

A ratio-based method for calibrating estimates of total landings (numbers and pounds of fish), and releases (numbers of fish) from MRIP-FCAL to SRFS for Hogfish (*Lachnolaimus maximus*) in Florida.

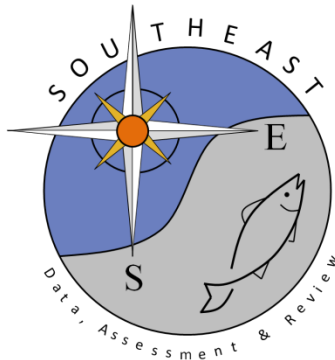
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A ratio-based method for calibrating estimates of total landings (numbers and pounds of fish), and releases (numbers of fish) from MRIP-FCAL to SRFS for Hogfish (*Lachnolaimus maximus*) in Florida.

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Due to changes in 2024 SRFS estimates due to edited sample weighting for APAIS assignments provided by MRIP

Background

In response to the need for more precise estimates of recreational catch for reef fishes, particularly from private boats, the Florida Fish and Wildlife Conservation Commission developed and implemented a survey that runs side-by-side with the historic Marine Recreational Information Program (MRIP). The MRIP is a general survey of all saltwater recreational fishing in both state and federal waters, whereas the State Reef Fish Survey (SRFS) is a supplemental, more specialized survey that directly targets participants in the reef fish fishery to collect information on effort and catch. The SRFS is the result of a decade of development and testing in Florida, in collaboration with independent statistical consultants and NOAA Fisheries scientists. The survey provides year-round, monthly estimates of fishing effort, landings, and discards for a suite of reef fish species commonly targeted by recreational anglers fishing from private boats in Florida. Initially named the Gulf Reef Fish Survey (GRFS), the methodology was implemented in May 2015 and was only conducted on the west coast of Florida, north of Monroe County (Fig. 1). In 2018, the survey design and estimation methods were peer-reviewed and subsequently certified by NOAA Fisheries as statistically valid and suitable for use (SRFS Certification Memo and design documentation, available online: <https://www.fisheries.noaa.gov/recreational-fishing-data/transitioning-new-recreational-fishing-survey-designs>). Hogfish (*Lachnolaimus maximus*) was not included as part of the suite of reef species during GRFS development in the Gulf, but was added when the survey was expanded into the Keys in mid-2020.

The SRFS runs concurrently with the MRIP survey in Florida, which has provided vital statistics on recreational fishing effort and catch in the Gulf of America and Atlantic Ocean off the coast of Florida since 1981. The SRFS and MRIP surveys use independent methods to estimate fishing effort (angler trips). The SRFS sends out 10,000 mail surveys a month to anglers who sign up for the state reef fish survey designation. This designation is required for anyone fishing for reef fish. The response rates for the mail survey are approximately 20%. Catch estimates derived from for SRFS and MRIP method are not completely independent. To estimate catch-per-unit-effort (CPUE), MRIP uses data collected in the Access Point Angler Intercept Survey (APAIS), and SRFS uses a combination of data from the APAIS and supplemental reef fish angler intercepts. Assignments for both intercept surveys are drawn together so that sample weights are compatible (Foster, 2018). Sample sizes of intercepts for Hogfish and confirmed intercepts of anglers fishing for anything are provided by year, region, and gear (Table 1).

Previous stock assessments of Florida-centric species such as Gag (SEDAR 72) and Red Grouper (SEDAR 88) in the Gulf of America and Southeast Mutton (SEDAR 79) and Yellowtail Snapper (SEDAR 96) have incorporated a time series of MRIP estimates converted to SRFS currency for historic estimates of landings and discards from recreational private boats and SRFS estimates for recent years (Cross et al., 2020a; Ramsay et al., 2024a-c). The method was developed to calibrate historic MRIP-FCAL estimates to SRFS currency and was peer-reviewed by NOAA Office of Science and Technology (OS&T) statistical consultants and approved for use (Cross et al. 2020a; Ramsay, NOAA OS&T, et al., 2024). The method is used herein to

calibrate MRIP estimates to SRFS currency for Florida Hogfish, which will facilitate the use of SRFS estimates in this assessment.

Objectives

The objective is to develop conversion factors that may be applied to annual, fully calibrated MRIP estimates, and produce a historic time series in the same currency as the SRFS for Hogfish (*Lachnolaimus maximus*) in Florida. Calibration ratios are applied to MRIP estimates by region and by region and gear to generate historic estimates for these two timeseries in the same currency as SRFS.

Methods

This analysis used private boat mode recreational estimates of total landings (numbers and pounds of fish) and releases (numbers) derived from SRFS and MRIP from January 2021 through December 2024. Overlapping estimates from the first six months of SRFS implementation (July-December 2020) were not included in this analysis due to challenges related to the global pandemic, which coincided with initial expansion of the survey. To our knowledge there are no biases in 2021-2024 data.

We did not apply calibrations at a fine scale back in time (*i.e.*, by month or area fished), as neither survey was designed to generate precise estimates at this scale. Instead, we quantified the overall differences between SRFS and FCAL estimates across the years over which the two surveys overlap by Florida assessment region. These regions were Southeast Florida (SEFL; Monroe county and the Atlantic Coast) and the West Florida Shelf (WFS; Gulf of America north of Monroe County). This allowed for a single calibration factor to be applied to FCAL estimates back in time for landings and releases. Separate conversion factors are provided by region for landings in numbers, landings in pounds, and releases in numbers.

All MRIP-FCAL landings and release estimates used in this calibration were generated by the NOAA Southeast Fisheries Science Center for the state of Florida. Variances for use in this calibration process were back-calculated using the PSE and estimate values.

To assess overall differences between SRFS and FCAL estimates the estimates (\hat{E}) and variances (\hat{V}) for each estimation method (m : *SRFS*, *FCAL*) were summed across years (y), two-month waves (w), and areas fished (a : federal or state waters) for each variable (v : number landed, pounds landed, number released) and region (r : WFS, SEFL) [1, 2].

$$\hat{E}_{m,r,v} = \sum_{m,r,v} \hat{E}_{y,w,a,m,r,v} [1]$$

$$\hat{V}(\hat{E}_{m,r,v}) = \sum_{m,r,v} \hat{V}(\hat{E}_{y,w,a,m,r,v}) [2]$$

This resulted in 6 pairs of SRFS and FCAL sums (3 variables and 2 regions; Table 1). For each of the paired sums, the ratio was calculated as the total SRFS estimate divided by the total FCAL estimate (landings and releases) [3].

$$\hat{R}_{r,v} = \frac{\hat{E}_{SRFS,r,v}}{\hat{E}_{FCAL,r,v}} [3]$$

Although SRFS and MRIP estimates are derived from survey data that are not completely independent, the strength of correlation between estimates from the two surveys is unknown. To calculate the variance of the ratio above, we assumed a 0% correlation as this is the most conservative approximation of variance if correlation between the two survey estimates is ignored (Cross et al. 2020a). This correlation percentage was recommended by peer review (Stokes et al. 2020). A delta method approximation for the variance of two independent variables was used to calculate the variance of the ratio above ($\hat{V}(\hat{R}_{r,v})$) because this method incorporates error associated with both the numerator (SRFS estimates) and denominator (FCAL estimates). The R statistical software package ‘msm’ and the function `deltamethod` (R Core Team 2023; Jackson 2011) were used to carry out these calculations.

Historic estimates from 1981-2020 were converted to SRFS currency by multiplying the annual FCAL estimate for each year, region, and variable type (number landed, pounds landing, and number released) [4] with the corresponding ratio [3]:

$$\hat{E}_{SRFS-hind,y,r,v} = \hat{R}_{r,v} \hat{E}_{FCAL,y,r,v} [4]$$

Variance was again approximated using the delta method and, once again, a 0% correlation was assumed.

From 2021-2024, when SRFS estimates could be provided, estimates were provided by region for number landed, pounds landed, and number released with associated error for each year and region.

The calculated ratios [3] were also applied to historic MRIP estimates at a finer scale of year, region, and gear type (*g*: hook and line, spear, or other) for consideration for use in the assessment [5].

$$\hat{E}_{SRFS-hind,y,r,g,v} = \hat{R}_{r,v} \hat{E}_{FCAL,y,r,g,v} [5]$$

Findings and Conclusions

For the years in which the SRFS and MRIP overlap, annual Hogfish estimates derived from SRFS and MRIP-FCAL and associated variances, observed ratios of summed SRFS to FCAL estimates, and approximate variance for each ratio are provided in table 2. The spatial distribution of Hogfish in Florida as estimated by SRFS is shown in figure 2. The annual SRFS and MRIP-FCAL estimates, as well as the cumulative sums are shown in figures 3 and 4 and by gear in figures 5 and 6 . SRFS estimates across all years and gear types are shown in table 3. SRFS estimate error is not capped at 100%. The calibration, run by region, ratios were smaller for the west Florida shelf (lbs of fish = 0.50, numbers of fish = 0.46, and releases=0.52) than the southeast Florida region (lbs of fish = 0.81, numbers of fish = 0.68, and releases=0.97). This indicates that the differences in estimates between these two surveys are larger in the Gulf than in the South Atlantic, as has been seen with other species (Ramsay et al. 2024a-c). Median PSE values for the calibrated landings in numbers, landings in pounds, and releases estimates were 55%, 56%, 84%, respectively for the annual estimates. Error is larger in the Southeast FL region for landings and larger on the West Florida Shelf for releases. The annual MRIP, SRFS, and calibrated estimates are provided from 1981-2020 for both the West Florida Shelf (Table 4; Fig. 7) and Southeast FL (Table 5; Fig. 8) regions. By gear, median PSE values for the calibrated landings in numbers, landings in pounds, and releases estimates were 62%, 63%, and 85%, respectively for hook and line anglers. The median PSE values were 55%, 56%, and 109%, for landings in numbers, landings in pounds, and release estimates respectively for the spear gear type. PSE values around or above 100% are due to MRIP PSE values being capped at 100%, with the added error from the calibration ratio. The annual MRIP, SRFS, and calibrated estimates by gear are provided from 1981-2020 for both the West Florida Shelf (Table 6 & 8 ; Fig. 9 & 10) and Southeast FL (Table 7 & 9; Fig. 11 & 12) regions.

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Saltwater Recreational Fishing Survey Map

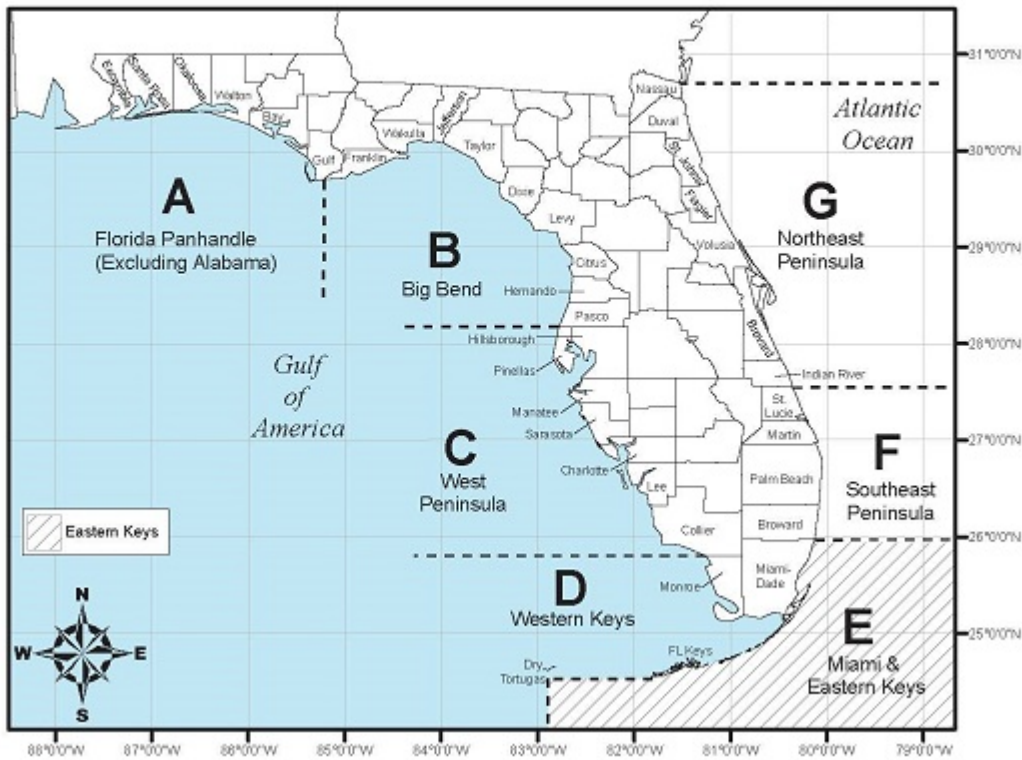


Figure 1. The Gulf Reef Fish Survey was only conducted in regions A-C. In July 2020, the survey was expanded to encompass all of Florida, was renamed the State Reef Fish Survey (SRFS), and Hogfish was added as a SRFS species. The West FL Shelf (WFS) regions are A-C and the Southeast FL (SEFL) regions are D-G.

Table 1. The sample sizes of total confirmed trip interviews completed by dockside samplers either through APAIS or SRFS supplemental sampling as well as the sample sizes of the total confirmed trip interviews where anglers harvested or released a Hogfish (*Lachnolaimus maximus*) are shown. Sample sizes are split by year and the Southeast FL (SEFL) or West Florida Shelf (WFS) regions.

Region	Year	Assignments	Interviews	Hogfish Trips	Hogfish Trips SP	Hogfish Trips HL
SEFL	2021	587	1538	56	23	33
	2022	649	1688	61	20	41
	2023	757	2256	67	22	45
	2024	640	1763	47	21	26
WFS	2021	607	1561	67	9	58
	2022	316	690	61	14	47
	2023	405	938	100	17	83
	2024	372	915	95	21	74

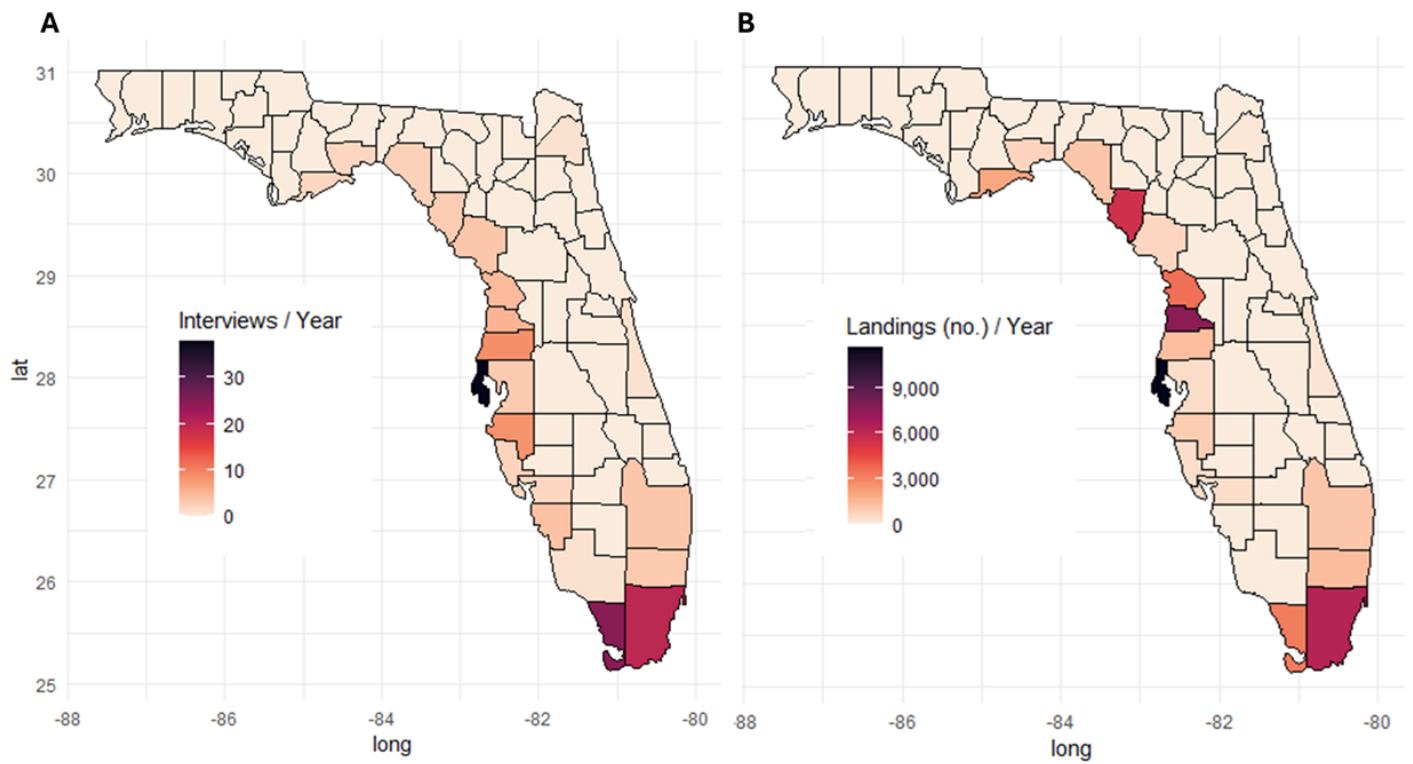


Figure 2. The spatial distribution of the number of interviews conducted where anglers caught or targeted Hogfish (*Lachnolaimus maximus*) per year (A) and the spatial distribution of the amount of Hogfish landed per year (no. fish; B) are shown.

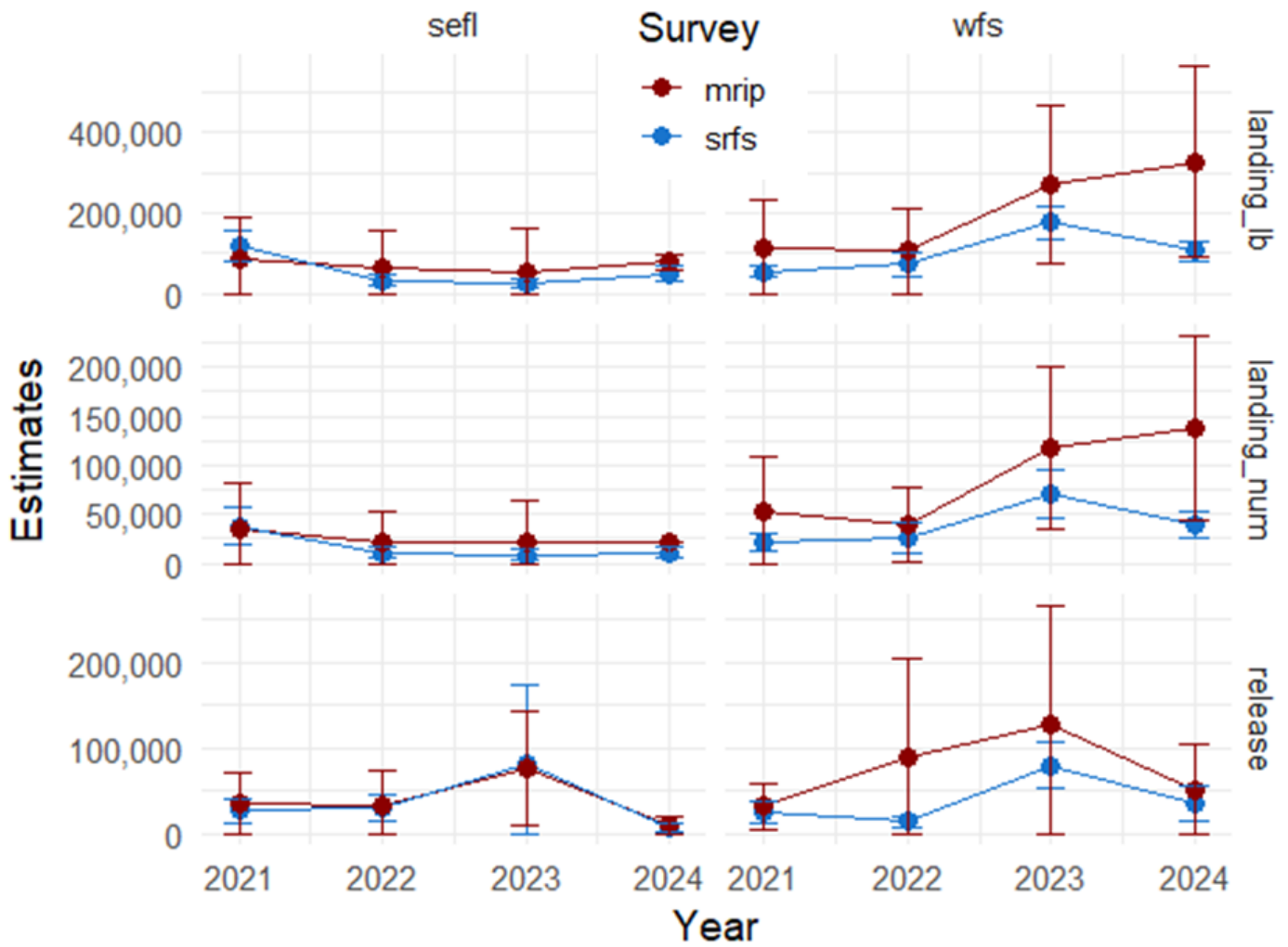


Figure 3. Estimates of landings and releases of Hogfish (*Lachnolaimus maximus*) across years in the Southeast Florida (sefl) or the West Florida Shelf (wfs) regions. Estimates generated by SRFS are shown in blue and estimates generated by MRIP are shown in red. Error bars depict 95% confidence limits.

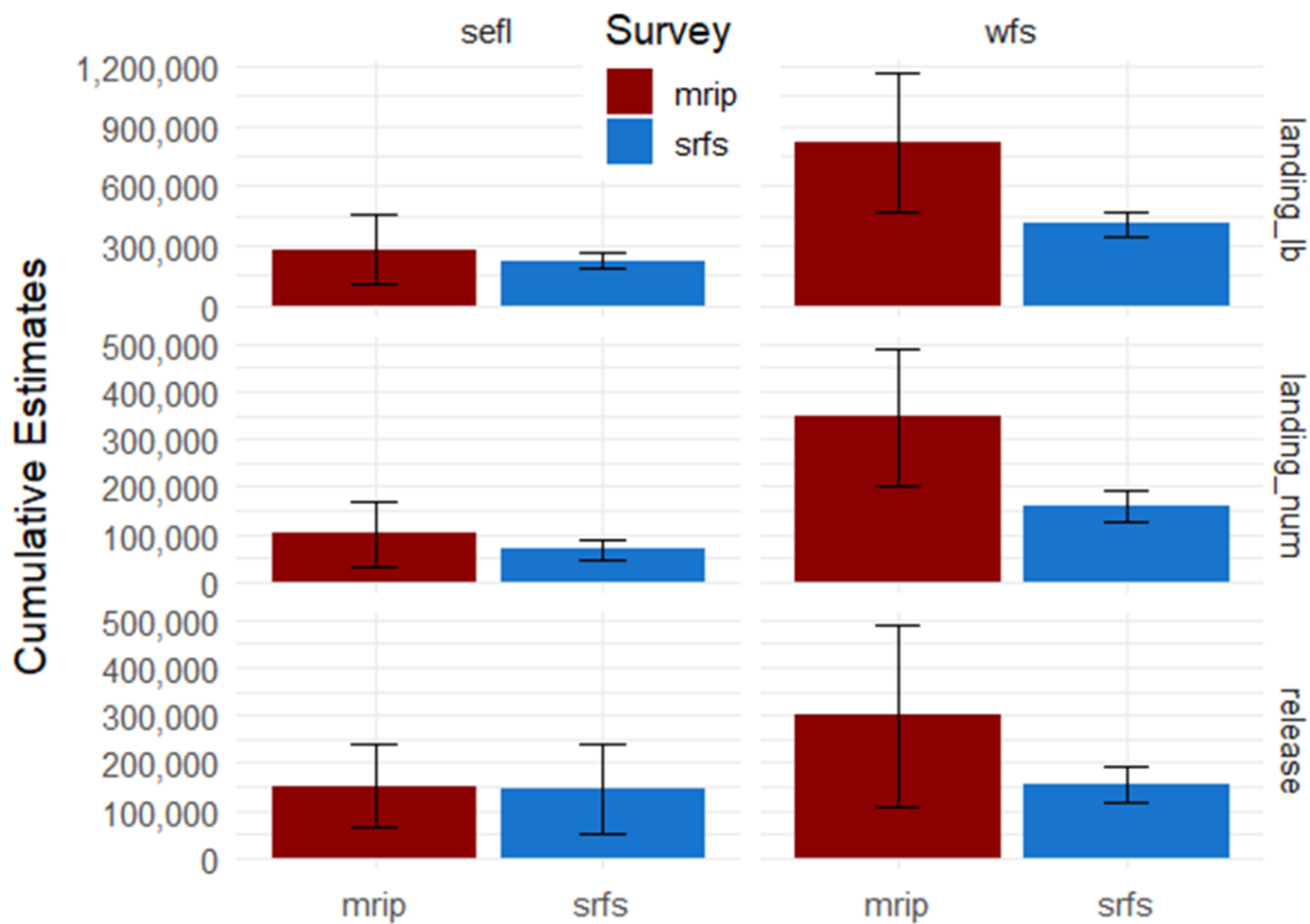


Figure 4. Estimates of landings and releases of Hogfish (*Lachnolaimus maximus*) cumulative across time in the Southeast Florida (sefl) or the West Florida Shelf (wfs) regions. Estimates generated by SRFS are shown in blue and estimates generated by MRIP are shown in red. Error bars depict 95% confidence limits.

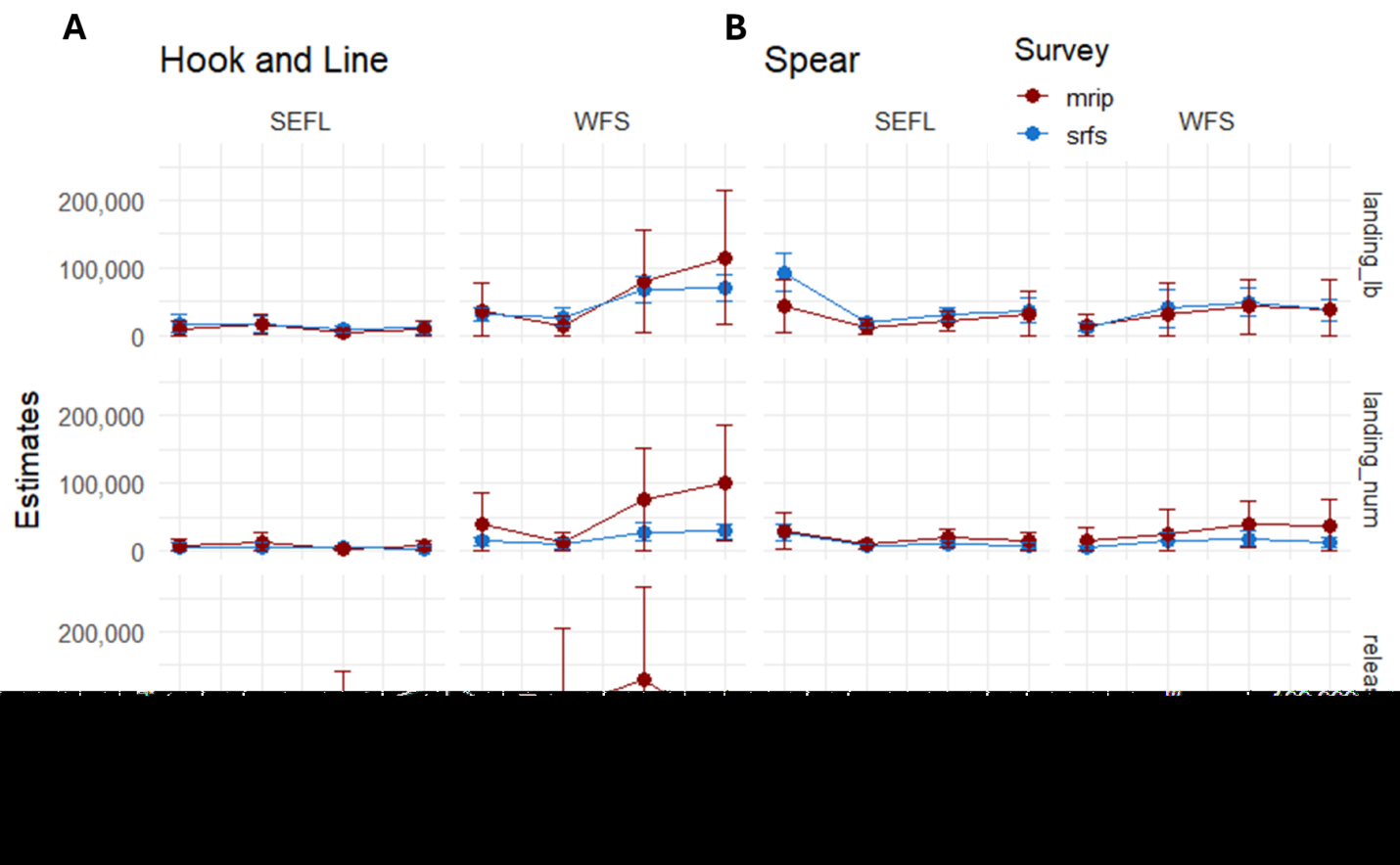


Figure 4. Estimates of landings and releases of Hogfish (*Lachnolaimus maximus*) across years in the Southeast Florida (sefl) and the West Florida Shelf (wfs) regions. Estimates are shown by gear type, either hook and line (A) or spear (B). Estimates generated by SRFS are shown in blue and estimates generated by MRIP are shown in red. Error bars depict 95% confidence limits.

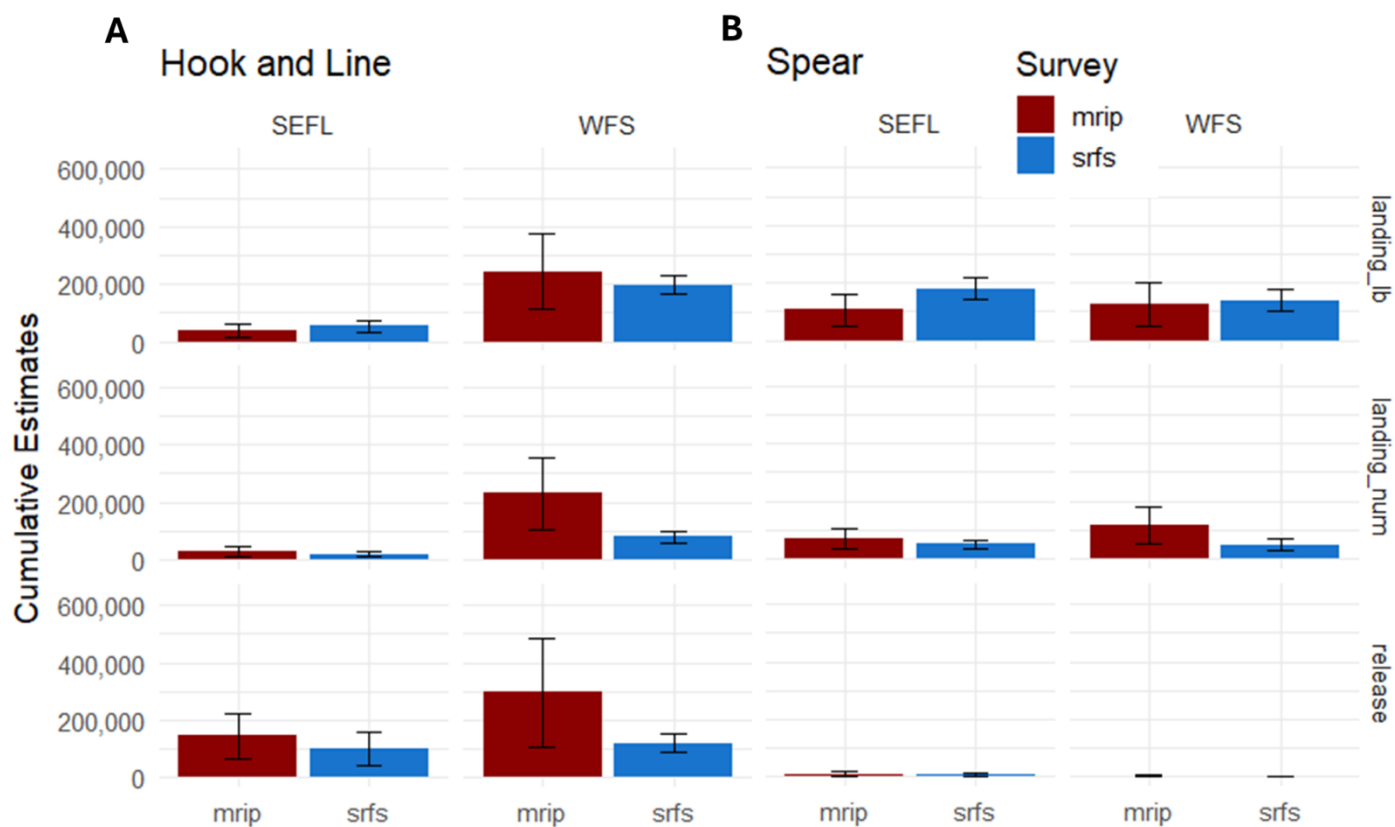


Figure 5. Estimates of landings and releases of Hogfish (*Lachnolaimus maximus*) cumulative across time in the Southeast Florida (sefl) or the West Florida Shelf (wfs) regions. Estimates are shown by gear type, either hook and line (A) or spear (B). Estimates generated by SRS are shown in blue and estimates generated by MRIP are shown in red. Error bars depict 95% confidence limits.

Table 2. Annual and summed SRFS and MRIP estimates (sum), variances, and ratios of MRIP to SRFS estimates are shown for Hogfish (*Lachnolaimus maximus*) in Florida. Estimates in Florida are separated into the West Florida Shelf (WFS) and Southeast Florida (SEFL) regions.

Estimate Type	Region	Year	SRFS Sum	SRFS Variance	MRIP Sum	MRIP Variance	Ratio
Landings (lbs)	SE FL	2021	119,049	355,997,819	83,249	2,932,257,360	0.8058
		2022	32,443	39,148,037	64,826	2,152,538,032	
		2023	25,707	22,199,516	54,539	2,974,484,445	
		2024	48,457	106,832,040	77,422	103,838,500	
		Total	225,656	524,177,412	280,036	8,163,118,336	
	WFS	2021	53,846	55,409,634	113,592	3,772,130,953	0.498
		2022	72,288	235,005,478	105,252	2,905,354,712	
		2023	176,351	415,290,972	270,690	10,188,288,303	
		2024	104,316	168,447,241	327,391	14,759,467,485	
		Total	406,802	874,153,325	816,925	31,625,241,453	
Landings (no. fish)	SE FL	2021	37,706	90,553,462	35,679	537,825,622	0.6845
		2022	10,809	8,970,829	22,229	249,089,046	
		2023	9,164	7,272,993	21,935	481,156,110	
		2024	11,258	10,224,812	20,866		
		Total	68,936	117,022,096	100,709	1,268,070,778	
	WFS	2021	22,103	19,313,997	53,217	825,812,870	0.4551
		2022	25,989	68,132,605	38,622	372,913,414	
		2023	70,503	149,839,327	117,169	1,779,222,150	
		2024	39,019	43,652,153	137,299	2,309,242,664	
		Total	157,614	280,938,083	346,306	5,287,191,099	
Releases (no. fish)	SE FL	2021	27,592	52,178,270	35,293	349,890,005	0.9662
		2022	29,573	57,801,744	31,680	437,164,847	
		2023	82,070	2,183,784,136	76,103	1,172,820,696	
		2024	8,083	6,867,913	9,402	33,980,857	
		Total	147,319	2,300,632,064	152,478	1,993,856,404	
	WFS	2021	25,338	41,684,490	32,259	192,413,428	0.5167
		2022	14,287	11,681,558	88,070	3,481,842,776	
		2023	80,030	187,579,838	127,500	4,917,535,439	
		2024	34,952	105,438,073	51,367	741,179,090	
		Total	154,607	346,383,958	299,197	9,332,970,733	

Table 3. Annual SRFS estimates and error by year (2021-2024), region (southeast Florida [SEFL] or the west Florida shelf [WFS]), and gear type (spear, hook and line, or combined).

Gear	Region	Year	Landings (no.fish)		Landings (lbs fish)		Releases (no. fish)	
			Estimate	PSE	Estimate	PSE	Estimate	PSE
Combined	SEFL	2021	37,706	25.2	119,049	15.8	27,592	26.2
		2022	10,809	27.7	32,443	19.3	29,573	25.7
		2023	9,164	29.4	25,707	18.3	82,070	56.9
		2024	11,258	28.4	48,457	21.3	8,083	32.4
	WFS	2021	22,103	19.9	53,846	13.8	25,338	25.5
		2022	25,989	31.8	72,288	21.2	14,287	23.9
		2023	70,503	17.4	176,351	11.6	80,030	17.1
		2024	39,019	16.9	104,316	12.4	34,952	29.4
Hook and Line	SEFL	2021	5,756	54.0	17,102	37.9	16,781	28.6
		2022	6,192	50.7	17,147	35.7	21,482	29.4
		2023	3,959	50.2	8,730	33.2	55,812	49.2
		2024	3,700	53.7	11,848	40.1	6,868	32.7
	WFS	2021	13,641	22.4	31,995	15.4	21,240	27.4
		2022	10,045	37.4	26,522	25.9	14,278	23.4
		2023	28,256	22.5	68,658	14.7	50,132	21.1
		2024	28,403	19.8	70,703	14.2	33,793	30.3
Spear	SEFL	2021	27,456	23.5	93,013	15.8	6,089	78.0
		2022	6,544	28.7	19,460	19.0	0	NA
		2023	10,302	25.5	30,719	15.2	165	90.0
		2024	7,558	33.1	36,609	25.1	928	125.6
	WFS	2021	4,786	39.8	12,294	26.5	673	150.7
		2022	13,759	53.3	39,600	34.9	0	NA
		2023	18,477	32.3	48,910	21.4	0	NA
		2024	12,064	30.1	37,196	22.7	0	NA

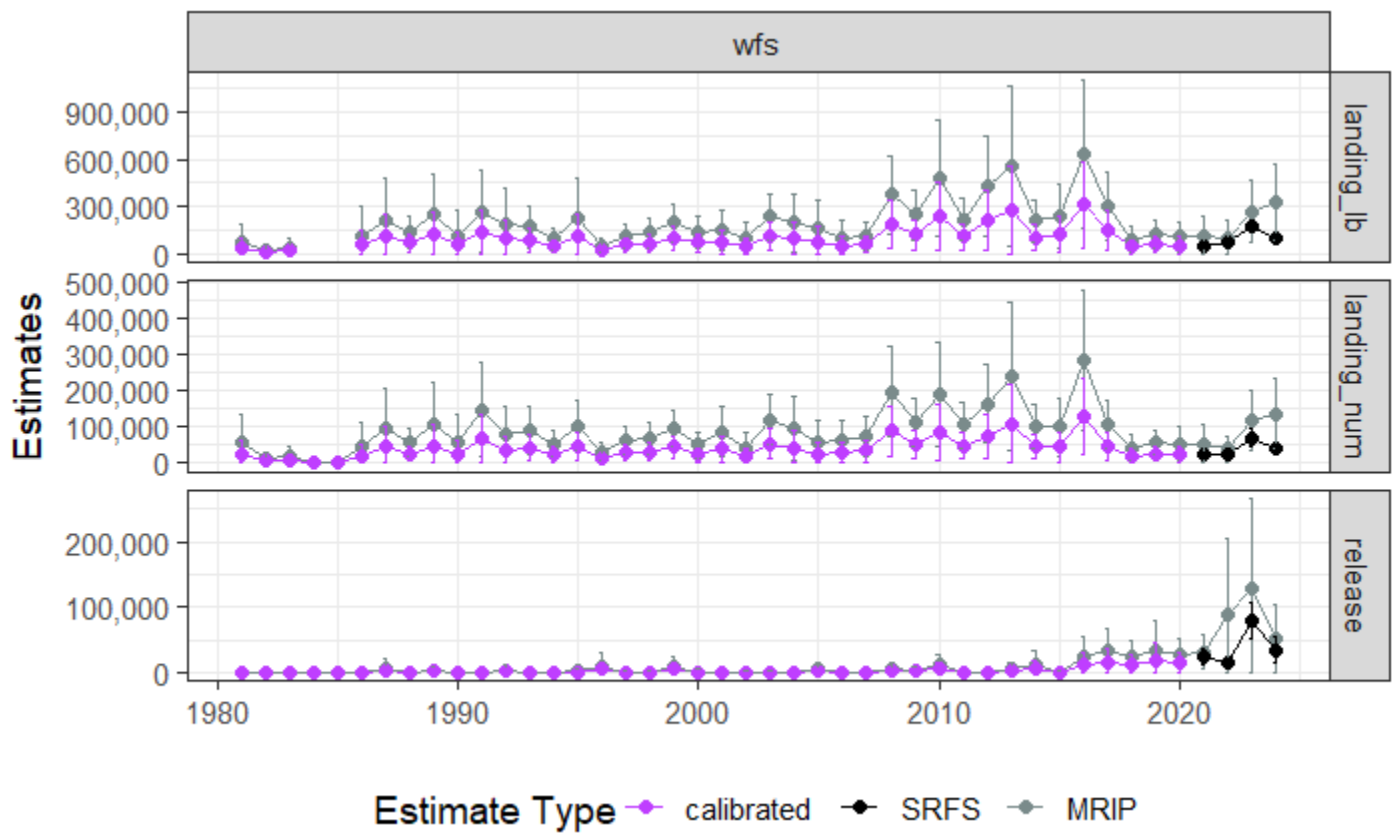


Figure 7. Hogfish (*Lachnolaimus maximus*) annual estimates on the West Florida Shelf (wfs), including original MRIP-FCAL time-series (MRIP), SRFS estimates (SRFS), and the MRIP-FCAL time-series calibrated to SRFS currency (calibrated). Estimates are shown from 1981-2024. Landings in pounds (landing_lb), landings in numbers of fish (landing_num), and releases in numbers of fish (release) are shown. Error bars are 95% confidence limits.

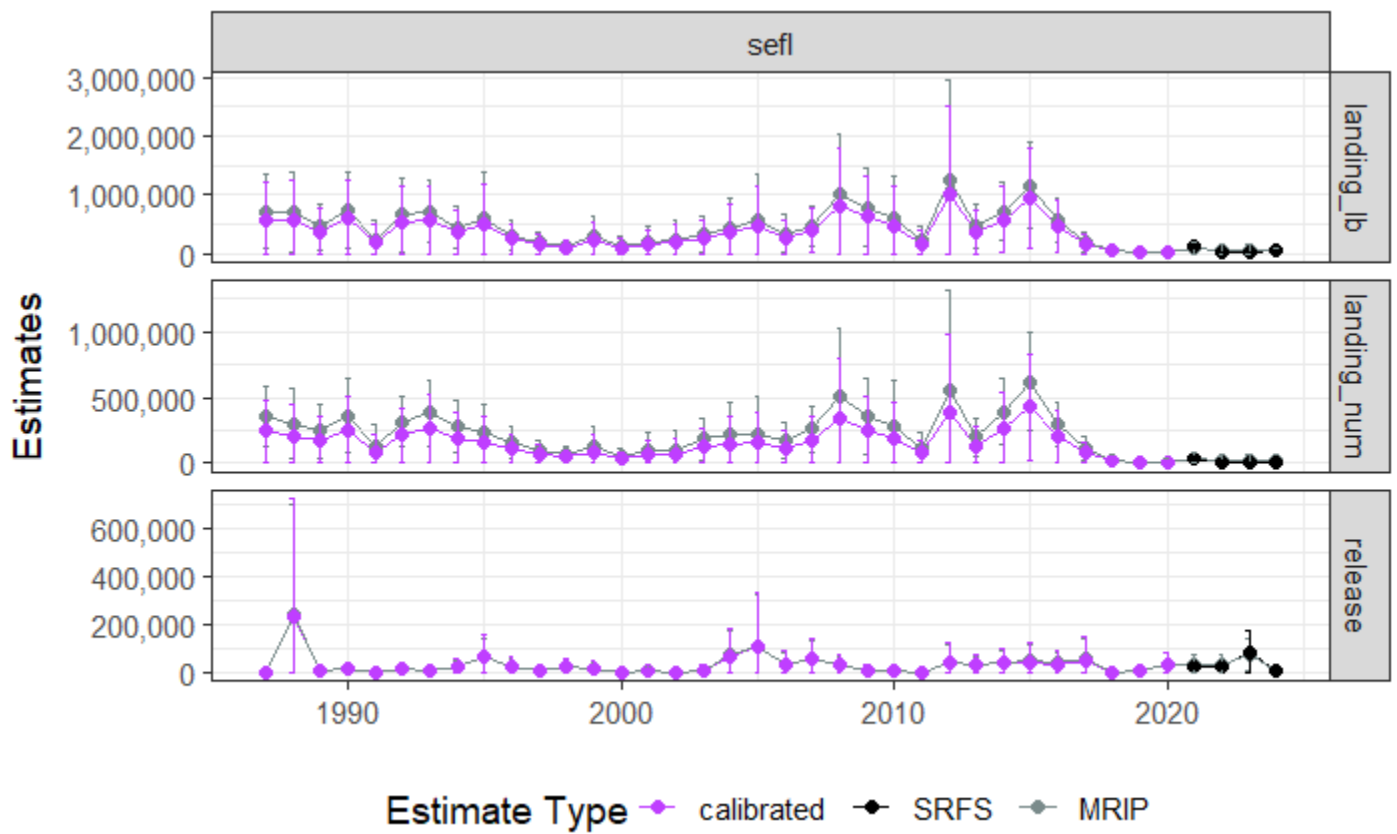


Figure 8. Hogfish (*Lachnolaimus maximus*) annual estimates in Southeast Florida (sefl), including original MRIP-FCAL time-series (MRIP), SRFS estimates (SRFS), and the MRIP-FCAL time-series calibrated to SRFS currency (calibrated). Estimates are shown from 1990-2024. Particularly high values in the 1980s are not shown. Landings in pounds (landing_lb), landings in numbers of fish (landing_num), and releases in numbers of fish (release) are shown. Error bars are 95% confidence limits.

Table 4. Original and calibrated MRIP-FCAL annual estimates for Hogfish (*Lachnolaimus maximus*) landing and release estimates in Florida from 1981-2020 on the West Florida Shelf.

Year	MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration	
	Landings (no.fish)	PSE	Landings (no. fish)	PSE	Landings (pounds)	PSE	Landings (pounds)	PSE	Releases (no.fish)	PSE	Releases (no. fish)	PSE
1981	58,163	66	26,472	70	78,568	68	39,124	72	0	NA	0	NA
1982	13,187	67	6,002	71	24,280	71	12,090	75	0	NA	0	NA
1983	19,922	73	9,067	77	41,438	78	20,635	81	0	NA	0	NA
1984	0	NA	0	NA	NA	NA	0	NA	0	NA	0	NA
1985	0	NA	0	NA	NA	NA	0	NA	0	NA	0	NA
1986	44,949	76	20,458	80	117,873	78	58,697	81	0	NA	0	NA
1987	98,583	57	44,868	62	214,772	63	106,949	67	6,828	100	3,528	106
1988	59,417	33	27,042	41	140,540	37	69,984	44	0	NA	0	NA
1989	107,300	54	48,835	59	247,925	54	123,459	59	3,471	100	1,794	106
1990	59,179	66	26,934	70	118,390	67	58,954	71	0	NA	0	NA
1991	148,305	45	67,498	51	268,388	50	133,649	55	0	NA	0	NA
1992	78,425	51	35,693	56	193,698	61	96,455	65	4,522	100	2,337	106
1993	91,847	37	41,802	44	170,043	40	84,676	46	0	NA	0	NA
1994	54,325	34	24,725	41	95,668	37	47,639	44	0	NA	0	NA
1995	104,008	34	47,337	41	225,326	57	112,205	61	2,149	100	1,110	106
1996	32,345	36	14,721	43	52,916	40	26,351	46	10,420	100	5,385	106
1997	61,863	31	28,155	39	112,034	36	55,789	43	758	100	392	106
1998	70,095	33	31,902	41	132,155	38	65,809	44	1,005	100	519	106
1999	96,530	25	43,933	34	196,016	32	97,610	39	9,699	86	5,012	93
2000	50,080	37	22,793	44	138,954	37	69,195	44	1,731	100	895	106
2001	87,355	39	39,758	46	153,232	43	76,305	48	0	NA	0	NA
2002	43,270	51	19,693	56	98,596	53	49,098	58	703	100	363	106
2003	119,835	29	54,540	37	236,133	31	117,587	39	964	100	498	106
2004	95,533	48	43,480	53	195,716	49	97,460	54	1,557	100	805	106
2005	57,129	56	26,001	61	158,673	58	79,014	63	5,687	71	2,939	79
2006	61,595	49	28,034	54	104,304	54	51,940	59	457	100	236	106
2007	74,747	39	34,020	46	114,035	41	56,786	47	0	NA	0	NA
2008	196,342	32	89,361	40	374,830	34	186,653	41	5,571	50	2,879	61
2009	112,822	29	51,349	37	246,725	32	122,861	40	4,576	58	2,364	67
2010	190,741	38	86,812	45	484,076	38	241,054	45	11,815	71	6,106	79
2011	104,864	30	47,726	38	219,463	32	109,285	39	1,512	100	781	106
2012	164,917	34	75,058	41	430,857	38	214,553	44	0	NA	0	NA
2013	241,355	43	109,847	49	556,828	46	277,282	52	7,081	56	3,659	66
2014	103,594	30	47,149	38	209,496	32	104,322	39	11,501	94	5,943	100
2015	99,868	41	45,453	47	244,715	42	121,860	48	833	100	430	106
2016	283,038	35	128,819	42	633,307	38	315,366	44	24,766	62	12,797	71
2017	105,345	32	47,946	40	303,440	36	151,103	43	32,367	54	16,725	64
2018	43,175	44	19,650	50	92,924	46	46,273	51	25,008	49	12,923	60
2019	55,747	31	25,372	39	125,548	35	62,519	42	35,194	66	18,186	74
2020	53,240	44	24,231	50	109,428	44	54,492	50	27,653	48	14,289	59

Table 5. Original and calibrated MRIP-FCAL annual estimates for Hogfish (*Lachnolaimus maximus*) landing and release estimates in Florida from 1981-2020 in Southeast Florida.

Year	MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration	
	Landings (no.fish)	PSE	Landings (no. fish)	PSE	Landings (pounds)	PSE	Landings (pounds)	PSE	Releases (no.fish)	PSE	Releases (no. fish)	PSE
1981	1,876,238	67	1,284,306	77	2,691,775	69	2,169,061	77	0	NA	0	NA
1982	155,783	65	106,635	76	346,218	69	278,986	77	0	NA	0	NA
1983	282,604	66	193,446	77	773,394	73	623,209	80	0	NA	0	NA
1984	9,620,456	93	6,585,310	101	11,030,951	93	8,888,857	99	0	NA	0	NA
1985	243,017	100	166,348	107	325,370	100	262,187	106	0	NA	0	NA
1986	182,479	49	124,909	62	373,179	54	300,712	64	0	NA	0	NA
1987	357,124	32	244,456	50	713,469	45	574,921	56	2,809	100	2,714	109
1988	302,578	46	207,118	60	719,516	49	579,793	59	238,584	99	230,511	108
1989	245,683	43	168,173	58	457,178	44	368,399	55	5,558	100	5,370	109
1990	358,954	40	245,708	56	744,966	44	600,301	55	16,659	67	16,095	80
1991	128,420	69	87,905	79	239,892	71	193,307	79	0	NA	0	NA
1992	311,542	31	213,254	50	671,28	48	540,923	58	18,394	64	17,771	78
1993	381,828	34	261,365	52	722,833	38	582,466	51	5,496	100	5,310	109
1994	274,170	37	187,673	54	452,241	40	364,421	52	22,660	64	21,894	78
1995	228,425	50	156,359	63	610,499	65	491,947	73	70,639	54	68,249	70
1996	158,963	38	108,812	54	312,650	42	251,936	54	25,247	71	24,392	83
1997	93,646	45	64,102	59	189,969	48	153,079	59	11,748	51	11,350	67
1998	69,179	47	47,354	61	124,010	50	99,928	61	25,364	59	24,506	73
1999	130,240	60	89,151	71	286,833	62	231,133	71	19,709	61	19,043	75
2000	46,634	72	31,922	82	125,116	72	100,820	80	1,411	0	1,363	44
2001	97,981	69	67,069	79	203,240	70	163,773	78	9,942	100	9,605	109
2002	105,024	71	71,890	81	239,830	72	193,258	80	3,258	100	3,148	109
2003	183,309	43	125,477	58	347,298	45	279,856	56	11,505	100	11,116	109
2004	219,187	57	150,036	69	453,444	58	365,390	67	73,114	72	70,640	84
2005	223,138	66	152,741	77	580,170	68	467,507	76	108,552	100	104,879	109
2006	168,271	42	115,183	57	340,287	48	274,207	59	35,917	70	34,702	83
2007	261,279	34	178,848	52	485,750	36	391,423	49	57,509	70	55,563	83
2008	507,684	52	347,516	65	1,000,049	53	805,850	63	30,705	59	29,666	73
2009	355,757	41	243,519	56	794,482	43	640,202	55	10,293	100	9,945	109
2010	278,997	63	190,977	74	595,535	63	479,889	72	6,353	100	6,138	109
2011	109,994	56	75,292	68	217,116	57	174,954	66	3,661	100	3,537	109
2012	559,152	69	382,746	79	1,242,235	70	1,001,006	78	43,971	87	42,483	97
2013	197,107	36	134,922	53	463,587	40	373,564	53	34,640	51	33,468	67
2014	389,256	33	266,450	51	723,016	35	582,614	49	44,804	54	43,288	70
2015	621,796	30	425,626	49	1,160,308	32	934,988	47	46,286	77	44,720	89
2016	299,489	29	205,004	48	581,265	32	468,390	47	38,893	57	37,577	72
2017	110,626	42	75,724	57	201,055	45	162,012	56	54,686	82	52,836	93
2018	27,027	63	18,500	74	65,145	64	52,494	72	3,932	100	3,799	109
2019	8,311	0	5,689	39	20,198	17	16,276	38	9,381	100	9,063	109
2020	13,112	72	8,975	82	30,036	72	24,203	80	32,406	80	31,309	91

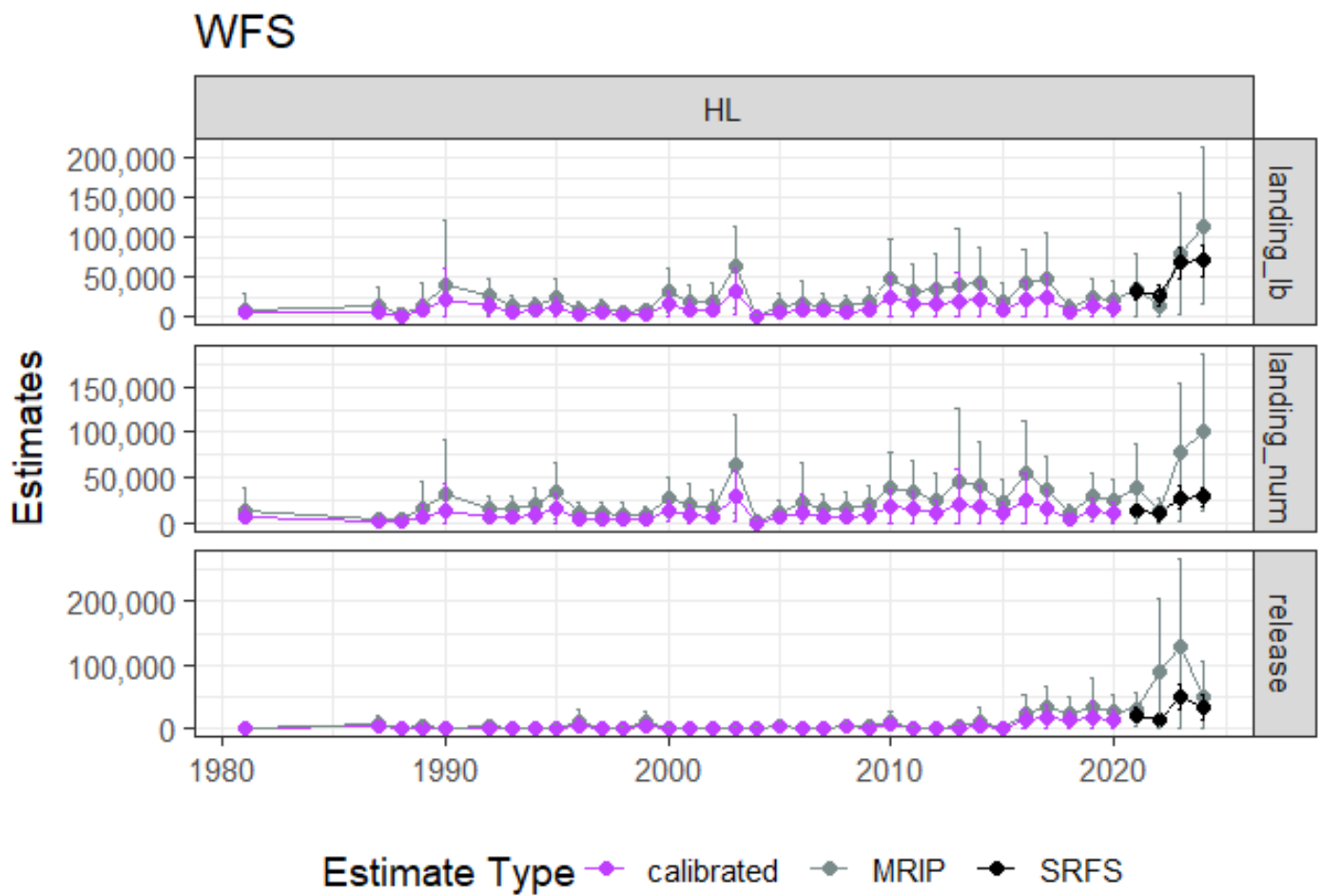


Figure 9. Hogfish (*Lachnolaimus maximus*) annual estimates on the West Florida Shelf (wfs) for only the hook and line (HL) gear type. Annual estimates shown include original MRIP-FCAL time-series (MRIP), SRFS estimates (SRFS), and the MRIP-FCAL time-series calibrated to SRFS currency (calibrated). Estimates are shown from 1981-2024. Landings in pounds (landing_lb), landings in numbers of fish (landing_num), and releases in numbers of fish (release) are shown. Error bars are 95% confidence limits.

WFS

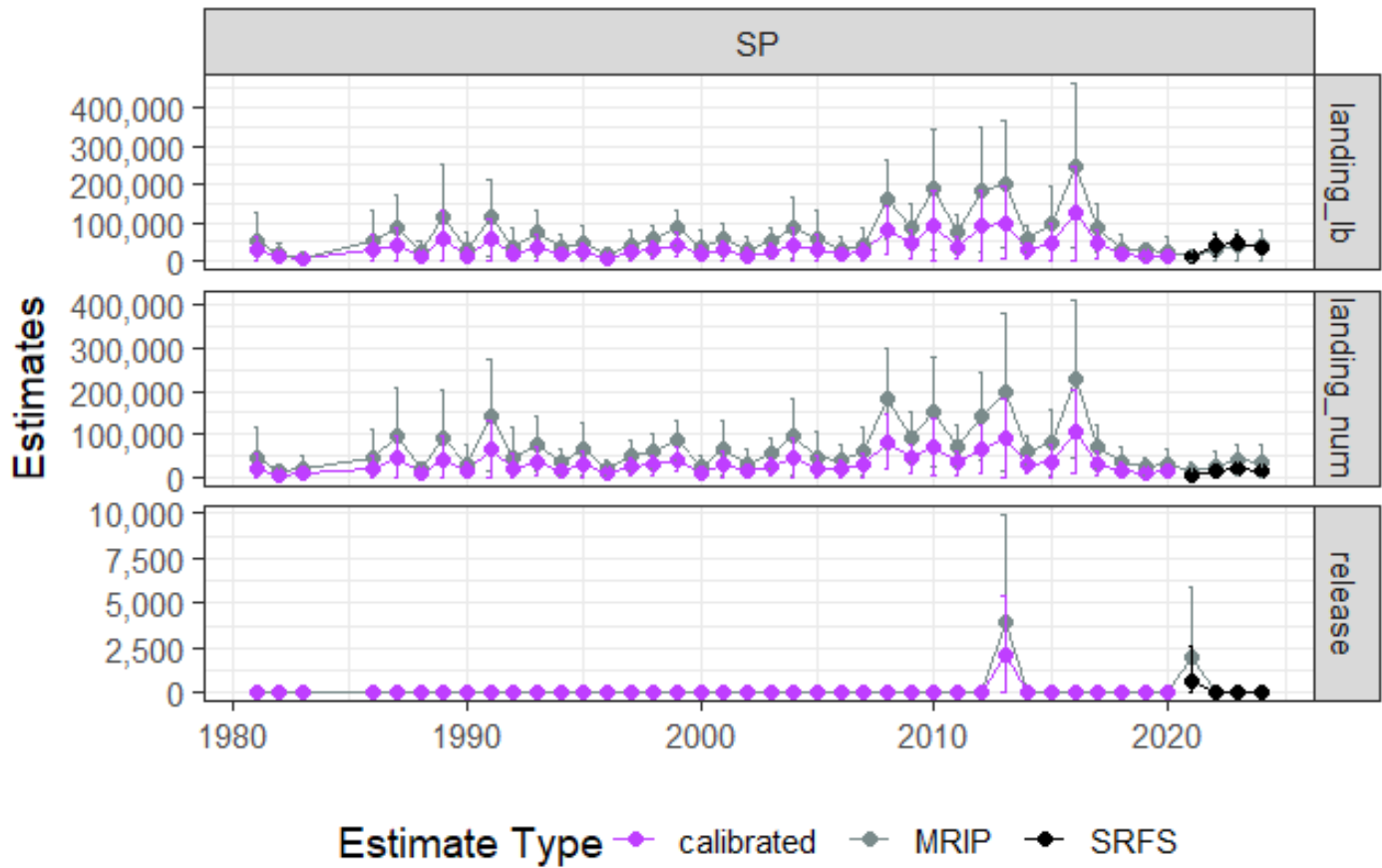


Figure 10. Hogfish (*Lachnolaimus maximus*) annual estimates on the West Florida Shelf (wfs) for only the spear (SP) gear type. Annual estimates shown include original MRIP-FCAL time-series (MRIP), SRFS estimates (SRFS), and the MRIP-FCAL time-series calibrated to SRFS currency (calibrated). Estimates are shown from 1981-2024. Landings in pounds (landing_lb), landings in numbers of fish (landing_num), and releases in numbers of fish (release) are shown. Error bars are 95% confidence limits.

SEFL

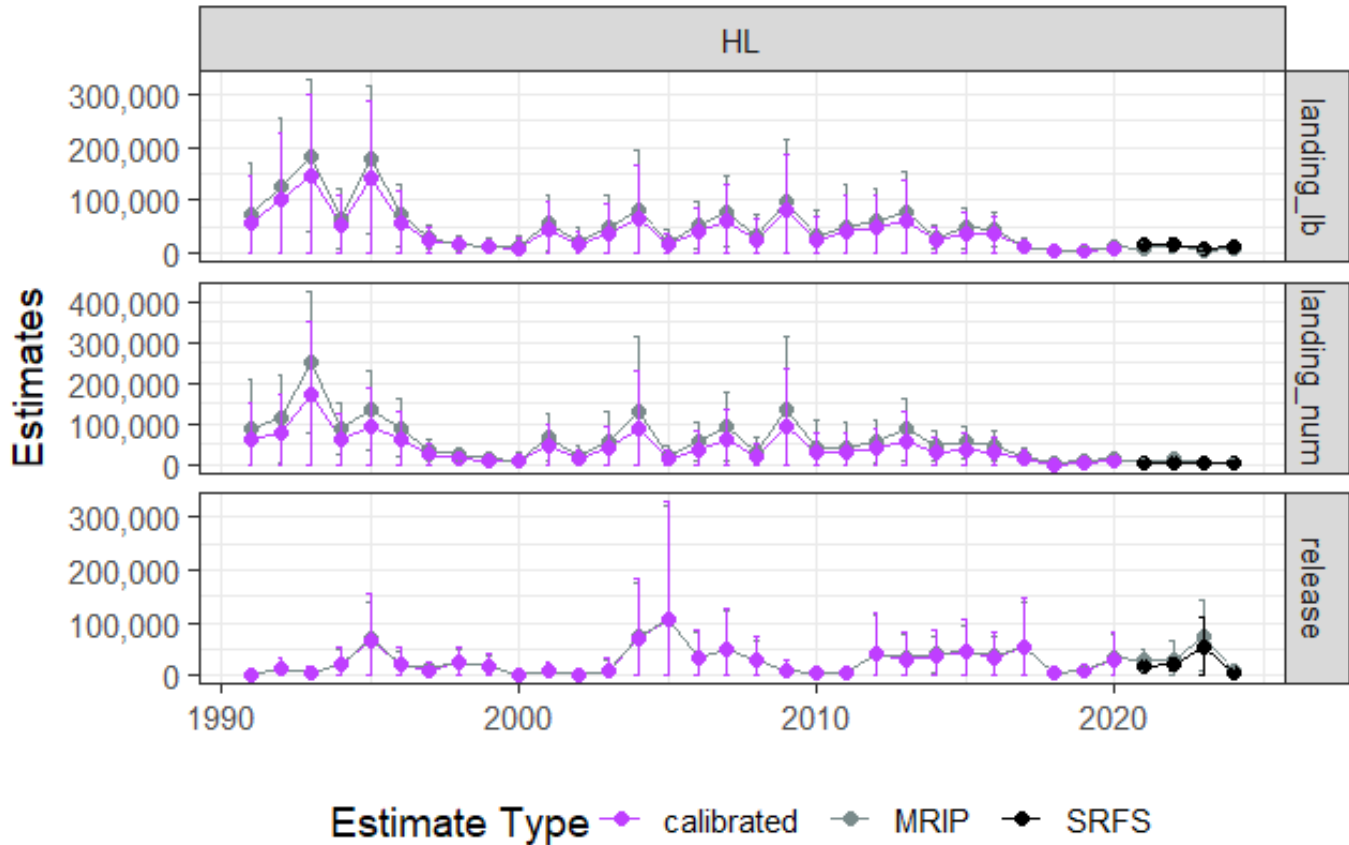


Figure 11. Hogfish (*Lachnolaimus maximus*) annual estimates in Southeast Florida (sefl) by gear type. Data shown are only for the hook and line (HL) gear type. Annual estimates shown include original MRIP-FCAL time-series (MRIP), SRFS estimates (SRFS), and the MRIP-FCAL time-series calibrated to SRFS currency (calibrated). Estimates are shown from 1990-2024. Particularly high values in the 1980s are not shown. Landings in pounds (landing_lb), landings in numbers of fish (landing_num), and releases in numbers of fish (release) are shown. Error bars are 95% confidence limits.

SEFL

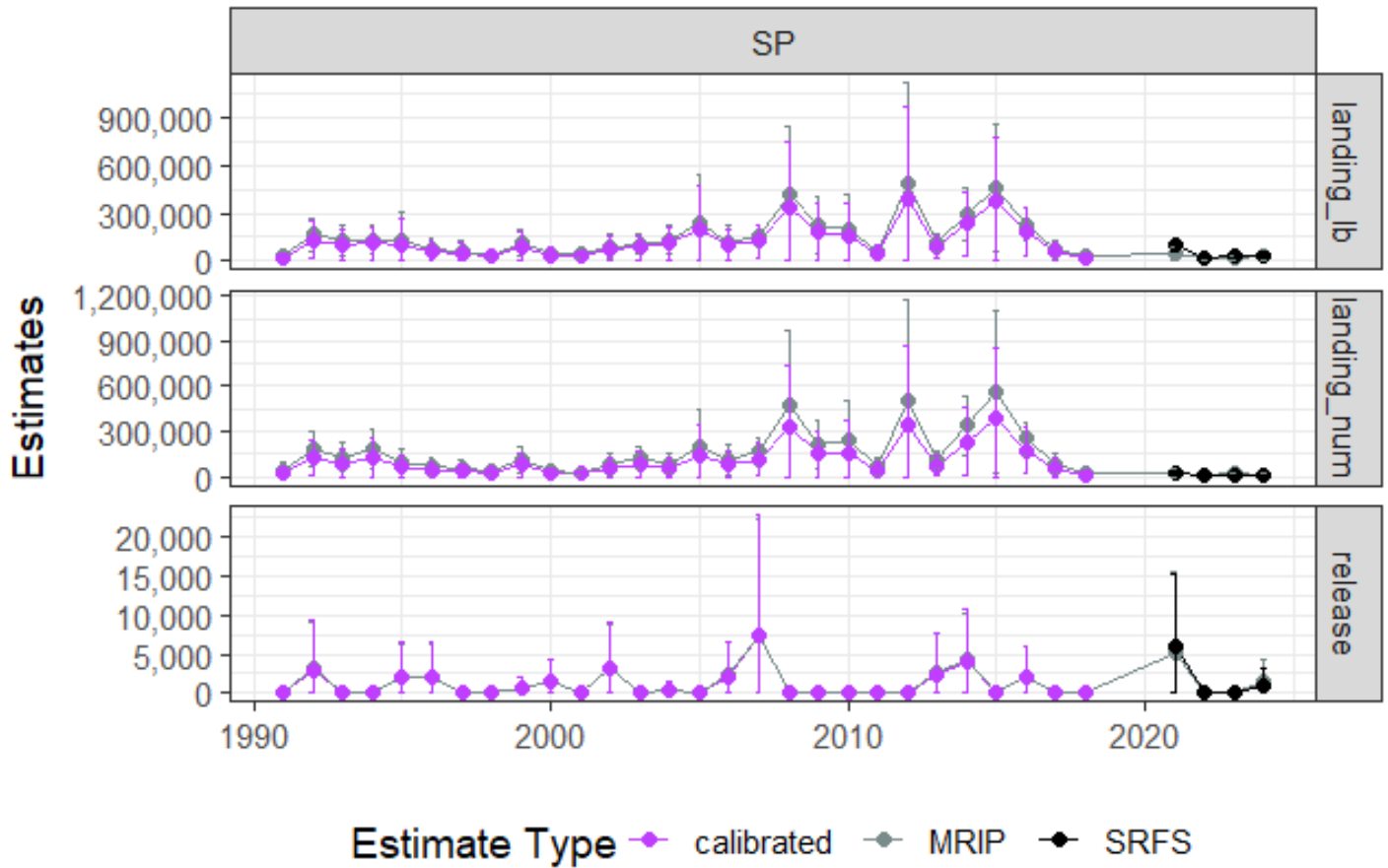


Figure 12. Hogfish (*Lachnolaimus maximus*) annual estimates in Southeast Florida (sefl) by gear type. Data shown are only for the spear (SP) gear type. Annual estimates shown include original MRIP-FCAL time-series (MRIP), SRFS estimates (SRFS), and the MRIP-FCAL time-series calibrated to SRFS currency (calibrated). Estimates are shown from 1990-2024. Particularly high values in the 1980s are not shown. Landings in pounds (landing_lb), landings in numbers of fish (landing_num), and releases in numbers of fish (release) are shown. Error bars are 95% confidence limits.

Table 6. Original and calibrated MRIP-FCAL annual estimates for Hogfish (*Lachnolaimus maximus*) landing and release estimates in Florida from 1981-2020 on the West Florida Shelf for the hook and line gear type.

Year	MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration	
	Landings (no.fish)	PSE	Landings (no. fish)	PSE	Landings (pounds)	PSE	Landings (pounds)	PSE	Releases (no.fish)	PSE	Releases (no. fish)	PSE
1981	12,893	100	5,868	103	9,669	100	4,815	103	0	NA	0	NA
1982	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1983	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1984	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1985	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1986	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1987	3,002	100	1,366	103	12,412	100	6,181	103	6,828	100	3,528	106
1988	3,222	100	1,467	103	3,588	100	1,787	103	0	NA	0	NA
1989	15,113	100	6,878	103	14,358	100	7,150	103	3,471	100	1,794	106
1990	30,984	100	14,102	103	41,053	100	20,443	103	0	NA	0	NA
1991	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1992	16,361	43	7,446	49	26,213	43	13,053	49	4,522	100	2,337	106
1993	14,450	51	6,577	56	13,701	51	6,822	56	0	NA	0	NA
1994	20,307	45	9,242	51	14,348	38	7,145	44	0	NA	0	NA
1995	34,457	46	15,682	51	24,739	49	12,319	54	2,149	100	1,110	106
1996	11,154	55	5,077	59	8,625	54	4,295	59	10,420	100	5,385	106
1997	11,327	46	5,155	51	11,011	48	5,483	53	758	100	392	106
1998	8,998	71	4,095	75	5,465	66	2,721	70	1,005	100	519	106
1999	9,109	49	4,146	54	8,893	49	4,428	54	9,699	86	5,012	93
2000	28,013	41	12,749	47	32,781	44	16,324	49	1,731	100	895	106
2001	20,029	58	9,116	62	18,560	60	9,242	65	0	NA	0	NA
2002	15,948	66	7,259	70	18,287	66	9,106	70	703	100	363	106
2003	64,826	43	29,504	49	63,067	41	31,405	47	964	100	498	106
2004	1,331	100	606	103	1,038	100	517	103	1,557	100	805	106
2005	11,550	57	5,257	61	13,476	57	6,710	62	5,687	71	2,939	79
2006	22,521	100	10,250	103	15,258	100	7,598	103	457	100	236	106
2007	15,252	53	6,942	58	14,255	57	7,098	62	0	NA	0	NA
2008	15,304	62	6,965	66	12,427	63	6,188	67	5,571	50	2,879	61
2009	19,818	55	9,020	60	18,163	57	9,044	62	4,576	58	2,364	67
2010	38,602	51	17,569	56	48,772	51	24,287	56	11,815	71	6,106	79
2011	33,307	56	15,159	60	31,649	58	15,760	62	1,512	100	781	106
2012	24,255	64	11,039	69	33,760	68	16,811	71	0	NA	0	NA
2013	44,991	93	20,477	95	40,185	91	20,011	94	3,071	83	1,587	90
2014	41,480	58	18,879	62	41,343	56	20,587	61	11,501	94	5,943	100
2015	21,847	60	9,943	65	19,507	60	9,714	64	833	100	430	106
2016	54,955	54	25,012	59	42,077	51	20,953	56	24,766	62	12,797	71
2017	36,556	52	16,638	57	46,813	64	23,311	68	32,367	54	16,725	64
2018	10,586	43	4,818	49	11,011	43	5,483	49	25,008	49	12,923	60
2019	30,572	39	13,914	46	24,883	49	12,391	54	35,194	66	18,186	75
2020	24,773	48	11,275	53	22,381	50	11,145	55	27,653	46	14,289	58

Table 7. Original and calibrated MRIP-FCAL annual estimates for Hogfish (*Lachnolaimus maximus*) landing and release estimates in Florida from 1981-2020 in Southeast Florida by hook and line gear type.

Year	MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration	
	Landings (no.fish)	PSE	Landings (no. fish)	PSE	Landings (pounds)	PSE	Landings (pounds)	PSE	Releases (no.fish)	PSE	Releases (no. fish)	PSE
1981	33,144	48.8	22,688	62	14,386	48	11,593	59	0	NA	0	NA
1982	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1983	15,303	84	10,475	93	8,979	72	7,235	79	0	NA	0	NA
1984	9,073,189	98	6,210,699	105	4,716,782	98	3,800,832	104	0	NA	0	NA
1985	243,017	95	166,348	103	212,930	94	171,581	100	0	NA	0	NA
1986	42,772	74	29,278	83	24,397	54	19,659	63	0	NA	0	NA
1987	112,792	38	77,208	54	89,039	38	71,748	51	2,809	100	2,714	109
1988	96,489	71	66,048	81	64,191	76	51,726	84	236,074	100	228,086	109
1989	156,345	39	107,020	55	89,026	39	71,738	51	5,558	100	5,370	109
1990	137,631	53	94,210	66	132,174	53	106,507	63	14,924	74	14,419	86
1991	87,323	71	59,774	80	73,350	67	59,106	75	0	NA	0	NA
1992	113,111	49	77,426	63	125,337	53	100,998	63	15,292	56	14,775	71
1993	251,685	36	172,281	53	183,474	40	147,845	52	5,496	100	5,310	109
1994	90,256	36	61,781	53	65,589	44	52,852	56	22,660	62	21,894	76
1995	134,549	37	92,101	53	176,532	40	142,252	53	68,495	54	66,178	70
1996	89,887	41	61,529	56	72,548	41	58,460	53	23,112	52	22,330	68
1997	37,954	35	25,980	52	30,028	37	24,197	50	11,748	50	11,350	67
1998	22,602	33	15,472	51	18,924	34	15,249	48	25,364	49	24,506	66
1999	15,833	49	10,838	62	14,472	53	11,661	63	19,044	51	18,400	67
2000	11,839	82	8,104	91	12,468	82	10,047	89	0	NA	0	NA
2001	67,145	46	45,961	60	55,366	48	44,614	59	9,942	82	9,605	93
2002	20,536	69	14,057	79	21,211	69	17,092	77	0	NA	0	NA
2003	56,064	66	38,376	77	47,531	68	38,301	76	11,505	87	11,116	98
2004	128,768	73	88,143	83	82,656	69	66,605	77	72,632	72	70,174	84
2005	21,592	56	14,780	68	20,482	57	16,505	66	108,552	100	104,879	109
2006	55,613	42	38,068	57	51,524	44	41,518	56	33,710	74	32,570	86
2007	91,863	47	62,881	61	77,999	44	62,853	55	49,991	73	48,300	85
2008	30,940	63	21,179	74	31,462	70	25,352	78	30,705	60	29,666	74
2009	136,490	67	93,429	78	99,143	60	79,890	69	10,293	100	9,945	109
2010	41,287	82	28,261	91	31,959	80	25,753	87	6,353	100	6,138	109
2011	41,899	78	28,681	87	51,082	77	41,162	84	3,661	66	3,537	79
2012	56,856	49	38,919	62	60,857	53	49,039	62	43,971	84	42,483	94
2013	86,062	47	58,910	60	76,197	53	61,400	63	32,070	75	30,985	87
2014	46,540	39	31,857	55	29,766	39	23,985	52	40,564	42	39,191	61
2015	54,419	36	37,250	53	48,247	40	38,878	52	46,286	55	44,720	70
2016	47,255	39	32,347	55	43,545	38	35,089	51	36,872	54	35,624	69
2017	21,390	52	14,642	65	13,965	51	11,253	61	54,686	79	52,836	91
2018	1,965	82	1,345	90	3,492	90	2,814	96	3,932	65	3,799	78
2019	8,311	100	5,689	107	3,906	100	3,148	106	9,381	52	9,063	68
2020	13,112	53	8,975	66	12,531	48	10,098	59	32,406	73	31,309	85

Table 8. Original and calibrated MRIP-FCAL annual estimates for Hogfish (*Lachnolaimus maximus*) landing and release estimates in Florida from 1981-2020 on the West Florida Shelf for the spear gear type.

Year	MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration		MRIP-FCAL		SRFS-FCAL calibration	
	Landings (no. fish)	PSE	Landings (no. fish)	PSE	Landings (pounds)	PSE	Landings (pounds)	PSE	Releases (no. fish)	PSE	Releases (no. fish)	PSE
1981	45,271	78	20,604	82	53,777	69	26,779	73	0	NA	0	NA
1982	13,187	67	6,002	71	20,766	61	10,341	65	0	NA	0	NA
1983	19,922	73	9,067	77	9,392	76	4,677	79	0	NA	0	NA
1984	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1985	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
1986	44,949	76	20,458	79	54,183	74	26,981	77	0	NA	0	NA
1987	95,581	59	43,502	63	84,635	51	42,145	56	0	NA	0	NA
1988	18,052	50	8,216	55	25,350	51	12,624	56	0	NA	0	NA
1989	92,187	60	41,957	65	116,240	60	57,883	64	0	NA	0	NA
1990	28,195	84	12,833	87	27,450	85	13,669	88	0	NA	0	NA
1991	143,377	46	65,255	51	112,545	46	56,044	51	0	NA	0	NA
1992	44,715	79	20,351	82	36,720	67	18,285	71	0	NA	0	NA
1993	77,397	43	35,225	49	73,709	42	36,705	48	0	NA	0	NA
1994	34,018	46	15,482	51	35,281	51	17,569	56	0	NA	0	NA
1995	64,518	47	29,364	53	48,362	46	24,083	51	0	NA	0	NA
1996	21,190	46	9,644	51	17,184	50	8,557	55	0	NA	0	NA
1997	50,535	37	23,000	44	43,815	42	21,818	48	0	NA	0	NA
1998	61,097	35	27,807	42	55,772	35	27,772	42	0	NA	0	NA
1999	87,420	27	39,788	36	87,817	27	43,730	35	0	NA	0	NA
2000	22,067	65	10,043	69	32,543	74	16,205	77	0	NA	0	NA
2001	67,326	47	30,642	53	56,223	40	27,997	46	0	NA	0	NA
2002	27,321	70	12,435	74	27,555	71	13,722	74	0	NA	0	NA
2003	55,008	35	25,036	42	49,625	36	24,712	43	0	NA	0	NA
2004	94,202	48	42,874	54	85,472	47	42,562	53	0	NA	0	NA
2005	45,579	68	20,744	72	55,435	73	27,605	76	0	NA	0	NA
2006	39,074	50	17,784	56	32,164	51	16,017	56	0	NA	0	NA
2007	59,495	47	27,078	53	43,489	47	21,656	53	0	NA	0	NA
2008	181,038	33	82,396	41	161,241	33	80,293	40	0	NA	0	NA
2009	93,004	33	42,329	40	88,312	34	43,976	41	0	NA	0	NA
2010	152,139	43	69,243	49	186,525	43	92,883	49	0	NA	0	NA
2011	71,556	35	32,567	42	72,901	34	36,302	41	0	NA	0	NA
2012	140,662	37	64,019	44	186,325	45	92,784	50	0	NA	0	NA
2013	196,364	48	89,371	53	202,058	42	100,618	48	4,010	75	2,072	83
2014	62,114	28	28,270	36	57,978	28	28,871	36	0	NA	0	NA
2015	78,021	50	35,510	55	95,214	52	47,413	57	0	NA	0	NA
2016	228,083	42	103,807	48	248,515	44	123,752	50	0	NA	0	NA
2017	68,790	38	31,308	44	88,888	36	44,263	43	0	NA	0	NA
2018	32,590	57	14,833	61	32,252	57	16,061	61	0	NA	0	NA
2019	25,175	39	11,458	45	26,768	38	13,330	44	0	NA	0	NA
2020	28,468	68	12,956	72	26,254	68	13,073	71	0	NA	0	NA

