# Estimated Commercial Discards of Florida Yellowtail Snapper (*Ocyurus chrysurus*) for the Vertical Line Fishery

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## Estimated Commercial Discards of Florida Yellowtail Snapper (*Ocyurus chrysurus*) for the Vertical Line Fishery

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## Introduction

For assessments where dominate catches are in the Florida Keys, discard logbook data was the main source of data for estimating commercial discards and used for SEDAR 62 (McCarthy & Diaz 2019). However, upon an analysis to determine the reliability of discard logbook data, the Southeast Fisheries Science Center (SEFSC) no longer recommends the use of discard logbook data for estimating discards for SEDAR (Alhale et al. 2024). Therefore, alternative methods were explored using commercial observer data.

The general approach for estimating discards for the commercial vertical line fleet utilizes a discard rate or discards-per-unit-effort from the reef fish observer programs and total fishing effort from the Coastal Fisheries Logbook Program (CFLP). Total discards include fish released alive, released dead, released in unknown condition, and used for bait. Discard analyses for SEDAR 96 attempted to provide discard estimates by region (FL Keys, Southeast FL, Northeast FL, Southwest FL, and Northwest FL). Only the FL Keys, Southeast FL, and Southwest FL regions had discards of Yellowtail Snapper which is also consistent with SEDAR 64 (McCarthy & Diaz 2019). Due to observer coverage differing across these regions, two different methodologies were conducted (Table 1). As a result, this working paper is divided into separate sections where Part I documents the methodology for estimating discards for the FL Keys where there is more data available and Part II summarizes a data-limited method used for the other regions (Southeast FL and Southwest FL) where Yellowtail Snapper are observed.

#### Relevant Management History of Florida Yellowtail Snapper

The minimum size limits of Yellowtail Snapper for Gulf of Mexico and South Atlantic managed regions is 12 inches total length. In the Gulf of Mexico, this minimum size limit was implemented in early 1990 and the South Atlantic established a minimum size limit in 1983. The South Atlantic reached their quota limit in 2015, 2017, and 2018 that resulted in closures. Each closure lasted for 2-3 months. The Gulf of Mexico has not had any closures from reaching their quota.

#### Gear

For the Florida region, observer data only sampled vertical line trips in eastern Florida. Therefore, discard estimation for Yellowtail Snapper was conducted for only this gear.

#### Spatial Domain

Per recommendation of the stock assessment analyst, discard estimates of Yellowtail Snapper were conducted using only data from fishing areas off the coast of Florida (Fig. 1). These fishing areas were separated into 5 regions where all fishing areas south of 25° N are considered FL Keys, fishing areas 3-6 is Southwest FL, 7-10 is Northwest FL, 2580-2780 is Southeast FL, and 2876-3081 is Northeast FL.

#### Data Sources

Observer data on vertical line vessels (e.g., handlines, electric and hydraulic reels aka bandit reels) have been collected in the western FL region since July 2006 under the Southeast Fisheries Science Center (SEFSC) Reef Fish Observer Program (RFOP) (Atkinson et al. 2021a, Scott-Denton et al. 2011). The SEFSC South Atlantic Reef Fish Observer Program (SARF) began collecting data consistently on vertical line vessels since 2018 (Decossas & Mathers 2023). For both observer programs, scientific observers on commercial fishing vessels record detailed information on catch and effort for a subset of trips. Catch by species was recorded according to the disposition category: kept (landed), released alive, released dead, released undetermined, and used for bait. Length and weight were recorded for a subsample of individual fish.

Total effort was determined from the commercial Coastal Fisheries Logbook Program in which fishers reported basic information on effort and catch by species for every trip (Atkinson et al. 2021b). The coastal logbook program began in 1990 for a subset of vessels in Florida, and expanded to all vessels in 1993; for Florida Yellowtail Snapper discard estimation, complete calendar years 1993-2023 were considered.

## Part I. Florida Keys Discard Estimation

Due to sufficient observer sample sizes in the Florida Keys the standard discard methodology first developed for Gulf of Mexico Red Grouper in SEDAR Working Paper 61-15 (Smith et al. 2018), Gulf of Mexico Gray Triggerfish in SEDAR Working Paper 62-07 (Smith et al. 2019a), and Gulf of Mexico Vermilion Snapper in SEDAR Working Paper 67-12 (Smith et al. 2019b) was applied to Yellowtail Snapper fished in the FL Keys.

## Methods

#### Trip-Level Catch for Observer Data

Observers collected catch data at a sub-trip level (e.g., a specific set and line for vertical line gear), but it was not feasible to sample every set, line, etc., for every trip. Gear-specific procedures were applied to estimate the trip-level landed catch from the observer data (Smith et al. 2018).

#### Trip-Level Effort for Observer and Logbook Data

For observer data, trip-level effort for vertical lines was computed as the cumulative daily fishing time (hours) from first hook in to last hook out; this time metric included the active fishing time as well as transit time between fishing locations during a given trip day. This effort variable generally matched trip fishing time reported in vessel logbook data (Smith et al. 2018).

#### Catch Expansion Procedures and Verification

Observer CPUE was calculated using trip-level nominal effort and catch for a given time period. Statistical estimation of total catch  $\hat{C}$  and associated variance followed procedures for a (Horvitz-Thompson) survey design ratio estimator (Jones et al. 1995; Lohr 2010):

$$\hat{C} = CP\bar{U}E * \hat{X},$$

where CPUE is observer mean CPUE and  $\hat{X}$  is total logbook nominal effort. Species- and gearspecific logbook total effort  $\hat{X}$  was calculated in two steps. First, logbook trip effort by gear was summed over trips reporting landings of the target species. Second, to obtain  $\hat{X}$ , logbook trip effort was adjusted by the proportion of observer trip effort that reported only discards of the target species. Logbook total trips N were calculated in a similar manner.

Mean CPUE was estimated by

$$CP\overline{U}E = \frac{\overline{y}}{\overline{x}},$$

where  $\bar{y}$  is average catch and  $y_i$  is observed catch per trip *i*,

$$\bar{y} = \frac{1}{n} \Sigma_i y_i,$$

 $\bar{x}$  is average effort and  $x_i$  is observer effort per trip *i*,

$$\bar{x} = \frac{1}{n} \Sigma_i x_i,$$

and n is the number of observer trips. Variance of total catch was estimated using

$$var[\hat{C}] = var[CP\overline{U}E] * \widehat{X^2}$$

where the variance of mean CPUE is

$$var[CP\overline{U}E] = \left(1 - \frac{n}{N}\right) \frac{s^2(y|x)}{n\overline{x}^2},$$

N is the total number of logbook trips, and sample variance is

$$s^{2}(y|x) = \frac{\Sigma_{i}(y_{i} - CP\overline{U}Ex_{i})^{2}}{n-1}.$$

Standard error of total catch was calculated as

$$SE[\hat{C}] = \sqrt{var[\hat{C}]}.$$

The CV of total catch  $\hat{C}$  was estimated by

$$CV[\hat{C}] = \frac{SE[\hat{C}]}{\hat{C}}.$$

A verification step compared annual total landed catch from logbook data with the estimated observer annual total catch  $\hat{C}$ . Once verified, the catch expansion procedure was used to estimate annual total discards in weight and number.

#### Stratification by Trip Catch or Effort Level

Computations of mean CPUE, total catch, and associated standard errors were generalized to include strata for trip catch and/or effort levels of Yellowtail Snapper. This enabled accurate estimation of total catch (and discards) in cases where observer sampling was not proportional to the fleet with respect to trip catch or effort (Smith et al. 2019a), e.g., observers sampled fewer or more low-catch trips with respect to logbook low-catch trips, etc. Comparisons of observer vs. logbook frequency distributions for trip-level catch, effort, and CPUE were used to delineate strata for trip catch and/or effort levels (e.g., low, moderate, high, etc.).

#### Hindcast Procedures

For years prior to 2007, before observer data were collected, hindcast discard estimation procedures for "Trending CPUE" described in Smith et al. (2019a) were applied to Yellowtail Snapper. For this method, the ratio of observer CPUE in weight to logbook CPUE was computed for the observer time period, and then multiplied by the annual logbook CPUE for the hindcast time period to produce an estimated annual observer CPUE. Then, the annual observer CPUE was multiplied by annual logbook effort for the pre-observer time period to estimate total catch  $\hat{C}$ in weight. An additional step computed the ratio of the observer CPUE in number to observer CPUE in weight. This ratio was then used to compute the observer estimated discards in number from the discards in weight for the hindcast period. Standard errors for the hindcast period were estimated using the respective CVs of total estimated catch  $\hat{C}$  kept and discarded as described in Smith et al. (2019a). To guide selection of appropriate time periods for hindcasting, time-series of annual length compositions for kept and discarded fish from observer sampling were evaluated with respect to management actions of Yellowtail Snapper. Verification compared total landed catch from logbook data with the estimated total catch  $\hat{C}$  and standard error from observer data for the hindcast time period.

#### **Results and Discussion**

The observer database has a total of 214 vertical line trips with corresponding trip and set information where Yellowtail Snapper were caught (discarded or kept) in the Florida Keys. Observer sampling effort is summarized in Table 1 for all FL regions where Yellowtail Snapper were caught (FL Keys, Southwest FL, and Southeast FL), distinguishing all trips from the subset of trips that discarded Yellowtail Snapper. It is important to note that traditionally the FL Keys is not well sampled by observer programs and sampled trips was often limited to fishing areas 1 and 2 (north of US 1). It is for this reason SEDAR 64 utilized discard logbook data for calculating discard rates because the observer data available for the previous assessment was not

representative of the entire FL Keys region (McCarthy & Diaz, 2019). Only with the temporary increased sampling in 2022 and 2023 and improved survey design starting in 2022 to capture all of the FL Keys, discard estimation for the FL Keys was possible using observer data.

Annual logbook CPUE of FL Keys Yellowtail Snapper showed a gradually increasing trend overtime (Fig. 2). Initially, observer and logbook data were pooled into two management regimes (2007-2014 and 2015-2023) to capture this variability. This is because the first year of a Yellowtail Snapper closure in South Atlantic waters for reaching commercial quota limits was in 2015. Using these two management regimes, CPUE expansion estimates of annual total landed FL Keys Yellowtail Snapper were consistently an underestimate of the reported logbook landings from 2007-2017. Any kind of catch or effort stratification to account for observer sampling disproportionately to the commercial fleet did not correct for this bias. This is likely because observer sampling prior to 2018 was not representative of the entire FL Keys region. Only when observer data from 2018-2023 was used in the CPUE expansion, estimates of annual total landed catch of FL Keys Yellowtail Snapper compared favorably with reported logbook landings (Fig. 3). No additional catch or effort stratification was necessary for this catch verification.

For estimating discards, logbook total effort was adjusted to account for trips that would have discarded only Yellowtail Snapper. This proportion was calculated based on observer data (Table 2) and the adjusted total logbook effort for FL Keys Yellowtail Snapper is presented in Table 3. Table 4 shows the observer CPUE in kept and discards. CPUE expansion estimates for annual discards in numbers and weight of FL Keys Yellowtail Snapper are provided in Table 5. Estimated discards in number ranged from 51,000 to 104,000 fish (Fig. 4A). Discards in weight accounted for about 4% of the total catch (kept + discards) from 1993-2023 (Fig. 4B).

#### Comparison to SEDAR 64

The two main differences between SEDAR 64 and SEDAR 96 are (1) the previous assessment provided estimated discards in number of the vertical line fleet using discard logbook data, while the current assessment utilizes commercial observer data and (2) the methodology differs in both the effort metric used and the kinds of logbook trips included in the expansion to the entire fleet. Given that the data sources and methods are widely different, a comparison of the two estimates should be cautioned because differences could be due to a multitude of reasons. Nevertheless, the overall magnitude of estimated number of discards of FL Keys Yellowtail Snapper are similar in some years (Fig. 5). Given that this observer discard approach has a built-in verification procedure, discard estimates provided for SEDAR 96 are considered more reliable than SEDAR 64 estimates.

## Part II. Southeast FL and Southwest FL Discard Estimation

Sample sizes for this species are low to moderate for trips observing Yellowtail Snapper, with a small subset of those trips observing discards in Southeast (N Trips = 29) and Southwest (N trips = 21) Florida (Table 1). Therefore, alternative, data-limited approaches for calculating discards using the observer and coastal logbook programs were used. These approaches were first introduced for SEDAR 89 (Thompson et al. 2024).

#### Methods

Given the low observation rate of this species, observer mean discard rates had to be calculated straightforwardly. Discard rates for the Southeast and Southwest FL regions were calculated two ways: (1) discards estimated in number where effort is either number of trips or cumulative fishing time and (2) discards estimated in pounds as a trip-level ratio of discarded pounds per kept pounds of Yellowtail Snapper. Cumulative fishing time was considered as an alternative effort variable to number of trips based on analysis conducted by Smith et al. (2018). To provide analysts with options and to more fully explore these data-limited observer approaches, these different mean discard rate ( $\overline{DR}$ ) calculations were conducted:

1a) Numbers per trip:

$$\overline{DR} = \frac{1}{n} \sum_{i} \frac{Discards \ (in \ numbers)_i}{trip_i}$$

1b) Numbers per fishing time:

$$\overline{DR} = \frac{1}{n} \sum_{i} \frac{Discards \ (in \ numbers)_{i}}{Fishing \ time_{i}}$$

2) Pounds per kept pounds:

$$\overline{DR} = \frac{1}{n} \sum_{i} \frac{Discards \ (in \ pounds)_{i}}{Kept \ (in \ pounds)_{i}}$$

where *i* is per trip and *n* is the number of observer trips.

The calculated rates and standard deviations above were then used to calculate total discards and associated variance using the logbook data. All logbook trips that reported catch of Yellowtail Snapper were used within the geographic area of the assessment (Fig. 1). Each discard rate was applied to the appropriate metric in the logbook data to yield annual discard and variance estimates. Total discards per year (t) and standard error (SE) were estimated as:

1a) Trip Numbers:

$$Discards_t = TotalTrips_t \times \overline{DR}$$
;  $SE_t = \sqrt{\sum DRsd^2 \times TotalTrips_t^2}$ 

1b) Fishing Time Numbers:

$$Discards_t = TotalFishingTime_t \times \overline{DR}; SSE_t = \sqrt{\sum DRsd^2 \times TotalFishingTime_t^2}$$

2) Pounds per kept pounds:

$$Discards_t = Total Catch_t \times \overline{DR}$$
;  $SE_t = \sqrt{\sum DRsd^2 \times TotalCatch_t^2}$ 

For the first method that used numbers, estimated discards were converted to weight using the observer data, calculated as the average weight of a discarded fish (*WTav*). Additionally, method two that used pounds, estimated discards will be converted to number using the same *WTav*. This additional source of variation (average weight of discarded fish standard deviation; *WTsd*) was then also incorporated into final estimates, so for example the annual standard error for total estimated discards using method 1b (fishing time in numbers) was:

$$SE = \sqrt{(WTsd^2 \times Discards_t^2) + (DRsd^2 \times WTav^2)}$$

These variance estimates were also converted to CVs.

#### **Results and Discussion**

Initial analyses were conducted regarding any patterns in catch, effort, or number of trips reporting Yellowtail Snapper in the coastal logbook data for the Southeast and Southwest FL regions. While there have been trends in the average fishing time, total catch, or total trips reporting Yellowtail Snapper in each region over time, given the lack of observer data, a pooled discard rate was unavoidable (Figs. 6-8). Furthermore, the limited samples of observer trips that had Yellowtail Snapper interactions could have yielded spurious discard rates for time periods if they were broken up.

Discard rates and subsequent annual discarded pounds could not be calculated for this species as described by method 2. In this fishery the majority of the trips in the observer data were either fully kept or fully discarded regarding Yellowtail Snapper with so few trips with both kept and discarded fish that a rate could not be determined. As such, the first two, number-based methods using number of trips or number per hour fished were calculated. Final discard rates for both data-limited regions with their associated SE and CV values are shown in Table 6. Note that CVs are the same for the time series as the rate is static through time using these methods, rather than vary by year which is commonly presented for these estimates.

The two methods, 1a and 1b, that were able to be used for this species showed relatively similar annual trends, though for Southeast FL the method using number of trips was smaller than the estimates using total fishing time (Fig. 9). Both estimates were much more similar for Southwest FL, where the fishery had a much smaller number of discards overall in terms of number as well as when scaled to a percent of the caught pounds in the fishery (Fig. 9 and 10). While the method 1a had lower CVs (Table 6) than the effort-based approach, previous analyses have recommended the use of effort-based metrics as they can account for fishing time, in this case, which number of trips misses. Final discard estimates using this recommended method are shown in Table 7. Ultimately, the recommended discards using method 1b are between 10-20% of the fishery landings for the Southeast and under 10% for most years for the Southwest, indicating this fishery has a low rate of discards (Fig. 10).

#### Comparison to SEDAR 64

For the Southeast and Southwest regions of FL, the main difference between SEDAR 64 and SEDAR 96 estimated discards is the data source used to calculate discard rates (McCarthy & Diaz 2019). SEDAR 64 utilized discard logbook data whereas SEDAR 96 relied on limited observer data due to the SEFSC recommendation to no longer use discard logbook data for discard estimation (Alhale et al. 2024). Figure 11 compares the two discard estimates by region.

The Southeast FL region yield somewhat different results between the two methods with SEDAR 96 being consistently higher than SEDAR 64 (Fig 11A). Due to observer sampling in this region, Yellowtail Snapper were only observed in the more recent years (2021-2023) where there was temporary increased coverage. Given that there have been no significant management actions for the entire time series where commercial discards are estimated (1993-2023), there is no reason to believe a discard rate using 2021-2023 data would be unrepresentative.

Results between the methods are comparable for the Southwest FL region (Fig. 11B). SEDAR 64 calculated annual discard rates which explains the peaks in some years because Yellowtail Snapper were only reported in Southwest FL for those years. For years prior to 2002 before discard logbook data was collected, an average discard rate using 2002-2006 data was used to hindcast. Since the discard rate was zero in those years, the estimates discards were also zero from 1993-2001. For SEDAR 96, a single discard rate is applied to annual logbook data from 1993-2023. Considering that Yellowtail Snapper are likely migrating north as indicated by higher catch in the more recent years, SEDAR 96 discard estimates are likely an overestimate in some years (Fig. 7). Overall, catch and estimates discards are low for this region compared to the FL Keys and Southeast FL.

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	Florid	Florida Keys Southeast Florida		Southeast Florida		Southeast Florida Southwest Florida		st Florida
Year	Total Observer Trips	Discarded Yellowtail Snapper Observer Trips	Total Observer Trips	Discarded Yellowtail Snapper Observer Trips	Total Observer Trips	Discarded Yellowtail Snapper Observer Trips		
2007	2	0	0	0	34	0		
2008	2	1	0	0	24	1		
2009	2	2	0	0	21	0		
2010	5	1	0	0	31	1		
2011	7	3	0	0	48	1		
2012	14	9	1	0	121	5		
2013	9	4	0	0	54	1		
2014	14	8	5	0	45	0		
2015	5	2	0	0	94	4		
2016	12	4	0	0	69	4		
2017	7	7	0	0	22	0		
2018	6	5	3	0	14	1		
2019	5	3	2	0	9	1		
2020	9	4	2	0	6	1		
2021	19	9	13	4	11	0		
2022	90	56	49	13	17	1		
2023	69	34	43	12	26	0		

**Table 1.** Number of total vertical line observer trips and observer trips with discarded YellowtailSnapper by year and Florida region.

**Table 2.** FL Keys Yellowtail Snapper vertical line trip and effort adjustment factor. The proportions of Yellowtail Snapper observer trips (from 2018-2023) and effort with kept Yellowtail Snapper were used to respectively adjust annual logbook total trips and effort (Table 3) to account for logbook trips that only had discarded fish.

	Proportion of Observer Data with Kept Yellowtail Snapper		
Number of Observer Trips (n)	Trips	Effort	
158	0.987	0.991	

	Logboo	ok Trips	Logbook Effort		
Year	Reported	Adjusted (N)	Reported	Adjusted (Â)	
1993	6,321	6,402	76,724	77,418	
1994	6,616	6,701	86,517	87,300	
1995	6,842	6,930	89,754	90,566	
1996	6,428	6,510	83,030	83,782	
1997	7,464	7,560	99,777	100,680	
1998	6,261	6,341	73,697	74,364	
1999	6,606	6,691	74,900	75,578	
2000	5,846	5,921	74,095	74,766	
2001	5,995	6,072	66,833	67,438	
2002	5,587	5,659	62,332	62,896	
2003	5,662	5,735	62,666	63,233	
2004	5,023	5,087	55,148	55,648	
2005	4,462	4,519	47,968	48,402	
2006	4,312	4,367	47,032	47,458	
2007	4,057	4,109	43,306	43,698	
2008	4,273	4,328	44,199	44,599	
2009	4,508	4,566	53,783	54,270	
2010	3,740	3,788	44,329	44,730	
2011	3,792	3,841	47,682	48,114	
2012	3,856	3,905	53,970	54,458	
2013	3,541	3,586	52,311	52,785	
2014	3,950	4,001	54,311	54,803	
2015	3,690	3,737	51,283	51,747	
2016	4,306	4,361	51,416	51,882	
2017	3,825	3,874	42,761	43,148	
2018	3,326	3,369	44,750	45,155	
2019	3,232	3,273	46,046	46,463	
2020	2,524	2,556	35,827	36,151	
2021	2,184	2,212	34,741	35,056	
2022	2,254	2,283	33,203	33,504	
2023	2,404	2,435	37,346	37,684	

**Table 3.** Annual time-series of vertical line logbook trips (number) and effort (hours) by catchlevel strata for FL Keys Yellowtail Snapper.

	Observer CPUE			
Logbook CPUE	Kept	Discard		
28.271	27.123	1.081		

**Table 4.** Estimated observer mean CPUE in weight for expansion estimates of vertical line FL Keys Yellowtail Snapper catch and discards. Observer CPUE utilized only 2018-2023 data.

**Table 5.** Time-series of CPUE expansion estimates for FL Keys Yellowtail Snapper vertical line discards in weight (lbs.) and number (with associated standard errors).

Year	Estimated Discards in Weight	SE of Estimated Discards in Weight	Estimated Discards in Number	SE of Estimated Discards in Number
1993	39,696	5,270	69,876	10,023
1994	42,468	5,638	74,754	10,723
1995	42,641	5,661	75,058	10,767
1996	38,194	5,071	67,231	9,644
1997	46,086	6,118	81,122	11,636
1998	39,239	5,209	69,070	9,908
1999	44,286	5,880	77,955	11,182
2000	42,722	5,672	75,202	10,787
2001	38,930	5,168	68,526	9,830
2002	36,869	4,895	64,898	9,309
2003	34,537	4,585	60,794	8,721
2004	33,302	4,421	58,620	8,409
2005	29,031	3,854	51,101	7,330
2006	30,226	4,013	53,205	7,632
2007	47,231	6,270	83,139	11,926
2008	48,206	6,400	84,854	12,172
2009	58,658	7,788	103,254	14,811
2010	48,347	6,419	85,104	12,208
2011	52,004	6,904	91,541	13,131
2012	58,862	7,815	103,612	14,862
2013	57,053	7,574	100,428	14,406
2014	59,234	7,864	104,267	14,956
2015	55,932	7,426	98,454	14,123
2016	56,077	7,445	98,709	14,159

Year	Estimated Discards in Weight	SE of Estimated Discards in Weight	Estimated Discards in Number	SE of Estimated Discards in Number
2017	46,637	6,192	82,093	11,776
2018	48,807	6,480	85,912	12,324
2019	50,220	6,667	88,400	12,680
2020	39,075	5,188	68,781	9,866
2021	37,890	5,030	66,696	9,567
2022	36,213	4,808	63,744	9,144
2023	40,731	5,408	71,697	10,285

**Table 6.** Calculated observer discard rate, standard error, and CV values for each of the datalimited methods for SE and SW FL, not including the Keys. Method 1a calculates a discard using number of trips as the effort metric whereas method 1b calculates a discard rate using number of sets as the effort metric. Method 2 uses pounds per kept pounds per trip but could not be calculated for this species as trips were primarily fully kept or fully discarded.

	Discard Rate Values			Stan	dard Error Val	ues
Region	Method 1a	Method1b	Method 2	Method 1a	Method1b	Method 2
SE FL	6.67	2.32	-	11.40	4.70	-
SW FL	1.43	0.07	-	3.16	0.24	-
		CVs				
	Method 1a	Method1b	Method 2			
	1.70	2.07	-			
	2.20	3.52	-			

**Table 7**. Commercial discard estimates in pounds and numbers with associated standard error (SE) for both data-limited FL regions. Southeast FL is indicated as SE\_FL and SW\_FL means Southwest FL. Estimated discards are recommended using method (1b) where the discard rate calculation and logbook expansion factor is in total hours fished.

		<u> </u>				
			Estimated	SE of Estimated	Estimated	SE of Estimated
			Discards in	Discards in	Discards in	Discards in
_	Year	Region	Weight	Weight	Number	Number
	1993	SE_FL	17406.19	36101.99	26421.94	53532.17
	1994	SE_FL	27391.37	56812.13	41579.07	84241.26
	1995	SE_FL	24106.82	49999.69	36593.25	74139.74
	1996	SE_FL	20507.96	42535.34	31130.32	63071.58
	1997	SE_FL	25039.80	51934.77	38009.48	77009.09

(A) Southeast FL (SE FL)

1998	SE_FL	20706.80	42947.74	31432.14	63683.08
1999	SE_FL	17328.95	35941.79	26304.70	53294.63
2000	SE_FL	16554.27	34335.03	25128.77	50912.13
2001	SE_FL	14713.55	30517.21	22334.62	45251.04
2002	SE_FL	17397.78	36084.54	26409.17	53506.30
2003	SE_FL	16567.27	34362.00	25148.50	50952.11
2004	SE_FL	15169.33	31462.55	23026.48	46652.79
2005	SE_FL	12514.16	25955.49	18996.03	38486.91
2006	SE_FL	10914.33	22637.30	16567.55	33566.68
2007	SE_FL	12667.11	26272.72	19228.20	38957.29
2008	SE_FL	9305.33	19300.07	14125.14	28618.23
2009	SE_FL	10562.55	21907.68	16033.56	32484.79
2010	SE_FL	7382.78	15312.53	11206.78	22705.49
2011	SE_FL	9530.16	19766.40	14466.42	29309.69
2012	SE_FL	8869.43	18395.98	13463.46	27277.63
2013	SE_FL	6605.80	13701.02	10027.36	20315.93
2014	SE_FL	9059.08	18789.34	13751.34	27860.91
2015	SE_FL	5813.53	12057.79	8824.73	17879.34
2016	SE_FL	6033.78	12514.59	9159.05	18556.69
2017	SE_FL	4282.53	8882.35	6500.72	13170.78
2018	SE_FL	3415.32	7083.67	5184.32	10503.70
2019	SE_FL	4261.12	8837.94	6468.22	13104.93
2020	SE_FL	3517.79	7296.21	5339.88	10818.86
2021	SE_FL	3158.37	6550.73	4794.28	9713.45
2022	SE_FL	4441.60	9212.26	6742.18	13659.98
2023	SE FL	4175.47	8660.29	6338.20	12841.51

## (B) Southwest FL (SW\_FL)

		Estimated	SE of Estimated	Estimated	SE of Estimated
		Discards in	Discards in	Discards in	Discards in
Year	Region	Weight	Weight	Number	Number
1993	SW_FL	384.12	1353.55	583.08	2038.27
1994	SW_FL	321.34	1132.32	487.78	1705.13
1995	SW_FL	241.83	852.16	367.09	1283.24
1996	SW_FL	297.34	1047.75	451.34	1577.78
1997	SW_FL	215.79	760.40	327.56	1145.06
1998	SW_FL	195.18	687.77	296.28	1035.70
1999	SW_FL	214.12	754.53	325.03	1136.22
2000	SW_FL	162.86	573.90	247.22	864.22
2001	SW_FL	159.35	561.51	241.89	845.57
2002	SW_FL	86.18	303.68	130.82	457.30

2003	SW_FL	88.76	312.76	134.73	470.98
2004	SW_FL	137.17	483.34	208.21	727.85
2005	SW_FL	192.53	678.45	292.26	1021.65
2006	SW_FL	177.42	625.21	269.32	941.48
2007	SW_FL	73.54	259.12	111.62	390.21
2008	SW_FL	44.64	157.31	67.76	236.88
2009	SW_FL	128.54	452.94	195.12	682.07
2010	SW_FL	35.74	125.94	54.25	189.65
2011	SW_FL	88.83	313.01	134.84	471.35
2012	SW_FL	169.76	598.18	257.68	900.79
2013	SW_FL	175.78	619.42	266.83	932.76
2014	SW_FL	243.52	858.11	369.65	1292.21
2015	SW_FL	423.14	1491.04	642.30	2245.31
2016	SW_FL	549.30	1935.61	833.82	2914.79
2017	SW_FL	599.56	2112.70	910.10	3181.47
2018	SW_FL	671.43	2365.96	1019.20	3562.83
2019	SW_FL	473.32	1667.89	718.49	2511.63
2020	SW_FL	392.74	1383.91	596.16	2084.00
2021	SW_FL	547.47	1929.18	831.05	2905.10
2022	SW_FL	444.22	1565.35	674.32	2357.22
2023	SW_FL	469.33	1653.81	712.42	2490.43



Figure 1. Map of coastal logbook fishing areas for Florida.



**Figure 2.** CPUE (catch in whole pounds per hour) time-series for logbook data from 1993 - 2023 for vertical line trips landing FL Keys Yellowtail Snapper.



**Figure 3.** Comparison of vertical line reported annual logbook catch of FL Keys Yellowtail Snapper (solid black line) with CPUE expansion estimates from observer data (open squares). Error bars (SE) are shown for observer estimates. The observer time period is from 2007-2023. Catch from 1993-2006 was hindcasted using a mean observer CPUE.







**Figure 5.** Commercial vertical line discard estimates of FL Keys Yellowtail Snapper for SEDAR 96 compared to SEDAR 64 with a terminal year of 2018.



**Figure 6.** Mean vertical line effort in hours fished per trip from 1993-2023 for the two datalimited regions. Note different y-axis scales.



**Figure 7.** Total vertical line catch in ponds of Yellowtail Snapper from 1993-2023 for the two data-limited regions. Note different y-axis scales.



**Figure 8.** Annual total number of logbook trips reporting Yellowtail Snapper from 1993-2023 for the two data-limited regions. Note different y-axis scales.



**Figure 9.** Commercial discard estimates in numbers for the two completed methods for Yellowtail Snapper for the data-limited regions from 1993-2023. Estimated discards using fishing time as the effort metric is recommended for SEDAR 96.



**Figure 10.** Discard estimates as a percent of catch in pounds for the two completed methods for Yellowtail Snapper for the data-limited regions from 1993-2023. Estimated discards using fishing time as the effort metric is recommended for SEDAR 96.



(A) Southeast FL



**Figure 11.** Commercial vertical line discard estimates of (A) Southeast FL Yellowtail Snapper and (B) Southwest FL Yellowtail Snapper for SEDAR 96 compared to SEDAR 64 with a terminal year of 2018.