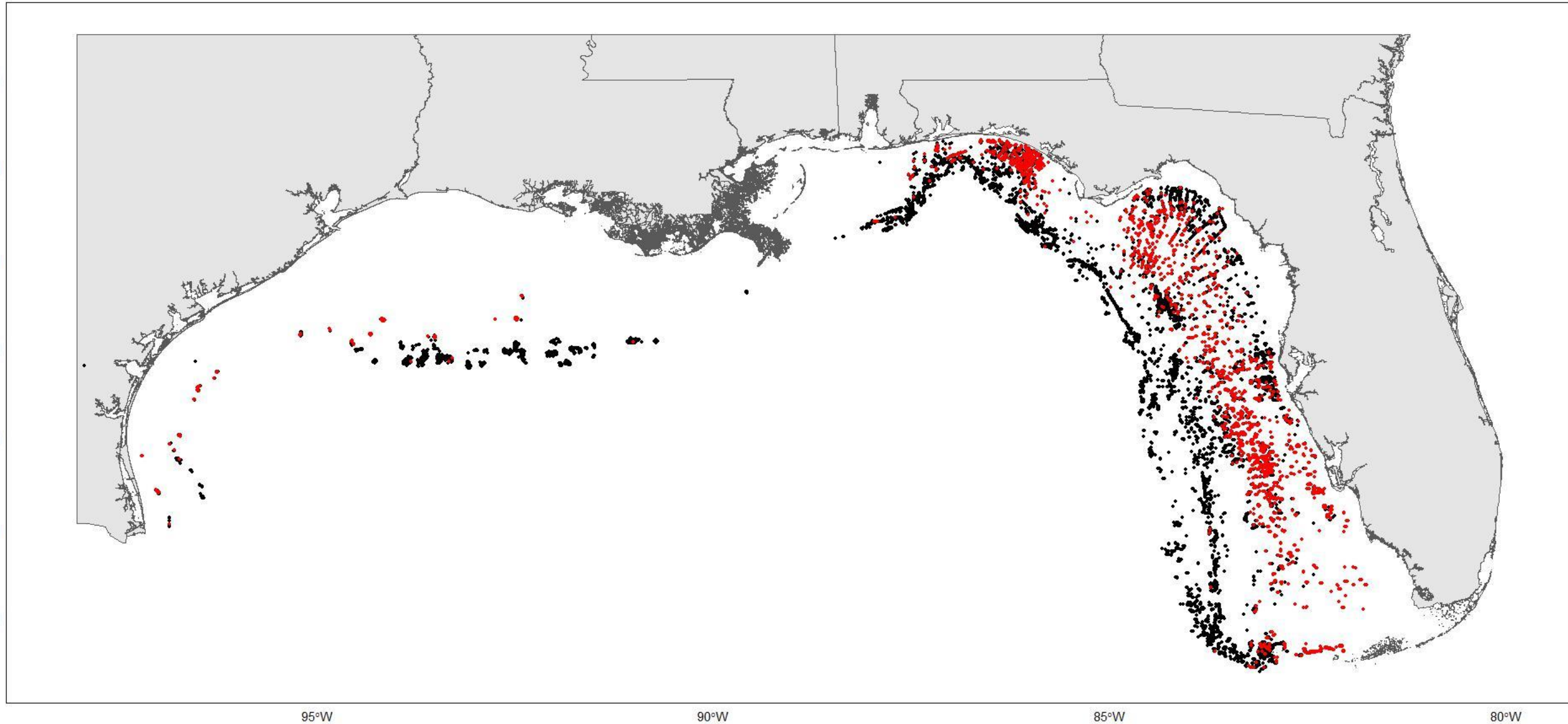


Survey Expansion

- Time series variation
 - **SFRV-NMFS Pascagoula (1993- 2019)**
 - **NMFS Panama City (2006-2019)**
 - **FWRI (zones 4/5: 2010-2019)**
 - **FWRI NFWF expansion (2016-2019)**
 - **G-FISHER (2020-2023)**
- 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
- Follow methods from SEDAR100 to produce Gulf-wide index of abundance for combined video survey



Natural Reef- *Lutjanus synagris* presence/absence



Natural Reef- Sampled by Survey

Year	SRFV_E		SRFV_W		PC_E		FWRI_E		GF_E		GF_W	
	N Sites	N Fish	N Sites	N Fish	N Sites	N Fish	N Sites	N Fish	N Sites	N Fish	N Sites	N Fish
2006	277	20	139	22	87	17						
2007	319	20	171	12	44	9						
2008	206	1	131	8	83	37						
2009	262	68	167	6	104	97						
2010	221	0	106	16	138	30	49	1				
2011	337	2	103	5	150	37	211	74				
2012	281	38	200	22	148	81	214	119				
2013	163	1	133	11	86	32	183	59				
2014	230	3	113	6	169	75	338	189				
2015	152	5	57	0	155	206	378	217				
2016	205	71	167	9	156	356	719	921				
2017	221	40	194	29	147	160	622	682				
2018	213	16	194	20	76	17	694	456				
2019	285	37	263	9	94	72	899	1083				
2020									764	1150	*	*
2021									1000	1466	285	38
2022									936	1423	309	40
2023									938	1238	281	59
Total	3372	322	2138	175	1637	1226	4307	3801	3638	5277	875	137

* No sampling occurred in the West Gulf in 2020

Natural Reef- Analytical methods-Habitat Model

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

MaxN ~ Year + Depth + Latitude + Longitude + Habitat Strata + Max Vertical Relief + Algae + Hard coral + Soft coral + Seagrass + Sponge + Unknown sessile + Rock + Sediment + Relief + Artificial



Natural Reef- Analytical methods- weighted GLM

- 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

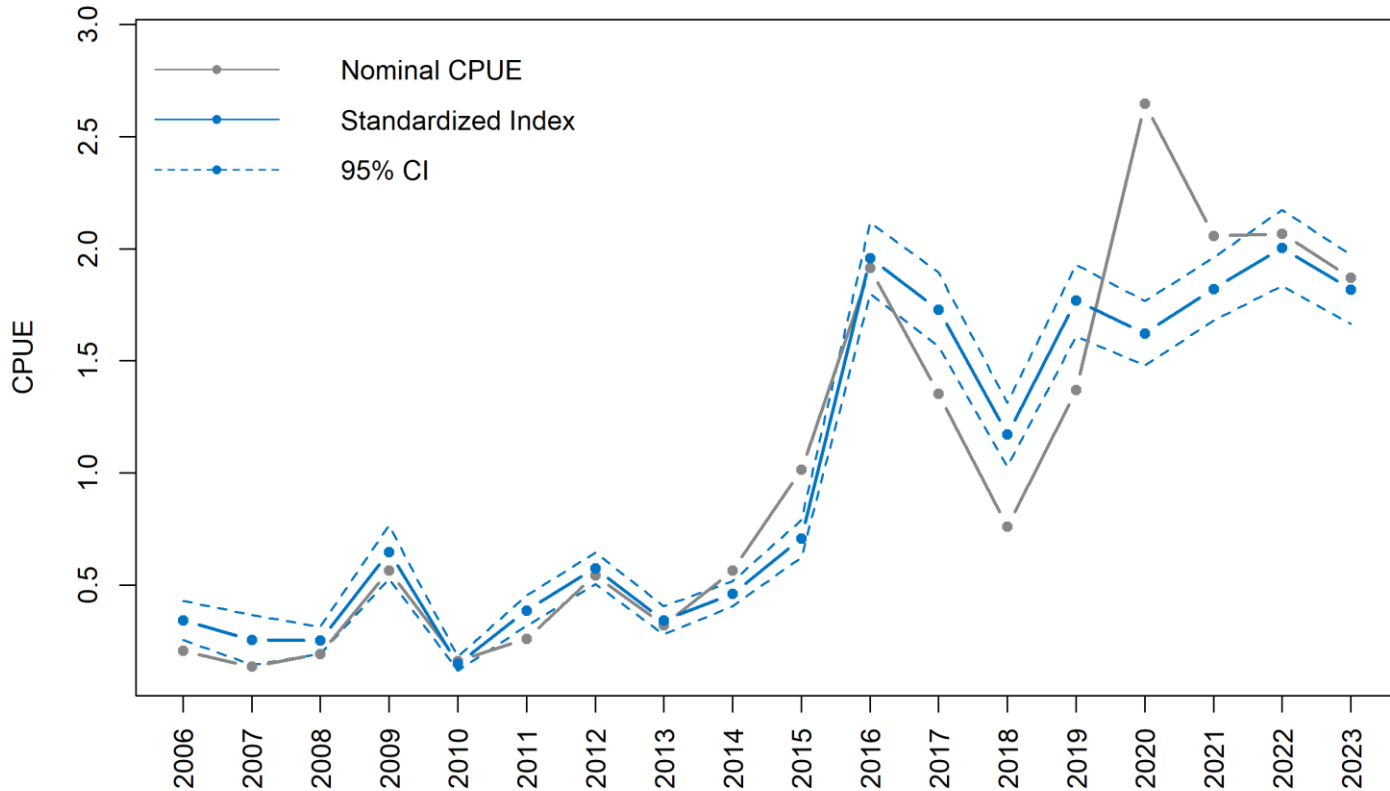
Natural Reef- Habitat

	SRFV_E			SRFV_W			PC_E			FWRI_E			GF_E			GF_W		Total
	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	L	
2006	37	142	98	38	14	87	2	30	55									503
2007	51	139	129	25	28	118	5	24	15									534
2008	34	86	86	27	15	89		44	39									420
2009	42	117	103	23	28	116	11	48	45									533
2010	19	103	99	38	16	52	36	65	37	20	6	23						514
2011	47	151	139	13	19	71	24	68	58	59	45	107						801
2012	36	123	122	47	34	119	31	64	53	69	44	101						843
2013	18	69	76	33	29	71	9	49	28	64	47	72						565
2014	36	90	104	18	17	78	30	97	42	115	99	124						850
2015	25	58	69		14	43	30	72	53	97	148	133						742
2016	22	86	97	44	32	91	29	82	45	141	304	274						1247
2017	30	89	102	53	28	113	19	77	51	109	192	321						1184
2018	20	83	110	76	31	87	11	16	49	72	217	405						1177
2019	28	120	137	55	28	180	21	48	25	143	300	456						1541
2020													199	387	178			764
2021													218	505	277	90	195	1285
2022													201	493	242	92	217	1245
2023													185	522	231	90	191	1219
Total	445	1456	1471	490	333	1315	258	784	595	889	1402	2016	803	1907	928	272	603	15967

Natural Reef- Area weights

	Survey							
	SRFV-West (2006- 2019)	SRFV-East (2006- 2019)	PC-East (2006- 2019)	FWRI (2010- 2013)	FWRI (2014- 2015)	FWRI (2016- 2019)	GF-East (2020- 2023)	GF-West (2021- 2023)
Total Universe Area (km2)	31258	37278	22105	46286	58970	144403	159028.5	31258
Area x Proportion of mapped with reef	11565.46	6428	5124	9820	11159.92	29000	30374.38	11565.46
Time Period Weighting Values								
2006-2009	0.50	0.28	0.22					
2010-2013	0.35	0.20	0.16	0.30				
2014-2015	0.34	0.19	0.15		0.32			
2016-2019	0.22	0.12	0.10			0.56		
2020-2023							0.72	0.28

Natural Reef-Index of Abundance



YEAR	N	Proportion positive	N fish	Std. Index	CV
2006	503	0.0636	59	0.3296	0.2651
2007	534	0.0318	41	0.2454	0.4585
2008	420	0.0595	46	0.2437	0.2467
2009	533	0.1163	171	0.6252	0.1917
2010	514	0.0739	47	0.1426	0.2222
2011	801	0.0836	118	0.3723	0.1842
2012	843	0.1139	260	0.5554	0.1266
2013	565	0.1133	103	0.3295	0.1927
2014	850	0.1647	273	0.4447	0.1249
2015	742	0.1846	428	0.6823	0.1220
2016	1247	0.2550	1357	1.8915	0.0848
2017	1184	0.2230	911	1.6698	0.0998
2018	1177	0.1461	509	1.1310	0.1266
2019	1541	0.1875	1201	1.7086	0.0944
2020	764	0.3469	1150	1.6223	0.0925
2021	1285	0.2918	1504	1.7590	0.0804
2022	1245	0.2843	1463	1.9360	0.0880
2023	1219	0.2830	1297	1.7564	0.0879

* No sampling in the West Gulf in 2020

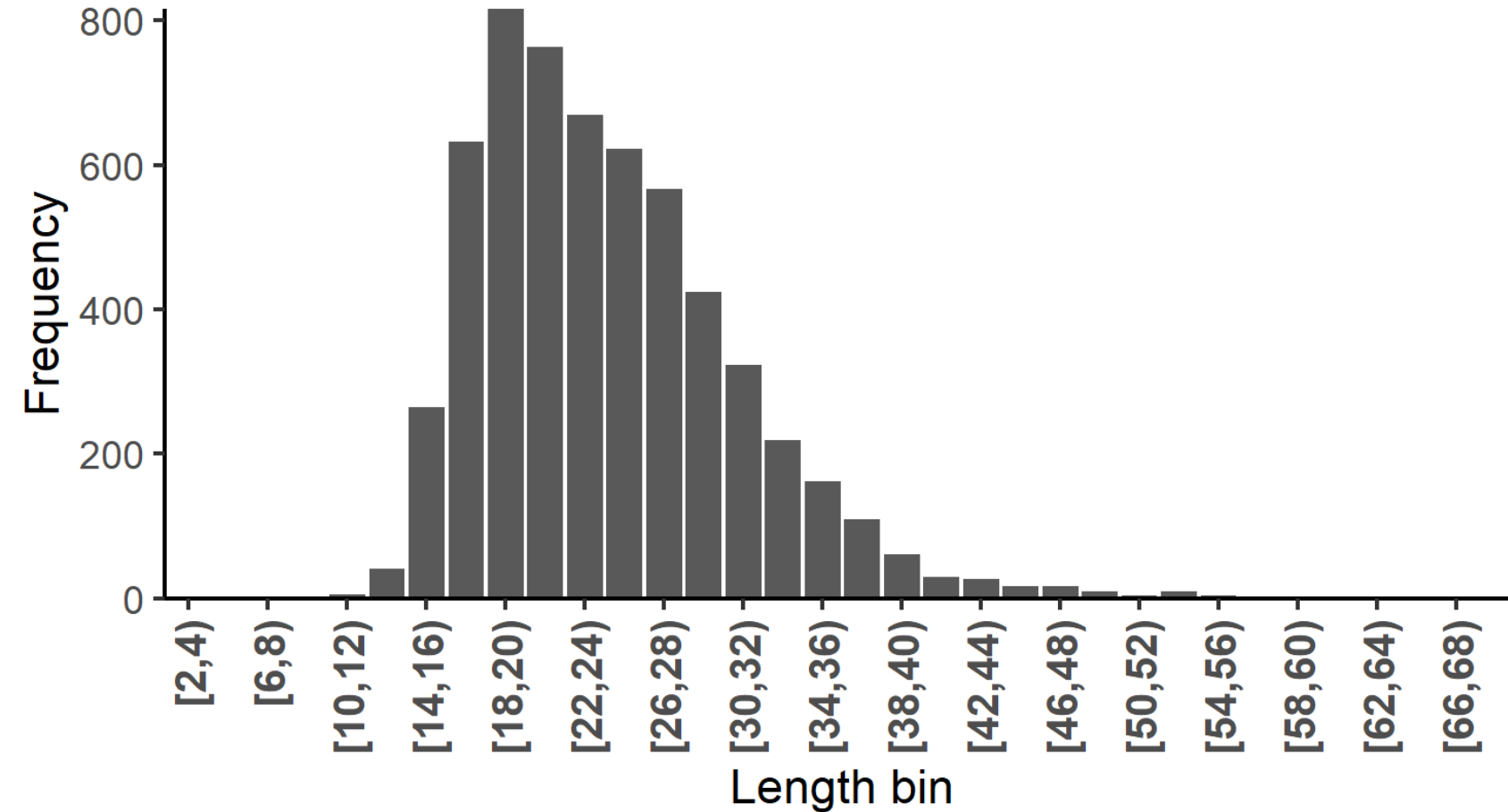
Natural Reef- Measurements by survey

	SRFV_W		SRFV_E		PC_E		FWRI_E		GF_W		GF_E		Total
	N_SITES	N_MEASURED	N_SITES	N_MEASURED	N_SITES	N_MEASURED	N_SITES	N_MEASURED	N_SITES	N_MEASURED	N_SITES	N_MEASURED	
2006	4	8	4	14	0	0							22
2007	0	0	1	3	0	0							3
2008	4	4	0	0	0	0							4
2009	0	0	10	27	11	19							46
2010	9	10	0	0	0	0	1	1					11
2011	1	1	2	2	2	2	15	25					30
2012	4	4	5	28	26	40	16	23					95
2013	3	5	1	1	6	8	17	21					35
2014	3	3	1	1	4	11	67	100					115
2015	0	0	2	3	0	0	74	138					141
2016	3	3	9	21	27	42	214	563					629
2017	10	15	5	6	26	39	166	486					546
2018	1	2	2	10	5	5	120	294					311
2019	1	4	2	15	19	26	206	663					708
2020											246	753	753
2021									3	21	266	769	790
2022									4	14	252	774	788
2023									5	52	258	735	787

Natural Reef- Length frequencies

YEAR	N_SITES	N_MEASURED
2006	8	22
2007	1	3
2008	4	4
2009	21	46
2010	10	11
2011	20	30
2012	51	95
2013	27	35
2014	75	115
2015	76	141
2016	253	629
2017	207	546
2018	128	311
2019	228	708
2020	246	753
2021	269	790
2022	256	788
2023	263	787

2006-2023



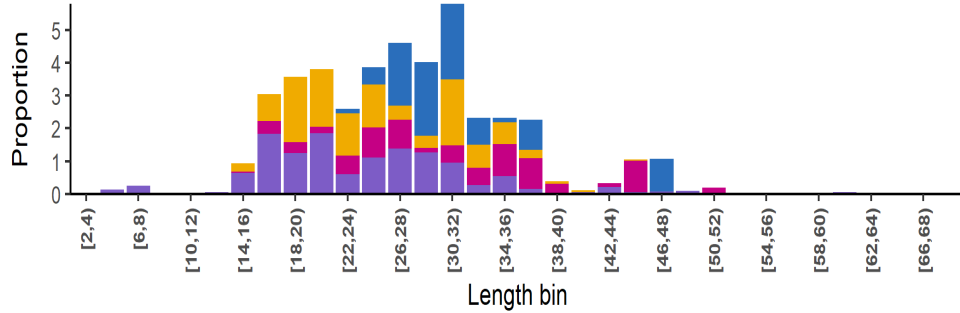
Natural Reef- Data compilation

- Annual length composition
 - Raw length frequencies
 - Mismatch with index weighting
- Weighted annual length composition
 - Bin proportion by survey and habitat
 - Habitat and area weights

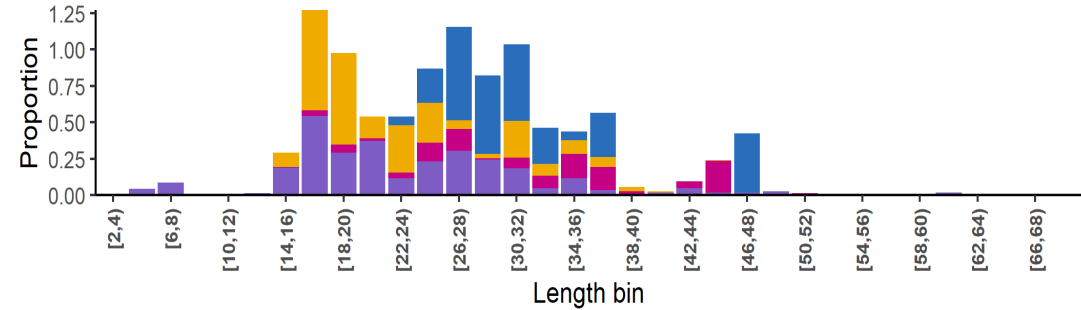
Raw length frequencies

Weighted length frequencies

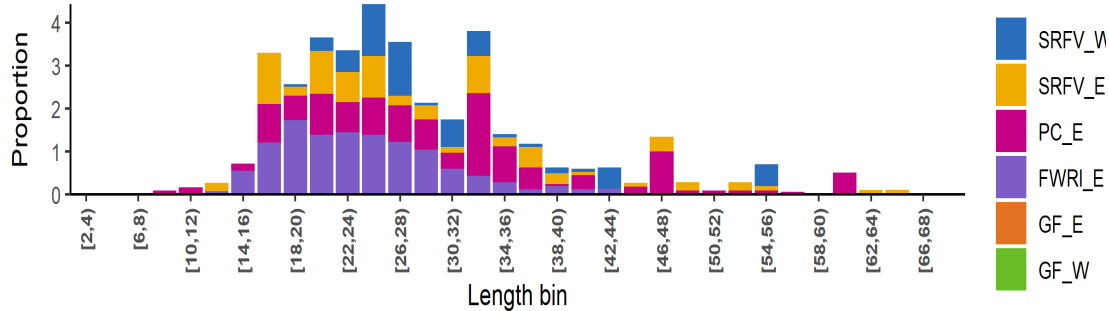
2006-2015



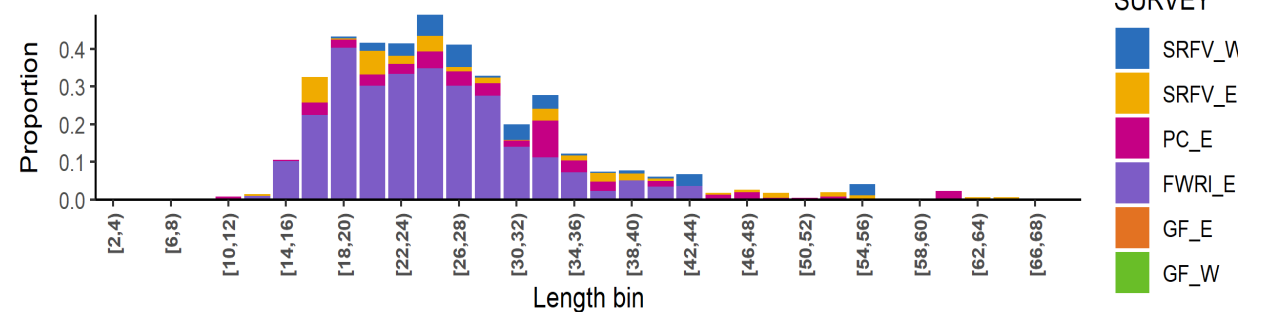
2006-2015



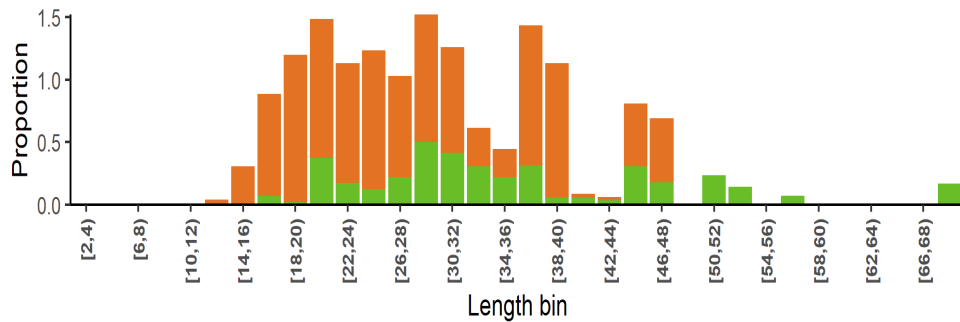
2016-2019



2016-2019



2020-2023



2020-2023

