Coastal Fisheries Creel Report Card

2022

ALL ISLANDS

Introduction

This Coastal Fisheries Creel Report Card summarises the results of key indicators, based on creel surveys. The Tuvalu Fisheries Department (TFD) carries out these surveys across all islands in Tuvalu, except Niulakita.

A total of 4,440 creel surveys were conducted, 92,900 samples, and 68% were coastal species (the focus of this report).

The key indicators we use to show the health of the resources and state of overfishing are:

Indicator 1: Percentage of fishes that are landed, which are smaller than the size at which at least 50% of the fish can breed (called length at maturity, Lm). This value should decline and approach zero as management actions improve, followed by improvements in the fisheries resources. This is an indicator of **overfishing**.

Indicator 2: Catch of fishes per unit of effort (CPUE). We use the weight (kg) of fishes being landed: (a) per fisher per hour spent fishing and (b) per fishing trip. The values for Indicator 2 should increase as things improve. That is, fishers should be able to catch more fish in less time. This is an indicator of **abundance** of the fishery as well as the **efficiency** of the fishing method.

Indicator 3: Spawning Potential Ratio (SPR). The SPR compares the number of eggs (spawn) produced by a fish species over its lifespan when there **is fishing**, to the spawn that would have been produced over the fish stock's lifespan if there were **no fishing**. SPR measures the impact that fishing has on the ability of fish to contribute to spawning.
This is an indicator of **relative fishing pressure.**

When there is no fishing, the SPR is 100%. An overfished fishery where all mature fish have been caught, or all female fish have been caught, has an SPR of 0%.

Results

Overall status of the coastal resources is poor, with an average of 36% of the fishes caught being undersized.

IDEAL: % UNDERSIZED should DECLINE over time and approach 0%

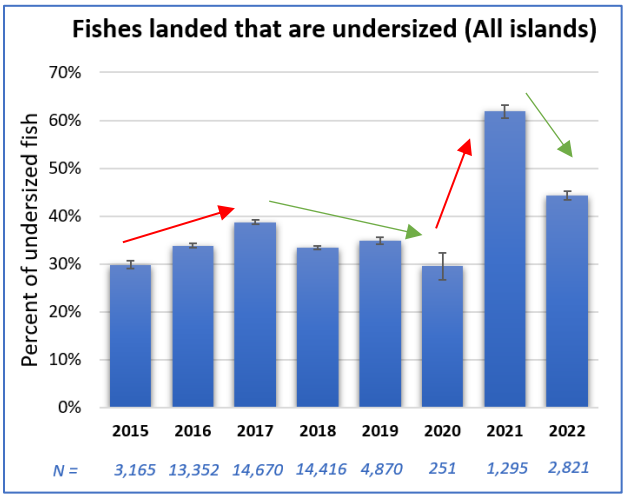

***Figure 1**: Percentage of fishes being landed undersized by year +/-SE. The total sample size (N) is reported in blue.*

Green arrow = good trend
red arrow = bad trend

Across the islands in Tuvalu, there was a slight increase between 2015 and 2017. This indicates a rise in the number of undersized fishes being landed, a concerning trend. However, this pattern reversed in 2018, with the numbers of undersized fish continuing to decline in 2020. Unfortunately, Indicator 1 drastically increased in 2021, with the percentage of undersized fishes doubling compared with previous years. This has shown some improvement in 2022 (Figure 1 and Table 1).

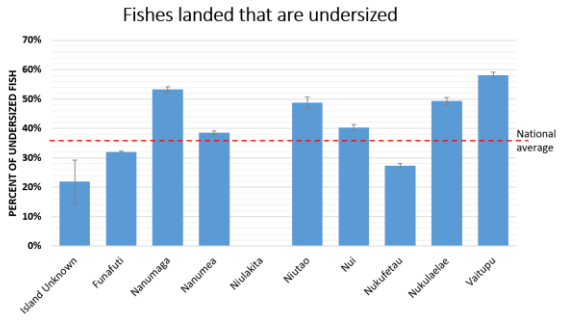

***Figure 2**: Percentage of fishes being landed undersized by island +/-SE (2015-2022).*

When comparing individual islands, only Funafuti and Nukufetau performed better than the national average of 36% (see Figure 2). The remaining islands exceeded the national average, with Nanumaga recording the highest percentage of fish landed undersize at 53%. There is insufficient data for Niulakita.

The ideal % of fishes being landed that are undersized is 0, so any actions that will reduce this to lower levels is a step in the right direction and is expected to lead to improvements in the resources.

Every fish should have the chance to breed at least once to ensure the resources can be replenished.

For Indicator 2, the total weight of fish being landed per fisher per hour spent fishing and the weight per fisher per trip seem to follow similar trends (Figure 3). The trend is generally decreasing between 2015 and 2021, which is not a good sign. However, this trend has reversed in 2022.

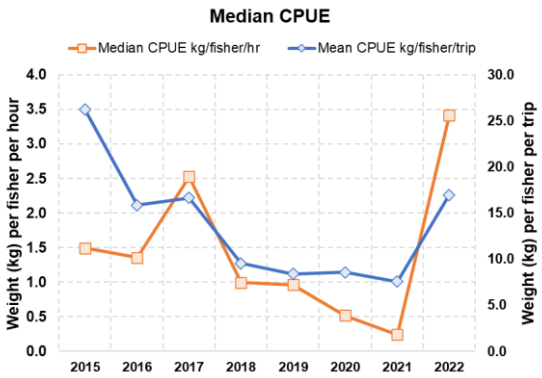

***Figure 3**: Indicator 2. (a) Weight (in kg) of fishes landed per fisher per hour spent fishing and (b) Weight of fishes landed per fisher per trip in Tuvalu from 2015-2022.*

When comparing individual islands, Nuitao, Nukufetau and Nukulaelae have CPUE that is better than the national CPUE (Figure 4). This may mean that it is easier to catch fish on each fishing trip, or that they use fishing methods such as trolling that has higher CPUE values than other methods.

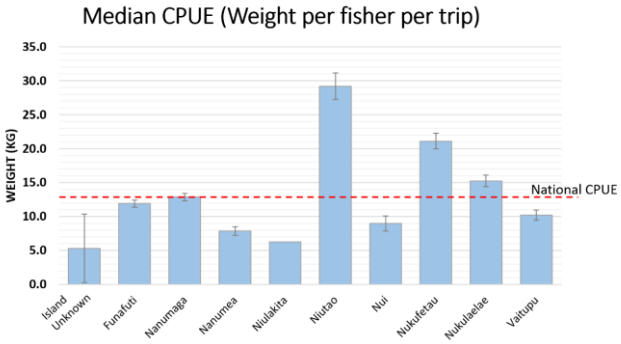

***Figure 4**: Indicator 2b. Weight (in kg) of fishes landed per fisher per fishing trip by island (2015-2022).*

The weight of fishes landed per fisher per entire fishing trip as Indicator 2b showed a decline between 2015 and 2017 for all methods, except for trolling which remained relatively stable (Figure 5). This shows that the returns per fishing trip have declined over that period. The returns stabilised in 2018 and 2019, with the exception of trolling, which decreased in 2018, and gleaning which increased in 2018. Trolling CPUE increased in 2020 then decreased in 2021. For most of the methods, there was an improvement in CPUE in 2022.

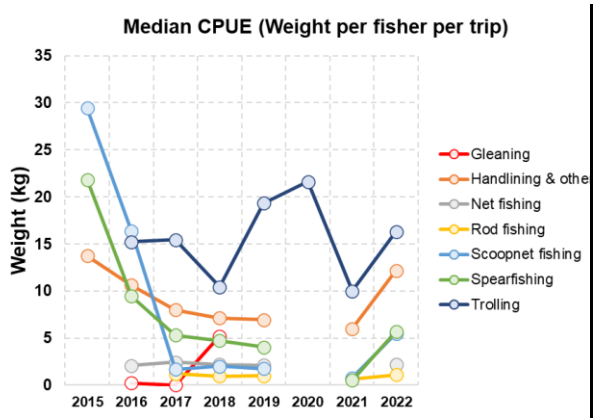

***Figure 5**: Indicator 2b. Weight (in kg) of fishes landed per fisher per fishing trip across Tuvalu 2015-2021. There was no method data available for 2020.*

Catch per unit of effort (CPUE) should INCREASE over time in a well-managed fishery.

Trolling appears to bring the best returns per fishing trip, compared to other methods. This is likely because of the target species are typically offshore species such as tuna and mackerels which are generally bigger than the reef species.

For Indicator 3, species that have an SPR less than 20% are considered to be the danger zone, where fishing is not considered to be sustainable (Figure 6, Table 2).

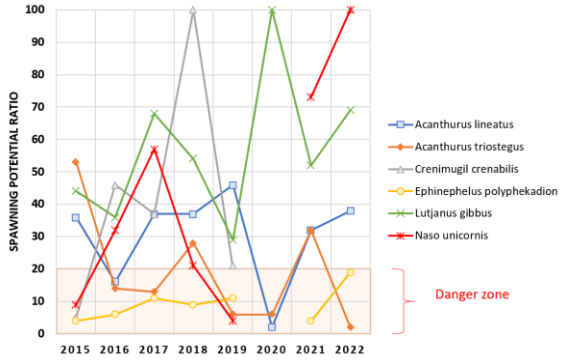

***Figure 6**: The spawning potential ratio (SPR) of selected species in Tuvalu. Anything below 20% is in the danger zone. These fish populations may not be able to replenish themselves (overfishing is occurring).*

Six species were assessed over the survey years. These species are part of the priority species identified for Tuvalu, and have sufficient data across the years. Only Taea (*Lutjanus gibbus*) had an SPR consistently above the danger zone (above 20%) since 2015. The SPR of Gatala (*Epinephelus polyhekadion*) is consistently in the danger zone, suggesting that these populations may not be able to replenish themselves, and fishing may not be sustainable.

SPR reference points based on international standards:
IDEAL (target): 40%
Danger zone (limit): 20% and below

Conclusions

Overall, there has been little improvement to the health of coastal fisheries the past 7 years, since surveys were begun. In 2022, the percentage of fish landed undersize reduced, while the CPUE increased, potentially reflecting an improvement in resources. However, it is important that consistent management measures are applied and monitored across all islands in order for more consistent improvements to be observed. Coastal fisheries management plans for all islands will be finalised and implemented in 2024.

Note: The catch reported do not include offshore fish species such as Atu (skipjack tuna). These pelagic species accounted for 32% of the total catch numbers and 71% of the biomass recorded in the creel surveys (2015-2022).

Why are some figures different from the previous report card?

This is due to a number of reasons:

1. We have received more data from 2015-2021
2. Instead of using the average CPUE, which can be influenced by really low or really high numbers, we report median CPUE

Appendix I: Size of maturity (L_m) for top 70 species

Table 1 is part of indicator 1. It shows the breakdown of species that have 50% or more fishes landed that are undersized. A value of 100 means that all fishes landed are undersized. The ideal value for a well-managed fishery is 0. Blank cells indicate that no catch has been recorded for that species in that year. This table shows that many of the species being monitored are being caught undersized, and this varies by year.

The species are listed in order of their abundance in the catch landed (% of total catch).

Table 1: List of species for which size at maturity (L_m) is known, showing percentages landed which are undersized (2015-2022).

	Species	Local Name	% in catch	2015	2016	2017	2018	2019	2020	2021	2022	Grand Total
1	*Lutjanus gibbus*	Taea	18.1%	20%	26%	25%	27%	7%	0%	24%	26%	**24%**
2	*Acanthurus triostegus*	Manini, Koinava	14.1%	0%	17%	37%	24%	34%	41%	16%	38%	**31%**
3	*Lutjanus kasmira*	Savane	4.4%	59%	55%	63%	43%	43%	100%	92%	62%	**53%**
4	*Acanthurus lineatus*	Ponelolo, Alogo, Pone hamoa	3.9%	7%	47%	32%	30%	8%	100%	17%	20%	**33%**
5	*Decapterus macarellus*	Atule	3.4%	31%	29%	13%	57%	44%				41%
6	*Lethrinus obsoletus*	Tanutanu	3.2%	10%	40%	21%	14%	7%		22%	21%	**22%**
7	*Crenimugil crenilabis*	Kanase	3.1%	100%	0%	67%	23%	64%			54%	**55%**
8	*Naso lituratus*	Maninilakau	2.7%	49%	27%	12%	7%	4%	0%	1%	33%	**16%**
9	*Myripristis pralinia?*	Malau puku	2.3%	0%	4%	1%	3%	3%	0%	0%	10%	**3%**
10	*Caranx sexfasciatus*	Teu	2.2%	33%	85%	63%	76%	89%		71%	64%	**75%**
11	*Lethrinus amboinensis*	Noto, Gutulo, Sapotu	2.1%	0%	6%	10%	11%	3%			0%	**8%**
12	*Myripristis berndti*	Malau	1.8%	29%	26%	14%	49%					24%
13	*Sargocentron spiniferum*	Tamalau	1.7%	66%	63%	50%	39%	54%		35%	35%	**53%**
14	*Liza vaigiensis*	Kafakafa	1.7%		60%	75%	63%	66%		100%	100%	**71%**
15	*Lutjanus fulvus*	Tagau,Takape	1.6%	0%	8%	26%	10%	14%	0%	27%	27%	**18%**
16	*Hipposcarus longiceps*	Ulafi	1.6%	24%	30%	22%	32%	26%			37%	**26%**
17	*Selar crumenophthalmus*	Salala, Atule	1.5%	4%	8%			31%		100%	84%	**34%**
18	*Lutjanus monostigma*	Taiva	1.4%	3%	8%	40%	27%	73%	0%	57%	22%	**28%**
19	*Monotaxis grandoculis*	Muu, Mufala	1.4%	74%	68%	39%	53%	27%	0%	71%	50%	**47%**
20	*Caranx melampygus*	Aseu, Ulua, Fuaika	1.3%	0%	36%	48%	35%	48%	67%	0%	80%	**49%**
21	*Epinephelus macrospilos*	Gatala (Ff), fapuku (Nm)	1.3%	13%	59%	85%	73%	53%	8%	50%		70%
22	*Epinephelus polyphekadion*	Gatala (one dot)	1.2%	54%	42%	26%	31%	33%		82%	58%	**37%**
23	*Sargocentron tiere*	Malau gutu loa, Malua mata loa	1.2%	50%	48%	74%	49%	20%	0%		75%	**47%**
24	*Naso unicornis*	Ume, Pokapoka	1.2%	60%	49%	24%	60%	75%		33%	33%	**47%**
25	*Caranx lugubris*	Tafauli, Tino tafauli (large), Aheu tafauli, Uluat	1.1%		3%	37%	56%	0%		78%	91%	**60%**
26	*Epinephelus merra*	Gatalaliki	1.1%	4%	0%	9%	16%	0%	0%	100%	1%	**7%**
27	*Kyphosus vaigiensis*	Nanue (Ff, Nm)	1.0%		75%	71%	60%	98%			83%	**74%**
28	*Naso brevirostris*	Pokapoka, Kosotu	0.9%	6%	27%	3%	2%	9%	0%	13%	17%	**14%**
29	*Aphareus furca*	Palusega, Kotua, Taelepe, Takuoga	0.9%	78%	97%	89%	100%	100%		100%	100%	**97%**
30	*Naso vlamingii*	Pokapoka lanulanu	0.9%	0%	33%	18%	16%	0%		40%		24%
31	*Caesio caerulaurea*	Ulia, Ulihega	0.9%	0%	9%	0%	0%			0%		8%

32	*Lutjanus bohar*	Fakamea, Fagamea	0.8%	66%	81%	64%	72%	50%		69%	80%	**72%**
33	*Lethrinus erythracanthus*	Saputu	0.7%	61%	52%	36%	50%	0%		40%	100%	**49%**
34	*Siganus argenteus*	Maiava	0.7%	0%	30%	27%	37%	0%		5%	40%	**17%**
35	*Elagatis bipinnulata*	Kamai, Kamaa, Kami	0.6%	100%	76%	80%	47%	100%	0%	67%	69%	**76%**
36	*Myripristis kuntee*	Malau	0.6%	6%	6%	50%	0%				0%	**6%**
37	*Kyphosus cinerascens*	Nanue	0.6%	25%	80%	22%	4%	65%			9%	**26%**
38	*Lethrinus variegatus*	Noto, Tanutanu	0.6%		0%	3%		0%				2%
39	*Chlorurus (Scarus) microrhino*	Laea	0.5%	0%	46%	51%	0%					47%
40	*Lethrinus miniatus*	Noto	0.5%	91%	75%	90%	85%	56%	0%	90%	0%	**83%**
41	*Lutjanus argentimaculatus*	Tagau	0.5%	100%	100%	100%	100%					100%
42	*Lethrinus xanthochilus*	Tanutanu	0.5%		72%	83%	0%		0%			73%
43	*Epinephelus fuscoguttatus*	Munua	0.4%	47%	38%	81%	63%	67%			0%	**74%**
44	*Lethrinus microdon*	Filoa, Kapatiko	0.4%				16%	23%		54%	50%	**39%**
45	*Sphyraena forsteri*	Taotao	0.4%	19%	6%	4%	16%	13%			0%	**13%**
46	*Aprion virescens*	Utu	0.4%	50%	71%	45%	39%	56%		50%	50%	**56%**
47	*Priacanthus hamrur*	Matapa	0.4%	33%	14%	2%	10%					12%
48	*Ctenochaetus binotatus*	Pone uli	0.4%	0%	2%	5%	33%					4%
49	*Anyperodon leucogrammicus*	Gatala lautalo, Gatala lautala	0.4%	8%	5%	87%	0%				0%	**47%**
50	*Epinephelus maculatus*	Fapuku	0.4%	65%	63%	69%	58%	63%		20%	76%	**65%**
51	*Parupeneus barberinus*	Malili, Kaivete	0.4%		2%	6%	0%				0%	**5%**
52	*Fistularia petimba*	Taotaoama (NB, Tvd)	0.3%	100%	100%	100%						100%
53	*Naso caesius*	Ume (Ff?), pokapoka (Nm?)	0.3%		9%	18%	57%	40%		38%		24%
54	*Parupeneus cyclostomus*	Kaivete piniki	0.3%		0%	40%	22%	0%				26%
55	*Selar boops*	Salala, Atule	0.3%				5%			100%	100%	**34%**
56	*Caranx ignobilis*	Tino ulua (lge), Lupo (small), Aseu (med); Mea tal	0.3%		100%	97%	99%	100%	100%	100%	100%	**99%**
57	*Myripristis adusta*	Malau fagamea, Malau matakelkele	0.3%	60%	60%	21%	82%					52%
58	*Naso hexacanthus*	Pokapoka, Ume tinae sega	0.3%		66%	64%	55%	100%	100%	100%		72%
59	*Rastrelliger kanagurta*	Salala	0.3%		0%		100%			100%		93%
60	*Cephalopholis urodeta*	Mataele	0.2%	75%	52%	43%	0%			0%	100%	**49%**
61	*Lethrinus microdon*	Kapatiko	0.2%	0%	11%	18%	0%	0%			0%	**10%**
62	*Siganus punctatus*	Maiava fiiti	0.2%	36%	29%	18%	10%			44%	100%	**29%**
63	*Carangoides plagiotaenia*	Aseu uluuli	0.1%			36%	83%	100%				56%
64	*Cephalopholis argus*	Loi	0.1%	0%	11%	19%	41%	60%		0%	33%	**28%**
65	*Myripristis violacea*	Malau	0.1%		0%	0%	33%	0%		0%	0%	**2%**
66	*Macolor niger*	Tilapia	0.1%	89%	87%	73%	70%				100%	**80%**
67	*Monotaxis heterodon*	Ma gutu pukupuku, ma gutu puku	0.1%	36%	5%	8%						13%
68	*Acanthurus nigricauda*	Kapalagi, Pone	0.1%	0%	15%	0%						8%
69	*Macolor macularis*	Tonu	0.1%	78%	50%	9%	16%					30%
70	*Epinephelus miliaris*	Gatala	0.1%	0%	0%	0%	0%	0%		100%		14%
	Grand Total		100.0%	**30%**	**34%**	**39%**	**33%**	**35%**	**29%**	**62%**	**42%**	**36%**

Appendix II: Length-based Spawning Potential Ratio Estimates for selected species

Indicator 3, the spawning potential ratio (SPR), provides information on whether fishing can be considered to be sustainable. Species that have an SPR less than 20% are considered to be the danger zone, whereas SPR between 40%-60% is considered ideal. The SPR for selected species varies from year to year. More data (larger sample sizes) are needed to confirm these trends, and life history parameters specific to our region are needed to improve the accuracy of the estimates.

Table 2: Spawning Potential Ratio (SPR) estimates of selected species with known life history parameters*

Species	Years	N	M/K	Lm/Linf	SPR (%)	SPR (95% confidence intervals)	SL50	SL95	F/M
Acanthurus lineatus#	2015	331	0.52	0.79	36	30 - 42	20.11	22.75	4.05 (2.72 - 5.38)
Acanthurus lineatus	2016	959	0.52	0.79	16	13 - 19	17.94	23.31	4.92 (3.84 - 6)
Acanthurus lineatus	2017	261	0.52	0.79	37	23 - 51	19.38	26.59	2.01 (0.82 - 3.2)
Acanthurus lineatus#	2018	363	0.52	0.79	37	24 - 49	19.98	27	2.39 (1.17 - 3.61)
Acanthurus lineatus	2019	73	0.52	0.79	46	32 - 60	18.28	19.35	1.24 (0.44 - 2.04)
Acanthurus lineatus^	2020	6	0.52	0.79	2	0 - 4	15	15.28	13.25 (0 - 29.38)
Acanthurus lineatus#	2021	70	0.52	0.79	32	12 - 53	20.6	25.77	4.11 (0.19 - 8.03)
Acanthurus lineatus#	2022	132	0.52	0.79	38	22 - 54	20.49	26.47	2.78 (0.75 - 4.81)
Acanthurus triostegus#	2015	6	0.52	0.79	53	0 - 0	17.51	17.58	341.56 (0 - 0)
Acanthurus triostegus	2016	150	0.52	0.79	14	7 - 21	12.77	16.32	3.1 (1.65 - 4.55)
Acanthurus triostegus	2017	820	0.52	0.79	13	1 - 15	9.94	12.57	2.15 (1.82 - 2.48)
Acanthurus triostegus	2018	2860	0.52	0.79	28	25 - 30	10.86	13.41	1.23 (1.11 - 1.35)
Acanthurus triostegus	2019	885	0.52	0.79	6	5 - 7	11.5	13.27	4.49 (3.95 - 5.03)
Acanthurus triostegus	2020	132	0.52	0.79	6	2 - 10	11.74	15.2	4.66 (2.57 - 6.75)
Acanthurus triostegus	2021	69	0.52	0.79	32	16 - 48	11.34	11.81	1.08 (0.45 - 1.71)
Acanthurus triostegus^	2022	780	0.52	0.79	2	3 - 6	11.39	13.94	5.26 (4.37 - 6.15)
Crenimugil crenabilis^	2015	21	2.4	0.55	5	0 - 13	19.94	22.75	5.67 (0 - 15.85)
Crenimugil crenabilis	2016	137	2.4	0.55	46	41 - 51	29.66	31.68	3.74 (1.92 - 5.56)
Crenimugil crenabilis	2017	851	2.4	0.55	37	30 - 45	18.59	24.57	0.66 (0.48 - 0.84)
Crenimugil crenabilis	2018	223	2.4	0.55	100	100 - 100	32.3	45.78	0 (0 - 0)
Crenimugil crenabilis	2019	393	2.4	0.55	21	16 - 27	20.42	23.73	1.47 (1.06 - 1.88)
Crenimugil crenabilis	2022	39	2.4	0.55	100	100 - 100	10.19	10.23	0 (0 - 0)
Ephinephelus polyphekadion^	2015	57	0.75	0.6	4	0 - 23	41.63	60.23	17.18 (0 - 58.52)
Ephinephelus polyphekadion^	2016	187	0.75	0.6	6	2 - 9	33.52	43.7	7.33 (3.77 - 10.89)
Ephinephelus polyphekadion	2017	154	0.75	0.6	11	5 - 17	33.69	43.13	4.09 (1.65 - 6.53)
Ephinephelus polyphekadion	2018	210	0.75	0.6	9	7 - 12	31.67	37.4	4.11 (3.01 - 5.21)
Ephinephelus polyphekadion	2019	43	0.75	0.6	11	5 - 16	30.21	32.41	3.22 (1.67 - 4.77)
Ephinephelus polyphekadion	2021	11	0.75	0.6	4	0 - 10	17.15	17.36	3.42 (0.68 - 6.16)
Ephinephelus polyphekadion	2022	19	0.75	0.6	19	0 - 41	16.37	16.93	1.27 (0.13 - 2.41)
Lutjanus gibbus	2015	1158	0.41	0.72	44	38 - 50	21.94	27.66	1 (0.75 - 1.25)
Lutjanus gibbus	2016	3159	0.41	0.72	36	33 - 39	20.93	26.46	1.22 (1.07 - 1.37)
Lutjanus gibbus	2017	1809	0.41	0.72	68	56 - 76	19.07	24.17	0.3 (0.19 - 0.41)

Lutjanus gibbus	2018	2442	0.41	0.72	54	49 - 59	18.76	22.09	0.5 (0.41 - 0.59)
Lutjanus gibbus	2019	761	0.41	0.72	29	26 - 32	24.83	28.57	4.78 (3.74 - 5.82)
Lutjanus gibbus	2020	54	0.41	0.72	100	99 - 100	21.78	21.88	0 (0 - 0.01)
Lutjanus gibbus	2021	62	0.41	0.72	52	25 - 79	19.1	19.52	0.52 (0.02 - 1.02)
Lutjanus gibbus	2022	703	0.41	0.72	69	55 - 83	26.18	44.12	0.51 (0.17 - 0.85)
Naso unicornis	2015	72	0.35	0.8	9	3 - 15	21.05	27.9	2.79 (1.56 - 4.02)
Naso unicornis	2016	394	0.35	0.8	32	26 - 40	13.38	15.42	0.91 (0.66 - 1.16)
Naso unicornis	2017	63	0.35	0.8	57	23 - 92	19.75	20.12	0.42 (0 - 0.94)
Naso unicornis	2018	40	0.35	0.8	21	3 - 39	20.09	20.71	1.47 (0.57 - 2.37)
Naso unicornis	2019	12	0.35	0.8	4	0 - 10	2234	22.44	4.43 (1.04 - 7.82)
Naso unicornis	2021	48	0.35	0.8	73	23 - 100	19.9	20.37	0.23 (0 - 0.76)
Naso unicornis	2022	24	0.35	0.8	100	67 - 100	7.13	7.16	0 (0 - 0.2)

*SPR is calculated using Barefoot Ecologist's LBSPR R Shiny application. Life history parameters obtained from Jeremy Prince (Pers. Communication), published data, and TFD maturity studies

#Estimated selectivity may be unrealistically high

^Estimated F/M may be unrealistically high